FlightSafety international

CHALLENGER 300 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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NORMAL PROCEDURES

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NORMAL PROCEDURES

GENERAL

The procedures in this chapter have been developed by Bombardier, Inc. for the certification of this aircraft. The presentation includes, but is not limited to, detailed checklist procedures by flight phase.

FIRST FLIGHT OF THE DAY

The [1] symbol in the procedure means that the associated procedure is accomplished only on the first flight of the day.

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, if certain criteria are met. In the following procedures (Exterior Preflight, Cabin Preflight, and Before Starting Engines), steps marked with the 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.) that would change the preflight status of the aircraft have not occurred.

For intermediate stops with no engine shutdown, completion of the Quick Turn-Around procedure in this chapter provides the minimum preflight requirements.

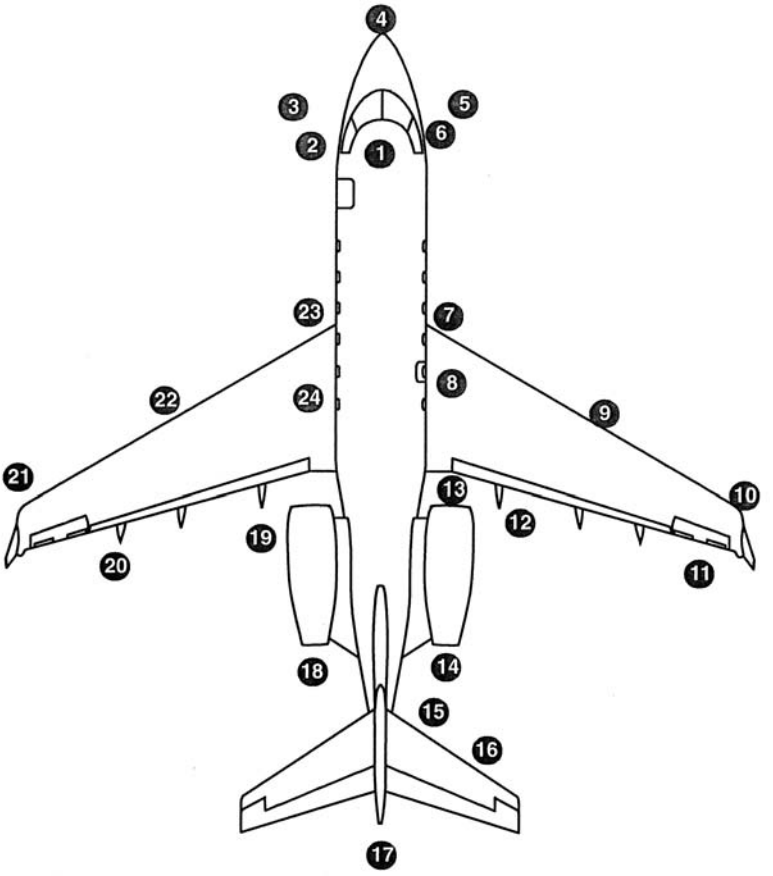


Figure NP-1. Walkaround Inspection

EXTERIOR PREFLIGHT

EXTERIOR SAFETY CHECK/WALKAROUND

1. Exterior Safety Check/Walkaround ..... Accomplish

♦ During Exterior Preflight, check all vents clear, check access doors for security, and all aircraft surfaces for condition.

● ♦ a. LANDING GEAR switch ..... DN

b. L, R, and AUX HYDRAULIC PUMP switches ..... OFF

c. L and R BATT switches ..... On

d. Fuel quantities ..... Check

e. Oxygen quantity ..... Check

f. L HYDRAULIC PUMP switch ..... ON

g. PARK/EMER BRAKE handle ..... Set

NOTE

If the brake toe pedals are depressed when the PARK/EMER BRAKE HANDLE is set, then the brake toe pedals should be depressed when releasing the PARK/EMER BRAKE handle. This prevents fluid transfer between the left and right hydraulic systems.

h. L HYDRAULIC PUMP switch ..... OFF

i. If night flight is anticipated, check exterior lighting.

All exterior light switches ..... ON

Check proper illumination, then all exterior light switches ..... OFF

j. L and R BATT switches ..... OFF

k. GUST LOCK lever ..... OFF

● a. Passenger door operating switch door ..... Closed

b. Left standby static port ..... Clear of obstructions

c. Stall warning vane ..... Check free motion

d. Left pitot-static and standby pitot probes ..... Cover removed, clear of obstructions

e. Ice detect probe ..... Check

f. Ground communication door ..... Closed

EXTERIOR PREFLIGHT (Cont)

● ♦ a. Nose gear check:

(1) Wheel well and gear ..... Condition

(2) Doors ..... Condition

(3) Wheels and tires ..... Condition

(4) Gear pin and chocks ..... Removed

(5) Nose landing and taxi light ..... Condition

● a. Radome ..... Condition

b. Windshields/windows ..... Condition

● a. Right ice detector ..... Check

b. Right pitot-static probe ..... Cover removed clear of obstructions

● a. R windshield/window ..... Condition

b. Stall warning vane ..... Check free motion

c. Total air temperature probe ..... Check

d. Right standby static port ..... Clear of obstructions

● ♦ a. Outflow valve access door ..... Closed

b. L and R engine oil level ..... Check, green

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. Fuel access doors ..... Closed

● a. Wing inspection and emergency exit lights and lenses ..... Condition

♦ b. Emergency exit ..... Closed

♦ c. Right engine inlet and fan ..... Condition, clear of obstructions

EXTERIOR PREFLIGHT (Cont)

d. Upper fuselage antennas and dorsal inlets ..... Condition

e. Lower fuselage antennas,
landing light fairing and lens..... Condition

[1] f. Fuel water drains ..... Drain

NOTE

The fuel sump drains are low points in the fuel system. Fuel drains from these when opened.

♦ g. Fuel and hydraulic drain masts ..... Check for leakage

● a. Right wing check:

(1) Leading edge and vortilons..... Condition

(2) Access panels ..... Fuel/Hydraulic leakage

(3) Fuel cap ..... Secure

CAUTION

The wing and flight control surfaces must be free of frost, snow, and ice. Ice can form on the surfaces of the wing even on very warm days if the fuel temperature supports it. The leading edge and lower surface of the flaps must be free of ice.

● a. Right winglet navigation light/lens
and static wicks ..... Condition

● a. Right aileron..... Check free motion,
balance tab linkage, bent tab
and brush seal condition

b. Right spoilers and flap ..... Condition

● ♦ a. Right main gear check:

(1) Wheel well and gear..... Hydraulic/fuel leakage
and condition

(2) Doors..... Condition

(3) Wheels, brakes and break wear indicators,
and tires..... Condition

EXTERIOR PREFLIGHT (Cont)

NOTE

The wear pins should be exposed with the PARKING BRAKE set.

(4) Gear pin and chocks ..... Removed

a. Oxygen overpressure relief indicator and service door ..... Check and close

b. Lav waste access door ..... Closed

c. Ground power supply access door ..... Closed

♦ a. Right generator scoop ..... Clear

b. Right engine cowl latches ..... Closed

c. Right engine turbine exhaust area ..... Condition, clear of obstructions

d. Right thrust reverser ..... Stowed

a. High pressure pneumatic supply door ..... Closed

a. APU inlet ..... Clear of obstructions

b. APU generator and compartment scoops ..... Clear of obstructions

c. APU exhaust ..... Clear of obstructions

d. Vertical stabilizer and rudder ..... Condition

e. Horizontal stabilizer and elevator ..... Condition

WARNING

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

f. Static discharge wicks ..... Condition

g. PACK exhaust vent ..... Clear

EXTERIOR PREFLIGHT (Cont)

a. Aft equipment bay door ..... Open, check for fluid leaks, security and condition of installed equipment, remote circuit breakers set

b. Aft equipment bay door ..... Close

♦ a. Left engine turbine exhaust area ..... Condition, clear of obstructions

b. Left thrust reverser ..... Stowed

♦ a. Cargo door ..... Closed

♦ b. Battery bay door ..... Closed

c. Battery vents ..... Check

d. Left engine cowl latches..... Closed

e. Left main gear check:

(1) Wheel well and gear ..... Fuel/Hydraulic leakage and condition

(2) Doors ..... Condition

(3) Wheels, brakes and brake wear indicators, and tires ..... Condition

NOTE

The wear pins should be exposed with the PARKING BRAKE set.

(4) Gear pin and chocks..... Removed

f. Left generator scoop ..... Clear

a. Left spoilers and flaps ..... Condition

b. Left aileron ..... Check free motion, balance and trim tab linkage, bent tabs and brush seal condition

a. Left winglet navigation light/lens and static wicks ..... Condition

EXTERIOR PREFLIGHT (Cont)

a. Left wing check:

(1) Leading edge and vortilions ..... Condition

(2) Access panels ..... Fuel/Hydraulic leakage

(3) Fuel cap ..... Secure

CAUTION

The wing and flight control surfaces must be free of frost, snow, and ice. Ice can form on the surfaces of the wing even on very warm days if the fuel temperature supports it. The leading edge and lower surface of the flaps must be free of ice.

[1] a. Fuel water drains ..... Drain

NOTE

The fuel sump drains are low points in the fuel system. Fuel drains from these when opened.

♦ a. Left engine inlet and fan ..... Condition, clear of obstructions

b. Upper fuselage ..... Condition

CABIN PREFLIGHT

♦ a. Cabin furnishings ..... Secure

♦ b. Emergency exit ..... Aisle clear and handle unobstructed; remove and stow aft emergency exit door security pin

BEFORE STARTING ENGINES

NOTE

All flight deck switches will be extinguished except as noted in the following procedures.

1. Circuit breakers (CB 1 and CB2) ..... Set

♦2. Seats, safety harnesses ..... Secure

3. Crew oxygen masks and smoke goggles ..... Check oxygen flow available. Masks and smoke goggles properly stowed

♦4. LANDING GEAR switch ..... DN

♦5. L, R, and AUX HYDRAULIC PUMP switches ..... OFF

♦6. AIR SOURCE switch ..... OFF

♦7. Electrical system:

a. STBY INST switch ..... On

b. L and R BATT switches ..... On

NOTE

Extended use of battery power only may result in a temporary GEN OVERLOAD message once the L, R, or APU generator is brought on-line.

c. EXT PWR (if desired) ..... Connect, Check AVAIL, then select ON

8. L and R COCKPIT LIGHTS ..... As desired

♦9. APU start:

a. CAS ..... Check, no APU or AIR COND FAULT messages

b. L and R BLEED switches ..... OFF

c. NAV lights ..... NAV

d. R FUEL PUMP switch ..... AUTO

e. APU switch ..... START (hold for 3 seconds) and release

BEFORE STARTING ENGINES (Cont)

f. EXT PWR switch (if applicable) ..... AVAIL and disconnect

g. APU BLEED switch ..... ON

h. XBLEED switch ..... Open

i. AIR SOURCE switch ..... NORM

10. SYSTEM TEST panel:

a. ANNUN A ..... Test

All switch lights should illuminate in each position.

NOTE

Holding the ANNUN A or ANNUN B test for longer than 15 seconds initiates an aural warning test.

b. ANNUN B ..... Test

All switch lights should illuminate in each position.

c. PROBES ..... Test

PROBE HEAT TEST OK illuminates.

d. STALL/RUD LIM ..... Test

- The STALL icon on both PFDs illuminates.
- Flashing AOA amber and red illuminates briefly.
- STALL voice sounds.
- Left stick shaker activates.
- Right stick shaker activates.
- Pusher activates.
- RUDDER LIMITER IN TEST illuminates.

NOTE

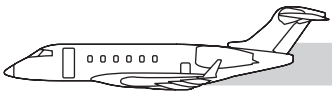
AIR DATA 1 (2) FAULT illuminates.

e. ICE DET ..... Test

ICE DETECTED and ICE icon on PFD illuminate.

11. L and R rudder pedals ..... Adjust

12. L and R audio panels ..... Set



BEFORE STARTING ENGINES (Cont)

♦ 13. Fuel quantity ..... Check

♦ 14. Standby instrument ..... Check

15. Clock ..... Zero flight time

16. NWS switch ..... OFF

♦ 17. L and R FUEL PUMP switches ..... AUTO

♦ 18. FMS ..... Initialize

19. REVERSION panel ..... NORM

20. AIR COND/BLEED panel ..... Check

[1] a. RAM AIR switch ..... ON
RAM AIR ON illuminates.

b. RAM AIR switch ..... OFF

21. ANTI-ICE panel:

a. WING SOURCE switch ..... NORM

b. L and R PROBES switches ..... OFF

♦ c. L and R WSHLD/WINDOW switches ..... ON

♦ 22. PRESSURIZATION panel ..... Check

a. LNDG ALT ..... Set

23. LIGHTING panel ..... As desired

a. Emergency lights check:

(1) EMER LIGHTS switch ..... OFF
EMER LIGHTS OFF illuminates.

(2) EMER LIGHTS switch ..... ON
EMER LIGHTS ON illuminates; check emergency lights displayed.

♦ (3) EMER LIGHTS switch ..... ARM

24. GUST LOCK lever ..... OFF

BEFORE STARTING ENGINES (Cont)

♦ 25. HYDRAULIC panel:

a. L and R PUMP switches ..... ON

NOTE

Selecting hydraulic pumps on in rapid succession may result in a momentary APU GEN OVERLOAD.

b. AUX PUMP switch ..... AUTO

c. PARK/EMER BRAKE handle ..... Set

NOTE

If the brake toe pedals are depressed when the PARK/EMER BRAKE handle is set, the brake toe pedals should be depressed when releasing the PARK/EMER BRAKE handle. This prevents fluid transfer between the left and right hydraulic systems.

d. L and R PUMP and PTU switches ..... AUTO

26. Trim system:

a. STAB TRIM switch ..... SEC

b. Pilot trim switch ..... NUP and NDN. verify movement

c, Copilot trim switch ..... NUP and NDN. verify movement

d. STAB TRIM switch ..... PRI

e. Pilot trim switch ..... NUP and NDN. verify movement

f Copilot trim switch ..... NUP and NDN. verify movement

♦ g. STAB TRIM switch ..... Set for takeoff

h. AIL and RUD trim ..... Check operation and set for takeoff

27. ELT ..... ARM

28. CABIN DC and AC PWR switches ..... On

29. PAX OXYGEN switch ..... AUTO

BEFORE STARTING ENGINES (Cont)

30. THERAPEUTIC OXYGEN switch ..... ON

    (Only required for flights requiring a mission completion altitude above 10,000 feet following a pressurization failure.)

    Switch ON light illuminates.

    a. THERAPEUTIC OXYGEN switch ..... Off

♦ 31. Altimeters ..... Set pilot, copilot and standby and cross-check

♦ 32. Avionics ..... Set for departure

♦ 33. Takeoff data (V_1, V_R, V_2, and distance ..... Computed, and speeds set (refer to Performance Chapter)

34. CAS messages ..... Check

STARTING ENGINES

Engine starts may be made by using the APU, an external air source, or cross-bleed from the other engine.

WARNING

Maintain a safe distance from the engine outlets at all times during engine operation. Airflow into the turbofan engine is sufficient to draw personnel and equipment into the engine inlet.

NOTE

Ensuring ITT is below 350°C (cranking if necessary) reduces the possibility of a hot start.

If the engine is started within 90 minutes after shutdown, an audible rumble or vibration may occur. This is not damaging to the engine and is normal engine behavior for a warm start.

1. Passenger door ..... Closed

   a. Green flag ..... Check

2. PARK/EMER BRAKE handle ..... Set

NOTE

If the brake toe pedals are depressed when the PARK/EMER BRAKE handle is set, the brake toe pedals should be depressed when releasing the PARK/EMER BRAKE handle. This prevents fluid transfer between the left and right hydraulic systems.

3. Thrust levers ..... IDLE

4. STROBE switch ..... BCN

5. Engine start (APU bleed source):

   a. ENGINE RUN switch ..... RUN

   b. STARTER switch ..... START and release

      Monitor the following:

      (1) IGN and FF (fuel flow) ..... Check

      (2) N_1 ..... Increasing as N_2 increases

(Continued)

STARTING ENGINES (Cont)

(3) ITT ..... Increasing

(4) Oil Pressure ..... Indication

c. Engine Instruments ..... Check

d. Start other engine by repeating Steps 5 a through c (optional).

5. Engine start (external bleed source):

a. External air source ..... Verify connected

b. XBLEED switch ..... Open

c. Bleed pressure ..... 32 psi minimum

d. ENGINE RUN switch ..... RUN

e. STARTER ..... START and release

Monitor the following:

(1) IGN and FF (fuel flow) ..... Check

(2) N_1 ..... Increasing as N_2 increases

(3) ITT ..... Increasing

(4) Oil Pressure ..... Indication

f. Engine Instruments ..... Check

g. Start other engine by repeating Steps 5 c through f (optional).

h. External air source ..... Disconnect

i. XBLEED switch ..... Closed

j. L and R BLEED switches ..... On

k. EXT PWR ..... AVAIL, disconnect

(Continued)

STARTING ENGINES (Cont)

5. Engine start (crossbleed source):

   a. APU BLEED switch ..... OFF

   b. XBLEED switch ..... Open

   c. Operating engine BLEED switch ..... On

   d. Operating engine thrust lever ..... Advance

   e. Bleed pressure ..... 32 psi minimum

   f. ENGINE RUN switch ..... RUN

   NOTE

   Starting with a tailwind may require a higher bleed pressure than 32 psi.

   g. STARTER ..... START and release

      Monitor the following:

      (1) IGN and FF (fuel flow) ..... Check

      (2) N_1 ..... Increasing as N_2 increases

      (3) ITT ..... Increasing

      (4) Oil Pressure ..... Indication

   h. Engine Instruments ..... Check normal

6. Generators ..... Check on line

BEFORE TAXI

[1] 1. WING ANTI-ICE switch ..... ON

WING ANTI-ICE (S) illuminates.

2. FLAPS ..... 10 or 20

3. Flight controls:

   a. Select FLIGHT CONTROLS synoptic page.

   b. Apply full range of motion to pitch, roll, and yaw while checking for elevator, aileron, roll spoilers, and rudder motion.

4. FLIGHT SPOILERS lever ..... Check extension

5. GND SPOILERS:

   a. MANUAL ARM ..... Check extended

   b. AUTO ..... Check stowed

6. YD ..... On

7. EICAS ..... Check

8. Passenger brief/cabin check ..... Complete

[1] 9. ANTI-ICE panel:

   a. Wing anti-ice flow lines green after 2 minutes ON ..... Check

   b. WING SOURCE switch ..... FROM L

   WING SOURCE XBLEED (S) illuminates.

   c. WING SOURCE switch ..... FROM R

   WING SOURCE XBLEED (S) illuminates.

NOTE

If L(R) WING ANTI-ICE FAIL (C) illuminates, it may be necessary to increase the thrust lever slightly.

   d. WING SOURCE switch ..... NORM

10. WING switch ..... As required

(Continued)

BEFORE TAXI (Cont)

11. Cabin check:

    a. Brief passengers. Briefing to include oxygen system operation, seat belt operation, life vest location and operation, fire extinguisher location, and emergency evacuation.

    NOTE

    Inform passengers that smoking is prohibited in the lavatory.

    Advise passengers not to use portable electronic equipment during takeoff, approach, and landing.

    b. Seats ..... Swivel forward or aft and in the outboard position. Headrests in place for occupied aft facing seats.

    c. Work tables ..... Check stowed

    d. Emergency exit ..... Aisle clear

12. Aircraft lighting ..... As required

13. SMKG/BELTS switch..... SMKG/BELTS

14. NWS switch..... On

15. PARK/EMER BRAKE handle..... Release

TAXI AND BEFORE TAKEOFF

1. Brakes and nose wheel steering ..... Check

2. Flight instruments..... Check

3. Thrust reversers:

> **CAUTION**
>
> Use of reverse thrust on poorly cleaned or maintained runway, taxiway, or ramp surfaces may cause foreign object damage to engine fan blades.
>
> Deployed time of the thrust reverser should be minimized to prevent foreign object damage. It is recommended that the aircraft be headed into the wind during the thrust reverser ground operational check.

   a. Thrust levers..... REV

      REV (white) EI, then REV (green) EI

   b. Thrust levers..... IDLE

      REV (white) EI, then extinguishes

4. Engine instrument and N_1 bugs..... Check, verify that the left and right bugs agree within 1%

5. Takeoff data (V_1, V_R, V_2, and distance)..... Check

6. Nav equipment ..... Check

7. Crew takeoff briefing ..... Complete

8. Radar/terrain ..... As required

> **WARNING**
>
> ***Do not*** transmit radar energy if personnel are within 9 feet (3 meters) radially from the nose of the aircraft, within 100 feet (30 meters) of large metallic objects including aircraft, or during refueling.

9. Transponder ..... On

10. ANTI-ICE panel:
    a. WING switch..... As required
    b. L and R ENG switch ..... As required

BEFORE TAXI (ONE ENGINE)

1. FLAPS selector ..... 10 or 20

2. Flight controls:

   a. Select FLIGHT CONTROLS synoptic page.

   b. Apply full range of motion to pitch, roll, and yaw while checking for elevator, aileron, roll spoilers, and rudder motion.

3. FLIGHT SPOILERS lever ..... Check extension

4. GND SPOILERS:

   a. MANUAL ARM ..... Check extended

   b. AUTO ..... Check stowed

5. YD ..... On

6. EICAS ..... Check

7. Cabin check:

   a. Brief passengers. Briefing to include oxygen system operation, seat belt operation, life vest location and operation, fire extinguisher location, and emergency evacuation.

   NOTE

   Inform passengers that smoking is prohibited in the lavatory.

   Advise passengers not to use portable electronic equipment during takeoff, approach, and landing.

   b. Seats ..... Swivel forward or aft and in the outboard position. Headrests in place for occupied aft facing seats.

   c. Work tables ..... Check stowed

   d. Emergency exit ..... Aisle clear

8. Aircraft lighting ..... As required

9. SMKG/BELTS switch ..... SMKG/BELTS

10. NWS switch ..... On

11. PARK/EMER BRAKE handle ..... Release

TAXI AND BEFORE TAKEOFF (ONE ENGINE)

1. Brakes and nose wheel steering ..... Check
2. Flight instruments..... Check
3. Takeoff data (V_1, V_R, V_2, and distance) ..... Check
4. Nav equipment ..... Check
5. Crew takeoff briefing ..... Complete
6. Radar/terrain ..... As required
7. Engine ..... Start
8. Generators ..... Check on line

[1] 9. ANTI-ICE panel:

a. WING switch..... ON

WING ANTI-ICE illuminates.

Anti-ice synoptic flow lines green after 2 minutes.

(1). WING SOURCE switch ..... FROM L

WING SOURCE XBLEED (S) illuminates.

(2) WING SOURCE switch..... FROM R

WING SOURCE XBLEED (S) illuminates.

NOTE

If L(R) WING ANTI-ICE FAIL (C) illuminates, it may be necessary to increase the thrust lever slightly.

(3) WING SOURCE switch..... NORM

b. WING switch ..... As desired

10. Thrust reversers:

CAUTION

Use of reverse thrust on poorly cleaned or maintained runway, taxiway, or ramp surfaces may cause foreign object damage to engine fan blades.

Deployed time of the thrust reverser should be minimized to prevent foreign object damage. It is recommended that the aircraft be headed into the wind during the thrust reverser ground operational check.

(Continued)

TAXI AND BEFORE TAKEOFF (ONE ENGINE) (Cont)

a. Thrust levers ..... REV

REV (white) EI, then REV (green) EI

b. Thrust levers ..... IDLE

REV (white) EI, then extinguishes

11. ANTI-ICE panel:

a. WING switch ..... As required

b. L AND R ENG ANTI-ICE switch ..... As required

RUNWAY LINEUP

1. L and R PROBES switches ..... On
2. L and R LANDING, N LDG/TAXI light switches ..... As required
3. STROBE switch ..... STROBE
4. CAS ..... Checked and cleared

TAKEOFF

1. Thrust levers ..... TO

At V_R:

2. Smoothly rotate toward flight director pitch guidance command. Adjust pitch as required to accelerate to a speed of not less than V_2 + 10 at 35 feet above the runway.

AFTER TAKEOFF

NOTE

If taxi and/or takeoff was on ice, snow, or slush, allow the wheels to spin down prior to gear retraction to throw off as much slush as possible.

1. LANDING GEAR switch..... UP after positive rate of climb
2. FLAPS selector..... 0 at V_2 + 15 (flaps 10); V_2 + 25 (flaps 20)
3. N LDG/TAXI light switch..... OFF
4. ANTI-ICE panel ..... As required

CLIMB

1. Thrust levers ..... CLB

10,000 ft checks:

2. SMKG/BELTS switch ..... As required
3. APU shutdown:
   a. XBLEED switch ..... Closed
   b. L BLEED switch ..... On
   c. APU BLEED switch ..... Off
   d. R BLEED switch ..... On
   e. APU switch ..... OFF
4. Pressurization ..... Check

Transition altitude (or 18,000 ft) checks:

5. Altimeters..... Set pilot, copilot, and standby, then cross-check
6. L and R LANDING light switches ..... As required

CRUISE

1. Fuel balance..... Check
2. Engine power settings for cruise..... Confirm
   Cruise tables are found in the *Flight Planning and Cruise Control Manual*.

NOTE

The VOR and FMS bearing pointers may differ by up to 7° when the VOR is being used as a waypoint.

DESCENT

1. Pressurization ..... LNDG ALT set
2. WING ANTI-ICE switch..... As required
3. L and R ENG ANTI-ICE switches ..... As required

Transition level (or FL 180) checks:

4. Altimeters..... Set pilot, copilot, and standby, and cross-check
5. L and R LANDING light switches ..... As required
6. Cabin check:
   a. Brief passengers.
   b. Seats ..... Swivel forward or aft and in outboard position. Headrests in place for occupied aft facing seats..
   c. Work tables..... Stowed
   d. Emergency exit ..... Aisle clear
7. SMKG/BELTS switch..... SMKG/BELTS
8. Fuel quantities and balance ..... Check

APPROACH

1. APU start:
   a. APU switch ..... START and release
   b. R BLEED switch ..... OFF
   c. APU BLEED switch..... ON
   d. L BLEED switch..... OFF
   e. XBLEED switch..... Open
2. Landing data (V_{REF}, V_{GA}, and distance)..... Set
3. Approach setup and crew briefing:
   a. Avionics and radios..... Set
   b. MIN..... Set
   c. Crew approach briefing ..... Complete

NOTE

When conducting a localizer backcourse approach, the TAWS WARN GS switch should be selected OFF to prevent nuisance glideslope aural warnings.

BEFORE LANDING

1. LANDING GEAR switch ..... DN
2. L LANDING, N LDG/TAXI, and R LANDING light switches ..... On
3. FLAPS selector 30

GO-AROUND

1. Autopilot ..... Disengage with the TO/GA button
2. Thrust levers ..... TO
3. FLAPS selector 10
4. LANDING GEAR switch ..... UP
5. Climb at V_{GA} or above.

NOTE

The flight director guidance only represents an initial target to rotate toward and does not guarantee that the climb speed will be achieved under all conditions.

6. When clear of obstacles, accelerate to V_{GA} + 15 and retract flaps.
7. Pressurization ..... LNDG ALT set

LANDING

1. Brakes ..... As required
2. Thrust reversers ..... As desired

   a. With nose wheel on runway, move both thrust levers to REV; a REV (white) EI illuminates.

   b. The thrust reversers are deployed when the REV (green) EI illuminates. Smoothly pull thrust levers to the desired reverse thrust.

WARNING

When landing on snow covered runways, apply reverse thrust with caution as visibility may be impaired.

   c. By 40 KIAS return the thrust levers to REV.

CAUTION

Do not use reverse thrust on poorly cleaned or poorly maintained surfaces. This may cause foreign object damage to engine fan blades.

If full reverse thrust is maintained below 40 KIAS, reingestion of exhaust gases in the engine and foreign object damage may occur.

   d. When reverse thrust is no longer required, return thrust levers to IDLE. The REV (green) EI changes to a REV (white) EI indication. Once the thrust reversers are stowed, the REV (white) EI extinguishes.

AFTER LANDING/CLEARING RUNWAY

1. Transponder ..... STBY
2. L and R PROBES switches ..... OFF
3. WING ANTI-ICE switch ..... As required
4. L and R ENG ANTI-ICE switches ..... As required
5. Lighting ..... As desired

   a. STROBE switch ..... BCN

6. FLAPS selector ..... As desired

SHUTDOWN

1. PARK/EMER BRAKE handle and chocks ..... Set

NOTE

If heavy braking was used during landing, setting the emergency/parking brake will decrease brake cooling efficiency and increase the possibility of wheel fuse plug release. Therefore, use of chocks is recommended.

Do not rely on park brake for overnight or unattended use.

If the brake toe pedals are depressed when the PARK/EMER BRAKE handle is set, the brake toe pedals should be depressed when releasing the PARK/EMER BRAKE handle. This prevents fluid transfer between the left and right hydraulic systems.

2. NWS switch..... OFF
3. L and R WSHLD/WINDOW switches..... OFF
4. EMER LTS switch ..... OFF
5. ENGINE RUN switches..... OFF
6. STROBE switch ..... OFF
7. HYDRAULIC panel:
   a, L, R PUMPS and PTU switches..... OFF
   b. R HYDRAULIC PRESS..... Verify less than 1,800 psi
   c. AUX switch..... OFF
8. GUST LOCK lever ..... ON

NOTE

It may be required to move the control wheel left and right near the neutral position to ensure lock engagement.

9. L and R COCKPIT LIGHTS..... As desired
10. APU switch ..... OFF
11. NAV lights..... OFF
12. STBY INST switch..... OFF
13. L and R BATT switches..... OFF

QUICK TURN-AROUND (NO ENGINE SHUTDOWN)

This procedure is intended for circumstances, such as training, where a landing is completed and the aircraft is taxied for another takeoff without an engine shutdown.

NOTE

Refer to the Performance chapter for landing weight limit and brake cooling time.

1. Fuel quantities and balance ..... Check
2. FMS ..... Set
3. Takeoff data (V_1, V_R, V_2, and distance) ..... Check
4. Avionics ..... Set
5. FLAPS selector ..... 10 or 20
6. Trims ..... Set STAB, AIL, and RUD for takeoff
7. Crew takeoff briefing ..... Complete
8. Radar/terrain ..... As required
9. WING ANTI-ICE switch ..... As required
10. L and R ENG ANTI-ICE switches ..... As required
11. Transponder ..... On
12. Go to Runway Lineup.

ABNORMAL PROCEDURES

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ABNORMAL PROCEDURES

INTRODUCTION

The procedures in this chapter of the manual have been developed by Bombardier, Incorporated for certification of this aircraft. This chapter contains those operating procedures requiring use of special systems and/or alternate use of regular systems that, if followed, maintain an acceptable level of airworthiness or reduce operational risk resulting from a failure condition.

The procedures in this chapter are used when a failure condition exists. Sound judgement, a thorough knowledge of the aircraft and its characteristics, and the flight manual procedures are essential in handling any failure condition.

NOTE

In all emergencies, the overriding consideration must be to accomplish the following:

- Maintain aircraft control
- Analyze the situation
- Take proper action

Terminology

Many emergencies require some urgency in landing the aircraft. The term “land as soon as practical” is defined as follows:

Land as soon as practical—Abnormal conditions are not as urgent as the procedures with “Land as soon as possible.” Althought the mission is to be terminated, the degree of the condition is such that an immediate landing at the nearest adequate airfield may not be necessary.

NOTE

The CAUTION part of this chapter contains all caution CAS (amber) messages.

AIR CONDITIONING AND PRESSURIZATION

AIR COND TEMP FAIL (C)

The automatic temperature control system has failed.

1, MAN TEMP switch ..... ON

2. COCKPIT and CABIN COLD-HOT knobs ..... As desired

AIR COND TEMP HIGH (C)

Excessive air temperature has been sensed in the cabin or cockpit air distribution duct.

1. AIR SOURCE switch ..... PACK ONLY

If airflow into cockpit/cabin stops:

2. AIR SOURCE switch ..... TRIM AIR ONLY

3. Altitude ..... 35,000 ft maximum

4. COCKPIT COLD-HOT knob (for cockpit and cabin) ..... As desired

If airflow into cockpit/cabin does not stop and if AIR COND TEMP HIGH remains displayed:

5. Descend to an altitude that safely allows unpressurized flight.

6. AIR SOURCE switch..... OFF

7. RAM AIR switch..... ON

8. EMER DEPRESS switch..... ON

AUTO PRESS FAIL (C)

The automatic pressurization modes have failed.

1. MANUAL PRESSURIZATION switch ..... ON

2. MAN RATE control..... As required

NOTE

The indicated cabin rate may be significantly higher than the commanded rate when the cabin altitude is increased in manual mode.

L (R) BLEED FAIL (C)

The affected engine bleed air valve has failed or a temperature or pressure has exceeded limits or the sensor has failed. Under certain low thrust conditions (ground idle at high field elevations or idle with single bleed on), there may be insufficient pressure to keep the bleed valve open.

1. Affected thrust lever ..... Increase

If BLEED FAIL (C) remains displayed:

2, Affected BLEED switch..... OFF

3. XBLEED switch..... Closed

If R BLEED FAIL is displayed:

4. APU BLEED switch ..... Off

If BLEED FAIL (C) does not remain displayed:

No further action required.

L (R) BLEED LOOP FAIL (C)

A failure (open or short circuit) has been detected in the bleed leak detection system.

1. Affected BLEED switch..... OFF

CABIN ALTITUDE (C)

Cabin altitude is above 8,500 feet.

1. Crew oxygen masks..... Don
2. AIR SOURCE switch..... Check NORM
3. L and R BLEED switches ..... Check On
4. CABIN ALT ..... Check

If cabin altitude continues to climb:

a. MANUAL PRESSURIZATION switch ..... ON

b. MAN RATE control..... DN, as required to maintain satisfactory pressurization

c. Descend as necessary to control cabin altitude.

If cabin altitude stabilizes at a safe altitude:

a. Continue flight.

CABIN PRESS FAULT (C)

Either the pressure sensor has failed or the cabin altitude limiter function has failed.

1. Altitude ..... 25,000 ft maximum

DITCHING NOT AVAIL (C)

The ditching switch has been selected ON with the pressurization switch in the manual mode.

1. DITCHING switch ..... Off

MANUAL DITCHING (aircraft below 15,000 feet and time permitting):

2. AIR SOURCE switch ..... Off
3. MANUAL PRESSURIZATION switch ..... Check ON
4. EMER DEPRESS switch ..... ON

When CABIN DELTA P is indicated less than 0.15 psid:

5. EMER DEPRESS switch ..... Off
6. MAN RATE control ..... Full DOWN

EQPT RACK TEMP HIGH (C)

The temperature in either equipment rack is high.

1. AIR SOURCE switch ..... NORM
2. COCKPIT COLD-HOT knob ..... Full COLD
3. Land as soon as practical.

OXYGEN QUANTITY LOW (C)

The oxygen quantity is less than 700 liters.

1. Altitude ..... 25,000 ft maximum

OXYGEN VALVE CLOSED (C)

The oxygen bottle valve is closed or there is a miscompare in the number of bottles installed and the number of bottles selected on the EPAV (electropneumatic actuating valve) unit. This message normally only occurs on the ground.

On the ground:

1. Oxygen bottle valve ..... Open

In flight:

1. Altitude ..... 25,000 ft maximum

NOTE

This CAS may occur in flight with the OXYGEN QUANTITY LOW (C) when the bottle(s) are depleted.

PACK FAIL (C)

A failure has been detected in the air conditioning PACK system.

On the ground:

1. AIR SOURCE switch..... OFF

In flight:

1. AIR SOURCE switch ..... TRIM AIR ONLY
2. L BLEED switch..... OFF
3. XBLEED switch..... Closed
4. Altitude ..... 35,000 ft maximum
5. COCKPIT COLD-HOT knob (for cockpit and cabin) ..... As desired

PACK LOOP FAIL (C)

Both bleed leak detection loops in the pack inlet ducting have failed during the power-up self test.

1. AIR SOURCE switch ..... TRIM AIR ONLY
2. Altitude ..... 35,000 ft maximum
3. COCKPIT COLD-HOT knob (for cockpit and cabin) ..... As desired

PACK TEMP HIGH (C)

An overheat has been detected in the PACK.

On the ground:

1. AIR SOURCE switch..... OFF

In flight:

1. AIR SOURCE switch ..... TRIM AIR ONLY
2. Altitude ..... 35,000 ft maximum
3. COCKPIT COLD-HOT knob (for cockpit and cabin) ..... As desired

If PACK TEMP HIGH remains on:

4. Descend to an altitude that safely allows unpressurized flight.
5. AIR SOURCE switch..... OFF
6. RAM AIR switch..... ON
7. EMER DEPRESS switch..... ON

If PACK TEMP HIGH does not remain on:

No further action required.

PAX OXYGEN AUTO FAIL (C)

The passenger oxygen system has failed to deploy with the cabin altitude greater than 15,000 feet and the pax oxygen system in AUTO. Either the pax masks have not deployed, or the pax oxygen system is not pressurized.

1. PAX OXYGEN switch..... DEPLOY

NOTE

Oxygen duration tables are in Volume 2 of this manual.

L (R) PYLON LOOP FAIL (C)

Both bleed leak detection loops in the respective pylon have failed during the power-up self test.

TRIM AIR FAIL (C)

1. AIR SOURCE switch ..... PACK ONLY
2. R BLEED switch ..... OFF
3. XBLEED switch ..... Closed
4. COCKPIT COLD-HOT knob (for cockpit and cabin) ..... As desired

TRIM AIR LOOP FAIL (C)

The bleed leak detection loops around the trim air ducting have failed.

1. AIR SOURCE switch ..... PACK ONLY
2. COCKPIT COLD-HOT knob (for cockpit and cabin) ..... As desired

XBLEED FAIL (C)

The crossbleed valve has failed.

1. XBLEED switch ..... Cycle

If XBLEED valve is failed closed:

a. Crossbleed engine starts are not possible. If necessary, conduct a windmilling start on the left engine and a windmilling or APU-assisted start on the right engine.

If XBLEED valve is failed open:

b. L or R BLEED switch ..... OFF

AUTOFLIGHT

AFCS MESSAGE FAIL (C)

Monitoring and indication of the autopilot modes may be unreliable.

1. Autopilot ..... Disconnect and do not reengage

AP HOLDING LWD (C)

AP HOLDING RWD (C)

AP HOLDING NOSE DOWN (C)

AP HOLDING NOSE UP (C)

The autopilot is holding control force in the direction indicated.

1. Flight controls..... Hold firmly

NOTE

When autopilot is disconnected in a mistrim condition, expect an abrupt change in control force.

2. Autopilot..... Use control wheel MSW switch to disconnect
3. Retrim aircraft if necessary.
4. Autopilot..... As desired

AP STAB TRIM FAIL (C)

The autopilot is unable to make a trim correction to the horizontal stabilizer.

1. Autopilot..... Use control wheel MSW switch to disconnect
2. Retrim aircraft if necessary.
3. Autopilot ..... Do not use

NOTE

AP stab trim is not available when STAB TRIM is selected to SEC.

FD MODE CHANGE (C)

1. Flight director ..... Select the desired mode

YAW DAMPER FAIL (C)

The yaw damper has failed.

1. YD..... Reengage

If YAW DAMPER FAIL remains on:

2. Autopilot..... Disconnect
3. ***Do not*** reengage yaw damper.
4. Altitude ..... 31,000 ft maximum

NOTE

Landing on a wide runway of sufficient length with minimum turbulence and crosswind is recommended.

AUTOPILOT DISCONNECT

Cavalry Charge

The autopilot system has detected a failure and disconnected.

1. Control wheel MSW switch..... Press to silence tone
2. Autopilot..... Reengage

If condition recurs:

3. Control wheel MSW switch..... Press to silence tone
4. ***Do not*** reengage autopilot.

AUXILIARY POWER UNIT

APU BLEED ALT LIMIT (C)

APU bleed air has been commanded above 20,000 feet or the APU bleed valve has modulated due to excessive EGT.

1. XBLEED switch ..... Closed
2. L BLEED switch ..... On
3. APU BLEED switch ..... Off
4. R BLEED switch ..... On

APU FUEL SOV FAIL (C)

If the APU fuel SOV has failed to close when commanded closed:

1. APU switch ..... OFF
2. XBLEED switch ..... Closed
3. L BLEED switch ..... On
4. APU BLEED switch ..... Off
5. R BLEED switch ..... On

APU OIL PRESS LOW (C)

The APU oil pressure is low while in flight.

1. XBLEED switch ..... Closed
2. L BLEED switch ..... On
3. APU BLEED switch ..... Off
4. R BLEED switch ..... On
5. APU switch ..... OFF

APU OIL TEMP HIGH (C)

The APU oil temperature is high while in flight.

1. XBLEED switch ..... Closed
2. L BLEED switch ..... On
3. APU BLEED switch ..... Off
4. R BLEED switch ..... On
5. APU switch ..... OFF

APU OVERSPEED (C)

The APU has shut down due to an overspeed.

1. XBLEED switch ..... Closed
2. L BLEED switch ..... On
3. APU BLEED switch ..... Off
4. R BLEED switch ..... On
5. APU switch ..... OFF

APU STARTER FAIL ON (C)

Power is still being supplied to the APU starter when the electronic control unit is not commanding a start.

1. APU ..... Leave operating until after landing SHUTDOWN checks in the NORMAL PROCEDURES Chapter are performed.

AVIONICS

PRIMARY FLIGHT DISPLAY (PFD) ANNUNCIATIONS

ADC 1, ADC 2—ADC REVERSION has been selected, and the indicated ADC is providing data to both PFDs.

AHS 1, AHS 2—ATT/HDG REVERSION has been selected, and the indicated AHS is providing data to all displays.

ALT—Indicates an invalid altitude source. Cross check standby instrument altitude to validate instruments; do not rely on erroneous altimeters.

AOA 1, AOA 2—One of the angle-of-attack channels is inoperative, and the displayed AOA channel is providing data to both PFDs.

ATT—Indicates there is at least a 3° split in pitch and/or roll between attitude heading computer (AHC) 1 and 2.

DCP—Indicates that the on-side display control panel has failed.

FD—Indicates a discrepancy between flight guidance system (FGS) steering commands.

GS—Indicates a discrepancy between NAV 1 and NAV 2 glideslope deviations.

HDG—Indicates a heading discrepancy of at least 6° between AHC 1 and 2.

IAS—Indicates an airspeed discrepancy of at least 10 knots between air data computer (ADC) 1 and 2.

ICE—Indicates that ice has been detected and the anti-ice systems (L and R ENG and WING) are not all on.

LOC—Indicates a discrepancy between NAV 1 and NAV 2 localizer deviations.

VSPD—Indicates a discrepancy of at least 2 knots vertical speed between flight management systems (FMS) 1 and 2.

XTLK—Indicates that communication between the PFD and the other displays is lost.

AIR DATA 1 (2) (C)

The angle-of-attack input to the ADC has failed. The affected altitude may indicate up to 150 feet low.

If the aircraft is above 29,000 feet:

1. AIR DATA REVERSION switch ..... Select operative side

NOTE

FLAPS FAULT (A), STAB TRIM FAULT (A), and L (R) ENG THRUST FAULT (A) CAS messages are displayed due to loss of one ADC input.

2. Flight guidance panel XFR switch ..... Select same side as air data reversion

If the aircraft is below 29,000 feet:

1. AIR DATA REVERSION switch ..... NORM

EFIS COMPARATOR INOP (C)

The EFIS comparator is unable to compare one or more of the following parameters: altitude, airspeed, roll attitude, pitch attitude, heading, radio altitude, flight director, localizer, or glideslope.

1. Instruments..... Cross check

NOTE

An EFIS COMPARATOR INOP may be displayed momentarily during takeoff if NAV1 and NAV2 are both tuned to the ILS.

EFIS MISCOMPARE (C)

There is a mismatch between the onside and cross-side data. Accompanied by a PFD annunciation ALT, IAS, ROL, PIT, HDG, LOC, GS, RA, or FD.

If accompanied by ALT or IAS:

1. Altitude and airspeed ..... Cross check
2. AIR DATA REVERSION switch ..... Select operative side
3. Flight guidance panel XFR switch ..... Select same side as air data reversion

If accompanied by HDG, ROL, or PIT:

1. Autopilot..... Disconnect
2. Attitude and heading ..... Cross check

NOTE

L and R WSHLD/WINDOW switches must be temporarily selected OFF while the standby compass is being read.

3. ATT/HDG REVERSION switch ..... Select operative side

If accompanied by LOC or GS:

1. Autopilot..... Disconnect
2. Localizer and glideslope ..... Cross check
3. NAV SRC button ..... Select operative side

If accompanied by RA:

1. Autopilot..... Disconnect
2. Radio altitude..... Cross check with barometric altimeter
3. Radio altimeter..... Use reliable side

If accompanied by FD:

1. Autopilot..... Disconnect
2. Flight directors ..... Cross check
3. Flight guidance panel XFR switch ..... Select operative side

L (R) IAPS FAIL (C)

The respective integrated avionics processing system has failed.

If L IAPS FAIL is displayed:

The left side of the IAPS has failed; YD, FD1, FMS1 may be inoperative. This message will always be posted with YAW DAMPER FAIL. NAV 1 tuning through the MFDs will be inoperative.

1. Autopilot ..... Disconnect
2. Flight guidance panel XFR switch ..... Select FD2
3. TUNE REVERSION switch ..... CDU ONLY

If R IAPS FAIL is displayed:

The right side of the IAPS has failed; FD2, and FMS2 (if installed) may be inoperative. NAV 2 tuning through the MFDs will be inoperative.

1. Flight guidance panel XFR switch ..... Select FD1
2. TUNE REVERSION switch ..... CDU ONLY

PFD X-TALK FAIL (C)

Communication between the PFDs has failed. REFs menu pages 1, 2, and 3 are not synchronized. The EFIS comparator is inoperative and is unable to compare one or more of the following parameters: altitude, airspeed, roll attitude, pitch attitude, heading, radio altitude, flight director, localizer, or glideslope.

1. Instruments ..... Cross check
2. Verify that the information is set (entered) on both display control panels.

AIR DATA COMPUTER (ADC) FAILURE—SINGLE

1. AIR DATA REVERSION switch ..... Select operative side

NOTE

FLAPS FAULT, STAB TRIM FAULT, L (R) ENG THRUST FAULT CAS messages are displayed due to loss of one ADC input.

2. Flight guidance panel XFR switch ..... Select same side as air data reversion

AIR DATA COMPUTER (ADC) FAILURE—DUAL

1. Maintain aircraft control by reference to the standby airspeed/Mach and altitude.
2. Operative flight director modes are PIT and ROL only.

AUDIO SYSTEM FAILURE

1, Affected audio NORM/EMER switch..... EMER

2. Affected crew member ..... Use headset

CDU FAILURE

A CDU has failed (either L or R).

1. TUNE REVERSION switch ..... MFD ONLY

DCU A AND DCU B FAILURE

DCU A and B simultaneous failure can be determined by loss of all synoptic pages, loss of all CAS messages, and loss of miscellaneous other EICAS information.

1. Autopilot..... Disconnect
2. L and R HYDRAULIC PUMP switches ..... ON
3. Land as soon as practical.

MFD FAILURE

If an MFD fails (either L or R), any information entered on the opposite MFD could be lost if the failed MFD comes back up.

1. Affected DISPLAYS REVERSION switch ..... PFD REV

or

1. TUNE REVERSION switch ..... CDU ONLY

NOTE

If more than one display has failed, it is necessary to select TUNE REVERSION switch to CDU ONLY to regain tuning capability through the CDUs.

PFD FAILURE

A PFD has failed (either L or R).

1. Affected DISPLAYS REVERSION switch ..... MFD REV

NOTE

If more than one display has failed, it is necessary to select TUNE REVERSION switch to CDU ONLY to regain tuning capability through the CDUs.

RADIO TUNING FAILURE

The ability to tune the COM radios is lost.

1. TUNE REVERSION switch ..... CDU ONLY

If unable to restore radio tuning on the failed side:

2. TUNE REVERSION switch..... NORM
3. Affected DISPLAYS REVERSION switch ..... PFD REV

If unable to restore COM tuning on at least one side:

4. TUNE REVERSION switch..... 121.5

TAWS AURALS

SINK RATE, SINK RATE

Excessive sink rate for the altitude has been detected.

1. Descent rate ..... Reduce

TERRAIN, TERRAIN or
DON'T SINK, DON'T SINK or
TOO LOW, TERRAIN or
CAUTION TERRAIN, CAUTION TERRAIN or
CAUTION OBSTACLE, CAUTION OBSTACLE

The TAWS system has detected a risk of impact from below.

1. Establish a positive rate of climb.

TOO LOW GEAR

The aircraft is too close to the ground with the landing gear UP.

If there is adequate time to extend gear:

1. GEAR switch ..... DN

If there is not adequate time to extend gear:

1. Execute a go-around.

TOO LOW FLAPS

The aircraft is too close to the ground with the flaps UP.

1. FLAPS lever 30

GLIDESLOPE

The aircraft is up to glideslope.

1. Fly aircraft up to glideslope.

CAUTION WINDSHEAR

An increasing headwind (or decreasing tailwiind) and/or severe updraft has been sensed. These are characteristics of conditions preceding an encounter with a microburst.

During final approach:

1. Add wind and gust allowances to the approach speed. Increase thrust as necessary.
2. Avoid getting low on the approach glidepath or letting the thrust levers remain at idle for extended periods of time.

During takeoff:

1. Thrust levers ..... TO
2. Airspeed ..... V_2 + 10 until safe climbout is assured

DOORS

AFT EQPT BAY DOOR (C)

The aft equipment bay door is not closed.

1. Avoid slips or skids that could open the door.

BATTERY BAY DOOR (C)

The battery bay door is not closed.

1. Avoid slips or skids that could open the door.

CARGO DOOR (C)

The cargo door is not closed.

1. SMKG/BELTS switch ..... BELTS

WARNING

Do not approach door. Door failure may be indicated by a loud noise, pressurization leak, or rumble emanating from the hatch area.

EMERGENCY EXIT (C)

The emergency exit is not closed.

1. SMKG/BELTS switch ..... BELTS

WARNING

Do not approach exit. Exit failure may be indicated by a loud noise, pressurization leak, or rumble emanating from the hatch area.

PASSENGER DOOR (C)

One or more of the passenger door proximity sensors is indicating that the passenger door may not be fully closed.

WARNING

Do not approach door. Door failure may be indicated by a loud noise, pressurization leak, or rumble emanating from the hatch area.

1. SMKG/BELTS switch ..... BELTS
2. EMER DEPRESS switch..... ON

   The cabin altitude climbs to approximately 15,000 feet and stabilizes.

3. Airspeed ..... 250 KIAS maximum
4. Establish descent to reduce cabin delta pressure but not lower than the minimum safe altitude.
5. Land as soon as possible.

NOTE

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

ELECTRICAL

APU GEN FAIL (C)

The APU generator has failed.

1. APU GEN switch..... ON

If APU GEN FAIL remains on:

2. Do not attempt a second reset of the APU GEN switch.

APU GEN OVERLOAD (C)

The APU generator load has exceeded 500 amps.

1. Electrical load..... Reduce

NOTE

Selecting L or R WSHLD/WINDOW switch OFF can result in up to an 80-amp reduction. Selecting either L or R PROBES switch OFF can result in up to a 20-amp reduction.

Selecting the CABIN AC and DC switches OFF can result in up to a 200-amp reduction.

L (R) BATT FAIL (C)

Either the affected battery contactor has failed or the battery has been automatically disconnected for overheat protection.

If L or R ESS BUS FAIL is also displayed:

1. Affected BATT switch..... OFF

If L or R ESS BUS FAIL is not displayed:

1. Affected BATT switch..... Verify OFF
2. Affected BATT temperature ..... Monitor

If BATT TEMP decreases below 60°C:

3. Applicable BATT switch ..... On

ELECTRICAL FAULT (C)

An electrical system failure has occurred that prevents the display of electrical indications.

1. Land as soon as practical.

L (R) ESS BUS FAIL (C)

The affected essential bus is not powered.

1. Land as soon as practical.

If L ESS BUS FAIL is displayed:

2. LEFT DISPLAYS REVERSION switch..... PFD REV
3. ATT/HDG REVERSION switch 2
4. AIR DATA REVERSION switch 2
5. Autopilot..... Disconnect
6. Flight guidance panel XFR switch ..... Select FD2
7. AIR SOURCE switch ..... TRIM AIR ONLY
8. L BLEED switch ..... OFF
9. XBLEED ..... Closed
10. WING SOURCE..... FROM R
11. Leave icing conditions as soon as possible.
12. Altitude ..... 25,000 ft maximum
13. If less than 60 minutes has elapsed from takeoff, operate with landing gear extended for 15 minutes prior to landing (to ensure cool brakes).
14. Final approach speed ..... V_{REF} + 10
15. Normal actual landing distance ..... Multiply by 1.75

NOTE

The STBY probe is not anti-iced.

The applicable procedures for the following CAS messages are consolidated within this procedure and do not need to be conducted separately:

L WING A/ICE FAIL (C) STALL PROTECT FAIL (C)

INBD BRAKES FAIL (C) L (R) ENGINE FAULT (A)

R ENG THRUST FAULT (A)

L ENG A/ICE FAIL ON (A)

L (R) ESS BUS FAIL (Cont)

The following equipment will be inoperative:

AIR CONDITIONING AND PRESSURIZATION
IASC 1
Left bleed leak detection
Left bleed pressure indication
Left engine BLEED valve
Left flow control valve
Pack

AUTO FLIGHT
Yaw damper

AVIONICS
Clock
L MFD
Left CDU
COM 1
NAV 1
Transponder 1
AHRS 1
ADC 1
RDC channel A
DCU channel A
Left display control panel

FIRE PROTECTION
1/2 of the fire detection system

FLIGHT CONTROLS
Left flap indication
Left stall shaker
Stall pusher

FUEL
Fuel GRAV XFLOW valve
Left fuel pump

HYDRAULICS
Left ejector pressure switch
Left hydraulic indications
Right DC and auxiliary hydraulic pumps

ICE AND RAIN PROTECTION
Left AOA vane
Left engine anti-ice
Left probes anti-ice
Left STBY static
Left wing anti-ice valve

LANDING GEAR, WHEELS, AND BRAKES
Inboard brakes

POWERPLANT
Engine sync/Mach hold
Left engine air turbine starter
Left and right thrust reverser

If R ESS BUS FAIL is displayed:

2. WING SOURCE switch ..... FROM L
3. Flight guidance panel XFR switch ..... Select FD1
4. Autopilot ..... Disconnect
5. Altitude ..... 31,000 ft maximum
6. If less than 60 minutes has elapsed from takeoff, operate with landing gear extended for 15 minutes prior to landing (to ensure cool brakes).
7. Final approach speed ..... V_{REF} + 10
8. Normal actual landing distance ..... Multiply by 1.75

L (R) ESS BUS FAIL (Cont)

NOTE

The applicable procedures for following CAS messages are consolidated within this procedure and do not need to be conducted separately:

STBY PITOT HEAT FAIL (C) R BLEED FAIL (C)

STALL PUSHER OFF (C)—Not applicable to JAA aircraft

OUTBD BRAKES FAIL (C) R ENG A/ICE FAIL ON (C)

L (R) ENGINE FAULT (A) L ENG THRUST FAULT (A)

The following equipment will be inoperative:

AIR CONDITIONING AND PRESSURIZATION

XBLEED valve
R engine bleed valve

AUTO FLIGHT

Autopilot
Yaw damper

AVIONICS

FDR

FIRE PROTECTION

Gear bay overheat detection
1/2 of the fire detection loops

FLIGHT CONTROLS

R flap indication

FUEL

Right ejector pressure switch
Right fuel pump

HYDRAULICS

Right hydraulic indications

ICE AND RAIN PROTECTION

Right engine anti-ice
Right probes anti-ice
Right wing anti-ice valve

POWERPLANT

Left and right thrust reverser
Right engine air turbine starter

L (R) GEN FAIL (C)

The affected generator has failed. If the APU generator is not on line, the BUS-TIE automatically closes and, inflight, the auxiliary buses are not powered.

If L or (R) MAIN BUS FAIL (C) is also displayed:

1. Affected GEN switch ..... OFF

If L or (R) MAIN BUS FAIL (C) is not displayed:

1. Affected GEN switch..... On

If GEN FAIL CAS remains on:

2. Do not attempt a second reset of the GEN switch.

L (R) GEN OVERLOAD (C)

The affected generator load has exceeded 500 amps.

1. Affected electrical load..... Reduce

NOTE

Selecting L or R WSHLD/WINDOW switch OFF can result in up to an 80-amp reduction. Selecting L or R PROBES switch OFF can result in up to a 20-amp reduction. Selecting the CABIN AC and DC switches OFF can result in up to a 200-amp reduction.

L (R) MAIN BUS FAIL (C)

The affected MAIN bus is not powered.

1. Land as soon as practical.

If L MAIN BUS FAIL is displayed:

2. LEFT DISPLAYS REVERSION switch ..... MFD REV

NOTE

MFD control panel does not control the MFD when reverted. Use display control panel.

3. AIR DATA REVERSION switch 2
4. Autopilot..... Disconnect
5. STAB TRIM switch ..... SEC

NOTE

The autopilot, MACH trim, and configuration trim are inoperative with SEC STAB TRIM selecteed.

L (R) MAIN BUS FAIL (Cont)

6. Airspeed ..... 0.75 M/250 KIAS maximum
7. Altitude ..... 31,000 ft maximum
8. Leave icing conditions as soon as possible.
9. Final approach speed ..... V_{REF} + 10
10. Normal actual landing distance ..... Multiply by:
    1.40 without thrust reversers
    1.30 with thrust reversers

NOTE

The applicable procedures for the following CAS messages are consolidated within this procedure and do not need to be conducted separately:

STALL PROTECT FAIL (C)

L PITOT HEAT FAIL (C)

L (R) AUX BUS OFF (A)

L (R) ENG THRUST FAULT (A)

The following equipment will be inoperative:

AIR CONDITIONING AND PRESSURIZATION
Automated oxygen deployment
IASC 1
Left bleed leak detection
Left bleed pressure indication
Left engine BLEED valve
Left flow control valve
Pack

AUTO FLIGHT
Yaw damper

AVIONICS
Avionics cooling fan
ADC 1
COM 3
CVR
DME 1
Flight director
L IAPS
HF 1
GPS 1
L PFD
TAWS
TCAS
Weather radar
Radio altimeter

FLIGHT CONTROLS
Inboard spoilers
Primary horizontal stabilizer trim
Primary rudder travel limiter
Stall pusher

HYDRAULICS
Left hydraulic indications

ICE AND RAIN PROTECTION
Left ice detector
Left pitot probe anti-ice
TAT probe anti-ice
Left windshield anti-ice
Left window anti-ice

MISCELLANEOUS
Cabin AC power
Cockpit stowage light
Pedestal lights
Pilot foot warmers
Left cockpit lights
MAP lights
Left landing light
Beacon/strobe lights
Wing inspection lights

POWERPLANT
Engine sync/Mach hold

L (R) MAIN BUS FAIL (C)

If R MAIN BUS FAIL (C) is displayed:

2. Autopilot ..... Disconnect
3. AIR SOURCE switch ..... PACK ONLY
4. R BLEED switch ..... OFF
5. XBLEED switch ..... Closed
6. WING SOURCE switch ..... FROM L
7. EMER LTS switch ..... OFF
8. Altitude ..... 25,000 ft maximum
9. Leave icing conditions as soon as possible.
10. Final approach speed ..... V_{REF} + 10
11. Normal actual landing distance ..... Multiply by:
    1.40 without thrust reversers
    1.30 with thrust reversers
12. EMER LTS switch ..... ON, when on final approach

NOTE

The applicable procedures for the following CAS messages are consolidated within this procedure and do not need to be conducted separately:

R WING A/ICE FAIL (C)

STALL PROTECT FAIL (C)

R PITOT HEAT FAIL (C)

L (R) AUX BUS OFF (A)

L (R) ENG THRUST FAULT (A)

L (R) MAIN BUS FAIL (Cont)

The following equipment will be inoperative:

AIR CONDITIONING AND PRESSURIZATION
Pressuriztion outflow valve
Trim air control
IASC 2
Right bleed leak detection
Right ECS bleed indication

AUTO FLIGHT
Autopilot
Yaw damper
Flight director 2

AVIONICS
ADC 2
AHRS 2
Right CDU
COM 2
CVR
DCU channel B
Right display control panel
DME 2
Flight director
HF 2
NAV 2
R PFD
R MFD
RDC channel B
RDC fan
Satcom
TAWS
TCAS
Transponder 2

FIRE PROTECTION
LAV smoke detector

FLIGHT CONTROLS
Outboard spoilers
Rudder pedal adjustment
Right stall shaker

FUEL
XFER valve

HYDRAULICS
Left DC pump

ICE AND RAIN PROTECTION
Right ice detector
Right AOA anti-ice
Right pitot anti-ice
Right windshield anti-ice
Right window anti-ice

MISCELLANEOUS
Cabin lights
Copilot foot warmers
Right cockpit lights
NAV lights
Nose taxi and landing lights
Right landing light
Cabin DC power

FIRE PROTECTION

APU FIRE DET FAIL (C)

The APU fire detection system has detected a failure that will not allow the detection system to indicate a fire.

1. APU shutdown:
   a. XBLEED switch ..... Closed
   b. L BLEED switch ..... On
   c. APU BLEED switch ..... Off
   d. R BLEED switch ..... On
   e. APU switch ..... OFF

CARGO SMOKE DET FAIL (C)

The baggage compartment smoke detection system has failed.

1. Doors between the cabin and the baggage compartment..... Open

L (R) FIRE DET FAIL (C)

The engine fire detection has failed.

1. Associated engine indications ..... Monitor

FIRE SYS FAULT (C)

The fire detection and extinguishing system has detected a fault.

1. FIRE DET (system test panel) ..... TEST

NOTE

Release the FIRE DET press-to-test after 3 seconds maximum or when FIRE SYS IN TEST message illuminates.

If all of the following CAS messages should come on:

L (R) ENG FIRE

APU FIRE

GEAR BAY OVHT

CARGO SMOKE

a. Continue flight.

If one of the following CAS messages should come on:

APU FIRE DET FAIL (C)

CARGO SMOKE DET FAIL (C)

L (R) FIRE DET FAIL (C)

FIREX APU SQUIB FAIL (C)

GEAR BAY DET FAIL (C)

FIREX BTL 1 (2) FAULT (A)

a. Refer to the appropriate displayed CAS message.

FIREX APU SQUIB FAIL (C)

The APU fire extinguisher squib on bottle #2 has failed (no low pressure indication).

1. APU shutdown:

   a. XBLEED switch ..... Closed

   b. L BLEED switch ..... On

   c. APU BLEED switch ..... Off

   d. R BLEED switch ..... On

   e. APU switch ..... OFF

GEAR BAY DET FAIL (C)

The gear bay overheat detection has failed.

If the CAS displays within 5 minutes of takeoff:

1, Airspeed ..... 250 KIAS maximum

2. LANDING GEAR switch ..... DN

After 5 minutes:

3. LANDING GEAR switch ..... UP

If the CAS does not display within 5 minutes of takeoff:

1, Continue flight.

FLIGHT CONTROLS

ELEVATOR SPLIT (C)

The elevator has a split of greater than 7.5°. The split may be caused by maneuvering with the elevator disconnected, if so:

1. Airspeed ..... Reduce to speed at which message clears, or 200 kts maximum, whichever is greater

NOTE

- Avoid excessive elevator input.
- Use pitch trim as necessary to minimize elevator deflection.
- Use aileron control as neccesary to stabilize the aircraft.

FLAPS FAIL (C)

The flap system has shut down due to a failure. The flaps are not resettable.

Descent checks:

1. Pressurization ..... LNDG ALT set
2. WING ANTI-ICE switch..... As required
3. L and R ENG ANTI-ICE switches ..... As required

Transition level (or FL 180) checks:

4. Altimeters ..... Set
5. L and R LANDING light switches ..... On
6. Passenger brief/cabin check ..... Complete
7. SMKG/BELTS switch..... SMKG/BELTS
8. Fuel quantities and balance ..... Check

Approach checks:

9. APU and bleeds ..... Set
10. Final approach speed..... As listed for flaps attained:

    Flaps 0..... V_{REF} + 20

    Flaps 10..... V_{REF} + 15

    Flaps 20..... V_{REF} + 5

    Flaps 30..... V_{REF}

FLAPS FAIL (Cont)

NOTE

Use the lesser flap deflection V_{REF} speed increment and distance factor for flap settings between the detent values.

11. Normal actual landing distance ..... Multiply by:

    Without thrust reversers:

    Flaps 0 ..... 1.45

    Flaps 10 ..... 1.35

    Flaps 20 ..... 1.25

    With thrust reversers:

    Flaps 0 ..... 1.40

    Flaps 10 ..... 1.30

    Flaps 20 ..... 1.20

12. FLAPS TAWS WARN switch ..... OFF

13. Approach setup and crew briefing ..... Complete

    a. Avionics and radios ..... Set

    b. MIN ..... Set

    c. Crew approach briefing ..... Complete

14. L and R HYDRAULIC PUMP switches ..... On

Before landing checks:

15. LANDING GEAR switch ..... DN

16. L LANDING, N LDG/TAXI, and R LANDING light switches ..... On

NOTE

A higher than normal nose-up pitch attitude is required with partial flaps.

The aircraft may tend to float or balloon if over-rotated on flare with lesser flap deflections.

Use of thrust reversers is recommended.

FLAPS FAULT (C)

The flaps are operating in a degraded mode. The fault may be resettable in some conditions by movement of the flap selector handle.

1. Airspeed ..... Decrease

2. FLAPS ..... Select the previous detent, then select a detent to agree with the closest flap position.

NOTE

Trying to reset the flaps with the flap handle three times results in a FLAPS FAIL (C) if the condition has not cleared. Ensure that all hydraulics are operating prior to resetting flaps the third time.

If FLAPS FAULT message clears:

No further action required.

If FLAPS FAULT message illuminates:

3. ALTN FLAPS switch..... ON

4. FLAPS selector..... Select the previous detent, then select a detent to agree with the closest flap position.

If FLAPS FAULT message remains:

5. Refer to Flaps Fail procedure in this chapter.

FLAPS NORM PRESS LOW (C)

The flaps normal hydraulic pressure is low. This is accompanied by a FLAPS FAULT message. Alternate pressure may be available:

1. ALTN FLAPS switch..... ON

   FLAPS RATE LOW displayed.

2. FLAPS selector..... As desired

FLT SPOILERS DEPLOY (C)

The flight spoilers are deployed below 500 feet, or the flight spoilers are deployed and the thrust levers are at CLB or above.

1. FLIGHT SPOILERS lever ..... RET

FLT SPOILERS FAIL (C)

The flight spoilers have failed.

1. Altitude ..... 41,000 ft maximum
2. Normal actual landing distance ..... Multiply by:
   1.25 without thrust reversers
   1.15 with thrust reversers

FLT SPOILERS FAULT (C)

Either the inboard or outboard flight spoilers have failed.

1. Altitude ..... 41,000 ft maximum
2. Normal actual landing distance ..... Multiply by:
   1.25 without thrust reversers
   1.15 with thrust reversers

GND SPLRS NOT ARMED (C)

The ground spoilers are not armed and not selected OFF.

1. GROUND SPOILERS switch..... MANUAL ARM

If GND SPLRS NOT ARMED remains on:

2. Normal actual landing distance ..... Multiply by:
   1.60 without thrust reversers
   1.50 with thrust reversers

After touchdown:

3. FLIGHT SPOILERS lever ..... EMER

GND SPOILERS FAIL (C)

The ground spoilers have failed.

1. GROUND SPOILERS switch ..... OFF
2. Normal actual landing distance ..... Multiply by:
   1.60 without thrust reversers
   1.50 with thrust reversers

After touchdown:

3. FLIGHT SPOILERS lever ..... EMER

MACH TRIM FAIL (C)

The Mach trim has failed. This message may also be displayed when the STAB TRIM switch is set of OFF or SEC.

1. Airspeed

   With AP engaged ..... M_{MO}/V_{MO} maximum

   With AP disengaged ..... 0.75 MI/250 KIAS maximum

PRI STAB TRIM FAIL (C)

The primary stabilizer trim has failed. Mach trim and flap and spoiler configuration trim will be inoperative.

1. STAB TRIM switch ..... SEC

NOTE

The autopilot, Mach trim, and configuration trim are inoperative with SEC STAB TRIM selected.

2. Control wheel trim switch ..... Operate as required to maintain trim
3. Airspeed ..... 0.75 MI/250 KIAS maximum

If stab trim is operative both directions: No further action.

If stab trim is inoperative in at least one direction:

4. STAB TRIM switch ..... OFF

   If elevator PULL force is encountered (stabilizer jams during high speed condition):

   a. Delay reducing airspeed as long as possible to minimize the time out of trim.

PRI STAB TRIM FAIL (Cont)

b. Move center of gravity aft if possible.

c. Continue to Descent checks (Step e).

If elevator PUSH force is encountered:

a. Do not increase airspeed to minimize the out-of-trim conditions.

b. Move center of gravity forward if possible.

c. Land as soon as possible to minimize center-of-gravity movement.

d. Continue to Descent checks.

Descent checks:

e. Pressurization ..... LNDG ALT set

f WING-ANTI-ICE switch ..... As required

g. L and R ENG ANTI-ICE switches ..... As required

Transition level (or FL 180) checks:

h. Altimeters ..... Set

i. L and R LANDING light switches ..... On

j. Cabin check:

(1) Brief passengers.

(2) Seats ..... Swivel forward or aft and in outboard position. Headrests in place for occupied aft facing seats.

(3) Work tables ..... Stowed

(4) Emergency exit ..... Aisle clear

k. SMKG/BELTS switch ..... SMKG/BELTS

l. Fuel quantities and balance ..... Check

PRI STAB TRIM FAIL (Cont)

Approach checks:

l. APU and bleeds:

(1) APU switch ..... START and Release

(2) R BLEED switch ..... OFF

(3) APU BLEED switch ..... ON

(4) L BLEED switch ..... OFF

(5) XBLEED switch ..... Open

m. Final approach speed ..... V_{REF}

n. Normal actual landing distance ..... Multiply by:
1.15 without thrust reversers
1.10 with thrust reversers

o. Approach setup and crew briefing:

(1) Avionics and radios ..... Set

(2) MIN ..... Set

(3) Crew approach briefing ..... Complete

Before landing checks

p. LANDING GEAR switch ..... DN

q. L LANDING, N LDG/TAXI,
and R LANDING light switches ..... On

r. FLAPS 30

ROLL SPOILERS FAIL (C)

The roll assist function has failed, but flight and ground spoilers have not. Roll control forces will be higher.

1. Final approach speed ..... V_{REF} + 5
2. Normal actual landing distance ..... Multiply by:
   1.20 without thrust reversers
   1.15 with thrust reversers

NOTE

Landing on a wide runway of sufficient length with minimum turbulence and crosswind is recommended.

ROLL SPOILERS FAULT (C)

Either the inboard or outboard roll spoilers have failed. Roll control forces will be higher.

1. Normal actual landing distance ..... Multiply by:
   1.15 without thrust reversers
   1.10 with thrust reversers

NOTE

Landing on a wide runway of sufficient length with minimum turbulence and crosswind is recommended.

ROLL SPOILERS OFF (C)

The roll spoilers have been turned off with the ROLL DISC not activated.

1. ROLL SPOILER switch ..... On

RUDDER LIMITER FAIL (C)

The rudder limiter has failed.

1. Avoid excessive rudder inputs.
2. Airspeed..... 185 KIAS Maximum

NOTE

Landing on a wide runway of sufficient length with minimum turbulence and crosswind is recommended.

SEC STAB TRIM FAIL (C)

The secondary stabilizer trim has failed. This message should not be displayed unless the primary stabilizer trim has already failed. This message may be displayed momentarily when moving the STAB TRIM switch.

If PRI STAB TRIM FAIL is displayed:

1. Refer to Pri Stab Fail procedure this chapter.

If PRI STAB TRIM FAIL is not displayed:

1. STAB TRIM switch..... PRI

SPOILERS FAIL (C)

The spoilers have failed. If the spoilers were deployed, they will retract down to a float position. The spoilers do not float up. A STAB TRIM FAULT message is also displayed due to the loss of spoilers configuration trim.

1. FLIGHT SPOILERS lever..... RET
2. Altitude..... 41,000 ft Maximum
3. Final approach speed ..... V_{REF} + 5
4. Normal actual landing distance ..... Multiply by:
   1.65 without thrust reversers
   1.45 with thrust reversers

NOTE

Landing on a wide runway of sufficient length with minimum turbulence and crosswind is recommended.

SPOILERS FAULT (C)

One or more of the spoiler panels has failed or one or more of the ground spoilers is up prior to touchdown. A STAB TRIM FAULT message is also displayed due to the loss of spoilers configuration trim.

1. Altitude ..... 41,000 ft Maximum

If any spoiler panel is jammed in an extended position:

2. Autopilot ..... Disconnect
3. Aileron trim ..... As Required to Minimize Roll Force
4. Land as soon as possible.
5. Final aproach speed ..... V_{REF} + 8
6. Normal actual landing distance ..... Multiply by:
   1.35 without thrust reversers
   1.30 with thrust reversers

NOTE

Landing on a wide runway of sufficient length with minimum turbulence and crosswind is recommended.

If no spoiler panel is jammed in an extended position:

2. Normal actual landing distance ..... Multiply by:
   1.25 without thrust reversers
   1.15 with thrust reversers

NOTE

Landing on a wide runway of sufficient length with minimum turbulence and crosswind is recommended.

STALL PROTECT FAIL (C)

The stall protection system has a failure in either channel A or B, or the pusher or AOA sensor has failed, or a miscompare has been detected between essential inputs or essential inputs are unavailable.

1. STALL PUSHER switch ..... OFF
2. Final approach speed ..... V_{REF} + 10
3. Normal actual landing distance ..... Multiply by:
   1.25 without thrust reversers
   1.20 with thrust reversers

NOTE

An AOA 1 or AOA 2 flag may be posted on the PFD indicating the common source for the low speed awareness cue. If an AOA flag is posted on the PFD, the low speed awareness cue is removed.

*STALL PUSHER OFF (C)

*(Not applicable to JAA aircraft)

The control wheel master switch (MSW) button has been depressed for at least 10 seconds, or a stall protection system failure has occurred that has inhibited operation of the stall pusher.

1. MSW disconnect button ..... Release

If STALL PUSHER OFF remains on:

2. Final approach speed ..... V_{REF} + 10
3. Normal actual landing distance ..... Multiply by:
   1.25 without thrust reversers
   1.20 with thrust reversers

If STALL PUSHER OFF does not remain on.

No further action.

FLIGHT SPOILER LEVER JAM

1, Altitude ..... 41,000 ft Maximum

If the spoiler lever is jammed in an extended position:

a. Final approach speed ..... V_{REF} + 8

b. Normal actual landing distance ..... Multiply by:
   1.25 without thrust reversers
   1.20 with thrust reversers

FUEL

L (R) FUEL COLLECTOR LOW (C)

The fuel collector tank quantity is less than 200 pounds. This message may also illuminate for several seconds after an engine start when the wing fuel quantity is less than 2,000 pounds.

1. Affected FUEL PUMP switch ..... ON
2. Sideslip..... Minimize
3. Land as soon as possible.

FUEL IMBALANCE (C)

The wing fuel imbalance is greater than:

- 250 lb (113 kg) with a total fuel weight of more than 13,700 lb (6,214 kg)
- 315 lb (143 kg) with a total fuel weight between 13,700 lb (6,214 kg) and 10,000 lb (4,536 kg)
- 450 lb (204 kg) with a total fuel weight between 10,000 lb (4,536 kg) and 4,700 lb (2,132 kg)
- 600 lb (272 kg) with a total fuel weight of less than 4,700 lb (2,132 kg)

If the right engine is shut down, it will be necessary to select the R FUEL PUMP OFF to be able to transfer fuel from left to right.

1. Fuel quantities ..... Check

CAUTION

Do not taxi until imbalance is rectified.

Do not land until imbalance is rectified unless a greater emergency exists.

Correct fuel distribution, if required:

2. FUEL XFER switch..... Open
3. L or R FUEL PUMP switch (heavy wing) ..... ON
4. Monitor fuel wing quantity.

When fuel balance is achieved:

5. L or R FUEL PUMP switch ..... AUTO
6 FUEL XFER switch ..... Close

L (R) FUEL PRESSURE LOW (C)

The engine fuel pressure is below 6 psig.

1. Affected FUEL PUMP switch ..... ON

If FUEL PRESS LOW CAS remains on:

2. Affected thrust lever ..... Reduce to minimum practical setting
3. Maintain 28,000 feet or below to enable suction feed.

L (R) FUEL PUMP FAIL (C)

The respective electric fuel pump has failed.

To balance fuel (if required):

1. GRAVITY XFLOW switch ..... Open

NOTE

It may be necessary to use a sideslip to transfer fuel.

FUEL QUANTITY FAIL (C)

Both channels of the fuel quantity gauging computer have failed. Fuel quantities will be indicated as magenta dashes on the EICAS.

1. Monitor fuel quantity on the FMS.

FUEL QUANTITY LOW (C)

The fuel quantity is 500 lb (227 kg) or less in either wing when the aircraft is in unaccelerated level flight.

1. Fuel quantities ..... Check
2. L and R FUEL PUMP switches ..... ON
3. Land as soon as possible. A go-around is not recommended.

WING FUEL TEMP LOW (C)

The fuel temperature in the wing is below –38°C (–36°F).

1. Descend to a warmer ambient temperature.

HYDRAULICS

AUX HYD TEMP HIGH (C)

The auxiliary hydraulic system fluid temperature is greater than 135°C.

1. AUX HYDRAULIC PUMP switch..... OFF

If temperature continues to rise:

2. AUX DC PUMP circuit breaker (CB1 D10)..... Pull
3. Land as soon as practical.

L (R) HYD PRESS LOW (C)

The affected hydraulic system pressure is less than 1,800 psi.

1. Affected HYDRAULIC PUMP switch..... ON
2. HYDRAULIC pressure and quantity ..... Monitor

   If quantity is dropping rapidly:

   a. Autopilot ..... Disconnect

   b. Affected HYDRAULIC PUMP switch..... OFF

   c. Affected HYDRAULIC SOV switch..... CLOSED
3. Altitude..... 41,000 ft Maximum
4. Land as soon as practical.

Descent checks:

1. Pressurization ..... LNDG ALT set
2. WING ANTI-ICE switch..... As required
3. L and R ENG ANTI-ICE switches ..... As required

Transition level (or FL 180) checks:

4. Altimeters ..... Set
5. L and R LANDING light switches ..... On
6. Cabin check:

   a. Brief passengers.

   b. Seats ..... Swivel forward or aft and in outboard position. Headrests in place for occupied aft facing seats.

L (R) HYD PRESS LOW (Cont)

c. Work tables ..... Stowed

d. Emergency exit ..... Aisle Clear

7. SMKG/BELTS switch ..... SMKG/BELTS

8. Fuel quantities and balance ..... Check

Approach checks:

9. APU and bleeds:

a. APU switch ..... START and release

b. R BLEED switch ..... OFF

c. APU BLEED switch ..... ON

d. L BLEED switch ..... OFF

e. XBLEED switch ..... Open

If L HYD PRESS LOW is displayed:

The following conditions exist:

- Pitch feel forces reduced by 40%
- Inboard MFS and ground spoilers may be inoperative
- Inboard brakes supplied by the accumulator only
- Left thrust reverser inoperative
- ALTN FLAPS inoperative
- Normal landing gear operation unavailable
- Nosewheel steering inoperative

10. Final approach speed ..... V_{REF}

11. Normal actual landing distance ..... Multiply by:
1.40 without thrust reversers
1.35 with thrust reversers

12. Approach setup and crew briefing:

a. Avionics and radios ..... Set

b. MIN ..... Set

c. Crew approach briefing ..... Complete

L (R) HYD PRESS LOW (Cont)

Before landing checks:

13. LANDING GEAR switch ..... DN

14. LG PULL handle ..... Pull

NOTE

Performing a sideslip to each side may help achieve MLG downlock. Increased airspeed may be required to ensure downlock during sideslip.

15. GEAR indication ..... Check for three green DN indications

CAUTION

Do not stow the handle until the gear pins are installed.

16. L LANDING, N LDG/TAXI, and R LANDING light switches ..... On

17. FLAPS 30

18. NWS switch ..... OFF, maintain directional control using differential braking

After touchdown:

19. Limit reverse thrust on the right side as required to maintain directional control.

NOTE

Do not deploy the left thrust reverser.

An INBD BRAKE PRESS LO message may illuminate during the stop. The brake accumulator depletes at a faster rate if the brake pedals are cycled during the stop.

If R HYD PRESS LOW is displayed:

The following conditions exist:

- Pitch feel forces reduced by 40%
- Outboard MFS and ground spoilers may be inoperative
- Outboard brakes supplied by the accumulator only
- Normal flaps inoperative
- Right thrust reverser inoperative

10. Final approach speed ..... V_{REF}

L (R) HYD PRESS LOW (Cont)

11. Normal actual landing distance ..... Multiply by:
    1.40 without thrust reversers
    1.35 with thrust reversers
12. ALTN FLAPS ..... ON
13. Approach setup and crew briefing:
    a. Avionics and radios ..... Set
    b. MIN ..... Set
    c. Crew approach briefing ..... Complete

Before landing checks:

14. LANDING GEAR switch ..... DN
15. L LANDING, N LDG/TAXI, and R LANDING light switches ..... On
16. FLAPS selector 30

NOTE

An OUTBD BRAKE PRESS LO message may illuminate during the stop. The brake accumulator depletes at a faster rate if the brake pedals are cycled during the stop.

After touchdown:

17. Limit reverse thrust on the left side as required to maintain directional control.

NOTE

Do not deploy the right thrust reverser.

HYD PTU FAIL (C)

The power transfer unit is not producing pressure when it should be.

1. Hydraulic quantity for both systems ..... Check

   If quantities are normal:

   a. PTU switch ..... ON

   If either quantity goes low or the message persists:

   a. PTU switch ..... OFF

L (R) HYD SOV FAIL (C)

The respective hydraulic shutoff valve did not close when one of the following occurred:

- The respective ENG FIRE switch was pressed
- The respective HYDRAULIC SOV switch was selected CLOSED
- The automatic overtemp closure was commanded

The respective hydraulic SOV is CLOSED when it should be open

1. Affected HYDRAULIC SOV switch ..... Check proper position

L (R) HYD TEMP HIGH (C)

The respective hydraulic system temperature is above 100°C.

1. Affected HYDRAULIC PUMP switch ..... OFF
2. Affected HYDRAULIC temperature..... Monitor

If hydraulic temperature reaches 135°C:

3. Autopilot..... Disconnect
4. Affected HYDRAULIC SOV switch ..... CLOSED.
   the associated HYD PRESS LOW (C) is displayed.

NOTE

The hydraulic SOV should automatically close at approximately 135°C.

5. Altitude ..... 41,000 ft maximum
6. Land as soon as practical.

If hydraulic temperature reaches 155°C:

a. Affected engine RUN switch ..... OFF

b. Rudder trim..... As required

c. Applicable BLEED switch..... OFF

d. XBLEED switch..... Open

e. Applicable ENGINE ANTI-ICE switch ..... Off

f. Fuel balance ..... Monitor

g. Go to Step 7.

L (R) HYD TEMP HIGH (Cont)

Descent checks:

7. Pressurization ..... LNDG ALT set
8. WING ANTI-ICE switch..... As required
9. L and R ENG ANTI-ICE switches ..... As required

Transition level (or FL 180) checks:

10. Altimeters ..... Set
11. L and R LANDING light switches ..... On
12. Passenger brief/cabin check ..... Complete
13. SMKG/BELTS switch..... SMKG/BELTS
14. Fuel quantities and balance ..... Check

Approach checks:

15. APU and bleeds:
    a. APU switch ..... START and release
    b. R BLEED switch ..... OFF
    c. APU BLEED switch..... ON
    d. L BLEED switch..... OFF
    e. XBLEED switch..... Open

If L HYD PRESS LOW is displayed:

The following conditions exist:

- Pitch feel forces reduced by 40%
- Inboard MFS and ground spoilers may be inoperative
- Inboard brakes supplied by the accumulator only
- Left thrust reverser inoperative
- ALTN FLAPS inoperative
- Normal landing gear operation unavailable
- Nosewheel steering inoperative

16. Final approach speed ..... V_{REF}
17. Normal actual landing distance ..... Multiply by:
    1.40 without thrust reversers
    1.35 with thrust reversers

L (R) HYD TEMP HIGH (Cont)

18. Approach setup and crew briefing:
    a. Avionics and radios ..... Set
    b. MIN .....Set
    c. Crew approach briefing ..... Complete

Before landing checks:

19. LANDING GEAR switch ..... DN

20. LG PULL handle ..... Pull

NOTE

Performing a sideslip to each side may help achieve MLG downlock. Increased airspeed may be required to ensure downlock during sideslip.

21. GEAR indication ..... Check for three green DN indications

CAUTION

Do not stow the handle until the gear pins are installed.

22. L LANDING, N LDG/TAXI, and R LANDING light switches ..... On

23. FLAPS 30

24. NWS switch..... OFF, maintain directional control using differential braking

After touchdown:

25. Limit reverse thrust on the right side as required to maintain directional control.

NOTE

Do not deploy the left thrust reverser.

An INBD BRAKE PRESS LO message may illuminate during the stop. The brake accumulator depletes at a faster rate if the brake pedals are cycled during the stop.

L (R) HYD TEMP HIGH (Cont)

If R HYD PRESS LOW is displayed:

The following conditions exist:

- Pitch feel forces reduced by 40%
- Outboard MFS and ground spoilers may be inoperative
- Outboard brakes supplied by the accumulator only
- Normal flaps inoperative
- Right thrust reverser inoperative

16. Final approach speed ..... V_{REF}

17. Normal actual landing distance ..... Multiply by:
    1.40 without thrust reversers
    1.35 with thrust reverser

18. ALTN FLAPS ..... ON

19. Approach setup and crew briefing:

    a. Avionics and radios ..... Set

    b. MIN ..... Set

    c. Crew approach briefing ..... Complete

Before landing checks:

20. LANDING GEAR switch ..... DN

21. L LANDING, N LDG/TAXI,
    and R LANDING light switches ..... On

22. FLAPS selector 30

NOTE

An OUTBD BRAKE PRESS LO message may illuminate during the stop. The brake accumulator depletes at a faster rate if the brake pedals are cycled during the stop.

After touchdown:

23. Limit reverse thrust on the left side as required to maintain directional control.

NOTE

Do not deploy the right thrust reverser.

ICE AND RAIN PROTECTION

L (R) AOA VANE HEAT FAIL (C)

The respective angle-of-attack vane heater has failed.

1. Affected PROBES switch ..... OFF, then On

If AOA VANE HEAT FAIL remains displayed:

a. Leave icing conditions as soon as possible.

If icing is encountered:

b. STALL PUSHER switch ..... OFF

c. Final approach speed ..... V_{REF} + 10

d. Normal actual landing distance ..... Multiply by:
1.25 without thrust reversers
1.20 with thrust reversers

NOTE

Respective stall warning stick shaker and low speed cue may be unreliable in icing conditions.

ICE DETECTED (C)

Ice has been detected and both the engine and wing anti-ice systems are not selected on.

1. WING ANTI-ICE switch ..... ON
2. L and R ENG ANTI-ICE switches ..... ON

ICE DETECTOR FAIL (C)

Both ice detectors have failed.

If in visible moisture or at night and SAT is +10°C to –40°C:

1. WING ANTI-ICE switch ..... ON
2. L and R ENG ANTI-ICE switches ..... ON

L (R) ENG ANTI-ICE FAIL (C)

Bleed air pressure to the respective nacelle is too low for effective anti-icing, or the electrically heated T_2 heater has failed when the respective L or R ENG ANTI-ICE switch is ON.

1. ANTI-ICE synoptic ..... Check

If affected engine anti-ice flow line is amber:

2. IGNITION switch ..... ON
3. Engine N_1 ..... Increase to improve airflow

If ENG ANTI-ICE FAIL remains on:

a. Leave icing conditions as soon as possible.

If an amber T_2 is displayed next to the engine graphic:

2. Leave icing conditions as soon as possible.

L (R) PITOT HEAT FAIL (C)

The respective pitot mast or base heater has failed.

1. Affected PROBES switch ..... OFF, then On

If PITOT HEAT FAIL remains displayed:

a. Cross check the three pitot-static systems.

If L PITOT HEAT FAIL is displayed and accompanied by erroneous pitot-static indications:

(1) AIR DATA reversion switch ..... Select 2

If R PITOT HEAT FAIL is displayed and accompanied by erroneous pitot-static indications:

(1) AIR DATA reversion switch ..... Select 1

If PITOT HEAT FAIL does not remain displayed:

No further action

L (R) PROBE HEAT OFF (C)

Probe heat is off.

In flight

1. Affected PROBES switch ..... On

STBY PITOT HEAT FAIL (C)

The standby pitot heater has failed.

1. L PROBES switch ..... OFF, then On

If STBY PITOT HEAT FAIL remains on:

a. Use the pilot and copilot airspeed/Mach indicators. Do not use the standby instrument.

NOTE

In icing conditions, the STALL PROTECTION FAIL may occur due to erroneous standby instrument Mach number. Only the stall pusher is inoperative; all the other stall warning indications are operational.

If STBY PITOT HEAT FAIL does not remain on:

No further action

L (R) STBY STAT HT FAIL (C)

The respective standby static heater has failed.

1. Affected PROBES switch ..... OFF, then On

If STBY STAT HT FAIL remains on:

a. Use the pilot and copilot airspeed/Mach indicators. Do not use the standby instrument.

NOTE

In icing conditions, the STALL PROTECTION FAIL may occur due to erroneous standby instrument Mach number. Only the stall pusher is inoperative; all the other stall warning indications are operational.

If STBY STAT HT FAIL does not remain on:

No further action

L (R) WINDOW HEAT FAIL (C)

The respective window heat has failed and the temperature is too low or too high. A failure may also be indicated by the formation of condensation (fog) on the window.

1. Affected WSHLD/WINDOW switch ..... OFF, then On

NOTE

Descent into conditions with a small split between the temperature and dewpoint may result in interior window condensation (fogging).

If either WSHLD/WINDOW switch is OFF or inoperative, circling approaches are not recommended in icing or fogging conditons.

Moving the COCKPIT and CABIN COLD-HOT knobs to HOT may help reduce fogging.

L (R) WING A/I PRESS HI (C)

High pressure has been sensed in the wing anti-ice system.

1. WING SOURCE switch ..... Select FROM L or FROM R as required
2. AUTO SYNC switch ..... OFF

If WING A/I PRESS HI remains displayed:

a. WING ANTI-ICE switch ..... Off

b. Leave icing conditions as soon as possible.

If approach and landing must be made with any ice or suspected ice:

(1) Refer to Wing Anti-Ice Failure Landing prcedure in this chapter.

If WING A/I PRESS HI does not remain displayed:

No further action

L (R) WING A/ICE FAIL (C)

1. Anti-ice synoptic ..... Check

If affected anti-ice flow line is amber:

a. Affected thrust lever ..... Increase to 74% N_2 minimum

If WING A/ICE FAIL extinguishes:

No further action

If both L WING A/ICE FAIL and R WING A/ICE FAIL are ON:

(1) WING ANTI-ICE switch ..... Off

(2) Leave icing conditions as soon as possible.

(3) Refer to Wing Anti-Ice Failure Landing prcedure in this chapter.

If either L WING A/ICE FAIL or R WING A/ICE FAIL is on:

b. WING SOURCE switch ..... Select FROM L or FROM R as required

c. AUTO SYNC switch ..... OFF

d. Affected thrust lever ..... Increase to 74% N_2 minimum

If WING A/ICE FAIL remains displayed:

(1) WING ANTI-ICE switch ..... Off

(2) Leave icing conditions as soon as possible.

(3) Refer to Wing Anti-Ice Failure Landing prcedure in this chapter.

If WING A/ICE FAIL does not remain displayed:

No further action

WING A/ICE LOOP FAIL (C)

Both wing anti-ice leak detect sensor loops have failed. This is only checked during power-up self-test.

1. Do not take off.

WING ANTI-ICE FAULT (C)

One outboard wing leading edge sensor has failed.

1. Leave icing conditions as soon as possible.

When out of icing:

2. WING ANTI-ICE switch ..... Off

L (R) WSHLD HEAT FAIL (C)

The respective windshield heat has failed and the temperature is too low or too high. A failure may also be indicated by the formation of ice or condensation (fog) on the windshield.

1. Affected WSHLD/WINDOW switch ..... OFF, then On

If WSHLD HEAT FAIL remains on:

a. Leave icing conditions as soon as possible.

b. Moving the COCKPIT and CABIN COLD-HOT knobs to HOT may help reduce fogging.

CRACKED, SHATTERED, DELAMINATED, OR ARCING WINDSHIELD OR WINDOW

1. Affected WSHLD/WINDOW switch..... OFF
2. Cabin differential pressure ..... Reduce to 5.8 maximum
3. Altitude ..... 15,000 ft maximum
4. Leave icing conditions as soon as possible.
5. Moving the COCKPIT and CABIN COLD-HOT knobs to HOT may help reduce fogging.

If core or inside plies are shattered:

6. Airspeed ..... 205 KIAS maximum below 8,000 ft

LANDING GEAR, WHEEL, AND BRAKE SYSTEM

CPLT BRAKE FAULT (C)

One or more of the copilot brake pedal sensors (LVDTs) has failed.

1. Use the pilot brakes.

GEAR DISAGREE (C)

The gear position and the LANDING GEAR switch position do not match after a delay of up to 28 seconds.

1. Airspeed ..... 250 KIAS maximum
2. LANDING GEAR switch..... DN

If GEAR DISAGREE remains with the landing gear selected down:

3. LG PULL handle..... Pull

NOTE

Performing a sideslip to each side may help achieve MLG downlock. Increased airspeed may be required to ensure downlock during slideslip.

4. GEAR indication ..... Check for three green DN indications

If all landing gear are down (three DN indications):

5. Land as soon as practical.

CAUTION

Do not stow the handle until the gear pins are installed.

If any landing gear is not down:

5. Refer to the Landing Gear UP/Unsafe Landing procedure, Emergency Procedures chapter.

GEAR SYS FAIL (C)

This indicates a complete failure of the gear control or the loss of the ARINC 429 signal from both channels. There is a potential for the loss of gear, door, and/or spoiler indications.

1. Airspeed ..... 250 KIAS maximum

2. LANDING GEAR switch..... DN

If all landing gear are down (three DN indications):

3. Land as soon as practical.

If any landing gear is not down:

3. LG PULL handle..... Pull

NOTE

Performing a sideslip to each side may help achieve MLG downlock. Increased airspeed may be required to ensure downlock during slideslip.

4, GEAR indication ..... Check for three green DN indications

If all landing gear are down (three DN indications):

5. Land as soon as practical.

CAUTION

Do not stow the handle until the gear pins are installed.

If any landing gear is not down:

5. Refer to the Landing Gear UP/Unsafe Landing procedure, Emergency Procedures chapter.

L (R) INBD BRAKE FAIL (C)

The respective (left or right but not both) inboard normal system brake has failed.

1. Normal actual landing distance ..... Multiply by:
   1.35 without thrust reversers
   1.45 with thrust reversers

NOTE

Expect a pull opposite the failed brake.

If heavy braking is used, the affected brake may lock up below 30 knots.

INBD BRAKE PRESS LO (C)

The INBD brake accumulator pressure is less than 1,400 psi.

1. If less than 60 minutes has elapsed from takeoff, operate with landing gear extended for 15 minutes prior to landing (to ensure cool brakes).
2. Normal actual landing distance ..... Multiply by:
   1.60 without thrust reversers
   1.45 with thrust reversers

NOTE

Use steady brake application. Do not cycle the brakes.

Maximize the use of thrust reversers.

INBD BRAKES FAIL (C)

Both inboard normal system brakes have failed.

1. Pilot or copilot brake pedals..... Fully apply
2. Pilot or copilot brake pedals..... Release

If NORM BRAKES FAIL (W) is displayed with brake pedals applied:

3. Refer to NORM BRAKES FAIL procedure, Emergency section.

If NORM BRAKES FAIL (W) is not displayed with brake pedals applied:

3. If less than 60 minutes has elapsed from takeoff, operate with landing gear extended for 15 minutes prior to landing (to ensure cool brakes).
4. Normal actual landing distance ..... Multiply by:
   1.60 without thrust reversers
   1.45 with thrust reversers

NOSE GEAR DOOR (C)

1. Airspeed ..... 250 KIAS maximum
2. Land as soon as practical.

NWS FAIL (C)

The nose wheel steering system has failed. In the event the nose wheel steering system malfunctions, internal monitors should disconnect the system allowing the nose wheels to castor.

At normal taxi speeds:

1. Maintain directional control using differential braking.
2. NWS switch ..... OFF
3. Thrust levers ..... IDLE
4. Brake to a stop.

NWS FAIL (C) (Cont)

In flight:

1. NWS switch ..... OFF

NOTE

Select the longest runway available with minimum turbulence and crosswind.

2. Maintain directional control using differential braking on landing.

NWS LIMIT EXCEEDED (C)

The nose wheel steering turning limit has been exceeded. There may be damage to the NLG feedback link.

1. Do not take off.

L (R) OUTBD BRAKE FAIL (C)

The respective (left or right but not both) outboard normal system brake has failed.

1. Normal actual landing distance ..... Multiply by:
   1.35 without thrust reversers
   1.25 with thrust reversers

NOTE

Expect a pull opposite the failed brake.

If heavy braking is used, the affected brake may lock up below 30 knots.

OUTBD BRAKE PRESS LO (C)

The OUTBD brake accumulator pressure is less than 1,400 psi.

1. If less than 60 minutes has elapsed from takeoff, operate with landing gear extended for 15 minutes prior to landing (to ensure cool brakes).

2. Normal actual landing distance ..... Multiply by:
   1.60 without thrust reversers
   1.45 with thrust reversers

NOTE

Use steady brake application. Do not cycle the brakes.

Maximize the use of thrust reversers.

OUTBD BRAKE FAIL (C)

Left and right outboard normal system brakes have failed.

1. Pilot or copilot brake pedals..... Fully apply
2. Pilot or copilot brake pedals..... Release

If NORM BRAKES FAIL (W) is displayed with brake pedals applied:

3. Refer to NORM BRAKES FAIL procedure, Emergency section.

If NORM BRAKES FAIL (W) is not displayed with brake pedals applied:

3. If less than 60 minutes has elapsed from takeoff, operate with landing gear extended for 15 minutes prior to landing (to ensure cool brakes).
4. Normal actual landing distance ..... Multiply by:
   1.60 without thrust reversers
   1.45 with thrust reversers

PARK/EMER BRAKE ON (C)

Park brake pressure is sensed with weight off wheels. Do not cycle the handle more than one time.

1. PARK/EMER BRAKE handle ..... Stow

If message remains:

2. Normal actual landing distance ..... Multiply by:
   2.40 without thrust reversers
   1.90 with thrust reversers
3. Use normal brakes.

CAUTION

All four brakes may be locked, and landing control will be affected.

PARK/EMER BRAKE PRESS LO (C)

The INBD brake accumulator pressure is too low for full PARK/EMER brake performance (below 1,200 psi). Normal brakes should function properly.

1. Normal brakes ..... Apply until chocks are in

PLT BRAKE FAULT (C)

One or more of the pilot brake pedal sensors (LVDTs) has failed.

1. Use the copilot brakes.

WOW FAIL (C)

One or more of the following conditions exists:

- Failures have been detected in two or more weight-on-wheels (WOW) sensors
- Any disagreement or hardware failure of one or more WOW outputs associated with a critical function.

1. Normal actual landing distance ..... Multiply by:
   1.30 without thrust reversers
   1.25 with thrust reversers

After touchdown:

2. FLIGHT SPOILERS lever ..... EMER
3. Directional control ..... Maintain differential braking

CAUTION

Normal brakes may be inoperative below 10 knots.

4. PARK/EMER BRAKE handle ..... Apply below 10 knots

LANDING PROCEDURES

SINGLE-ENGINE LANDING

Descent checks:

1. Pressurization ..... LNDG ALT set
2. WING ANTI-ICE switch..... As required
3. L or R ENG ANTI-ICE switches..... As required

Transition lever (or FL 180) checks:

4. Altimeters ..... Set
5. L and R LANDING light switches ..... On
6. Cabin check:
   a. Brief passengers.
   b. Seats ..... Swivel forward or aft and in outboard position. Headrests in place for occupied aft facing seats.
   c. Work tables..... Stowed
   d. Emergency exit ..... Aisle clear
7. SMKG/BELTS switch..... SMKG/BELTS
8. Fuel quantities and balance ..... Check

Approach checks:

9. APU and bleeds
   a. APU switch ..... START and release
   b. R BLEED switch ..... OFF
   c. APU BLEED switch..... ON
   d. L BLEED switch..... OFF
   e. XBLEED switch ..... OPEN
10. Final approach speed ..... V_{REF}
11. Normal actual landing distance ..... Multiply by:
    1.15 without thrust reversers
    1.10 with thrust reverser

SINGLE-ENGINE LANDING (Cont)

12. Approach setup and crew briefing:
    a. Avionics and radios ..... Set
    b. MIN ..... Set
    c. Crew approach briefing ..... Complete

Before landing checks:

13. LANDING GEAR switch ..... DN
14. FLAPS 30
15. GEAR indication ..... Check
16. L LANDING, N LDG/TAXI, and R LANDING light switches ..... On

After landing:

17. Applicable thrust reverser ..... As required, limit to maintain directional control

NOTE

Do not deploy the thrust reverser on the inoperative engine.

WING ANTI-ICE FAILURE LANDING

WARNING

Approach low-speed flight with care so that detection of abnormal flying qualities can be obtained. Increased buffet may indicate ice formation on the wing leading edge.

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

Visually inspect wing for ice accumulation if possible. Use WING INSP light at night.

Descent checks:

1. Pressurization ..... LNDG ALT set
2. L and R ENG ANTI-ICE switches ..... As required

Transition lever (or FL 180) checks:

3. Altimeters ..... Set
4. L and R LANDING light switches ..... On
5. Cabin check:
   a. Brief passengers.
   b. Seats ..... Swivel forward or aft and in outboard position. Headrests in place for occupied aft facing seats.
   c. Work tables ..... Stowed
   d. Emergency exit ..... Aisle clear
6. SMKG/BELTS switch ..... SMKG/BELTS
7. Fuel quantities and balance ..... Check
8. Airspeed ..... Increase to V_{MO}/M_{MO} if possible to disperse ice

WING ANTI-ICE FAILURE LANDING (Cont)

Approach checks:

9. APU and bleeds:
   a. APU switch ..... START and release
   b. R BLEED switch ..... OFF
   c. APU BLEED switch..... ON
   d. L BLEED switch..... OFF
   e. XBLEED switch ..... OPEN
10. Final approach speed ..... V_{REF} +25
11. Normal actual landing distance ..... Multiply by:
    1.55 without thrust reversers
    1.45 without thrust reversers
12. Approach setup and crew briefing:
    a. Avionics and radios..... Set
    b. MIN.....Set
    c. Crew approach briefing ..... Complete

Before landing checks:

13. LANDING GEAR switch..... DN
14. L LANDING, N LDG/TAXI,
    and R LANDING light switches ..... On
15. Flaps 20

MISCELLANEOUS SYSTEMS

EMER LIGHTS OFF (C)

The cabin emergency lights are off when they should be armed.

1. EMER LTS switch..... ARM

EMER LIGHTS ON (C)

The cabin emergency lights are on.

POWERPLANT

L (R) ENG DSPL MISCOMP (C)

1. L DISPLAYS switch ..... PFD REV

If L (R) ENG DSPL MISCOMP extinguishes:

a. L DISPLAYS switch ..... Leave in PFD REV

If L (R) ENG DSPL MISCOMP remains on:

2. L DISPLAYS switch ..... NORM

NOTE

The left MFD is not corrupting the engine data. One of the other displays is.

L (R) ENGINE FLAMEOUT (C)

The affected engine has decelerated at least 5% N_2 below idle.

1. Affected engine thrust lever ..... IDLE

If engine does not auto restart:

2. Refer to Engine Shutdown in Flight procedure in this chapter.

ENGINES FUEL BYPASS (C)

Both engine fuel filters are impending bypass.

1. L and R FUEL PUMP switches..... ON
2. Land as soon as possible.

L (R) ENGINE VIBRATION (C)
VIB (EI ICON)

A higher than normal level of vibration has been sensed in the respective engine.

During icing conditions:

1. Affected thrust lever..... Increase above 70% N_1, then as desired

2. If ENGINE VIBRATION persists, go to During Non-Icing Conditions that follows.

During non-icing conditions:

1. Engine instruments..... Monitor for abnormal indications (oil temperature, N_1, ITT, and N_2) or unusual sounds or vibrations

If ENGINE VIBRATION CAS remains on for more than 30 seconds and if conditions permit:

2. Respective thrust lever ..... Adjust

NOTE

Engine shutdown is not recommended unless there are other indications of severe engine abnormalities.

L (R) ENG FUEL SOV FAIL (C)

If affected engine fuel SOV has failed to close when commanded closed:

1. Affected ENGINE RUN switch ..... OFF

2. Refer to Engine Shutdown in Flight procedure in this chapter.

L (R) ENG OIL PRESS HIGH (C)

The engine oil pressure is high.

1. Affected thrust lever ..... Reduce

L (R) ENG OIL TEMP HIGH (C)

The engine oil temperature is high.

1. Affected thrust lever ..... Reduce

NOTE

Upon reduction of engine power, the oil temperature may rise initially due to a reduction in fuel flow through the fuel heater oil cooler.

2. OIL TEMP..... Monitor

If OIL TEMP remains high:

3. Affected engine thrust lever ..... IDLE
4. Land as soon as practical.

If OIL TEMP does not remain high:

3. Continue flight.

L (R) FADEC FAIL (C)

A major failure has occurred in both channels of the respective FADEC. The engine may shut down or go to idle, or engine operation may be degraded. Failure of the control system may cause control effect, performance degradation, or a loss of a protective system.

If engine shuts down:

1. Refer to Engine Shutdown in Flight in this chapter.

If engine decelerates to idle:

1. Affected engine thrust lever ..... IDLE
2. Land as soon as practical. Refer to Single-Engine Landing procedure in this chapter.

If engine continues to operate:

1. Avoid rapid thrust lever movements. Expect deteriorated engine response.
2. Engine instruments..... Monitor

IGN (EI ICON) (C)

Manual or auto ignition is ON, and one or both ignitor plugs has failed.

1. Engine starts are not possible.

L (R) REVERSER FAIL

The respective thrust reverser has failed.

1. Affected thrust lever ..... Do not use

L (R) START ABORTED (C)

The ground engine start on the respective engine has been aborted.

1. Affected engine RUN switch ..... OFF
2. If conditions warrant, another start may be initiated.
   a. Affected STARTER switch ..... CRANK, hold for 30 seconds
   b. Affected engine RUN switch ..... RUN
   c. Affected STARTER switch ..... START and release

NOTE

Observe engine starter limitatons.

L (R) STARTER FAIL (C)

The respective engine starter has failed.

GROUND:

If the message comes on during start:

1. Affected ENGINE RUN switch ..... OFF

If the message comes on any other time:

1. Continue.

IN FLIGHT:

If attempting an airstart:

1. Refer to Engine Airstart, Windmill Airstart in this chapter.

If the message comes on any other time:

1. Continue.

L (R) STARTER FAIL ON (C)

The respective engine starter has failed ON.

GROUND:

1. Affected engine RUN switch ..... OFF
2. L, R, and APU BLEED switches ..... OFF

IN FLIGHT:

If L STARTER FAIL ON is displayed:

1. XBLEED switch..... Close
2. L BLEED switch ..... OFF

If R STARTER FAIL ON is displayed:

1. XBLEED switch..... Close
2. APU BLEED switch ..... Off
3. R BLEED switch..... OFF

ENGINE SHUTDOWN IN FLIGHT

Affected engine:

1. Thrust lever..... IDLE
2. Engine RUN switch..... OFF

NOTE

The engine fuel and hydraulic pumps continue to operate with a windmilling engine. Prolonged operation without fluid available to the pumps may cause damage. Therefore, the ENG FIRE switch should not be pushed unless a fuel or hydraulic leak is suspected.

3. Rudder trim..... As required
4. Applicable BLEED switch..... OFF
5. XBLEED switch ..... Open
6. Applicable ENG ANTI-ICE switch ..... Off
7. Monitor fuel balance. Transfer as required.
8. Transponder ..... TA ONLY
9. Land as soon as practical.
10. Refer to Engine Airstart, if applicable. Refer to Single-Engine Landing procedure or Thrust Reverser Deployed Landing procedure in this chapter, as appropriate.

ENGINE AIRSTART

WARNING

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

CAUTION

Do not attempt an airstart without an indication of N_1 rotation.

BEFORE START

Affected engine:

1. Make sure that the aircraft is within the appropriate airstart envelope as shown in Figure AP-1.
2. FUEL panel:
   a. XFER switch ..... Closed
   b. PUMP switch..... AUTO
3. ENG ANTI-ICE switch..... Off
4. BLEED switch ..... OFF
5. Thrust lever..... IDLE
6. Conduct the following windmill, crossbleed, or APU-assisted start.

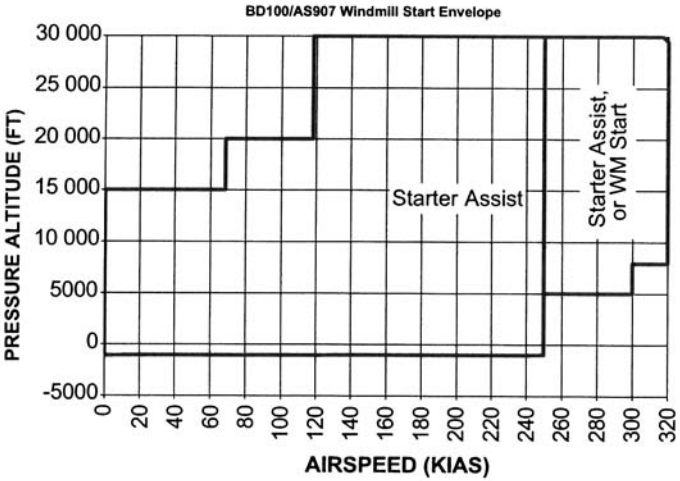

Figure AP-1 Engine Airstart Envelope

ENGINE AIRSTART (Cont)

7. If IGNITION switch is ON:

   Affected RUN switch ..... OFF for 3 seconds minimum

START

Crossbleed started-assisted airstart

1. BLEED pressure ..... 32 minimum

Affected engine:

2. ENGINE RUN switch ..... RUN
3. STARTER switch..... START and release
4. IGN and FUEL FLOW..... Check
5. ITT .....Check rise

NOTE

Start may be as long as 3 minutes to idle.

If no indication that light-off is obtained within:

- 20 seconds (if engine has been windmilling for 2 minutes or less) after STARTER switch-START

  or

- 45 seconds (if engine has been windmilling for more than 2 minutes) after STARTER switch-START:

  a. Affected ENGINE RUN switch ..... OFF

  b. Repeat a starter-assisted airstart or refer to Engine Shutdown in Flight procedure in this chapter.

6. Go to After Start section.

APU bleed starter-assisted airstart (below 20,000 feet)

1. L and R BLEED switches ..... OFF
2. APU BLEED switch..... ON

Affected engine:

3. ENGINE RUN switch ..... RUN
4. STARTER switch..... START and release
5. IGN and FUEL FLOW..... Check
6. ITT .....Check rise

ENGINE AIRSTART (Cont)

NOTE

Start may be as long as 3 minutes to idle.

If no indication that light-off is obtained within:

- 20 seconds (if engine has been windmilling for 2 minutes or less) after STARTER switch-START

  or

- 45 seconds (if engine has been windmilling for more than 2 minutes) after STARTER switch-START:

  a. Affected ENGINE RUN switch ..... OFF

  b. Repeat an airstart or refer to Engine Shutdown in Flight procedure in this chapter.

7. Go to After Start section.

Windmill Airstart

Altitude	Minimum N_2
≤ 10 000 ft	6.0%
20 000 ft	7.1%
30 000 ft	8.2%

Affected engine:

1. ENGINE RUN switch ..... RUN
2. IGN and FUEL FLOW ..... Check
3. ITT .....Check rise

NOTE

Start may be as long as 3 minutes to idle.

If no indication that light-off is obtained within:

- 20 seconds (if engine has been windmilling for 2 minutes or less) after ENGINE RUN switch-RUN

  or

- 45 seconds (if engine has been windmilling for more than 2 minutes) after ENGINE RUN switch-RUN:

  a. Affected ENGINE RUN switch ..... OFF

  b. Repeat an airstart or refer to Engine Shutdown in Flight procedure in this chapter.

ENGINE AIRSTART (Cont)

AFTER START

Affected engine:

1. Engine instruments ..... Check
2. GEN switch ..... Check On
3. ENG ANTI-ICE switch ..... As required
4. L and R, and APU BLEED switch(es) ..... As required

SINGLE-ENGINE GO-AROUND

1. Autopilot ..... Disengage with TO/GA button
2. Thrust lever ..... TO
3. Pitch attitude ..... Adjust as required to achieve V_{GA}

NOTE

Initially rotate toward flight director pitch guidance command. Adjust pitch as required to maintain V_{GA}.

4. FLAPS selector 10
5. LANDING GEAR switch ..... UP, after positive rate of climb established
6. Climb at V_{GA}.

NOTE

The flight director guidance only represents an initial target to rotate toward and does not guarantee that the climb speed will be achieved under all conditions.

7. When clear of obstacles, accelerate to V_{GA} + 15 and retract flaps.
8. Go to After Takeoff procedure in the Normal Procedures chapter.

EMERGENCY PROCEDURES

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EMERGENCY PROCEDURES

GENERAL

The procedures in this chapter have been developed by Bombardier, Inc. for certification of this aircraft. The procedures in this chapter describe actions that are necessary to protect the aircraft and its occupants from impending or critical harm. The emergencies described in this chapter require immediate response. For some emergency procedures, the delay involved in referring to a checklist is potentially dangerous. Therefore, the flight crew must be able to carry out the applicable procedure by memory. Procedures emphasized by enclosure in a box such as this and boldfaced should be accomplished without reference to this manual (memorized).

The procedures in this chapter are to be used when an emergency condition exists. 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 aircraft 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 landing at the nearest suitable airfield may not be necessary.

AIR CONDITIONING AND PRESSURIZATION

CABIN ALTITUDE (W)

The cabin altitude has exceeded 9,400 feet:

1. **Crew oxygen masks..... Don**
2. **Pilot and copilot O2 MASK/NORM switches ..... O2 MASK**
3. **Thrust levers ..... IDLE**
4. **Autopilot..... Disconnect**
5. **FLIGHT SPOILERS lever ..... EMER**
6. **Descend at MMO/VMO but not below minimum safe altitude.**

WARNING

If structural failure is evident, limit speeds and maneuvering loads as much as possible in descent.

Prolonged operation above 20,000 ft cabin altitude may result in decompression sickness.

NOTE

Descent from 45,000 ft to 15,000 ft requires approximately 4 minutes.

7. Pilot and copilot INPH switches ..... INPH

If time and conditions permit:

8. Controlling agency ..... Notify
9. Transponder..... Emergency 7700
10. Passengers..... Check condition and provide assistance

CABIN DELTA P (W)

The cabin differential pressure is greater than 9.2 psid or less than –0.5 psid.

If cabin Delta P is 9.2 psid or greater:

1. MANUAL PRESSURIZATION switch ..... ON
2. MAN RATE control..... UP,
   as required to reduce differential pressure

If CABIN DELTA P remains on:

a. One L or R BLEED switch ..... OFF

b. Adjust N_1 on opposite engine to control cabin pressurization.

If still unable to regulate the overpressurization:

(1) AIR SOURCE switch ..... OFF

(2) Descend but not below minimum safe altitude.

If CABIN DELTA P does not remain on:

No further action

If cabin Delta P is –0.5 psid or less:

1. MANUAL PRESSURIZATION switch ..... ON
2. MAN RATE control..... DN,
   as required to increase differential pressure

If CABIN DELTA P remains on:

a. Decrease aircraft descent rate.

NOTE

After the aircraft descends through the cabin altitude, a CABIN DELTA P message may illuminate, requiring a slower descent rate.

L (R) BLEED LEAK (W)

A leak has been detected in the bleed-air ducting downstream of the bleed valve.

1. XBLEED switch ..... Closed
2. Affected BLEED switch ..... OFF
3. If R BLEED LEAK is on:
a. L BLEED switch ..... On
b. APU BLEED switch ..... Off

PACK LEAK (W)

A leak has been detected in the air conditioning pack ducting.

1. AIR SOURCE switch ..... TRIM AIR ONLY

If PACK LEAK extinguishes:

a. Altitude ..... 35,000 ft maximum

b. COCKPIT COLD-HOT knob (for cockpit and cabin) ..... As Desired

If PACK LEAK remains on after 40 seconds:

a. AIR SOURCE switch ..... OFF

b. Altitude ..... 9,000 ft maximum but now below minimum safe altitude

c. EMER DEPRESS switch ..... ON

d. RAM AIR switch..... ON

L (R) PYLON BLEED LEAK (W)

A leak has been detected in the engine pylon or tail cone (before the shutoff valve).

Affected engine:

1. Thrust lever ..... IDLE

If PYLON BLEED LEAK remains on:

2. Affected engine RUN switch ..... OFF

3. Refer to Engine Shutdown in Flight procedure in Abnormal Procedures chapter.

TRIM AIR LEAK (W)

A leak has been detected in the bleed-air ducting downstream of the right flow control valve, up to the precooler crossover valve, and up to the trim air check valve.

1. AIR SOURCE switch..... PACK ONLY

If TRIM AIR LEAK extinguishes:

a. COCKPIT COLD-HOT knob
(for cockpit and cabin) ..... As Desired

If TRIM AIR LEAK remains on after 40 seconds:

a. AIR SOURCE switch ..... OFF

b. Altitude ..... 9,000 ft maximum but not below minimum safe altitude

c. EMER DEPRESS switch ..... ON

d. RAM AIR switch..... ON

AUXILIARY POWER UNIT

APU FIRE (W)

The APU fire detection loop has activated. On the ground, the system should automatically shut down the APU and activate the fire extinguisher. In flight, the system does not automatically shut down the APU or activate the fire extinguisher.

1. APU FIRE switch ..... FIRE push
2. FIRE EXT 2 switch..... ARMED push

3. XBLEED switch..... Closed
4. L and R BLEED switches..... On
5. APU BLEED switch ..... Off
6. APU switch ..... OFF
7. Land as soon as possible.

APU OVERTEMP (W)

An APU EGT overtemperature has been detected. On the ground, the APU automatically shuts down.

1. APU switch..... OFF

AVIONICS

MULTIFUNCTION DISPLAY (MFD) ANNUNCIATIONS

The following messages indicate in red.

HDG

Indicates an invalid heading source and illuminates in the center of the heading display. Most likely cause is an AHRS failure.

If HDG is displayed on left MFD:

1. ATT/HDG REVERSION switch 2

If HDG is displayed on right MFD:

1. ATT/HDG REVERSION switch 1

PRIMARY FLIGHT DISPLAY (PFD) ANNUNCIATIONS

ALT

Indicates an invalid altitude source. Cross-check standby instrument altitude to validate instruments.

1. Monitor standby instrument.

If ALT is displayed on left PFD:

2. AIR DATA REVERSION switch 2

If ALT is displayed on right PFD:

2. AIR DATA REVERSION switch 1

AP

The AP above the attitude sphere indicates a monitored autopilot disconnect. This may be accompanied by a YD (yaw damper disconnect). The AP will flash for 5 seconds then turn steady.

1. Control wheel MSW switch..... Depress and release

NOTE

An autopilot monitored disconnect is not always accompanied by a yaw damper failure/disconnect.

Depressing the MSW cancels the AP disconnect aural warning.

PRIMARY FLIGHT DISPLAY (PFD) ANNUNCIATIONS (Cont)

ATT

Indicates an invalid altitude source and illuminates in the center of the attitude sphere. Most likely cause is an AHRS fault or failure.

1. Monitor standby instrument.

If ATT is displayed on left PFD:

2. ATT/HDG REVERSION switch 2

If ATT is displayed on right PFD:

2. ATT/HDG REVERSION switch 1

FD

Indicates a fault in the flight guidance computer.

If the FD flag is displayed on the side the transfer arrow is pointing to:

1, Flight guidance panel XFR button..... Select opposite side

FMS 1 FMS 2
LOC 1 LOC 2
VOR 1 VOR 2

Indicates that data from the active nav source is missing or invalid.

1, NAVSRC button ..... Select cross-side source

HDG

Indicates an invalid heading source and illuminates in the center of the heading display. Most likely cause is an AHRS fault or failure.

If HDG is displayed on left PFD:

1. ATT/HDG REVERSION switch 2

If HDG is displayed on right PFD:

2. ATT/HDG REVERSION switch 1

PRIMARY FLIGHT DISPLAY (PFD) ANNUNCIATIONS (Cont)

IAS

Indicates an invalid air data source and illuminates in the center of the airspeed tape.

1. Monitor standby instrument.

If IAS is displayed on left PFD:

2. AIR DATA REVERSION switch 2

If IAS is displayed on right PFD:

2. AIR DATA REVERSION switch 1

MACH

Indicates an invalid air data source and illuminates in the center of the airspeed tape.

1. Monitor standby instrument.

If MACH is displayed on left PFD:

2. AIR DATA REVERSION switch 2

If MACH is displayed on right PFD:

2. AIR DATA REVERSION switch 1

RA

Indicates an unreliable radar altitude.

1. Normal actual landing distance ..... Multiply by:
   1.20 without thrust reversers
   1.15 with thrust reversers

After touchdown:

2. FLIGHT SPOILERS lever ..... EMER

VNAV

Indicates when VNAV data from the FMS is missing or invalid.

1. Use alternate means of vertical navigation.

VS

Indicates in place of the vertical speed scale when vertical speed data from the air data computer is missing or invalid.

If VS is displayed on left PFD:

2. AIR DATA REVERSION switch 2

If VS is displayed on right PFD:

2. AIR DATA REVERSION switch 1

TCAS AURALS

CLEAR OF CONFLICT

Resume normal flight.

CLIMB, CLIMB

Change vertical speed to 1,500 ft/min. climbing or as indicated on the VSI.

CLIMB, CROSSING, CLIMB —CLIMB, CROSSING, CLIMB

Change vertical speed to 1,500 ft/min. climbing or as indicated on the VSI. The converging flight paths will cross at some altitude.

DESCEND, DESCEND, DESCEND

Change vertical speed to 1,500 ft/min. descending or as indicated on the VSI.

DESCEND, CROSSING, DESCEND –DESCEND, CROSSING, DESCEND

Change vertical speed to 1,500 ft/min. climbing or as indicated on the VSI. The converging flight paths will cross at some altitude.

ADJUST VERTICAL SPEED ADJUST

Reduce climbing vertical speed to that shown on the VSI.

INCREASE CLIMB—INCREASE CLIMB

This follows a CLIMB advisory. The climb vertical speed should be increased typically to 2,500 ft/min. as shown 0n the VSI.

INCREASE DESCENT—INCREASE DESCENT

This follows a DESCEND advisory. The descent vertical speed should be increased typically to 2,500 ft/min. as shown 0n the VSI.

CLIMB, CLIMB NOW

This follows a DESCEND advisory. This advisory indicates that a reversal of vertical speed from descent to climb is needed to provide adequate separation.

TCAS AURALS (Cont)

DESCEND, DESCEND NOW

This follows a CLIMB advisory. This advisory indicates that a reversal of vertical speed from climb to descent is needed to provide adequate separation.

MAINTAIN VERTICAL SPEED MAINTAIN

Maintain present vertical speed and direction.

MAINTAIN VERTICAL SPEED, CROSSING, MAINTAIN

A flight path crossing is predicted but is being monitored by TCAS. Maintain present vertical speed and direction.

MONITOR VERTICAL SPEED

Be alert for approaching traffic.

TRAFFIC, TRAFFIC

Gain visual contact with traffic. Check TCAS display for traffic bearing and range if necessary.

TAWS AURALS

PULL UP or
TERRAIN, TERRAIN, PULL UP or
OBSTACLE, OBSTACLE, PULL UP

The TAWS system has detected a risk of impact from below. These aurals are combined with a PULL UP on the PFDs.

1. **Autopilot ..... Disengage**
2. **Thrust levers..... APR**
3. **Climb at maximum practical rate.**
4. **FLIGHT SPOILERS lever..... RET**
5. **LANDING GEAR switch ..... UP**
6. Maintain climb until the warning ceases.

WINDSHEAR, WINDSHEAR

The TAWS system has detected a decreasing headwind (or increasing tailwind and/or severe downdraft). This aural is combined with a WINDSHEAR on the PFDs. The flight director command cue will be removed.

1. **Autopilot ..... Disengage**
2. **Thrust levers..... APR**
3. **Rotate smoothly to takeoff/go-around pitch attitude,** allowing airspeed to decrease if necessary. Maintain wings level. Do not retract flaps or landing gear**.**
4. If the aircraft continues to descend, increase pitch attitude smoothly and in small increments, bleeding airspeed as necessary to stop descent. Use stall warning onset (stick shaker) as the upper limit of pitch attitude.
5. Maintain escape attitude and thrust and delay retracting flaps or landing gear until safe climb out is assured.

ELECTRICAL

L (R) BATT OVERHEAT (W)

The respective battery internal temperature has exceeded 70°C.

1. Affected BATT switch ..... OFF

2. Battery temperature ..... Monitor

If battery temperature increases:

a. Land as soon as possible.

ESSENTIAL POWER ONLY (W)

The essential buses are powered by the batteries only. AUX and MAIN buses are automatically deactivated in flight.

1. L and R GEN switches ..... One at a time, select On

If a generator comes online:

No further action.

If a generator does not come online:

NOTE

The applicable procedures for the following CAS messages are consolidated within this procedure and do not need to be conducted separately:

L (R) GEN FAIL (C)

L (R) PITOT HEAT FAIL (C)

STALL PROTECT FAIL (C)

R WING ANTI-ICE FAIL (C)

L (R) MAIN BUS OFF (A)

L (R) AUX BUS OFF (A)

L (R) ENG THRUST FAULT (A)

RUDDER LIMITER FAULT (A)

2. DOME light switch ..... BRT for night operations
3. LEFT DISPLAYS REVERSION switch ..... MFD REV
4. TUNE REVERSION switch ..... CDU ONLY
5. Use the standby instrument for airspeed, attitude, and altitude.
6. Airspeed ..... 0.75 MI/250 KIAS maximum

ESSENTIAL POWER ONLY (Cont)

7. STAB TRIM switch ..... SEC
8. AIR SOURCE switch ..... PACK ONLY
9. R BLEED switch ..... OFF
10. XBLEED switch ..... Closed
11. Altitude ..... 25,000 ft maximum
12. WING SOURCE switch ..... FROM L
13. AUX HYDRAULIC PUMP switch ..... OFF
14. EMER LTS switch ..... OFF
15. Leave icing conditions as soon as possible.
16.. L and R WSHLD/WINDOW switches ..... OFF
17. MAN TEMP switch ..... ON

NOTE

If a generator does not come online, battery duration (with two 44 amp-hour batteries) with the generators off is one hour. The integrated standby instrument (ISI) is powered for a duration of 3.5 hours following loss of generated power.,

Time duration predicated upon the following conditions:

- L WSHLD/WINDOW switch—On for no more than 15 minutes
- No more than 3 APU start attempts
- Any deviation from these conditions significantly reduces the battery duration. Each additional APU start attempt reduces battery endurance by approximately 2 minutes.

ESSENTIAL POWER ONLY (Cont)

The following equipment is inoperative:

AUTO FLIGHT	**FLIGHT CONTROLS**
Autopilot/flight director (except PIT and ROL modes)	PRI STAB trim
Yaw damper	Spoilers
Flight director 2	Stall pusher
	Right stall shaker
AVIONICS	**HYDRAULICS**
AHRS 2	L DC pump
Left and right PFDs	**ICE AND RAIN PROTECTION**
Right MFD	Left and right window anti-ice
FMS 2	Right windshield anti-ice
GPS 2	**LANDING GEAR, WHEELS and BRAKES**
NAV 2	Nose wheel steering
COM 2	**MISCELLANEOUS**
TCAS	Cabin lights (other than dome)
TAWS	External lights

At 30,000 ft and below:

18. APU switch..... START and release

If the APU starts:

a. APU GEN..... Verify ON

b. LEFT DISPLAYS REVERSION switch..... NORM

c. TUNE REVERSION switch ..... NORM

d. STAB TRIM switch ..... PRI

e. AUX HYDRAULIC PUMP switch..... AUTO

f. L and R WSHLD/WINDOW switches ..... On

g. MAN TEMP switch..... Off

h. EMER LTS switch ..... ARM

i. Land as soon as practical.

If the APU does not start:

19. Land as soon as possible.

NOTE

Landing on a wide runway of sufficient length with minimum turbulence and crosswind is recommended.

ESSENTIAL POWER ONLY (Cont)

Descent checks:

20. Pressurization ..... LNDG ALT set (LNDG ALT display is available on summary page using FRMT switch on display panel)
21. Standby altimeter ..... Set
22. Cabin check:
    a. Brief passengers
    b. Seats ..... Swivel forward or aft and in outboard position. Headrests in place for occupied aft facing seats.
    c. Work tables ..... Check stowed
    d. Emergency exit ..... Aisle clear
    e. SMKG/BELTS switch ..... SMKG/BELTS

Approach checks:

23. Final approach speed ..... V_{REF} + 10
24. Normal actual landing distance ..... Multiply by: 1.80 without thrust reversers 1.55 with thrust reversers
25. L WSHLD/WINDOW switch ..... As required (to defog left window)
26. Approach setup and crew briefing ..... Complete

Before landing checks:

NOTE

Pitch, roll, and yaw control authority is less than normal. Directional control on the runway is limited without nose wheel steering.

27. LANDING GEAR switch ..... DN
28. FLAPS selector 30
29. EMER LTS switch ..... ON

EVACUATION

EMERGENCY EVACUATION

1.	**PARK/EMER BRAKE**	**Set**
2.	**EMER DEPRESS switch**	**ON**
3.	**L and R ENG, and APU FIRE switches**	**Push**
4.	**Evacuation**	**Command**
5.	**Controlling agency**	**Notify**
6.	**L and R BATT switches**	**OFF**
7.	**STBY INST switch**	**OFF**

8. Evacuate the aircraft using the passenger door and/or emergency exit.

FLIGHT CONTROLS

OVERSPEED

V_{MO}/M_{MO} has been exceeded.

1. **Thrust levers ..... IDLE**
2. **Autopilot ..... Disconnect**
3. **FLIGHT SPOILERS lever ..... EMER**
4. **Level wings, then pitch up.**
5. Stab trim..... As required to raise the nose

STALL ON PFD

STALL

The stall warning computer has sensed an angle-of-attack limit. This warning is also accompanied with the activation of the control column stick shaker. If the angle-of-attack continues to increase, a stall pusher activates.

1. **Lower the pitch attitude to reduce angle-of-attack.**
2. **Thrust levers ..... TO**
3. **Level the wings.**

PITCH AXIS UNCOMMANDED MOTION OR TRIM CLACKER

1. **Master disconnect switch (MSW) ..... Depress and hold**

NOTE

The following conditions exist when the MSW switch id depressed:

- The autopilot disengages.
- Stabilizer, configuration, Mach, aileron, and rudder trims are inoperative while the switch is depressed.
- The stall pusher is inoperative while the switch is depressed.

If control force is relieved with MSW depressed:

a. STALL PUSHER switch..... OFF

b. Flight guidance panel AP/YD DISC bar..... Pull Down

c. Master disconnect switch (MSW) ..... Release

PITCH AXIS UNCOMMANDED MOTION OR TRIM CLACKER (Cont)

If control force continues with MSW depressed:

The malfunction is most likely a trim malfunction.

a. STAB TRIM switch ..... SEC

b. Master disconnect switch (MSW) ..... Release

c. Control wheel trim switch ..... As required

If control force continues while on SEC STAB trim:

d. Refer to PRI STAB TRIM procedure, Step 3, Abnormal Procedures chapter, and complete remainder of the procedure.

If control force is relieved on SEC STAB trim:

d. Do not use PRI STAB trim.

e. Do not use autopilot.

ROLL OR YAW AXIS UNCOMMANDED MOTION

1. Master disconnect switch (MSW) ..... Depress and hold

NOTE

The following conditions exist when the MSW switch is depressed:

- The autopilot disengages.
- Stabilizer, configuration, Mach, aileron, and rudder trims are inoperative while the switch is depressed.
- *The stall pusher is inoperative while the switch is depressed.

*Not applicable to JAA aircraft

2. Flight guidance panel AP/YD DISC bar ..... Pull down

If control force is relieved with MSW depressed:

a. Master disconnect switch (MSW) ..... Release

If control force continues with MSW depressed:

The malfunction is most likely a trim malfunction.

a. AIL and RUD trim indications..... Check

b. Affected AIL or RUD circuit breaker ..... CB2 B1 or B2, Pull

c. Master disconnect switch (MSW) ..... Release

PITCH CONTROL JAM

1. **PITCH DISC handle..... PULL & TURN**
   The pilot controls the left elevator, and the copilot controls the right elevator.
2. **Determine elevator without the jam and transfer control to that pilot.**

   a. ***Do not*** apply additional control force to a jammed control.

   b. ***Do not*** reconnect.

3. Airspeed..... Airspeed at which the jam occurred or 200 KIAS maximum, whichever is greater

4. Land as soon as possible.

NOTE

Avoid excessive elevator inputs. ELEVATOR SPLIT (C) may be displayed if elevator use is aggressive.

Use pitch trim as necessary to minimize elevator deflection.

Use aileron control as necessary to stabilize the aircraft.

Descent checks:

5. Pressurization ..... LNDG ALT set
6. WING ANTI-ICE switch..... As required
7. L and R ENG ANTI-ICE switches ..... As required

Transition level (or FL 180) checks:

8. Altimeters..... Set pilot, copilot and standby, and cross-check
9. L and R LANDING light switches ..... On
10. Cabin check:

    a. Brief passengers

    b. Seats ..... Swivel forward or aft and in outboard position. Headrests in place for occupied aft facing seats.

    c. Work tables..... Stowed

    d. Emergency exit ..... Aisle clear

11. SMKG/BELTS switch..... SMKG/BELTS
12. Fuel quantities and balance ..... Check

PITCH CONTROL JAM (Cont)

Approach checks:

13. APU start:
    a. APU switch ..... START and release
    b. R BLEED switch ..... OFF
    c. APU BLEED switch..... ON
    d. L BLEED switch..... OFF
    e. XBLEED switch..... Open
14. Final approach speed ..... V_{REF}
15. Normal actual landing distance ..... Multiply by:
    1.15 without thrust reversers
    1.10 with thrust reversers
16. Approach setup and crew briefing:
    a. Avionics and radios..... Set
    b. MIN..... Set
    c. Crew approach and briefing..... Complete

Before landing checks:

17. LANDING GEAR switch..... DN
18. N LDG/TAXI light switch..... On
19. FLAPS selector..... 30

ROLL CONTROL JAM

1. ROLL DISC lever ..... PULL TO ACTUATE
2. Determine the side without the jam and transfer control to that pilot.

If the jam is on the copilot side:

a. ***Do not*** use the copilot controls.

b. ***Do not*** use aileron trim.

c. ***Do not*** reconnect.

d. Go to Step 3.

If the jam is on the pilot side:

a. ROLL SPOILERS switch ..... OFF

b. ***Do not*** reconnect.

3. Land as soon as possible.

NOTE

Landing on a wide runway of sufficient length with minimum turbulence and crosswind is recommended.

Descent checks:

4. Pressurization ..... LNDG ALT set
5. WING ANTI-ICE switch..... As required
6. L and R ENG ANTI-ICE switches ..... As required

Transition level (or FL 180) checks:

7. Altimeters..... Set pilot, copilot and standby, and cross-check
8. L and R LANDING light switches ..... On
9. Cabin check:
   a. Brief passengers
   b. Seats ..... Swivel forward or aft and in outboard position. Headrests in place for occupied aft facing seats.
   c. Work tables..... Stowed
   d. Emergency exit ..... Aisle clear
10. SMKG/BELTS switch..... SMKG/BELTS
11. Fuel quantities and balance ..... Check

ROLL CONTROL JAM (Cont)

Approach checks:

12. APU start:
    a. APU switch ..... START and release
    b. R BLEED switch ..... OFF
    c. APU BLEED switch..... ON
    d. L BLEED switch..... OFF
    e. XBLEED switch..... Open
13. Final approach speed ..... V_{REF} + 5
14. Normal actual landing distance ..... Multiply by:
    1.20 without thrust reversers
    1.15 with thrust reversers
15. Approach setup and crew briefing:
    a. Avionics and radios..... Set
    b. MIN..... Set
    c. Crew approach briefing ..... Complete

Before landing checks:

16. LANDING GEAR switch..... DN
17. N LDG/TAXI light switch..... On
18. FLAPS selector..... 30

YAW CONTROL JAM

1. Use ailerons and asymmetric thrust as required.
2. Land as soon as possible.

NOTE

Limited travel may be available through use of rudder trim.

Landing on a wide runway of sufficient length with minimum turbulence and crosswind is recommended.

Use asymmetric power if required to minimize sideslip.

Flying the approach and landing with minimum control and thrust lever inputs help maintain directional control.

Descent checks:

3. Pressurization ..... LNDG ALT set
4. WING ANTI-ICE switch..... As required
5. L and R ENG ANTI-ICE switches ..... As required

Transition level (or FL 180) checks:

6. Altimeters..... Set pilot, copilot and standby, and cross-check
7. L and R LANDING light switches ..... On
8. Cabin check:
   a. Brief passengers
   b. Seats ..... Swivel forward or aft and in outboard position. Headrests in place for occupied aft facing seats.
   c. Work tables..... Stowed
   d. Emergency exit ..... Aisle clear
9. SMKG/BELTS switch..... SMKG/BELTS
10. Fuel quantities and balance ..... Check

ROLL CONTROL JAM (Cont)

Approach checks:

11. APU start:
    a. APU switch ..... START and release
    b. R BLEED switch ..... OFF
    c. APU BLEED switch..... ON
    d. L BLEED switch..... OFF
    e. XBLEED switch..... Open
12. Final approach speed ..... V_{REF} + 5
13. Normal actual landing distance ..... Multiply by:
    1.20 without thrust reversers
    1.15 with thrust reversers
14. NWS switch ..... OFF
15. Approach setup and crew briefing:
    a. Avionics and radios..... Set
    b. MIN..... Set
    c. Crew approach briefing ..... Complete

Before landing checks:

16. LANDING GEAR switch..... DN
17. N LDG/TAXI light switch..... On
18. FLAPS selector..... 30
19. Carry power down to touchdown to aid in directional control.

NOTE

Thrust reversers may be used. Stow the thrust reversers if directional control is in doubt.

HYDRAULICS

HYD PRESS LOW (W)

The left and right hydraulic pressures are less than 1,800 psi.

Inoperative equipment:

- Elevator hydraulic power (pitch forces are high)
- All spoiler functions
- Normal brakes supplied by the accumulators only
- Thrust reversers
- Flaps
- Normal landing gear control
- Nose wheel steering

1. L and R HYDRAULIC PUMP switches ..... ON

If hydraulic pressure is restored:

a. Land as soon as practical.

If hydraulic pressure is not restored:

a. Autopilot ..... Disconnect
b. L and R HYDRAULIC PUMP switches..... OFF
c. L and R HYDRAULIC SOV switches..... Closed

NOTE

The MLG downlock assist accumulator retains pressure for 30 minutes after a complete hydraulic failure. The landing gear must be down prior to this time if the flaps are not at 0°.

Avoid icing conditions for a prolonged period of time.

d. Altitude ..... 41,000 ft maximum
e. Land as soon as possible.

NOTE

Landing on a wide runway of sufficient length with minimum turbulence and crosswind is recommended.

Descent checks:

3. Pressurization ..... LNDG ALT set
4. WING ANTI-ICE switch..... As required
5. L and R ENG ANTI-ICE switches ..... As required

HYD PRESS LOW (Cont)

Transition level (or FL 180) checks:

5. Altimeters ..... Set pilot, copilot and standby, and cross-check
6. L and R LANDING light switches ..... On
7. Cabin check:
   a. Brief passengers
   b. Seats ..... Swivel forward or aft and in outboard position. Headrests in place for occupied aft facing seats.
   c. Work tables ..... Stowed
   d. Emergency exit ..... Aisle clear
8. SMKG/BELTS switch ..... SMKG/BELTS
9. Fuel quantities and balance ..... Check

Approach checks:

10. APU start:
    a. APU switch ..... START and release
    b. R BLEED switch ..... OFF
    c. APU BLEED switch ..... ON
    d. L BLEED switch ..... OFF
    e. XBLEED switch ..... Open
11. Final approach speed ..... As listed for flaps attained:
    Flaps 0 ..... V_{REF} + 25
    Flaps 10 ..... V_{REF} + 20
    Flaps 20 ..... V_{REF} + 10
    Flaps 30 ..... V_{REF} + 5
12. Final actual landing distance ..... Multiply by:
    Flaps 0 ..... 2.00
    Flaps 10 ..... 2.05
    Flaps 20 ..... 1.90
    Flaps 30 ..... 1.80

HYD PRESS LOW (Cont)

13, FLAPS TAWS WARN ..... OFF

14. Approach setup and crew briefing:

a. Avionics and radios ..... Set

b. MIN ..... Set

c. Crew approach briefing ..... Complete

Before landing checks:

15. LANDING GEAR switch ..... DN

16. LG PULL handle ..... PULL

NOTE

Performing a sideslip to each side may help achieve MLG downlock. Increased airspeed may be required to ensure downlock during sideslip.

17. GEAR indication ..... Check, for three green DN indications

CAUTION

Do not stow handle until gear pins are installed.

18. L LANDING, N LDG/TAXI, and R LANDING light switches ..... On

19. NWS switch ..... OFF, maintain directional control using differential braking

After touchdown:

20. Normal brakes ..... Apply, using one continuous application to a full stop

ICE AND RAIN PROTECTION

WING ANTI-ICE LEAK (W)

A leak has been detected along the wing anti-ice ducting.

1. WING ANTI-ICE switch ..... Off

2. Leave icing conditions as soon as possible.
3. Refer to Wing Anti-Ice Failure Landing procedure, Abnormal Procedures.

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.

L (R) WING OVERHEAT (W)

A wing anti-ice overheat condition exists in the indicated wing.

1. WING ANTI-ICE switch ..... Off

If L WING OVERHEAT is displayed:

2. WING SOURCE switch ..... FROM R
3. AUTO SYNC switch ..... OFF
4. WING ANTI-ICE switch ..... ON

If R WING OVERHEAT is displayed:

2. WING SOURCE switch ..... FROM L
3. AUTO SYNC switch ..... OFF
4. WING ANTI-ICE switch ..... ON

If the message reappears:

5. WING ANTI-ICE switch ..... Off
6. Leave icing conditions as soon as possible.
7. Refer to Wing Anti-Ice Failure Landing procedure, Abnormal Procedures.

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.

LANDING GEAR, WHEEL, AND BRAKES

GEAR (W)

The GEAR CAS is accompanied by a red icon on the EICAS for each gear that is not down and locked.

NOTE

If the radio altimeter is inoperative, the GEAR aural may be muted via the master WARNING/CAUTION switch.

Illumination of a GEAR CAS with a nonmutable GEAR aural warning indicates a radar altitude of less than 500 ft and thrust levers below CLB or flaps at 30 with any gear not down.

Illumination of a GEAR CAS with the radar altitude failed and mutable (via master WARNING/CAUTION switch) GEAR aural warning indicates the following:

- Any gear is not down and
- An altitude of less than 15,000, thrust levers below CLB and
- IAS—below 170 kts and flaps—0° or
- IAS—below 160 kts and flaps—10° or
- IAS—below 155 kts and flaps—20° or

If there is adequate time available to extend gear:

1. LANDING GEAR switch..... DN

If there is not adequate time available to extend gear:

1. Execute a go-around.

GEAR BAY OVHT (W)

An overheat condition has been detected in the main landing gear bays.

1. AIRSPEED ..... 250 KIAS maximum
2. LANDING GEAR switch..... DN

Wait 10 minutes:

3. LANDING GEAR switch ..... UP

If GEAR BAY OVHT occurs again:

4. LANDING GEAR switch..... DN
5. Land as soon as possible.

LANDING GEAR UP/UNSAFE LANDING

The landing gear manual extend system is available to extend the landing gear. It should be used when electrical or hydraulic problems do not allow the gear to be extended normally.

1. Airspeed ..... 250 KIAS maximum
2. LANDING GEAR ..... DN
3. LG PULL handle ..... PULL

NOTE

Performing a sideslip to each side may help achieve MLG downlock. Increased airspeed may be required to ensure downlock during sideslip.

4. GEAR indication ..... Check for three DN indications

If all landing gear are down (three DN indications):

5. Land as soon as practical.

CAUTION

Do not stow handle until gear pins are installed.

If any landing gear is not down:

NOTE

If a gear-up landing must be made, select a long, wide runway with as little crosswind a possible. If time and conditions permit, plan the descent to ensure minimum fuel remaining on the aircraft. Ensure sufficient fuel for a controlled, power-on approach.

5. Brief passengers as required:
   a. Location and operation of emergency exits.
   b. All loose items..... Secure
   c. Seat belts and shoulder harnesses..... Secure
   d. Emergency landing brace position.

Descent checks:

6. Pressurization ..... LNDG ALT set
7. WING ANTI-ICE switch..... As required
8. L and R ENG ANTI-ICE switches ..... As required

LANDING GEAR UP/UNSAFE LANDING (Cont)

Transition level (or FL 180) checks:

9. Altimeters ..... Set pilot, copilot and standby, and cross-check
10. L and R LANDING light switches ..... On
11. Cabin check:
    a. Brief passengers
    b. Seats ..... Swivel forward or aft and in outboard position. Headrests in place for occupied aft facing seats.
    c. Work tables ..... Stowed
    d. Emergency exit ..... Aisle clear
12. SMKG/BELTS switch ..... SMKG/BELTS
13. Fuel quantities and balance ..... Check

Approach checks:

14. APU start:
    a. APU switch ..... START and release
    b. R BLEED switch ..... OFF
    c. APU BLEED switch ..... ON
    d. L BLEED switch ..... OFF
    e. XBLEED switch ..... Open
15. Approach setup and crew briefing:
    a. Avionics and radios ..... Set
    b. MIN ..... Set
    c. Crew approach briefing ..... Complete

Before landing checks:

16. N LDG/TAXI light switch ..... On
17. AURAL WARNING DCU A and DCU B switches ..... OFF
    This will disable ***all*** aural warnings.
18. FLAPS selector 30

LANDING GEAR UP/UNSAFE LANDING (Cont)

If no landing gear is extended:

a. Plan to land slightly nose high. Perform normal power-on approach at VREF and touchdown at the lowest possible airspeed with minimum sink rate. Do not decelerate below shaker speed.

b. Go to At Touchdown section that follows.

If the nose gear fails to extend:

a. Relocate passengers aft to obtain aft C.G. if possible.

b. Hold the nose off the runway as long as elevator control is available.

c. Go to At Touchdown section that follows.

If one main gear fails to extend:

NOTE

Performing a sideslip to each side may help achieve MLG downlock. Increased airspeed may be required to ensure downlock during sideslip.

a. Plan to land on the same side of the runway as the extended gear.

b. Hold the applicable wing up as long as possible. Maintain directional control with the rudder and the nose wheel steering.

At touchdown:

19, L and R ENG FIRE switches ..... Push

20. Normal braking may be used and the spoilers deployed. Use the rudder and/or the brakes for directional control.

After aircraft stops:

21. PARK/EMER BRAKE ..... Set

22. APU switch ..... OFF

23. L and R BATT switches ..... OFF

24. STBY INST switch ..... OFF

25. Evacuate the aircraft using the passenger door and/or the emergency exit.

NORM BRAKES FAIL (W)

NORMAL BRAKES FAIL

The NORM BRAKES FAIL CAS indicates that three or all four normal brakes have failed. This message is accompanied by a NORMAL BRAKES FAIL voice warning.

1. Normal actual landing distance ..... Multiply by:
   1.65 without thrust reversers
   1.50 with thrust reversers

After landing:

2. FLIGHT SPOILERS lever ..... EMER
3. PARK/EMER BRAKE handle ..... Pull smoothly

NOTE

On the hydraulic synoptic page, the INBD BRAKES pressure icon may be displayed in green, but the OUTBD BRAKES pressure icon may be replaced with magenta dashes.

LANDING PROCEDURES

DITCHING

Ditching of this aircraft has not been demonstrated. However, the following procedure should enhance the probability of a successful ditching.

Plan the descent to ensure minimum fuel remaining to improve buoyancy. Ensure sufficient fuel for controlled, power-on approach.

1. If time and conditions permit:
   a. Proceed to nearest land or vessel.
   b. Notify controlling agency.
   c. Transponder..... Emergency 7700
   d. ELT switch..... ON
   e. Life vests ..... On

   NOTE

   Inform passengers not to inflate life vests while inside aircraft.

   f. Shoulder harnesses ..... Locked
   g. Cabin check:
      (1) Brief passengers
      - Use of flotation equipment
      - Operation of emergency exit
      - Secure loose items
      - Emergency landing brace position
      - Several impacts may be felt. Allow aircraft to stop before releasing seat belt.

      (2) Seats ..... Swivel forward or aft and in outboard position. Headrests in place for occupied aft facing seats.
      (3) Work tables..... Stowed
      (4) Emergency exit ..... Aisle clear
   h. SMKG/BELTS switch ..... SMKG/BELTS

DITCHING (Cont)

2. AURAL WARNING DCU A and DCU B switches ..... OFF
   This will disable ***all*** aural warnings.
3. TAWS circuit breaker (CB2 A6) ..... Pull
4. DITCHING switch..... ON

At approximately 2,000 ft:

Plan landing direction as follows;

a. Calm sea..... Into wind

b. Moderate swells ..... Parallel to swells

c. High wind ..... Into wind, attempting to land upwind (far) side of swell

5. LANDING GEAR switch ..... UP
6. FLAPS selector..... 30
7. EMER LIGHTS switch..... ON

Just before contact:

8. Perform normal power-on approach at VREF and touchdown at the lowest possible airspeed with minimum sink rate. Do not decelerate below shaker speed.
9. Thrust levers..... IDLE at touchdown

After contact:

10. L and R ENG and APU FIRE switches ..... Push
11. L and R BATT switches ..... OFF
12. STBY INST switch ..... OFF
13. Emergency exit ..... Open after aircraft comes to a complete stop

FORCED LANDING—BOTH ENGINES INOPERATIVE

Recommended aircraft best glide speed with aircraft in a clean configuration is shown in Table EP-1.

Table EP-1 RECOMMENDED GLIDE SPEED

AIRCRAFT WEIGHT	BEST GLIDE SPEED
28,000 lb (12,701 kg)	160 KIAS
33,000 lb (14,969 kg)	174 KIAS
38,000 lb (17,237 kg)	185 KIAS

NOTE

Interpolate for weights between the weights provided.

1. If time and conditions permit:
   a. Notify controlling agency.
   b. Transponder..... Emergency 7700
   c. ELT switch..... ON
   d APU start:
      (1) APU switch ..... START and release
      (2) R BLEED switch ..... OFF
      (3) APU BLEED switch..... ON
      (4) L BLEED switch..... OFF
      (5) XBLEED switch..... Open
   e. Cabin check:
      (1) Brief passengers
         - Operation of emergency exit
         - Secure loose items
         - Emergency landing brace position
         - Several impacts may be felt. Allow aircraft to stop before releasing seat belt.

FORCED LANDING—BOTH ENGINES INOPERATIVE (Cont)

(2) Seats ..... Swivel forward or aft and in outboard position. Headrests in place for occupied aft facing seats.

(3) Work tables ..... Stowed

(4) Emergency exit ..... Aisle clear

f. SMKG/BELTS switch ..... SMKG/BELTS

2. TAWS circuit breaker (CB2 A6) ..... Pull

Before landing checks:

3. LANDING GEAR switch ..... DN
4. LG PULL handle ..... PULL
5. FLAPS selector 30
6. EMER DEPRESS switch ..... ON
7. Shoulder harnesses ..... Locked
8. EMER LIGHTS switch ..... ON
9. L and R ENG FIRE switches ..... FIRE push
10. Touchdown at the lowest possible airspeed with minimum sink rate. Do not decelerate below shaker speed.

After aircraft comes to a complete stop:

11. APU switch ..... OFF
12. PARK/EMER BRAKE ..... Set
13. L and R ENG and APU FIRE switches ..... Push
14. L and R BATT switches ..... OFF
15. STBY INST switch ..... OFF
16. Evacuate the aircraft using the passenger door and/or emergency exit.

POWERPLANT

L (R) ENGINE EXCEEDANCE (W)

The respective engine has exceeded a speed or temperature limit.

Affected engine:

1. Thrust lever..... Retard

If engine responds:

a. Continue flight

If engine does not respond:

a. Affected ENGINE RUN switch..... OFF

If engine shuts down:

(1) Refer to Engine Shutdown in Flight procedure, Abnormal Procedures chapter.

If engine does not shut down:

(1) Affected ENG FIRE switch..... Push

(2) Refer to Engine Shutdown in Flight procedure, Abnormal Procedures chapter.

L (R) ENGINE FIRE (W)

LEFT (RIGHT) ENGINE FIRE

During Takeoff

The L (R) ENGINE FIRE CAS, FIRE EI in the N1 indicator, FIRE indication in the L (R) ENG FIRE switch or LEFT (RIGHT) ENGINE FIRE voice message indicates that the engine fire detection loop has activated. An engine fire is usually accompanied by other indications such as excessive ITT, erratic or rough engine operation, fluctuating engine indications, or smoke in the cabin.

NOTE

The L (R) ENG FIRE switch stops the flow of fuel and hydraulic fluid to the engine, shuts off bleed air from the engine, shuts down the generator and ignition, and arms the engine fire extinguishing system.

Below V_1 speed:

1. **Thrust levers ..... IDLE**
2. **Brakes ..... Maximum, or as required**
3. **Thrust levers ..... MAX REV, or as required**

After stopping:

4. **Affected ENG FIRE switch ..... FIRE push**
5. **FIRE EXT 1 switch ..... ARMED push**
6. **PARK/EMER BRAKE ..... Set**
7. **EMER DEPRESS switch ..... ON**
8. **Nonaffected ENG and APU FIRE switches ..... Push**
9. **Evacuation ..... Command**
10. **Controlling agency ..... Notify**
11. **L and R BATT switches ..... OFF**
12. **STBY INST switch ..... OFF**

13. Evacuate the aircraft using the passenger door and/or the emergency exit.

L (R) ENGINE FIRE (Cont)

During Takeoff (Cont)

Above V_1 speed:

1. Rotate at V_R.

2. Pitch attitude ..... Adjust as required to achieve V_2

NOTE

Initially rotate toward the flight director pitch guidance command. Adjust pitch as required to maintain V_2.

3. LANDING GEAR switch ..... UP after positive rate of climb

4. Affected engine thrust lever..... IDLE, unless a critical thrust situation exists

5. Affected ENG FIRE switch ..... FIRE push

After 10 seconds if L (R) ENGINE FIRE CAS persists or there are other indications of fire:

a. FIRE EXT 1 switch ..... ARMED push

b. Affected ENGINE RUN switch..... OFF

c. Affected FUEL PUMP switch..... OFF, if not required

After 30 seconds if L (R) ENGINE FIRE CAS persists or there are other indications of fire:

(1) FIRE EXT 2 switch..... ARMED push

6, Climb at V_2 until clear of obstacles; accelerate to V_2 + 15 (flaps 10) or V_2 + 25 (flaps 20); retract flaps; then climb at en route climb speed.

7. Rudder trim..... As required

8. Monitor fuel balance. Transfer as required. Fuel PUMP may be used.

9. Land as soon as possible.

10. Refer to Single-Engine Landing procedure, Abnormal Procedures chapter.

L (R) ENGINE FIRE (Cont)

In Flight

Affected engine:

1. Thrust lever ..... IDLE, unless a critical thrust situation exists

2. Affected ENG FIRE switch ..... FIRE push

After 10 seconds if L (R) ENGINE FIRE CAS persists or there are other indications of fire:

a. FIRE EXT 1 switch ..... ARMED push

b. Affected ENGINE RUN switch ..... OFF

c. Affected FUEL PUMP switch..... OFF, if not required

After 30 seconds if L (R) ENGINE FIRE CAS persists or there are other indications of fire:

(1) FIRE EXT 2 switch ..... ARMED push

3. Rudder trim ..... As required
4. Monitor fuel balance. Transfer as required. Fuel PUMP may be used.
5. Land as soon as possible.
6. Refer to Single-Engine Landing procedure, Abnormal chapter.

L (R) ENG OIL PRESS LOW (W)

The engine oil pressure is low.

If ENG OIL PRESS LOW CAS is displayed and L (R) OIL PRESS digits are red:

1. Affected engine thrust lever ..... IDLE
2. Affected ENGINE RUN switch ..... OFF
3. Refer to Engine Shutdown in Flight procedure, Abnormal Procedures chapter.

If only the L (R) OIL PRESS digits are red:

1. Affected engine OIL TEMP ..... Check

If OIL TEMP is high:

a. Affected thrust lever..... IDLE

b. Affected ENGINE RUN switch ..... OFF

c. Refer to Engine Shutdown in Flight procedure, Abnormal Procedures chapter.

If OIL TEMP is not high:

a. OIL PRESS and OIL TEMP ..... Monitor

The most likely problem is a single-pressure sensor failure.

L (R) REVERSER UNSAFE (W)
REV EI

Illumination of either the L or R REVERSER UNSAFE CAS, and a REV EI indicates an unsafe thrust reverser condition. The affected engine should automatically decelerate to idle.

During Takeoff

Below V_1 speed:

1. **Thrust levers ..... IDLE**
2. **Brakes..... Maximum or as required**
3. **Thrust reversers ..... MAX REV or as required**

Above V_1 speed:

1. **Rotate at V_R.**
2. **Pitch attitude ..... Adjust as required to achieve V_2**

NOTE

Initially rotate toward the flight director pitch guidance command. Adjust pitch as required to maintain V_2. Flight director pitch guidance command may indicate high for conditions.

3. **LANDING GEAR switch ..... UP**
   after positive rate of climb
4. **Affected engine thrust lever..... IDLE**
5. Climb at V_2 until clear of obstacles; accelerate to V_2 + 15 (flaps 10) or V_2 + 25 (flaps 20); retract flaps; then climb at en route climb speed.

If other indications of thrust reverser deployment are present:
(buffeting or excessive pitch, roll, or yaw):

a. ENGINE RUN switch (deployed engine)..... OFF

b. Rudder trim..... As required

c. Affected BLEED switch ..... OFF

d. XBLEED switch..... Open

e. Affected ENG ANTI-ICE switch ..... Off

f. Monitor fuel balance. Transfer as required.

g. Land as soon as possible.

h. Go to Thrust Reverser Deployed Landing procedure, this chapter.

L (R) REVERSER UNSAFE (W) (Cont)
REV EI

If other indications of thrust reverser deployment not present:
(buffeting or excessive pitch, roll, or yaw):

a. Thrust levers ..... As required

In Flight

1. Thrust lever (deployed engine)..... IDLE
2. Airspeed ..... 190 KIAS maximum

If other indications of thrust reverser deployment are present:
(buffeting or excessive pitch, roll, or yaw):

a. ENGINE RUN switch (deployed engine)..... OFF

b. Rudder trim..... As required

c. Affected BLEED switch ..... OFF

d. XBLEED switch..... Open

e. Affected ENG ANTI-ICE switch ..... Off

f. Monitor fuel balance. Transfer as required.

g. Land as soon as possible.

h. Go to Thrust Reverser Deployed Landing procedure, this chapter.

If other indications of thrust reverser deployment not present:
(buffeting or excessive pitch, roll, or yaw):

3. Thrust levers ..... As required

THRUST REVERSER DEPLOYED LANDING

WARNING

Go-around may not be possible with a deployed thrust reverser.

NOTE

Landing on a wide runway of sufficient length with minimum turbulence and crosswind is recommended.

Descent checks:

1. Pressurization ..... LNDG ALT set
2. WING ANTI-ICE switch..... As required
3. L and R ENG ANTI-ICE switches ..... As required

Transition level (or FL 180) checks:

4. Altimeters..... Set pilot, copilot and standby, and cross-check
5. L and R LANDING light switches ..... On
6. Cabin check:
   a. Brief passengers
   b. Seats ..... Swivel forward or aft and in outboard position. Headrests in place for occupied aft facing seats.
   c. Work tables..... Stowed
   d. Emergency exit ..... Aisle clear
7. SMKG/BELTS switch..... SMKG/BELTS
8. Fuel quantities and balance ..... Check

Approach checks:

9. APU start:
   a. APU switch ..... START and release
   b. R BLEED switch ..... OFF
   c. APU BLEED switch..... ON
   d. L BLEED switch..... OFF
   e. XBLEED switch..... Open

THRUST REVERSER DEPLOYED LANDING (Cont)

10. Final approach speed ..... V_{REF}

11. Normal actual landing distance ..... Multiply by:
    1.15 without thrust reversers
    1.10 with thrust reversers

12. Approach setup and crew briefing:

    a. Avionics and radios ..... Set

    b. MIN ..... Set

    c. Crew approach briefing ..... Complete

Before landing checks:

13. LANDING GEAR switch ..... DN

14. N LDG/TAXI light switch ..... On

15. FLAPS selector 30

NOTE

After landing, use of the operative thrust reverser is allowable.

DUAL ENGINE FLAMEOUT

1. Crew oxygen masks (if above 14,000 ft) ..... Don
2. Pilot and copilot O2 MASK/NORM switches ..... O2 MASK
3. Best glide speed ..... Establish

Table EP-2 GLIDE SPEED

AIRCRAFT WEIGHT	BEST GLIDE SPEED
28,000 lb (12,701 kg)	160 KIAS
33,000 lb (14,969 kg)	174 KIAS
38,000 lb (17,237 kg)	185 KIAS

NOTE

Interpolate for weights between the weights provided.

4. Thrust levers ..... IDLE
5. ENGINE RUN switches ..... OFF
6. Pilot and copilot INPH switches ..... INPH

Aircraft is above 20,000 ft:

7. Descend to below 30,000 ft.
8. APU start:
   a. APU switch ..... START and release
   b. L and R BLEED switches ..... OFF
   c. APU BLEED switch (above 20,000 ft) ..... OFF
9.. Airspeed ..... Increase to 250 KIAS or greater
10. FUEL panel:
   a. XFER switch ..... Closed
   b. L and R PUMP switches ..... AUTO
11. ENG ANTI-ICE switches ..... Off
12. ENGINE RUN switch ..... RUN

DUAL ENGINE FLAMEOUT (Cont)

If lightoff occurs within 45 seconds:

a, Other engine ..... Start

b. If only one engine is operating, refer to Engine Shutdown in Flight procedure, Abnormal chapter.

If lightoff does not occur within 45 seconds:

a. ENGINE RUN switches ..... OFF

b. Attempt another windmill relight at a lower altitude or higher airspeed or establish best glide speed and descend below 20,000 ft for a starter-assisted airstart (go to Step 13).

If aircraft is below 20,000 ft:

13. APU start:

    a. APU switch ..... START and release

    b. L and R BLEED switch ..... OFF

    c. APU BLEED switch..... ON

    d. XBLEED switch..... Open

14. FUEL panel:

    a. XFER switch..... Closed

    b. L and R PUMP switches ..... AUTO

15. ENG ANTI-ICE switches ..... Off

16. ENGINE RUN switch ..... RUN

17. STARTER switch ..... START

If lightoff occurs within 45 seconds:

a, Other engine ..... Start

b. If only one engine is operating, refer to Engine Shutdown in Flight procedure, Abnormal chapter.

If lightoff does not occur within 45 seconds:

a. ENGINE RUN switches ..... OFF

b. Attempt another starter-assisted airstart at a lower altitude or higher airspeed or refer to Ditching or Forced Landing—Both Engines Inoperative procedure in this chapter.

ENGINE FAILURE

During Takeoff

Below V_1 speed:

1. Thrust levers ..... IDLE
2. Brakes..... Maximum or as required
3. Thrust reversers ..... MAX REV or as required

Above V_1 speed:

1. Rotate at V_R.
2. Pitch attitude ..... Adjust or as required to achieve V_2

NOTE

Initially rotate toward the flight director pitch guidance command. Adjust pitch as required to maintain V_2.

3. LANDING GEAR switch ..... UP
after positive rate of climb

4. Climb at V_2 until clear of obstacles; accelerate to V_2 + 15 (flaps 10) or V_2 + 25 (flaps 20); retract flaps; then climb at en route climb speed.
5. Refer to Engine Shutdown in Flight procedure, Abnormal chapter.

In Flight

1. Autopilot..... Disconnect
2. Thrust lever (operative engine)..... Increase as required
3. Rudder trim..... As required
4. Refer to the following procedure as applicable:
   a. Engine Shutdown in Flight, Abnormal chapter
   b. Single-Engine Landing, Abnormal chapter
   c. Single-Engine Go-Around, Abnormal chapter

REJECTED TAKEOFF

REJECTED TAKEOFF

1.	**Thrust levers**	**IDLE**
2.	**Brakes**	**Maximum or as required**
3.	**Thrust reversers**	**MAX REV or as required**

SMOKE OR FIRE

CABIN/COCKPIT FIRE, SMOKE OR FUMES

WARNING

In the event of smoke or fire, prepare to land without delay while completing fire suppression and/or smoke evacuation procedures. Whether or not smoke has dissipated, if it cannot be visibly verified that the fire has been extinguished following fire suppression and/or smoke evacuation procedures, land immediately at the nearest suitable airport.

1. Crew oxygen masks..... Don, select EMERGENCY
2. Smoke goggles..... Don
3. Pilot and copilot O2 MASK/NORM switches ..... O2 MASK

4. Pilot and copilot INPH switches ..... INPH
5. PAX OXYGEN switch ..... OFF
6. OXYGEN THERAPEUTIC switch ..... Off
7. EMER DEPRESS switch..... ON

NOTE

During EMER DEPRESS operation in manual mode, the cabin rate digital value may be replaced with magenta dashes momentarily. The cabin rate is still controlled within safe limits.

If cabin does not depressurize:

a. MANUAL PRESSURIZATION switch ..... ON
b. MAN RATE control..... Full up

NOTE

With the MASK/NORM switches in the MASK position and the INPH selector switches out (enabled), both cockpit speakers and interphone function are activated, enabling the crew to communicate via the interphone. With the INPH selector switch in (disabled), the crew can communicate via the interphone by pushing the control column RADIO & INTERCOM switch inboard.

8. Descend as necessary but now below minimum safe altitude.
9. Land as soon as possible.

CABIN/COCKPIT FIRE, SMOKE OR FUMES (Cont)

If source is known:

10. Extinguish fire using hand-held extinguisher to eliminate the source of smoke or fumes. If fire is extinguished and can be visibly verified, the pressurization and oxygen systems may be returned to normal.

If source is not known:

If electrical system is suspected source:

11. Autopilot ..... Disconnect
12. EMER LTS switch ..... OFF

If L GEN is operative:

a. APU GEN switch ..... OFF

If L GEN is inoperative:

a. APU GEN switch ..... ON

13. R GEN switch ..... OFF
14. R BATT switch ..... OFF
15. BUS TIE switch ..... Open

If smoke or fumes dissipate:

a. AIR SOURCE switch ..... PACK ONLY
b. WING SOURCE ANTI-ICE switch ..... FROM L
c. R BLEED switch ..... OFF
d. TUNE REVERSION switch ..... CDU ONLY
e. Transponder ..... Select ATC1
f. Flight guidance panel XFR switch ..... Select FD1
g. Airspeed ..... 0.75 M/250 KIAS maximum
h. Altitude ..... 25,00 ft maximum
i. Leave icing conditions as soon as possible.
j. STALL PUSHER ..... OFF

NOTE

Standby probes will not be anti-iced.

If smoke or fumes DO NOT dissipate, go to A.

If bleed air system is suspected source, go to B.

-CONTINUED-

CABIN/COCKPIT FIRE, SMOKE OR FUMES (Cont)

Electrical system is suspected source: (Cont)

Smoke or fumes dissipate: (Cont)

The following equipment is inoperative:

AIR CONDITIONING AND PRESSURIZATION

Trim air
Right engine bleed air
ECS XBLEED valve
IASC 2
Manual pressurization
R ECS bleed pressure indication
Right bleed leak detection
Oxygen quantity indication

AUTO FLIGHT

Autopilot
Yaw damper
Flight director 2

AVIONICS

R PFD and MFD
FMS 2 and R CDU
COM 2, NAV 2, DME 2
Trandponder 2
GPS
AHRS 2, ADC 2
RDC channel B
DCU channel B
RDC fan
DCU fan
TAWS

ELECTRICAL

R main bus
R ESS bus
Left and right aux buses

FIRE PROTECTION

1/2 of the fire detection loop
Gear by overheat detection
Cargo smoke detector

FLIGHT CONTROLS

Outboard flight spoilers
Outboard ground spoilers
Secondary stabilizer trim
Aileron and rudder trim
Stall pusher

FLIGHT CONTROLS (Cont)

Right stall shaker
Right flap indicator
Rudder travel limiter (secondary channel)
Pilot and copilot rudder pedal adjustment

FUEL

Fuel XFER valve
Right fuel pump
Fuel quantity indication

HYDRAULICS

Left DC hydraulic pump and PTU

ICE AND RAIN PROTECTION

Right windshield and window anti-ice
Right engine anti-ice failed on
Right ice detector
IASC 2
R probe heat controller (R pitot static heat, R stby static heat, R AOA heat, STBY pitot heat)

LANDING GEAR, WHEELS and BRAKES

Outboard brakes

MISCELLANEOUS

Nose landing/taxi lights
Right landing light
Nav lights
ANNUN B test

POWERPLANT

Engine sync and Mach hold
Left and right thrust reverser
R FADEC fault due to loss of ADC2
Ground idle (engines remain at flight idle)

CABIN/COCKPIT FIRE, SMOKE OR FUMES (Cont)

Electrical system is suspected source: (Cont)

Smoke or fumes dissipate: (Cont)

NOTE

The applicable procedures for the following CAS messages are consolidated within this procedure and do not need to be conducted separately:

OUTBD BRAKES FAIL (C)

STALL PROTECT FAIL (C)

R WING ANTI-ICE FAIL (C)

R PITOT HEAT FAIL (C)

STBY PITOT HEAT FAIL (C)

R ENG A/ICE FAIL ON (A)

L (R) ENGINE FAULT (A)

R ESS BUS OFF (A)

R MAIN BUS OFF (A)

L (R) AUX BUS OFF (A)

L ENG THRUST FAULT (A)

Descent checks:

k. Pressurization ..... LNDG ALT set

l. WING ANTI-ICE switch ..... As required

m. L and R ENG ANTI-ICE switches ..... As required

Transition level (or FL 180) checks:

n. Altimeters ..... Set pilot, copilot and standby, and cross-check

o. L and R LANDING light switches ..... On

p. Cabin check:

(1) Brief passengers

(2) Seats ..... Swivel forward or aft and in outboard position. Headrests in place for occupied aft facing seats.

(3) Work tables ..... Stowed

(4) Emergency exit ..... Aisle clear

q. SMKG/BELTS switch ..... SMKG/BELTS

r. Fuel quantities and balance ..... Check

CABIN/COCKPIT FIRE, SMOKE OR FUMES (Cont)

Electrical system is suspected source: (Cont)

Smoke or fumes dissipate: (Cont)

Approach checks:

s. Final approach speed ..... V_{REF} + 10

t. Normal actual landing distance ..... Multiply by 1.95

NOTE

Extend gear as soon as possible during approach (to ensure cool brakes).

u. Approach setup and crew briefing:

(1). Avionics and radios ..... Set

(2). MIN ..... Set

(3). Crew approach briefing ..... Complete

Before landing checks:

v. LANDING GEAR switch ..... DN

w. N LDG/TAXI light switch ..... On

x. R HYDRAULIC PUMP switch ..... ON

y. FLAPS selector 30

z. EMER LIGHTS switch ..... ON

A **Smoke or fumes *do not* dissipate:**

a. R BATT switch ..... On

If R GEN is operative:

a. R GEN switch ..... On

Transition to the standby instrument and magnetic compass until the AHRS realigns.

NOTE

L and R WSHLD/WINDOW switches must be temporarily selected OFF while the standby compass is being read.

The AHRS requires approximately one minute to initialize during straight and level flight. The equipment listed below is inoperative when the left electrical buses are depowered.

(2) APU GEN switch ..... OFF

CABIN/COCKPIT FIRE, SMOKE OR FUMES (Cont)

Electrical system is suspected source: (Cont)
Smoke or fumes *do not* dissipate: (Cont)

If R GEN is inoperative:

(1) APU GEN switch ..... OFF

Transition to the standby instrument and magnetic compass until the AHRS realigns.

NOTE

L and R WSHLD/WINDOW switches must be temporarily selected OFF while the standby compass is being read.

The AHRS requires approximately one minute to initialize during straight and level flight. The equipment listed below is inoperative when the left electrical buses are depowered.

b L GEN switch ..... OFF

c. L BATT switch..... OFF

d. STAB TRIM switch ..... SEC

e. AIR SOURCE switch ..... TRIM AIR ONLY

f. L BLEED switch..... OFF

g. XBLEED switch ..... Closed

h. Leave icing conditions as soon as possible.

i. WING SOURCE ANTI-ICE switch ..... FROM R

j. Airspeed..... 185 KIAS/0.75MI Maximum

k. TUNE REVERSION switch..... MFD ONLY

l. Transponder ..... Select ATC 2

m. Altitude ..... 25,000 ft maximum

n. Avoid excessive rudder inputs.

NOTE

Standby probes will not be anti-iced.

The applicable procedures for the following CAS messages are consolidated within this procedure and do not need to be conducted separately:

STALL PROTECT FAIL (C)	L WING ANTI-ICE FAIL
INBD BRAKES FAIL (C)	L PITOT HEAT FAIL (C)
L ESS BUS OFF (A)	L MAIN BUS OFF (A)
L (R) AUX BUS OFF (A)	L (R) ENGINE FAULT
R ENG THRUST FAULT (A)	L ENG A/ICE FAIL ON

CABIN/COCKPIT FIRE, SMOKE OR FUMES (Cont)

Electrical system is suspected source: (Cont)
Smoke or fumes *do not* dissipate: (Cont)

The following equipment is inoperative:

AIR CONDITIONING AND PRESSURIZATION
- Pack
- Left engine bleed air
- ECS XBLEED valve
- Left bleed leak detection
- IASC 1
- L bleed pressure indication

AURAL/VISUAL WARNING SYSTEM
- Aural warning DCU A

AUTO FLIGHT
- Autopilot
- Yaw damper
- Flight director 1

AVIONICS
- L PFD and MFD
- FMS 1 and left CDU
  - FMS 2 is operative but only in dead reckoning (DR).
- COM 1, COM 3, NAV 1, DME 1
- Trandponder 1
- GPS
- AHRS 1, ADC 1
- Standby instrument
- RDC channel A
- DCU channel A
- CVR
- IAPS fan
- Clock
- Radio altimeter

ELECTRICAL
- L main bus
- L ESS bus
- Left and right aux buses

FIRE PROTECTION
- 1/2 of the fire detection loop

FLIGHT CONTROLS
- Inboard flight spoilers
- Inboard ground spoilers
- Primary stabilizer trim
- Mach trim
- Aileron and rudder trim
- Left aileron and elevator indications
- Stall pusher
- Left stall shaker
- Left flap indicator
- Rudder travel limiter

ICE AND RAIN PROTECTION
- Left windshield and window anti-ice
- Left engine anti-ice failed on
- Left ice detector
- IASC 1
- L probe heat controller (TAT heat L pitot static heat, AOA heat)

LANDING GEAR, WHEELS and BRAKES
- Inboard brakes

MISCELLANEOUS
- ANNUN A test
- Beacon and strobe lights
- Left and right map lights
- Left landing light
- Wing inspection light
- Ground idle
  - (engines remain at flight idle)

POWERPLANT
- Engine sync and Mach hold
- Left and right thrust reverser
- L FADEC fault due to loss of ADC 1
- Left engine anti-ice failed on

CABIN/COCKPIT FIRE, SMOKE OR FUMES (Cont)

Electrical system is suspected source: (Cont)
Smoke or fumes *do not* dissipate: (Cont)

Descent checks:

o. Pressurization ..... LNDG ALT set

p. WING ANTI-ICE switch ..... As required

q. L and R ENG ANTI-ICE switches ..... As required

Transition level (or FL 180) checks:

r. Altimeters ..... Set copilot and standby, and cross-check

s. L and R LANDING light switches ..... On

t. Cabin check:

(1) Brief passengers

(2) Seats ..... Swivel forward or aft and in outboard position. Headrests in place for occupied aft facing seats.

(3) Work tables ..... Stowed

(4) Emergency exit ..... Aisle clear

u. Fuel quantities and balance ..... Check

Approach checks:

v. Final approach speed ..... V_{REF} + 10

w. Normal actual landing distance ..... Multiply by 1.95

NOTE

Extend gear as soon as possible during approach (to ensure cool brakes).

x. Approach setup and crew briefing:

(1). Avionics and radios ..... Set

(2). MIN ..... Set

(3). Crew approach briefing ..... Complete

Before landing checks:

y. LANDING GEAR switch ..... DN

z. N LDG/TAXI light switch ..... On

aa. L HYDRAULIC PUMP switch ..... ON

ab. FLAPS selector 30

ac. EMER LIGHTS switch ..... ON

CABIN/COCKPIT FIRE, SMOKE OR FUMES (Cont)

B **Bleed-air system is suspected source:**

If APU supplies bleed air:

a. XBLEED switch ..... Closed

b. L BLEED switch ..... On

c. APU BLEED switch ..... Off

d. R BLEED switch ..... On

If smoke or fumes are eliminated:
No further action

If smoke or fumes are not eliminated:

(1) AIR SOURCE switch ..... TRIM AIR ONLY

If smoke or fumes are eliminated:
No further action

If smoke or fumes are not eliminated:

(a) AIR SOURCE switch ..... PACK ONLY

If engines supply bleed air:

a. R BLEED switch ..... OFF

b. XBLEED switch ..... Closed

If smoke or fumes are eliminated:
No further action

If smoke or fumes are not eliminated:

(1) R BLEED switch ..... On

(2) L BLEED switch ..... OFF

If smoke or fumes are eliminated:
No further action

If smoke or fumes are not eliminated:

(a) AIR SOURCE switch ..... TRIM AIR ONLY

If smoke or fumes are eliminated:
No further action

If smoke or fumes are not eliminated:

(i) AIR SOURCE switch .....PACK ONLY

(ii) L BLEED switch ..... On

CARGO SMOKE (W)

Smoke has been detected in the cargo (baggage) area.

NOTE

In the event of smoke or fire, prepare to land without delay while completing fire suppression and/or smoke evacuation procedures. Whether or not smoke has dissipated, if it cannot be visibly verified that the fire has been extinguished following fire suppression and/or smoke evacuation procedures, land immediately at the nearest suitable airport.

1. Crew oxygen masks ..... Don, select EMERGENCY
2. Smoke goggles ..... Don
3. Pilot and copilot O2 MASK/NORM switch ..... O2 MASK
4. Pilot and copilot INPH switches ..... INPH (enabled)

NOTE

With the O2 MASK/NORM switches in the MASK position and the INPH selector switches out (enabled) both cockpit speakers and interphone functions are activated, enabling the crew to communicate via the interphone. With the INPH selector switch in (disabled), the crew can communicate via the interphone by pushing the control column RADIO & INTERCOM switch inboard.

5. PAX OXYGEN switch ..... OFF
6. OXYGEN THERAPEUTIC switch ..... Off
7. CABIN DC and AC PWR ..... OFF
8. EMER DEPRESS switch ..... ON
9. Descend as necessary but not below minimum safe altitude.

NOTE

The cabin altitude climbs to aircraft altitude or approximately 15,000 feet, whichever is lower, and stabilizes with EMER DEPRESS switch ON.

10. Land as soon as possible.

Designated Crewmember:

11. Protective breathing equipment ..... Don
12. Fire extinguisher ..... Prepare for use
13. Fire or smoke source ..... Extinguish

TAKEOFF CONFIGURATION WARNINGS

CONFIGURATION WARNING

CONFIGURATION

CONFIG AILERON TRIM (W)
CONFIG AUTOPILOT (W)
CONFIG FLAPS (W)
CONFIG RUDDER TRIM (W)
CONFIG SPOILERS (W)
CONFIG STAB TRIM (W)
PARK/EMER BRAKE ON (W)

The aircraft is on the ground and the takeoff parameters (autopilot, flaps, spoilers, and trims in any axis) are not properly configured for takeoff. Illumination of the respective red CAS is accompanied by the takeoff CONFIGURATION voice warning.

1. Thrust levers ..... IDLE
2. Brakes ..... Maximum or as required
3. Thrust reversers ..... MAX REV or as required
4. After stopping, takeoff configuration ..... Check

PITCH DISCONNECT (W)

Pitch disconnect has occurred on the ground with the thrust levers at or above CLB.

1. Thrust levers ..... IDLE
2. Brakes ..... Maximum or as required
3. Thrust reversers..... MAX REV or as required
4. After stopping, align control columns.
5. PULL & TURN the PITCH DISC handle to release, and push to full stow position.
6. Verify ROLL DISCONNECT CAS extinguishes. Slight movement of the control columns may be required to reconnect the controls.

ROLL DISCONNECT (W)

Roll disconnect has occurred on the ground with the thrust levers at or above CLB.

1. Thrust levers ..... IDLE
2. Brakes ..... Maximum or as required
3. Thrust reversers..... MAX REV or as required
4. After stopping, align control wheels.
5. Release the small locking lever and push the ROLL DISC lever forward.
6. Verify ROLL DISCONNECT CAS extinguishes. Slight movement of the control wheels may be required to reconnect the controls.

LIMITATIONS

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LIMITATIONS

GENERAL

Observance of the limitations in the *Airplane Flight Manual* is mandatory. This manual assumes that all applicable service bulletins have been performed. Consult the *Airplane Flight Manual* for additional limitations if service bulletins have not been complied with.

BASIC LIMITATIONS

KINDS OF OPERATION

This aircraft is certificated to the applicable regulations in the transport category and is eligible for the following kinds of operations when the appropriate instruments and equipment required by the airworthiness and operating requirements are installed and approved and are operable.

This aircraft is approved for the following:

- VMC (Visual meteorological conditions)
- IMC (Instrument meteorological conditions)
- Day
- Night
- Icing

The aircraft is certified capable of RVSM operations in accordance with the FAA interim guidance material on the approval of operations/aircraft for RVSM operations, 91-RVSM, dated June 30, 1999 and the *JAA Temporary Guidance Leaflet, TGL No. 6*, revision 1, RVSM.

NOTE

Compliance with the material above does not constitute an operational approval.

RVSM operations must not be commenced or continued unless all of the required equipment specified in Table LIM-1 is operational.

Table LIM-1. RVSM REQUIRED EQUIPMENT LIST

EQUIPMENT	REQUIREMENTS FOR RVSM
Autopilot (1)	Must be operational
Altitude alerting system	Must be operational
Altitude Reporting Transponder (2)	One must be operational
Air Data Computers (2)	Two must be operational

Operation in Icing Conditions

Do not hold in icing conditions with flaps extended.

Super-Cooled Large Droplet Icing

Flight in super-cooled large droplet icing (SLD) conditions may, but not necessarily, be indicated by ice accretion on the side windows.

When side window icing is observed:

- Wing and engine anti-icing systems must be on
- Leave icing conditions as soon as possible

Engine Anti-Ice Systems

Ground Operations

The engine anti-icing system must be ON when the outside air temperature (OAT) on the ground and for takeoff is 10°C (50°F) or below and visible moisture in any form is present (such as fog with visibility of one mile(1500m) or less, rain, snow, sleet, or ice crystals).

The engine anti-icing system must also be ON when the OAT is 10°C (50 °F) or below when operating on ramps, taxiways, or runways where surface snow, ice, standing water, or slush is present.

Flight Operations

Icing conditions exist when the static air temperature (SAT) in flight is 10°C (50°F) to –40°C (–40°F) and visible moisture in any form is present (such as clouds, rain, snow, sleet, or ice crystals).

The engine anti-icing system must be ON when the ICE DETECTED CAS message is on, or in icing conditions.

Wing Anti-Ice System

Ground Operations

The wing anti-icing system must be ON for takeoff when the OAT is 5°C (41°F) or below and visible moisture in any form is present (such as fog with visibility of one mile (1500m) or less, rain, snow, sleet, or ice crystals).

The wing anti-icing system must also be ON when the OAT is 5°C (41°F) or below when operating on ramps, taxiways, or runways where surface snow, ice, standing water, or slush is present.

Flight Operation

Icing conditions exist when the (SAT) in flight is 10°C (50°F) to –40°C (–40°F) and visible moisture in any form is present (such as clouds, rain, snow, sleet, or ice crystals).

The wing anti-icing system must also be ON when:

- The ICE DETECTED CAS message is on or
- In icing conditions

Ditching

This aircraft is certified for ditching when the appropriate safety equipment is installed per applicable regulations.

Minimum Flight Crew

The minimum flight crew shall consist of a pilot and a copilot.

WEIGHT AND CENTER-OF-GRAVITY (CG) LIMITATIONS

Maximum ramp weight ..... 39,000 lb (17,690 kg)

Maximum certified takeoff weight ..... 38,850 lb (17,622 kg)

Maximum certified landing weight ..... 33,750 lb (15,309 kg)

Maximum zero fuel weight ..... 27,000 lb (12,247 kg)

Minimum flight weight ..... 23,100 lb (10,478 kg)

All weights in excess of maximum zero fuel weight must consist of fuel.

The maximum takeoff weight (MTOW) and/or maximum landing weight (MLW) may be further limited due to performance considerations.

CENTER OF GRAVITY

The center of gravity of the aircraft for all flight conditions must be maintained with the applicable center-of-gravity envelope (Figure LIM-1). For specific details on the center of gravity envelope, refer to *CH 300 WBM* (Challenger 300 Weight and Balance Manual).

NOTE

The aircraft must be loaded in accordance with the loading instructions associated with the Challenger 300 Weight and Balance Manual. The effect of landing gear retraction on the CG position is negligible.

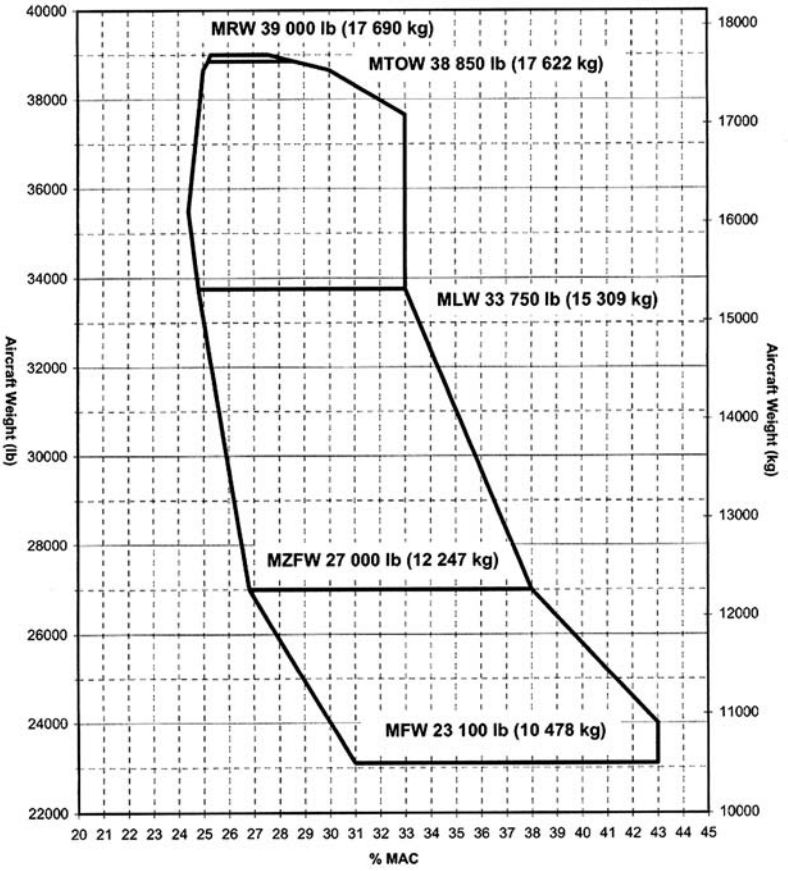

Figure LIM-1 Center-of-Gravity Envelope

SPEED LIMITATIONS

MAXIMUM OPERATING SPEED (V_{MO}/M_{MO})

V_{MO} (up to 8,000 ft) ..... 300 KIAS

V_{MO} (8,001 to 29,475 ft) ..... 320 KIAS

M_{MO} (above 29,475 ft) ..... 0.83 MI

V_{MO}/M_{MO} may not be deliberately exceeded in any regime of flight (climb, cruise, or descent), unless a higher speed is specifically authorized for flight test or training operations.

MANEUVERING SPEED (V_A)

V_A is the highest speed that full roll and yaw control can be applied without overstressing the aircraft. Full application of rudder and aileron controls as well as maneuvers that involve angles of attack near the stall must be confined to speeds below V_A.

Figure LIM-2 shows airspeed/mach limitations for V_A.

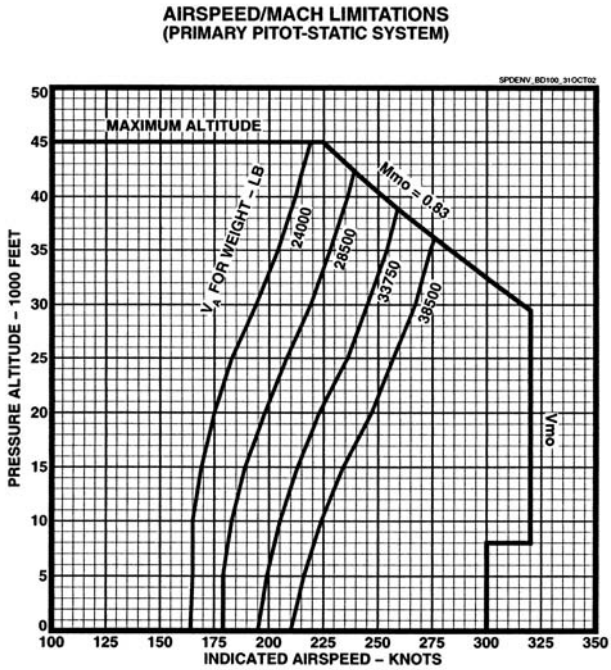

Figure LIM-2 Airspeed/Mach Limitations

CAUTION

Rapid and large alternating control inputs, especially in combination with large changes in pitch, roll or yaw (e.g., large sideslip angles) may result in structural failures at any speed, even including below V_A.

ROUGH AIR PENETRATION SPEED (V_{RA})

V_{RA} .....265 KIAS/0.75 MI

MAXIMUM LANDING GEAR OPERATING SPEED—RETRACTION

V_{LO} RET..... 200 KIAS

MAXIMUM LANDING GEAR OPERATING SPEED—EXTENSION

V_{LO} EXT..... 250 KIAS

MAXIMUM LANDING GEAR EXTENDED SPEED (V_{LE})

V_{LE} ..... 250 KIAS

MAXIMUM FLAP EXTENDED SPEED (V_{FE})

V_{FE}

Flaps 10 ..... 210 KIAS

Flaps 20 ..... 210 KIAS

Flaps 30 ..... 175 KIAS

MINIMUM OPERATING SPEED

Intentional speed reduction below the onset of stall warning, as defined by stick shaker operation, is prohibited unless a lower speed is specifically authorized for flight test or training operations.

TIRE SPEED

Maximum tire speed (ground speed) ..... 182 kts

OPERATIONAL LIMITATIONS

TAKEOFF AND LANDING

Maximum takeoff and landing pressure altitude ..... 10,000 ft

Maximum tailwind component ..... 10 kts

Takeoffs and landings are limited to paved runways.

The maximum runway slopes approved for takeoff and landing are +2% uphill and –2% downhill.

ENROUTE

Maximum pressure altitude ..... 45,000 ft

MANEUVERING LOAD FACTORS

Flaps up ..... +2.6 g to –1.0 g

Flaps extended ..... +2.0 g to 0.0 g

OPERATION WITH TYPE II/IV ANTI-ICING FLUIDS

When Type II/IV anti-icing fluids have been applied, the wing anti-ice system must only be selected ON, if required, just prior to thrust increase for takeoff.

MANEUVERS

Aerobatic maneuvers and spins are prohibited.

Figure LIM-3 shows altitude and temperature limitations.

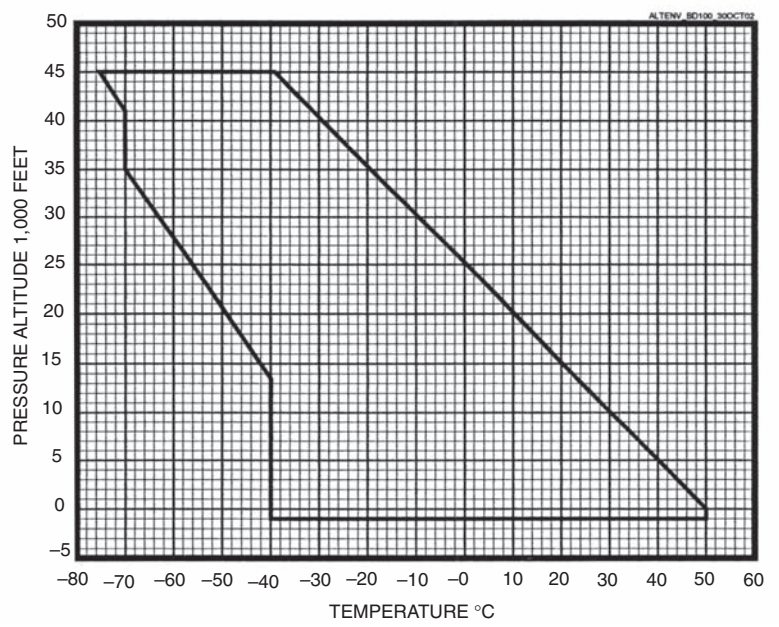

Figure LIM-3 Altitude and Temperature Limitations

SYSTEMS LIMITATIONS

AIR CONDITIONING AND PRESSURIZATION

Air Conditioning

Do not select the AIR SOURCE switch to TRIM AIR ONLY while the aircraft is on the ground.

The pack must be operating (APU or engine running and AIR SOURCE switch—NORM or PACK ONLY) when the aircraft electrical power is on (BATTs or EXT PWR—On) for more than 30 minutes and the OAT is above 40°C (104°F).

Oxygen

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.

Crew and passenger oxygen masks are not approved for use about 40,000 feet cabin altitude. Prolonged operation of passenger masks above 25,000 feet cabin altitude is not recommended.

Pressurization

The maximum differential pressure on the ground (during taxi) must not exceed 0.1 psi.

The maximum differential pressure during landing must not exceed 1.0 psi.

The maximum positive differential pressure is 9.4 psi. The maximum negative differential pressure is –0.5 psi.

AUTOFLIGHT

Do not intentionally overpower the autopilot.

Operation with an ILS glidepath angle that exceeds 3.5° is prohibited.

Autopilot minimum use height:

Climb, enroute or descent ..... 700 feet AGL

Approach

Precision ..... 80 feet AGL

Visual and nonprecision ..... 200 feet AGL

The maximum altitude with yaw damper off is 31,000 feet.

AVIONICS

DATALINK (If installed)

The DATALINK is approved for the transmission and receipt of messgaes that will not create an unsafe condition if the message is improperly received. An unsafe condition may exist if:

- The message or part of the message is delayed or not received.
- The message is delivered to the wrong recipient.
- The message content is corrupted.

Crew actions based on messages such as predeparture clearance, oceanic clearance, digital automatic terminal information service, weight and balance, takeoff data (speeds, trim settings, runway distances) are prohibited unless the approved operational procedures are used to verify that the message is received by the intended recipient, that the message is valid, and that the content is not corrupted.

Flight Management System (FMS)

The Collins FMS-5000 *Flight Management System Pilot's Guide* (part number 523-0780848-001117 dated 7 March 2003 or later) must be immediately available to the flight crew whenever navigation is predicated on the use of the FMS.

The FMS is approved for use with software version (FMC SCID #832-4118-018) or later applicable revision. The software status in the FMS Pilot's Guide must match that displayed on the equipment.

The performance database part number must be verified to be 815-5959-001.

FMS range and fuel management information is advisory only.

When the batteries are removed, the FUEL USED on the FMS will indicate the value from the previous flight. After reinstalling the batteries, the FUEL USED should be manually reset to zero.

To be used for navigation, the FMS must be receiving suitable navigation information from one of the following sources:

- One VOR/DME
- Two DMEs
- GPS—If the GPS is the only available sensor, use of the FMS for navigation is not approved unless the Collins prediction program 832-3443-005 has been run.

Use of the FMS V-speed data is prohibited for temperatures above ISA +33°C.

Single FMS:

- The FMS V-speed data (if installed) is advisory only and must be verified with *AFM* data.

- V-speed database part number must be verified to be: 815-5961-002.

Dual FMS (if installed):

- The FMS V-speed data (if installed) does not need to be verified with the *AFM* provided two flight management computers are available.
- V-speed database part number must be verified to be: 815-5961-002.

IFR enroute and terminal navigation is prohibited unless the pilot verifies the currency of the database or verifies the waypoints for accuracy by reference to current publications.

Instrument approaches must be accomplished only in accordance with instrument approach procedures that are contained in the FMS database. The database must incorporate the current update cycle. The pilot must verify approach waypoints for accuracy by reference to current publications.

Use of FMS instrument approaches is prohibited unless APPR is annunciated on the PFD.

Use of VNAV vertical guidance for V-MDA type approach between the final approach fix and the missed approach fix is prohibited.

The FMS with inputs from GPS may only be used for approach guidance if the reference coordinate data system for the instrument approach is WGS-84 or NAD-83.

When the altimeter is adjusted to show the height above ground (QFE) rather than sea level, VNAV shall not be used.

CAUTION

Errors to VNAV defined paths may occur because of coding errors in the navigation data base and because of altimetry errors. The actual VNAV path may deviate significantly below the intended VNAV path in very cold temperatures, unless an approved temperature compensation function (if equipped) is used to correct for nonstandard temperatures.

Database coding of VNAV altitudes for approach waypoints may result in VNAV paths continuing below minimum descent altitude (MDA), decision altitude (DA), or decision height (DH), or ending at an altitude too high to continue a safe descent to landing. VNAV paths (often call pseudo-glidepaths) are not equivalent to an ILS glideslope.

Position along an approach must be verified prior to commencement of VNAV descent as displayed by the FMS. The required visual reference must be obtained prior to commencing descent below published MDAs, DA or DHs.

Approval Status

Provided the FMS is receiving adequate usable signals, it has been demonstrated capable of and has been shown to meet the performance requirements for the following operations:

- Lateral Navigation—VFR/IFR enroute oceanic and remote, enroute domestic, terminal operation, and instrument approach using WGS-84 (or NAD 83) coordinate reference datum in accordance with the performance/accuracy requirements of AC20-130A.

- Primary Means Oceanic and Remote—Use of the FMS with GPS has been found to comply with the requirements of FAA Notice 8110.60 for GPS primary means of navigation in oceanic and remote airspace, when used in conjunction with the Collins prediction program 832-3443-005 and with two operational GPS receivers and two operational FMS systems.

- NAT MNPS—Provided dual FMS and dual GPS are installed and operating, the FMS with GPS inputs has been demonstrated capable of flight into North Atlantic (NAT) minimum navigation performance specifications (MNPS) and has been shown to meet the accuracy specification in accordance with AC 120-33 or AC 91-49.

- P-RNAV—The FMS installation meets the P-RNAV requirements of JAA TGL 10, provided the operator implements navigation database integrity checks using appropriate software tools or approved procedures as per TGL 10 section 10.6.

- RNP-5/BRNAV—This FMS installation has been demonstrated to meet the RNP-5 airspace (BRNAV) requirements of AC90-96 and JAA AMJ 20X2 leaflet 2, revision l.

- RNP-10—With dual FMS and dual GPS are installed and operational, this FMS installation of GPS with RAIM meets the criteria of FAA Order 8400.12A as a means of navigation for flights without time limitations.

- Vertical Navigation—The FMS meets the accuracy requirements of VFR/IFR enroute and terminal VNAV operation within the contiguous United States and Alaska in accordance with the criteria of AC20-129.

NOTE

The above statements do not constitute an operational approval.

Standby Instrument

Use of the standby instrument localizer deviation guidance is prohibited during localizer backcourse approaches.

Standby Compass

L and R WSHLD/WINDOW switches shall be temporarily selected OFF while the standby compass is being read.

Terrain Awareness and Warning System (TAWS)

Do not use the terrain awareness and warning system for navigation.

Traffic Alert and Collision Avoidance System (TCAS)

Pilots are authorized to deviate from their air traffic control (ATC) clearance in order to comply with a resolution advisory (RA) command.

Maneuvers shall not be based solely on information presented on the traffic map overlay.

Integrated Flight Information System (If Installed)

- Incorporation of dual IFIS does not constitute operational approval to dispatch without adequate backup documentation.
- The IFIS related databases utilized (i.e., charts, airspace, airways, geographic, political, graphical weather) must incorporate the current update cycle.
- The IFIS does not include enroute charts.
- The use of the aircraft symbol on the electronic charts for navigation is prohibited.
- The display of geo-political boundaries, airspace, and airways on the MFD (enhanced map overlays) is for enhanced situational awareness only, and use for navigation is prohibited.
- All weather products data linked to the aircraft are advisory.
- For a single IFIS, adequate backup documentation must be immediately available to the flight crew.
- Use of the aircraft symbol for guidance during taxi operations is prohibited.

ELECTRICAL

Ground or Flight Operations

Continuous:

Two or three generators operating ..... 400 amps

One generator operating (on the ground) ..... 400 amps

One generator operating (in flight) ..... 500 amps

Transient (5) minutes ..... 600 amps

NOTE

Refer to APU Limitations section in this chapter for APU generator altitude limits.

Do not take off it battery temperatures are below –20°C (–4°F).

FLIGHT CONTROLS

Flaps

Do not extend the flaps above 18,000 feet.

Spoilers

Do not select flight spoilers to EMER except during emergency conditions or as required by procedure.

Flight spoilers shall not be extended in flight at airspeeds below approach speed +8 KIAS.

Flight spoilers shall not be extended in flight below 500 feet AGL.

HYDRAULICS

Hydraulic fluid of type phosphate ester fire resistant per BAMS 564-003 Type IV, Skydrol LD-4, Hyjet IV-a Plus is approved for use.

LANDING GEAR, WHEELS, AND BRAKES

Do not extend the gear above 18,000 feet.

Brake cooling times (established in accordance with the procedures in the *AFM*—Performance Data chapter) shall be observed between a landing or a rejected takeoff (RTO) and a subsequent takeoff to ensure that a sufficient brake energy is available to bring the aircraft to a complete stop if the subsequent takeoff is rejected.

FUEL LIMITATIONS

APPROVED FUELS

Fuels conforming to any of the following specifications in Table LIM-2 are approved for use. Mixing of fuel types is permitted.

The maximum altitude is limited to 16,000 feet when JP-4 or JET B is used.

Table LIM-2. FUEL SPECIFICATIONS

CANADIAN	AMERICAN	BRITISH
CAN/CGSB-3.23-97	ASTM D 1655-99-JET A	Def-Stan 91-91/3
CAN/CGSB-3.23-97	ASTM D 1655-99-JET A-1	Def-Stan 91-91/3
3-GP-24c	MIL-DTL-5624T-JP-5	Def-Stan 91-86/2
CAN/CGSB-3.22-97	ASTM D 1655-99-JET B	Def-Stan 91-88/1
CAN/CGSB-3.22-97	MIL-DTL-5624T-JP-4	Def-Stan 91-88/1

APPROVED FUEL ADDITIVES

Fuel additives (kerosene):

- Anti-icing additives MIL-I-27686 (0.1 to 0.15% by volume)
- Methyl cellosolve
- Biobar JF biocide (270 ppm)
- Shell ASA-3 anti-static additive
- Corrosion inhibitors: Apollo PRI-19 (0.0227 g/l), Dupont DCI-4A (0.0227 g/l), Dupont DCI-6A (0.0227 g/l), Hitec E-515 (0.0457 g/l), Hitec E-580 (0.0227 g/l), Nalco 5403 (0.0227 g/l), Nalco 5405 (0.0227 g/l), Tolad 245 (0.0340 g/l).
- Anti-static additive: STADIS 450 (a), (b), (e), Sigbol (cis), TU-38101741

FUELING

Single-point pressure refueling is limited to 55 psig (3792 hPa) and defueling is limited to –8 psig (–552 hPa).

FUEL TRANSFER SYSTEMS

The power and gravity shutoff valves shall be selected off for takeoff.

The maximum usable fuel load for each fuel tank is given in Table LIM-3

Table LIM-3. MAXIMUM USABLE FUEL LOAD

PRESSURE REFUEL		
Fuel Tank	**Fuel Mass ***	
Right	7,075 lb	3,210 kg
Left	7,075 lb	3,210 kg
Left and Right	14,150 lb	6,420 kg
*Based on a fuel density of 6.75 lb/USG (0.809 kg/litre), rounded to the nearest 5 lb or 5 kg.		

GRAVITY REFUEL (AIRCRAFT LEVEL)		
Fuel Tank	**Fuel Mass ***	
Right	6,500 lb	2,950 kg
Left	6,500 lb	2,950 kg
Left and Right	13,000 lb	5,900 kg
*Based on a fuel density of 6.75 lb/USG (0.809 kg/litre), rounded to the nearest 50 lb or 25 kg.		

MINIMUM FUEL QUANTITY FOR GO-AROUND

The minimum fuel quantity for go-around is 500 lb (227 kg) per side.

MAXIMUM FUEL IMBALANCE

The maximum allowable fuel imbalance values are detailed in the *Flight Crew Operating Manual*, Volume 1.

TEMPERATURE LIMITATIONS

The aircraft is prohibited from taking off if the bulk fuel temperature is below –30°C (–22°F) for Jet A, and –35°C (–31°F) for Jet A1 and JP 5, and –40°C (–40°F) for JP-4 and Jet B.

The aircraft is prohibited from taking off if the bulk fuel temperature is above 50°C (122°F).

With wing bulk fuel temperature at 45°C (113°F) or above:

- The minimum fuel load for takeoff is 2,800 lbs
- With less then 1,000 lbs of fuel per side, do not operate engine for more than 30 minutes

POWERPLANT LIMITATIONS

ENGINE TYPE

AS907-1-1A turbofan propulsion engines.

ENGINE OPERATION

The engine indicating system is designed to show system status with specified colors. The limits are indicated in red. Table LIM-4 shows engine operating limits.

Table LIM-4. ENGINE OPERATING LIMITS

LIMIT	GROUND START	AIR START ⑦	IDLE	MAX REVERSE	MAXIMUM CONTINUOUS (CLB) ①	NORMAL TAKEOFF (TO) ②	APR (MAX POWER) ③
N_1	--	--	--	70.7% ④	95.2%	96.1%	96.1%
N_2	--	--	46.0% min.	--	97.2%	97.2%	96.1%
ITT	650 °C	700 °C ⑤	--	928 °C	928 °C	928 °C	946 °C
OIL TEMP	-40 °C min.	--	⑥	--	138 °C max.	138 °C max. 27 °C min.⑥	138 °C max.
OIL PRESS	--	--	28 psi min.	⑧	⑧	⑧	⑧

1. Climb (CLB) equals maximum continuous thrust (MCT)
2. Normal Takeoff power is limited to 5 minutes
3. APR power (one engine inoperative) is limited to 10 minutes
4. Maximum reverse thrust is automatically reduced (ramped) commencing at 85 KIAS
5. Maximum ITT limit varies with N_2 speed (400 °C when N_2 <18% and ITT at start initiation <250 °C)
6. Minimum oil temperature must be achieved before commencing takeoff. Below -30 °C (-22 °F) the minimum oil temperature limit is 15 °C provided a fuel system icing inhibitor is used and the Cold Weather Operations procedures in FCOM volume 1 are followed.
7. The in flight re-start envelope is defined in Figure 05-32-01 of this manual
8. Minimum oil pressure varies with engine speed. Maximum allowable oil pressure increases with engine speed and with low oil temperature
9. A minimum oil temperature of 5 °C is required to operate engines above ground idle power. Between 5 and 14 °C, the engines may be operated from idle up to but not including CLB power.

Engine Start

Three consecutive engine start cycles may be conducted, followed by a cooling period of 15 minutes prior to additional starts and motoring.

The engine must be motored for 30 seconds after an aborted start.

Figure LIM-4 shows engine ground starting altitude and temperature limits.

Fuel system icing inhibitor must be used when fuel temperature is below –20°C (–4°F) (for takeoff only), unless cold weather procedures are followed.

Engine Cranking

The engine can be motored (cranked) for up to five minutes followed by a cooling period of 15 minutes prior to additional starts or motoring.

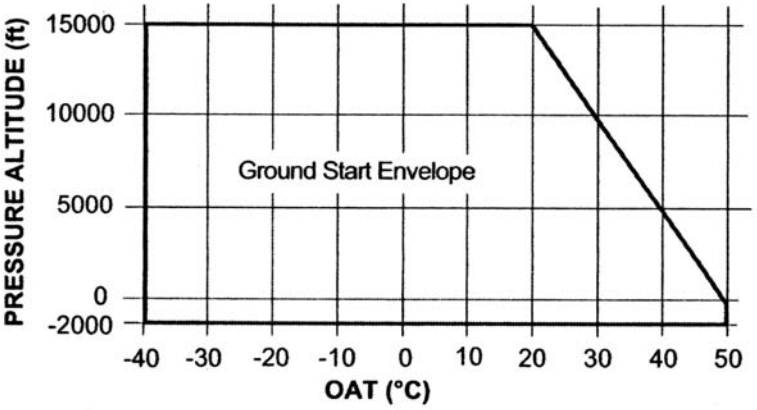

Figure LIM-4. Ground Start Envelope

OIL

Oils conforming to Honeywell specification EMS 53110, Type II are approved. Refer to Engine Oil Servicing for a listing of approved oils.

THRUST REVERSERS

Limit thrust reverser system use to ground operations on paved surfaces.

Do not attempt to deploy thrust reversers in flight.

Do not use thrust reversers to back up the aircraft.

Do not use thrust reversers for touch-and-go landings.

Reverse thrust above idle reverse is prohibited below 40 KIAS.

AUXILIARY POWER UNIT (APU) LIMITATIONS

APU TYPE

Honeywell 36-150BD auxiliary power unit.

MAXIMUM ALTITUDE

APU operation ..... 37,000 ft

APU GEN ..... 30,000 ft

Bleed air for ECS ..... 20,000 ft

Bleed air for engine start..... 20,000 ft

Do not use the APU to start the left engine on the ground above 9,000 ft.

Operation of the APU during fluid deicing/anti-icing is prohibited.

Do not take off with an APU SHUTDOWN (A) CAS displayed without conducting an inspection. If the APU automatically shuts down due to an APU failure, a visual inspection of the unit must be conducted prior to flight.

APU START

Delay starting the APU for five minutes after application of anti-icing fluid near the APU area.

The APU may be started up to an altitude of 30,000 ft (14,000 ft on the ground). The APU started is limited to 30 seconds continuous cranking time.

Do not start the APU above 300 KIAS.

Three start attempts may be made, each followed by a one-minute cooling period. After the third attempt, there must be a 20-minute cooling period. Two more start attempts may then be made. No further attempts may be made for at least 40 minutes. Six successful starts may be made at ten minute intervals with a one hour waiting period prior to additional attempts.

APU OPERATION

The EICAS system is designed to show system status with specified colors. The maximum and minimum limits are indicated in red.

The maximum APU rpm is 110%. The maximum APU EGT is 1024°C for start and 714°C for normal operations.

APPROVED FUELS/OILS

Fuels approved for the main aircraft engines are also approved for the APU.

Type I (MIL-L-7808) and Type II (MIL-L-23699) are approved oils.

MANEUVERS AND PROCEDURES

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MANEUVERS AND PROCEDURES

INTRODUCTION

This chapter presents recommended maneuvers and procedures for the Challenger 300 aircraft. The practices and techniques in this chapter are based on experience of Challenger 300 pilots and the *Airplane Flight Manual* (*AFM*). If the information conflicts with the *AFM*, the *AFM* always takes precedence. Power settings and airspeeds are given as targets.

A common sense approach to any given situation is stressed.

GENERAL

The predeparture briefing includes a discussion of non-normal or emergency conditions. When a crewmemeber recognizes these situations, the following questions should be asked:

- Who controls the aircraft?
- Who performs the tasks?
- What items should be monitored?

Following these designations, the pilot flying calls for the appropriate checklist. The designated crewmember accomplishes the checklist items with the appropriate challenge and response.

Both pilots must be able to respond to an emergency situation that requires immediate corrective memory items without reference to a checklist. Upon completion of these memory items, identify and accomplish each of the checklist procedures by referring to the printed checklist and *AFM*.

Crewmembers must make every effort to confirm and identify a malfunction before initiating any emergency items. Use positive oral and graphic communication to identify and direct the proper response.

PRIOR TO TAKEOFF

PREFLIGHT

Prior to passengers arriving, the pilot-in-command (PIC) briefs the second-in-command (SIC) on the route to be flown, altitude, passenger load, any catering requirements, etc. The PIC then assigns responsibility for tasks to be accomplished to evenly divide the workload.

Normally, one pilot accomplishes the Exterior Preflight checklist while the other pilot accomplishes the Before Starting Engines checklist. Along with the exterior preflight, monitor the fueling operation to ensure the proper fuel load is achieved.

The pilot accomplishing the Before Starting Engines checklist should copy the clearance and the ATIS (if available). Once this information is collected, the navigation equipment should be set up and the flight plan, fuel, cargo, and passenger data should be programmed into the FMS. The pilot should then compute the takeoff data on the takeoff data card or through the FMS and set V-speeds on the PFDs.

STARTING ENGINES

The full authority digital engine control (FADEC) on the HTF 7000 series engine makes starts virtually automatic. The ENGINE RUN switch is positioned in the RUN position for an engine start, which removes the ENGINE SHUTDOWN collector CAS message and posts several other CAS messages.

Initiate an engine start by turning the L or R START switch and monitoring the appropriate engine indications. For a normal engine start, a green IGN appears next to the ITT digital readout and a green START appears vertically adjacent to the N_2, OIL PSI, and OIL °C digital readouts on the respective engine EI.

Unless an abnormality occurs, there is no other input required for engine start. The green IGN and START extinguish at the completion of the start sequence. If an abnormality occurs, the FADEC automatically terminates the start sequence. The pilot may also terminate the start by moving the ENGINE RUN switch to OFF.

PRETAKEOFF

Prior to taking the runway, the PF should conduct a crew takeoff briefing. Prior planning is essential to avoid a dangerous state of confusion during an emergency.

The taxi and landing lights, strobes, rotating beacons, and radar should be on for takeoff. Do not transmit radar energy if personnel are within 15 ft (5 m) radially from the nose of the aircraft or if the aircraft is within 100 ft (30 m) of large metallic objects including other aircraft or during refueling.

The FD should be setup in the TO mode. Standard instrument departure (SID) procedures assume a standard rate turn and a 2.5% net climb gradient or more if stated or depicted on the SID. Appropriate navigation modes should be set up at this time. Both pilots should be aware of which pilot is in command of the FD by verifying the position of the FD couple arrow on the top center of both PFDs.

Determine which navigation source (FMS or VHF) should be used and set up both PFDs accordingly. Tune appropriate frequencies, set courses, and select bearing pointers as desired. Radar and TCAS and TAWS modes should also be selected.

Before entering the runway environment, the crew should scan the PFDs and EICAS, review displayed information, and ensure CAS messages are appropriate for the configuration. Set V speeds and preselect altitude. Initially, the VT speed bug should be set at V_2 +15 for flaps 10 and V_2 +25 for flaps 20. This provides a reference for flap retraction speed after takeoff.

The PNF is responsible for several areas of attention; some areas overlap with the PF. Throughout the takeoff, the PNF monitors EICAS. A flaps 10 setting is recommended for takeoff in most cases due to a better second climb performance. A flaps 20 setting is available when runaway length is a limiting factor. Refer to the *AFM* for specific flap settings.

Takeoff procedures such as a standing spool-up versus a rolling takeoff should be discussed before takeoff. Runway length, runway conditions, and weather conditions are among the deciding factors. Many flight crews use restricted abort criteria above 80 kt if the runway requirement exceeds 70% of the available runway or if the runway conditions are other than dry. Usually after a 80 kt call by the PNF, the abort is initiated only for loss of directional control, CAS message, obvious engine failure, or TR deployment. A fire warning can be included as well as other issues based on circumstances and other department requirements.

To standardize normal operations, unless the PF requests otherwise, the PNF should set the NAV aids for the departure. If desired, the PNF can setup the departure on the FMS to have a visual picture (PPOS or PLAN) of the route on the MFD.

Message Inhibit

Because of the numerous different CAS messages that could be displayed, an added safety feature is the CAS takeoff or landing inhibit mode. Distractions can complicate the critical phases of flight, mostly takeoff, final approach, and landing. For this reason, restrictions have been built into the CAS messaging logic to inhibit certain warning, caution, and advisory CAS messages until the takeoff or landing phase is completed.

This mode also prevents the master caution or warning light and chime from activation should a CAS message be detected.

Takeoff from a Standing Start

Takeoff from a standing start must be accomplished when the computed takeoff distance is at or near actual runway length. Hold the brakes as thrust is advanced to the takeoff detent and takeoff power is achieved. Then release the brakes smoothly. Only by using this procedure can computed takeoff and climb performance figures be met.

Rolling Takeoff

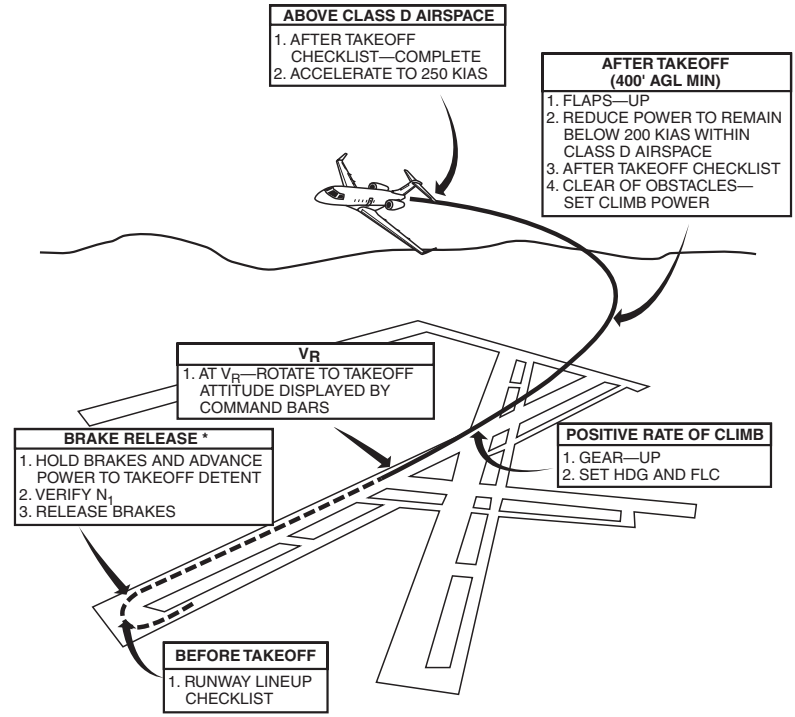
A rolling takeoff may be accomplished when actual runway length is at least 100 ft longer than computed takeoff distance and obstacle clearance is not a factor. As the aircraft is aligned on the runway, advance the thrust levers smoothly to the takeoff detent.

Cleared for Takeoff

When cleared for takeoff (Figure MAP-1), the PNF should call “Runway Lineup checklist complete; cleared for takeoff.” The PF smoothly advances thrust levers to the takeoff (T/O) detent and tracks the runway centerline. In a crosswind, the PF should make the appropriate crosswind correction inputs. The maximum demonstrated crosswind component is 28 kt and should not be considered limiting. The PNF confirms the N_1 setting matches the N_1 bugs and calls “N_1 set.” At the appropriate times, the PNF calls “airspeed alive” and “80kt.” At V_1 speed, the PNF calls “V_1.” The PF releases the thrust levers and puts both hands on the control wheel. At V_R, the PNF calls “rotate.” Under normal circumstances with two engines running, the PF rotates the aircraft at 3 to 4° per second to the command bars.

When a positive rate of climb is achieved, the PNF calls “positive rate”, and the PF then calls “gear up.” The PNF moves the gear handle to the up position and monitors the gear lights while the gear is retracting. The PF should then call for desired flight director modes and for flaps up at V_T or as required prior to V_{FE}. V_T is defined as V_2 + 15 for a flaps 10 takeoff or V_2 + 25 for a flaps 20 takeoff.

The PNF positions the flap handle to the 0 position and monitors the flap indicator for the correct setting. After contacting departure control, the PF calls for the After Takeoff checklist. The PNF should then complete the After Takeoff checklist and announce “flaps up, After Takeoff checklist complete.” After clearing the respective airspace airspeed restrictions, set the thrust levers to maximum climb power (CLB) and select the desired climb schedule or technique.



*** FOR A ROLLING TAKEOFF, DO NOT HOLD BRAKES AND ADD 100 FEET TO THE CALCULATED TAKEOFF FIELD LENGTH.**

Figure MAP-1. Cleared for Takeoff

CLIMB AND CRUISE PROCEDURES

The PNF announces all assigned altitudes and sets them in the altitude preselect window. The PNF also calls out 1,000 ft above or below all assigned altitudes and any altitude restrictions. For example, “Through 9,000 ft, climbing to 10,000 ft,” or “Through FL 400, climbing to FL 410.” The PNF also announces other significant altitudes such as “Transition altitude” or “Through 18,000 ft, Transition Altitude checklist.”

Passing through 10,000 ft, the Climb checklist should be completed. This is also a reminder for those operators who subscribe to a sterile cockpit (no distractions or extraneous conversations) below 10,000 ft to discontinue sterile cockpit procedures. Since the aircraft can climb to altitudes in excess of FL 410 in a very short time, it is recommended the crew check the pressurization system (pressure differential vs. cabin altitude) at each 10,000-ft interval throughout the climb.

The Cruise checklist should be completed when the final cruising altitude is reached.

DESCENT PROCEDURES

For normal planning purposes, the aircraft should be down to 10,000 ft 30 miles from the airport. The VNAV function in the FMS is a useful tool for planning a descent.

When the descent is initiated, the PF calls for the “Descent checklist.” The PNF accomplishes the Descent checklist, as directed by the PF, and makes the appropriate altitude callouts. However, as with any other checklist, should the PF fail to call for the appropriate checklist, the PNF should prompt the PF by calling, “Standing by with the _____ checklist."

APPROACH PLANNING

Approach planning and briefing should be accomplished during cruise or initial descent, if possible, or at the latest, when called for in the Approach checklist. Review of hazardous terrain, minimum enroute altitudes (MEAs), and minimum sector altitudes (MSAs) should be accomplished.

Complete and review performance data to include V_{REF}/V_{GA} speeds and landing distance. During the early part of the descent, the PNF should obtain destination weather.

The PF normally assumes ATC communications during this period. After checking the weather, the destination weather should be briefed along with the expected approach and any other significant information. At this point, the type of approach can be selected.

The PF normally transfers aircraft control to the PNF during the approach briefing.

In addition to the above items, the following should also be addressed in the approach briefing:

- Approach to be flown and backup approach, if available
- Special procedures during approach, such as circling approach, interception of a radial from an arc, VDP, etc.
- Altitudes of IAF, FAF, step-downs, sector altitudes, and obstacles
- Minimums (DH, MDA), HAT, HAA, and radio altimeter setting
- Cyan RA and BARO numbers set in the PFDs
- Missed approach point, procedures, and timing to MAP/VDP
- NAV aid setup desired and confirmation that AP/FD XFR arrow is pointing to the side from which the approach is flown
- Anti-icing requirements
- Specific PNF duties and call outs
- Procedure for transitioning to visual flight
- Request for "any questions?" directed to the other pilot

Visual Approach

The PF should initiate the Transition and Approach checklists when descending out of FL 180 or when within 50 miles of the destination airport. The checklist is accomplished so it does not interfere with the visual scan for traffic.

Configuration changes during the approach should be accomplished using the same crew coordination techniques for after takeoff. The PF calls for a configuration change. The PNF acknowledges the change, selects the switch position, monitors, and reports when the configuration is in the selected position.

The Approach checklist is completed. The aircraft is slowed to 200 kt or less and configured to flaps 10 when entering the terminal airspace.

Approximately seven miles from the runway, the PF should slow the aircraft to V_{REF} + 20 and then call "flaps 20, gear down, Before Landing checklist." The PNF completes the Before Landing checklist down to flaps 30. Both crew members should verify the gear down indications and check hydraulic system pressure.

Within five miles from the runway for a straight-in two-engine approach, the PF slows the aircraft to V_{REF} +10. The PF then calls for flaps 30, begins a descent, and slows to VREF.

The PNF also confirms the communication and navigation radios are set properly, checks the flight instruments, airspeed bugs, preselect altitude display, and displays on both PFDs. The PNF subsequently reports "Before Landing checklist complete." While in the terminal airspace, a vigilant visual scan should be maintained by both crewmembers. During the approach, the PNF should also make airspeed and vertical speed calls as requested by the PF.

NORMAL APPROACH FOR LANDING

The last mile (at least) of the final approach should approximate an ILS glideslope with a rate of descent of approximately 600 to 800 fpm. A widely recognized rule for computing an acceptable sink rate is (KIAS x 10)/2 equals sink rate in feet per minute (i.e., add a zero to the end of the airspeed value and divide by 2):

$$\frac{130 \text{ kt} \times 10}{2} = 650$$

Maintaining V_{REF} on final approach is important to obtain the calculated landing distances. Each knot over the calculated V_{REF} can cause excessive runway usage. Flying the final approach slower than V_{REF} causes extremely hard and/or premature touchdowns.

The previously mentioned practices are for an optimal approach to landing. If operating in a busy terminal airspace, the speeds and procedures should be adjusted accordingly.

LANDING

Figure MAP-2 shows a normal VFR landing pattern.

In a V_{REF} landing configuration, the aircraft is in a near landing attitude. Constantly trim pitch to neutral and maintain V_{REF} until within a few feet of the runway. At 50 feet above the runway, smoothly reduce thrust to idle and raise the nose very slightly from the attitude maintained on final approach. With aft mounted engines, the nose tends to rise as thrust is reduced and very little back pressure is required.

Maintain attitude and allow the aircraft to fly onto the runway surface. During this slight flare, do not continue to raise the nose as the airspeed decreases (known as holding it off) or the aircraft will float and the calculated performance numbers will not be obtained.

Short field approaches and landings should also be made at V_{REF}. Do not attempt to grease it on or flare as much as normal landing. The wheel brakes are the primary means of stopping the aircraft and help achieve the calculated landing distance.

Upon touchdown, the spoilers deploy automatically if armed. The PNF should verify and call "spoilers deployed."

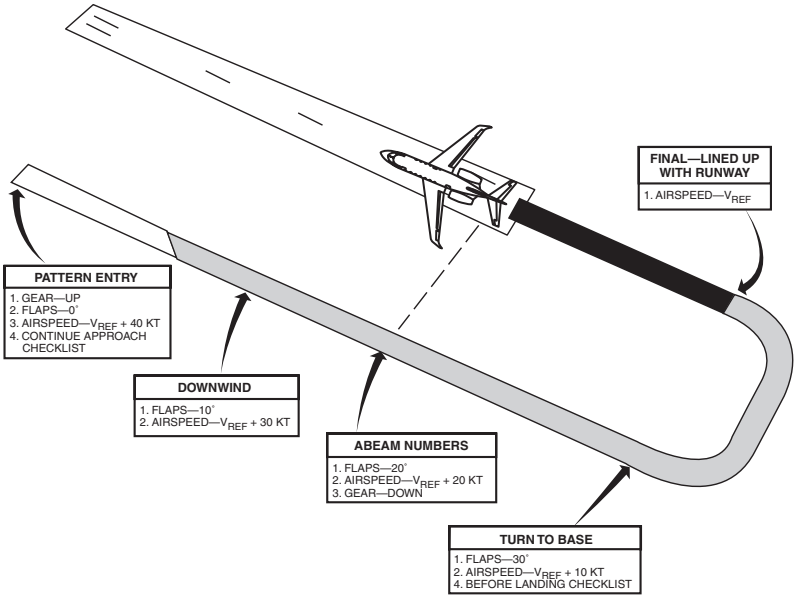


Figure MAP-2. Normal VFR Landing Pattern

Lower the nosewheel smoothly to the runway. Apply braking as necessary and deploy TRs. To achieve maximum braking, do not pump the brakes. Use a smooth application, steadily increasing pressure on the brake pedals until the aircraft decelerates at an appropriate rate. Use sufficient braking action early in the landing roll, while keeping passenger comfort in mind.

After the nosewheel is on the ground, apply brakes. Raise the thrust reverser levers and move the thrust levers back to the REV position. Until the white REV EI is displayed, a hard stop is provided by the thrust reverser lever balk solenoid. The hard stop is released as the green REV indication illuminates in the N_1 readouts.

When the PNF calls "two deployed," smoothly pull the thrust levers to the desired reverse thrust. If the thrust levers remain in the maximum reverse thrust position, the engines begin to schedule down as the aircraft decelerates.

Prior to reaching 40 KIAS, smoothly and deliberately return the thrust levers to the IDLE position. Use brakes and rudder as necessary for directional control. The PNF should confirm the green and white REV EI indication has extinguished and the reversers are stowed. Refer to the *AFM* limitations for operation of the thrust reversers. After clearing the runway, proceed with normal after landing procedures.

Crosswind Landing

Crosswind landings are similar to those in other aircraft. Adequate aircraft control during landing in a crosswind velocity of 24 kt (measured at a 10-m height) was demonstrated during certification tests. Use the crab approach, then transition to a wing low, slipped drift correction prior to touchdown.

Hold the upwind aileron into the wind through touchdown and track the centerline on the rollout. The spoilers deploy automatically (if armed). This destroys lift and makes the brakes more effective.

In extreme crosswind conditions, an airspeed slightly higher than V_{REF} is warranted. As a general rule, an increase of one-half the gust factor up to 10 kt over V_{REF} may be appropriate on final approach. Do not allow the aircraft to float with power off prior to touchdown.

Fly the aircraft to touchdown with little to no flare. Upon touchdown, keep the aircraft on the surface. As the spoilers deploy automatically, follow through the landing roll with roll control into the wind.

Slippery Surfaces

Landing on a slippery surface requires careful consideration of many factors such as type of runway surface, approach hazards, temperature, ice, water, snow, and other crosswind scenarios. Normally, thrust reverser operation helps achieve the computed stopping distance with a greater margin of safety. Wet and contaminated runway data is published in the *AFM* and *AFM Supplements*.

One Engine Inoperative Landing

With one engine inoperative, TRs may not be as effective on a contaminated runway as on a dry runway. From a directional control standpoint, full single-engine reverse is fine on a dry runway, Do not attempt, however, high power single-engine reverse on slippery runways. Differential reversing on a slippery runway may not yield satisfactory performance. Be prepared to stow thrust reversers immediately if the aircraft begins to slide sideways.

Hydroplaning

If there is a possibility of hydroplaning, use aerodynamic braking to slow below hydroplaning speed. Hydroplaning speed is approximately 112 kt for accelerating aircraft (nine times the square root of tire pressure) and 100 kt for a decelerating aircraft (eight times the square root of tire pressure).

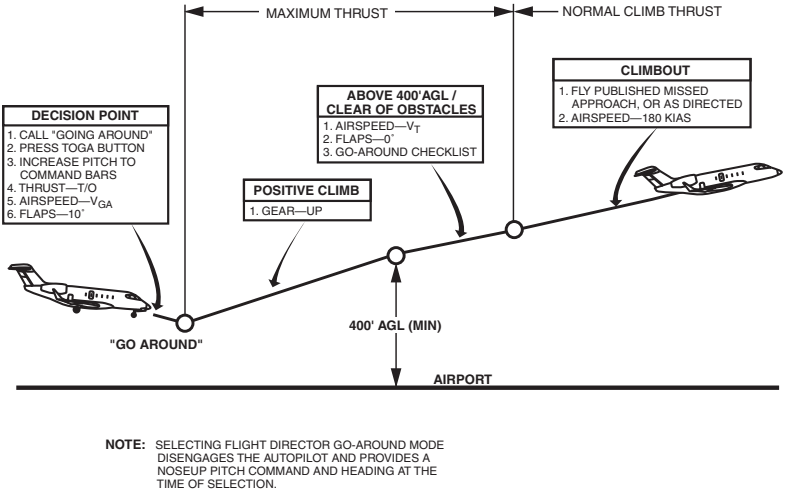
The main gear tire pressure should be serviced to 155 to 163 psi. Nose gear tire pressure should be serviced to 113 to 119 psi. If brakes are applied while the tires are hydroplaning, the hydroplaning can continue to a much lower speed.

GO-AROUND

Figure MAP-3 shows the Go-Around—Two Engines configuration and Figure MAP-4 shows the Go-Around—Single Engine configuration. If a go-around is necessary, the PF calls “going around.”

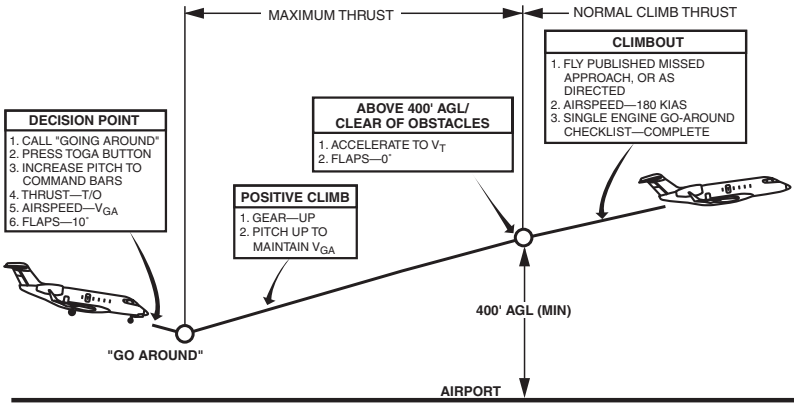
At this point, selecting FD go-around mode on the left throttle repositions the command bars to 8° nose up and disengages the autopilot. Set power to the takeoff detent and initiate a climb. The pitch attitude may have to increase to more than 8° to attain V_{GA}. The PF calls for flaps 10° and gear up (after a positive rate of climb is established). The PF climbs at V_{GA} and checks spoilers retracted.

The PNF sets or confirms flaps 10°, calls out the direction of turn, if one is required, and the missed approach heading and altitude. The PNF also notifies ATC of the missed approach. The Go-Around checklist is accomplished following a go-around. The PF calls for flaps up once clear of obstacles and V_T is attained. For a go-around, V_T is defined as V_{GA} + 15 kt.



NOTE: SELECTING FLIGHT DIRECTOR GO-AROUND MODE DISENGAGES THE AUTOPILOT AND PROVIDES A NOSEUP PITCH COMMAND AND HEADING AT THE TIME OF SELECTION.

Figure MAP-3. Go-Around—Two Engines



NOTE: SELECTING FLIGHT DIRECTOR GO-AROUND MODE DISENGAGES THE AUTOPILOT AND PROVIDES A NOSEUP PITCH COMMAND AND HEADING AT THE TIME OF SELECTION.

Figure MAP-4. Go-Around—Single Engine

TOUCH-AND-GO LANDINGS

Touch-and-go landings in conjunction with practicing non-normal procedures are not recommended. Full stop landings with a simulated inoperative engine are much safer. Simulated engine cuts during a touch-and-go landing can be hazardous in any aircraft. The PF may become confused concerning aborting or continuing the takeoff. These combinations are not recommended.

All touch-and-go landings should be preplanned and cockpit procedures should be established (Figure MAP-5). The PIC thoroughly briefs all aspects of the touch-and-go landing. Both crewmembers ensure the runway length is sufficient for touch-and-go maneuvers.

Compute V_1, V_R, V_2, and required landing distance. These numbers do not vary much with successive touch-and-go landings. V_1 is difficult to positively call on every touch-and-go landing. Generally, V_R is reached at approximately the same time (or very shortly after) takeoff thrust is established.

After touchdown, the PF performs the following:

- Lower the nosewheel to the surface
- Keep the aircraft heading straight down the runway
- Keep thrust levers in idle and do not rush the touch and go landing
- When the PNF calls “go,” advance the thrust levers smartly and deliberately to the T/O detent
- When the PNF calls “rotate,” rotate to no less than 9° nose-up
- When a positive rate of climb is established, call “gear up”

After touchdown, the PNF performs the following:

- Set wing flaps for takeoff while calling “resetting flaps” (flaps 20 is recommended for touch-and-go landings)
- Check elevator trim is set for takeoff
- Check EICAS (silent check)
- Call “go”
- Call “set N_1”
- Check thrust levers in the T/O detent.
- Call “N_1 set”
- Call “V_1”
- Call “rotate”

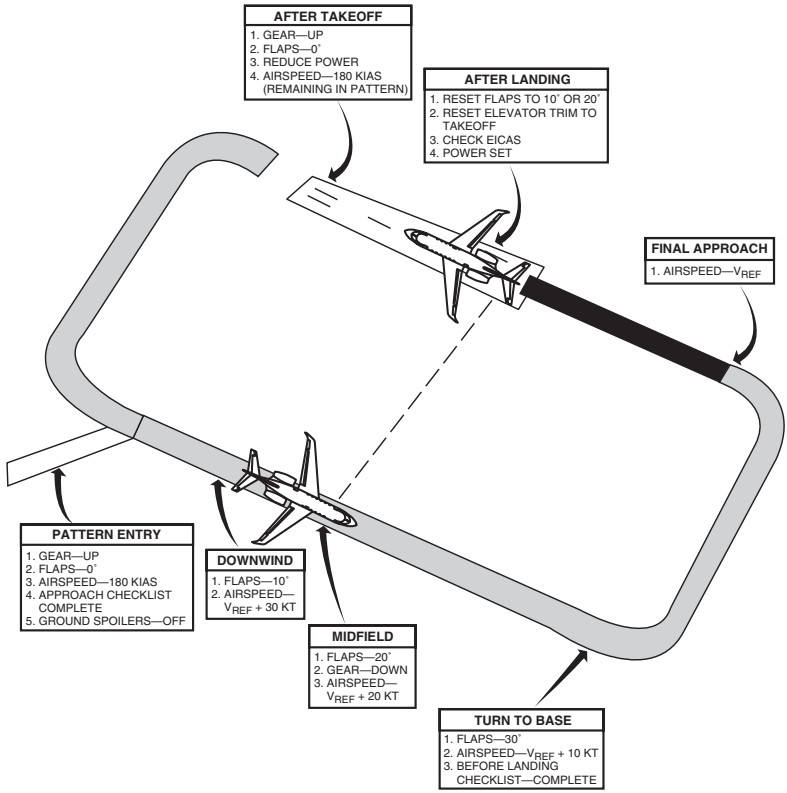


Figure MAP-5. Touch-and-Go Landing

After liftoff, the PF calls "gear up and flaps 10." It is recommend to leave the flaps set at 10 for transition to downwind. Reduce thrust to avoid an extremely nose-high attitude and high rate of climb. Use the trend vector as a helpful tool. Enter the downwind leg at approximately 160 KIAS. Complete the After Takeoff, Approach, and Before Landing checklists.

AFTER LANDING AND CLEARING RUNWAY

After clearing the runway, the After Landing/Clearing Runway checklist is initiated. The engines must operate at or near idle for three minutes prior to shutdown. Landing roll at idle and taxi time may be included in the three-minute cooling period. Upon shutting down an engine, the master caution lights flash, a single chime sounds, and new CAS messages appear. Confirm all indications are appropriate for the configuration before canceling the flashing master caution lights. Monitor hydraulic pressure when taxiing to the ramp area.

Before shutting down an engine while taxiing to the parking area, some factors need to be considered. The runway and taxiway may be clear of ice, snow or slush, but the parking area might still be contaminated. Do not shut down an engine until the condition of the parking area is known. With one engine operating on a slippery surface, the aircraft may turn in one direction easily and be difficult to taxi straight. If this situation is encountered, consider shutting down completely and towing the aircraft or restarting the other engine and resuming taxiing.

Chock the main gear when the aircraft is parked. If strong winds are expected, all wheels should be chocked. Install the gust lock, even for short periods. High winds may suddenly develop or jet blast/helicopter rotorwash may damage the controls. Before securing the aircraft, ensure all battery bus items are off, particularly the emergency, baggage, and entrance lights. Set all switches to off, remove all power from the aircraft, and close the access doors.

INSTRUMENT PROCEDURES

This section focuses on operations with the Challenger 300 in instrument conditions, e.g., precision, nonprecision, and circling approaches. Procedure turns, missed approach, and holding procedures are also discussed.

INSTRUMENT APPROACH CONSIDERATIONS

Several factors must be considered prior to commencing an approach. In addition to basic knowledge required for a flight (departure and destination weather, airport information, runway conditions, NOTAMS, etc.), the crew must also have a thorough understanding of the aircraft.

The crew should know what resources are available in the aircraft avionics package and how to effectively use them. The enroute and initial descent phases of flight are where flight crews should prepare, brief, and make decisions on what instrument approach procedures to execute. Study the respective approaches and procedures carefully.

Published approaches for Category C aircraft have a height above touchdown (HAT) in excess of 600 ft requiring only one mile of visibility. For example, in moderate or heavy rain there would be much less than a mile before the runway is seen if the aircraft is much higher than it should be (approximately 300 ft) to make a normal landing with normal maneuvers.

Additionally, consider a normal straight-in approach with 500 ft HAT and one mile visibility required. If the approach speed is 115 KIAS, the aircraft is moving along at 1.9 NM per minute. Optimally, the runway comes into sight one NM out, which requires an average descent rate of 1,000 fpm to make the touchdown point. Any delay in establishing visual contact and/or starting a descent worsens the problem. If the aircraft is not in a position to make a normal descent to landing, execute a missed approach or visual pattern, if possible. Consider going to the alternate.

The visibility reporting system can sometimes work against the crew. If visibility is reported as one mile, it is one statute mile that equates to 0.87 NM. This is enough of a difference to increase the descent required for the approach to more than 1,100 fpm. If the ceiling and visibility is less than published minimums, the approach should not be attempted.

In different conditions, it may be advantageous to plan a circling approach. If so, ensure published circling approach minimums are being reported. Refer to the *Airman s Information Manual* (*AIM*) for visibility and radius distance minimums for Category C aircraft. If the aircraft is to remain within this radius, precise airspeed and bank control are essential. Lower airspeeds result in a decreased turn radius. It is also easy to lose sight of the airport if the circling approach speed is too high or the bank is too shallow. Circling approaches are discussed later in this section.

After evaluating all the weather factors, flight crews may find the destination approach situation to be marginal. If so, consider proceeding to a suitable alternate before descending out of the high altitude structure.

When descending out of 18,000 ft or when within 50 NM of the terminal area for landing, call for and complete the Descent and Approach checklists. Compute V_{REF} and V_{GA}. Set the airspeed bug to help anticipate approach speeds. Slow the aircraft early to avoid requiring rapid configuration changes and increasing the risk of falling behind the aircraft.

For a perspective, consider that if 10 NM is flown at 250 kt ground speed, it takes 2 minutes and 24 seconds to cover the distance. If 10 NM is flown at 200 kt ground speed, it takes three minutes to cover. If the ground speed is 150 kt, it takes four minutes.

Note how many miles are allowed for each published procedure turn. Two hundred knots keep the aircraft within 10 NM if the wind is calm, the timing outbound is no more than 60 seconds, and a 30° bank is promptly initiated for 180° turns. In this case, the aircraft flies approximately 8 NM at the furthermost point in the procedure turn.

At major airports with busy terminal environments with a lot of airline traffic, flying a final approach at V_{REF} (unless minimum conditions exist or instructed to do so by ATC) would be unrealistic. The aircraft offers flexibility

to change speeds and configurations easily. The *Challenger AFM* makes recommendations on how to fly the aircraft in optimal speeds and configurations and/or instrument approach procedures for the lowest published instrument conditions combined with a short runway.

Fly the aircraft at minimum maneuvering speeds for each approach and landing configuration. Flying the recommended minimum maneuvering speeds allows more time to plan ahead. Course intercepts are smoother and cleaner. Crews also have more time on final approach. This allows slower descents and enables the aircraft to remain within the confirms of circling approach areas. Recommended maneuvering speeds are shown in Table MAP-1 .

Table MAP-1. RECOMMENDED MANEUVERING SPEED

FLAP SETTING	AIRSPEED
Flaps 0	V_{REF} + 40 kt
Flaps 10	V_{REF} + 30 kt
Flaps 20	V_{REF} + 20 kt
Flaps 30	V_{REF} + 10 kt

ADDITIONAL INSTRUMENT SYSTEMS

Additional instrument systems, such as a radio altimeter and an altitude alerter, are navigational safety devices on the Challenger 300. These systems contribute to a safe instrument approach if used properly. Becoming so involved in setting and resetting these devices, however, compromises safety.

The following is a brief review of some of these aids:

- Min alert—In addition to setting BARO or RA minimums, the MIN ALERT should be set as appropriate. This is usually BARO.

- Altitude select (ASEL) knob—Before takeoff, the initial level-off altitude should be set. When climbing or descending, the altitude preselect should be set to the next level-off altitude. Once established on the final approach fix (FAF) inboard, the missed approach altitude should be set in the altitude preselect unless there are step-down altitudes inside the FAF. Generally, since the PNF accomplishes the radio communications, the PNF also has responsibility for resetting the ASEL knob. Whether the ASEL knob is a function of the PF or the PNF is up to the crew as along as it is clear who is responsible so that an altitude assignment is not missed.

- Navigation radios—Navigation and communication radios should be assigned to one crewmember. Ensure there is an understanding who changes and identifies frequencies and who sets the approach headings. Neither pilot should change a navigation or communication frequency or gearing without informing the other pilot of their intentions.

HOLDING

Whether holding is accomplished enroute for ATC delays or as part of an approach procedure, the techniques are similar. If holding takes place in the enroute phase of the flight, holding speeds should be in compliance with the *AIM* (Table MAP-2) and flight planning cruise control speeds.

Table MAP-2. MAXIMUM HOLDING AIRSPEEDS

CIVIL TURBOJET	MAXIMUM AIRSPEED
6,000 ft or below	200 KIAS
6,000 ft–14,000 ft	230 KIAS
Above 14,000 ft	265 KIAS

When holding as part of an instrument approach, the manufacturer recommends holding at speeds published in the *AFM*. In icing conditions, the crew should consider higher holding speeds and higher power settings.

Slow the aircraft to holding speed within three minutes prior to reaching the holding fix. Do not hold in icing conditions with flaps down. The initial outbound leg should be flown for 1 minute or 1.5 minutes, whichever is appropriate for altitude. Timing of subsequent outbound legs should be adjusted as necessary to achieve proper inbound leg time (Table MAP-3).

Table MAP-3. HOLDING —INBOUND LEG TIMING

AT OR BELOW 14,000 FT MSL	ABOVE 14,000 FT MSL
1 minute	1.5 minutes

If the holding procedure is used as a procedure turn for an instrument approach, start slowing the aircraft three minutes prior to the IAF to arrive over the IAF at V_{REF} +30 and flaps 10°. When crossing the IAF, initiate the holding procedure, start timing when abeam the IAF, start descent to procedure turn altitude (if cleared), and maintain V_{REF} +30. At 60 seconds, turn back toward the inbound course and intercept the course inbound. When on course inbound, follow the same procedures as stated in the applicable precision or nonprecision approach procedures.

PRECISION APPROACH

The PNF confirms the COM/NAV radios are set properly, checks the flight instruments, airspeed bugs, preselect altitude display, and BARO. If possible, the aircraft should be configured with flaps 10 and slowed to 160 KIAS within 10 NM of the outer marker (Figure MAP-6).

Within three to five miles of the outer marker, the PF calls “flaps 20, gear down, Before Landing checklist" and slows the aircraft to V_{REF} +20. The PNF completes the Before Landing checklist to the flaps 30 item. Just prior to glideslope intercept (approximately one dot) for a two-engine approach, the PF calls for flaps 30, slows the aircraft to V_{REF}, and begins a descent at the glideslope intercept.

The PNF then reports “Before Landing checklist complete” and repeats the last ATC clearance. After passing the outer marker, the PNF begins looking for visual references outside the aircraft. The PNF also monitors the instruments and calls out significant deviations such as one dot or more deflection on the localizer or glideslope and/or airspeed variations greater than +5 or –0 of V_{REF}.

The PNF makes altitude callouts at 1,000, 500, and 100 ft above minimums. The PNF reports any visual contact with the ground or when the runway environment is in sight. Approaching minimums, the PF continues cross-checking outside the aircraft for omit or missed approach point visual references. When satisfied visual references are adequate for landing, the PF announces “Going visual” or “Going outside.”

At this point, the PNF transfers attention inside the aircraft while cross-checking outside. The PNF then calls airspeeds, descent rates, and altitudes. The purpose is to verbally provide the PF the same information he would have if still flying instruments. A missed approach should be initiated at the missed approach point if necessary.

NONPRECISION APPROACH

If the weather is close to or at published minimums, it is sometimes impractical or impossible to complete a nonprecision approach successfully. This is due to the mathematical relationship of the minimum descent altitude (MDA) versus the minimum visibility combined with the approach speed.

These items occasionally combine to require an intolerable descent for landing. To continue the approach to landing after arrival at MDA, the runway environment must be in sight and the aircraft must be in a position from which a normal landing can be accomplished. A 3° approach calls for being at the following approximate altitudes:

- 600 ft at 1.8 NM
- 500 ft at 1.5 NM
- 400 ft at 1.23 NM
- 300 ft at .9 NM

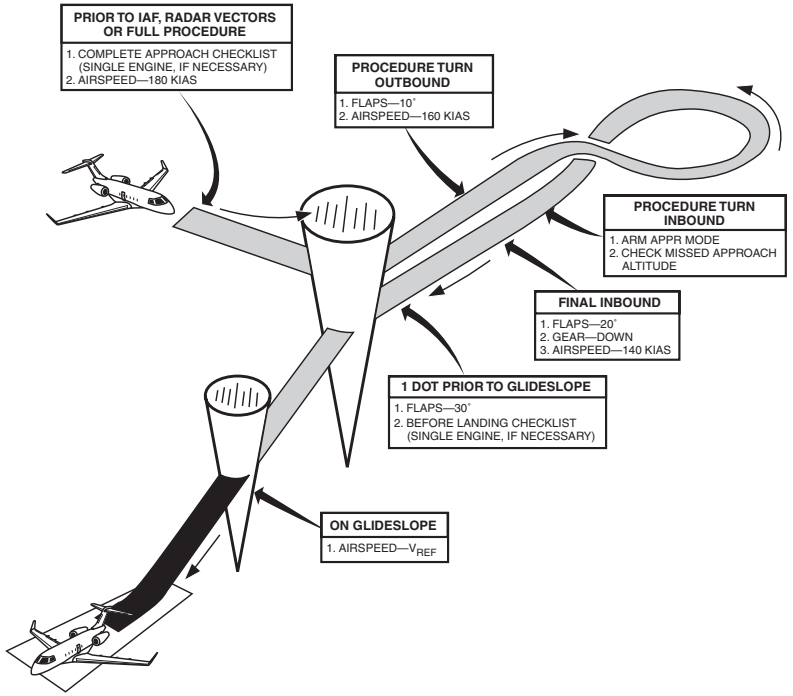


Figure 6. Precision Approach

For nonprecision approaches with no published visual descent point (VDP), the manufacturer recommends that a time to see (the runway) point be calculated. Divide the HAT or HAA by 10. The result is the number of seconds the runway should be seen before arriving at the missed approach point (MAP).

For example, if the HAT/HAA is 400 ft, divide by 10 (400/10 = 40). Forty seconds prior to the expiration of the time from FAF to MAP, the crew should be at MDA and have the runway environment in sight to accomplish a normal visual approach. Consequently, it is desirable to descend to the MDA before arriving over the VDP. A descent rate to accomplish this should be calculated accordingly.

The PNF also confirms the COM/NAV radios set properly, checks the flight instruments, airspeed bugs, preselect altitude display, and MDA displays on both PFDs. If possible, the aircraft should be slowed to 160 KIAS within 10 miles of the FAF (Figures MAP-7).

Within three to five miles of the FAF, the PF slows the aircraft to V_{REF} +20 and calls "flaps 20, gear down, Before Landing checklist." The PNF completes the Before Landing checklist down to the flaps 30 item. Just prior to the FAF, the PF slows the aircraft to V_{REF} for straight-in approaches or V_{REF} +10 for circling approaches and calls for flaps 30. Descent is started at the FAF (at least 1,000 fpm) and the approach timing initiated. The PNF then reports "Before Landing checklist complete" and repeats the last ATC clearance.

After passing the FAF, the PNF begins looking for visual references outside the aircraft, while monitoring the instruments and calling out significant deviations such as one dot or more deflection on the CDI and airspeed variations greater than +5 or –0 of V_{REF}. A missed approach should be initiated at the missed approach point if necessary.

The PNF makes altitude callouts at 1,000, 500, and 100 ft above MDA and also gives approach timing updates in reference to the VDP. The PNF also reports any visual contact with the ground or when the runway environment is in sight. Approaching the missed approach point, the PF continues cross-checking outside the aircraft for visual references. When satisfied visual references are adequate for landing, the PF announces, "Going visual", or "Going outside." At this point, the PNF transfers attention inside the aircraft while cross-checking outside. The PNF calls airspeeds, descent rates, and altitudes. The purpose is to verbally provide the PF the same information as if still on instruments.

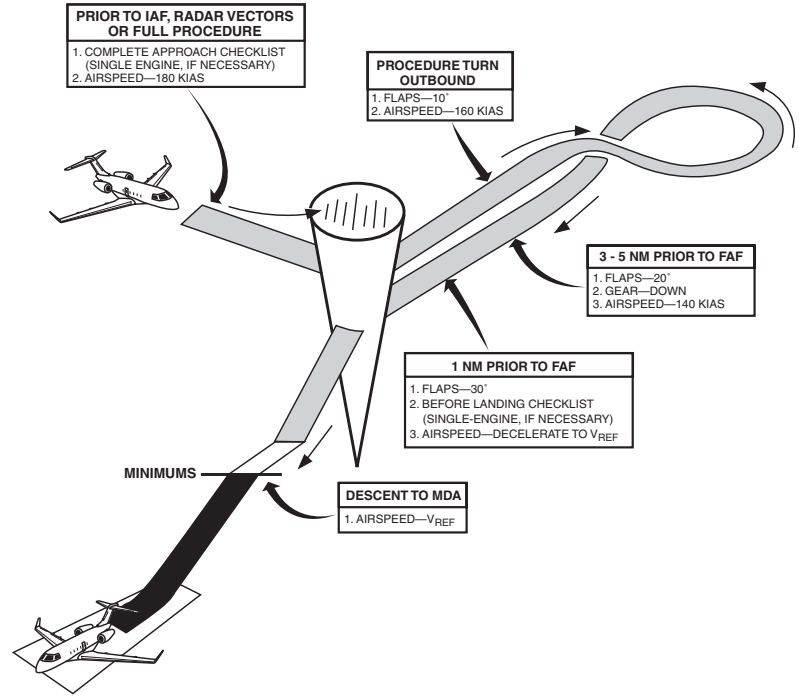


Figure 7. Non-Precision Approach

PROCEDURE TURNS

When a procedure turn is required, the instrument approach procedure specifies the outbound and inbound courses, the distance within which the procedure turn shall be completed, and the side of the inbound course on which the turn should be made. Unless otherwise specified or restricted, the type, rate of turn, and point at which the turn is begun is left to the discretion of the crew. When a holding pattern is depicted in lieu of a procedure turn, it must be executed within the one-minute limitation or published leg length.

A teardrop procedure/penetration turn may be specified. Its purpose is to permit an aircraft to reverse direction and lose considerable altitude within reasonably limited airspace. This procedure works best when approaching the IAF from a direction requiring less than a 45° turn to the selected (or depicted) teardrop course.

When depicted, this type turn must be executed. In some cases, the approach is made directly or via an arc procedure from a specified intermediate fix to the final approach fix. If a procedure turn is desired when no PT is specified, special arrangements must be made with ATC. Other notes, symbols or ATC restrictions that limit a procedure turn are listed on the approach charts.

For published instrument approaches with no procedure turn restrictions, most pilots elect the Jeppesen depicted 45°-type procedure turn. Other acceptable types of procedure turns are teardrop, 90°/270°, and racetrack (holding pattern type). Abiding by the following guidelines ensures the aircraft stays within the procedure turn maneuvering airspace.

45°-Type Procedure Turn

Within three minutes of the initial approach fix (IAF), slow the aircraft to arrive over the IAF at 160 KlAS and flaps 10. When crossing the IAF outbound, start timing and intercept the outbound course. Also, start descent to procedure turn altitude (if cleared) and maintain 160 KlAS.

At 60 seconds (on course outbound), turn 45° as depicted and start timing for 45 seconds. If 160 KlAS is not maintained, the timing outbound should be adjusted accordingly. At expiration of 45 seconds or 20°-track change, turn 180° and level off at procedure turn altitude as required.

Intercept the inbound course with FD and/or raw data as required. Lead the turn as necessary to roll out on the inbound course. When on course inbound, follow the same procedures as stated in the applicable precision or nonprecision approach procedures addressed earlier.

Teardrop-Type Procedure Turn

Within three minutes of the initial approach fix, slow to arrive over the fix at flaps 10 and 160 KIAS. When crossing the initial approach fix outbound, start timing (one minute for a 30° teardrop), turn to a heading to intercept the course outbound, and start descent to procedure turn altitude (if cleared). At expiration of time, turn toward the inbound course and maintain procedure turn altitude (if applicable).

Intercept the inbound course with the FD and/or raw data, as required. Lead the turn as necessary to roll out on the inbound course. Ideally, completion of the teardrop turn places the aircraft on course inbound. When on course inbound, follow the same procedures as in the applicable precision or nonprecision approach procedures

90°/270°-Type Procedure Turn

Within three minutes of the initial approach fix, slow to arrive over the fix at flaps 10 and 160 KIAS. When crossing the initial approach fix outbound, start timing over or abeam the IAF, turn to a heading to intercept the outbound course within 60 seconds, maintain 160 KIAS, and start descent to procedure turn altitude (if cleared).

At expiration of 60 seconds and on course outbound, turn 90° to the maneuvering side and immediately reverse the direction of turn for another 270° and maintain procedure turn altitude (if applicable). Intercept the inbound course with the FD and/or raw data as required.

Lead the turn as necessary to roll out on the inbound course. When on course inbound, follow the same procedures as stated in the applicable precision or nonprecision approach procedures addressed earlier

Circling Approach

A circling approach can be one of the most challenging of the instrument approach procedures (Figures MAP-8). Turbulence, strong winds, poor visibility, and low maneuvering altitude can add to the challenge.

Maintain proficiency and skills practice to minimize the high-risk maneuvering required for executing a circling approach. Advanced approach planning and briefing also add to the success of a circling maneuver. Airspeed control is extremely important. The handling characteristics and stability of the aircraft at slower speeds help flight crews reduce even more the high risks of these procedures.

A circling procedure itself is not difficult. The key is to stay within the prescribed distance from the airport. Depending on the configuration and aircraft weight, the aircraft is operated as a Category C aircraft. Under normal circumstances, the aircraft falls into Category C for circling approaches, thus having a circling radius of 1.7 NM from the runway end.

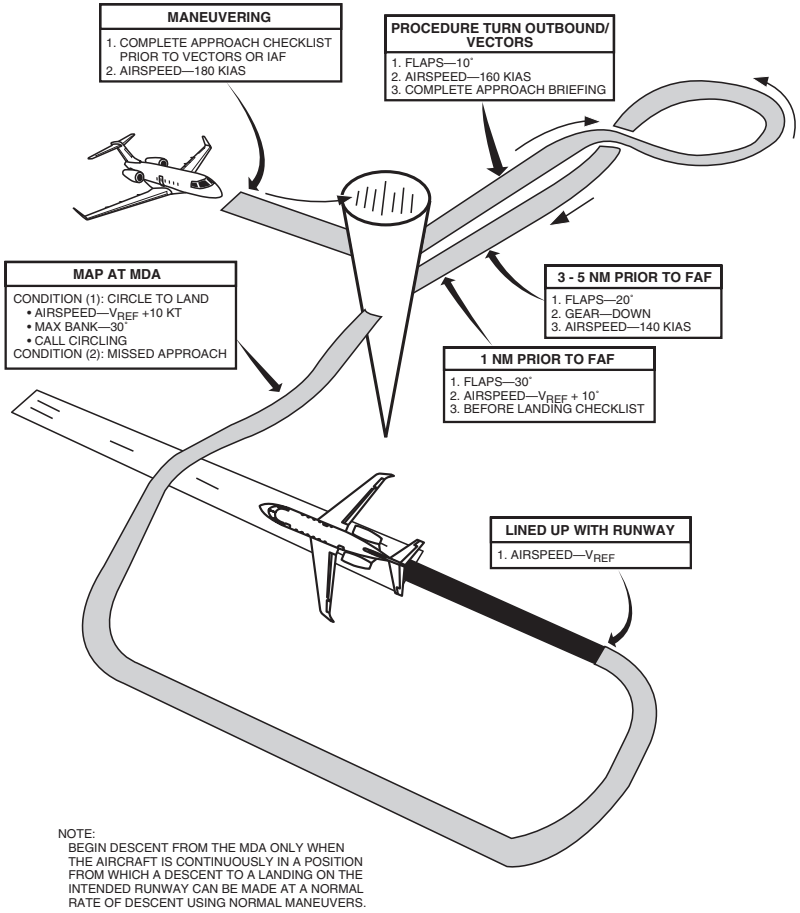


Figure MAP-8. Circling Approach

Whenever possible, the circling approach is made to the left to make it easier for the PF to maintain visual contact with the intended runway. The PNF monitors the flight instruments calling out excessive deviations in airspeed (±10 kt), altitude (+ 100 ft, –0 ft), and bank angle (±5°).

If the situation calls for executing the circle to the right, the PNF is the one who is better able to maintain visual contact with the intended runway. The PF should fly the aircraft primarily on instruments and follow the timing and heading directions as the PNF calls them out.

MISSED APPROACH

A missed approach is accomplished when at DH, the MDA when the time period is expired, set distance is reached, sight of the intended landing runway is lost, or when in the aircraft is in a position from which a normal visual landing approach cannot be accomplished. Other situations could also warrant the initiation of a missed approach.

If a missed approach is necessary, the PF calls "missed approach." At this point, select TOGA on the throttle. Set power to the T/O detent and initiate a climb. The PF calls for flaps 10, gear up (after a positive rate of climb is established), climb at V_{GA}, and checks that spoilers retracted. The PNF sets or confirms flaps 10, calls out the direction of turn if one is required, and call out the missed approach heading and altitude.

At relatively light gross weights, the aircraft quickly accelerates to V_{GA} with takeoff thrust. After climb and desired speed are established and when clear of all obstacles, reduce thrust as necessary to establish approximately 2000 fpm rate of climb. The trend vector is a helpful tool in accomplishing this. The PNF also notifies ATC of the missed approach.

Perform the Go-Around checklist. Initiate the Approach, and Before Landing checklists if another landing is attempted.

ABNORMAL/EMERGENCY PROCEDURES

The key to handling abnormal/emergency procedures is to apply the basic principles of crew resource management (CRM). As always, the overriding consideration in any unusual situation must be to maintain aircraft control, analyze the situation, and take the proper action.

CAS INHIBITING SYSTEM

The crew alerting system (CAS) is a tremendous asset for keeping the crew informed about the overall health of the aircraft. There are phases of flight where distraction needs to be minimized. The CAS inhibit mode prevents many CAS messages from being displayed until after takeoff and after landing. Once the inhibit mode is deactivated, a CAS message displays immediately if the condition is still valid.

The takeoff inhibit feature is automatically entered when the aircraft accelerates through 80 kt and ends when the aircraft climbs above 400 ft AGL or 60 seconds after the inhibit time started.

The landing inhibit feature is automatically entered when all the following conditions are met as the aircraft descends through 400 ft AGL and ends as the aircraft decelerates through 40 kt or 60 seconds after the inhibit time started.

TAKEOFF EMERGENCIES

The takeoff is a very critical phase of any flight. The crew takeoff briefing should leave no questions as to crew actions during the takeoff sequence.

Although there can be no clearly defined briefing to cover every contingency, there should be no question as to what each crewmember expects. The PNF should have full abort authority up to a given point, generally 80 kt. Takeoff aborts should normally not be attempted after the V_1 call. Takeoff field length (TOFL) versus runway available is a large part in the takeoff decision process. Takeoff abort scenarios basically fall into two different decision scenarios:

- Runway available >TOFL
- Runway available =TOFL

Prior to takeoff, the flight crew should discuss go versus abort scenarios. For example, a go decision may be the better decision at V_1 minus 10 kt for a main gear blown tire. Remember the calculated TOFL is based on four properly inflated main tires. If a tire is blown on takeoff, the calculated TOFL lengthens considerably and is no longer valid. If takeoff is aborted due to a blown tire, most likely the other tire will blow. The brakes will be damaged by tire FOD. In addition other areas of the aircraft may receive FOD damage.

Should the decision to go or stop be influenced by a critical TOFL for a fire indication at V_1 minus 5 kt? These are questions the flight crews and flight department need to consider for crew takeoff briefings.

Directional control is the primary goal. If directional control is lost, then there are no decisions to be made; the takeoff should be aborted. Nothing replaces good judgment. The final decision rests with the PIC. But knowing what to expect, what the parameters are, and the expected reaction makes everything much easier.

The toe brake system is the primary means of stopping the aircraft if a takeoff abort is initiated. The aircraft brakes are very effective. Upon initiating the takeoff abort, the procedure calls for maximum braking immediately. This brake application should be even and firm while simultaneously retarding the thrust levers to idle. If the aircraft starts to deviate from the centerline, apply rudder and differential braking to compensate. During training, flight crews should not execute consecutive multiple rejected takeoffs. The brakes should be allowed to cool between rejected takeoffs.

Engine Failure below V_1 Speed

Prior to 80 kt, a takeoff should be aborted for any abnormality. If an engine failure, fire, or a loss of directional control occurs after 80 kt and before V_1 (Figure MAP-9), either pilot may call "Abort! Abort! Abort!" The PF then applies the brakes, retards the thrust levers to idle, deploys thrust reversers, and verifies spoilers fully extend. Maximum braking must be used until reaching a full stop.

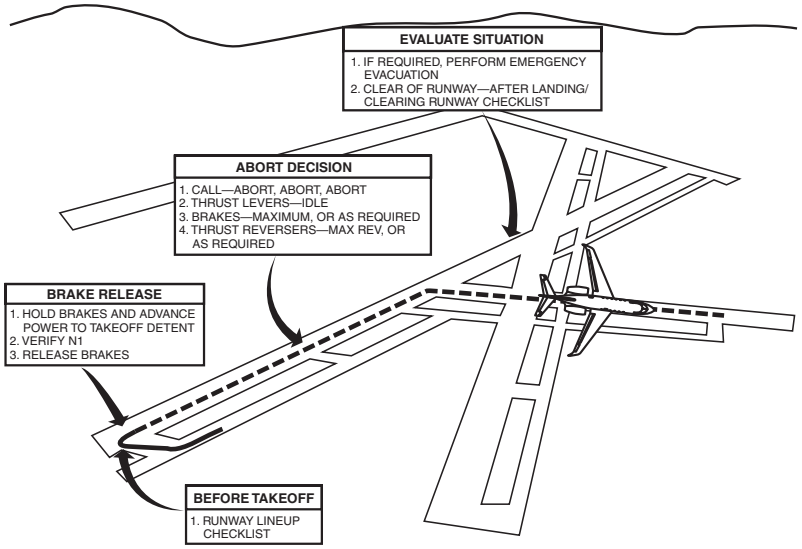


Figure MAP-9. Engine Failure below V_1 Speed

Engine Failure above V_1 Speed

If an engine fails at or above V_1, keep the nosewheel on the runway until V_R and track the centerline. At V_R, rotate the aircraft and continue to apply rudder to maintain track and bank into the good engine. The slip-skid indicator above each PFD should be centered.

With a positive rate of climb, select gear up. Pitch the aircraft to command bar noseup attitude to establish V_2. Once V_2 is established, the PF should maintain V_2 until obstacle clearance altitude. Accelerate to V_T and retract the flaps. Call for the checklist.

Use the following procedures to continue the takeoff (Figure MAP-10). When the aircraft starts to yaw because of engine failure or other causes, apply a small amount of forward pressure on the control wheel. This keeps the nose wheel on the runway. Use rudder for directional control. Do not attempt to return to centerline; maintain parallel motion.

When the V_R rotate call is made, smoothly rotate to the command bars noseup pitch. Maintain aircraft control. Do not rotate until the aircraft is under control on the runway.

When a positive rate of climb is established, call for "gear up." Increase pitch to maintain V_2. Flight level change (FLC) can be used for airspeed control.

Both pilots ensure climb speed is attained and pitch attitude maintained so the aircraft satisfies all obstacle clearance requirements. When the aircraft is stable, the rudder trim may reduce rudder pedal pressure. When clear of obstacles, accelerate to V_T. Call for flaps up and then call for the Engine Failure Above V_1 checklist.

Increase airspeed to 170 kt. Continue the enroute climb if necessary. As airspeed increases, the need for rudder deflection decreases. APR thrust is limited to 10 minutes. Reduce thrust levers to CLB within 10 minutes of takeoff.

Both pilots positively identify which engine is not operating. The PF should guard the operating engine while the PNF slowly retards the non-operating engine to IDLE. Turn the engine run switch to OFF. ***Nothing should change.*** Upon completing all checklist items, select a suitable airport for a single-engine landing. An engine restart may be attempted if conditions warrant.

During takeoff roll, the PNF devotes his attention primarily to the engine instruments, annunciator panel, and airspeed indicator. This should allow any malfunction to be recognized and confirmed in the shortest amount of time. Callouts to the PF should be exactly as briefed. The PF should have primary focus on the aircraft, using peripheral vision to backup the PNF inside.

Late takeoff abort decisions after V_1 are notoriously unsuccessful for all turbjet aircraft. Know what is critical and stick with the decision made in the crew takeoff briefing. There should be no doubt by either crewmember as to what is expected during takeoff.

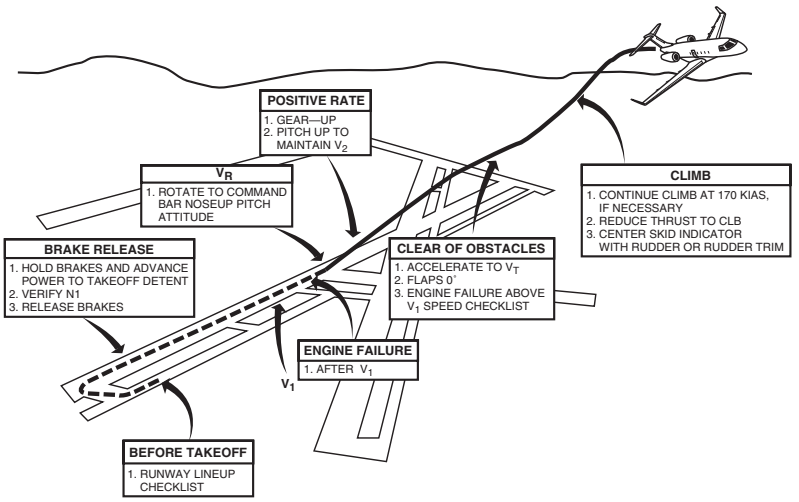


Figure MAP-10. Engine Failure above V_1 Speed

CRUISE EMERGENCIES

Malfunctions at altitude require the same thought process as those on takeoff. Maintaining aircraft control is the number one priority. Someone should always be flying the aircraft. For example, if an emergency descent is necessary, the crew's primary concern should be to don the oxygen masks, if not already donned. At altitudes above FL 410, the time of useful consciousness (TUC) decreases significantly without supplemental oxygen (Figure MAP-11).

Pilots always pull on oxygen masks first before dropping the passengers masks. The emergency descent memory items on the checklist are necessary to learn and accomplish.

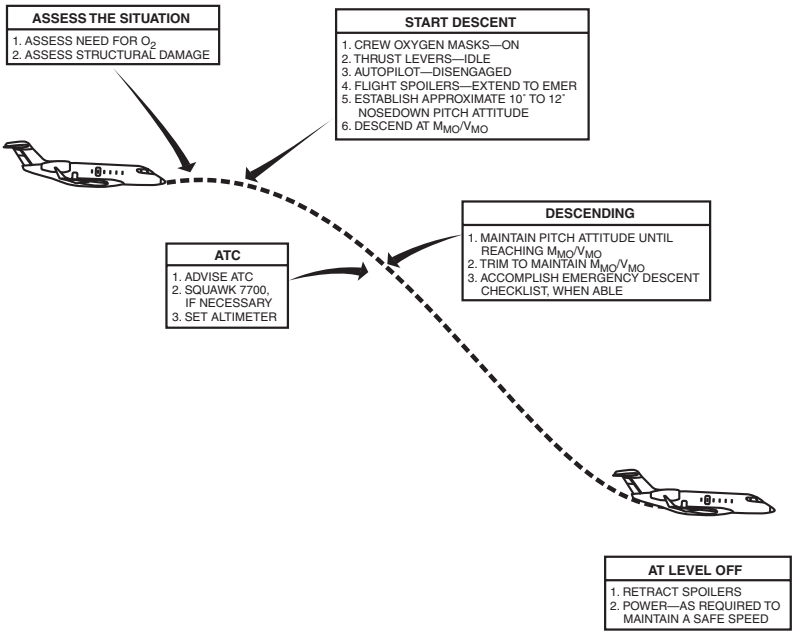


Figure MAP-11. Emergency Decent

APPROACH/LANDING EMERGENCIES

For a single-engine approach, the procedure is the same as with both engines running (Figure MAP-12). The single-engine landing distance need only be increased by 1.15 over the distance required for normal landing.

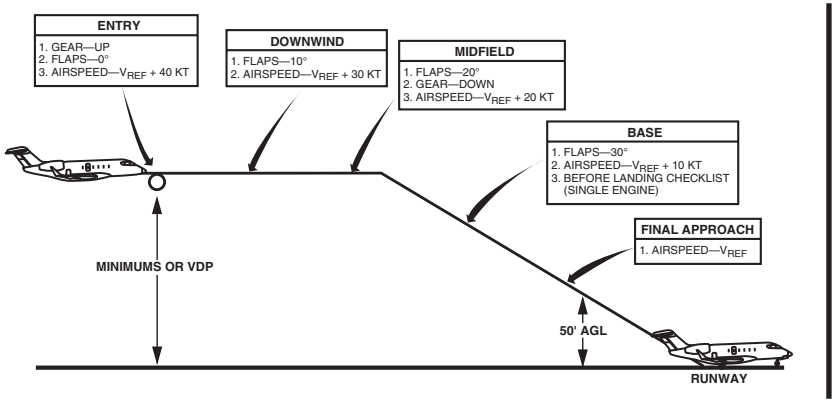


Figure MAP-12. Landing—One Engine

Knowledge of the emergency checklists (especially the memory items) and aircraft limitations is important in successfully handling an emergency situation. Also, keep the passengers informed on the progress of the emergency. Overall, good CRM is one of the best tools in an emergency situation.

The objective in any emergency is to protect the passengers and safely land the aircraft. Depending on the type of emergency, there are situations when it is better to enter a holding pattern, sort things out, and then proceed with the approach and landing (Figure MAP-13).

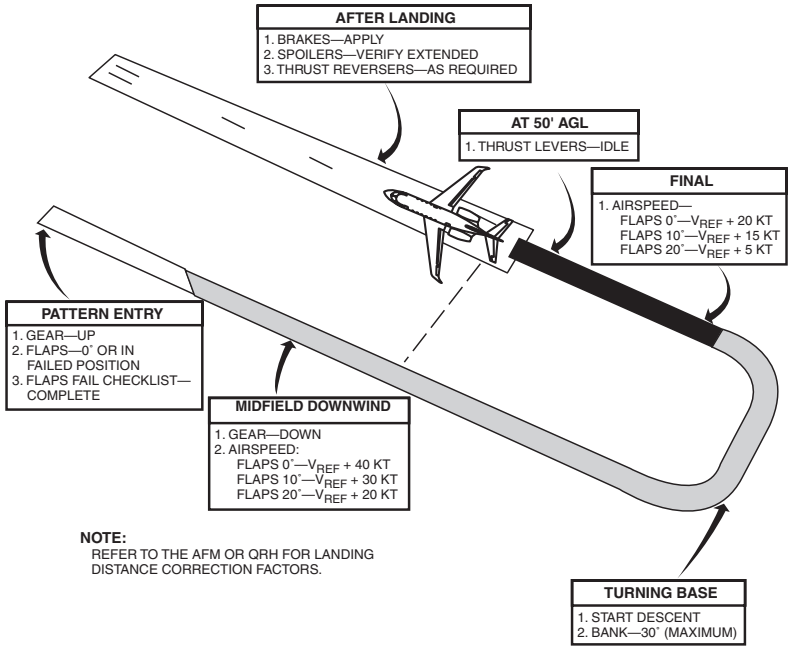


Figure MAP-13. Partial Flaps/No FlapsApproach

Windshear

If extreme windshear is encountered, the FAA windshear recovery technique is recommended. Climb using full power at stick shaker speed by reference to the attitude indicator. Do not rely on pressure instruments until after exiting windshear conditions; reference the radio altimeter.

Be alert for windshear reports and conditions. Study approach weather and wind conditions carefully. Be prepared to use thrust if a sudden sustained airspeed loss on final approach is encountered. Conversely, if the aircraft suddenly picks up too much speed, deliberately and carefully decrease thrust.

If the increase in airspeed was caused by a sudden increase in headwind component, the ground speed may not significantly change immediately.

TRAINING MANEUVERS

In addition to evaluating normal operational skills and procedures, certain training and testing maneuvers are required to pass the type checkride. The following section focuses on a few of the maneuvers required.

All airwork is accomplished with the flight director off. Fly with only PFD raw data.

The following maneuvers are flown at an altitude of 10,000 to 15,000 ft:

- Steep bank turns
- Approach to stall—Clean configuration
- Approach to stall—Takeoff/approach configuration
- Approach to stall—Landing configuration
- Unusual attitude recovery

STEEP BANK TURNS

These maneuvers are accomplished at 45° of bank turning in both left and right directions of 180 or 360°, 250 kt, and a constant altitude (Figure MAP-14).

Stabilize at 250 kt in level flight. This should yield a pitch attitude of approximately 0° with 64% N_1. Before rolling into the turn, add 2 to 4% additional power to maintain 250 kt airspeed at 45° of bank. While rolling into the turn, maintain a pitch of approximately 2° to maintain altitude. Trim nose up to reduce the yoke pressures and help control altitude.

Start the rollout approximately 10° prior to the desired heading. The aircraft response is quick; it rapidly rolls out on the selected heading. If turning the opposite direction, no pause is necessary. Continue the turn, rolling into an opposite direction 45° bank. Very little trim correction is required.

In preparation for the stall maneuvers in the aircraft, FAA guidelines state the airspeed should decrease one kt per second during approach to stall maneuvers. Smooth throttle technique can move the airspeed trend vector to approximately 10 kt below the airspeed indicator. The pilot can easily control entry into the stall regime.

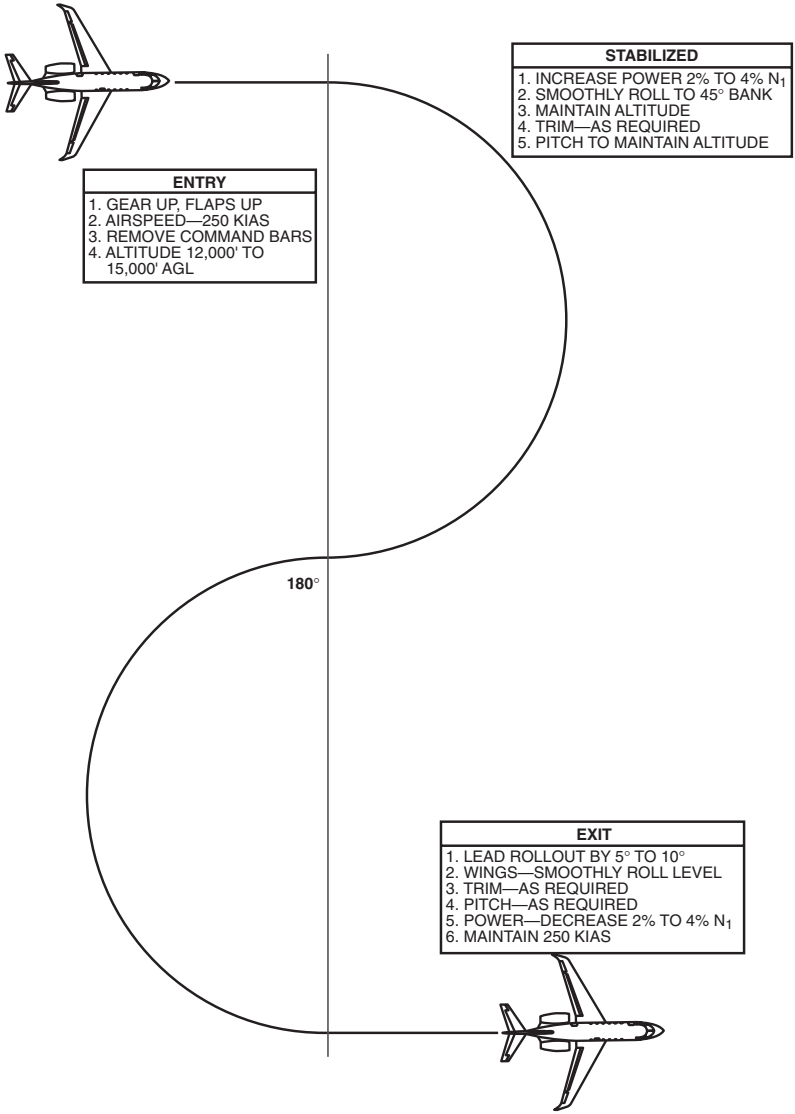


Figure MAP-14. Steep Bank Turns

At normal weights, the power required for a clean stall maneuver is flight idle. For a flaps 20/gear down stall maneuver N_1 should be approximately 50%. Recovery is initiated at the first indication of stall, which could be airframe buffet or stall-warning indications (stick shaker or aural warning).

Recovery from stalls should be accomplished using takeoff power (T/O detent) and maintaining the pitch angle established at the initial stall indication until out of the stall condition.

APPROACH TO STALL—CLEAN (FLAPS 0)

The approach to stall—clean is accomplished with flaps and gear retracted (Figure MAP-15). Initially, stabilize the aircraft at 180 kt. Place thrust levers at IDLE. Hold existing altitude. As airspeed decreases, increase pitch to maintain altitude (up to approximately 11° pitch).

At the first indication of stall warning or buffet, increase power to takeoff (the second detent). Reduce angle of attack to regain airspeed and fly out of the stalled condition quicker. A small altitude loss may result.

As the aircraft accelerates, recover to original altitude and heading. Reduce thrust to 180 kt or an airspeed directed by the instructor.

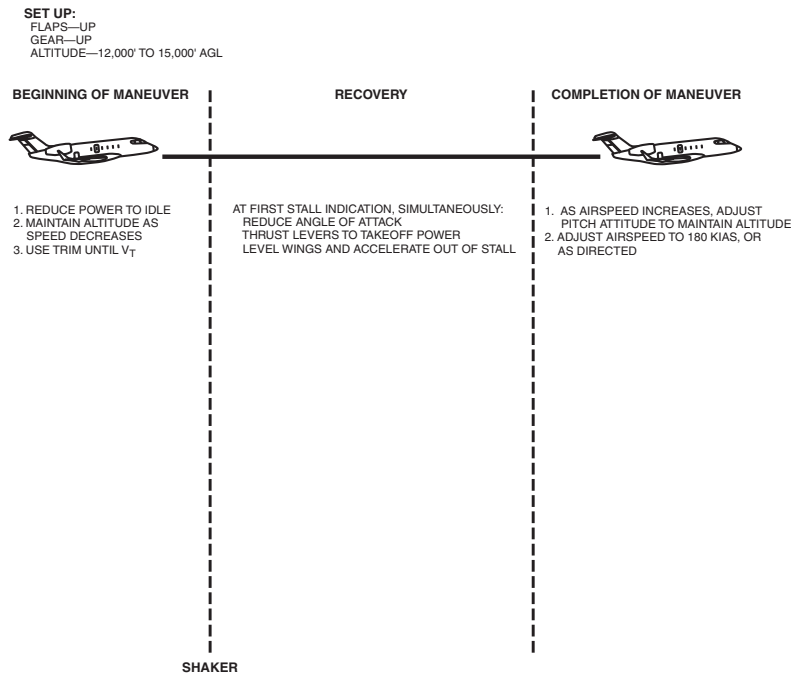


Figure MAP-15. Approach to Stall—Clean (Flaps 0)

APPROACH TO STALL— TAKEOFF OR APPROACH CONFIGURATION

Prior to approaches to stalls, compute and set the airspeed bug at V_{REF} for weight and configuration (Figure MAP-16). While slowing the aircraft, use pitch trim to reduce control forces. Discontinue trim, however, when reaching the computed V_{REF}.

Initially, stabilize the aircraft at 180 kt with approximately 50% N_1. Configure with flaps 20 and landing gear extended. Roll into a bank between 15 to 30°. Leave thrust set at 50% N_1. Increase pitch to maintain altitude and allow airspeed to decrease. All aircraft configuration changes, including pitch trim, are made prior to V_{REF}.

At the first indication of stall warning or buffet, roll wings level and increase power to takeoff (the second detent). Reduce angle of attack to regain airspeed and fly out of the stalled condition. This may result in a small loss of altitude. Do not change configuration when airspeed is below V_{REF}.

As the aircraft accelerates above V_{REF}, call for flaps 10. When a positive rate of climb or increase in airspeed is indicated, call for gear retraction. When airspeed increases above V_T, call for flaps up. Return to the original altitude and heading. Reduce thrust to recover to 180 kt or an airspeed directed by the instructor.

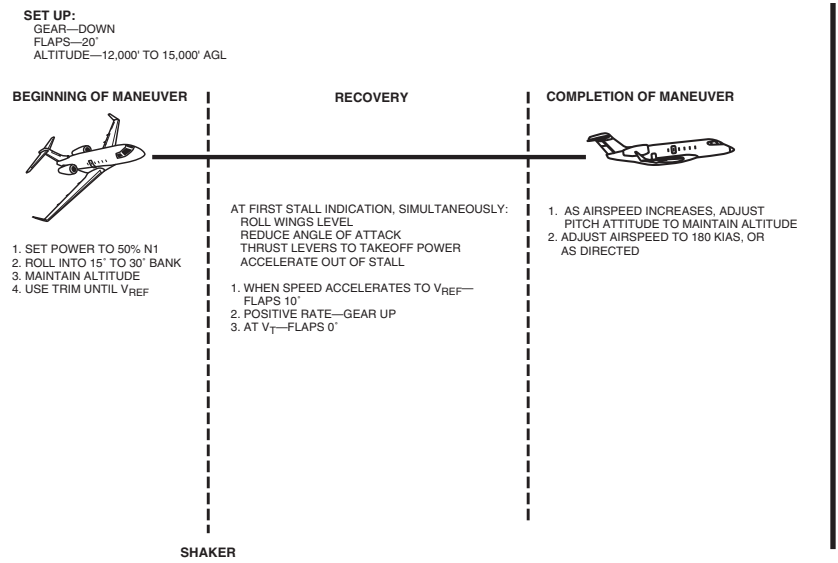


Figure MAP-16. Approach to Stall—Takeoff or Approach Configuration

APPROACH TO STALL—LANDING CONFIGURATION

Prior to approaches to stalls, compute and set the airspeed bugs at V_{REF} and V_{GA} for weight and configuration (Figure MAP-17).

While slowing the aircraft, use pitch trim to reduce control forces. Discontinue trim, however, before reaching the computed V_{REF}.

Stabilize the aircraft on an altitude and at an airspeed below 175 kt, approximately 55% N_1. Compute and set V_{REF} and V_{GA}. Establish the aircraft to the landing configuration, gear extended, and flaps down. Maintain the assigned heading and altitude. Adjust the thrust levers to approximately 55% N_1. Lower pitch to simulate a normal 3° descent, then level off by holding an altitude until the first indication of stall warning or buffet.

At the first indication, maintain or level the wings while advancing the thrust levers to takeoff(second detent). Reduce the angle of attack to help the aircraft regain airspeed and fly out of the stalled condition quicker. This may result in a small loss of altitude. Do not change configuration below the indicated airspeed of V_{REF}. When the airspeed increases above V_{REF}, call for flaps 10. When a positive rate of climb (or level flight with increasing airspeed) is attained, call for gear retraction.

Recover to the starting altitude and heading. When the airspeed increases to V_T, call for flaps up. When established on the original heading and altitude, reduce thrust to maintain 180 kt or an airspeed directed by the instructor.

UNUSUAL ATTITUDE RECOVERY

It is important to maintain positive control of the aircraft by recognizing the flight condition. This is normally accomplished with reference to the altitude, airspeed, and attitude of the aircraft. During a sudden or unknown change to an unusable/unusual attitude, verify aircraft attitude with all available indicators. Use these references to make the proper recovery.

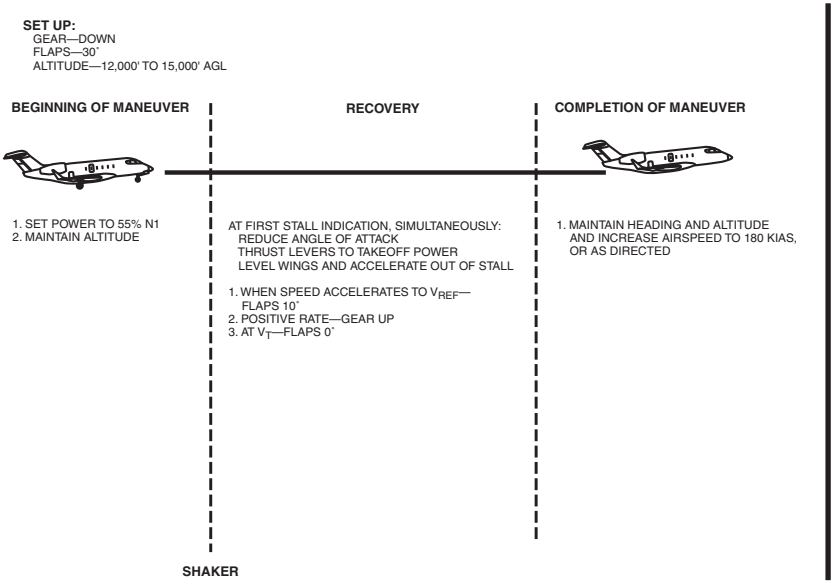


Figure MAP-17 Approach to Stall—Landing Configuration

Nose High—Airspeed Slowing

Once the nose high, airspeed slowing, and increasing altitude indications are confirmed, roll wings toward the nearest horizon while simultaneously applying power to counter the decreasing airspeed (Figure MAP-18). Allow the nose to pass through the horizon. Roll wings level and return the aircraft to level flight. Adjust power to maintain the desired airspeed.

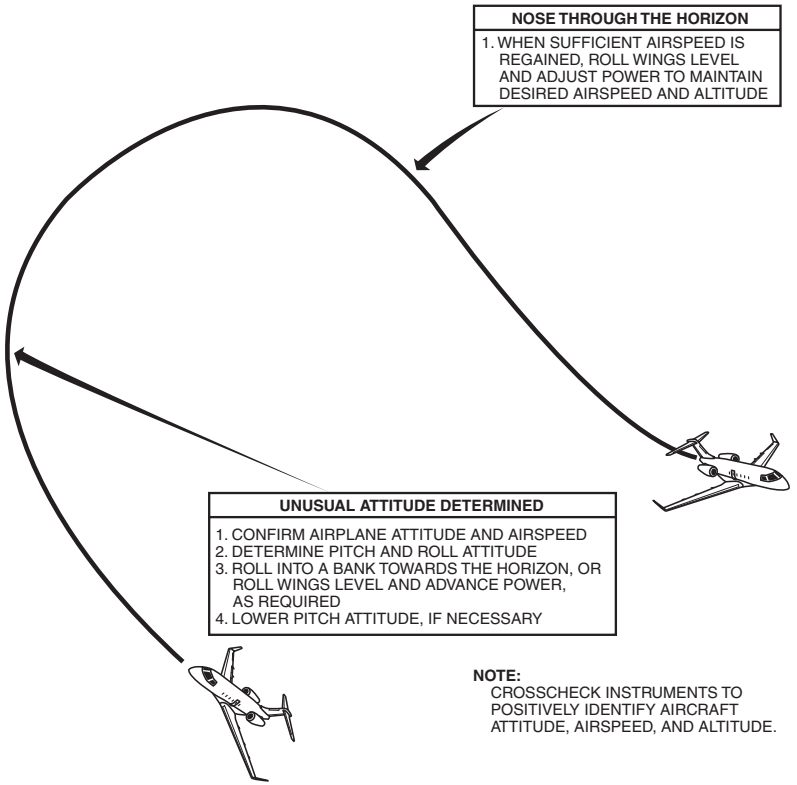


Figure MAP-18. Nose High—Airspeed Slowing

Nose Low—Airspeed Increasing

Once the nose low, airspeed rapidly increasing, and altitude decreasing condition is confirmed, rapidly place the thrust levers to idle and rol1 wings level to the horizon (Figure MAP-19). Before adding elevator pressure, ensure wings are level. Use elevator pressure to return to level flight. Adjust power to maintain the desired indicated airspeed.

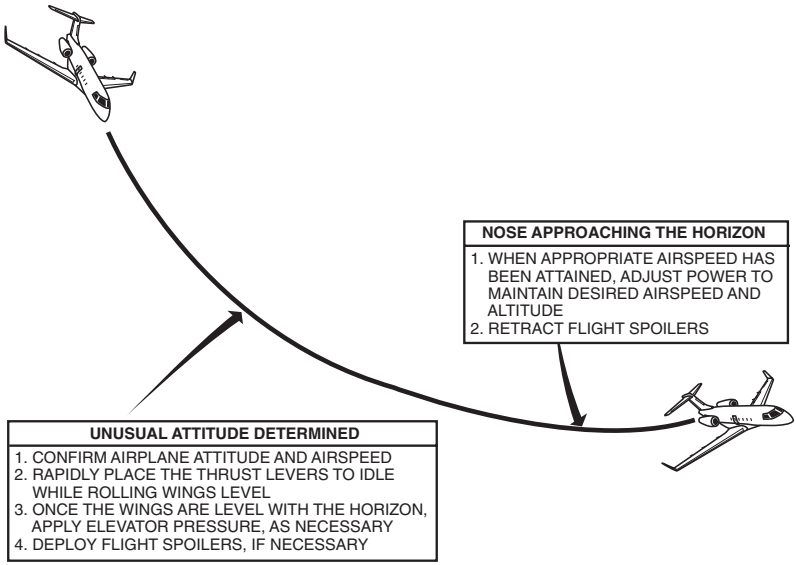


Figure MAP-19. Nose Low—Airspeed Increasing

For information commonly found in the Weight and Balance section see the *Performance Manual.*

For information commonly found in the Performance Chapter see the *Performance Manual.*

CREW RESOURCE MANAGEMENT

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CREW RESOURCE MANAGEMENT (CRM)

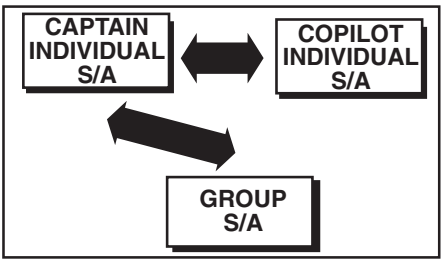
CREW CONCEPT BRIEFING GUIDE

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

Pilot in Command (PIC)	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.
Pilot Flying (PF)	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.
Pilot Not Flying (PNF)	Maintains ATC communications, copies clearances, accomplishes checklists and other tasks as directed by the PIC.
Both (B)	



REMEMBER

2 + 2 = 2

– or –

2 + 2 = 5
(Synergy)

IT'S UP TO YOU!

CLUES TO IDENTIFYING:

- **Loss of Situational Awareness**
- **Links in the Error Chain**

OPERATIONAL	1. FAILURE TO MEET TARGETS 2. UNDOCUMENTED PROCEDURE 3. DEPARTURE FROM SOP 4. VIOLATING MINIMUMS OR LIMITATIONS 5. NO ONE FLYING AIRPLANE 6. NO ONE LOOKING OUT WINDOW
HUMAN	7. COMMUNICATIONS 8. AMBIGUITY 9. UNRESOLVED DISCREPANCIES 10. PREOCCUPATION OR DISTRACTION 11. CONFUSION OR EMPTY FEELING

CRM-1. Situational Awareness in the Cockpit

LEADERSHIP STYLES

AUTOCRATIC STYLE (EXTREME)	AUTHORITARIAN LEADERSHIP STYLE	DEMOCRATIC LEADERSHIP STYLE	LAISSEZ-FAIRE STYLE (EXTREME)

PARTICIPATION

LOW ⟷ **HIGH**

Command — Designated by Organization
— Cannot be Shared
Leadership — Shared among Crewmembers
— Focuses on "What's right," not "Who's right"

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 PF 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 PNF to obtain destination weather. Transfer of communication duties to the PF may facilitate the accomplishment of this task.

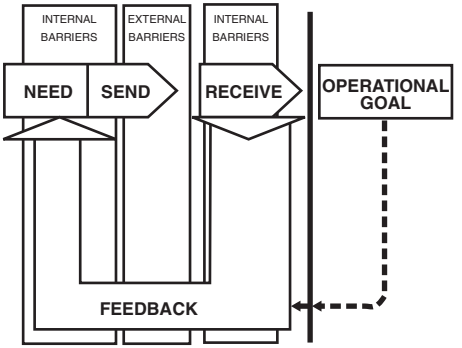
PNF—Advises the pilot of current destination weather, approach in use, and special information pertinent to the destination.

PF—Requests the PNF 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 PNF, advising, "You have control, heading ____ altitude _____" and special instructions. (Communications duties should be transferred back to the PNF at this point.)

PNF—Responds, "I have control, heading _____, altitude _____."



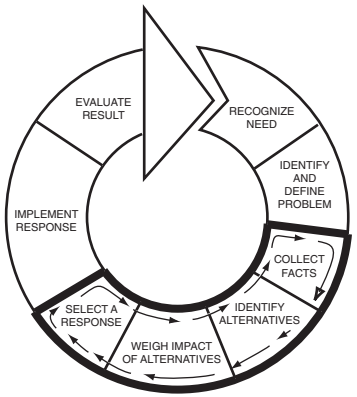
THINK:
- **Solicit and give feedback**
- **Listen carefully**
- **Focus on behavior, not people**
- **Maintain focus on the goal**
- **Verify operation outcome is achieved**

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".

CRM-3. Communication 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**

CRM-4. Decision-Making Process

PF—Advises, “Approach briefing”.

PF—At the completion of the approach briefing, the PF 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 PF and PNF have not been reversed during the time that transfer of control occurs.

ALTITUDE CALLOUTS

PNF	PF
ENROUTE	
1,000 feet prior to level off	1,000 feet prior to level off
State altitude leaving and assigned level-off altitude	"ROGER"
"100 above/below"	"LEVELING"
APPROACH—PRECISION	
At 1,000 feet above minimums "1,000 feet above minimums"	At 1,000 feet above minimums "Decision Altitude _____"
At 500 feet above minimums "500 feet above minimums"	At 500 feet above minimums "NO FLAGS"
At 100 feet above minimums "100 feet above minimums"	At 100 feet above minimums "APPROACHING MINIMUMS"
At minimums "Minimums, approach lights at (clock position)"	At minimums "CONTINUING"
or	
"Minimums, runway at (clock position)"	"CONTINUING"
or	
"Minimums, runway not in sight"	"GO AROUND"

PNF	PF
APPROACH—NONPRECISION	
At 1,000 feet above minimums "1,000 feet above minimums"	At 1,000 feet above minimums "MDA ——— "
At 500 feet above minimums "500 feet above minimums"	At 500 feet above minimums "NO FLAGS"
At 100 feet above minimums "100 feet above minimums"	At 100 feet above minimums "APPROACHING MINIMUMS"
At minimums "Minimums"	At minimums "LEVEL"
At missed approach point (MAP) "Approach lights at clock position" or "Runway at (clock position)" or "Runway not in sight"	At missed approach point (MAP) "CONTINUING" "CONTINUING" "GO AROUND"

PNF	PF
SIGNIFICANT DEVIATION CALLOUT	
IAS ±10 KIAS "V_{REF} ± _____"	IAS ±10 KIAS "CORRECTING TO _____"
Heading ±10° enroute, 5° on approach "Heading _____° left/right"	Heading ±10° enroute, 5° on approach "CORRECTING TO _____"
Altitude ±100 feet enroute, +50/–0 feet on final approach "Altitude _____ high/low"	Altitude ±100 feet enroute, +50/–0 feet on final approach "CORRECTING TO _____"
CDI left or right one dot "Left/right of course _____ dot"	CDI left or right one dot "CORRECTING"
RMI course left or right ±5° "Left/right of course _____ °"	RMI course left or right ±5° "CORRECTING"
Vertical descent speed greater than 1,000 fpm on final approach "Sink rate _____"	Vertical descent speed greater than 1,000 fpm on final approach "CORRECTING"
Bank in excess of 30° "Bank _____°"	Bank in excess of 30° "CORRECTING"

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SYSTEMS REVIEW

AIR CONDITIONING SYSTEM

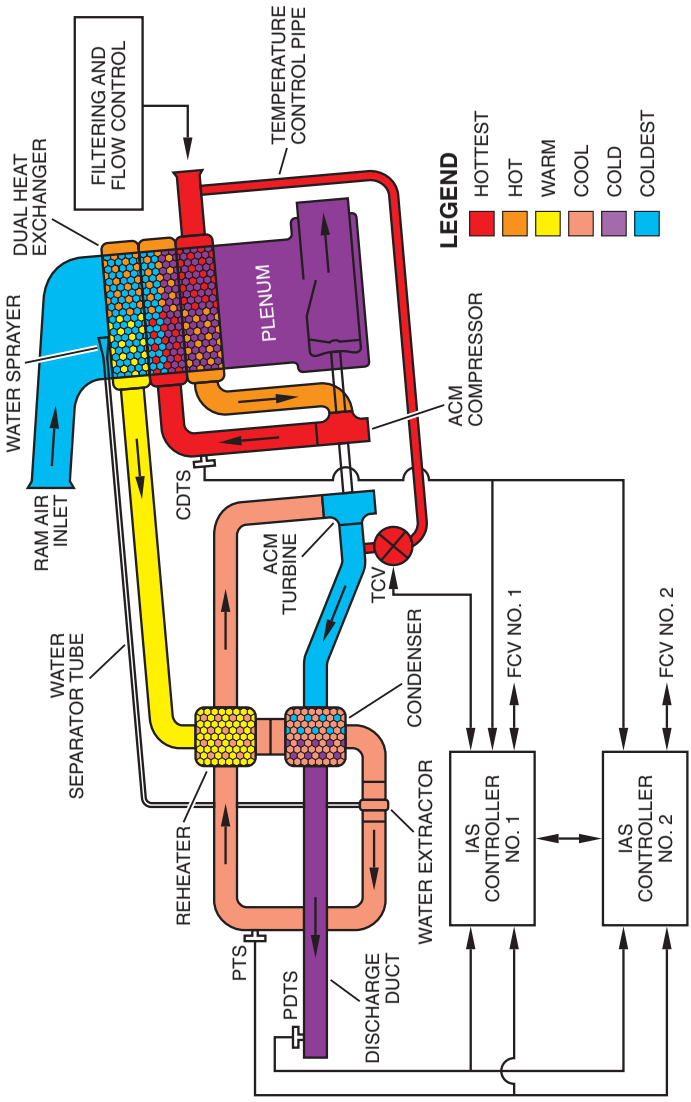

Figure SR-1. Air Conditioning System

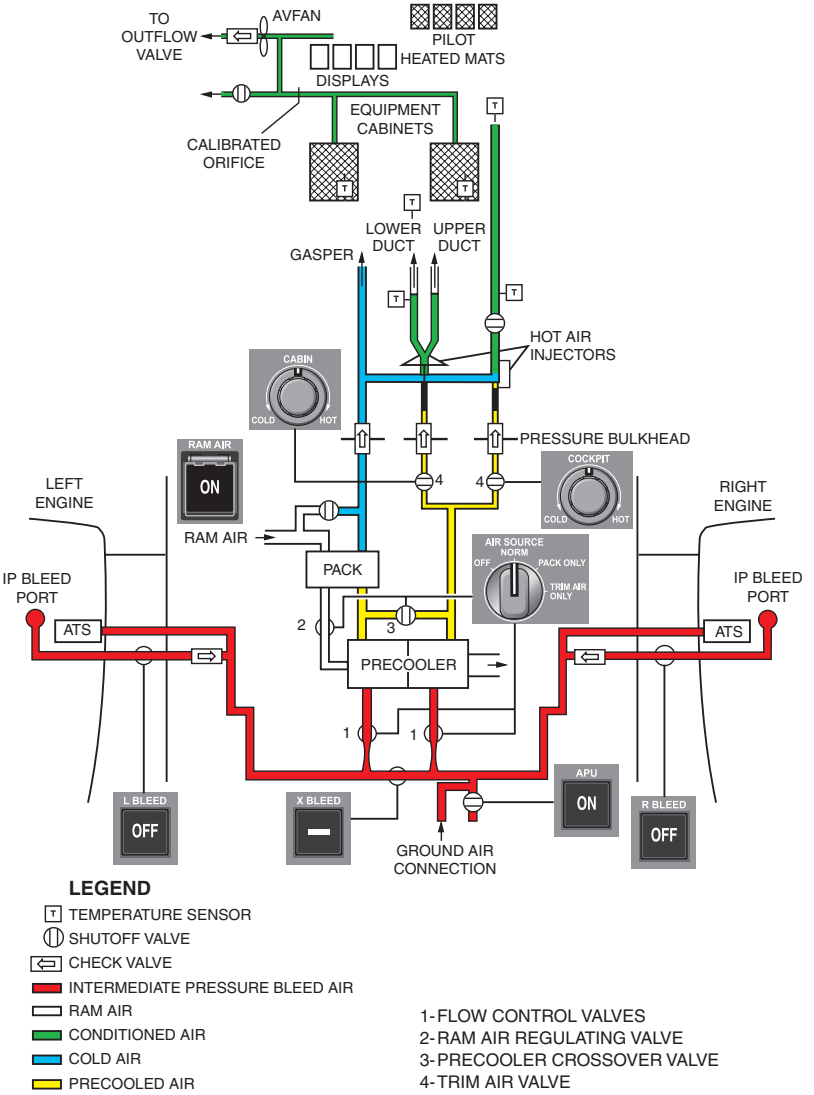

Figure SR-2. Cockpit/Cabin Air Distribution Schematic

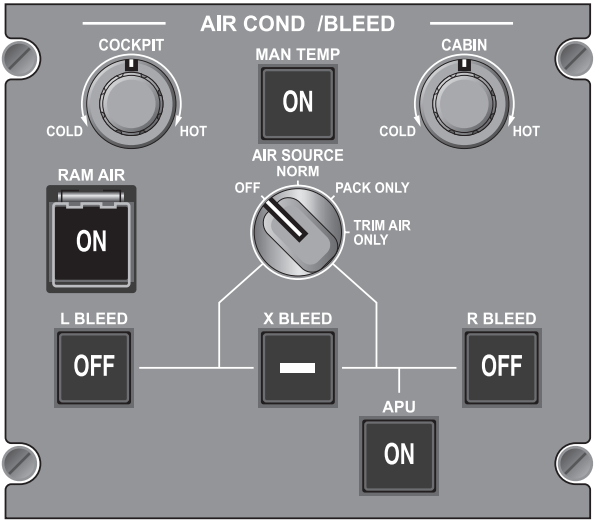

Figure SR-3. AIR COND/BLEED Control Panel

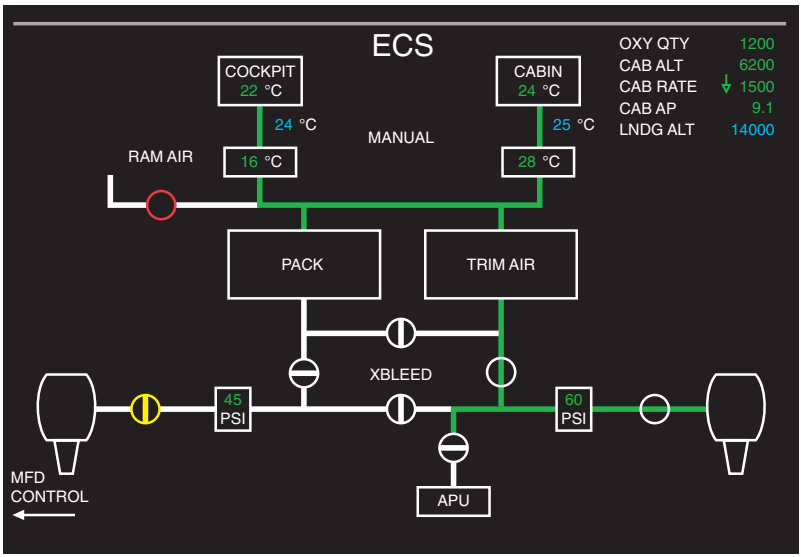

Figure SR-4. ECS Synoptic Page

Table SR-1. EICAS MESSAGES—AIR CONDITIONING

MESSAGE	INHIBITS	MEANING	AURAL WARNING
PACK LEAK	TO/LAND	A leak has been detected in the pack ducting.	
TRIM AIR LEAK	TO/LAND	A leak has been detected in the bleed-air ducting downstream of the right flow control valve, up to the precooler crossover, and up to the trim air check valve.	
AIR COND TEMP FAIL	TO/LAND	The automatic temperature control system has failed.	
AIR COND TEMP HIGH	TO/LAND	Excessive air temperature has been sensed in the cabin or cockpit air distribution duct.	
EQPT RACK TEMP HIGH	TO/LAND	The temperature in either equipment rack is high.	
PACK FAIL	TO/LAND	A failure has been detected in the PACK system.	
PACK LOOP FAIL	TO/LAND	Both bleed-air leak detection loops in the PACK have failed during the power-up self-test.	
PACK TEMP HIGH	TO/LAND	An overheat has been detected in the air conditioning PACK system.	
TRIM AIR FAIL	TO/LAND	A hot air regulating valve has failed.	
TRIM AIR LOOP FAIL	TO/LAND	The bleed-air leak detection loops around the trim air ducting have failed.	
AIR COND FAULT	TO/LAND	A fault has been detected in the air conditioning system, or there has been a loss of temperature sensing.	
EQUIP RACK COOL FAULT	TO/LAND	A fault has been detected in the avionics equipment rack cooling system.	
PACK COOL AIR FAIL	TO/LAND	The ram air regulating valve supplying cooling air to the PACK heat exchanger has failed.	
RAM AIR FAIL	TO/LAND	The RAM AIR ventilation valve has failed to move to the commanded position.	
AIR COND MAN TEMP ON		The air conditioning temperature control is in manual mode.	
AIR SOURCE OFF	TO/LAND	The AIR SOURCE switch is in the OFF position resulting in no conditioned air entering the cabin.	
PACK ONLY	TO/LAND	The AIR SOURCE switch is in the PACK ONLY position resulting in all air conditioning bleed air being routed through the PACK.	
RAM AIR ON	TO/LAND	The RAM AIR switch has been selected ON providing ram air ventilation.	
TRIM AIR ONLY	TO/LAND	The AIR SOURCE switch is in the TRIM AIR ONLY position resulting in all air conditioning bleed air being routed through the trim air system. The air will be warm.	

AUXILIARY POWER SYSTEM

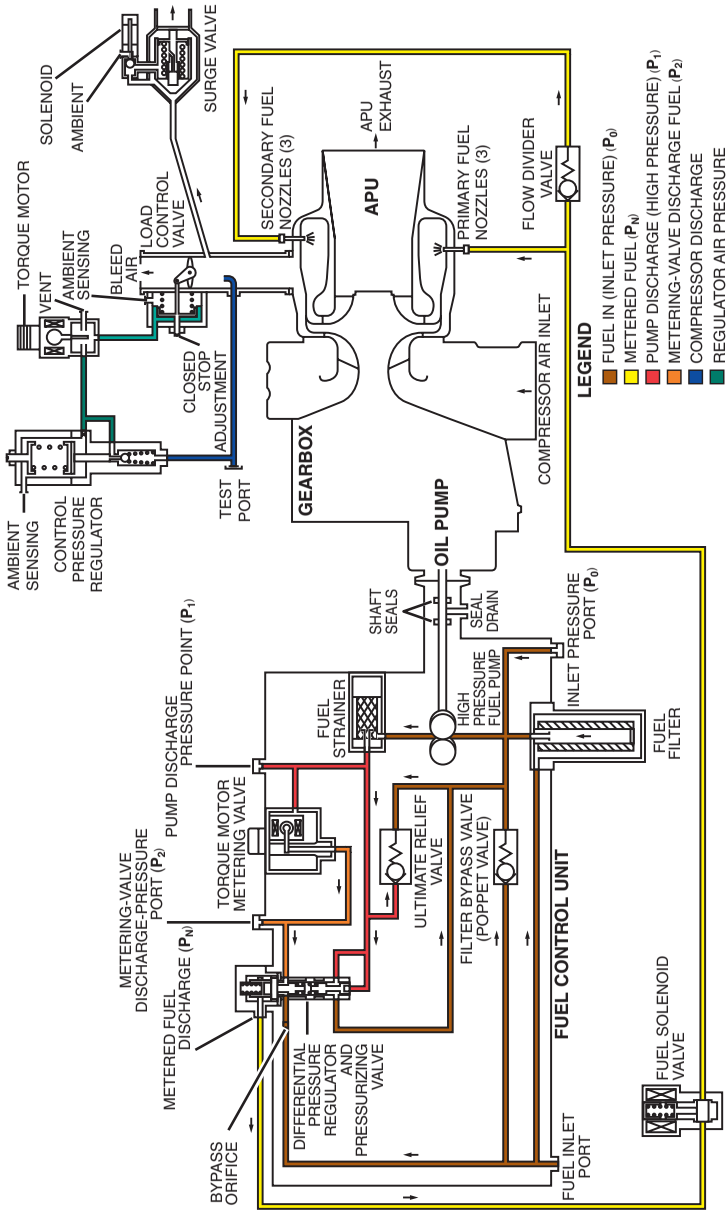

Figure SR-5. APU Fuel and Airflow Schematic

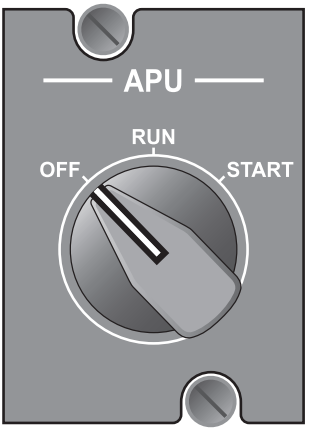

Figure SR-6. APU Control Panel

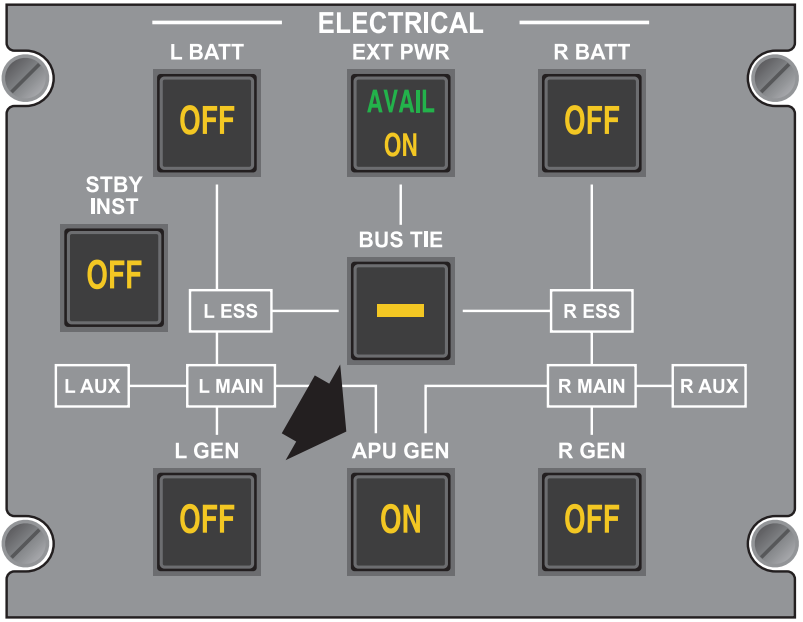

Figure SR-7. APU GEN Switch

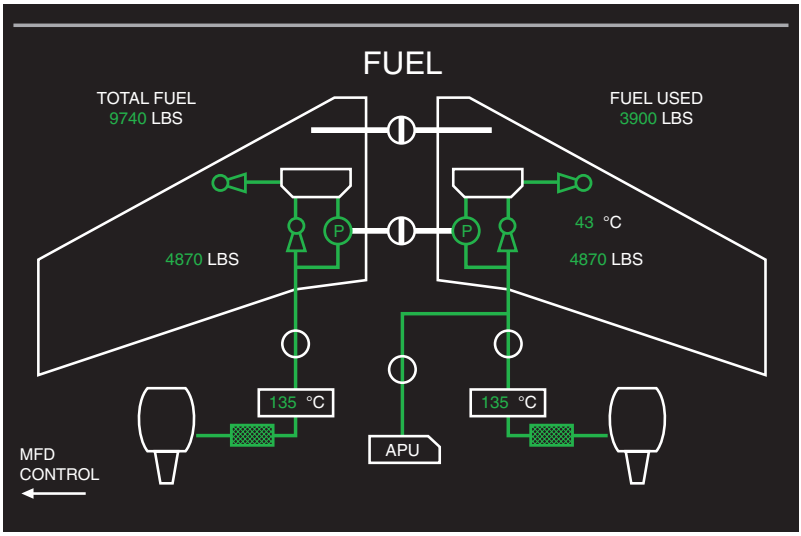

Figure SR-8. Fuel Flow to APU and APU Shutoff Valve Indications on FUEL Synoptic Page

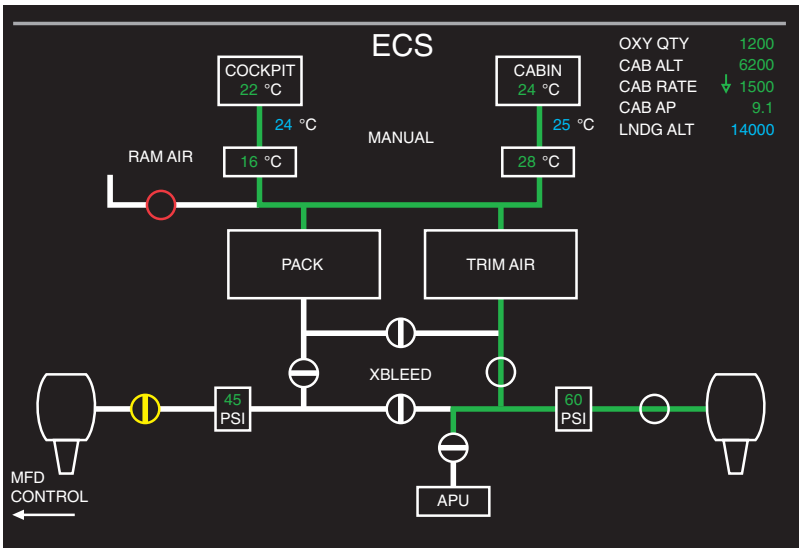

Figure SR-9. APU Load Control Valve on ECS Synoptic Page

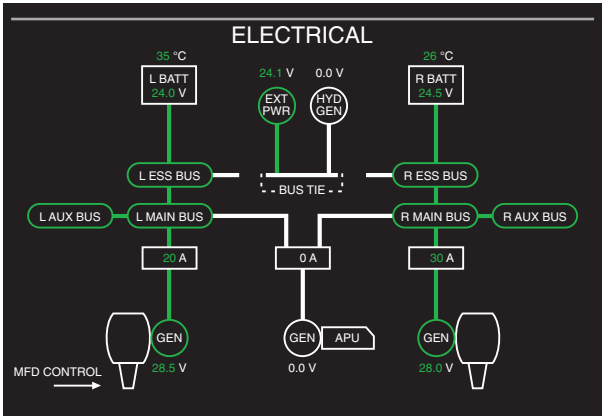

Figure SR-10. APU Voltage and Amps on ELECTRICAL Synoptic Page

Table SR-2. EICAS MESSAGES—APU

MESSAGE	INHIBITS	MEANING	AURAL WARNING
APU FIRE		The APU fire detection loop has activated. On the ground, the system should automatically shut the APU down and activate the fire extinguisher. In flight, the APU will not automatically shut down or activate the fire extinguisher.	"APU FIRE"
APU OVERTEMP	TO	An APU EGT overtemperature has been detected. On the ground, the APU will automatically shut down.	
APU BLEED ALT LIMIT	TO/LAND	APU bleed air has been commanded above 20,000 ft or the APU bleed modulated due to excessive EGT.	
APU FUEL SOV FAIL	TO/LAND	The APU shutoff valve has failed.	
APU OVERSPEED	TO/LAND	The APU has shut down due to an overspeed.	
APU OIL PRESS LOW	TO/LAND	The APU oil pressure is low while in flight.	
APU OIL TEMP HIGH	TO/LAND	The APU oil temperature is high while in flight.	
APU STARTER FAIL ON	TO/LAND	Power is still being supplied to the APU starter when electronic control unit is not commanding a start.	
APU FAULT	TO/LAND	A fault is indicated in the APU system. One or more of the following has occurred: • The APU bleed valve has failed • The APU fuel solenoid has failed • A start is prevented • The avionics are not communicating with the APU electronic control unit • Reverse flow has been detected	
APU SHUTDOWN	TO/LAND	The auxiliary power unit electronic control unit has shut down the APU for protective reasons.	

AVIONICS

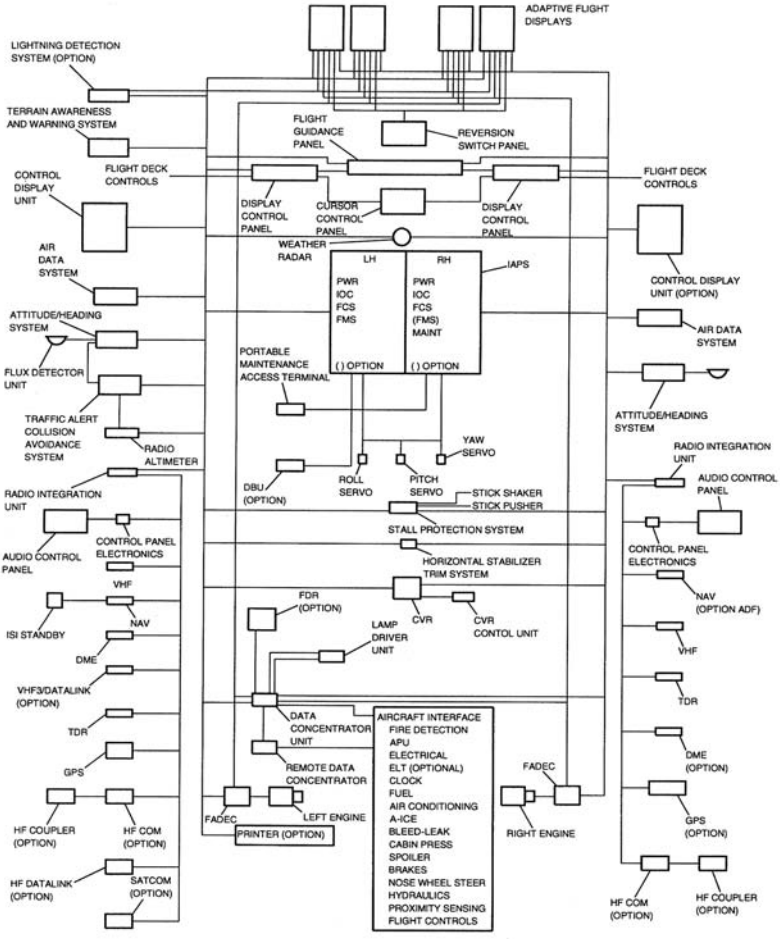

Figure SR-11. Integrated Avionics System (IAPS)

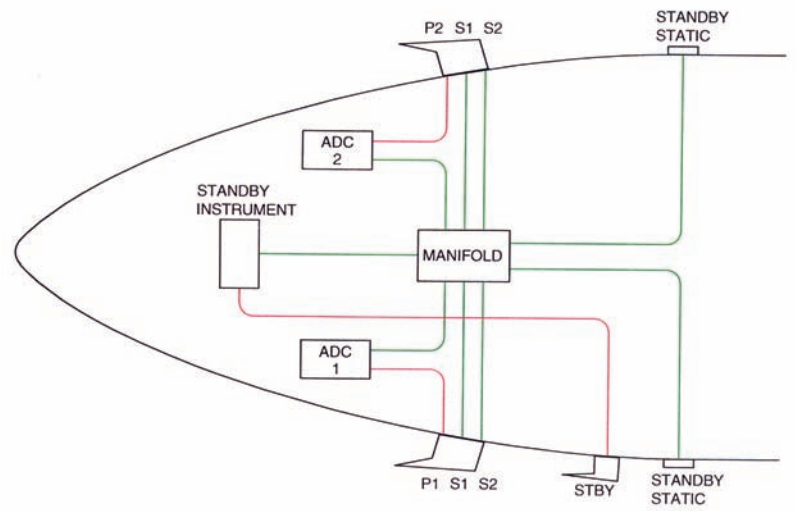

Figure SR-12. Air Data System

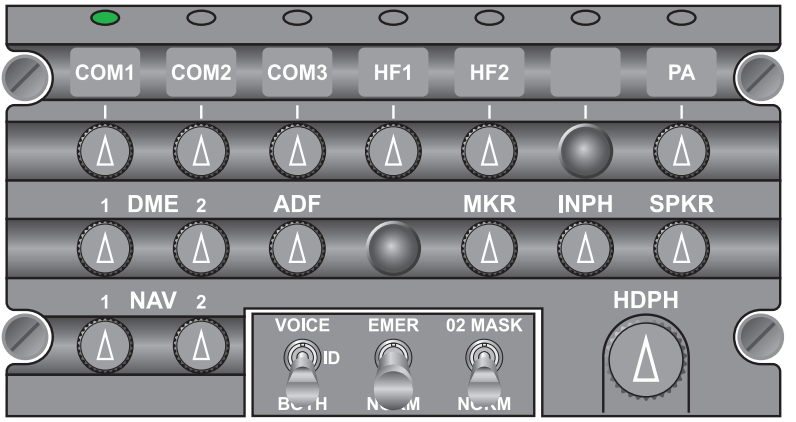

Figure SR-13. Communications Control

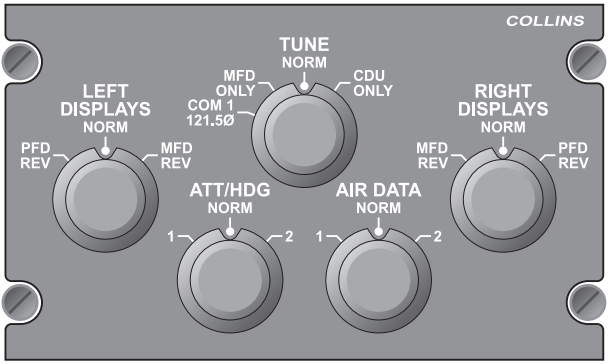

Figure SR-14. Reversion Control Panel

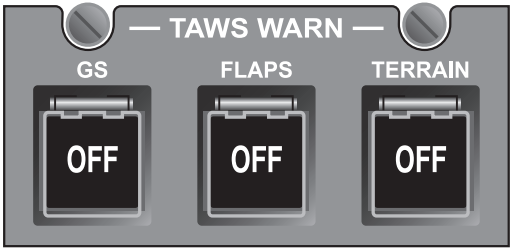

Figure SR-15. TAWS WARN Control Panel

Table SR-3. EICAS MESSAGES—AVIONICS

MESSAGE	INHIBITS	MEANING	AURAL WARNING
FLIGHT INSTRUMENTS			
EFIS COMPARATOR INOP	TO/LAND	The EFIS comparator is unable to compare one or more of the following parameters: altitude, airspeed, roll attitude, pitch attitude, heading, radio altitude, flight director, localizer, or glideslope.	
EFIS MISCOMPARE		There is a mismatch between the onside and cross-side data. Accompanied by a PFD annunciation ALT, IAS, ROL, PIT, HDG, LOC, GS, RA, or FD.	
L IAPS FAIL R IAPS FAIL	TO/LAND	The respective integrated processing system has failed.	
PFD X-TALK FAIL	TO/LAND	Communication between the PFDs has failed. REFs menu pages 1, 2, and 3 are not synchronized. The EFIS comparator will be inoperative and is unable to compare one or more of the following parameters: altitude, airspeed, roll attitude, pitch attitude, heading, radio altitude, flight director, localizer, or glideslope.	
CAS MISCOMPARE		There has been a miscompare of Warning, Caution, Advisory, Status, or Aurals for greater than 20 seconds. All current CAS messages are displayed and aurals are sounded.	
DCU FAN FAIL	TO/LAND	The avionics data concentrator unit fan has failed.	
DCU FAULT	TO/LAND	Channel A or B in the data concentrator unit has failed; the yaw damper may fail. The rudder travel limiter monitoring may be inoperative.	
IAPS FAN FAULT	TO/LAND	The IAPS is indicating an overtemperature condition or fan failure. Opening avionics rack doors and/or lowering cabin and cockpit temperatures may aid in cooling.	
MFD X-TALK FAIL	TO/LAND	Communication between the MFDs has failed, and cross-side tuning is not available.	
RDC FAULT	TO/LAND	Channel A or B of the remote data concentrator has failed with no loss of functionality.	
AUTOMATIC FLIGHT CONTROL SYSTEM			
CONFIG AILERON TRIM CONFIG AUTOPILOT CONFIG FLAPS CONFIG RUDDER TRIM CONFIG SPOILERS CONFIG STAB TRIM	TO	The aircraft is on the ground, and the takeoff parameters (autopilot, flaps, spoilers, and trims in any axis) are not properly configured for takeoff.	"Configuration"
AFCS MESSAGES FAIL		Monitoring and indication of the autopilot modes may be unreliable.	
AP HOLDING LWD AP HOLDING RWD AP HOLDING NOSE DOWN AP HOLDING NOSE UP	TO	The autopilot is holding control force in the direction indicated.	
AP STAB TRIM FAIL	TO	The autopilot is unable to make a trim correction to the horizontal stabilizer.	
FD MODE CHANGE		An indirect mode change has occurred within the flight director. An example of an indirect mode change would be NAV or APPR mode changing to ROLL with a navigation source or frequency change.	
YAW DAMPER FAIL	TO/LAND	The yaw damper has failed.	
FD 1 FAIL FD 2 FAIL	TO/LAND	The respective flight director has failed accompanied by an FD flag on the PFD.	

Table SR-3. EICAS MESSAGES—AVIONICS (Cont)

MESSAGE	INHIBITS	MEANING	AURAL WARNING
COMMUNICATIONS			
CVR FAIL	TO/LAND	The cockpit voice recorder has failed.	
FDR FAIL	TO/LAND	The flight data recorder has failed.	
FDR FAULT	TO/LAND	The longitudinal, lateral, or normal accelerations parameters in the flight data recorder are inoperative. It may be possible to clear this message.	
SELCAL HF 1 SELCAL HF 2	TO/LAND	The SELCAL code has been received on HF 1 or HF 2.	"SELCAL"
SELCAL VHF 1 SELCAL VHF 2 SELCAL VHF 3	TO/LAND	The SELCAL code has been received on VHF 1, VHF 2, or VHF 3.	"SELCAL"
SELCAL DATALINK	TO/LAND	The SELCAL code has been received on DATALINK.	"SELCAL"
ELT ON		Pilot status that ELT is transmitting.	
NAVIGATION			
TAWS BASIC FAIL	TO/LAND	Some of the basic modes (Mode 1 through 6) of the terrain awareness warning system have failed.	
TAWS SYSTEM FAIL	TO/LAND	The terrain awareness warning system has failed.	
TAWS TERR FAIL	TO/LAND	The terrain function of the terrain awareness system has failed.	
TAWS TERR NOT AVAIL	TO/LAND	The TAWS terrain data base has no data for the current location.	
TAWS WINDSHEAR FAIL	TO/LAND	The windshear function of the terrain awareness warning system has failed.	
TAWS FLAPS OFF		The flap warning function of the terrain awareness warning system has been selected OFF by the crew.	
TAWS GS WARN OFF		The glideslope warning function of the terrain awareness warning system has been selected OFF.	
TAWS TERR OFF		The terrain warning function of the terrain awareness warning system has been selected OFF.	

ELECTRICAL SYSTEM

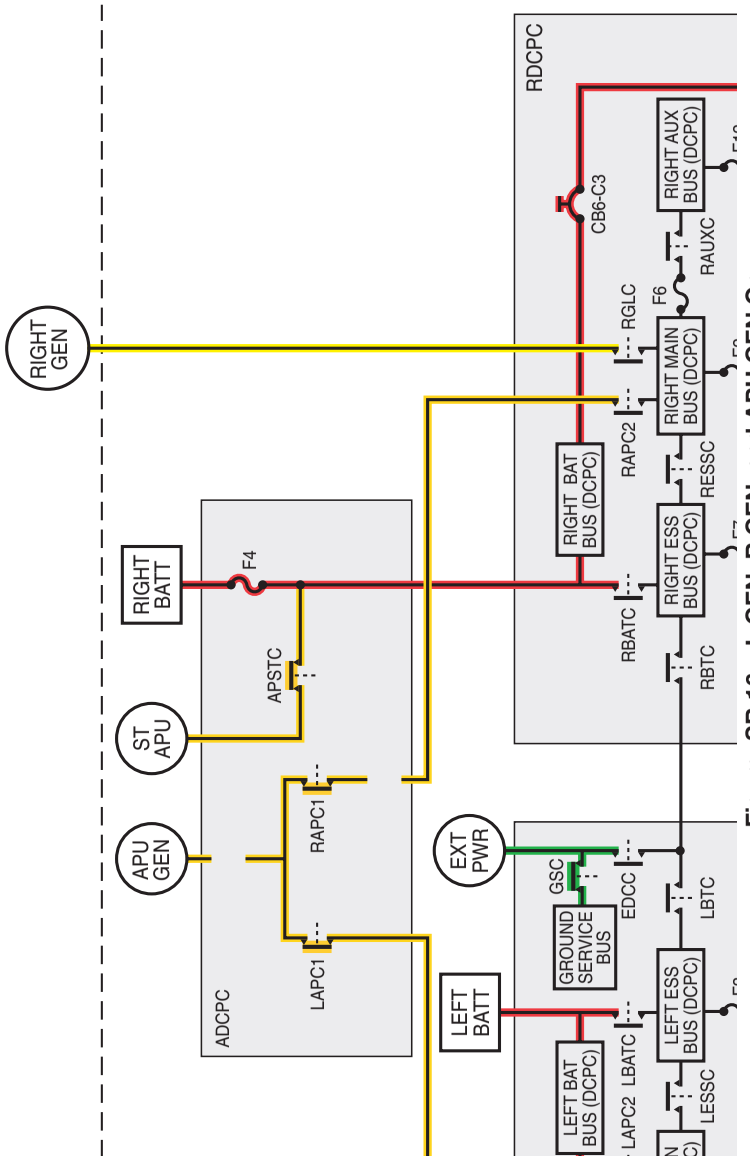

Figure SR-16. L GEN, R GEN, and APU GEN On

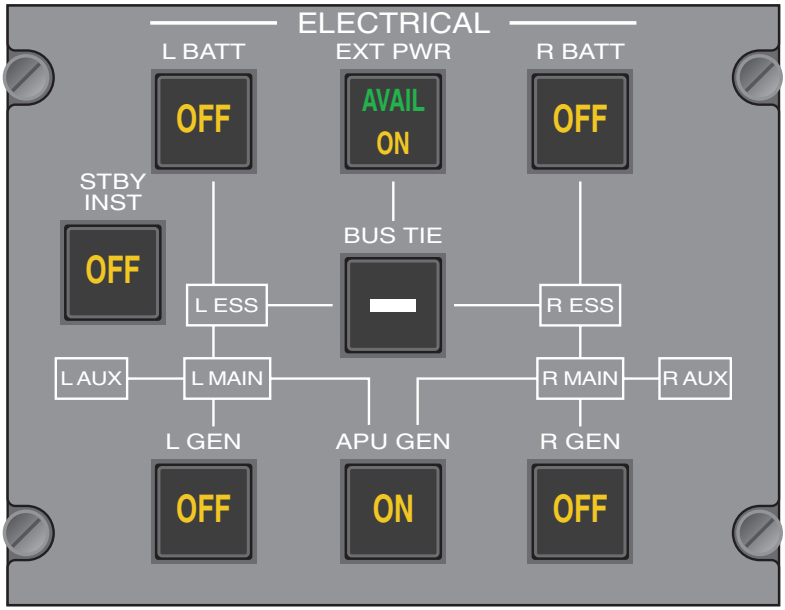

Figure SR-17. ELECTRICAL Control Panel

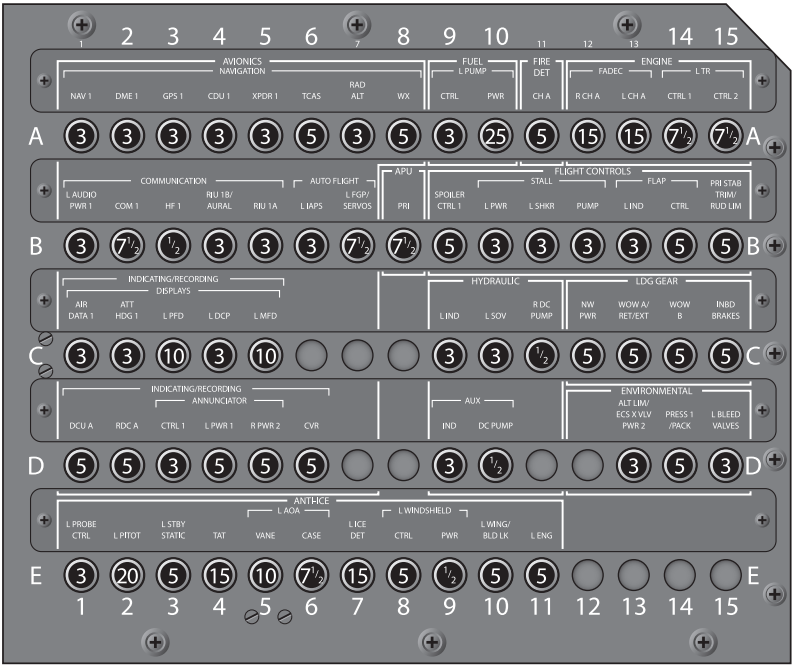

Figure SR-18. CB1 Left Cockpit Circuit Breaker Panel

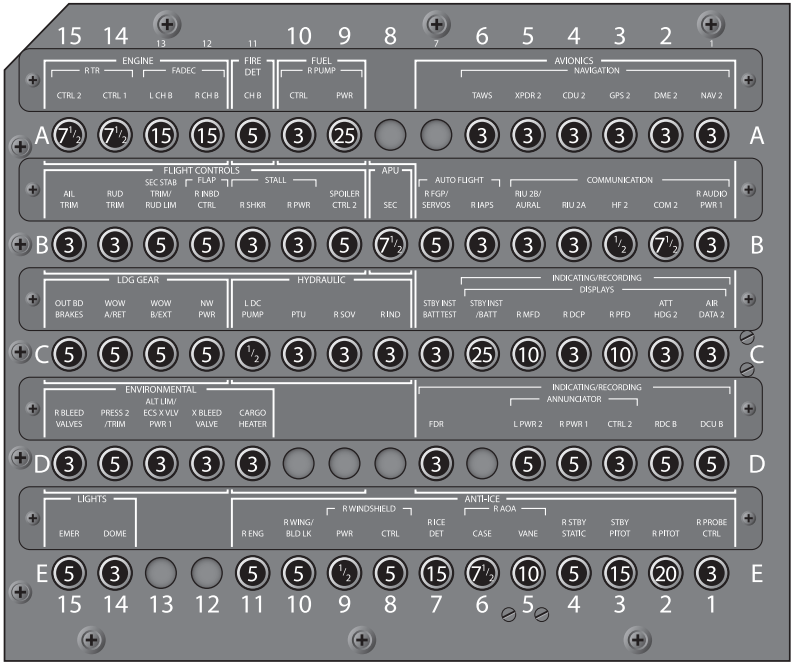

Figure SR-19. CB2 Right Cockpit Circuit Breaker Panel

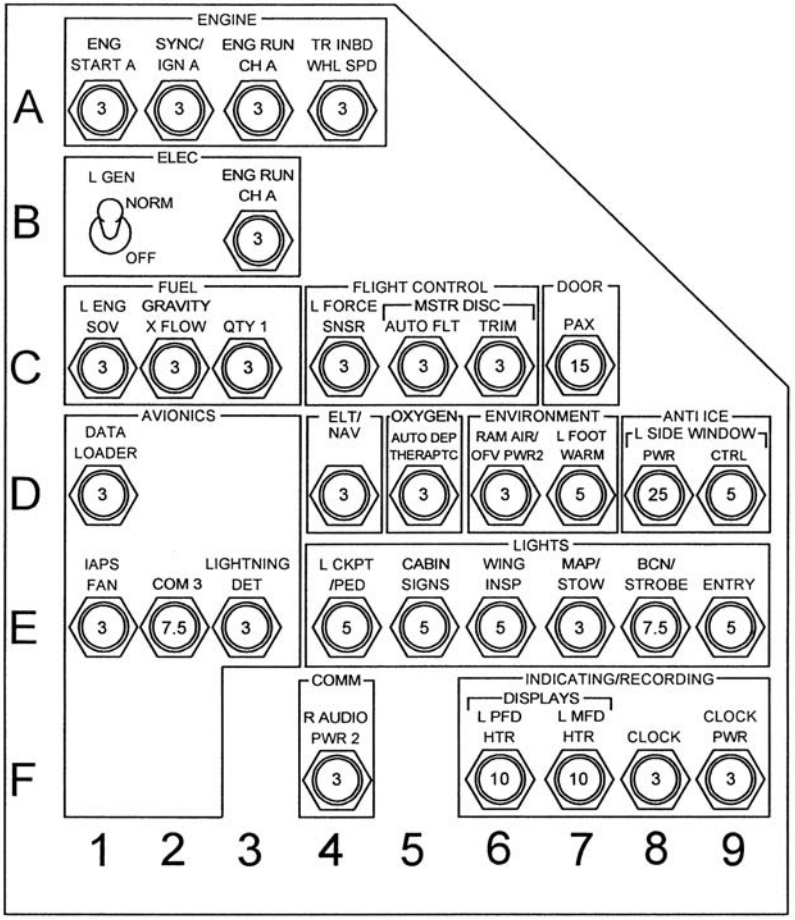

Figure SR-20. CB3 Left Equipment Rack Circuit Breaker Panel

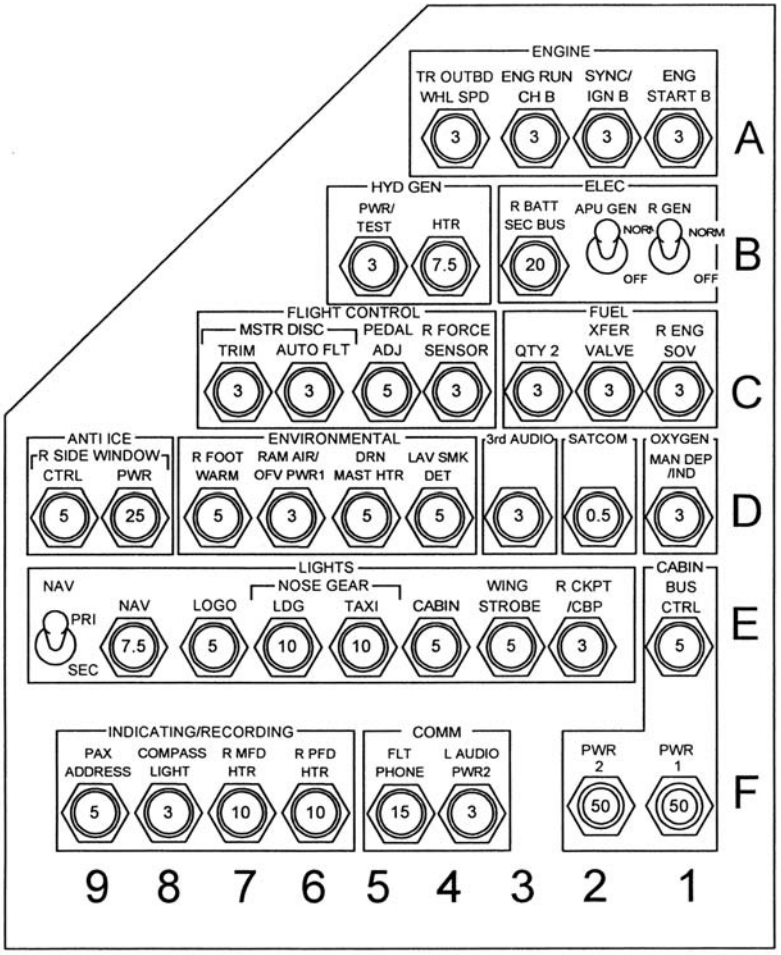

Figure SR-21. CB4 Right Equipment Rack Circuit Breaker Panel

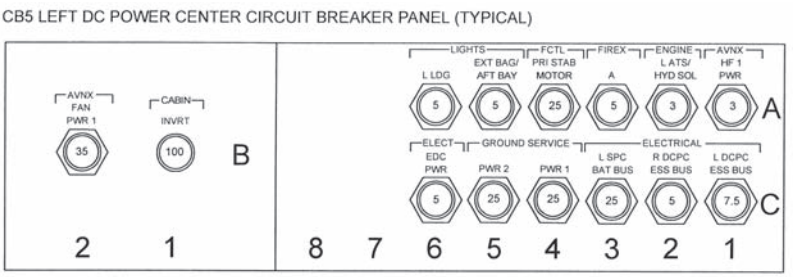

Figure SR-22. CB5 Left DC Power Center Circuit Breaker Panel

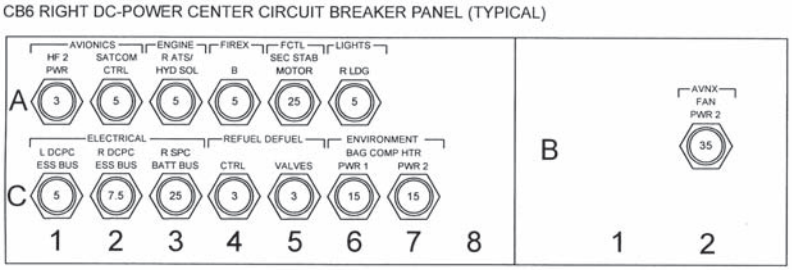

Figure SR-23. CB6 Right DC Power Center Circuit Breaker Panel

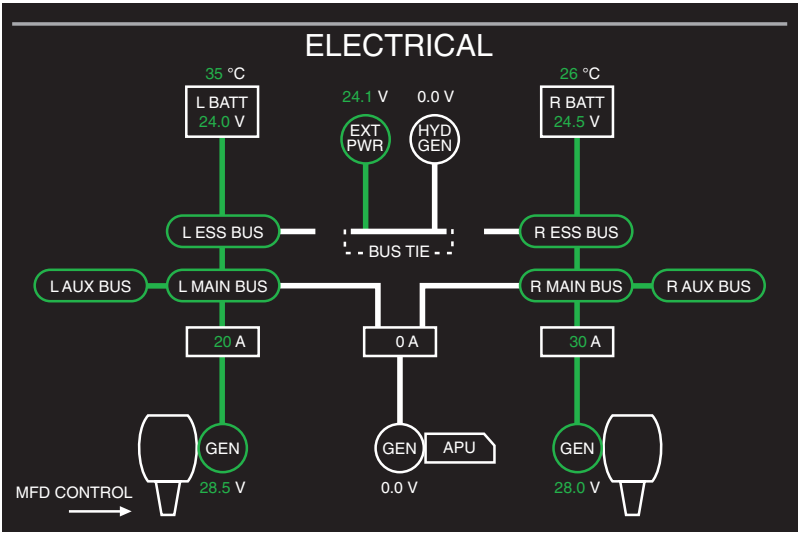

Figure SR-24. ELECTRICAL Synoptic Page

Table SR-4. EICAS MESSAGES—ELECTRICAL

MESSAGE	INHIBITS	MEANING	AURAL WARNING
L (R) BATT OVERHEAT	TO/LAND	Respective battery internal temperature exceeded 70°C.	
ESSENTIAL POWER ONLY		The essential buses are powered by the batteries only. AUX and MAIN buses are automatically deactivated in flight.	
APU GEN FAIL	TO/LAND	The APU generator failed.	
APU GEN OVERLOAD	TO/LAND	The APU generator has exceeded 500 amp.	
L (R) BATT FAIL	TO/LAND	Either the respective battery contactor failed or the battery has been automatically disconnected for overheat protection.	
ELECTRICAL FAULT	TO/LAND	An electrical system failure has occurred that prevents display of electrical indications.	
L (R) GEN FAIL	TO/LAND	The affected generator has failed. If the APU generator is not on line, the BUS-TIE will automatically close and, in-flight, the auxiliary buses will not be powered.	
L (R) ESS BUS FAIL	TO/LAND	Affected bus is not powered.	
(L) (R) GEN OVERLOAD	TO/LAND	Respective generator load exceeded 500 amp.	
L (R) MAIN BUS FAIL	TO/LAND	The affected MAIN bus is not powered.	
L (R) AUX BUS FAIL	TO/LAND	The affected auxiliary BUS is not powered with a power source available.	
L (R) AUX BUS OFF	TO/LAND	Respective AUX BUS is selected off.	
ELECTRICAL FAULT	TO/LAND	An electrical system fault occurred, resulting in loss of redundancy in the display of electrical indications.	
STBY INST BATT FAULT	TO/LAND	At least one of the following has occurred: • Standby instrument heater is inoperative • Standby instrument battery charger is inoperative • Standby instrument battery temperature is greater than 80°C • At least two cells of the standby instrument battery have failed.	
APU GEN OFF		APU GEN switch has been selected OFF.	
L (R) BATT OFF		The affected battery has been selected OFF.	
BUS TIE MAN OPEN		The bus tie has been manually selected open. This prevents automatic operation of the bus tie. Pressing the BUS TIE switch a second time restores automatic control.	
ELEC HYD GEN ON		The optional hydraulic motor-driven generator (HMDG) has been activated.	
L (R) GEN OFF		The affected engine generator switch has been selected OFF.	

FIRE PROTECTION SYSTEM

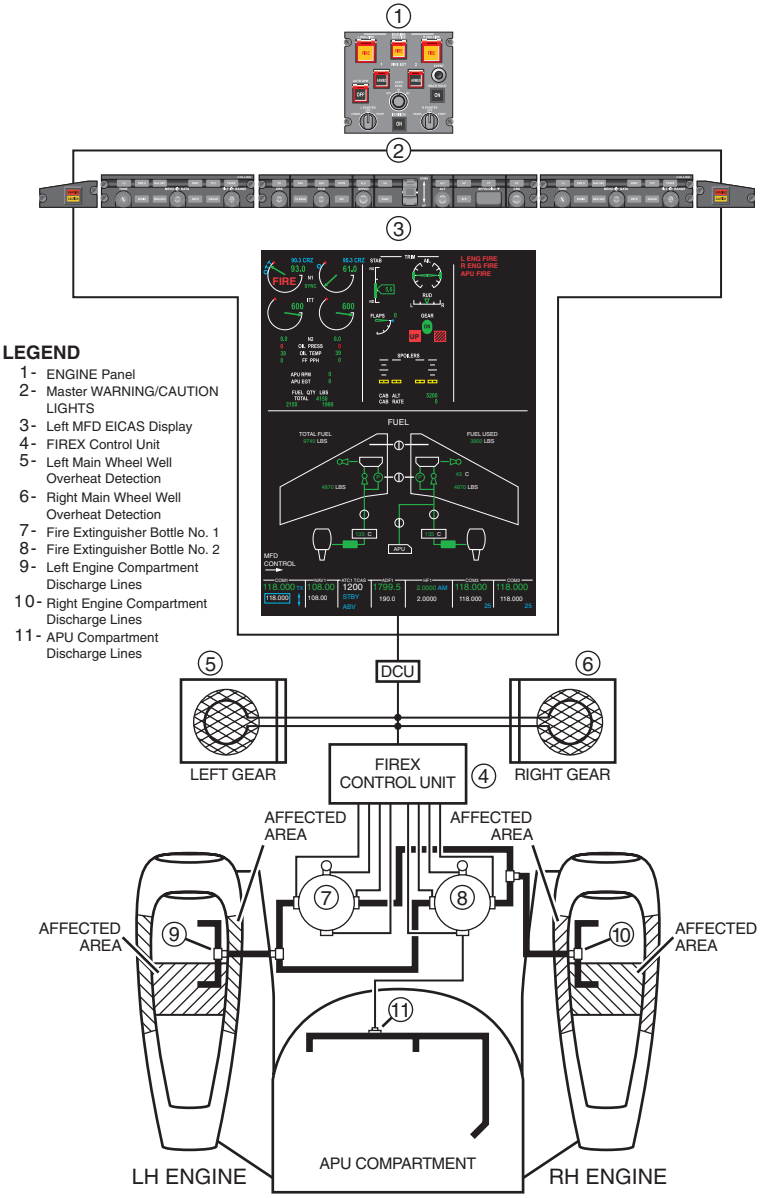

Figure SR-25. Fire Protection System Overview Schematic

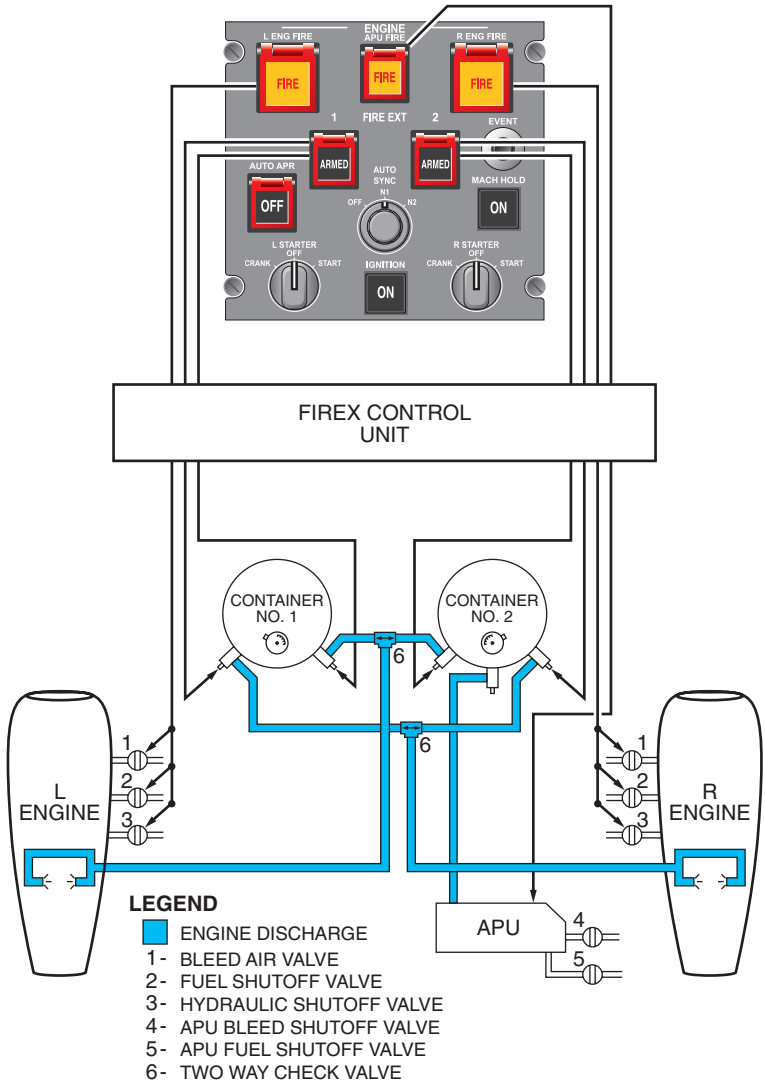

Figure SR-26. FIREX Control Unit Schematic

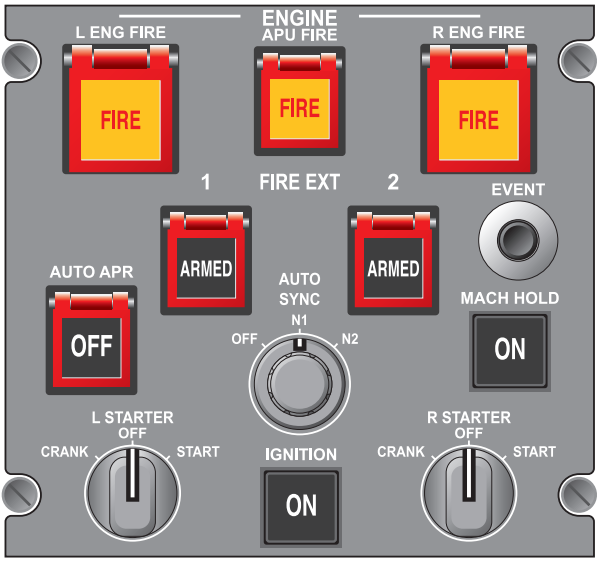

Figure SR-27. Fire Switches

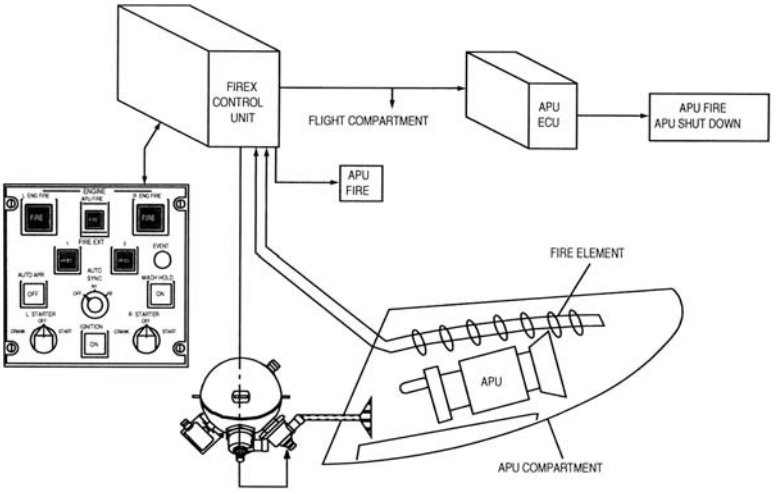

Figure SR-28. APU Fire Protection

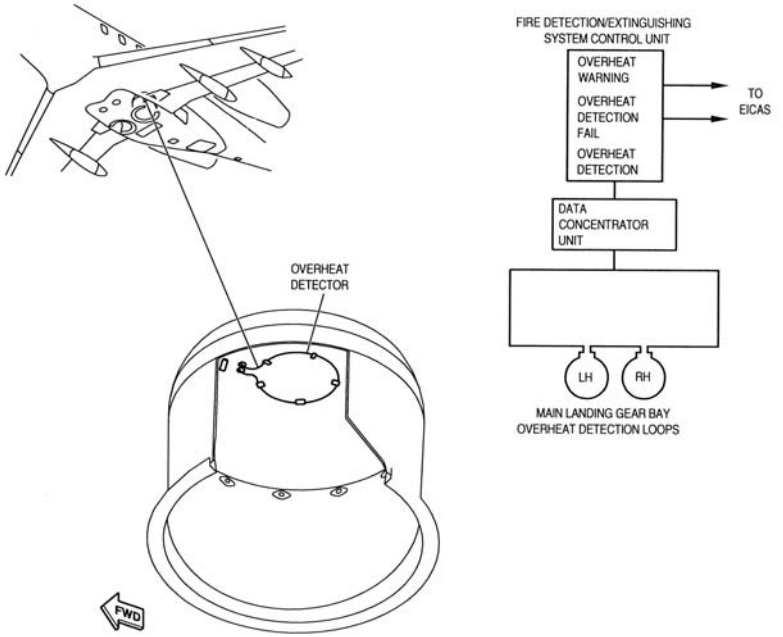

Figure SR-29. Main Landing Gear Overheat Detection

Table SR-5. EICAS MESSAGES—FIRE PROTECTION

MESSAGE	INHIBITS	MEANING	AURAL WARNING
APU FIRE		Fire has been detected in the APU compartment.	
L (R) ENGINE FIRE		The L (R) ENGINE FIRE CAS, FIRE EI in the N1 indicator, FIRE indication in the L (R) ENG FIRE switch, or LEFT (RIGHT) ENGINE FIRE voice message indicates that the engine fire detection loop has activated. An engine fire is usually accompanied by other indications such as: excessive ITT, erratic or rough engine operation, fluctuating engine indications, or smoke in the cabin.	
CARGO SMOKE		Smoke has been detected in the cargo (baggage area.	
GEAR BAY OVHT	TO/LAND	An overheat condition has been detected in the main landing gear bays.	
APU FIRE DET FAIL	TO/LAND	An APU fire detection system has detected a failure that will not allow the detection system to indicate a fire.	
CARGO SMOKE DET FAIL	TO/LAND	The cargo smoke detection system has failed.	
L (R) FIRE DET FAIL	TO/LAND	The engine fire detection system has failed.	
FIRE SYS FAULT	TO/LAND	The fire detection and extinguishing system has detected a fault.	
FIREX APU SQUIB FAIL	TO/LAND	APU fire extinguisher squib on bottle #2 has failed (NO low pressure indication).	
GEAR BAY DET FAIL	TO/LAND	The gear bay overheat detection has failed.	
FIRE SYS FAULT	TO/LAND	The FIREX control unit has detected a fault.	
FIREX BTL 1 (2) FAULT	TO/LAND	The respective bottle squib for the left or right engine has failed.	
FIREX BTL 1 (2) LOW	TO/LAND	The respective bottle pressure is low.	
FIRE SYS IN TEST		The fire detect test system is conducting the manually activated system test.	
FIRE SYS TEST OK		The fire detect test system has passed the system test.	

FLIGHT CONTROLS

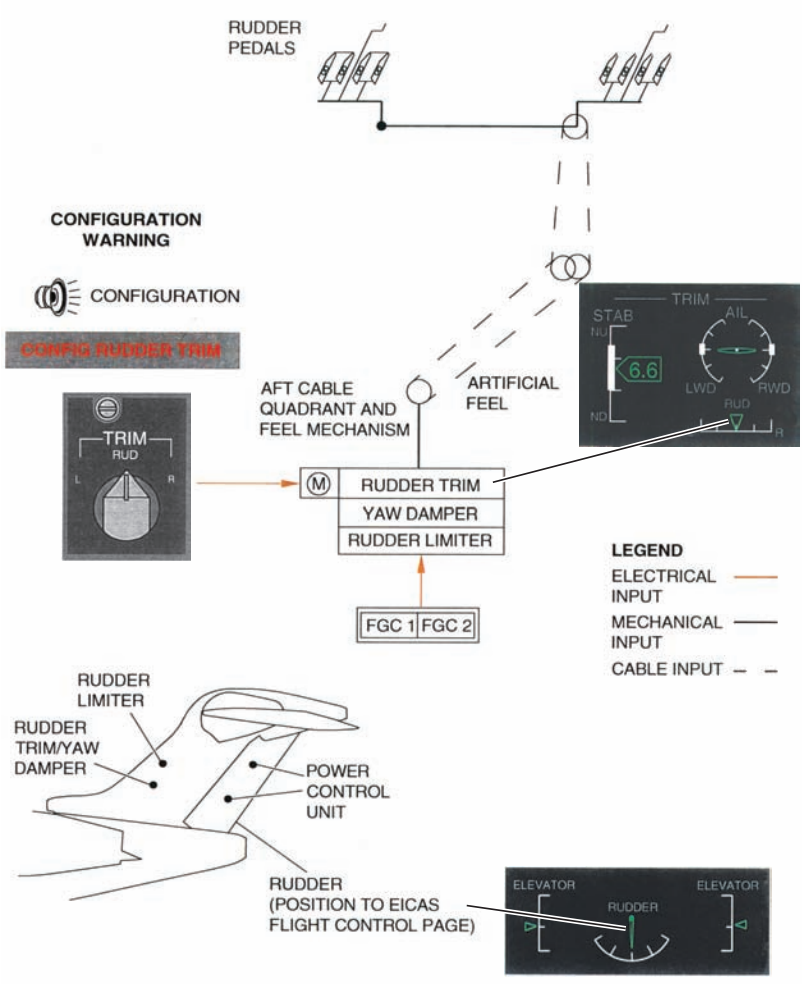

Figure SR-30. Rudder Pedal Assemblies

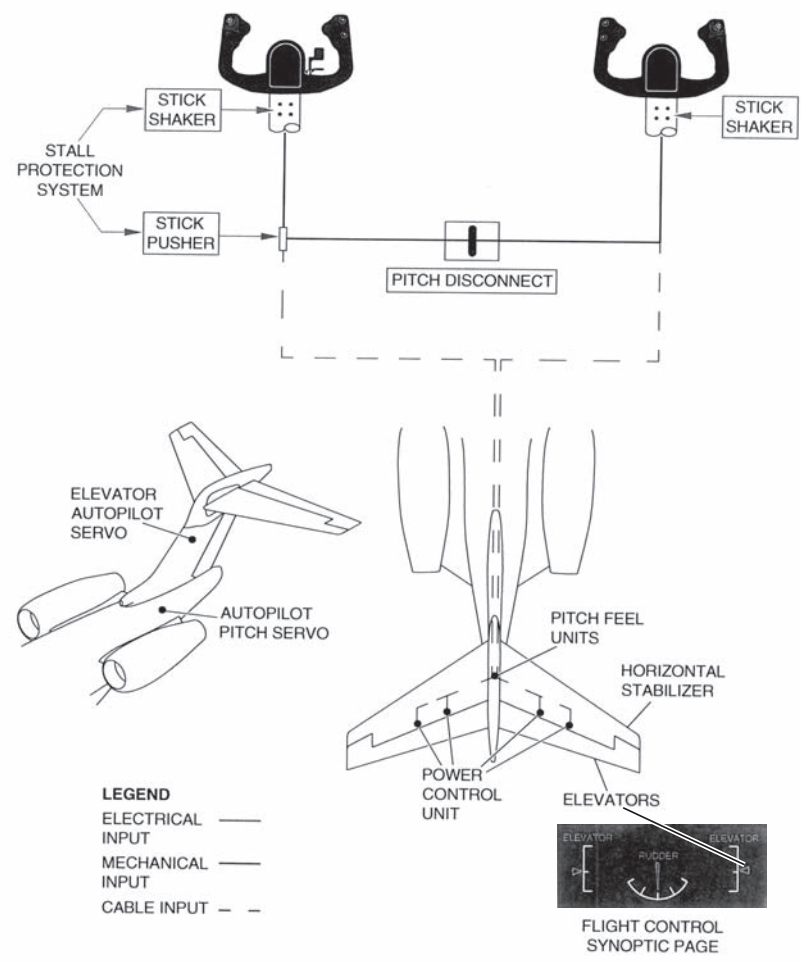

Figure SR-31. Elevator Control Schematic

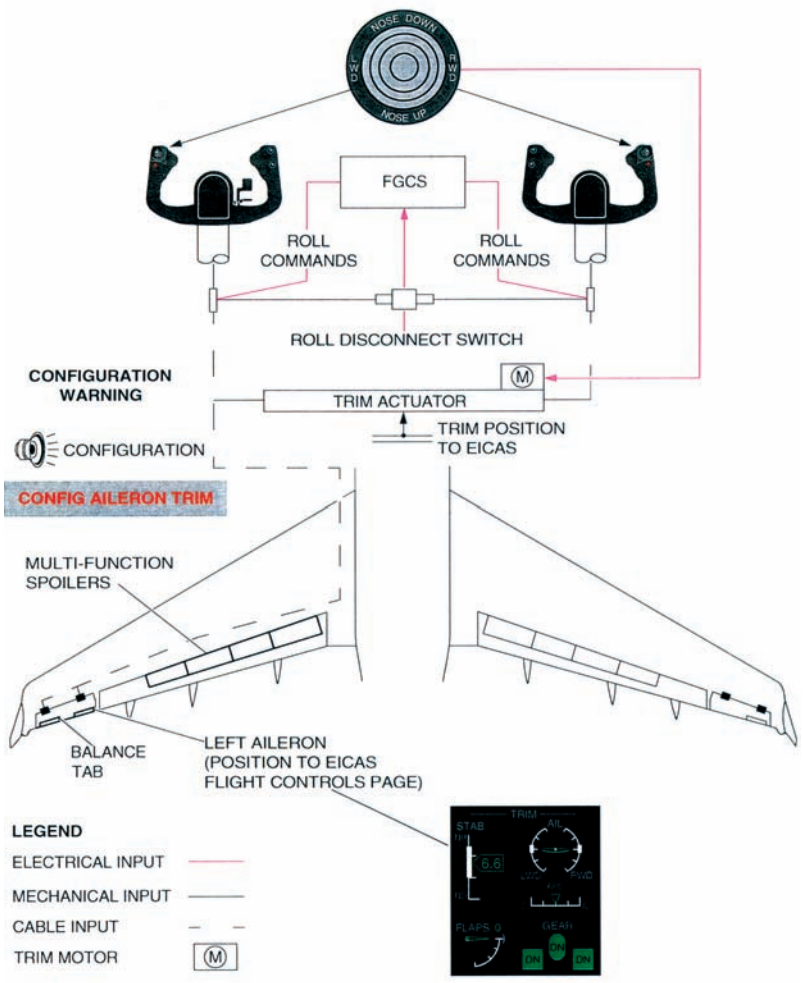

Figure SR-32. Aileron Trim Schematic

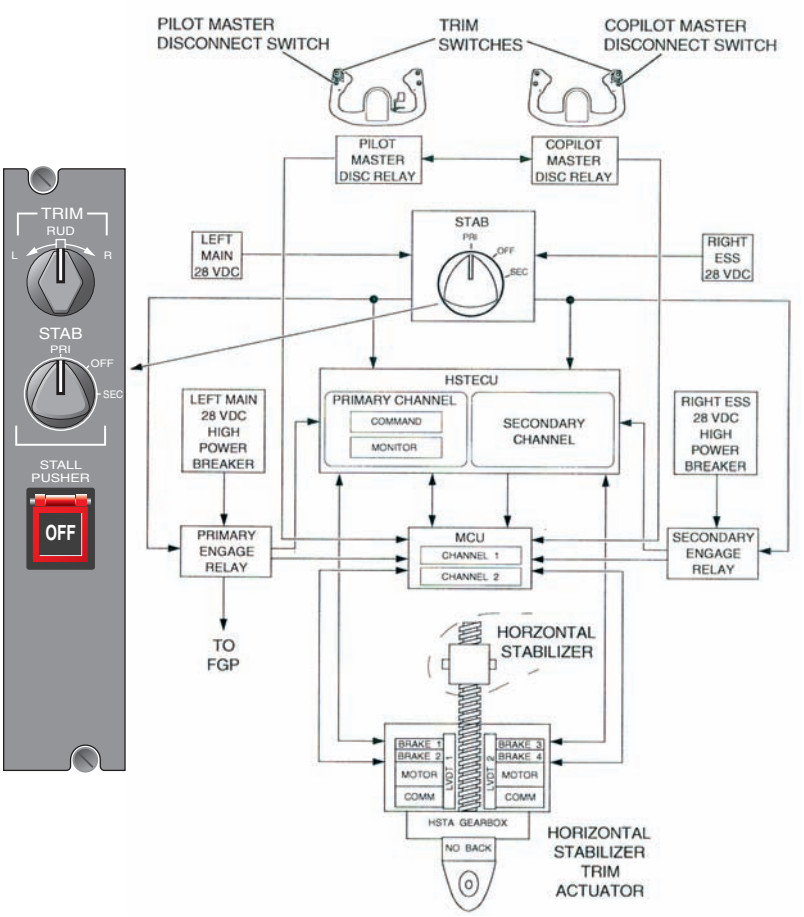

Figure SR-33. Horizontal Stabilizer Trim Schematic

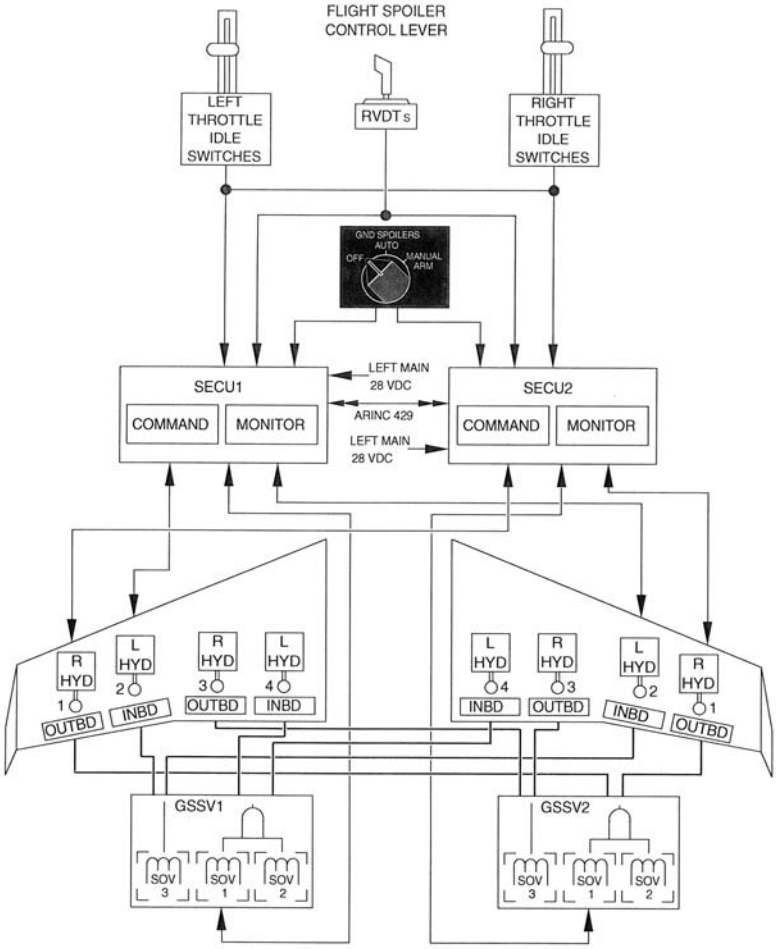

Figure SR-34. Flight Spoiler Schematic

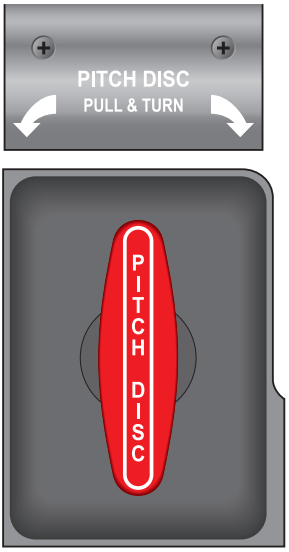

Figure SR-35. PITCH DISC Handle

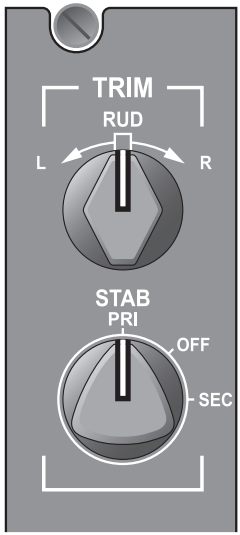

Figure SR-36. RUD TRIM Switch

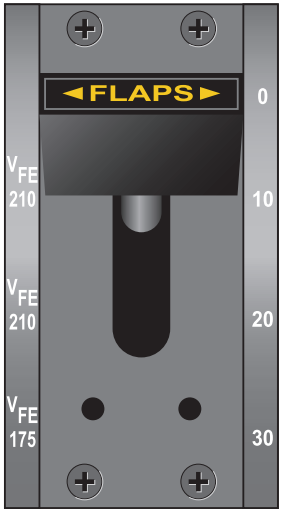

Figure SR-37. FLAPS Control Lever

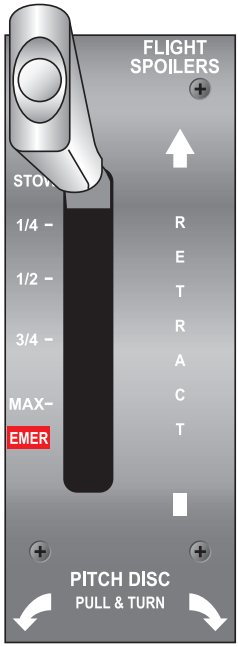

Figure SR-38. FLIGHT SPOILERS Lever

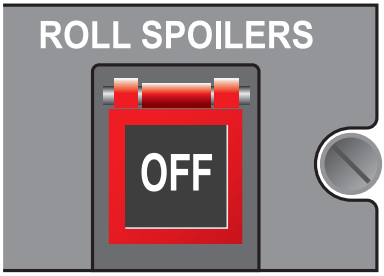

Figure SR-39. ROLL SPOILERS Switch

Figure SR-40. GND SPOILERS Switch

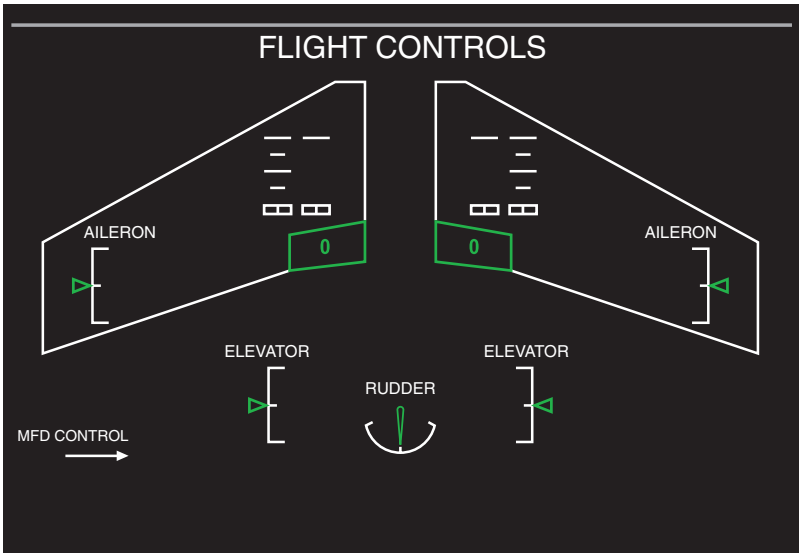

Figure SR-41. FLIGHT CONTROLS Synoptic Page

Table SR-6. EICAS MESSAGES—FLIGHT CONTROLS

MESSAGE	INHIBITS	MEANING	AURAL WARNING
CONFIG AILERON TRIM		Aileron trim is not in the takeoff range (green band)	"Configuration"
CONFIG AUTOPILOT		Autopilot is not configured for takeoff.	"Configuration"
CONFIG FLAPS		Flaps are not in takeoff position.	"Configuration"
CONFIG RUDDER TRIM		Rudder trim is not in the takeoff range (green band).	"Configuration"
CONFIG SPOILERS		Spoilers are not in takeoff position.	"Configuration"
CONFIG STAB TRIM		Elevator trim is not in the takeoff range (green band).	"Configuration"
PARK/EMER BRAKE ON		Emergency brake is engaged with throttles at or above climb.	"Configuration"
PITCH DISCONNECT		Pitch disconnect has occurred on the ground with throttles at or above CLB.	
ROLL DISCONNECT		Roll disconnect has occurred on the ground with throttles at or above CLB.	
ELEVATOR SPLIT		The elevator has a split of greater than 7.5°. The split may be caused by maneuvering with the elevator disconnected.	
FLAPS FAIL	TO	The flap system has shut down due to a failure. The flaps are not resettable.	
FLAPS FAULT	TO	The flaps are operating in a degraded mode. The fault may be resettable in some conditions by movement of the flap selector handle.	
FLAPS NORM PRESS LOW	TO/LAND	The flaps normal hydraulic pressure is low. This will be accompanied by a FLAPS FAULT CAS. Alternate pressure may be available.	
FLT SPOILERS DEPLOY		The flight spoilers are deployed below 500 feet (FAA), (800 ft JAA) or the flight spoilers are deployed and the throttles are at CLB or above.	
FLT SPOILERS FAIL		All flight spoilers have failed.	
FLT SPOILERS FAULT	TO	Either the inboard or outboard spoilers have failed.	
GND SPLRS NOT ARMED		The ground spoilers are not armed and not selected off.	

Table SR-6. EICAS MESSAGES—FLIGHT CONTROLS (Cont)

MESSAGE	INHIBITS	MEANING	AURAL WARNING
GND SPOILERS FAIL		The ground spoilers have failed.	
MACH TRIM FAIL	TO/LAND	The Mach trim has failed.	
PRI STAB TRIM FAIL		The stabilizer trim has failed. Mach trim, flap and spoiler config trim inoperative.	
ROLL SPOILERS FAIL		Roll assist function has failed but flight and ground spoilers have not. Roll control forces will be higher.	
ROLL SPOILERS FAULT		Either the inboard or outboard roll spoilers have failed. Roll control forces will be higher.	
RUDDER LIMITER FAIL		The rudder limiter has failed.	
SEC STAB TRIM FAIL		The secondary stabilizer trim has failed. This message should not be displayed unless the primary stabilizer trim has already failed.	
SPOILERS FAIL		The spoilers have failed. If the spoilers were de-played, they will retract down to a float position. The spoilers will not float up.	
SPOILERS FAULT		One or more of the spoiler panels has failed or one or more of the ground spoilers is up prior to touchdown.	
SPOIL PROTECT FAIL		The stall protection has a failure in either channel A or B, or the pusher or AOA sensor has failed, or a miscompare has been detected between essential inputs or essential inputs are unavailable.	
STALL PUSHER OFF		The control wheel master switch button has been depressed for at least ten seconds, or a stall protection system failure has occurred that has inhibited operation of the stall pusher.	
FLAPS FAULT	TO	There is a fault in the flap system. The flaps should operate normally.	
FLAPS RATE LOW	TO/LAND	The flap extension and retraction rates are slower than normal. This message will illuminate when the right engine is shut down or if the engine-driven pump is shut down.	

Table SR-6. EICAS MESSAGES—FLIGHT CONTROLS (Cont)

MESSAGE	INHIBITS	MEANING	AURAL WARNING
RUDDER LIMITER FAULT	TO/LAND	A minor failure resulting in the loss of redundancy has occurred in the rudder limiter system. The rudder travel limiter will continue to function.	
SPOILERS FAULT	TO/LAND	There is a fault in the spoiler system that does not affect spoiler operation. Selecting the roll disconnect on the ground and moving the control wheel(s) separately will result in a SPOILERS FAULT message. If this occurs, removing all power from the aircraft and repowering will cause the message to clear.	
STAB TRIM FAULT	TO/LAND	A minor failure has occurred causing a loss of redundancy in the horizontal stabilizer trim system. The stabilizer trim will continue to function.	
STALL PROTECT FAULT	TO/LAND	The stall protection computer has automatically reverted to settings for flaps 30.	
L (R) STALL SHAKER FAIL	TO/LAND	The respective stall shaker has failed.	
GND SPOILERS OFF		The ground spoilers are selected OFF.	
PITCH DISCONNECT		The pitch disconnect has been selected. The pilot control column moves the left elevator. The copilot control column moves the right elevator. Autopilot will disengage and not reengage.	
ROLL DISCONNECT		The roll disconnect has been selected. The pilot control wheel moves the aileron. The autopilot will disengage and not reengage.	
ROLL SPOILERS OFF		The roll spoilers have been turned off and the roll disconnect has been activated.	
RUD LIMITER IN TEST		The rudder travel limiter system is conducting the manually activated system test.	
SEC STAB TRIM ON		The secondary channel of the horizontal stabilizer trim system is selected. The autopilot will be inoperative.	
STAB TRIM OFF		The STAB TRIM switch is in the OFF position. The autopilot will be inoperative.	
STALL PUSHER OFF		The stall pusher has been manually deactivated.	

FUEL SYSTEM

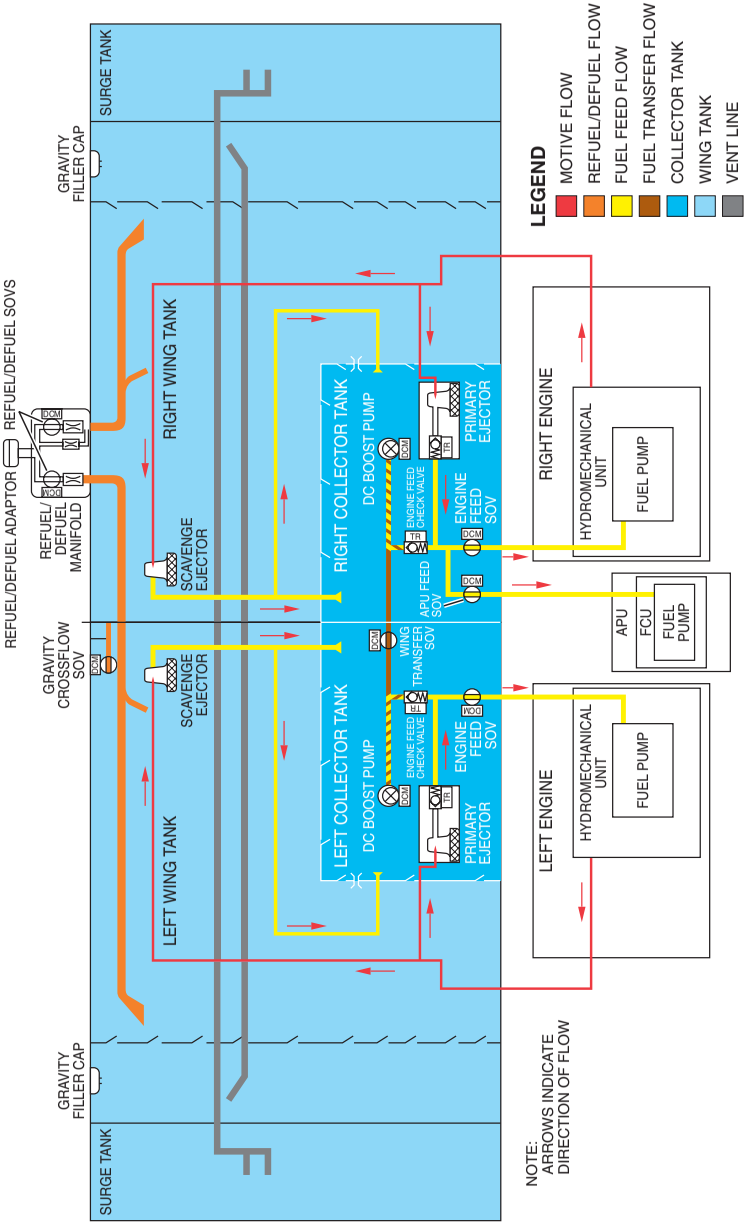

Figure SR-42. Distribution System

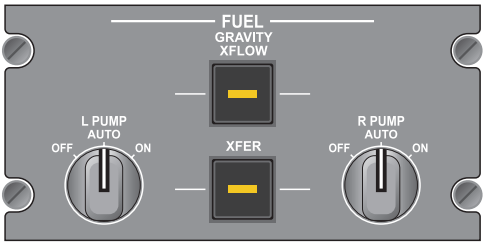

Figure SR-43. FUEL Panel

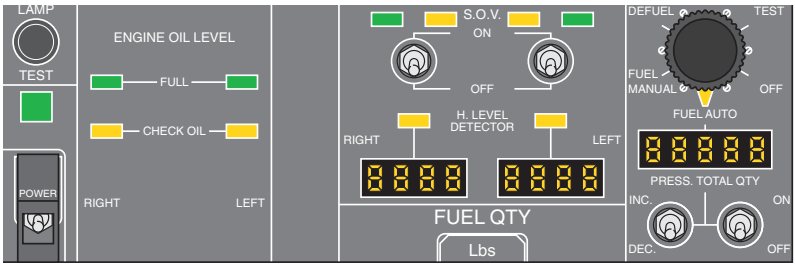

Figure SR-44. Refuel/Defuel Control Panel

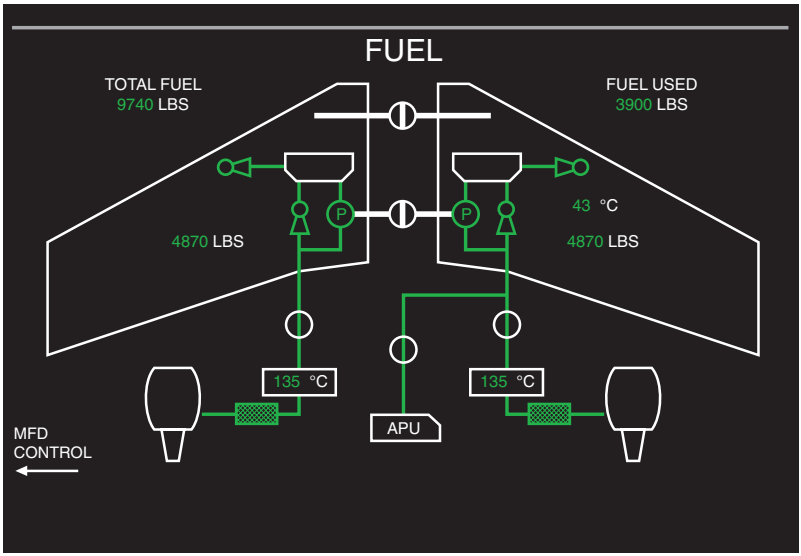

Figure SR-45. FUEL Synoptic Page

Table SR-7 EICAS MESSAGES—FUEL

MESSAGE	INHIBITS	MEANING	AURAL WARNING
L (R) ENG FUEL SOV FAIL		The respective engine fuel shutoff valve has failed to close when commanded.	
L (R) FUEL COLLECTOR LOW	TO	The fuel collector tank quantity is less than 200 pounds.	
FUEL IMBALANCE	TO/LAND	The wing fuel imbalance is greater than: • 250 lb (113) kg) with a total fuel weight of more than 13,700 lb (6,214 kg) • 315 lb (143 kg) with a total fuel weight between 13,700 lb (6,214 kg) • 450 lb (204 kg) with a total fuel weight between 10,000 lb (4,536 kg) • 600 lb (272 kg) with a total fuel weight of less than 4,700 lb (2,132 kg)	
L (R) FUEL PRESSURE LOW		The engine fuel pressure is below 6 psig.	
L (R) FUEL PUMP FAIL	TO/LAND	The respective electric fuel pump has failed/	
FUEL QUANTITY FAIL	TO/LAND	Both channels of the fuel quantity gauging computer have failed. Fuel quantities will be indicated as magenta dashes on the EICAS.	
FUEL QUANTITY LOW		Total fuel quantity is 300 lb (136 kg) or less in either wing when the aircraft is in unaccelerated level flight.	
WING FUEL TEMP LOW	TO/LAND	Fuel temperature in the wing is below –38°C (–36°F).	
L (R) FUEL EJECTOR FAIL	TO/LAND	The affected ejector pump has failed to provide sufficient pressure. The electric fuel pump should automatically turn on to provide sufficient fuel pressure.	
FUEL GRAV XFLOW FAIL	TO/LAND	The wing fuel gravity crossflow valve is not fully opened or closed as commanded.	
L (R) FUEL PUMP ON		The respective electric fuel pump has been automatically turned on.	
FUEL QUANTITY FAULT	TO/LAND	The left or right channel has detected a fault or loss of temperature compensation.	
FUEL XFER FAIL	TO/LAND	The fuel transfer valve has failed.	
L (R) ENG FUEL SOV CLOSED		Respective engine fuel shutoff valve is closed.	
FUEL BALANCED	TO/LAND	The fuel is balanced within 100 lb with the FUEL XFER valve open.	
FUEL GRAV XFLOW OPEN		Wing fuel gravity crossflow valve is open.	
L (R) FUEL PUMP OFF		The respective fuel pump is OFF.	
L (R) FUEL PUMP ON		The respective fuel pump is ON.	
FUEL XFER OPEN		The fuel transfer valve is open.	

HYDRAULIC POWER SYSTEM

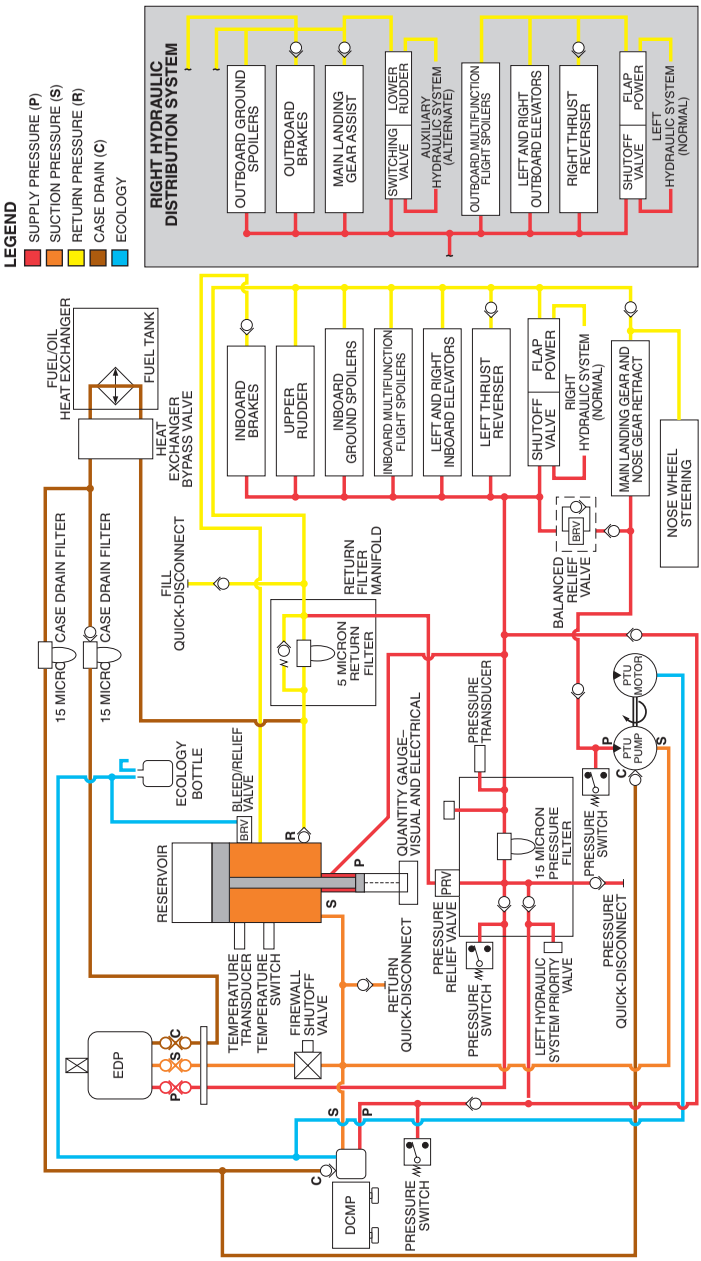

Figure SR-46. Left Hydraulic System

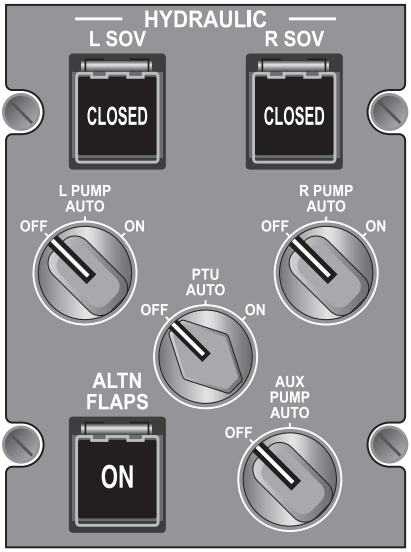

Figure 47. HYDRAULIC Control Panel

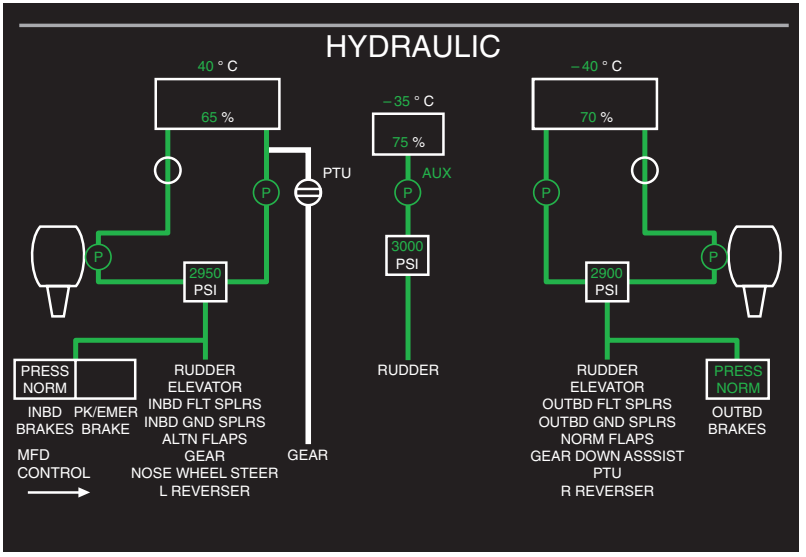

Figure 48. HYDRAULIC Synoptic Page

Table SR-8. EICAS MESSAGES—HYDRAULICS

MESSAGE	INHIBITS	MEANING	AURAL WARNING
HYD PRESS LOW		The left and right hydraulic pressures are less than 1,800 psi.	
AUX HYD TEMP HIGH	TO/LAND	The auxiliary hydraulic fluid system temperature is greater than 135°C.	
L (R) HYD PRESS LOW	TO/LAND	The affected hydraulic system pressure is less than 1,800 psi.	
HYD PTU FAIL	TO/LAND	The power transfer unit is not producing pressure when it should be.	
L (R) HYD SOV FAIL	TO/LAND	The respective hydraulic shutoff valve did not close when one of the following occurred: • The respective ENG FIRE switch was pressed. • The respective HYDRAULIC SOV switch was selected CLOSED. • The automatic overtemp closure was commanded Or the respective hydraulic SOV is CLOSED when it should be OPEN.	
L (R) HYD TEMP HIGH	TO/LAND	The respective hydraulic system temperature is above 100°C.	
AUX HYD SYS FAIL	TO/LAND	The auxiliary hydraulic pump is not producing pressure when it should.	
AUX HYD PUMP FAIL ON	TO/LAND	The auxiliary hydraulic pump is running continuously.	
L (R) HYD DC PUMP FAIL	TO/LAND	The respective hydraulic pump is not producing pressure when it should.	
L (R) HYD ENG PUMP FAIL	TO/LAND	The respective hydraulic pump is not producing pressure when it should.	
HYD PUMP NOT AUTO	TO/LAND	At leases one of HYDRAULIC PUMP (L, R, PTU, or AUX) switch is not in the AUTO position.	
L (R) HYD SOV CLOSED	TO/LAND	The respective hydraulic shutoff valve is closed.	

ICE AND RAIN PROTECTION SYSTEM

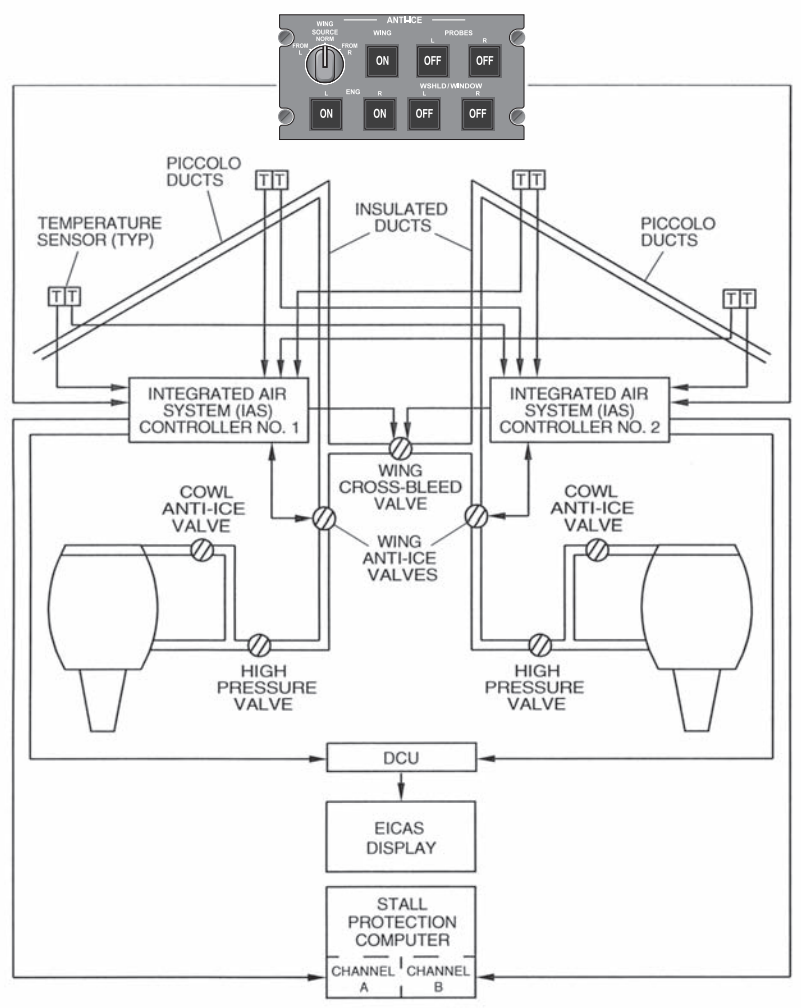

Figure SR-49. Wing Anti-ice Schematic

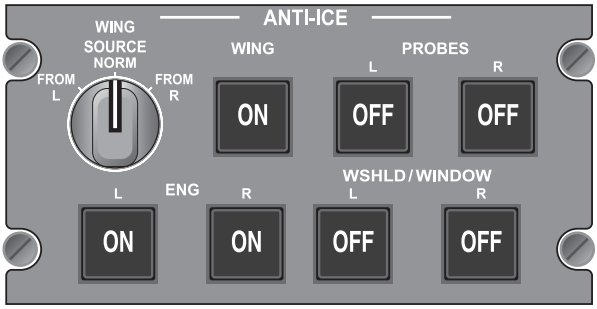

Figure SR-50. ANTI-ICE Control Panel

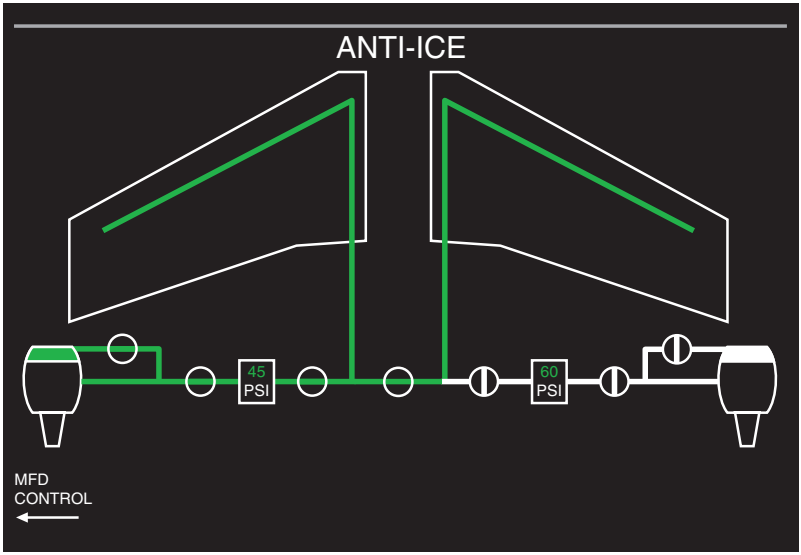

Figure SR-51. ANTI-ICE Synoptic Page

Table SR-9. EICAS MESSAGES—ICE AND RAIN PROTECTION

MESSAGE	INHIBITS	MEANING	AURAL WARNING
WING ANTI-ICE LEAK		A leak has been detected along the wing anti-ice ducting.	
L (R) WING OVERHEAT		A wing anti-ice overheat condition exists in the indicated wing.	
L (R) ENG ANTI-ICE FAIL	TO	Bleed air pressure to the respective nacelle is too low for effective anti-icing, or the electrically heated T2 heater has failed when the respective L or R ENG switch is on.	
ICE DETECTED	TO/LAND	Ice has been detected, and both the engine and wing anti-ice systems are not selected on.	
ICE DETECTOR FAIL	TO/LAND	Both ice detectors have failed.	
L (R) PITOT HEAT FAIL	TO/LAND	The respective pitot mast or base heater has failed.	
L (R) PITOT HEAT OFF	TO/LAND	Probe heat is off.	
STBY PITOT HEAT FAIL	TO/LAND	The standby pitot heater has failed.	
STBY STAT HEAT FAIL	TO/LAND	The respective standby static heater has failed.	
L (R) WING ANTI-ICE FAIL	TO/LAND	The respective anti-ice system has failed.	
WINDOW HEAT FAIL	TO/LAND	The respective window heat has failed, and the temperature is too low or too high. A failure may also be indicated by the formation of condensation (fog) on the window.	
WING ANTI-ICE FAULT	TO/LAND	Both outboard wing leading-edge sensors have failed.	
WING A/ICE LOOP FAIL	TO/LAND	Both detection loops failed. This is only checked during power up self-test.	
L (R) WING A/I PRESS HI	TO/LAND	High pressure has been sensed in the wing anti-ice system.	
L (R) WSHLD HEAT FAIL	TO/LAND	The respective window heat has failed, and the temperature is too low or too high. A failure may also be indicated by the formation of ice or condensation (fog) on the windshield.	

Table SR-9. EICAS MESSAGES—ICE AND RAIN PROTECTION (Cont)

MESSAGE	INHIBITS	MEANING	AURAL WARNING
L (R) AOA CASE HEAT FAIL	TO/LAND	The respective angle-of-attack case heater as failed.	
L (R) ENG A/ICE FAIL ON	TO/LAND	The respective engine nacelle anti-ice has failed ON. If the T2 probe heater has failed on, an amber T2 icon will be displayed on the anti-ice synoptic. If engine anti-ice bleed air has failed on, a green flow line will be displayed downstream of the failed anti-ice valve on the synoptic.	
ICE DETECTED	TO/LAND	Ice has been detected, and the engine and wing anti-ice systems are selected on.	
ICE DETECTOR FAULT	TO/LAND	One ice detector has failed; the other should continue to operate normally.	
L (R) PROBE HT CTRL FAIL	TO/LAND	The respective probe heat controller has failed. The probe heat will fail ON.	
TAT HEAT FAIL	TO/LAND	The total air temperature probe heater has failed.	
WING SOURCE XBLEED		Wing xbleed valve open.	
WING ANTI-ICE FAULT	TO/LAND	One channel has failed on the outboard wing leading-edge sensor. The wing anti-ice should work normally.	
L (R) ENGINE ANTI-ICE ON		The respective (or both) ENG ANTI-ICE switch (es) is/are ON.	
ENGINE ANTI-ICE ON		The respective (or both) ENG ANTI-ICE switch (es) is/are ON.	
PROBE HEAT TEST OK		The pilot-initiated probe heat test has passed.	
WING ANTI-ICE ON		The WING ANTI-ICE switch is selected ON.	
WING/ENG ANTI-ICE ON		The wing and both engine anti-ice systems are ON.	
WING SOURCE XBLEED		Either FROM L or FROM R has been selected on the ANTI-ICE WING SOURCE switch.	

LANDING GEAR SYSTEM

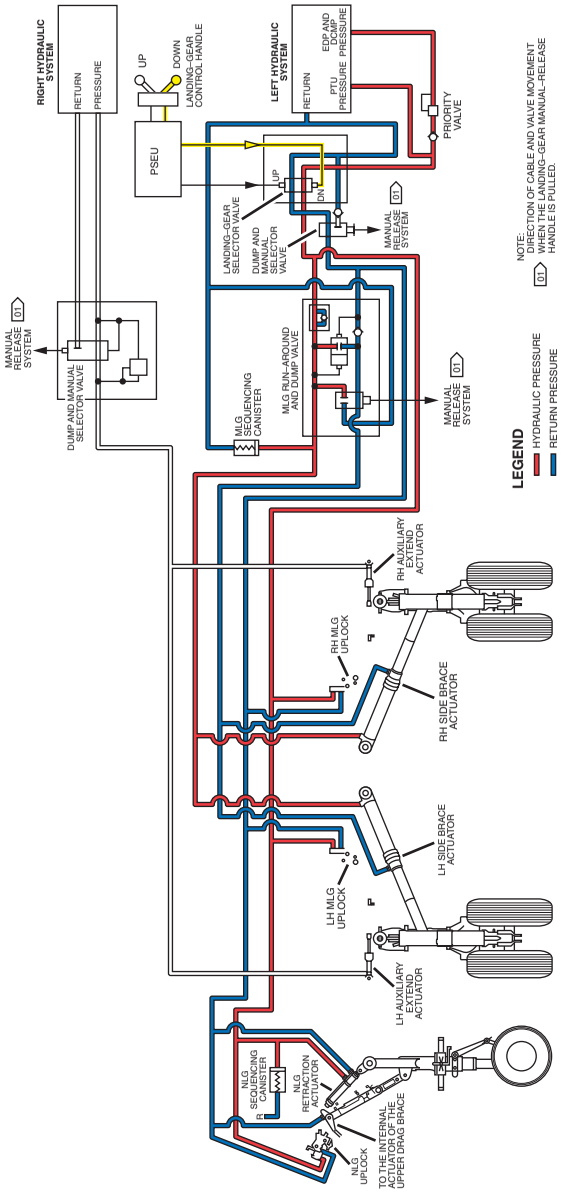

Figure SR-52. Landing Gear Down

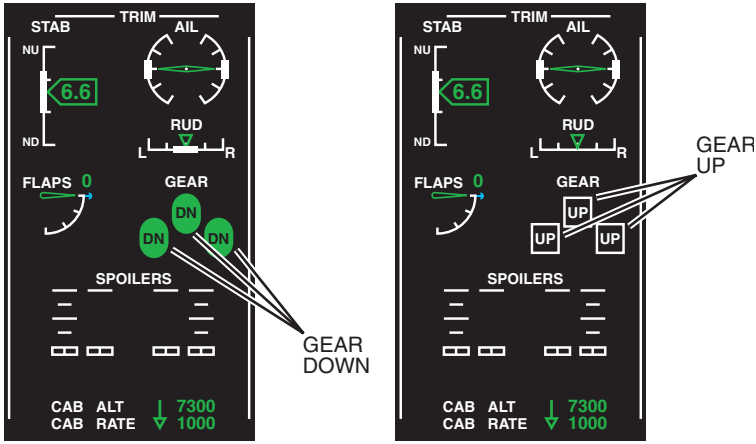

Figure SR-53. EICAS Landing Gear Indications

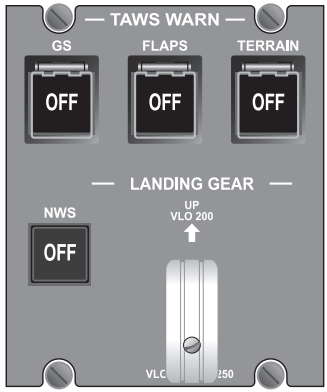

Figure SR-54. LANDING GEAR Control Panel

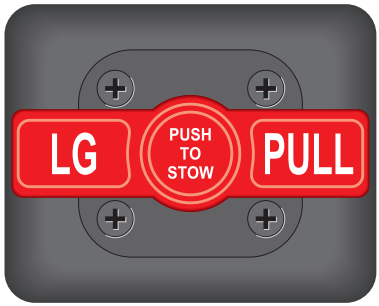

Figure SR-55. Manual Release Handle

Table SR-10 EICAS MESSAGES—LANDING GEAR

MESSAGE	INHIBITS	MEANING	AURAL WARNING
GEAR		Gear Warning—The GEAR CAS will be accompanied by gear icon on the EICAS for each gear that is not down and locked.	"Gear"
GEAR BAY OVHT	TO/LAND	An overheat condition has been detected in the main landing gear bays.	
NORM BRAKES FAIL	TO	The NORM BRAKES FAIL CAS indicates that all normal brakes have failed.	"Normal brakes fail"
BRAKE FAULT	TO	One or both pairs (inboard and/or outboard) of the brake pressure transducers has failed.	
CPLT BRAKE FAULT	TO	One or more of the copilot brake pedal sensors (LVDTs) has failed.	
GEAR DISAGREE	TO	This indicates that the landing gear position and the LANDING GEAR switch position do not match after the 28-second delay.	
GEAR SYS FAIL	TO	This indicates a complete failure of the gear control or the loss of the ARINC 429 signal from both channels. There is a potential for the loss of gear, door, and/or spoiler indications.	
L (R) INBD BRAKE FAIL	TO	The respective (left or right but not both) inboard normal system brake has failed.	
INBD BRAKE PRESS LO	TO	The INBD brake accumulator pressure is less than 1,400 psi.	
INBD BRAKES FAIL	TO	Both inboard normal system brakes failed.	
NOSE GEAR DOOR	TO/LAND	The nose gear doors are not closed, and the nose gear is up.	
NWS FAIL		The nose wheel steering system has failed. In the event the nose wheel steering system malfunctions internal monitors should disconnect the system allowing the nose wheels to castor.	
NWS LIMIT EXCEEDED		The nose wheel steering turning limit has been exceeded. There may be damage to the NLG feedback link.	
L (R) OUTBD BRAKE FAIL	TO	The respective (left or right but not both) outboard normal brake system has failed.	

Table SR-10 EICAS MESSAGES—LANDING GEAR (Cont)

MESSAGE	INHIBITS	MEANING	AURAL WARNING
OUTBD BRAKE PRESS LO	TO	The OUTBD brake accumulator pressure is less than 1,400 psi.	
OUTBD BRAKES FAIL	TO	Left and right outboard normal brake systems have failed.	
PARK/EMER BRAKE ON	TO	Park brake pressure is sensed with weight-off-wheels. Do not cycle handle more than one time.	
PK/EMER BRK PRESS LO	TO	The INBD brake accumulator pressure is too low for full PARK/EMER brake performance (below 1,200 psi). Normal brakes should function properly.	
PLT BRAKE FAULT	TO	One or more of the pilot brake pedal sensors (LVDTs) has failed.	
WOW FAIL	TO	One or both of the following conditions exist: • Failures have been detected in two or more weight-on-wheels (WOW) sensors • Any disagreement or hardware failure of one or more WOW outputs associated with a critical function.	
BRAKE FAULT	TO/LAND	A minor brake system fault has occurred that does not affect brake performance. A subsequent brake failure could cause uncommanded braking.	
NWS FAULT	TO/LAND	The nose wheel steering selector valve is open. The system will operate normally.	
PROX SYS FAULT	TO/LAND	This indicates a failure in the proximity sensor channel or the loss of the signal from one of the channels.	
NWS OFF		The nose wheel steering has been selected OFF.	
PARK/EMER BRAKE ON		Park brake pressure is sensed while on the ground.	

LIGHTING SYSTEM

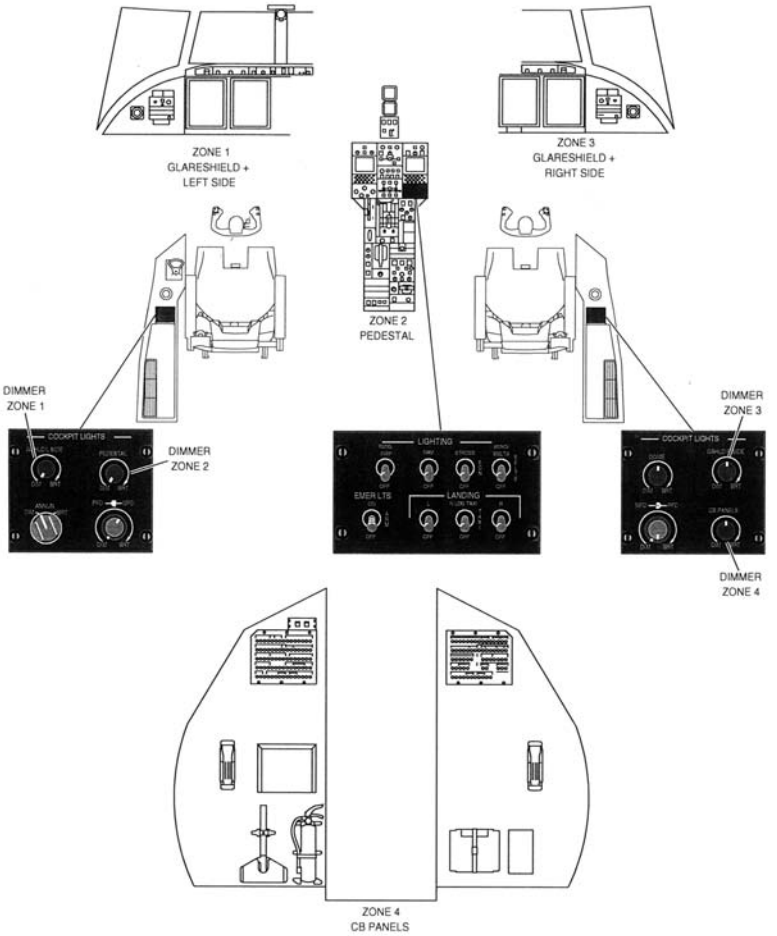

Figure SR-56. Flight Compartment Lighting Zones

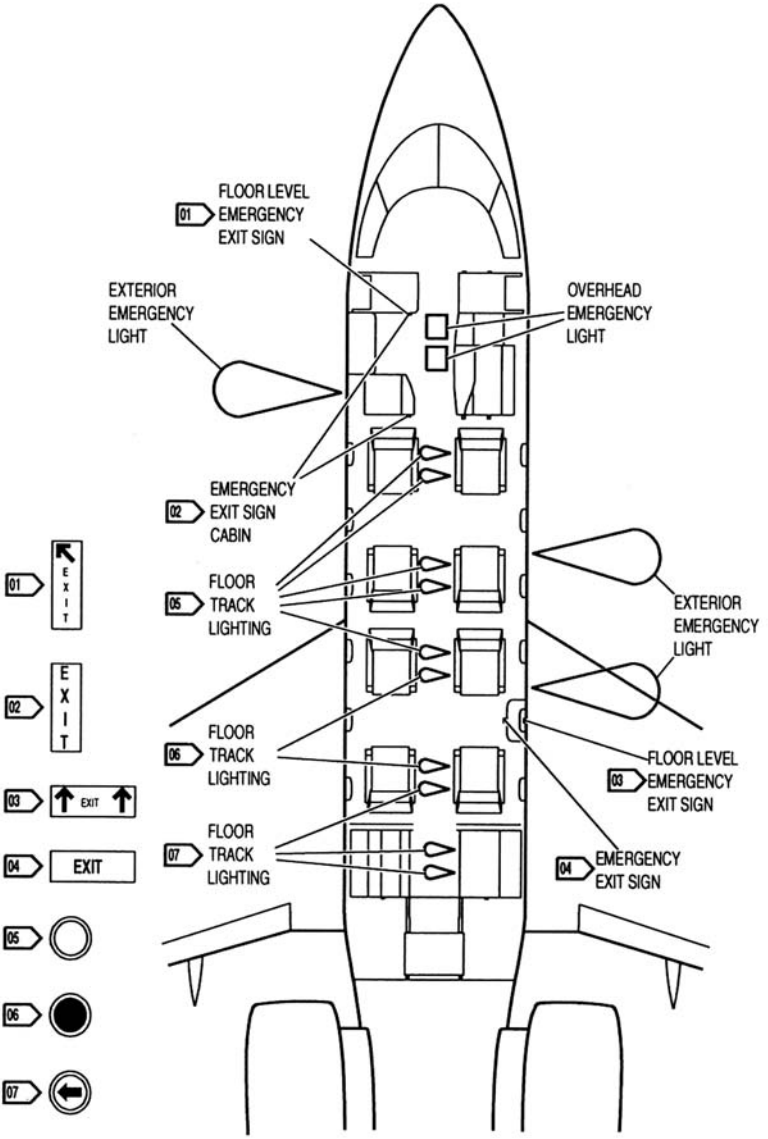

Figure SR-57. Emergency Lighting—Location and Components

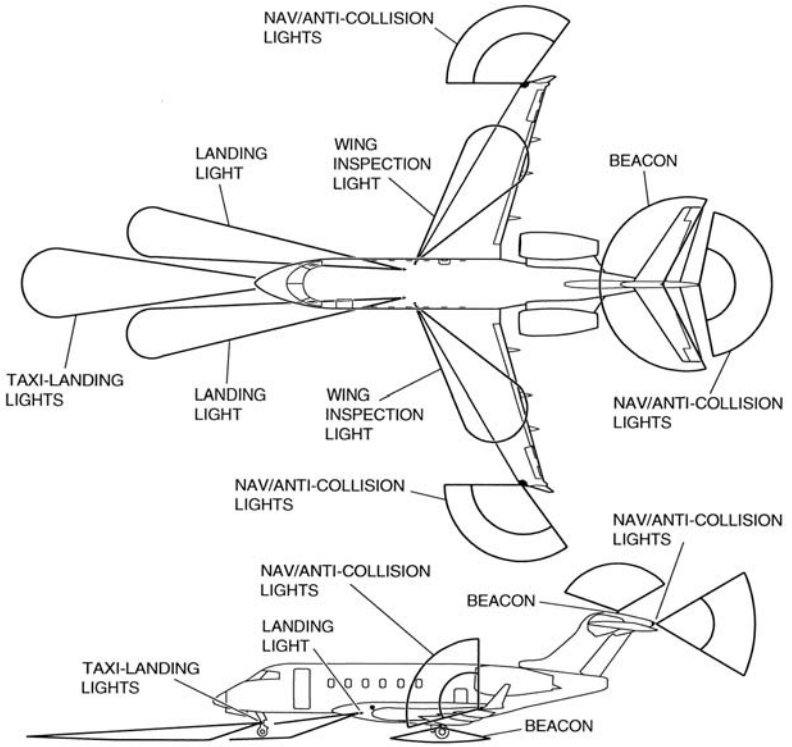

Figure SR-58. Aircraft External Lighting

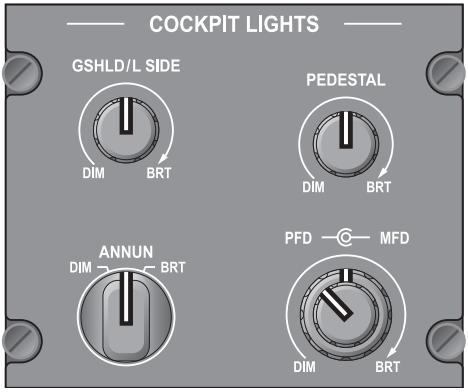

Figure SR-59. Left COCKPIT LIGHTS Panel

Figure SR-60. Right COCKPIT LIGHTS Panel

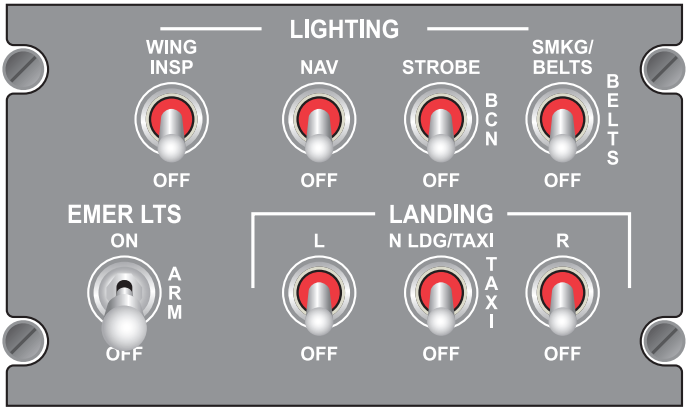

Figure SR-61. LIGHTING Control Panel

Table SR-11. EICAS MESSAGES—LIGHTING

MESSAGE	INHIBITS	MEANING	AURAL WARNING
EMER LIGHTS OFF		The cabin emergency lights are off when they should be armed.	
EMER LIGHTS ON		The cabin emergency lights are on.	

MISCELLANEOUS SYSTEMS

OXYGEN SYSTEM

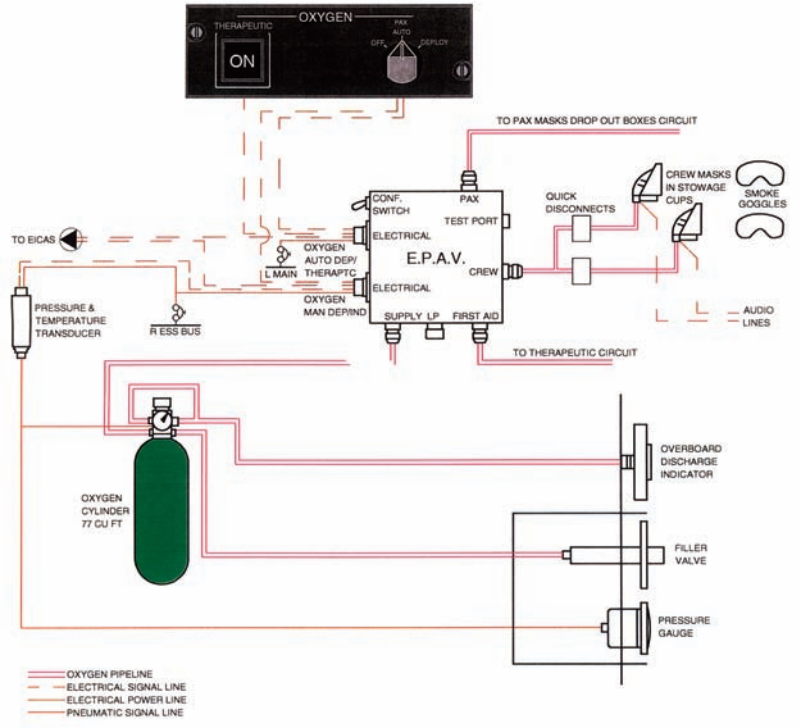

Figure SR-62. Oxygen System—Standard Configuration

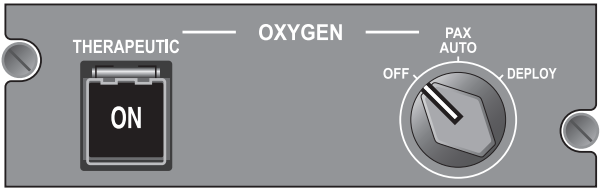

Figure SR-63. OXYGEN Panel

Table SR-12. EICAS MESSAGES—OXYGEN

MESSAGE	INHIBITS	MEANING	AURAL WARNING
NAVIGATION			
OXYGEN QUANTITY LOW	TO/LAND	Oxygen is less than 700 liters.	
OXYGEN VALVE CLOSED	TO/LAND	The oxygen bottle valve is closed, or there is a miscompare in the number of bottles installed and the number of bottles selected on the electro-pneumatic actuating valve unit. This message only occurs on the ground.	
PAX OXYGEN AUTO FAIL	TO/LAND	Passenger oxygen system has failed to deploy with the cabin altitude greater than 15,000 ft and the pax oxygen system in AUTO. Either the pax masks have not deployed, or the pax oxygen system is not pressurized.	
PAX OXYGEN OFF		The passenger oxygen switch has been selected OFF.	
PAX OXYGEN ON		Pressure has been detected in the passenger oxygen lines.	

PNEUMATIC SYSTEM

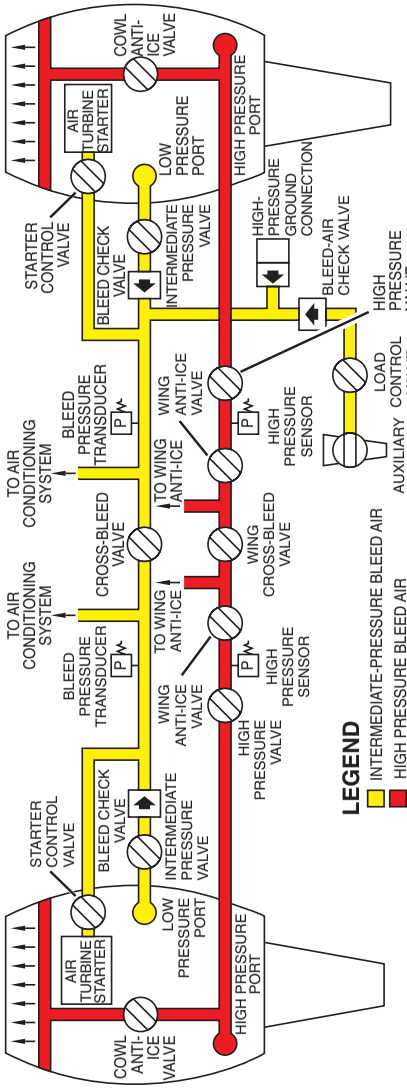

Figure SR-64. Pneumatic Distribution System

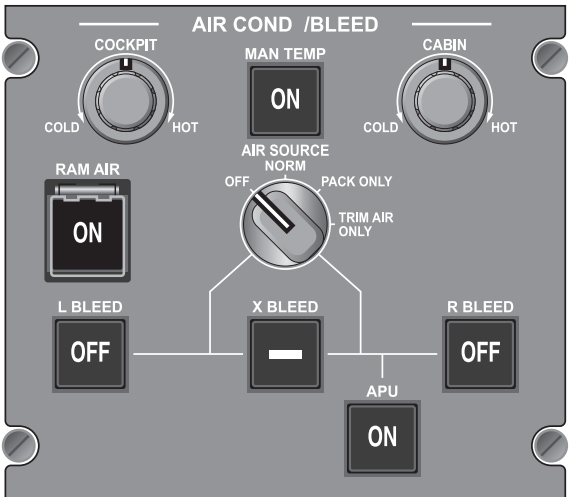

Figure SR-65. AIR COND/BLEED Control Panel

Table SR-13 EICAS MESSAGES—PNEUMATICS

MESSAGE	INHIBITS	MEANING	AURAL WARNING
L (R) BLEED LEAK	TO/LAND	A leak has been detected in the bleed-air ducting downstream of the bleed valve.	
L (R) PYLON BLEED LEAK	TO/LAND	A leak has been detected in the engine pylon or tail cone (before shutoff valve).	
L (R) BLEED FAIL	TO/LAND	The affected engine bleed-air valve has failed or a temperature or pressure has exceeded limits or the sensor has failed. Under certain low thrust conditions (ground idle at high field elevations or idle with single bleed on), there may be insufficient pressure to keep the bleed valve open.	
L (R) BLEED LOOP FAIL	TO/LAND	A failure (open or short circuit) has been detected in the bleed leak detection system.	
L (R) PYLON LOOP FAIL	TO/LAND	Both bleed-air leak detection loops in the respective pylon have failed during the power-up self-test.	
XBLEED FAIL	TO/LAND	The crossbleed valve has failed to move to the commanded position.	
BLEED LOOP FAULT	TO/LAND	A fault has been detected in the bleed leak detection loop system, and redundancy in lost.	
L (R) BLEED FAULT	TO/LAND	The bleed pressure data is invalid, or the affected flow control valve is failed closed.	
BLEED OFF	TO/LAND	The L, R, and APU BLEEDS are OFF.	
XBLEED OPEN	TO/LAND	The cross-bleed valve is open.	

POWERPLANT SYSTEM

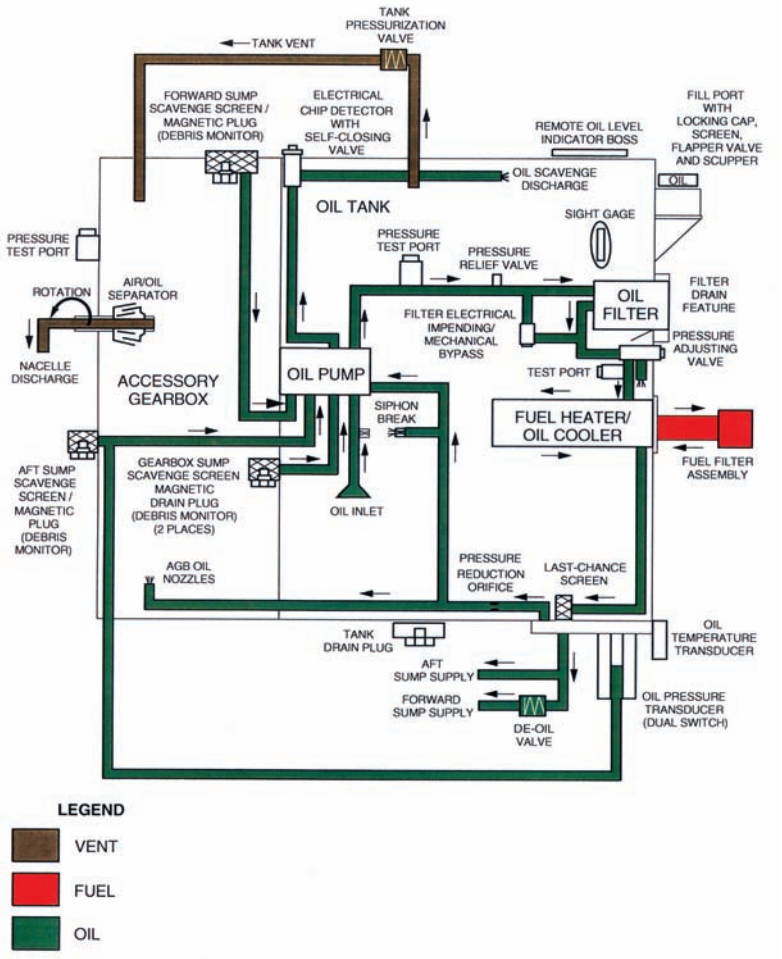

Figure SR-66. Engine Lubrication Schematic

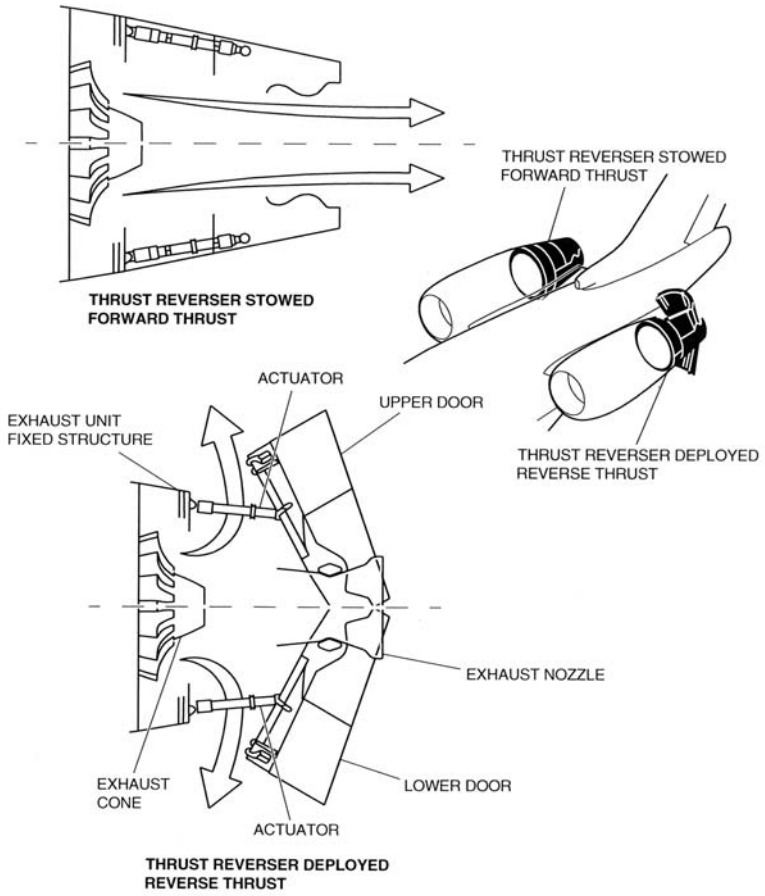

Figure SR-67. Thrust Reverser System

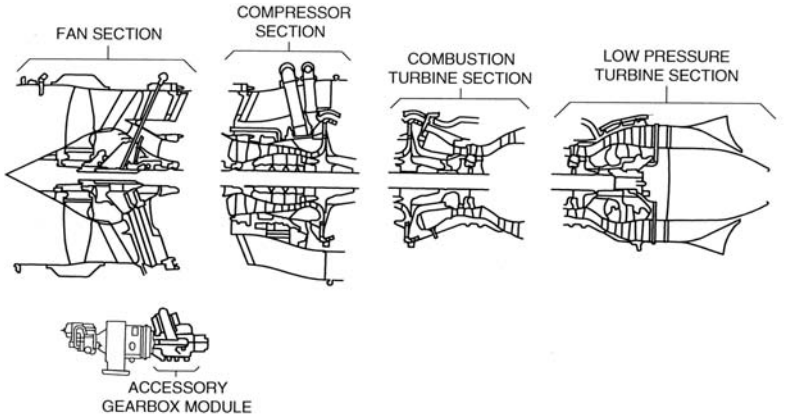

Figure SR-68. Engine Modules

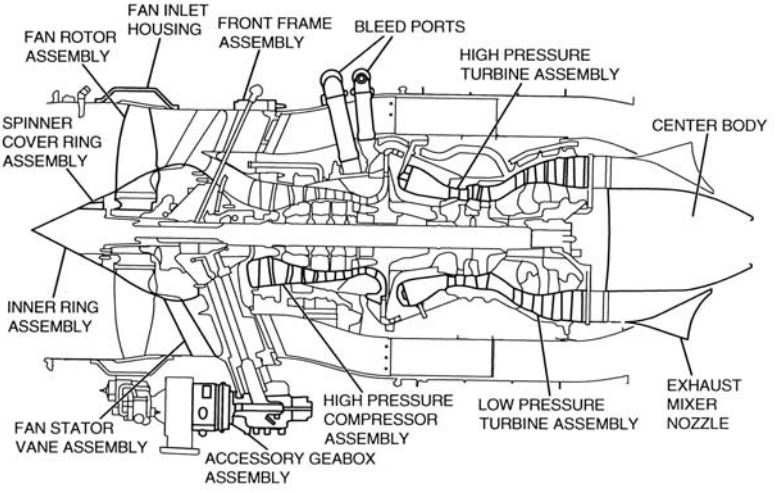

Figure SR-69. Engine Sections

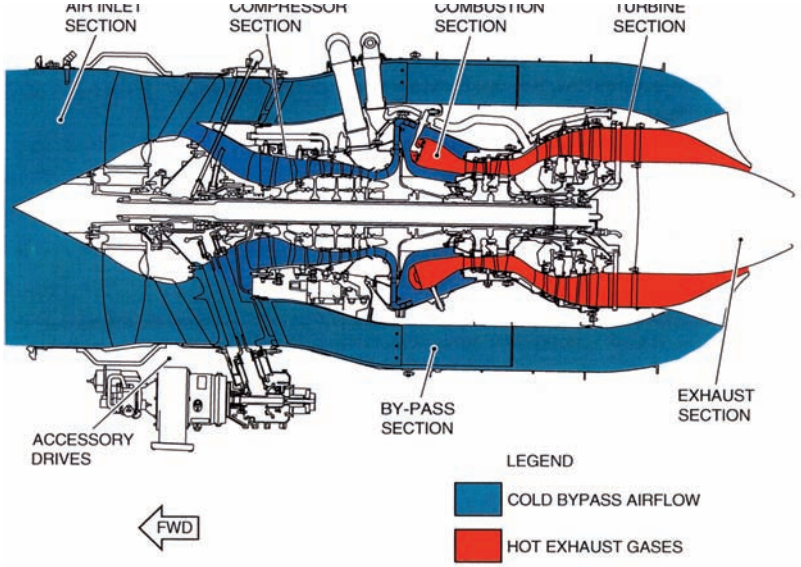

Figure SR-70. Airflow Paths

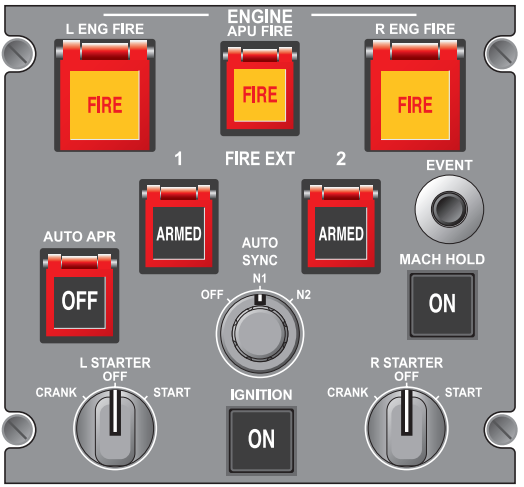

Figure SR-71. ENGINE Panel

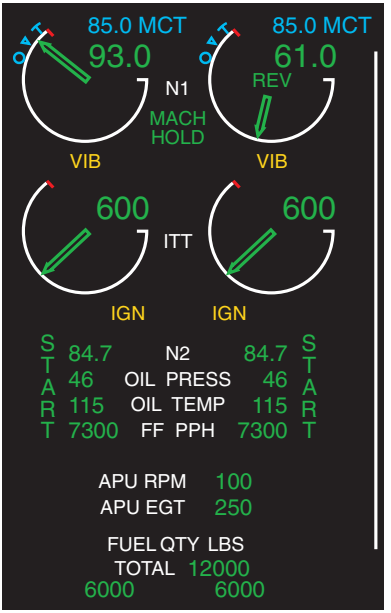

Figure SR-72. Engine Indications

Table SR-14. EICAS MESSAGES—POWERPLANT

MESSAGE	INHIBITS	MEANING	AURAL WARNING
L (R) ENGINE EXCEEDANCE		The respective engine has exceeded a speed or temperature limit.	
L (R) ENG OIL PRESSURE LOW	TO/LAND	The respective engine oil pressure is low.	
L (R) REVERSER UNSAFE		Illumination of either the L or R REVERSER UNSAFE CAS or a REV EI indicates an unsafe thrust reverser condition. The affected engine should automatically decelerate to idle. The autostow function will attempt to stow the reverser doors.	
L (R) ENGINE FLAMEOUT		The respective engine has had a flameout.	
ENGINES FUEL BYPASS	TO/LAND	Both engine fuel filters are impending bypass.	
L (R) ENG ANTI-ICE FAIL	TO/LAND	The respective engine anti-ice has failed.	
L (R) ENG FUEL SOV FAIL	TO/LAND	The respective engine fuel shutoff valve has failed to close when commanded.	
L (R) ENG OIL TEMP HIGH	TO/LAND	The respective engine oil temperature is high.	
L (R) OIL PRESS HIGH	TO/LAND	The respective engine oil pressure is high.	
L (R) ENGINE VIBRATION	TO/LAND	A higher than normal level of vibration has been sensed in the respective engine.	
L (R) FADEC FAIL	TO	Major control system failure affecting both channels of the respective FADEC. The engine may shut down or go to idle, or engine operation may be degraded. Failure of the control system may cause control effect, performance degradation, or a loss of a protective system.	
L (R) REVERSER FAIL	TO	The respective thrust reverser has failed.	
L (R) START ABORTED	TO/LAND	The ground engine start on the respective engine has been aborted.	
L (R) STARTER FAIL	TO/LAND	The respective engine starter has failed.	
L (R) STARTER FAIL ON	TO/LAND	The respective engine starter has failed ON.	

Table SR-14. EICAS MESSAGES—POWERPLANT (Cont)

MESSAGE	INHIBITS	MEANING	AURAL WARNING
DOWNLOAD FADEC	TO/LAND	The FADEC maintenance data should be down loaded.	
ENG SYNC/M-HOLD FAIL	TO/LAND	Engine SYNC and Mach hold are not available.	
L (R) ENG A/ICE FAIL ON	TO/LAND	The respective nacelle anti-ice has failed ON.	
L (R) ENG FUEL TEMP LOW	TO/LAND	The fuel temperature in the respective engine filter is low.	
L (R) ENG IGN FAULT	TO/LAND	A fault has been detected in the respective engine ignition.	
L (R) ENG THRUST FAULT	TO/LAND	A fault has been detected in the respective engine thrust.	
L (R) ENGINE FAULT	TO/LAND	A fault has been detected in the respective engine.	
L (R) ENGINE FUEL BYPASS	TO/LAND	The respective engine fuel filter is impending bypass.	
L (R) ENGINE MINOR FAULT	TO/LAND	The engine has detected a minor engine fault.	
L (R) ENGINE OIL BYPASS	TO/LAND	The respective engine oil filter is impending bypass.	
L (R) ENG VIBRATION FAIL	TO/LAND	Loss of vibration signal from affected engine	
L (R) ENGINE ANTI-ICE FAULT	TO/LAND	Anti-ice bleed overpressure detection may result in higher ITT than normal.	
L (R) ENGINE OIL CHIP	TO/LAND	Metal debris detected in engine lube system.	
AUTO APR OFF		Auto APR has been selected off.	
L (R) ENGINE SHUTDOWN		The respective engine has shut down with the RUN switch OFF or the respective FIRE switch pushed.	
L (R) REVERSER INOP		The respective thrust reverser is inoperative and is mechanically pinned, hydraulically and electrically isolated.	

PRESSURIZATION SYSTEM

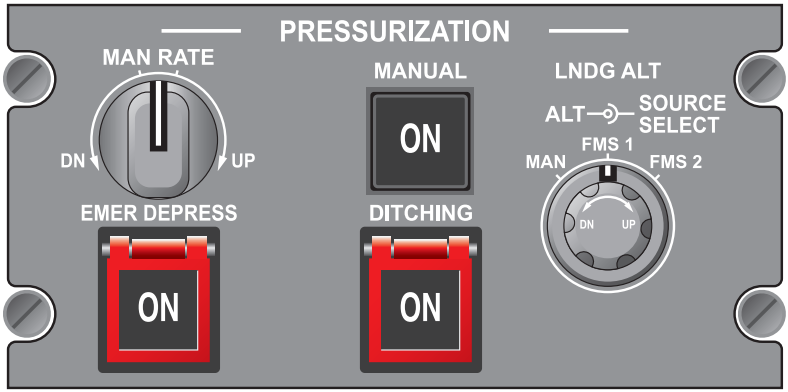

Figure SR-73. PRESSURIZATION Control Panel

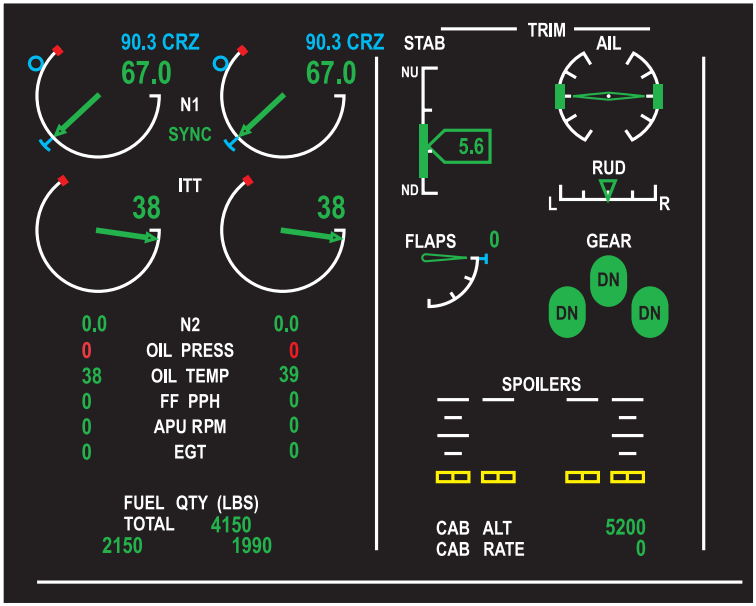

Figure SR-74. CAB ALT and CAB RATE

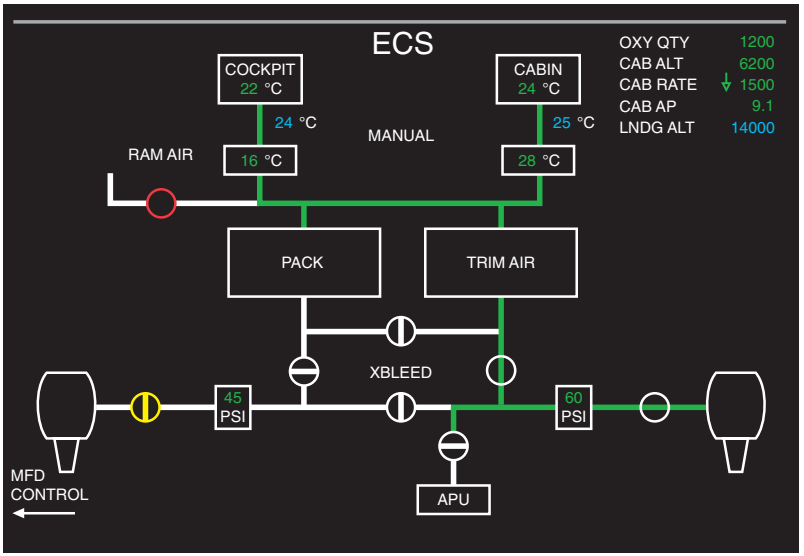

Figure SR-75. Pressurization Indications—ECS Synoptic Page

Table SR-15. EICAS MESSAGES—PRESSURIZATION

MESSAGE	INHIBITS	MEANING	AURAL WARNING
CABIN ALTITUDE	TO/LAND	The normal cabin altitude warning is at 9,400 ft. When a takeoff or landing is conducted above 7,850 ft, the warning is at the field elevation +1,550 ft but limited to no higher than 14,300 ft.	"Cabin altitude"
CABIN DELTA P	TO/LAND	The cabin differential pressure is greater than 9.2 psid or less than –.05 psid.	
AUTO PRESS FAIL	TO/LAND	Both automatic pressurization modes have failed.	
CABIN ALTITUDE	TO/LAND	Normal cabin altitude caution is 8,500 ft. During takeoff or landing above 7,850 ft, the caution is set to field altitude +650 ft with a maximum limit of 14,300 ft.	
CABIN PRESS FAULT	TO/LAND	Either the pressure sensor has failed or cabin altitude limiter function has failed.	
DITCHING NOT AVAILABLE	TO/LAND	The ditching switch has been selected on with the pressurization switch in the manual mode.	
CABIN ALT WARN HIGH	TO/LAND	A high takeoff or landing has been initiated, and the pressurization system is in the automatic mode.	
MANUAL PRESS FAIL	TO/LAND	The manual pressurization mode is not operational.	
DITCHING ON		The DITCHING switch/indicator has been selected ON. This closes the flow control valves and commands the outflow valve open for 100 seconds or 10 seconds after cabin differential pressure decreases below 1,595 psid. The outflow valve then closes.	
EMER DEPRESS ON		Emergency depressurization has been selected. Emergency depressurization commands the outflow valve open but will attempt to limit the cabin altitude to approximately 15,000 ft.	
MAN PRESS ON		The MANUAL PRESSURIZATION mode has been selected.	

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VOLUME 2
AIRCRAFT SYSTEMS

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NOTICE

The material contained in this training manual is based on information obtained from the aircraft manufacturer's Airplane Flight Manual, Pilot Manual 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.

FOR TRAINING PURPOSES ONLY

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AIRCRAFT GENERAL

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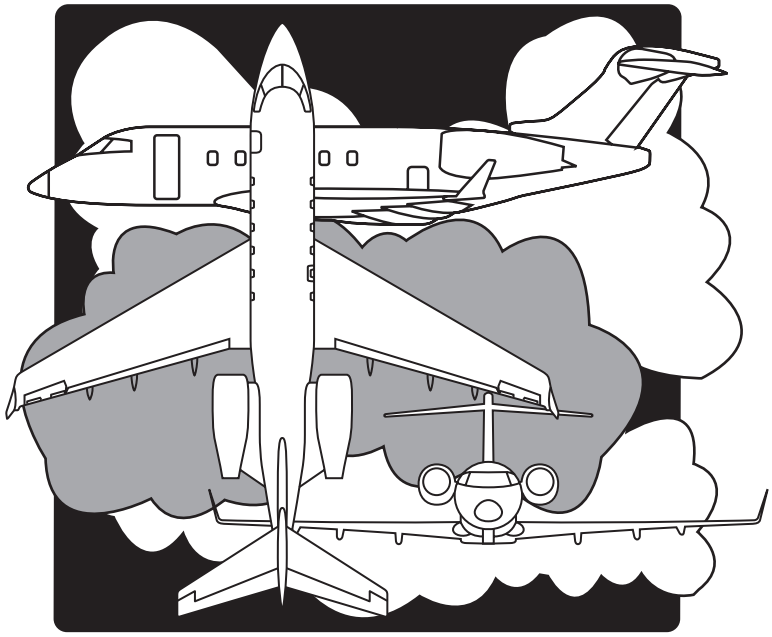
CHAPTER 1
AIRCRAFT GENERAL



INTRODUCTION

The Challenger 300 is an all-metal, pressurized, low-wing, turbofan-powered aircraft. Manufactured by Bombardier Aerospace, the aircraft has fully cantilevered, swept-back wings with winglets. The wings are of a conventional riveted construction except for the upper section of the winglets where a full-depth honeycomb core is bonded to the outer skin. The fuselage is of semimonocoque construction with a constant circular cross-sectional shape.

GENERAL

Two AS907 Honeywell turbofan engines provide thrust. Fuel is stored in wing tanks. Engine-driven hydraulic pumps power the brakes, landing gear, nosewheel steering, thrust reversers, and flight controls of flaps, spoilers, elevator, and rudder.

The landing gear system is a fully retractable tricycle-type trailing link gear with dual main gear wheels, nosewheel steering, and a brake-by-wire control/anti-skid braking system. The air conditioning system, incorporating an air cycle machine and a trim air system, provides heating, cooling, and pressurization.

DIMENSIONS

Figure 1-1 depicts the aircraft dimensions from front, overhead, and lateral views.

STRUCTURE

FUSELAGE

The fuselage is a semi-monocoque assembly with aluminum alloy frames and stringers. The fuselage has forward, center, and rear sections attached together. It also includes attachments for the wing, tail cone, engines, nose landing gear, vertical and horizontal stabilizers, and wing body fairing.

The nose fuselage is made of machined and assembled frames without stringers.The section between FS220.00 and FS326.00 has a thermal and acoustic insulation above and below the floor. Insulation blankets are installed over, around, and between the frames.

The floor support structure is assembled with longitudinal floor beams and cross beams. Floor panels of a light weight composite material are installed on the floor structure. These floor panels can be removed.

WING

The wing is a fully cantilevered, one piece, sweepback airfoil. The wing is at the bottom of the fuselage middle section attached to the fuselage keel longerons and fuselage frames.

The center wing is composed from a wing box structure with skin panels on the top and bottom. The center wing is sealed between the front spar and rear spar and the rib at WS35.60 to make the integral fuel tank. The center wing is a rigid assembly.

The center front and rear spars are made from machined aluminum alloy with stiffeners and the caps.

The rib assemblies consist of five shear web-type ribs that provide the contour to the wing skin panels. The ribs are made from machined aluminum alloy that includes the stiffeners and the caps.

All of the wing-to-fuselage attachment fittings are made from machined aluminum alloy.

The MLG side stay fittings are made from hand-forged aluminum alloy. They are installed between the aft fitting and the rear side fitting on the rear spar with the extension fittings.

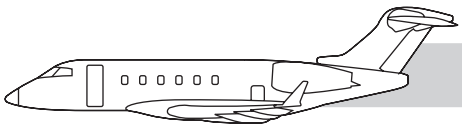
TAIL

The empennage/tail is composed from external sheet metal skins of aluminum alloy sheets made stronger with stringers, machined frames.

The tailcone is attached to the rear part of the empennage/tail with rivets. The tailcone skin is made from a carbon composite material (graphite) with five plies of carbon fabric with a ply of copper mesh on the external side for lightning protection.

The tailcone is made from two pieces, a top and bottom half. There are six more plies of carbon fabric with an overlap along the splice line of these two halves to make it stronger. Six more plies of carbon fabric are around the edges of the panel openings to make them stronger.

An aluminum support frame and one layer of fiberglass fabric is on the internal surface of each opening for protection against a galvanic potential. The tailcone has two titanium firewalls. The forward firewall gives fire protection to the fuselage area forward of the tailcone. The upper firewall gives fire protection to the empennage structure above the tailcone. Both firewalls are attached to the tailcone with rivets.



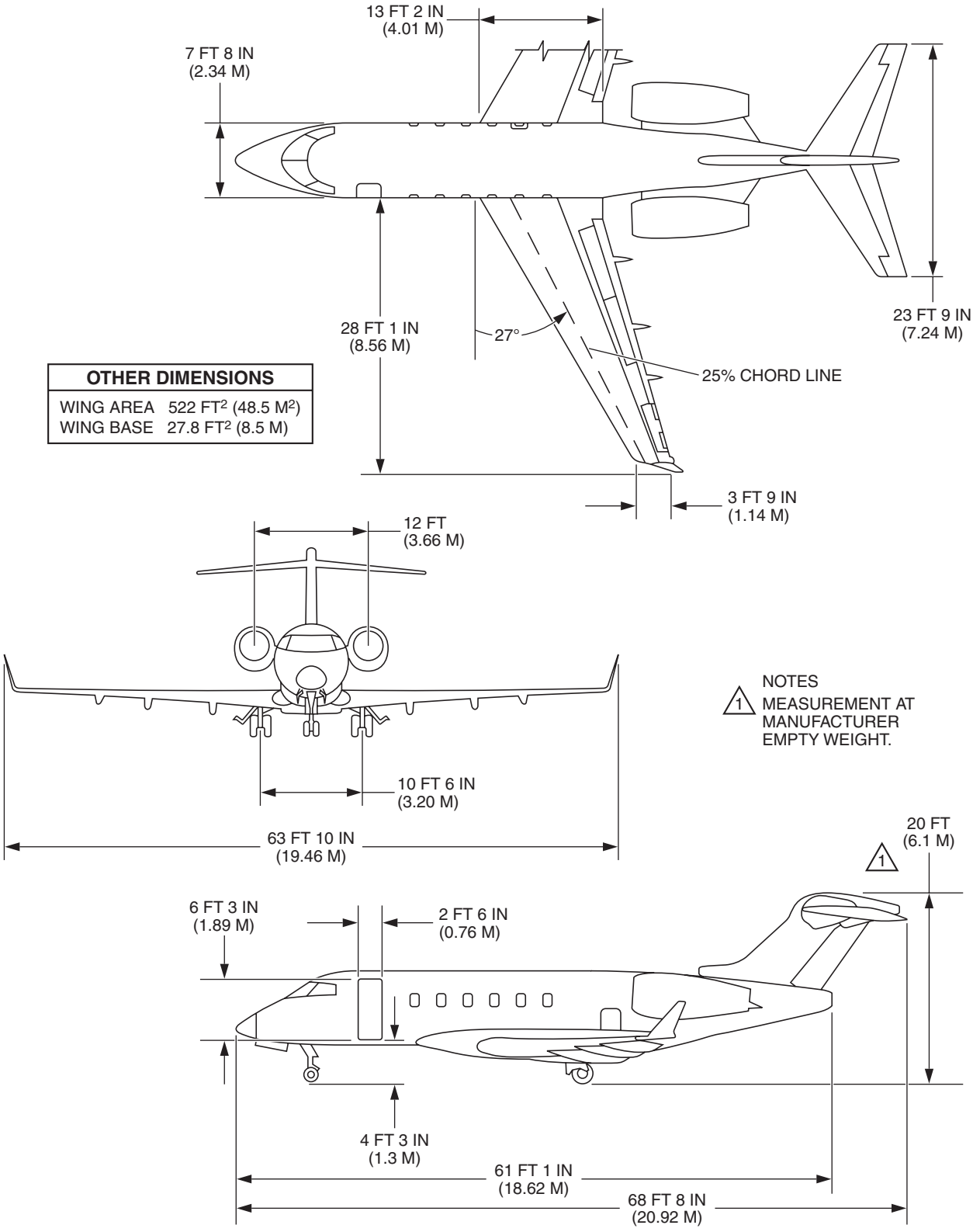


Figure 1-1. Aircraft Dimensions

The part that connects to the empennage/tail also has one layer of fiberglass fabric on the internal surface for protection against a galvanic potential. The rear part of the tailcone has two more plies of carbon fabric with an overlap to make it stronger.

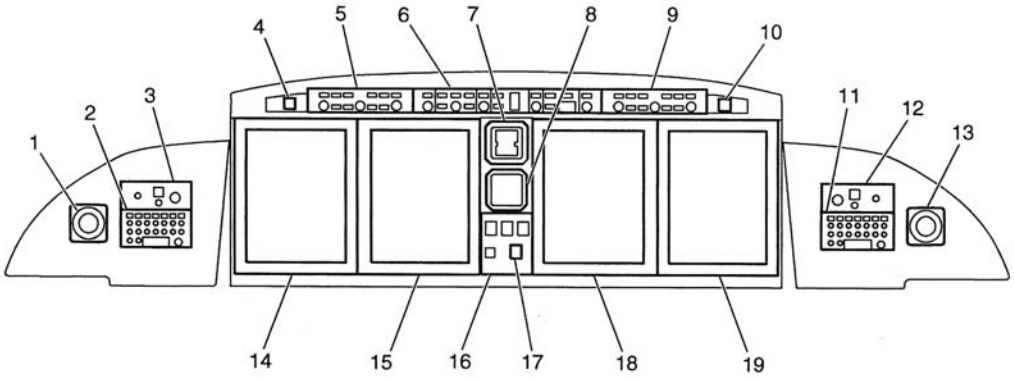
COCKPIT

The major portion of the cockpit center instrument panel contains pilot and copilot multi-function displays (MFDs) and pilot and copilot primary flight displays (PFD). In addition, the following panels are around the MFDs and PFDs (Figure 1-2):

- Audio control panel
- Master warning/caution lights
- Flight guidance panel
- Pilot and copilot display control panels (DCPs)
- Landing gear handle
- TAWS warning panel
- Standby instrument
- Clock

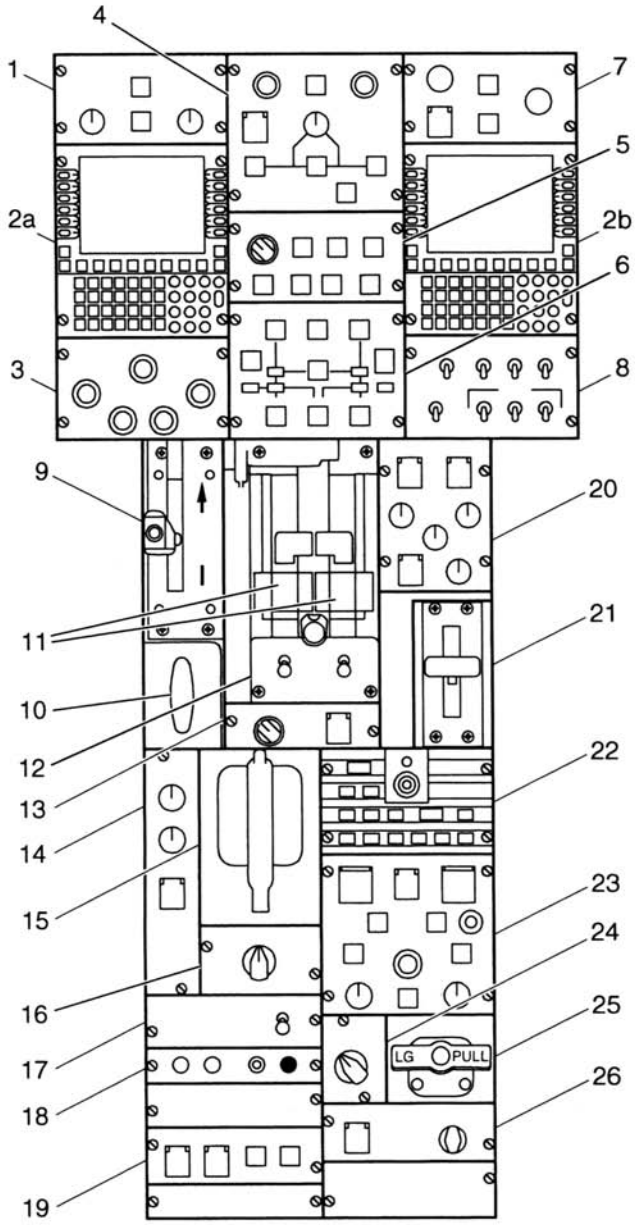
The pilot side console contains the nose steering wheel and switches for control of the cockpit lights. The right console also contains switches for cockpit lights.

The pedestal contains controls for the aircraft systems and the flight management system (FMS) (Figure 1-3).



1. AIR OUTLET
2. PILOT AUDIO CONTROL PANEL
3. PILOT COMPASS/BARO/RUDDER PEDAL ADJUSTMENT
4. MASTER WARNING/CAUTION
5. PILOT DISPLAY CONTROL PANEL (DCP)
6. FLIGHT GUIDANCE PANEL (FGP)
7. STANDBY INSTRUMENT
8. CLOCK
9. COPILOT DISPLAY CONTROL PANEL (DCP)
10. MASTER WARNING/CAUTION
11. COPILOT AUDIO CONTROL PANEL
12. COPILOT COMPASS/BARO/RUDDER PEDAL ADJUSTMENT
13. AIR OUTLET
14. LEFT PRIMARY FLIGHT DISPLAY (PFD)
15. LEFT MULTI FUNCTION DISPLAY (MFD)
16. TAWS WARNING PANEL
17. LANDING GEAR HANDLE
18. RIGHT MULTI FUNCTION DISPLAY (MFD)
19. RIGHT PRIMARY FLIGHT DISPLAY (PFD)

Figure 1-2. Cockpit Center Instrument Panel



1. FUEL PANEL
2a. FMS CONTROL DISPLAY UNIT (OPTIONAL)
2b. FMS CONTROL DISPLAY UNIT (STANDARD)
3. REVERSION PANEL
4. AIR CONDITIONING/BLEED PANEL
5. ANTI-ICE PANEL
6. ELECTRICAL PANEL
7. PRESSURIZATION PANEL
8. LIGHTING PANEL
9. FLIGHT SPOILERS HANDLE
10. PITCH DISCONNECT HANDLE
11. THRUST LEVERS
12. ENGINE RUN SWITCH PANEL
13. GROUND SPOILERS/ROLL SPOILERS PANEL
14. TRIM AND STALL PANEL
15. PARK/EMER BRAKE HANDLE
16. SYSTEM TEST PANEL
17. ELT PANEL
18. COCKPIT VOICE RECORDER PANEL
19. CABIN CONTROL PANEL
20. HYDRAULIC PANEL
21. FLAP LEVER
22. MFD CONTROL PANEL (MCP)
23. ENGINE PANEL
24. APU SWITCH
25. LANDING GEAR MANUAL RELEASE HANDLE
26. PAX OXYGEN PANEL

Figure 1-3. Center Pedestal (Typical)

CONTROL WHEEL

The pilot and copilot control wheels contain the following switches (Figure 1-4):

- Autopilot synchronization switch—Enables pilot to maneuver aircraft without disconnecting the autopilot
- Checklist line advance switch—Advances electronic checklist on MFD
- Transponder identification switch—Activates the transponder IDENT function
- Microphone key switch—Activates the selected radio transmitter when pulled outboard and the interphone when pushed inboard
- Master disconnect switch—Disengages the autopilot and interrupts all trims and stall pusher (stall pusher is not deactivated on JAA-approved aircraft); when released, the pitch trim and pusher are immediately reactivated but autopilot remains disengaged.
- Pitch and roll trim switch—Enables the pilot/copilot to control the trim from each control wheel

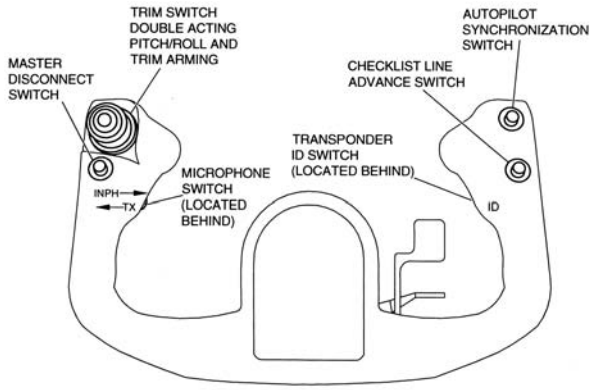


Figure 1-4. Control Wheel

CREW SEATS

Crew seats (Figure 1-5) have adjustments fore and aft, height and armrest position, and recline. Oxygen masks are mounted back and to the side of the headrest. A hook for a trash bag is also included (Figure 1-6).

An eye on the center windshield post allows the pilot to adjust the seat for the correct eye-to-wheel height. Proper sight line is attained when the rear ball is no longer visible because it is covered by a white ball in front. Figure 1-7 displays the arrangements of the balls.

Correct seat placement (height, fore, and aft) is obtained when the following is accomplished:

- All fight controls are unrestricted through full travel
- Flight instruments and warning lights are visible without being obstructed
- Out-of-cockpit visibility is unobstructed
- Seat position is comfortable

Figure 1-5. Crew Seat

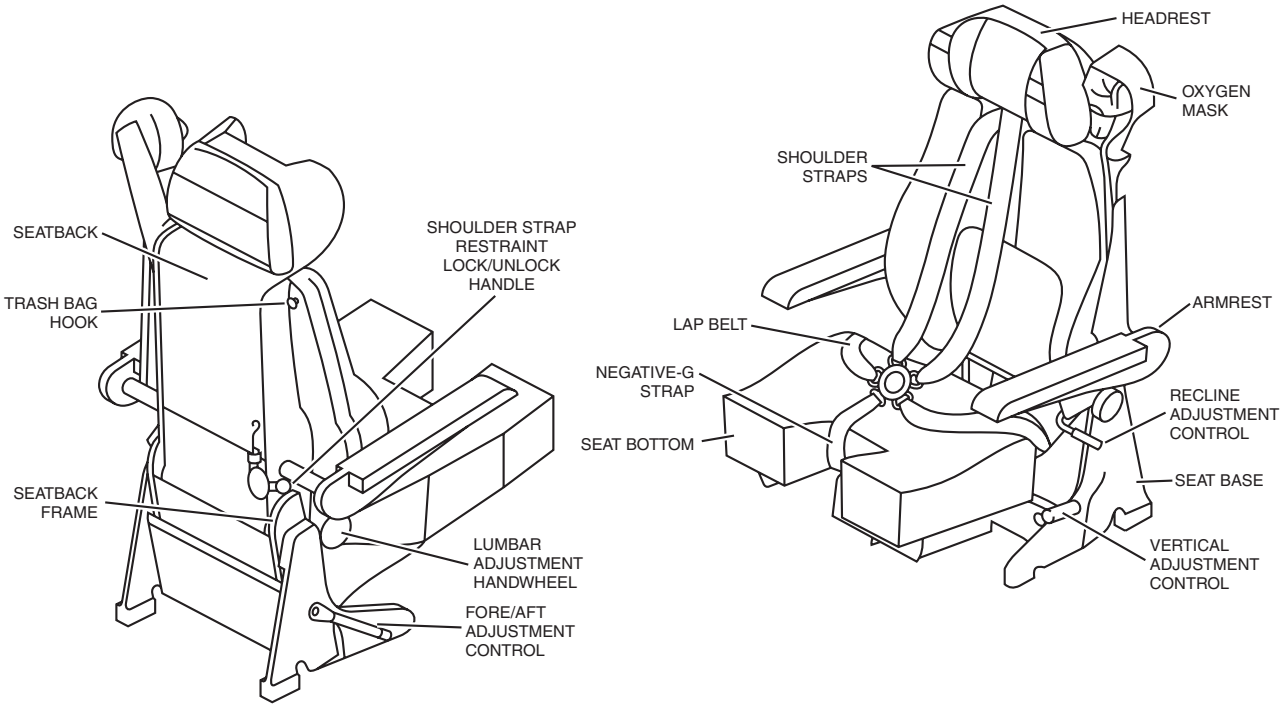


Figure 1-6. Crew Seats Adjustments

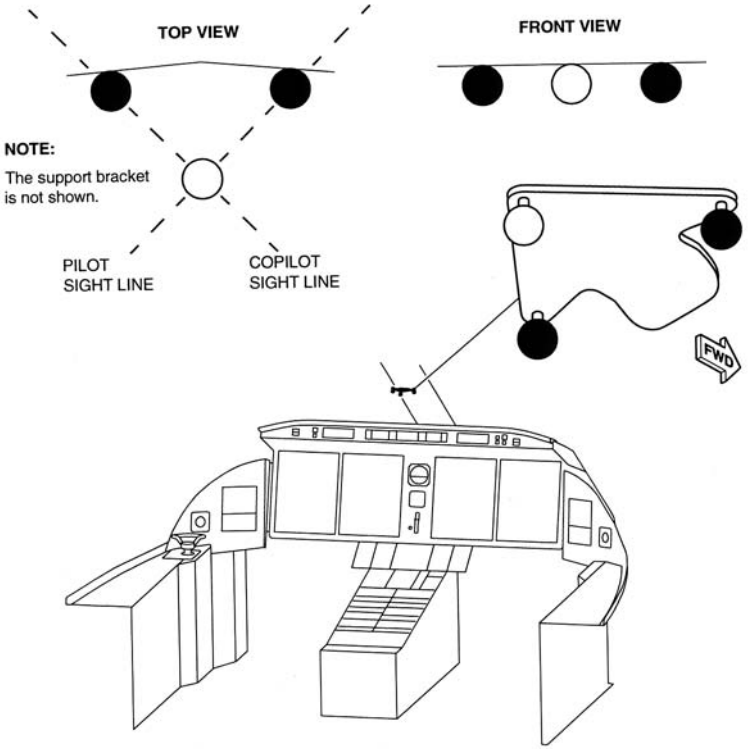


Figure 1-7. Eye Locator—Seat Adjustment

CIRCUIT-BREAKER PANELS

Circuit-breaker panels are marked for easy identification with numbers at the bottom of each panel and letters at the side of each panel. Six CB panels exist: one behind each pilot seat (CB 1 and CB 2), left and right DC power center panels (CB 5 and CB 6), and CB 3 and CB 4 panels, which are in the right and left instrument racks. Typical CB panel layouts are presented in Chapter 2— Electrical.

CABIN

Individual cabin layouts vary, but a typical layout and cross-section of the cabin is displayed in Figure 1-8.

Table 1-1 provides passenger compartment dimensions.

Table 1-1. PASSENGER COMPARTMENT DIMENSIONS

PASSENGER COMPARTMENT DIMENSIONS		
LENGTH	28 ft 7 in	8.71 m
WIDTH (FLOORLINE)	5 ft 1 in	1.55 m
WIDTH CENTERLINE	7 ft 2 in	2.18 m
HEIGHT	6 ft 1 in	1.85 m
VOLUME	896 ft ^{3}	25.37 m ^{3}
FLOOR AREA	146 ft ^{2}	13.5 m ^{2}

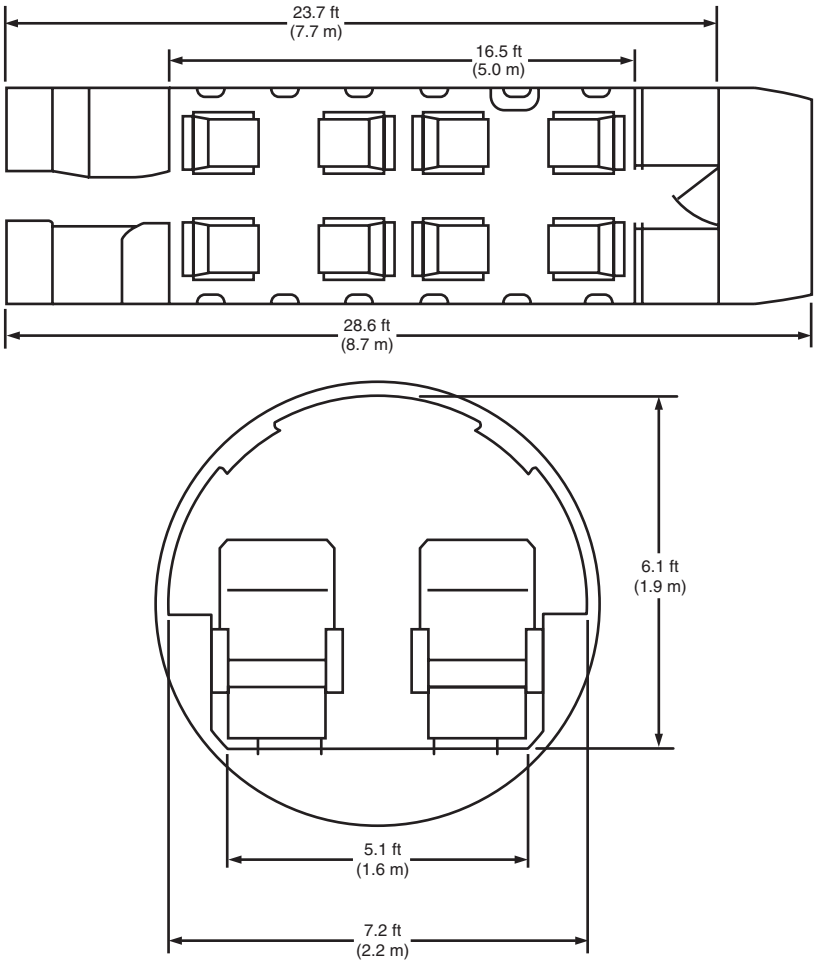


Figure 1-8. Cabin Layout (Typical)

Interior lighting consists of the following (Figure 1-9):

- Airstair and entry lights
- Crew closet and forward wardrobe lights
- Galley lights
- Cabin upwash and downwash lighting
- Cabin reading and table lights
- Lavatory lights
- Lavatory upwash lighting
- Lavatory mirror lights
- Baggage compartment lighting
- Emergency light
- Ordinance lights NO SMOKING, FASTEN SEAT BELT, and RETURN TO SEAT

A remote switch panel in the cockpit on the pedestal controls the cabin and entry lights, cabin DC, and cabin AC power.

EQUIPMENT

The following equipment is normally installed in the Challenger 300:

- Passenger service units
- Arm ledges
- Cabin-controlled lighting
- Galley
- Tables
- Entertainment center
- Lavatory

Figure 1-9. Interior Lighting

The cabin area also contains upwash and downwash LED lighting, entertainment system speakers, and a cabin temperature sensor.

Passenger Service Units

Passenger service units are on both sides of the main cabin. Each unit contains the following:

- Manually adjustable air vents
- Drop down oxygen masks
- Manually adjustable reading and table lights

Depending on cabin configuration, the following items are found in one or more of the passenger service units:

- Upwash and downwash LED lighting
- Cabin entertainment center speakers
- Cabin temperature sensor

Arm Ledge

An arm ledge is on the left and right side of the cabin below the window panels (Figure 1-10). Each ledge contains the following:

- Dual drink holder
- Bi-fold executive table
- Storage box
- Switch panelsfor cabin lighting and entertainment system

Depending on cabin configuration, the following items are found in one or more of the arm ledges:

- 115 60 Hz electrical outlet
- VIP switch

Galley

The galley (Figure 1-11) is in the forward entry area of the cabin on the right side. The galley contains an insulated ice compartment, two AC outlets, two hot liquid containers, and cup dispensers.

Figure 1-10. Arm Ledge

Figure 1-11. Galley

Lighting, liquid waste line and ventilations are also provided.

A switch on the cabin lighting panel operates a pump in the galley to empty the water in the ice containers through a heated mast. The

mast is on the bottom of the fuselage near the entry door.

A magazine rack is on the aft side of the galley. It also contains the subwoofer installation.

Tables

Three bi-fold retractable executive tables are included in the cabin interior. A right aft plug-in table near the emergency exit is also available. A closeout conceals the table cavity when the tables are deployed.

Entertainment Center

Cabin speakers and/or headphones provide the audio for the audio/video system. Components include eight mid-high speakers and two subwoofer speakers.

Two remote controlled transmitters operate a single CD changer. The transmitters are in the left forward wardrobe cabinet above the monitor or in the forward side of the right aft partition above the monitor. A handheld remote control is available.

The LCD monitors of the video system display movies or other prerecorded media. Components consist of a single channel DVD player and two 15-inch flat screen monitors. One is on the aft side of the left forward wardrobe cabinet and the other on the forward side of the right aft cabin partition.

The system also includes a chime/page-audio/video amplifier.

An Airshow 400 or 4000 system, which offers enhanced graphics, cockpit monitor, and interface to telephone or satellite systems, is also part of the entertainment center.

Lavatory

The lavatory is in the aft cabin. It has a sink, mirror, storage compartment, soap dispenser, electrical outlet, and ordinance signs on the left side (Figure 1-12). An electric flushing toilet with timer and overboard servicing, storage area, tissue, and trash drawer are on the right side (Figure 1-13). Access to the aircraft oxygen bottle (s) is also in the area behind an upper closeout panel. Fire extinguisher storage is also provided behind the closeout panel (Figure 1-14).

Figure 1-12. Aft Cabin Lavatory

Figure 1-13. Toilet

Figure 1-14. Fire Extinguisher in Storage

The toilet switch panel is on the left side of the right lavatory partition. The switches control the toilet flush, reading light, upwash lighting, mirror light, and a lavatory call annunciated in the cockpit and gallery (Figure 1-15).

Overboard lavatory service is provided by an external connector that acccepts a standard airline service cart. The service instruction placard is installed in the lavatory servicing compartment.

Figure 1-15. Toilet Switch Panel

DOORS

PASSENGER DOOR

The passenger door (Figure 1-16) is on the left side of the aircraft in the forward section of the fuselage and is the primary entry and exit for the aircraft.

The passenger door is attached to the fuselage by a goose-neck hinge at the centerline of the door. The door opens out and downward.

When closed and locked, the door mechanism pulls the door inward against the fabric seal that lines the door frame. This minimizes the pressurization leak through the door area.

Components

The passenger door consists of integral stairs, stairway lighting, folding handrail, actuator assembly, two telescopic support struts, door lock mechanism, inside door lever, and an outside door handle (Figure 1-17). When the passenger door is open, the top step of the stairs is one step below the cabin floor level.

Figure 1-16. Passenger Door

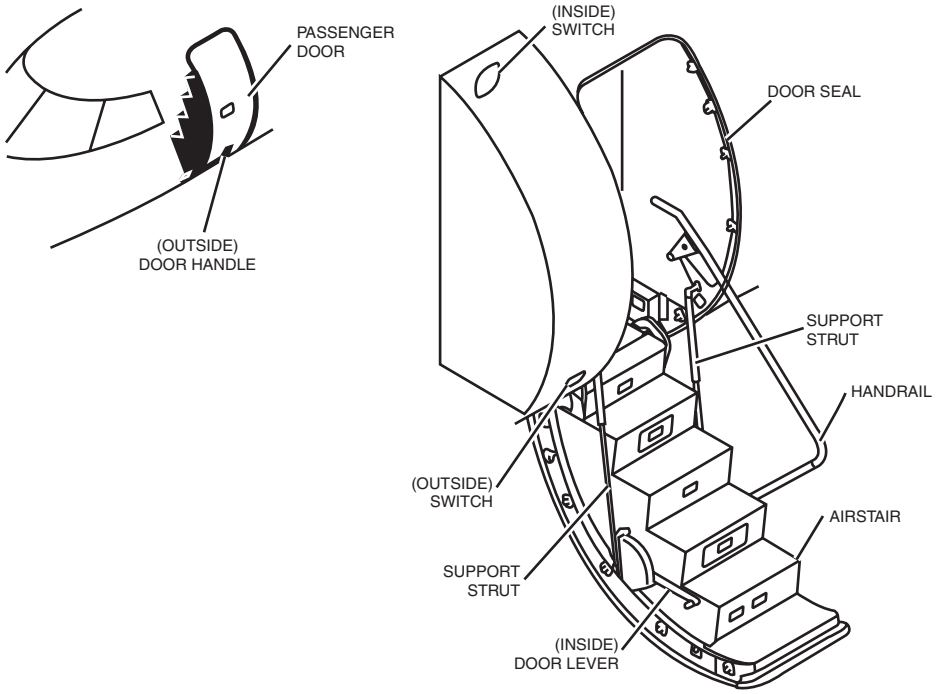


Figure 1-17. Passenger Door Components

The passenger door is normally closed electrically using an inside or outside switch. The door can be opened or closed manually.

Door Actuator Assembly

The door actuator assembly consists of an electric motor, inside and outside switch, lifting cable, pulley, and a hand-operated cable (Figure 1-18). Pushbutton switches operate the electric motor to accomplish normal operation. If power to the motor is lost, the door can be operated manually with the inside lever, outside handle, and the hand-operated cable.

Handrail

A two-part folding handrail is on the aft side of the passenger door. As the door opens, the handrail unfolds parallel to the stairs. A nylon stabilizer between the base of the handrail and the stairs prevents unwanted movement of the handrail. As the door closes, the handrail folds at the hinge point.

Door Seal

A flexible blade-type door seal constructed of silicone rubber and fabric is in the frame channel in the fuselage. A seal is formed when the passenger door is closed and latched. The door seal prevents a rapid decrease of cabin pressure if any part of the seal becomes unserviceable. The door seal also keeps water out of the fuselage if ditching occurs.

Normal Operation from the Ground

To open the passenger door from the ground, use the outside handle in the center of the door (Figure 1-19).

Push the spring-loaded finger-flap inward. Pull the handle out of the recess in the door. Continue to lift the handle upward until the handle stops (approximately 110° travel). As the handle is lifted upward, the vent flap in the door opens. This equalizes cabin pressure. At the end of the handle travel, the latch mechanism disengages the door locks; gravity then opens the door. As the door opens downward, the actuator assembly, which functions as an inertia-reel, slows the door opening. The handle should be fully raised with one motion.

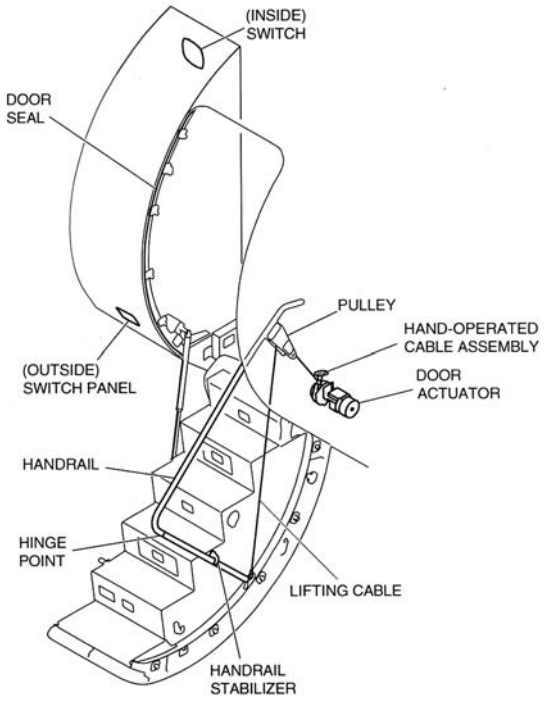


Figure 1-18. Actuator Assembly

Figure 1-19. Passenger Door Outside Handle

This prevents the door from falling prematurely and causing damage to the skin of the fuselage around the door.

To close the passenger door from the ground, open the door-switch access panel forward of the passenger door (Figure 1-20). Push and hold the switch to activate the actuator motor. The lifting cable attached to the door wraps into the actuator housing to close the passenger door.

As the door closes, a vent flap in the handle seals cabin pressure. Pull the external door handle downward and into the stowed position in the recess in the door. The door then can be locked with a key on the outside handle.

Figure 1-20. Door Switch Access Panel

Normal Operation from the Inside

To open the passenger door from inside the aircraft, rotate the inside handle to the full up position, (approximately 100° travel). The door locks disengage. Gravity opens the door.

When the door is unlocked, a red flag indicator shows through a window in the handle. To close the passenger door from inside the aircraft, push the switch on the bulkhead (Figure-21). The switch must be held until the electric motor fully raises the door into the closed position.

Figure 1-21. Inside Passenger Door Switch

To lock the door, rotate the inside lever downward until it stops (approximately 100° travel). When the door is locked, a green flag indicator shows through the window in the handle.

NOTE

If pressure bumps are felt during door closure, select the air conditioning supply OFF prior to the door being closed. Following door closure, the air conditioning supply can be selected.

Manual Operation

In the event of loss of power to the actuator, the passenger door can be closed manually.

To close the door manually from outside the aircraft, lift the door upward to the closed position (Figure 1-22). To engage the door locks, push the outer door handle into the recess in the door.

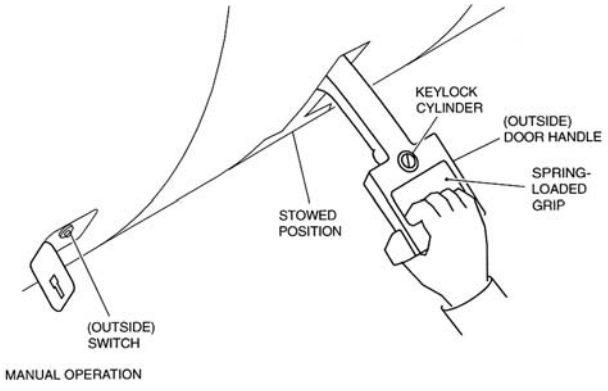


Figure 1-22. Outside Door Handle

To close and lock the passenger door from inside the aircraft, raise the hinged cover on top of the actuator housing and pull up on the T-handle (Figure 1-23). Pulling on the cable handle a number of times wraps the door lifting cable into the actuator housing and raises the passenger door into the closed position.

To lock the door, rotate the inside handle downward until it stops. When the door is closed, a green flag indicator shows through the window in the handle.

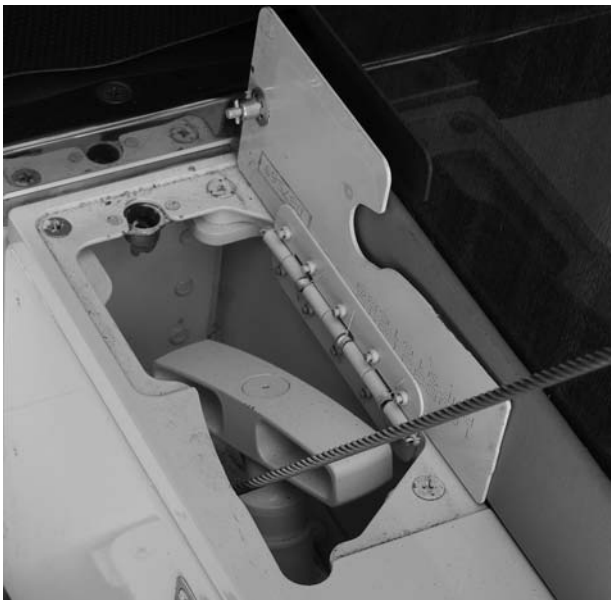


Figure 1-23. Inside Door Manual Closing Mechanism

Door Latching Mechanism

The door latch mechanism consists of two cams that are part of a primary shaft installed horizontally on the door structure. The primary shaft turns with inputs from the internal handle and the external handle. The internal handle attaches directly to the primary shaft. The external handle connects to the primary shaft through control rods and a lever.

The latch mechanism has three different primary functions as follows:

- Vent flap function
- Door lifting function
- Open lock function

Vent Flap Function

It is not possible to open the cabin door if some cabin pressure remains. A pressure lock lever, which connects to the vent flap through a control rod and link, prevents movement of the inner handle so that the vent flap stays closed.

After cabin pressure is released, the springs allow the vent flap to open. The pressure lock disengages. The door handles can then operate.

The spring also ensures that the vent flap opens if a part of the operating mechanism becomes unserviceable or disconnects. If one spring breaks, the other two springs can open the vent flap to release cabin pressure.

Door Lifting Function

When closed and locked, the door sits in a channel, below the lower lip of the fuselage door opening. Therefore the door must be moved upward before it can move outward.

Another cam on the primary shaft of the latch mechanism moves the door vertically. As the cam turns, force is applied to a lever connected to a lifting shaft parallel to the primary shaft. At each end of the lifting shaft is a lever that connects to the door hinge mechanism. Movement of the two levers moves the door vertically in relation to the hinge.

The lifting shaft has a locking ratchet cam connected to the vent flap cam that stops vertical movement unless the vent flap is fully open.

A pressure lock system also stops more movement of the primary cam shaft if the vent flap is kept closed by too much cabin pressure. When pressure decreases sufficiently, the springs open the vent flap and the locking cam so the lifting shaft can turn.

Open-Lock Function

When the door is fully open, it is not possible to close it until a system of mechanical locks is released. This lock mechanism also prevents too much vertical movement of the steps when people are entering and exiting.

When the door is fully open, the primary lock engages the locking cam on the external handle pivot shaft.

Annunciations

A PASSENGER DOOR status CAS message is displayed if the passenger door is not fully closed and the aircraft is on the ground with left engine run switch in the OFF position.

A PASSENGER DOOR caution CAS message is displayed if the passenger door is not fully closed and the following conditions exist:

- Aircraft on ground with left engine run switch in the ON position
- Aircraft in flight and passenger door rollers are not fully engaged into the fitting guides

EMERGENCY EXIT

The emergency exit is over the wing on the right side of the aircraft (Figure 1-24). It is a Type III escape hatch that measure 20 inches wide by 36 inches high. It weighs approximately 45 pounds.

The emergency hatch is a removable plug-type hatch. The force of cabin pressure holds the hatch in place with a two-pin locking mechanism.

A security pin can be installed on the inside at one of the locking pins to prevent unauthorized entry from the outside. The security pin has a small flag attached that states REMOVE BEFORE FLIGHT (Figure 1-25).

NOTE

The emergency hatch can be opened and removed from inside or outside of the aircraft, but must be installed from inside the aircraft.

Figure 1-24. Emergency Exit

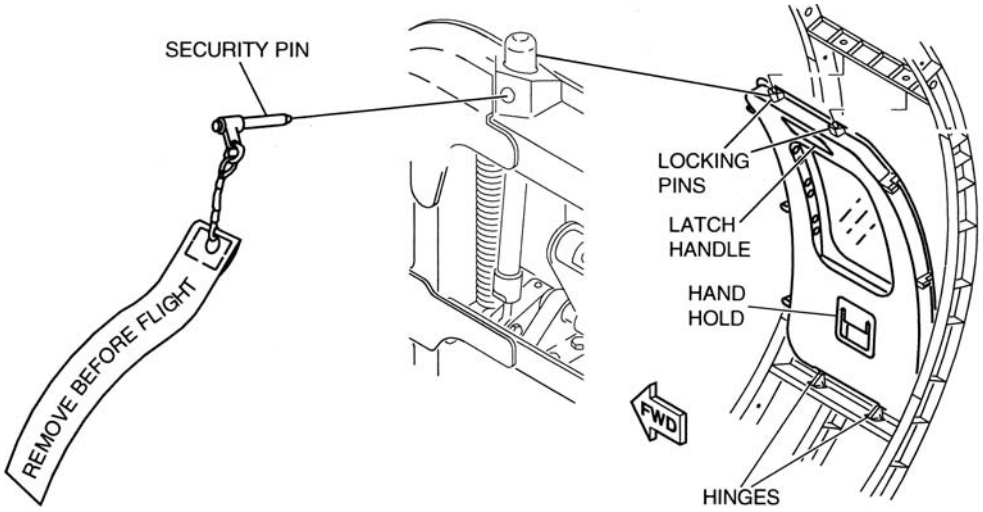


Figure 1-25. Security Pin

Inside Removal

To remove the hatch from inside, use the upper latch handle EXIT-PULL. Remove the cover from the latch handle and pull the spring-loaded handle inward (Figure 1-26). This retracts the locking pins in the top of the hatch. Rotate the hatch downward into the aircraft (approximately 12 inches). Use the latch handle and the handhold to lift the hatch upward and away from the hinges at the bottom of the hatch. Place the hatch clear of the exit to allow passage (Figure 1-27).

Outside Removal

To remove the emergency hatch from outside, push in on the spring-loaded latch panel placarded EMERGENCY DOOR PUSH TO OPEN DOOR OPENS INWARD. While holding the panel in, push in on the hatch to rotate the top of the hatch into the aircraft (approximately 12 inches). With both hands, lift the hatch upward and away from the hinges at the bottom of the hatch. Move the hatch clear of the emergency exit to allow passage.

Figure 1-26. Inside Hatch Removal

Installation

The emergency exit hatch must be installed from inside the aircraft. The passenger seat nearest the emergency hatch must be in the full inboard position.

Install the emergency hatch into the frame in the fuselage in the opposite order of the Inside Removal procedure. Ensure that the seal around the door is seated correctly. Locking pins at the top of the hatch should be fully extended into the frame (the pins are fully extended when the latch handle is fully retracted).

Install the cover for the latch handle. Secure the hook and loop fasteners for the cover.

An EMERGENCY EXIT caution CAS message is displayed if the proximity sensor detects that the emergency hatch is not completely closed and locking pins fully engaged.

Figure 1-27. Hatch Placement

CARGO DOOR

The cargo bay door is a plug-type door forward of the left engine nacelle. It opens inward and upward to the overhead position above the doorway. The cargo door is accessible from inside the aircraft through the passenger compartment but is not certified as an emergency exit.

The cargo door consists of the following (Figure 1-28):

- Direct-coupled inner and outer handle
- Trigger-lock mechanism
- Fore and aft locking pin
- Balance springs and cables
- Roller/track assembly

Operation

To open the door from inside, raise the spring-loaded cover on the center of the handle. Push the handle toward the door pane and turn clockwise.

To open from outside the aircraft, push the trigger-lock in the outer handle to release the handle from the recess. Rotate the handle 90° counterclockwise to retract the locking pins. Open the door inward. As the door moves inward, the rollers engage into the door tracks so the door can be lifted and latched in the overhead position. A balance spring/cable assembly on each side of the door takes the weight off of the door as the door is lifted.

If the aircraft is on the ground and the left engine run switch is selected ON, a CARGO DOOR caution CAS message is displayed. Normally only a white status CARGO DOOR CAS message is illuminated.

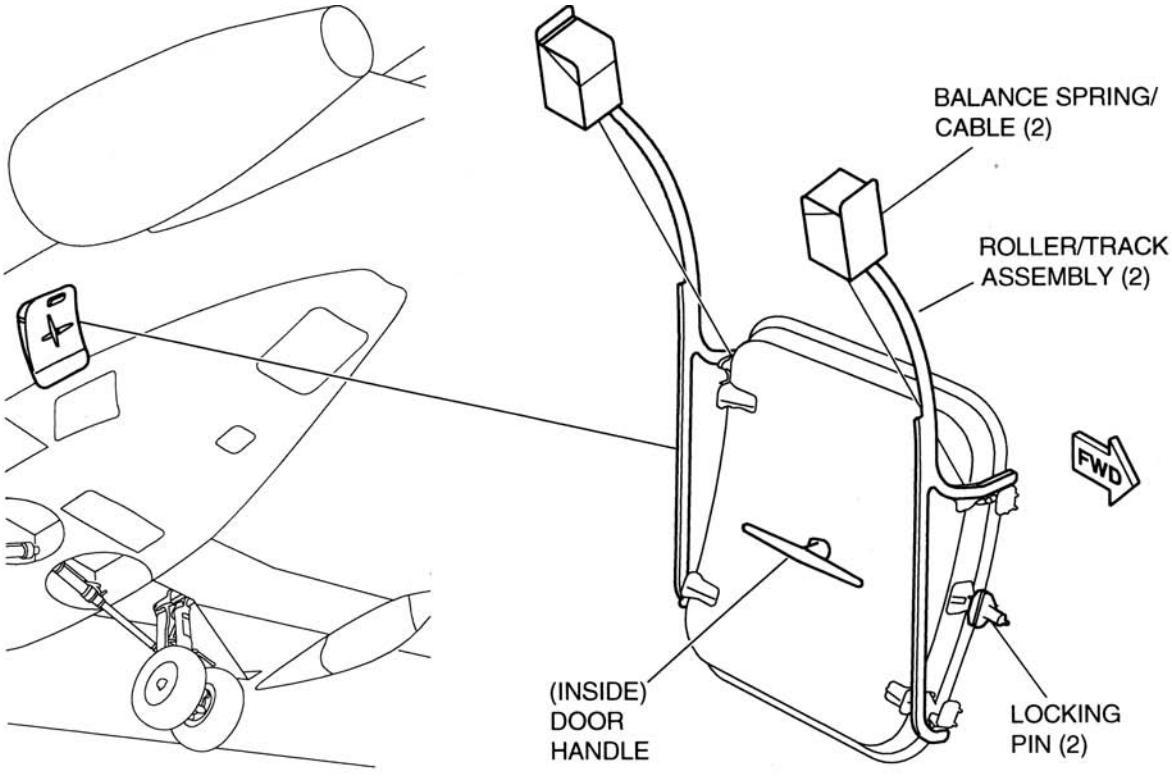


Figure 1-28. Cargo Bay Door Components

SERVICE DOORS

The service doors (Figure 1-29) access various systems and components requiring servicing and/or inspection. These include the following:

- Ground power door—Accesses the service panel for ground power supply
- Oxygen fill/indicator door—Accesses the oxygen indicator and servicing components
- Refuel/defuel door—Accesses the refuel/defuel adapter
- Refuel/defuel control panel door—Accesses the computer control panel for refueling and defueling

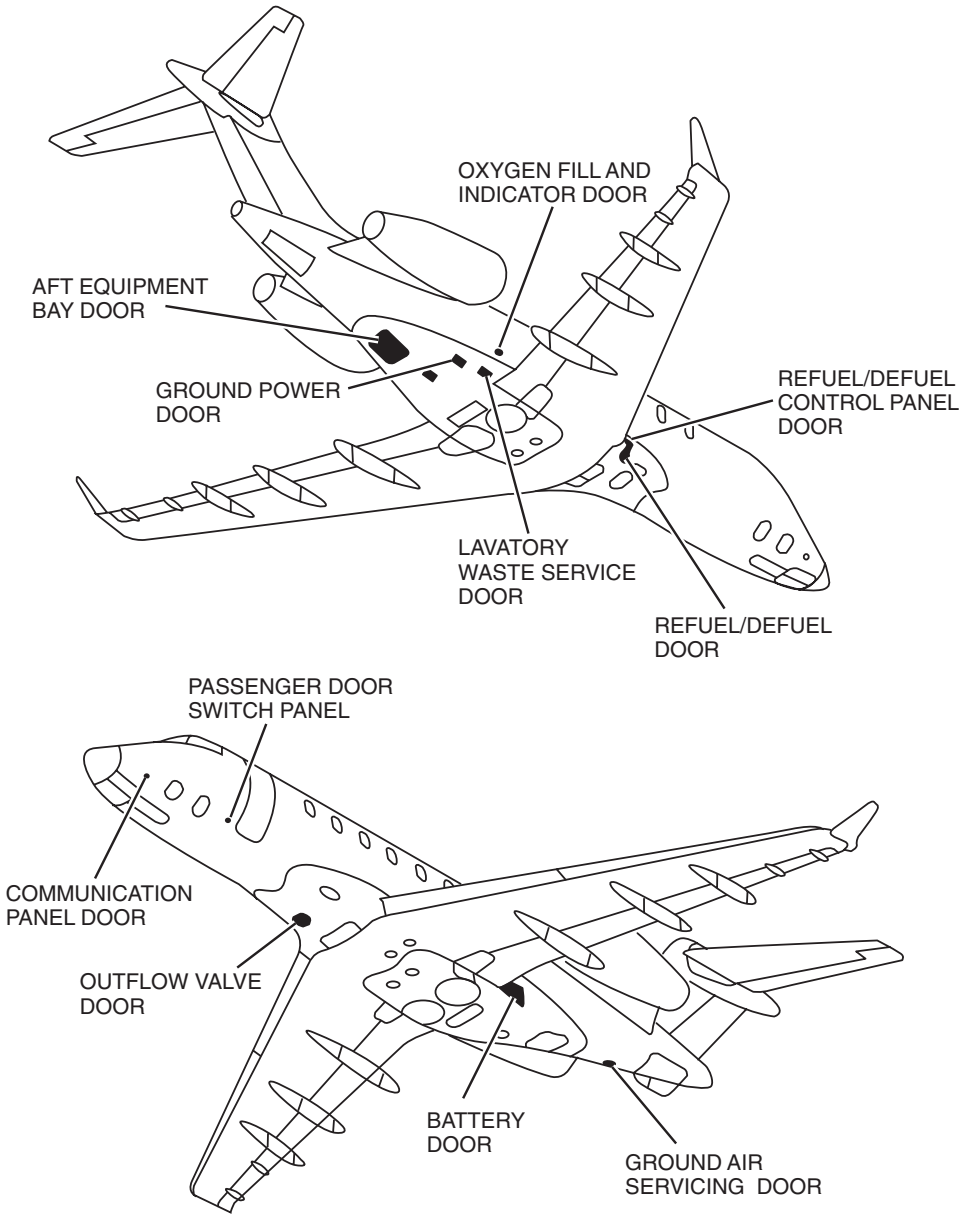


Figure 1-29. Service Doors—Locations

- Lavatory waste door—Accesses the lavatory waste service panel
- Communication panel door—Accesses the ground communication panel
- Outflow valve door—Accesses the outflow valve panel
- Battery bay door—Accesses the main batteries
- Ground air servicing door—Accesses the ground air servicing connection
- Aft equipment door (Figure 1-30)—Accesses aft equipment area; the door, which is hinged in front and opens downward, has a lever-type latch mechanism. A support strut on the door can be connected to the fairing bracket to stabilize the door in the open position. The strut must be disconnected from the fairing bracket to close the door

Each of these doors is discussed in appropriate chapters later in this manual.

Door Annunciations

If the battery bay access door is not closed, a proximity sensor prompts the BATTERY BAY DOOR caution CAS message.

If the aft equipment bay door is not closed, the AFT EQPT BAY DOOR caution CAS message illuminates.

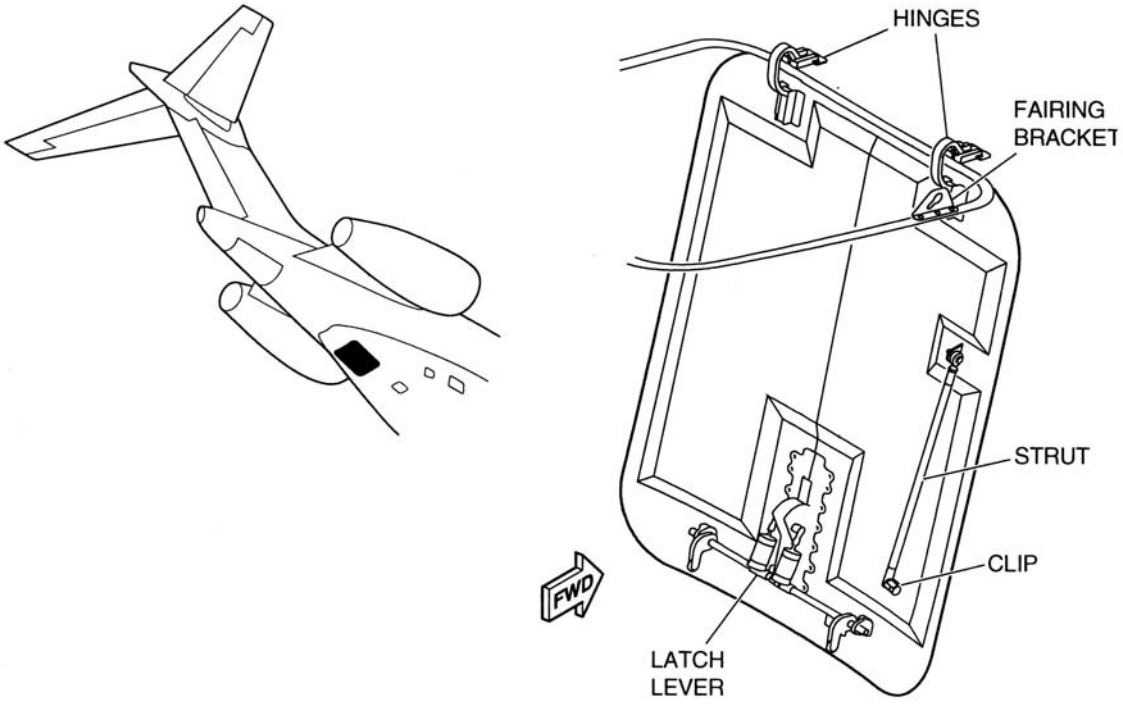


Figure 1-30. Aft Equipment Door

DOOR WARNING SYSTEM

The door warning system monitors the following doors:

- Passenger door
- Emergency exit hatch
- Cargo bay door
- Aft equipment bay door
- Battery bay door

A magnet with an electronic proximity sensor is mounted at each door. These interface with the proximity sensor electronic unit (PSEU), data concentrator unit (DCU), and the multifunction display (Figure 1-31).

The flight crew receives a single chime and a visual CAS annunciation if a door is not in the correct position under specific conditions.

On the ground, the CAS displays the EMERGENCY EXIT caution message and other door warnings in amber. However, if the left engine is set to RUN, the PASSENGER DOOR caution and CARGO DOOR caution messages also illuminate.

In flight, the door warnings on CAS are displayed in amber.

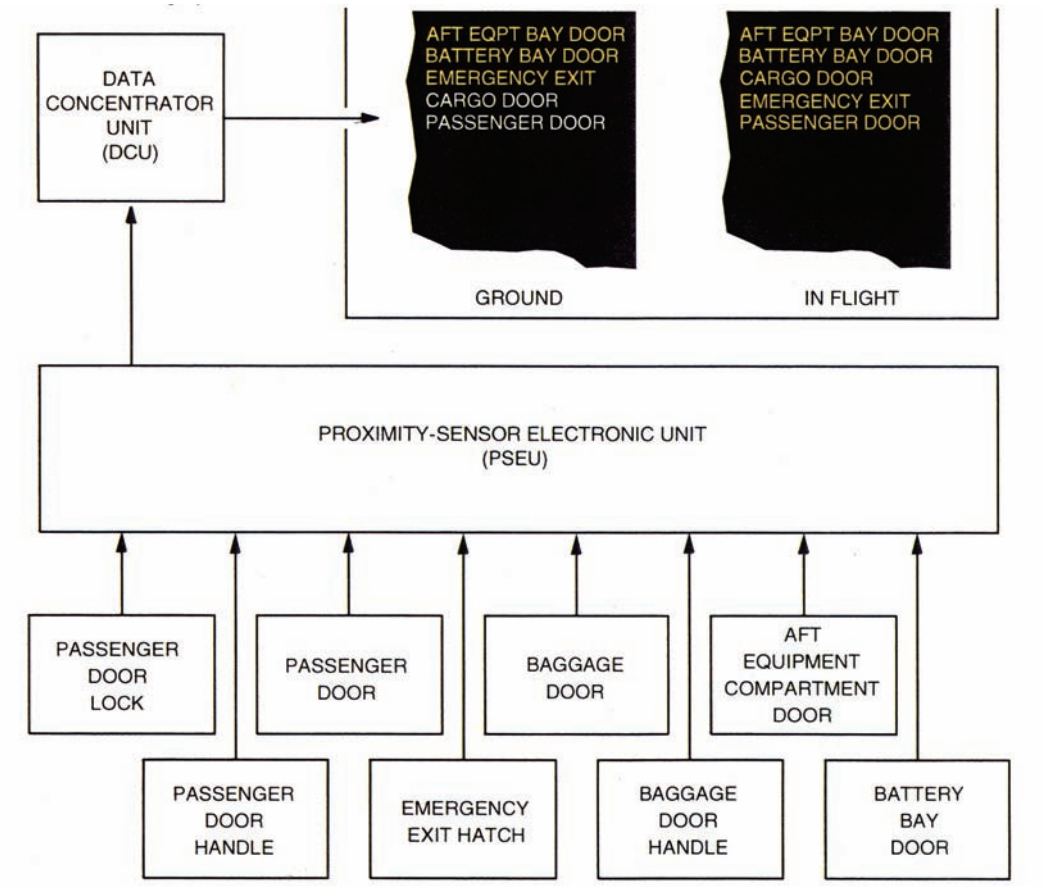


Figure 1-31. Door Warning System

DANGER AREAS

Figure 1-32 depicts the danger areas surrounding the Challenger 300.

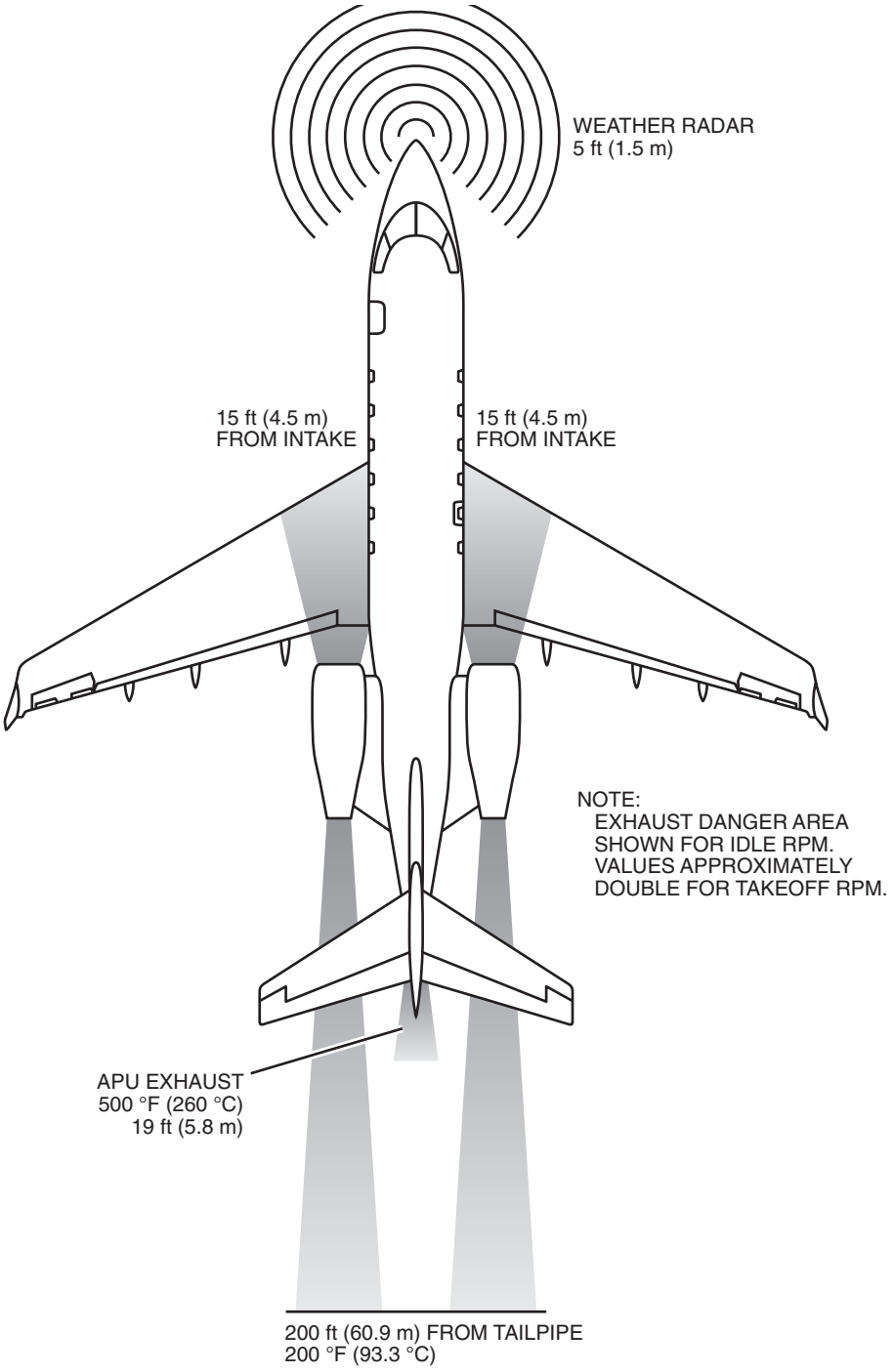


Figure 1-32. Danger Areas

STEERING/TURNING

Steering and turning radii are shown in Figure 1-33.

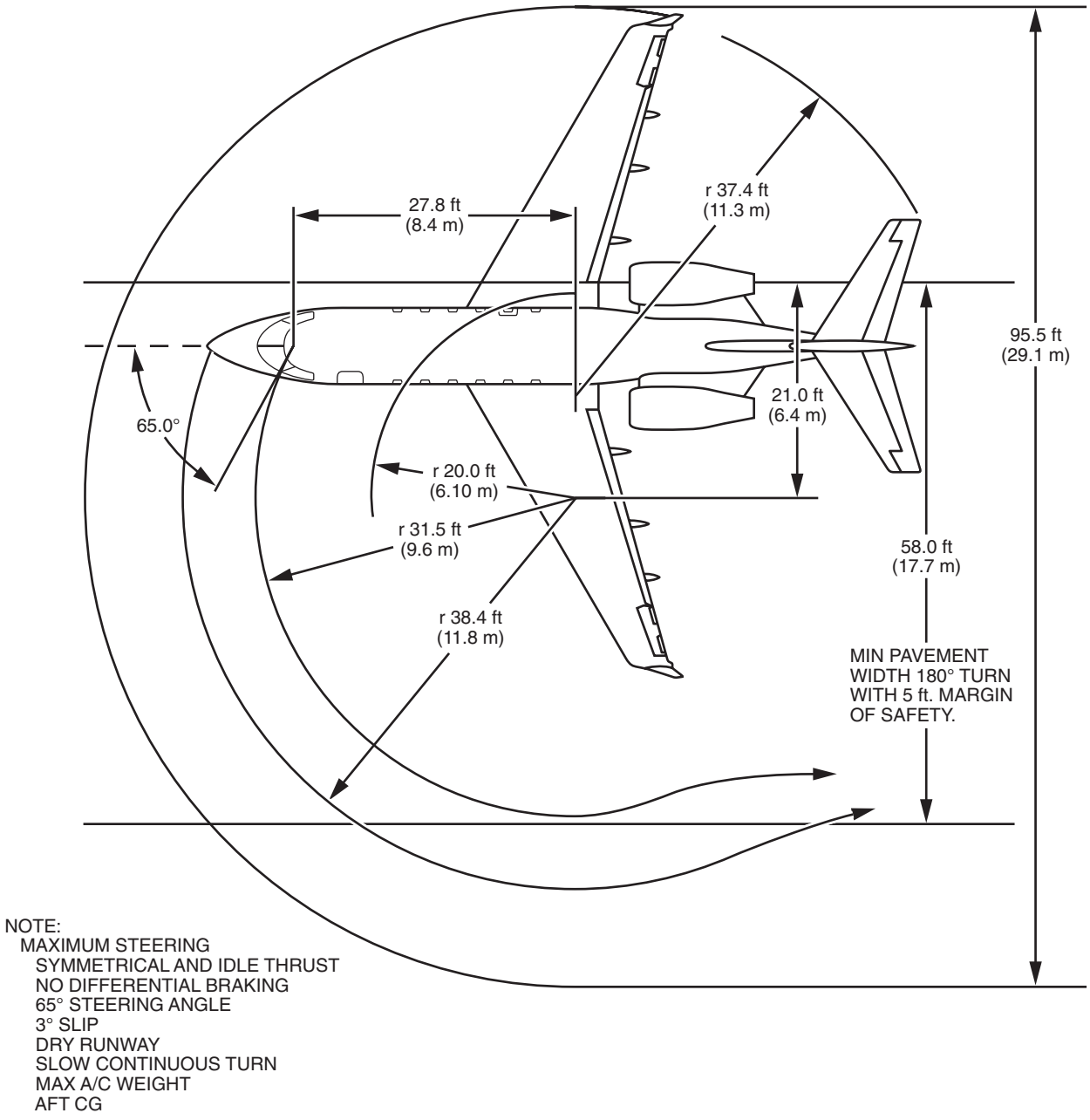


Figure 1-33. Steering and Turning

JACKING

Three points are provided for jacking the aircraft: one forward on the fuselage and one on each wing at the rear spar (Figure 1-34). Gear jacking points are also provided for tire/wheel/brake changes. Jacking procedures are detailed in the *Aircraft Maintenance Manual* (Chapter 7).

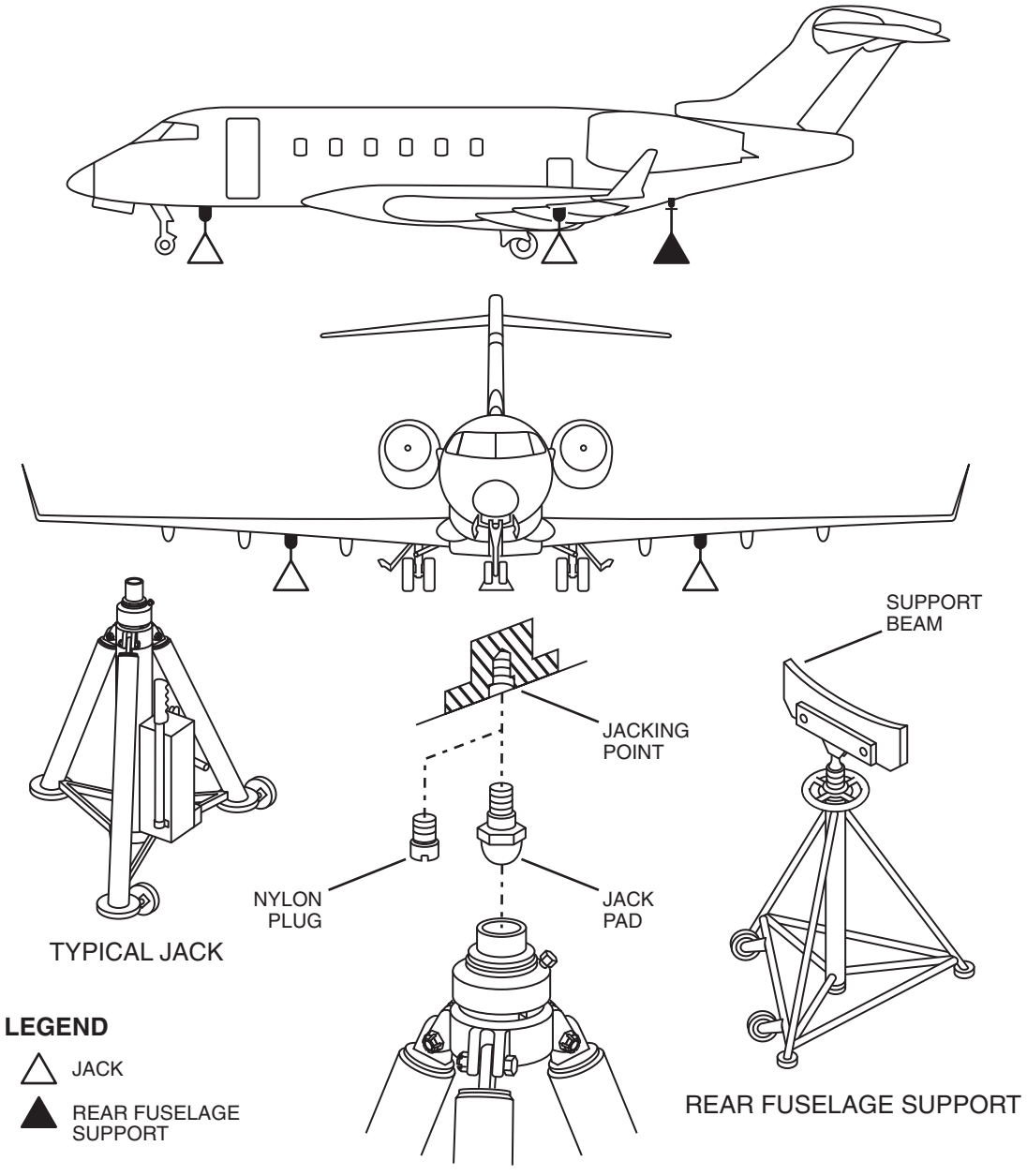


Figure 1-34. Aircraft Jacking

TOWING

With torque links connected and the steering control system deenergized, the aircraft may be towed up to a limit of 120° of nosewheel angle (Figure 1-35). Should the nosewheel angle exceed this value, a NWS LIMIT EXCEEDED caution CAS message is displayed. At approximately 123°, the indicator pins on the nose landing gear are sheared off. This provides a physical indication that damage may have been done to the feedback linkage and surrounding area.

For special hangar operations, the torque links may be disconnected to allow towing at any angle. A warning plate on the nose landing gear indicates the operational limit for towing.

For further towing information, refer to the *Aircraft Maintenance Manual* (Chapter 9).

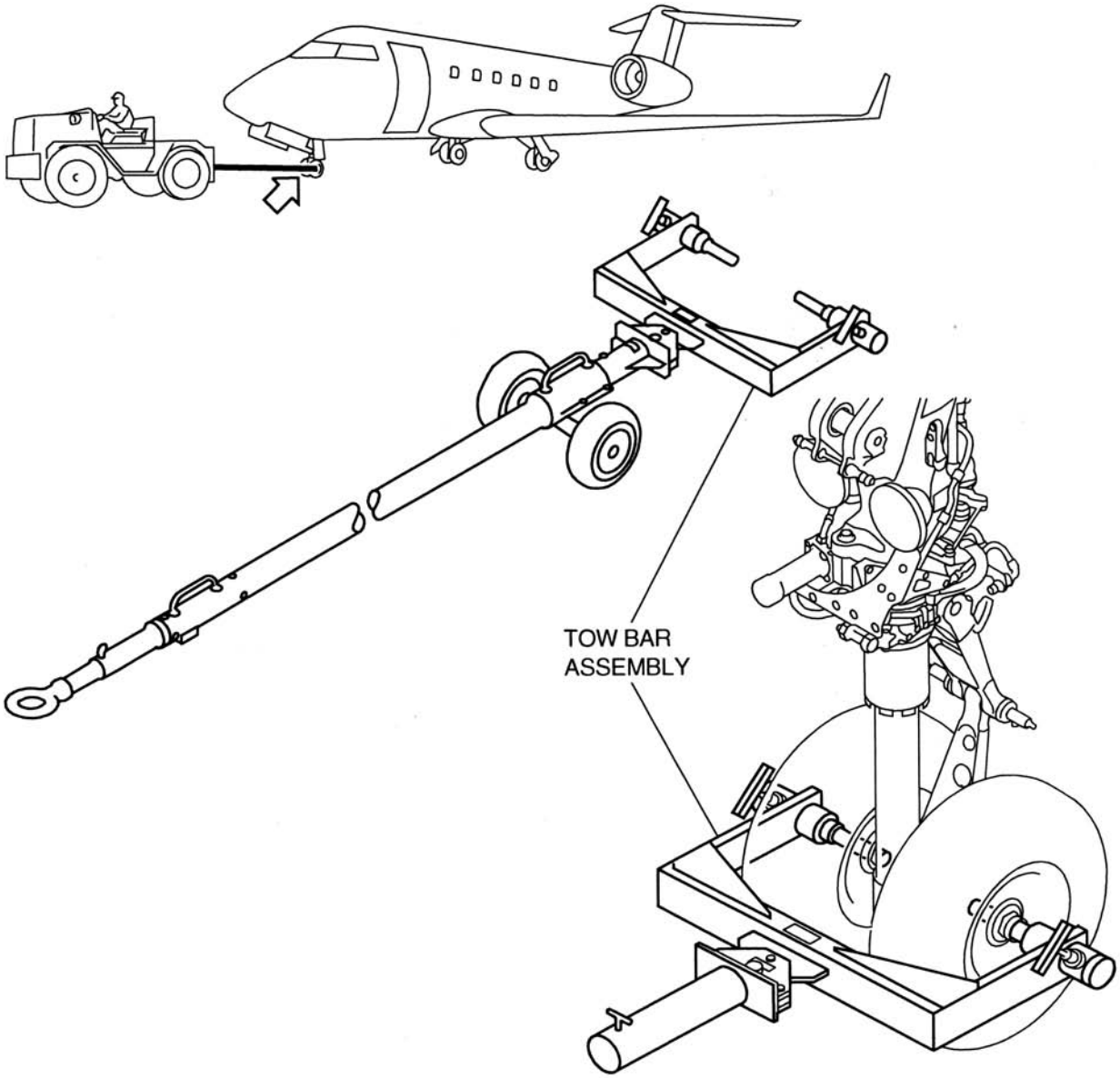


Figure 1-35. Towing

MOORING

Fittings on the fuselage and wing jacking points permit mooring of the aircraft. Use chocks on all wheels. Mooring procedures are listed in the *Aircraft Maintenance Manual* (Chapter 10).

QUESTIONS

1. The minimum pavement width for a 180° turn with a 5 foot margin of safety is:

a. 45 feet
b. 52 feet
c. 58 feet
d. 65 feet

2. The aircraft may be towed up to a limit of _____ of nosewheel angle with the torque links connected and the nosewheel steering control system deenergized:

a. 58°
b. 95.5°
c. 120°
d. 123°

3. At what degree of nosewheel angle will the nose landing gear swivel pins shear?

a. Approximately 60°
b. Approximately 90°
c. Approximately 120°
d. Approximately 123°

4. How is the passenger door normally closed?

a. Electrically
b. Hydraulically
c. Manually
d. With the hand-operated cable

5. The purpose of the vent flap in the cabin door handle is:

a. To exhaust smoke in the cabin
b. To provide a handhold to open the door from the outside
c. To equalize cabin pressure to ambient pressure
d. To provide an secondary safety lock when opening the door manually

6. Under what condition does a PASSENGER DOOR caution (amber) CAS message display when the aircraft is on the ground and the door is not fully secured?

a. The left engine RUN switch is in the OFF position
b. The left engine RUN switch is in the RUN position
c. The right engine RUN switch is in the RUN position
d. The right engine RUN switch is in the OFF position

7. Under what condition does the PASSENGER DOOR caution (amber) CAS message display when the aircraft is in flight?

a. The inflatable door seal has become compromised
b. The vent flap has opened
c. The electric door closing mechanism has failed
d. The passenger door rollers are not fully engaged into the fitting guides

8. What is the indication if the aircraft is on the ground and the cargo door is open?

a. With the left engine run switch in RUN, a CARGO DOOR caution (amber) CAS message is displayed
b. With the left engine run switch OFF, a CARGO DOOR advisory (cyan) CAS message is displayed
c. With the right engine run switch in RUN, a CARGO DOOR caution (amber) CAS message is displayed
d. With both engine run switches OFF, a CARGO DOOR advisory (cyan) CAS message is displayed

CHAPTER 2
ELECTRICAL POWER SYSTEMS

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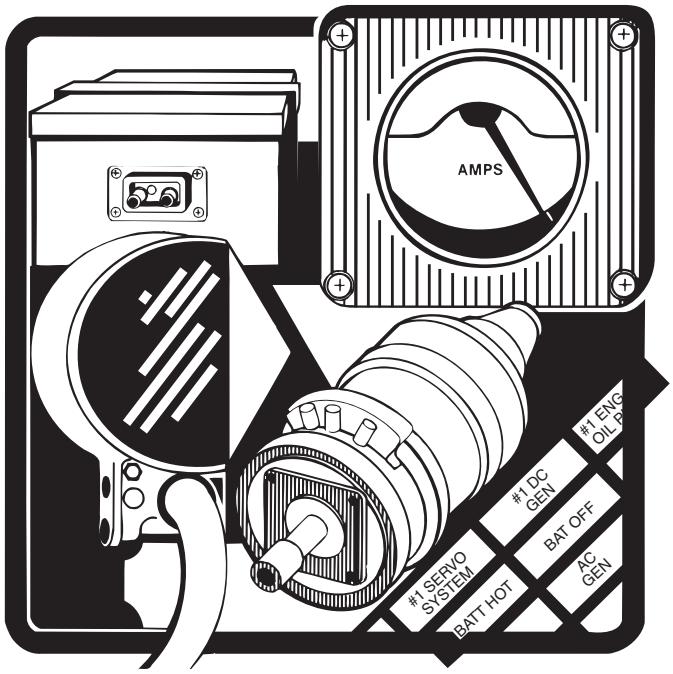
CHAPTER 2
ELECTRICAL POWER SYSTEMS



INTRODUCTION

The electrical system of the Challenger 300 is a highly automated 28 VDC system with several levels of redundancy. The system generates and appropriately distributes power with very few pilot actions.

GENERAL

Electrical power for the Challenger 300 is provided through a 28 VDC split-bus system. Inverters provide AC power only for passenger conveniences.

Sources of power include three identical generators (two engine-driven and one APU-driven), two batteries, a ground power receptacle, and an optional hydraulic motor-driven generator.

Power is distributed through three DC power centers (DCPCs) and two secondary power centers (SPCs). Contactors, fuses, and circuit breakers interconnect the multiple buses and react automatically to isolate a malfunctioning circuit.

An independent standby instrument, with its own battery, is provided as a backup in the event of a loss of all generated electrical power.

Components of the power generation system and the power distribution system are shown in Figure 2-1.

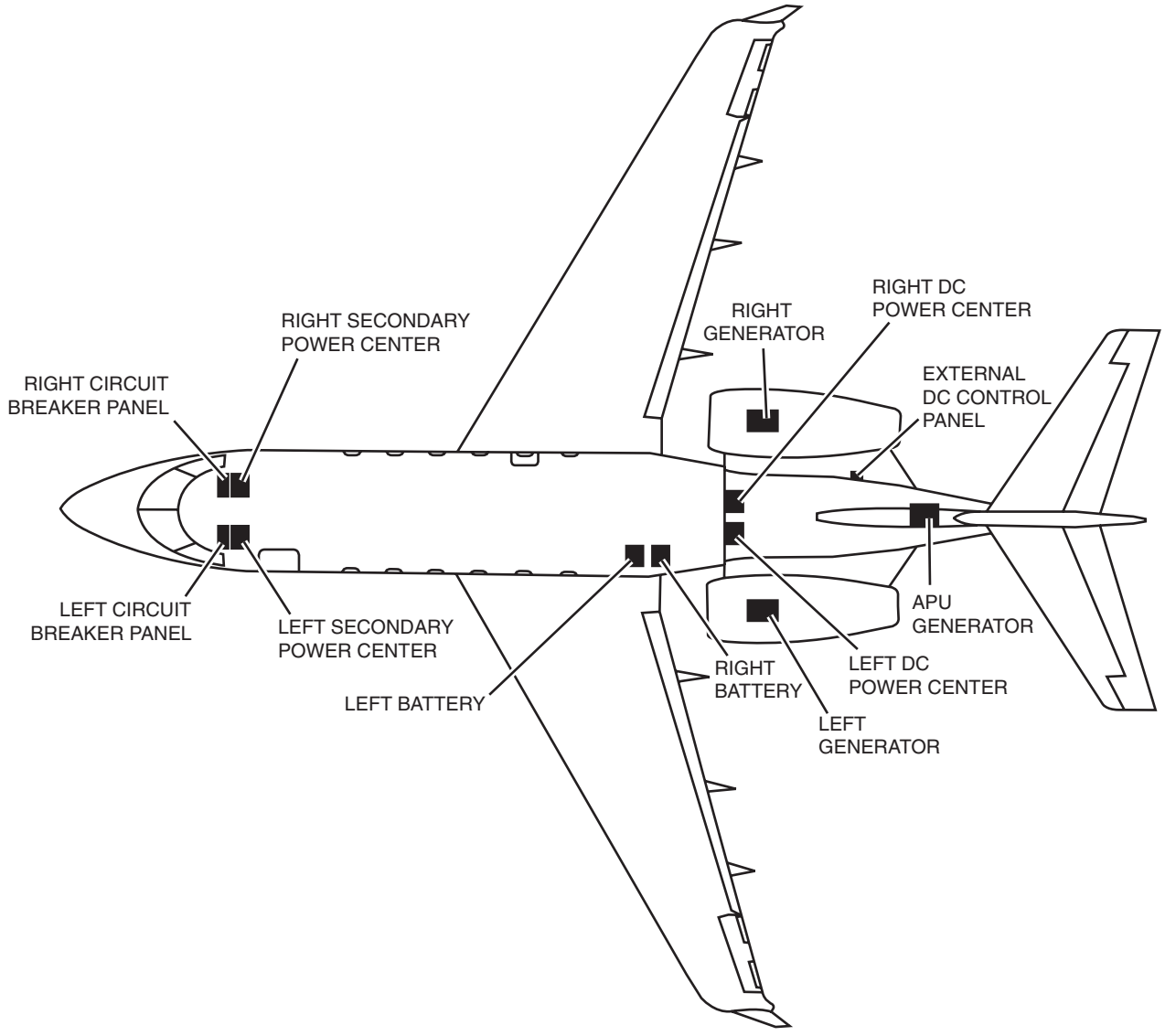


Figure 2-1. Power Generation System and Power Distribution System Components

BATTERIES

Two 24 V nickel-cadmium (Nicad) batteries (Figure 2-2) rated at 44 amp-hour provide power for ground operations, APU starting, and emergency backup of the generators. The batteries are located in the fuselage fairing aft of the left wing. Two tubes extend from the battery cases to vent overboard gases produced by the batteries.

The batteries are directly connected to their respective left or right battery buses, powering the buses even when the battery switch is selected off. If the batteries significantly discharge prior to bringing a generator online, the charging current may be large enough to result in an APU GEN OVERLOAD(C) or a L/R GEN OVERLOAD(C) message for a short time while the batteries recharge.

Individual battery voltages and temperatures can be read on the SUMMARY page and the ELECTRICAL synoptic displays on the MFD.

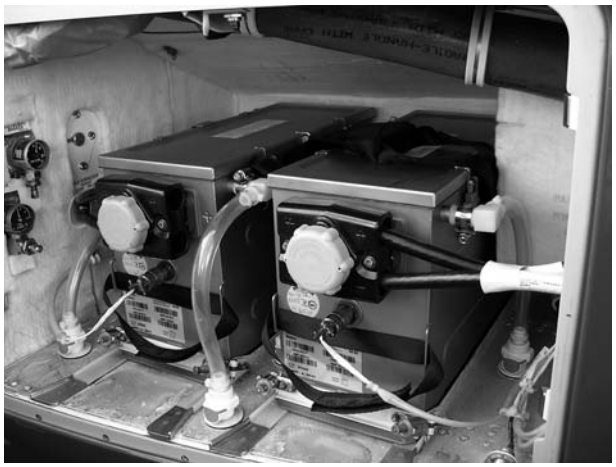


Figure 2-2. Batteries

POWER GENERATION

The electrical system has three brushless generators that provide primary electrical power. All three generators are identical. They are rated at 400A, 12 kVA at nominal 28.5 VDC. A dedicated generator control unit (GCU) regulates each generator. The two engine-driven generators are the normal power sources.

The engine-driven generators (Figure 2-3) are mounted on the accessory gearboxes on each engine. The generators are air-cooled and include an integrated fan. The generators come online automatically with the engines running and ground power deactivated. Either one of the engine-driven generators provides enough power for normal operations.

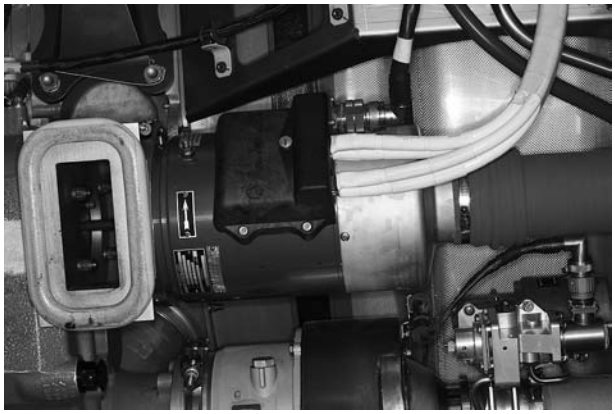


Figure 2-3. Generator

With the APU running, the APU-driven generator (Figure 2-4) is available to replace one or both of the engine-driven generators or to supply power together with the two main generators. The APU generator can supply sufficient power to either main bus to dispatch in the event of the loss of one main generator. It can also serve as an alternate source of power in flight if one or both of the main generators becomes defective.

NOTE

The approved minimum equipment list should be consulted prior to dispatch with inoperative components.

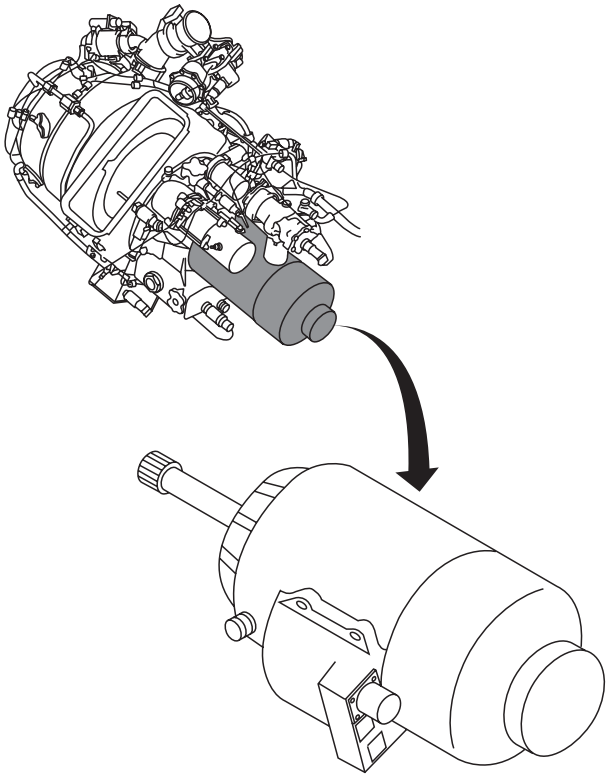


Figure 2-4. APU Generator

POWER DISTRIBUTION

The Challenger 300 electrical system contains multiple buses that are connected through both hard wiring and contactors. The following is a list of buses and a short description of each:

- L/R Main Bus (MAIN)—The primary power sources for most major systems
- L/R Essential Bus (ESS)—The power sources for critical systems
- L/R Auxiliary Bus (AUX)—The power sources for nonessential equipment
- L/R Battery Bus (BATT)—The power sources for equipment that operates with all power sources turned off (i.e. hot buses)

A list of systems and the buses that power them is at the end of this chapter.

Bus tie contactors (BTCs) automatically transfer power from the opposite side in the event of a generator failure.

Figure 2-5 shows the electrical system architecture.

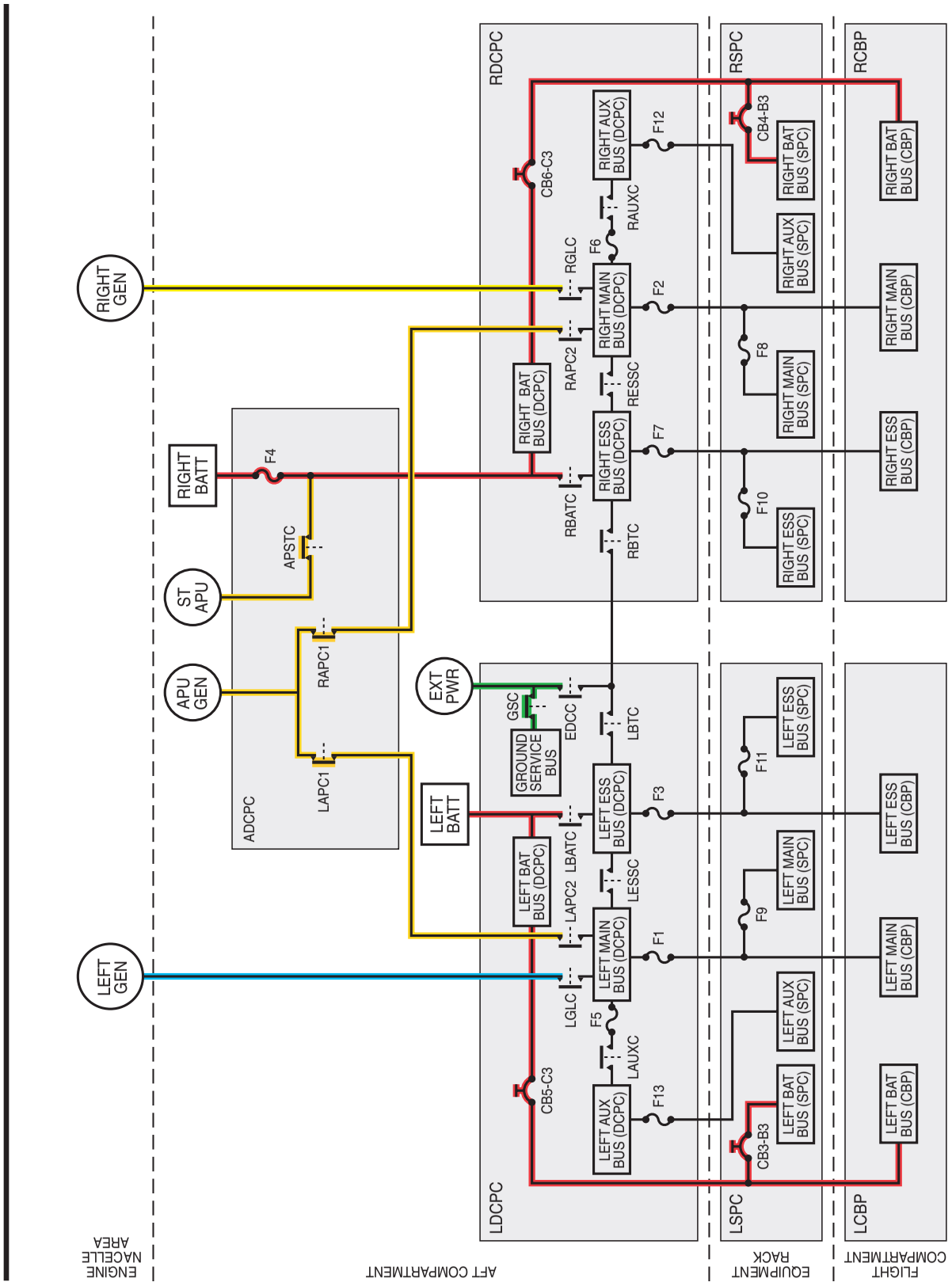


Figure 2-5. Electrical System

Electrical power for the Challenger 300 is routed through at least one of three DC power centers (DCPCs). The left and right DCPCs contain their respective main, essential, battery, and aux buses. They also contain the GCUs, multiple contactors, and the electronic logic for load shedding. The aux DCPC contains the APU GCU and contactors for directing power to either the right or left DCPC. The contactors in the DCPCs can isolate faults on a bus or feeder line.

The buses in the DCPCs directly power equipment in the aft section of the aircraft through a circuit breaker panel mounted on the outside of the DCPC (Figures 2-6 and 2-7).

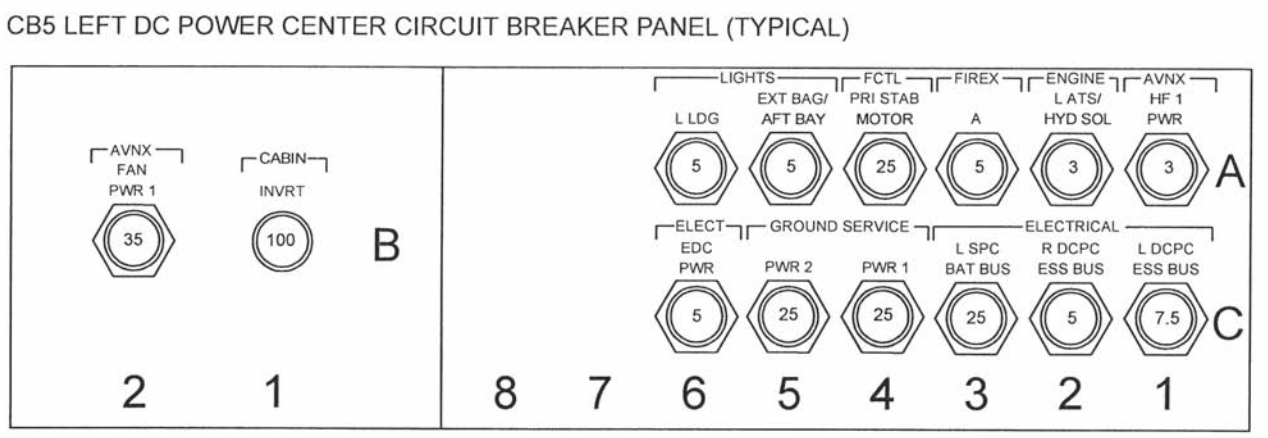


Figure 2-6. CB5 Left DC Power Center Circuit Breaker Panel—Typical

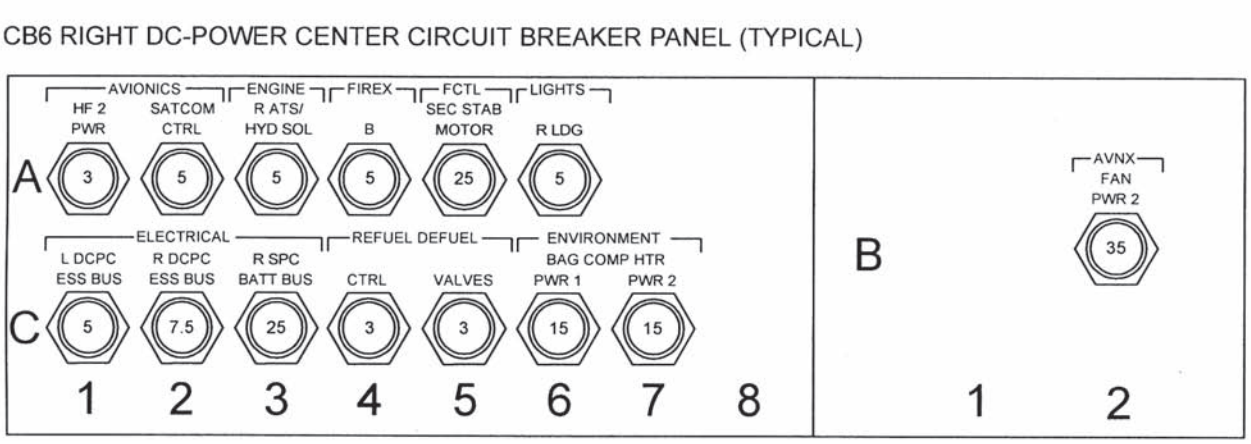


Figure 2-7. CB6 Right DC Power Center Circuit Breaker Panel—Typical

Loads in the forward section of the aircraft are fed through the left or right secondary power centers (SPCs) in the left and right equipment racks. One feed from each bus on the DCPCs runs to its respective SPC. The feeds split at the SPC—one for the cockpit circuit breaker panels (Figures 2-8 and 2-9) and one for the circuit breaker panels on the equipment rack (Figures 2-10 and 2-11).

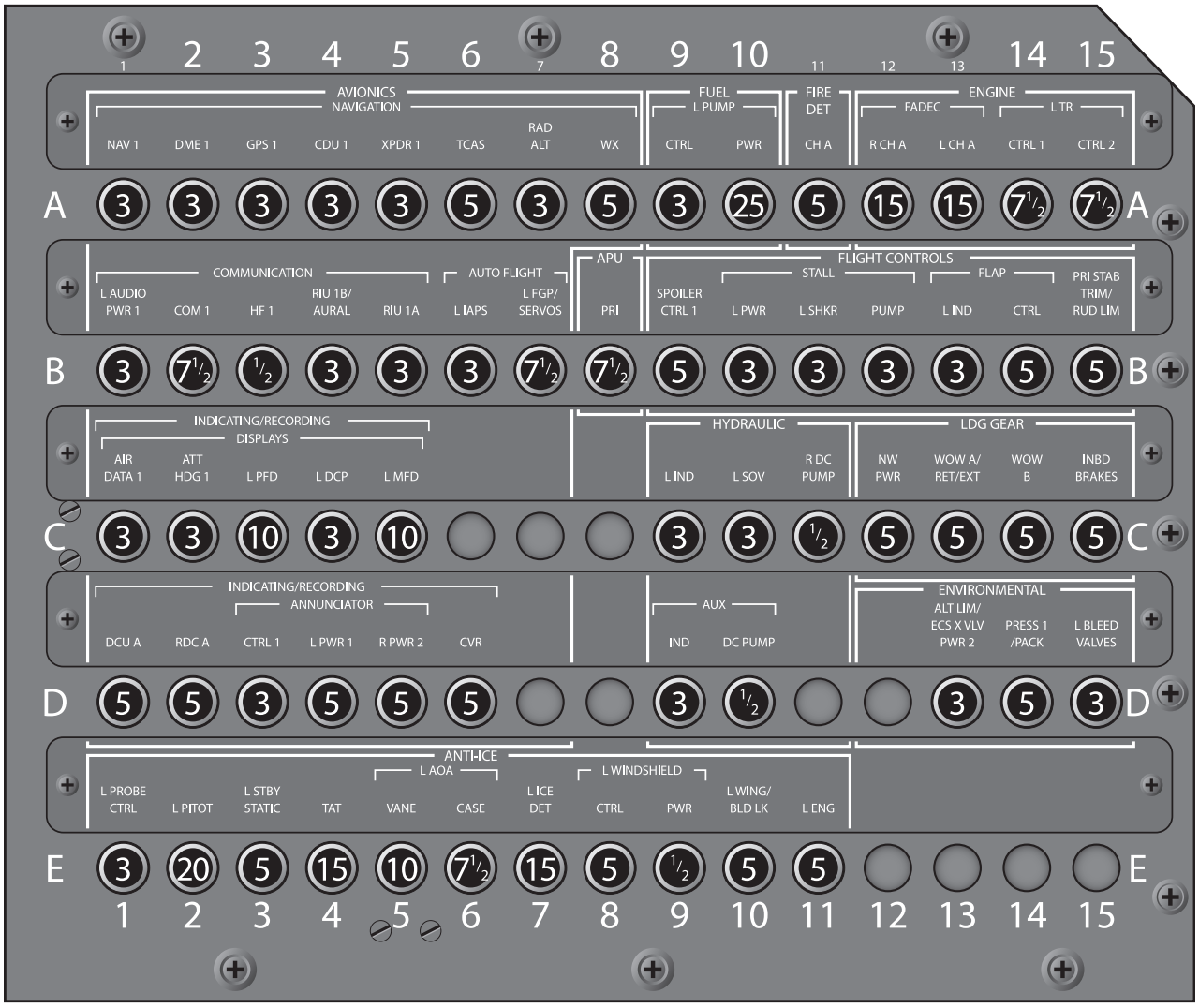


Figure 2-8. CB1 Left Cockpit Circuit Breaker Panel—Typical

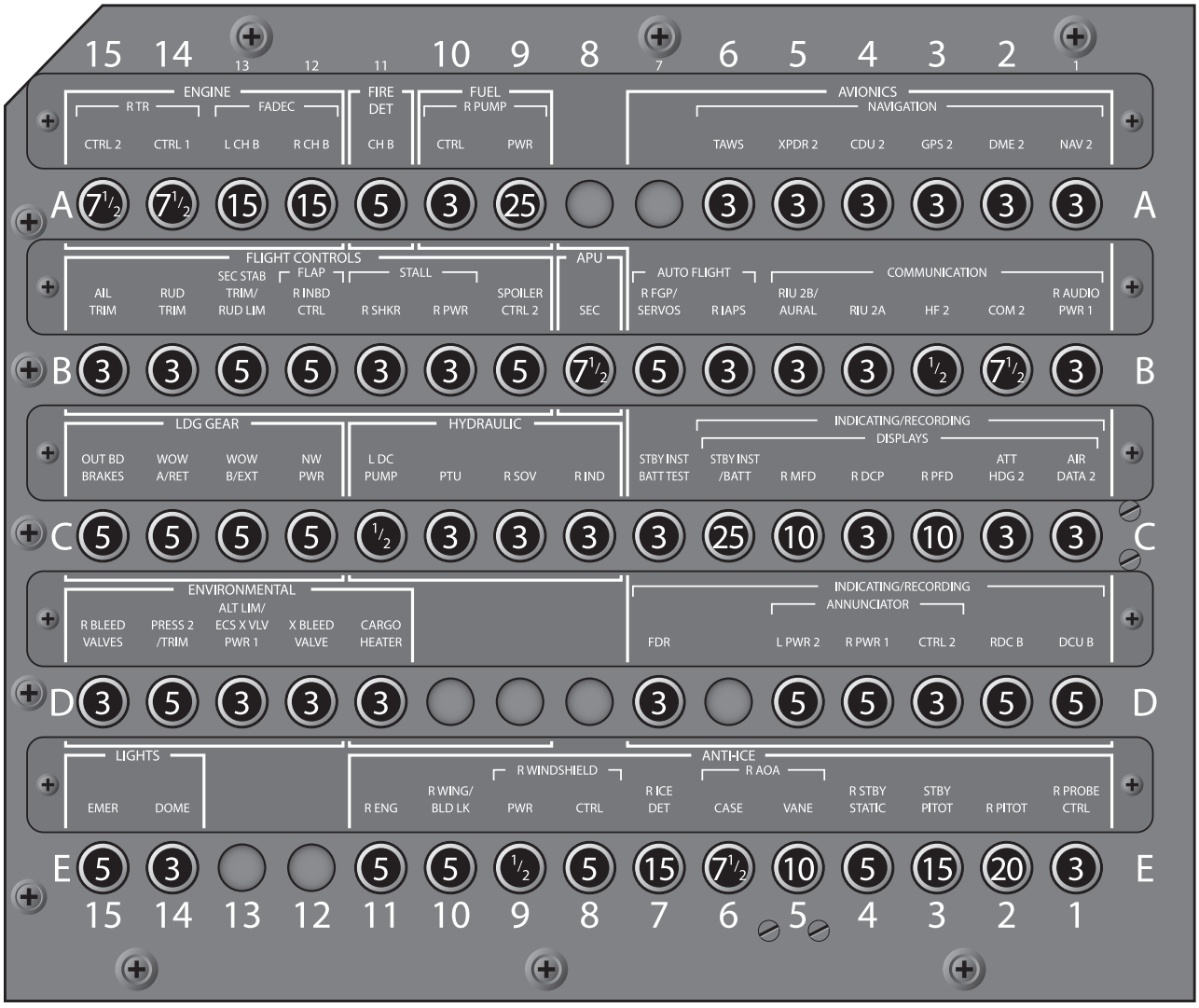


Figure 2-9. CB2 Right Cockpit Circuit Breaker Panel—Typical

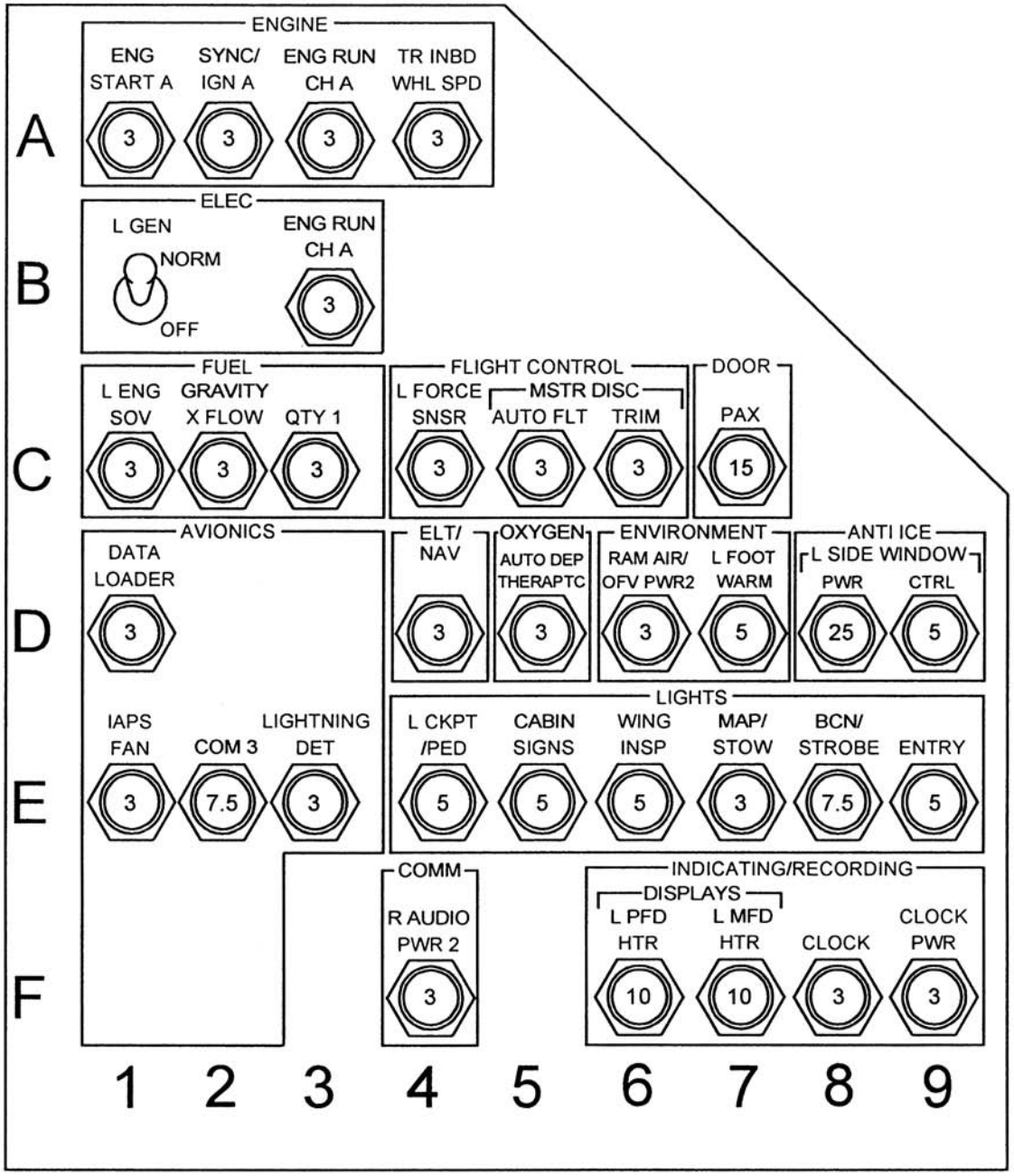


Figure 2-10. CB3 Left Equipment Rack Circuit Breaker Panel—Typical

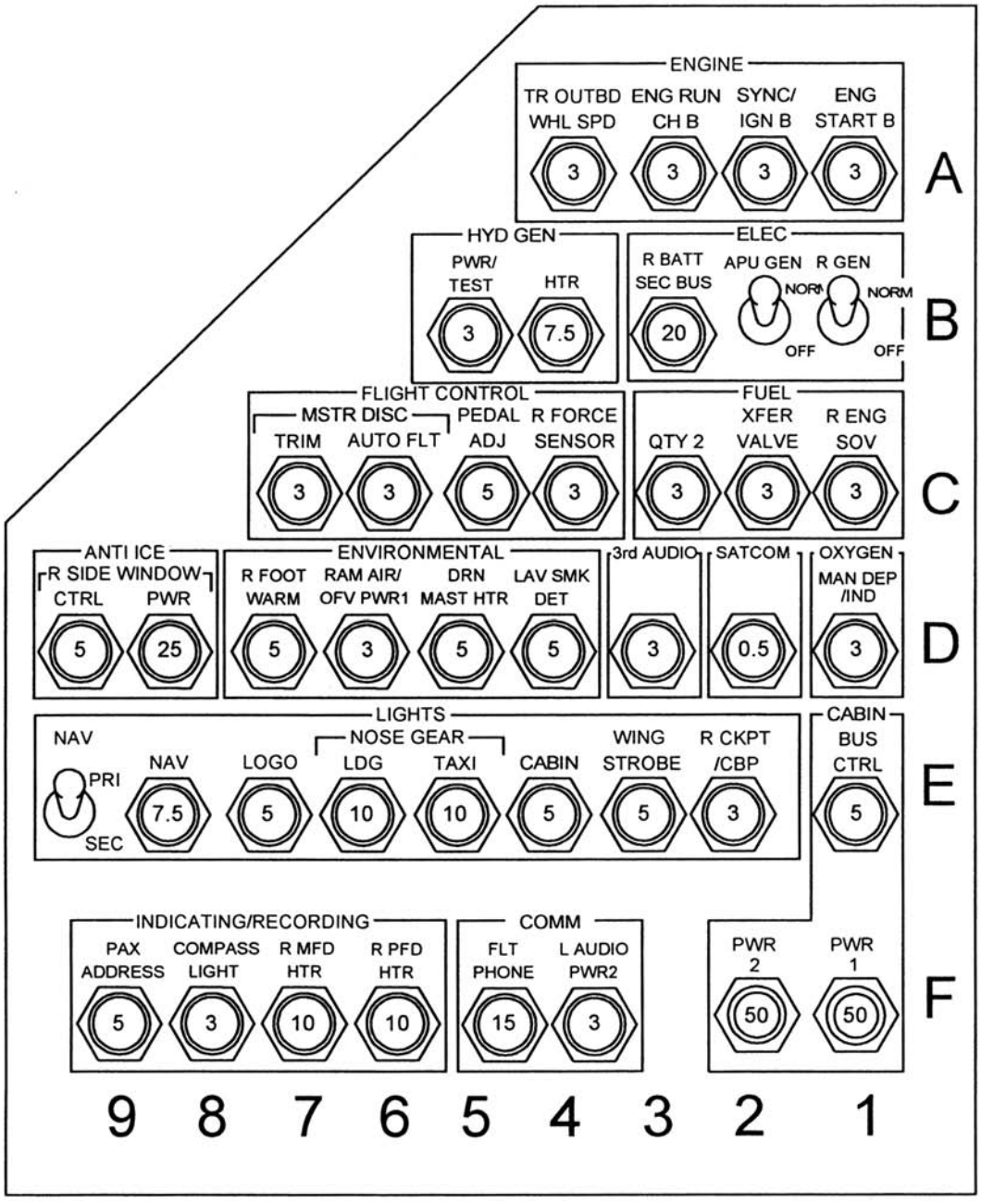


Figure 2-11. CB4 Right Equipment Rack Circuit Breaker Panel—Typical

NORMAL OPERATIONS

During normal operations, the left and right generators power their respective main buses in the DCPCs. The main buses then power their respective essential and aux buses. The left and right batteries continually power their battery buses. As long as the battery switches are selected on, the batteries remain connected to their essential buses for charging. The APU generator can be brought online to supplement the engine-driven generators. With both engine-driven generators operational, the APU generator powers the right main bus along with the right engine-driven generator.

During ground operations on battery power only, the PSEU signals the DCPCs to close the essential contactors (ESSCs), allowing the batteries to power the essential buses, main buses, and auxiliary buses.

For APU starting, the APU start contactor (APSTC) closes, isolating the right battery from the rest of the electrical system. The BTCs close, allowing the left battery to power the rest of the aircraft during the start cycle. The APU starter can also draw from the left battery through the BTCs if the right battery provides insufficient power. In this situation, the left battery does not disconnect from the rest of the electrical system.

While on the ground on APU power, the APU generator directly powers the right main bus, which powers the right essential and right auxiliary buses. The BTCs close, allowing power from the right essential bus to flow to the the left essential bus, the left main bus, and the left auxiliary bus.

ABNORMAL/EMERGENCY OPERATIONS

During inflight single-generator operations, the auxiliary contactors (AUXCs) open, shedding both aux buses. The BTCs close, ensuring that both sides of the aircraft are powered. Additionally, a hydraulic pump may be load-shed by the DCPCs based on electronic logic.

If the APU is brought online with one engine-driven generator operational, the APU will directly power the main bus normally powered by the inoperative generator. However, if the APU generator is the only operational generator, it will directly power the right main bus. Power will then be transferred to the left side via the BTCs.

In the event of a total loss of generated power, the ESSCs open and the BTCs close. The batteries directly power their essential buses and battery buses only, and can share loads through the closed BTCs. The battery duration in this situation is one hour.

MISCELLANEOUS POWER SOURCES

EXTERNAL POWER

Ground power can be connected through a receptacle on the lower right side of the fuselage just below the engine pylon. A control panel above the receptacle provides a test for the panel lights, a guarded APU SHUTDOWN switch, EXT DC captions AVAIL and IN USE, and an ON caption to indicate ground service on (Figure 2-12).

Figure 2-12. External Power Control Panel

The ground power unit (GPU) should be regulated to 28 VDC and 1500 amps. An anti-flash contactor protects against improper voltage and polarity. The contactor closes, connecting the GPU to the aircraft electrical system, if the polarity is correct and the voltage is between approximately 24 and 32V.

The EXT PWR switch is in the cockpit on the ELECTRICAL control panel. The green AVAIL caption illuminates if the GPU is regulated within acceptable parameters. Depressing the EXT PWR switch accepts the power. The ON caption illuminates and the AVAIL caption extinguishes. Depressing the switch again deselects external power.

With the GPU selected ON, the bus tie closes, allowing the GPU to power both sides of the aircraft. All generators are inhibited with the GPU selected ON. The batteries do not have to be selected ON to accept ground power.

The ELECTRICAL synoptic (Figure 2-13) page and SUMMARY page display GPU output voltage and show the flow of ground power through the system. When the AVAIL caption is illuminated, a white EXT PWR icon is displayed on the synoptic page. With ON selected, the icon and appropriate flow lines turn green.

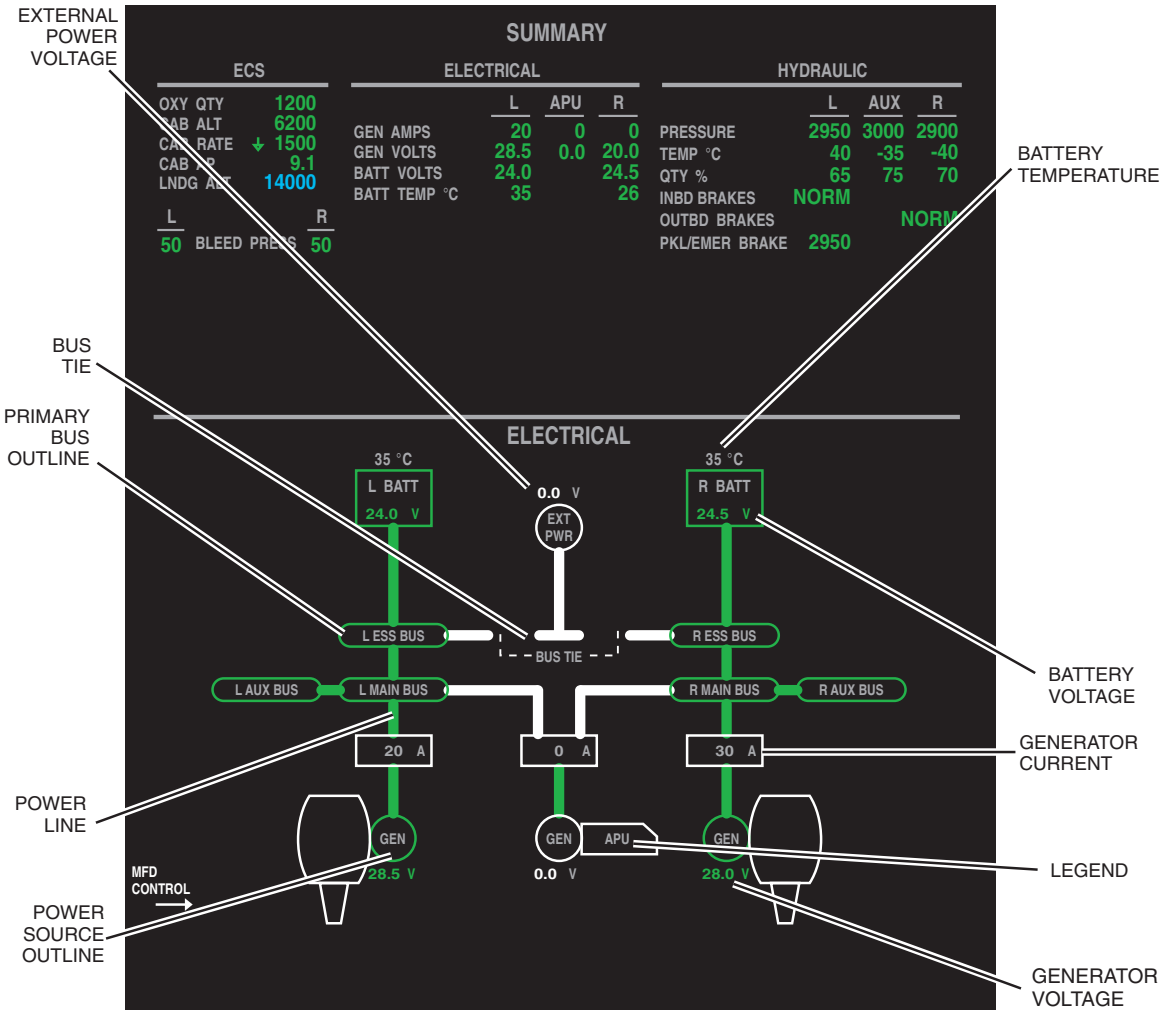


Figure 2-13. ELECTRICAL Synoptic Page

HYDRAULIC MOTOR-DRIVEN GENERATOR

A hydraulic motor-driven generator (HMDG) is available as an option on the Challenger 300. It consists of a hydraulic motor and a 65-amp generator. The generator can provide a non-time limited source of electrical power in case all generated power is lost.

The left hydraulic system powers the HMDG. When selected ON on the ELECTRICAL control panel, the HMDG connects to the electrical system at the bus tie and an ELEC HYD GEN ON (S) message is displayed.

STANDBY INSTRUMENT POWER

A dedicated 24 VDC battery supplies standby instrument power. A separate switch labeled STBY INST on the ELECTRICAL panel activates the standby instrument.

ELECTRICAL CONTROL PANEL

The ELECTRICAL control panel depicts a simplified block diagram of the electrical system, surrounded by various captions (Figure 2-14).

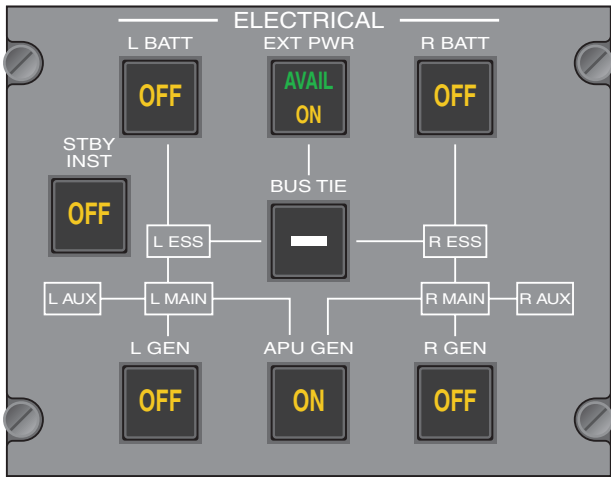


Figure 2-14. Electrical Control Panel

The L and R BATT lights are connected to the L and R ESS buses. Depressing the BATT switches connects the batteries to their ESS buses. The OFF caption illuminates when the battery is not powering its ESS bus. The STBY INST switch also has an OFF caption that illuminates when it is not activated.

The EXT PWR switch has AVAIL and ON captions and is used for selecting and deselecting ground power.

The L and R GEN switches deselect the engine-driven generators. The switches have OFF captions that illuminate when the generators are offline.

The APU GEN switch deselects the APU generator. The switch has an ON caption that illuminates when the generator is online.

The BUS TIE switch in the center of the panel opens both BTCs, inhibiting the automatic connection of the left and right sides of the electrical system.

If the HMDG is installed, a guarded HYD GEN switch with an ON caption is on the right side of the panel (Figure 2-15). Depressing the switch activates the HDMG.

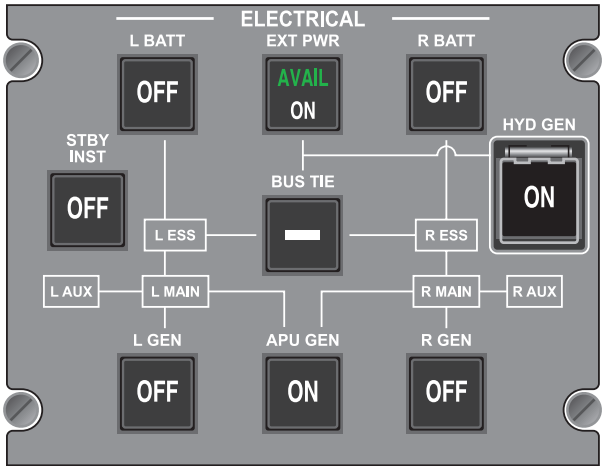


Figure 2-15. HYD GEN Switch

EICAS MESSAGES

Table 2-1 lists the EICAS messages associated with the electrical system, a brief explanation of the message, and whether the message is inhibited during takeoff and/or landing.

Table 2-1. EICAS MESSAGES

MESSAGE	INHIBITS	MEANING	AURAL WARNING
L (R) BATT OVERHEAT	TO/LAND	Respective battery internal temperature exceeded 70°C.	
ESSENTIAL POWER ONLY		The essential buses are powered by the batteries only. AUX and MAIN buses are automatically deactivated in flight.	
APU GEN FAIL	TO/LAND	The APU generator failed.	
APU GEN OVERLOAD	TO/LAND	The APU generator has exceeded 500 amp.	
L (R) BATT FAIL	TO/LAND	Either the respective battery contactor failed or the battery has been automatically disconnected for overheat protection.	
ELECTRICAL FAULT	TO/LAND	An electrical system failure has occurred that prevents display of electrical indications.	
L (R) GEN FAIL	TO/LAND	The affected generator has failed. If the APU generator is not on line, the BUS-TIE will automatically close and, in-flight, the auxiliary buses will not be powered.	
L (R) ESS BUS FAIL	TO/LAND	Affected bus is not powered.	
(L) (R) GEN OVERLOAD	TO/LAND	Respective generator load exceeded 500 amp.	
L (R) MAIN BUS FAIL	TO/LAND	The affected MAIN bus is not powered.	
L (R) AUX BUS FAIL	TO/LAND	The affected auxiliary BUS is not powered with a power source available.	
L (R) AUX BUS OFF	TO/LAND	Respective AUX BUS is selected off.	
ELECTRICAL FAULT	TO/LAND	An electrical system fault occurred, resulting in loss of redundancy in the display of electrical indications.	
STBY INST BATT FAULT	TO/LAND	At least one of the following has occurred: • Standby instrument heater is inoperative • Standby instrument battery charger is inoperative • Standby instrument battery temperature is greater than 80°C • At least two cells of the standby instrument battery have failed.	

Table 2-1. EICAS MESSAGES (Cont)

MESSAGE	INHIBITS	MEANING	AURAL WARNING
APU GEN OFF		APU GEN switch has been selected OFF.	
L (R) BATT OFF		The affected battery has been selected OFF.	
BUS TIE MAN OPEN		The bus tie has been manually selected open. This prevents automatic operation of the bus tie. Pressing the BUS TIE switch a second time restores automatic control.	
ELEC HYD GEN ON		The optional hydraulic motor-driven generator (HMDG) has been activated.	
L (R) GEN OFF		The affected engine generator switch has been selected OFF.	

ELECTRICAL BUSES AND COMPONENTS

The following is a listing of electrical systems and the buses that power them.

LEFT MAIN BUS		
SYSTEM	**COMPONENT**	**CIRCUIT BREAKER LOCATION**
Air Conditioning/Pressurization	OXYGEN AUTO DEP/THERAPEUTIC	CB3-D5
Autoflight	L FGP SERVOS	CB1-B7
Avionics	AIR DATA 1	CB1-C1
Avionics	ANNUNCIATOR R PWR 2	CB1-D5
Avionics	CLOCK PWR	CB3-F9
Avionics	CVR	CB1-D6
Avionics	DATA LOADER	CB3-D1
Avionics	DME 1	CB1-A2
Avionics	HF1 PWR	CB5-A1
Avionics	HF1 RCCB	CB1-B3
Avionics	IAPS FAN	CB3-E1
Avionics	LIGHTNING DET	CB3-E3
Avionics	L MFD HTR	CB3-F7
Avionics	L PFD	CB1-C3
Avionics	L PFD HTR	CB3-F6
Avionics	RAD ALT	CB1-A7
Avionics	R AUDIO PWR 2	CB3-F4
Avionics	TCAS	CB1-A6
Avionics	VHF 3	CB3-E2
Avionics	WX	CB1-A8
Flight Controls	L FORCE SENSOR	CB3-C4
Flight Controls	PRI STAB MOTOR	CB3-C4
Flight Controls	SPOILER CTRL 1	CB1-B9
Flight Controls	STALL PUSHER	CB1-B12
Flight Controls	TRIM PRI STAB	CB1-B15
Ice and Rain Protection	L AOA CASE	CB1-E6
Ice and Rain Protection	L ICE DET	CB1-E7
Ice and Rain Protection	L PITOT	CB1-E2
Ice and Rain Protection	L WINDSHIELD CTRL	CB1-E8
Ice and Rain Protection	L WINDSHIELD PWR	CB1-E9
Ice and Rain Protection	TAT	CB1-E4
Landing Gear, Wheels, Brakes	NWS PWR 1	CB1-C12
Landing Gear, Wheels, Brakes	WOW B	CB1-C14
Miscellaneous	BCN/STROBE LIGHT	CB3-E6
Miscellaneous	CABIN SIGNS	CB3-E5
Miscellaneous	LH LDG LIGHT	CB5-A5
Miscellaneous	LIGHTS L CKPT/PED	CB3-E4
Miscellaneous	MAP STOW LIGHT	CB3-E7
Miscellaneous	WING INSP LIGHT	CB3-E6
Powerplant	SYNC/IGN A	CB3-A2

RIGHT MAIN BUS

SYSTEM	COMPONENT	CIRCUIT BREAKER LOCATION
Air Conditioning/Pressurization	PRESS 2/TRIM	CB2-D14
Air Conditioning/Pressurization	RAM AIR/OFV PWR 1	CB4-D6
Autoflight	R FGP SERVOS	CB2-B7
Avionics	AIR DATA 2	CB2-C1
Avionics	ANNUNCIATOR L PWR 2	CB2-D5
Avionics	ATT HDG 2	CB2-C2
Avionics	CDU 2	CB2-A4
Avionics	COM 2	CB2-B2
Avionics	DME 2	CB2-A2
Avionics	EICAS DCU B	CB2-D1
Avionics	EICAS RDC B	CB2-D2
Avionics	FAN PWR 2	CB6-B2
Avionics	FLIGHT PHONE	CB4-F5
Avionics	GPS 2	CB2-A3
Avionics	HF 2	CB2-B3
Avionics	HF 2 PWR	CB6-A1
Avionics	L AUDIO PWR 2	CB4-F4
Avionics	NAV 2	CB2-A1
Avionics	R DCP	CB2-C4
Avionics	RIU 2A	CB2-B4
Avionics	RIU 2B/AURAL	CB2-B5
Avionics	R PFD	CB2-C3
Avionics	R PFD HTR	CB4-F6
Avionics	R MFD	CB2-C5
Avionics	R MFD HTR	CB4-F7
Avionics	SATCOM	CB4-D2
Avionics	SATCOM CONTROL	CB6-A2
Avionics	TAWS	CB2-A6
Avionics	XPDR 2	CB2-A5
Avionics	3RD AUDIO	CB4-D3
Fire Protection	LAV SMK	CB4-D4
Flight Controls	R FORCE SENSOR	CB4-C4
Flight Controls	RUD PEDAL ADJ	CB4-C5
Flight Controls	SPOILER CTRL 2	CB2-B9
Flight Controls	STALL R PWR	CB2-B10
Flight Controls	STALL R SHKR	CB2-B11

RIGHT MAIN BUS (Cont)		
SYSTEM	**COMPONENT**	**CIRCUIT BREAKER LOCATION**
Fuel	FUEL QTY 2	CB4-C3
Fuel	FUEL XFER VALVE	CB4-C2
Hydraulics	L DCMP RCCB	CB2-C11
Ice and Rain Protection	R AOA CASE	CB2-E6
Ice and Rain Protection	R AOA VANE	CB2-E5
Ice and Rain Protection	R ICE DET	CB2-E7
Ice and Rain Protection	R PITOT	CB2-E2
Ice and Rain Protection	R WINDSHIELD CTRL	CB2-E8
Ice and Rain Protection	R WINDSHIELD PWR	CB2-E9
Ice and Rain Protection	R WING/BLD LK	CB2-E10
Landing Gear, Wheels, Brakes	NWS PWR 2	CB2-C12
Landing Gear, Wheels, Brakes	WOW A/RET	CB2-C14
Miscellaneous	APU SECONDARY CONTROL	CB2-B8
Miscellaneous	CABIN LIGHTS	CB4-E4
Miscellaneous	CARGO HEATER	CB2-D11
Miscellaneous	DRN MAST HTR	CB4-D5
Miscellaneous	EMER LTS	CB2-E15
Miscellaneous	LIGHTS R CKPT/CBP	CB4-E2
Miscellaneous	NAV LTS	CB4-E8
Miscellaneous	NOSE LDG LIGHT	CB4-E6
Miscellaneous	NOSE TAXI LIGHT	CB4-E5
Miscellaneous	RH LDG LIGHT	CB6-A6
Powerplant	SYNC/IGN B	CB4-A2

LEFT ESSENTIAL BUS		
SYSTEM	**COMPONENT**	**CIRCUIT BREAKER LOCATION**
Air Conditioning/Pressurization	ALT LIM/ECS XVLV PWR 2	CB1-D13
Air Conditioning/Pressurization	L BLEED VALVES	CB1-D15
Air Conditioning/Pressurization	PRESS 1/PACK	CB1-D14
Air Conditioning/Pressurization	RAM AIR/OFV PWR 2	CB3-D6
Autoflight	MASTER DISC AUTO FLIGHT	CB3-C5
Avionics	ANNUNCIATOR CTRL 1	CB1-D3
Avionics	ANNUNCIATOR L PWR 1	CB1-D4
Avionics	ATT HDG 1	CB1-C2
Avionics	CDU 1	CB1-A4
Avionics	COM 1	CB1-B2
Avionics	EICAS DCU A	CB1-D1
Avionics	EICAS RDC A	CB1-D2
Avionics	ELT/NAV	CB3-D4
Avionics	GPS 1	CB1-A3
Avionics	L AUDIO PWR 1	CB1-B1
Avionics	L DCP	CB1-C4
Avionics	L IAPS	CB1-B6
Avionics	L MFD	CB1-C5
Avionics	NAV 1	CB1-A1
Avionics	RIU 1A	CB1-B5
Avionics	RIU 1B/AURAL	CB1-B4
Avionics	XPDR 1	CB1-A5
Fire Protection	FIRE DET CH A	CB1-A11
Flight Controls	FLAP CTRL	CB1-B14
Flight Controls	FLAP L IND	CB1-B13
Flight Controls	MSTR DISC (TRIM)	CB3-C6
Flight Controls	STALL L PWR	CB1-B10
Flight Controls	STALL L SHKR	CB1-B11
Fuel	FUEL GRAV XFLOW	CB3-C2
Fuel	FUEL QTY 1	CB3-C3
Fuel	L FUEL PUMP CTRL	CB1-A9
Fuel	L FUEL PUMP PWR	CB1-A10
Hydraulics	AUX DCMP RCCB	CB1-D10
Hydraulics	HYD SYS AUX IND	CB1-D9
Hydraulics	HYD SYS L IND	CB1-C9
Hydraulics	R DCMP RCCB	CB1-C11

LEFT ESSENTIAL BUS (Cont)		
SYSTEM	**COMPONENT**	**CIRCUIT BREAKER LOCATION**
Ice and Rain Protection	L AOA VANE	CB1-E5
Ice and Rain Protection	L NAC (ENG)	CB1-E11
Ice and Rain Protection	L PROBE CTRL	CB1-E1
Ice and Rain Protection	L SIDE WINDOW CTRL	CB3-D9
Ice and Rain Protection	L SIDE WINDOW PWR	CB3-D8
Ice and Rain Protection	L STBY STATIC	CB1-E3
Ice and Rain Protection	L WING/BLD LK	CB1-E10
Landing Gear, Wheels, Brakes	INBD BRAKES	CB1-C15
Landing Gear, Wheels, Brakes	WOW A/RET/EXT	CB1-C13
Miscellaneous	APU	CB1-B8
Powerplant	ENG RUN CH A	CB3-A3
Powerplant	ENG START A	CB3-A1
Powerplant	FADEC L CH A	CB1-A13
Powerplant	FADEC R CH A	CB1-A12
Powerplant	L ATS/HYD SOL	CB5-A2
Powerplant	L TR CNTL 1	CB1-A14
Powerplant	L TR CNTL 2	CB1-A15
Powerplant	TR INBD WHL SPD	CB3-A4

RIGHT ESSENTIAL BUS		
SYSTEM	**COMPONENT**	**CIRCUIT BREAKER LOCATION**
Air Conditioning/Pressurization	ALT LIM/ECS XVLV PWR 1	CB2-D13
Air Conditioning/Pressurization	R BLEED VALVES	CB2-D15
Air Conditioning/Pressurization	XBLEED VALVE	CB2-D12
Autoflight	MASTER DISC AUTO FLIGHT	CB4-C6
Avionics	ANNUNCIATOR R PWR 1	CB2-D4
Avionics	FDR	CB2-D7
Avionics	PAX ADDRESS	CB4-F9
Avionics	R AUDIO PWR 1	CB2-B1
Avionics	R IAPS	CB2-B6
Avionics	STBY INST/BATT	CB2-C6
Avionics	STBY INST BATT TEST	CB2-C7
Fire Protection	FIRE DET CH B	CB2-A11
Flight Controls	AIL TRIM	CB2-B15
Flight Controls	FLAP R IND/CTRL	CB2-B12
Flight Controls	MSTR DISC (TRIM)	CB4-C7
Flight Controls	RUD TRIM	CB2-B14
Flight Controls	SEC STAB MOTOR	CB6-A5
Flight Controls	TRIM SEC STAB	CB2-B13
Fuel	R FUEL PUMP CTRL	CB2-A10
Fuel	R FUEL PUMP PWR	CB2-A9
Hydraulics	HYD GEN PWR/TEST	CB4-B5
Hydraulics	HYD PTU	CB2-C10
Hydraulics	HYD SYS R IND	CB2-C8
Ice and Rain Protection	R NAC (ENG)	CB2-E11
Ice and Rain Protection	R PROBE CTRL	CB2-E1
Ice and Rain Protection	R STBY STATIC	CB2-E4
Ice and Rain Protection	STBY PITOT	CB2-E3
Landing Gear, Wheels, Brakes	OUTBD BRAKES	CB2-C15
Landing Gear, Wheels, Brakes	WOW B/EXT	CB2-C13
Miscellaneous	COMPASS LIGHTING	CB4-F8
Miscellaneous	OVHD LIGHTS	CB2-E14
Miscellaneous	OXYGEN MAN DEP/IND	CB4-D1
Powerplant	ENG RUN CH B	CB4-A3
Powerplant	ENG START B	CB4-A1
Powerplant	FADEC L CH B	CB2-A13
Powerplant	FADEC R CH B	CB2-A12
Powerplant	R ATS/HYD SOL	CB6-A3
Powerplant	R TR CNTL 1	CB2-A14
Powerplant	R TR CNTL 2	CB2-A15
Powerplant	TR OUTBD WHL SPD	CB4-A4

SYSTEM	COMPONENT	CIRCUIT BREAKER LOCATION
LEFT BATTERY BUS		
Avionics	CLOCK	CB3-F8
Fire Protection	FIREX A	CB5-A3
Fuel	L ENG SOV	CB3-C1
Hydraulics	L HYD SOV	CB1-C10
Miscellaneous	ENTRY LTS	CB3-E9
Miscellaneous	EXT BAG/AFT BAY LIGHT	CB5-A5
Miscellaneous	PAX DOOR	CB3-C7
RIGHT BATTERY BUS		
Fire Protection	FIREX B	CB6-A4
Fuel	R ENG SOV	CB4-C1
Fuel	REFUEL/DEFUEL CONTROL	CB6-C4
Fuel	REFUEL/DEFUEL VALVES	CB6-C5
Hydraulics	R HYD SOV	CB2-C9
LEFT AUXILIARY BUS		
Miscellaneous	CABIN INVRT	CB5-B1 (FUSE)
Miscellaneous	L FOOT WARMER	CB3-D7
RIGHT AUXILIARY BUS		
Ice and Rain Protection	R SIDE WINDOW CTRL	CB4-D9
Ice and Rain Protection	R SIDE WINDOW PWR	CB4-D8
Hydraulics	HYD GEN HTR	CB4-B4
Miscellaneous	BAG COMP HTR PWR 1	CB6-C6
Miscellaneous	BAG COMP HTR PWR 2	CB6-C7
Miscellaneous	CABIN BUS PWR CNTL	CB4-E1
Miscellaneous	CABIN BUS PWR NO 1	CB4-F1
Miscellaneous	CABIN BUS PWR NO 2	CB4-F2
Miscellaneous	R FOOT WARMER	CB4-D7

QUESTIONS

1. The AC inverters provide power for:
   a. The standby instrument
   b. Passenger conveniences only
   c. Cargo heat
   d. Engine instrument annunciation

2. Individual battery voltage can be read on:
   a. Voltage indicator
   b. EICAS messages
   c. Electrical control panel
   d. The electrical synoptic page

3. The generators come online:
   a. When the bus tie switch is opened on the electrical control panel
   b. With engines running and ground power activated
   c. Automatically with engines running and ground power deactivated
   d. When the generator switch is pushed on the electrical control panel

4. When are the auxiliary buses load shed:
   a. In flight, with only one generator operative
   b. In flight or on the ground, with only one generator operative
   c. On the ground
   d. On the ground whenever the APU generator is the only generator on line

5. What buses will remain powered during loss of all generators in flight:
   a. The main buses
   b. The essential buses only
   c. The essential and battery buses
   d. The auxiliary buses

6. When does the green AVAIL light illuminate on the electrical control panel:
   a. When external power is selected on the external electrical control panel
   b. When the GPU voltage and polarity is correct
   c. When the EXT PWR switch is selected on the electrical control panel
   d. When battery switches are selected on and external power is selected

7. Selecting the battery switch to the ON position:
   a. Connects the batteries to the battery buses
   b. Connects the batteries to their respective essential buses
   c. Connects the batteries to their respective main buses
   d. Connects the batteries to their respective main and auxiliary buses

8. The DC power centers provide the following except for:
   a. Power for loads in the front section of the aircraft
   b. Power for loads in the aft section of the aircraft
   c. Electronic logic for load shedding
   d. Their respective main, essential, battery and aux buses

9. The secondary power centers provide power for the following except:
   a. The cockpit circuit breaker panel
   b. Loads in the front section of the aircraft
   c. Loads in the aft section of the aircraft
   d. The circuit breaker panels on the equipment rack

CHAPTER 3
AIRCRAFT LIGHTING

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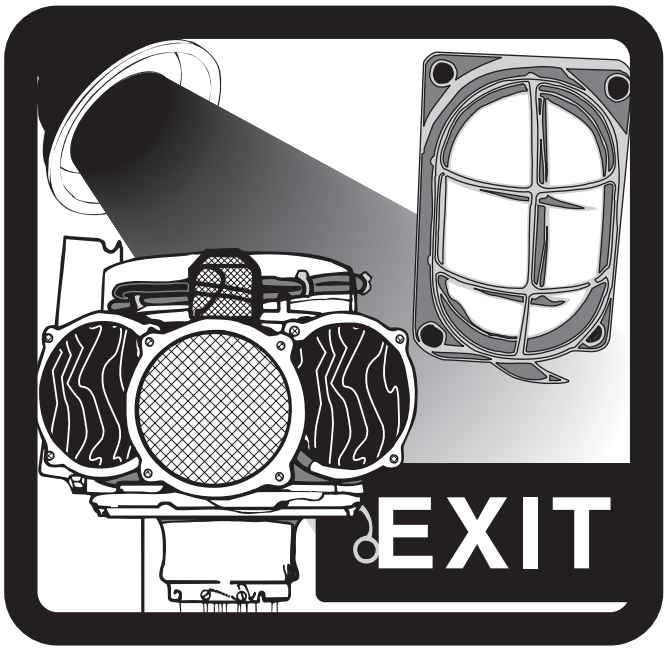
CHAPTER 3
AIRCRAFT LIGHTING



INTRODUCTION

The Challenger 300 lighting system provides interior and exterior illumination of the aircraft. In addition, lights provide information and guidance to passengers in normal and emergency situations.

GENERAL

The lighting system includes the following:

- Flight compartment
- Emergency
- Entrance and cabin
- Service compartment
- External

Control panels on the center pedestal and side consoles control the flight compartment and external lighting systems.

Passenger compartment lighting consists of indirect LED lighting and adjustable reading lights in the overhead passenger service unit (PSU).

The flight crew controls the emergency lights from the cockpit. When armed, the emergency lights automatically illuminate when right main bus power is lost (i.e., total loss of generated electrical power). Emergency lighting, which is provided by the emergency power supply units, lasts a minimum of 10 minutes at critical ambient conditions (e.g., low temperature).

EICAS messages display the status of the emergency lights and passenger signs.

FLIGHT COMPARTMENT

The cockpit lighting provides illumination of all control panels and instruments in the cockpit that are not otherwise illuminated by their own integral lighting system or display. Cockpit lighting includes the following:

- Dome light
- Stowage light
- Reading lights
- Integral lighting system

COCKPIT LIGHTING

Dome Light

The cockpit dome light is a one-light unit in the overhead fascia panel. It provides general illumination of the cockpit and its entrance area. The right essential bus powers the dome light.

Stowage Lights

The stowage light on the aft end of the center pedestal illuminates the cockpit stowage box. When the stowage door is opened, the light is activated.

Reading Lights

Two reading lights recessed in the headliner on each side of the cockpit provide illumination to the pilot and copilot lap area (Figure 3-1). Each light can be rotated ±30°. The unit has a built-in shutter with an ON/OFF position and continuous light intensity adjustment from bright to dim.

Figure 3-1. Cockpit Area

Integral Lighting System

The integral lighting system is divided into the following four control zones (Figure 3-2):

- Zone 1—Pilot panel and part of glareshield
- Zone 2—Center pedestal
- Zone 3—Copilot panel and part of glareshield
- Zone 4—Circuit breaker panels

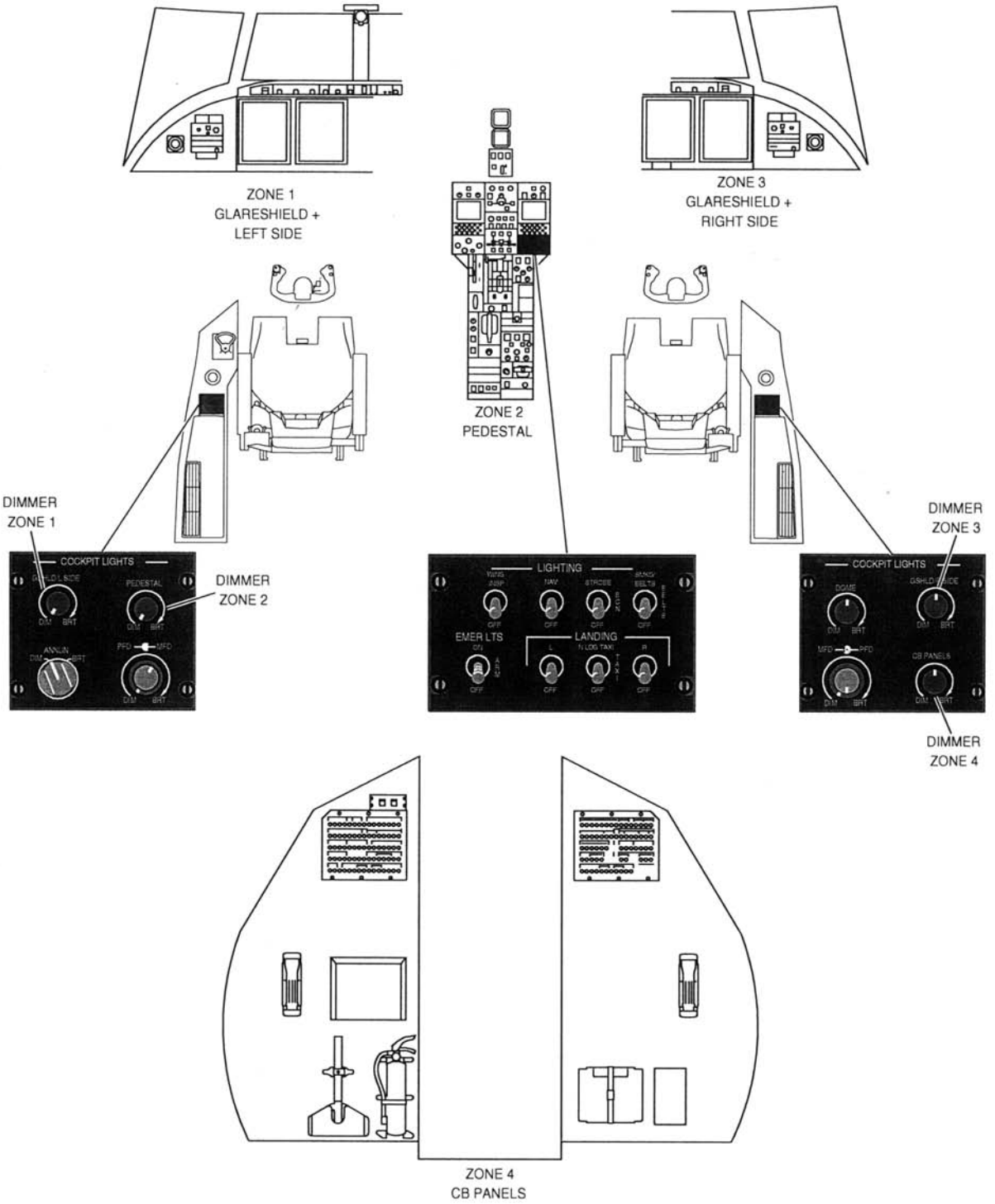


Figure 3-2. Flight Compartment Lighting Zones

Left Cockpit Lights Panel

The left COCKPIT LIGHT panel is powered by 28 VDC (Figure 3-3). Controls include the following:

- GSHLD/L SIDE—Dims pilot display control panel (DCP), flight guidance panel, pilot audio panel, pilot compass control panel, left COCKPIT LIGHT panel, and standby compass
- PEDESTAL—Controls lighting intensity of equipment on the pedestal except for the FMS display, which is regulated by the dim button on the FMS control panel
- ANNUN—Controls brightness of the other switches from DIM to BRT
- PFD/MFD—Controls intensity of the primary flight display (PFD) and the multi-function display (MFD)

Right Cockpit Lights Panel

The right COCKPIT LIGHT panel also receives 28 VDC power (Figure 3-4). Controls include the following:

- DOME—Controls overhead dome light
- GSHLD/R SIDE—Dims copilot DCP, copilot audio panel, copilot compass control panel, and right COCKPIT LIGHT panel
- MFD/PFD—Controls intensity of the MFD and PFD
- CB PANELS—Controls intensity of lighting to the pilot and copilot circuit breaker panels.

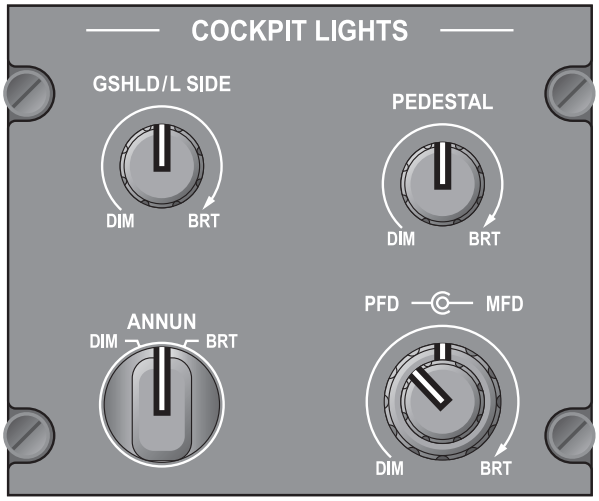


Figure 3-3. Left COCKPIT LIGHT Panel

Figure 3-4. Right COCKPIT LIGHT Panel

Standby Instrument Lighting

The standby instrument lights supply lighting to the standby compass, standby instrument, and clock (Figure 3-5). Normally powered by the left main bus, the standby instrument lights automatically switch to the right essential bus if left main bus power is lost.

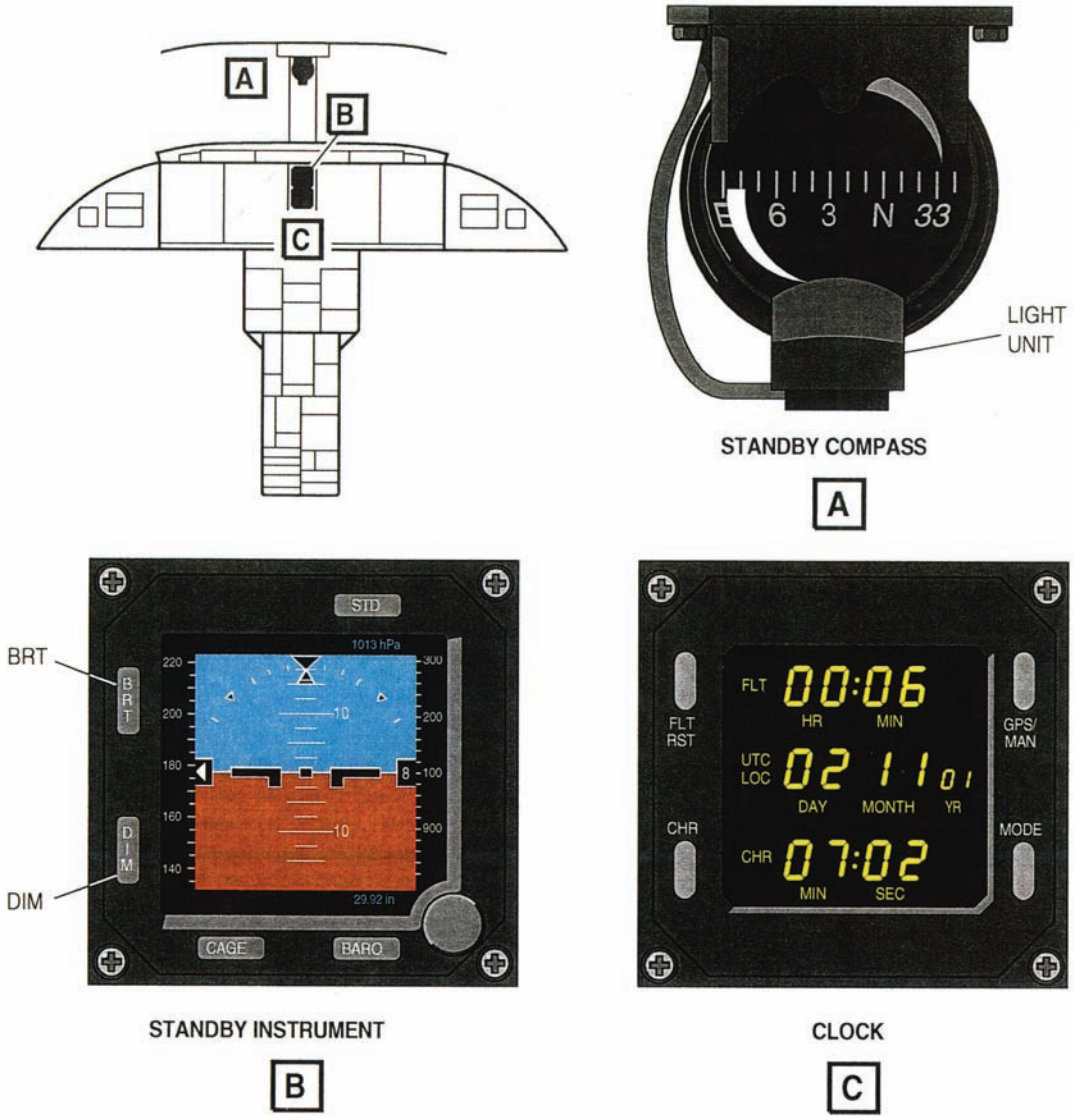


Figure 3-5. Standby Instrument Lighting

Miscellaneous Lighting

Chart holders on the control yokes have integral lights (Figure 3-6).

Figure 3-6. Integral Lights on Chart Holders

Flashlights are in holders behind the pilot and copilot seats below the circuit breaker panels (Figure 3-7). Flashlights are also available in the lavatory area of the cabin.

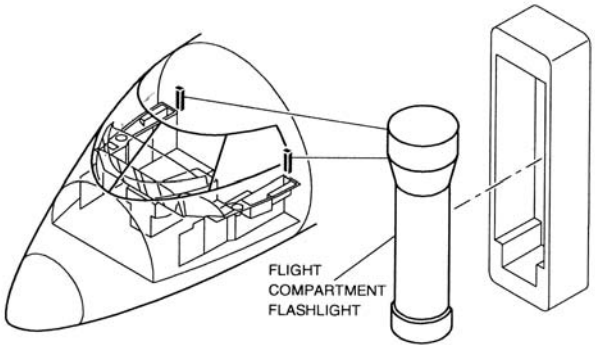


Figure 3-7. Cockpit Flashlight

EMERGENCY

Emergency lighting contributes to the safe exit of passengers during an emergency (Figure 3-8). The following components comprise the system:

- Exit signs
- Ceiling emergency floodlights
- Floor emergency floodlights
- Exterior emergency lights

Figure 3-8. Emergency Exit Light

Figure 3-9 depicts the location and type of lighting for the emergency system.

Two independent rechargeable battery packs provide approximately 15 minutes of power for the emergency lights. Battery duration may be reduced to a minimum of approximately 10 minutes at critical ambient conditions.

The LIGHTING control panel contains an EMER LTS switch with three positions: ON-ARM-OFF.

- ON—Emergency lights illuminate; EMER LIGHTS ON caution message displayed on EICAS
- ARM—All interior and exterior emergency lights illuminate automatically when right main bus power is lost
- OFF—Emergency lights are inhibited; when battery switch selected ON, EMER LIGHTS OFF caution message is displayed

During an emergency, the exterior emergency lights illuminate the aircraft's immediate area.

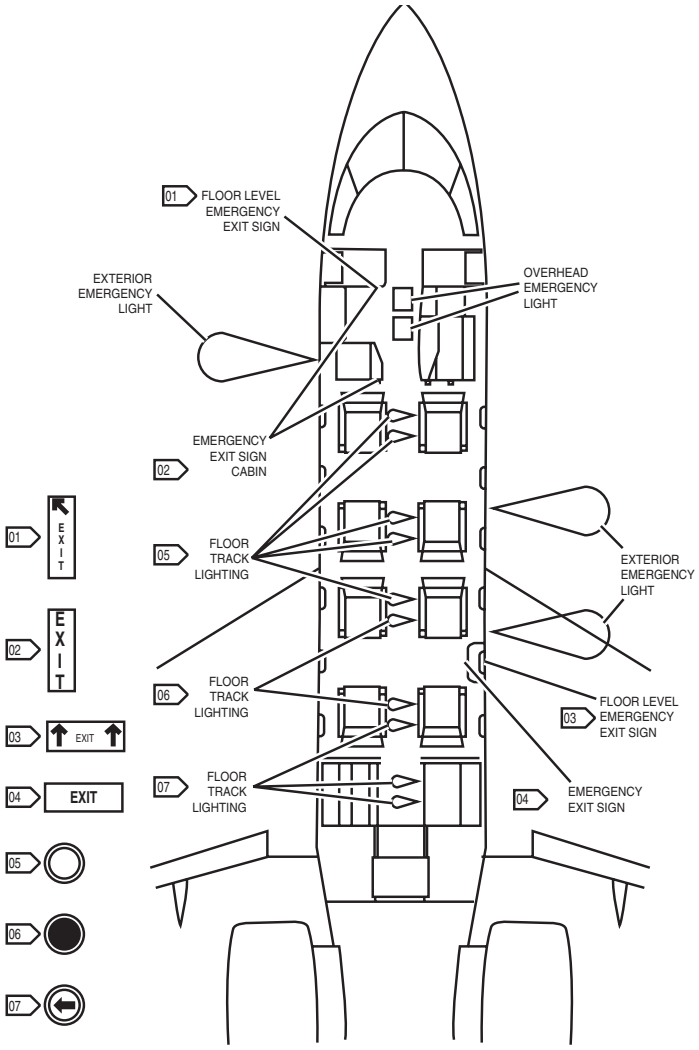


Figure 3-9. Emergency Lighting—Location and Components

ENTRANCE AND CABIN

Entrance and cabin lighting provides for safe entry and exit through the main cabin door as well as a comfortable, adjustable lighting environment for the passeger compartment.

The left and right main buses power the cabin lighting except for the entry/exit lighting and baggage compartment lighting.

Entrance and cabin lighting include the following:

- Entry/exit
- Overhead
- Passenger reading/table
- Galley
- Lavatory (read/vanity)
- Seat belts/no smoking
- Baggage

The main entryway control panel (Figure 3-10) on the left storage cabinet aft of the main cabin door controls the primary cabin lighting. An optional CABIN LIGHTS control panel is on the center pedestal in the cockpit.

Entry/Exit

The cabin entry/exit lights consist of the airstair lights (Figure 3-11) and an overhead entryway dome light. These lights are controlled by the ENTRY LIGHTS switches on the main entryway lighting control panel and the outside door operating switch. The entry/exit lights are powered by the left battery bus and turn off automatically when the cabin door is closed.

Figure 3-10. Entryway Lighting Control Panel

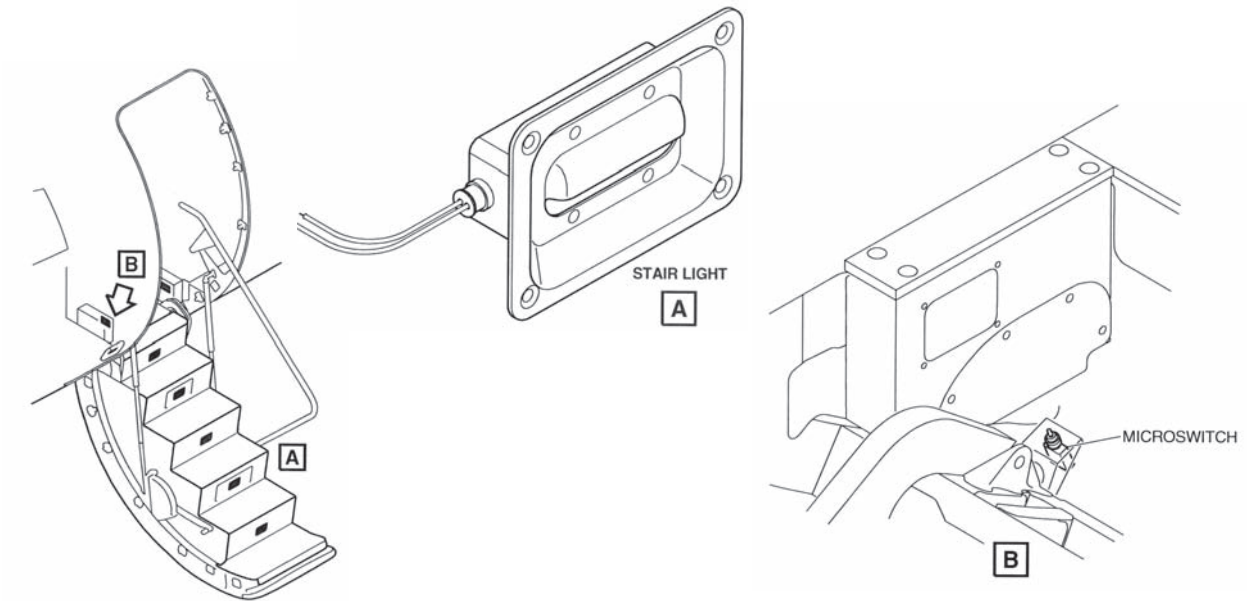


Figure 3-11. Airstair Lighting

Overhead

The overhead lights consist of LED lighting within the cabin passenger service unit (Figure 3-12). Lenses cover the lights. The CABIN LIGHTS menu on the main entry control panel controls the lights.

Figure 3-12. Cabin Overhead Lights

Passenger Reading/Table

Lights in the passenger service units above the seats on each side of the cabin provide directed illumination. The seats have one light while the table lights have a two-light assembly above each table. Armrest-mounted control units are provided (Figure 3-13).

Figure 3-13. Passenger Light Control Units

Galley

The passenger refreshment area has fluorescent lighting.

Lavatory

Lavatory lights consist of wraparound fluorescent lights covered with lenses and two overhead spotlights (one above the left cabin stowage area and one above the toilet). The lavatory control panel and the main entryway control panel control the spotlights.

The LAV LIGHTS menu switch on the main entryway panel and the LIGHT switch on the lavatory panel control the fluorescent light.

No Smoking/Seat Belts Lights

A switch on the LIGHTING panel controls the various no smoking/seat belts signs throughout the aircraft (Figure 3-14). The SMKG/BELTS switch has positions for OFF, BELTS, and SMKG/BELTS.

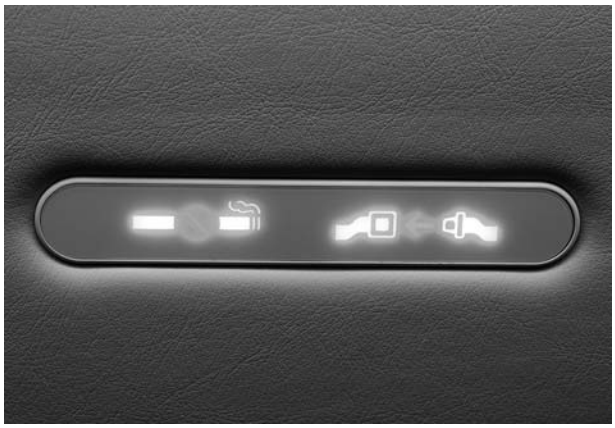


Figure 3-14. SMKG/BELTS Signs

Baggage Lights

A switch inside the baggage compartment controls the internal light. The switch is automatically switched off when the cargo bay door is closed. The left battery bus powers the light. The main entry light control panel can also control the internal baggage compartment light.

A cargo loading light is also provided for the area in front of the cargo door (Figure 3-15).

SERVICE COMPARTMENT

The service lights provide adequate lighting to the work area of the aircraft for general servicing, maintenance, and inspection purposes. Two service lights in the aft compartment illuminate that area (Figure 3-15).

The auto shutoff box may be switched on by a single click on the pushbutton. After 15 minutes in normal operation, the lights automatically flash for a period of 10 seconds. The lights then go back to normal operation for approximately five minutes. After 20 minutes of total time, the auto shutoff box automatically switches to standby mode. The timing interval can be reset or restarted by pressing the button a second time while the lights are on. Two quick clicks switches the auto shutoff box from normal operation to standby operation.

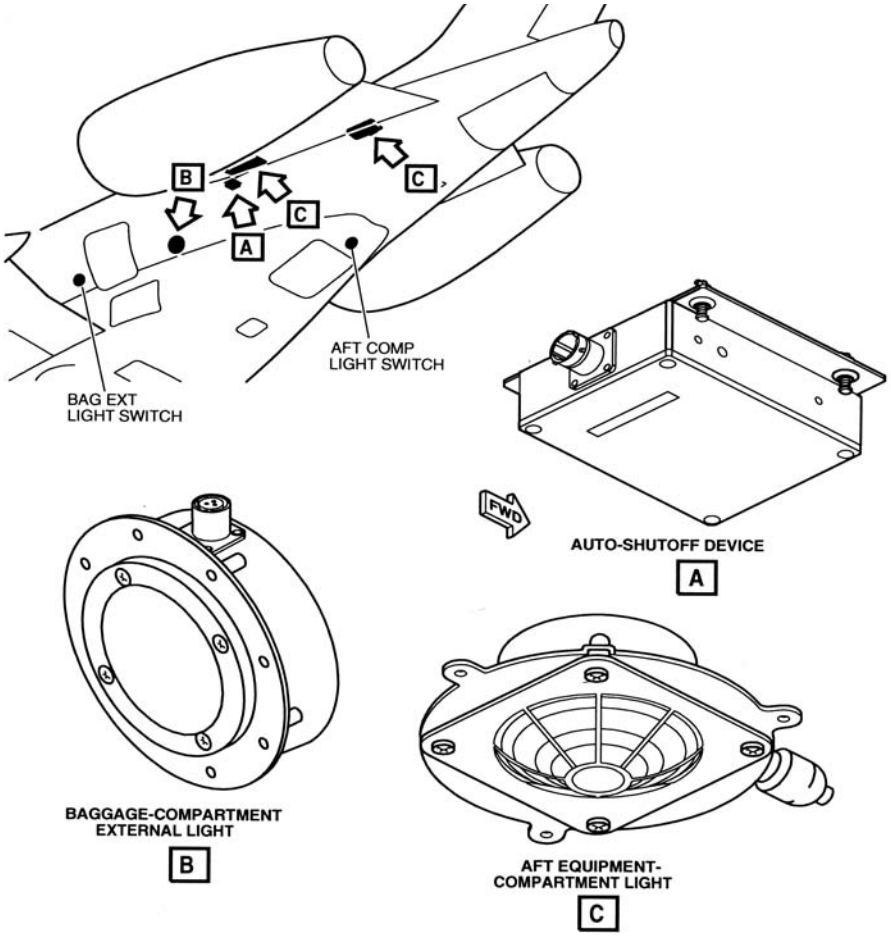


Figure 3-15. Cargo and Service Compartments Lighting

EXTERNAL

The following external lights make the aircraft visible to other aircraft and controllers:

- Anti-collision strobe and optional wing tip anti-collision strobe
- Rotating beacons
- Navigation
- Logo (optional)

In addition, the Challenger 300 external lighting system has wing inspection lights, a taxi light, a nose gear landing light, and two high intensity discharge (HID) landing lights.

Figure 3-16 locates the various external lights.

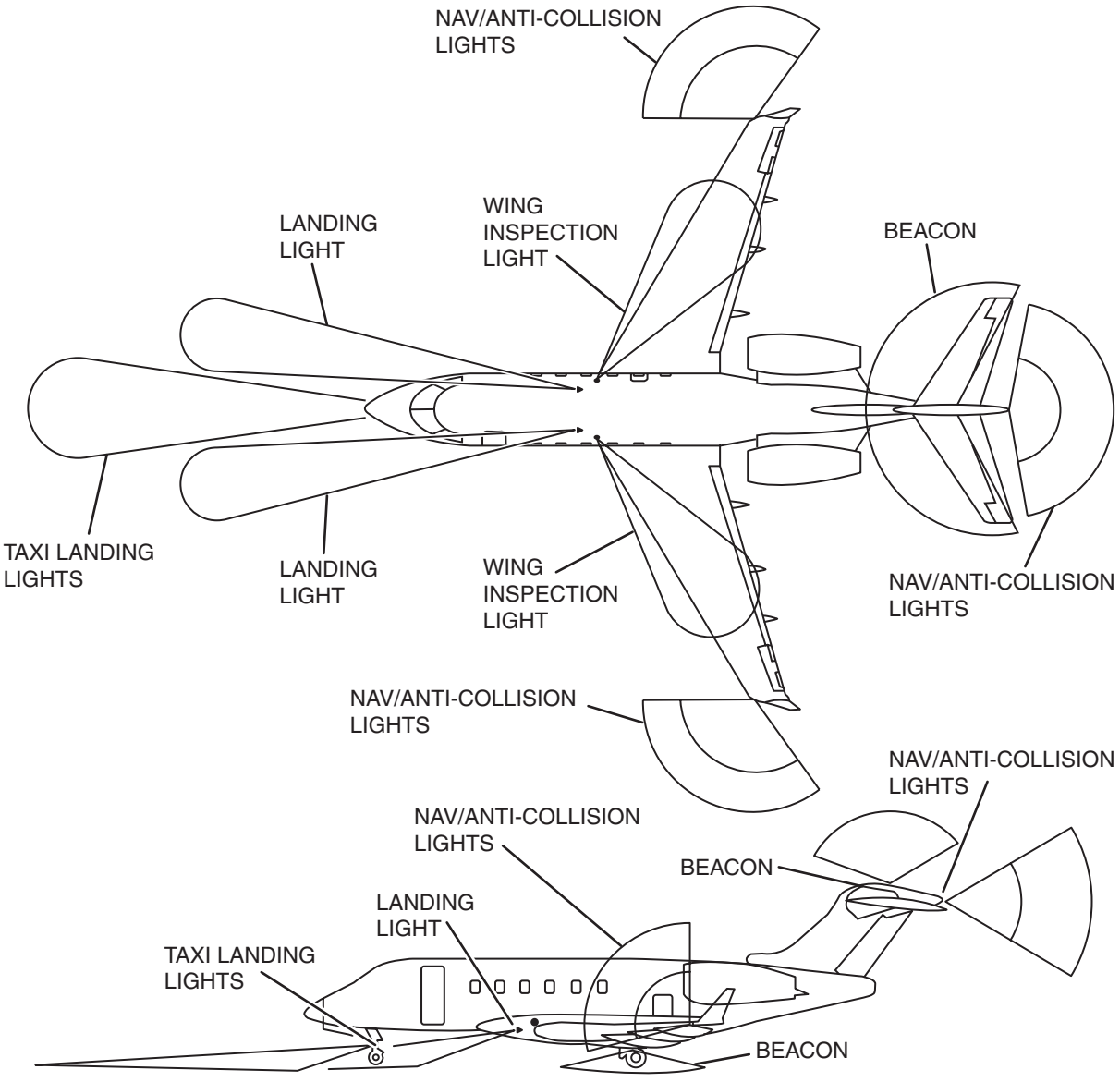


Figure 3-16. Aircraft External Lighting

The LIGHTING control panel on the pedestal contains switches for emergency lights, ordinance signs (SMKG/BELTS), and external lighting (Figure 3-17).

STROBE/BEACON LIGHTS

The STROBE BCN switch controls the red beacon lights, white anti-collision strobe lights, and the optional wing anticollision strobe light. The color of the strobe/beacon light system can be selected white or red depending on switch position: STROBE for white and BCN for red.

The red light system is normally for ground operations because it minimizes the effects on vision of crew or personnel outside the aircraft during ground handling. Because the light emission of the red light is reduced, it cannot be used as a backup anticollision light.

The shape of the strobe/beacon lights minimizes aerodynamic drag.

A dedicated power supply powers the lights. When the STROBE BCN switch is selected to any position, the flight data recorder (FDR) is activated.

NAVIGATION LIGHTS

The navigation lights allow an observer to visually track, orient, or position an aircraft in flight.

The navigation lights have a dual light system that increases dispatch reliability.

The wing tip navigation lights consist of a primary and secondary unit in each wing tip under the same lens (Figure 3-18). The NAV switch, which is on the right avionics rack circuit breaker panel, has PRI and SEC positions. If the primary navigation light fails, the secondary light illuminates when the NAV switch is selected to SEC.

The optional wingtip strobes replace the secondary navigation lights. In this configuration, the NAV switch on the circuit breaker panel affects only the tail navigation lights.

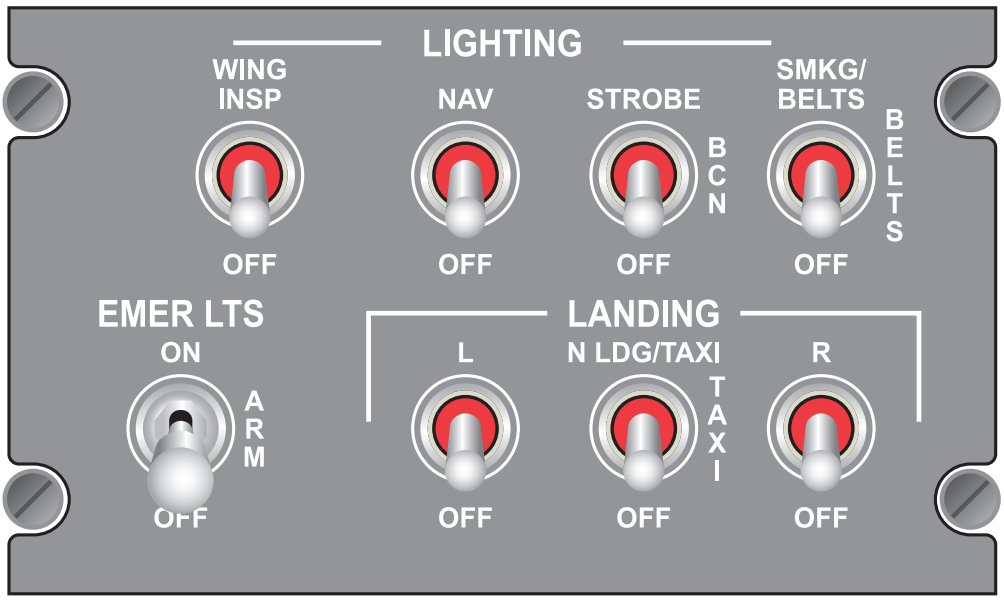


Figure 3-17. LIGHTING Control Panel

Figure 3-18. Wing Tip Navigation Lights

Tail Navigation Light

The tail navigation light also utilizes a dual light system of two identical high intensity halogen lamps in each unit (Figure 3-19). The upper unit is the primary tail navigation light while the lower unit is the secondary light.

The NAV switch on the LIGHTING panel controls the navigation lights.

Figure 3-19. Tail Navigation Light

LOGO LIGHTS

Optional logo lights are on the top rear of each engine pylon. The right auxiliary bus powers the lights.

The NAV switch on the LIGHTING PANEL is replaced with a three-position switch that includes the LOGO position for this option.

WING INSPECTION LIGHT

The wing inspection lights mounted on either side of the fuselage allow the crew to visually inspect the wings for ice formation.

TAXI LIGHT

The taxi light on the nose gear illuminates the ground reference during takeoff and taxi (Figure 3-20).

The three-position N LDG/TAXI light switch controls both the nose gear landing light and the taxi light. The center position TAXI controls the taxi light. The N LDG/TAXI position illuminates both lights. In the OFF position, both nose landing gear light and taxi light are extinguished.

Figure 3-20. Taxi Light

The proximity-sensor electronic unit (PSEU), which is part of the landing gear system, also controls both the nose gear landing and taxi lights. The lights are powered when the landing gear is in the down and locked position.

LANDING LIGHTS

The nose gear landing light illuminates the ground reference during final approach and takeoff. It also illuminates any major obstructions in the approach area or on the runway. The N LDG/TAXI switch previously discussed controls the light.

The two high-intensity discharge landing lights are in the wing-to-body fairing. They provide sufficient illumination for night landing and recognition. They also ensure that no objectionable glare is visible to the pilots.

The L and R LANDING switches on the LIGHTING control panel activate the lights.

EICAS MESSAGES

Table 3-1 lists the EICAS messages associated with the aircraft lighting system, a brief explanation of the message, and whether the message is inhibited during takeoff and/or landing.

Table 3-1. EMERGENCY LIGHTS AND PASSENGER EICAS MESSAGES

MESSAGE	INHIBITS	MEANING	AURAL WARNING
EMER LIGHTS OFF		The cabin emergency lights are off when they should be armed.	
EMER LIGHTS ON		The cabin emergency lights are on.	

QUESTIONS

1. When armed, when do emergency lights come on automatically?

a. When one generator is lost
b. When two generators are lost
c. When left main bus power is lost
d. When right main bus power is lost

2. Emergency lighting will last a minimum of:

a. 10 minutes at critical ambient temperature (low temperatures)
b. 30 minutes at critical ambient temperature (low temperatures)
c. 60 minutes at critical ambient temperature (low temperatures)
d. 90 minutes at critical ambient temperature (low temperatures)

3. Power is normally supplied to the standby instrument lighting by:

a. The left essential bus
b. The right essential bus
c. The left main bus
d. The right main bus

4. If power to the standby instrument light's normal source is lost, standby lights are automatically switched to:

a. The left essential bus
b. The right essential bus
c. The right main bus
d. The right battery bus

5. What powers the emergency lights?

a. Two independent rechargeable battery packs
b. The left battery bus regardless of the position of the battery switch
c. The left and right essential buses
d. The left battery bus if the battery switch is ON

6. The cabin entry/exit door light switch is powered by:

a. The left and right main buses
b. The left battery bus if the battery switch is on
c. The left battery bus regardless of the battery switch position
d. Two independent rechargeable battery packs

7. The secondary navigation light is selected on the:

a. Lighting control panel
b. Right cockpit lighting control panel
c. Service compartment lighting control panel
d. Right avionics rack CB panel

CHAPTER 4
INDICATING AND RECORDING SYSTEMS

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CHAPTER 4
INDICATING AND RECORDING SYSTEMS

INTRODUCTION

This chapter discusses the systems that record and display information about the aircraft and its operation. These include the following:

- Engine indication and crew alerting system (EICAS)—Provides visual and aural warnings
- Maintenance diagnostic computer (MDC)—Records engine and line replaceable unit (LRU) status and parameters for system diagnosis and fault identification
- Cockpit voice recorder (CVR)—Stores up to two hours of voice recordings
- Flight data recorder

In addition, this chapter covers the master warning/caution lights, the warning disable system, and the systems test control panel.

EICAS

GENERAL

EICAS displays engine instruments and real-time interpretations of the operation of various aircraft systems. EICAS also provides visual and aural crew-alert messages.

EICAS functions include the following:

- Automatic system monitoring
- Integration of system information
- Color logic for visual presentation of operating limits
- Aural alert warning messages

The two data concentrator units (DCU A and DCU B) collect data from various aircraft systems, process the information, and relay it to the proper component or display (Figure 4-1).

The crew alerting system (CAS) provides visual and aural alerts when the DCUs detect a malfunction. The CAS prioritizes message by order of order of importance and order of occurrence. The DCUs also generate the aural warning signals through cockpit speakers and headsets.

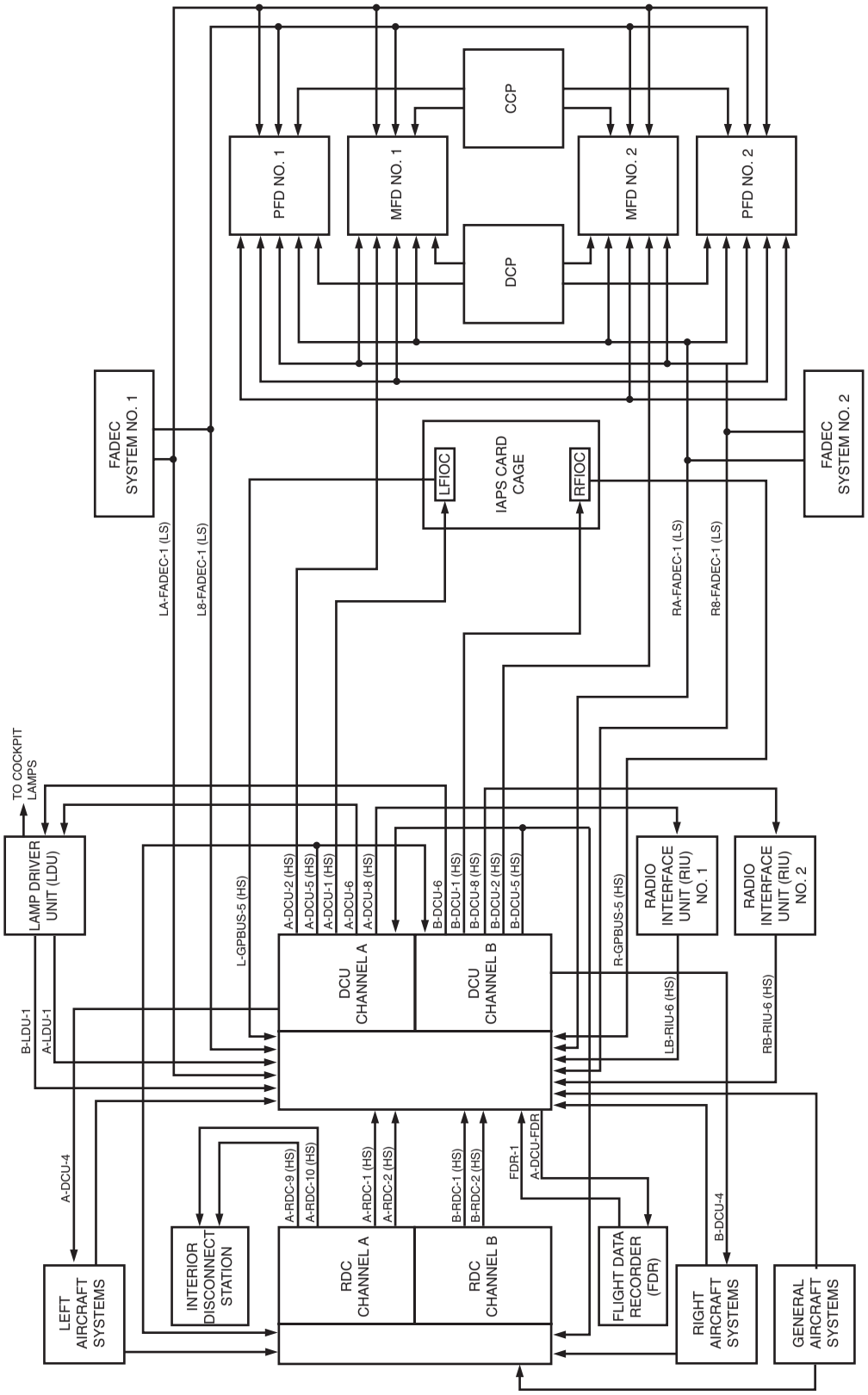

Figure 4-1. Input and Output of EICAS

Four liquid crystal adaptive flight displays (AFDs) present the DCU-compiled information on two pilot flight displays (PFDs) or two multifunction displays (MFDs). All four displays are identical and interchangeable (Figure 4-2). Two separate concentric knobs (PFD and MFD) adjust the lighting intensity of the displays. The knobs are on the COCKPIT LIGHTS panel on the left and right side panels.

The cockpit air distribution system provides cooling and ventilation for the PFDs and MFDs. The avionics cooling fan and cockpit air conditioning systems maintain the ambient temperature of the displays.

For more detailed information about the integrated avionics processor system card cage, power, and input/output concentrator unit see Chapter 16—Avionics.

MULTIFUNCTION DISPLAYS

Most EICAS information is on the left and right MFDs. The MFD control panel (MCP) on the center pedestal controls the information to be displayed.

The top half of the left MFD normally displays engine indications (EI) on the left, the aircraft configuration with gear, flaps, spoilers, and trim in the middle, and CAS messages on the right (Figure 4-3).

The top half of the right MFD normally displays the summary synoptic page, which is depicted in the bottom half of Figure 4-3.

The electronic crew checklist can be selected to appear in the top half. Maintenance personnel can also display diagnostic information in the same area.

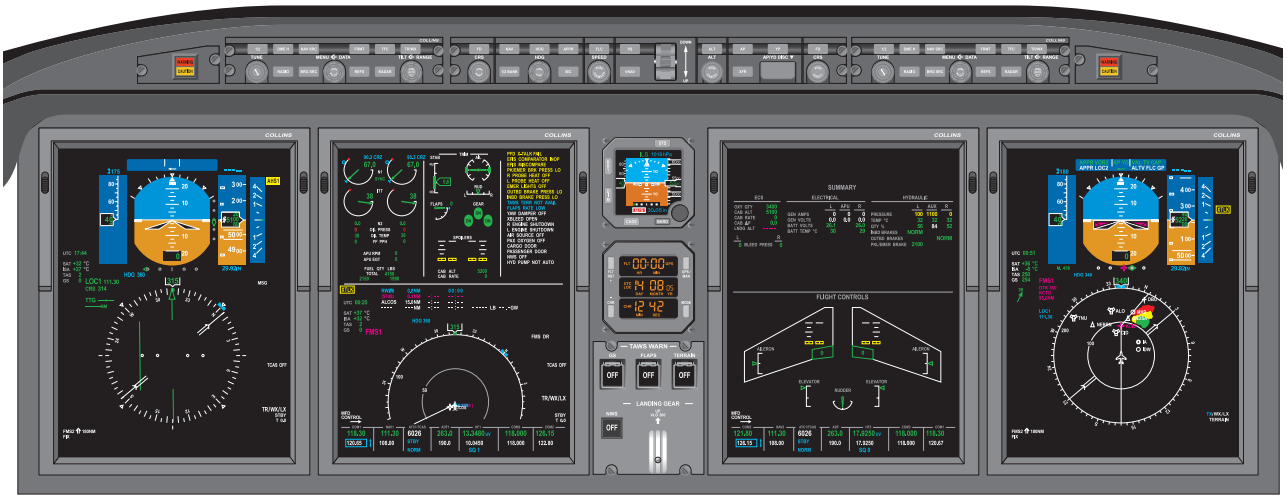

Figure 4-2. Left PFD, Left MFD, Right MFD, Right PFD

The bottom half of both MFDs can display navigation information or system synoptic depending on the selection on the MFD control panel (MCP) on the center pedestal.

If a display failure occurs, a composite flight instrument/EICAS can be displayed.

Color Logic

The Challenger 300 uses a "quiet dark cockpit philosophy" so that cockpit indications remain quiet and dark during the following:

- Normal operation (no abnormalities or failures)
- Daylight
- Visual meteorological conditions (VMC)
- Nonicing conditions
- Cruise flight

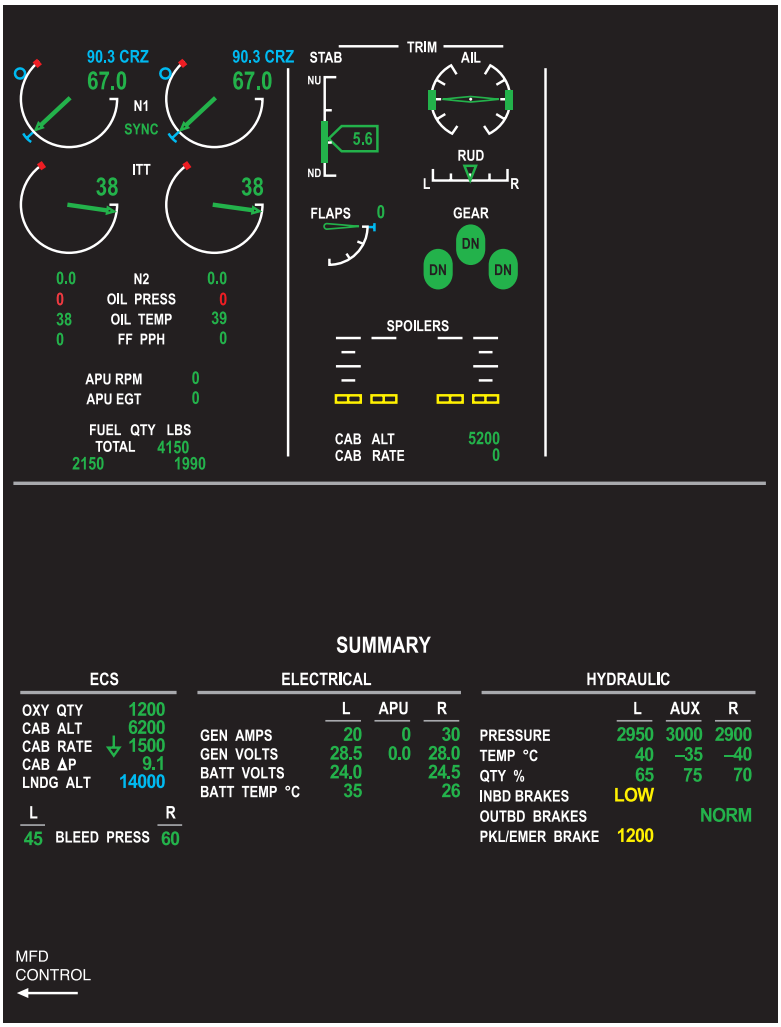

Figure 4-3. Multifunction Display (MFD)

Color denotes the following:

- Red—Warning condition or system limit exceeded
- Amber—Component or system failed (no flow, energy, or pressure)
- Green—Normal operation (normal flow, energy, or pressure)
- White—Normal status of component (pump, valve, etc.) or no flow through the line
- Magenta—Invalid or unknown data

Engine, APU, Fuel Indications

Engine indications are presented in digital readouts and in analog scale format for N_1 and ITT on top half of the left MFD (Figure 4-4). Engine parameters include the following:

- N_1 speed (%)
- Interturbine temperature (ITT) (°C)
- N_2 speed (%)
- Oil pressure (psi)
- Oil temperature (°C)
- Fuel flow (lb/hr-kg/hr)

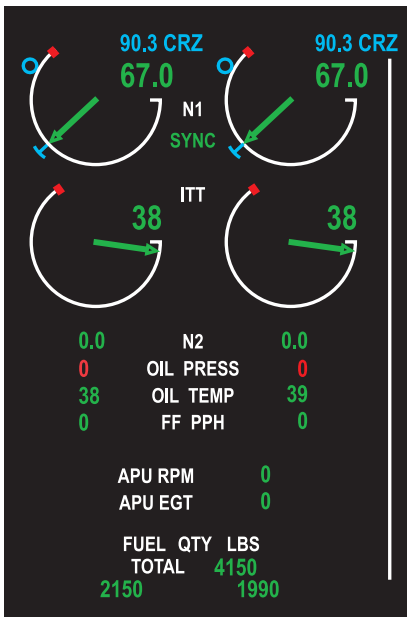

Figure 4-4. Engine Indications

When required, the following additional indications are displayed:

- Reverse thrust icon (REV) within the N_1 gage—White when reversers in transition, green when deployed, or red when unsafe
- Amber VIB icon below the N_1 gage—Vibration exceeds a predetermined value; associated CAS message is also displayed
- SYNC or MACH HOLD between the N_1 analog displays—Engine sync or Mach hold mode selected (green for active; white for armed)
- Ignition icon (IGN) below ITT gage—Igniter operating (green) or failed (amber)
- START icon vertically outside digital indications—FADEC commanding a start

Beneath the digital engine indications are the green digital RPM and EGT indications for the auxiliary power unit (APU).

Fuel quantities are displayed below the APU indications in green for total, left, and right.

Flight Control, Gear, Pressurization Indications

Information for flight controls, landing gear, and pressurization are displayed next to the engine indications in the upper middle of the left MFD (Figure 4-5):

- Trim settings—Aileron, horizontal stabilizer, and rudder trim settings in green when in the takeoff range on the ground and in red for a configuration warning; in flight, the indicators are white
- Flaps, landing gear, and spoilers—Green graphical presentations with an additional digital readout for flaps; information is decluttered (removed) when equipment retracted or stowed
- Cabin pressurization—Cabin altitude and cabin rate of climb/descent displayed below spoiler information; an arrow displays climb or descent

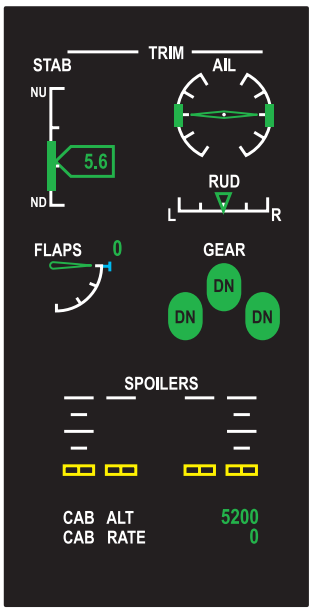

Figure 4-5. Flight Control, Gear, Pressurization Indications

CAS Messages

The crew alerting system (CAS) provides visual and aural alerts during a malfunction. CAS messages are displayed on the right side of the top half of the left MFD.

The four levels of importance are the following: warning, caution, advisory, and status. CAS prioritizes messages by order of importance and order of occurrence. All red messages are at the top in order of occurrence (last message at top). Amber, cyan, and then white messages are below the red ones. Tables 4-2 through 4-5 at the end of this chapter list all EICAS messages.

Warning (W) Messages

The most urgent messages are warnings. These red messages remain in view at the top of the list until the problem is solved.

Warning messages require immediate action. A triple chime and flashing master warning lights also accompany the red CAS. Warning message also can generate voice messages.

Pressing either master warning switch silences the aural alerts (except for a nonmutable gear warning) and stops the flashing master warning lights.

Caution (C) Messages

Caution messages are second in order of importance. Amber caution messages appear directly below any warning messages that may be displayed.

Caution messages require prompt action. A single chime and flashing master caution lights accompany the amber CAS.

Pressing either master caution switch stops the flashing master caution lights.

Advisory (A) Messages

Cyan advisory messages appear directly below any caution messages that may be displayed. Advisory messages are generated when crew awareness is required and subsequent crew action may be required.

Advisory messages indicate:

- Nonpilot selected automatic activation of certain critical systems (L or R FUEL PUMP ON)
- Loss of system redundancy
- Needed information not related to a change of system status (SELCAL)

Advisory messages may have a tone associated with it (i.e., cabin call or voice SELCAL).

Status Messages

White status messages appear directly below any advisory messages that may be present. They indicate the state of a specific system that has been manually activated.

Inhibited EICAS Messages

Because takeoffs and landings are the most workload intensive, they are the most critical phases of flight. Accidents can occur during these phases of flight because the crew becomes distracted by minor non-relevant system problems. To reduce this possibility, some warning messages, most caution messages, and all advisory messages are inhibited during the takeoff and landing phase.

Some selected messages are inhibited for take-off when airspeed is above 80 kts until the aircraft reaches 400 ft AGL or one minute elapses. Other selected messages are inhibited during landing when the aircraft descends below 400 ft AGL until airspeed decreases to less than 40 kts.

When a message is triggered during an inhibit period, the message and the master/caution (if appropriate) illuminates as the aircraft exits the inhibit envelope.

Synoptic Pages

The synoptic pages are displayed on the bottom half of either MFD. These pages are selected through individual switches on the MFD control panel (see next section). The synoptic pages provide the pilot real-time indication of aircraft system operation. Each synoptic page displays the aircraft systems as a schematic diagram.

MFD CONTROL PANEL (MCP)

The MFD control panel is on the center pedestal. Figure 4-6 depicts the MCP with the optional 3D map display switches.

The switches include the following:

- L/R TOGGLE—Allows flight crew to select control of left or right MFDs
- CAS—Pressing once replaces the caution, advisory, and status messages with a white MSGS icon displays; pressing a second time displays the messages again. When a new message is generated, it appears above the MSGS icon. Pressing the CAS switch hides the new message. Warning messages can not be paged out of view
- CKLST—Displays the electronic checklist on the right MFD
- SKIP—Skips checklist items on the display

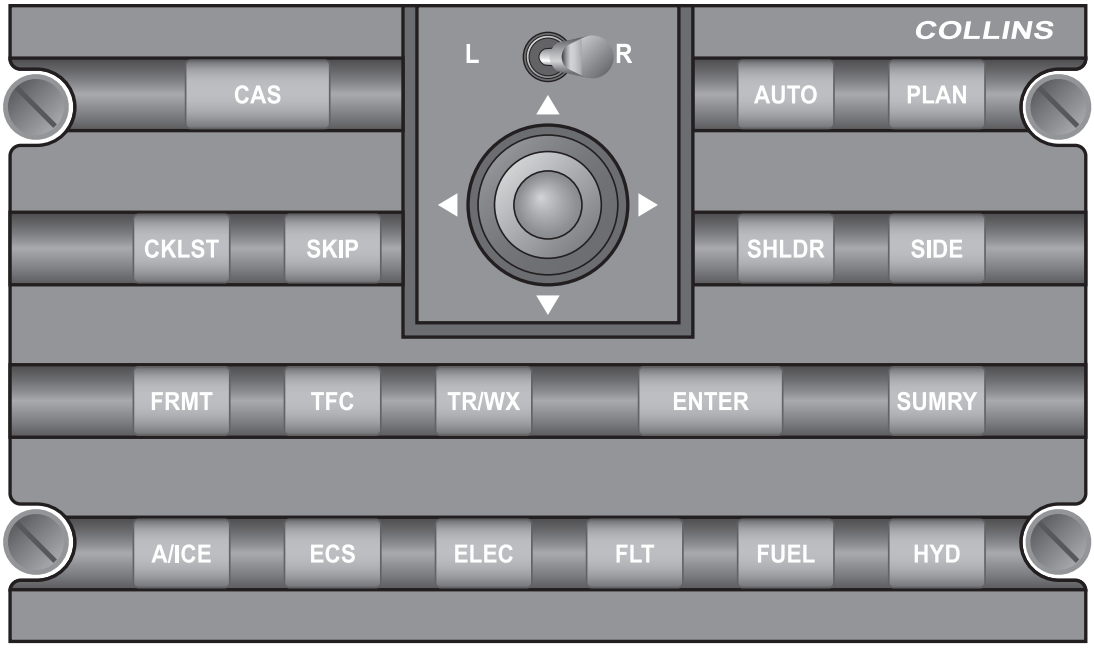

Figure 4-6. MFD Control Panel (MCP)

- FRMT—Selects MFD format; available selections are present position (PPOS, heading at top), PLAN (north at top), TCAS only
- TFC—Selects TCAS overlays
- TR/WX—Selects terrain, weather, and lightning overlays
- ENTER—Enters waypoints and completes checklist items when used in conjunction with the joystick
- SUMRY—Displays summary synoptic on the bottom part (Figure 4-7).

The following switches display their appropriate synoptic page:

- A/ICE—Bleed air, wing anti-ice, and engine anti-ice systems
- ECS—Bleed air, air conditioning, and pressurization systems
- ELEC—Electrical system
- FLT—Ailerons, elevator, rudder, flaps, and spoilers
- FUEL—Fuel quantities, fuel temperature, and fuel system
- HYD—Engine pumps, auxiliary pumps, reservoir status, hydraulic fluid temperature and pressure; the page represents actual valve operation and flowline with color to identify state and serviceability of the valve:
  - Red—Failure
  - Yellow—Cautionary status
  - White—Normal with no dynamic flow
  - Green—Normal with dynamic flow
  - Magenta—Invalid or unknown status

Figures 8 through 13 illustrate the synoptic pages.

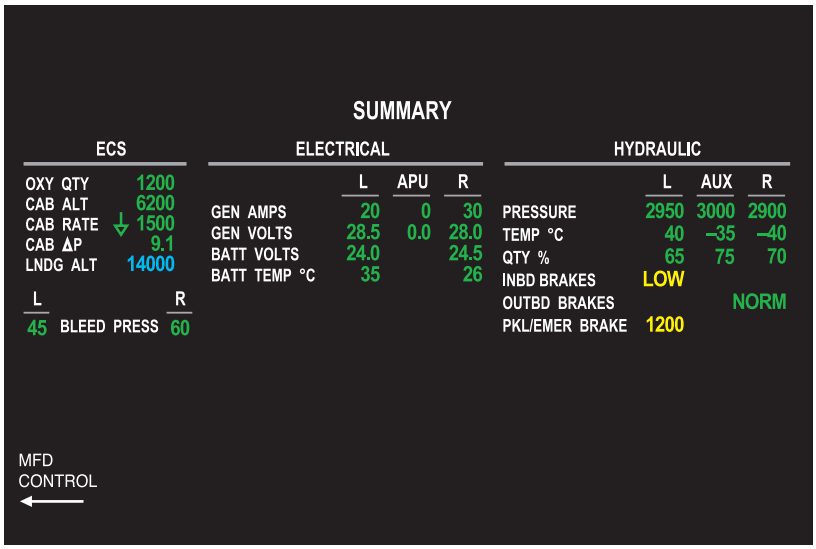

Figure 4-7. Summary Synoptic

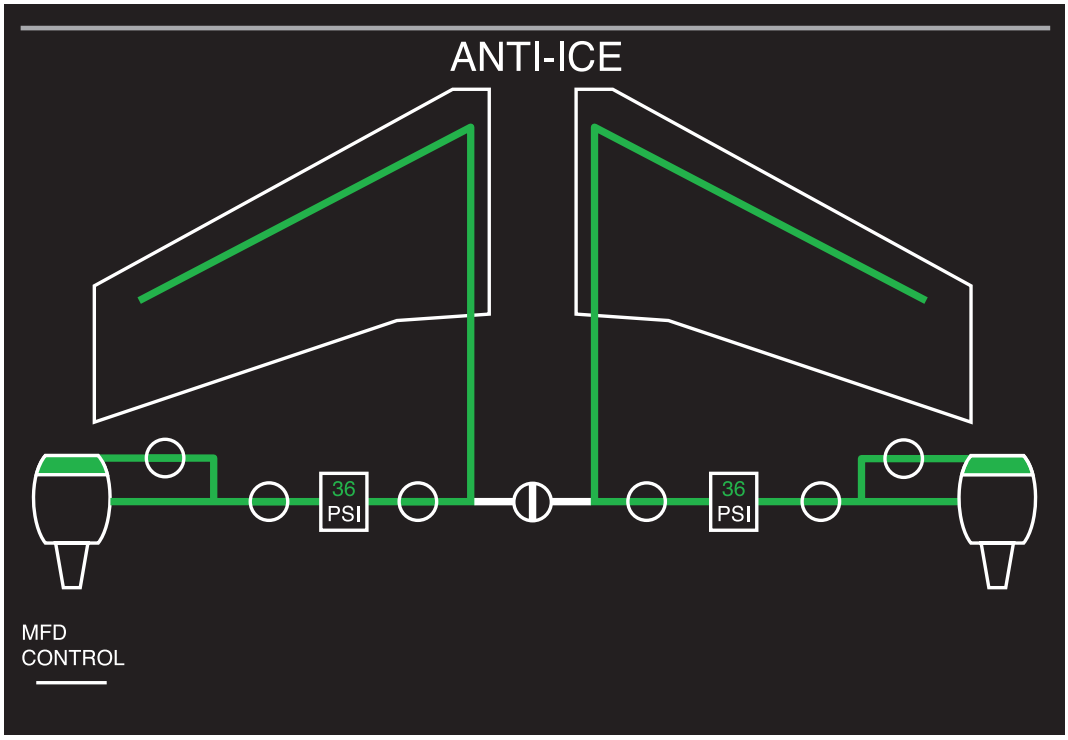

Figure 4-8. A/ICE Synoptic Page

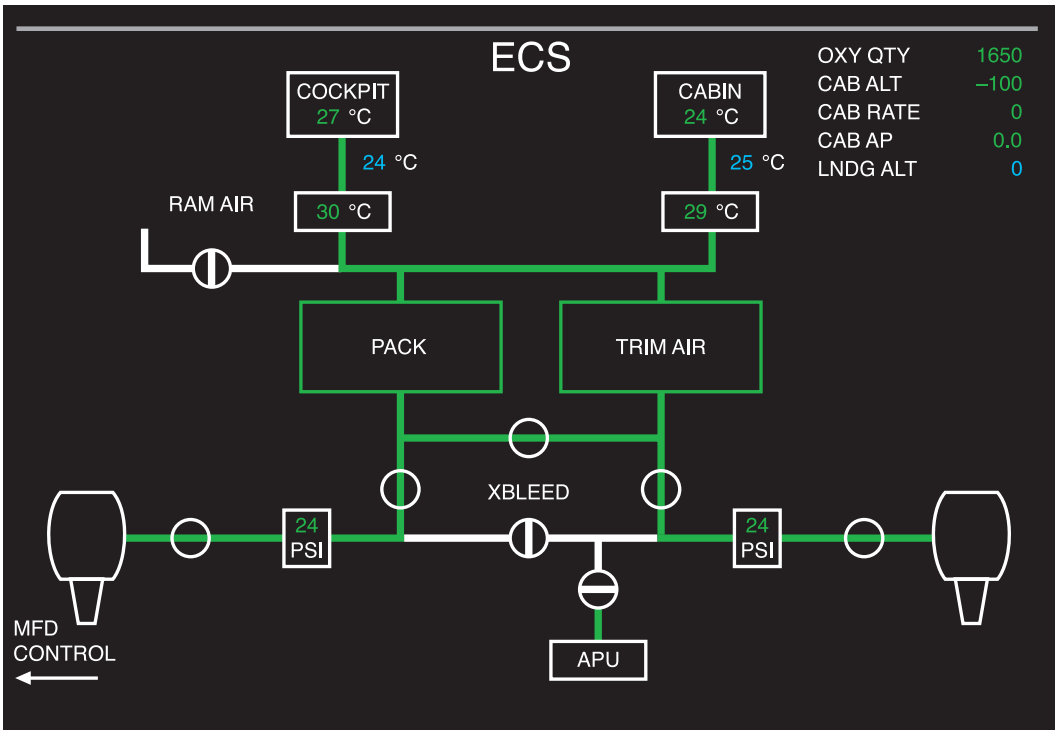

Figure 4-9. ECS Synoptic Page

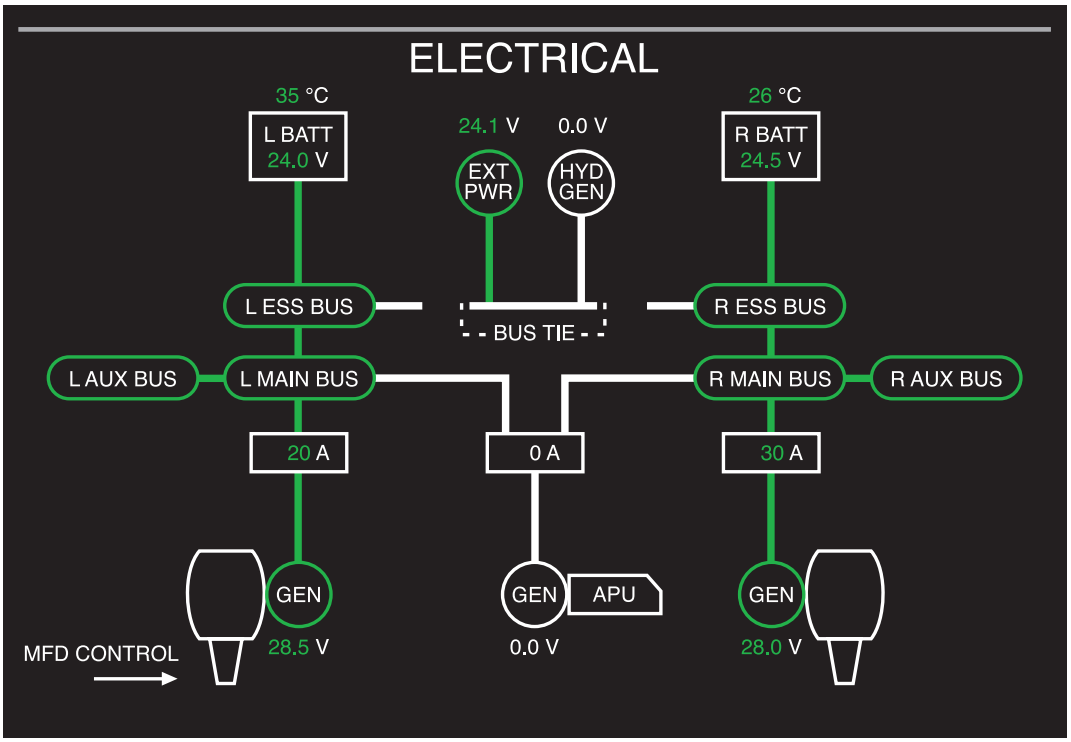

Figure 4-10. ELEC Synoptic Page

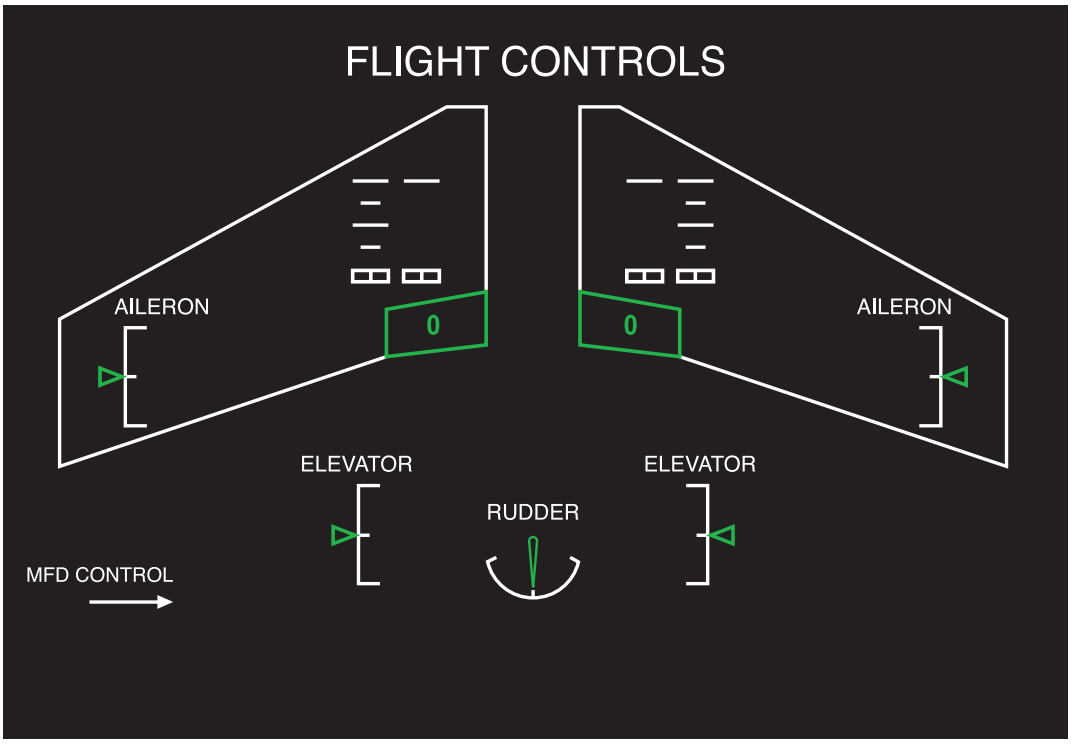

Figure 4-11. FLIGHT CONTROLS Synoptic Page

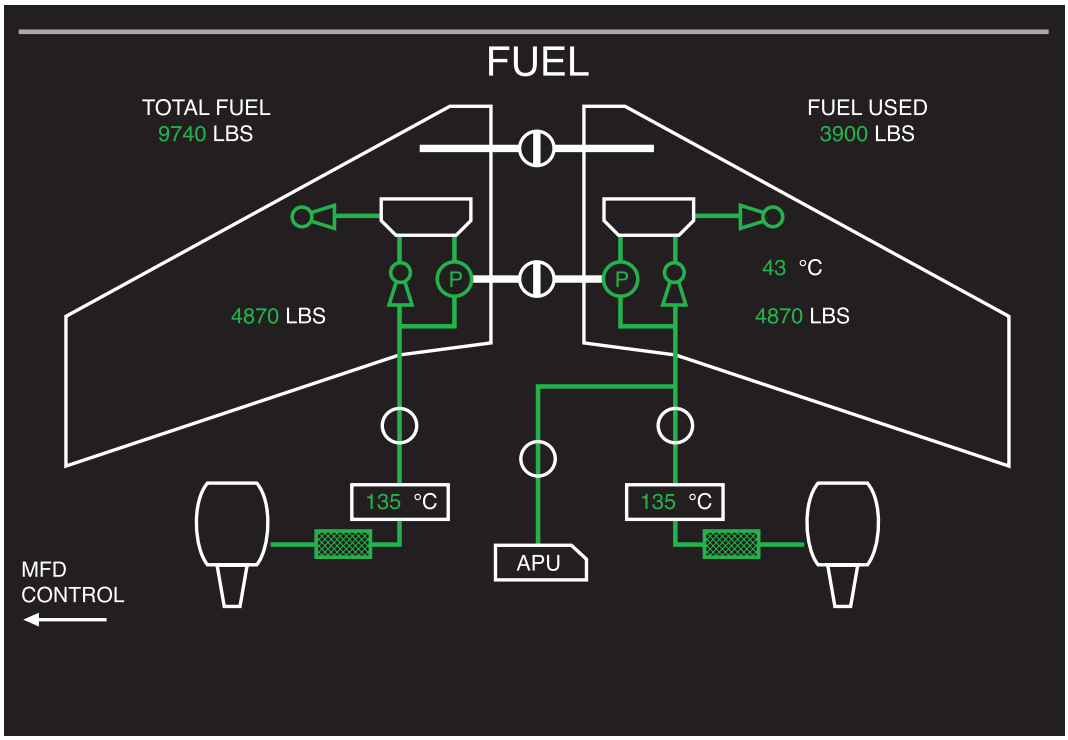

Figure 4-12. FUEL Synoptic Page

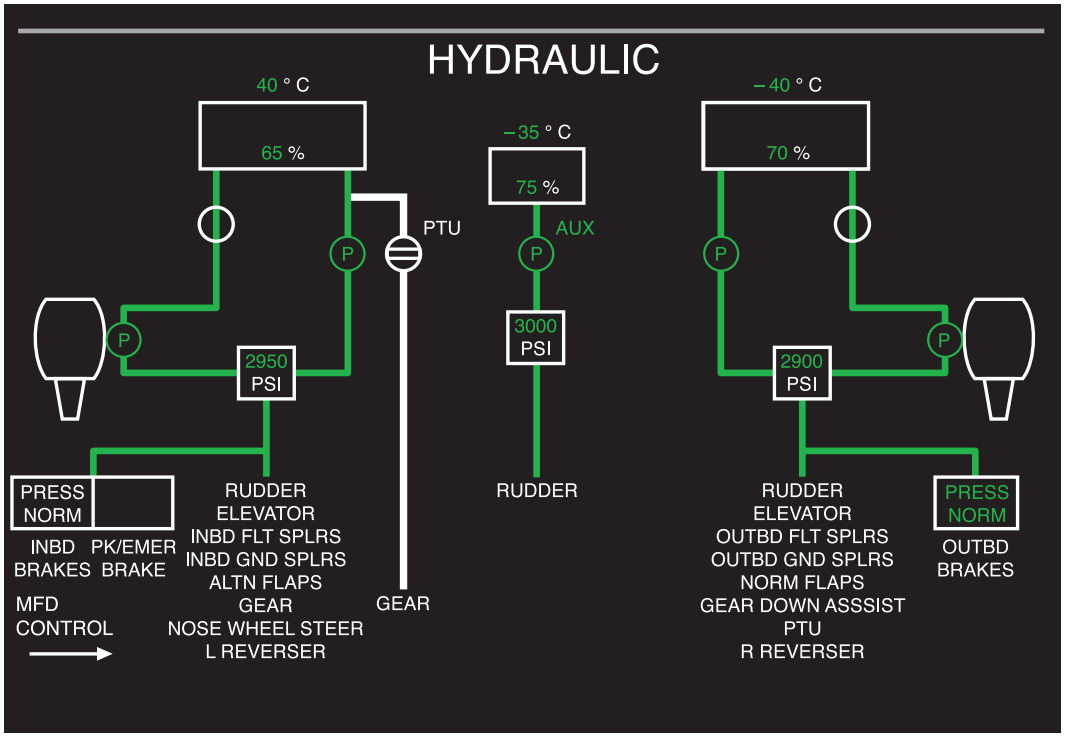

Figure 4-13. HYD Synoptic Page

REVERSION SWITCH PANEL

A reversion switch panel provides an alternate method for displaying EICAS information if one display fails. The panel is on the pilot side of the center pedestal above the spoiler handle (Figure 4-14).

LEFT DISPLAYS Switch

This switch enables reversion of the left side PFD/MFD display:

- NORM—L MFD and PFD are normal
- PFD REV—L MFD is shut down; L PFD displays compressed format
- MFD REV—L PFD is shut down; L MFD displays compressed format

RIGHT DISPLAYS Switch

This switch enables reversion of the right side MFD/PFD display:

- NORM—R MFD and R PFD formats are normal
- MFD REV—R PFD is shut down; R MFD displays compressed format
- PFD REV—R MFD is shut down; R PFD displays compressed format

ATT/HDG Switch

Switch positions are as follows:

- NORM—Displays use their own side AHRS (pilot-1; copilot-2)
- 1—All displays use AHRS 1 data
- 2—All displays use AHRS 2 data

AIR DATA Switch

Switch positions are as follows:

- NORM—Displays show on-side data
- 1—All displays use ADC 1 data
- 2—All displays use ADC 2 data

TUNE Switch

- NORM—Tuning is normal through MFDs or CDUs as desired
- COM 1 121.50—VHF 1 tuned to 121.50 emergency frequency
- MFD ONLY—MFD can only tune radios; CDU tuning disabled
- CDU ONLY—CDUs can only tune radios; MFD tuning disabled

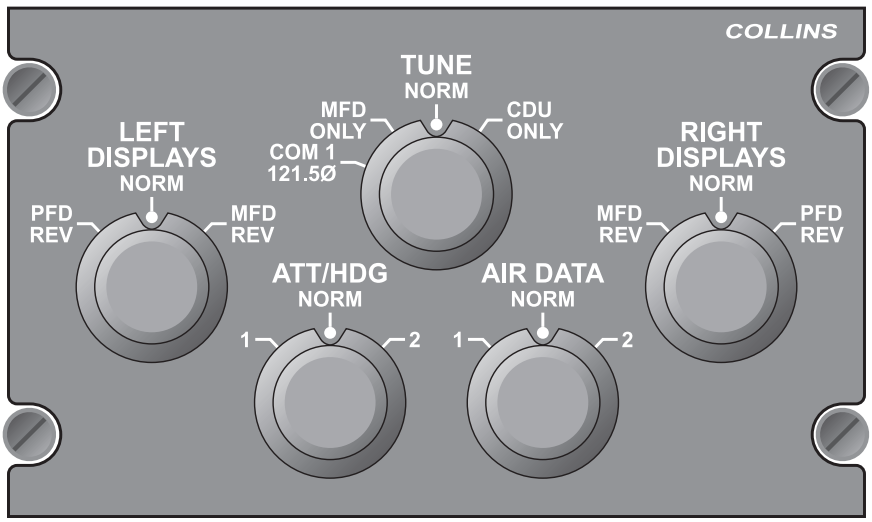

Figure 4-14. Reversion Switch Panel

MASTER WARNING/ MASTER CAUTION SWITCHES

The master warning/master caution switches are on the glareshield (Figure 4-15). When the DCUs generate a warning message, the master warning part flashes red. A triple chime accompanies the master warning lights. Dedicated tones or voice messages may sound.

When the switch is pressed, the flashing light and the audio alerts are reset.

When the DCUs generate a caution message, the master caution part flashes amber. A single chime accompanies the master caution lights.

When the switch is pressed, the flashing light resets.

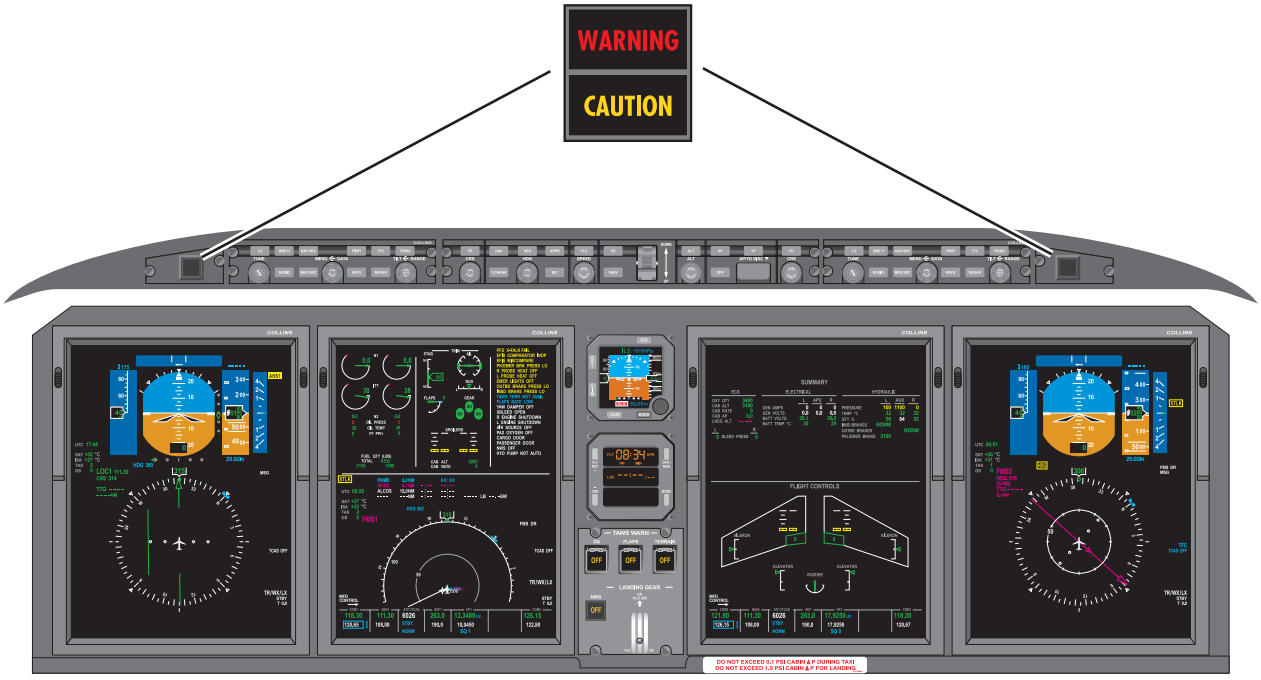

Figure 4-15. Master Warning and Master Caution Switches

AURAL WARNING DISABLE

Two AURAL WARNING switches on the AURAL WARNING panel disable and silence the aural warnings of a malfunctioning DCU. The AURAL WARNING panel (Figure 4-16) is on the aft cockpit bulkhead above the copilot circuit-breaker panel.

When DCU A is selected to OFF, DCU B provides the aural warning function. Selecting both switches to OFF disables all EICAS aural warnings. These should be used only if problems occur with the aural warning system, or as directed by *AFM* procedure.

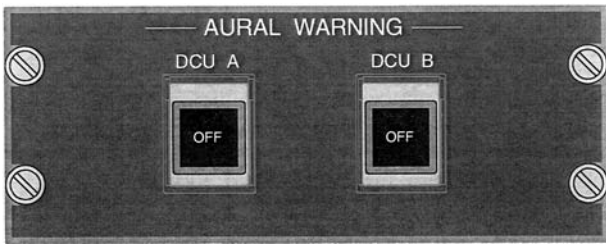

Figure 4-16. AURAL WARNING Panel

COCKPIT VOICE RECORDER

The solid state cockpit voice recorder (CVR) consists of a flight deck control panel and a recorder unit painted bright orange with reflective stripes (Figure 4-17). The unit records data in a solid state, non-volatile memory. It stores 120 minutes of recorded information.

COMPONENTS

The recorder unit is housed inside a crash survivable container with access through the aft equipment bay.

An underwater locator device (ULD) on the front of the recorder emits a pulsed acoustic signal into the water after ditching. The ULD sonar beacon is capable of transmitting up to 30 days after activation.

Figure 4-17. Cockpit Voice Recorder

The recorder has an underwater locator beacon. It is mounted on the crash survivable memory unit front bracket to facilitate reading battery replacement date and for quick removal and replacement of the beacon. The unit has a battery with a life expectancy of six years.

The area microphone, which picks up sounds and voices in the flight compartment, is just above the liquid compass on the windshield center post.

OPERATION

The CVR receives four channels of audio data from the audio electronics control unit. The recorded information includes all audio received and transmitted from the following locations:

- Pilot station
- Copilot station
- Area microphone (center of glareshield)
- Observer station

The CVR starts recording as soon as electrical power is applied to the aircraft. When the

aircraft experiences impact deceleration, electrical power is removed from the recorder to prevent erasure of the stored audio data.

The CVR control panel on the center pedestal tests the system (Figure 4-18). The panel contains a green TEST button and light, a headset jack, and an ERASE button.

The CVR TEST button performs an internal test of the system. A successful test is indicated by illumination of the green light.

When the ERASE button is pushed, all recorded information is erased as long as the aircraft is on the ground, hydraulic systems pressurized, and parking brake set.

Figure 4-18. CVR Control Panel

FLIGHT DATA RECORDER

The solid state flight data recorder (FDR) unit in the tail section records flight parameters. The optional unit includes a digital FDR, an underwater locator device (ULD), and a tri-axial accelerometer.

The recorder unit housed inside a crash survivable container is accessed through the aft equipment bay. The unit records data with a solid state, non-volatile memory for the last 25 hours of critical aircraft and flight parameter data.

UNDERWATER LOCATOR

The underwater locator device (ULD) is mounted on the FDR front panel. The ULD is a battery-operated underwater acoustic pulse generator. It transmits a pulsed acoustic signal into the water after ditching. The ULD beacon is capable of transmitting up to 30 days after activation.

TRI-AXIAL ACCELEROMETER

The tri-axial accelerometer measures acceleration. The accelerometer contains three separate seismic sensors that measure vertical, lateral, and longitudinal acceleration near the center of gravity of the aircraft. This data is sent to the DCUs where it is formatted for the FDR.

OPERATION

The FDR starts to record when one of the following occurs:

- STROBE/BEACON switch placed in BEACON or STROBE position
- Weight-off-wheels as sensed by the proximity sensing electronic unit (PSEU)

If the aircraft experiences impact deceleration, electrical power is removed from the recorder. Removal of power prevents erasure of the stored digital information.

Pressing the EVENT button on the ENGINE panel places an event marker in the FDR data. This can be used during system functional testing required by some regulatory agencies.

MAINTENANCE DIAGNOSTIC COMPUTER

The maintenance diagnostic computer (MDC) is an onboard computer that records aircraft mechanical and avionics system data.

Maintenance personnel can retrieve the information for use in engine trend analysis computation, significant event recording, and avionics/aircraft system failure detection.

The MDC, which is part of the IAPS, consists of an electronic circuit board in the IAPS card cage (ICC).

The MDC continuously records data for fault analysis and engine trend monitoring.

The MDC monitors engine operating time and counts the number of engine starts and thrust reverser deployments.

To track engine efficiency, the MDC records engine parameters at takeoff. If the engines exceed a maximum operating limit, the peak exceedance value is recorded along with the time and duration of the occurrence.

The MDC data is downloaded to a maintenance facility computer. The database unit (DBU) is behind the pilot on the bulkhead forward of the entry door. There is also a portable maintenance access terminal (PMAT) on the aft side of the equipment rack near the floor.

MDC data is available on the top half of the right MFD when on the ground by simultaneously selecting A/ICE, ECS, and FUEL on the MCP.

Accessing MDC data is not needed during flight; it is intended as a maintenance function only.

SYSTEMS TEST CONTROL PANEL

The SYSTEMS TEST control panel is in the center pedestal (Figure 4-19). The switch starts pilot-initiated tests of several systems. The switch is momentarily pushed to start the applicable test.

The aural warnings other than TCAS and TAWS occur in sequence of importance. Once the test has started, the switch may be released. Pressing the switch again cancels the test.

Selecting ANUN A and ANUN B and pressing and holding the switch for 15 seconds illuminates all panel lights and gives the aural warnings as follows:

- Triple or single chime
- Aural warning tones
- Voice alarms

Other tests available on the panel are the following:

- PROBES—Test air data probes and sensors
- STALL RUD/LIM—Tests stall protection system and rudder travel limiter
- ICE DET—Test ice detection system
- FIRE DET—Tests fire detection and extinguishing (FIREX) system
- TAWS—Tests terrain avoidance warning system

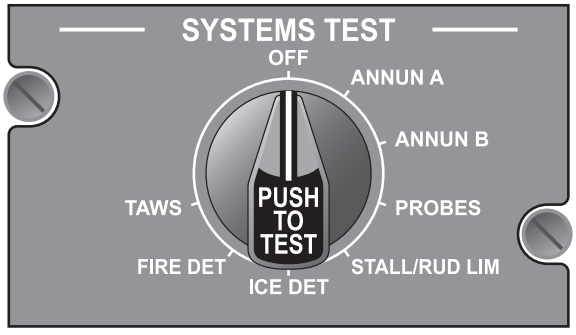

Figure 4-19. SYSTEMS TEST Switch

EICAS MESSAGES

Table 4-1 lists the EICAS messages associated with the master warning system, a brief explanation of the message, and whether the message is inhibited during takeoff and/or landing.

Table 4-1. EICAS MESSAGES

MESSAGE	INHIBITS	MEANING	AURAL WARNING
EFIS COMPARATOR INOP	TO/LAND	EFIS comparator unable to compare one or more of the following parameters: altitude, airspeed, roll attitude, pitch attitude, heading, radio altitude, flight director, localizer or glideslope.	
EFIS MISCOMPARE		There is a mismatch between the onside and cross-side data and accompanied by a PFD, annunciation ALT, IAS, ROL, PIT, HDG, LOC, GS, RA, or FD.	
L (R) IAPS FAIL	TO/LAND	The respective integrated avionics processing system has failed.	
PFD X- TALK FAIL	TO/LAND	Communication between the PFDs has failed. REFs menu pages 1, 2, and 3 are not synchronized. The EFIS comparator will be inoperative and is unable to compare one or more of the following parameters: altitude, airspeed, roll attitude, pitch attitude, heading, radio altitude, flight director, localizer or glideslope.	
DCU FAULT	TO/LAND	Channel A or B in the DCU failed. The yaw damper may fail. The rudder travel limiter monitoring may be inoperative.	
MFD X-TALK FAIL	TO/LAND	Communication between the MFDs has failed, and cross-side tuning will not be available.	
RDC FAN FAIL	TO/LAND	Channel A or B of the remote data concentrator has failed.	
RDC FAULT	TO/LAND	RDC channel A or B failed with no loss of functionality.	
AURAL WARN A (B) MUTED		The respective AURAL WARNING DCU A or DCU B switch as been selected, muting all warnings through that channel.	

Table 4-2. WARNING MESSAGES

EICAS WARNING (RED) MESSAGES			
Most warning messages are preceded by a triple chime.			
MESSAGE	**INHIBITS**	**AURAL ALERTS**	**VOICE ALERTS**
APU FIRE		Triple chime	APU FIRE
APU OVERTEMP	TO/LAND	Triple chime	None
L (R) BATT OVERHEAT	TO/LAND	Triple chime	None
ESSENTIAL POWER ONLY		Triple chime	None
L (R) BLEED LEAK	TO/LAND	Triple chime	None
CABIN ALTITUDE	TO/LAND	None	CABIN ALTITUDE
CABIN DELTA P	TO/LAND	Triple chime	None
CARGO SMOKE		Triple chime	None
CONFIG AILERON TRIM		Triple chime	CONFIGURATION
CONFIG AUTOPILOT		Triple chime	CONFIGURATION
CONFIG FLAPS		Triple chime	CONFIGURATION
CONFIG RUDDER TRIM		Triple chime	CONFIGURATION
CONFIG SPOILERS		Triple chime	CONFIGURATION
CONFIG STAB TRIM		Triple chime	CONFIGURATION
GEAR		Triple chime	GEAR
GEAR BAY OVHT	TO/LAND	Triple chime	None
L (R) ENG OIL PRESS LOW	TO/LAND	Triple chime	None
L (R) ENGINE EXCEEDENCE		Triple chime	None
L (R) ENGINE FIRE		Triple chime	LEFT (RIGHT) ENGINE FIRE
HYD PRESS LOW		Triple chime	None
NORM BRAKES FAIL	TO	Triple chime	NORMAL BRAKES FAIL
PACK LEAK	TO/LAND	Triple chime	None
PARK/EMER BRAKE ON		Triple chime	CONFIGURATION
PITCH DISCONNECT		Triple chime	CONFIGURATION
L (R) PYLON BLEED LEAK	TO/LAND	Triple chime	None
L (R) REVERSER UNSAFE		Triple chime	None
ROLL DISCONNECT		Triple chime	CONFIGURATION
TRIM AIR LEAK	TO/LAND	Triple chime	None
WING ANTI-ICE LEAK	TO/LAND	Triple chime	None
L (R) WING OVERHEAT		Triple chime	None

Table 4-3. CAUTION MESSAGES

EICAS CAUTION (AMBER) MESSAGES			
All caution messages are preceded by a single chime.			
MESSAGE	**INHIBITS**	**MESSAGE**	**INHIBITS**
AFCS MESSAGES FAIL	TO	CARGO SMOKE DET FAIL	TO/LAND
AFT EQPT BAY DOOR	TO/LAND	CPLT BRAKE FAULT	TO
AIR COND TEMP FAIL	TO/LAND	DITCHING NOT AVAIL	—
AIR COND TEMP HIGH	TO/LAND	EFIS COMPARATOR INOP	TO/LAND
AIR DATA 1 (2) FAULT	TO/LAND	EFIS MISCOMPARE	—
L (R) AOA VANE HEAT FAIL	TO/LAND	ELECTRICAL FAULT	TO/LAND
AP HOLDING LWD	TO	ELEVATOR SPLIT	—
AP HOLDING RWD	TO	ELT ON	TO/LAND
AP HOLDING NOSE DOWN	TO	EMER LIGHTS OFF	TO/LAND
AP HOLDING NOSE UP	TO	EMER LIGHTS ON	TO/LAND
AP STAB TRIM FAIL	TO	EMERGENCY EXIT	TO/LAND
APU BLEED ALT LIMIT	TO/LAND	L (R) ENG ANTI-ICE FAIL	TO/LAND
APU FAULT	TO/LAND	L (R) ENG DSPL MISCOMP	TO/LAND
APU FIRE DET FAIL	TO/LAND	L (R) ENG FUEL SOV FAIL	TO/LAND
APU FUEL SOV FAIL	TO/LAND	L (R) ENG OIL PRESS HIGH	TO/LAND
APU GEN FAIL	TO/LAND	L (R) OIL TEMP HIGH	TO/LAND
APU GEN OVERLOAD	TO/LAND	L (R) ENGINE FLAMEOUT	—
APU OIL PRESS LOW	TO/LAND	L (R) ENGINE VIBRATION	TO/LAND
APU OIL TEMP HIGH	TO/LAND	ENGINES FUEL BYPASS	TO/LAND
APU OVERSPEED	TO/LAND	EQPT RACK TEMP HIGH	TO/LAND
APU SHUTDOWN	TO/LAND	L (R) ESS BUS FAIL	TO/LAND
APU STARTER FAIL ON	TO/LAND	L (R) FADEC FAIL	TO
AUTO PRESS FAIL	TO/LAND	FD MODE CHANGE	TO
AUX HYD TEMP HIGH	TO/LAND	L (R) FIRE DET FAIL	TO/LAND
L (R) BATT FAIL	TO/LAND	FIRE SYS FAULT	TO/LAND
BATTERY BAY DOOR	TO/LAND	FIREX APU SQUIB FAIL	TO/LAND
L (R) BLEED FAIL	TO/LAND	FLAPS FAIL	TO
L (R) BLEED LOOP FAIL	TO/LAND	FLAPS FAULT	TO
BRAKE FAULT	TO/LAND	FLAPS NORM PRESS LOW	TO/LAND
CABIN ALTITUDE	TO/LAND	FLT SPOILERS DEPLOY	TO
CABIN PRESS FAULT	TO/LAND	FLT SPOILERS FAIL	—
CARGO DOOR	TO/LAND	FLT SPOILERS FAULT	—

Table 4-3. CAUTION MESSAGES (Cont)

EICAS CAUTION (AMBER) MESSAGES			
All caution messages are preceded by a single chime.			
MESSAGE	**INHIBITS**	**MESSAGE**	**INHIBITS**
L (R) FUEL COLLECTOR LOW	—	OXYGEN VALVE CLOSED	TO/LAND
FUEL IMBALANCE	TO/LAND	PACK FAIL	TO/LAND
L (R) FUEL PRESSURE LOW	TO/LAND	PACK LEAK	TO/LAND
L (R) FUEL PUMP FAIL	TO/LAND	PACK LOOP FAIL	TO/LAND
FUEL QUANTITY FAIL	TO/LAND	PACK TEMP HIGH	TO/LAND
FUEL QUANTITY LOW	TO	PASSENGER DOOR	LAND
GEAR BAY DET FAIL	TO/LAND	PAX OXYGEN AUTO FAIL	TO/LAND
GEAR DISAGREE	—	L (R) PITOT HEAT FAIL	TO/LAND
GEAR SYS FAIL	TO	PFD X-TALK FAIL	TO/LAND
L (R) GEN FAIL	TO/LAND	PARK/EMER BRAKE ON	TO
L (R) GEN OVERLOAD	TO/LAND	PK/EMER BRK PRESS LO	TO
GND SPLRS NOT ARMED	TO	PLT BRAKE FAULT	TO
GND SPOILERS FAIL	TO	PRI STAB TRIM FAIL	TO
L (R) HYD PRESS LOW	TO/LAND	L (R) PROB HEAT OFF	TO/LAND
HYD PTU FAIL	—	L (R) PYLON LOOP FAIL	TO/LAND
L (R) HYD SOV FAIL	TO/LAND	L (R) REVERSER FAIL	TO
L (R) HYD TEMP HIGH	TO/LAND	ROLL SPOILERS FAIL	—
L (R) IAPS FAIL	TO/LAND	ROLL SPOILERS FAULT	—
ICE DETECTED	TO/LAND	ROLL SPOILERS OFF	—
ICE DETECTOR FAIL	TO/LAND	RUDDER LIMITER FAIL	—
L (R) INBD BRAKE FAIL	TO	L (R) START ABORTED	TO/LAND
INBD BRAKE PRESS LO	TO	SEC STAB TRIM FAIL	—
INBD BRAKES FAIL	TO	SPOILERS FAIL	—
MACH TRIM FAIL	TO/LAND	SPOILERS FAULT	—
L (R) MAIN BUS FAIL	TO/LAND	STALL PROTECT FAIL	—
NOSE GEAR DOOR	TO/LAND	STALL PUSHER OFF	TO/LAND
NWS FAIL	TO	L (R) START ABORTED	TO/LAND
NWS LIMIT EXCEEDED	TO/LAND	L (R) STARTER FAIL	TO/LAND
L (R) OUTBD BRAKE FAIL	TO	L (R) STARTER FAIL ON	TO/LAND
OUTBD BRAKE PRESS LO	TO	STBY PITOT HEAT FAIL	TO/LAND
OUTBD BRAKES FAIL	TO/LAND	L (R) STBY STAT HT FAIL	TO/LAND
OXYGEN QUANTITY LOW	TO/LAND	TRIM AIR FAIL	TO/LAND

Table 4-3. CAUTION MESSAGES (Cont)

EICAS CAUTION (AMBER) MESSAGES	
All caution messages are preceded by a single chime.	
MESSAGE	**INHIBITS**
TRIM AIR LOOP FAIL	TO/LAND
L (R) WINDOW HEAT FAIL	TO/LAND
L (R) WING A/ICE FAIL	TO/LAND
WING A/ICE LOOP FAIL	TO/LAND
L (R) WING A/I PRESS HI	TO/LAND
WING ANTI-ICE FAULT	TO/LAND
WING FUEL TEMP LOW	TO/LAND
L (R) WSHLD HEAT FAIL	TO/LAND
WOW FAIL	TO
XBLEED FAIL	TO/LAND
YAW DAMPER FAIL	TO/LAND

Table 4-4. ADVISORY MESSAGES

EICAS ADVISORY (CYAN) MESSAGES			
MESSAGE	**INHIBITS**	**MESSAGE**	**INHIBITS**
IAPS FAN FAULT	TO/LAND	CVR FAIL	TO/LAND
ACARS MESSAGE	TO/LAND	DCU FAULT	TO/LAND
AFIS MESSAGE	TO/LAND	DOWNLOAD FADEC	TO/LAND
AIR COND FAULT	TO/LAND	ELECTRICAL FAULT	TO/LAND
L (R) AOA CASE HEAT FAIL	TO/LAND	L (R) ENG A/ICE FAIL ON	TO/LAND
APU FAULT	—	L (R) ENG IGN FAULT	TO/LAND
APU SHUTDOWN	—	L (R) ENGINE FAULT	TO/LAND
L (R) AUX BUS FAIL	TO/LAND	L (R) ENG FUEL TEMP LOW	TO/LAND
L (R) AUX BUS OFF	TO/LAND	L (R) ENGINE FUEL BYPASS	TO/LAND
AUX HYD PUMP FAIL ON	TO/LAND	L (R) ENGINE MINOR FAULT	TO/LAND
AUX HYD SYS FAIL	TO/LAND	L (R) ENGINE OIL BYPASS	TO/LAND
CABIN ALT WARN HIGH	—	L (R) ENGINE OIL CHIP	TO/LAND
*CABIN CALL	TO/LAND	L (R) ENG THRUST FAULT	TO/LAND
L (R) BLEED FAULT	TO/LAND	L (R) ENG VIBRATION FAIL	TO/LAND

*Accompanied by aural tone

Table 4-4. ADVISORY MESSAGES (Cont)

EICAS ADVISORY (CYAN) MESSAGES			
MESSAGE	**INHIBITS**	**MESSAGE**	**INHIBITS**
ENG SYNC/M-HOLD FAIL	TO/LAND	MFD X-TALK FAIL	TO/LAND
EQPT RACK COOL FAULT	TO/LAND	NWS FAULT	TO/LAND
L (R) ESS BUS OFF	TO/LAND	PACK COOL AIR FAIL	TO/LAND
FAX RECEIVED	TO/LAND	L (R) PROBE HT CTLR FAIL	TO/LAND
FD 1 (2) FAIL	TO/LAND	PROX SYS FAULT	TO/LAND
FDR FAIL	TO/LAND	RAM AIR FAIL	TO/LAND
FDR FAULT	TO/LAND	RDC FAULT	TO/LAND
FIRE SYS FAULT	TO/LAND	RUDDER LIMITER FAULT	TO/LAND
FIREX BTL 1 (2) FAULT	TO/LAND	** SELCAL DATALINK	TO/LAND
FIREX BTL 1 (2) LOW	TO/LAND	** SELCAL HF 1 (2)	TO/LAND
FLAPS RATE LOW	TO/LAND	** SELCAL VHF 1 (2) (3)	TO/LAND
FUEL GRAV XFLOW FAIL	TO/LAND	SPOILERS FAULT	TO/LAND
L (R) FUEL PUMP ON	TO/LAND	STAB TRIM FAULT	TO/LAND
FUEL QUANTITY FAULT	TO/LAND	STALL PROTECT FAULT	TO/LAND
FUEL XFER FAIL	TO/LAND	L (R) STALL SHAKER FAIL	TO/LAND
L (R) HYD DC PUMP FAIL	TO/LAND	STALL WARN BASIC	TO/LAND
L (R) HYD SOV CLOSED	TO/LAND	STBY INST BATT FAULT	TO/LAND
ICE DETECTED	TO/LAND	TAT HEAT FAIL	TO/LAND
ICE DETECTOR FAULT	TO/LAND	TAWS BASIC FAIL	TO/LAND
L (R) ENG FUEL TEMP LOW	TO/LAND	TAWS SYSTEM FAIL	TO/LAND
L (R) ENGINE OIL BYPASS	TO/LAND	TAWS TERR FAIL	TO/LAND
L (R) HYD DC PUMP FAIL	TO/LAND	TAWS TERR NOT AVAIL	TO/LAND
* LAV CALL	TO/LAND	TAWS WINDSHEAR FAIL	TO/LAND
L (R) MAIN BUS OFF	TO/LAND	WING ANTI-ICE FAULT	TO/LAND
MANUAL PRESS FAIL	TO/LAND	WING SOURCE-XBLEED	TO/LAND

* Accompanied by aural tone.
** Accompanied SELCAL voice message.

Table 4-5. STATUS MESSAGES

EICAS STATUS (WHITE) MESSAGES			
MESSAGE	**INHIBITS**	**MESSAGE**	**INHIBITS**
AIR COND MAN TEMP ON	—	L (R) HYD SOV CLOSED	—
AIR SOURCE OFF	—	MANUAL PRESS ON	—
APU GEN OFF	—	NWS OFF	—
AURAL WARN A (B) MUTED	—	PACK ONLY	—
AUTO APR OFF	—	PARK/EMER BRAKE ON	—
AUTOPILOT DISCONNECT	—	PASSENGER DOOR	TO/LAND
L (R) BATT OFF	—	PAX OXYGEN OFF	—
BLEED OFF	—	PAX OXYGEN ON	—
BUS TIE MAN OPEN	—	PITCH DISCONNECT	—
CARGO DOOR	TO/LAND	PROBE HEAT TEST OK	—
DITCHING ON	—	RAM AIR ON	—
EMER DEPRESS ON	—	L (R) REVERSER INOP	—
L (R) ENG ANTI-ICE ON	—	ROLL DISCONNECT	—
ENG ANTI-ICE ON	—	ROLL SPOILERS OFF	—
L (R) ENG FUEL SOV CLSD	—	RUD LIMITER IN TEST	—
L (R) ENGINE SHUTDOWN	—	SEC STAB TRIM ON	—
FIRE SYS IN TEST	—	STAB TRIM OFF	—
FIRE SYS TEST OK	—	STBY INST OFF	—
FUEL BALANCED	—	TAWS FLAPS OFF	—
FUEL GRAV XFLOW OPEN	—	TAWS GS WARN OFF	—
L (R) FUEL PUMP OFF	—	TAWS TERR OFF	—
L (R) FUEL PUMP ON	—	TRIM AIR ONLY	—
FUEL XFER OPEN	—	WING ANTI-ICE ON	—
L (R) GEN OFF	—	WING/ENG ANTI-ICE ON	—
GND SPOILERS OFF	—	WING SOURCE-XBLEED	—
HYD PUMP NOT AUTO	—	YAW DAMPER OFF	—
		XBLEED OPEN	—

QUESTIONS

1. The engine indicating and crew alerting system (EICAS) provides all of the following except:

a. Automatic system monitoring
b. Aural alert warning messages
c. Integration of system information
d. Integration of standby instrument system information

2. Which of the following denotes normal status of a component or no flow through the line?

a. Green
b. White
c. Amber
d. Magenta

3. Which of the following denotes component failure (no flow, energy or pressure)?

a. Red
b. Amber
c. White
d. Magenta

4. On the synoptic page display, a parameter that exceeds the established limits changes the indication to what color?

a. Red
b. Green
c. Amber
d. Cyan

5. Which EICAS messages are accompanied by a single chime and flashing master caution lights?

a. Warning (red)
b. Caution (amber)
c. Advisory (cyan)
d. Status (white)

6. Which EICAS messages require prompt action?

a. Warning (red)
b. Caution (amber)
c. Advisory (cyan)
d. Status (white)

7. How are CAS messages prioritized on the MFD display?

a. By order of importance
b. By order of occurrence
c. By order of importance and order of occurrence
d. In alphabetical order

8. Selected EICAS messages are inhibited for takeoff when:

a. TO/GA is selected until the aircraft is airborne
b. Throttles are advanced to the TO detent
c. Airspeed is above 80 knots and continues until the aircraft reaches 400 feet AGL or one minute elapses
d. Airspeed is above 40 knots until the aircraft reaches 800 feet AGL

9. How does the pilot select a synoptic page to display on an MFD?

a. The synoptic page displays automatically when there is a system malfunction
b. By selecting the individual system switch on the MFD control panel (MCP)
c. By selecting the appropriate page on the advisory control panel
d. By selecting the individual system switch on the display control panel

10. The aural warning panel is located:

a. On the left aft cockpit bulkhead above the circuit breaker panel
b. On the right equipment rack circuit breaker panel
c. On the left equipment rack circuit breaker panel
d. On the right aft cockpit bulkhead above the circuit breaker panel

CHAPTER 5
FUEL

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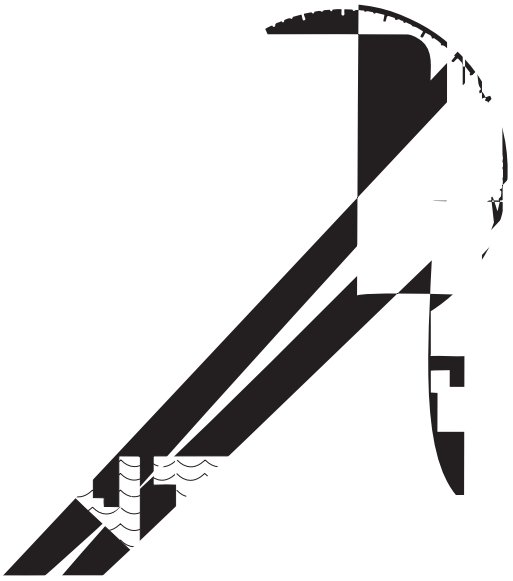

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resistant sealant.

from the tanks. Low drag NACA vent sco
provide static venting.

Fuel flows through the left and right collector tanks inside each wing tank. When the engines are operating, fuel flows by gravity through flapper valves separating the wing tank and the collector tank. A scavenge ejector pump also replenishes fuel in the collection tank.

The right backup DC fuel pump takes fuel from the right collector tank for the APU.

A surge tank is in the outboard area of each wing.

CAPACITY

Table 5-1 lists the maximum usable fuel loads.

Table 5-1. MAXIMUM USABLE FUEL LOADS

PRESSURE REFUEL		
FUEL TANK	**FUEL MASS***	
Right	7,075 lb	3,210 kg
Left	7,075 lb	3,210 kg
Left and right	14,150 lb	6,420 kg
*Based on a fuel density ot 6.75lb/USG (0.809 kg/litre), rounded to the nearest 5 lb or 5 kg. Fuel mass is provided for reference only and should not be considered limiting.		

GRAVITY REFUEL (AIRPLANE LEVEL)		
FUEL TANK	**FUEL MASS***	
Right	6,500 lb	2,950 kg
Left	6,500 lb	2,950 kg
Left and right	13,000 lb	5,900 kg
*Based on a fuel density ot 6.75lb/USG (0.809 kg/litre), rounded to the nearest 50 lb or 25 kg. Fuel mass is provided for reference only and should not be considered limiting.		

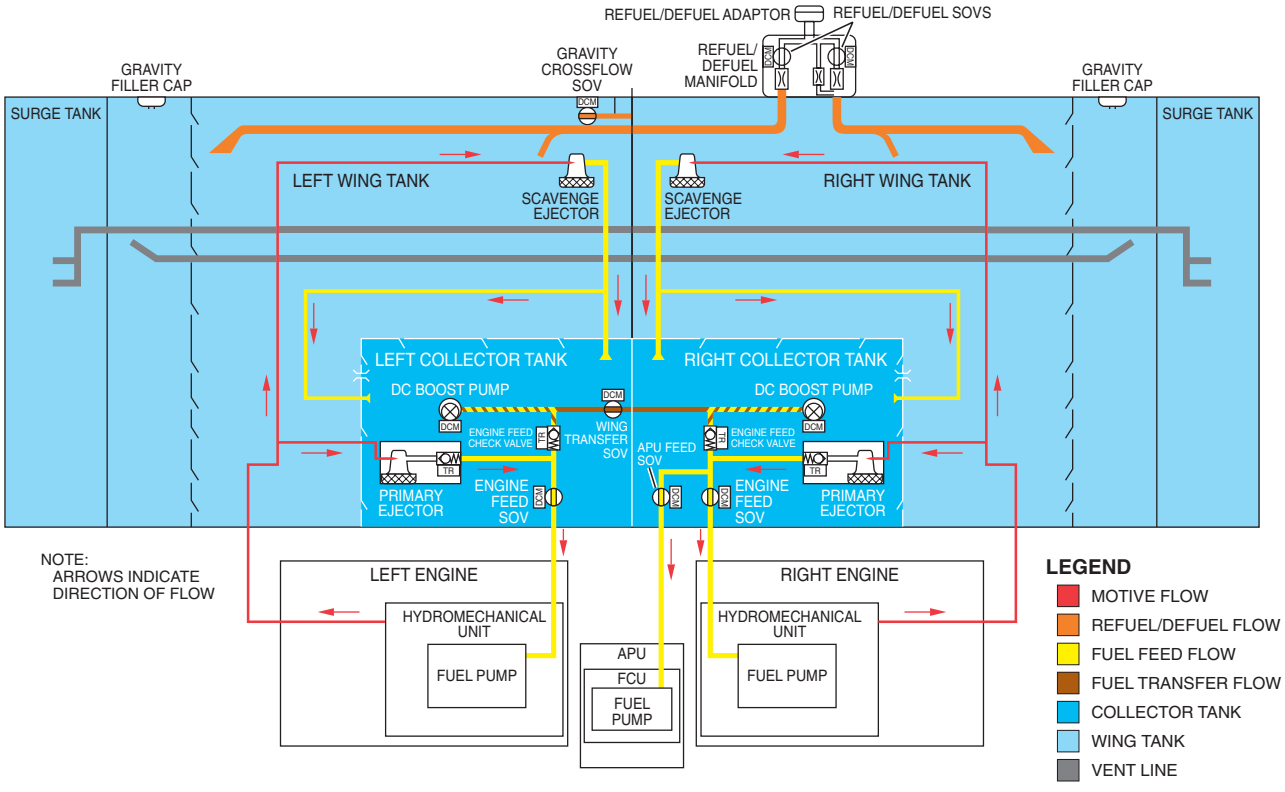

Figure 5-1. Fuel Tank System

COMPONENTS

Drain Valves

Three water drain valves are in each wing (Figure 5-2):

- One for collector tank
- One for wing tank
- One for surge tank

The valves drain water and contaminates that collect in the fuel tanks. They also can be used to complete the removal of the remaining fuel during defueling.

If contamination is suspected, all tanks should be drained until the fuel is clear of water or other contaminates.

Flapper Check Valves

Each wing tank incorporates flapper check valves that are attached to the internal wing ribs. These valves prevent outward flow of the fuel during wing low maneuvers.

Vent System

The tanks are vented through interconnecting vent lines to NACA scoops (low drag vents) on the lower surface of the wing trailing edges. Each wing has a NACA scoop.

During operation on the ground and in flight, the scoop provides static ventilation of the tanks. This relieves air pressure differential caused by the refueling process, thermal expansion of the fuel, or variation in altitude during flight.

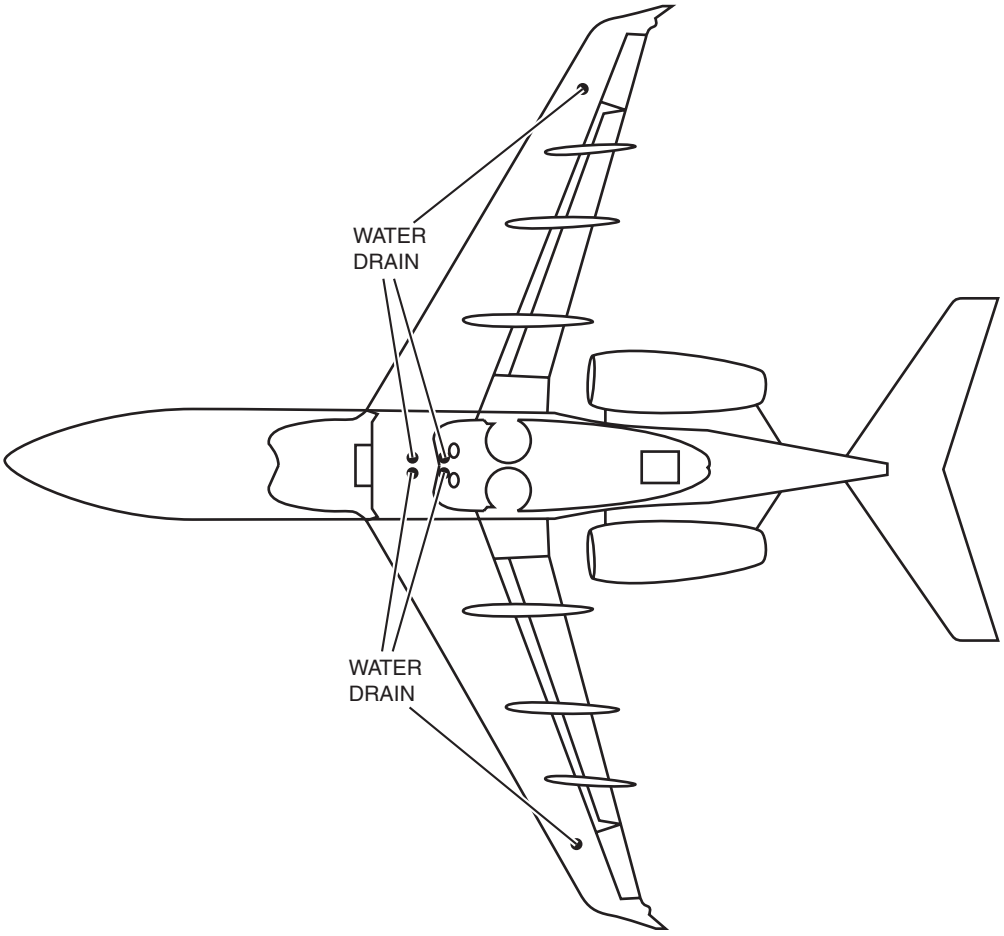

Figure 5-2. Water Drain Valves

Surge Bays

Surge bays provide additional expansion volume for the vent system to prevent fuel spillage. Each surge bay holds 53.6 lbs of fuel. Flapper valves between the surge bays and tanks prevent outward flow of fuel.

DISTRIBUTION

The left distribution system feeds the left engine while the right distribution system feeds the right engine and the APU.

Each tank independently provides primary fuel feed to its engine.

COMPONENTS

Components of the distribution system include the following:

- Collector Tanks
- Main Ejectors
- Scavenge Ejectors
- Standby Boost Pumps
- Engine Fuel Shutoff Valves
- Fuel Heater/Oil Cooler
- Fuel Filter
- APU Fuel SOV
- Control Panel

Collector Tank

The collector tanks furnish all fuel consumed by the engines. The tanks are in the aft section of each wing tank. Fuel from the wings flow into the left and right collector tanks from the associated wing tank through flapper check valves.

For the APU, the right collector tank supplies fuel while the right main ejector or right electric fuel pump feeds the APU line. The electric standby boost pump feeds the APU if ejector pressure is low.

The scavenge ejectors remove fuel from the wing tanks and deliver the fuel to the associated collector tank.

Main Ejectors

Each ejector pump takes fuel from its associated collector tank and delivers it to the engine. The main ejectors are on the bottom of the collector tanks.

The high-pressure output of the engine-driven fuel pumps creates the motive flow that operates the two main ejectors. They do not rely on any other power sources for control or operation. Pressure switches at the ejector outlets signal proper operation.

Scavenge Ejector

Motive flow also operates the scavenge ejectors. The two scavenge ejectors are at the lowest inboard point of each wing tank. These ejectors transfer fuel from the wing tanks to the collector tanks.

Standby Boost Pumps

The electric standby boost pumps provide fuel pressure to the engines during engine start or when a main ejector pump fails. They also provide fuel pressure for transferring fuel from one wing tank to the other.

Engine Fuel Shutoff Valves (SOV)

An independently operated fuel shutoff valve for each engine feed is forward of the engine rotor burst area. If an engine fire occurs, the valves are closed with activation of the L and/or R ENG FIRE switches on the center pedestal. If required, depressing the switches a second time reopens the SOVs.

The engine fuel SOVs are electrically operated valves that stop the flow of fuel to the engines.

Fuel Heater/Oil Cooler

The fuel heater/oil cooler (FHOC) is in the engine accessory gearbox. The engine FHOC heats the fuel sufficiently to prevent ice formation in the engine fuel system while maintaining engine oil temperature within limits.

Fuel Filter

The fuel filter assembly is mounted just aft of the oil tank on the engine. The filters are monitored for contamination by an impending bypass switch. If fuel pressure parameters are exceeded, a signal is sent to the EICAS.

APU Fuel SOV

The APU fuel feed SOV is electrically operated. In case of an APU fire, pushing the APU FIRE switch on the ENGINE control panel closes the SOV.

Control Panels

The FUEL control panel controls the boost pumps and provides manual control and indications of the gravity and powered crossflow system (Figure 5-3). It contains the following switches:

- L PUMP and R PUMP switches for the standby boost pumps; rotary switch positions are OFF-AUTO-ON
- XFER switch
- GRAVITY XFLOW switch

The ENGINE control panel contains the APU FIRE and the L and R ENG FIRE switches that operate the fuel SOVs.

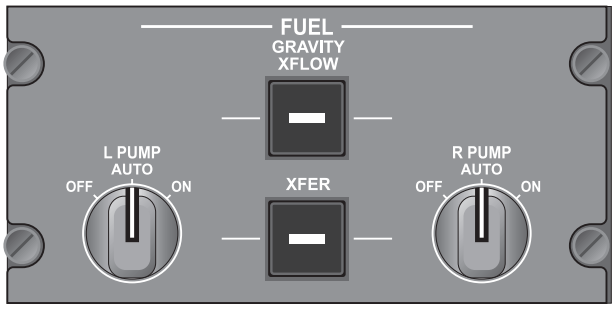

Figure 5-3. FUEL Control Panel

OPERATION

Motive flow from the high-pressure stage of the engine fuel system enables the main ejector to pressurize the fuel line. As motive flow passes through the venturi of the ejector, fluid velocity is increased. Low pressure is thus created. The suction caused by the low pressure moves fuel out of the tank.

In order to provide pressure during engine start or in the event of a main ejector failure, a standby boost pump is in parallel with each main ejector. When the engine RUN switch is selected to ON and the respective standby boost pump is in the AUTO position, the pump operates whenever the main ejector does not deliver sufficient pressure to the engine.

For added safety, when sufficient pressure is achieved at the main ejector outlet, a time delay commands the boost pump to remain on for an additional 10 seconds.

Fuel Balancing

The standby boost pumps can pump fuel from one wing to the other for lateral balance. A transfer valve connects the two standby pumps.

The transfer valve is normally closed to isolate left and right engine feed systems. When restoring balance, however, the transfer valve is opened (XFER on FUEL control panel) and the standby boost pump on the heavy side is switched on.

Fuel is then pumped from the wing through the transfer valve and the inactive standby boost pump into the other wing.

Gravity Crossflow

A gravity crossflow system that is independent of the standby pumps provides a secondary method to balance fuel loads. The crossflow system provides a direct flow path between the wings controlled by a gravity crosssflow shutoff valve.

When the gravity crossflow valve is opened (GRAVITY XFLOW selected on), aircraft maneuvering (steady heading sideslip) may be required.

If the initial imbalance is minimal, the maneuvering helps achieve transfer of fuel. Aircraft maneuvering is not required when the imbalance between the two tanks is large.

Monitoring Imbalance

The pilot controls fuel balancing with the standby boost pumps or through gravity crossflow while visually monitoring fuel contents and EICAS messages.

INDICATION AND CONTROL

The fuel indication and control system consists of the following:

- Fuel computer
- Fuel quantity probe
- Fuel temperature probes
- Fuel level sensors
- Refuel/defuel panel (discussed in Refueling/Defueling section)

FUEL COMPUTER

The fuel system computer provides the following functions:

- Processing of fuel quantity probe, fuel density probe, fuel level, fuel temperature, and sensor signals (discussed in previous section)
- Failure monitoring and indication to EICAS and maintenance diagnostic computer
- Automatic control of refueling and defueling when selected
- Engine oil level indication to the refuel/defuel panel

One channel of the dual-channel fuel computer controls each side of the fuel system. If the onside channel fails, the other channel automatically assumes control. Each channel receives signals from the fuel probes. The AHRS furnishes each channel with aircraft attitude information.

The computer calculates the fuel quantity as weight in each tank from fuel density, fuel probe readings, aircraft attitude and acceleration, and the weight-on-wheels signal.

FUEL QUANTITY PROBES

Nine fuel quantity probes are distributed throughout each wing tank. The probes provide fuel level indications to the fuel computer.

FUEL TEMPERATURE PROBE

The fuel temperature probe in the right wing tank provides temperature information.

FUEL LEVEL SENSORS

A tank full fuel level sensor is at the top of each tank. This sensor provides a cutoff signal to the refuel valve when the tank is full.

FUEL SYNOPTIC PAGE

The fuel synoptic page presents a simplified schematic of the fuel system (Figure 5-4). Fuel quantities are displayed in pounds (lbs) or kilograms (kg) on EICAS and the FUEL synoptic page. Fuel flow is indicated in either pounds per hour (PPH) or in kilograms per hour (KPH). Magenta dashes display if input value is invalid.

A bulk fuel temperature readout above the right wing quantity indication shows the temperature of fuel in the right wing. Green readouts indicate temperatures above –38°C. Display of a WING FUEL TEMP LOW caution CAS message indicates –38°C or below.

Fuel Quantity Indications

- TOTAL FUEL—Total quantity over 600 lb (272 kg) in green digits (amber if below 600 lb) in upper left corner
- Wing Tanks—Quantity over 300 lb (136 kg) in green digits (amber if below 300 lb) within each wing
- FUEL USED—Amount used since counter reset in upper right corner; FADEC automatically resets the counter on power-up

The left or right wing tanks indicate quantity in amber digits along with a FUEL IMBALANCE caution CAS message if the following imbalance conditions exist:

- 250 lb (113 kg) or more with a total fuel weight of more than 13,700 lb (6,214 kg)
- 315 lb (143 kg) or more with a total fuel weight between 13,700 lb (6,214 kg) and 10,000 lb (4,536 kg)
- 450 lb (204 kg) or more with a total fuel weight between 10,000 lb (4,536 kg) and 4,700 lb (2,132 kg)
- 600 lb (272 kg) or more with a total fuel weight of less than 4,700 lb (2,132 kg)

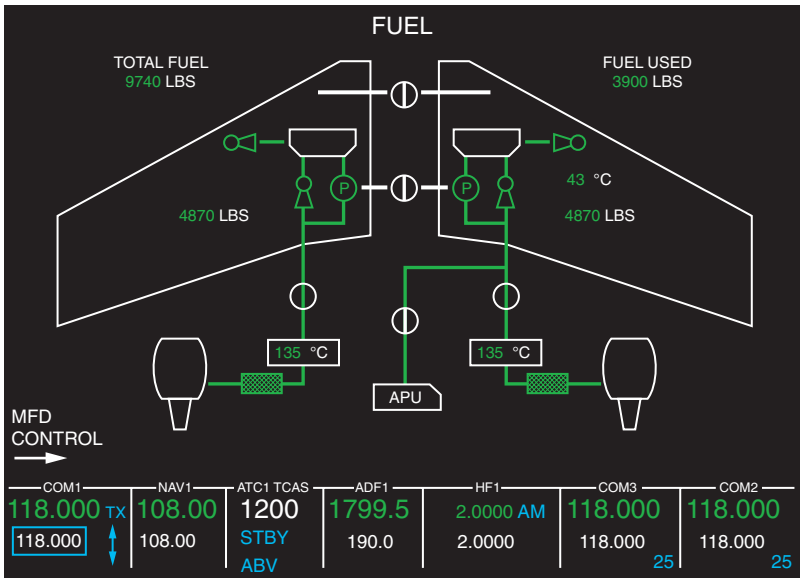

Figure 5-4. FUEL Synoptic Page

REFUELING/DEFUELING

Refueling can be accomplished using either pressure or gravity refueling procedures. A list of approved fuels and maximum pressure for refueling is placarded on the door of the single-point adapter (Figure 5-5). Pressure refueling is preferred. Over the wing gravity refueling is used only when single-point refueling capabilities do not exist.

Defueling of the aircraft is not a pilot function. For defueling, maintenance personnel apply suction to the single-point refuel/defuel adapter when the control panel is configured for defueling.

The fuel system computer discussed earlier monitors and controls the refueling process.

Pressure refueling and suction defueling can be conducted using the single-point fuel port and the refuel/defuel panel. Both are in the right wing root leading-edge fairing.

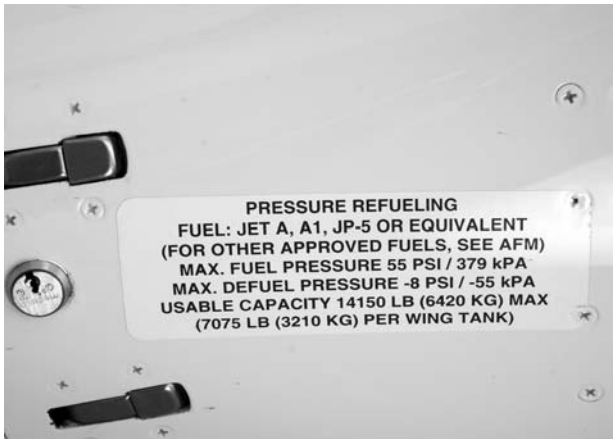

Figure 5-5. Pressure Refueling Placard

COMPONENTS

Grounding Receptacles

Receptacles for grounding the aircraft to the refueling equipment are the following:

- Adjacent to each gravity filler port
- Adjacent to the pressure refueling coupling
- Nose gear stud

High-Level Sensors

High-level sensors provide the fuel computer with the tank full signal. The sensors allow for a three percent expansion space. When the high-level sensor signals a full condition, the computer closes the respective refuel shutoff valve.

Single-Point Adapter

The refuel/defuel single-point adapter connects the refueling nozzle to the aircraft (Figure 5-6). The adapter is in the right fuselage fairing just forward of the right wing.

Figure 5-6. Single-Point Adapter

Refuel/Defuel Control Panel

The refuel/defuel control panel controls refueling and defueling operations, tests the integrity of the fuel system components, and displays individual fuel tank quantities (Figure 5-7).

The controls allow the required total fuel loads to be preselected. The fuel system computer then automatically controls the loads.

Alternatively, the quantity of fuel loaded into the aircraft can be manually controlled from the refuel panel. A high-level sensor in each tank prevents the tanks from being overfilled if the automatic or manual refuel control fails.

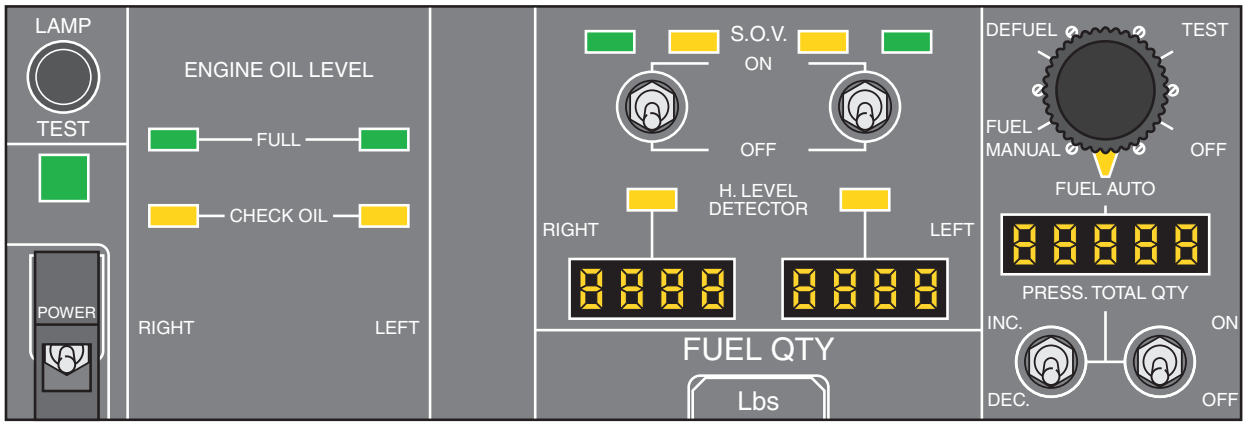

Figure 5-7. Refuel/Defuel Control Panel

System Test

Before automatic or manual pressure refueling or defueling, satisfactory tests of the system must be performed (Figure 5-8). One test verifies lamps are operating correctly.

The second test checks the SOVs. This electrically simulates high-level sensor operation and then verifies refuel valve closure.

The test procedure is as follows:

1. Ground aircraft.
2. Connect nozzle.
3. Select POWER switch to ON.
4. Allow 10 seconds for self-test.
5. Push LAMP TEST button. Verify all panel lamps illuminate.
6. Apply fuel pressure.
7. Select TEST position on fuel selector switch. Verify SOV OP and H. LEVEL DETECTOR lamps illuminate.
8. Select OFF position on fuel selector switch. Verify only the SOV CL lamps illuminate.

The panel is now ready for automatic or manual fueling.

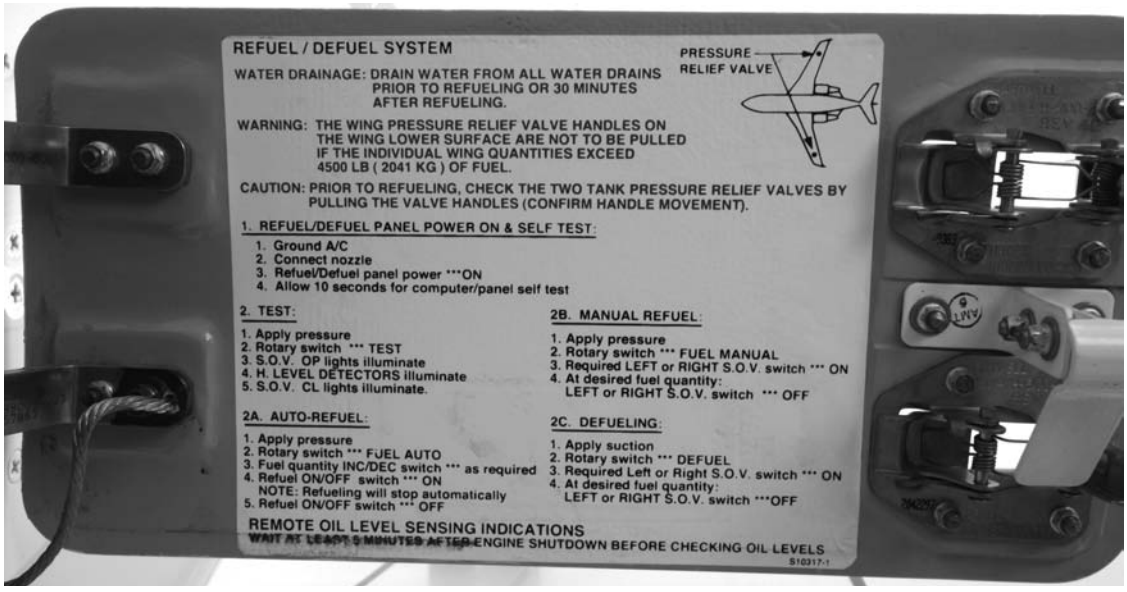

Figure 5-8. Refuel/Defuel System Test Checks

PRESSURE FUELING

With the fuel selector switch in FUEL AUTO, the refueling operator preselects the total fuel quantity through the INC/DEC switch. When the desired quantity is set, the ON/OFF toggle switch is set to ON to start refueling.

The fuel system computer automatically directs the preselected quantity of fuel, which is dispensed at 368.5 lbs per minute at 55 psi. When the desired quantity is reached, refueling automatically stops.

Reposition the ON/OFF toggle switch to OFF once refueling has stopped.

To fuel in manual mode, position the fuel selector switch to the FUEL MANUAL setting. Use the SOV ON/OFF switches to add the desired fuel quantity to the respective wing tanks. The manual mode allows refueling personnel to direct fuel to a specific tank by selecting the appropriate shutoff valve to open or closed.

GRAVITY REFUELING

Gravity refueling is only accomplished in exceptional circumstances. The refueling process is accomplished through the filler ports on the upper wing surfaces.

Because of the shallow depth of the wing at the filler cap, a protective plate is in the tank so the refueling nozzle cannot damage the bottom skin.

WARNING

Gravity filler caps for the wing tanks are below the maximum pressure refueling level. Never remove the gravity filler caps if the wing tanks are full or fuel quantity is unknown.

EICAS MESSAGES

Table 5-2 lists the EICAS messages associated with the fuel system, a brief explanation of the message, and whether the message is inhibited during takeoff and/or landing.

Table 5-2. EICAS MESSAGES

MESSAGE	INHIBITS	MEANING	AURAL WARNING
L (R) ENG FUEL SOV FAIL		The respective engine fuel shutoff valve has failed to close when commanded.	
L (R) FUEL COLLECTOR LOW	TO	The fuel collector tank quantity is less than 200 pounds.	
FUEL IMBALANCE	TO/LAND	The wing fuel imbalance is greater than: • 250 lb (113) kg) with a total fuel weight of more than 13,700 lb (6,214 kg) • 315 lb (143 kg) with a total fuel weight between 13,700 lb (6,214 kg) • 450 lb (204 kg) with a total fuel weight between 10,000 lb (4,536 kg) • 600 lb (272 kg) with a total fuel weight of less than 4,700 lb (2,132 kg)	
L (R) FUEL PRESSURE LOW		The engine fuel pressure is below 6 psig.	
L (R) FUEL PUMP FAIL	TO/LAND	The respective electric fuel pump has failed	
FUEL QUANTITY FAIL	TO/LAND	Both channels of the fuel quantity gauging computer have failed. Fuel quantities will be indicated as magenta dashes on the EICAS.	
FUEL QUANTITY LOW		Total fuel quantity is 300 lb (136 kg) or less in either wing when the aircraft is in unaccelerated level flight.	
WING FUEL TEMP LOW	TO/LAND	Fuel temperature in the wing is below –38°C (–36°F).	
L (R) FUEL EJECTOR FAIL	TO/LAND	The affected ejector pump has failed to provide sufficient pressure. The electric fuel pump should automatically turn on to provide sufficient fuel pressure.	
FUEL GRAV XFLOW FAIL	TO/LAND	The wing fuel gravity crossflow valve is not fully opened or closed as commanded.	
L (R) FUEL PUMP ON		The respective electric fuel pump has been automatically turned on.	
FUEL QUANTITY FAULT	TO/LAND	The left or right channel has detected a fault or loss of temperature compensation.	
FUEL XFER FAIL	TO/LAND	The fuel transfer valve has failed.	

Table 5-2. EICAS MESSAGES (Cont)

MESSAGE	INHIBITS	MEANING	AURAL WARNING
L (R) ENG FUEL SOV CLOSED		Respective engine fuel shutoff valve is closed.	
FUEL BALANCED	TO/LAND	The fuel is balanced within 100 lb with the FUEL XFER valve open.	
FUEL GRAV XFLOW OPEN		Wing fuel gravity crossflow valve is open.	
L (R) FUEL PUMP OFF		The respective fuel pump is OFF.	
L (R) FUEL PUMP ON		The respective fuel pump is ON.	
FUEL XFER OPEN		The fuel transfer valve is open.	

QUESTIONS

1. All fuel supplied to the engines comes from the:

a. Scavenge ejector pumps
b. Collector tanks
c. Wing tanks
d. Gravity feed manifolds

2. How is fuel supplied to the APU?

a. The left DC electric pump takes fuel from the left collector tank
b. Directly from the right wing tank
c. The right main ejector or right electric fuel pump takes fuel from the right collector tank
d. Through the flapper check valve in the left wing tank

3. What is the function of the surge bay?

a. To provide additional expansion volume for the vent system
b. To collect fuel to route to the engines and APU
c. To prevent the outward flow of fuel during wing-low maneuvers
d. To relieve air pressure differential caused by the refueling process

4. What operates the main ejectors?

a. 28 VDC from the associated main bus
b. 28 VDC from the associated battery bus
c. The electric standby boost pumps
d. Motive flow from the engine-driven fuel pumps

5. The FUEL BALANCED status (white) CAS message is displayed when:

a. Fuel is balanced and the XFER valve is closed
b. Fuel is balanced within 100 lb. and the XFER valve is open
c. Fuel is balanced within 250 lb. and the XFER valve is open
d. Fuel is balanced within 150 lb. and the XFER is open

6. With more than 13,700 lbs. of fuel, fuel balance must be maintained within:

a. 250 lb/113 kg.
b. 315 lb/143 kg.
c. 450 lb/204 kg.
d. 600 lb/272 kg.

7. Single-point pressure refueling is limited to:

a. 35 psig
b. 45 psig
c. 55 psig
d. 65 psig

CHAPTER 6
APU

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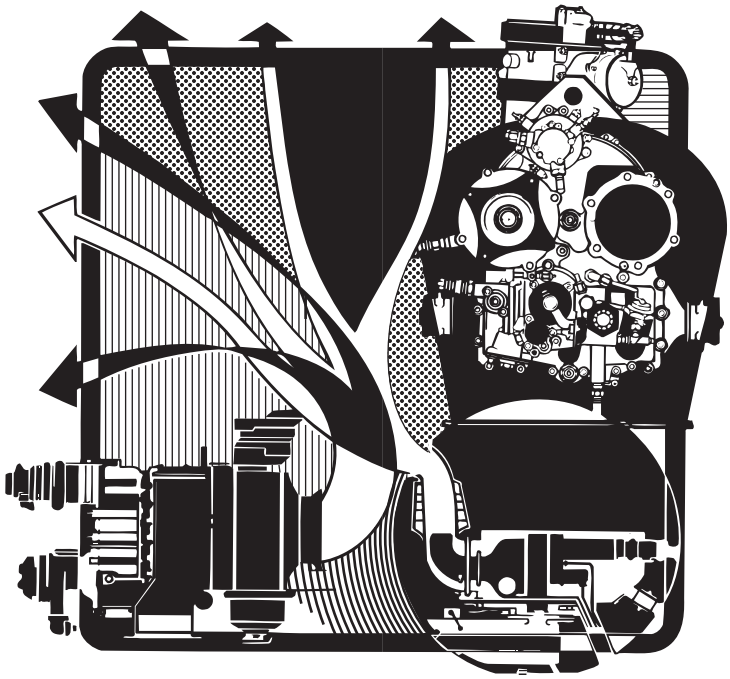
CHAPTER 6
APU



INTRODUCTION

The Challenger 300 has a Honeywell 36-150BD auxiliary power unit (APU) to provide power for the gearbox-mounted 400 amp DC generator. The self-contained unit also can supply bleed air for the environmental control system (ECS) and main engine starting. With high demand, the APU electrical loads take priority over pneumatic loads.

GENERAL

The Honeywell 36-150BD APU is a fully automated constant-speed gas turbine powerplant in a fireproof compartment in the tailcone (Figure 6-1). It has automatic fault detection, automatic and remote shutdown, and automatic fire extinguishing.

A single panel aft of the aft equipment bay door (Figure 6-2) accesses the APU compartment. The panel must be unscrewed from the fuselage underside.

The APU compartment has a NACA inlet for ventilation. Air is pulled through the inlet and routed through the compartment to cool the APU and its components. The APU-driven air-cooled DC generator also has a NACA inlet for cooling air flow. The air is pulled through the generator and dumped in the APU compartment.

Air from both NACA inlets is then exhausted overboard via the APU exhaust eductor.

For APU maximum operating altitude for ground and flight and for continuous starter limitations, refer to the approved *Airplane Flight Manual* (*AFM*).

The APU should not be started above speed limits stated in the *AFM* because it may reverse windmill.

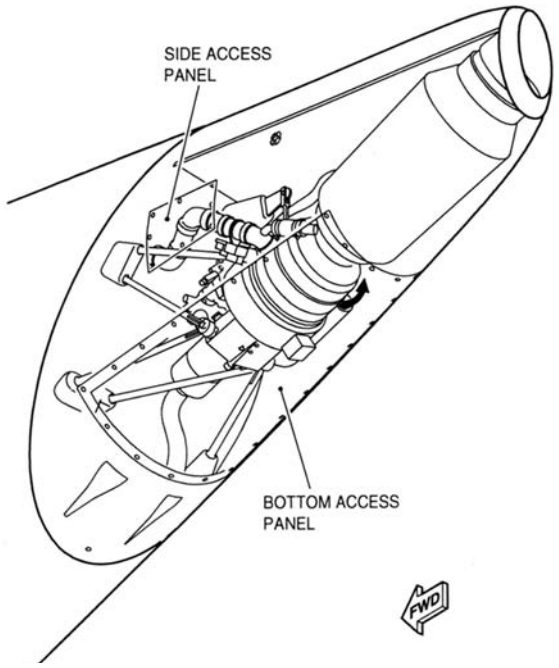


Figure 6-2. APU Access Panel Locations

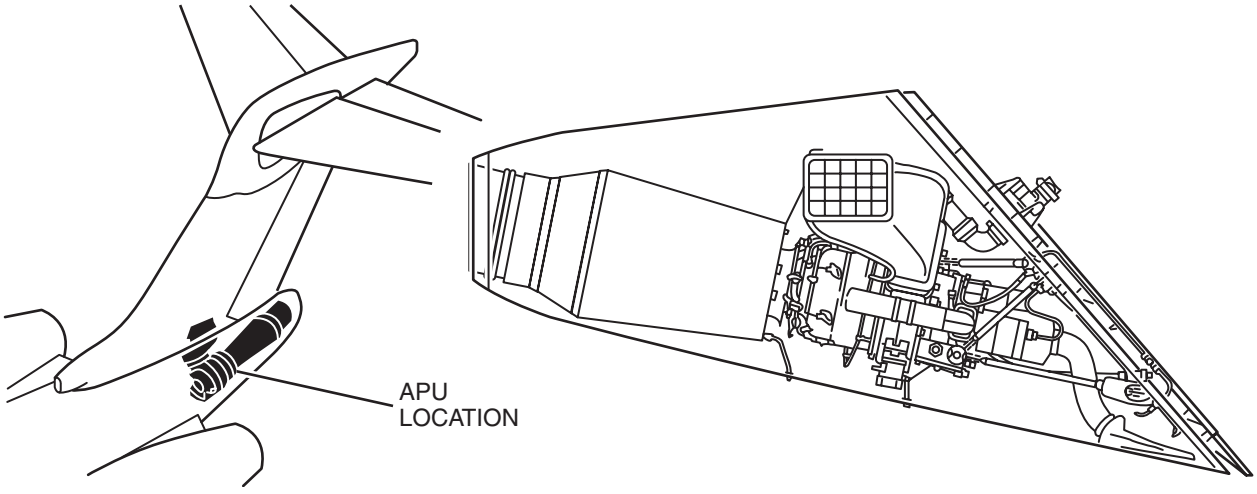


Figure 6-1. APU Location

DESCRIPTION

An engine control unit (ECU) controls and monitors all facets of APU operation including the recording of operating hours and start cycles. The DC-powered ECU sets up the appropriate fuel, acceleration, and EGT temperature schedules. It also relays appropriate operating data to the EICAS displays.

The power section of the APU consists of a gas turbine engine (gas generator) with integrated oil, ignition, and start systems.

GAS GENERATOR

The gas generator contains the following components:

- Single-stage centrifugal compressor
- Single-stage radial turbine
- Annular reverse flow combustor

Compression of ambient air by the centrifugal compressor develops the engine power. The compressed air, when mixed with fuel and ignited in the annular reverse flow combustor, drives a single-stage radial turbine. The rotating shaft of the turbine rotor drives the compressor, output drive shaft, and accessories.

This power section drives a gearbox that reduces the rotational speed of the APU for operation of the gearbox-mounted accessories.

GEARBOX ASSEMBLY

The gearbox assembly provides power transfer from the starter motor to the accessories and power section during APU starting as well as to all gearbox-mounted accessories during on-speed operation.

The accessories include the following:

- Starter
- DC generator
- Oil pump
- Speed sensor
- Fuel control unit and high-pressure pump

The APU gearbox also serves as a sump for the lubrication system and incorporates the oil gravity fill cap and quantity sight glass.

AIR INTAKE AND EXHAUST

The APU air intake is above the APU compartment on the right side of the fuselage, below the vertical stabilizer.

APU exhaust gases are discharged by an exhaust duct and eductor through the tailcone of the aircraft. An insulated exhaust muffler covers the duct.

The APU exhaust gas temperature (EGT) is displayed as a digital readout on EICAS.

LUBRICATION SYSTEM

The APU has a self-contained lubrication system. Major components include a gearbox-mounted oil pump and an integral gearbox oil sump. Intake air cools oil and ventilates the APU enclosure.

A magnetic chip collector provides visual indication of metal particles in the lubrication system.

The oil pump directs filtered oil under pressure to the APU bearings, gearbox, and generator bearings.

START SYSTEM

The APU start system consists of a DC starter and a series of relays. The ECU controls the relays.

The left essential bus powers the APU ECU while the right battery directly supplies the starter.

IGNITION SYSTEM

The APU ignition system consists of an ignition unit, igniter plug lead and a single igniter plug. The ignition system is energized during the APU start cycle and is deenergized when the APU start sequence is complete.

Should a flameout occur during operation, the ignition unit automatically fires the igniter through the autorelight function of the ECU. An immediate restart (APU starter reengagement) can be initiated upon APU roll-down below 10% rpm.

FUEL SYSTEM

The Honeywell 36-150BD APU fuel system is a full-authority digital electronic engine (FADEC) controlled system. During start, the fuel system provides the correct amount of fuel to support combustion and smooth acceleration of the engine to full power. When full power is reached, fuel flow is modulated to meet electrical and pneumatic load while maintaining a constant engine speed.

The APU fuel system incorporates:

- Right DC-powered fuel pump
- Fuel feed shutoff valve (SOV)
- Fuel shutoff solenoid
- Fuel system filters
- High-pressure fuel pump (mounted on the APU)
- Fuel control unit (FCU)
- Fuel manifold assembly

The APU receives fuel from the right collector tank. The right DC-powered fuel pump delivers fuel under pressure to the APU FCU. When the right engine is running, the fuel pump ceases operation and the main engine ejector pump delivers fuel.

The FCU meters fuel under command of the ECU. During the start sequence, the ECU opens the fuel shutoff solenoid between the FCU and the fuel nozzles at 5% rpm. Fuel is supplied in accordance with a schedule that accelerates the APU throughout the start sequence.

When the APU is stabilized, the rpm and EGT as well as generator and bleed-air demands influence fuel scheduling.

During normal or automatic APU shutdown, an overspeed signal closes the fuel solenoid valve and torque motor at the APU. This causes the APU to shut down.

Protective features incorporated in the ECU provide protection from overtemperature during APU acceleration.

CONTROLS AND INDICATIONS

APU PANEL

The APU panel contains a single three-position switch with OFF-RUN-START positions (Figure 6-3). The switch is on the pedestal.

APU GENERATOR

The ELECTRICAL panel on the pedestal controls DC electrical power provided by the APU generator (Figure 6-4). The APU GEN switch is between the L and R GEN switches. White lines depict its connection to the left and right main buses.

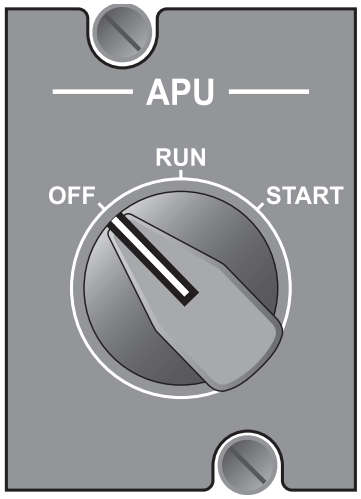


Figure 6-3. APU Panel

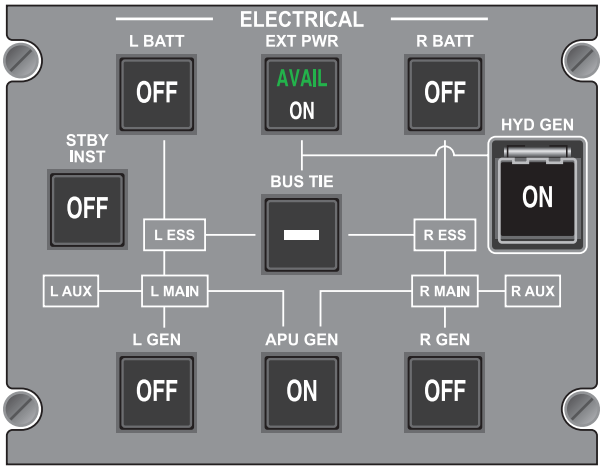


Figure 6-4. Electrical Panel

EICAS

EICAS pages display system operation and fault presentation. Engine indications in the upper left corner of the MFD include a digital display of the APU rpm and EGT.

The FUEL synoptic page depicts fuel flow to the APU and the position of the APU shutoff valve (SOV) (Figure 6-5).

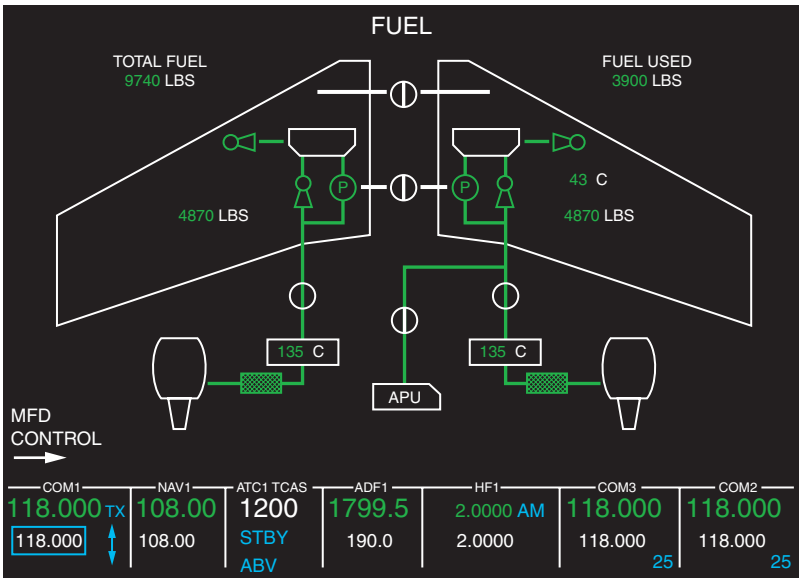


Figure 6-5. FUEL Synoptic Page

The ECS synoptic page monitors the APU load control valve (Figure 6-6).

The ELECTRICAL synoptic page depicts the APU voltage and amps (Figure 6-7).

APU system messages are also displayed on EICAS (see EICAS section at the end of the chapter).

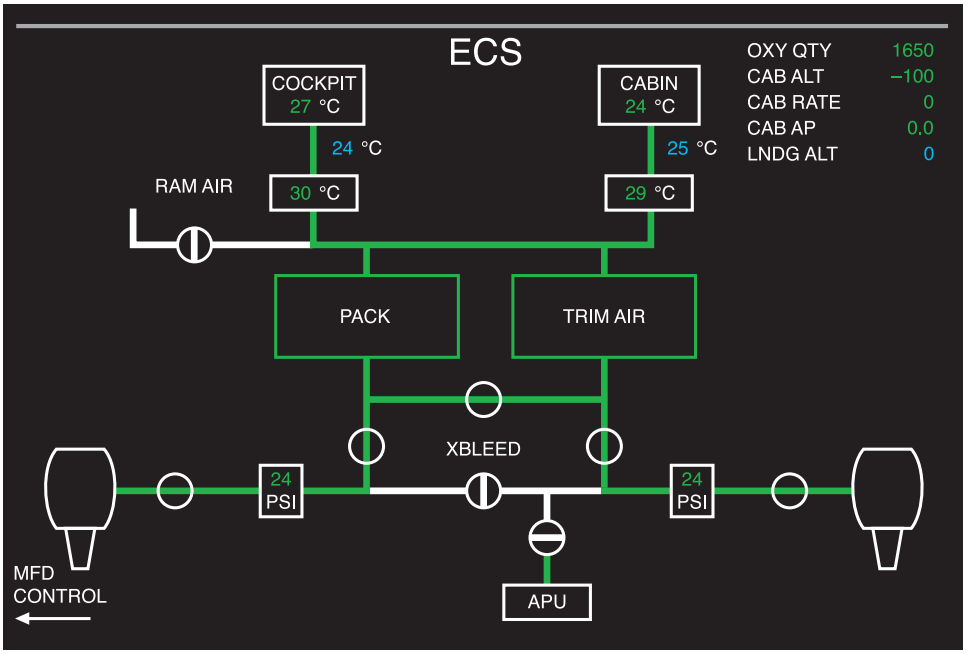


Figure 6-6. ECS Synoptic Page

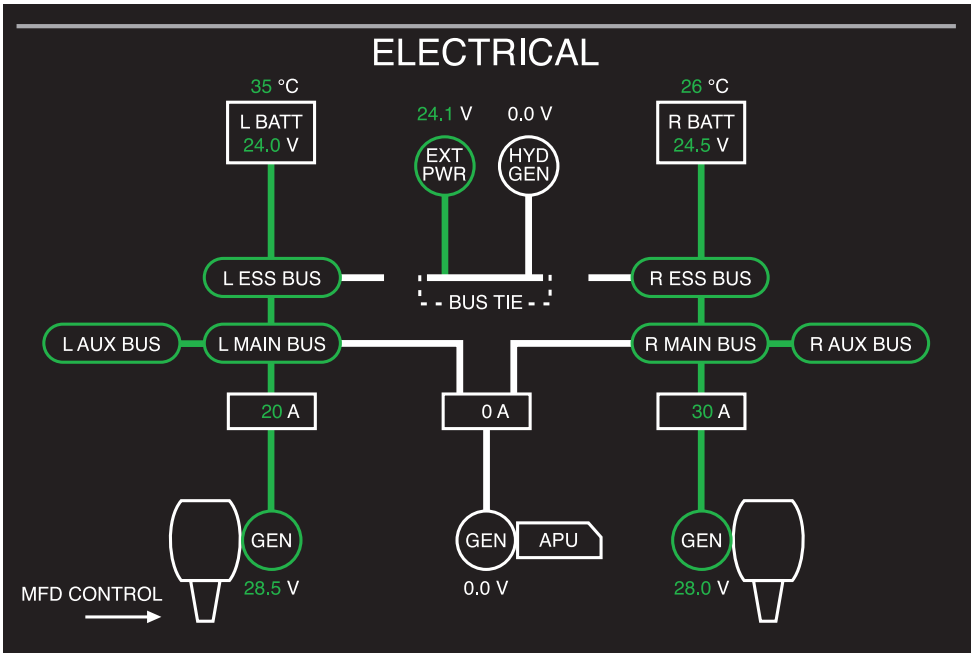


Figure 6-7. ELECTRICAL Synoptic Page

BLEED SERVICE SWITCH

The APU switch on the AIR COND/BLEED panel controls bleed air (Figure 6-8) through the APU bleed valve.

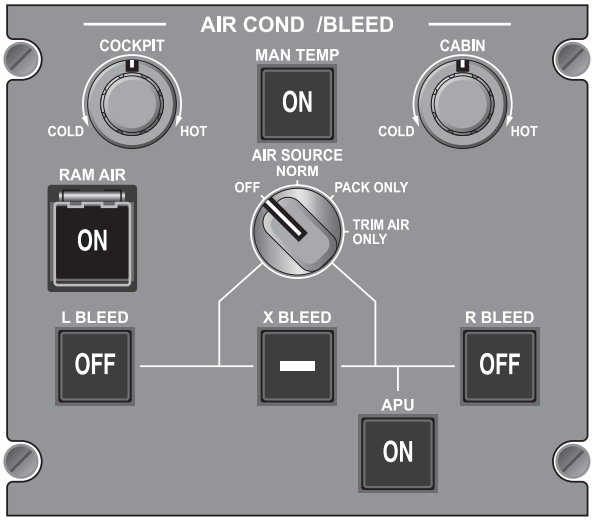


Figure 6-8. AIR COND/BLEED Panel

REMOTE CUTOFF SWITCH

A remote cutoff switch is on the right side of the aircraft. This switch is for ground operations only (Figure 6-9). The switch is aft of the wing and behind the electrical connection access door.

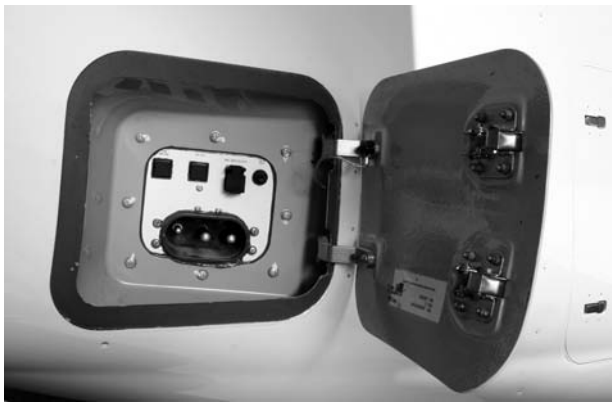


Figure 6-9. Remote Cutoff Switch

OPERATION

STARTING

The starting and ignition systems operate automatically during the APU start sequence.

Pull up on the APU switch on the APU panel and position it to START. This action closes the APU start contactor and connects the right battery to the APU starter. The right battery contactor is opened to isolate the right battery from the right essential bus to prevent a voltage drop on the essential buses. The left battery maintains power to the left and right essential buses during APU start. The START switch signals the FADEC to initiate the start sequence.

Hold the APU switch in the START position for approximately three seconds and then release. The switch will return to the RUN position.

The ECU uses 28-VDC power from the right aircraft battery bus to energize the ignition system during the ignition/start sequence. During the start sequence, the R BATT switch is illuminated OFF on the ELECTRICAL panel and the flow line from R BATT to the R ESS BUS on the ELECTRICAL synoptic page is depicted in white.

The ignition system is energized at 5% APU rpm and stays energized until 95% rpm.

Personnel should delay starting the APU for five minutes after application of anti-icing fluid near the APU area. This allows any anti-icing fluid inadvertently directed into the APU inlet to drain out.

Three consecutive APU start attempts may be made at one-minute intervals, followed by a 20-minute wait. Two more start attempts may be made. No further attempts may be made for a period of at least 40 minutes.

Six consecutive and successful APU starts may be made at 10-minute intervals with a one-hour waiting period prior to additional start attempts.

PNEUMATIC SUPPLY

When the APU is running, compressor bleed air pressurizes the right side of the bleed air manifold to provide pneumatics for engine starting and air conditioning. A check valve provides reverse airflow protection (Figure 6-10).

The pneumatic control system consists of a bleed valve and a surge control valve. The APU switch on the AIR COND/BLEED panel controls bleed air through the bleed valve (see Figure 6-8).

For the ECU to energize the bleed air supply system, the APU must be operating at more than 95% of its maximum speed.

Bleed Valve

The APU bleed valve controls airflow to the bleed system and protects the APU from an overtemperature condition. The APU bleed switch electrically controls the bleed valve, which then operates pneumatically.

When the bleed valve is open (APU bleed switch ON), the ECU adjusts the butterfly plate position to supply the correct quantity of bleed air. These adjustments are related to the required quantity of bleed air and APU EGT.

Surge Control Valve

The ECU automatically controls the surge control valve. When the APU is supplying electrical loads at flight altitudes above 15,000 ft, the valve is commanded open. This function reduces APU surge potential when operating in an unloaded condition.

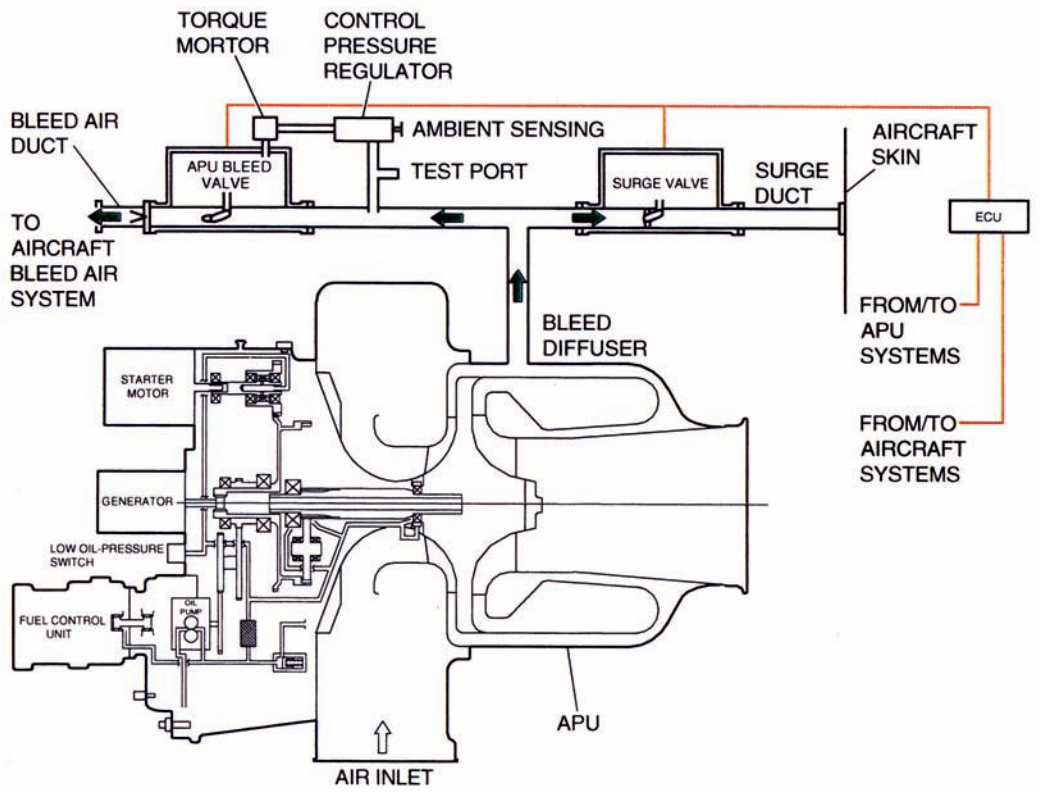


Figure 6-10. APU Schematic

Operation

The ECU controls the pneumatic load on the APU as a function of demands from the APU bleed valve. When the bleed valve is opened, a portion of the compressor discharge air is diverted from the plenum chamber to the right side of the bleed-air manifold.

The APU engine reaction to bleed loads is different from shaft loading in that bleed air extraction from the APU diverts pneumatic energy from the turbine and some of the cooling air from the combustion system. The rpm drops with shaft load. The rpm recovers to full speed with the corresponding ECU-commanded fuel flow increase. Air diverted into the bleed manifold is no longer available to drive the turbine or cool the combustion system. The loss of pneumatic energy is replaced with thermal energy (higher fuel burn) with significant temperature increase.

The following variables influence exhaust gas temperature (EGT) under bleed air load conditions:

- Aircraft demand for bleed air
- Ambient air temperature and density

Should EGT reach the limit, the ECU reduces bleed-air flow by modulating the bleed valve toward the closed position to prevent overtemperature.

Refer to the *AFM* for bleed air limitations.

SHUTDOWN

The ECU initiates the APU shutdown sequence by commanding the fuel off. When the shutdown sequence is complete, the ECU transitions to idle mode and then powers down if the APU master switch is in the OFF position.

Any of the following actions initiates APU shutdown mode:

- APU master switch to OFF
- Use of the remote stop switch
- Emergency and/or fire (see list below)
- Limits exceeded

The APU may automatically command a protective shutdown. The APU will automatically shut down inflight or on the ground under the following conditions:

- Loss of DC power
- Failure of the ECU
- Overspeed
- Loss of overspeed protection

The APU will automatically shut down on the ground under the following conditions:

- Loss of EGT signal
- Reverse flow
- High oil temperature
- Low oil pressure
- No acceleration
- No flame
- Overtemperature
- Loss of speed signal
- Defective oil temperature sensor
- Defective surge control valve
- Fire

If an APU fire is detected on the ground, the APU will shut down and fire extinguishing agent will automatically be discharged into the APU enclosure.

EICAS MESSAGES

Table 6-1 lists the EICAS messages associated with the APU system, a brief explanation of the message, and whether the message is inhibited during takeoff and/or landing.

Table 6-1. EICAS MESSAGES

MESSAGE	INHIBITS	MEANING	AURAL WARNING
APU FIRE		The APU fire detection loop has activated. On the ground, the system should automatically shut the APU down and activate the fire extinguisher. In flight, the APU will not automatically shut down or activate the fire extinguisher.	"APU FIRE"
APU OVERTEMP	TO	An APU EGT overtemperature has been detected. On the ground, the APU will automatically shut down.	
APU BLEED ALT LIMIT	TO/LAND	APU bleed air has been commanded above 20,000 ft or the APU bleed modulated due to excessive EGT.	
APU FUEL SOV FAIL	TO/LAND	The APU shutoff valve has failed.	
APU OVERSPEED	TO/LAND	The APU has shut down due to an overspeed.	
APU OIL PRESS LOW	TO/LAND	The APU oil pressure is low while in flight.	
APU OIL TEMP HIGH	TO/LAND	The APU oil temperature is high while in flight.	
APU STARTER FAIL ON	TO/LAND	Power is still being supplied to the APU starter when electronic control unit is not commanding a start.	
APU FAULT	TO/LAND	A fault is indicated in the APU system. One or more of the following has occurred: • The APU bleed valve has failed • The APU fuel solenoid has failed • A start is prevented • The avionics are not communicating with the APU electronic control unit • Reverse flow has been detected	
APU SHUTDOWN	TO/LAND	The auxiliary power unit electronic control unit has shut down the APU for protective reasons.	

QUESTIONS

1. Which of the following is not a function of the Honeywell 36-150BD APU?

a. Automatic fault detection
b. Automatic variable intake door
c. Automatic and remote shutdown
d. Automatic fire extinguishing

2. The primary function of the APU is:

a. To supply bleed-air for air conditioning and pressurization
b. Main engine starting
c. To provide power for the gearbox-mounted generator
d. To operate the hydraulic system

3. The APU emergency shutoff switch is located:

a. On the air conditioning/bleed-air panel
b. Inside the APU compartment
c. On the APU control panel
d. Right side, aft of wing, adjacent to external power connector

4. The _____ controls airflow to the bleed system and protects the APU from an overtemperature condition:

a. APU bleed valve
b. APU surge control valve
c. XBLEED switch
d. R engine bleed valve

5. When does the ECU command the APU surge control valve to open?

a. Anytime the APU is operating
b. When the APU is providing bleed air for air conditioning and pressurization
c. When the APU is supplying electrical loads, at flight altitudes above 15,000 feet
d. When the APU is operated above 30,000 feet

6. An APU FIRE warning (red) CAS message on the ground:

a. Indicates a failure of one loop of the fire detection system
b. Will automatically shut the APU down and activate the fire extinguisher
c. Will not automatically shutdown the APU
d. Will not automatically activate the fire extinguisher

7. Above what altitude will an APU BLEED ALT LIMIT caution (amber) CAS message be displayed?

a. Above 15,000 feet
b. Above 20,000 feet
c. Above 30,000 feet
d. Above 37,000 feet

CHAPTER 7
POWERPLANT

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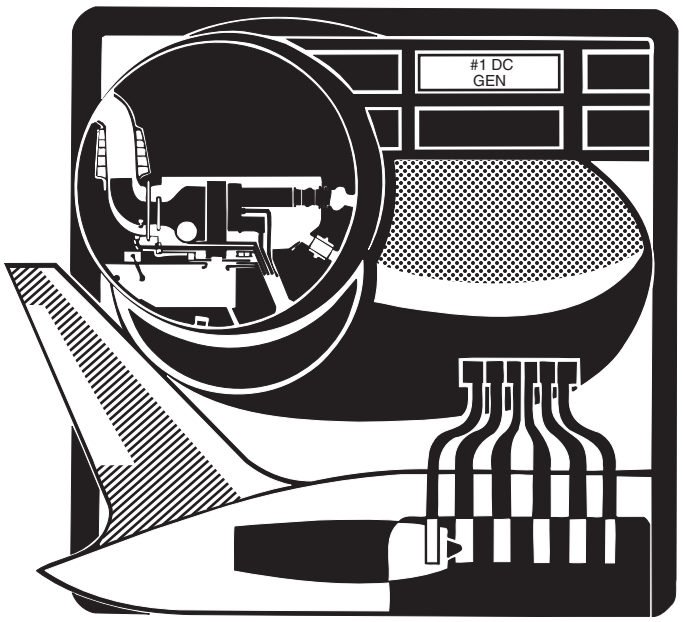
CHAPTER 7
POWERPLANT



INTRODUCTION

This chapter discusses the Honeywell AS907 turbofan engines, their subsystems, and the thrust reverser system. Explanation of the construction and components of the engine is presented along with detailed descriptions of the subsystems: fuel, oil, bleed air, start, and ignition. Information about the automatic power reserve and vibration monitoring systems is also included.

GENERAL

The Challenger 300 is equipped with two Honeywell AS907 high-bypass turbofan engines with a 4.2 to 1 bypass ratio. The engine is a two-spool direct-drive engine. A three-stage low-pressure turbine drives the single-stage, wide-chord fan.

The core consists of a four-stage-axial compressor with two stages of variable geometry, a single-stage centrifugal compressor, a through-flow annular combustor, 16 fuel nozzles, two igniters, and a two-stage high-pressure turbine (Figure 7-1).

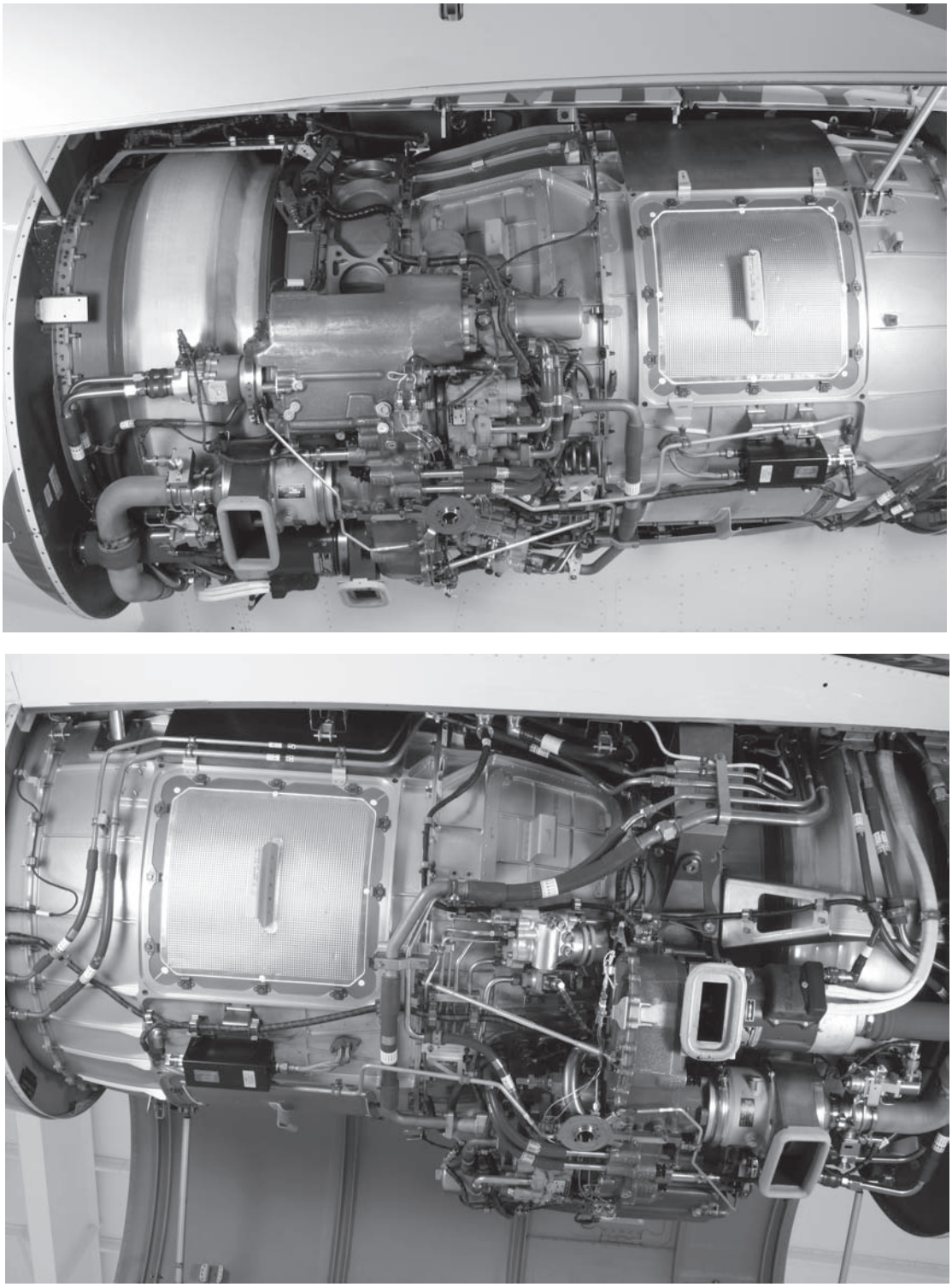


Figure 7-1. Honeywell AS907 Turbofan Engine

The exhaust system includes an exit guide vane and a mixer nozzle.

The accessory gearbox on each engine provides engine lubrication and accessory drive pads for the hydraulic pump and generator. The air turbine starter is also mounted to the accessory gearbox.

Figure 7-2 depicts the engine modules.

A full authority digital engine control system (FADEC) controls each engine.

FLAT-RATED THRUST

Because outside air temperature and pressure altitude are determining factors in achieving takeoff power, any increase in ambient temperature or pressure altitude adversely affect an engine's ability to produce rated thrust.

Normal takeoff thrust rating is 6,826 pounds. The AS907 is flat rated to ISA +15°C (86°F) at sea level. The automatic power reserve (APR) system extends the flat rating to ISA +20°C (95°F) during emergency situations.

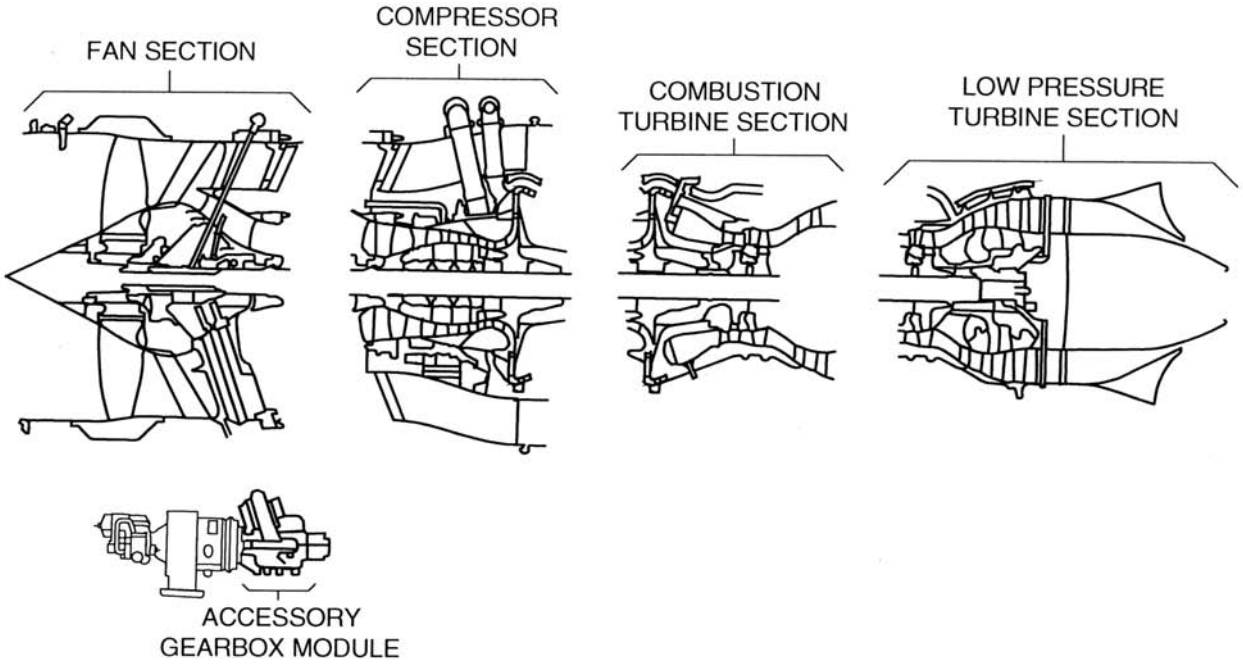


Figure 7-2. Engine Modules

POWERPLANT

The AS907 powerplant has two independent major assemblies. The N_1 section consists of a three stage low-pressure turbine that drives a fan rotor through a shaft. The N_2 section is composed of the axial flow compressor, the centrifugal compressor, the combustor, the accessory gearbox, and a two-stage high-pressure turbine. The high-pressure turbine drives the compressor. Figure 7-3 illustrates the engine sections.

AIRFLOW

The fan initially accelerates and compresses the inlet air to split it into two streams. A large percentage of the fan air exits into the bypass duct. The remainder is directed into the core of the engine.

This core airflow passes through the four-stage axial compressor and the single-stage centrifugal compressor. Airflow exiting the high-pressure compressor diffuser is directed into the in-line annular combustor where fuel is injected.

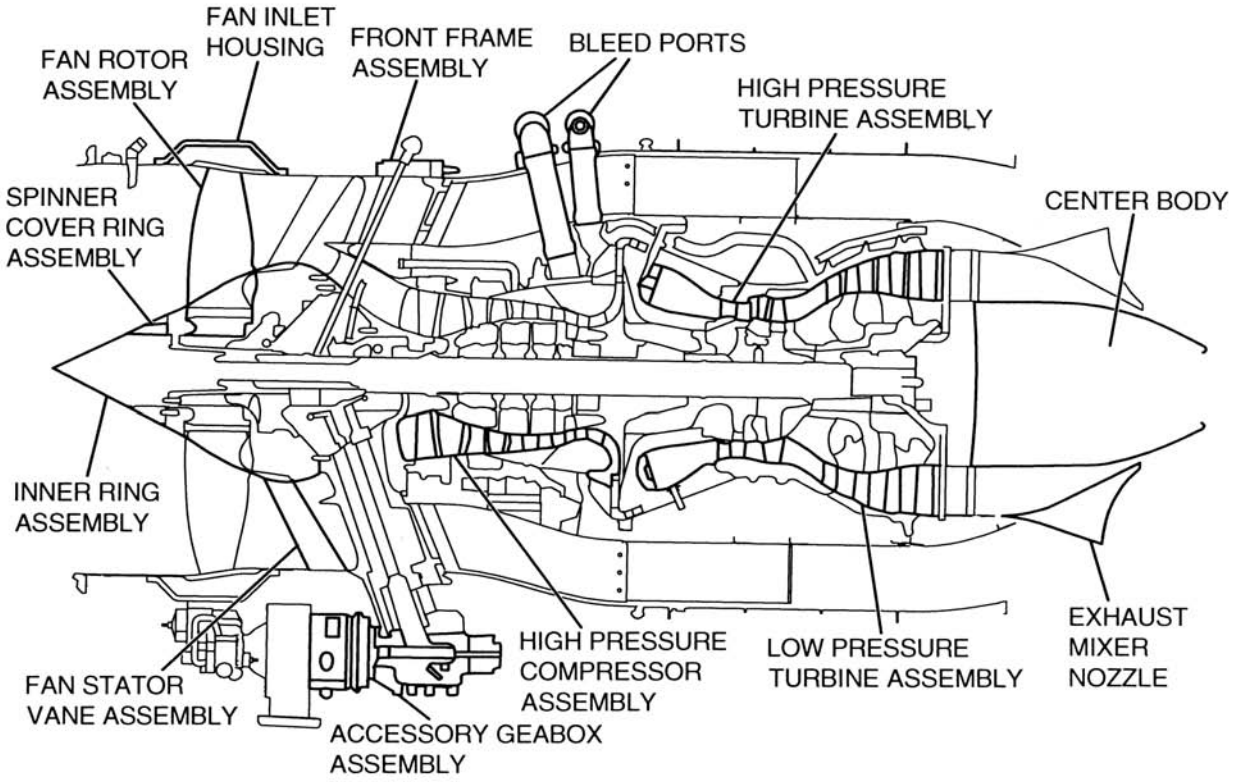


Figure 7-3. Engine Sections

The fuel/air mixture is ignited so that a continuous combustion is maintained. The expanding gases are then directed through the two-stage high-pressure and three-stage low pressure turbine assemblies. These gases drive both rotating segments. They exit the engine through the mixer nozzle. Figure 7-4 depicts the airflow.

COMPONENTS

The N_1 fan consists of 22 titanium-inserted blades. The fan containment system uses an aluminum honeycomb material surrounded by an aramid fiber wrap. N_1 fan speed is indicated on EICAS.

The high-pressure turbine assembly mechanically drives the N_2 compressor, which is a variable geometry (VG) axial flow compressor. N_2 speed is displayed on EICAS.

VG System

The VG system regulates airflow across the N_2 compressor. The system changes the position of the inlet guide vanes and the stator vane for the inlet and first stage of the compressor.

The VG system optimizes the angle of attack of the airflow at the compressor blades to provide compressor stall and surge protection.

The FADEC programs the VG inlet guide vanes and stators, which are positioned by actuators and mechanical linkages. High-pressure fuel from the engine fuel metering unit hydraulically moves the actuators. There is no EICAS indication for the VG system.

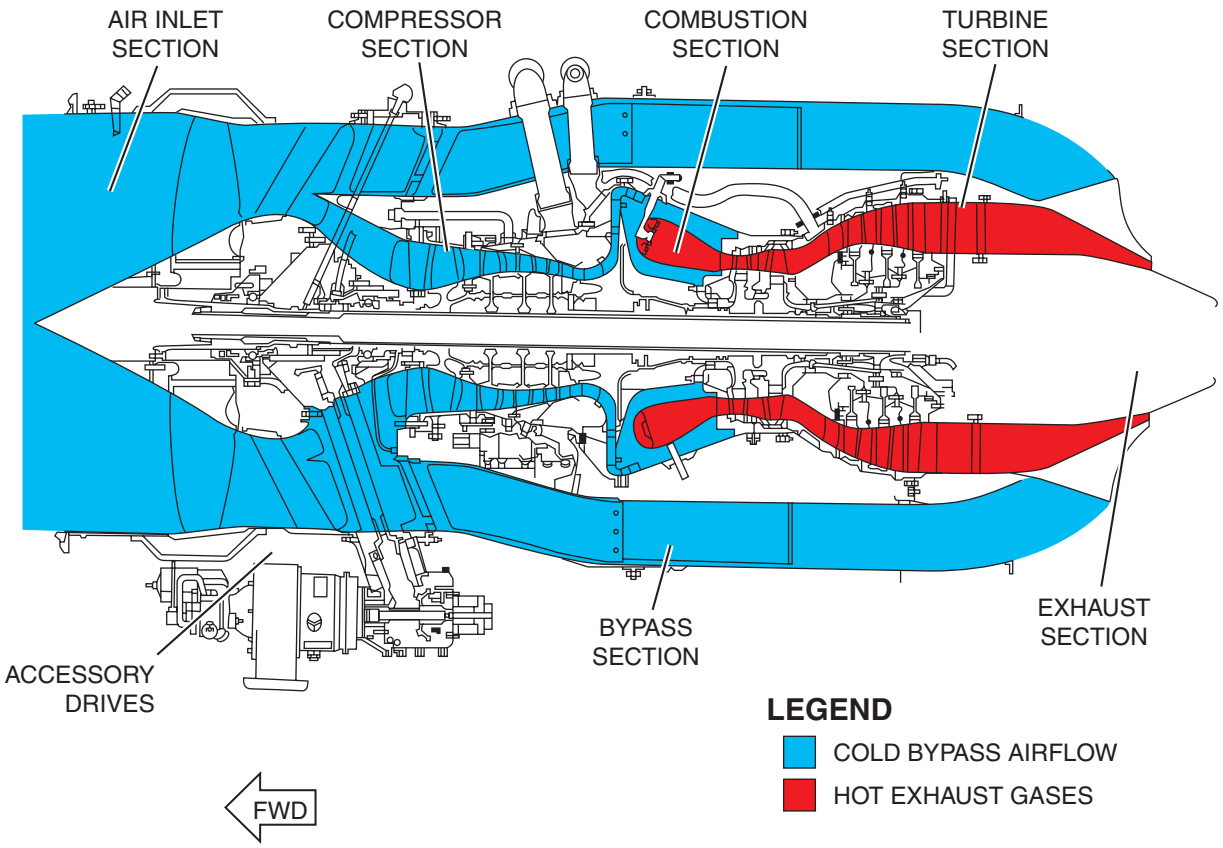


Figure 7-4. Airflow Paths

Accessory Gearbox

The N_2 compressor drives the engine accessory gearbox (Figure 7-5). The following components are mounted on the gearbox:

- Engine lubrication pumps
- Hydraulic pump (EDP 1 or EDP 2)
- Engine fuel pump and fuel metering unit (FMU)
- Air turbine starter
- Integral oil reservoir
- Generator
- Permanent magnet alternator (PMA)

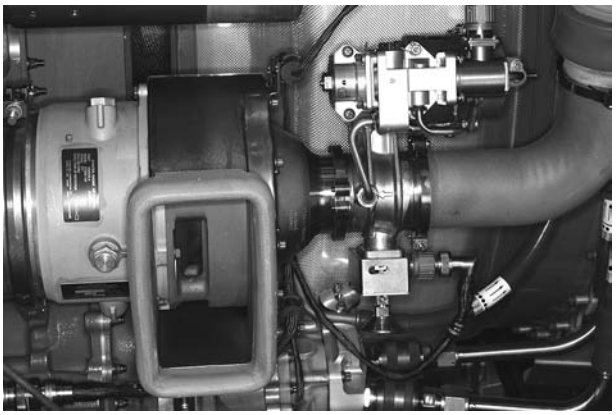


Figure 7-5. Accessory Gearbox

VIBRATION MONITORING SYSTEM

The powerplant fan assembly is continuously monitored for vibration by a sensor on each engine. EICAS messages indicate to the crew abnormal vibration levels. Maintenance personnel also use the monitoring system for ground based fan trim balancing (Figure 7-6).

The vibration monitoring sensor is a self-generating velocity pickup that outputs a voltage signal proportional to velocity. Both ECUs share the signal.

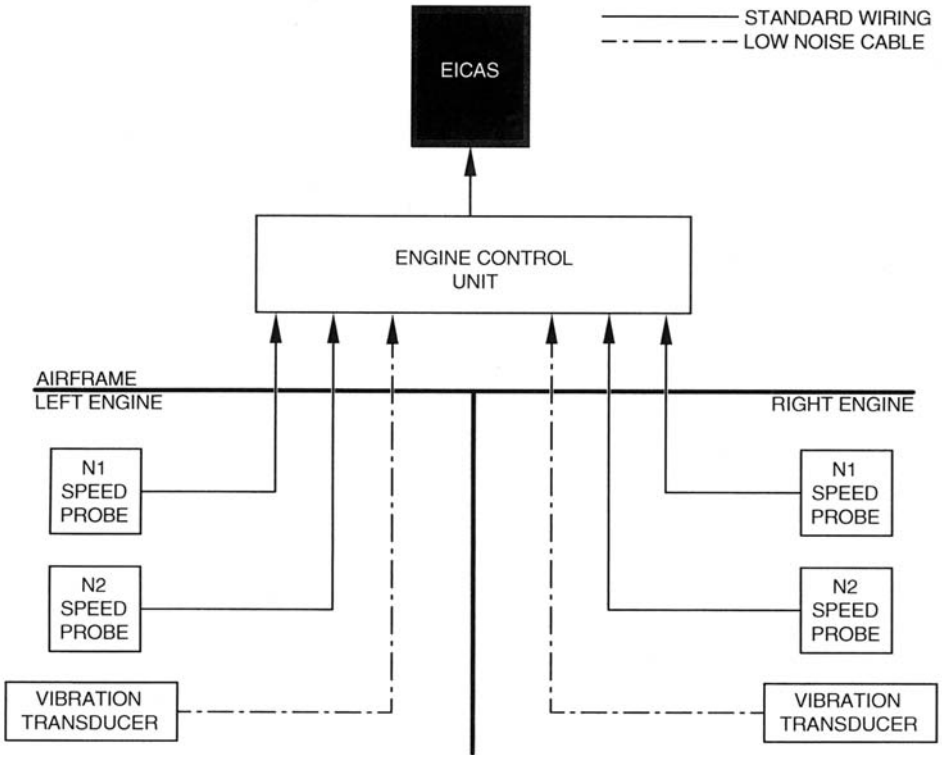


Figure 7-6. Vibration Monitoring System

The following annunciations are displayed in the cockpit:

- L/R ENGINE VIBRATION—Amber message illuminates along with a VIB icon on the MFD
- L/R ENGINE VIB FAIL—Advisory CAS message indicates if a loss of vibration signals from the designated engine occurs

CONTROLS AND INDICATIONS

The following controls and indications are part of the powerplant system:

- Thrust levers—Control the application of forward and reverse thrust
- RUN/OFF switches—Turns on the fuel DC boost-pump and operates the ECU
- TOGA switches—Selects FMS/Flight Director to TO or GA mode
- ENGINE panel—Contains switches to various powerplant function
- EICAS display—Presents engine-operating parameters

THROTTLE QUADRANT

The thrust lever quadrant controls the engines in forward and reverse. The quadrant contains the thrust levers, thrust reverser finger lifts, microswitches, and internal locks and stops (Figure 7-7).

Thrust lever quadrant settings are MAX REV, REV, IDLE, CLB, TO, APR. The range of movement between the IDLE and CLB position is defined as the cruise range.

The thrust levers incorporate both mechanical stops and soft detents. Self-centering soft detents prevent the thrust levers from moving inadvertently. A friction knob allows the pilot to change the friction setting for the thrust levers.

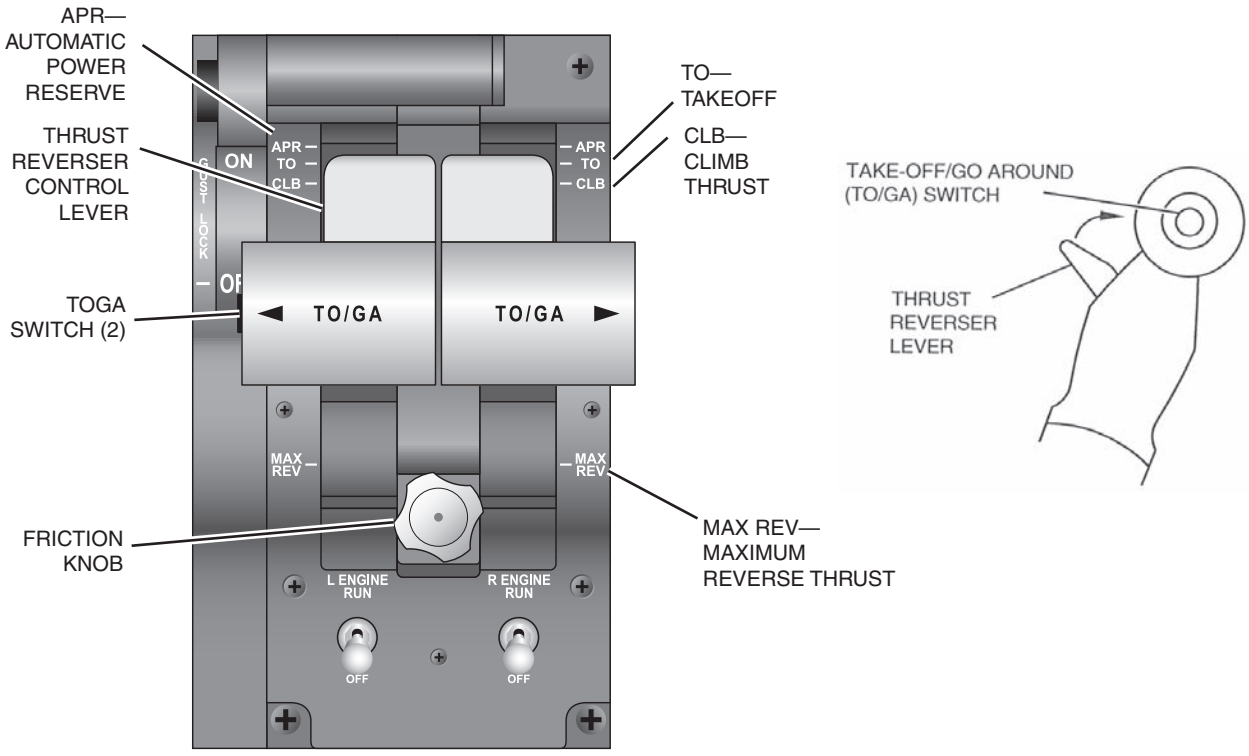


Figure 7-7. Thrust Lever Quadrant

Rotary variable differential transformers (RVDTs) electrically measure the actual thrust lever position. In addition, microswitches housed within the thrust quadrant sense lever position.

The RVDTs and microswitches provide information to the FADEC, the flight control computers (FCC), and data concentrator units (DCUs).

Other aircraft systems affected by thrust lever position are the following:

- Landing gear warning system
- Takeoff configuration warning system
- Cabin pressurization system
- Ground spoilers

Reverse Levers

The thrust levers are linear throttles. To engage reverse thrust, the reverse levers are lifted above a gate to allow the thrust levers to translate aft to modulate the reverse thrust level (Figure 7-8).

RUN/OFF Switches

The L/R ENGINE switches at the base of the throttle quadrant are part of the start subsystem and discussed in that section.

TOGA Switches

Takeoff and go-around (TOGA) switches are in each thrust lever. When pressed, the switches select Flight Director Takeoff mode while on the ground or Go-Around mode while in the air.

ENGINE PANEL

The ENGINE panel is on the right side of the lower center pedestal (Figure 7-9). The panel contains controls for engine starts, continuous ignition, Mach hold, engine synchronization, disabling of the auto APR function, and fire extinguishing. Details about these switches are discussed in their appropriate section or chapter.

EICAS DISPLAY

Engine parameters are displayed in the upper left corner of the multifunction display (MFD). These displays include the following (Figure 7-10):

- N_1 and N_2 (in percent values)
- ITT
- Fuel flow
- Oil pressure and temperature
- Ignition system and start status

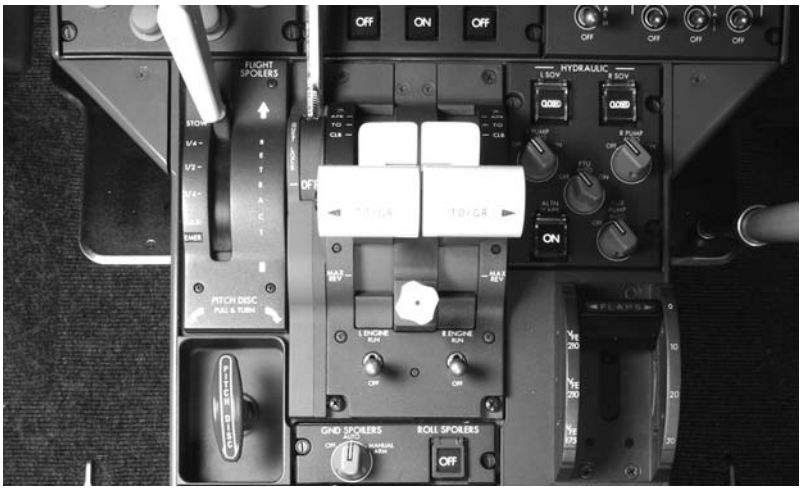
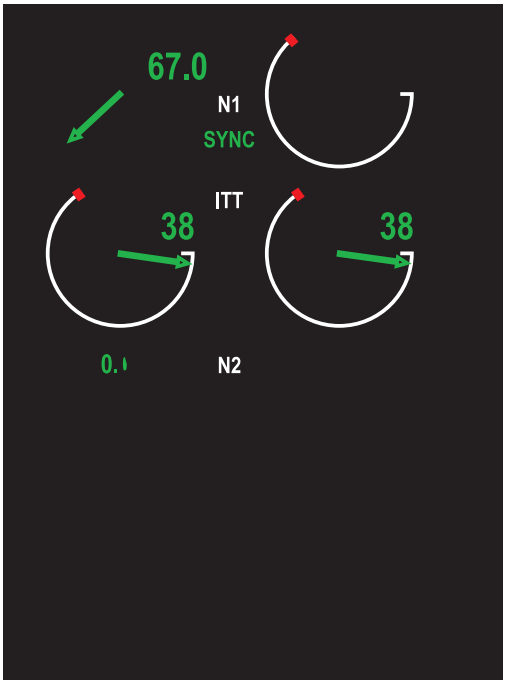


Figure 7-8. Throttles

- High engine vibration levels
- Thrust reverser use
- Selection of engine synchronization and mach hold

A full list of EICAS messages related to the powerplant are at the end of this chapter.

Figure 7-9. Engine Panel



OPERATING LIMITS

Refer to the AFM for engine limitations.

ENGINE CONTROL SYSTEM

The full authority digital electronic control (FADEC) system controls the Honeywell AS907. The FADEC provides a full range of engine control to regulate the operation and performance of the engines under all steady state and transient engine conditions.

The FADEC controls the following critical functions through fuel control, compressor airflow management, and engine starting/ignition:

- Control of engine thrust within the required limits, including control of bleed valves, compressor guide vanes (CGVs), and nacelle anti-ice bleed flow.
- Validates N_1, N_1 limits, and interstage turbine temperature (ITT)
- Thrust reverser operation
- Overspeed circuits

FADEC COMPUTER

Each powerplant has two single-channel FADEC computers. One FADEC channel operates as the in-control channel and processes information for engine control outputs. The other channel operates in standby.

The standby channel processes all the input information but does not provide control output unless an engine overspeed occurs. In this case, both the in-control and standby channels command the shutoff valve in the fuel metering unit to close. This returns the engine to an onspeed condition.

The in-control and standby channels continuously share command and status data through a crosstalk data bus. The standby channel assumes the in-control role if the designated in-control channel becomes unserviceable.

During normal operations with two serviceable FADEC channels, the software directs the channels to alternate in-control and standby roles on each successive engine start.

FADEC malfunctions are presented as either caution or advisory messages. Each message has a different impact on the dispatch ability of the aircraft.

Engine Condition and Fault Reporting

An engine condition and fault reporting system (ECFR) integrated into the FADEC monitors engine health. The system periodically records engine parameters.

The crew may also request that conditions be recorded at any time. The EVENT switch on the ENGINE control panel manually initiates data collection.

Maintenance personnel download data from the FADEC for review. The data may be downloaded at anytime to assist in diagnosing engine problems. The ECFR is intended for maintenance functions and inflight monitoring.

Automatic Power Reserve

When an engine fails, the automatic power reserve (APR) feature of the FADEC extends the flat rated takeoff thrust of the operating engine to ISA + 20°C (95°F). Depending upon flight conditions, this may result in an increase in thrust.

APR is armed for takeoff when thrust levers are in the TO detent. On approach, APR is armed for the go-around when flaps are greater then 20° or the landing gear is down. When APR is armed with the thrust levers in the TO detent and an engine failure is detected, the FADEC on the operating engine commands APR thrust. APR thrust continues until the thrust lever on the operating engine is retarded from the TO detent up to a maximum of 10 minutes.

APR power for both engines can also be selected by advancing both thrust levers to the APR stop.

A cyan APR icon appears to the right of each N_1 indicator.

Automatic activation of the APR function may be inhibited by selecting the AUTO APR guarded switch on the ENGINE panel to OFF. This is recommended when conducting single-engine training in the aircraft.

PERMANENT MAGNET ALTERNATOR

The permanent magnet alternator (PMA) provides three-phase power to each engine control unit (ECU). The ECU measures N_2 from one of the three-phase inputs.

The PMA provides the electric power required by the control system and engine at and above 45% N_2. This speed is less than the minimum N_2 idle speed.

The PMA is the primary source of ECU power. The aircraft's 28 VDC is the backup source.

Starting and shutdown require 28 VDC from the electrical system.

OPERATION

ENGINE IDLE

When the thrust reverser is placed at IDLE, the FADEC programs the maximum N_2 idle rpm. Idle rpm is dependent upon atmospheric information, bleed-air loading, and phase of flight.

The FADEC always programs the best idle speed for any phase of flight. As the aircraft transitions from one flight phase to the next, idle rpm is automatically adjusted.

There are three different N_2 idle settings: flight idle, reverse idle, and ground idle.

- Flight idle—Thrust lever is set to idle while airborne (weight-off-wheels)
- Ground Idle—Thrust lever is set to idle with weight on wheels. N_2 ground idle is the minimum thrust setting and varies with altitude and temperature:

- Increases in altitude or ambient temperature increase N_2 idle rpm
- Decreases in altitude or ambient temperature decrease N_2 idle rpm

- Reverse Idle—FADEC activates reverse balk; further movement rearward beyond REV detent is restricted until the thrust reverser is fully deployed

THRUST CALCULATIONS

FADEC automatically computes a target thrust rating for thrust lever position and presents the target or maximum value on the N_1 indicator.

On the ground, normal rated takeoff thrust is automatically calculated when an engine is started. Normal rated N_2 takeoff rpm is continuously updated for changes in the Mach number, ambient temperature, and pressure altitude.

During the takeoff roll, the N_1 normal rated takeoff thrust value is continuously updated as the aircraft accelerates. At 65 kt discrete inputs for the thrust calculations are locked in. The calculation is unlocked when the aircraft altitude exceeds 400 ft. AGL or the thrust lever is retarded from the TO detent.

Thrust Mode Annunciation

The thrust mode annunciation identifies the position of the thrust lever during most phases of operation or during a specific armed condition.

The cyan color target N_1 appears on the N_1 indicator as the following:

- N_1 caret (or circle for cruise power)
- N_1 digital reference
- Appropriate thrust mode annunciation
  - APR
  - TO
  - CLB
  - CRZ
  - REV

Max Power (APR)

When either or both thrust levers are placed in the APR detent, the FADEC increases the engine thrust to automatic power reserve power (APR). The APR power setting is an emergency thrust setting.

To protect against inadvertent APR activation, the pilot must apply increased force to move the thrust lever forward to the APR detent.

APR mode annunciation is indicated on the associated N_1 gage along with the N_1 caret and digital reference.

AUTO APR Function

The AUTO APR function indications are the same as the APR indications. If the aircrew elects to disable the AUTO APR function, an AUTO APR OFF status CAS message is displayed. The AUTO APR OFF switch also illuminates.

Normal-Rated Takeoff N_1 Indications (TO)

FADEC automatically calculates normal-rated takeoff thrust when electrical power is applied to the aircraft on the ground. Takeoff thrust is set on the takeoff roll by placing the thrust levers in the TO detent.

The programmed normal-rated takeoff thrust value is displayed on the MFD with the cyan caret, N_1 digital reference, and TO mode annunciation.

Climb Thrust (CLB)

When the thrust lever is placed in the CLB detent, the FADEC electronically programs the engine to accelerate or decelerate to the climb thrust setting.

The programmed climb thrust value is displayed on the MFD with the cyan caret, N_1 digital reference, and CLB mode annunciation.

Cruise Range (CRZ)

Cruise power is not associated with a thrust lever detent.

Positioning the thrust lever in the quadrant range between IDLE and CLIMB sets cruise power. In this range, the pilot manually sets the thrust levers to maintain cruise speed or sets thrust for descent and approach.

FADEC does not set the cruise thrust to match the FADEC-generated maximum cruise thrust target value. To distinguish maximum cruise power (CRZ) from other detent-related thrust setting, a cyan N_1 doughnut is used instead of a caret. The N_1 digital reference and CRZ mode are also annunciated

SINGLE ENGINE THRUST MANAGEMENT

The FADEC computers continuously cross talk to share data on the health of each engine. If the APR has not been disabled by the crew, the FADEC automatically activates the APR function on an operating engine if the other engine fails and the TLA is in the TO detent or above.

The FADEC system monitors N_2 rpm of both engines. If the mismatch of N_2 speed exceeds 15%, the FADEC automatically increases the N_1 speed of the operable engine.

ENGINE SYNCHRONIZATION

The AUTO SYNC switch on the ENGINE control panel has N_1/N_2/OFF positions. If the thrust levers are in the CRZ or CLB position and the switch is in the N_1 or N_2 position, the two engines are synchronized.

The left and right engines automatically designate themselves as master and slave engines using a cross-engine communication link.

The engine with higher N_1 or N_2 compensation, or the left engine when N_1 or N_2compensation of the two engines is the same, becomes the master engine. If the measured N_1 or N_2 of the slave engine is not within 5% of the master engine set point, the FADEC indicates that synchronization is commanded but not achieved.

Mach Hold

FADEC provides Mach hold to minimize throttle movements during cruise over long periods.

Limited adjustment is available to the master engine to hold the selected Mach. For MACH HOLD to be active, N_1 and N_2 must be synchronized, the aircraft trimmed for steady, level flight, and the autopilot engaged in either altitude hold or altitude select (altitude captured).

Mach hold authority only allows N_1 to be adjusted within +1 or–2% N_1 for the thrust lever position at the time it is active. When active, a green MACH HOLD displays between the N_1 indicators.

At authority limits, a white MACH HOLD is displayed.

ENGINE FUEL SYSTEM

The main fuel ejectors or standby boost pumps deliver fuel from the collector tanks to the engines via the fuel feed manifolds (see Chapter 5—Fuel).

Fuel is delivered to the fuel injectors at necessary pressure and flow rates to maintain the desired engine thrust. The engine fuel system also performs the following:

- Moves VG inlet guide and compressor stator vanes
- Cools engine oil (through heat transfer)
- Actuates and lubricates fuel system components
- Provides motive flow for scavenge and main ejector pumps

At the engine, the fuel is pressurized, heated, filtered, metered, and then distributed to the combustion chamber. The FADEC controls all fuel scheduling.

COMPONENT DESCRIPTION

Components of the engine fuel system include the following:

- Fuel pump
- Fuel/Oil Heater Exchanger
- Fuel Filter
- Fuel Metering Unit

Fuel Pump

The fuel pump on the accessory gearbox comprises three separate pumps within a single housing. The fuel pump provides fuel under high pressure and at a flow rate that exceeds the requirements of the engine at any power setting. Excess fuel is bypassed back through the fuel filter system for recirculation.

Fuel/Oil Heat Exchanger and Fuel Filter

A fuel/oil heat exchanger warms engine fuel and cools engine oil. The engine fuel temperature is indicated on the FUEL synoptic page.

A 10-micron fuel filter removes solid contaminants from the fuel. The filter is also depicted on the FUEL synoptic page.

An advisory CAS message indicates an impending fuel filter bypass condition while an amber caution message indicates a dual impending fuel filter bypass condition on both engines.

Fuel Metering Unit

The fuel metering unit (FMU) is an electro-hydraulic device that meters and distributes fuel for combustion. The FMU also supplies high-pressure fuel to actuate the VG inlet guide and compressor stator vanes. The FADEC provides the necessary control signals to the FMU.

The FMU primary components are the fuel metering valve and pressurizing and shutoff valve. The metering valve supplies fuel in response to FADEC commands to maintain combustion under all operating conditions. The pressurizing and shutoff valve controls the supply of fuel for combustion.

TERMINATING FUEL FLOW

Delivery of fuel can be interrupted by moving the L/R ENGINE RUN switches to OFF or by selecting the L/R ENGINE FIRE switches.

The OFF position shuts off fuel at the fuel metering unit.

The ENGINE FIRE switch closes the appropriate engine fuel shutoff valves (SOVs) in the manifold to interrupt the fuel supply. The switch also closes the fuel metering valve shutoff valve.

EICAS INDICATIONS

A full list of EICAS messages related to the powerplant are at the end of this chapter. Those specific to this subsystem include the following:

- L/R ENGINE FUEL BYPASS—Advisory of impending fuel filter bypass
- ENGINES FUEL BYPASS—Indicates dual impending fuel filter bypass

ENGINE OIL SYSTEM

The engine oil system cools and lubricates the engine bearings, gears, and splines. It also provides fuel heating and shaft vibration damping (through the use of hydraulic mounts). The engine oil sump venting and breather system is integral to the overall lubrication system.

OIL LEVEL AND REPLENISHMENT SYSTEM

Each engine oil tank capacity is 7.8 quarts (7.4 liters) with one quart unusable.

The primary way to check oil is through the remote oil level sensor (ROLS). The ARINC 429 bus transmits oil levels to the refuel/defuel panel in the right wing root fairing.

The engine oil servicing doors are on the forward left side of each nacelle.

A sight gage on the accessory gearbox also allows oil quantity to be checked (Figure 7-11). A filler port is available for replenishing oil. The sight gage is marked FULL/ONE LOW/NO DISPATCH. Oil volume at the FULL mark is 5.7 quarts (5.4 liters).

Wait at least15 minutes, but not more than one hour following engine shutdown before checking the ROLS.

Service the tank if more than one quart (0.95 liter) low.

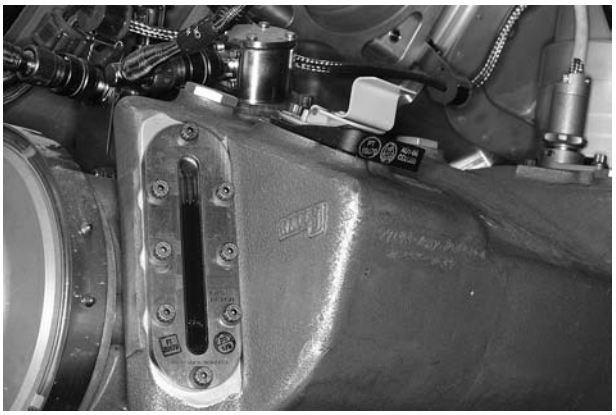


Figure 7-11. Sight Gage

OPERATION

The oil pump draws hot oil from the accessory gearbox oil tank and supplies it to the engine (Figure 7-12). The engine compressor spool drives the oil pump through the accessory gearbox.

The oil is filtered and cooled in the fuel heater/oil cooler (FHOC) prior to flowing into the engine bearing sumps.

In the engine bearing sumps (forward and aft) and in the accessory gearbox, the oil lubricates bearings, seals, and gears. The oil also cools these components by absorbing heat as it passes in and around.

Before oil is returned to the oil tank it flows across the chip detector in the accessory gearbox housing. The chip detector is linked to the ECU, which provides an indication on EICAS.

Dedicated scavenge pumps recover oil and then return it to the oil tank.

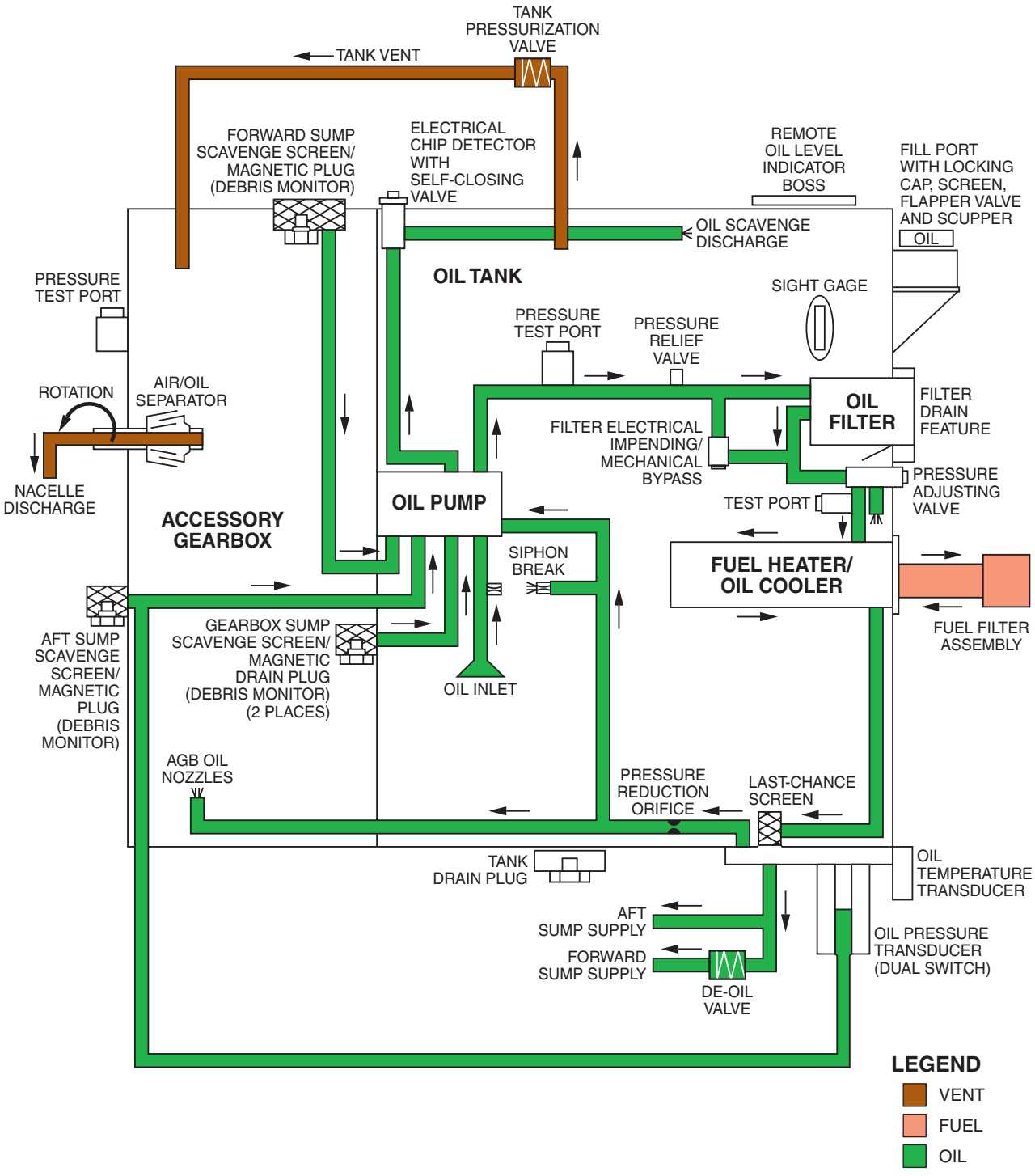


Figure 7-12. Engine Oil

Oil Bypass

Parallel with the oil filter is a bypass valve and an impending bypass switch.

When the filter becomes clogged and pressure across the filter increases to 45 psi, bypass is imminent.

The bypass switch opens the bypass valve at 65 psi.

The ECU monitors the switch and oil temperature to provide an indication of impending filter bypass when the switch is open and oil temperature is in the normal operating range. During bypass mode, the system still provides a minimum filtration level by means of an accessible screen.

Once the impending bypass warning has been indicated, the CAS message remains illuminated during bypass mode. The FADEC logs the bypass condition for maintenance action prior to the next flight.

EICAS Indications

To provide system redundancy, a pressure switch and separate pressure transmitter monitor engine oil pressure. Filter bypass, high oil temperature, and chip detection are also monitored.

A full list of EICAS messages related to the powerplant are at the end of this chapter. Those specific to this subsystem include the following:

- L/R ENG OIL PRESS LOW—Low oil pressure
- L/R OIL PRESS HIGH—Excessively high oil pressure
- L/R ENGINE OIL BYPASS—Advisory CAS message for imminent bypass oil filter
- L/R ENG OIL TEMPERATURE HIGH—Excessively high engine oil temperatures
- L/R ENGINE OIL CHIP—Metallic chip detected in the engine oil

BLEED AIR SYSTEM

Bleed air is drawn from the engines through ports on the intermediate pressure and high pressure compressor sections. The pneumatic system (see Chapter 9—Pneumatics) then distributes bleed air for environmental control, anti-ice, and engine starting.

Surge bleed valves also extract bleed air from the compressor to regulate airflow through the engine core. FADEC controls the surge bleed valves.

The engine fire detection system monitors the nacelle bleed air ducts for leakage. (See Chapter 8—Fire Protection for more details.)

ENGINE STARTING SYSTEM

The start system with its air turbine starter (ATS) and starter control valve provides assisted ground starts, assisted inflight starts, and windmill inflight starts.

The engine also has an auto ignition function that automatically provides ignition if a stall, combustor blow-out, or momentary loss of fuel occurs.

The starting system accelerates the N_2 high-pressure section to a speed at which combustion light-off and self-sustaining rpm occurs.

Placing the engine run switch to RUN turns on the electrical boost pump. The START switch then signals the FADEC to initiate the start sequence.

DC electrical power and air from the bleed-air manifold are required to open the start valve and engage the air turbine starter. The bleed-air manifold can be pressurized by:

- APU bleed air
- Ground air cart
- Opposite engine bleed air (cross-bleed)

The pneumatic pressure from any of the three pneumatic sources is displayed on the ECS synoptic page.

AIR TURBINE STARTER

The air turbine starter (ATS) is mounted on the accessory gearbox. The ATS converts pneumatic energy into mechanical motion. The starter mechanically engages the accessory gearbox through a sprag clutch to assist in accelerating the engine to idle speed.

During the start sequence, the start valve closes and the ATS disengages when N_2 reaches or exceeds 46% or the OFF position is selected on the throttle quadrant.

For subsequent starts, the starter sprag clutch does not require that the engine rotation be completely stopped before engaging the starter. The ATS may be engaged at any rpm up to starter cutout speed.

STARTER CONTROL VALVE

The starter control valve is adjacent to the air turbine starter (ATS) inside the engine nacelle. The valve normally requires 28 VDC power and pneumatic pressure to open. When the L/R starter switch on the ENGINE control panel is moved to the START position, the FADEC supplies 28 VDC power to energize the solenoid. This allows pneumatic pressure to open the valve and engage the air turbine starter.

When N_2 rpm is >50%, the FADEC removes power from the solenoid. The start valve then closes and the air turbine starter disengages.

START SEQUENCE OPERATION

Start Sequence

Each engine has a STARTER switch on the ENGINE control panel and a RUN/OFF switch on the throttle quadrant.

To start an engine, set the applicable engine switch to RUN. This turns on the fuel standby boost pumps and operates the ECU start cycle. Next, set the applicable starter switch to the START position and hold for one second.

When the engine RUN position is selected and the starter switch is set to START the start valve on the associated engine opens to allow pressure from the bleed air manifold to engage the ATS.

When the engine's N_2 reaches 46%, the start valve closes. The ATS then mechanically disconnects from the gearbox at approximately 50%.

If the start valve fails to close after achieving 50% N_2, a L R STARTER FAIL ON amber CAS message is shown.

ENGINE START LIMITATIONS

Engine Start

Three consecutive engine start cycles may be conducted, followed by a cooling period of 15 minutes prior to additional starts and motoring.

The engine must be motored for 30 seconds after an aborted start.

Figure 7-13 shows engine ground starting altitude and temperature limits.

Fuel system icing inhibitor must be used when fuel temperature is below –20°C (–4°F) (for takeoff only), unless cold weather procedures are followed.

Cold weather procedures may be found in the supplemental data section of the *Flight Crew Operating Manual.*

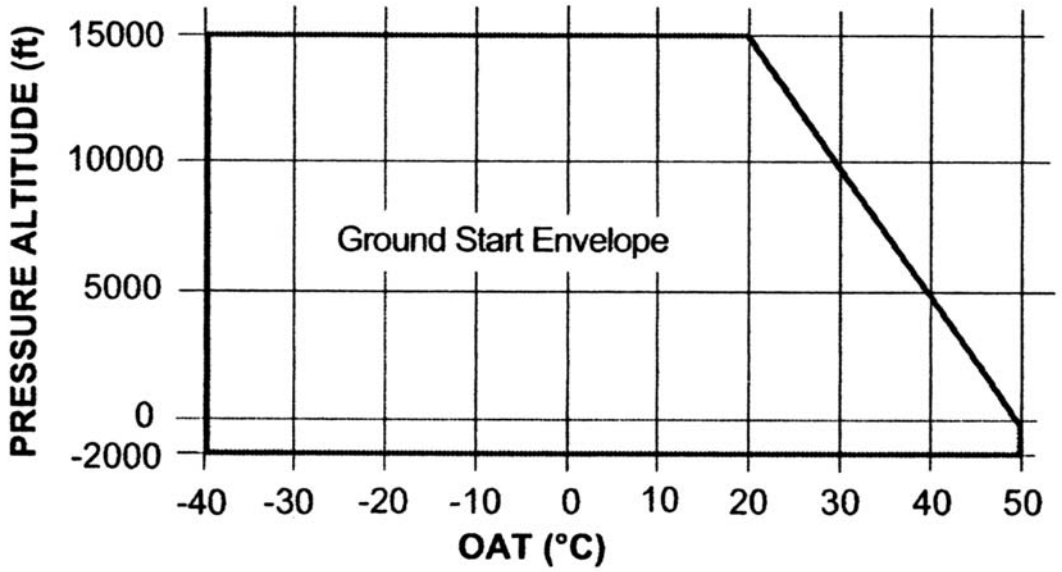


Figure 7-13. Ground Start Envelope

Engine Cranking

The engine can be motored (cranked) for up to five minutes followed by a cooling period of 15 minutes prior to additional starts or motoring.

ENGINE MOTORING

Dry motoring may become necessary to cool the engine if the engine is restarted immediately after shutdown. Turning the start switch to CRANK and holding it for the duration of the cranking accomplishes dry motoring.

Setting the RUN/OFF switch to RUN and then holding the start switch to CRANK and holding for the duration of cranking accomplishes wet motoring. The ECU then energizes the air turbine starter control valve and controls the run solenoid and the fuel metering valve per the start sequence.

A dry motoring follows the wet motoring start. Dry motoring clears any pool of fuels that may have collected in the engine during the wet motoring.

IGNITION SYSTEM

The ignition system consists of an ignition exciter, two igniter plugs, and two sets of igniter leads. The ignition system for each engine is a dual independent and redundant system.

The ECU activates the ignition system during automatic starts and restarts. The ECU also automatically turns the ignition system off when the engine is running. The pilot can manually activate the ignition system by selecting the IGNITION switch to the ON position.

For automatic ground starts, the ECU uses one ignition channel. The channel is alternated on each start. For all other starts, both ignition channels are used simultaneously. The system is capable of continuous operation manually by the pilot, but is normally only energized during the starting sequence.

When the FADEC in-control channel is determined during N_2 spool-up, the in-control channel closes the associated ignition relay. When the applicable ENGINE RUN switch is selected, the FADEC selected DC powered ignition exciter is energized. The FADEC de-energizes the ignition at starter cutout.

AERODYNAMIC STALL

At an excessively high angle of attack (AOA), turbulent airflow from the wing root could disrupt the flow of air into the engine intake. Disruption of airflow could lead to engine compressor stall. The stall protection computer and FADEC provide two levels of compressor stall protection.

As the aircraft AOA reaches the stick shaker firing angle, the stall protection computer signals the FADEC to energize both ignition channels.

If the FADEC detects a compressor stall or surge, the FADEC will modulate engine thrust to clear the event.

MANUAL IGNITION

Press the IGNITION switch to ON to manually select ignition. Both ignitions A and B are energized. Manual ignition is recommended during the following flight conditions.

- Takeoff and landings on contaminated runways
- Flight through moderate or heavy intensity rain
- Flight through moderate or heavy intensity turbulence
- Flight in the vicinity of thunderstorms

FLAMEOUT PROTECTION

If the FADEC detects an engine flameout, it automatically initiates a relight. Both ignition systems are energized.

The FADEC uses the following criteria to determine the need to command flameout protection:

- Engine is sub-idle
- Either ITT rate of change is negative or N_2 rate of change is lower than commanded
- Engine RUN/OFF switch is still in RUN position
- L/R ENGINE FLAMEOUT amber message illuminated

When the affected engine's RUN switch is placed in the OFF position, the appropriate ENGINE FLAMEOUT message is replaced by ENGINE SHUTDOWN status message.

A full list of EICAS messages related to the powerplant is at the end of this chapter.

THRUST REVERSER SYSTEM

The thrust reversers help stop the aircraft on landing and during a rejected takeoff (RTO). The system is operable only on the ground.

The left hydraulic system powers the left reverser while the right hydraulic system powers the right reverser. The FADEC and electrical signals from the aircraft control the thrust reverser system.

The thrust levers are linear throttles that are lifted above a gate. This action allows the thrust lever to translate aft to modulate the reverse thrust level.

HYDRAULIC COMPONENTS

The thrust reverser system uses the following hydraulic components (Figure 7-14):

- Isolation control unit
- Directional control unit
- Hydraulic and electro-hydraulic primary locks
- Door actuators
- Tertiary actuator locks

The isolation unit controls the hydraulic system pressure to the reverser system. The two tertiary locks prevent uncommanded reverser deployment.

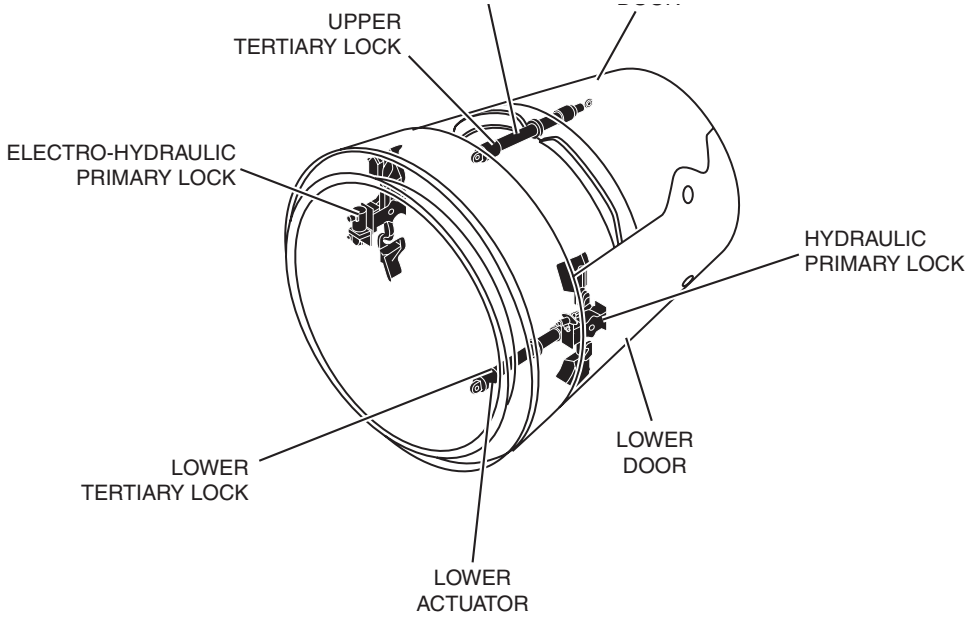


Figure 7-14. Thrust Reverser

Directional Control Unit

The directional control unit controls hydraulic pressure to the upper and lower door actuators. A pressure switch signals the directional control unit to open the upper and lower door actuators. This causes an overstow of the thrust reverser doors that enables the primary locks to unlock.

A solenoid valve controls the valve in the directional control unit. Microswitches in the thrust levers and signals from WOW and wheel spinup control the solenoid valve. When the solenoid is energized, a deploy valve opens so hydraulic pressure can sequentially release the two primary locks. Next, the signals from WOW or wheel spinup command the tertiary locks to release the directional control valve to the deploy position.

As the aircraft decelerates, the maximum N_1 is reduced to limit reverser authority. This also helps prevent thrust reverser controllability problems.

ELECTRICAL COMPONENTS

The aircraft electrical system includes the following components for the thrust reverser system:

- Isolation control unit inhibition switch
- Stow switches—Two per thrust reverser door to signal feedback to the FADEC
- Deploy switches—One per thrust reverser door to signal feedback to the FADEC
- Maintenance test switch—Allows technicians to operate the thrust reverser without the engine operating

OPERATION

DEPLOYMENT

To deploy the thrust reversers (Figure 7-15), the pilot moves the thrust levers aft to the IDLE position. With the thrust levers in this position, the reverser levers may be lifted. This allows the main thrust levers to be pulled further rearward to the REV soft detent.

Figure 7-15. Thrust Reverser Deployment

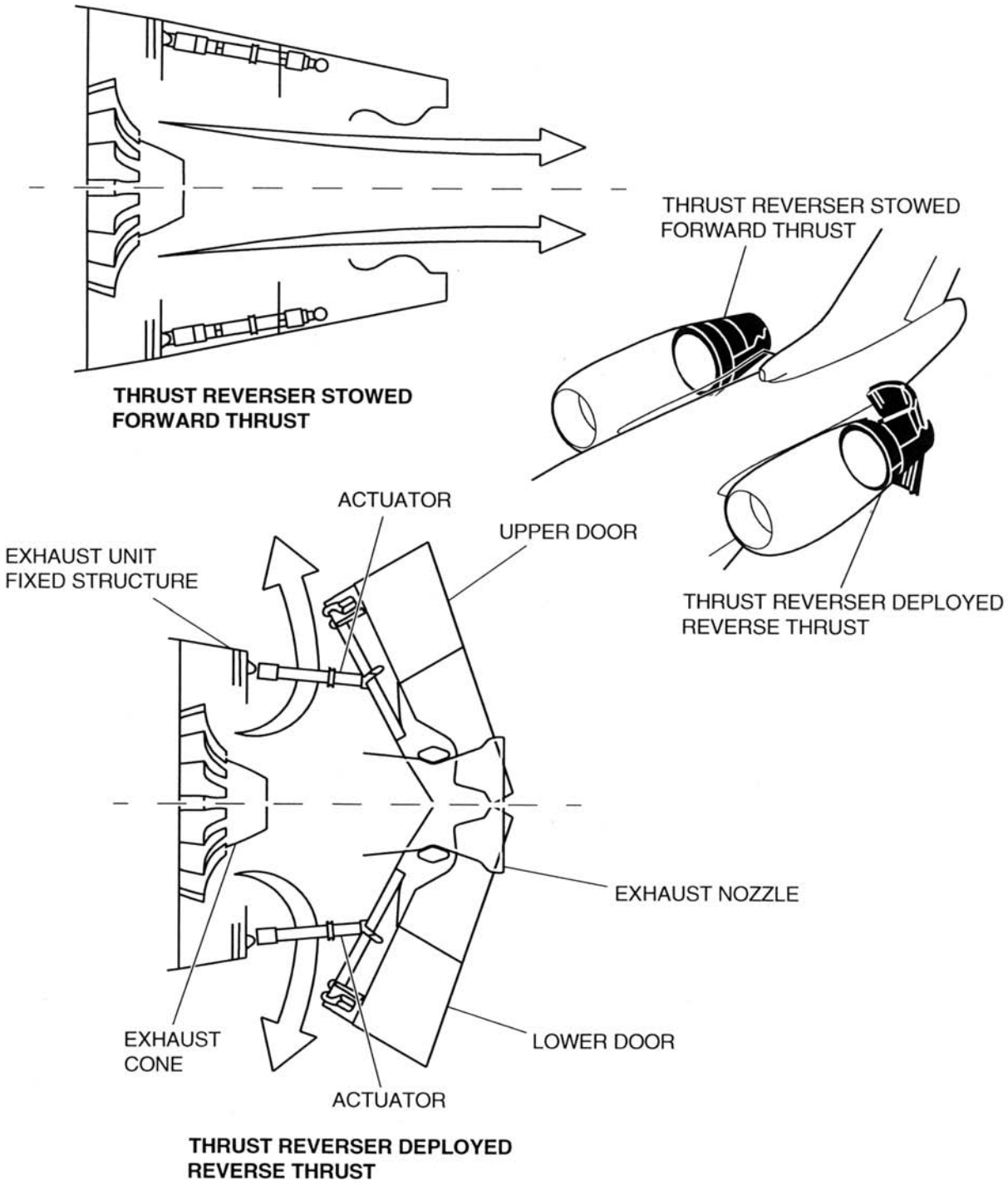


Figure 7-16. Thrust Reverser System

The movement to REV signals the FADEC (via the RVDTs) and thrust reversers (via microswitches in the throttle quadrant assembly) that reverser deployment has been commanded.

Once the main thrust levers are in the REV detent, the reverser levers stay in place until the pilot selects forward operation. Interlock balks prevent movement of the levers rearward beyond REV until the deploy switches indicate the reverser doors are fully deployed (Figure 7-16).

During the deployment sequence, a white REV icon appears on ECIAS and the N_1 target and bug disappear.

Once the doors are fully deployed, the REV icon changes to green. The interlock balk releases to allow for thrust lever modulation between the REV and MAX REV positions. N_1 target and bug are set to maximum reverser N_1 setting.

STOWING

Move the main thrust levers forward to the IDLE position to stow the thrust reversers. As the levers move between the REV and IDLE positions, the reverser levers return to their forward thrust position. Interlock balks prevent movement of the main thrust levers forward beyond IDLE until the reverser stow switches signal that the doors have completely closed.

During stowing, the REV icon changes from green to white. The N_1 target and bug disappear from the display.

Once the doors are fully stowed, the REV icon disappears; the N_1 target and bug reset to the takeoff setting. In addition, the forward interlock balk is removed so that the thrust levers can be moved above idle thrust.

NOTE

If deployed, the thrust reversers should not be stowed until after the deploy cycle has been completed.

ABNORMAL OPERATION

Thrust reverser operation of each engine is independent of the other engine. If FADEC senses a reverser door is unlocked in flight, it limits that engine's thrust to idle regardless of thrust lever position. FADEC also posts a L/R REVERSER UNSAFE warning message.

If the main thrust levers are pulled rearward to the REV position when the aircraft is not on the ground (no WOW or wheel spinup signal), the doors cannot be unlocked. An amber REV icon is displayed inside the N_1 display. If the levers are restored to IDLE or forward while in the air, this caution icon disappears.

EICAS MESSAGES

Table 7-1 lists the EICAS messages associated with the powerplant system, a brief explanation of the message, and whether the message is inhibited during takeoff and/or landing.

Table 7-1. EICAS MESSAGES

MESSAGE	INHIBITS	MEANING	AURAL WARNING
L (R) ENGINE EXCEEDANCE		The respective engine has exceeded a speed or temperature limit.	
L (R) ENG OIL PRESSURE LOW	TO/LAND	The respective engine oil pressure is low.	
L (R) REVERSER UNSAFE		Illumination of either the L or R REVERSER UNSAFE CAS or a REV EI indicates an unsafe thrust reverser condition. The affected engine should automatically decelerate to idle. The autostow function will attempt to stow the reverser doors.	
L (R) ENGINE FLAMEOUT		The respective engine has had a flameout.	
ENGINES FUEL BYPASS	TO/LAND	Both engine fuel filters are impending bypass.	
L (R) ENG ANTI-ICE FAIL	TO/LAND	The respective engine anti-ice has failed.	
L (R) ENG FUEL SOV FAIL	TO/LAND	The respective engine fuel shutoff valve has failed to close when commanded.	
L (R) ENG OIL TEMP HIGH	TO/LAND	The respective engine oil temperature is high.	
L (R) OIL PRESS HIGH	TO/LAND	The respective engine oil pressure is high.	
L (R) ENGINE VIBRATION	TO/LAND	A higher than normal level of vibration has been sensed in the respective engine.	
L (R) FADEC FAIL	TO	Major control system failure affecting both channels of the respective FADEC. The engine may shut down or go to idle, or engine operation may be degraded. Failure of the control system may cause control effect, performance degradation, or a loss of a protective system.	
L (R) REVERSER FAIL	TO	The respective thrust reverser has failed.	
L (R) START ABORTED	TO/LAND	The ground engine start on the respective engine has been aborted.	
L (R) STARTER FAIL	TO/LAND	The respective engine starter has failed.	
L (R) STARTER FAIL ON	TO/LAND	The respective engine starter has failed ON.	

Table 7-1. EICAS MESSAGES (Cont)

MESSAGE	INHIBITS	MEANING	AURAL WARNING
DOWNLOAD FADEC	TO/LAND	The FADEC maintenance data should be down loaded.	
ENG SYNC/M-HOLD FAIL	TO/LAND	Engine SYNC and Mach hold are not available.	
L (R) ENG A/ICE FAIL ON	TO/LAND	The respective nacelle anti-ice has failed ON.	
L (R) ENG FUEL TEMP LOW	TO/LAND	The fuel temperature in the respective engine filter is low.	
L (R) ENG IGN FAULT	TO/LAND	A fault has been detected in the respective engine ignition.	
L (R) ENG THRUST FAULT	TO/LAND	A fault has been detected in the respective engine thrust.	
L (R) ENGINE FAULT	TO/LAND	A fault has been detected in the respective engine.	
L (R) ENGINE FUEL BYPASS	TO/LAND	The respective engine fuel filter is impending bypass.	
L (R) ENGINE MINOR FAULT	TO/LAND	The engine has detected a minor engine fault.	
L (R) ENGINE OIL BYPASS	TO/LAND	The respective engine oil filter is impending bypass.	
L (R) ENG VIBRATION FAIL	TO/LAND	Loss of vibration signal from affected engine	
L (R) ENGINE ANTI-ICE FAULT	TO/LAND	Anti-ice bleed overpressure detection may result in higher ITT than normal.	
L (R) ENGINE OIL CHIP	TO/LAND	Metal debris detected in engine lube system.	
AUTO APR OFF		Auto APR has been selected off.	
L (R) ENGINE SHUTDOWN		The respective engine has shut down with the RUN switch OFF or the respective FIRE switch pushed.	
L (R) REVERSER INOP		The respective thrust reverser is inoperative and is mechanically pinned, hydraulically and electrically isolated.	

QUESTIONS

1. Normal takeoff thrust flat rated to ISA +15°C at sea level for the Honeywell AS 907 engine is:

a. 5,830 pounds
b. 6,826 pounds
c. 7,000 pounds
d. 9,120 pounds

2. The engine run/off switches perform which of the following functions:

a. Activates ignition system
b. Position the starter control valve to open
c. Turn on the fuel DC boost-pump
d. Activate the fire warning detection system

3. During a normal start cycle, engine rotation is achieved by:

a. Bleed air pressure from the APU, opposite engine bleed air, or GPU
b. DC power to the starter generator
c. Electric power from an external power source
d. AC power from the APU or opposite engine PMA

4. During a normal start sequence, when does the start valve close and the ATS (air turbine starter) disengage?

a. 35% N_2
b. 46% N_2
c. 65% N_2
d. 50%

5. What are the maximum consecutive start cycles allowed prior to a required 15 minute cooling period?

a. 2
b. 3
c. 4
d. 5

6. How long must the engine be motored (cranked) after an aborted engine start?

a. 15 seconds
b. 30 seconds
c. 1 minute
d. 2 minutes

7. APR thrust is indicated on the associated N_1 gage by:

a. White APR indication inside the N_1 display
b. Green APR icon
c. Green digital reference
d. Cyan APR icon

8. When low engine oil pressure is detected, the digital readout changes to:

a. Green
b. Cyan
c. Amber
d. Red

9. When N_1 or N_2 sync is selected, the engines are synchronized if both engines are in the CRZ or CLB rating and the N_1 difference between the two engines is within ____ %.

a. 5
b. 4
c. 3
d. 2

10. Manually selecting the ignition switch to ON is recommended:

a. Prior to takeoff
b. For ice accumulation
c. During flight through moderate or heavy intensity turbulence
d. For landing

11. What are the cockpit indications for a normal TR deployment?

a. Amber REV icon followed by white REV icon
b. White REV icon followed by green REV icon
c. Amber REV icon followed by green REV icon
d. Amber IN TRANSIT icon followed by green REV icon

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FIRE PROTECTION

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CHAPTER 8
FIRE PROTECTION

INTRODUCTION

The fire protection system is actually two systems: one for detection and one for extinguishing. The detection system detects fire in the engines and APU. It also detects any overheat condition in the main landing gear bays. The fire extinguishing system has extinguishing capability for the engines and APU.

GENERAL

The system consists of the following components (Figure 8-1):

- FIRE and FIRE EXT switches on the ENGINE panel
- Master warning and caution lights
- Left and right MFD EICAS displays
- Detection loops
- Control Unit
- Two fire extinguishing bottles
- Left and right main wheel well overheat detection
- Left and right engine compartment discharge lines
- APU compartment discharge lines

1. ENGINE Panel.
2. Master WARNING/CAUTION LIGHTS.
3. Left MFD EICAS display.
4. FIREX Control Unit
5. Left Main Wheel Well Overheat Detection.
6. Right Main Wheel Well Overheat Detection.
7. Fire Extinguisher Bottle No.1.
8. Fire Extinguisher Bottle No. 2.
9. Left Engine Compartment Discharge Lines.
10. Right Engine Compartment Discharge Lines.
11. APU Compartment Discharge Lines.

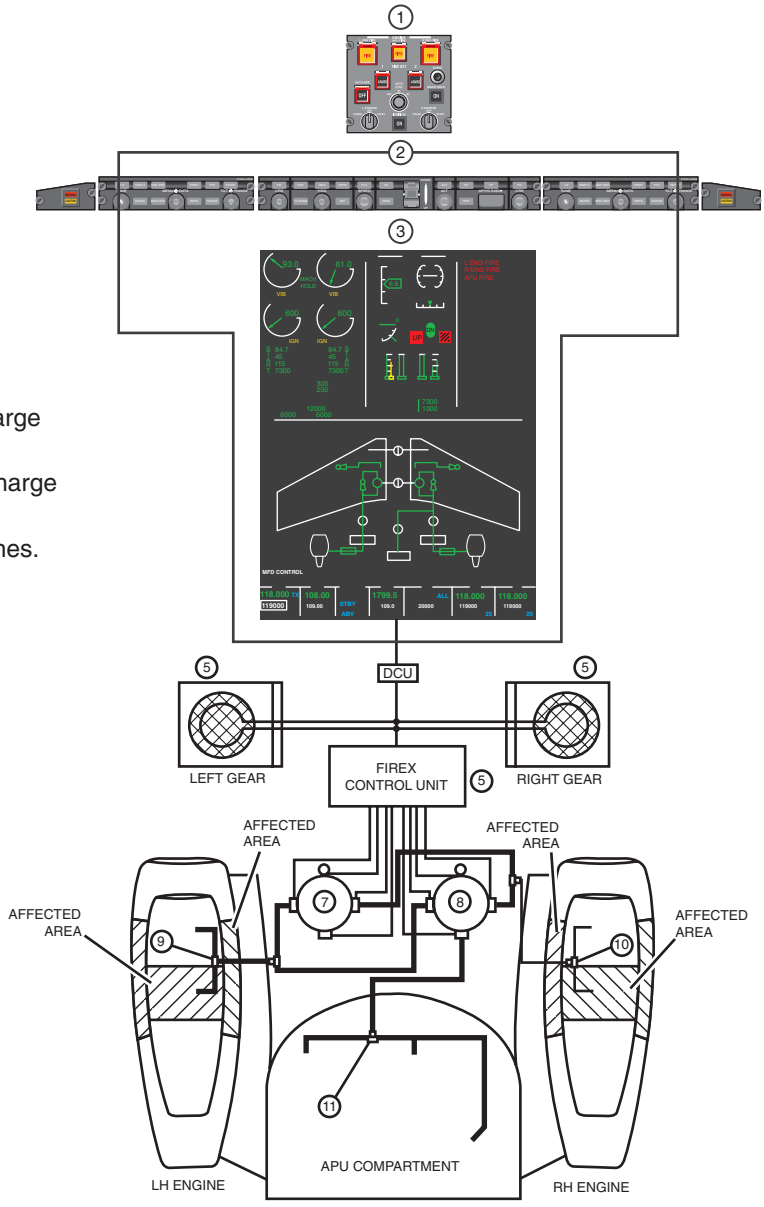

Figure 8-1. Fire Protection System Overview Schematic

FIRE DETECTION SYSTEM

FIRE DETECTION LOOPS

Both engines and the APU have dual fire detection loops. The loop system minimizes the possibility of false fire warnings. Both loops must sense the fire or overheat condition under similar parameters before fire indications are generated. Figure 8-2 illustrates the loop system for the engines, APU, and main landing gear.

The loops are constructed of an outer metal sheathing with two internal wires separated by an insulating material (thermistor). One of the wires carries electrical current; the other is grounded to the outer sheathing at the control unit. The resistance of the thermistor decreases with an increase in temperature.

When the electrical resistance decreases to a trip point, electrical current from the live internal wire conducts to the second internal wire. A fire indication is then generated.

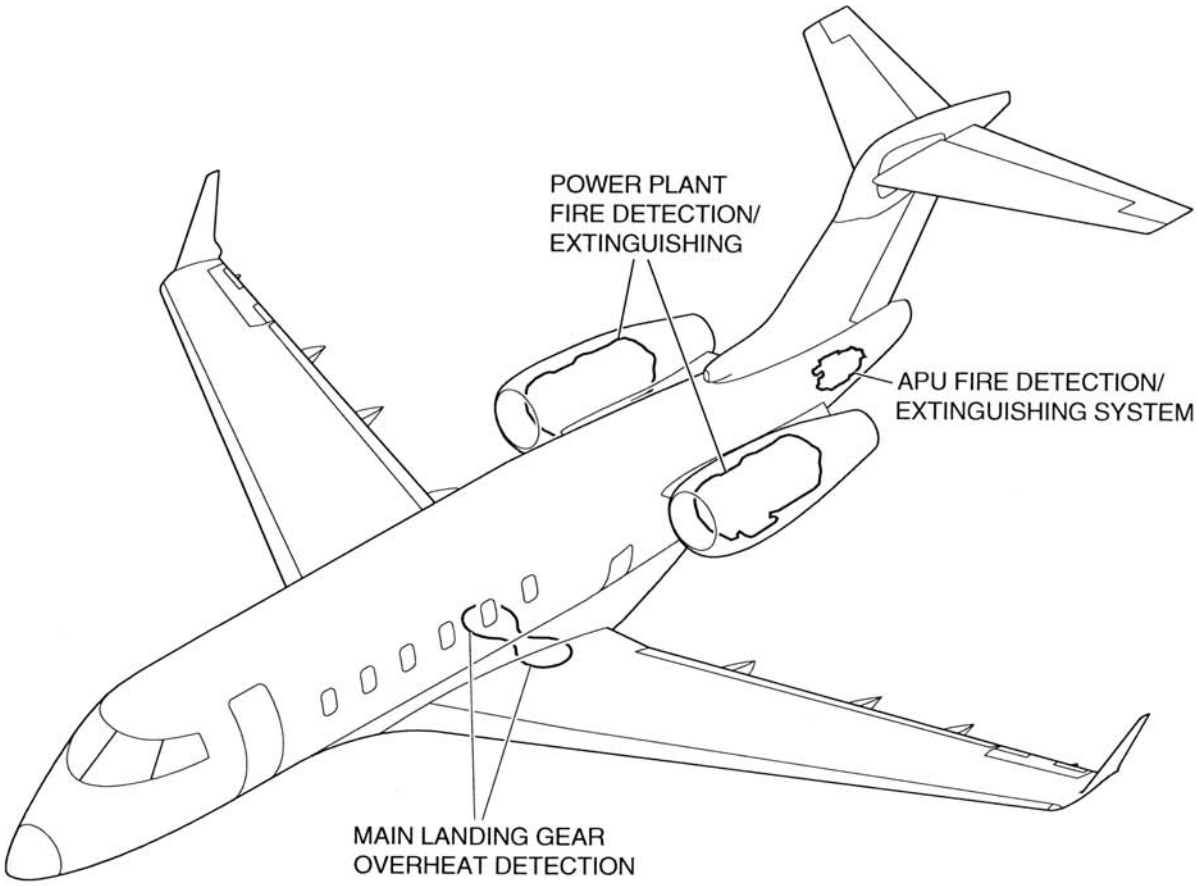

Figure 8-2. Fire Detection Loops

CONTROL UNIT

The electronic fire detection and extinguishing control unit (FIREX-CU) monitors the electrical resistance of the loops. The control unit is in the aft equipment bay.

When both loops experience the same decrease in resistance within a preset time, the control unit sends a fire signal to EICAS (Figure 8-3). The FIREX-CU monitors each individual control circuit and its related sensing loop. If one loop malfunctions, the second loop can still detect a fire.

ENGINE FIRE DETECTION

The loops in each engine provide fire detection around the core engine area, engine accessory area, forward nacelle, and pylon areas.

If a fire is detected in the engine, the following occurs:

- Affected L/R ENG FIRE switch illuminates
- Master warning light illuminates
- Master warning chimes
- Affected L/R ENGINE FIRE message appears on EICAS
- Red FIRE EI appears in the N_1 indicator
- Aural “Left” or “Right Engine Fire” sounds

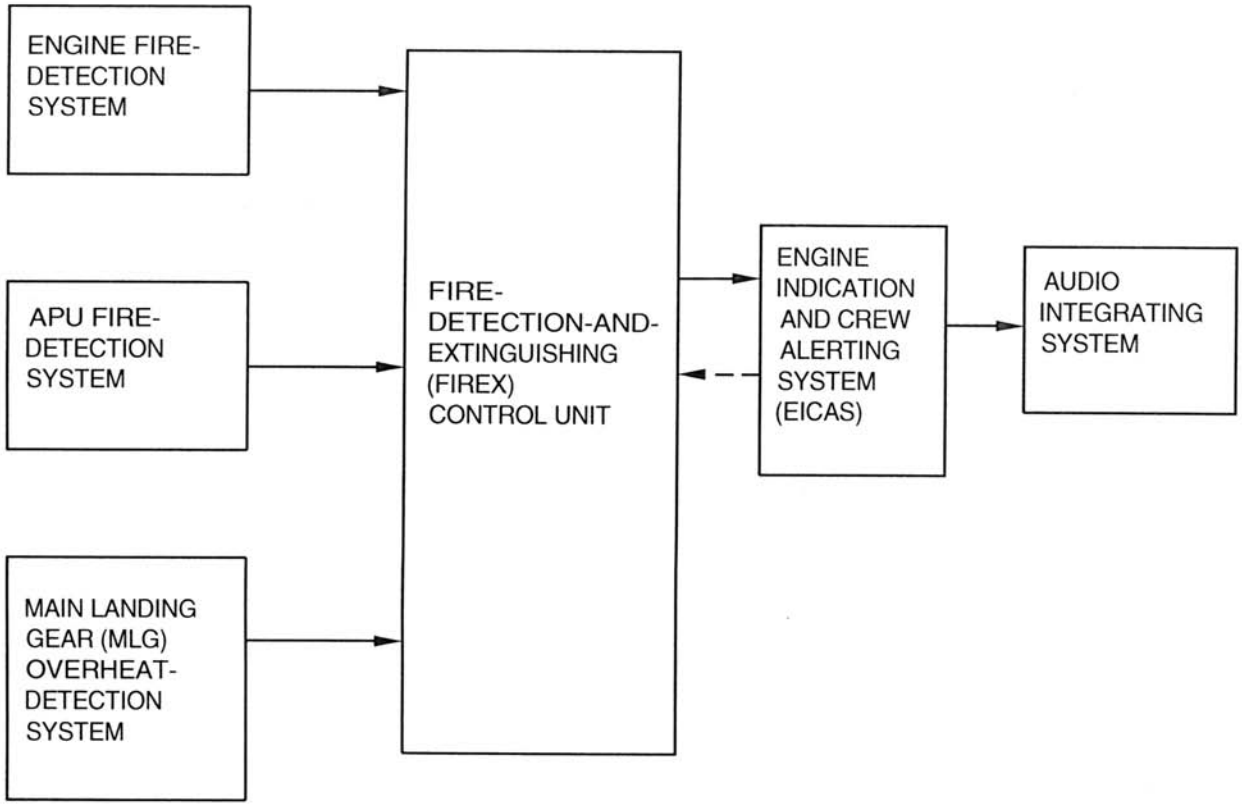

Figure 8-3. Fire Detection Control Unit

APU FIRE DETECTION

The auxiliary power unit (APU) fire detection system detects an overheat condition within the APU enclosure (Figure 8-4). An APU fire can only be extinguished from bottle 2. The system has provisions for fire protection in ground mode for unattended operation and in flight mode.

When an overheat condition occurs on the ground, the APU shuts down automatically. Five seconds later, bottle 2 automatically discharges Halon into the APU enclosure.

When a fire condition is detected in flight, the APU FIRE switch is pushed to shut down the APU and arm the discharge cartridge on bottle 2. The flight crew discharges the bottle by pushing the FIRE EXT 2 switch.

If a fire is detected in the APU enclosure, the following occurs:

- APU FIRE switch illuminates
- Master warning light illuminates
- Master warning chimes
- APU FIRE red warning message appears on EICAS
- Aural “APU Fire” sounds

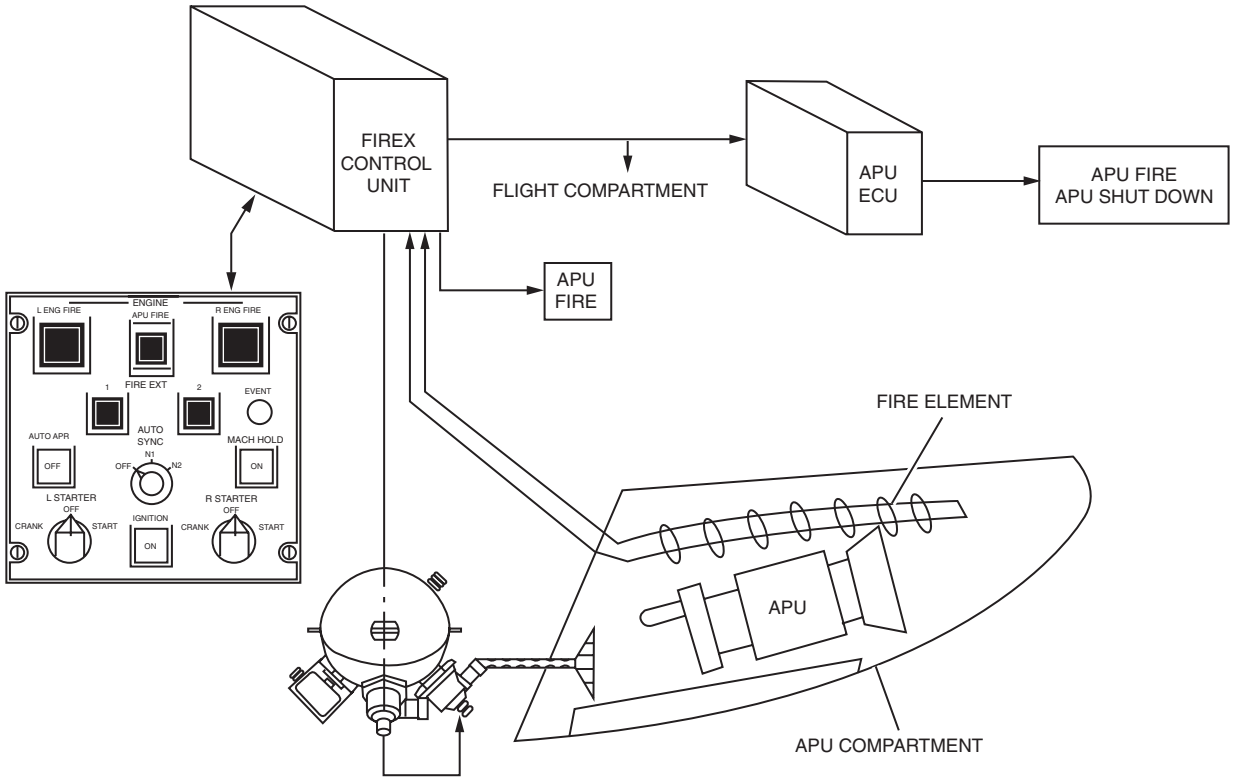

Figure 8-4. APU Fire Protection

LANDING GEAR BAY OVERHEAT

The Challenger 300 includes two main landing gear bays (MLG) or main wheel wells. Because the wheel wells are made of composite materials, they require an overheat detection system.

The main landing gear bay is protected by a single overheat detection loop for each main landing gear bay and a dual channel overheat detection unit. Each overheat sensing loop is installed around the top of the inner surface of each main wheel bin.

The overheat detection loops are connected to the FIREX-CU. The loops are similar in construction and operation to the detection loops around the engines and APU.

Operation

When the electrical resistance decreases to a trip point, electrical current from the live internal wire conducts to the second internal wire. An overheat indication is generated.

The control unit monitors the electrical resistance of each single loop system. When the loop experiences a decrease in resistance over a preset time, the control unit sends an overheat signal to the data concentrator unit (DCU).

The DCU then routes the signals to EICAS (Figure 8-5). The master warning lights illuminate, a triple chime sounds, and a GEAR BAY OVHT red warning CAS message illuminates.

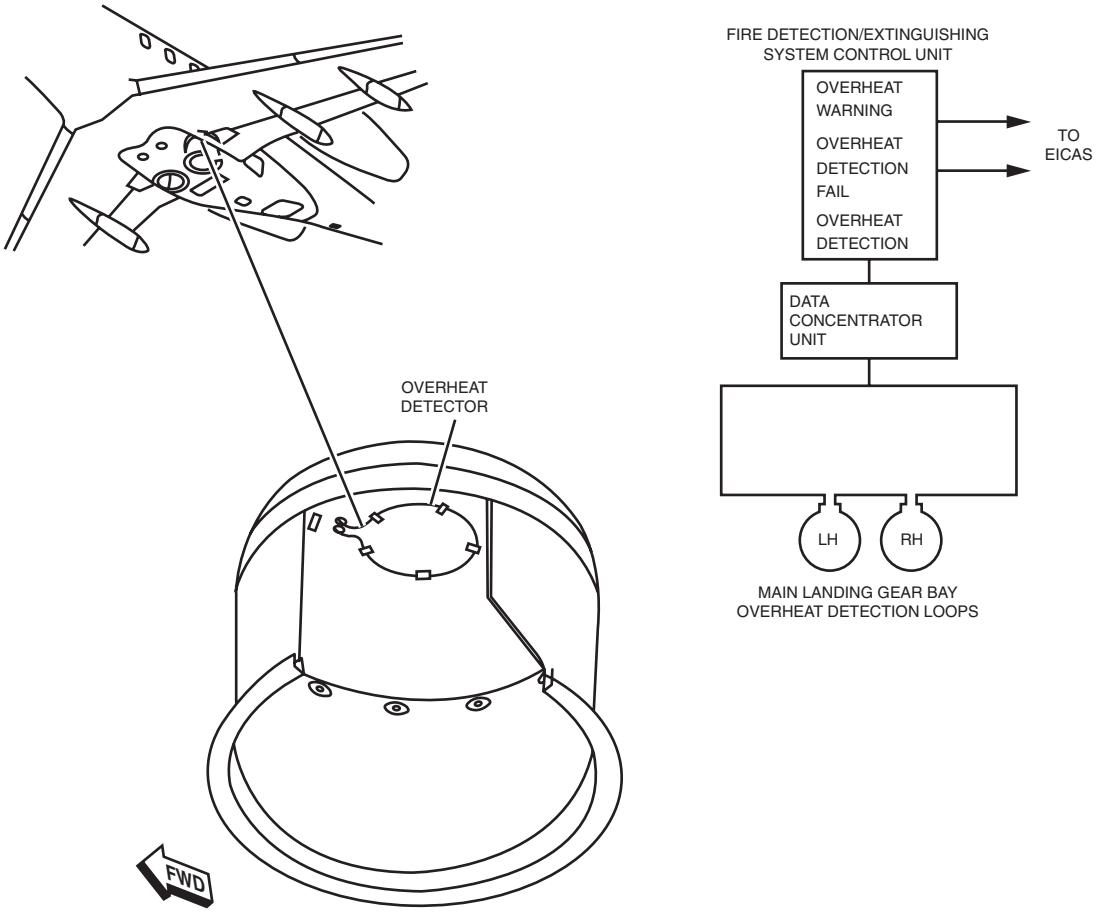

Figure 8-5. Main Landing Gear Overheat Detection

CARGO BAY FIRE PROTECTION

A smoke detector is installed in the cargo bay. A fire in this area must be extinguished with a portable fire extinguisher.

A single smoke detector is mounted on the ceiling of the cargo bay. If smoke is detected, the master warning lights illuminate, the master warning chime sounds, and a CARGO SMOKE red warning message illuminates on EICAS.

NOTE

Operation of mobile transceivers in close proximity to the smoke detectors or exhaust fumes from ground handling equipment may cause a false alarm.

FIRE EXTINGUISHING SYSTEM

FIREX BOTTLES

Two fire extinguisher bottles are in the aft equipment bay outside the aircraft's pressure bulkhead. Each bottle has a pressure switch and a pressure gage. The number 1 bottle has two discharge heads with explosive squibs, and the number 2 bottle has three discharge heads with explosive squibs (Figure 8-6).

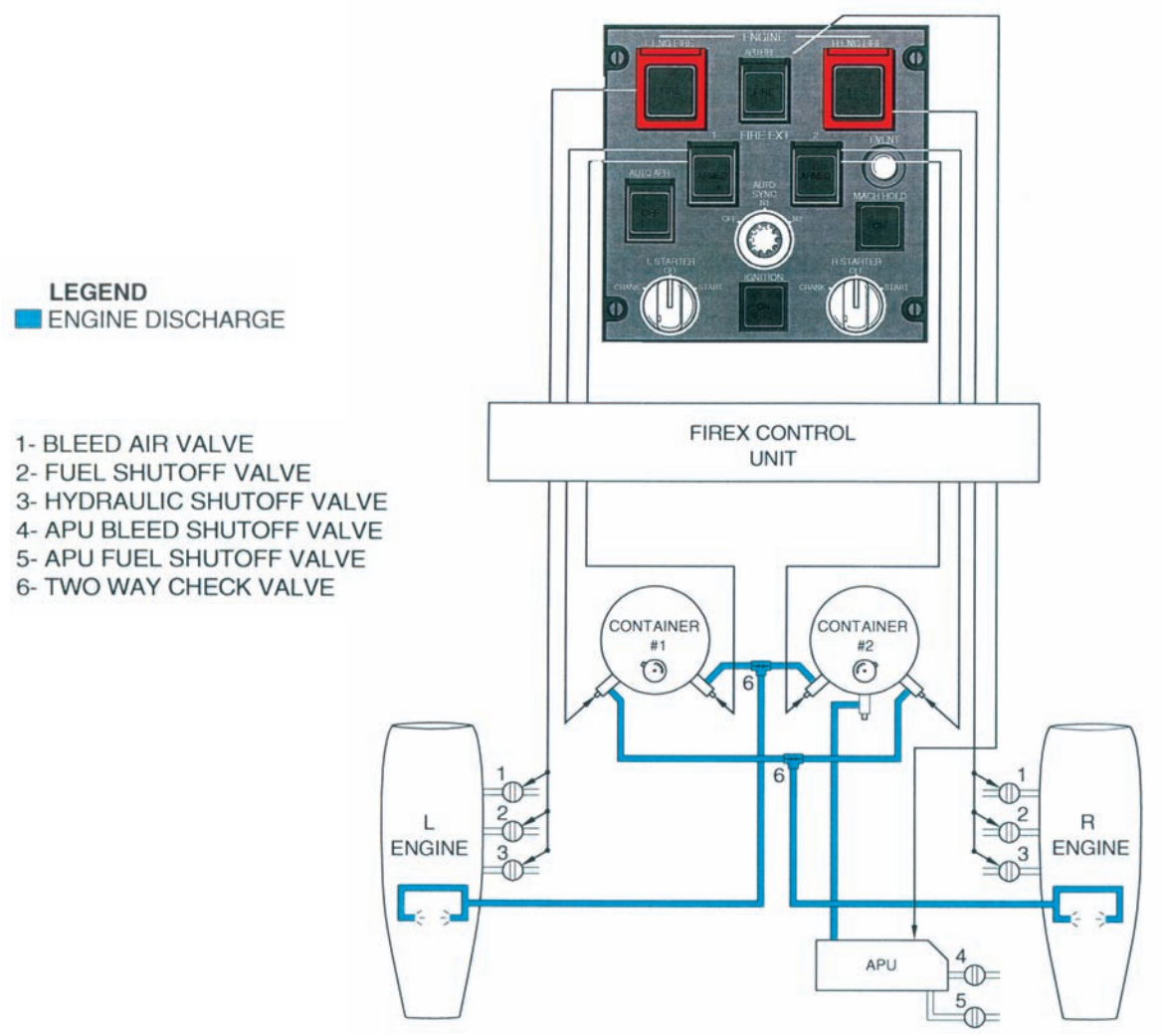

Figure 8-6. FIREX Control Unit Schematic

Each squib has two firing bridge-wires fed by separate electrical circuits. The bottles are filled with Halon 1301.

During checks on the FIREX bottles, the following pressure/temperature chart can be used to determine if bottle pressure is within acceptable limits for bottle temperature. Table 8-1 applies to bottles with 4.3 lb agent.

For the left and right engines, a check tee is at the intersection between the plumbing from

Table 8-1. FIREX BOTTLE PRESSURES

Minimum/Maximum FIREX Bottle Pressure (4.3 lb nominal weight)		
	Gage reading (psig)	
Temp °C	Minimum	Maximum
-55	251	343
-50	277	354
-45	288	367
-40	302	380
-35	315	394
-30	330	410
-25	347	427
-20	365	445
-15	384	465
-10	404	486
-5	427	508
0	450	533
5	476	559
10	503	587
15	532	616
20	578	648
25	596	681
30	631	717
35	668	755
40	708	795
45	750	838
50	796	886
55	849	941
60	895	982
65	964	1096
70	1032	1165
75	1100	1235
80	1168	1305
85	1235	1375
90	1303	1445
95	1371	1515
100	1439	1585

the two bottles and the common plumbing going to the fire zone. The check tee prevents extinguishing agent from the second discharged bottle back-filling into the bottle discharged first.

If required, both bottles can be discharged into one engine. The selection of the L or R ENG FIRE switch determines which squib is fired. Only bottle No.2 can be discharged into the APU compartment.

For both the main powerplants and the APU, two switches are required to discharge the extinguisher. The first one is the guarded latching FIRE switch that shuts down and isolates the engine/APU. It also arms the corresponding discharge cartridges on the bottle(s). The second FIRE EXT switch is a momentary switch that applies discharge current to the selected cartridge.

FIRE SWITCHES

The ENGINE control panel on the pedestal contains the FIRE switches that illuminate when a fire is detected and the FIRE EXT switches that discharge the extinguishing agent (Figure 8-7).

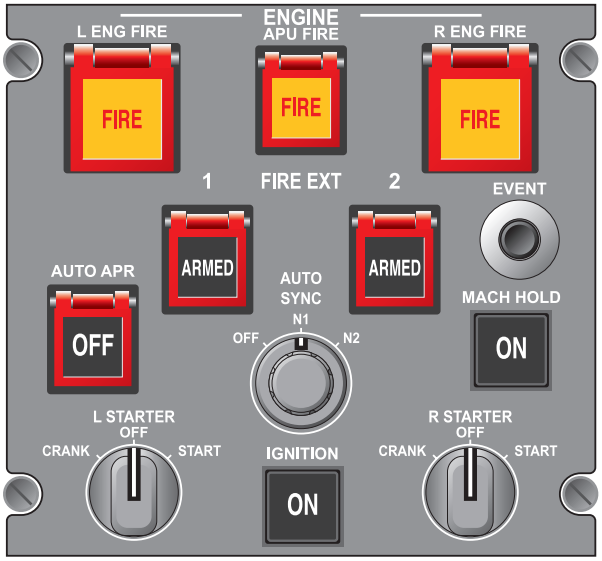

Figure 8-7. Fire Switches

When either the L or R ENG FIRE switch is depressed, the following occurs:

- Applicable squib on both bottles armed
- Both EXT 1 and 2 switches illuminate ARMED
- Fuel shutoff valve closes
- Hydraulic shutoff valve closes
- Generator selected offline
- FADEC commands engine shutdown
- Bleed air shutoff valve closes

When the APU FIRE switch is depressed:

- APU squib on bottle 2 is armed
- EXT 2 switch illuminates ARMED
- APU fuel shutoff valve closes
- APU electronic control unit closes APU fuel metering valve
- APU bleed-air shutoff valves closes
- APU generator selected offline

OPERATION

After the fire detection system has illuminated the ENG FIRE switch, the crew activates the extinguishing system by pressing the ENG FIRE switch.

Next, the pilot presses the FIRE EXT 1 or FIRE EXT 2 switch. Electrical current fires the squib in the associated bottle. Pressurized Halon is then directed into the engine fire zones.

The selection of the L/R ENG FIRE switch determines into which engine the bottles are discharged. During an engine fire, FIRE EXT 1 should always be depressed first regardless of which engine has the fire.

Only bottle 2 can be used in the APU compartment. If the fire is extinguished with bottle No.1, bottle No.2 remains for use on the other engine or the APU.

After an extinguisher bottle is discharged, the ARMED light on the FIRE EXT switch extinguishes; the FIREX BTL 1/2 LOW advisory message illuminates.

TESTING

Because the FIREX system continuously monitors the engine, APU, main landing gear bay, and fire protection systems, no preflight test is required. These systems, however, can be tested if desired or when directed by an *AFM* procedure.

The SYSTEMS TEST rotary switch (see Chapter 4) on the pedestal has FIRE DET and CARGO SMOKE test functions. When the SYSTEMS TEST switch is rotated to the FIRE DET position and then pressed, the following occurs:

- Red warning messages illuminate:
  - L ENGINE FIRE
  - R ENGINE FIRE
  - APU FIRE
  - MLG BAY OVHT
- Control unit tests all detection and extinguishing components
- FIRE SYS IN TEST status message illuminates
- Both master warning lights flash
- Master warning chime sounds
- "Left engine fire" voice aurals sound repeatedly
- L ENG FIRE, R ENG FIRE, APU FIRE switches illuminate
- FIRE EXT 1 and FIRE EXT 2 switches illuminate

After a satisfactory completion of the test, a FIRE SYS TEST OK message illuminates. If any component does not pass the test, the FIRE SYS TEST OK status message does not illuminate. A CAS message then illuminates to indicate which component failed. The test takes approximately 10 seconds to complete.

The CARGO SMOKE rotary switch position checks the smoke detector in the cargo bay.

EICAS MESSAGES

Table 5-2 lists the EICAS messages associated with the fire protection system, a brief explanation of the message, and whether the message is inhibited during takeoff and/or landing.

Table 8-2. EICAS MESSAGES

MESSAGE	INHIBITS	MEANING	AURAL WARNING
APU FIRE		Fire has been detected in the APU compartment.	"APU Fire"
L (R) ENGINE FIRE		The L (R) ENGINE FIRE CAS, FIRE EI in the N1 indicator, FIRE indication in the L (R) ENG FIRE switch, or LEFT (RIGHT) ENGINE FIRE voice message indicates that the engine fire detection loop has activated. An engine fire is usually accompanied by other indications such as: excessive ITT, erratic or rough engine operation, fluctuating engine indications, or smoke in the cabin.	"Left Engine Fire" or "Right Engine Fire"
CARGO SMOKE		Smoke has been detected in the cargo (baggage area.	
GEAR BAY OVHT	TO/LAND	An overheat condition has been detected in the main landing gear bays.	
APU FIRE DET FAIL	TO/LAND	An APU fire detection system has detected a failure that will not allow the detection system to indicate a fire.	
CARGO SMOKE DET FAIL	TO/LAND	The cargo smoke detection system has failed.	
L (R) FIRE DET FAIL	TO/LAND	The engine fire detection system has failed.	
FIRE SYS FAULT	TO/LAND	The fire detection and extinguishing system has detected a fault.	
FIREX APU SQUIB FAIL	TO/LAND	APU fire extinguisher squib on bottle #2 has failed (NO low pressure indication).	
GEAR BAY DET FAIL	TO/LAND	The gear bay overheat detection has failed.	
FIRE SYS FAULT	TO/LAND	The FIREX control unit has detected a fault.	
FIREX BTL 1 (2) FAULT	TO/LAND	The respective bottle squib for the left or right engine has failed.	
FIREX BTL 1 (2) LOW	TO/LAND	The respective bottle pressure is low.	
FIRE SYS IN TEST		The fire detect test system is conducting the manually activated system test.	
FIRE SYS TEST OK		The fire detect test system has passed the system test.	

QUESTIONS

1. Which of the following is not a function of the fire protection system:
   a. Fire detection in the engines and APU
   b. Cabin smoke detection
   c. Overheat detection in the main landing gear bay
   d. Fire extinguishing capability for the engines and APU

2. The engines and APU are fitted with dual fire detection loops. The loops are connected to the:
   a. APU and engine ECUs
   b. Fire extinguisher control panel
   c. FIREX control unit
   d. Fire/shutdown unit

3. The electronic fire detection and extinguishing control unit (FIREX-CU) is in:
   a. The aft equipment bay
   b. In the engine accessory section
   c. In the aft cargo bay
   d. On the engine control panel

4. If a fire is detected in an engine, all of the following occur except:
   a. Affected L/R FIRE switch illuminates
   b. Master warning light illuminates
   c. Master warning chimes
   d. Engine FIREX system automatically shuts down the engine

5. The APU fire detection system:
   a. Automatically shuts down the APU and discharges a fire exinguisher when an APU fire occurs in flight
   b. Detects an overheat condition within the APU enclosure
   c. Provides fire extinguishing capability from fire bottle 1
   d. Will automatically shut down the APU only when the cabin door is open

6. The main landing gear bay is protected:
   a. By a single overheat detection loop
   b. By a dual overheat detection loop
   c. By the right engine FIRE EXT control unit
   d. By a single channel overheat detection unit

7. What triggers the fire detection systems?
   a. A temperature sensor located at specific points around the engines, APU, and main landing gear
   b. An infrared light sensor is tripped
   c. When electrical resistance decreases to a trip point
   d. Two of the three smoke detectors are tripped

CHAPTER 9
PNEUMATICS

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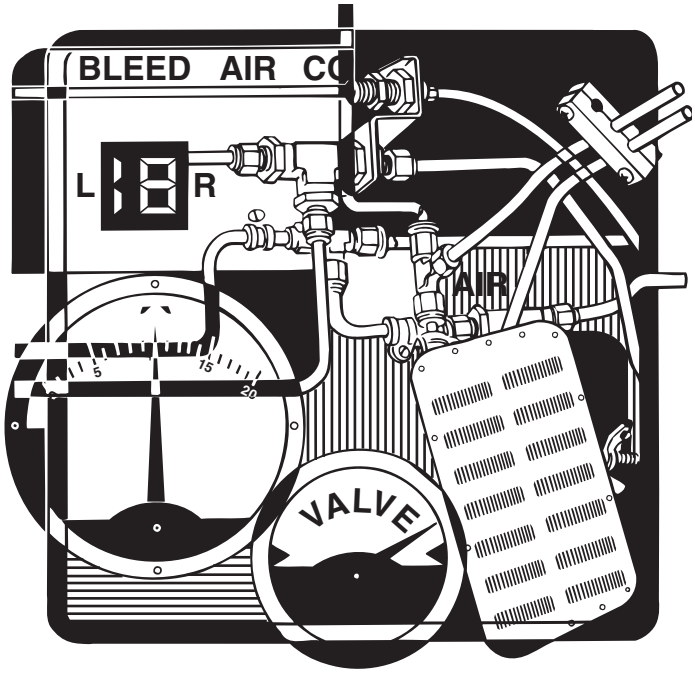
PNEUMATICS



INTRODUCTION

This chapter introduces the pneumatic or bleed air system that furnishes bleed air to various aircraft systems. Most of the controls and indications for the bleed air system are part of the air conditioning/pressurization and anti-ice systems. This chapter describes the sources of bleed air and airflow into the bleed air manifold. See Chapter 10—Ice and Rain Protection and Chapter 11—Air Conditioning for specifics on how the bleed air is used.

GENERAL

The engines, APU, and ground power unit are sources of bleed air for the pneumatic system's ducting and manifold. The engines provide bleed air at all altitudes. The APU provides bleed air in flight up to 20,000 feet.

The pneumatic system distributes the low-pressure and high-pressure bleed air to user systems through ducts (Figure 9-1). The bleed air ducts are constructed of stainless steel, titanium or aluminum and wrapped with insulation.

High-pressure (HP) bleed air is routed through HP valves in the ducting to the wing anti-ice system.

Intermediate-pressure (IP) air is routed through IP valves to the common manifold where the environmental control system (ECS) controls it. The IP ports of the engine, APU, or external ground supply cart can supply the common bleed air manifold.

Regulating valves and check valves in the aft equipment bay ducting control bleed air from the left and right engines and the APU.

The IP system also includes switches and a leak detection system.

Pressure sensors in the bleed air lines monitor the bleed air and send information to the integrated air system controller (IASC) for processing and displaying on EICAS.

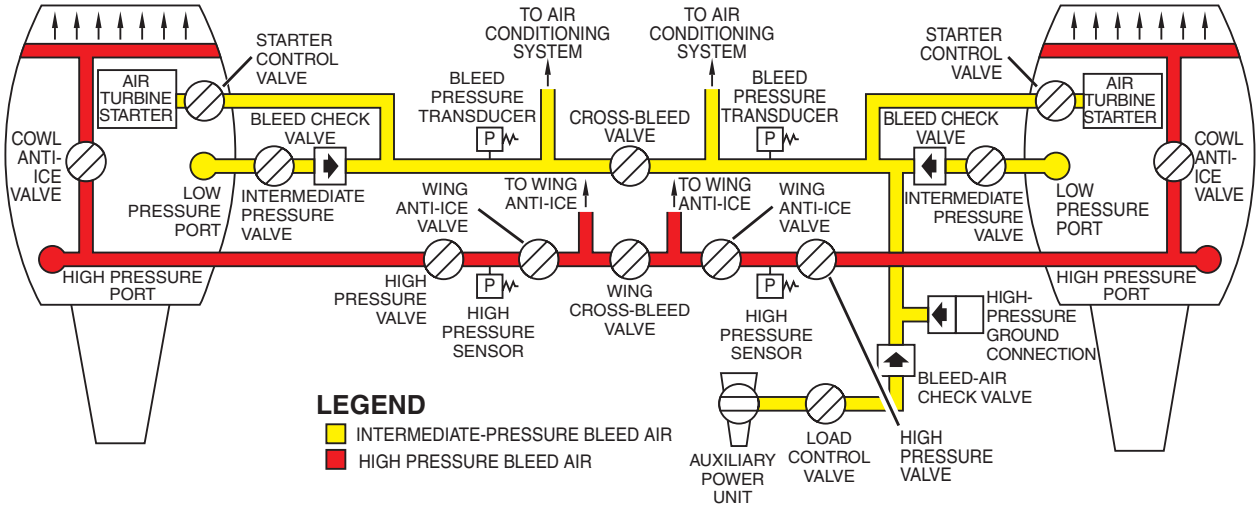


Figure 9-1. Pneumatic Distribution System

COMPONENTS

BLEED AIR MANIFOLD

The bleed air manifold is in the engine pylons and aft equipment bay. The crossbleed valve divides the manifold into a right side and left side. The engines provide bleed air to their respective side. Both the APU and ground air cart supply air to the right side of the crossbleed valve.

INTERMEDIATE PRESSURE VALVES

The intermediate pressure (IP) valves control and regulate the distribution of IP air to the users. The L/R BLEED switches on the AIR COND/BLEED panel electrically control the pneumatically operated IP valves.

Engine bleed air pressure increases proportionally with N_2 compressor speed. The pressure regulating function of the IP valve limits the engine discharge pressure to 50 ±3 psi. When N_2 compressor speed is low and engine bleed-air pressure is less than the regulated valve (and at least 10 psi or greater), the valve is fully open.

If an IP valve fails and manifold pressure exceeds 60 psi, a L/R BLEED AIR caution messages is displayed on EICAS.

The IP valves are in a closed position when any of the following occurs:

- Engines shut down
- Power lost to the valves
- Associated ENG FIRE switch selected
- Bleed air valves selected closed on AIR COND/BLEED panel

HIGH-PRESSURE VALVES

The high-pressure valves (HP) regulate the engine high pressure bleed to 36 ±3 psi, which is then routed to the wing anti-ice system.

The WING SOURCE switch and WING switch on the ANTI-ICE panel electrically control the pneumatically operated valves.

The HP valves are in the closed position when any of the following occurs:

- Engines shut down
- Power lost to the valves
- Associated ENG FIRE switch selected
- WING anti-ice is selected off

APU BLEED VALVE

The APU electrical control unit (ECU) controls the APU bleed valve and energizes the bleed air supply system to supply compressed air from the APU power section through the bleed air duct.

Bleed air extraction from the APU is commanded by the APU BLEED switch on the AIR COND/BLEED panel. Selecting APU BLEED ON signals the ECU to determine when the APU is ready for bleed air loading. The ECU then modulates the APU bleed valve.

The valve is connected to the compressor outlet of the APU. When the valve is open, the ECU adjusts the butterfly plate position to supply the correct quantity of bleed air. The ECU senses APU exhaust temperature to determine the amount of bleed air taken from the APU (Figure 9-2).

When the valve is open, APU bleed air flows to the right side only where it can be used for engine starting and air conditioning.

When the APU is shut down or a signal loss from the ECU occurs, the APU bleed valve moves to a closed position.

CROSS-BLEED VALVE

A cross-bleed valve (CBV) in the aft equipment compartment interconnects the left and right hand intermediate-pressure bleed air systems.

The integrated air system controller opens the valve automatically during engine startup. The controller closes the valve when the engines are operational.

The X BLEED switch on the AIR COND/BLEED panel can manually control the valve.

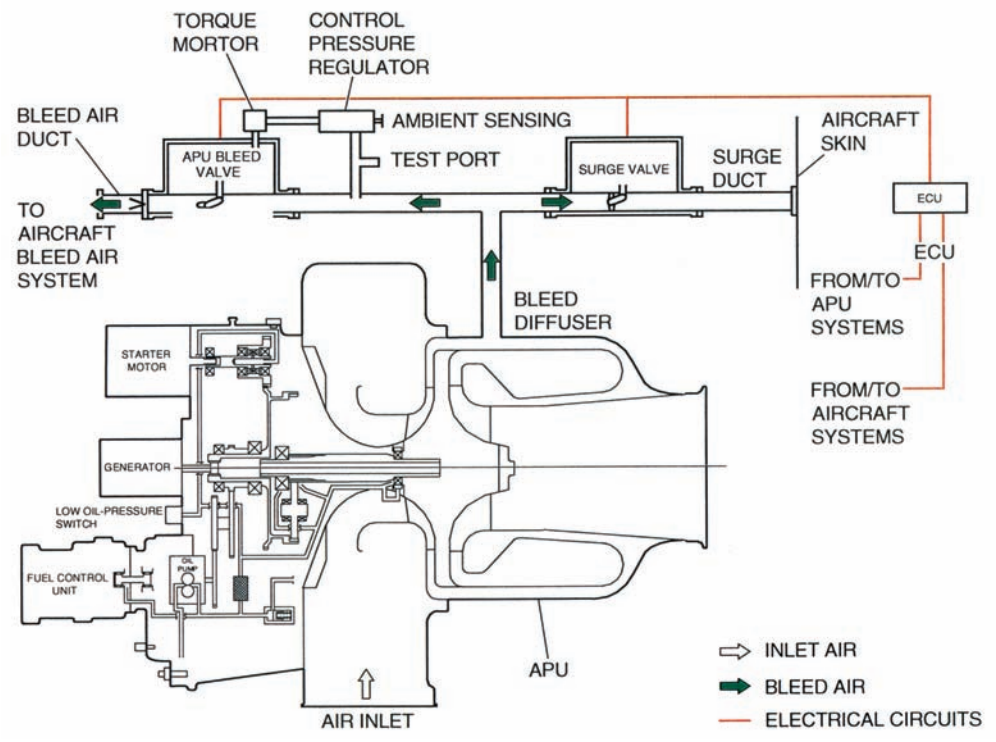


Figure 9-2. APU Bleed Valve

INTEGRATED AIR SYSTEM CONTROLLERS

Two integrated air system controllers (IASCs) ensure overall system control and monitoring. One unit is under the floor and the other is under the liner of the lavatory above the floor.

The units gather air conditioning and bleed air control functions and monitor cabin pressure and airframe ice protection functions.

IASC 1 monitors the left HP valve and left IP valve while the IASC 2 monitors the right HP valve and right IP valve.

Each IASC consists of two channels that monitor the following system operations:

- Channel A for the environmental control system and cabin pressure control
- Channel B for wing anti-icing monitoring and control along with leak detection monitoring

CHECK VALVES

Four check valves are in various locations in the bleed air ducting.

An intermediate-pressure check valve in each engine bleed air duct prevents reverse flow into the engines.

Check valves are also installed at the external air connector and in the APU bleed air duct. The check valve at the external connector prevents loss of air to the atmosphere. The APU check valve prevents reverse flow of manifold air to the APU when the APU is shut down.

The EICAS synoptic displays for the environmental control system (ECS) and the anti-ice system (A/ICE) do not depict the check valves on the block schematics.

GROUND AIR CONNECTOR

An external air connector is aft of the equipment bay door on the exterior surface of the fuselage (Figure 9-3). When external air is connected, air pressure is displayed as a manifold pressure digital readout on the ECS synoptic page.

Figure 9-3. Ground Air Connector

OPERATION

The crew primarily manages bleed air through control and monitoring of the valves controlling bleed air sources.

The AIR COND/BLEED control panel (Figure 9-4) includes the following switches:

- L/R BLEED valves
- XBLEED valve
- APU valve (via the ECU)

The IASCs ensure overall system control and monitoring.

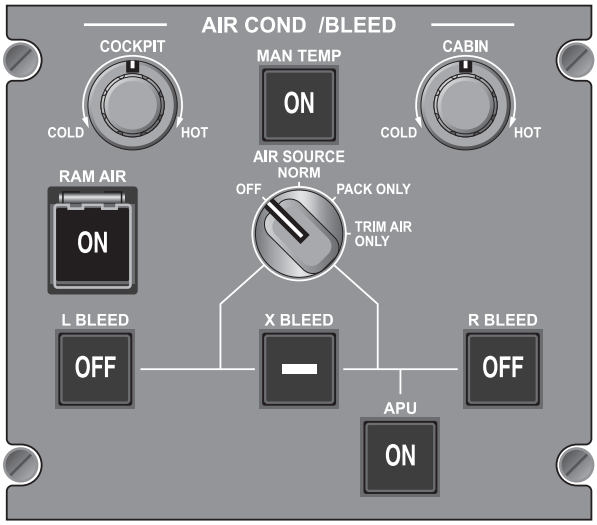


Figure 9-4. AIR COND/BLEED Control Panel

START SEQUENCE

If a bleed source has been selected during engine starts on the ground, engaging the engine start switch automatically isolates the air conditioning system so bleed air flows to the air turbine starters (ATS).

When the L/R STARTER switch is positioned to START, the following occurs:

- Crossbleed valve opens (if previously closed)
- Flow control valves close (if previously open)
- Associated start valve opens
- Engine ATS engages

When the engine achieves a self-sustaining rpm, the ATS disengages, the start valve closes, and the flow control and crossbleed valves return to the previous position.

Cross-engine bleed air (from one engine to the other) can power the starter.

IN FLIGHT

Takeoffs and landings are normally accomplished with the APU as the sole source of bleed air. The APU BLEED switch is ON, the L and R BLEED switches are OFF, and the XBLEED is open.

During climb, the engines become the bleed air source. The pilot switches the X BLEED closed, the L BLEED on, the APU BLEED off, and the R BLEED on. The pilot may then shut down the APU.

During approach, the pilot starts the APU so it can supply bleed air. The pilot then switches the R BLEED off, APU BLEED on, L BLEED off, and the X BLEED switch open.

BLEED AIR LEAK DETECTION

The bleed leak detection system monitors the bleed air and anti-ice ducts for leakage. The IASCs control the fully automatic leak detection system.

The ducts may be monitored by either a single or dual heat detection loop installation. The dual-loop system minimizes false leak indication. Under certain circumstances, it also allows for aircraft dispatch if one loop is inoperative. A BLEED LOOP FAULT message indicates that one loop of a dual-loop system has failed, while a BLEED LOOP FAIL message indicates that both loops are inoperative. The BLEED LOOP FAIL message also appears when one loop in a single-loop system fails.

The pneumatic system is divided into the following eight areas for bleed air leak detection and presentation on the EICAS.

LEFT AND RIGHT BLEED DUCTS

The left and right bleed duct monitoring systems consist of single heat detection loops. These systems protect the areas between their respective intermediate pressure bleed valves and the crossbleed valve. Also included are the ducts leading to the air turbine starters. The left bleed duct includes the crossbleed valve and the duct leading to the pack flow control valve. The right bleed duct includes the APU bleed duct, the external air connection, and the duct leading to the trim air flow control valve. Both systems monitor the crosbleed valve. A L/R BLEED LEAK message is posted if one of these ducts is compromised.

LEFT AND RIGHT PYLON DUCTS

The pylon duct monitoring systems consist of dual heat detection loops. These systems protect the intermediate pressure and high pressure bleed systems. The pylon ducts include the areas from the intermediate pressure ports to the intermediate pressure bleed valves and the areas from the high pressure ports to the wing anti-ice valves. A L/R PYLON BLEED LEAK message is posted if one of these ducts is compromised.

LEFT AND RIGHT ANTI-ICE DUCTS

Dual loops protect the entire length of each anti-ice duct. The left and right anti-ice duct monitoring systems protect the ducts between the wing anti-ice valves and the wing tips. The ducts connecting to the wing crossbleed valve are also protected. Separate sets of heat detecting loops protect the ducts in the wings and the ducts in the fuselage. A WING ANTI-ICE LEAK message is generated if any of these ducts is compromised.

PACK DUCT

Dual heat detection loops protect the pack duct. The pack duct monitoring system protects the duct between the left flow control valve and the pack inlet duct. This also includes the duct to the precooler inlet. A PACK LEAK message is generated if the pack duct is compromised.

TRIM AIR DUCT

A single heat detection loop protects the trim air duct. The trim air duct monitoring system protects the duct between the right flow control valve and the trim air discharge ducts. A TRIM AIR LEAK message is generated if any of the trim air ducts is compromised.

EICAS MESSAGES

Table 9-1 lists the EICAS messages associated with the pneumatics system, a brief explanation of the message, and whether the message is inhibited during takeoff and/or landing.

Table 9-1. EICAS MESSAGES

MESSAGE	INHIBITS	MEANING	AURAL WARNING
L (R) BLEED LEAK	TO/LAND	A leak has been detected in the bleed-air ducting downstream of the bleed valve.	
L (R) PYLON BLEED LEAK	TO/LAND	A leak has been detected in the engine pylon or tail cone (before shutoff valve).	
L (R) BLEED FAIL	TO/LAND	The affected engine bleed-air valve has failed or a temperature or pressure has exceeded limits or the sensor has failed. Under certain low thrust conditions (ground idle at high field elevations or idle with single bleed on), there may be insufficient pressure to keep the bleed valve open.	
L (R) BLEED LOOP FAIL	TO/LAND	A failure (open or short circuit) has been detected in the bleed leak detection system.	
L (R) PYLON LOOP FAIL	TO/LAND	Both bleed-air leak detection loops in the respective pylon have failed during the power-up self-test.	
XBLEED FAIL	TO/LAND	The crossbleed valve has failed to move to the commanded position.	
BLEED LOOP FAULT	TO/LAND	A fault has been detected in the bleed leak detection loop system, and redundancy in lost.	
L (R) BLEED FAULT	TO/LAND	The bleed pressure data is invalid, or the affected flow control valve is failed closed.	
BLEED OFF	TO/LAND	The L, R, and APU BLEEDS are OFF.	
XBLEED OPEN	TO/LAND	The cross-bleed valve is open.	

QUESTIONS

1. The pneumatic system provides high-pressure (HP) air for:

a. Engine starting
b. Air conditioning
c. Windshield heat
d. Wing anti-icing

2. The high-pressure (HP) valve limits engine discharge pressure to:

a. 36 ±3 psi
b. 45 ±3 psi
c. 50 ±3 psi
d. 60 ±3 psi

3. The IP valves are closed when:

a. N_2 compressor speed is low
b. Power is lost to the valves
c. Engine bleed air pressure is at least 10 psi
d. Engine bleed-air pressure is less than the regulated valve

4. The source of bleed air for takeoff and landing is normally:

a. L Bleed
b. R Bleed
c. APU Bleed
d. Off

5. During climb, the sequence to switch to engine bleed air is:

a. X BLEED closed, L BLEED on, APU BLEED off, R BLEED on
b. R BLEED off, APU BLEED on, L BLEED off, X BLEED open
c. X BLEED open, L and R BLEEDs on, APU BLEED off
d. APU BLEED off, L BLEED on, XBLEED open, R BLEED on

6. All of the following are monitored by dual-sensing loops except:

a. Pack ducts
b. Bleed air ducts in engine pylons
c. Trim air ducts
d. Anti-ice ducts

7. A BLEED LOOP FAIL CAS message indicates:

a. The cross-bleed valve is not in the commanded position
b. One loop of a dual-loop zone is inoperative
c. The engine bleed-air valve has failed
d. Both loops of a dual-loop zone are inoperative

8. Channel B of the IASC monitors which of the following:

a. Air conditioning control and monitoring
b. Avionics cooling
c. Bleed leak detection monitoring and control
d. Cabin pressurization

CHAPTER 10
ICE AND RAIN PROTECTION

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CHAPTER 10
ICE AND RAIN PROTECTION

INTRODUCTION

The Challenger 300 has both ice detection and anti-icing as part of the ice and rain protection system. Bleed air heats the wing leading edges and engine intake cowls to prevent icing while electrical power heats the windshields, windows, and air data probes. Anti-icing of the tail surface is not required. Two ice detector probes indicate icing conditions.

ICE DETECTION SYSTEM

The Challenger 300 has two ice detectors supplied with 28 VDC: one on each side of the fuselage just above the nose landing gear doors (Figure 10-1). Each detector continuously monitors internal circuits and components for failure conditions.

Figure 10-1. Ice Detectors

ICE DETECTOR

The ice detector uses a vibrating probe to detect icing conditions. Because only one signal is needed to generate an EICAS message, the two detectors provide system redundancy.

Operation

The probes vibrate at high frequency. As the ice detector enters an icing environment, ice collects on the sensing probe. This ice accumulation decreases the frequency of the probe.

If the anti-ice systems are off when ice is detected, the amber ice icon is displayed on the PFD along with an amber ICE DETECTED message.

If the anti-ice systems are on when ice is detected, the cyan advisory ICE DETECTED message is displayed.

During flight, internal thermal heaters deice the ice detector strut and probe (Figure 10-2). Once the ice is shed, the probe returns to the frequency vibration of a nonicing environment. The detection system then reassesses if ice is accumulating.

When the ice is removed, the heaters are deenergized. As ice builds again on the probe, the heaters are reenergized, and the process is repeated.

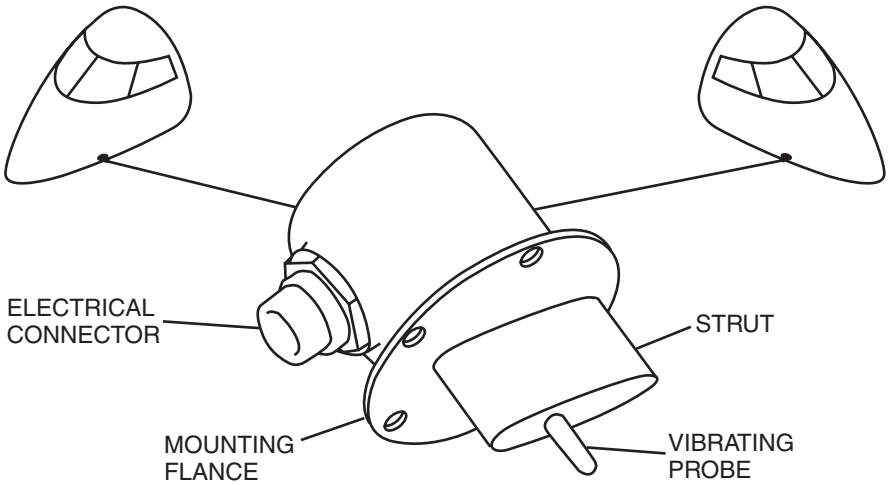

Figure 10-2. Ice Detector Components

Detector Failure

When one of the detectors fails, an advisory ICE DETECTOR FAULT displays on EICAS.

When both detectors fail, an amber ICE DETECTOR FAIL caution message displays.

TESTING

Each ice detector conducts a self-check during power-up as well as continuous built-in testing. Additionally, the pilot can initiate a test by selecting ICE DET on the SYSTEMS TEST panel.

During the test sequence, an internal check of the electronics, probe heater, and CAS messages are conducted

WING ANTI-ICE SYSTEM

The wing anti-icing system heats the leading edge of the wing with high-pressure bleed air from the engines (Figure 10-3). The left and right wings are normally heated with bleed air from their respective engine. It is possible, however, to provide bleed air from either engine to both wings.

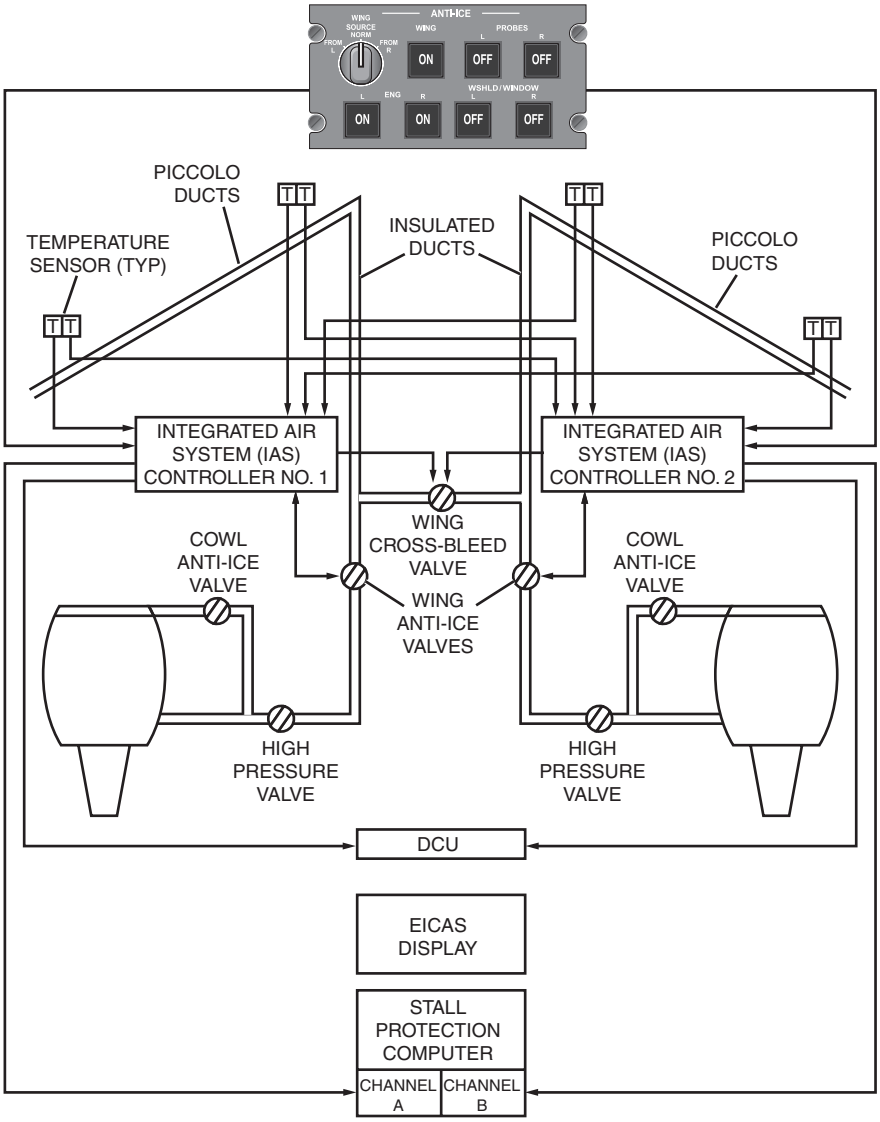

Figure 10-3. Wing Anti-Ice System Schematic

The two dual-channel integrated air system controllers (IASC) control the operation of the wing anti-ice and leak detection system. Each IASC receives data from dual temperature sensors in the inboard and outboard section of each leading edge. The IASC then independently controls the amount of bleed air to ensure the leading edges are maintained in the correct temperature range.

The ANTI-ICE synoptic display presents an overview of status of the pneumatically operated anti-icing system (Figure 10-4).

The anti-ice ducting is continuously monitored for bleed-air leakage.

The ANTI-ICE control panel contains two switches for the wing anti-icing system (Figure 10-5): the WING pushbutton operates the system and the WING SOURCE rotary knob allows the pilot to choose the source of bleed air.

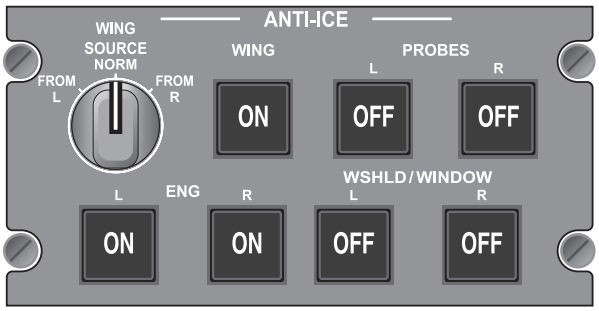

Figure 10-5. ANTI-ICE Control Panel

COMPONENTS AND NORMAL OPERATION

Wing Anti-Icing Valves

The left and right wing anti-icing valves are on the bleed-air manifold in the aft equipment bay.

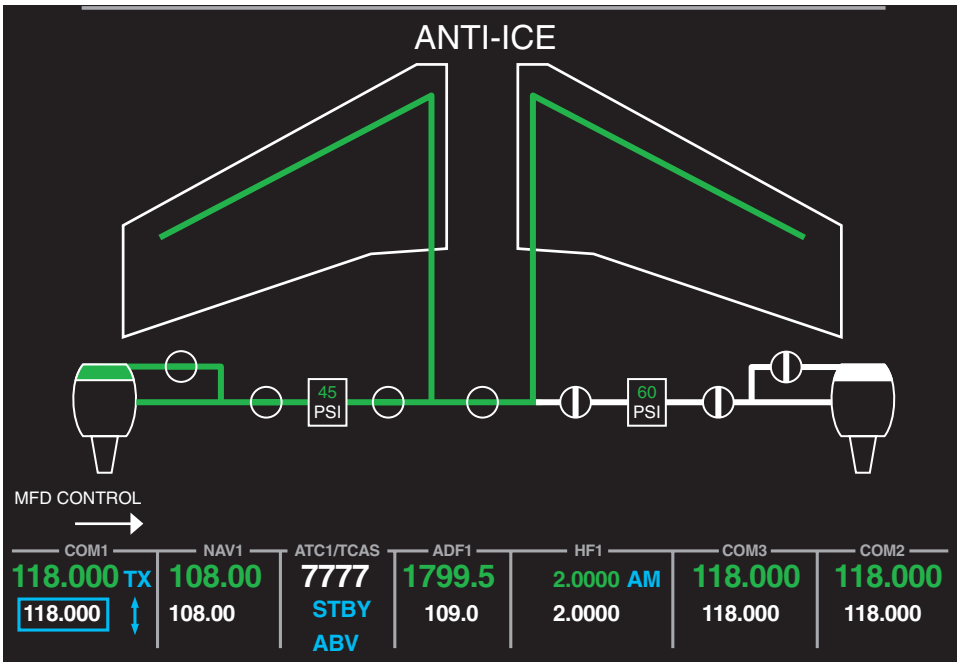

Figure 10-4. ANTI-ICE Synoptic Page

When the WING switch is selected to ON, the wing anti-icing valves modulate as a function of the wing temperature. The valves, which are spring-loaded to the closed position, close when any of the following occurs:

- Removal of bleed-air supply pressure
- Loss of electrical power at the valve
- Failure of an anti-ice duct
- Operation in either FROM L or FROM R mode

The high-pressure valves limit high-stage engine bleed pressure to 36 ±3 psi. If a valve fails and pressure exceeds 46 psi, a caution CAS message is displayed.

Wing Anti-Ice Ducts

Anti-icing ducts in the aft equipment bay and center fuselage provide bleed-air to the wing anti-icing ducts. The hot air enters the wing via the piccolo tube in the leading edges. The piccolo ducts uniformly spray the hot bleed air onto the inner surfaces of the leading edges. The bleed-air then dissipates to the atmosphere through vent holes on the bottom side of the wing surface.

In the wing leading edges, dual sensing loops and dual temperature sensors detect the failure of a wing anti-ice duct (piccolo tube) or duct connector. The detectors can discriminate between an overheat condition caused by a leaking duct and the normal temperatures associated with wing anti-icing.

Wing Temperature Sensors

Dual temperature sensors provide feedback temperature data to the IASCs. Two dual-temperature sensors are in the outboard section of each wing and two are in the inboard section. Channel B of each IASC receives data from one sensor at each of the four wing positions.

Each outboard sensor monitors the leading edge of its associated wing for insufficient temperature. A L/R WING ANTI-ICE FAIL caution message illuminates if there is insufficient heat.

The inboard sensor supplies the temperature data that modulates the wing anti-icing valves. The sensor also monitors the wing for overheat and displays L/R WING OVHT warning CAS message if the conditions exists.

ABNORMAL OPERATION

Wing Cross-Bleed Valve

A cross-bleed duct that bridges the two anti-ice lines contains the wing cross-bleed valve. When the valve is open, one engine can supply bleed air to the wings. Normally, the cross-bleed valve is closed.

If an engine failure occurs, the valve automatically opens. The wing cross-bleed valve is pneumatically actuated and electrically controlled. The WING SOURCE rotary knob controls the cross-bleed valve.

When FROM L is selected, the right wing anti-ice and high-pressure valves close while the cross-bleed valve opens. Bleed air from the left engine flows to anti-ice both wings.

When FROM R is selected, the left wing anti-ice and high-pressure valves close while cross-bleed valve opens. Bleed air from the right engine flows to anti-ice both wings.

Wing Overheat

When the anti-icing system overheats, a red L/R WING OVERHEAT warning CAS message illuminates. The overheated leading edge is identified in red on the ANTI-ICE synoptic page.

The pilot shuts off the wing anti-ice system. After selecting FROM L or FROM R, the pilot then turns the wing anti-ice system back on. The sensor on the same side as the bleed source then modulates bleed flow. This procedure can be used to isolate a malfunctioning wing anti-ice valve or wing temperature sensor.

Bleed Leak Detection System

When a bleed air leak is detected downstream of the HPV, a WING ANTI-ICE LEAK warning CAS message is illuminated. The IASC automatically closes both wing anti-ice valves to isolate the failure and stop the leakage. If the leak stops after the automatic shutdown, the warning message is replaced with an amber L/R WING ANTI-ICE FAIL caution message. The pilot then completes the shutdown of the wing anti-ice system.

ENGINE ANTI-ICE

Engine bleed air provides ice protection for each of the nacelle inlets. The L/R ENG switches on the ANTI-ICE panel control the anti-icing system (see Figure 10-5).

OPERATION

Nacelle anti-icing valves on top of each engine are upstream of the high pressure valves.

When the L/R ENG switch is in the ON position, the valves open and direct hot bleed-air to a piccolo tube (Figure 10-6). The piccolo tube then sprays the hot bleed air onto the inner surface of the nacelle leading edge. The air is discharged overboard through an exhaust duct at the bottom of the nacelle inlet.

T2 Sensor

A T2 sensor in the inlet housing of each engine senses the engine inlet total-air temperature and supplies it to both electronic control units (ECU).

The in-control ECU uses the inlet total-air temperature for power control. The sensor contains two resistance temperature devices and an electric heat device for anti-ice.

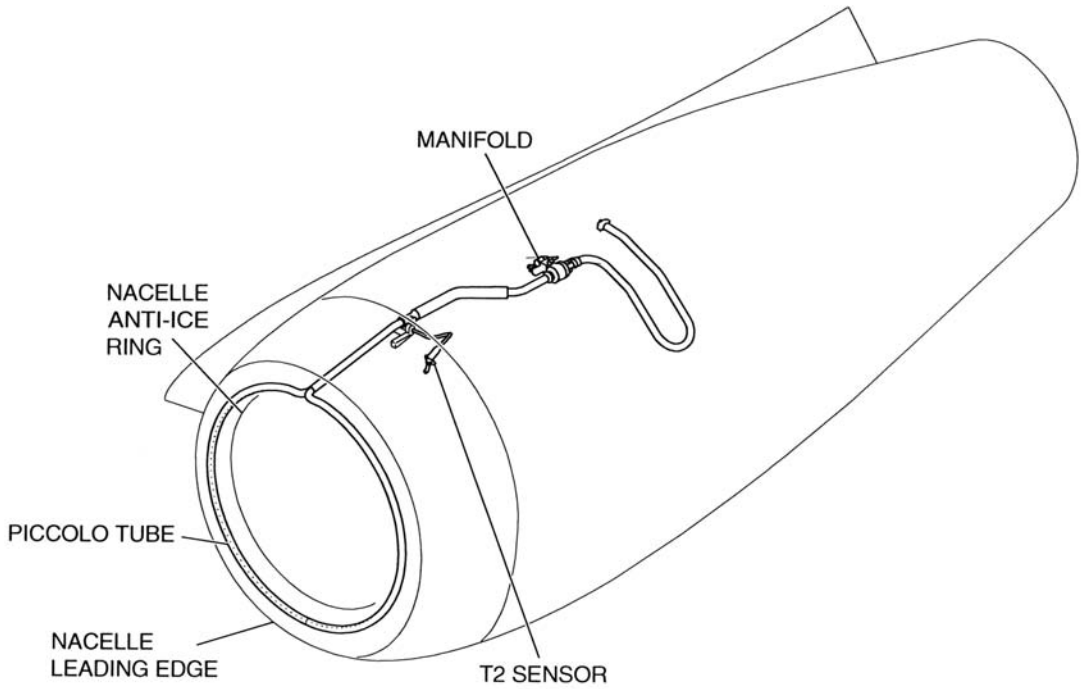

Figure 10-6. Engine Nacelle Anti-Icing Operation

Engine Spinner

The engine spinner is a two-piece, aluminum forging with a conical shape (Figure 10-7). The spinner's shape provides a surface that sheds ice during icing conditions. The spinner does not need anti-icing heat.

AIR DATA AND SENSORS

The air data probes and sensors are on either side of the aircraft nose (Figure 10-8). The two pitot static masts, one on either side of the nose, consist of a head and mounting base. The mast has two heaters, one in the head and the other in the base.

The remaining probe and sensors include:

- Standby pitot probe—Left side
- Standby flush static ports—One on each side of the aircraft
- Angle-of-attack (AOA) vanes—Under side windows behind pitot tubes
- One total air temperature (TAT) sensor—Right side

The probes and sensors are electrically heated to prevent ice formation. Separate air data sensor heat controllers control and monitor the probe heaters.

When the L/R PROBES switches on the ANTI-ICE panel are on, the probes and sensors are heated.

Failure of a probe heater signals the data concentrator unit to display the appropriate EICAS message.

Figure 10-8. Air Data Probes

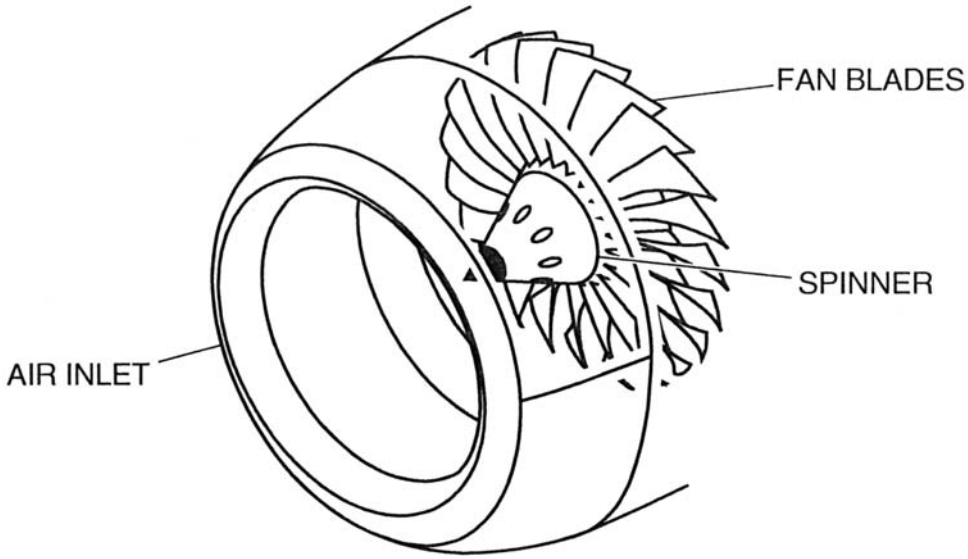

Figure 10-7. Engine Spinner

WINDSHIELD

The windshield and cockpit windows are treated with a rain-resistant coating. The two windshields (Figure 10-9) and two side windows (Figure 10-10) contain embedded heater and sensor elements.

The windshield heater elements are segmented into three sections to allow for concentration of heating in a smaller area. This allows visibility in severe icing conditions. The side window heater elements have no segmentation.

Figure 10-9. Windshields

Figure 10-10. Side Windows

OPERATION

Temperature controllers, one for each windshield and window, monitor the electrical resistance of the temperature sensors embedded in the glass. The controllers cycle power on and off to maintain a predetermined glass surface temperature (Figure 10-11).

The WSHLD/WINDOW switch on the ANTI-ICE panel controls the left windshield and left window (L) and right windshield and right window (R).

Overheat protection circuits for each windshield or window remove power from the affected surface during an overheat condition. Selecting the L/R WSHLD/WINDOW off de-energizes the applicable windshield and window and resets the temperature controller.

Flight in super-cooled large droplet (SLD) icing conditions may be indicated by ice accretion on side windows.

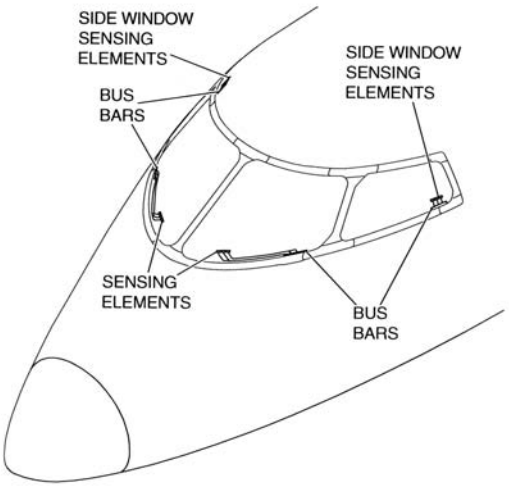

Figure 10-11. Windshield Temperature Controllers

EICAS MESSAGES

Table 10-1 lists the EICAS messages associated with the ice and rain protection system, a brief explanation of the message, and whether the message is inhibited during takeoff and/or landing.

Table 10-1 EICAS MESSAGES

MESSAGE	INHIBITS	MEANING	AURAL WARNING
WING ANTI-ICE LEAK		A leak has been detected along the wing anti-ice ducting.	
L (R) WING OVERHEAT		A wing anti-ice overheat condition exists in the indicated wing.	
L (R) ENG ANTI-ICE FAIL	TO	Bleed air pressure to the respective nacelle is too low for effective anti-icing, or the electrically heated T2 heater has failed when the respective L or R ENG switch is on.	
ICE DETECTED	TO/LAND	Ice has been detected, and both the engine and wing anti-ice systems are not selected on.	
ICE DETECTOR FAIL	TO/LAND	Both ice detectors have failed.	
L (R) PITOT HEAT FAIL	TO/LAND	The respective pitot mast or base heater has failed.	
L (R) PITOT HEAT OFF	TO/LAND	Probe heat is off.	
STBY PITOT HEAT FAIL	TO/LAND	The standby pitot heater has failed.	
STBY STAT HEAT FAIL	TO/LAND	The respective standby static heater has failed.	
L (R) WING ANTI-ICE FAIL	TO/LAND	The respective anti-ice system has failed.	
WINDOW HEAT FAIL	TO/LAND	The respective window heat has failed, and the temperature is too low or too high. A failure may also be indicated by the formation of condensation (fog) on the window.	
WING ANTI-ICE FAULT	TO/LAND	Both outboard wing leading-edge sensors have failed.	
WING A/ICE LOOP FAIL	TO/LAND	Both detection loops failed. This is only checked during power up self-test.	
L (R) WING A/I PRESS HI	TO/LAND	High pressure has been sensed in the wing anti-ice system.	
L (R) WSHLD HEAT FAIL	TO/LAND	The respective window heat has failed, and the temperature is too low or too high. A failure may also be indicated by the formation of ice or condensation (fog) on the windshield.	

Table 10-1 EICAS MESSAGES (Cont)

MESSAGE	INHIBITS	MEANING	AURAL WARNING
L (R) AOA CASE HEAT FAIL	TO/LAND	The respective angle-of-attack case heater as failed.	
L (R) ENG A/ICE FAIL ON	TO/LAND	The respective engine nacelle anti-ice has failed ON. If the T2 probe heater has failed on, an amber T2 icon will be displayed on the anti-ice synoptic. If engine anti-ice bleed air has failed on, a green flow line will be displayed downstream of the failed anti-ice valve on the synoptic.	
ICE DETECTED	TO/LAND	Ice has been detected, and the engine and wing anti-ice systems are selected on.	
ICE DETECTOR FAULT	TO/LAND	One ice detector has failed; the other should continue to operate normally.	
L (R) PROBE HT CTRL FAIL	TO/LAND	The respective probe heat controller has failed. The probe heat will fail ON.	
TAT HEAT FAIL	TO/LAND	The total air temperature probe heater has failed.	
WING SOURCE XBLEED		Wing xbleed valve open.	
WING ANTI-ICE FAULT	TO/LAND	One channel has failed on the outboard wing leading-edge sensor. The wing anti-ice should work normally.	
L (R) ENGINE ANTI-ICE ON		The respective (or both) ENG ANTI-ICE switch (es) is/are ON.	
ENGINE ANTI-ICE ON		The respective (or both) ENG ANTI-ICE switch (es) is/are ON.	
PROBE HEAT TEST OK		The pilot-initiated probe heat test has passed.	
WING ANTI-ICE ON		The WING ANTI-ICE switch is selected ON.	
WING/ENG ANTI-ICE ON		The wing and both engine anti-ice systems are ON.	
WING SOURCE XBLEED		Either FROM L or FROM R has been selected on the ANTI-ICE WING SOURCE switch.	

QUESTIONS

1. The Challenger 300 has how many ice detectors?

a. 1
b. 2
c. 3
d. 4

2. What EICAS message will be displayed when the anti-ice systems are ON and ice is detected?

a. WING SOURCE XBLEED status (white) CAS message
b. L(R) WING ANTI-ICE FAIL caution (amber) CAS message
c. ICE DETECTED caution (amber) CAS message
d. ICE DETECTED advisory (cyan) CAS message

3. What EICAS message will be displayed when the anti-ice systems are OFF and ice is detected?

a. ICE DETECTED caution (amber)
b. ICE DETECTOR FAULT
c. ICE DETECTED advisory (cyan)
d. L(R) WING ANTI-ICE FAIL caution (amber) CAS message

4. Which of the following is not tested during the ICE DET systems check?

a. Ice detector probe heater
b. EICAS messages
c. Ice detection electronics
d. Wing anti-ice valves

5. The wing anti-ice valves are:

a. Electrically actuated
b. Spring-loaded to the closed position
c. Controlled and monitored by the FADEC
d. Fail-safe open when power to the valve is lost

6. The wing cross-bleed valve:

a. Is normally open
b. Is normally closed
c. Is controlled by the wing pushbutton actuator
d. Automatically opens when L(R) WING-ANTI ICE FAIL CAS illuminates

CHAPTER 11
AIR CONDITIONING

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CHAPTER 11
AIR CONDITIONING

INTRODUCTION

This chapter describes the Challenger 300 environmental control system (ECS) that provides regulated conditioned air to the cockpit and passenger cabin for air conditioning and pressurization. The system takes hot pressurized bleed air and cools it to create a controlled atmosphere. In addition, descriptions of the ventilation system for avionics and cockpit displays and the electrical cockpit floor heaters are also included in this chapter.

GENERAL

The engines, APU, and ground power unit furnish bleed air through the pneumatic system (see Chapter 9—Pneumatic System) for the air conditioning system to control the temperature within the aircraft. The pressurized air is cooled to just above freezing and then mixed with hot trim air to provide conditioned air at the desired temperature.

COMPONENTS

The system consists of the following:

- Bleed air valves (part of the pneumatic system)
- Precooler
- Flow control valves
- Ram air and regulating valve

- Air conditioning PACK (includes the air cycle machine)
- Trim air system and valves
- Integrated air system controllers
- Control panels

BLEED-AIR VALVES

The engines provide bleed air at all altitudes. The APU provides bleed air in flight up to 20,000 feet. Intermediate-pressure (IP) air is routed through IP valves to the common manifold where the bleed air is then controlled by the environmental control system (ECS).

The IP ports of the engine, APU, or external ground supply cart can supply the common bleed-air manifold. Because of the low pressure from the engines at ground idle, however, the APU is recommended for air conditioning during ground operations.

PRECOOLER

A precooler in the aft equipment compartment decreases the temperature of hot bleed air from the engines.

The hot bleed air is cooled by convection with the exhaust ram air that comes from the PACK. The precooler limits the PACK inlet and trim inlet air temperature to 220°C (430°F).

FLOW CONTROL VALVES

Flow control valves (FCVs) control the airflow through the PACK and trim air system. The valves are electrically controlled, pneumatically operated modulating shutoff valves.

The AIR SOURCE selector on the AIR COND/BLEED panel operates the opening and closing of these valves.

When the engine START switch is selected, the FCVs are automatically closed to shut down the air conditioning system. This ensures that the air turbine starters (ATS) receive sufficient airflow for starter operation. When the start valve closes, the air source returns to the previous selection.

RAM AIR

Ram air enters the aircraft at the ram air inlet at the base of the vertical fin (Figure 11-1). Ram air is the cooling medium for the air-to-air heat exchangers. Ram air passes through the precooler, primary, and secondary heat exchangers to extract heat from the air circulated through the air conditioning system.

The ram air system supplies the ram air upstream of the dual exchanger. The air then flows through the dual heat exchanger. The plenum collects the air flow. From the plenum, the air is ducted toward the dual pre-cooler heat exchanger and then ducted overboard.

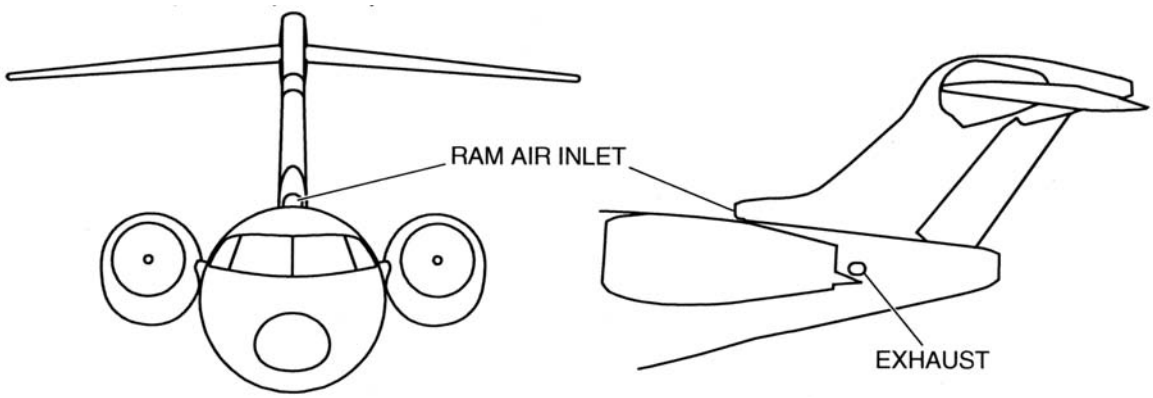

Figure 11-1. Ram Air Inlet

Ram Air Valve

If both the pack and trim air fail, ram air can ventilate the cockpit and cabin at low altitude. Below 10,000 ft, the guarded RAM AIR switch may be selected to ON to open the ram air valve.

AIR CONDITIONING PACK

The air conditioning PACK receives bleed air from the precooler and decreases the temperature and water content to provide conditioned air throughout the aircraft.

TRIM AIR SYSTEM

The trim air system provides auxiliary temperature control and pressurization if the air conditioning PACK fails. The system provides hot trim air.

The subsystem is composed of trim air ducting, two hot air regulating shutoff valves, two hot air check valves, and three trim air injectors. Most of the components are in the aft equipment bay.

The hot air check valves isolate the pressurized area from the unpressurized rear bay to prevent cabin depressurization in case of a trim air supply duct failure. The hot air check valves are just downstream from the trim air bulkhead.

INTEGRATED AIR SYSTEM CONTROLLERS

Two integrated air system controllers (IASCs) ensure overall air conditioning system control and monitoring. One unit is under the floor and the other is under the liner of the lavatory above the floor.

The units also control bleed air functions for the pneumatic system, monitor cabin pressure for the pressurization system, and control and monitor ice protection functions.

Each IASC consists of two channels that monitor the following system operations:

- Channel A for the air conditioning control and monitoring, avionics cooling, and cabin pressurization
- Channel B for wing anti-icing monitoring and control, bleed leak detection monitoring, and limited backup control for the air conditioning system.

IASC 1 channel B also has a backup cabin pressure sensor.

CONTROLS AND INDICATIONS

The AIR COND/BLEED panel contains the following controls (Figure 11-2):

- CABIN and COCKPIT temperature rotary selectors with a range from full COLD to full HOT
- MAN TEMP switch for manual control when an automatic temperature sensor is not working
- RAM AIR switch to open the ram air regulating valve
- AIR SOURCE knob to select the source of bleed air
- L BLEED, XBLEED, R BLEED, and APU switches to control the pneumatic system (see Chapter 9—Pneumatic System)

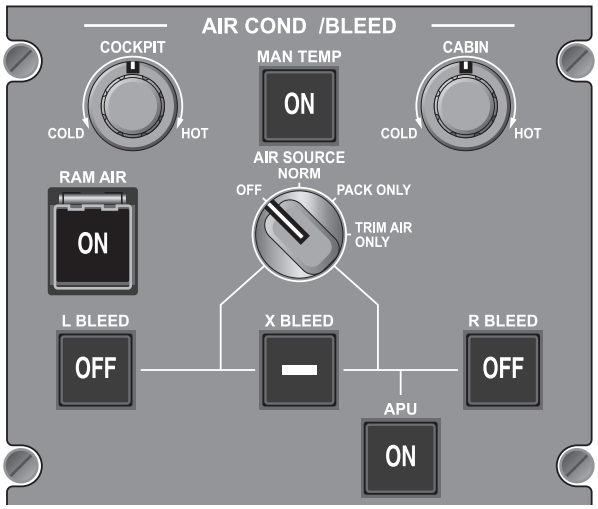

Figure 11-2. AIR COND/BLEED Control Panel

AIR SOURCE Selector

The AIR SOURCE selector switch has the following positions:

- OFF—Both FCVs close to prevent bleed air from entering the cabin
- NORM—Bleed air from left and right side of the manifold flow through the PACK and TRIM AIR valves
- PACK ONLY—Left FCV opens and right FCV and precooler crossover valve (PCV) close so that all bleed air flows through the PACK
- TRIM AIR ONLY—Opens the right FCV and closes the left FCV and PCV so that all bleed air flows through the trim air valves

When a trim air system failure exists, the PACK ONLY position is selected. A white PACK ONLY status message displays on EICAS.

When a PACK failure exists, the TRIM AIR ONLY position is selected. A white TRIM AIR ONLY status message is displayed on EICAS.

Synoptic Displays

The EICAS synoptic display for environmental control system (ECS) presents a block schematic of the system (Figure 11-3).

OPERATION

Figure 11-4 illustrates the bleed-air flow from the engines, APU, or ground air cart through the air conditioning system. The position of the AIR SOURCE selector determines the hot bleed air flow through the FCVs. The valves control the airflow into the precooler in the aft equipment compartment. In the precooler, the temperature of the airflow is decreased by convection with the exhaust ram air from the PACK.

The precooler has two outlets: PACK outlet and trim air outlet.

From the trim air outlet, the trim air system ducts air through trim air injectors toward two lines. Two injectors feed the cabin low pressure distribution line and one injector feeds the cockpit low pressure distribution line.

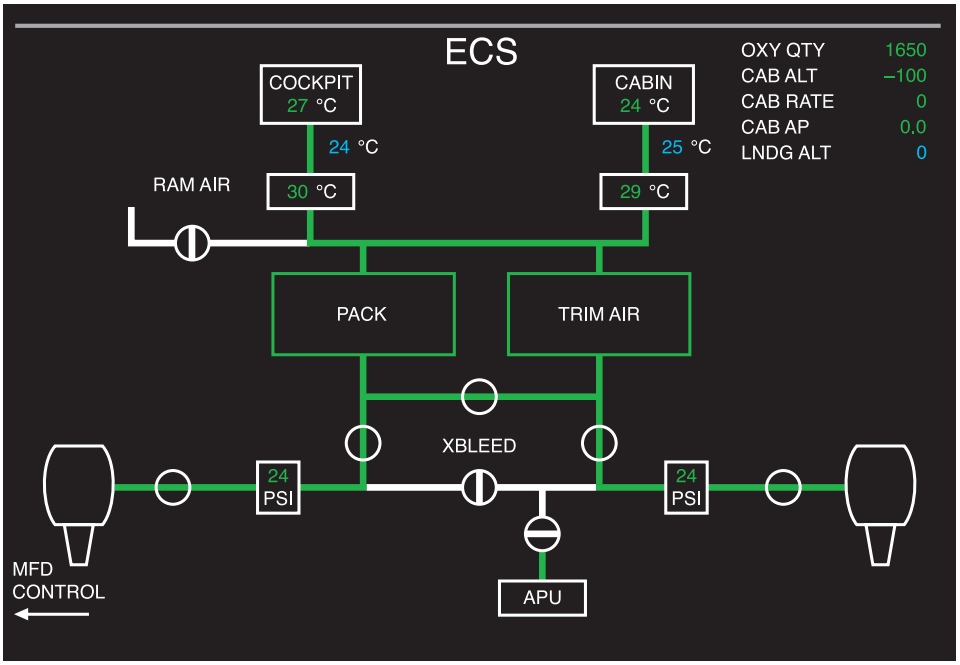

Figure 11-3. ECS Synoptic Page

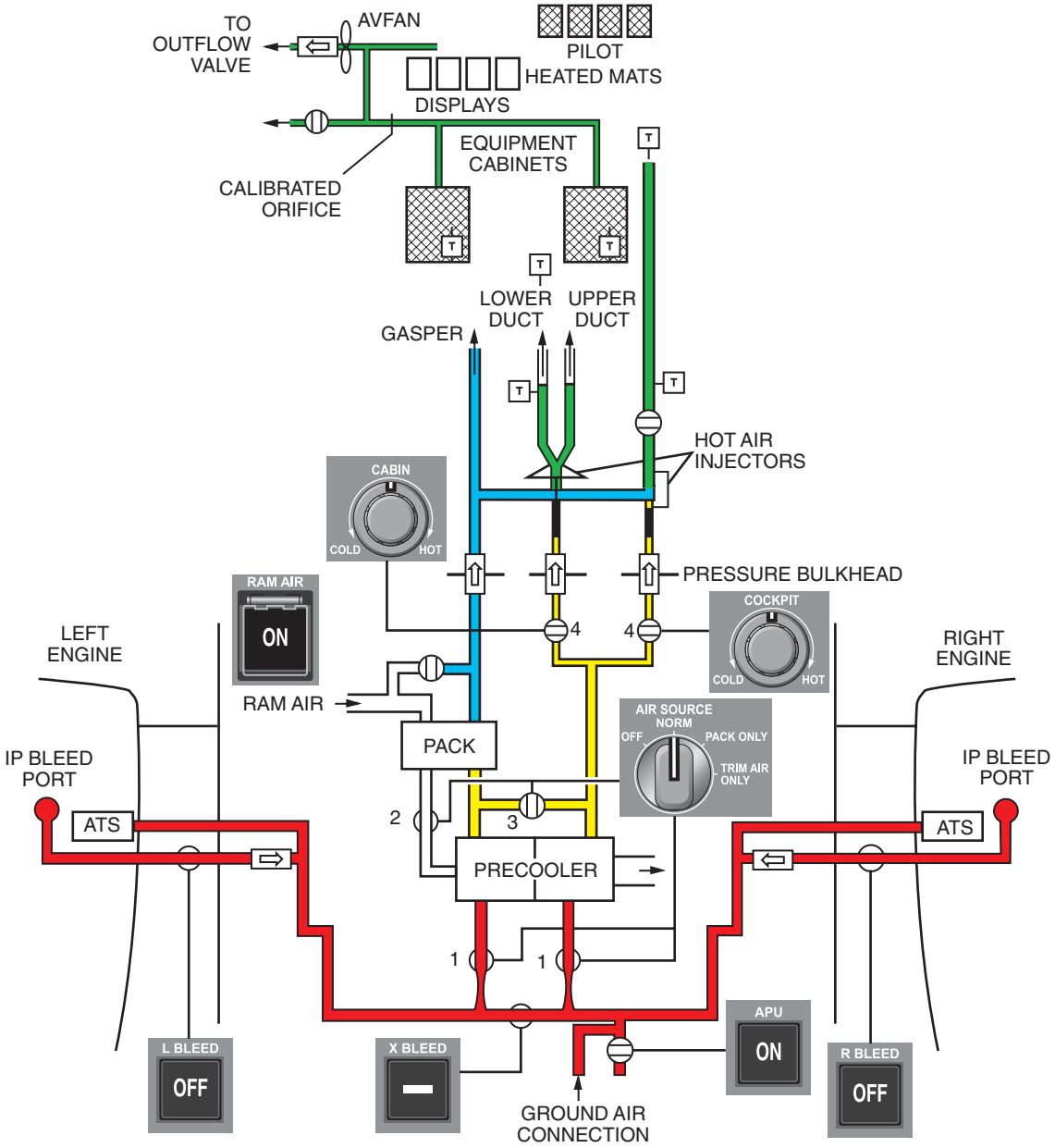

Figure 11-4. Cockpit/Cabin Air Distribution Schematic

Each of the distribution lines has one hot air shutoff valve to modulate the hot air flow to adjust its temperature. The valves are fitted on the trim air ducts in the unpressurized aft equipment bay.

At the PACK outlet, precooled bleed air enters the PACK at the primary exchanger inlet where bleed air temperature is reduced (Figure 11-5). From the primary heat exchanger, the bleed air then flows into the compressor of the air cycle machine where temperature and pressure increases.

A pressure loss occurs as the air flows into and through a secondary heat exchanger. The temperature is also reduced with ram air.

The air then flows to the reheater/condenser. At the condenser outlet, a water extractor uses centrifugal effect to extract water from the air before it is routed to the reheater cold air pass where the air's temperature increases prior to re-entering the air cycle machine.

The turbine of the air cycle machine expands the air to a pressure close to normal cabin air pressure. Air temperature is also subsequently reduced.

From the turbine outlet, the air flows through the condenser heat exchanger where it is used as coolant for the water separation loop.

The conditioned air then enters the distribution system.

ADJUSTING TEMPERATURE

The CABIN and COCKPIT switches adjust the temperature of the conditioned air.

A temperature control valve modulates the hot air flow that bypasses the air cycle machine between the primary heat exchanger inlet and air cycle machine outlet. This modulation adjusts the air temperature at the PACK discharge.

Automatic and manual modes differ mainly in their range of temperature. The automatic mode has a range of 15 to 35°C (59 to 95°F) because its sensors are located in the passenger cabin and cockpit. The manual mode has a wider range of 3 to 70°C (37.4 to 158°F) because its sensors are located in the ducts just downstream of the hot air injectors.

GROUND OPERATION

On the ground, airflow through the ram air inlet is inadequate for cooling the heat exchangers. A fan in the ram air duct, which is mechanically driven by the air cycle machine, increases airflow through the duct to cool the heat exchangers.

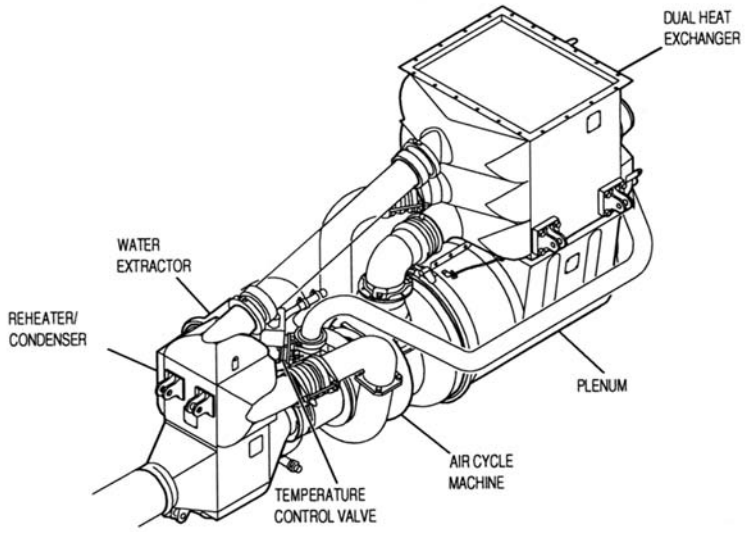

Figure 11-5. Air Conditioning Pack

On ground static operation, a suction effect of the air cycle machine fan generates ram air flow. This suction closes the plenum check valve. Whenever dynamic air is available at the ram air inlet, the plenum check valve opens to bypass the air cycle machine fan. Ram air is then driven by the total pressure available at ram air inlet.

DISTRIBUTION

The air distribution and exhaust system (Figure 11-6) distributes conditioned air to the cockpit, cabin, and lavatory areas. The system consists of low pressure ducting below and above the aircraft floor.

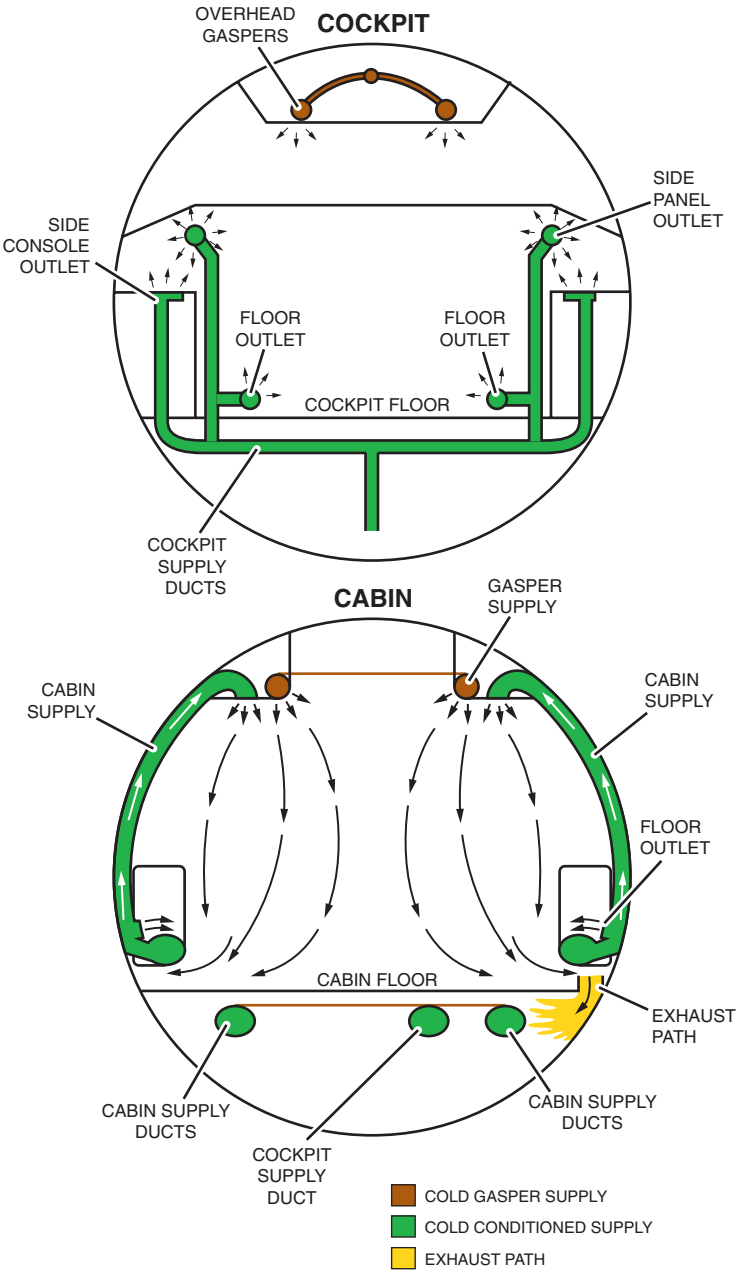

Figure 11-6. Air Distribution and Exhaust System

COCKPIT

A duct connected to the bulkhead check valve manifold distributes cockpit air. The duct runs under the aircraft floor from the aft pressure bulkhead area to the cockpit. The temperature-controlled air is then distributed by outlets at foot and leg level and through a grill outlet on each side console.

Overhead gaspers distribute cold air only (Figure 11-7).

Figure 11-7. Cockpit Overhead Gaspers

CABIN

Two main lines connected to the bulkhead check valve manifold distribute cabin air at foot and head level (Figure 11-8). Air distribution from the overhead gaspers is cold air only (Figure 11-9). Air at floor level is temperature controlled.

The upper feed line runs upward between the aircraft skin and liner of the cargo compartment. It is integral to the interior furniture at head level on either side.

Figure 11-9. Cabin Overhead Gaspers

LAVATORY

A gasper supplies fresh air to the lavatory compartment. To avoid unpleasant odors in the passenger cabin, more air from the lavatory is exhausted underfloor than what is supplied by the air conditioned air system. A vent in the lavatory wall equalizes pressure.

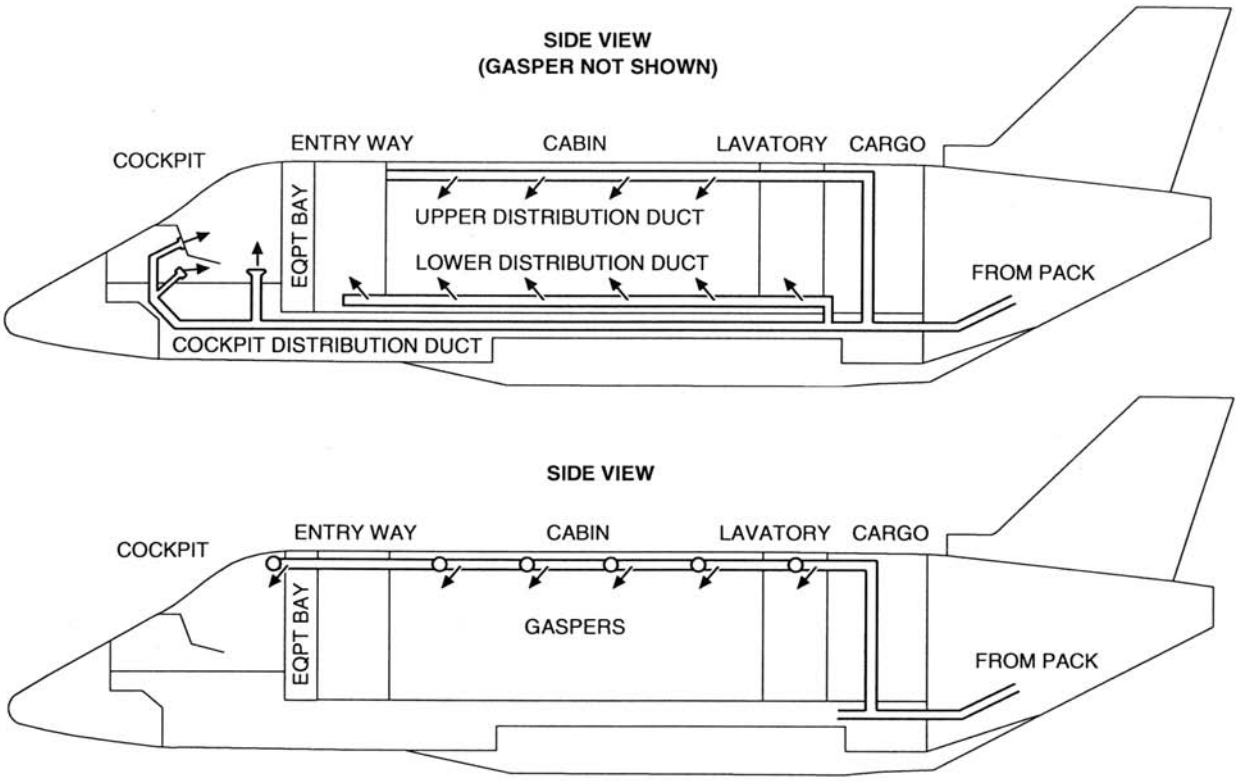

Figure 11-8. Cabin Distribution System

AIR EXHAUST AND VENTILATION SYSTEM

Fresh air to the cabin and cockpit is dumped overboard through the cabin pressure control system (see Chapter 12—Pressurization).

Holes in the floor sill allow cabin exhaust airflow to the underfloor area and outflow valve. Some of the cabin air exhaust is also directed under the floor to ventilate and heat the battery compartment. The exhaust is then directly dumped overboard through the avionics valve.

Holes in the cockpit floor and center pedestal allow cabin exhaust to flow to the underfloor area and outflow valve. Air circulation is also provided at the back of the cockpit displays through specially designed grilles.

AVIONICS VENTILATION SYSTEM

An additional cooling system provides a continuous flow of cooling air to the avionics racks and cockpit displays.

The system consists of a fan under the cockpit floor and the avionics cooling valve (Figure 11-10). Either can pull air from the cockpit panel area behind the displays or from above the avionics rack.

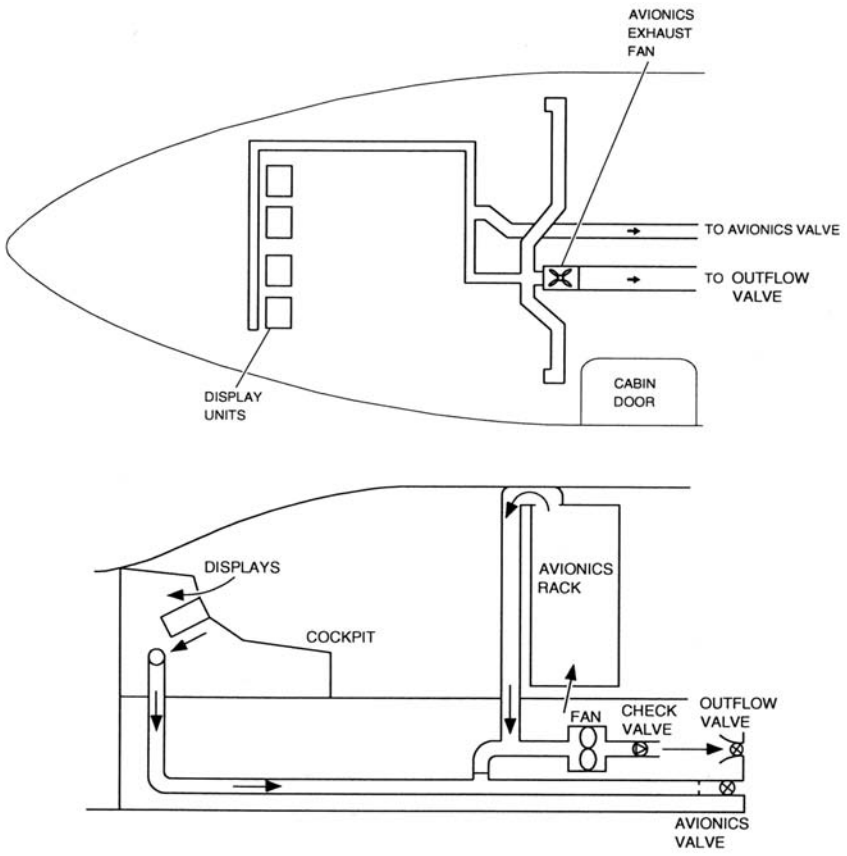

Figure 11-10. Avionics and Cockpit Displays Ventilation System

OPERATION

The IASC 1 normally controls and monitors the ventilation system. If a failure in IASC 1 occurs, IASC 2 activates and controls the system in a degraded mode. The avionics fan is turned on. If the fan has failed, the avionics valve opens.

During normal ground operation, the fan operates in high speed mode.

During flight, the fan normally operates at low speed. If the temperature in the avionics racks reaches 50°C (122°F) in 60 seconds, the fan then operates at high speed. If the temperature rises above 65°C (149°F) during a 60-second time period while the aircraft is above 10,000 ft, the fan is turned off. The IASC opens the avionics cooling valve.

If the fan or valve fails, an EQPT RACK COOL FAULT advisory CAS message is displayed. If an overheat condition occurs in the avionics rack, an EQPT RACK TEMP HIGH caution message is displayed.

COCKPIT FLOOR HEATERS

Four cockpit floor heaters are on the flight compartment floor: one on each side of the two control columns. A scuff plate covers each heater to prevent damage to the heat strips.

Because there are no pilot-operated controls, a temperature limiting circuit keeps the temperature between 20°C (68°F) and 35°C (95°F). An internal thermal switch prevents the floor heaters from an overheat condition.

The pilot floor heater is connected to the left equipment rack circuit breaker panel. The copilot floor heater is connected to the right equipment rack CB panel.

EICAS MESSAGES

Table 11-1 lists the EICAS messages associated with the air conditioning system, a brief explanation of the message, and whether the message is inhibited during takeoff and/or landing.

Table 11-1. EICAS MESSAGES

MESSAGE	INHIBITS	MEANING	AURAL WARNING
PACK LEAK	TO/LAND	A leak has been detected in the pack ducting.	
TRIM AIR LEAK	TO/LAND	A leak has been detected in the bleed-air ducting downstream of the right flow control valve, up to the precooler crossover, and up to the trim air check valve.	
AIR COND TEMP FAIL	TO/LAND	The automatic temperature control system has failed.	
AIR COND TEMP HIGH	TO/LAND	Excessive air temperature has been sensed in the cabin or cockpit air distribution duct.	
EQPT RACK TEMP HIGH	TO/LAND	The temperature in either equipment rack is high.	
PACK FAIL	TO/LAND	A failure has been detected in the PACK system.	
PACK LOOP FAIL	TO/LAND	Both bleed-air leak detection loops in the PACK have failed during the power-up self-test.	
PACK TEMP HIGH	TO/LAND	An overheat has been detected in the air conditioning PACK system.	
TRIM AIR FAIL	TO/LAND	A hot air regulating valve has failed.	
TRIM AIR LOOP FAIL	TO/LAND	The bleed-air leak detection loops around the trim air ducting have failed.	
AIR COND FAULT	TO/LAND	A fault has been detected in the air conditioning system, or there has been a loss of temperature sensing.	
EQUIP RACK COOL FAULT	TO/LAND	A fault has been detected in the avionics equipment rack cooling system.	
PACK COOL AIR FAIL	TO/LAND	The ram air regulating valve supplying cooling air to the PACK heat exchanger has failed.	
RAM AIR FAIL	TO/LAND	The RAM AIR ventilation valve has failed to move to the commanded position.	

Table 11-1. EICAS MESSAGES (Cont)

MESSAGE	INHIBITS	MEANING	AURAL WARNING
AIR COND MAN TEMP ON		The air conditioning temperature control is in manual mode.	
AIR SOURCE OFF	TO/LAND	The AIR SOURCE switch is in the OFF position resulting in no conditioned air entering the cabin.	
PACK ONLY	TO/LAND	The AIR SOURCE switch is in the PACK ONLY position resulting in all air conditioning bleed air being routed through the PACK.	
RAM AIR ON	TO/LAND	The RAM AIR switch has been selected ON providing ram air ventilation.	
TRIM AIR ONLY	TO/LAND	The AIR SOURCE switch is in the TRIM AIR ONLY position resulting in all air conditioning bleed air being routed through the trim air system. The air will be warm.	

QUESTIONS

1. Which source of bleed air is recommended for air conditioning during ground operations?

a. Right engine
b. External ground supply cart
c. Left engine
d. APU

2. The APU provides bleed air for air conditioning in flight up to:

a. 15,000 feet
b. 20,000 feet
c. 25,000 feet
d. 30,000 feet

3. When the START switch is selected, the flow control valves:

a. Modulate airflow through the PACK and trim air system
b. Automatically move to the full open position
c. Automatically close to shut down the air conditioning system
d. Are not affected

4. RAM AIR can be used to open the ram air valve to ventilate the cabin:

a. Below 10,000 feet
b. Below 15,000 feet
c. At any altitude
d. Only in an emergency descent

5. The primary source of air conditioning in the Challenger 300 is:

a. APU air
b. PACK air
c. TRIM air
d. RAM air

6. What is the function of the AIR SOURCE selector switch?

a. To modulate air flow to adjust its temperature
b. To control the position of the flow control valves
c. To select the source for wing anti-ice
d. To select the source for engine anti-ice

CHAPTER 12
PRESSURIZATION

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CHAPTER 12
PRESSURIZATION

INTRODUCTION

This chapter describes how the pressurization system controls the outflow of conditioned air to maintain a comfortable cabin pressure. The system has three independent modes of operation: two automatic and one manual.

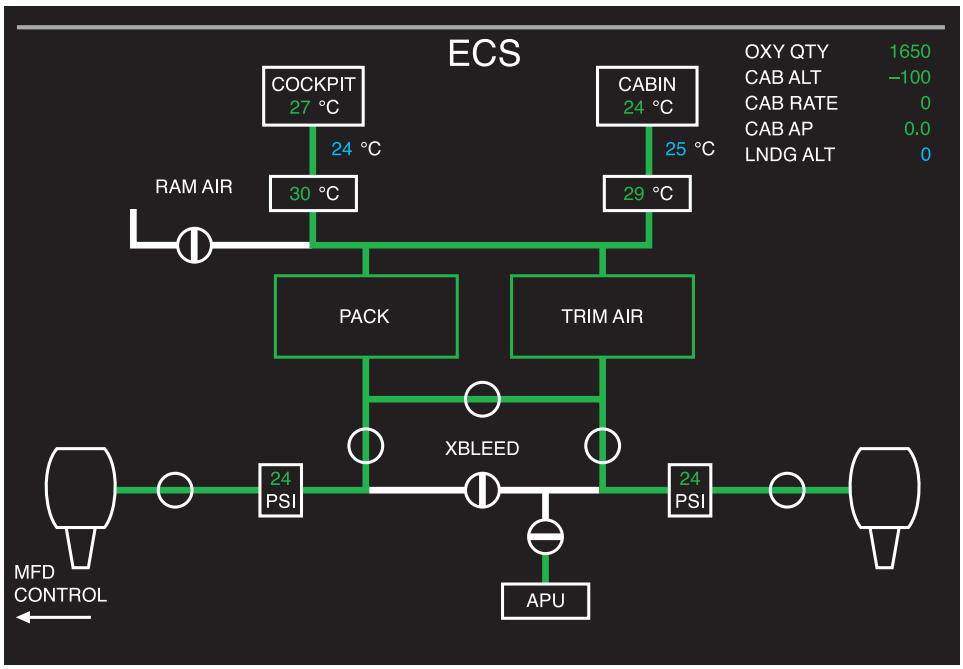
GENERAL

The system controls the leakage rate, or outflow, of cabin air through an outflow valve. Two automatic modes are available from two digital controllers. A manual mode is also available.

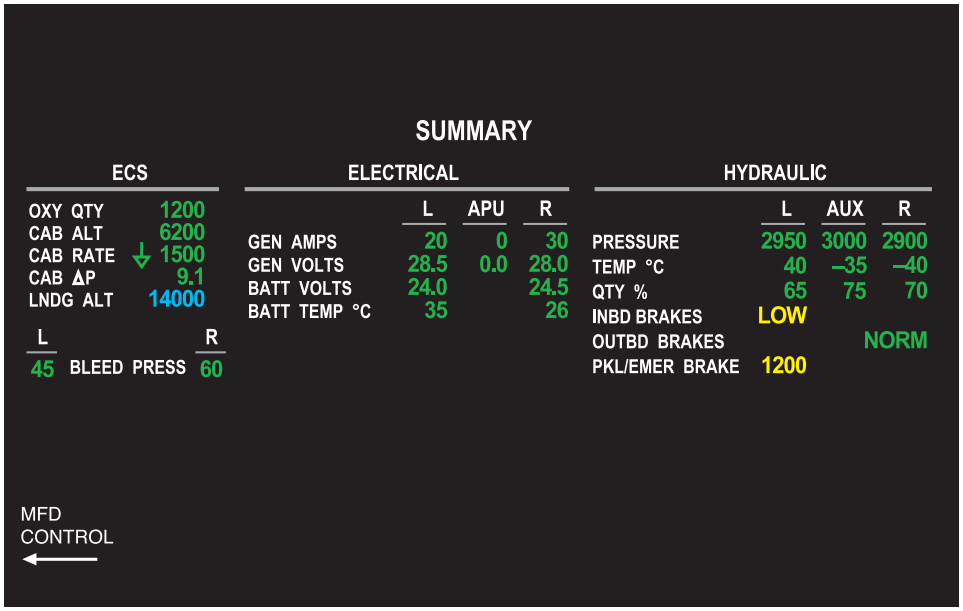
Two safety valves prevent cabin overpressure and negative pressure conditions. The safety valves operate independently of the automatic and manual pressurization modes to provide an additional level of protection.

Normal operation of the pressurization system is automatic when the destination airport is programmed into the FMS and the FMS sends the correct landing altitude to the controller.

Pressurization system indications are displayed on the ECS and SUMMARY synoptic displays (Figure 12-1). CAB ALT and CAB RATE are displayed on the pilot MFD (Figure 12-2).



ECS SYNOPTIC PAGE



SUMMARY SYNOPTIC PAGE

Figure 12-1. Synoptic Displays

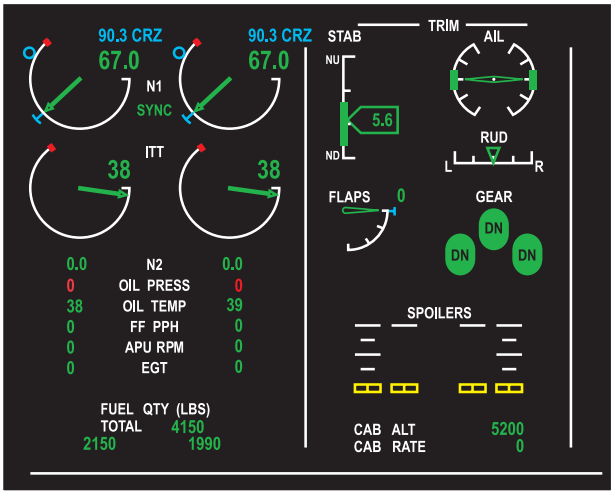


Figure 12-2. CAB ALT and CAB RATE

COMPONENTS

Components of the system include the following:

- Integrated air system controllers
- Outflow valve
- Safety valve
- Control panel

INTEGRATED AIR SYSTEM CONTROLLERS (IASC)

Two integrated air system controllers (IASCs) control all automatic phases of pressurization. The IASCs also control the pneumatic, air conditioning, and ice and rain protection systems.

In the automatic mode, each IASC can drive the outflow valve through the AUTO drive mechanism of its actuator. In the manual mode, the IASC 1 analog circuitry drives the outflow valve through the manual drive mechanism of its actuator.

One controller is active and the other is in standby. If the operating controller fails, the standby controller automatically takes the active role.

Unless a failure is detected in IASC 1, it becomes the active controller after power-up tests are complete.

OUTFLOW VALVE

The electrical outflow valve below the passenger compartment floor consists of a composite flow body, butterfly plate, and electrical double actuator (Figure 12-3). The actuator has two motors: one for manual and one for automatic operation.

Access to the outflow valve is through a panel in front of the wing.

The MAN RATE switch on the PRESSURIZATION panel electrically controls the outflow valve in manual mode. The pilot can manually control the rate at which the cabin altitude climbs (UP) or descends (DN). To hold a particular cabin altitude, the pilot commands a zero cabin rate of climb.

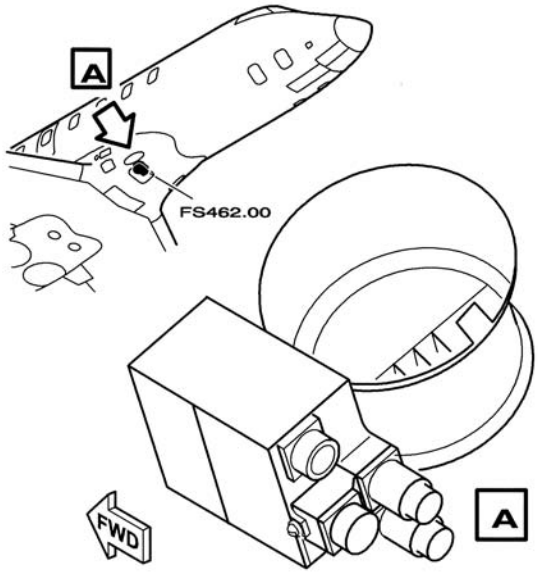


Figure 12-3. Electrical Outflow Valve

SAFETY VALVE

Two safety valves are on the aft pressure bulkhead. One provides overpressure relief and one provides negative pressure relief.

The safety valves, which are spring loaded closed, are pneumatically operated. When cabin differential pressure exceeds normal limits, the safety valves automatically open to relieve excess cabin pressure.

If a negative pressure condition develops (ambient pressure greater than cabin pressure), the safety valves automatically open to equalize cabin pressure.

CONTROL PANEL

The PRESSURIZATION control panel (Figure 12-4) on the center pedestal contains the following switches:

- MAN RATE knob
- EMER DEPRESS switch
- LNDG ALT knob
- MANUAL switch
- DITCHING switch

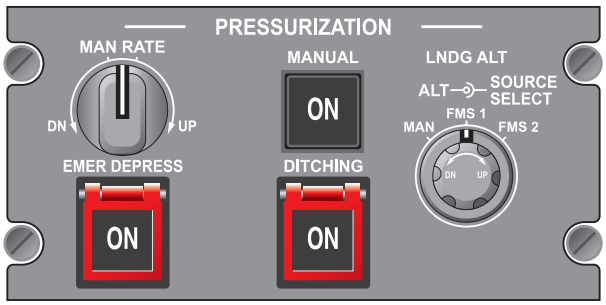


Figure 12-4. PRESSURIZATION Control Panel

MAN RATE Knob

The MAN RATE knob allows the crew to control how fast the cabin pressurization system reaches the desired cabin altitude. The switch permits adjustments to the manual pressurization rate toward DN or UP positions.

- 12 o'clock position corresponds to 0 fpm
- Approximately two-thirds of the potentiometer angle range obtains cabin rate of change from –1,000 to +1, 000 fpm.
- Full counter-clockwise position (max DN) or full clockwise position (UP) obtains cabin rate of change limited to 2,500 fpm

When the desired cabin altitude is approached, rotate the switch to center position to stabilize the cabin at the selected altitude.

MANUAL Pressurization Switch

Manual control of the pressurization system is initiated by pressing the MANUAL switch to ON initiates manual control of pressurization

LNDG ALT Knob

The LNDG ALT knob selects landing field elevation during automatic pressurization mode. The LNDG ALT control is two concentric knobs.

The outer knob has selections of MAN, FMS (for single installation), or FMS 1 and FMS 2 (for dual installation). Selection of one of the FMS settings allows the pressurization landing altitude to be set from the applicable FMS destination airport database.

With the knob in MAN, the inner knob controls the pressurization landing altitude.

EMER DEPRESS Switch

The guarded EMER DEPRESS switch depressurizes the cabin for smoke and fume evacuation. This function is available in both automatic and manual modes.

When EMER DEPRESS is selected during AUTO mode, the cabin depressurizes at 2,500 fpm up to 14,000 ft ±100 ft or the aircraft altitude, whichever is lower.

In MANUAL mode, the cabin depressurizes at 3, 000 fpm up to 14,500 ft ±500 ft or the aircraft altitude, whichever is lower.

NOTE

In manual mode, selecting the MAN RATE to max UP can also depressurize the cabin.

DITCHING Switch

The DITCHING switch depressurizes the cabin, shuts off the air conditioning, and keeps the OFV closed in the event of a water landing. The sequence is inhibited above 15,000 ft.

NOTE

The ditching function is not available in manual mode. To close the outflow valve, turn the MAN RATE knob to max down.

PRESSURIZATION MODES

The following section discusses the automatic and manual pressurization modes as well as special circumstances with field elevations above 6,780 ft.

The amber CABIN ALTITUDE caution CAS message is normally set for 8,500 ft and the red CABIN ALTITUDE warning CAS message and aural CABIN ALTITUDE warning is set for 9,400 ft.

AUTOMATIC PRESSURIZATION MODE

The following automatic pressurization modes are a function of the active IASC:

- Prepressurization
- Takeoff and return to base sequence
- Climb
- Cruise
- Descent
- Depressurization sequence on ground

Prepressurization Mode

When thrust levers are advanced for takeoff, the prepressurization mode is activated. The outflow valve achieves a controlling position prior to takeoff to eliminate any noticeable pressure changes at takeoff. The cabin is pressurized to 300 ft below actual field elevation.

Takeoff and Return to Base Sequence

When the aircraft leaves the ground, the takeoff sequence is initiated (Figure 12-5). The system maintains the prepressurization cabin altitude of 300 ft below field elevation until the one of the following occurs:

- Aircraft reaches 6,000 feet above takeoff elevation
- 10 minutes elapses

If a descent is initiated, the cabin altitude descends to the takeoff altitude and the landing field elevation does not have to be reset.

Climb Mode

Cabin pressurization is programmed according to selected landing elevation and a theoretical schedule of cabin altitude versus aircraft altitude. The cabin climb profile varies directly with the aircraft's climb rate.

A typical cabin climb rate is approximately 300-500 fpm. For light aircraft climbs at the best climb rate, the maximum cabin climb rate is 635.

NOTE

When step climbs are performed at flight altitudes greater than 25,000 ft and at aircraft climb rates greater than 6,000 fpm, the cabin climb rate might exceed the max normal limit of 635 fpm for automatic overpressure protection. For comfortable cabin climb rates, a maximum aircraft climb rate of 6,000 fpm is recommended.

Cruise Mode

Cabin pressurization is programmed to activate cruise mode if either of the following occurs:

- Aircraft rate of climb is less than 500 fpm for more than 10 seconds
- Aircraft is climbing at any rate with the aircraft altitude greater than 25,000 ft

The cabin altitude is stabilized at a level in accordance with the pressure schedule.

Descent Mode

The rate of cabin descent is directly related to the aircraft's rate of descent. In the case of a high-speed descent, the rate of cabin descent

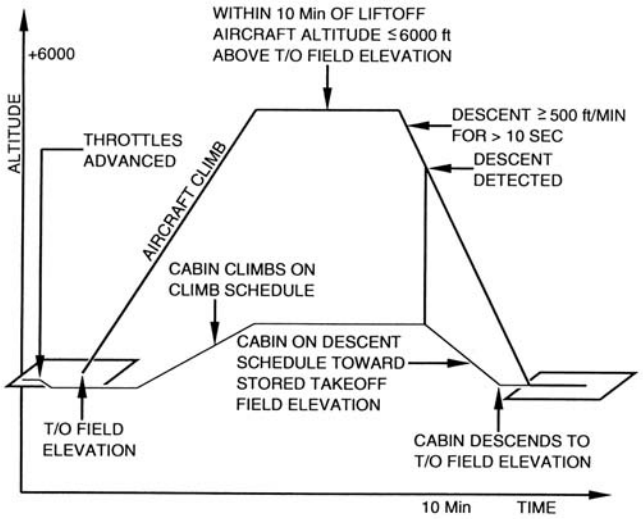


Figure 12-5. Takeoff and Return to Base

is increased according to the calculation of remaining flight time. The remaining flight time is calculated from the aircraft speed received from the ADC.

A typical cabin descent rate is approximately 300 fpm. For example, if the aircraft's descent rate is 2,000 fpm, the cabin descends at approximately 300 fpm. If the aircraft is descending at greater than 5,000 fpm, the cabin descends at 750 fpm.

Cabin altitude descends on schedule until the cabin altitude is approximately 300 feet below the selected landing destination elevation.

Depressurization Sequence on Ground

After landing or after an aborted takeoff, the cabin depressurizes at a rate of 500 fpm to equalize cabin pressure. The outflow valve then goes to full open. It remains in that configuration while on ground.

MANUAL PRESSURIZATION MODE

The crew has the option of manually setting the landing altitude with the selection of MAN on the SOURCE SELECT and the setting of the landing altitude with the ALT switch.

When MANUAL is selected on the PRESSURIZATION control panel, the pilot manually controls the outflow valve. The MAN RATE knob selects the desired cabin pressure altitude rate of change.

An UP selection on the MAN RATE knob increases cabin altitude. A DN selection of the MAN RATE knob decreases cabin altitude. When the MAN RATE knob is set directly between UP and DN, cabin altitude is maintained regardless of changes to aircraft altitude.

The maximum rate of change in the MANUAL mode is 2,500 fpm.

Before Takeoff

Before takeoff, determine cabin altitude. Adjust the MAN RATE switch toward the DN position to start prepressurizing. Although any rate may be selected, approximately -300 fpm is recommended.

Because of the lack of initial differential pressure, cabin pressure slowly starts to increase (cabin altitude goes down). If enough time is allowed before the actual takeoff run, select cabin rate of climb to zero upon reaching 300 ft below noted cabin altitude. Allow the cabin to stabilize (CAB RATE shows as 0 FPM on the ECS column of the EICAS summary page). If actual takeoff is performed prior to cabin prepressurization, pressure bumps may occur.

Takeoff and Climb

Before takeoff, cabin altitude may be selected as desired.

Monitor CAB ALT and CAB ΔP. Make necessary adjustments to keep the differential pressure within limits. Adjustments may be performed through the MAN RATE switch. Although any rate may be selected, +500 fpm to raise cabin altitude and –300 fpm to descend cabin altitude are recommended.

Cruise

During cruise, cabin altitude can be selected as desired if applicable limits for cabin altitude and delta P are observed (Figure 12-6).

DESCENT AND LANDING

Set the desired cabin altitude for landing to 300 ft below the field elevation. For initial descent steps, any comfortable cabin rate may be selected.

For final descent and landing, or if an unrestricted descent is intended, the cabin rate should be proportional to the aircraft descent time (Figure 12-7). For example, if the aircraft is at 27,000 ft and a 3,000 fpm descent is desired, it takes approximately nine minutes to land. To determine the rate of descent, divide the difference between the current cabin altitude and the landing altitude.

NOTE

Monitor cabin delta P during descent and approach to make the necessary adjustments to keep delta P less than 1 psid (maximum allowed for landing).

AFTER LANDING

After landing, adjusting the MAN RATE switch toward the UP position until field elevation is attained depressurizes the aircraft.

Aircraft Altitude (ft)	Cabin Altitude (ft)	Cabin Delta P (PSID)	Aircraft Altitude (ft)	Cabin Altitude (ft)	Cabin Delta P (PSID)	Aircraft Altitude (ft)	Cabin Altitude (ft)	Cabin Delta P (PSID)
-1500	-1786	0.1	15 000	1379	5.8	33 000	4955	8.3
-1000	-1273	0.1	16 000	1504	6.0	34 000	5272	8.3
0	-245	0.1	17 000	1637	6.3	35 000	5612	8.3
1000	-135	0.6	18 000	1778	6.5	36 000	5877	8.3
1500	-81	0.8	19 000	1926	6.8	37 000	6076	8.4
2000	-26	1.0	20 000	2091	7.0	38 000	6331	8.5
3000	81	1.4	21 000	2258	7.2	39 000	6586	8.5
4000	187	1.9	22 000	2429	7.4	40 000	6827	8.5
5000	294	2.3	23 000	2608	7.6	41 000	7056	8.5
6000	399	2.7	24 000	2795	7.7	42 000	7272	8.5
7000	504	3.0	25 000	2984	7.7	43 000	7476	8.6
8000	610	3.4	26 000	3189	8.0	44 000	7669	8.7
9000	716	3.8	27 000	3404	8.2	45 000	7850	8.8
10 000	816	4.1	28 000	3628	8.3	-	-	-
11 000	925	4.4	29 000	3864	8.3	-	-	-
12 000	1036	4.8	30 000	4111	8.3	-	-	-
13 000	1150	5.1	31 000	4375	8.3	-	-	-
14 000	1268	5.4	32 000	4653	8.3	-	-	-

Figure 12-6. Pressurization Schedule—Climb and Cruise

Aircraft Altitude (ft)	Cabin Altitude (ft)	Cabin Delta P (PSID)	Aircraft Altitude (ft)	Cabin Altitude (ft)	Cabin Delta P (PSID)	Aircraft Altitude (ft)	Cabin Altitude (ft)	Cabin Delta P (PSID)
-1500	-1786	0.1	15 000	1118	5.8	33 000	4699	8.5
-1000	-1291	0.1	16 000	1229	6.0	34 000	5098	8.5
0	-299	0.1	17 000	1347	6.3	35 000	5487	8.5
1000	-202	0.6	18 000	1473	6.5	36 000	5782	8.5
1500	-155	0.8	19 000	1606	6.8	37 000	6064	8.6
2000	-107	1.0	20 000	1756	7.0	38 000	6332	8.6
3000	-13	1.5	21 000	1907	7.2	39 000	6587	8.6
4000	80	1.9	22 000	2063	7.4	40 000	6828	8.6
5000	173	2.3	23 000	2226	7.6	41 000	7057	8.7
6000	264	2.7	24 000	2396	7.7	42 000	7273	8.7
7000	356	3.1	25 000	2569	7.9	43 000	7477	8.7
8000	448	3.5	26 000	2754	8.0	44 000	7670	8.8
9000	540	3.9	27 000	2948	8.2	45 000	7850	8.8
10 000	626	4.2	28 000	3151	8.3	-	-	-
11 000	721	4.6	29 000	3366	8.4	-	-	-
12 000	818	4.9	30 000	3591	8.5	-	-	-
13 000	918	5.2	31 000	3873	8.5	-	-	-
14 000	1022	5.5	32 000	4291	8.5	-	-	-

Note: For holding above 25,000 ft following descent, the pressurization schedule for Climb and Cruise applies.

Figure 12-7. Pressurization Schedule—Descent and Hold (<25,000 Ft)

FIELD ELEVATION GREATER THAN 7,850 FT

Figure 12-8 contrasts a takeoff below 7,850 ft with a takeoff above 7,850 ft.

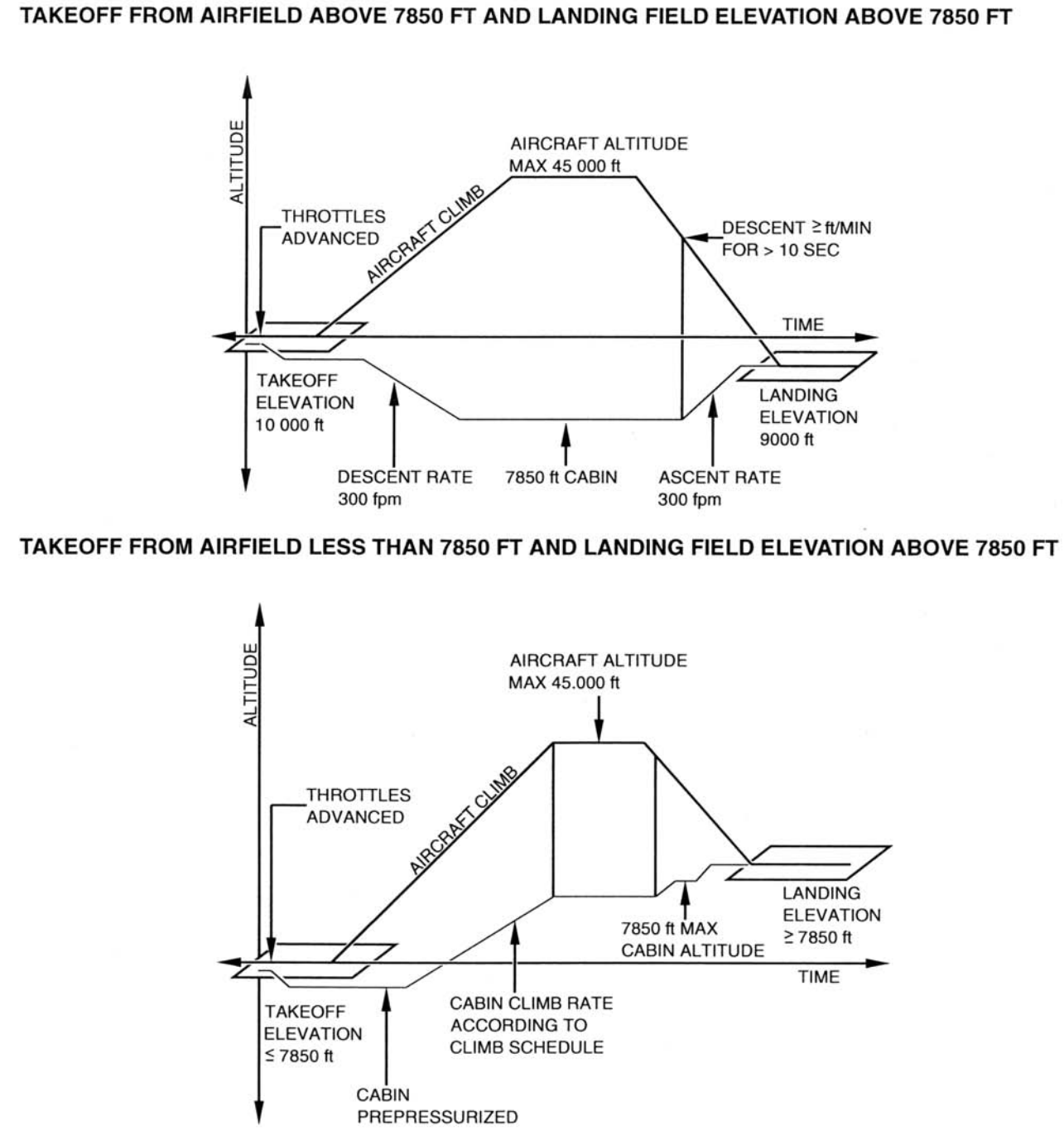


Figure 12-8. Contrast in Takeoff Elevation

Takeoff and Return to Base

Similar to the takeoff at lower field elevations, the takeoff sequence is initiated as the aircraft leaves the ground (see Figure 12-5). The system maintains the prepressurization cabin altitude of 300 ft below takeoff pressure altitude until the aircraft reaches 6,000 ft AGL or 10 minutes has elapsed.

If a return to base is initiated, the aircraft lands slightly pressurized at the prepressurization value to avoid cabin bumps. The landing field elevation does not have to be reset.

During this sequence, the caution and warning thresholds are maintained at the takeoff pressure altitude.

Climb Mode

When the aircraft is in climb following a takeoff from an airfield above 7,850 ft, the cabin altitude decreases at a rate of –500 fpm towards the maximum normal limit of 7,850 ft. The caution and warning thresholds decrease as a function of the aircraft altitude and rate of climb at a minimum rate of –500 fpm. This allows the caution threshold to reach 8,500 ft and the warning threshold to reach 9,400 ft before the aircraft reaches 41,000 ft.

Cruise Mode

When the aircraft is in cruise following a takeoff and climb from an airfield above 7,850 ft, the cabin altitude continues to decrease at a rate of –300 fpm until the maximum normal cabin altitude limit for 7,850 ft aircraft altitude is reached.

The warning and caution thresholds continue to decrease at a rate of -300 fpm until the caution threshold of 8,500 ft and the warning threshold of 9,400 ft are reached.

Leveling Off During Descent

If a leveling off occurs above 41,000 ft, the following occurs during descent:

- Cabin altitude remains at 7,850 ft
- CABIN ALTITUDE caution and warning remain at 8,500 ft and 9,400 ft respectively

If the level off is between 41,000 and 25, 000 ft, the cabin altitude as well as caution and warning thresholds level as a function of aircraft altitude. If the leveling off lasts for more than three minutes, the cabin altitude descends at a rate of –300 fpm backwards towards 7,850 ft. The caution and warning thresholds also descend at a rate of –300 fpm until aircraft descent is initiated.

If leveling off occurs at or below 25,000 ft, the following occurs during descent:

- Cabin reaches and remains at targeted landing field pressure altitude minus 300 ft
- CABIN ALTITUDE caution and warning thresholds reach and remain at landing field pressure altitude +650 ft and +1,550 ft, respectively, with both limited to 14,300 ft

If a short climb followed by a level off is performed below 25,000 ft, cabin altitude descends at a rate of –300 fpm back toward 7,850 ft. A subsequent aircraft descent automatically initiates the return to the landing field pressure altitude. It also decreases the caution and warning thresholds.

Landing

The landing does not require additional crew action if the actual landing field elevation was selected prior to takeoff. The scheduled cabin pressure altitude is normally limited to 7,850 ft during flight. It automatically resets to the landing field pressure altitude.

When the aircraft descends below 41,000 ft, the caution and warning thresholds start to increase as a function of the aircraft altitude and rate of descent. The CABIN ALT WARN HIGH advisory CAS message informs the crew that the warning and caution limits have been reset to higher than normal values.

The amber CABIN ALTITUDE caution message increases up to 650 ft above landing field pressure altitude; the CABIN ALTITUDE warning message increases up to 1,550 ft above the landing field pressure altitude. Both thresholds are limited to 14,300 ft pressure altitude.

Takeoff Above 7,850 Ft and Landing Less than 7,850 Ft

During climb and cruise mode, the target for the cabin altitude is the normal cabin pressure schedule, which is below the maximum normal limit of 7,850 ft for aircraft altitudes below 45,000 ft. The warning and caution thresholds decrease until the caution threshold reaches 8,500 ft and the warning threshold reaches 9,400 ft (Figure 12-9).

EICAS MESSAGES

Table 12-1 lists the EICAS messages associated with the pressurization system, a brief explanation of the message, and whether the message is inhibited during takeoff and/or landing.

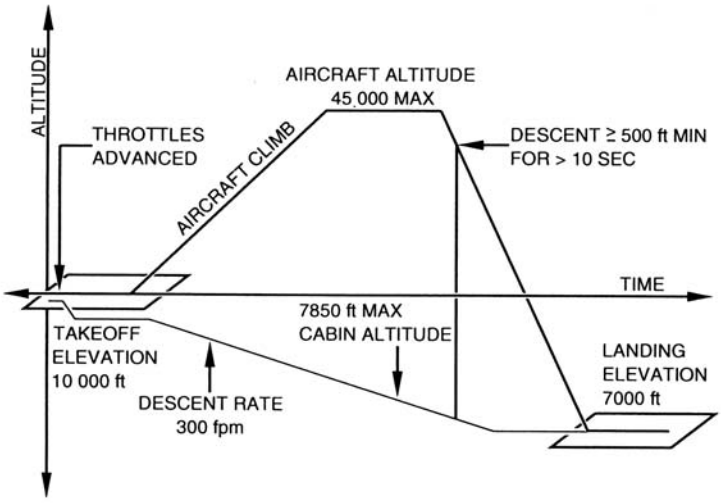


Figure 12-9. Takeoff above 7,850 Ft and Landing Less than 7,850 Ft.

Table 12-1. EICAS MESSAGES

MESSAGE	INHIBITS	MEANING	AURAL WARNING
CABIN ALTITUDE	TO/LAND	The normal cabin altitude warning is at 9,400 ft. When a takeoff or landing is conducted above 7,850 ft, the warning is at the field elevation +1,550 ft but limited to no higher than 14,300 ft.	"Cabin altitude"
CABIN DELTA P	TO/LAND	The cabin differential pressure is greater than 9.2 psid or less than –0.5 psid.	
AUTO PRESS FAIL	TO/LAND	Both automatic pressurization modes have failed.	
CABIN ALTITUDE	TO/LAND	Normal cabin altitude caution is 8,500 ft. During takeoff or landing above 7,850 ft, the caution is set to field altitude +650 ft with a maximum limit of 14,300 ft.	
CABIN PRESS FAULT	TO/LAND	Either the pressure sensor has failed or cabin altitude limiter function has failed.	
DITCHING NOT AVAILABLE	TO/LAND	The ditching switch has been selected on with the pressurization switch in the manual mode.	
CABIN ALT WARN HIGH	TO/LAND	A high takeoff or landing has been initiated, and the pressurization system is in the automatic mode.	
MANUAL PRESS FAIL	TO/LAND	The manual pressurization mode is not operational.	
DITCHING ON		The DITCHING switch/indicator has been selected ON. This closes the flow control valves and commands the outflow valve open for 100 seconds or 10 seconds after cabin differential pressure decreases below 0.16 psid. The outflow valve then closes.	
EMER DEPRESS ON		Emergency depressurization has been selected. Emergency depressurization commands the outflow valve open but will attempt to limit the cabin altitude to approximately 15,000 ft.	
MAN PRESS ON		The MANUAL PRESSURIZATION mode has been selected.	

QUESTIONS

1. The pressurization system has how many independent modes of operation?

a. One
b. Two
c. Three
d. Four

2. The purpose of the safety valves is:

a. To control outflow of air in the manual mode
b. To control the ice and rain protection system
c. To provide overpressure and negative pressure relief
d. To provide overpressure relief for the therapeutic oxygen system

3. When LNDG ALT is set automatically from the FMS destination airport database, it will be displayed in what color on EICAS:

a. Cyan
b. Magenta
c. White
d. Green

4. Pressing EMER DEPRESS during AUTO mode will depressurize the aircraft _____ up to the aircraft altitude, whichever is lower:

a. At desired rate up to 14,000'±100'
b. At 2,500 fpm up to 14,000' ±100'
c. At 2,500 fpm up to 13,000' ±500'
d. At 3,000 fpm up to 14,500' ±500'

5. Which of the following is not true about ditching?

a. Ditching is available in auto or manual mode
b. Ditching depressurizes the cabin
c. Is inhibited above 15,000'
d. Keeps the OFV closed in the event of a water landing

6. In the "Takeoff and Return to Base Pressurization Sequence":

a. The landing field elevation must be set through the FMS departure airport database
b. The pressurization system reduces the cabin altitude to the takeoff altitude if a descent is initiated
c. The cabin altitude climbs at 300' per minute for 10 minutes
d. The pressurization system holds field elevation for 10 minutes or until the aircraft reaches 6,000' AGL

7. The maximum differential pressure allowed for landing is:

a. –.5 psid
b .5 psid
c. 1 psid
d. 1.1 psid

8. A CABIN DELTA P warning (red) CAS message indicates:

a. Cabin differential pressure is greater than 8.8 psid
b. Cabin differential pressure is greater than 9.2 psid or less than –.5 psid
c. Cabin differential pressure is greater than 9.4 psid
d. Cabin differential pressure is less than 1.0 psid

9. Which of the following is not a function of the pressurization control panel?

a. Switching to manual control of cabin pressure when automatic control fails
b. Control of cabin pressure altitude rate and setting of cabin altitude in manual mode
c. Display of the environmental control system synoptic page
d. Depressurization of the cabin to evacuate smoke or fumes in an emergency

CHAPTER 13
HYDRAULIC SYSTEM

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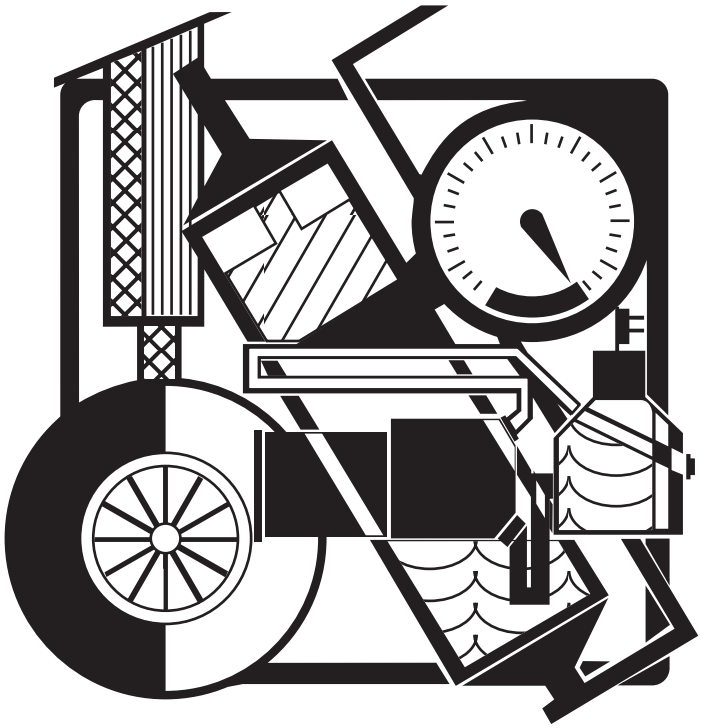
CHAPTER 13
HYDRAULIC SYSTEM



INTRODUCTION

This chapter describes the Challenger 300 hydraulic system, which consists of left, right, and auxiliary systems. The left and right hydraulic systems are independent from each other. The auxiliary system is tied to the right hydraulic system.

GENERAL

The hydraulic systems, which use phosphate ester based MIL-H-5440 Type II fluid, normally operate at 3,000 psi. Engine-driven pumps (EDPs), which are backed by DC motor-driven pumps (DCMPs), power the left and right hydraulic systems.

The HYDRAULICS panel immediately to the right of the throttle quadrant controls the left, right, and auxiliary systems.

USER SYSTEMS

The hydraulic systems power various flight controls, landing gear, brakes, and thrust reversers (Figure 13-1).

Table 13-1 lists those systems that employ hydraulics. For details about how the hydraulic system works with each system, refer to the appropriate chapter.

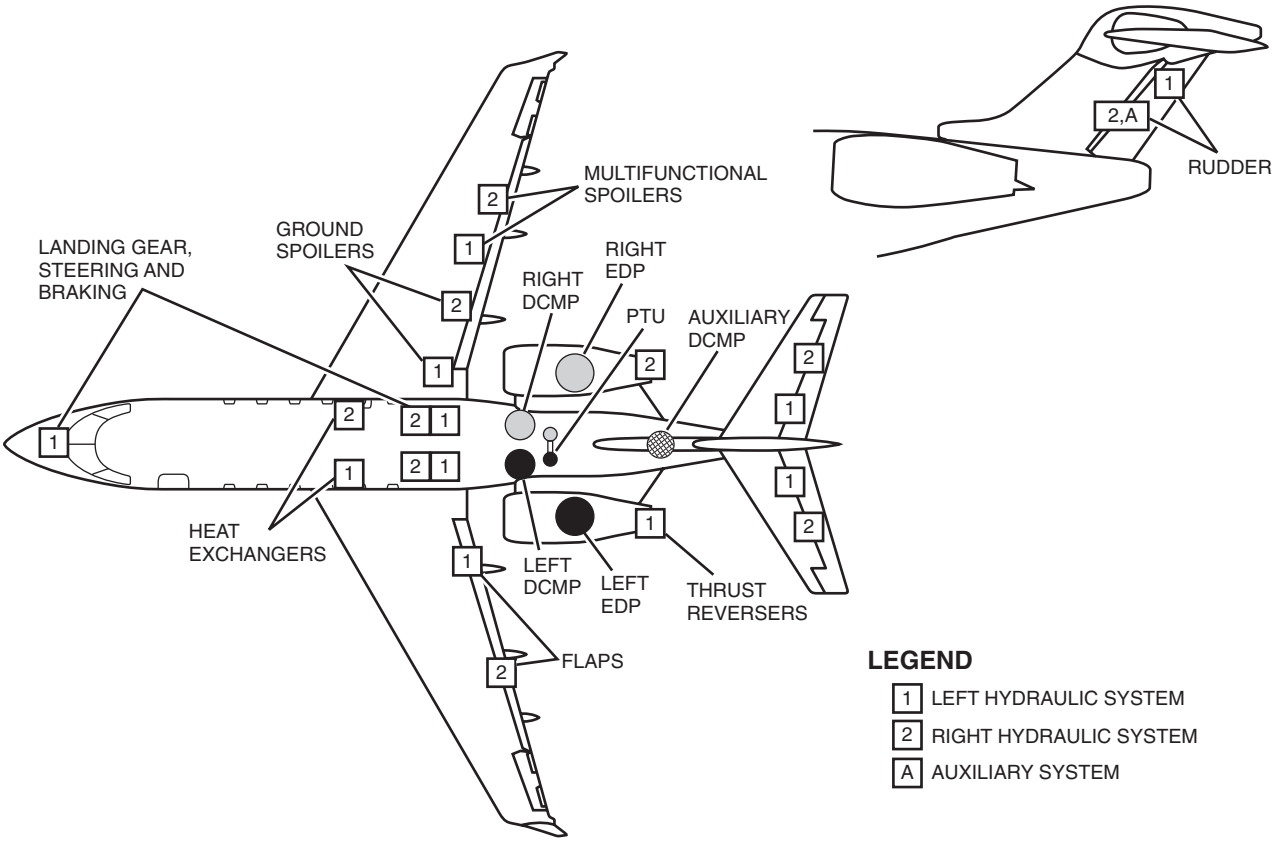


Figure 13-1. Left and Right Hydraulic Systems

Table 13-1. USER SYSTEMS

LEFT HYDRAULIC SYSTEM	RIGHT HYDRAULIC SYSTEM	AUX HYDRAULIC SYSTEM
Multi-functional spoilers (inboard)	Multi- functional spoilers (outboard)	Lower Rudder PCU
Ground spoilers (inboard)	Ground spoilers (outboard)	
Rudder (upper PCU)	Rudder (lower PCU)	
Left thrust reverser	Right thrust reverser	
Inboard brakes, emergency	Outboard brakes	
Nose-wheel steering actuator	Main landing gear assist-actuators	
Elevator (inboard PCUs)	Elevator (outboard PCUs)	
Alternate flaps	Normal flap supply	
Landing gear	Power transfer unit	

LEFT AND RIGHT SYSTEMS

Major components of the left and right hydraulic system include the following:

- Reservoirs
- Engine-driven pumps (EDPs)
- DC motor pumps (DCMPs)
- Firewall shutoff valves (SOVs)
- Control valves
- Sensors for monitoring and control

The left and right hydraulic systems each have a fuel/hydraulic fluid heat exchanger in the wing fuel tank. With the exception of the EDPs and heat exchangers, the major components are in the aft equipment compartment. The EDPs are mounted on the engine accessory gearboxes.

Figures 13-2 and 13-3 illustrate the left and right systems.

HYDRAULIC RESERVOIR

Each of the hydraulic systems contains a bootstrap-type reservoir to store hydraulic fluid. The reservoir provides the necessary fluid volume demanded by the hydraulic system, including pressurization of the pump inlet.

The design of each reservoir considers changes in the fluid volume because of thermal expansion/contraction, system leakage, and differential area of the user actuators.

The left and right hydraulic system reservoirs are installed on their respective sides in the aft equipment compartment.

Fluid volume of the left hydraulic reservoir is 13 quarts (12.3 liters). Fluid volume of the right hydraulic reservoir is 9.1 quarts (8.6 liters).

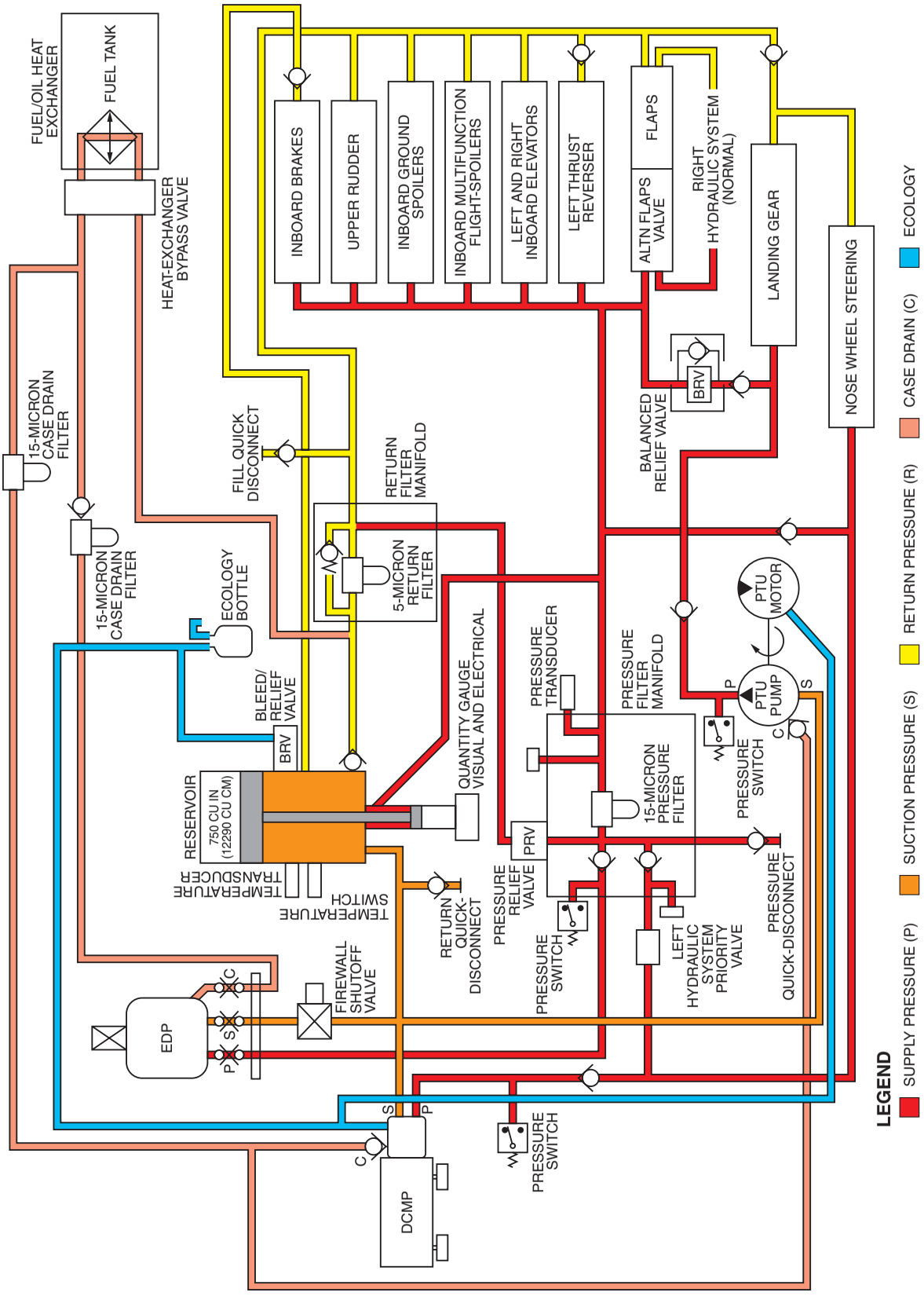


Figure 13-2. Left Hydraulic System Schematic

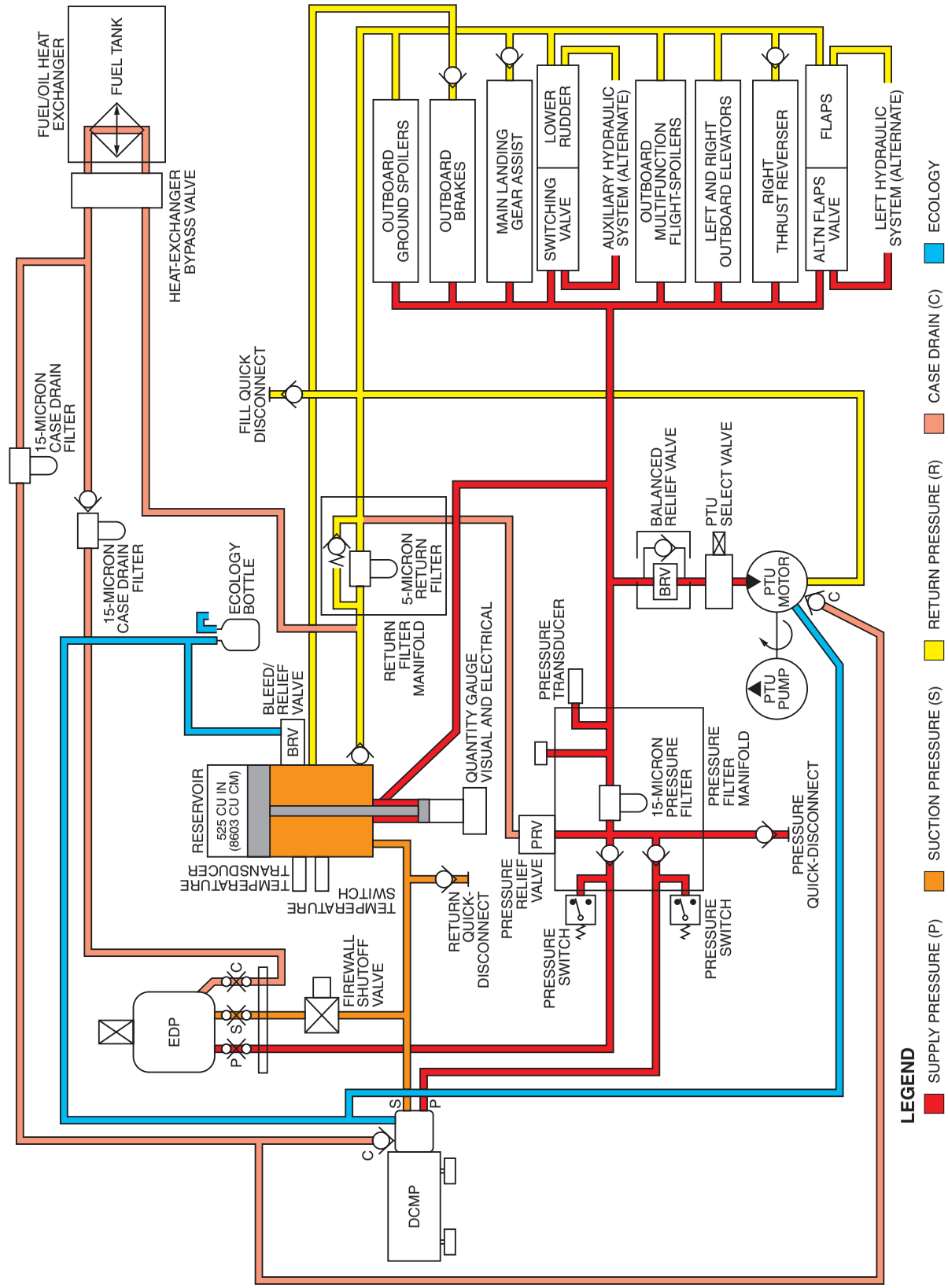


Figure 13-3. Right Hydraulic System Schematic

Each reservoir has a bleed/relief valve, visual quantity indicator, suction shutoff valve, and ports for the temperature switch and temperature transducer (Figure 13-4). A check valve is installed in the fluid return port.

Bleed/Relief Valve

The bleed valve at the high point of the reservoir is accessible to maintenance personnel. Depressing a lever manually opens the valve. When released, the lever automatically returns to the closed position. The location of the valve and the routing of the internal porting to the valve ensure that air in the fluid migrates to the outlet and is released when the valve is opened. Flow from the valve is routed to the ecology bottle.

Ecology Bottle

The left and right hydraulic systems each contain an ecology bottle in the lower part of the rear fuselage.

The ecology bottles collect hydraulic fluid leakage from the DCMP shaft seals, power transfer unit (PTU) seal drain port, and the reservoir bleed/relief valves. The bottles are translucent so the level of hydraulic fluid inside is visible.

Indicators

The visual quantity gage displays hydraulic fluid level in the reservoir. The gage has marks from 0 to 100% in increments of 10%. The quantity indicator senses the position of the low-pressure piston as a measure of the remaining fluid volume.

The quantity indicator also electrically signals the remote data concentrator (RDC) to display fluid quantity on the HYDRAULICS synoptic page and on the summary page. Quantity values appear in green when the left reservoir is between 30 and 85% and when the right reservoir is between 40 and 85%.

Figure 13-4. Left Hydraulic Reservoir

Suction Shutoff Valve

The suction shutoff valve is in the pump suction port of the reservoir. The reservoir piston closes the shutoff valve when the fluid level is almost empty. This prevents fuel from being pumped into the hydraulic system if a break occurs in a hydraulic line inside the fuel tank.

ENGINE-DRIVEN PUMP

An engine-driven pump (EDP) (Figure 13-5) on each engine gearbox powers the hydraulic system. A splined input shaft drives the flange-mounted pump.

The pumps are a variable-delivery, piston-type that maintain a nominal system pressure of 3,000 psi. The EDPs operate any time the engines are turning. Pressure switches in the pump outflow lines provide low pressure indications to the crew.

The discharge, suction, and case drain ports of the pump include quick-disconnect fittings directly connected through hoses to the user systems. To allow for maximum case drain cooling of pump components, the case drain port is on the topside near the mounting flange. This location also ensures bleeding of air after installation of a new pump.

The pump incorporates a solenoid isolation/actuation valve. When energized, the valve reduces discharge pressure and torque.

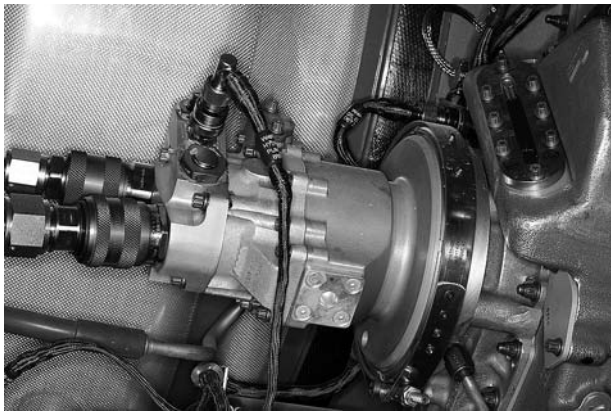


Figure 13-5. Engine-Driven Pump

The full-authority digital engine control (FADEC) activates the solenoid during an engine windmill restart to depressurize the pump.

The left EDP flow and left DCMP flow combine in the left filter manifold. The right EDP flow and right DCMP flow combine in the right filter manifold. Hydraulic fluid is never mixed between the left and right systems.

MOTOR-DRIVEN PUMP

The left and right hydraulic systems each have a DC motor-driven pump (DCMP) to pressurize its respective hydraulic system during an engine or EDP failure (Figure 13-6). The DC electric motor is attached to a variable-delivery hydraulic pump that changes the volume of fluid flow to maintain the necessary system pressure. The DCMPs are installed on their respective side of the aft equipment compartment.

A three-position switch controls the DCMPs. The AUTO position is designed to be the normal position for all phases of flight. In this position, the DCMPs are off with flaps up and on with flaps set at 10° or greater. In addition, if low hydraulic system pressure is detected, the DCMP automatically turns on.

The OFF and ON positions are for manual operation.

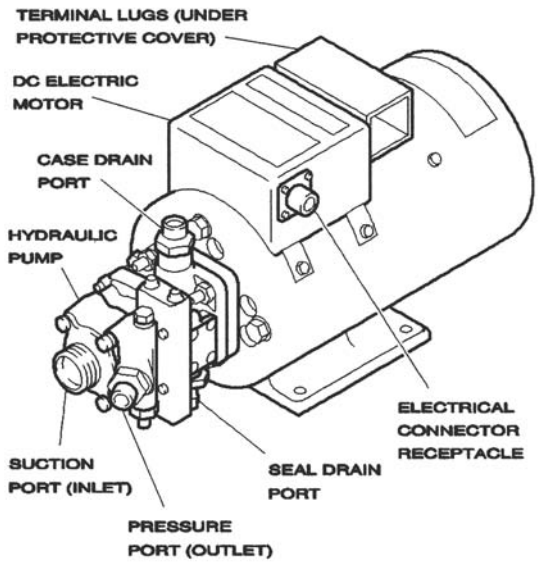


Figure 13-6. Motor-Driven Pump

HYDRAULIC SHUTOFF VALVE

Each of the left and right hydraulic systems contains a firewall shutoff valve (SOV) in the EDP suction line outside of the pylon area. If a fire occurs, the valve can be closed to stop hydraulic fluid from reaching the engine area.

Both SOVs are inside the aft equipment compartment forward of the hatch opening.

The valves are normally in the open position. Pressing the L/R SOV pushbutton on the HYDRAULIC control panel or the L/R ENG FIRE pushbutton on the ENGINE control panel closes the corresponding hydraulic SOV.

Control logic also closes the valve automatically when the system fluid temperature exceeds 135°C.

When a firewall SOV is closed, the DCMPs are the only hydraulic pressure source available for the left or right hydraulic systems.

CONTROL PANEL AND DISPLAYS

The HYDRAULIC panel (Figure 13-7) controls the electric hydraulic pumps, shutoff and selector valves, and power transfer unit. Switches on the panel include the following:

- L and R SOV
- L and R PUMP
- PTU
- ALTN FLAPS
- AUX PUMP

Each switch is discussed in its appropriate section.

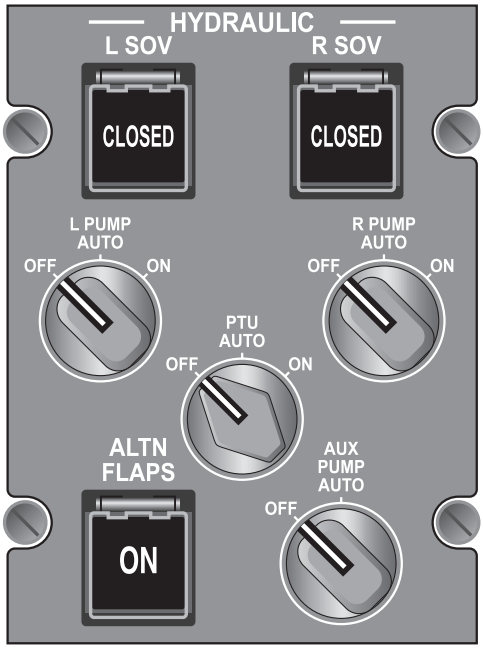


Figure 13-7. HYDRAULIC Panel

Operation of the hydraulic system is displayed on the HYDRAULIC synoptic page (Figure 13-8). The synoptic page displays a block diagram depicting the reservoirs, the pumps, and user systems. Temperature and pressure are also displayed.

SYSTEM COOLING

Cooling of the hydraulic system components is accomplished through fuel/hydraulic heat exchangers in each wing fuel tank.

A thermostatically controlled bypass valve between the heat exchanger inlet and outlet line on each hydraulic system controls the flow of pump case drain fluid to the heat exchanger. The valve also acts as a thermal bypass valve if pressure drop through the heat exchanger becomes excessive.

At fluid temperatures above 52°C, the valve is in full open mode to provide cooling. The open valve routes all incoming fluid through the heat exchanger.

Below 35°C, the valve is in bypass mode. All incoming fluid is routed around the heat exchanger and directly to the reservoir.

If fluid temperature of 135°C is detected for more than three seconds, the SOV closes and an amber L/R HYD TEMP HIGH caution CAS message is illuminated.

AUXILIARY HYDRAULIC SYSTEM

The auxiliary hydraulic system provides hydraulic pressure to the lower rudder power control unit (PCU) if the right hydraulic system fails (Figure 13-9). The auxiliary hydraulic system includes a DCMP, a reservoir, and an accumulator aft of the engine rotor burst zone.

The right hydraulic system normally powers the lower rudder PCU. During a loss of right system pressure, a hydraulic switching valve allows the auxiliary system to provide the pressure.

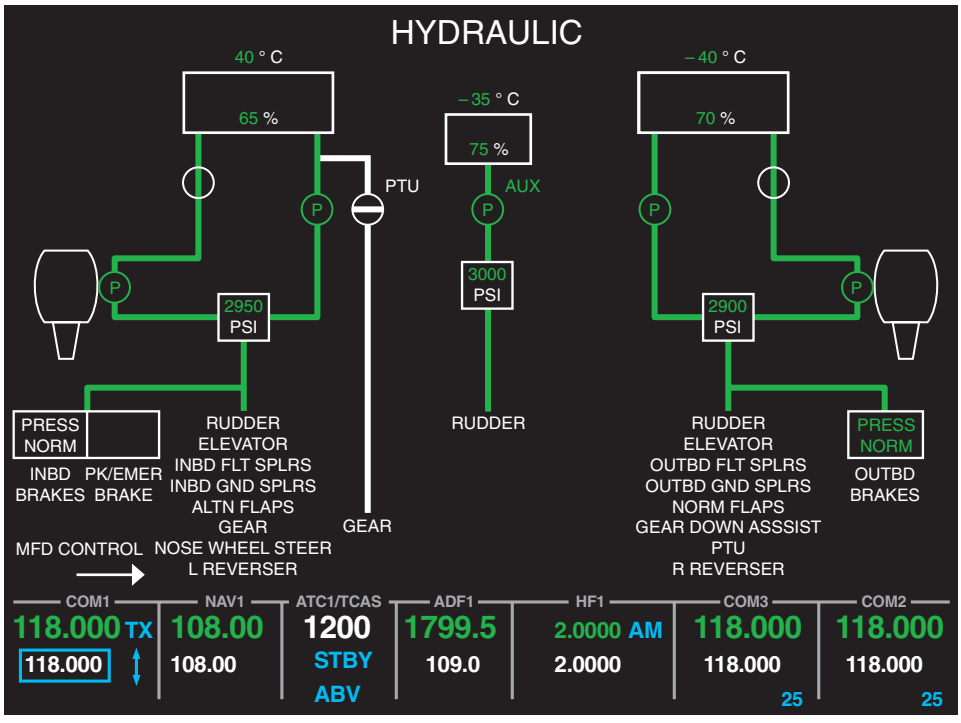


Figure 13-8. HYDRAULIC Synoptic Page

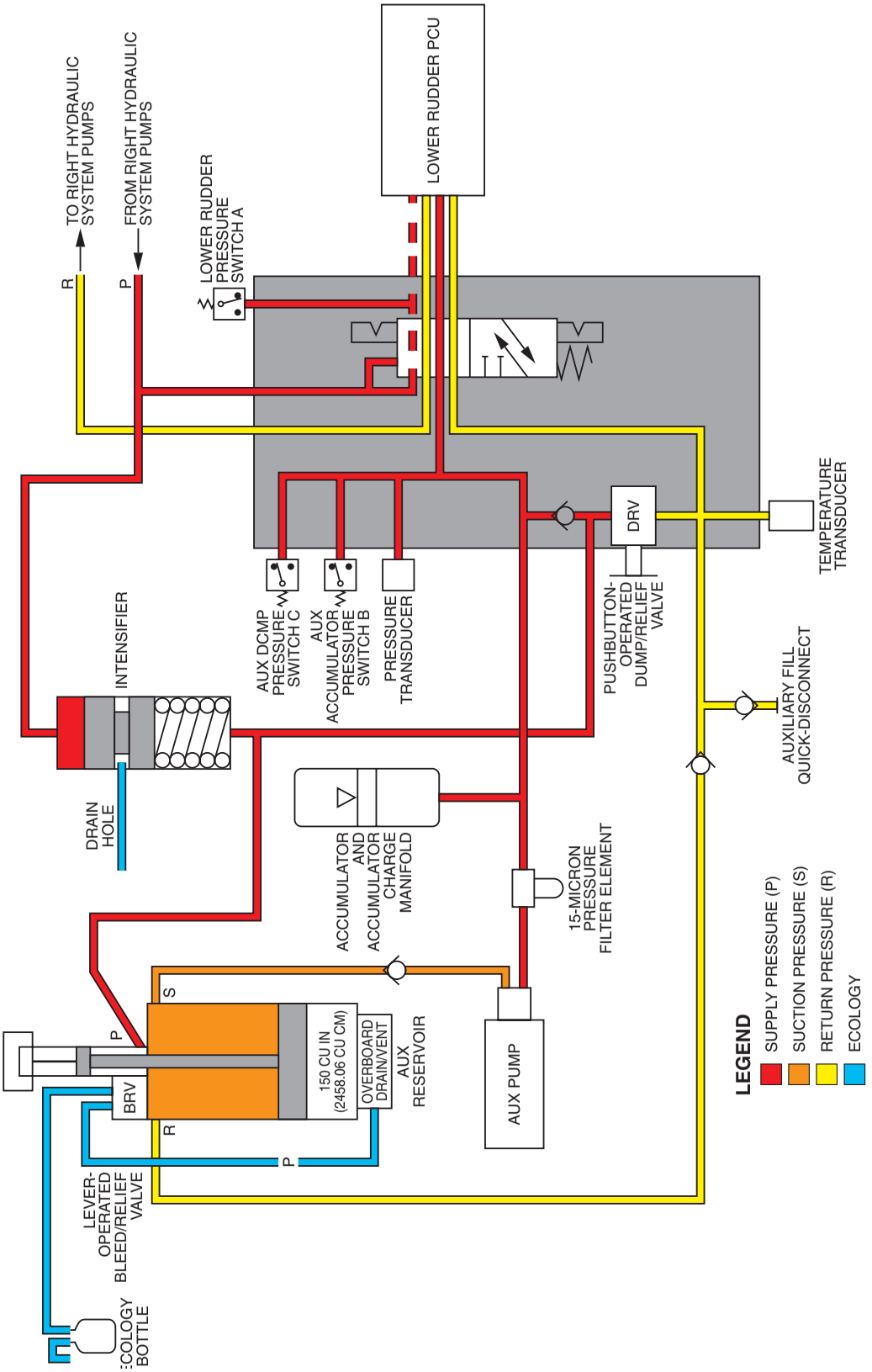


Figure 13-9. Auxiliary Hydraulic System Schematic

A constant displacement DCMP generates auxiliary hydraulic system pressure. A two position AUX PUMP switch controls the pump. The OFF position disables the pump. In the AUTO position, a pressure switch allows the pump to activate as needed.

The auxiliary system has an intensifier pressurized by the right hydraulic system. Therefore, during the preflight check, it is important to select R PUMP ON before selecting AUX PUMP to AUTO to prevent cavitation.

AUXILIARY DCMP

The auxiliary DC motor-driven pump maintains fluid pressure on the auxiliary system accumulator. When system pressure decreases to 2,500 psi, an external pressure switch turns on the pump until pressure reaches 3,350 psi. At that time, the pressure switch deactivates to command the pump off.

ACCUMULATORS AND RESERVOIR

The auxiliary system accumulator has a nominal gas volume for 50 cubic inches of dry nitrogen to satisfy the instantaneous demands of the hydraulic pressure and dampen out pressure surges within the system.

The accumulator provides smooth and continuous hydraulic pressure to the lower rudder PCU until the aux DCMP comes online at approximately 2,500 psi.

To prevent cavitation, the auxiliary system uses an intensifier to augment the inlet pressure to the auxiliary DCMP. The intensifier is a simple spring-loaded piston that transmits pressure from the right system to the pressure side of the auxiliary system reservoir. The DC pumps come on prior to the engines starting and supply the intensifier with pressure. The auxiliary DCMP comes on if the following occurs:

- AUX DCMP selected to AUTO
- Aircraft has power
- Aux system accumulator pressure low

Once the AUX DCMP pressurizes, it is self-priming and its operation is independent of the right system.

SWITCHING VALVE

Under normal operating conditions, the auxiliary system switching valve transmits right system pressure to the lower rudder PCU.

With loss of right hydraulic system pressure, the switching valve shuttles and applies auxiliary system pressure to the lower rudder PCU. The valve shuttles strictly in accordance with the right system pressure and does not rely on any software or electrical interface to function.

FILTER

A pressure filter assembly filters the supply pressure fluid from the DCMP. The assembly is composed of a filter element and bowl, a differential pressure indicator, and an automatic shutoff device.

The filter is non-bypassing. When the bowl is removed, the flow through the assembly is blocked.

The noncleanable filter element removes 100% of all contaminants larger than 15 microns.

The auxiliary system pressure filter and the case drain filter on the filter manifolds of the left and right systems are identical and interchangeable.

OPERATION

POWER TRANSFER UNIT

The power transfer unit (PTU) is a fixed displacement, uni-directional device to transfer fluid power from the RH system to the LH system without sharing fluid between systems.

The PTU consists of two fixed-displacement, axial piston rotating groups that are housed separately yet connected by a driveshaft. The motor side (right system) is slightly larger in displacement than the pump side (left system) to compensate for mechanical losses within the unit while maintaining system pressure.

The pump side contains a case drain to route internal leakage, idle bypass, and relief valve flow back to a reservoir. The idle bypass flow permits the PTU to operate smoothly and continuously at all demand flows from zero to rated system pressure.

When the PTU selector valve is energized, pressure from the right hydraulic system drives the hydraulic motor.

The PTU, which is connected to the left hydraulic system, is dedicated to retracting the landing gear when the left EDP system is not operational. If the left engine fails during takeoff, gear retraction time is excessively slow with the DCMP. When the PTU is engaged, however, gear retraction time is normal.

A priority valve upstream of the PTU protects the right system pressure from being pulled down to unacceptable levels due to excessive flow demand from the PTU.

PTU Switch

A three-position switch controls the PTU (Figure 13-10). In the OFF and ON positions, the PTU valve is manually closed or open. In the AUTO mode, the control logic of the PTU energizes the PTU select valve when all of the following conditions are met:

- Landing-gear select lever is UP
- Landing gear has not fully retracted
- Hydraulic pressure from left EDP is low
- Hydraulic pressure from right EDP is normal (if PTU is set to ON, it operates if sufficient power from the right hydraulic system exists; if right hydraulic pressure is low, the balanced relief valve restricts flow to the PTU motor)

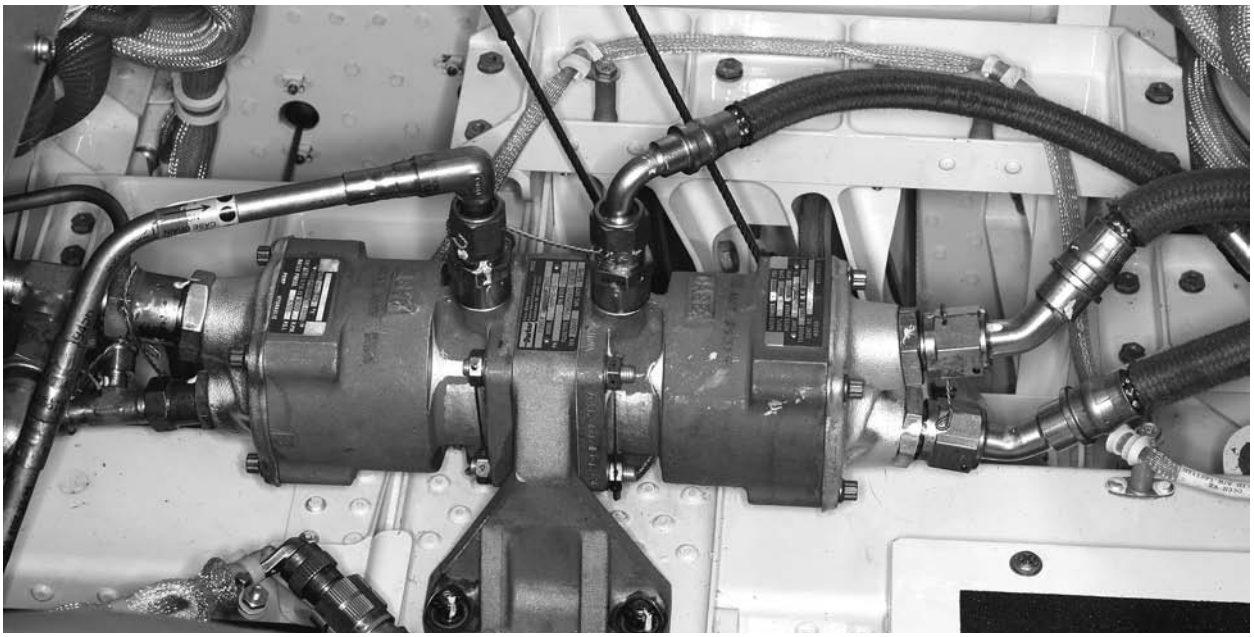


Figure 13-10. Power Transfer Unit

If the PTU is selected to AUTO and does not produce hydraulic pressure within 10 seconds, it latches to OFF to minimize the load placed on the right hydraulic system. The latch resets if the crew deselects the AUTO mode or power removed from the proximity sensing electronics unit (PSEU).

POWER SUPPLIES

The generator on the engine opposite the one driving the EDP supplies power to the DC bus. Hydraulic power, therefore, is available for the left and right systems after any single engine failure.

The right main bus powers the left DCMP. There is no battery backup. If the right DC generator fails, the left DC generator or the APU can power the right main DC bus.

The left essential bus powers the right DCMP. If the left DC generator fails, the right DC generator or the APU can power the left essential bus.

If no generators are operational, the right DCMP automatically starts only if the pilot selects the flaps to a non-zero position.

If only one generator is operational, only one of the DCMPs is operational. One DCMP is load shed from the operating hydraulic system. The right DCMP takes priority over the left DCMP if both EDPs fail.

Auxiliary System

The auxiliary DCMP is not load shed for single generator operation. The left essential bus powers the auxiliary DCMP.

TOTAL GENERATOR FAILURE

If all electrical generators fail, the pilot may select the right and aux DCMPs OFF to conserve battery life, assuming both EDPs are functioning. The left DCMP is not powered in this condition.

If all electrical generators and both EDPs fail, the pilot may again elect to turn the DCMPs off and fly using manual reversion of the flight controls. The right DCMP may be turned back on prior to landing.

If the auxiliary hydraulic system fails, the rudder is in manual reversion. In addition, roll assist with roll spoilers is lost. The crew must manually control the ailerons through cables and pulleys. Because flaps, thrust reversers, and lift dumping devices are all lost, landing distances is significantly increased.

INFLIGHT AIRSTARTS

The engine-driven pump incorporates a depressurization circuit to unload the pump during inflight airstarts. The circuit reduces the input torque required.

OVERTEMP PROTECTION

When the reservoir fluid temperature reaches 135°C, the PSEU commands the FADEC to depressurize the engine-driven pump. The motor-driven pump automatically continues to provide hydraulic pressure to other systems after the EDP stops functioning.

SERVICING

The left and right hydraulic systems each have quick-disconnects for ground fill and pressure and return fluid circuits. These are for ground maintenance tasks such as system bleeding, flushing, draining, and ground pressurization. Figure 13-11 depicts the servicing panel and its location .

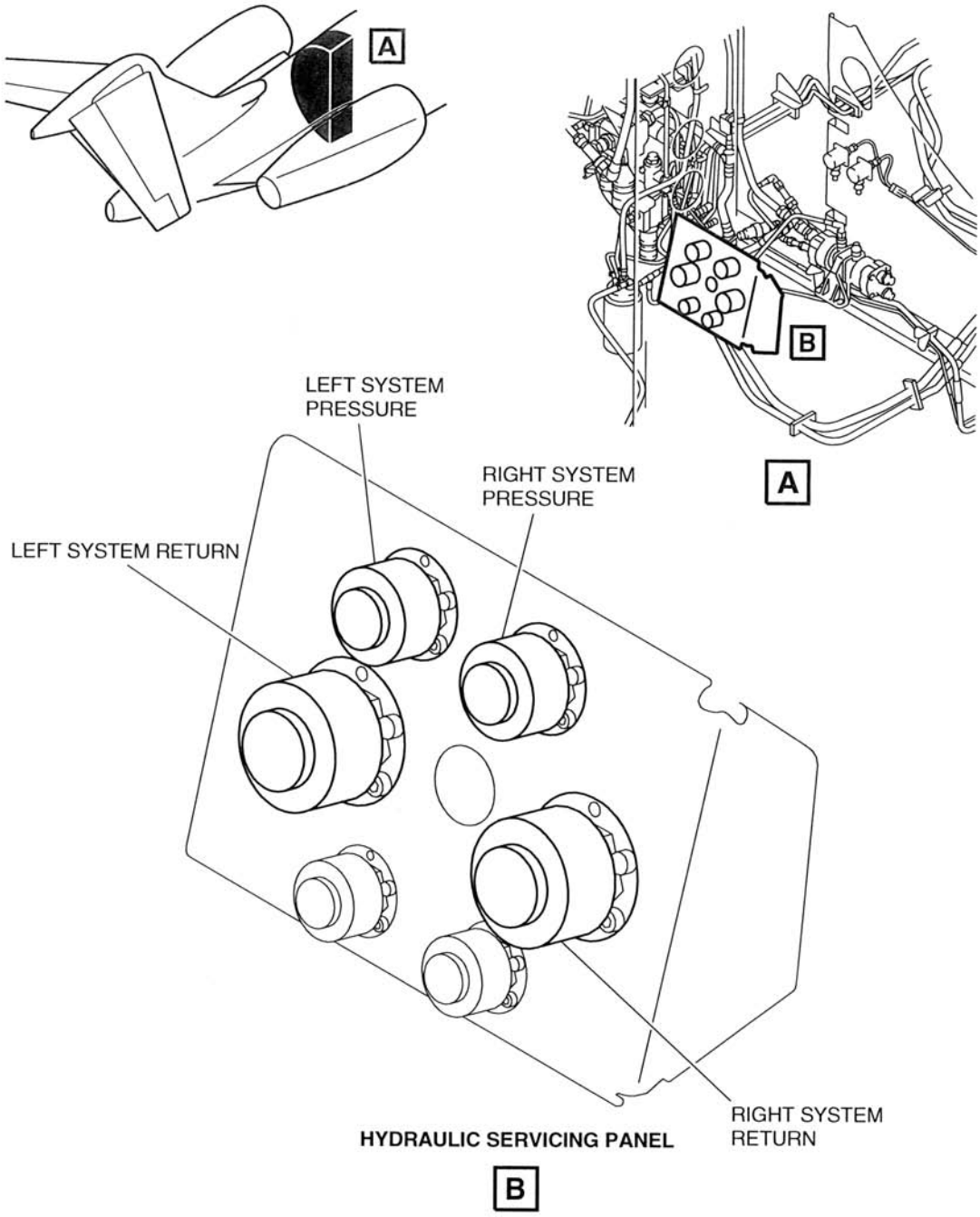


Figure 13-11. Hydraulic Servicing Panel

The auxiliary system filler has a quick-disconnect to add hydraulic fluid to the auxiliary reservoir. The quick-disconnects are on panels near the system access doors (Figure 13-12).

EICAS MESSAGES

Table 13-2 lists the EICAS messages associated with the hydraulics system, a brief explanation of the message, and whether the message is inhibited during takeoff and/or landing.

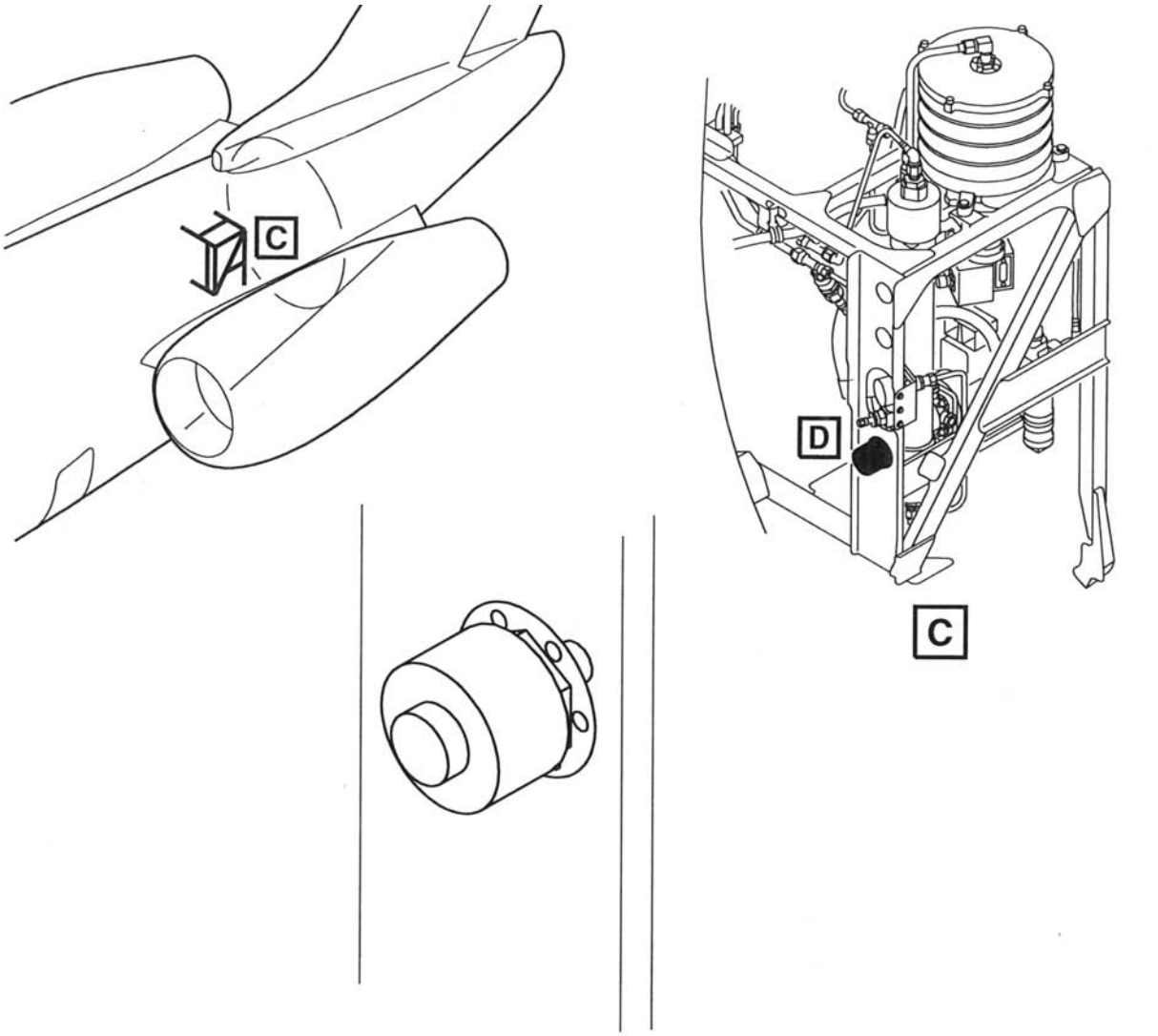


Figure 13-12. Auxiliary Accumulator Servicing

Table 13-2. EICAS MESSAGES

MESSAGE	INHIBITS	MEANING	AURAL WARNING
HYD PRESS LOW		The left and right hydraulic pressures are less than 1,800 psi.	
AUX HYD TEMP HIGH	TO/LAND	The auxiliary hydraulic fluid system temperature is greater than 135°C.	
L (R) HYD PRESS LOW	TO/LAND	The affected hydraulic system pressure is less than 1,800 psi.	
HYD PTU FAIL	TO/LAND	The power transfer unit is not producing pressure when it should be.	
L (R) HYD SOV FAIL	TO/LAND	The respective hydraulic shutoff valve did not close when one of the following occurred: • The respective ENG FIRE switch was pressed. • The respective HYDRAULIC SOV switch was selected CLOSED. • The automatic overtemp closure was commanded Or the respective hydraulic SOV is CLOSED when it should be OPEN.	
L (R) HYD TEMP HIGH	TO/LAND	The respective hydraulic system temperature is above 100°C.	
AUX HYD SYS FAIL	TO/LAND	The auxiliary hydraulic pump is not producing pressure when it should.	
AUX HYD PUMP FAIL ON	TO/LAND	The auxiliary hydraulic pump is running continuously.	
L (R) HYD DC PUMP FAIL	TO/LAND	The respective hydraulic pump is not producing pressure when it should.	
L (R) HYD ENG PUMP FAIL	TO/LAND	The respective hydraulic pump is not producing pressure when it should.	
HYD PUMP NOT AUTO	TO/LAND	At least one of HYDRAULIC PUMP (L, R, PTU, or AUX) switch is not in the AUTO position.	
L (R) HYD SOV CLOSED	TO/LAND	The respective hydraulic shutoff valve is closed.	

QUESTIONS

1. What is the purpose of the PTU?
   a. Gear retraction when the right EDP is not operational
   b. Gear retraction when the left EDP is not operational
   c. Gear retraction when the DCMP is not operational
   d. Gear retraction under high EDP loads

2. The hydraulic firewall shutoff valves:
   a. Are normally open
   b. Are normally closed
   c. Close automatically when system temperature is >100°C
   d. Are closed when the DCMPs are operational

3. The aux hydraulic system provides hydraulic system pressure to the rudder when:
   a. There is loss of hydraulic power from the left system
   b. There is loss of hydraulic power from the right system
   c. There is a dual hydraulic failure
   d. There is a PCU failure

4. The left DCMP is powered by the:
   a. Right essential bus
   b. Left essential bus
   c. Left main DC bus
   d. Right main DC bus

5. Normal hydraulic system pressure is:
   a. 1,800 psi
   b. 2,800 psi
   c. 3,000 psi
   d. 3,600 psi

6. The DCMPs:
   a. Are capable of providing sufficient hydraulic pressure on their own
   b. Are powered by their same-side generators
   c. Are normally in the ON position
   d. Are disabled when the FIRE buttons are pushed

7. The hydraulic firewall SOVs close when the respective L/R SOV pushbuttons are pressed, the L/R ENG FIRE pushbuttons are pressed, or:
   a. When the respective hydraulic reservoir fluid quantity is less than 10%
   b. Automatically when system fluid temperature exceeds 135°F
   c. Automatically when system fluid temperature exceeds 135°C
   d. When both engines and the APU are shut down

CHAPTER 14
LANDING GEAR AND BRAKES

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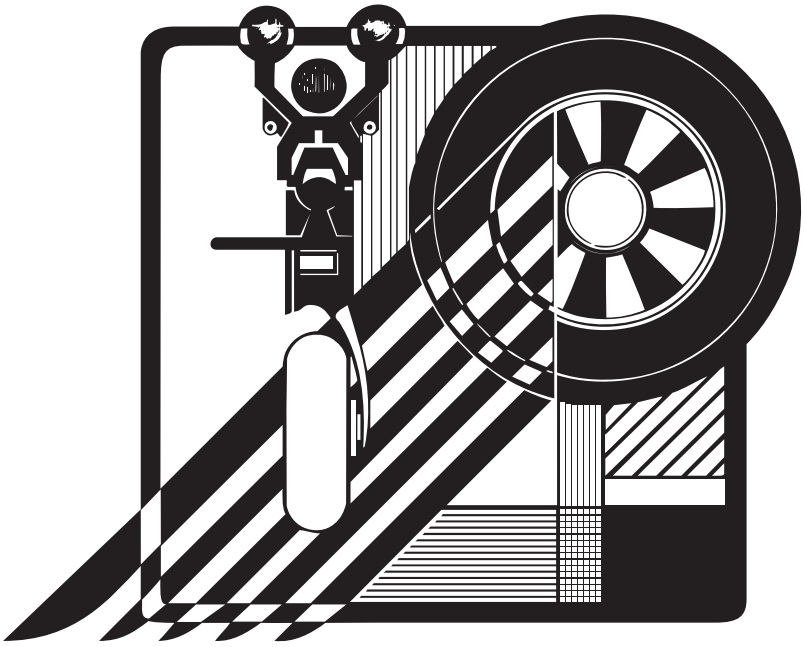
CHAPTER 14
LANDING GEAR AND BRAKES



INTRODUCTION

This chapter describes the retractable tricycle configuration landing gear system of the Challenger 300. A discussion of the nosewheel steering system, antiskid system, and dual wheel assemblies and braking system is also included.

GENERAL

The landing gear system has two main landing gear assemblies and a steerable nose gear assembly (Figure 14-1). Each landing gear assembly has twin wheels and tires. The left hydraulic system powers normal extension and retraction. A manual release system deploys the landing gear if normal extension is inoperative.

The proximity sensing system monitors landing gear position. A combination of EICAS messages and aural alerts display gear position.

Each of the main landing gear is equipped with self-adjusting carbon brakes. The left hydraulic system powers brakes of the inboard wheels while the right hydraulic system powers outboard wheels.

Antiskid control and locked-wheel protection are also available. The PARK/EMER BRAKE operates inboard and outboard brakes. Antiskid is not available with emergency braking.

Major components and subsystems include the following:

- Main landing gear and doors
- Nose landing gear and doors
- Gear extension and retraction system
- Manual release system
- Steering control system
- Proximity sensing system
- Brake system
- EICAS messages and audio alerts

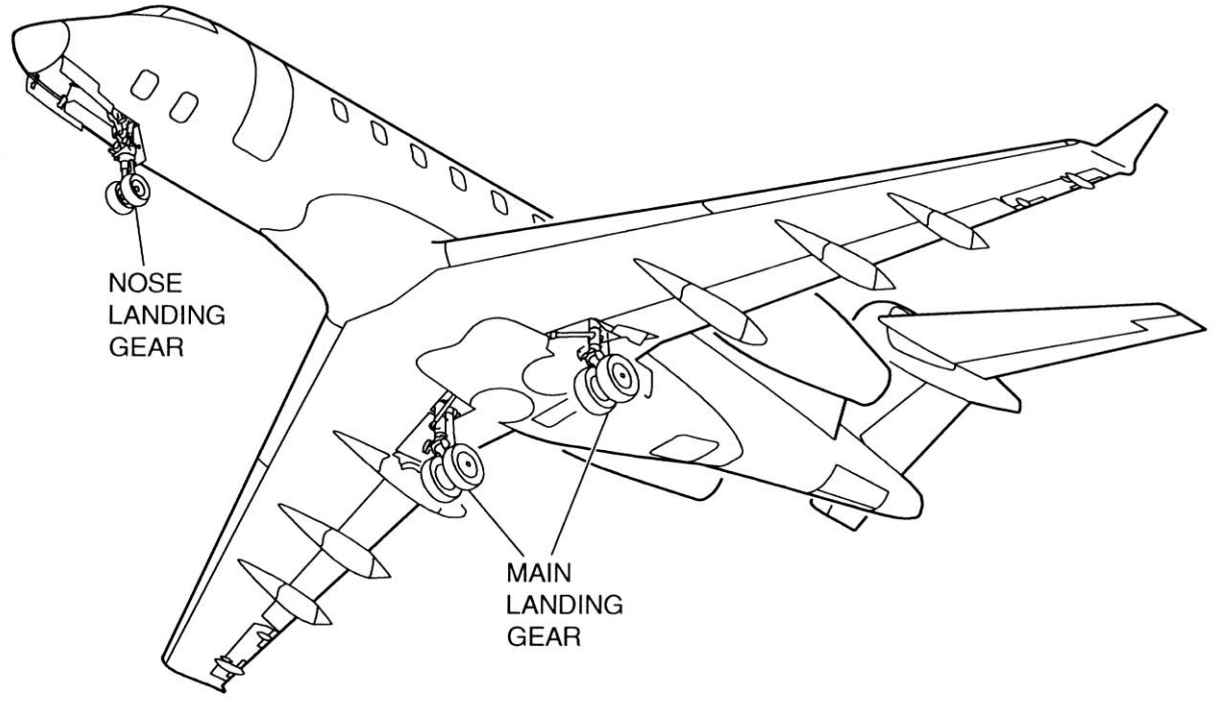


Figure 14-1. Landing Gear System

LANDING GEAR SYSTEM

MAIN LANDING GEAR

The main landing gear (MLG) consists of two shock strut type trailing link assemblies (Figure 14- 2). The main landing gear retracts toward the centerline of the fuselage. The left hydraulic system hydraulically actuates the main landing gear while the proximity sensing system electrically controls the gear.

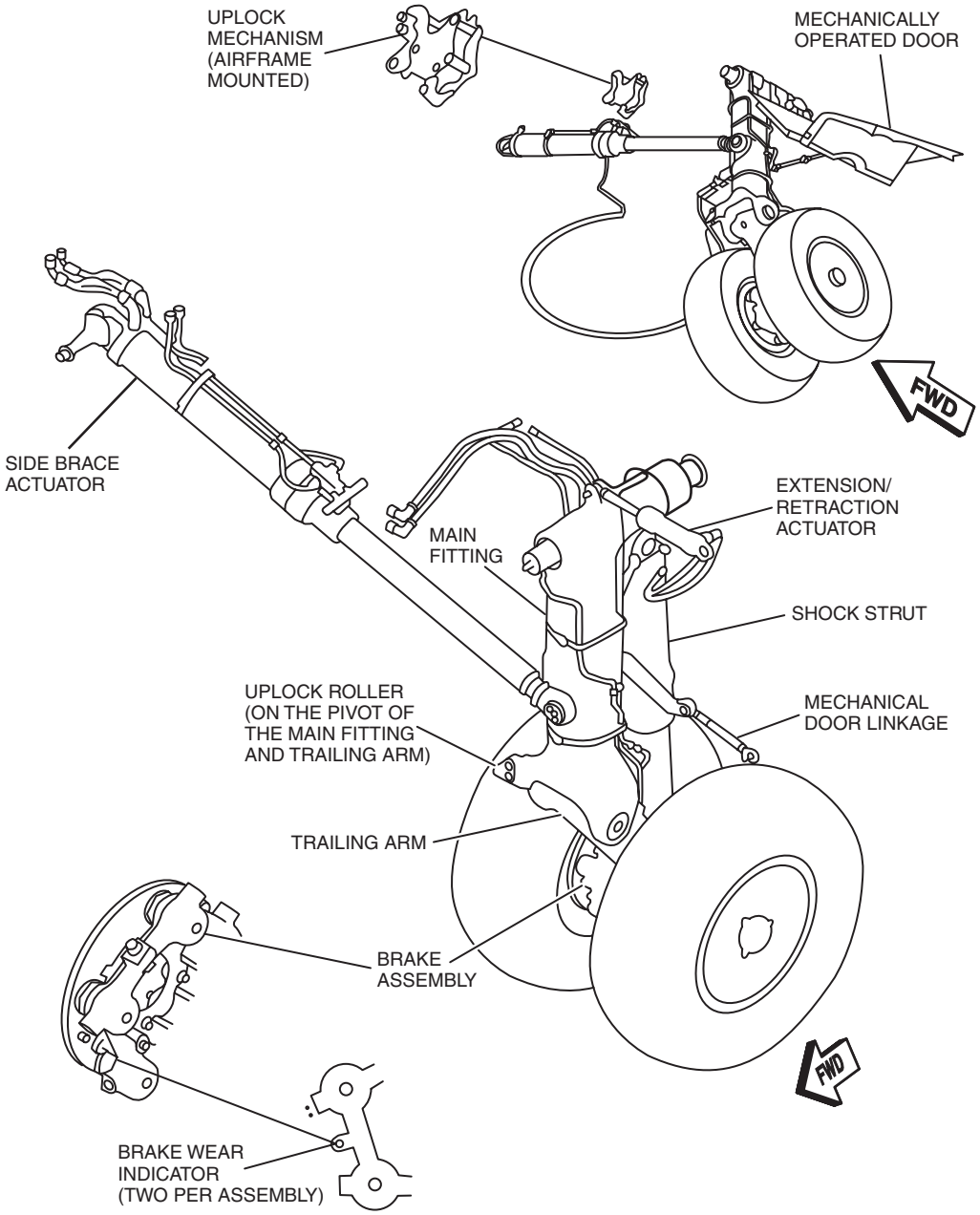


Figure 14-2. Main Landing Gear Components

Each main landing gear assembly consists of the following:

- Main landing door mechanism
- Main fitting
- Side brace actuator assembly
- Nitrogen gas/oil filled shock strut
- Trailing arm assembly
- Axle with carbon brake assemblies
- Dual wheels
- Uplock mechanism
- Extension and retraction actuator
- Auxiliary extend assembly
- Electrical harnesses and hydraulic dressings

Side Brace Actuator

A side brace actuator (Figure 14-3) hydraulically extends and retracts the main gear into the bay in the wing underside. The actuator is a hydraulic piston-cylinder actuator with an internal segmented downlocking mechanism. Each gear is held in the uplock position with an uplock assembly.

Figure 14-3. Side Brace Actuator

Main Gear Door

The main gear door, which is mechanically linked to the main gear assembly, moves with the gear during extension and retraction. Each main gear door is attached to the wing structure with two hinges (Figure 14-4). The main door structure is composed from a clad-aluminum alloy sheet. A nylon door brush on the bottom edge of the door creates a seal between the tire and fuselage.

Figure 14-4. Main Gear Door

Main Wheel Bins

Each main gear assembly retracts inward into wheel bins recessed into the MLG bay. The wheel bins isolate the wheels from the main gear bays and prevent tire-thrown debris from damaging equipment in the bay.

Each wheel bin contains a single loop overheat detection wire to provide a CAS warning should a wheel overheat. The bins can be removed to allow maintenance personnel access to the main landing gear bay.

Uplocks and Downlocks

Mechanical uplocks hold the main landing gear in the up-and-locked position. With the gear extended, locking mechanisms in the side-brace lock the gear in the down position.

Downlock Safety Pins

A downlock safety pin at the end of the side brace assembly secures each of the main gear in position while on the ground (Figure 14- 5).

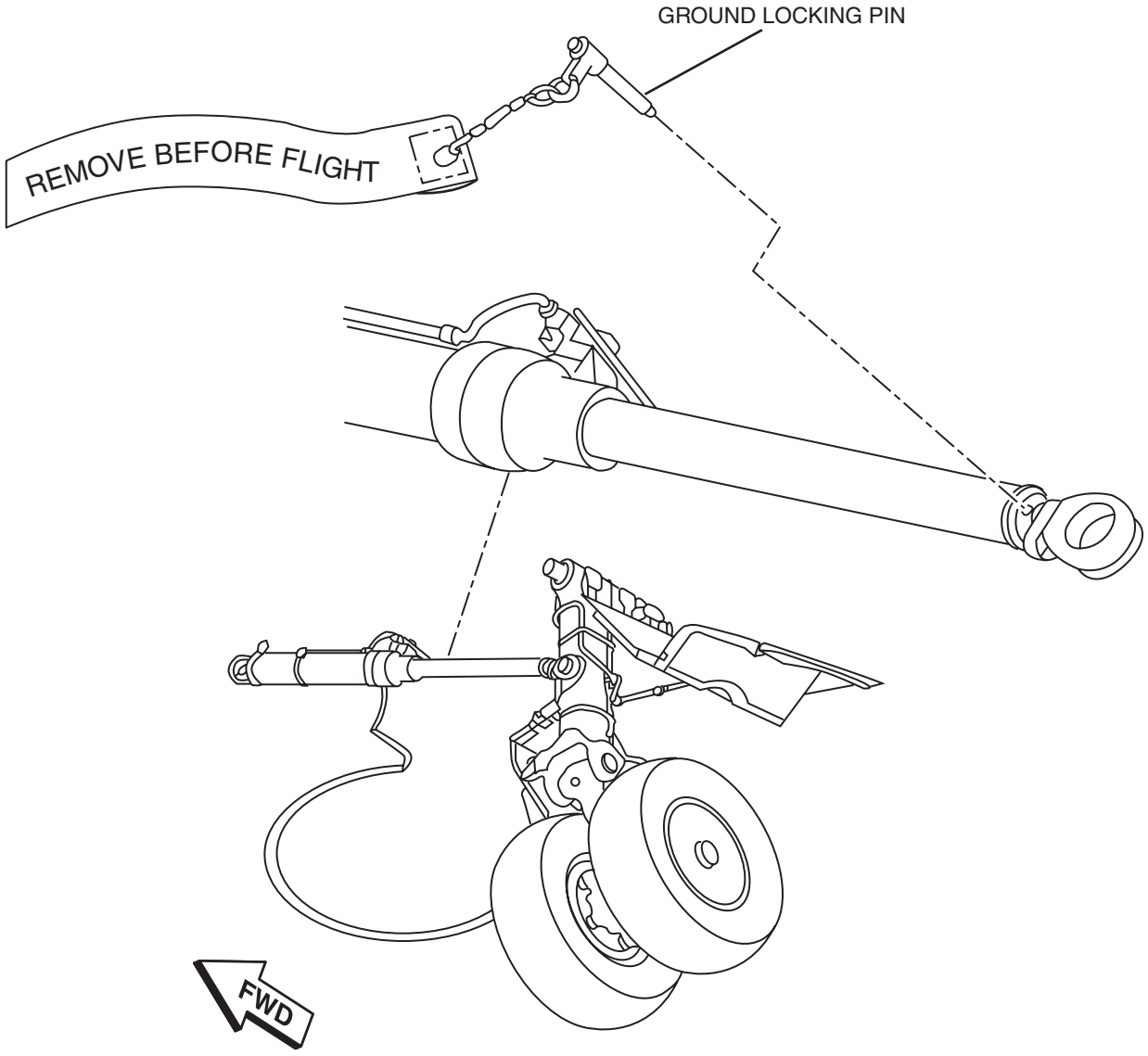


Figure 14-5. Main Gear Downlock Safety Pins

NOSE LANDING GEAR

The nose landing gear (NLG) consists of a twin wheel that retracts forward, a cantilever shock strut, and a folding drag strut with a mechanical downlock (Figure 14-6).

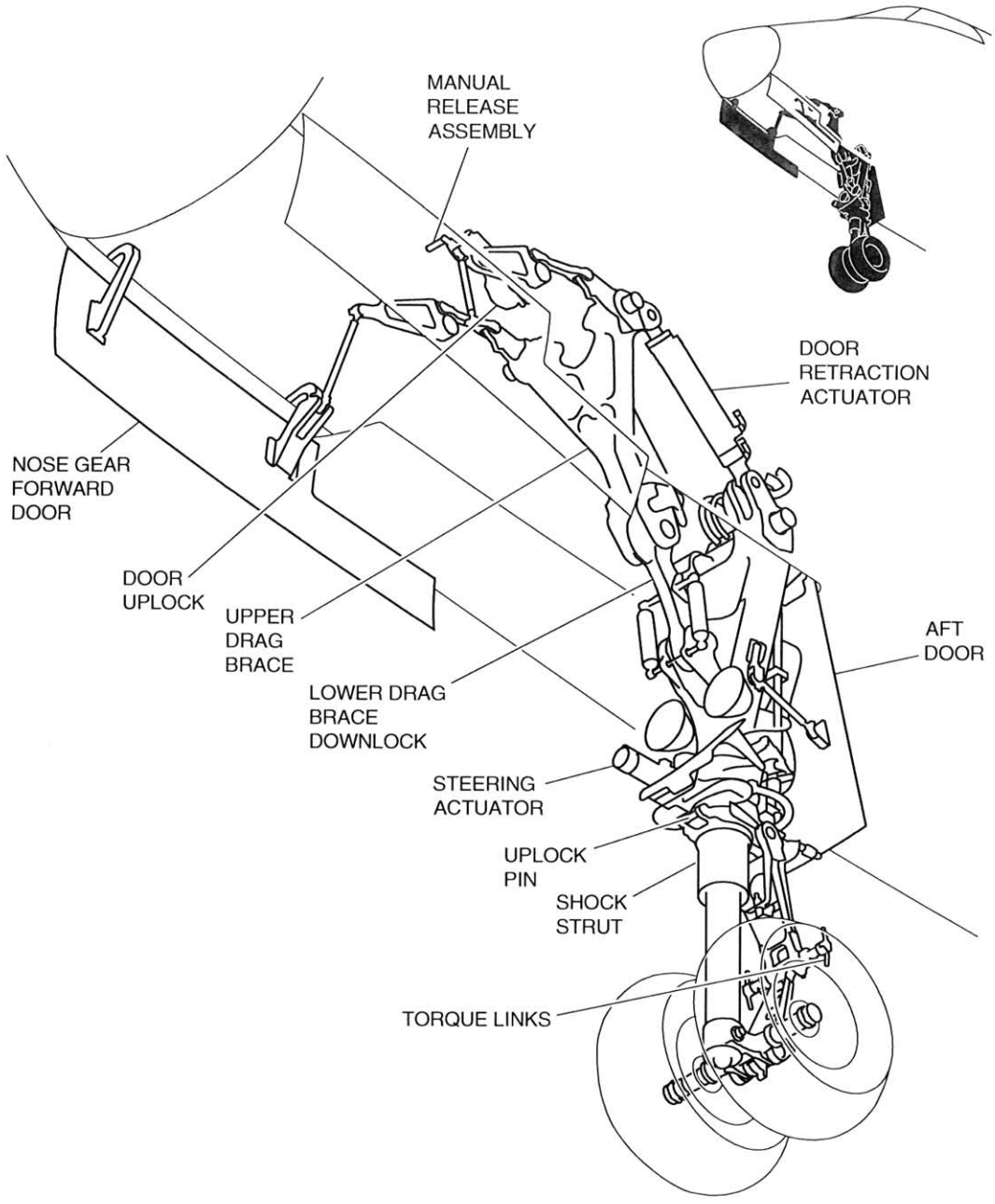


Figure 14-6. Nose Landing Gear

Major subassemblies of the nose landing gear include the following (Figure 14-7):

- Shock strut
- Retraction actuator
- Wheel and tire
- Drag brace and harness assemblies
- Hydraulic hoses
- Taxi/landing lights (refer to Chapter 3—Lighting)

Figure 14-7. Subassemblies—Nose Gear

The left hydraulic system actuates the nose landing gear. The proximity sensor system electrically controls the nose gear through the proximity sensor electronic unit and landing gear handle.

Selecting the desired landing gear position UP or DOWN with the control handle on the main instrument panel initiates normal landing gear extension and retraction.

After takeoff, upon gear retraction, the steering control unit (SCU) electronically centers the nose gear.

A spring-operated external lock mechanism on the drag brace mechanically locks the nose gear in the extended position.

A nose landing gear ground locking pin can be inserted into the upper drag brace subassembly to prevent inadvertent unlocking while the aircraft is on the ground.

The nose landing gear also contains the steering manifold assembly and steering actuator. See "Nosewheel Steering" section in this chapter.

Nose Doors

The nose doors (Figure 14-8) provide aerodynamic smoothness to the fuselage when the nose landing gear is retracted in the wheel well.

Figure 14-8. Nose Doors

The aft door, which is mechanically attached to the landing gear assembly, provides partial enclosure of the gear. Two control rods attach the aft door to the nose gear shock strut. A hinge attaches the aft door to the fuselage structure.

The forward doors attach to the left and right sides of the wheel well with hinges (Figure 14-9). The nose gear system operates the mechanically linked doors. Each of the two forward-door mechanisms has a link that operates a bell crank and control rod.

When the nose gear is retracted, the mechanisms pull the two forward doors fully closed. When the nose gear is down, the forward doors and aft door remain open.

Figure 14-9. Forward Nose Doors

Downlock Safety Pin

A downlock safety pin within the drag brace assembly secures the nose landing gear in position while on the ground (Figure 14-10).

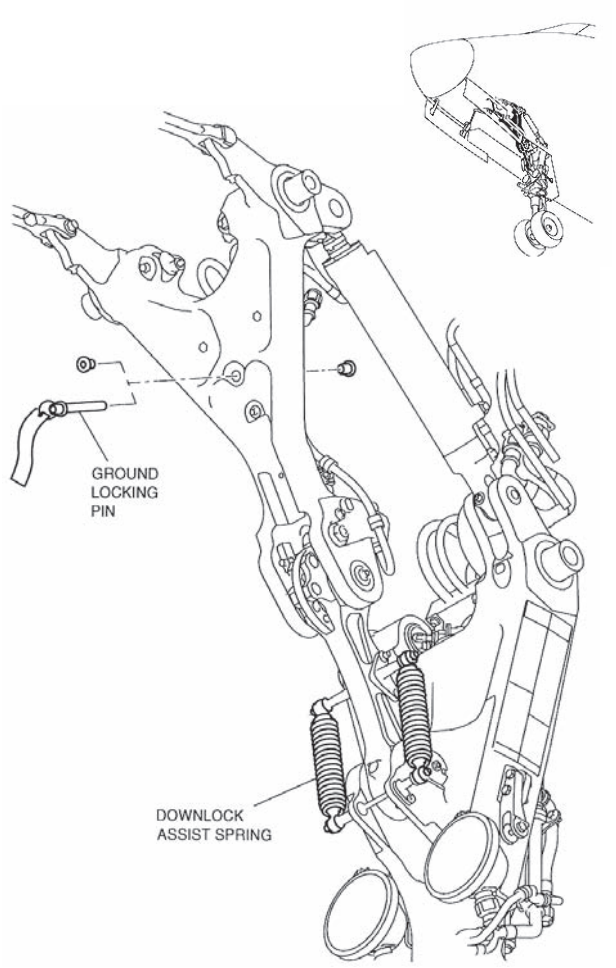


Figure 14-10. Downlock Safety Pin

PROXIMITY SENSING SYSTEM

The proximity sensing system sequences the landing gear operation. It also monitors the aircraft doors, thrust levers, and spoiler position. The system consists of the proximity sensing electronic unit (PSEU) and proximity sensors.

The PSEU processes data from the LANDING GEAR selector handle and various proximity sensors to sequence the landing gear and program other aircraft systems for flight and ground operations.

The PSEU also monitors the position of the landing gear, uplocks, and downlocks. During normal extension and retraction, the PSEU electrically controls the hydraulic selector valves.

After takeoff, the PSEU disables the normal brakes and nosewheel steering systems. At touchdown, it re-arms the systems for use during the landing roll and taxi.

The sensors measure the physical relationship between two aircraft components. If the components are close, the sensors provide a near signal. If the components are separated, a far signal is generated. The PSEU processes this information to command landing gear and other aircraft systems operation.

NOTE

Dual proximity sensors on each of the landing gear, supply the PSEU with weight-on-wheels (WOW) information. The dual main landing gear WOW sensors and dual nose landing gear WOW sensors provide redundancy if a failure of any one WOW proximity sensor fails.

LANDING GEAR WARNING SYSTEM

The PSEU uses inputs from various proximity sensors to determine the status of the landing gear. The resulting output is sent to EICAS, which monitors the condition and position display of each item. A GEAR DISAGREE caution message is posted if any of the following conditions occur:

- Any gear remains in-transit for more than 28 seconds
- Position of at least one gear does not agree with gear control lever except during normal transit
- Landing gear handle is left in the up position during manual extension

The gear down, in-transit, and disagree conditions are displayed as long as the condition exists. The gear and flaps display is removed from the primary page 30 seconds after the flaps are retracted and the gear is up.

Aural Warning

When the red GEAR warning CAS message illuminates and the affected gear icon(s) turns red, mutable and non-mutable GEAR voice warnings sound. Although a valid muting command may be applied, the visual cues remain and can not be suppressed as long as the conditions triggering the original warning persist.

When permitted, pressing the master warning/master caution switch on the glareshield mutes the voice warning. The warning automatically resets if the condition no longer exists. The warning becomes active again on a subsequent landing attempt if the logic conditions are met.

The logic driving the mutable and non-mutable warnings ensure adequate time to either lock the gear down or perform a go-around.

Nonmutable Warning

The aural GEAR is nonmutable if the following conditions occur:

- Any gear not down and locked and
- Radio altimeter valid with reading <500 feet and
- Left and right thrust levers <26° thrust lever angle or flaps ≥27°

Mutable Warning

If the radio altimeter is inoperative, the GEAR voice warning is a mutable condition. This mutable GEAR voice warning sounds when the following occur:

- Any gear not down and locked and
- Radio altimeter invalid and
- Left and right thrust levers <26° thrust lever angle and
- Altitude <15 000 feet and
- One of the following:
  - Airspeed <170 KIAS and flaps <3°
  - Airspeed <160 KIAS with flaps <13°
  - Airspeed <155 KIAS with flaps>13°

LANDING GEAR INDICATIONS

The EICAS landing gear indications provide the positions of the landing gear.

In flight, position is provided on the EICAS as depicted in Figure 14-11.

When the magenta symbol displays, data from the proximity sensor systems is not available or is invalid.

Downlocked Safe

When green DN displays, at least one of the two redundant downlock sensors detects that the gear is down and locked.

Landing Gear Up

The uplock sensor detects gear up and both downlock sensors detect gear not downlocked.

The color of UP indicates the following:

White—Gear up, no gear warning, and either no gear disagree or gear disagree with handle up

Yellow—Gear up, no gear warning, and gear disagree and gear handle down

Red—Gear up and gear warning

Landing Gear in Transit

Uplock and downlock sensors detect gear is not locked.

The color of symbol indicates the following:

White—Gear in transit and no gear disagree and no gear warning

Yellow—Gear in transit and gear disagree and no gear warning

Red—Gear in transit and gear warning

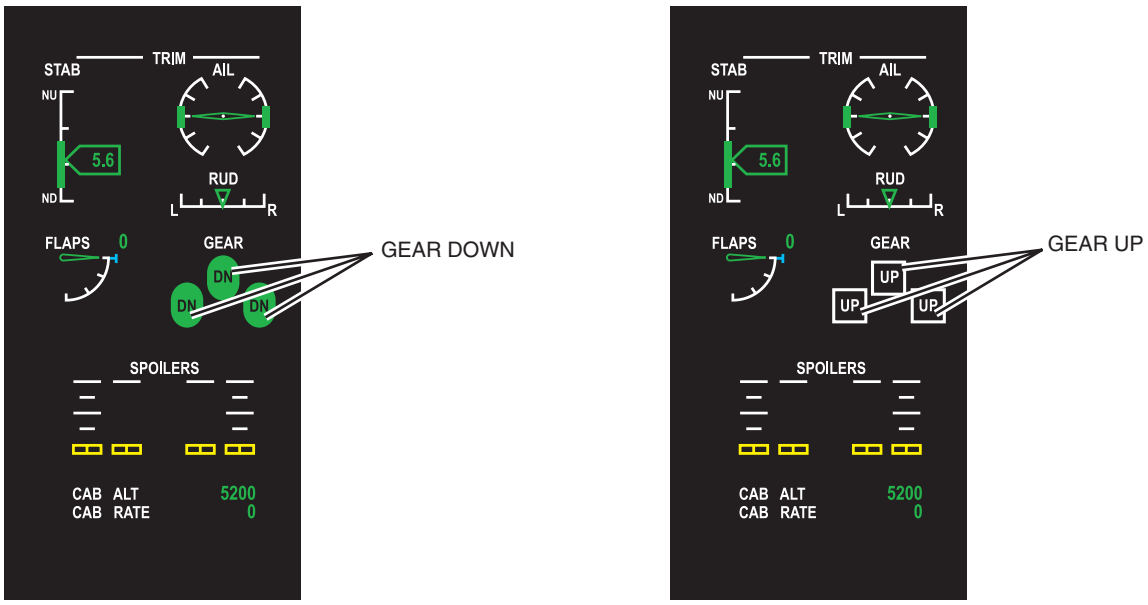


Figure 14-11. Landing Gear Indication

OPERATION

The flight crew activates the normal gear extension and retraction, emergency extension, nosewheel steering, and warning horn mute.

The LANDING GEAR control contains the NWS switch for nosewheel steering and the landing gear handle (Figure 14-12). Limitations for extension (VLO 250/VLE 250) and retraction (VLO 200) are displayed on the panel.

Selecting the landing gear switch UP or DN initiates normal retraction and extension of the landing gear. The retraction or extension signal is sent to the proximity sensor system that monitors various gear proximity sensors and weight-on-wheels (WOW) inputs. If the correct parameters are met, the proximity system electronic unit (PSEU) energizes the selector valve to retract or extend. The left hydraulic system powers the operation.

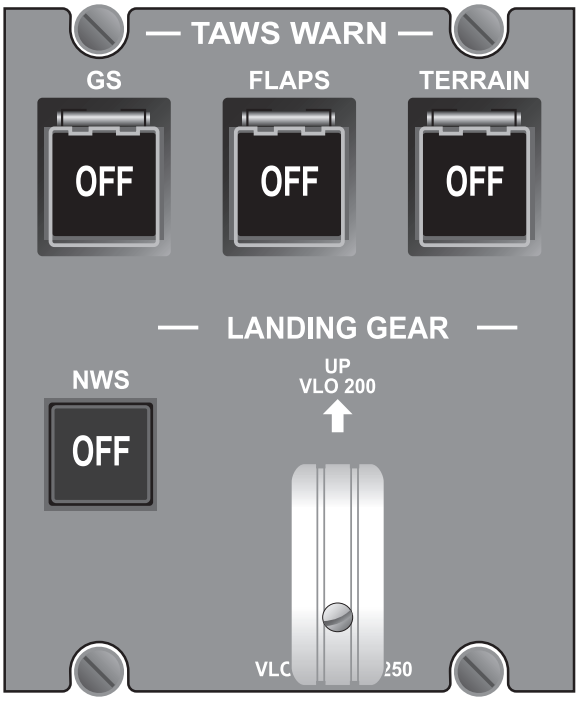


Figure 14-12. Landing Gear Control Panel

Gear Extension

During gear extension (Figure 14-13), the nose landing gear extends rearward and the main landing gear extends outward. The PSEU commands and monitors the events.

When the landing gear switch is selected to the DN position, the landing gear selector valve is energized to direct hydraulic fluid to release the uplocks and extend the nose landing gear and main landing gear. The main and nose landing gear downlocks are hydraulically and mechanically engaged to secure the landing gear in the extended position.

Gear Retraction

During retraction (Figure 14-14), the nose gear retracts forward and the main gear retract inward. The PSEU commands and monitors gear retraction.

The landing gear selector valve is energized to direct hydraulic fluid to release the downlocks and retract the main and nose landing gear. This retracts the main and nose landing gear. The brake control unit commands a brake pressure of 350 psi for four seconds during gear retraction to ensure main wheels have stopped spinning as they enter the bay.

When the gear is fully retracted, the landing gear mechanical uplocks are engaged.

A restrictor is installed in the nose landing gear wheel well in the “up” hydraulic line. When the landing gear selector handle is selected UP, the restrictor decreases hydraulic fluid flow to decrease retraction speed. This allows the nose landing gear to retract smoothly with less noise.

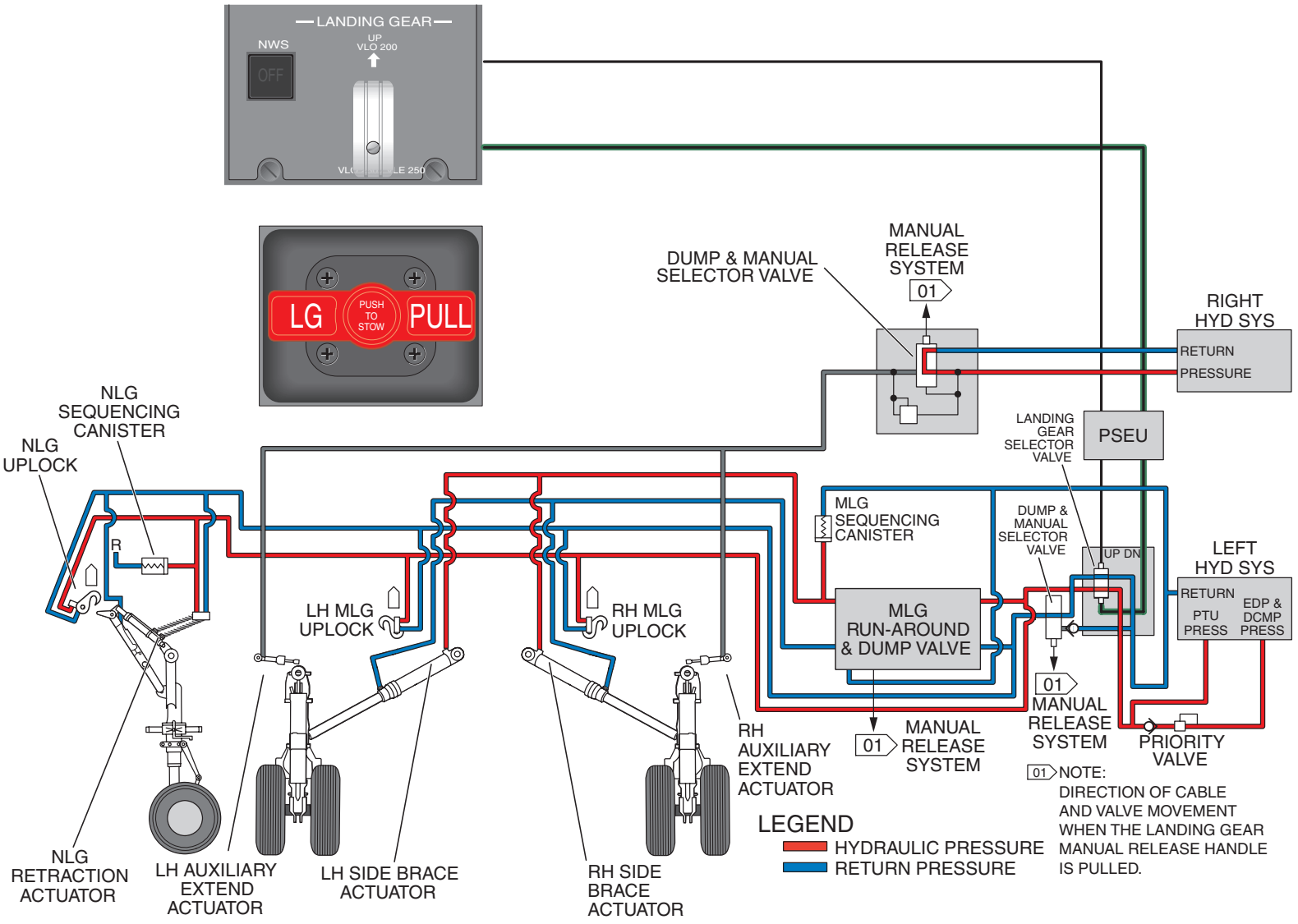


Figure 14-13. Landing Gear Down

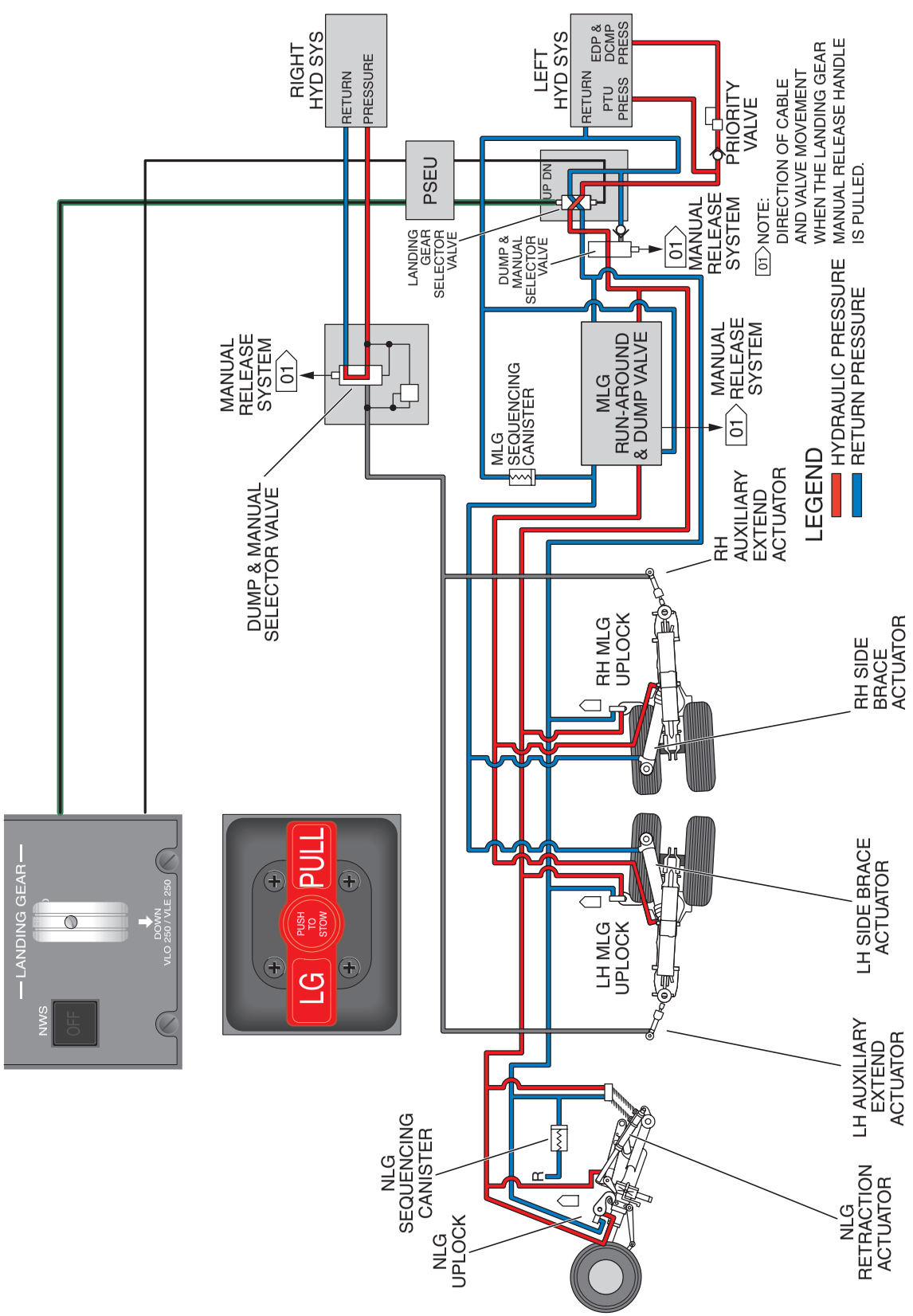


Figure 14-14. Landing Gear Up

MANUAL RELEASE SYSTEM

If the landing gear control circuitry or the left hydraulic system fails, a manual release system is available as an alternate means to extend the landing gear. Auxiliary extend actuators assist in the extension of the main landing gear. The nose landing gear fully extends with the aid of gravity and spring forces.

During normal operation, the auxiliary extend actuators are bypassed to the right hydraulic system return so the piston moves freely as the landing gear extend and retract.

Release Handle

The manual release handle is near the rear of the center pedestal on the copilot side (Figure 14-15). Operating the handle transmits cable movement through the main quadrant. This is done through a closed loop cable assembly to the main landing gear quadrant and main landing gear valve assemblies.

The displacement of the spools on the two dump valves blocks the supply of hydraulic pressure. It also connects the downstream landing gear components via the return lines to the left hydraulic system reservoir, thus bypassing the landing gear actuators.

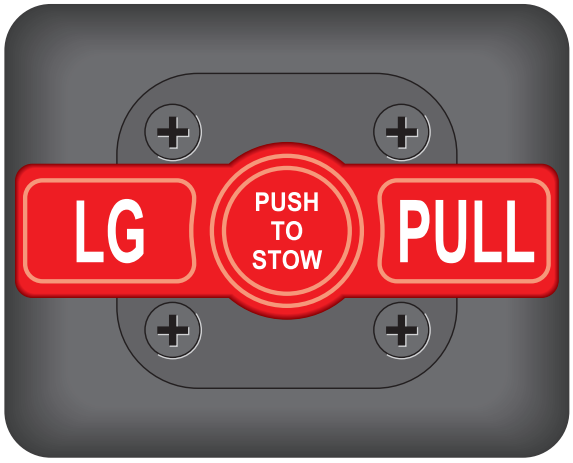


Figure 14-15. Release Handle

Main Gear

The main landing gear quadrant operates the MLG uplock manual release levers via tension cables (Figure 14-16). Displacement of the uplocks releases the main gear for gravity extension.

When activated by the MLG quadrant, the manual selector valve admits pressure from the right hydraulic system supported by an accumulator to both auxiliary extend actuators to assist the main landing gear into downlock. The mechanical locks in the side brace actuator then engage to lock the gear down.

Nose Gear

Manual release handle movement is transmitted from the main quadrant to the manual release lever on the nose landing gear uplock. The uplock then releases to extend the nose landing gear to the down and locked position.

Stowing

Moving the manual release handle to the stowed position resets the landing gear extension and retraction system for normal operation. Landing gear retraction, however, is only initiated when the landing gear handle is moved to the UP position.

After an actual gear failure, the manual release handle should be stowed only after the aircraft has landed and the gear pins have been installed.

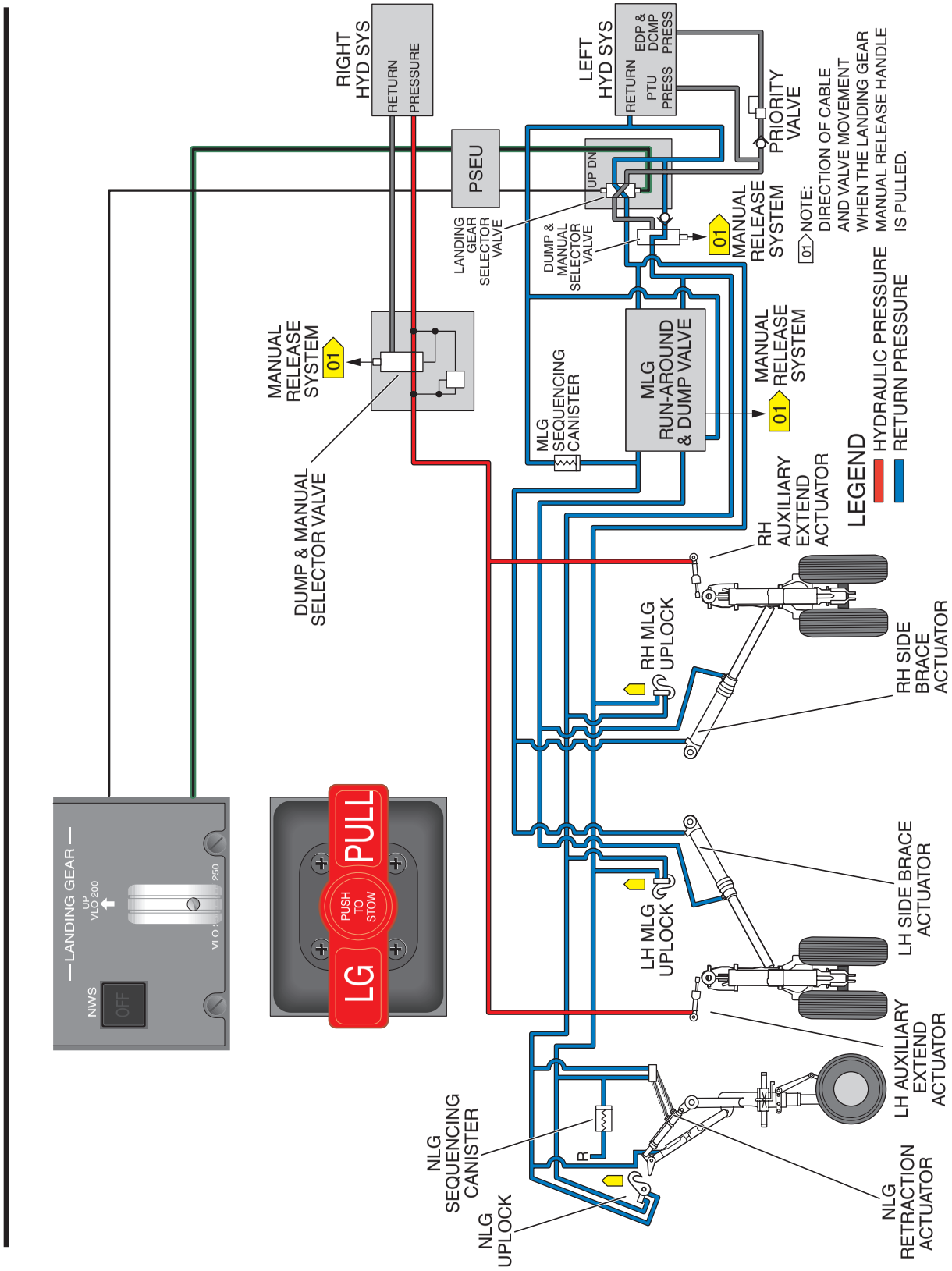


Figure 14-16. Emergendy Gear Extension

BRAKE SYSTEM

The Challenger 300 has a main braking and emergency/parking brake system to provide stable braking control under all operating conditions.

The aircraft has dual wheel assemblies and brakes on each main landing gear (Figure 14-17). The nose gear has two wheels with chine tires to eject the ground water away from the aircraft engines.

The speed limit of all tires is 182 kt. To prevent tire burst, each main wheel has four heat sensitive fusible plugs that melt when heat buildup in the wheel/tire assembly exceeds a preset value. This permits the tire to deflate safely.

The PARK/EMER BRAKE handle on center pedestal controls the emergency/parking brake system.

The main landing gear overheat detection system generates CAS messages to indicate an overheat condition (see Chapter 8—Fire Protection for details).

Figure 14-17. Dual Wheel Assembly

MAIN BRAKING SYSTEM

Each wheel of the main landing gear is equipped with self-adjusting multidisc carbon brakes (Figure 14-18).

The brake control system is partitioned into two separate braking channels. One channel controls braking and antiskid operation for the inboard wheels while the second controls the outboard wheels. An independent hydraulic system and an independent electrical power source power each braking channel.

Figure 14-18. Brake Discs

Brake Control System

The brake control system provides brake pressure application, antiskid protection, touchdown protection, locked wheel crossover protection, gear retract braking and pressure control functions (Figure 14-19).

When the landing gear is selected down or when ground mode is detected, the braking control system energizes the inboard and outboard shutoff valves so hydraulic pressure reaches the inboard and outboard brake control valves. Either left or right weight-on-wheels input from proximity sensors for more than five seconds or achievement of wheel spin-up greater than 50 kts establishes ground mode.

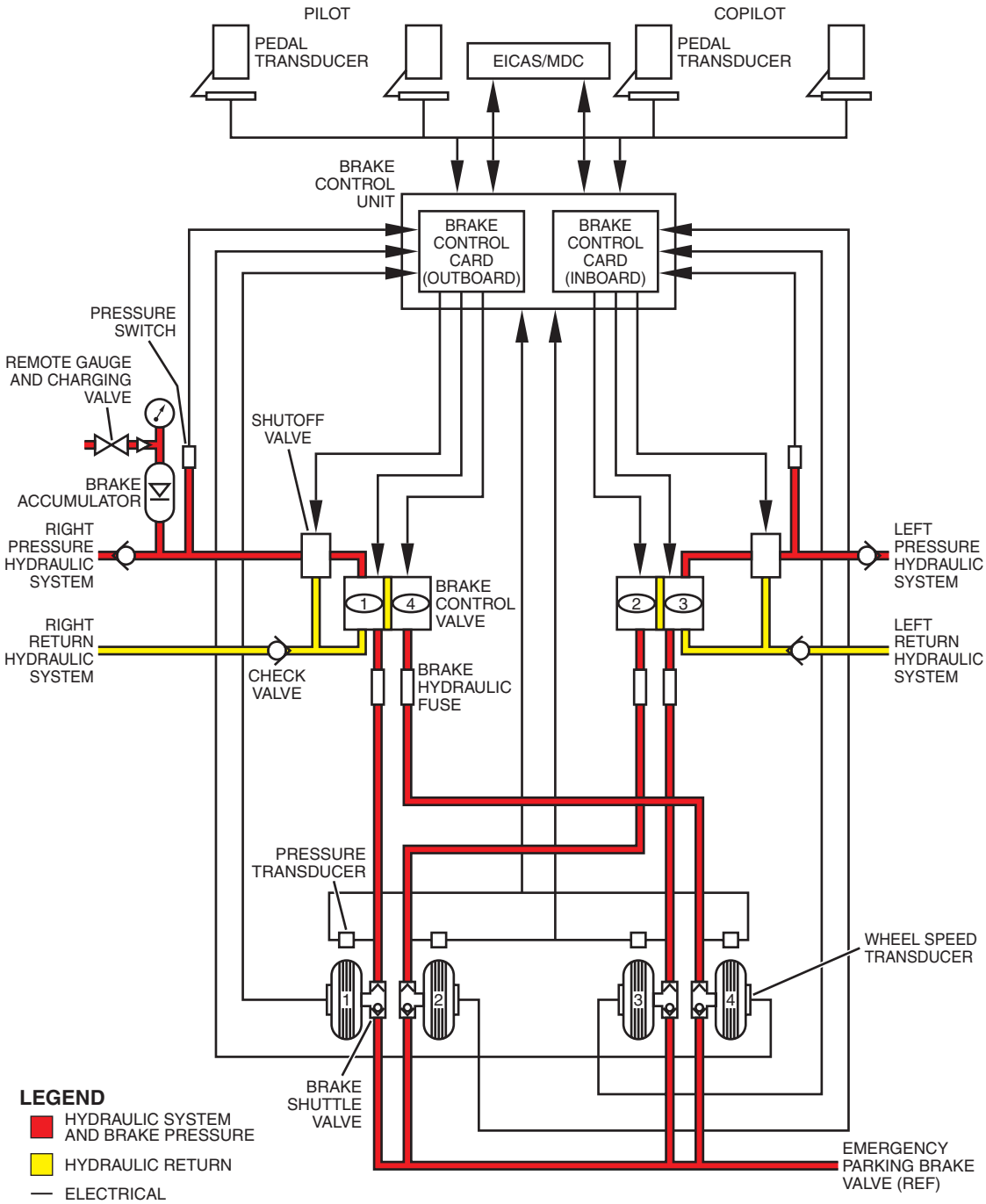


Figure 14-19. Brake Control System

Brake Control Unit

Full braking authority and differential braking are available to both the pilot and copilot.

The brake control unit (BCU) uses the greater input of the two for the pedal brake command. The system provides low initial pressure gain to provide suitable pedal force to brake torque characteristics for adequate directional control during taxi.

Each braked wheel is fitted with a wheel speed transducer. The BCU monitors the wheel speed transducers to provide independent ant-skid protection down to 10 kts to each of the main wheels and to determine wheel speed thresholds for spin-up override and locked wheel crossover protection.

The BCU also uses the wheel speed transducers to provide wheel speed outputs for spoiler and thrust reverser deployment.

The BCU commands a brake pressure of 350 psi for four seconds during gear retraction to ensure the main wheels have stopped spinning as they enter the main landing gear bay.

The shutoff valves remove hydraulic pressure to the brake control valves to disarm the BCU during flight when the following requirements have been met:

- Weight-off -wheel on both main landing gears
- Landing gear handle up
- Wheel speeds and velocity reference equal zero

Wear Indicator Pins

Two brake wear indicator pins on each brake assembly provide a visual indication of brake wear (Figure 14-20). Service the brakes when the end of the wear indicator pin is flush with the top of the indicator housing.

Before conducting the visual indication of the pins, the parking brake must be set.

NOTE

The brake wear indicator pins must be checked with the brakes applied and the left and right hydraulic systems pressurized.

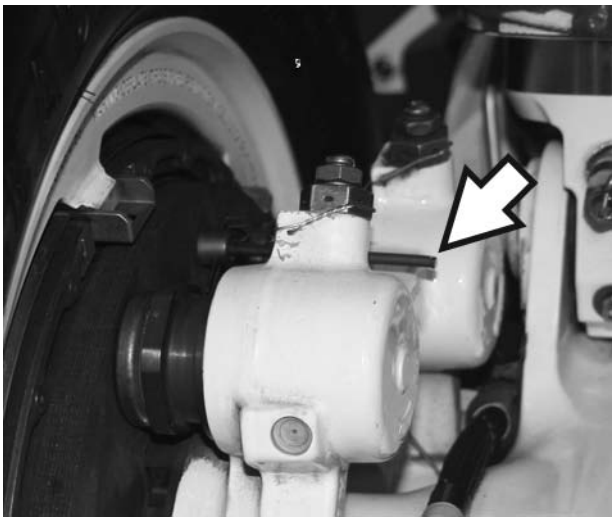


Figure 14-20. Wear Indicator Pins

Brake Accumulators

A main brake accumulator and a park/emergency brake accumulator provide brake pressure in the event of failure or deactivation of the hydraulic systems. Both accumulators are on the aft side of the underwing fairing support frame (Figure 14-21).

The main brake accumulator provides pressure to the outboard brakes to ensure that the aircraft can be stopped following a loss of all hydraulic systems.

The park/emergency brake accumulator retains pressure for extended parking periods and may also be used during a hydraulic system failure. This accumulator is connected to a gage and charge valve in the rear fuselage battery compartment.

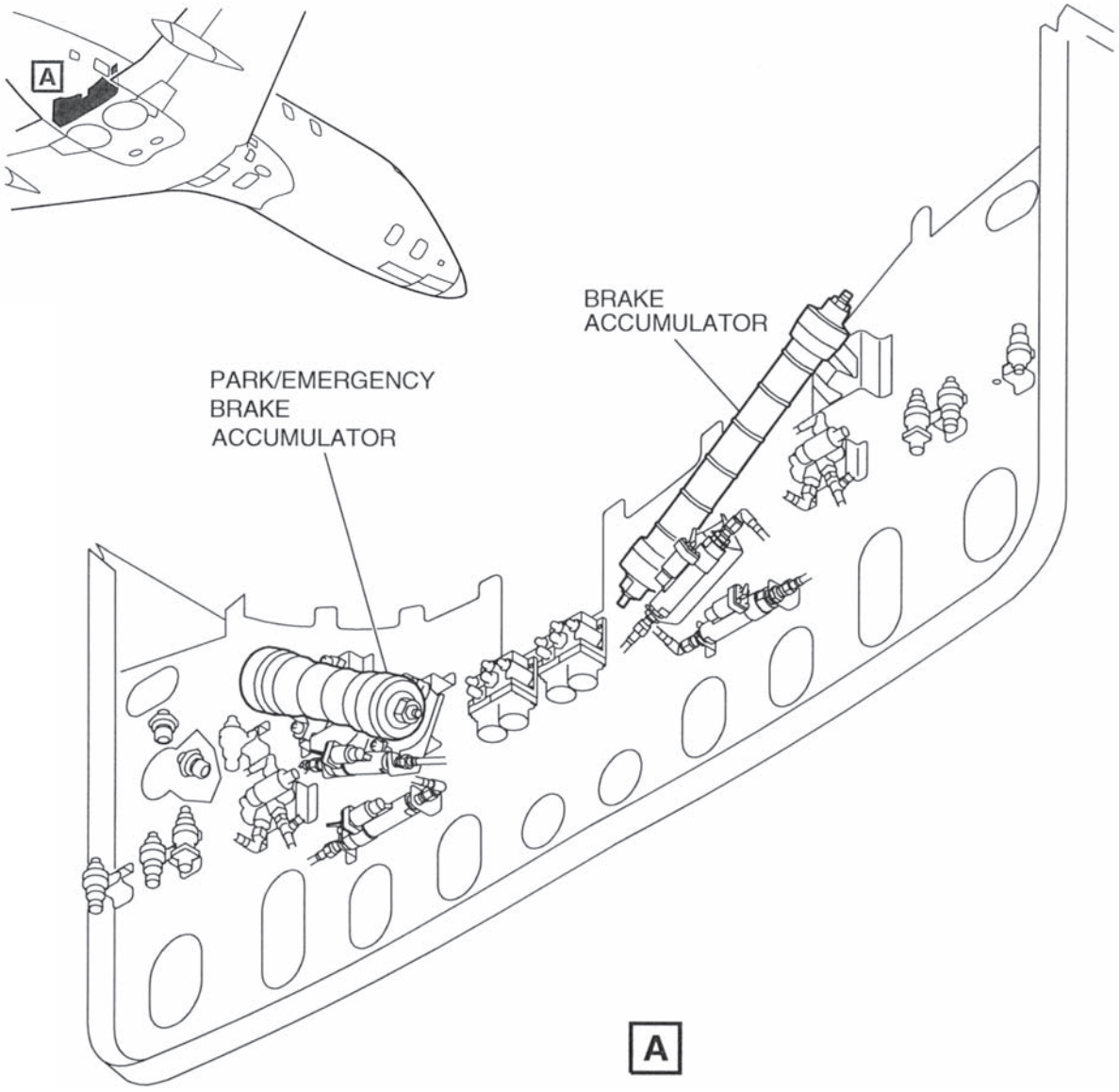


Figure 14-21. Brake Accumulators

EMERGENCY/PARKING BRAKE SYSTEM

An emergency/parking brake system is available for parking or braking the aircraft when normal brakes are inoperative. The system prevents the aircraft from rolling.

The PARK/EMER BRAKE handle mounted on the cockpit center pedestal controls the hydromechanical system (Figure 14-22). The handle increases brake pressure when pulled up and decreases brake pressure when it is allowed to return down.

The emergency/parking brake valve meters hydraulic system pressure to all four main wheel brakes as commanded through the handle. Hydraulic pressure from the emergency/parking brake valve is connected to each of the main wheel brakes by shuttle valves.

The emergency/parking system does not provide antiskid protection or differential braking.

Operation

Pulling the handle up until it latches initiates the park brake system. Pulling the handle up, pushing and holding the button on the end, and allowing the handle to retract down releases the system.

If toe brake pedals are depressed before the PARK/EMER BRAKE is set, hydraulic fluid from the right system pressurizes the outboard brakes. If the toe brakes are released prior to releasing the PARK/EMER BRAKE, the trapped hydraulic fluid returns to the left hydraulic system.

To prevent this hydraulic fluid migration from the right system to the left system, setting and releasing the PARK/EMER BRAKE must be done in a specific sequence.

If toe brake pedals are depressed prior to setting the PARK/EMER brake, then the toe brake pedals have to be depressed again prior to releasing the brake. If this sequence is not

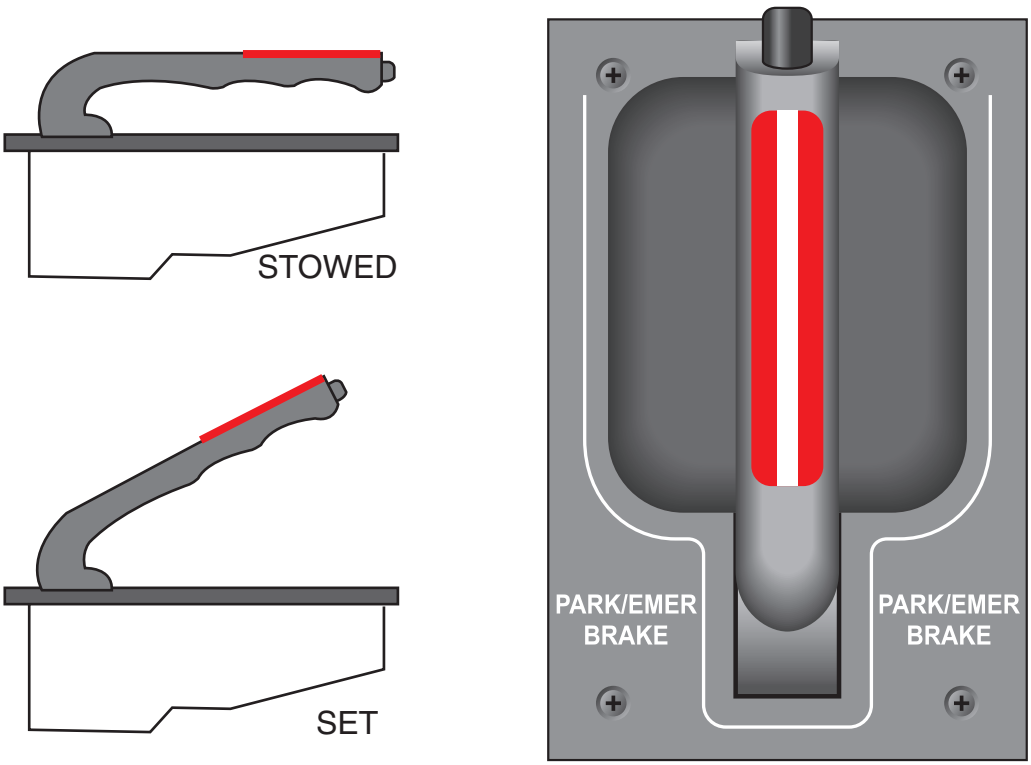


Figure 14-22. PARK/EMER BRAKE Handle

followed, the left hydraulic system eventually becomes over-full and the right hydraulic system low.

The park/emergency brake accumulator, charged by the left hydraulic system, allows extended parking or at least six emergency brake pressure applications. A pressure transducer provides accumulator pressure information to the crew.

EICAS indicates normal parking brake engagement or any fault detected with visual or aural messages.

ANTISKID

The antiskid function controls brake pressure to prevent skids. The brake control unit provides antiskid protection down to 10 kts to each of the main wheels.

Wheel speed transducers sense rotation speed and rate of deceleration of each wheel. This data is transmitted to the brake control unit which modulates hydraulic pressure at the brake.

By comparing the speed of each wheel on the same landing gear assembly, the system prevents lockup.

It also compares the speed between each wheel of the same brake system, outboard or inboard. For example, if the right inboard wheel rotates at a significantly slower speed than the left inboard, the brake control unit releases the brake on the slower turning wheel. When both paired wheels return to the same speed, the brake control unit reapplies brake pressure.

NOSEWHEEL STEERING

Nosewheel steering provides safe and reliable directional control of the aircraft during all phases of taxi, takeoff, and landing.

When nosewheel steering is not armed or has failed, the system continues to provide effective damping to ensure dynamic stability of the nose landing gear.

STEERING MANIFOLD AND ACTUATOR

The nose landing gear contains the steering manifold assembly and steering actuator for steering and castering functions during ground maneuvers. The steering actuator is electrically controlled and hydraulically powered.

NWS SWITCH

The NWS switch on the LANDING GEAR panel arms the system when selected on. The switch is illuminated in the OFF position (Figure 14-23).

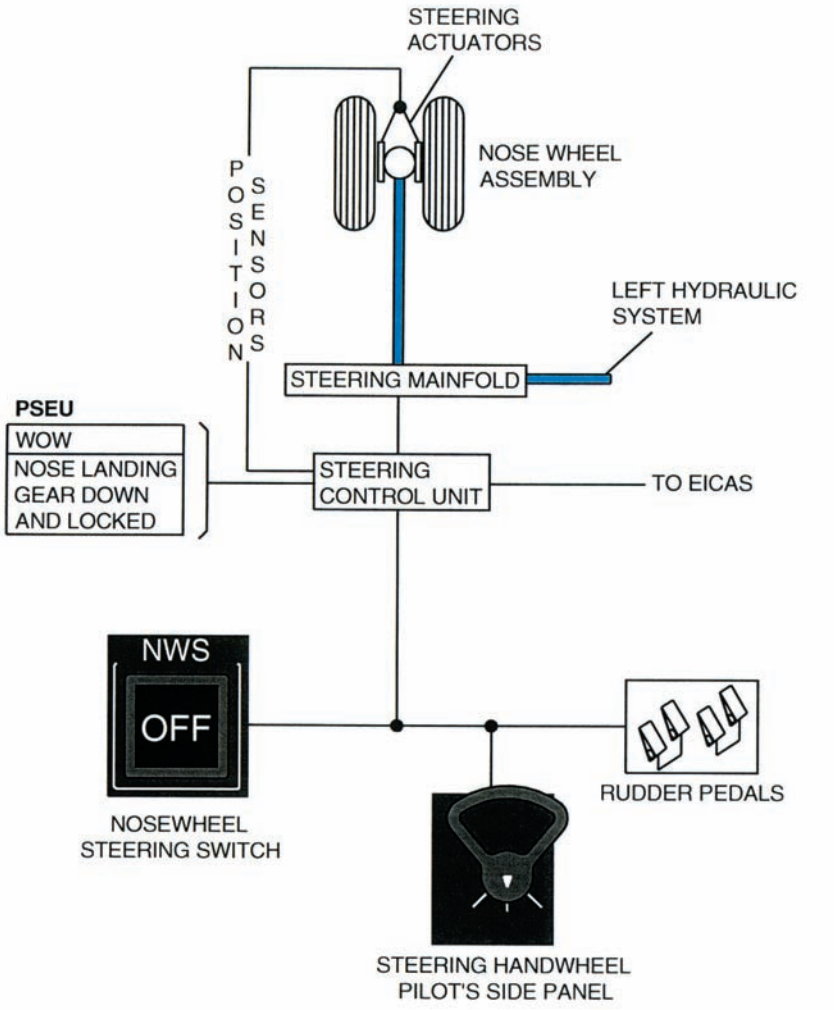


Figure 14-23. NWS Switch

STEERING CONTROL UNIT

The steering control unit (SCU) controls the electrohydraulic steering valve that ports hydraulic fluid to either end of the steering actuator (Figure 14-24).

Hydraulic pressure moves the rack. This action engages and rotates the pinion gear on the steering cuff. Mechanical torque links transmit the movement of the steering cuff to the nose landing gear axle.

Transducers on the steering actuator send nosewheel feedback to the SCU. The SCU continuously monitors. Fault detection results in steering system shutdown. Any faults detected are annunciated as CAS messages.

When the steering system is shut down or disarmed, the SCU reverts nosewheel steering to free castering mode.

WARNING

Prior to taxi, ensure the nosewheel assembly is clear of personnel and towing equipment before selecting steering on.

Figure 14-24. Nosewheel Steering Tiller

OPERATION

The nosewheel steering system is operable when the following occurs:

- Left hydraulic system pressurized
- Nose landing gear down and locked
- Nose landing gear in a weight-on-wheels condition
- NWS selected on
- No faults detected by the SCU

The full authority of the NWS system is 65° in either direction. Full steering authority is available through the pilot handwheel. Additionally, the rudder pedals command nosewheel steering up to 7° in either direction.

A position transducer on the nose landing gear provides position feedback to the SCU. Nosewheel steering commands are transmitted electronically with steer-by-wire technology. The cockpit controls and steering actuators have no mechanical connection.

TOWING LIMITS

With the torque link attached, the gear can only be rotated 120° in either direction. Attempting to rotate beyond this limit trips a switch that initiates display of an amber NWS LIMIT EXCEEDED message. Potential structural damage is possible.

In addition to the cockpit indication, the feedback mechanism also incorporates indicator pins at approximately 123° of steering angle. If the steering angle exceeds this value during towing while the torque links are connected, the pins yield. This indicates the need to inspect the feedback links for possible damage. Refer to the *Aircraft Maintenance Manual* for details.

For special hangar operations, the torque links may be disconnected to allow towing at any angle as long as the shock strut extension exceeds 3.50 inches of chrome showing.

EICAS MESSAGES

Table 14-1 lists the EICAS messages associated with the landing gear and brakes system, a brief explanation of the message, and whether the message is inhibited during takeoff and/or landing.

Table 14-1. EICAS MESSAGES

MESSAGE	INHIBITS	MEANING	AURAL WARNING
GEAR		Gear Warning—The GEAR CAS will be accompanied by gear icon on the EICAS for each gear that is not down and locked.	"Gear"
GEAR BAY OVHT	TO/LAND	An overheat condition has been detected in the main landing gear bays.	
NORM BRAKES FAIL	TO	The NORM BRAKES FAIL CAS indicates that all normal brakes have failed.	"Normal brakes fail"
BRAKE FAULT	TO	One or both pairs (inboard and/or outboard) of the brake pressure transducers has failed.	
CPLT BRAKE FAULT	TO	One or more of the copilot brake pedal sensors (LVDTs) has failed.	
GEAR DISAGREE	TO	This indicates that the landing gear position and the LANDING GEAR switch position do not match after the 28-second delay.	
GEAR SYS FAIL	TO	This indicates a complete failure of the gear control or the loss of the ARINC 429 signal from both channels. There is a potential for the loss of gear, door, and/or spoiler indications.	
L (R) INBD BRAKE FAIL	TO	The respective (left or right but not both) inboard normal system brake has failed.	
INBD BRAKE PRESS LO	TO	The INBD brake accumulator pressure is less than 1,400 psi.	
INBD BRAKES FAIL	TO	Both inboard normal system brakes failed.	
NOSE GEAR DOOR	TO/LAND	The nose gear doors are not closed, and the nose gear is up.	
NWS FAIL		The nose wheel steering system has failed. In the event the nose wheel steering system malfunctions internal monitors should disconnect the system allowing the nose wheels to castor.	
NWS LIMIT EXCEEDED		The nose wheel steering turning limit has been exceeded. There may be damage to the NLG feedback link.	
L (R) OUTBD BRAKE FAIL	TO	The respective (left or right but not both) outboard normal brake system has failed.	

Table 14-1. EICAS MESSAGES (Cont)

MESSAGE	INHIBITS	MEANING	AURAL WARNING
OUTBD BRAKE PRESS LO	TO	The OUTBD brake accumulator pressure is less than 1,400 psi.	
OUTBD BRAKES FAIL	TO	Left and right outboard normal brake systems have failed.	
PARK/EMER BRAKE ON	TO	Park brake pressure is sensed with weight-off-wheels. Do not cycle handle more than one time.	
PK/EMER BRK PRESS LO	TO	The INBD brake accumulator pressure is too low for full PARK/EMER brake performance (below 1,200 psi). Normal brakes should function properly.	
PLT BRAKE FAULT	TO	One or more of the pilot brake pedal sensors (LVDTs) has failed.	
WOW FAIL	TO	One or both of the following conditions exist: • Failures have been detected in two or more weight-on-wheels (WOW) sensors • Any disagreement or hardware failure of one or more WOW outputs associated with a critical function.	
BRAKE FAULT	TO/LAND	A minor brake system fault has occurred that does not affect brake performance. A subsequent brake failure could cause uncommanded braking.	
NWS FAULT	TO/LAND	The nose wheel steering selector valve is open. The system will operate normally.	
PROX SYS FAULT	TO/LAND	This indicates a failure in the proximity sensor channel or the loss of the signal from one of the channels.	
NWS OFF		The nose wheel steering has been selected OFF.	
PARK/EMER BRAKE ON		Park brake pressure is sensed while on the ground.	

QUESTIONS

1. The nose landing gear is actuated by:

a. The left hydraulic system
b. The right hydraulic system
c. The auxiliary hydraulic system
d. Accumulator pressure

2. The nose landing gear is centered:

a. Spring loading through the lock brace
b. By the nosewheel steering actuators
c. By the steering manifold assembly
d. Electronically by the steering control unit (SCU)

3. The speed limit for all tires is:

a. 176 knots
b. 182 knots
c. 184 knots
d. 192 knots

4. Rudder pressure commands nosewheel steering up to _____° in either direction:

a. 5
b. 7
c. 15
d. 20

5. The landing gear system is electronically controlled by:

a. The proximity sensing system
b. The brake control unit
c. The left DC power center
d. The right DC power center

6. The main landing gear is held in the up-and-locked position by:

a. Hydraulic uplocks
b. Overcenter mechanism
c. Mechanical uplocks
d. Electrohydraulic mechanism

7. Nose wheel steering using the tiller is limited to:

a. 7° either side of center
b. 20° either side of center
c. 40° either side of center
d. 65° either side of center

8. In case of failure of both the left and right hydraulic systems, accumulators in both hydraulic brake systems provide pressure for:

a. At least 4 brake applications
b. At least 5 brake applications
c. At least 6 brake applications
d. Unlimited brake applications

CHAPTER 15
FLIGHT CONTROLS

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CHAPTER 15
FLIGHT CONTROLS

INTRODUCTION

The Challenger 300's flight controls maneuver the aircraft around the three axes of flight. This chapter discusses the aircraft's primary and secondary flight controls. Also included are the stall protection system and the takeoff configuration warning system.

PRIMARY FLIGHT CONTROLS

Primary flight controls include the following:

- Ailerons and roll spoilers—Lateral (roll) control
- Elevators—Vertical (pitch) control
- Rudder—Longitudinal (yaw) control

The primary flight controls are arranged conventionally with dual control wheels, dual control columns, and dual rudder pedal assemblies. The aileron system is a reversible mechanical cable system. An electronic/hydraulic fly-by-wire system controls the spoilers. The elevators and rudder, which are mechanically controlled and hydraulically powered systems, have a manual reversion capability in case multiple hydraulic failures occur.

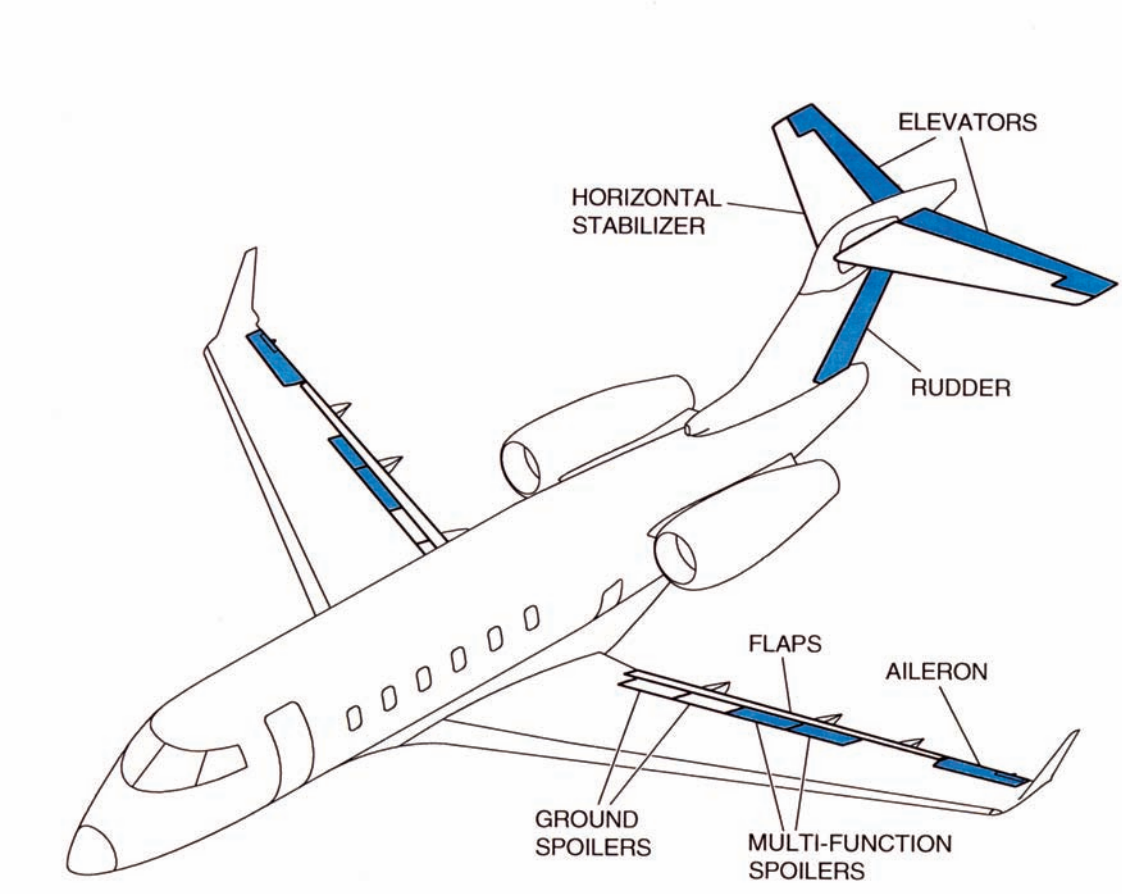

Figure 15-1. Flight Controls

AILERONS

The cable-operated ailerons control the roll of the aircraft (Figure 15-2). Each wing has an aileron and four spoiler panels. An aileron balance geared tab is mounted on each aileron to reduce roll control forces.

Figure 15-2. Cable-Operated Aileron

The two outboard panels are multifunction spoilers that operate asymmetrically in a roll, symmetrically for flight spoilers, and as ground spoilers on the ground.

The two inboard spoilers only operate on the ground. A single power control unit is used on each spoiler.

Control cables connect the ailerons to the cockpit control wheels. Because the control wheels are normally interconnected, there is a simultaneous and coordinated movement of all lateral control surfaces from either pilot station.

The pilot control wheel has a roll disconnect mechanism that disconnects the wheel from the aileron circuit. When disconnected, the pilot controls the roll spoilers and the copilot controls both ailerons.

A roll damper is mounted on the pilot control column. Under normal operation, the roll damper transmits all crew input. In case any aileron cable fails, the roll damper limits the rate the control wheel deflects (driving the roll spoilers) to a recoverable level.

The FLIGHT CONTROL synoptic page displays the aileron position. A full-scale deflection of the AIL indicator corresponds to maximum aileron deflection.

Multifunction Spoilers (MFS)

Moving the control wheels generates a signal to the spoiler electronic control units (SECU 1 and SECU 2), which control the extension/retraction of the multifunction spoilers (MFS). The SECUs combine the control wheel signals with other information to determine the required multifunction spoiler panel deflection for any given aircraft configuration. To assist the ailerons in roll control, the multifunction spoilers operate only on the "down-going" wing.

Balance Tabs

The balance tabs have a maximum ±15° degrees of travel each side of the aileron chord line. The balance tab consists of a constant length pushrod hinged at both ends on brackets rigidly mounted on the wing at one end and on the balance tab at the other end.

The mechanism acts as a linkage with the aileron surface being the driving link and the geared balance tab being the driven link. The aileron balance tab is geared to move in the opposite direction of its corresponding aileron's movement.

Gust Lock

The pilot can install a gust lock to prevent wind gusts from damaging the aileron surfaces when the aircraft is parked.

The lock is installed via a telescoping gust lock lever in the throttle quadrant. The lever moves a cable that engages a spring-loaded pawl into a quadrant mounted cam recess. When the gust lock is engaged, the throttles are physically prevented from being moved above idle.

Roll Disconnect

Roll disconnect on the left control wheel allows the crew to isolate the left control wheel from the aileron control system (Figure 15-3). If a jam occurs in the mechanical circuit, the pilot can disconnect from the aileron circuit and retain roll control through the multifunction spoilers. If a jam occurs in the pilot control wheel, the pilot can disconnect from the circuit. The copilot retains control of the ailerons.

A microswitch senses the retraction and signals the display of a red ROLL DISCONNECT warning on EICAS.

The controls may be reset in flight by realigning the control wheels and releasing the disconnect lever.

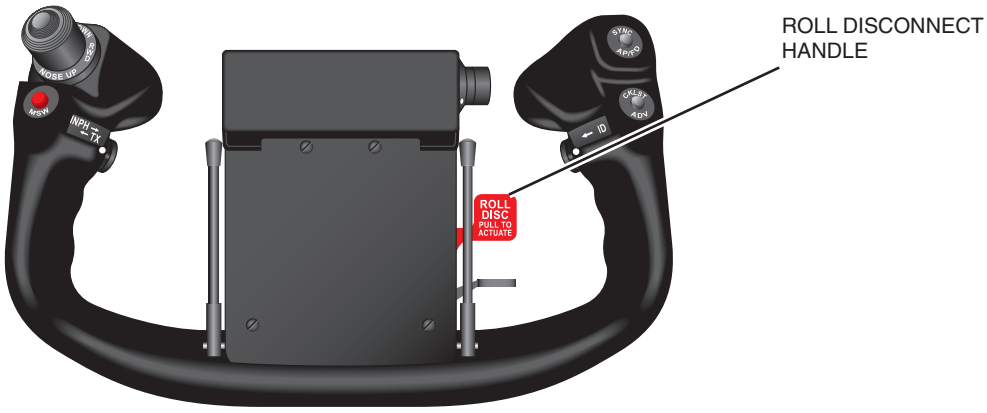

Figure 15-3. Roll Disconnect

RUDDER

The rudder (Figure 15-4) provides direction control about the yaw axis. The system is mechanically controlled and hydraulically powered.

Figure 15-4. Rudder

The mechanical part of the system has control pedals, levers, pulleys and cables that connect to two hydraulic power control units (PCUs) in the vertical stabilizer. The PCUs cause the rudder to move in proportion to pedal input.

A rudder-control feel unit supplies a simulated pedal load to the flight crew.

The pilot and copilot rudder pedal assemblies are connected to the forward quadrant assembly with no means to disconnect one from the other (Figure 15-5).

Two cable systems beginning at the forward quadrants follow the same path in the fuselage until they reach the engine rotor burst zone. There they are routed separately toward the rear fuselage. If a single cable in the rotor burst zone is severed, the aft quadrant still receives input from the unaffected cables to retain rudder system functionality.

On the ground, trapped hydraulic fluid provides rudder control surface gust lock damping when the hydraulic systems are depressurized.

The FLIGHT CONTROLS synoptic page displays rudder position. A full-scale deflection of the rudder indicator corresponds to maximum rudder travel.

Rudder Power Control Unit (PCU)

Two hydraulic rudder PCUs are attached to the rear spar of the vertical stabilizer. The left hydraulic system energizes the upper rudder PCU while the right hydraulic system energizes the lower rudder PCU.

If the right hydraulic system loses pressure, the auxiliary hydraulic system powers the lower rudder PCU.

The rudder PCUs also protect the rudder control surface against gust loads when the aircraft is on the ground.

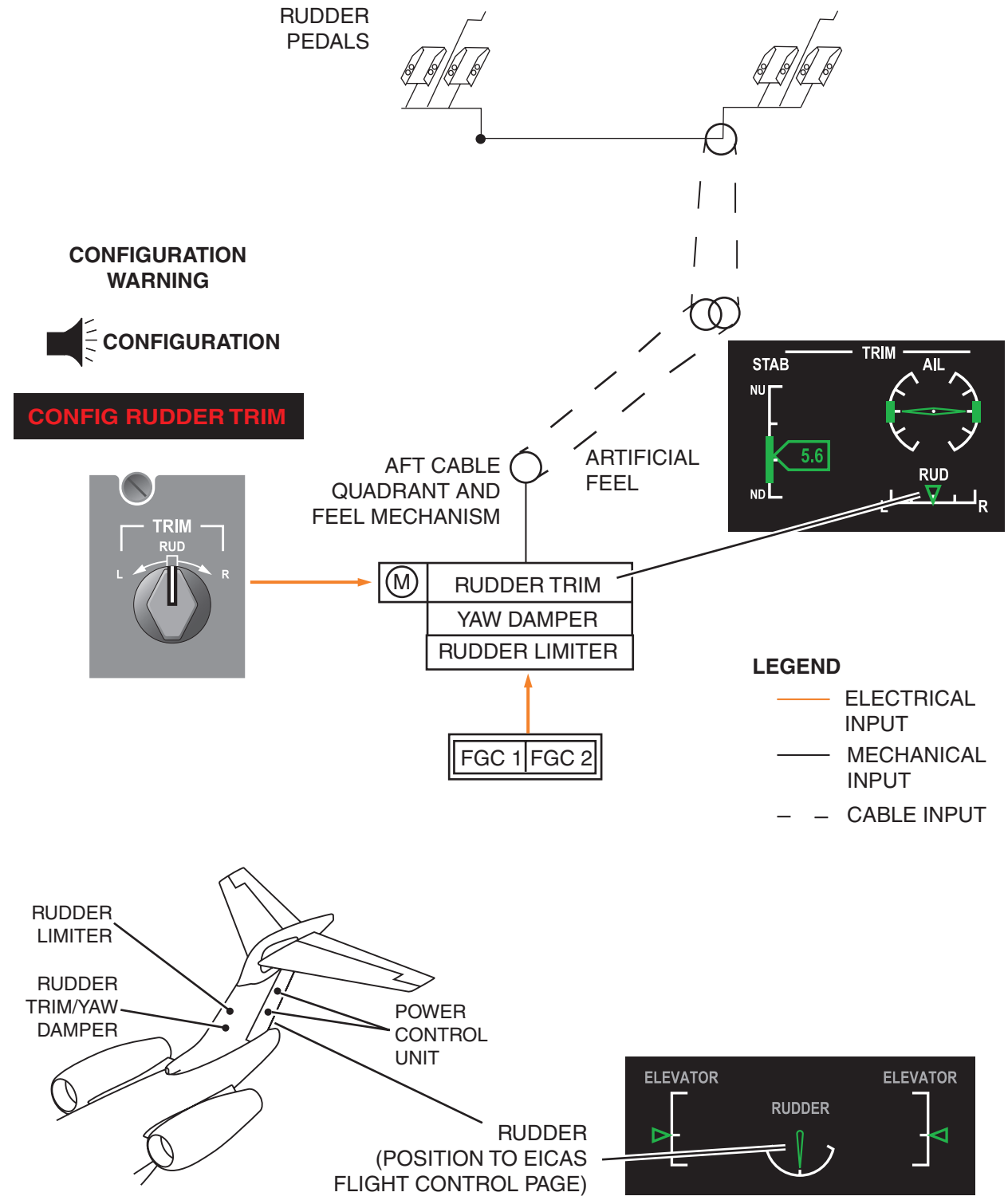

Figure 15-5. Rudder Pedal Assemblies

Rudder Travel Limiter

The rudder travel limiter actuator limits movement of the rudder control surface as a function of airspeed. This ensures that the aerodynamic force on the rudder is not more than the structural limit of the vertical stabilizer. The horizontal stabilizer trim electronic control unit (HST ECU) controls the movement of the rudder travel limiter actuator.

Yaw Damper

The yaw damper provides damping of the aircraft inherent dutch roll characteristic with yaw rate information from an attitude heading computer. It also provides turn coordination with roll attitude information from the same computer.

Because the yaw damper is installed in a series configuration, yaw damper movement does not move the pilot pedals. The system is mechanically limited to a ±5° of rudder motion.

The yaw damper button (YD) is on the glareshield flight guidance panel (FGP).

If the autopilot is engaged, the yaw damper is automatically engaged. However, the yaw damper may be engaged independently of the autopilot.

The YD switch engages and disengages the yaw damper. A self-test is performed upon every engagement. Disengaging the yaw damper disengages the autopilot.

The FGP AP/YD DISC bar provides a positive means of disengagement of the yaw damper. The yaw damper cannot engage when the bar is in the down (disconnect) position.

The yaw damper is active while on the ground if YD has been selected on the FGP. This allows the flight crew to observe yaw damper activity for system checks. When the aircraft accelerates above 60 kt IAS, the damping function is disabled until weight is off the wheels.

When the yaw damper channel fails or disconnects, an amber YAW DAMPER FAIL caution CAS message is displayed.

ELEVATORS

The elevators supplemented by a moveable horizontal stabilizer provide pitch control (Figure 15-6).

Figure 15-6. Elevator

Two power control units hydraulically power each of the two elevators. The PCUs are mechanically linked to the control columns via cable runs and quadrants. The left elevator PCUs are connected to the pilot control column, and the right elevator PCUs are connected to the copilot control column (Figure 15-7).

Normally, the control systems are interconnected and there is simultaneous movement of both elevators. If the elevator split is greater than 7.5°, an amber ELEVATOR SPLIT caution CAS message is displayed.

Elevator position is displayed on the FLIGHT CONTROLS synoptic page. A full-scale deflection of the elevator's position indicator corresponds to maximum travel.

Operation

Pilot inputs to the elevator are through dual control columns. These are connected through a torque tube so they rotate in unison.

A control rod transmits pilot commands to the left and right forward quadrants. The left side quadrant assembly includes a cable interface with the stick pusher servo of the stall protection system (Figure 15-8).

Separate left and right cable circuits carry the elevator command through the fuselage and terminate at the respective aft quadrants in the rear section of the fuselage. The aft quadrants each drive an output rod connected to two control rods in series.

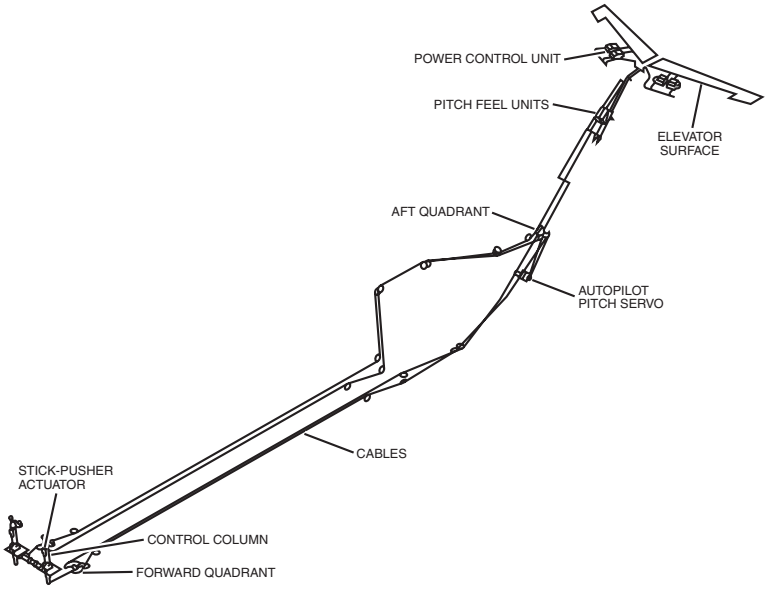

Figure 15-7. Elevator Components

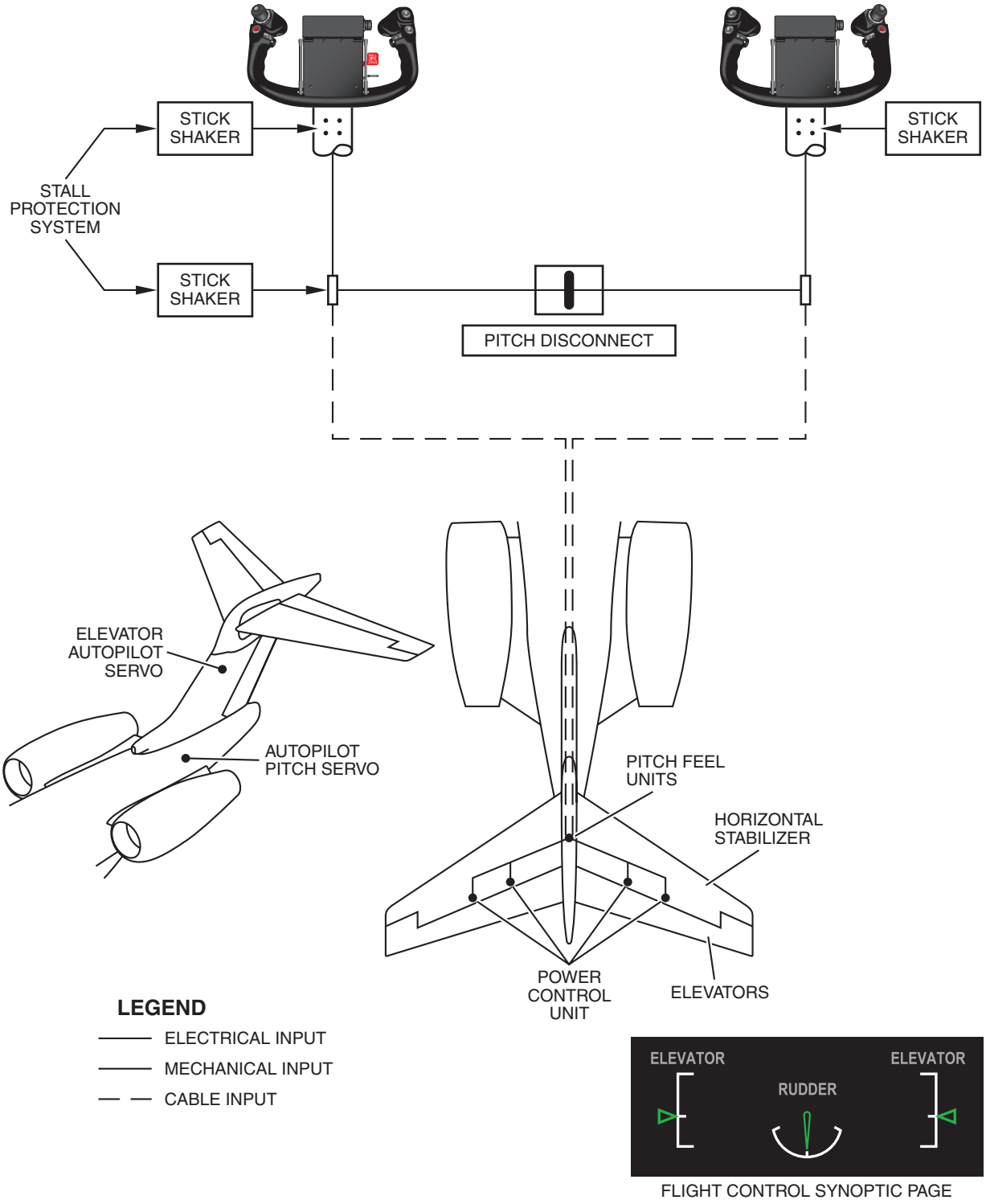

Figure 15-8. Elevator Control Schematic

The first control rod is connected to a gain changer mechanism. It is a four bar linkage that provides a non-linear gearing between control column movement and elevator surface.

The second rod is connected to a pitch feel simulator providing artificial feel forces. Aft of the gain changer mechanism, a series of control rods, levers, and a torque tube transmit the elevator command to two elevator power control units per elevator.

Pitch Disconnect

A PITCH DISC handle on the center pedestal below the FLIGHT SPOILERS control separates the two control columns, allowing each to independently control its respective elevator (Figure 15-9). PITCH DISC is used to isolate a jammed elevator control circuit. Pulling the handle and then turning it 90° allows the pilot or copilot to control the nonjammed elevator.

A red PITCH DISCONNECT warning CAS message illuminates on the MFD.

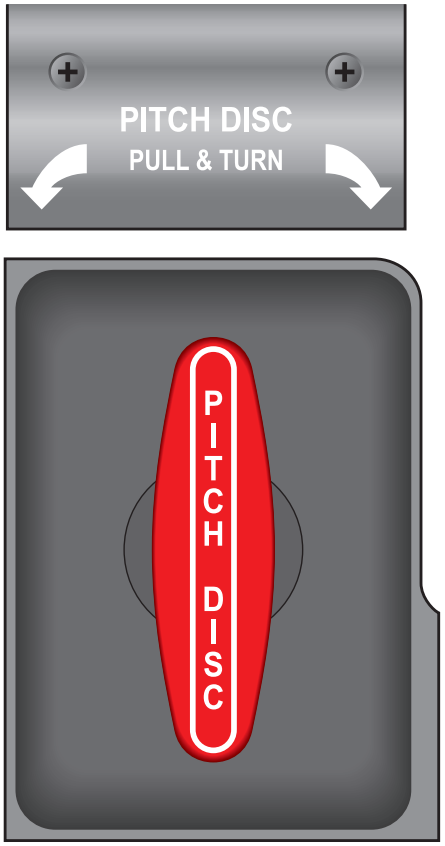

Figure 15-9. PITCH DISC Handle

SECONDARY FLIGHT CONTROLS

Secondary flight controls include the following (Figure 15-10):

- Aileron, rudder, and horizontal stabilizer trims
- Flaps
- Multifunction spoilers and ground spoilers

The aileron, rudder, and horizontal stabilizer trims are electrically operated. Flaps are electrically controlled and hydraulically actuated. The multifunction spoilers and ground spoilers are operated hydraulically while electrical signals generated by the SECU control the spoilers.

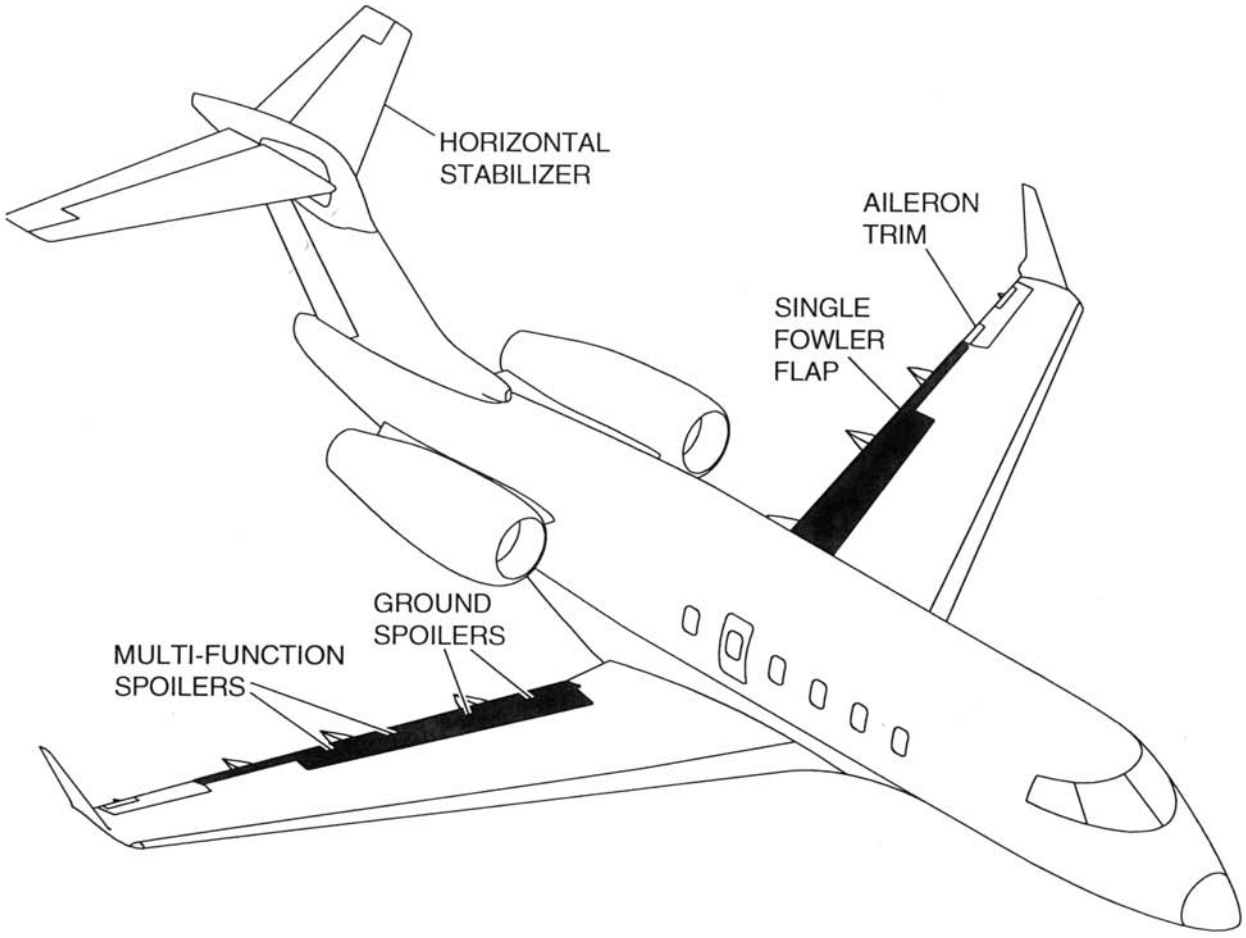

Figure 15-10. Elevator Control Schematic

Position indicators for the secondary control surfaces are located on the EICAS and the FLIGHT CONTROLS synoptic page (Figure 15-11).

AILERON TRIM

An aileron trim tab is on the left aileron. Movement of aileron trim switches on the pilot and copilot control wheels activates an electromechanical actuator in the left aileron to move the trim tab (Figure 15-12).

The aileron trim tab has ±20° of travel with respect to the aileron surface.

The aileron trim switches consist of a single unit containing a split-pole four-throw toggle button (left and right for aileron trim; up and down for horizontal stabilizer trim) and a pushbutton to arm.

To activate aileron trim, the button must be pressed down and simultaneously pushed left or right.

The red CONFIG AILERON TRIM warning CAS message illuminates if takeoff is attempted with aileron trim out of the takeoff trim band.

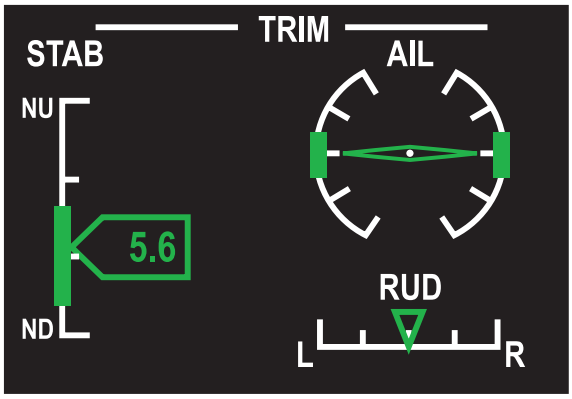

Figure 15-11. EICAS TRIM Status Display

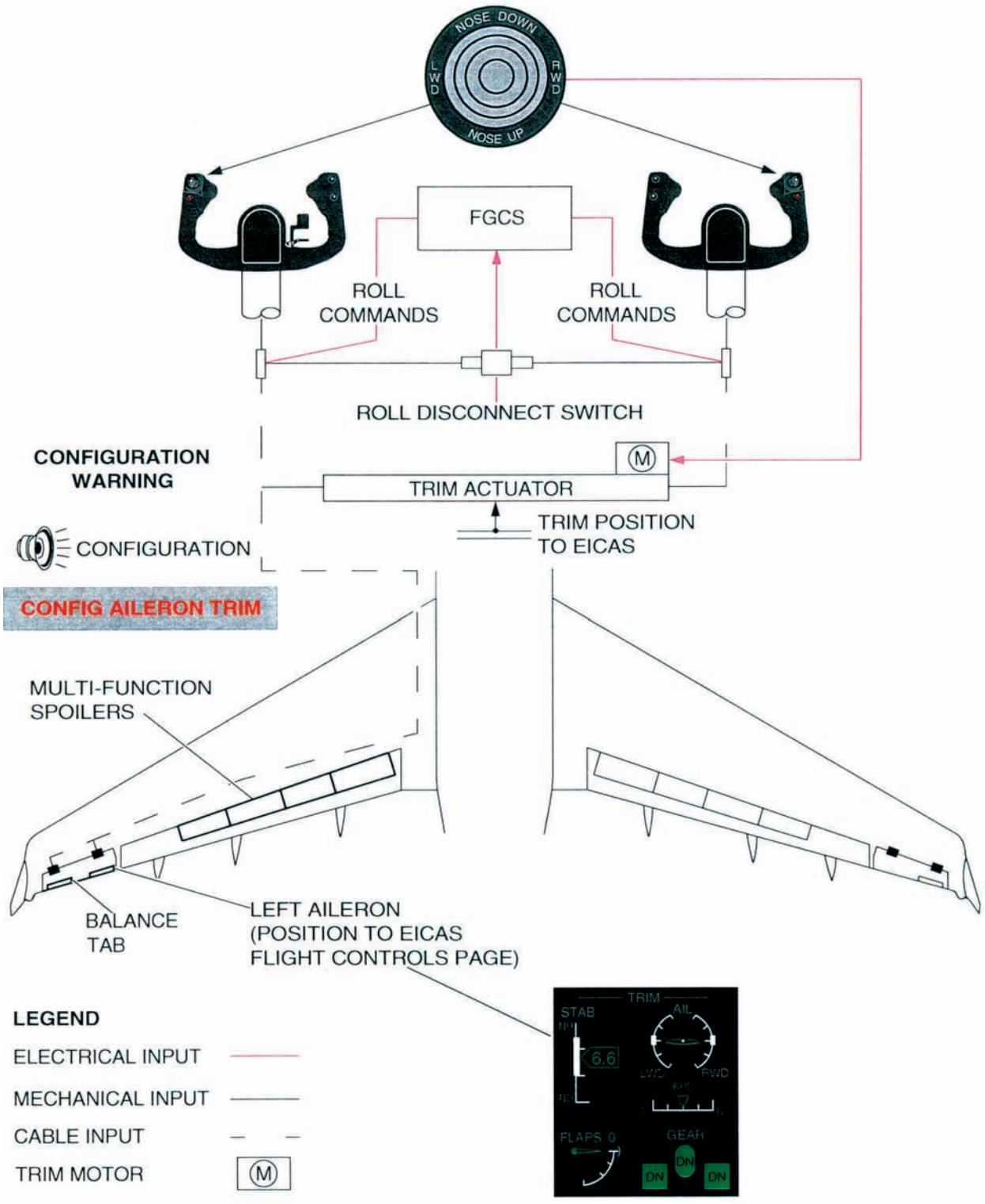

Figure 15-12. Aileron Trim Schematic

RUDDER TRIM

An electromechanical rudder trim actuator provides rudder trim. The crew activates rudder trim with the RUD TRIM switch on the pedestal (Figure 15-13).

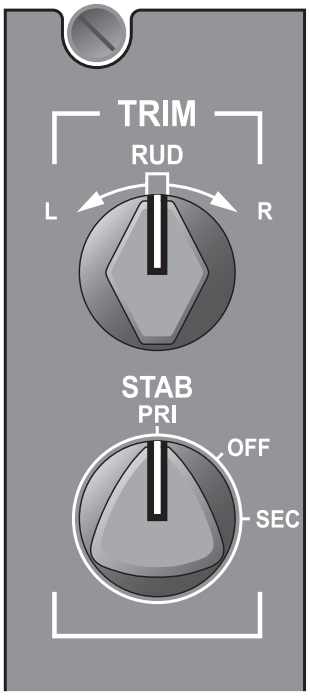

Figure 15-13. RUD TRIM Switch

Trimming of the rudder is done directly with the rudder surface because there are no trim tabs on the rudder.

Activation of the RUD TRIM switch causes electrical inputs to the rudder power control units that move the rudder to the position selected.

A red CONFIG RUDDER TRIM warning CAS illuminates if the rudder is not properly configured for takeoff.

HORIZONTAL STABILIZER TRIM

The stabilizer trim controls pitch trim by varying the horizontal stabilizer's angle of incidence (Figure 15-14).

Electric motors drive a jack screw that positions the stabilizer. Each trim motor has a brake to prevent trim runaway.

The horizontal stabilizer trim control unit controls the positioning. The trim control unit receives inputs from the control wheel trim switches, the autopilot, the flaps, and air data computers.

The stabilizer trim position indicator and readout is displayed on EICAS and the FLIGHT CONTROLS synoptic page. The digital readout indicates the stabilizer position in units of trim corresponding to horizontal stabilizer angle of incidence. The stab trim range of movement is 0 to 15° with the normal takeoff range of 2.5 to 8.0 units (green).

A red CONFIG STAB TRIM warning CAS message is displayed if stabilizer trim is not in normal takeoff range.

Manual Trim

The pilot can manually move the stabilizer trim with the control wheel trim switches.

Manual trim rates differ depending on which channel is engaged. The STAB switch has positions of PRI-OFF-SEC.

When the switch is in PRI, the primary channel is engaged. The trim rate is a function of airspeed (Mach). When the switch is in SEC, the secondary channel is engaged. Trim rate is a constant 0.2° per second.

The primary channel trim rate limit is 0.4°per second at airspeeds up to Mach 0.4, decreasing linearly to 0.1° per second at Mach 0.8 and 0.1° per second above Mach 0.8. If Mach data is not available, the trim rate limit defaults to 0.2° per second.

Pressing and holding the master disconnect switch (MSW) on either control wheel disconnects all trims.

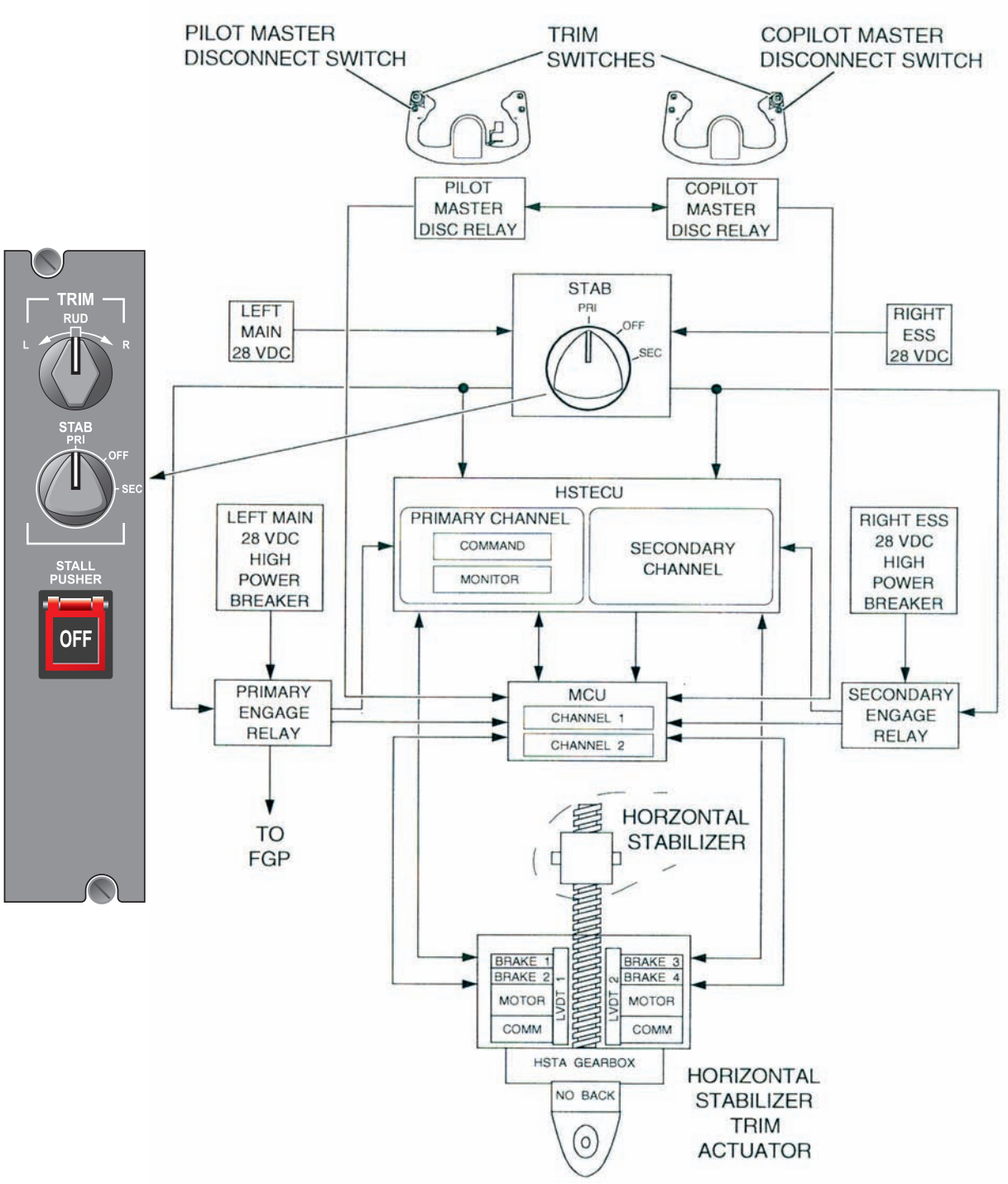

Figure 15-14. Horizontal Stabilizer Trim Schematic

Configuration Trim

The aircraft has automatic trim movement (configuration trim) when the flaps are extended or retracted and the spoilers are extended or retracted.

The aircraft has a nose-down pitching moment with flap extension and nose-up pitching moment with spoiler extension. When these control surfaces are deflected, the horizontal stabilizer trim moves to reduce control column forces.

Mach Trim

The Mach trim allows for the rearward shift of the aerodynamic center of pressure as the Mach number increases. Without correction, this shift in the center of pressure decreases longitudinal stability.

When the autopilot is not engaged, the horizontal stabilizer trim control unit automatically adjusts the stabilizer as a function of the Mach number.

The Mach trim system uses Mach information from the air data computers (ADCs) to command movement of the horizontal stabilizer actuator. This varies the angle of incidence.

When Mach trim is active, increasing speed from a trimmed condition results in Mach trim inputting slight nose-up trim. Decreasing aircraft speed from a trimmed condition results in Mach trim inputting slight nose-down trim. These increase the aircraft's natural speed stability.

The Mach trim system is continuously monitored. Any fault detected is displayed on EICAS.

FLAPS

The single-slotted Fowler flaps are electronically controlled. A hydraulic motor in the flap power unit (FPU) operates the flaps. A stainless steel shaft transfers power from the hydraulic motor to each flap actuator.

Each flap panel, one on each wing, has three flap tracks driven by two screw jack actuators. The flap actuators attached to the rear spar convert the rotary input motion into linear output motion through these screw jacks to drive the flaps. Each actuator has over-travel end stops. The screw jack design of the flap actuators prevents uncommanded retraction from air loads or vibration.

Components

Flap Control Unit

The flap control unit (FCU) performs the following:

- Controls flap panel movement according to pilot commands
- Monitors critical system conditions (runaway/uncommanded movement, surface asymmetry, system jam, overspeed, and speed differential)
- Switches the system to fail-safe condition after detection of a critical failure
- Monitors FPU for internal/external hydraulic leakage and provides annunciation
- Provides flap position to the stall protection system
- Provides data for cockpit indication and maintenance purposes

In addition to control and monitoring, the FCU also contains the left hand and right hand flap position indication unit (FPIU) that provides flap panel position to the EICAS.

Flap Power Unit

The flap power unit (FPU) is aft of the wing center section behind the wing attachment fitting. It contains the hydraulic motor, servo control vale, arming solenoid valve and pressure switch.

The servo valve responds to electrical signals from the flap control unit to meter hydraulic pressure to extend or retract the bidirectional hydraulic motor. Before hydraulic pressure is

available to the servo valve, the FPU must open the arming solenoid valve. The pressure switch monitors system pressure between the arming solenoid and servo valve.

Stainless steel shafts routed along the rear wing spar transmit the rotary motion of the FPU to the input shaft of each flap actuator. Two rotary variable differential transformers (RVDTs) on the outboard side of each outboard flap actuator provide position information to the flap control unit and the flap position indicating unit.

FLAPS Control Lever

The FLAPS control lever has four positions (0, 10, 20, and 30) with detents at the 10 and 20 positions (Figure 15-15). To prevent inadvertent retraction of flaps from 30 to 0 in one motion during a go-around maneuver, a gate at the 10 position must be pulled up slightly when retracting the flaps to 0.

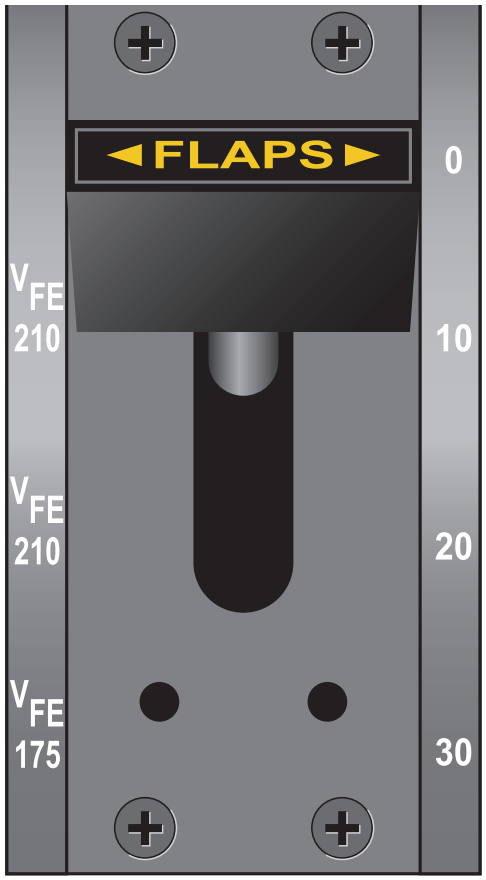

Figure 15-15. FLAPS Control Lever

The lever is attached to dual RVDTs co-located with a flap lever detent switch below the flap handle. These RVDTs transmit the selected position to a flap control unit.

Moving the lever between positions actuates the flap lever detent switch to energize a 75-second timing circuit within the flap control unit. This circuit arms a solenoid valve within the flap power unit to energize open for 75 seconds and then deenergize.

Operation

Under normal conditions, the right hydraulic system operates the flaps. Normal flap extension from 0 to 30 does not exceed 20 seconds with the right engine-driven hydraulic pumps operating.

The pilot may change the source of hydraulic power to the flaps with the ALTN FLAPS button on the HYDRAULICS control panel. When ALT FLAPS is selected on, the left hydraulic system powers flap movement. A green FLAPS ALT PRESS message illuminates on EICAS.

When ALTN FLAPS is selected or when the right DC motor-driven pump supplies hydraulic power, the time needed for flap movement extends up to 60–70 seconds while lowering flaps from 0 to 20 in flight.

An advisory FLAPS RATE LOW message illuminates if the flap control unit is controlling the system at a lower than nominal speed to reduce the hydraulic flow. This is the case if either the pressure switches of the hydraulic system indicate the engine-driven pump for the main system is not working or the alternate hydraulic supply is selected.

If hydraulic pressure is not available on flap selection, the flaps are inoperative.

Flap Position Indication

Flap position is shown in a digital display on EICAS and the FLIGHT CONTROLS synoptic page.

Flap Alerting

The flap position alerting system monitors airspeed, altitude, and the position of the flaps, spoilers, and landing gear. An overspeed warning horn is activated if flaps are extended above the following speeds:

- V_{FE} 210 kts—10°
- V_{FE} 210 kts—20°
- V_{FE} 175 kts—30°

SPOILER SYSTEM

The upper surface of each wing has four spoiler panels (Figure 15-16). The two inboard panels are ground spoilers; the two outboard panels are multifunction spoilers. The inboard and outboard ground spoilers tied with the multifunction spoilers comprise the ground spoilers system (Figure 15-17). The system is computer controlled and hydraulically operated. Each panel is actuated by a single PCU.

The two ground spoilers provide ground lift dumping functions. The multifunction spoilers provide roll assist, proportional lift dumping, and ground dumping functions (Figure 15-18).

The ground spoilers have only two positions: fully retracted during flight or fully deployed after landing.

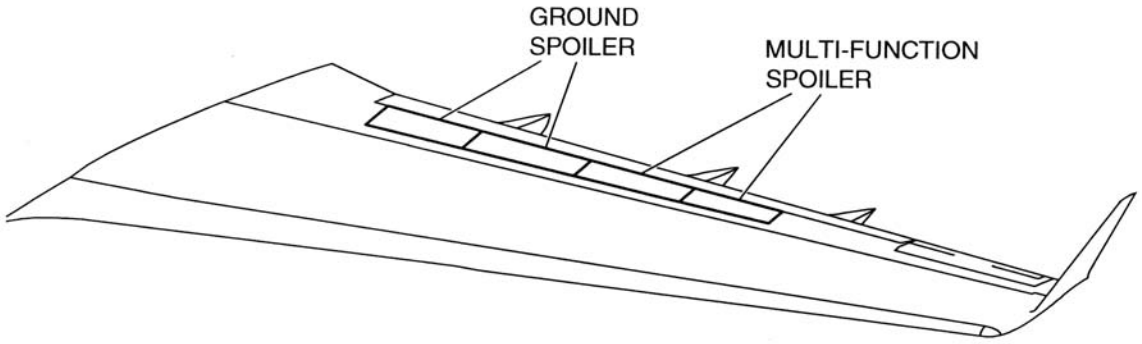

Figure 15-16. Spoiler Panels

Figure 15-17. Ground Spoiler System

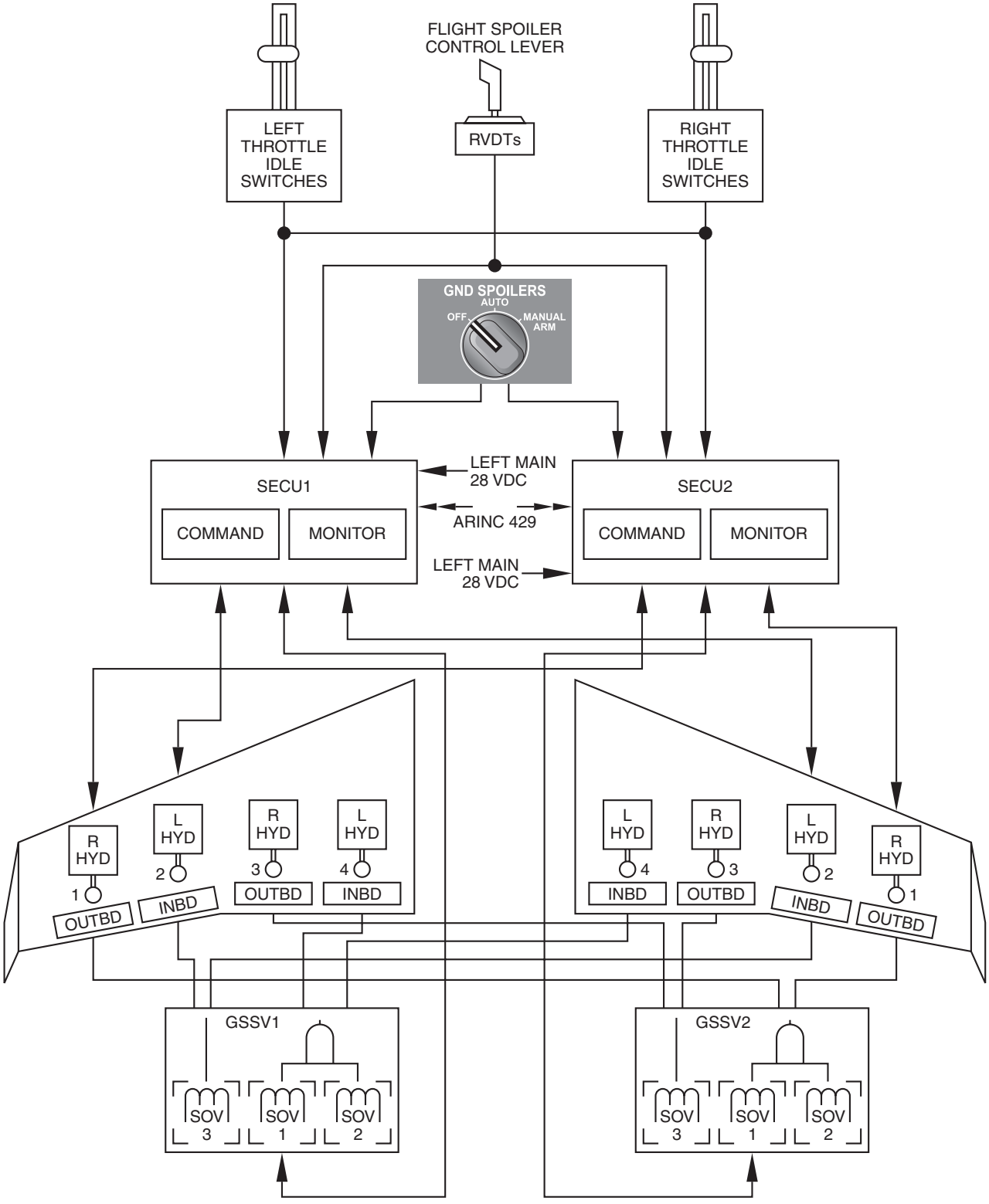

Figure 15-18. Flight Spoiler Schematic

Spoiler Electronic Control Unit (SECU)

Two electronic units, SECU 1 and SECU 2, control the spoilers. The SECUs transmit the spoiler sensor outputs and control the spoiler actuators. The SECUs also supply CAS messages, maintenance messages, and flight data recorder data.

FLIGHT SPOILERS Lever

The FLIGHT SPOILERS lever (Figure 15-19) provides symmetric deployment of the two pairs of multifunction spoilers via the SECU.

In normal operation, there are nine detented positions between 0 and MAX. The 0 position is gated. To release the position, the pushbutton on top of the lever must be pressed. The 0 position can be reselected without pushing the button.

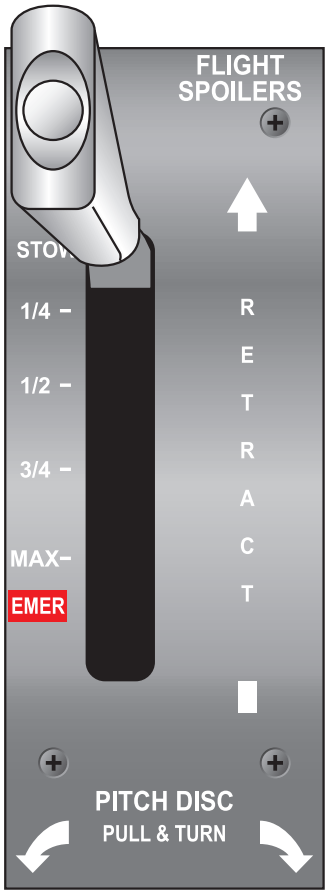

Figure 15-19. FLIGHT SPOILERS Lever

The FLIGHT SPOILERS lever positions gradually deploy the multifunction spoilers beginning with the outboard panel on each wing. The MAX position corresponds to full deployment of the outboard panel on each wing. A 10th position, used for emergency descent, fully deploys the outboard and inboard MFS panels on each wing.

The EMER position is also gated and requires pressing the pushbutton to engage. The lever returns from EMER to anywhere between the 0 to MAX without pressing the button.

The spoiler graphic display on the top half of the left MFD declutters after 60 seconds when the spoilers are retracted. The graphic automatically displays again when the ground or flight spoilers are extended or a spoiler failure occurs.

Roll Spoilers

Roll spoilers assist the ailerons in roll control through the multifunction spoilers (MFSs). The SECU electronically controls each panel.

Inputs to the roll assist system are through the pilot control wheel and the ROLL SPOILERS switch on the center pedestal (Figure 15-20).

If roll disconnect is selected due to a jam in the pilot control wheel, raising the guarded switch and pressing OFF disables the roll assist function.

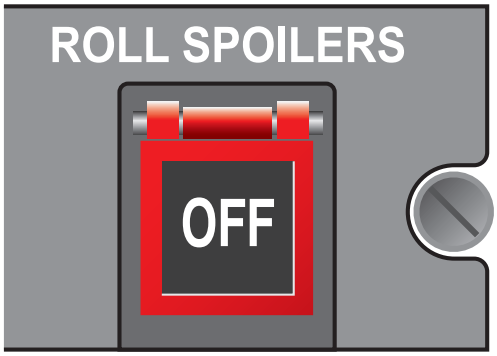

Figure 15-20. ROLL SPOILERS Switch

Ground Spoilers

After touchdown or during a rejected takeoff, the ground spoilers extend in conjunction with the multifunction spoilers to spoil lift and increase drag to assist in braking. The ground spoiler function is normally automatic, but the pilot can activate it using a manual arm mode. The ground spoilers have no inflight function.

The three-position GND SPOILERS switch selects the ground spoiler function (Figure 15-21):

- OFF—Inhibits the ground spoilers
- AUTO—Automatically arms the ground spoilers. This is the normal switch position for all phases of flight.
- MANUAL ARM—Overrides the automatic arming function to manually arm the ground spoilers

The ground spoilers deploy to 60° and the multifunction spoilers deploy to 45°. However, the multifunction spoilers will still respond to roll assist inputs.

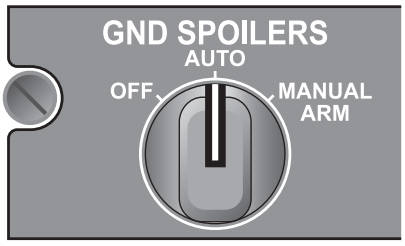

Figure 15-21. GND SPOILERS Switch

The position of all panels is shown on the FLIGHT CONTROLS synoptic page. Arrows and position scales indicate relative deflection of the surfaces. Ground spoilers are limited to two positions: up or down. The spoilers are continuously monitored. If any fault is detected, a message is displayed on the EICAS.

Automatic Mode

In the AUTO mode the ground spoilers are automatically armed for landing or rejected takeoff, and automatically disarmed during the landing rollout or after the rejected takeoff as described below.

The spoilers are initially armed during the takeoff roll under the following conditions:

- Both thrust levers at TO or above or
- Main wheel speed 60 kt or
- Weight-off-wheels and radio altitude >7 feet

Once armed, the ground spoilers deploy under the following conditions:

- Both thrust levers at idle and
- Two of the following:
  - o Weight-on-wheels
  - o Main wheel speed >16 kt
  - o Radio altitude <7 feet

Once armed, the multifunction spoilers deploy as ground spoilers under the following conditions:

- Thrust levers at idle and
- Weight-on-wheels and
- Main wheel speed >16 kt or radio altitude <7 feet

Following a landing or rejected takeoff, the spoilers are disarmed under the following conditions:

- Weight-on-wheels for 40 seconds and
- Main wheel speed <45 kt for 10 seconds

MANUAL ARM Mode

MANUAL ARM is selected during an abnormal situation where the arming criteria are not met. When selected, MANUAL ARM takes the place of the automatic arming sequence during the takeoff roll. However, the SECU still requires the same conditions to be met for spoiler deployment as in the AUTO mode. Additionally, there is no automatic disarming of the ground spoilers.

If MANUAL ARM is used, the recommended procedure is to select MANUAL ARM as the thrust levers are advanced for takeoff. The spoilers should be selected to OFF after takeoff. Select MANUAL ARM again prior to landing and select OFF once clear of the landing runway.

TAKEOFF CONFIGURATION WARNING SYSTEM

The takeoff configuration warning system is armed when the aircraft is on the ground. The system monitors the position of the following to ensure they are in a safe configuration for takeoff:

- Flaps
- Flight spoilers
- Parking brake
- Autopilot
- Aileron trim
- Rudder trim
- Roll and pitch disconnect
- Horizontal stabilizer trim

If one or more of the monitored systems is in an unsafe takeoff configuration and both throttles are at or above the climb (CLB) detent, the following occurs:

- Master warning lights flash
- Aural alerts sound
- Warning messages displayed

Correctly positioning the applicable control or retarding the thrust levers cancels the configuration warning indications.

Signals from the proximity sensing system enable and disable the takeoff configuration warning system.

STALL PROTECTION SYSTEM

The stall protection system (SPS) provides the crew with aural, visual, and tactile (stick shaker) indications of an impending stall. If the pilot does not take corrective action, the system activates the stick pusher mechanism.

Each control column has a stick shaker. A single stick pusher mechanism is attached to the left pitch control system.

A dual-channel stall protection system (SPS) computer monitors the following inputs:

- Angle of attack—left, right angle-of-attack (AOA) transducers (vanes) (Figure 15-22)
- Lateral acceleration—Attitude heading reference systems (AHRS)
- Flap position
- Weight-on-wheels—WOW 1 and WOW 2
- Mach and airspeed—ADC 1, ADC 2, and standby instrument (ADCs supply primary Mach data for Mach compensation of the aircraft's stall margin)

The SPS uses the inputs to calculate the angle-of-attack trip points. The stick shaker activation and ignition activation are simultaneous.

If AOA increases at a rate greater than one degree per second, the stall protection computer lowers the activation trip point. This prevents the aircraft's pitching momentum from carrying it too deep into the stall through the stall warning/stick pusher sequence.

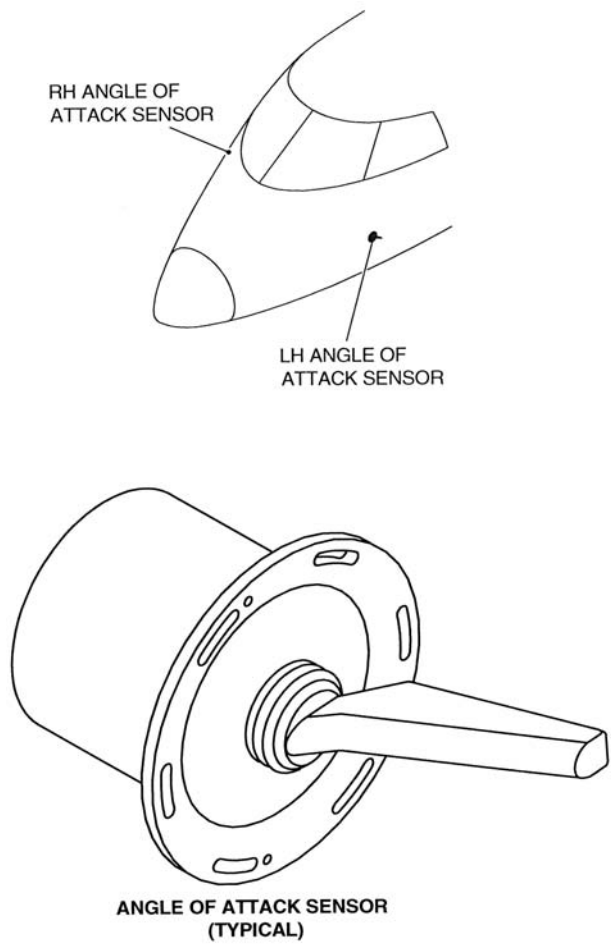

Figure 15-22. Angle-of-Attack Sensors

STICK PUSHER DISCONNECT

Pressing and holding either control wheel MSW stops the stick pusher.

When the MSW switch is released, the stick pusher operates immediately. This function is inoperable on JAA approved aircraft.

If the SPS incorrectly activates the stick pusher, select the STALL PUSHER switch to OFF to disable the pusher (Figure 15-23).

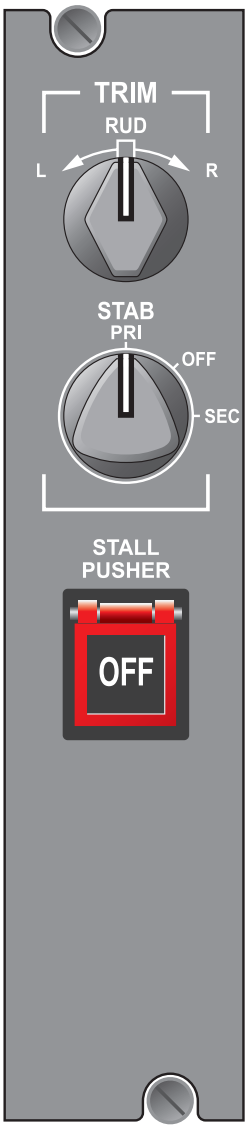

Figure 15-23. STALL PUSHER Switch

EICAS

The FLIGHT CONTROLS synoptic page presents the flight controls on a block diagram of the wings (Figure 15-24).

MESSAGES

Table 15-1 lists the EICAS messages associated with the flight controls system, a brief explanation of the message, and whether the message is inhibited during takeoff and/or landing.

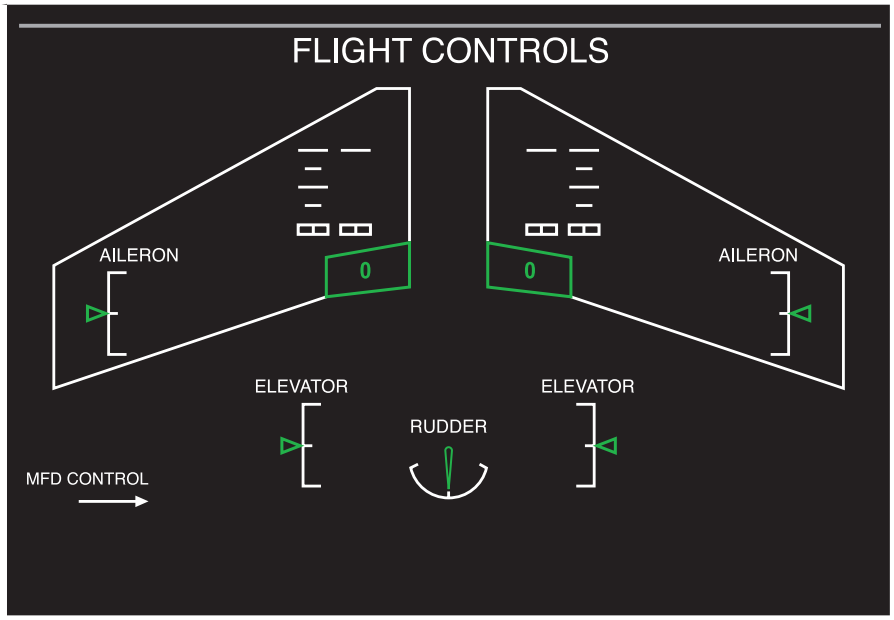

Figure 15-24. FLIGHT CONTROLS Synoptic Page

Table 15-1. EICAS MESSAGES

MESSAGE	INHIBITS	MEANING	AURAL WARNING
CONFIG AILERON TRIM		Aileron trim is not in the takeoff range (green band)	"Configuration"
CONFIG AUTOPILOT		Autopilot is not configured for takeoff.	"Configuration"
CONFIG FLAPS		Flaps are not in takeoff position.	"Configuration"
CONFIG RUDDER TRIM		Rudder trim is not in the takeoff range (green band).	"Configuration"
CONFIG SPOILERS		Spoilers are not in takeoff position.	"Configuration"
CONFIG STAB TRIM		Elevator trim is not in the takeoff range (green band).	"Configuration"
PARK/EMER BRAKE ON		Emergency brake is engaged with throttles at or above climb.	"Configuration"
PITCH DISCONNECT		Pitch disconnect has occurred on the ground with throttles at or above CLB.	"Configuration"
ROLL DISCONNECT		Roll disconnect has occurred on the ground with throttles at or above CLB.	"Configuration"
ELEVATOR SPLIT		The elevator has a split of greater than 7.5°. The split may be caused by maneuvering with the elevator disconnected.	
FLAPS FAIL	TO	The flap system has shut down due to a failure. The flaps are not resettable.	
FLAPS FAULT	TO	The flaps are operating in a degraded mode. The fault may be resettable in some conditions by movement of the flap selector handle.	
FLAPS NORM PRESS LOW	TO/LAND	The flaps normal hydraulic pressure is low. This will be accompanied by a FLAPS FAULT CAS. Alternate pressure may be available.	
FLT SPOILERS DEPLOY		The flight spoilers are deployed below 500 feet (FAA), (800 ft JAA) or the flight spoilers are deployed and the throttles are at CLB or above.	
FLT SPOILERS FAIL		All flight spoilers have failed.	
FLT SPOILERS FAULT	TO	Either the inboard or outboard spoilers have failed.	
GND SPLRS NOT ARMED		The ground spoilers are not armed and not selected off.	

Table 15-1. EICAS MESSAGES (Cont)

MESSAGE	INHIBITS	MEANING	AURAL WARNING
GND SPOILERS FAIL		The ground spoilers have failed.	
MACH TRIM FAIL	TO/LAND	The Mach trim has failed.	
PRI STAB TRIM FAIL		The stabilizer trim has failed. Mach trim, flap and spoiler config trim inoperative.	
ROLL SPOILERS FAIL		Roll assist function has failed but flight and ground spoilers have not. Roll control forces will be higher.	
ROLL SPOILERS FAULT		Either the inboard or outboard roll spoilers have failed. Roll control forces will be higher.	
RUDDER LIMITER FAIL		The rudder limiter has failed.	
SEC STAB TRIM FAIL		The secondary stabilizer trim has failed. This message should not be displayed unless the primary stabilizer trim has already failed.	
SPOILERS FAIL		The spoilers have failed. If the spoilers were de-played, they will retract down to a float position. The spoilers will not float up.	
SPOILERS FAULT		One or more of the spoiler panels has failed or one or more of the ground spoilers is up prior to touchdown.	
SPOIL PROTECT FAIL		The stall protection has a failure in either channel A or B, or the pusher or AOA sensor has failed, or a miscompare has been detected between essential inputs or essential inputs are unavailable.	
STALL PUSHER OFF		The control wheel master switch button has been depressed for at least ten seconds, or a stall protection system failure has occurred that has inhibited operation of the stall pusher.	
FLAPS FAULT	TO	There is a fault in the flap system. The flaps should operate normally.	
FLAPS RATE LOW	TO/LAND	The flap extension and retraction rates are slower than normal. This message will illuminate when the right engine is shut down or if the engine-driven pump is shut down.	

Table 15-1. EICAS MESSAGES (Cont)

MESSAGE	INHIBITS	MEANING	AURAL WARNING
RUDDER LIMITER FAULT	TO/LAND	A minor failure resulting in the loss of redundancy has occurred in the rudder limiter system. The rudder travel limiter will continue to function.	
SPOILERS FAULT	TO/LAND	There is a fault in the spoiler system that does not affect spoiler operation. Selecting the roll disconnect on the ground and moving the control wheel(s) separately will result in a SPOILERS FAULT message. If this occurs, removing all power from the aircraft and repowering will cause the message to clear.	
STAB TRIM FAULT	TO/LAND	A minor failure has occurred causing a loss of redundancy in the horizontal stabilizer trim system. The stabilizer trim will continue to function.	
STALL PROTECT FAULT	TO/LAND	The stall protection computer has automatically reverted to settings for flaps 30.	
L (R) STALL SHAKER FAIL	TO/LAND	The respective stall shaker has failed.	
GND SPOILERS OFF		The ground spoilers are selected OFF.	
PITCH DISCONNECT		The pitch disconnect has been selected. The pilot control column moves the left elevator. The copilot control column moves the right elevator. Autopilot will disengage and not reengage.	
ROLL DISCONNECT		The roll disconnect has been selected. The pilot control wheel moves the aileron. The autopilot will disengage and not reengage.	
ROLL SPOILERS OFF		The roll spoilers have been turned off and the roll disconnect has been activated.	
RUD LIMITER IN TEST		The rudder travel limiter system is conducting the manually activated system test.	
SEC STAB TRIM ON		The secondary channel of the horizontal stabilizer trim system is selected. The autopilot will be inoperative.	
STAB TRIM OFF		The STAB TRIM switch is in the OFF position. The autopilot will be inoperative.	
STALL PUSHER OFF		The stall pusher has been manually deactivated.	

QUESTIONS

1. Horizontal stabilizer trim range of movement is:

a. 0° to 10°
b. 0° to 12°
c. 0° to 15°
d. 0° to 20°

2. Normal flap extension from 0 to 30 degrees should not exceed:

a. 10 seconds
b. 15 seconds
c. 20 seconds
d. 25 seconds

3. Multifunction spoilers extend to any position up to:

a. 10°
b. 20°
c. 30°
d. 45°

4. Which of the following primary flight controls is not hydraulically assisted:

a. Ailerons
b. Elevators
c. Rudders
d. Multifunction spoilers

5. Which of the spoiler panels operate as multifunction spoilers?

a. The two inboard panels
b. The two outboard panels
c. All four wing panels
d. Only the most outboard panel

6. When disconnected, the roll disconnect mechanism:

a. Allows the pilot to control the left aileron and roll spoilers
b. Allows the pilot to control both ailerons
c. Allows the pilot to control roll spoilers
d. Allows the copilot to control roll spoilers

7. When engaged, the gust lock:

a. Prevents damage to ailerons, rudder and elevators when the aircraft is parked
b. Prevents damage to the aileron surfaces from wind gusts
c. Prevents damage to the elevator and rudder from wind gusts
d. Allows movement of the throttle quadrant and control column

8. Which of the following is not true of the rudder system?

a. The left hydraulic system powers the lower rudder PCU
b. Trapped hydraulic fluid provides rudder gust lock damping
c. A rudder control unit supplies simulated pedal load to the crew
d. A full scale deflection on the rudder position synoptic corresponds to maximum rudder travel

CHAPTER 16
AVIONICS

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CHAPTER 16
AVIONICS

INTRODUCTION

This chapter describes the air data system, attitude and heading reference system, flight instruments, automatic flight control system (AFCS), communication system, and navigation system for the Challenger 300. The integration of all these systems in one chapter provides a central reference point for avionics. Although this manual does not normally contain procedures, a section at the end of this chapter includes some step-by-step procedures for tuning radios, accessing various menus, etc. as a reference tool.

PITOT STATIC SYSTEM

The aircraft is equipped with a primary pitot static system and a standby pitot static system (Figure 16-1).

The primary system provides total and static pressures to air data computers (ADC) 1 and 2. The left and right pitot static probes sense the pressures.

A standby pitot static system provides total and static pressures to the integrated standby instrument. A standby pitot probe and two flush-mounted standby static ports sense the pressures.

The primary pitot static probes each have one total pressure port and two static pressure ports. The standby pitot probe has a single pressure port.

All of the probes and the flush standby static ports are electrically heated . Probe heat is discussed in Chapter 10—Ice and Rain Protection.

The use and distribution of the pitot and static sources are as follows:

- P1—Normal pitot input to ADC 1
- S1—Normal static input to ADC 1
- P2—Normal pitot input to ADC 2
- S2—Normal static input to ADC 2
- P3—Pitot input to integrated standby instrument
- S3—Static input to integrated standby instrument

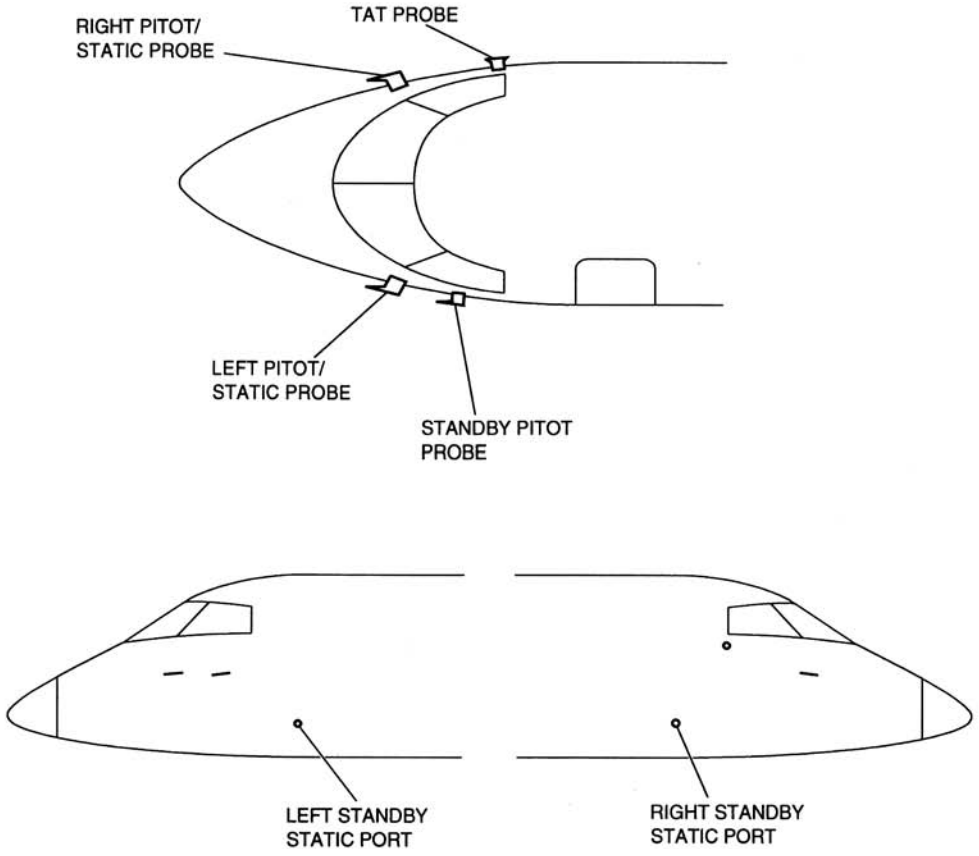

Figure 16-1. Primary and Standby Pitot Static Systems

TOTAL AIR TEMPERATURE PROBE

An electrically heated total air temperature (TAT) probe is mounted on the right forward fuselage. The TAT probe has two independent temperature sensors (Figure 16-2). One sensor is connected to ADC 1 and the other to ADC 2.

The ADCs use the total air temperature to calculate static air temperature (SAT) and true airspeed (TAS).

Figure 16-2. TAT Probe

AIR DATA SYSTEM

The pitot static system and total air temperature (TAT) probe sense air data information (Figure 16-3). The ADCs process this data and send it to the flight displays, integrated avionics processor system (IAPS), and several aircraft systems.

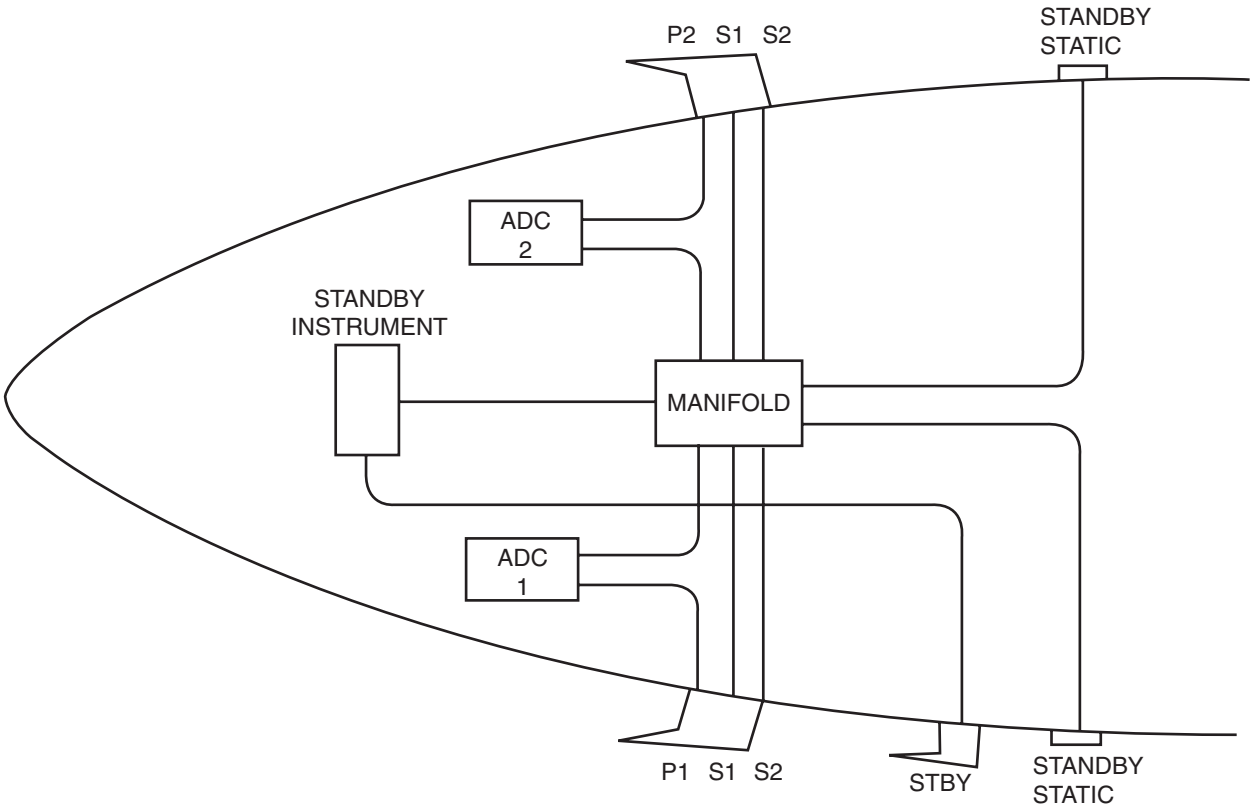

Figure 16-3. Air Data System

AIR DATA COMPUTERS

Each ADC senses total pressure, static pressure, and total temperature. The pressure sensors are solid-state piezoresistive type that transform the pressure to an analog electrical signal. The analog signal is then digitized and used for all ADC calculations.

The ADC calculates the following air data parameters:

- Pressure altitude
- Static pressure
- Total pressure
- Vertical speed
- Airspeed
- Mach number
- Maximum airspeed (VMO)/maximum mach number (MMO)
- Baro correction
- Barometric corrected altitude
- Static air temperature
- Total air temperature
- True airspeed
- Temperature difference from standard (ISA)

ADC CONTROLS

Altimeter Barometer Knob

The altimeter barometer (ALTM BARO) knob (Figure 16-4) is rotated to increase or decrease the barometric pressure setting, which is displayed on the primary flight display (PFD).

The standard barometric pressure setting of 29.92 inches of mercury or 1013 hPa is selected when the center of the BARO knob is pressed.

Figure 16-4. ALTM BARO Knob

Air Data Reversion Switch

The AIR DATA switch is on the reversion panel on the center pedestal (Figure 16-5). Its positions include the following:

- NORM—The pilot and copilot adaptive flight displays receive data from their respective ADC.
- 1—The PFDs receive data from ADC 1 only. An amber ADC 1 message is displayed on both PFDs.
- 2—The displays receive data from ADC 2 only. An amber ADC 2 message is displayed on both PFDs.

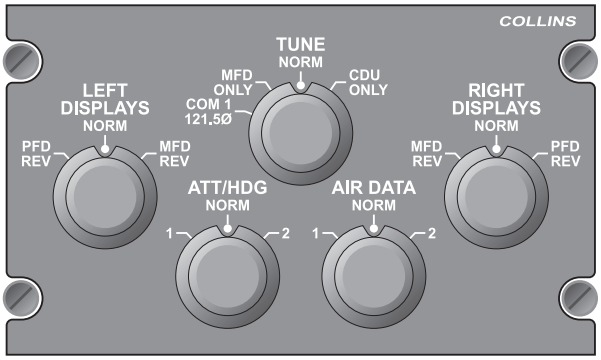

Figure 16-5. Air Data Reversion Switch

ATTITUDE AND HEADING REFERENCE SYSTEM

The aircraft attitude and heading reference system (AHRS) is a strapped gyro reference system that generates angular rate and linear acceleration information about the aircraft axes.

Combining the acceleration gyro information with heading data from the flux detector provides highly accurate three-axis AHRS information.

The AHRS interfaces with the following systems:

- EFIS
- Weather radar
- Autoflight control system (AFCS)
- Flight data recorder (FDR)
- IAPS, Terrain awareness warning system (TAWS), Traffic alert and collision avoidance system (TCAS)
- Stall protection system

The AHRS consists of two computers, two flux detector units, and two external compensator units. During normal flight, both AHRS are constantly active.

The COMPASS HEADING and COMPASS SLEW switches select the AHRS modes. The AHRS normally operates in magnetic mode (MAG). Directional gyro mode (DG) may be selected in areas where magnetic field disruptions exist.

The AHRS system is not for use as a polar navigator. Flying in or around the fringe of low magnetic flux areas can cause temporary dropouts in required flux levels for the system to operate properly.

Initialization and operation of the AHRS occur automatically when electrical power is established and the aircraft is stationary. Initialization takes approximately 40 seconds in MAG mode and 4.5 minutes in DG mode.

AHRS COMPUTERS

Each AHRS computer has a dual-sensor assembly. Each sensor assembly has four pairs of piezoelectric accelerometer sensors mounted on a rotating wheel that provide the rate and acceleration data.

The AHRS computers process the sensor data combined with ADC and heading information. The AHRS computers then transmit the data to the adaptive flight displays (AFDs) and IAPS, which interfaces with the flight guidance computer and flight management system.

MAGNETIC FLUX DETECTORS

Magnetic flux detectors mounted in each wing sense the earth's magnetic field and provide corrected heading information to their respective attitude heading computers.

External compensator units correct for any north/south or east/west errors or misalignment of the flux detectors.

CONTROLS

COMPASS/SLEW Switches

The COMPASS HEADING and SLEW switches are on either side of the main flight instrument panel (Figure 16-6).

The two modes of operation are magnetic heading (slaved) mode and directional gyro (DG or free gyro) mode. The COMPASS HEADING switches select the mode. In the magnetic heading mode, heading computations are slaved to the attitude heading computer and flux detectors. In DG mode, magnetic flux detector data is removed. DG mode is not intended for long term heading reference.

In DG mode, the selection of the SLEW switch slews the heading in the selected direction.

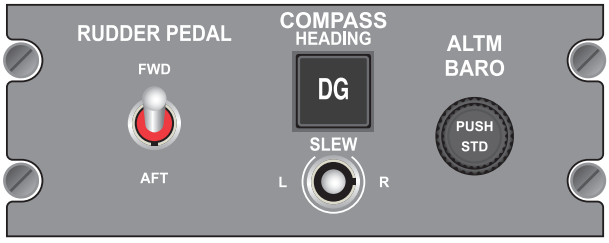

Figure 16-6. COMPASS/SLEW Switches

ATT/HDG Reversion Switch

The ATT/HDG switch is on the reversion panel on the center pedestal (Figure 16-7). Its positions include the following:

- NORM—Left PFD and MFD receive data from AHRS1; right PFD and MFD receive data from AHRS2
- 1—All displays receive data from AHRS 1 only; an amber AHS1 message is displayed on both PFDs
- 2—All displays receive data from AHRS 2 only; an amber AHS2 message is displayed on both PFDs

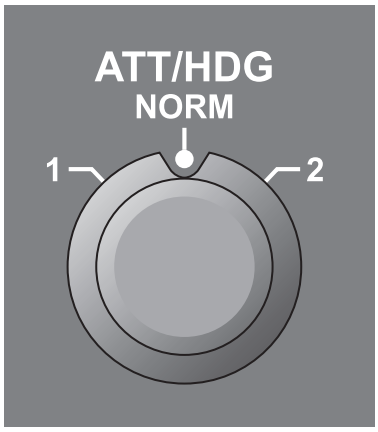

Figure 16-7. ATT/HDG Reversion Switch

ALIGNMENT

During the ground alignment process, the PFD displays the red ATT and MAG flags along with the message ATT/HDG ALIGNING DO NOT TAXI (Figure 16-8).

When alignment is complete, the messages are removed and the attitude indicator is displayed. The aircraft can be moved at this time.

If excessive aircraft motion is detected during a ground alignment, the AHRS automatically reinitializes.

If an airborne alignment occurs because of a power interruption, the system takes 40 seconds to realign. During the in-flight alignment process, the aircraft must remain in straight and level unaccelerated flight.

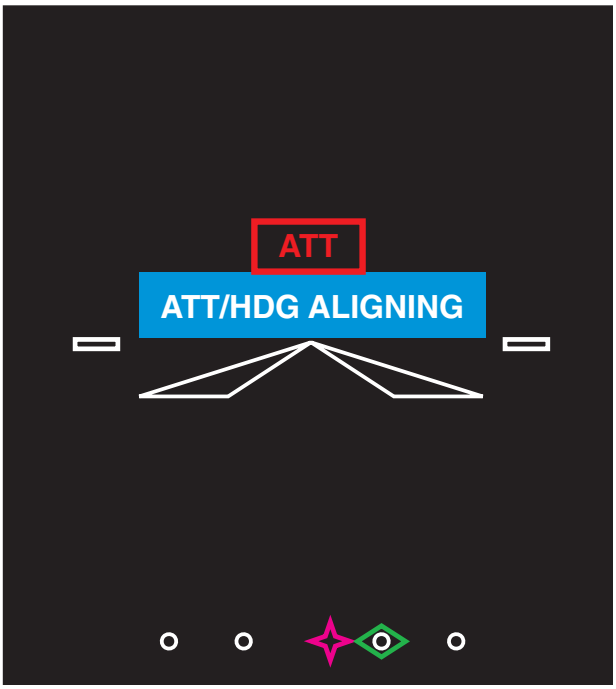

Figure 16-8. Alignment Display

FLIGHT INSTRUMENTS

The Challenger 300's electronic flight instrumentation system (EFIS) consists of a left PFD and multifunction display (MFD) and a right MFD and right PFD. Two display control panels (DCP), one MFD control panel, and one reversion panel control the system (Figure 16-9).

A DCP on the pilot and copilot side provides configuration and selection controls for the appropriate PFD as well as radio controls for the MFD. The reversion panel selects a compressed PFD format on either adaptive flight display as well as a reversion to cross-side attitude/heading data, air data, and radio tune control.

The adaptive flight displays present airspeed, altitude, attitude, heading, navigation, and system information on the adaptive flight displays for each pilot.

The integrated avionics processor system (IAPS), data concentrator unit (DCU), and the remote data concentrator (RDC) all interface with the EFIS.

The air data system and AHRS, discussed in the previous section, provide information to the EFIS for display.

Switches and pushbuttons on the glareshield, the center console, and the side instrument panels provide control for EFIS display modes.

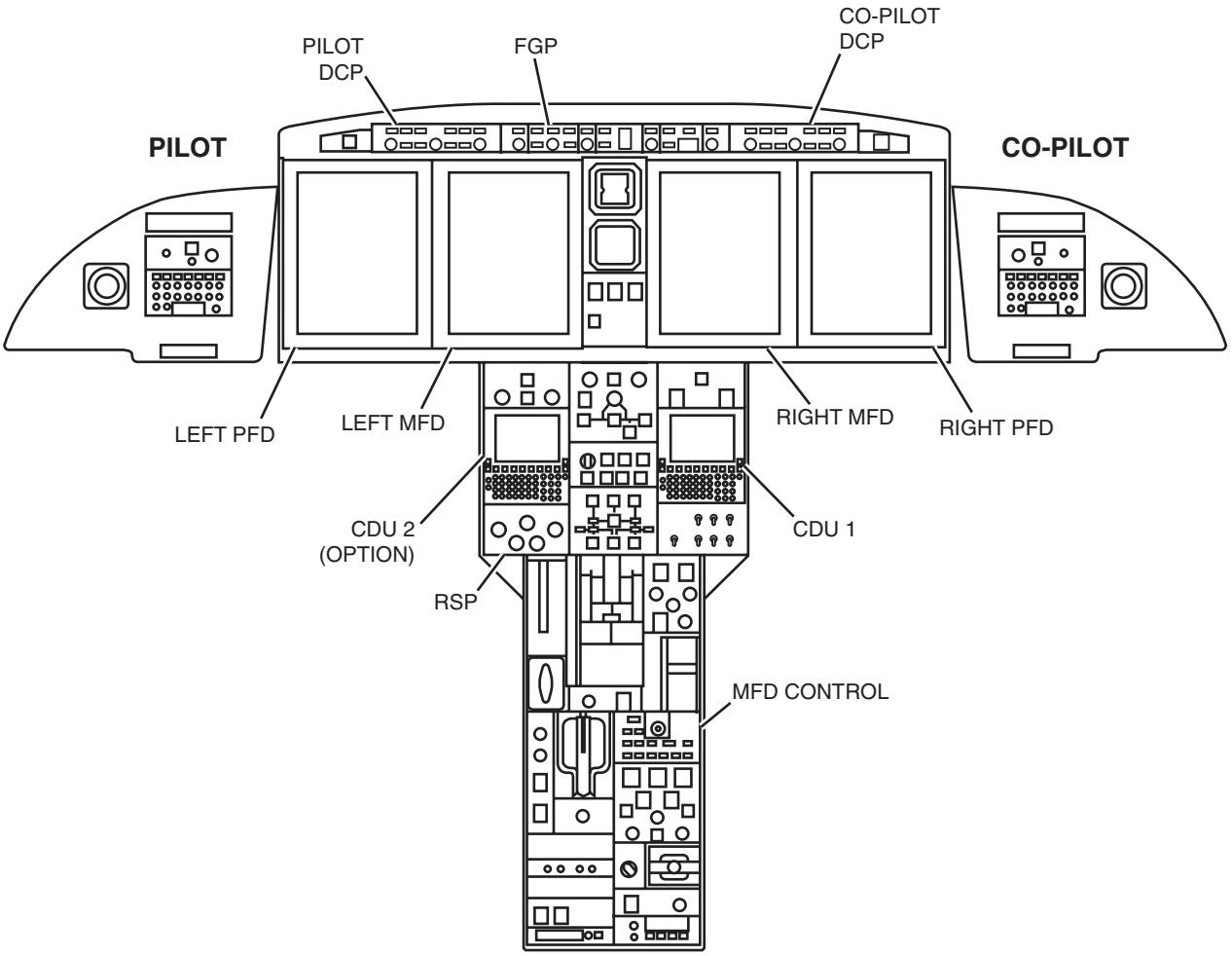

Figure 16-9. Electronic Flight Instrumentation System (EFIS)

INTEGRATED AVIONICS PROCESSOR SYSTEM

The IAPS is the central point of information flow for the entire aircraft. In addition to performing the integration function required to connect the various aircraft systems, the IAPS contains flight guidance computers (FGC), flight management computer (FMC), and maintenance diagnostic computer (MDC) modules (Figure 16-10).

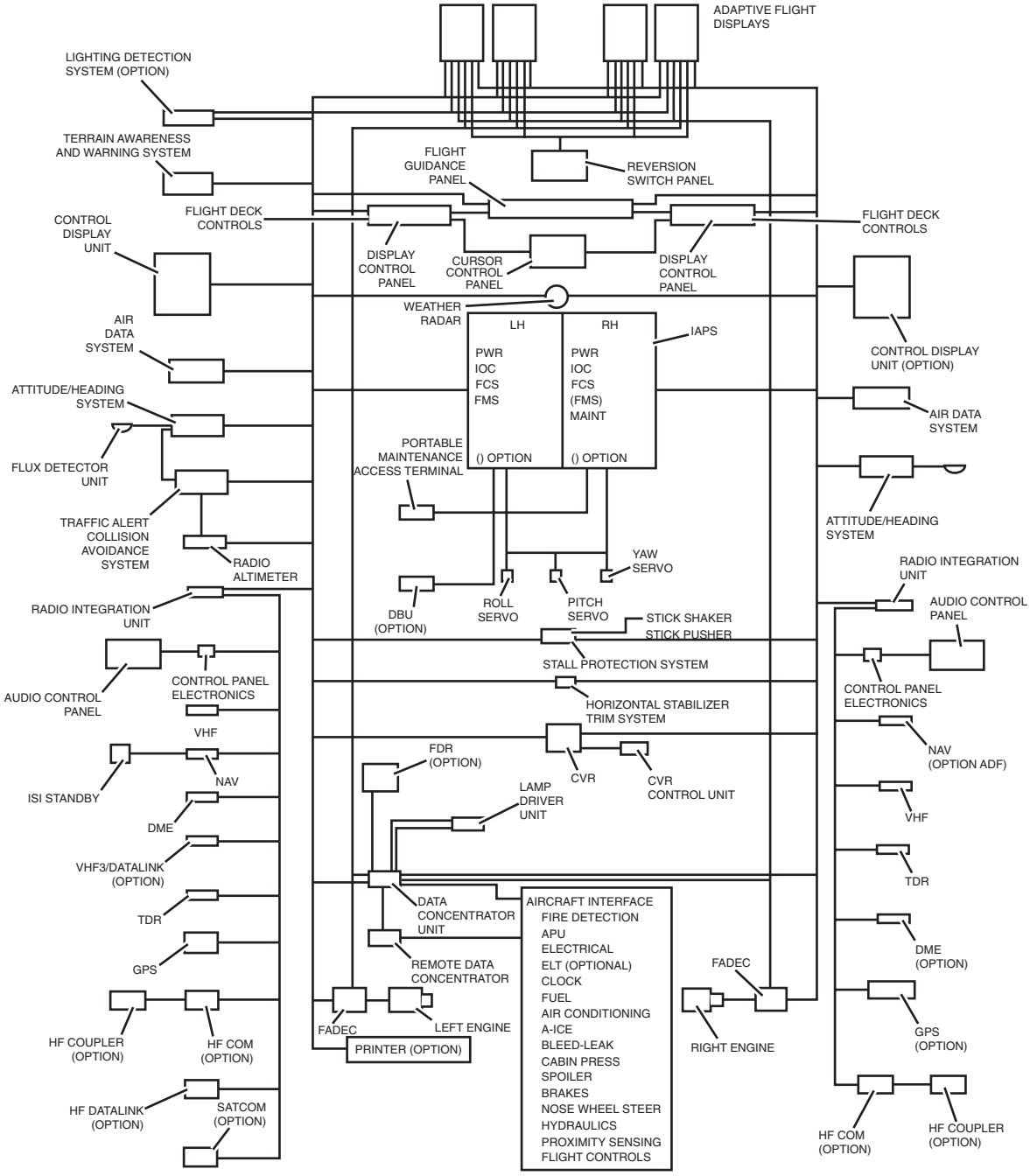

Figure 16-10. Integrated Avionics Processor System (IAPS)

The IAPS is a collection of combined modules that minimizes size, weight, and aircraft wiring. There are no pilot-controlled normal or reversionary operations required for the IAPS.

The IAPS reads avionics buses and sends data words to the line replaceable units (LRUs). It also performs ARINC data processing and distribution for avionic LRUs.

Functional units of the IAPS include the following:

- Input/output concentrator unit (IOC)
- IAPS environmental controller (IEC)
- Control strapping unit (CSU)

The main buses supply 28 VDC to the IAPS. Power is filtered and applied to IAPS power supplies. The two power supplies independently power the units in the IAPS.

The No. 1 power supply energizes the No. 1 FGC, FMC, and IOC No. 1. The No. 2 power supply energizes the No. 2 FGC, FMC, MDC, and IOC No. 2.

Input/Output Concentrator Unit

The IAPS data is received from and transmitted to many external systems. External system data is transmitted through the IOC circuit card. The two IOCs transmit data to other LRUs related to their operation. The IOCs transmit all the display data from other LRUs to the displays.

IAPS Environmental Controller

The IAPS environmental controller (IEC) controls the temperature for the IAPS card cage (ICC). The IEC monitors a pair of ICC temperature sensors. It also operates fans to control the IAPS environment in each half of the IAPS.

The IEC has a power supply, two thermostats, two transducer monitor circuits, a two-speed fan, and a heat exchanger.

Control Strapping Unit

The CSUs and the options control modules (OCMs) set the IAPS strap setting.

PRIMARY FLIGHT DISPLAYS

The primary flight displays (PFD) are integrated displays of attitude, air data, and navigation information (Figure 16-11).

The PFD is divided into the following main areas:

- Attitude display—Pitch, roll, and yaw information from the AHRS
- Airspeed/Mach display
- Altitude display—Moving tape with a fixed digital readout window
- Vertical speed display
- AFCS mode display
- Navigation display—Course, course deviation, bearing and distance information from the selected navaid in conventional HSI format or a moving map display

ATTITUDE DISPLAY

The attitude display reflects a traditional aircraft attitude indicator. The aircraft symbol is a black symbol with a white outline. It is triangular in shape when used with the single-cue flight director, and is based on a horizontal line when used with the double-cue flight director. The blue and brown image provides a visual representation of the actual position of the sky and ground with respect to the aircraft.

Refer to page 16-30 for more information about flight director formats and usage.

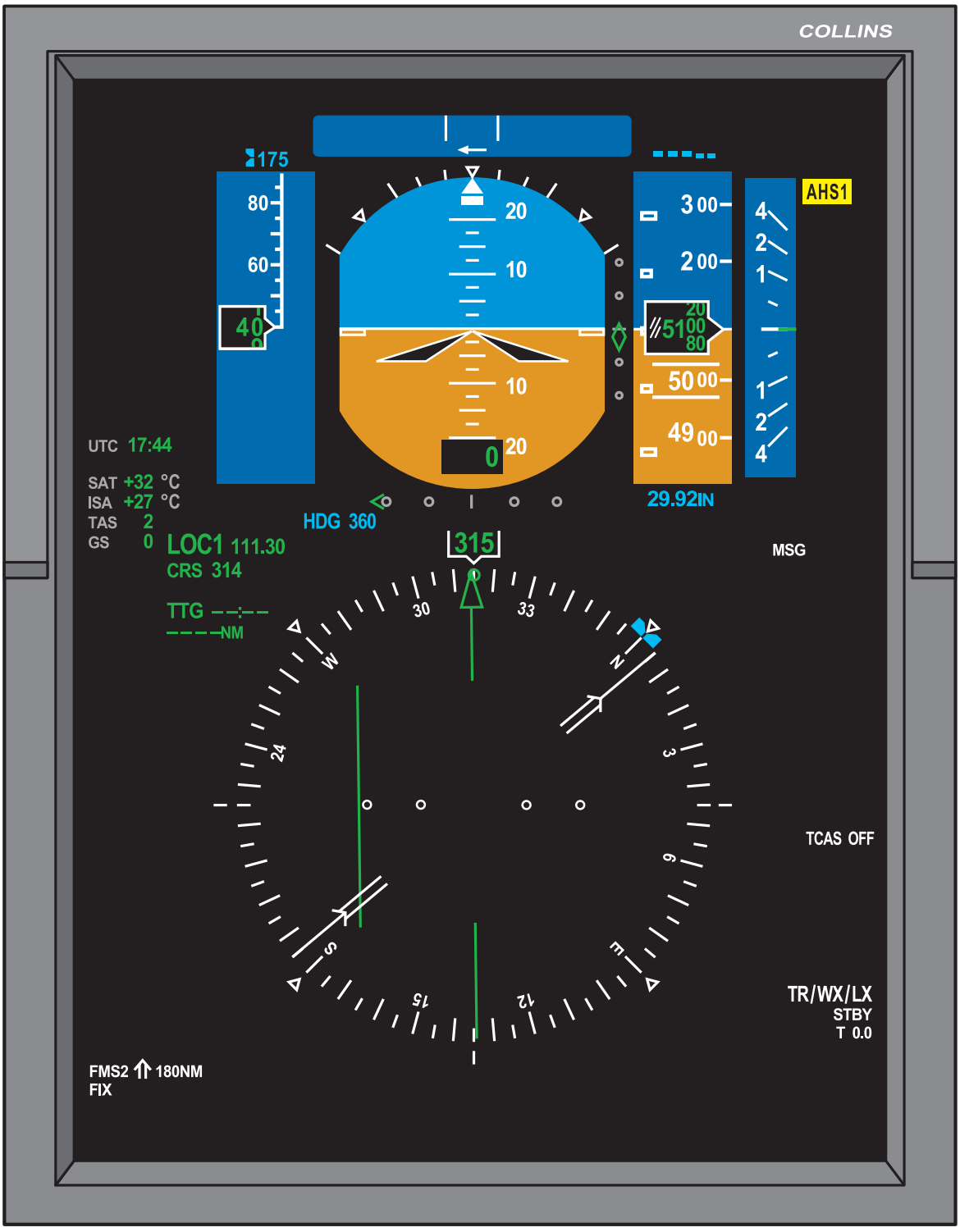

Figure 16-11. Primary Flight Displays

Pitch Tape and Chevrons

The pitch tape is fixed on the attitude indicator and moves with the horizon line. The tape has wide line markings every 10º, medium line markings every 5º, and small line markings every 2.5º. Red warning chevrons appear during maneuvers of excessive pitch attitude and point toward the 0º position.

Roll Scale and Pointer

At the top of the blue display is a roll scale and pointer (Figure 16-12). The scale covers ±60º from level attitude. The scale is marked as follows:

- Small triangle at 0º of bank angle
- Large tick marks at ±30 and ±60º
- Small tick marks at ±10 and ±20º
- Small triangle at ±45º

The roll pointer moves in reference to the center of the aircraft symbol and indicates aircraft roll angle.

Slip/Skid Indicator

The slip/skid indicator is a small rectangle below the roll pointer that is driven by lateral acceleration. It turns with the roll pointer and moves laterally with respect to the base of the roll pointer.

Deflection of one full width of the rectangle is equivalent to a displacement of one ball width on a conventional slip/skid indicator.

Vertical Deviation Display

The vertical deviation display to the right of the attitude display is a white fixed scale with a moving deviation icon. The deviation icon is green when displaying the onside data and amber when displaying cross-side data.

The scale has two dots above and below a reference line. Each dot represents a 1/4 degree deviation above or below the glideslope beam. There is a diamond for glideslope data and a star for VNAV data.

During an ILS with invalid glideslope information, a red boxed GS flag replaces the pointer and scale.

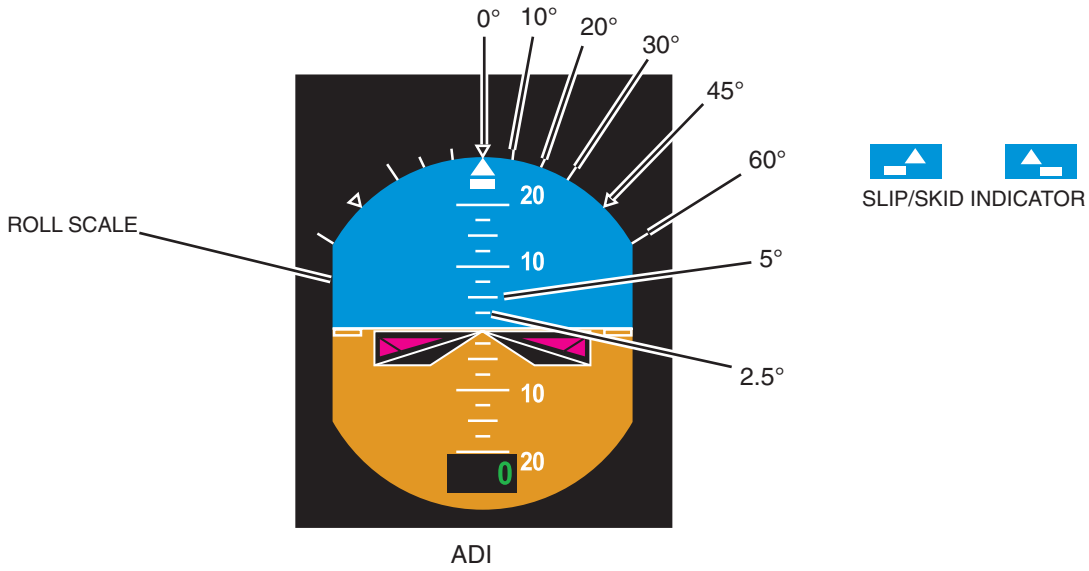

Figure 16-12. Roll Scale and Pointer

AIRSPEED INFORMATION

Airspeed information displayed on the PFD includes the following:

- Airspeed/Mach number
- Reference speeds
- Low/high/speed cues
- Airspeed trend vector

The V_1, V_R, V_2, V_{REF}, V_{GA}, and V_T reference speeds are set through the REFS pushbutton on the display control panel (DCP). The SPEED knob on the flight guidance panel (FGP) sets the cyan speed bug on the airspeed display.

Airspeed Display

The airspeed display is a moving vertical tape with the digital display of current airspeed in the fixed window.

The display is to the left of the attitude indicator on the PFDs. The current Mach number is indicated as a digital value at the bottom of the tape. If the aircraft speed is greater than 0.4 Mach, the crew can select a Mach tape to replace the airspeed tape.

The indicated airspeed tape has a range from 40 to 400 kt. The tape has a scale marked every 5 kt and numerically marked every 20 kt.

Reference Speed

The takeoff reference speeds are presented on speed scale as a V_1, V_R, V_2, and V_T. Manually set V speed values are cyan characters; optional FMS-calculated V speeds are displayed in magenta.

The SPEED knob selects and sets the airspeed reference bug to the desired speed on the airspeed tape. The speed bug is beside the selected speed with a ±5 knot deviation indication.

When the center of the SPEED knob is depressed, the speed reference toggles between Mach and airspeed.

Speed Cues

A low speed cue indicates a calculated airspeed of 1.06 V_S. It appears from the lower portion of the airspeed scale as a solid red line that changes to an expanded alternating red and black band when the aircraft is within a few knots of activating the stick shaker. The top of this cue visually represents the speed at which the stick shaker will activate.

An overspeed cue indicates the maximum operating speed. It appears in the upper portion of the airspeed scale as a solid redline that changes to an alternating red and black band when approaching overspeed.

The overspeed cue reduces to the flap operating speed limit when flaps are extended.

Trend Vector

The airspeed trend vector originates from the tail of the indicated airspeed arrow. The magenta trend vector moves vertically in response to aircraft acceleration or deceleration indicating the speed predicted in the next 10 seconds.

ALTITUDE DISPLAY

Barometric altitude information on the PFD consists of the following:

- Altitude display and readout
- Preselected altitude
- Altitude alert
- Barometric pressure setting readout
- Minimum descent altitude (MDA)

The air data computer (ADC) calculates the pressure altitude and barometric corrected altitude. The altitude is preselected with the flight guidance panel (FGP). DH/MDA is set through the REFS menu.

The altitude display is shown on the right side of the PFD as a moving tape with a fixed digital readout window.

The fine portion of the tape is marked and numbered every 100 feet. The coarse portion of the tape assists the pilot in altitude captures and gross altitude awareness and is not numbered. It is marked with large rectangles for increments of 1,000 feet and small rectangles for 500 feet (Figure 16-13).

The barometric altitude readout ranges from -1,000 feet to 50,000 feet.

The digital readout in the fixed altitude window indicates the actual altitude and is marked in increments of 20 feet.

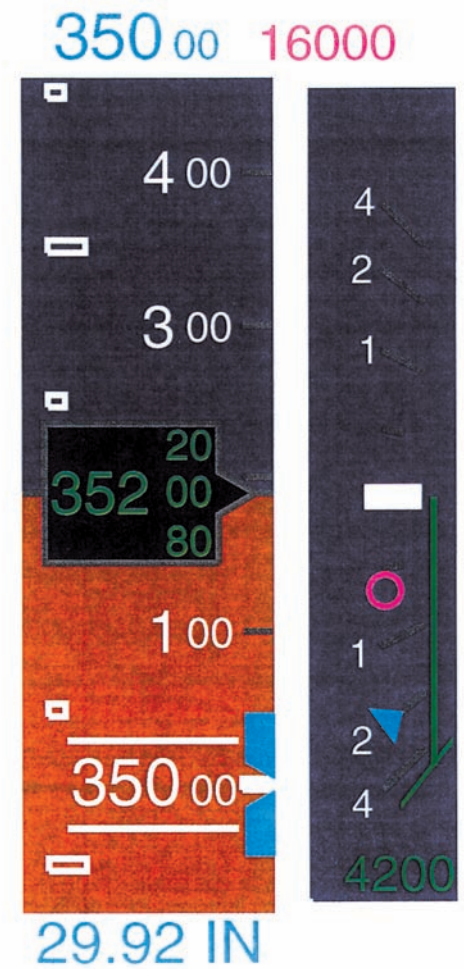

Figure 16-13. Altitude Display

Preselected Altitude

The preselected altitude is a reference for the altitude alert and autopilot systems.

The ALT knob on the FGP sets the preselected altitude bug and digital readouts. If the ALT knob is pushed while turning, the preselected altitude increments are 100 feet or 10 meters. If the ALT knob is in the normal out position, the preselect altitude increments are 1,000 feet or 100 meters. If a hundred-foot value has been previously set, this action resets to the next higher/lower thousands value with the first rotation of the knob.

When BARO MIN is on, the preselect altitude can be set at the value of BARO MIN. Rotating the knob one click counterclockwise from the closest thousand-foot increment above the baro minimums results in the altitude preselect set at the exact baro minimums.

This allows leveling off at the exact non-precision approach minimums with the flight director or autopilot on approach.

The cyan preselect altitude readout is displayed above the altitude tape; it has a selection range of –1,000 feet to 45,000 feet in increments of 100 feet.

The range of the metric preselect altitude is from –300 meters to 17,000 meters.

Altitude Alert

The altitude alert functions in the acquisition, deviation, and tracking modes of the flight director. The preselect altitude bug changes color and flashes when the altitude acquisition and deviation parameters are exceeded.

Aural alerts accompany the visual alerts for acquisition and deviation modes. Pressing the ALT knob cancels an altitude alert if active.

- Acquisition mode—Both preselect altitude bugs flash cyan and an aural C-chord tone sounds when the altitude is 1,000 feet above or below the preselected altitude

- Deviation mode—Both preselect indicators flash amber and the C-chord sounds when an altitude deviation of 200 feet or more above or below the selected altitude occurs
- Tracking mode—Monitoring of the preselected altitude tracking is a function of the ADCs

Radio Altitude Display

The PFD radio altitude display is presented as both a digital and moving tape readout.

The digital readout is displayed from -20 to 2,500 feet above ground level (AGL) in the lower center part of the ADI ball.

To set the RA/BARO MIN, or MIN ALERT, push the REFS button on the DCP to display and scroll through the menu pages on the PFD. Rotate the MENU knob to position the cyan cursor box around the selectable value.

The PUSH SELECT button on the DCP selects the next MIN ALERT option in the sequence. Rotating the DATA knob increases or decreases the values to be set. To change a value, the cyan selection box must be moved to that value. The selected value shows in large cyan text; non-selected text shows in small white text.

The menu pages are automatically removed from the PFD 20 seconds after the last activity.

Radio Altitude Flag

If the radio altitude data is invalid, a red boxed RA label is displayed and the radio altitude tape and digital readouts are removed.

The digital range can be selected from 0 to 999 feet. It is set on the REFS menu. When the aircraft descends to decision height, an amber boxed MIN indication is displayed when selected minimums are reached.

BARO MIN

BARO MIN with a range of 0 to 15,000 feet is set on the REFS menu. The selected minimums display in cyan as MIN XXX RA or MIN XXX BARO depending on which was set. The XXX represents the selected digital value.

As minimum descent altitude is approached, the cyan minimums pointer appears on the altitude tape. When the aircraft reaches minimums, a flashing amber MIN label is displayed on the right edge of the attitude indicator.

Air Data Flags

When ADC airspeed, altitude, or vertical speed data is invalid, red air data flags replace the affected systems information.

VERTICAL NAVIGATION DISPLAY

When vertical navigation is selected (VNAV), the following are displayed:

- FMS reference altitude
- Vertical deviation and scale
- Suggested vertical speed (circular bug)

Vertical Speed Field

The vertical speed (VS) display consists of a vertical analog scale and pointer with a green drag line. A part-time digital readout of the vertical speed is also provided.

The VS pointer moves up and down the scale to indicate current VS. As the pointer moves, the drag line displays to emphasize the VS.

The vertical speed scale has a range of ±4,000 fpm. A part-time digital readout of the vertical speed is displayed on either the top or bottom of the scale respective of climb or descent.

Selected VS shows on the VS scale as a reference bug and as a digital readout on the AFCS mode field above the attitude indicator.

When VS mode is selected, the VS readout in the AFCS mode field appears. The VS bug icon is to the left of the VS scale, and the

climb/descent arrow is to the right. The readout, icon, and arrow remain in view as long as the VS mode is active.

The VS bug and display show in cyan when commanded by the UP/DOWN wheel on the FGP. The readout icon and bug are magenta when the FMS is in control.

The vertical speed scale also displays TCAS advisory deviations.

The FMS vertical speed required (VSR) advisory pointer is a magenta open circle that indicates the minimum average VS required to climb or descend from the present position to the next climb (or descend) altitude constraint. The FMS must be the active navigation source for the pointer to be displayed.

NAVIGATION DISPLAY

The navigation indications on the PFD provide course, course deviation, bearing and distance information from the selected navaid. The data is normally presented in a conventionaly HSI format but may be switched to a moving map display. The moving map display is referred to as present position (PPOS) mode.

Horizontal Situation Indicator

The horizontal situation indicator (HSI) represents the compass card, which incorporates selectable navaids, bearing and course pointers. HSI indications include course pointer, lateral deviation bar, lateral deviation scale, and to/from indicator.

- Course pointer—Arrow that points to the course position of the compass card; CRS knob controls the pointer
- Lateral deviation bar—Indicates aircraft deviation from selected course; bar moves from side to side and its position is read against the deviation scale
- To/from arrow—An outlined triangle on the course/desired track pointer; arrow points toward head to indicate TO and toward tail to indicate FROM.

Green is for VOR onside information and amber for cross-side information; in FMS mode, the entire display is magenta.

Navigation Data

Navigation data is displayed on the lower part of the PFD. The display includes:

- Navigation source indicator
- Course display
- Distance display
- Station identifier

Navigation Source Indicator

The navigation source indicator is presented in digital format. The NAV SRC button on the DCP selects the navigation source. A menu window opens vertically on the left side. By repeatedly pushing the NAV SRC switch, the available list is shown:

- VOR1/LOC1
- VOR2/LOC2
- FMS1
- FMS2
- OFF (no display)

Course Display

The selected source display is a three-digit display preceded by a CRS label. The course range is from 1° to 360° selected with the CRS knob on the FGP.

The track pointer is positioned on the compass rose or compass tape at the current aircraft track over the earth; pointer is a green open circle shape. The difference between the track pointer position and the lubber line is the drift angle.

Bearing Pointers

Bearing pointers display bearing information from a selected navaid. Two bearing pointers can be displayed on the compass rose or PPOS map format: one from a number 1 bearing source and another from a number 2 bearing source.

The number 1 source is a cyan single lined pointer; the number 2 source is a white double lined pointer.

Bearing icons are miniature representations of the bearing pointers that identify the actively selected bearing pointer. The bearing source display is blank if the BRG source selection is OFF. The bearing pointer is removed from view when bearing source is invalid.

The source indicator and pointers are selectable through the BRG SRC pushbutton on the DCP. The bearing source indicators are displayed vertically in the lower left portion of the PFD.

The selection box is moved with the MENU knob to select the number 1 or number 2 navigation source. The PUSH SELECT or DATA knob selects the bearing source or OFF.

As in the navigation source indicator, the bearing source indicator and bearing pointers show which bearing source is in use:

- VORl/VOR2
- ADFl/ADF2
- FMSl/FMS2
- OFF (no display)

Distance Display

The distance display shows the DME slant range distance to the navaid station.

When the DME H button is selected on the DCP, the held DME frequency replaces the AUTO annunciation on the NAV CONTROL menu; the DME frequency can be tuned separately from the VOR frequency.

When the DME transceiver is in hold mode, a cyan H beside the DME frequency in NAV replaces the normally green NM on the PFD.

When the DME TEST control is selected, the TEST annunciation shows in large cyan text. The DME distance is 100 NM, the TTG is 60 minutes, the station ID is AOK, and ground speed is 100 knots. This test lasts about 10 seconds.

Station Identifier

The navaid identifier is shown in the navigation data field above the distance display. The DME supplies data for the identifier. In DME hold, the identifier is removed from view.

Alert Flags

A red boxed navigation source flag (VOR, LOC, and FMS) is displayed during a failure of the selected NAV source. The navigation display is removed from view when the flag is displayed.

Invalid data from the selected bearing source causes the bearing source icon to be replaced by a red boxed warning flag. The bearing pointer is removed from view when the flag is displayed.

HEADING DISPLAY

The aircraft is displayed on a compass card at the bottom of the PFD. The AHRS system supplies the data to produce the display. Magnetic or directional gyro heading information may be displayed.

Heading Indicators

Heading indications are represented on the compass card. The display shows 360° from the current heading. The compass card has 10° major indices, 5° minor indices, cardinal point characters at N, S, E, W, and numeric labels at 30° intervals.

The fixed lubber line is at the top center position of the compass card. The lubber line indicates the aircraft heading reference.

Selected Heading Reference

The selected heading reference is presented on the heading display as a heading bug, bug vector, and heading readout. The heading bug indicates the heading selected at the HDG knob on the flight guidance panel.

Attitude and Heading Flags

When the attitude or heading data from the AHRS becomes invalid, warning flags are displayed.

- Red boxed attitude flag ATT—Attitude information is invalid; all other attitude information disappears from the PFD
- Red boxed heading flag HDG—Heading source is invalid; flag replaces the heading readout; compass rose (or arc) is rotated to north-up, and lubber line around the digital heading is removed

AFCS MODE DISPLAY

The automatic flight control system (AFCS) information on the PFD consists of flight guidance mode, autopilot mode indications, and flight director command bars.

Autopilot Indication

Autopilot information concerning engagement, disengagement, and flight director in use is displayed in the top center portion of the attitude display. A green AP indicates autopilot engaged; the horizontal arrow points to the FD coupled side.

A flashing red AP indicates autopilot has disengaged. The AP symbol flashes for five seconds and the aural cavalry charge is heard. A white arrow indicates autopilot is not engaged and control of the FD is transferred to the indicated side when engaged.

Flight Guidance Mode

Flight guidance modes are displayed on the top center portion of the PFD with three fields divided by thin vertical grey lines. The left field of the line represents the lateral modes. The center field represents AP/YD engagement. The right side represents the vertical modes. Active modes are green and armed modes are white.

1/2 Bank Indicator

When the aircraft climbs above 31,600 ft, the 1/2 bank flight director commands are automatically generated. The flight director 1/2 BANK mode can be manually selected on the FGP.

When the 1/2 BANK mode is active, a green arc is drawn above the top of the attitude scale above the ADI. The length of the marks represents 15º of roll. Selecting 1/2 BANK a second time disengages the mode.

Flight Director Warning Flag

A red boxed FD warning flag appears when either pitch or roll attitude input to the flight director becomes invalid. The flight director command bar is removed when the FD label is displayed.

Command Bars

The flight director command bars provide flight control computer guidance instructions.

The magenta command bars are a V-shaped cue symbol or cross pointers that move horizontally and vertically around the apex of the black aircraft symbol.

Pressing the REF button on the DCP permits selection of the command bars option. This provides a vertical menu on the left side of the PFD with three pages of menus. Rotate the MENU/DATA knob to scroll through the various options. On the third page, the VBAR or XPNTR is selected by toggling the PUSH/SELECT button in the MENU/DATA knob.

DECLUTTER

Declutter clears all nonessential information from the PFD during aircraft upset or unusual attitudes (Figure 16-14). Red chevrons appear, pointing toward the horizon.

Declutter occurs when pitch angle exceeds +30° or –20° or roll angle exceeds 65° left or right.

When the pitch and roll limits are restored, the PFD resumes displaying all information.

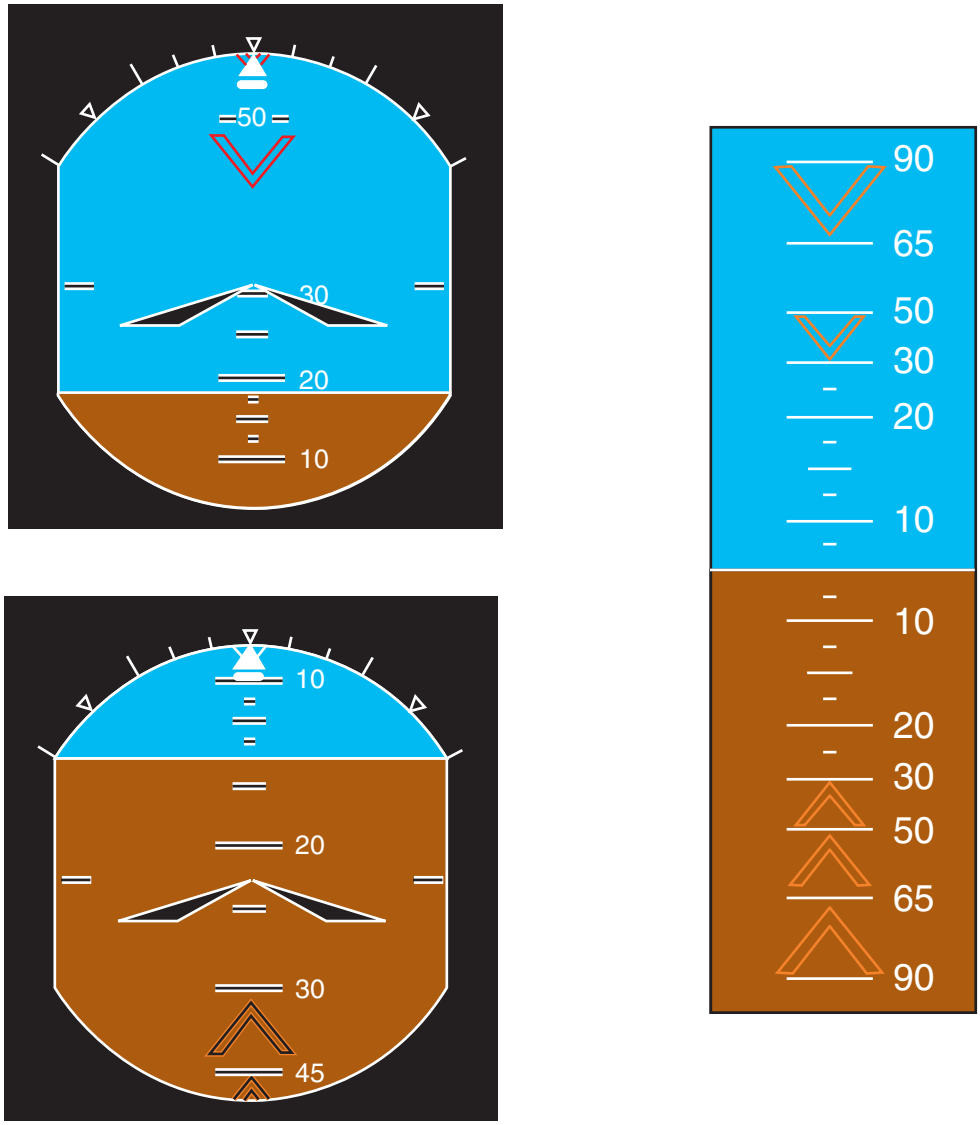

Figure 16-14. Decluttered EADI in Excessive Pitch—Example

DISPLAY CONTROL PANEL

The display control panel (DCP) controls the information displayed on the PFD and the radio functions on the MFD. The following is a brief description of the DCP control knobs, switches, and pushbuttons (Figure 16-15):

- 1/2 button—Selects and deselects cross-side radio menu on the MFD; when a radio submenu is in view, the equivalent cross-side radio submenu is selected/de-selected when the RADIO button is pushed
- DME/H button—Selects and deselects DME hold function; when DME hold is selected, the DME holds the current NAV frequency while allowing the VOR radio to be tuned independently
- NAVSRC button—Cycles through the list of available navigation sources; re-peated pushes select the next listed source as the new active navigation source. The list automatically times out.
- FRMT button—Selects the current PFD display format between present posi-tion (PPOS) and compass rose (ROSE)
- TFC (traffic) button—Overlays TCAS on PFD compass rose or map. When there is not an active RA or TA, the range is the last active TCAS range. A second press removes TCAS. Continuously pressing for more than one second se-lects compass rose/TCAS format with range set to the default 10 mile full range; radar or terrain overlays, if pre-viously displayed, are removed.
- TR/WX button—Selects and deselects the display of terrain, weather, and light-ning (if installed) on the PFD.
  - o First push selects a new state in the TR/WX list; PFD automatically changes range to an appropriate range if required
  - o Second push moves cursor to next available state
  - o If TAWS declares a terrain awareness warning or caution, pressing the TR/WX button causes an immediate response regardless of the current for-mat. The first momentary press selects terrain for display at its default 10 nm range and PPOS format.
- TUNE knob—For MFD radio tuning; larger and smaller knobs change the most significant and least significant digits of the frequency respectively; up down arrow button in the center swaps the recall and the active frequencies
- RADIO button—Selects and deselects on the MFD the tuning control sub-menu of the radio associated with the current position. Pressing the RADIO button when another menu is displayed closes the menu and returns the tune box to its home position.
- BRGSRC button—Displays a menu of bearing pointer sources with the cur-rent bearing pointer source highlighted; MENU, DATA knob, and PUSH SE-LECT button select and deselect the bearing pointers

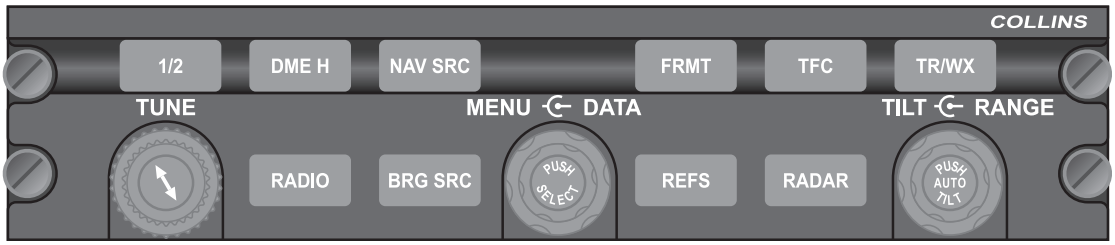

Figure 16-15. Display Control Panel

- MENU/DATA knob
  - o MENU—Moves a cyan selection box to allow activation of various display items on PFD and MFD
  - o DATA—Changes the value in the selection box
  - o PUSH SELECT button in center—Makes the value entered with DATA knob the active display value or changes the state of item in the selection box
- REFS button—Selects the desired V-speed reference menu. The selected V-speed references are shown on the airspeed display; V_1, V_R, V_2, V_T, V_{GA}, and V_{REF} are initialized to default values but remain inactive until selected or changed by the pilot.

  The REFS push button located on the DCP is used to select the desired reference menu. Repetitive pushes of the REFS button toggle through the three pages of the REFS menu.
- RADAR button—Selects and deselects radar control menu on the PFD; the menu provides mode, ground clutter suppression, gain, sector scan, and target selections.
- TILT-RANGE knob
  - o RANGE—Controls the decrease or increase of the PFD and MFD navigation display range until the minimum or maximum range is reached
  - o TILT—Selects radar antenna tilt range (–15 to +15º).
  - o PUSH AUTO TILT button—Located in the center of the knob selects and deselects automatic tilt control

DCP WARNING FLAG

A display control panel (DCP) failure results in display of an amber boxed DCP flag. This flag will appear on the PFD and MFD displays.

MULTIFUNCTION DISPLAY

The left and right multifunction displays (MFDs) are in the center of the instrument panel (Figure 16-16). During normal operation, the top half of the left MFD displays EICAS data, including engine indications, full time system indications, and CAS messages.

The top half of the right MFD displays the summary page or electronic checklist.

The lower half of both left and right MFDs can display synoptic or navigation information. Navigation information can be displayed in PPOS, PLAN (north-up display), or TCAS-only formats.

The top half of the right MFD can also display maintenance diagnostic system information.

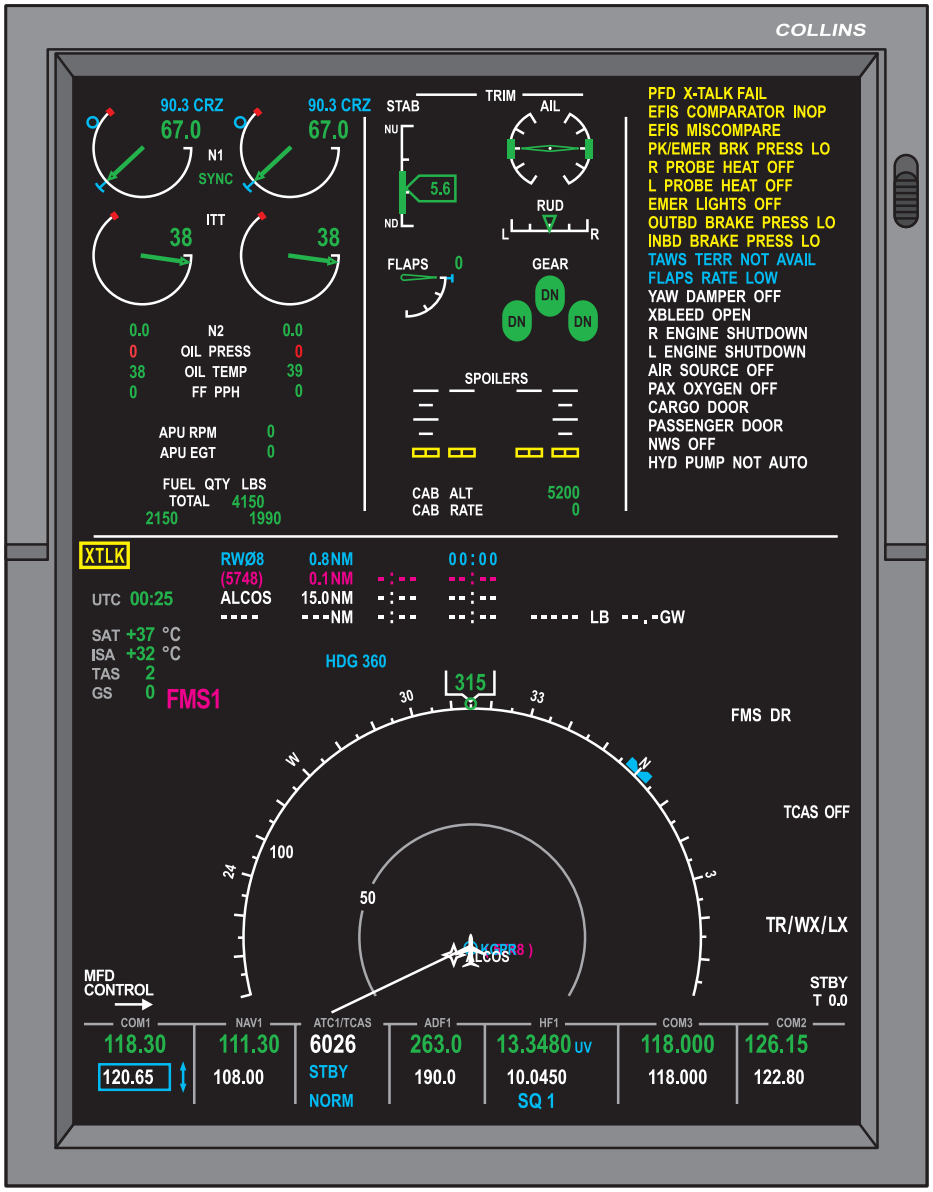

Figure 16-16. Multifunction Display

MFD CONTROL PANEL

The MFD control panel is on the center pedestal (Figure 16-17). The L/R toggle switch determines which MFD is controlled when button selections are made.

The panel controls CAS paging, electronic checklist functions, navigation displays, and synoptic displays.

- CAS button—Pages through the list of CAS messages. Caution, advisory, and status messages may be hidden by paging through all existing messages to a blank page. New messages then appear on the blank page. All messages can be retrieved by subsequently pressing the CAS button.
- CKLST switch—Presents or removes a checklist display
- SKIP switch—Skips checklist items on the display
- FRMT switch—Selects the MFD format (PPOS, Plan, and TCAS modes)
- TFC switch—Selects TCAS overlays
- TR/WX switch—Selects terrain, weather, and lightning
- ENTER switch (associated with joystick)—Enters PPOS waypoint or selects current menu item in the top half
- SUMRY—Displays the EICAS summary display
- A/ICE button—Displays anti-ice synoptic page
- ECS button—Displays environmental control system synoptic page
- ELEC button—Displays electrical synoptic page
- FLT button—Displays flight controls synoptic page
- FUEL button—Displays fuel synoptic page
- HYD button—Displays hydraulic synoptic page

3D MAP DISPLAY

The optional 3D map format is an advanced FMS feature that provides lateral, vertical, and performance predicted flight plan information in a single combined three-dimensional (3D) format on the MFD.

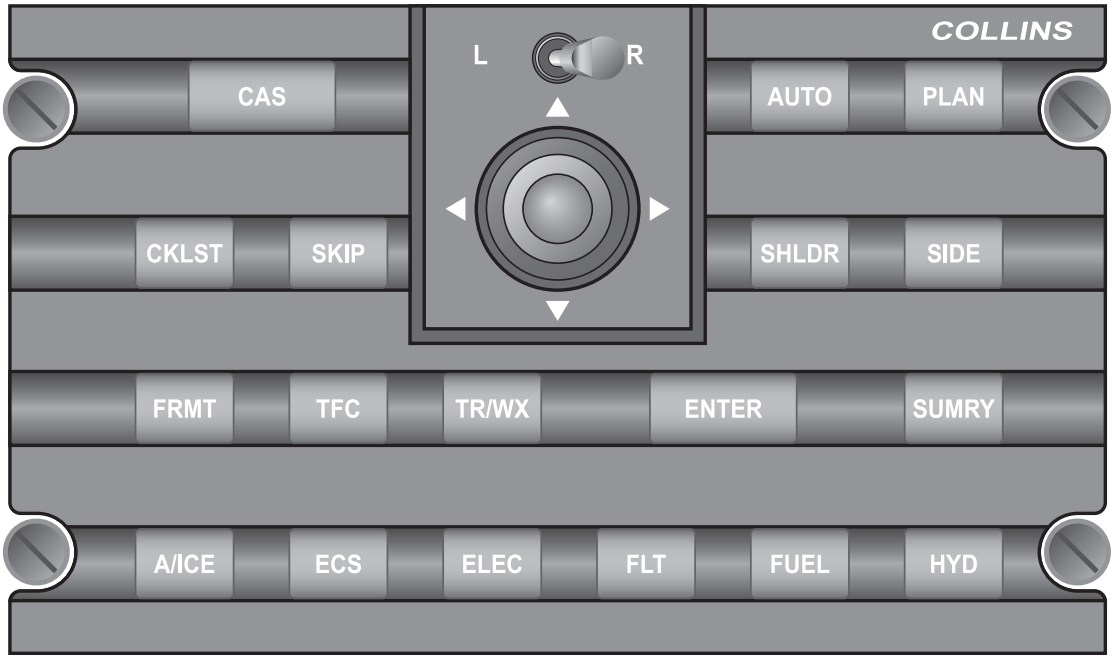

Figure 16-17. MFD Control Panel

The 3D presentation depicts the flight plan and predicted vertical trajectory of the aircraft so the pilot can interpret the current and future aircraft situation. The display is referenced to true North. Waypoints are drawn at their actual latitude and longitude.

The CCP joystick, SHLDR, SIDE, and PLAN controls manipulate the presentation.

Joystick—Rotates the display clockwise, counterclockwise, and allows vertical viewing angles from 90° to 0°. Refer to the *Rockwell-Collins Pro Line 21 Avionics System Operator's Guide* for a more detailed description.

- AUTO view—When AUTO view is on, the MFD automatically rotates the view to maintain a consistent viewing angle as the inbound course changes. When flying a curved flight leg or holding pattern, the viewing angle is the inbound course relative to the abeam point angle.
- PLAN Switch—Display gives a vertical view of the inbound course.
- SHLDR view—Viewing angle is 22° lateral and 75° vertical relative to the inbound course
- SIDE view—Provides the pilot with 90° lateral and 90° vertical viewing angles relative to the inbound course

REVERSION SWITCH PANEL

The following reversionary modes are available for the PFDs and MFDs (Figure 16-18):

- LEFT DISPLAYS
  - o NORM—L-MFD format is normal; L-PFD is normal
  - o MFD REV—L-MFD displays compressed PFD format; L-PFD is shut down
  - o PFD REV—L-MFD is shut down; L-PFD displays compressed format
- RIGHT DISPLAYS
  - o NORM—R-MFD format is normal; R-PFD is normal
  - o MFD REV—R-MFD displays compressed PFD format; R-PFD is shut down
  - o PFD REV—R-MFD is shut down; R-PFD displays compressed format

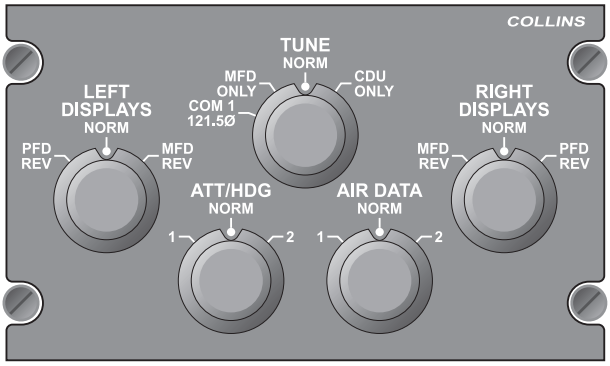

Figure 16-18. Reversion Control Panel

MISCELLANEOUS INSTRUMENTS

STANDBY INSTRUMENT

The self-contained standby instrument supplies backup indications received from the standby pitot static system (Figure 16-19).

Figure 16-19. Standby Instrument

The indicator supplies the crew with displays of aircraft speed, attitude, slip/skid, and ILS data.

The standby instrument is normally powered by the right essential bus. If power to the right essential bus is lost, the standby instrument is powered by its own independent battery pack. Standby instrument battery endurance is approximately 3.5 hours.

VHF navigation receiver 1 supplies data to the localizer and glideslope. The localizer and glideslope pointers and scales are not in view until an ILS frequency is selected.

If the localizer data becomes invalid, a red LOC or GS flag is visible; the pointer and scale are removed.

Aligning Flag

When the standby instrument is first energized, an aligning flag is visible. From initial application of the 28 VDC, the display requires a maximum of 90 seconds to stabilize if aircraft attitude is less than 5°. After aligning, the flag is no longer visible.

Operation

The standby instrument has the following controls:

- Gyro caging (CAGE)
- Baro-settings (STD)
- Dimming adjustment (BRT and DIM)
- Rotary knob (BARO) to enter the barometric pressure correction

CLOCK/CHRONOMETER

A digital electronic clock/chronometer is in the center of the instrument panel just below the standby instrument. It consists of a flight time display, a time of day display (UTC or local), and a chronometer. Flight time (FLT) represents the time the aircraft is in the air as determined by the PSEU (Figure 16-20).

Figure 16-20. Clock/Chronometer

Controls include the following:

- FLT RST switch—Resets flight time to 00:00 when held for 2 or more seconds
- CHR switch—Controls the chronograph (CHR)
  - o First depression starts the CHR from zero (00:00)
  - o Second press stops the timer
  - o Third press deletes display and resets the timer
- GPS mode—Illuminated GPS indication on the LCD display; chronometer uses external GPS time
- MAN mode—Indicated by absence of GPS indication on the LCD display; chronometer now uses a highly accurate internal time base
- MODE pushbutton—Toggles between UTC (zulu time), LOC (local time), and date displays; pressing and holding the pushbutton for more than two seconds allows the chronometer to enter the UTC, LOC, and date mode

STANDBY COMPASS

The standby compass supplies magnetic heading data.

The standby compass is installed in a bracket on the center post of the windshield above the flight guidance panel (Figure 16-21). The compass is aligned with the aircraft longitudinal axis.

The compass is a self-contained unit that has a transparent and molded bowl filled with silicon fluid. In the fluid is a sphere with a compass dial. Silicone fluid ensures free and smooth movement to provide an accurate indication. Metal bellows in the compass let the fluid volume expand and contract to changes in temperature and altitude.

The standby compass is lighted and uses a special non-magnetic bulb. The light unit is powered by 5 VDC from the integral light controller.

The compass dial shows markings for the four cardinal heading (N, E, S, W) and has numerals every 30° with bars every 10°. The last numeral is not shown (for example “24” means “240”). Heading of the aircraft is read against the vertical lubber line.

Figure 16-21. Standby Compass

Compass Correction Card

A compass correction card is installed on a bracket above the standby compass. The card has a STEER row to write the corrected heading for each of the cardinal headings and for the 30° increments.

AUTOMATIC FLIGHT CONTROL SYSTEM

The automatic flight-control system (AFCS) consists of dual-independent flight directors, a two axis (pitch and roll) autopilot, and a single axis yaw damper. The AFCS reduces the workload in the cockpit by providing steering commands through the flight director or automatically flying the aircraft.

The AFCS operates with the integrated avionics processor system (IAPS). The IAPS collects the data for the avionics systems. The AFCS gives the course, heading, and preselected altitude data to the electronic flight instrument system (EFIS).

The AFCS calculates the vertical and lateral flight-guidance commands to keep the aircraft on the correct pitch/roll attitude. The flight directors show the flight-guidance commands on the primary flight displays.

FLIGHT GUIDANCE PANEL

The flight guidance panel (FGP) (Figure 16-22) selects and controls the flight director, autopilot, and yaw damper functions. The FGP on the glareshield is accessible to both pilots.

The FGP is divided by the functional areas:

- Flight director/course
- Lateral modes
- Vertical modes
- Autopilot

FD Button

FD 1 or 2 buttons select or deselect the onside flight director. This includes the lateral and vertical steering commands and text messages, which represent selected modes.

When the FD button is pushed to activate the flight director, pitch and roll modes are automatically selected.

Pushing the FD button when the flight director is already active deselects the flight director. With the autopilot engaged and the flight director showing, deselection of the flight director removes steering commands but not text messages. The flight director, however, continues to supply steering commands to the autopilot.

CRS Knob

The course set knob (CRS) at each end of the FGP individually sets the courses on the left and right PFD HSI displays. The CRS knob primarily sets the course for a VOR radial or LOC course.

The knobs have a pushbutton in the center to synchronize the display to the aircraft direct-to course.

NAV Button

Pressing the navigation (NAV) button alternately selects and deselects navigation mode. NAV mode normally intercepts route segments identified with VOR radials and intercepts and flies desired FMS tracks.

HDG Button and Knob

The heading (HDG) button engages the heading mode. A green HDG is displayed on the PFDs. The heading button controls the heading bug and digital display.

Pressing the pushbutton in the center of the HDG knob synchronizes the HDG bug on all display units to the aircraft current heading. The flight director command bars command a turn in the direction the heading bug was moved to achieve the set heading.

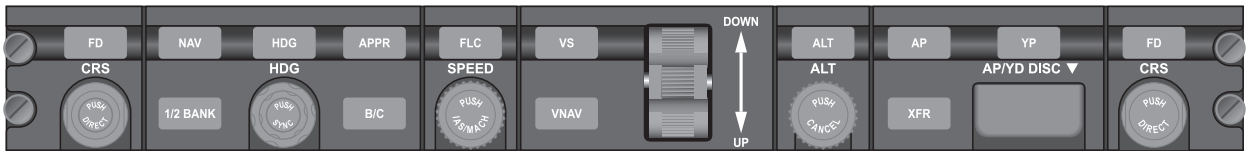

Figure 16-22. Flight Guidance Panel

APPR Button

The approach (APPR) button selects or deselects approach mode, which enables lateral and vertical guidance for all types of approaches.

The VOR approach mode is selected by pressing the APPR mode button with the navigation receiver tuned to a VOR frequency and selected as active navigation.

When the navigation receiver is tuned to an ILS frequency, ILS is selected as the active navigation source.

Selection of APPR mode when the navigation source is FMS engages the FMS lateral mode the same as described for NAV mode. It also arms VNAV for approach.

B/C Button

The back course (B/C) button selects or deselects the back course mode for flying a localizer back course approach.

1/2 BANK Button

Pressing the 1/2 BANK button selects or deselects a reduced maximum bank angle of 15° (for all lateral modes except roll) on both flight directors. When selected, a green 1/2 bank arc appears on the top of the attitude direction indicators.

FLC Button

Depressing the flight level change (FLC) button synchronizes on engagement to the current airspeed/Mach. The speed reference can then be changed with the SPEED knob. Pushing the FLC switch again disengages the mode.

SPEED Knob

The rotary SPEED knob changes the IAS/Mach speed reference (FLC mode). The speed knob changes the bug airspeed or Mach at any time. The integral PUSH IAS/MACH button within the SPEED knob toggles the airspeed tape between IAS and Mach.

The master flight director computes the airspeed reference; the slave flight director synchronizes to this reference.

VS Button

The VS button selects vertical speed mode. When activated, the system maintains the vertical speed reference. The vertical speed reference is set to the current vertical speed at the time of mode selection.

After mode selection, rotation of the DOWN/UP wheel slews the vertical speed reference in the direction of knob rotation. Range is ±8000 fpm.

VNAV Button

The vertical navigation (VNAV) button arms and then captures the FMS pitch steering commands for enroute and approach operations.

ALT Button

The altitude hold (ALT) button engages altitude hold. With ALT engaged, the flight director holds the existing altitude at the time the ALT button was pushed (except during a precision approach with the glideslope captured).

ALT Knob

The altitude select (ALT) knob sets a preselected altitude. This mode allows the FD/AP to climb or descend to a preselected altitude and then level off to maintain the preselected altitude.

If an altitude deviation (±200 ft) has occurred, the altitude preselect digits turn amber and flash. Press the PUSH CANCEL button in the center of the ALT knob to cancel the flashing. The digits then revert to cyan.

AP Button

The autopilot (AP) button engages the autopilot. Pressing the button a second time disengages the autopilot.

YD Button

The yaw damper (YD) button engages the yaw damper. The YD can be engaged independently of the autopilot, but the autopilot system does not engage without the YD.

XFR Button

The transfer (XFR) button selects desired flight director (left or right) to command the autopilot.

ADDITIONAL CONTROLS AND INDICATIONS

The autopilot/yaw damper disconnect bar (AP/YD/DISC) is used to disconnect the autopilot and yaw damper by removing power to the servo clutches. A red line is visible on the top edge of the switch when the switch has been moved to the disengage position.

Each thrust lever has a takeoff/go-around (TOGA) switch (Figure 16-23).

Both PFDs and MFDs display AFCS information.

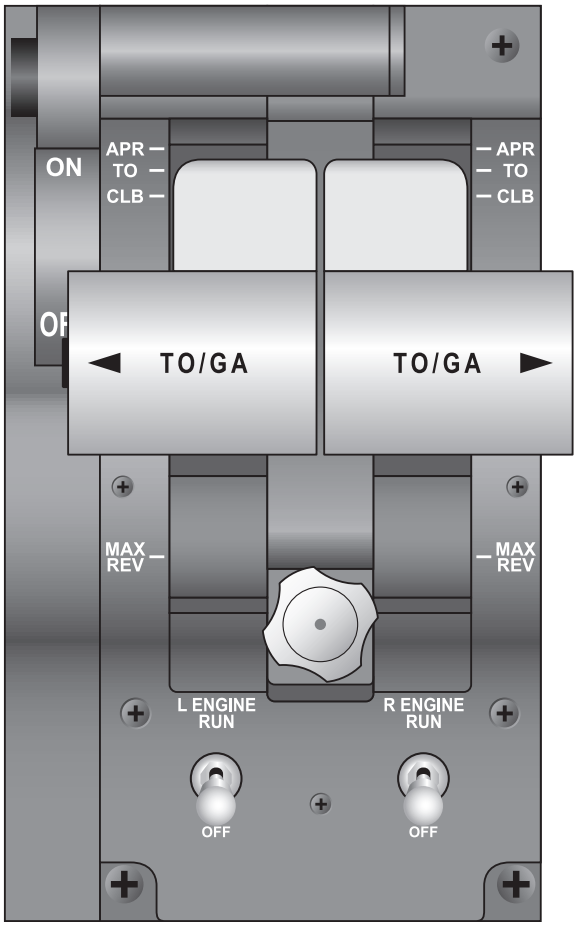

Figure 16-23. TO/GA Switch

FLIGHT DIRECTORS

The flight directors (FDs) display flight guidance cues on the attitude indicators to assist the crew in maintaining a specified flight path. The crew can choose to hand fly the aircraft with raw data (FDs not displayed), hand fly the aircraft using the FD command bars, or couple the autopilot to the flight director.

When manually flying the aircraft, dual flight directors provide steering commands through FD command bars on the primary flight displays. For automatic flight control, the flight director steering commands are coupled to the autopilot.

Visual display guidance includes single cue inverted V-shaped command bars or cross-pointer command bars (Figure 16-24). The command bars provide visual guidance regardless of the autopilot engagement mode.

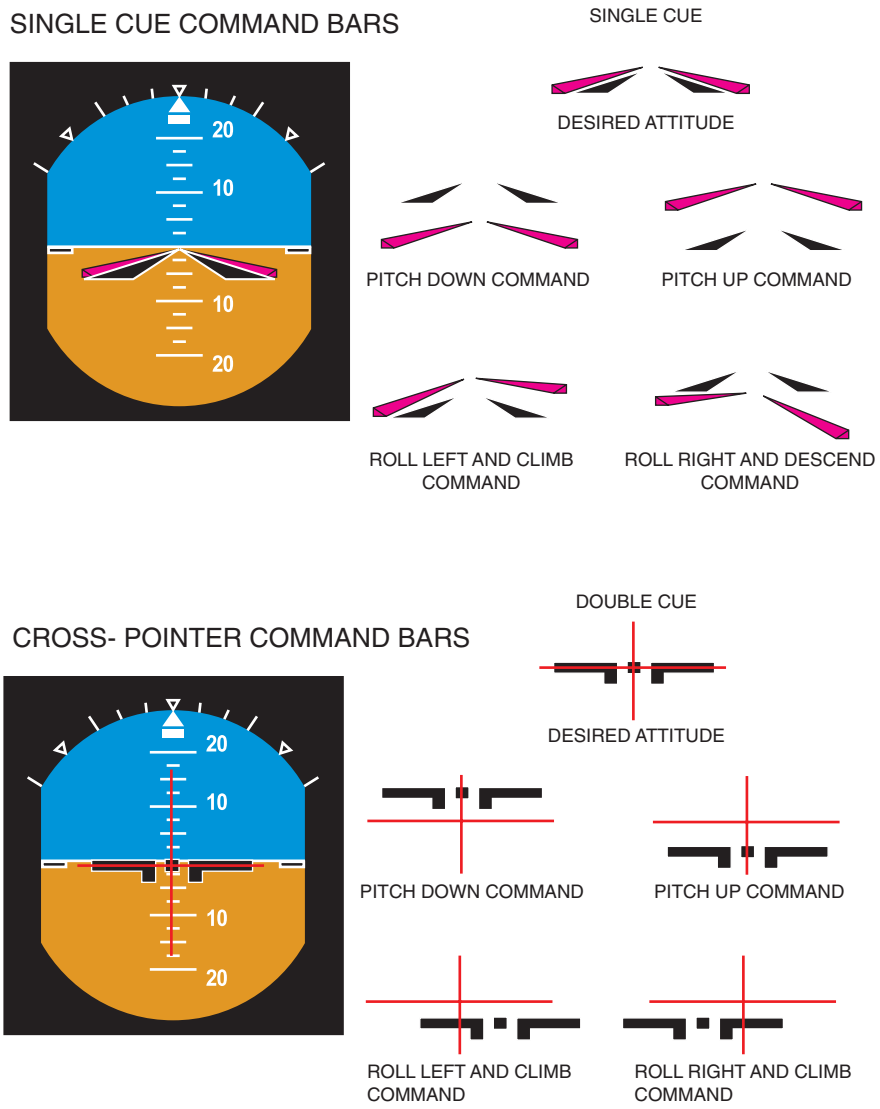

Figure 16-24. Flight Director Command Bars

Lateral and vertical FD modes are presented in the flight mode annunciator display on each PFD. The flight guidance mode display area is above the attitude indicator (Figure 16-25).

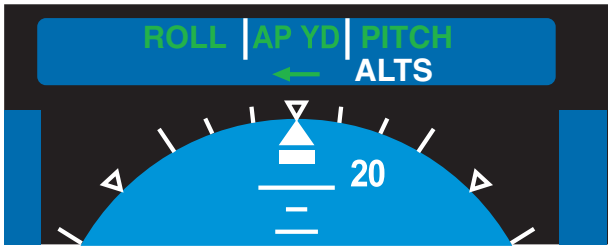

Figure 16-25. Flight Guidance Mode Display

Active modes are displayed in green on the top line and armed modes are displayed in white on the bottom line.

Flight director (and autopilot and yaw damper) processing is accomplished within the two FGCs in the IAPS. The left and right FGCs are identical. During precision approach and go-around modes, each FGC provides guidance to the onside displays. In all other FD modes, only one FGC provides guidance to both left and right flight displays.

The pilot flying can select between flight director by using the transfer (XFR) button on the flight guidance panel.

If the active flight director fails, a red boxed FD appears on the primary flight display and a cyan FDl (2) FAIL CAS message is displayed. Selecting the XFR switch on the FGP deselects the failed flight director. The functional flight director becomes active.

SYNCHRONIZATION

Pushing the AP/FD SYNC button on the side of each control wheel synchronizes the flight director lateral and vertical references to those currently being flown. Synchronization continuously updates as long as the SYNC button is held. When the SYNC button is released, the flight director is commanded to hold the present aircraft attitude.

When the autopilot is engaged, depressing the SYNC button momentarily releases the aileron and elevator servo clutches so the aircraft can be flown manually. Upon release, the autopilot smoothly reengages and follows the flight director steering commands.

LATERAL MODES

Lateral modes are armed or activated by pushbuttons on the FGP or thrust levers. Reselecting the active FGP pushbutton or selecting another lateral mode disables the active lateral mode.

There are eight lateral flight director modes:

- ROLL
- TO (takeoff)
- HDG (heading)
- NAV (navigation, i.e., FMS, VOR)
- GA (go-around)
- APPR (approach)
- BC (back course)
- 1/2 BANK (half bank)

The lateral modes field on the PFD is shown in Figure 16-26.

ROLL Mode

ROLL mode is the default lateral mode. When the autopilot is engaged and no other lateral mode is selected, the flight director automatically defaults to the basic ROLL mode. A green ROLL is displayed in the active lateral field of the PFD.

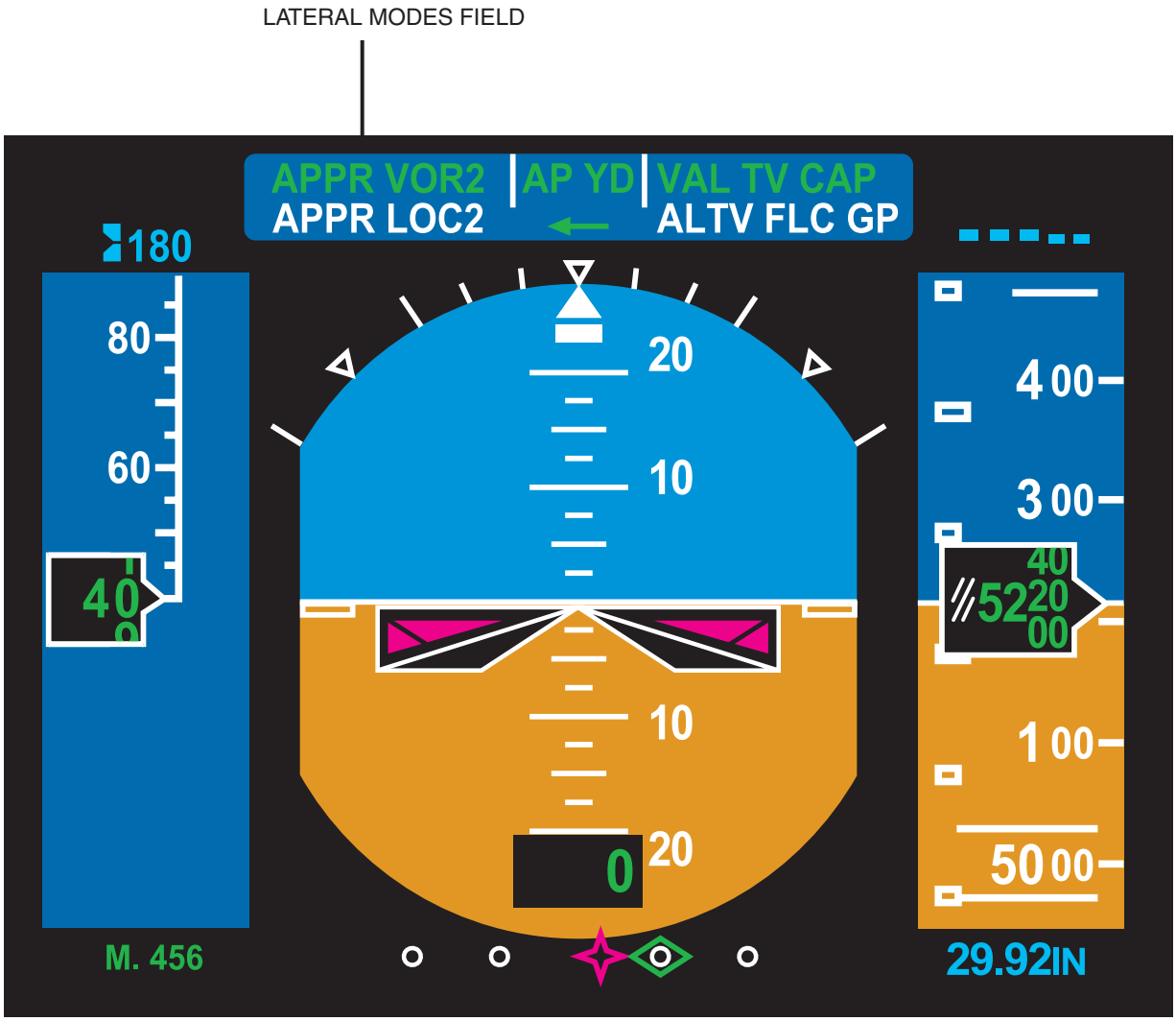

Figure 16-26. Lateral Modes on the PFD

Roll mode generates commands to hold the existing heading unless the roll angle is over 5°. In that case, commands are generated to hold the roll angle present at the time of mode selection.

The roll mode reference is reset to the current heading or the current roll angle upon autopilot engagement or flight director synchronization.

The flight director automatically defaults to the basic ROLL mode when NAV mode is being used and the navigation source is lost.

ROLL mode is annunciated by a green ROLL in the active lateral field of the PFD.

Lateral Takeoff Mode

Pushing one of the TOGA switches prior to start of the takeoff roll activates the lateral and vertical takeoff modes. A takeoff flap setting, however, is required to get proper takeoff mode display. A green TO annunciates the mode in the active lateral field on the PFD.

Once airborne, the lateral takeoff mode generates a heading hold command. The heading hold is based upon the actual aircraft heading at the moment of weight-off-wheels.

The mode has a 5° bank angle authority.

Heading Mode

The HDG switch and knob generate commands to capture and maintain a pilot selected heading. A digital heading readout and heading bug on the PFD display selected headings. A green HDG in the active lateral field indicates the mode.

Pushing the HDG pushbutton selects the heading mode. The HDG knob changes the selected heading command. Pressing the pushbutton in the center of the knob resets the heading bug and digital readout to the current aircraft heading.

When first selected, commands are generated to turn in the direction closest to the selected heading. If the selected heading reference is adjusted by more than 180°, commands are generated to turn in the same direction the knob was rotated.

NAV Mode

The NAV mode generates commands to capture and track the active navigation source displayed on the PFD. Navigation mode arms when it is selected, but it cannot capture if the FGC is not receiving valid navigation data.

Pushing the NAV switch activates the NAV mode. The mode can be deselected in one of the following ways:

- Pushing NAV switch again
- Selecting another lateral mode
- Changing frequency of onside navigation signal
- Changing navigation source
- Turning off the flight directors with the AP disengaged
- Changing coupled side

Prior to capture, the flight director operates in heading mode. The capture point is a function of closure rate. Navigation capture clears the heading select mode. Localizer capture also clears the half bank mode.

The flight director provides a NAV to NAV capture logic that allows automatic transition from FMS navigation to LOC or back course mode when FMS is the selected NAV source.

The following are navigation sub modes:

- FMS navigation
- VOR navigation
- LOC and backcourse

Annunciations

When navigation mode is selected, the green HDG displays in the lateral capture field. A white navigation source identifier (VOR1, VOR2, LOC1, LOC2, FMS1, FMS2) displays in the lateral arm field.

When navigation mode capture/tracking occurs, a green message displays in the lateral capture field that identifies the navigation source.

Dead reckoning operation is executed during the VOR station passage. Small green DR letters are added to the lateral navigation capture annunciation.

Go-Around Mode

When airborne, pressing either TOGA switch activates the lateral and vertical go-around modes. Lateral go-around mode generates a heading hold command with a 5° bank angle authority. A green GA message displays in the lateral capture field of the PFD for lateral go-around.

Pushing the TOGA switch disengages the autopilot (but not the yaw damper) and clears all existing modes. The resultant autopilot warning may be cancelled by another push of the TOGA switch or by pushing the MWS switch on the control wheel.

GA is deselected if any of the following occurs:

- Autopilot engagement
- Another lateral or vertical mode selected
- Pressing SYNC button, which selects pitch and roll modes
- Turning off the flight directors
- Rotation of the UP/DOWN wheel

Selection of GA causes the flight directors to operate independently.

APPR Mode

Pressing the APPR button selects the approach mode. In this mode, the flight director generates commands to capture and track lateral guidance for localizer, VOR, and FMS approaches. A green APPR is displayed.

The approach mode can be cleared in one of the following ways:

- Pushing APPR button again
- Selecting another lateral mode
- Changing frequency of the onside navigation signal
- Changing onside navigation source
- Turning off flight directors with autopilot disengaged
- Changing coupled side

The lateral approach mode generates commands to capture and track the signal from the navigation source displayed on PFD. The approach mode can be selected, but it will not capture until the onside PFD's active navigation source is valid and capture criteria has been met (except for FMS).

Selection of an approach mode arms each FGC's lateral guidance to the onside navigation source. The capture point is independently determined for each FGC.

Half bank mode is automatically deselected when APPR mode is selected.

B/C Mode

Pushing the B/C button selects the localizer back course mode. Back course mode generates the command to capture and track the back course signal from the LOC source displayed on the PFD.

Upon back course mode selection, the flight director arms to capture the signal from the selected navigation source. If the flight director is capturing or tracking FMS in NAV mode (with the LOC as the preselected course), it continues to track FMS and arms LOC for capture.

Back course capture clears half bank and heading modes.

Back course mode can be deselected in one of the following ways:

- Pressing B/C button again
- Selecting another lateral mode
- Changing frequency of the navigation signal
- Changing preselect navigation source (other than changing to localizer)

Regardless of whether the approach is a front course or back course approach, always set the course to the inbound (front) course.

1/2 BANK Mode

Pushing the 1/2 BANK button manually selects the half bank mode unless any of the following modes is active: approach capture or track, NAV capture or track in LOC, or GA.

1/2 BANK is automatically selected when climbing through 31,600 ft. pressure altitude (the half bank transition altitude) or if the aircraft is above that altitude when the flight director is turned on. This mode selection is inhibited when the aircraft is in takeoff mode, go around mode, approach mode capture, or localizer capture.

The half bank mode is manually cleared by pushing the 1/2 BANK button again. This mode is automatically cleared by the following:

- Descending through the half bank transition altitude
- Takeoff mode
- Go-around mode
- Approach capture or any localizer capture

The half bank mode reduces the maximum commanded bank angle to 15°. The mode has no effect on roll mode operation. A green arc drawn above the roll scale index marks indicates half bank mode. The length of the mark represents ±15° of roll.

VERTICAL MODES

There are 10 vertical flight director modes.

- Pitch (PTCH)
- Altitude preselect (ALTS)/altitude hold (ALT)
- Takeoff (TO)
- Overspeed
- Vertical Navigation (VNAV)
- Glidepath (GP)
- Flight Level Change (FLC)
- Vertical speed (VS)
- Glideslope (GS)
- Go-around (GA)

Vertical modes are armed or activated by FGP switches, the UP/DOWN wheel, or TOGA switches on the thrust levers. Pushing the active FGP pushbutton or selecting another vertical mode disables the active vertical mode.

The vertical modes field on the PFD is shown in Figure 16-27.

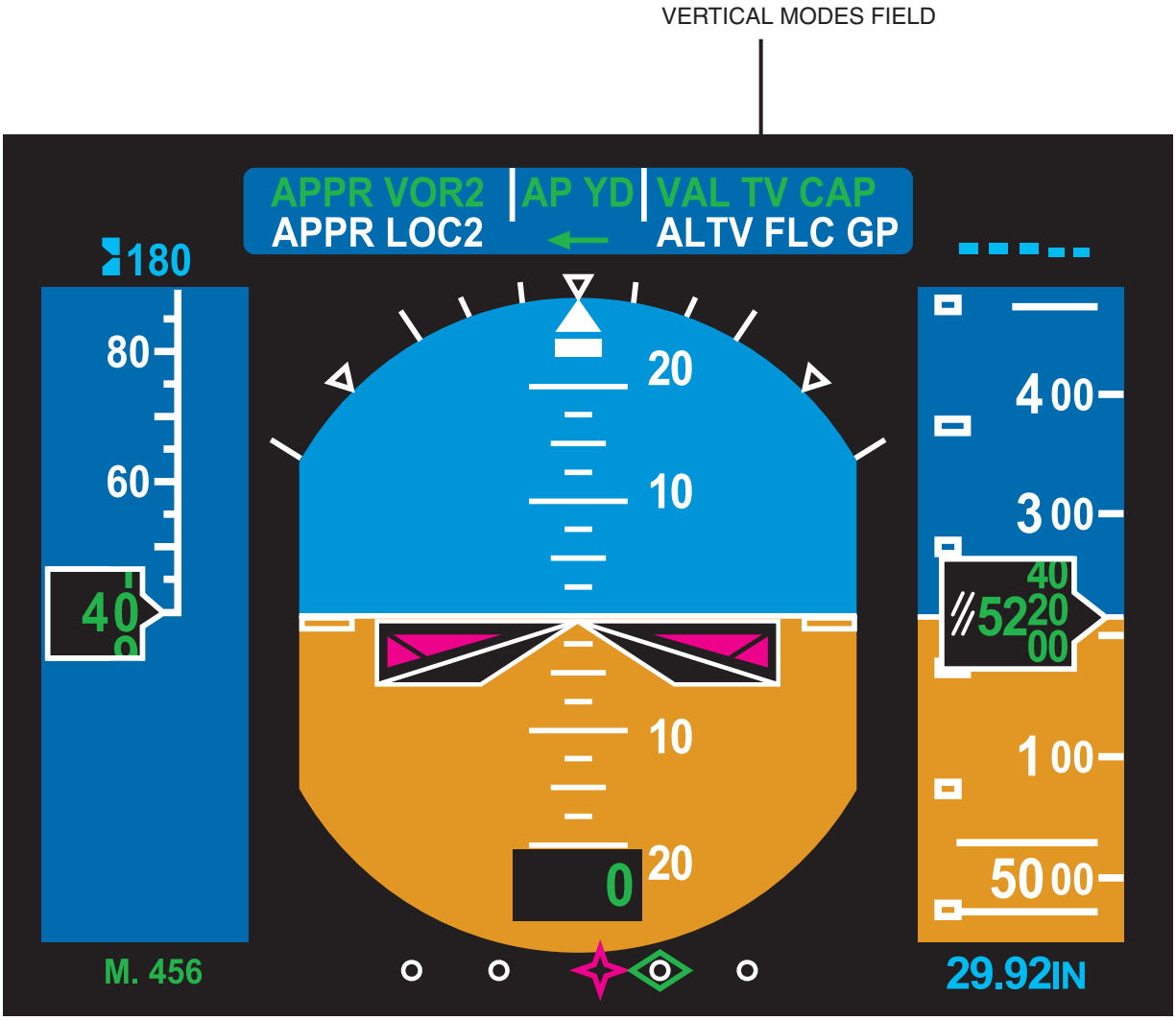

Figure 16-27. Vertical Modes on the PFD

PTCH Mode

When pitch mode is selected, the flight director generates commands to hold the current pitch attitude. Selection of the mode is automatic in the following cases:

- Any other vertical mode deselected manually or automatically
- Autopilot engaged with flight director off
- Flight director is on with no other vertical mode(s) selected
- SYNC button pressed in takeoff or go-around mode
- Go-around active mode and another lateral mode selected
- Coupled side changed while AP engaged or FD ON
- UP/DOWN wheel moved (except in: VS Mode, vertical glidepath, capture or track, or overspeed function)
- If VNAV selected, the FMS may select pitch hold mode
- Deselecting VNAV during an active VNAV track

The pitch mode is deselected when selection or automatic capture of another active vertical mode occurs.

The pitch reference value can be changed with the UP/DOWN wheel. Rotation of the VS/pitch wheel changes the pitch reference by 0.5° per click. The pitch reference is reset to the current pitch attitude, upon either AP engagement, transfer to pitch mode, or FD sync. When in altitude select capture, rotating the VS/pitch wheel also re-arms altitude select mode.

When capturing or tracking a preselected altitude, a new preselect altitude must be chosen prior to selection of pitch mode to avoid an immediate recapture of the existing preselected altitude.

Green PTCH displays in the vertical capture field for pitch mode.

ALTS Mode

The altitude select (ALTS) mode consists of arm, capture, and track states. In the arm state, the FGC monitors aircraft closure rates towards the target altitude and determines the optimum capture point. The capture state performs calculations for a smooth acquisition of the target altitude. In the track state, the system maintains the target altitude.

There are two possible target altitudes for ALTS operation:

- Preselect altitude value—Manually selected with ALT knob
- FMS flight plan target altitude provided by the FMS

This mode is automatically enabled (no button for manual selection) upon selection of any mode (flight director on or AP engaged) except for glideslope capture, vertical go around, altitude hold or VNAV glide path capture while FMS altitude is invalid or missing.

During an altitude capture maneuver or after established on the selected altitude (altitude track), if the selected altitude is changed, the altitude hold mode is automatically selected.

A deselection of vertical navigation mode while capturing/tracking an FMS altitude also selects altitude hold mode. In addition to altitude preselect being set with the altitude preselect knob, an FMS flight path target altitude can be programmed for use with VNAV. In the VNAV glidepath capture mode, capturing the preselected altitude is prohibited.

ALTS arm is deselected with any of the following:

- Automatic transition to the capture state
- Turning off flight director while AP disengaged
- Activation of APPR mode
- Selection of vertical go-around or altitude hold modes

ALTS capture is deselected with any of the following:

- Automatic transition to the track state
- Turning off flight director while AP disengaged
- Selection of any other active vertical mode
- Turning of the altitude preselect knob
- If VNAV deselected, pitch is selected as the active mode

Deselecting of ALTS track occurs with any of the following:

- Turning off flight director while AP disengaged
- Turning altitude preselect knob when the VNAV altitude is not the same as preselected altitude being tracked (altitude hold automatically selected as active mode)
- Change of FMS flight plan target altitude if VNAV altitude is target (altitude hold automatically selected as active mode)
- VNAV deselected while ALTS tracking flight plan target altitude (altitude hold is active mode)
- Activation of vertical APPR capture/track states
- Selection of any other vertical mode

Annunciation

When the closest altitude being approached is the preselected altitude, altitude preselect is annunciated as follows:

- Arm—ALTS in white in the vertical arm field
- Capture—ALTS CAP in green in the vertical capture field
- Track—ALTS in green in the vertical capture field

When the closest altitude being approached is the FMS altitude, altitude select is annunciated as follows:

- Arm—ALTV in white in the vertical arm field
- Capture—ALTV CAP in green in vertical capture field
- Track—ALTV in green in vertical capture field

Altitude Alert System

The altitude alert system provides aural and visual indications of the preselected altitude capture and tracking. It also provides aural and visual indications of altitude deviation from the preselected altitude.

The altitude alerting system processes data from the ADCs and is independent of the flight director or autopilot modes.

At approximately 1,000 feet prior to the preselected altitude, an aural tone and flashing altitude preselect digits advise of impending level-off. If the flight director is tracking a preselected altitude and the aircraft subsequently deviates more than 200 feet from the selected altitude, the altitude bugs flash and a series of tones are produced.

If the aircraft continues to deviate uncorrected, altitude bugs and digital readout flash amber and audible tones are produced at ±1,000 ft. from the selected altitude.

Altitude Hold Mode

Pressing the ALT button selects altitude hold (ALT) mode unless in glideslope capture. A green ALT displays in the vertical capture field.

The mode can also be engaged with the following:

- FMS may automatically select altitude hold if VNAV selected
- Altitude preselect changed during ALTS track state
- While in ALTS track, a change of FMS VNAV altitude if VNAV altitude is the target automatically selects ALT as active mode

The ALT mode can be deselected by one of the following:

- Turning flight directors off while AP disengaged
- Another vertical mode selected
- FMS selects another vertical mode if VNAV selected
- Another vertical mode automatically captures becoming the active mode
- Pressing ALT mode button
- Changing coupled side

Takeoff Mode

Prior to takeoff, the vertical takeoff mode is selected when either TOGA switch is pressed, the flaps are set for takeoff and takeoff V-speeds are entered. A green TO message is displayed in the active vertical field.

This mode generates a pitch up command that is calculated when the pilot enters V_2 and V_R values in the REFS page or via the FMS TAKE-OFF REF page.

Loss of an engine reduces the pitch up command appropriately. If V_2 and V_R are not entered when the TOGA switch is pushed, the command bars disappear from the display.

Go-Around Mode

Pushing one of throttle-mounted TOGA buttons while airborne selects the go-around (GA) mode. The GA mode generates a 10° pitch up command. A green GA displays in the lateral and vertical capture field.

Selection of GA mode turns on both flight directors, disengages the autopilot (but not the yaw damper), clears all other vertical modes (except overspeed), and switches the flight guidance commands to a dual-independent configuration.

This mode is cleared by one of the following:

- Turning off flight directors
- Engaging autopilot
- Selecting another vertical mode
- Pressing AP/FD SYNC button
- Rotating UP/DOWN wheel which selects Pitch Hold

Flight Level Change Mode

In flight level change mode (FLC), the flight director provides commands to acquire and track an IAS or Mach reference airspeed during a climb or descent.

Turning the speed knob on the FGP adjusts IAS/MACH reference values. These values can also be synchronized by the FGC or by the FMS when in VNAV mode and RESUME VNAV PLAN SPEED is selected on the FMS PERF MENU page.

FLC mode may be selected in the following ways:

- Pressing FLC button (except FLC inhibited while in vertical approach capture/track mode)
- Using FMS if VNAV selected

The FLC mode may be deselected by one of the following:

- Turning flight director off while AP disengaged

- Another vertical mode selected or automatically captured
- If VNAV selected and FMS selects another active vertical mode
- Pressing FLC button
- Changing coupled side

When the FLC mode is first selected, the flight director synchronizes the IAS or Mach airspeed reference to the current speed. This also occurs when the autopilot is first engaged.

FLC is displayed in green letters in the vertical capture field.

Overspeed Mode

When the aircraft is at or above the overspeed transition altitude with airspeed greater than 0.845 M_I or the aircraft is below the overspeed transition altitude with airspeed greater than 10 kt above V_{MO} and a significant overspeed occurs, the FGC automatically engages the overspeed mode unless altitude hold or altitude capture are active. The FGC generates the commands to reduce the airspeed to below V_{MO}/M_{MO}.

While in overspeed mode, the selection or activation of a vertical mode other than altitude hold or ALTS capture or track is inhibited. Activation of overspeed mode causes the FGC to automatically turn on the flight directors and inhibit the FD from being turned off until another mode is manually or automatically selected.

Flight guidance cannot be deselected in FLC overspeed. While in FLC overspeed, the altitude preselector does not inhibit commands to climb or descend as required to capture the reference airspeed.

When flight level change overspeed is detected, amber FLC OSPD flashes in the top (capture) field on the PFD. If VNAV is active in the vertical field, an amber VFLC OSPD flashing CAS message is depicted on the PFD.

Vertical Navigation Mode

The vertical navigation (VNAV) mode issues various commands to the AFCS to allow the FMS to execute its vertical flight plan. VNAV, therefore, is not a true mode. Rather it enables the FMS to command various vertical modes and to provide references associated with those modes.

VNAV is selected only when the onside FMS is the active navigation source on the PFD. Pressing the VNAV button selects the mode.

The mode is inhibited:

- When AFCS is in the vertical approach capture/track
- If ILS is vertical source
- When overspeed mode active

VNAV mode is deselected as follows:

- Turning off FD while AP disengaged
- Automatic capture/track of vertical approach mode when ILS is vertical source
- Selecting TO or GA mode
- Changing source of active VNAV data
- By pressing VNAV mode button on FGP

Vertical Speed Mode

When the vertical speed (VS) mode is selected, the FGC commands the aircraft to climb or descend with a vertical speed measured in feet per minute. Initially the rate is vertical speed sensed at the time of VS mode engagement.

Turning the UP/DOWN wheel on the FGP changes the VS reference value. Each click of the wheel is equal to ±100 ft/min.

Approach Mode

In the approach (APPR) mode, the FGC generates commands to track vertical guidance for ILS precision glideslope approaches or for FMS glidepath (GP) approaches. Select approach mode by pushing the APPR button on the FGP.

Glideslope Mode

Glideslope (GS) mode is automatically selected when the aircraft is in approach mode, inbound, and with a valid localizer as the lateral navigation source. The mode generates commands to capture and track glideslope. The white GS message is displayed in the vertical (arm) field on the PFD when the mode is engaged.

Captures can be performed from below or above the beam. The capture point is a function of the closure rate, with the capture point moving away from the beam for high closure rates. Capture does not occur if the localizer is not captured or if the FGC is not receiving valid glideslope data.

Upon glideslope capture, other vertical modes are automatically cleared.

When the APPR capture occurs, the flight directors automatically change to independent mode. If glideslope captures are not concurrent and only one side has captured, vertical mode selection, PFD annunciation, etc., operate independently on the noncaptured side.

The GS mode is deselected when one of the following occurs:

- Another mode selected
- Active NAV source changed (when captured)
- VOR/LOC frequency changed (when armed)
- Pressing APPR button a second time
- XFR side changed when APPR armed
- FDs are turned off with AP disengaged

Glidepath Mode

Glidepath (GP) mode generates commands to track a vertical path defined by the FMS. Glidepath capture disables preselected altitude mode operation.

Indications of glidepath mode are as follows:

- White GP in vertical arm field of PFD—Glidepath armed
- Green GP in vertical capture field of PFD—Glidepath capture

There is no button for glidepath mode. The FMS selects the mode when all of the following conditions are met:

- VNAV mode and APPR selected
- FMS active navigation source
- No preselect navigation active
- FMS VNAV is valid

Deselection of VNAV or approach modes or the selection or capture of another active vertical mode automatically clear or deselect the glidepath mode.

AUTOPILOT

The Challenger 300 is equipped with a two-axis autopilot (Figure 16-28) and yaw damper. Autopilot servos provide command inputs to the ailerons and elevators. The yaw damper system controls the rudder. Both flight guidance computers must be operational for the autopilot to function.

The coupled FGC provides signals to drive the servos. The aileron servo is on the control cable run for the right aileron. Because the left and right ailerons are normally interconnected, the servo is capable of moving both ailerons. The elevator servo is in the left elevator cable run. The servo moves both elevators when the elevators are interconnected.

Normal and non-normal AFCS indications are displayed on the PFDs and MFDs.

If any single failure occurs, the autopilot does not:

- Cause significant displacement of the aircraft from its approach path or altitude loss below the nominal glide path
- Upon system disconnection, involve any out-of-trim condition not easily controlled by the pilot
- Cause any action to occur with the flight control system that is not readily apparent to the pilot, either by control column movement or advisory display

AUTOPILOT ENGAGEMENT

Pressing the AP switch on the FGP engages the autopilot if the following conditions exist:

- Yaw damper operable
- Both FGCs serviceable
- Primary horizontal stabilizer trim engaged
- FGCs detect no faults with horizontal stabilizer trim system
- No significant instability of the aircraft exists

When the autopilot is engaged, both channels are coupled to the onside FGC. A green AP on the PFD indicates engagement. Pressing the AP switch when the autopilot is engaged causes the autopilot to disengage.

The controlling FGC directs pitch and roll commands to the aileron and elevator servos. When a change in roll or pitch attitude is required, the FGC signals the aileron servo or elevator servo to move the control cables to move the associated control surface.

When an out-of-trim condition is sensed in the pitch axis, the FGC signals the horizontal stabilizer trim control unit to reposition the horizontal stabilizer.

Out-of-Trim Indications

The FGC continuously monitors all three axes of the autopilot when it is engaged. If a control surface is detected to be significantly out of trim, a CAS caution message is displayed. The amber CAS message identifies whether it is the aileron or elevator that is affected and in which direction the control surface is out of trim.

Takeoff Configuration Warning

If a takeoff is attempted with the autopilot on, the takeoff configuration warning system displays an EICAS warning message and sounds a voice alert. The warning sounds when the thrust lever is advanced for takeoff.

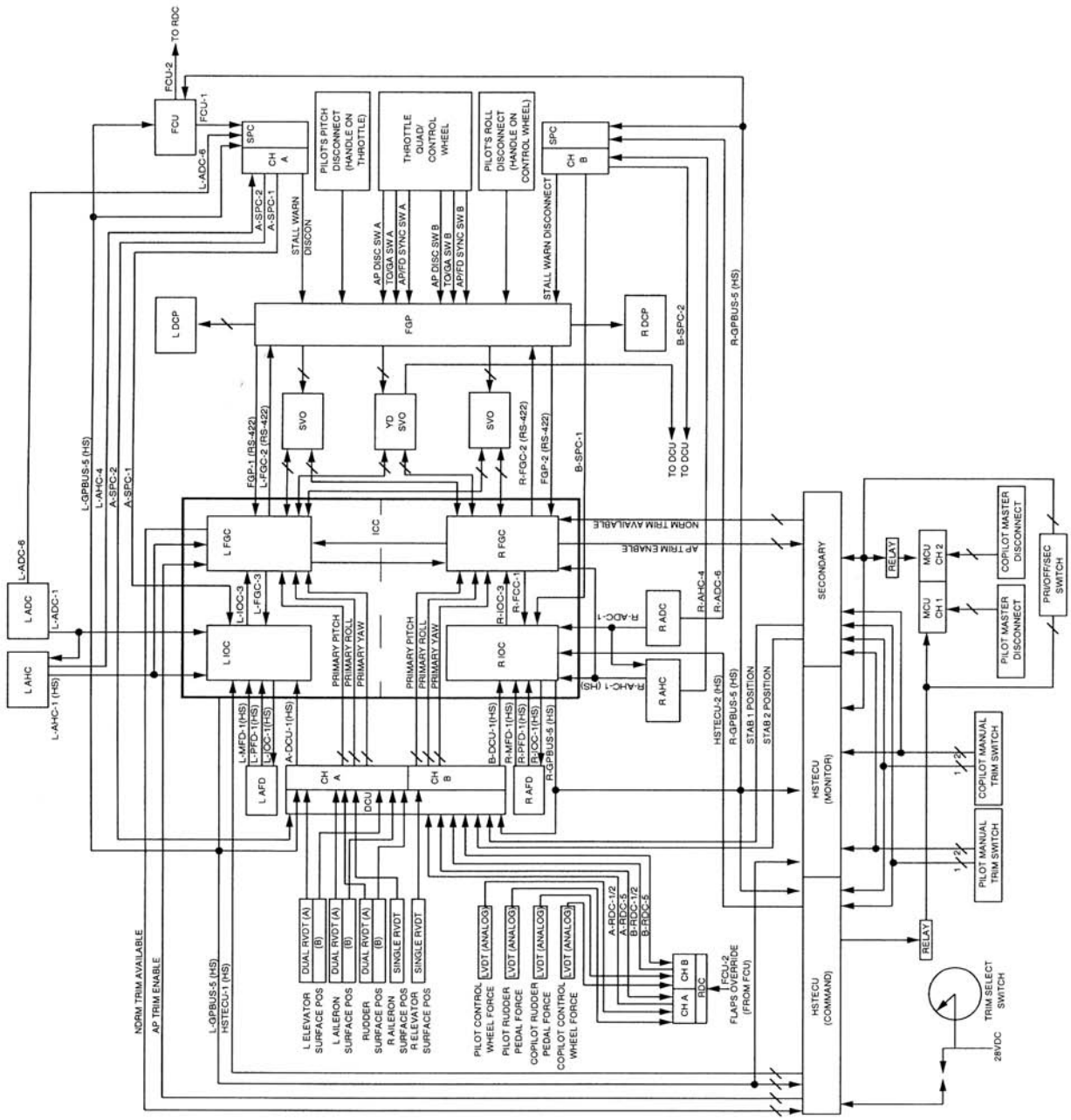

Figure 16-28. Autopilot Schematic

AUTOPILOT DISENGAGEMENT

The autopilot can be manually disengaged by one of the following:

- Pressing either master disconnect pushbutton on the outboard horn of each control wheel
- Activating stab trim switches on control wheels
- Pressing the AP pushbutton on the FGP
- Pressing the AP/YD DISC bar down on the FGP
- Pressing either TOGA switch on thrust levers
- Pressing the YD pushbutton

When the autopilot is manually disengaged, the AP symbols on each PFD flash red. An aural warning sounds for approximately 1 1/2 seconds.

The autopilot automatically disengages upon stall warning.

If a system fault causes the autopilot to disengage, pressing either master disconnect switch cancels the red flashing AP message and silences the aural warning.

If the autopilot warning sounds because the TOGA switch is selected, a second press of the TOGA switch clears the warnings.

Autopilot Synchronization

When the autopilot is disengaged, an autopilot synchronization switch on the control wheel allows the FD command bars to be synchronized with the actual aircraft vertical and lateral reference.

YAW DAMPER

Yaw damping improves the aircraft's stability by damping out oscillations in yaw. If these are not corrected, the oscillations lead to the phenomenon called dutch roll.

The yaw damper provides yaw oscillation damping and automatic turn coordination.

The FGCs provide signals to operate the yaw damper actuators, which is a mechanically limited linear actuator.

The AP/YD DISC switch, YD switch, and control wheel disconnect switches disengage the yaw damper. When a yaw damper channel fails or disconnects, the amber YAW DAMPER FAIL CAS message is displayed.

PFD MESSAGES

Table 16-1 lists indications displayed on the PFD. A brief explanation of each indication is provided.

Table 16-1. PFD MESSAGES

ALT	Green	Altitude HOLD mode—Capturing/tracking
ALTS	White	Altitude select mode—Armed preselect
	Green	Altitude select mode—Track, preselect
	Flashing yellow	Altitude select mode—Aborted capture preselector
ALTS CAP	Green	Altitude select mode—Armed for FMS
ALTV	White	Altitude select mode tracking FMS
	Green	Altitude select mode—Track, preselect
	Flashing yellow	Altitude select mode—Aborted capture FMS
ALTV CAP	Green	Altitude select mode—capturing FMS
← AP	Green	AP engaged and not transferred—Left FD selected
	Flashing red	AP disengage warning and not transferred—Left FD selected
	Yellow	AP engaged and not transferred, with AP synchronization in process (the aileron and elevator clutches are released)
→ AP	Green	AP engaged and transferred—Right FD selected
	Flashing red	AP disengage warning and transferred to the right FD
	Yellow	AP engaged and transferred, with AP synchronization in process (the aileron and elevator clutches are released)
B/C1 B/C2	White	Back course mode armed (annunciated in the lateral arm field, by identifying the nav source)
	Green	Back course mode—Capture/tracking (annunciated in the lateral arm field by identifying the nav source)
DR	White	Dead reckoning operation
FD (boxed)	Red	Flight director flag (within the attitude ball)
FD1	Green	FD computations performed by FD1 (on the copilot PFD)
FD2	Green	FD computations performed by FD2 (on the pilot PFD)
FLC	Green	Flight level change mode (on the vertical capture field)
GA	Green	Lateral go-around mode (in lateral capture field)
	Green	Vertical go-around mode (in vertical capture field)

Table 16-1. PFD MESSAGES (Cont)

LNV1 LNV2 LOC1 LOC2 VOR1 VOR2	White	Navigation or approach mode—Armed (annunciator in the lateral arm field by identifying nav source)
	Green	Navigation or approach mode—Capture/tracking (in the later capture field by identifying the nav source)
GS	White	Glideslope mode—Armed (announced in the vertical arm field)
	Green	Glideslope mode—Captured (in the vertical capture field)
GP	White	Glidepath mode—Armed in the vertical arm field
	Green	Glidepath mode—Capturing/tracking a vertical path
HDG	Green	Heading select mode
PATH	Green	Vertical Nav mode—Capturing/tracking a vertical path
PTCH	Green	Pitch mode
ROLL	Green	Roll mode
SYNC	Yellow	FD synchronization in process
TEST	Yellow	Diagnostic mode (displayed in large text)
TO	Green	Lateral takeoff mode (annunciator in lateral capture field)
	Green	Vertical takeoff mode (annunciator in vertical capture field)
V	Green	VNAV mode, FMS NAV is valid and not overspeed mode (V is prefixed on the vertical capture annunciator)
	Flashing yellow	VNAV mode, FMS NAV is valid and overspeed mode (V is prefixed on the vertical capture annunciator)
VNV	Yellow	Vertical Nav mode and FMS NAV is valid and overspeed mode (V is prefixed on the vertical capture annunciator)
VS	Green	Vertical speed mode
1/2 BNK	Green	Half bank mode
v-bars	Magenta	Integrated lateral and vertical flight guidance commands (not present if either command is invalid)
Pitch command cross-pointer	Magenta	Vertical flight guidance command (not present if the command is invalid)
Roll command cross-pointer	Magenta	Lateral flight guidance command (not present if the command is invalid)
Cross-line over the annunciation symbol(s)	Red	A required data source is invalid for the active lateral outer loop (the line is drawn through the active lateral mode annunciation)
		A required data source is invalid for the active vertical outer loop (the line is drawn through the active vertical mode annunciation)

COMMUNICATIONS

The radio communication system (RCS) contains the radios and controls. It shares controls with other systems (intercom, audio, passenger address, navigation, and FMS).

The RCS consists of the following:

- Two audio control panels
- Two VHF communication transceivers
- Two VHF communication antennas
- Third VHF transceiver and antenna
- HF transceiver and antenna (optional)
- Two radio integration units
- Two maintenance interphone panels

Two separate systems for VHF radio communication ensure that failure of one system does not preclude operation of the other system. Both systems are connected to the onside and cross-side cockpit controls, displays, and audio features.

The multifunction display (MFD) is the primary radio-tuning source for the RCS. Frequency, as well as the state of other control functions, is maintained in memory so that the radio does not change state or frequency if there is an interruption in power.

The FMS control display unit (CDU) may also tune and control VHF radios in normal operation. The CDU is the primary control in reversionary operation if the reversion selection panel (RSP) tune switch is in the CDU ONLY position. The CDU provides integrated control of the combinations of aircraft communications radio subsystems. It provides single point control of both on-side and cross-side radio from the pilot or copilot position in both normal and CDU ONLY configurations.

AUDIO CONTROL PANELS

An audio control panel (ACP) on either side of the instrument panel allows the pilots to monitor navigation radios and monitor and transmit on VHF and HF communication radios, the PA system, and the intercom system (Figure 16-29).

Each ACP has receiver controls and volume adjustment for the intercom and radio. The output from each ACP is directed to the associated headset jacks and speaker.

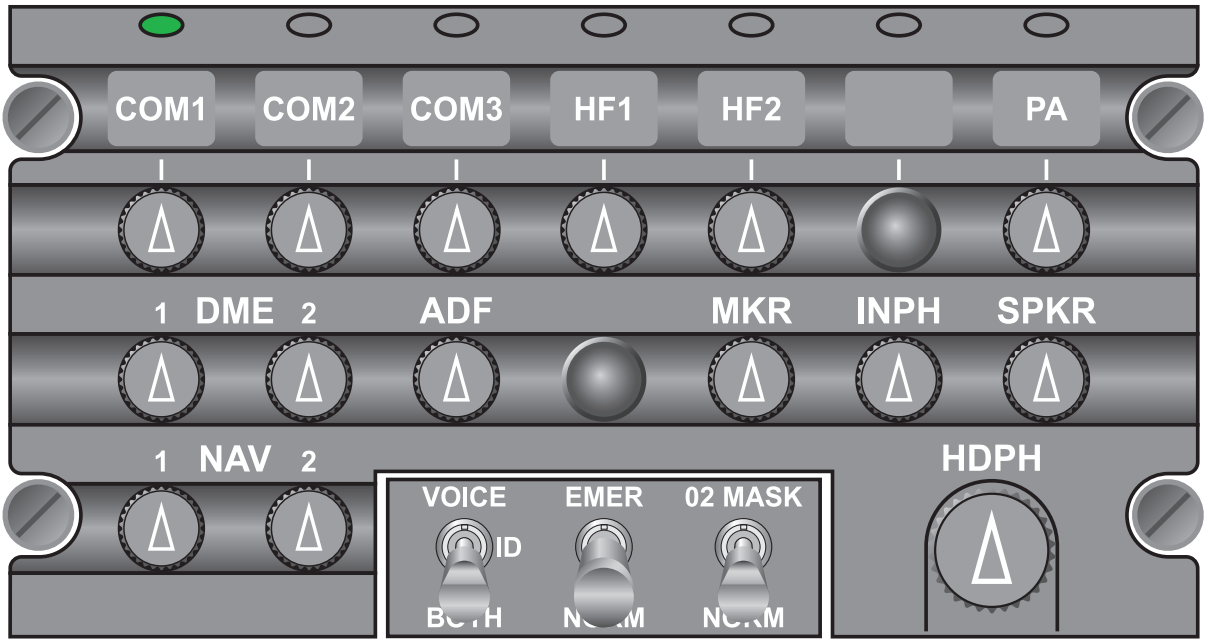

Figure 16-29. Audio Control Panel

The aural warning system volume is not adjustable. Audio signals from the aural warning system, TAWS, and TCAS do not go through the volume control switches.

Headphone audio is always available with the volume control capability from any control switch.

Specific controls include the following:

- SPKR audio selector—Enables selected audio to be routed to the onside crew speaker; warning audio can be heard with the switch in any position.
- INPH audio selector—Enables intercommunication between the crew and service to the interphone positions external to the aircraft with hot mic.
- VOICE/ID/BOTH toggle switch—Allows pilot to separate audio when monitoring the simulcast audio of a radio transmission
  - o VOICE—VOR, ILS, or ADF station morse code identifier filtered out so only the voice signal is audible
  - o ID position—Only NAV and ADF identifier code heard
  - o BOTH—Station morse code identifier and voice message audible
- EMER/NORM—Toggles between NORM (audio system operation normal) and EMER (audio routed directly to headphones)
- O2 MASK—Toggles between NORM (headphone boom microphone input active) and O2 (oxygen mask microphone active)

The remaining controls of the ACP are discussed in the appropriate following sections.

TX/INPH CONTROL WHEEL SWITCHES

The pilot and copilot control wheels are equipped with TX/INPH momentary switches (Figure 16-30).

Figure 16-30. TX/INPH Switches

The TX position allows transmitting on the selected radio. The INPH position allows intercom transmissions when the interphone is selected off on the ACP.

The control wheel radio/intercom switches at each pilot station and the hand microphones allow pilots to transmit on the communication radios or interphone (Figure 16-31).

MISCELLANEOUS EQUIPMENT

Headset panels are available at the two flight deck positions to connect the headsets to the audio system (Figure 16-32). Hand microphones are mounted on the control columns at each of the pilot's stations.

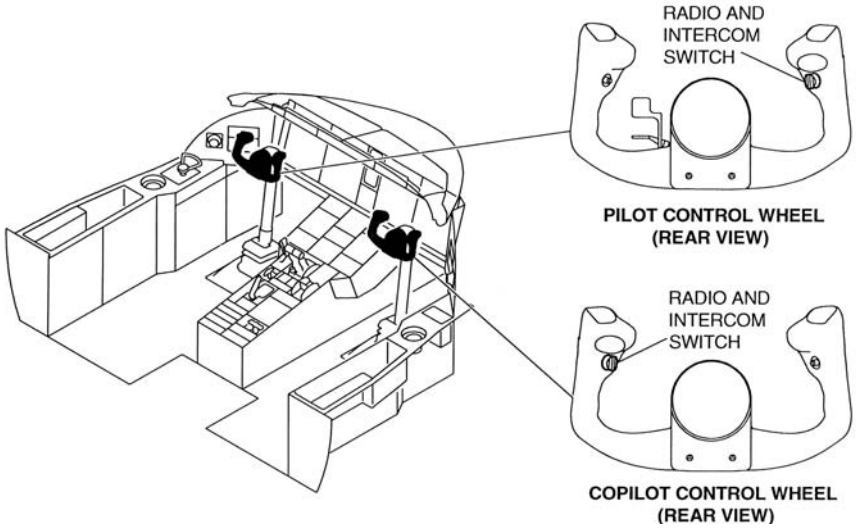

Figure 16-31. Radio and Intercom Switches and Hand Microphones

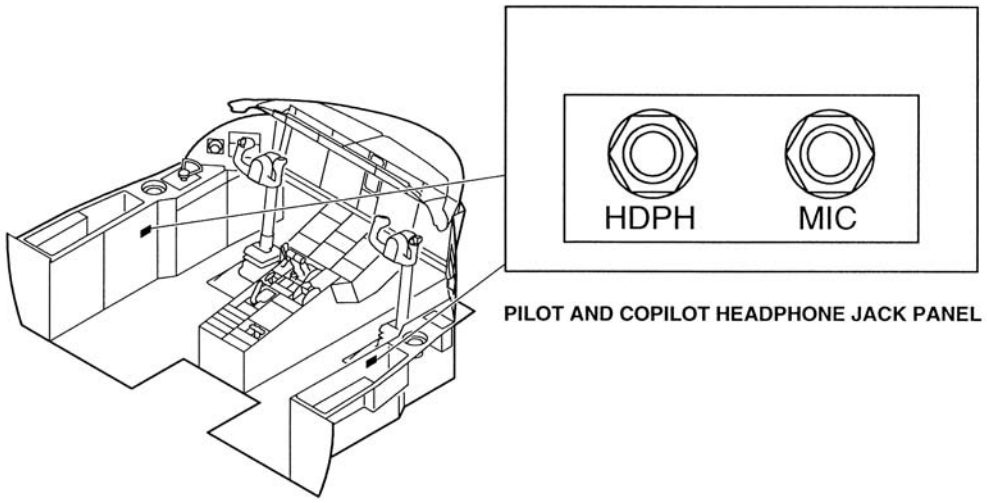

Figure 16-32. Headset Jack Plugs

Two speakers are overhead in the flight compartment. The speaker volume can be adjusted by rotating the SPKR knob. The speaker can be selected off by pressing the SPKR knob in.

When selected on the cockpit ACP, two maintenance interphone panels permit hot microphone communications to interface with the flight compartment. A headphone and microphone jack are in the left side of the aircraft in the nose compartment area (accessible behind the communication access door) and in the left side of the aft equipment compartment (Figure 16-33).

VHF COMMUNICATION

The VHF-4000 is a remote-mounted very high frequency (VHF) communications transceiver. Two VHF radios are standard. A third VHF radio is available as an option.

VHF radio displays are integrated into the lower part of the left and right MFDs. The radios can be controlled through the display control panels (DCPs) on the glareshield or the FMS CDU.

The radios operate in the domestic VHF communications band from 118.000 through 136.991 MHz. When tuning in 25kHz increments, tuning is from 118.000 to 136.975MHz. In 8.33 kHz increments, tuning is from 118.000 to 136.991 MHz.

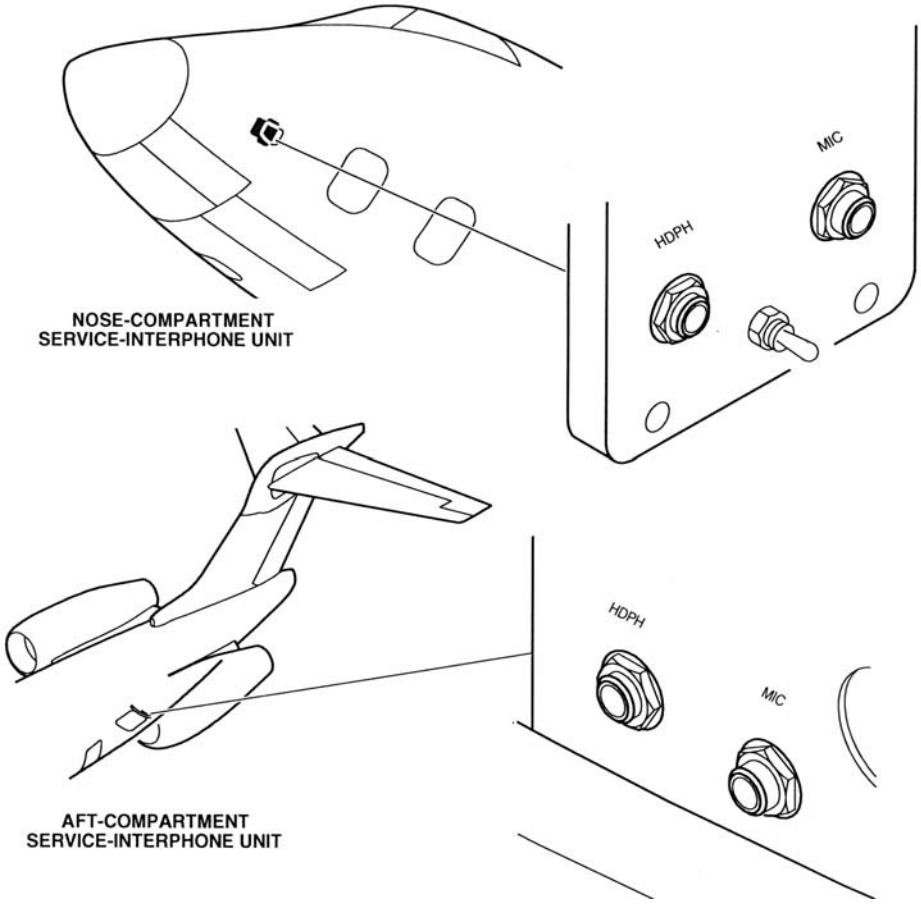

Figure 16-33. Maintenance Interphone Panels

General MFD Tuning

The MFD and the DCP provide single-point control of both the onside and cross-side radios from the pilot and copilot position. The radio menu provides an at-a-glance summary of the radios as well as control for each.

1. If another menu/list is active, push RADIO button to show MFD radio menu

2. Push the 1/2 button if necessary to alternately select side 1 radios and side 2 radios

3. Turn MENU knob to move the selection box on the radio menu to the radio (COM, NAV, ATC/CAS, etc.) frequency or channel to be tuned

4. Turn TUNE knob to tune the desired frequency or channel
   - Larger outer knob tunes digits to the left of decimal point
   - Smaller inner knob tunes digits to the right of decimal point

5. To activate the new frequency/channel—Push transfer button in the center of the tune knob

6. To change modes, adjust squelch, and other nontuning functions of a radio:
   - Turn MENU knob to move selection box to the appropriate radio (COM1, NAV2, ATC/TCAS, etc.)
   - Push RADIO button to select the submenu
   - Turn MENU knob to move selection box on the submenu
   - Turn DATA knob to change the mode or select an option (i.e., tune mode, squelch level, traffic mode, etc.)
   - Push PUSH SELECT button to step through available options (the PUSH SELECT button acts the same as the DATA knob in selecting options)
   - Push the RADIO button to exit the sub menu; the display returns to the radio menu

NOTE

The menu is automatically removed 20 seconds after the last activity of the MENU, DATA, or PUSH SELECT knob or when another menu or list button is pushed.

DCP COM Radio Operation

The radio menu provides basic COM radio tuning control (Figure 16-34). The COM submenu provides control display for other COM radio operation. Each COM radio has its own submenu. The active frequency, recall frequency, and squelch status displays are identical to the display on the radio menu.

A cyan control box indicates current control location. The default location is the last tuned communication radio (VHF or HF). After 20 seconds of inactivity, the cyan control box returns to the default location.

Selecting the 1/2 button displays cross side radios; radio legends are displayed in yellow.

- Push RADIO button to show menu on the MFD if another menu/list is active
- Turn MENU knob to move selection box to desired radio (COM 1, COM 2, COM 3 if installed) display on radio menu
- Push RADIO button to show appropriate submenu on MFD

Submenu Operations

The following operations are performed on the submenu:

- Change SQUELCH mode
  - o Turn MENU knob to move selection box to the SQUELCH control
  - o Turn DATA knob or push PUSH SELECT button to select squelch ON or OFF
- Change the frequency spacing for radio tuning
  - o Turn MENU knob to move selection box to FREQ SEL control
  - o Turn DATA knob or push PUSH SELECT button to select 8.33 or 25 kHz spacing for tuning
- Select the COM TEST mode
  - o Turn MENU knob to move selection box to TEST control
  - o Turn DATA knob or push PUSH SELECT button to select TEST mode
- Change COM 3 mode (only if Voice/Data option is enabled)
  - o Turn MENU knob to move selection box to COM 3 MODE control
  - o Turn DATA knob or push PUSH SELECT button to select VOICE or DATA mode; When DATA mode is selected, squelch annunciation, squelch status, transfer arrow, frequency selections 8.33 and 25, and TEST selection do not show on COM 3 CONTROL menu

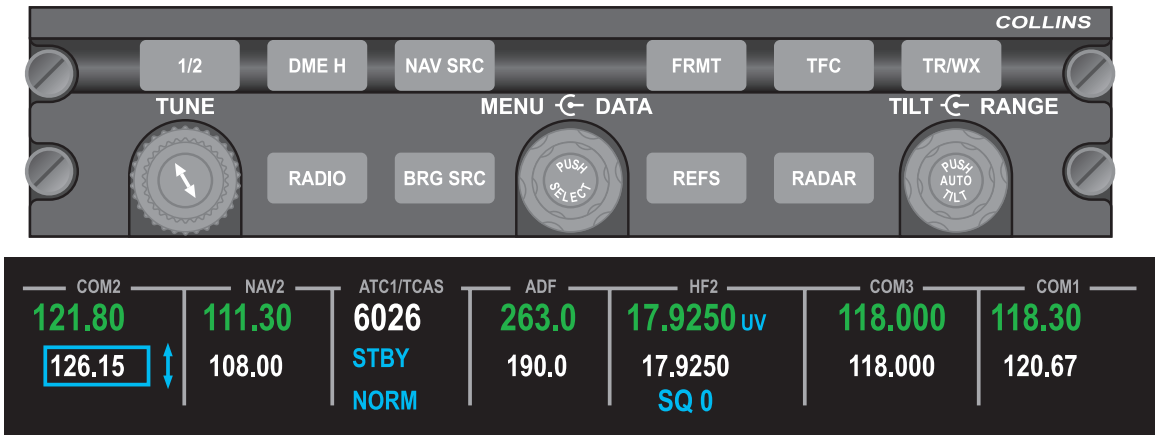

Figure 16-34. COM Radio Tuning Control

FREQ SEL Settings

When the FREQ SEL setting is changed to 8.33, the recall COM radio frequency display resolution on the MFDs is three decimal places for that radio. If the prior recall frequency had two decimal places, the MFD adds the appropriate 0 or 5 to the frequency value.

When the FREQ SEL setting is changed to 25, the recall COM radio frequency display resolution on the MFDs is two decimal places for that radio. If the prior recall frequency had an 8.33 kHz frequency, the MFD changes the frequency to the next lower valid 25 kHz frequency value. If the prior recall frequency was a 2 digit 25 kHz frequency, the third decimal digit is removed.

Control Display Unit (CDU)

The control display unit (CDU) is also capable of tuning the communication radios, ADF receivers, and ATC transponders (Figure 16-35).

The CDU provides tuning control of both the on-side and cross-side radios. Data entry to the CDU is made through the scratch pad and line select keys. Information is entered on the scratch pad, then transferred to the appropriate location with the adjacent line select key.

Figure 16-35. Control Display Unit

Messages show if the information entered is not appropriate for the data field. Access to CDU tuning is accomplished through the TUNE page.

To tune the radio using the CDU, execute the following steps:

1. Push TUN key on the CDU to show TUNE page.

2. To tune a radio directly, do one of the following steps:
   - Enter frequency into the scratch pad; then push line select key for appropriate radio
   - Enter a preset channel number (1 through 20) into scratch pad; then push line select key for appropriate radio
   - NAV radios only: enter three-letter identifier for NAVAID; then push line select key for appropriate radio (NAV 1 or NAV 2)

3. To show the submenu for a particular radio (to set presets, select modes, etc.), push line select key for the radio when scratch pad is empty.

4. To return to TUNE page from a CONTROL submenu, push line select key for the radio or push TUN key.

TUNING REVERSION

The TUNE reversion switch is on the reversion selection panel (RSP) on the center pedestal.

- MFD ONLY—Radio can be tuned with the DCP only
- NORM—Radio can be tuned with either DCP or the CDU
- CDU ONLY—Radio can be tuned with CDU only
- COM 1 121.5 MHz switch allows the pilot to directly transmit on the emergency frequency 121.5 MHz via COM 1.

Normally, the MFD provides the master tuning control. However, if the MFD fails or reverts to a compressed PFD format, radio tuning through that MFD is no longer available.

Tuning reversion allows the pilot to select either the MFD or the CDU as the master tuning control for the onside radios. When the TUNE knob on the RSP is set to MFD ONLY, the MFDs ignore tuning commands from the CDUs. Additionally, the CDU TUNE page is blank when the TUNE knob is set to MFD ONLY.

When the TUNE knob is set to CDU ONLY, the CDUs ignore tuning commands from the MFDs and the MFD radio menus is blanked.

When the TUNE knob is in the COM 1 121.50 position, tuning is as normal (MFD is the master tuning control), but the COM 1 radio is forced to the emergency frequency 121.50.

HF COMMUNICATION

The optional high-frequency radio provides long-range communication within the frequency range of 2.0 to 29.9999 MHz. The HF radio has 280,000 communication channels together with six emergency and 16 programmable preset channels.

The HF system operates in simplex or duplex mode as:

- Upper side band voice (UV)
- Upper side band data (UD)
- Lower side band voice (LV)
- Lower side band data (LD)
- Amplitude modulation equivalent (AME)
- Continuous wave (CW)

In simplex mode the radio transmits and receives on the same frequency. Simplex is the most common transmission/reception mode.

The duplex mode is similar to a cellular phone in that transmission is on one frequency and reception is another. The duplex mode relays radio signals between stations or communicates with marine facilities.

Receiver/Transmitter

The receiver/transmitter in the aft equipment bay controls all the functions associated with signal transmission and reception, power generation, and fault detection.

HF Coupler

The HF coupler near the receiver/transmitter tunes the system by matching the impedance of the antenna to the transmitter. Matching the impedance allows maximum power transfer to the antenna during transmissions.

The coupler tunes to the new frequency when the transmit switch is momentarily pushed. The tuning time for a new frequency is nominally less than one second, but it can take up to a maximum of six seconds. A 1,000 Hz tone is heard in the headset and stops when tuning is complete.

Impedance data for the previous last 50 frequencies tuned are stored in memory and reused whenever a frequency is reselected. This minimizes the tuning times for frequently used frequencies.

HF Antenna

The HF antenna is classified as a conformal-type antenna in that it is an integral part of the leading edge of the vertical stabilizer.

Tuning Control

DCP

1. Push RADIO button to show the radio menu on the MFD if another menu/list is active

2. Turn MENU knob to move selection box to HF radio (HFI or HF2) display on the radio menu

3. Push RADIO button to show HF CONTROL submenu on the MFD

4. The following operations are performed on the HF CONTROL submenu:
   - Select HF tune mode
     - o Turn MENU knob to move selection box to MODE control
     - o Turn DATA knob or push PUSH SELECT button to select FREQ, EMER, or MAR mode; each click of DATA knob or push of the button selects the next mode option
   - Select the HF transmission mode
     - o Turn MENU knob to move selection box to MODE control
     - o Turn DATA knob or push PUSH SELECT button to select SIMP (simplex) or DUP (duplex) transmission mode
   - Select HF emission mode
     - o Turn MENU knob to move selection box to emission mode control (beneath MODE control)
     - o Turn DATA knob or push PUSH SELECT button to select LV (lower voice single sideband), UV (upper voice single sideband), or AM (amplitude modulation) mode; each click of knob or push of button selects the next mode option
   - Select the HF squelch level
     - o Turn MENU knob to move selection box to SQUELCH control
     - o Turn DATA knob or push PUSH SELECT button to select squelch level; each click of knob or push of button selects the next squelch level option
   - Select the HF power level
     - o Turn MENU knob to move selection box to POWER control
     - o Turn DATA knob or push PUSH SELECT button to select squelch level; each click of knob or push of button selects the next squelch level option
   - Select HF TEST mode
     - o Turn MENU knob to move selection box to TEST control
     - o Turn DATA knob or push PUSH SELECT button to select TEST mode

MFD

The HF CONTROL menu provides control for HF radio modes other than those available through the radio MENU. Each HF radio on the aircraft has its own HF CONTROL menu. The active frequency, recall frequency, and squelch status that show on the left side of the HF CONTROL menu are identical to the HF display on the radio menu.

The TUNE MODE control selects the HF tuning mode as follows:

1. Tune directly by tuning a frequency (FREQ)

2. Select an emergency channel (EMER)

3. Select a maritime (optional) channel (MAR)

CDU

To tune the HF radio with the CDU, accomplish the following steps:

1. Push the TUN key to show the TUNE page

2. Select page 2 by selecting NEXT button (depending on radio options, there will be 1 or 2 pages)

3. Enter frequency into the scratchpad; and then push line select key for the appropriate radio.

or

4. Enter a preset channel number (1 through 20) into the scratchpad; then push line select key for the appropriate radio

5. To show the submenu for a particular radio (to set presets, select modes, etc.), push the line select key for the radio when the scratchpad is empty

6. To return to the TUNE page from a submenu, push the line select key for the radio or push the TUN key

PRESET Page

In the tune mode, PRESET allows the pilot to select and to configure 16 predetermined combinations of transmit and receive frequencies and transmission modes on the CDU PRESET pages or the MFD radio control pages.

Five CDU preset pages are available for each HF (HF1 and HF2), depending on the type of preset data and selected HF mode of operation. Selection of the preset mode changes the HF preset frequency to the last selected numbered preset selection.

Simplex/Duplex Operation

The simplex/duplex mode selection is applicable to all modes of transmission.

Simplex mode allows transmission and reception to occur on only one frequency and in only one direction at a time. Both parties cannot receive at the same time as they are transmitting.

The duplex mode is actually half-duplex mode. It allows transmission and reception on separate frequencies, but still only in one direction at a time.

SELCAL SYSTEM

The optional SELCAL system allows the crew to maintain continuous VHF or HF radio watch with a ground facility without the burden of listening to the assigned radio.

The selective calling (SELCAL) system monitors the pre-assigned SELCAL VHF or HF frequency. Each SELCAL equipped aircraft is assigned its own four-letter SELCAL code. When the ground station wants to talk to the crew, it transmits the aircraft's assigned SELCAL code.

When the VHF or HF radio receives the code, the SELCAL decoder sends a signal to the EICAS data concentrator unit to display the cyan advisory message. The advisory message identifies which of the VHF or HF systems received the message.

An aural SELCAL alert is sounded to advise the crew of the incoming call.

The SELCAL message on EICAS is removed when the radio/transmit switch is activated for the VHF or HF radio that received the message.

SATCOM

The satellite communication (SATCOM) system (optional) makes possible voice and data communications in most locations in the world (except in the farthest polar regions). SATCOM is better than other long-range communication systems in connectivity, voice quality, reliability, and traffic volume capacity.

Components

The factory option of SATCOM consists of a six channel SATCOM system and antenna. Components include the following:

- Satellite data unit (SDU)—Provides interface to all avionics; contains location of applicable satellites and rate/frequency translation for two-voice communication
- Radio interface unit—Provides three additional simultaneous voice communication channels when operated in conjunction with the SDU
- High-power amplifier—Provides rate/frequency power amplification on the L band signals generated by the SDU or radio frequency unit to a power level required for transmission to the satellite
- Antenna—Transmits and receives data to the SATCOM LNA/duplexes and antenna control unit; the one antenna on top of the vertical stabilizer is directional and mechanically controlled
- Antenna control unit (ACU)—Processes signals from the antenna to calculate location; it also transmits data to the antenna to control the antenna direction.

The ACU gives built-in-test equipment and location data to the SATCOM transceiver.

- Optional data link—Operation via VHF, HF, or SATCOM is controllable from the FMS CDU. The system utilizes the same data loading unit as the FMS with air-ground-air and air-to-air capabilities. Crew advisory messages are displayed on the CDU scratch pad.

Operation

The SATCOM system interfaces with a dedicated antenna subsystem to provide satellite communications. A minimum of three satellite communications channels are required: two voice channels and one data channel.

One voice channel is dedicated to the flight compartment and another voice channel is dedicated to the office in the sky (OITS) telephone. The data channel is assigned for either the airborne flight information system (AFIS) or the OITS facsimile or modem.

The SATCOM option consists of three primary systems:

- Space system
- Ground system (ground earth stations [GESs], service providers, public telephone systems, etc.)
- Aircraft earth station (AES)

The space system is a series of satellites that act as a two-way relay between the AES and GES. The satellites in geosynchronous orbits 22,300 mi (36,000 km) above the equator operate between 75° north and south latitude with an overlap in the areas of coverage.

The ground system has GESs and local/long distance telephone networks. The GESs interchange data between the space system and the public or private telephone and data networks for worldwide communications.

The AES operates within the satellite communications system of the international maritime satellite organization. The AES uses the satellite for digital communication between the aircraft and the GES.

The AES accesses the international maritime satellite organization satellites with L-band communications. The satellites then transmit and receive the data with C-band to the GES.

The GES can transmit packet data (such as ARINC communications addressing and reporting system that provides data on aircraft conditions, departure time, arrival time, or flight delay time). The GES can also transmit telephone communications (such as voice, fax, and PC modem data).

STATIC WICKS

Static wicks are installed to discharge static electricity and reduce radio interference (Figure 16-36).

They are installed at the following locations:

- Winglets/wingtips
- Ailerons
- Elevators
- Rudder
- Vertical stabilizer
- Horizontal stabilizer
- Tail cone

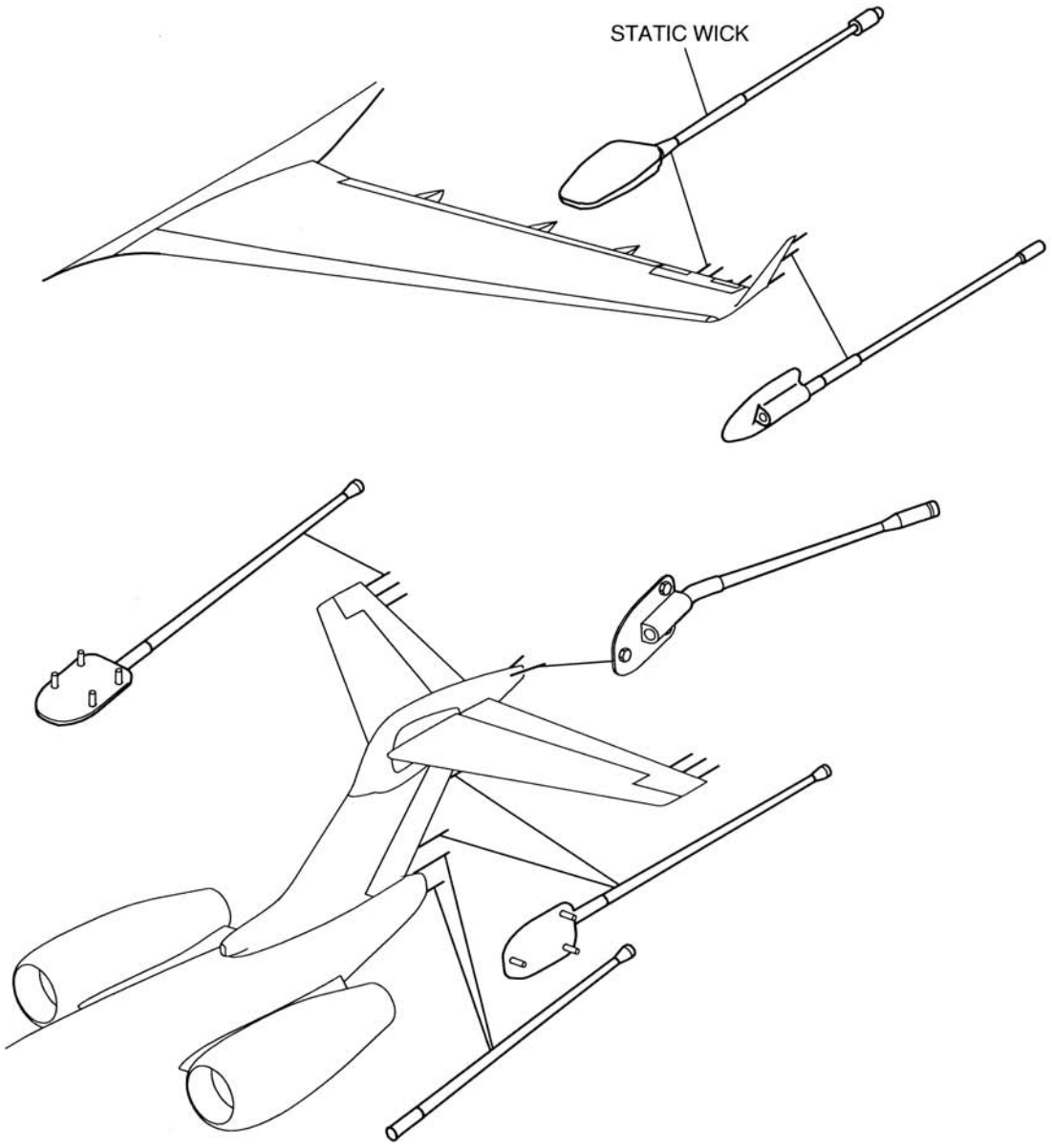

Figure 16-36. Static Wicks

EMERGENCY LOCATOR TRANSMITTER

The emergency locator transmitter (ELT) is a self contained battery operated unit in the top left side of the aft fuselage.

When the aircraft is subjected to excessive longitudinal forces, the ELT automatically activates and transmits on 121.5 (VHF), 243.0 MHz (UHF), and 406.025 MHz. When the ELT is transmitting, a caution ELT ON CAS message illuminates.

The flight deck ELT switch is normally set to ARM (Figure 16-37). The ON position is for system test or to manually activate the ELT. The RESET position, if available, resets the ELT.

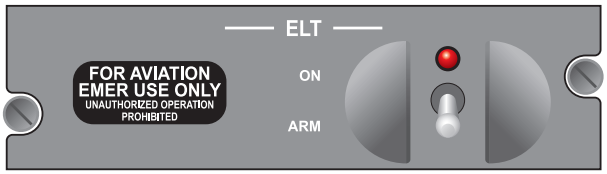

Figure 16-37. Flight Deck ELT Switch

An ELT buzzer alarm is provided to alert flight and maintenance personnel of inadvertent deployment of the ELT. It is designed only to be heard during ground operations when the engines are not operating.

CABIN COMMUNICATION SYSTEM

The cabin communication system option provides a private automatic branch exchange switching network. This network routes voice and data communications for up to nine optional active devices (handsets/FAXs/modems/data link, etc.) and provides two air-to-ground channels.

The system includes connections of basic telephone/telecomputing equipment to UHF antenna and SATCOM links. If a data link device is on the airplane, the cabin communication system can communicate with the data link device with an internal modem.

The digital radio components consist of one UHF antenna, a duplexer, and one airborne radio telecommunication unit.

The digital handset in the flight compartment has a backlit LCD display and telephone style keypad to dial calls and select various options. A credit card reader (for optional billing) is built into the handset with a two-button increase/decrease volume control (side of handset).

Refer to the *Magnastar C-2000 User Guide CA1030* for description/function and operation of the system.

FLIGHT COMPARTMENT PRINTER

The optional flight compartment printer is in the copilot side console. The printer with ARINC 429 and standard PC interfaces is capable of full format and graphic printing of information from the central aircraft information maintenance system (CAIMS) and data link.

The printer can print messages and weather data sent to it via the airborne data link system. The printer is also used by CAIMS to print out certain maintenance faults and status information.

NAVIGATION

The Challenger 300 navigation system includes conventional navigation items and the radio navigation system. Conventional items include integrated navigation receivers, distance measuring equipment, and an automatic direction finder. The radio navigation system contains radios and controls for the following systems:

- VHF navigation radios
- Mode S Transponder
- Traffic Alert and Collision Avoidance System (TCAS)
- Terrain Awareness Warning System (TAWS)
- Weather Radar
- Flight Management System (FMS)
- Global Positioning System (GPS)

Two separate radio navigation systems are provided so that failure of one system does not preclude operation of the other system. Both systems are connected to the onside and crossside cockpit displays and controls. Equipment, controls, and wiring are installed so that the operation of any of the system components does not adversely affect or will not be adversely affected by the simultaneous operation of any other radio, electronic unit, or system.

RADIO INTERFACE UNIT

The left and right radio interface units (RIUs) are on their respective equipment racks forward of the entry door. The RIUs accommodate data concentration, communications and audio management, and control functions by providing interface between radios and the rest of the aircraft systems and equipment. The RIUs also receive inputs from TAWS and TCAS and distribute digital audio signals from the audio control panels (ACPs).

VHF NAVIGATION SYSTEM

The standard VHF navigation system includes dual VOR/localizer receivers, dual glideslope receivers, dual marker beacons, single distance measuring receiver (DME), and single automatic direction finder receiver (ADF). A second ADF and a second DME are available as options.

The basic aircraft is equipped with a NAV-4000 receiver and a NAV-4500 receiver. Aircraft equipped with dual ADFs have two NAV-4000 receivers.

INTEGRATED NAVIGATION RECEIVERS

The two NAV-4000 receivers (NAV 1 and NAV 2) are remote mounted. The receivers combine VHF omnirange (VOR), localizer (LOC), glideslope (GS), and marker beacon (MKR) signals to the navigation system and flight crew. The receiver also contains an ADF receiver. The NAV-4500 contains all the features of the NAV-4000 except for the ADF module.

Included in the NAV receiver module is the single-channel marker receiver that operates at a fixed frequency of 75 MHz and provides audio and visual marker information for cockpit indications.

The ADF receiver operates in the frequency range of 190 to 1799 kHz and the maritime distress bands of 2088-2094 kHz and 2179-2185 kHz. It can operate as an AM radio receiver and automatic direction finder with the capability of receiving keyed carrier stations via a beat frequency oscillator (BFO) signal.

VHF Navigation Receivers

Two VHF navigation receivers (NAV 1 and NAV 2) provide VHF omnirange (VOR), localizer (LOC), glideslope (GS), and marker beacon(MKR) signals to the navigation systems.

The display control panel (DCP) or control display unit (CDU) select frequencies (Table 16-2).

Marker Beacons

Marker beacons indications are displayed on the primary flight displays (PFDs). If audio is selected, the marker beacons sound in the speakers and headsets during station passage. Two marker beacon antennas are installed on the bottom of the fuselage.

Table 16-2. VHF NAVIGATION RECEIVERS

SYSTEM	FREQUENCY RANGE	CHANNEL SPACING
VOR	108.00 to 117.9 MHz	50 kHz (160 chan)
LOC	108.10 to 111.95 MHz	50 kHz (40 chan)
GS	329.15 to 335.00 MHz	150 kHz (40 chan)
MKR	75.00MHz	Preset

MFD TUNING

The multifunction display (MFD) and DCP provide single point control of both the onside and cross-side radios.

The RADIO button on the DCP displays the radio menu on the MFD. This menu includes a summary of the radios as well as control for each. The MFD signals the aircraft radios to tune frequencies, set operating modes, adjust squelch levels, and select voice/data modes.

The MFD also responds to tune/control commands from the cross-side MFD or the CDU. Either acts as the master tuning control.

NAV RADIO OPERATION

The radio menu provides basic NAV radio tuning control. The NAV CONTROL menu controls the display for other NAV radio functions. Each NAV radio has its own NAV CONTROL menu. The active, recall, and DME frequency displays are identical to the display on the radio menu.

TRANSPONDER OPERATION

Two transponders are installed in the Challenger 300. The active transponder selection selects the desired transponder. With ATC1, the pilot side transponder is active. With ATC2, the copilot side transponder is active.

The radio menu accesses the TRANSPONDER/TCAS CONTROL menu. The active beacon code, TCAS mode, and TCAS altitude limits selection that display on the left of the TRANSPONDER/TCAS CONTROL menu are identical to the TRANSPONDER/TCAS display on the radio menu.

DISTANCE MEASURING EQUIPMENT (DME)

The DME-4000 is a remote mounted, three-channel unit that provides position navigation, including distance, information.

In the single DME configuration, the pilot tunes channel 1 and the copilot tunes channel 2. The FMS uses channel 3. In the optional dual DME configuration, each pilot has control over channel 1 of the onside DME while channels 2 and 3 of each DME are used by the onside FMS.

DME measures line-of-sight distance between the aircraft and selected DME ground stations by calculating the rate of closure and time to reach the selected station.

The DME operates in the frequency range of 962 to 1213 MHz. Most DME channel assignments are paired with VOR or ILS facilities. Frequency selection is done with the CDU or the DCP in the frequency range of 108.00 to 117.95 MHz. DME frequencies not paired with VOR or ILS facilities are arbitrarily associated with a group of frequencies (133 to 135 MHz) in the VHF communications band.

STATION IDENTIFICATION

If a station identifier signal is received, the audio signal to the audio control unit is sent to the flight compartment speakers or the pilot and copilot headsets.

The DME transceiver calculates distance, which is displayed on the PFDs and CDUs through the IAPS computer. The distance display is shown in a four-digit field followed by NM.

When a no-computed data condition occurs, dashes replace the distance indication.

Maximum DME tracking range is 300 NM. Actual range under particular conditions vary with altitude, terrain features, and other factors.

DME HOLD FUNCTION

The DME hold function splits the paired tuning between DME and VHF navigation systems to enable independent operation.

The DME hold function holds the DME transceiver to the current VHF navigation frequency so the VHF navigation receiver can be independently tuned. When DME hold is on, an “H” is displayed below the NAV radio frequency on the radio menu or NAV CONTROL menu.

Select the function with the DME H pushbutton on the DCP. The paired VHF navigation frequency display is then activated. If the DME H pushbutton is pressed again, the DME hold function is canceled. The paired VHF navigation frequency display is also removed.

AUTOMATIC DIRECTION FINDER

The automatic direction finder (ADF) system is a dual low-frequency radio system that indicates the bearing to a selected ground station.

The ADF system supplies station identification and voice signals to the audio integrating system. The transmitting stations can be non-directional beacons (NDBs) or standard broadcasting stations in the frequency range of 190 to 1799 kHz and maritime distress bands of 2088 to 2094 kHz.

Bearing-to-station data is shown on the PFDs and backup reversionary navigation display.

The ADF unit receives unmodulated-voice/tone-modulated carrier or keyed carrier transmissions from non-directional beacons or AM stations. It then calculates the station bearing relative to the nose of the aircraft as an output.

Using the beat frequency oscillator (BFO) function, the receiver produces a bearing to the station and a 1020 Hz output tone when a carrier is present in addition to the residual audio/noise from the detected carrier. A data-load option may be included so that the BFO audio output will contain no noise, even under low signal strength conditions.

ADF RADIO OPERATION

The radio menu provides basic ADF radio tuning. The ADF CONTROL menu provides control display for other ADF radio operations. Each ADF radio installed on the aircraft has its own ADF CONTROL menu.

If only one ADF radio is installed, ADF CONTROL with no numerical designator shows on both the onside and cross-side menus. The active frequency, recall frequency, and antenna mode that show on the left of ADF CONTROL menu are identical to the ADF display on the radio menu.

CDU Tuning

The CDU provides tuning control of both the onside and cross-side radios. Data entry is made through the scratchpad and line select keys. Information is entered on the scratchpad, and then transferred to the appropriate location with the adjacent line select key.

Warning messages show if the information entered is not appropriate for the data field. Access to CDU tuning is via the TUNE page.

Tuning Reversion

Normally, the MFD provides master tuning control. If the MFD fails or reverts to a compressed format, radio tuning through that MFD is no longer available. Tuning reversion allows the pilot to select either the MFD or the CDU as the master tuning control.

MODE S TRANSPONDER SYSTEM

The Mode S transponder system consists of two Mode S transponder units. Only one transponder unit is active at a time; the other has a standby role.

The transponder system supplies ATC or a traffic alert and collision avoidance system (TCAS) with aircraft identification and altitude data in response to an interrogation. The transponder on a TCAS-equipped aircraft has two paired antennas to transmit and receive interrogations above and below the aircraft without the signal being masked by the airframe.

The transponder goes into identification mode for approximately 18 seconds when the ID function key is pushed. The annunciator also illuminates.

Mode definition and selection is discussed in the TCAS section.

TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM

The Traffic Alert and Collision Avoidance System II (TCAS) is an airborne system that interrogates transponders in nearby aircraft and uses computer processing to identify and display potential and predicted collision threats.

The system protects a volume of airspace around the TCAS-equipped aircraft. The system provides appropriate aural and visual advisories to maintain adequate separation when computer analysis of intruding aircraft transponder replies predicts a penetration of the protected airspace.

The TCAS II equipment is viewed as a supplement to the pilot, who, with the aid of the ATC system, has the primary responsibility for avoiding mid-air collisions. The system provides no indication of traffic conflicts with aircraft without operative transponders.

The TCAS II system provides two types of advisories.

TRAFFIC ADVISORY

A traffic advisory (TA) is issued when an intruding aircraft penetrates the 35 second TCAS surveillance area and is considered a possible threat. The TA provides the flight crew an opportunity to use the TCAS page on the MFD to assist in visually locating the intruding aircraft.

The following advisories are shown on the PFD and MFD and heard on the speakers:

- Aural advisory TRAFFIC TRAFFIC sounds
- Amber TRAFFIC displays below VSI scale on the PFD
- Amber TAs display as solid amber circle on TCAS page of MFD

RESOLUTION ADVISORY

A resolution advisory (RA) advises the pilot that corrective action is required to avoid an intruder.

The RA produces a threat resolution in the form of a vertical maneuver that increases separation when the intruder aircraft is within approximately 25 seconds from the closest point of approach.

RAs show on the vertical speed scale indicating forbidden/acceptable vertical speeds. TCAS overlays are available on both PFDs and MFDs. A TCAS only map is available on the MFDs.

Identical TCAS control selections show on both onside and cross-side MFDs so that either pilot can make TCAS control selections.

Aural alerts sound over the cockpit audio system.

OPERATION

The TCAS II system provides the following capabilities:

- Collision avoidance tracking
- Threat detection
- Threat resolution
- Communication and coordination
- Surveillance

TA and RA symbols have priority over any conflicting display. They overwrite any other symbols or characters.

TCAS II has a maximum range of 40 nm with a maximum of 32 intruders displayed.

Four different TCAS symbols are used on the TCAS page to represent TCAS targets. Indicators that represent the intruder's vertical speed and relative altitude data accompany each TCAS symbol.

Relative/Absolute Altitude Modes

Relative altitude mode displays the difference in altitude between the aircraft and any intruder aircraft. Absolute altitude mode is used when the barometric altitude of the intruder aircraft is desired. The relative (REL) or absolute (ABS) altitude of intruder aircraft is shown below the traffic symbols on the TCAS display. Relative altitude mode is the default mode. Altitude is not shown for intruder aircraft not reporting altitude data.

Arrows indicate vertical speed of the target aircraft. The arrow indicates that an aircraft is changing altitude at a rate of 500 fpm or greater.

Plus or minus signs along with a number symbolizes the relative altitude of the threat airplane. Plus indicates above and minus indicates below.

THREAT LEVELS AND DATA TAGS

The system provides four types of symbols for the advisories:

- Solid amber circle—Traffic advisories (TAs) appear on MFD when target(s) is projected to converge with the TCAS-equipped airplane in approximately 35 seconds (with the closest point of the approach inside a minimum vertical separation envelope). TAs are generated for aircraft with operative Mode S, Mode C, or Mode A transponders. The relative bearing and range of the intruder are displayed.
- Solid red square—Resolution advisories (RAs) appear on MFD when target(s) is predicted to penetrate the protected vertical envelope in approximately 25 seconds. An RA display on the PFD vertical speed indicator (VSI) indicates vertical rate that must be achieved to maintain safe separation. During an RA, red and green bands overlay the VSI scale. Red band indicates what vertical speed range should be avoided; the green band indicates vertical speed needed to achieve safe separation. The red band indicates pitch rates that should be avoided to fly vertical speeds within the green band. RA display can only be issued if an intruder aircraft is equipped with a Mode S transponder.
- Solid cyan diamond—Proximity traffic (PROX) symbols appear on MFD when non-threat aircraft have a flight path approaching collision area. The PT symbol is displayed if the target does not qualify for a TA but is currently within ±6 nm and ±1200 feet of the TCAS aircraft
- Open cyan diamond—Other traffic (OT) in surveillance area is not a collision threat

Altitude Data

When altitude data is available, an ALT TAG shows altitude of each intruder aircraft on TCAS traffic display. When the altitude of the intruder aircraft is more than that of the interrogation aircraft, ALT TAG shows above the traffic symbol. When the altitude of the intruder aircraft is less than that of the interrogation aircraft, ALT TAG shows below the traffic symbol.

If the intruder aircraft altitude changes at a rate of ±500 ft/min or more, an arrow after the traffic symbol shows the altitude change direction.

INDICATIONS

RAs are presented on the PFD. The word TRAFFIC appears below the altitude strip display.

- Red TRAFFIC—RA
- Amber TRAFFIC—TA
- White TA ONLY—RA is inhibited

A white TCAS TEST appears when the system is tested. A white TCAS OFF appears when the system is off. Failures messages TCAS RA FAIL and TCAS FAIL appear on VSI and MFD

Table 16-3 shows TCAS voice messages and what they indicate.

Table 16-3. TCAS VOICE-RELATED AURAL ALERTS

VOICE MESSAGE	MEANING
Climb, Climb	Climb at a nominal 1,500 fpm
Climb, Crossing Climb	Same as Climb, Climb, aircraft's flight path will cross the flight path of the intruder
Increase Climb	Follows a climb advisory—Climb rate should be increased to the rate on the VSI (nominally 2,500 fpm)
Adjust Vertical Speed, Adjust	Reduce vertical speed to speed shown on vertical speed indicator.
Descend, Descend NOW	Follows a climb advisory—TCAS indicates that a reversal of vertical speed is needed to provide adequate separation.
Descend, Descend	Descend at nominal 1,500 fpm
Descend, Crossing Descend	Same as Descend, Descend, aircraft's flight path will cross the flight path of the intruder
Increase Descent	Follows a descent advisory—Descent rate should be increased to the rate on the VSI (nominally 2,500 fpm)
Reduce Descent	Reduce vertical speed to speed shown on vertical speed indicator.
Climb, Climb NOW	Follows a descent advisory—TCAS indicates that a reversal of vertical speed is needed to provide adequate separation.
Monitor Vertical Speed	Follow the vertical speed indicator—The present vertical speed of the aircraft is not within the area indicated by the VSI
Clear of Conflict	Reposition to assigned altitude
Maintain Vertical Speed, Maintain	Maintain climb or descent rate
Maintain Vertical Speed, Crossing Maintain	Maintain climb rate
Traffic, Traffic	Traffic Advisory

RA Inhibits

TCAS RA and some aural alerts are inhibited below certain radio altitudes. Radio altitudes and the associated RA status are shown in Table 16-4.

TCAS OPERATION AND DISPLAY MODES

The MFD radio menus and DCP select TCAS modes. The TUNE and TCAS CONTROL pages on the CDU are another way to control TCAS mode selection.

- Radio menu—Basic transponder and TCAS control
- TRANSPONDER/TCAS menu—Control display for other transponder and TCAS operations

The active beacon code, TCAS mode, and TCAS altitude limits selection on the left of the TRANSPONDER/TCAS menu are identical to the TRANSPONDER/TCAS display on the radio menu.

Display modes include the following:

- ATC/TCAS operation modes
- Altitude display modes
- Traffic display modes
- Other-traffic altitude-limits modes
- Self-test mode

ATC/TCAS Modes

The possible selections for the ATC/TCAS modes are the following:

- STBY (standby)—TCAS goes to standby mode; system automatically powers up in standby mode on the ground. TCAS does not show traffic, supply RAs, or reply to other TCAS interrogations
- TA /RA—Normal mode in which TCAS computer generates intruder traffic symbology and RA vertical speed fly-to commands. The symbology displays on the PFD and/or MFD when selected. RA vertical speed fly-to commands show on the PFD vertical speed scale when TCAS commands it.
- TA—TCAS supplies intruder traffic display only; does not show RAs nor supply vertical speed fly-to commands; annunciation in cyan turns yellow and flashes when a TA is present.
- ALT ON (altitude on)—ATC transponder operates in mode C (altitude data) but TCAS does not supply RAs and transponder does not reply to other TCAS interrogation
- ALT OFF (altitude off)—TCAS and ATC transponder operation not desired. The TCAS computer does not show traffic nor issue RAs; the ATC transponder does not reply to other aircraft TCAS interrogations. Also, mode C is not reported when interrogated by ATC.

Table 16-4. RESOLUTION ADVISORY INHIBITS

RADIO ALTITUDE	RESOLUTION ADVISORY (RA) STATUS
Below 900 ft AGL, descending Below 1,100 ft AGL, climbing	All RAs inhibited (TA ONLY) and TA aural message inhibited
Below 1,000 ft AGL, descending Below 1,200 ft AGL, climbing	DESCEND RA is inhibited
Below 1,450 ft AGL	INCREASE DESCENT inhibited

Altitude Display Modes

The pilot can select between absolute (ABS) or relative (REL) altitude modes.

Other Traffic Display-Modes

The pilot can add to or remove other traffic (OT) from the TCAS display. When the OT display selection is set to ON, TCAS shows all traffic type targets. When the OT display selection is set to OFF, TCAS does not show OT type targets.

Other Traffic Altitude-Limits Modes

The TCAS surveillance area for the OT traffic is limited by TCAS display range and altitude limits above and/or below the interrogation aircraft.

The OT altitude limits are set to different values in relation to the flight-crew mode selections that follow:

- NORM (normal mode)—Sets limits to 2,700 ft above and 2,700 ft below the interrogation aircraft
- ABV (above mode)—Sets limits to 9,900 ft above and 2,700 ft below the interrogation aircraft
- BLW (below mode)—Sets limits to 2,700 ft above and 9,900 ft below interrogation aircraft
- ABV/BLW (above/below mode)—Sets limits to 9,900 ft above and below the interrogation aircraft

Self-Test Mode

Self-test mode monitors the system and fault conditions. Test results are kept in non-volatile memory. Fault conditions are automatically sent to the maintenance diagnostic computer.

TERRAIN AWARENESS WARNING SYSTEM

The terrain awareness warning system (TAWS) helps the crew avoid controlled flight into terrain (CFIT) and provides detected windshear warning (Figure 16-38). The system provides aural alert messages and visual displays if boundaries of any alerting envelopes are exceeded.

The TAWS contains three systems in one line replaceable unit.

- Ground proximity warning system (GPWS)
- Terrain/obstacle awareness
- Windshear systems

GPWS produces warnings that require action based on real time input to the GPWS. These warnings help prevent CFIT and are categorized into five modes. Each mode has distinct aural and visual alerts. The GPWS is also capable of providing a sixth mode that includes altitude related callouts and excessive bank angle callout. The displays include PULL UP and GND PROX annunciations on the PFD.

Mode 7 provides windshear caution or warning alerts if threshold values along the flight path and perpendicular to the flight path are exceeded. The displays provide WINDSHEAR annunciations on the PFD.

COMPONENTS AND CONTROLS

Warning Computer

The enhanced ground proximity warning computer (EGPWC) processes all inputs and provides all aural and visual alerts and warnings. A warning annunciation indicates a prediction of impact with terrain. All annunciations are displayed on pilot and copilot PFDs.

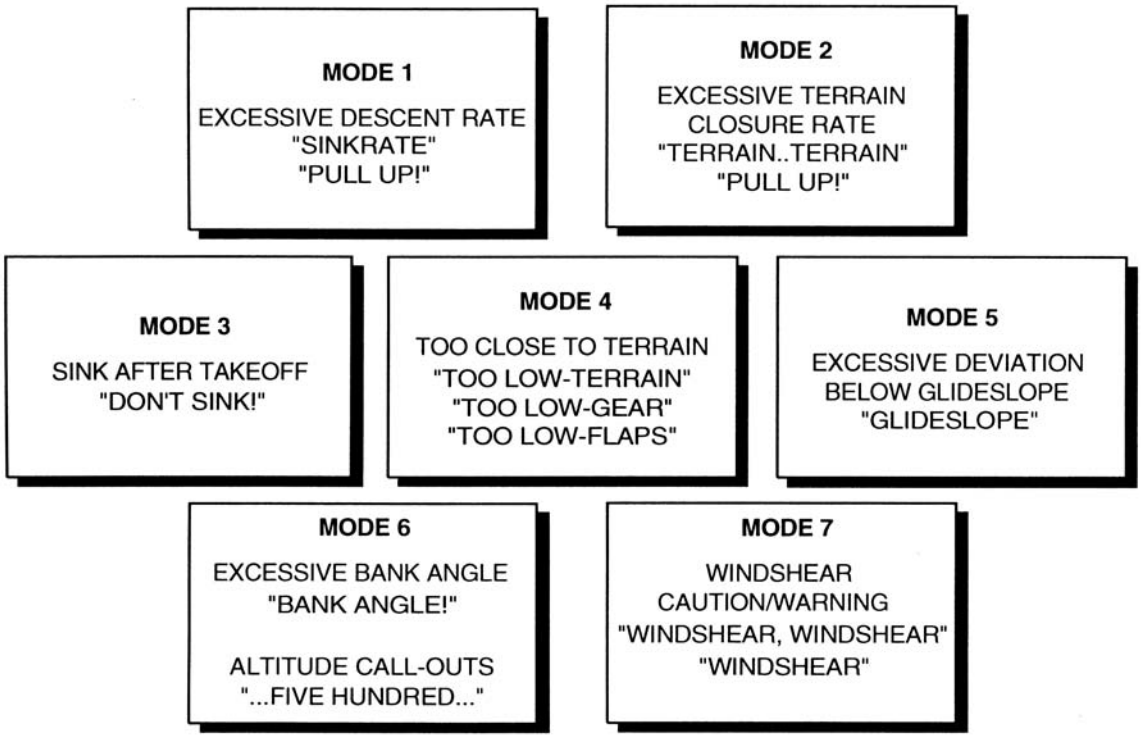

Figure 16-38. TAWS Modes

Display

The MFD control panel selects the terrain (TR/WX) display on the respective MFD while the DCP is used to display TR/WX on the PFD.

Graphical terrain data is automatically displayed on the MFD when a terrain hazard is encountered. Each time the TAWS computer commands a terrain popup, the MFD automatically commands terrain overlay to the current format if the onside PFD is not displaying terrain and if the MFD format is compatible with terrain.

The PFD commands the normal range to 10 NM. If the current MFD format is incompatible with terrain, the format is changed to PPOS with TR selected and a l0 nm range.

Regardless of the current format, selecting TR/WX automatically selects terrain for display. Similarly, selection of WX or WX/LX automatically deselects terrain.

Terrain Range

Terrain range is selectable from the onside DCP RANGE knob with selected ranges up to 300 nm. If the display range is at a value greater than 300 nm when the pilot selects terrain, the display range automatically reduces to 300 nm.

On the Challenger 300, range can be selected up to 600 nm when in plan map format. If terrain data has been selected for display, selection of display ranges greater than 300 nm are inhibited.

OPERATION

TAWS computes minimum terrain clearance envelopes for areas along the flight path using airspeed and flight path angle data in conjunction with a database containing worldwide topographical relief information in grid format. The terrain display is available by pressing the TR/WX button on the DCP. Terrain within 2,000 feet of the aircraft altitude is displayed.

Colors and their significance on the display include the following (Figure 16-39):

- Solid red areas—Terrain that satisfy terrain warning alert criteria
- Solid amber areas—Terrain that satisfy terrain caution alert criteria
- Green, amber, red dot pattern areas—Terrain significantly close to the aircraft but do not satisfy warning alert or caution alert criteria.
- Blue—Water

1. SOLID RED — Areas of terrain that satisfy the terrain warning alert criteria.
2. SOLID AMBER— Areas of terrain that satisfy the terrain caution alert criteria.
3. GREEN, AMBER, RED DOT PATTERN — Areas of terrain that are significantly close to the aircraft but do not satisfy warning alert or caution alert criteria.

Figure 16-39. TAWS Display

When a terrain threat is detected, an aural CAUTION TERRAIN, CAUTION TERRAIN sounds and an amber GND PROX is displayed on the PFD. If there is a terrain threat caution at 60 seconds from impact, terrain automatically comes up in MAP mode on the MFD at a 10 nm range.

When a collision with terrain is predicted, an aural TERRAIN PULL UP, PULL UP warning sounds (Figure 16-40); an amber PULL UP displays on the PFD. Areas that meet the collision alert criteria are depicted in red. If there is a terrain warning at 30 seconds from impact, terrain automatically comes up in MAP mode on MFD at a 10 nm range.

NOTE

When landing at an airport not in the database, TERRAIN functions can be inhibited by selecting the TERRAIN switch on TAWS WARN panel to OFF.

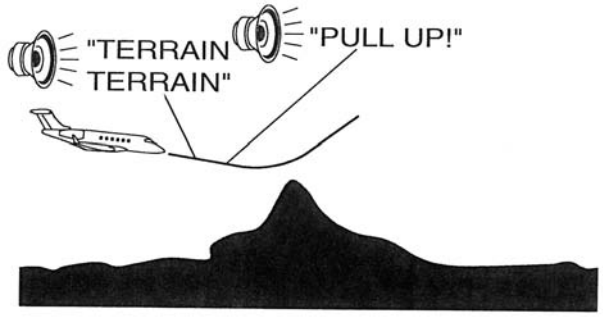

Figure 16-40. Terrain Warning

Control Panel

The TAWS WARN control panel on the center instrument panel inhibits GS and FLAPS aural warnings and TERRAIN (Figure 16-41).

- GS Switch—Mutes nuisance glideslope warnings; normally selected when a backcourse approach conducted; TAWS GS WARN OFF status message displays when switch is set to OFF
- FLAPS Switch–Mutes related GPWS warnings when a landing will be attempted with flaps not at 30°; TAWS FLAPS OFF status message displays when the switch is set to OFF
- TERRAIN Switch—Deselects terrain function of TAWS; TAWS TERR OFF status message displays when switch set to OFF

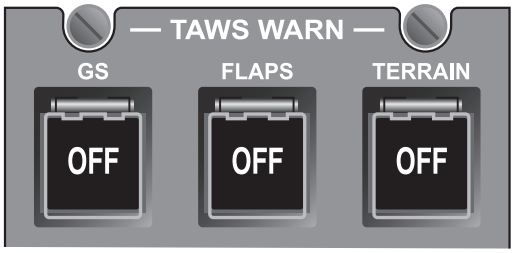

Figure 16-41. TAWS WARN Control Panel

MODES

Mode 1 Excessive Descent Rate

Mode 1 alerts if aircraft descends close (less than 2,500 ft AGL) to the terrain (Figure 16-42). Mode 1 requires radio altitude and rate-of-descent data.

- Penetration of alert area—Amber GND PROX displays alert on PFD; SINKRATE, SINKRATE sounds. The aural alert sounds once and repeats only if condition degrades by more than 20% based on computed time to impact; visual alert remains until condition rectified.
- Penetration of the warning area—Red PULL UP displays on PFD; PULL UP sounds. The aural warning sounds continuously until condition rectified.

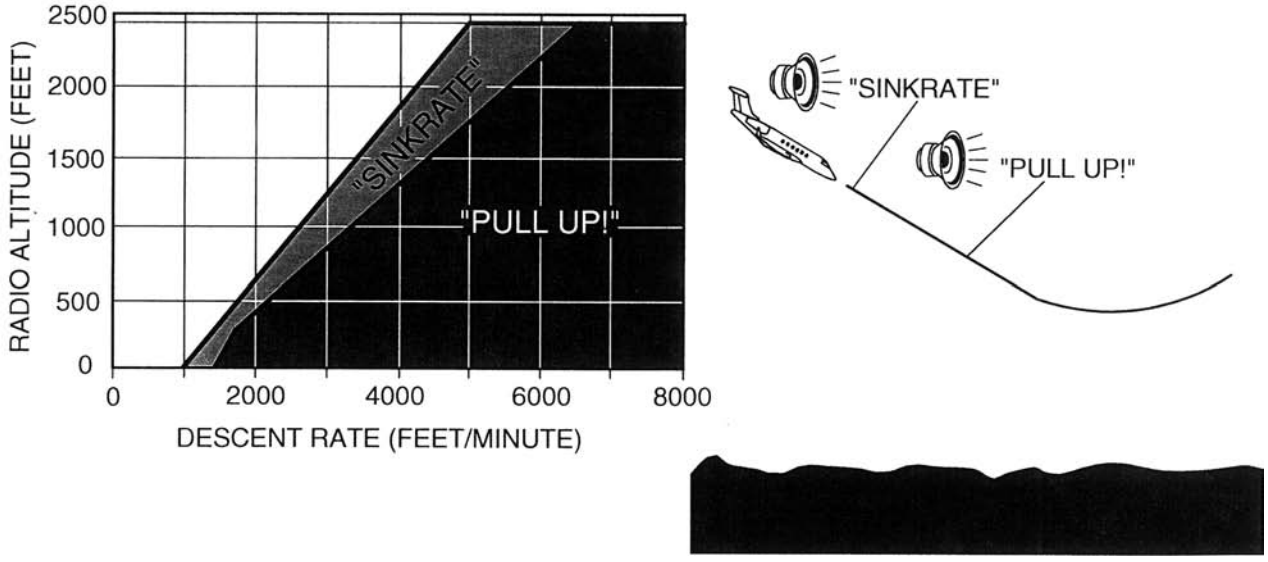

Figure 16-42. Mode 1 Warning

Mode 2 Excessive Terrain Closure Rate

Mode 2 alerts when closure rate between the aircraft and terrain is excessive. The aircraft need not be in descent; rising terrain may be encountered in level flight or terrain may be rising at a rate greater than aircraft rate of climb. Mode 2 uses radio altitude and vertical speed inputs.

Mode 2A

Mode 2A activates when flaps are not in the landing position (Figure 16-43).

- Penetration of alert area—Amber GND PROX displays on PFD; TERRAIN, TERRAIN sounds. The aural sounds once; the visual alert remains until condition rectified.
- Penetration of warning area—Red PULL UP displays on PFD; PULL UP sounds. The aural and visual warning annunciate continuously until condition rectified.

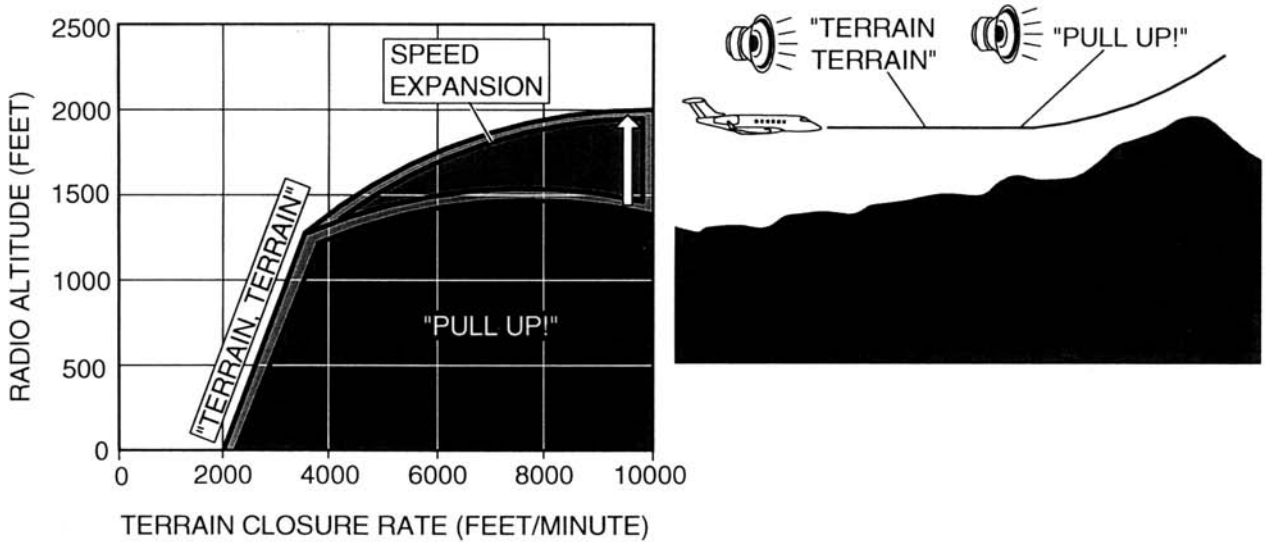

Figure 16-43. Mode 2A Warning

Mode 2B

Mode 2B activates when flaps are in landing configuration or flaps are up and aircraft is on an ILS approach with glideslope and localizer deviations less than ±2 dots and for 60 seconds after takeoff (Figure 16-44).

- Penetration of alert area—Amber GND PROX displays on attitude display of PFD; TERRAIN, TERRAIN sounds. The aural and the visual alerts annunciate continuously and remain until condition rectified.
- Penetration of warning area—Red PULL UP displays on attitude display of PFD; PULL UP sounds. The aural and visual warning annunciate continuously until condition rectified. The Mode 2B warning envelope is inhibited at an altitude below 30 feet AGL.

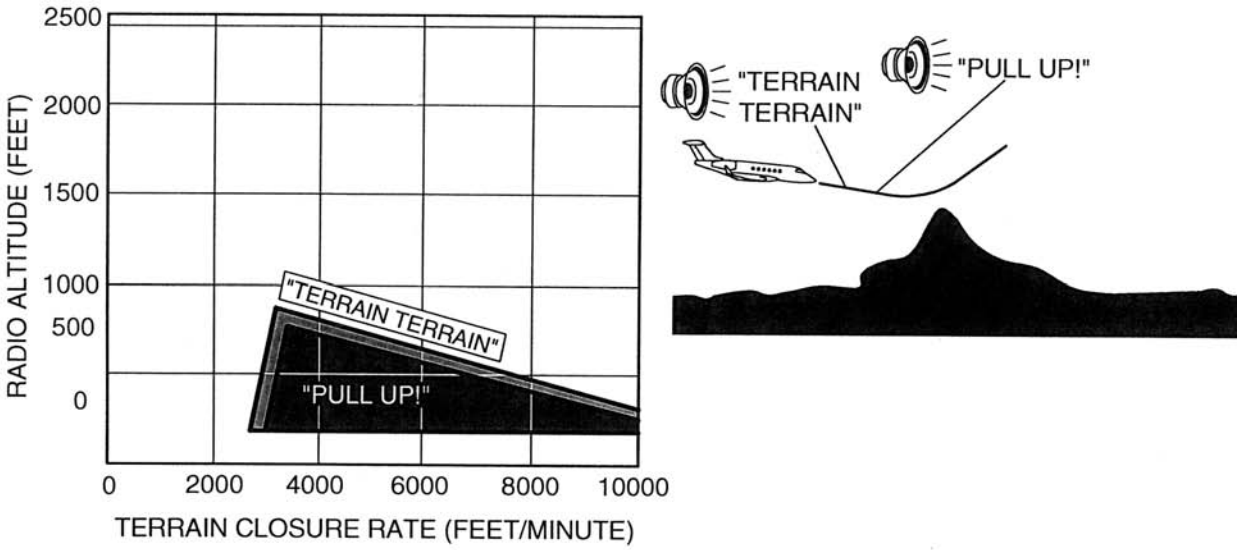

Figure 16-44. Mode 2B Warning

Mode 3 Altitude Loss after Takeoff

Mode 3 warns when a significant amount of altitude is lost immediately after takeoff or during go-around. Mode 3 uses radio altitude, barometric altitude, and vertical speed (Figure 16-45).

Mode 3 is enabled after takeoff or go-around when landing gear or flaps are not in landing configuration. It stays enabled until TAWS detects that the aircraft has gained sufficient altitude and is no longer in takeoff phase of flight.

If a descent is initiated following takeoff or go-around, TAWS stores the altitude value at which the descent began and compares successive altitude data to the stored value. Activation of the warning is induced when the minimum terrain clearance as a function of altitude lost is exceeded.

- Penetration of alert area—GND PROX displays on PFD; DONT SINK, DONT SINK sounds. The aural warning sounds only once unless the altitude value degrades by more than 20% from the initially stored value and again at each additional 20% degradation from the initially stored value. This condition remains until the aircraft regains the initial altitude value. Mode 3 is inhibited for radio altitude values in excess of 1,500 feet.

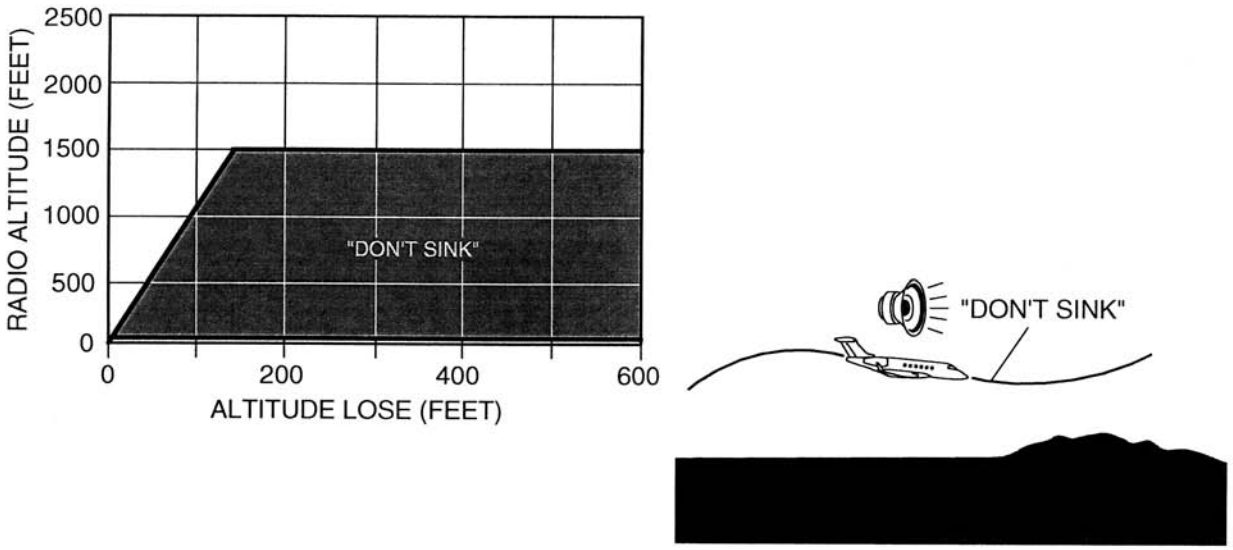

Figure 16-45. Mode 3 Warning

Mode 4 Unsafe Terrain Clearance

Mode 4 provides alerts and warnings for sufficient terrain clearance based on the aircraft phase of flight and speed. Mode 4 requires radio altitude, computed airspeed, gear position, and flap position inputs. The alert and warning envelopes are based on minimum allowable terrain clearance as a function of computed airspeed.

Mode 4A

Mode 4A is active when the aircraft is in cruise or approach phase of flight and landing gear is not in the landing position. The alert envelope for Mode 4A begins at 30 feet AGL and extends vertically to an altitude of 500 feet AGL (Figure 16-46). During penetration of the alert area above 190 knots, the upper boundary increases with airspeed to a maximum of 1,000 feet radio altitude at 250 knots or more.

- Penetration of alert area—GND PROX displays; TOO LOW TERRAIN sounds.
- Penetration of alert area at 190 kt—GND PROX displays; TOO LOW GEAR sounds. The aural and visual warnings remain until the aircraft exits the envelope.

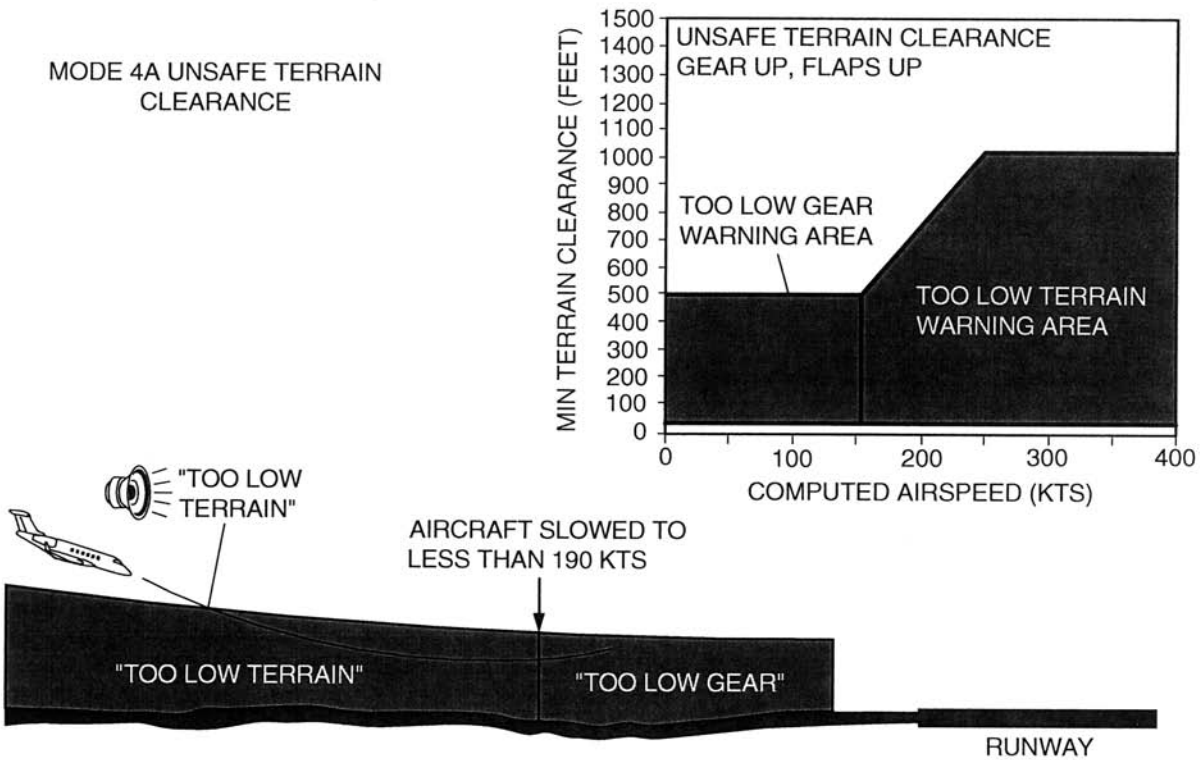

Figure 16-46. Mode 4A Warning

Mode 4B

Mode 4B is active when the aircraft is in cruise or approach phase of flight and landing gear is in the DN position. The alert envelope for Mode 4B begins at 30 feet AGL and extends vertically to an altitude of 245 feet AGL (Figure 16-47).

- Penetration of alert area above 159 knots—Amber GND PROX displays on the PFD; TOO LOW TERRAIN continuously sounds. The aural and visual warnings remain until the aircraft exit the envelope.
- Penetration of alert area below 159 knots—Amber GND PROX displays on the PFD; TOO LOW FLAPS sounds. Aural TOO LOW FLAPS warning can be silenced by selecting OFF on the FLAPS switch on the TAWS WARN panel.

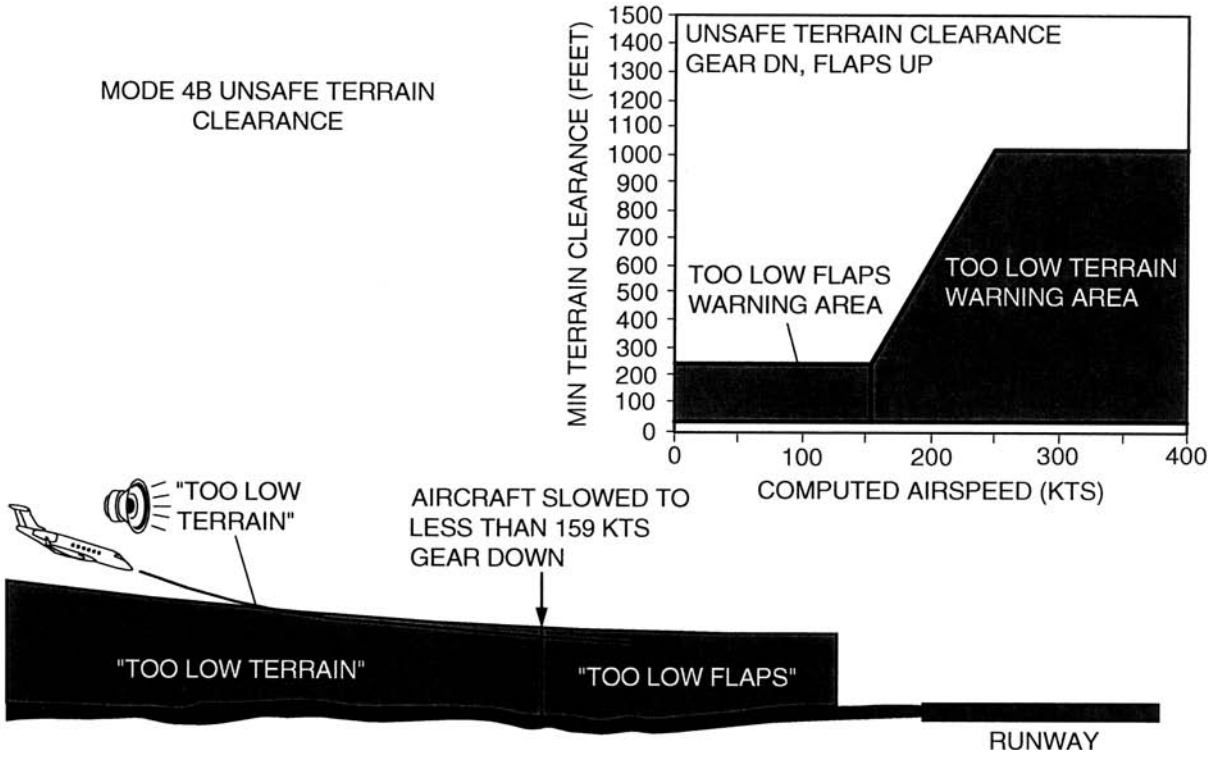

Figure 16-47. Mode 4B Warning

Mode 4C

Mode 4C is based on a minimum terrain clearance or floor that increases with radio altitude during takeoff (Figure 16-48). Any decrease in altitude below minimum terrain clearance annunciates an amber GND PROX display on the PFD and generates an aural TOO LOW TERRAIN warning.

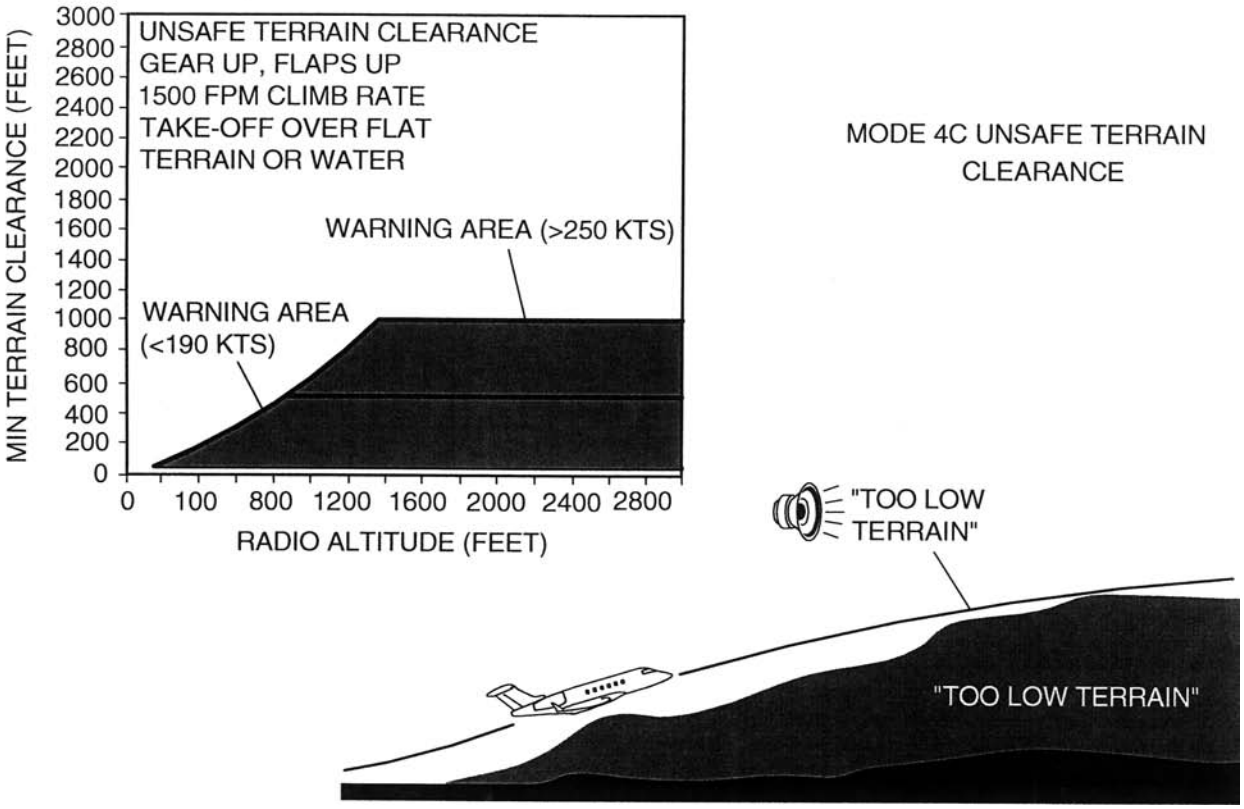

Figure 16-48. Mode 4C Warning

Mode 5 Descent below Glideslope

Mode 5 warns when the aircraft descends below the glideslope on an ILS approach (Figure 16-49). The alerts and warnings sound in two distinct tones depending on the position of the aircraft on the glideslope.

When the aircraft descends more than 1.3 dots (but no more than 2 dots) below glideslope, a quiet (6 dB) aural GLIDESLOPE sounds. If the aircraft continues to descend and deviates more than 2 dots below glideslope, an aural GLIDESLOPE sounds at the same volume level as all other warnings. An amber GND PROX is displayed on the PFD. The aural and visual alerts and warnings are continuously annunciated until the aircraft exits the alert envelope.

The GLIDESLOPE warning can be muted by selecting the GS switch on the TAWS WARN panel to OFF.

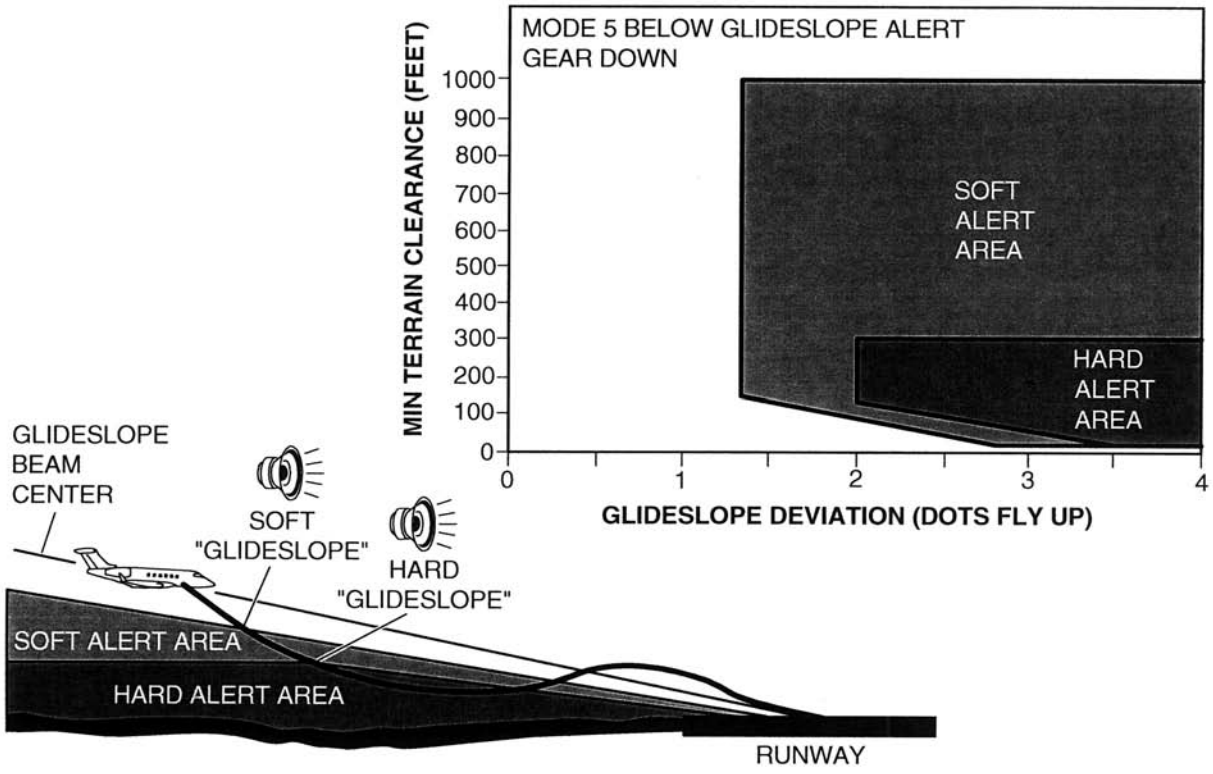

Figure 16-49. Mode 5 Warning

Mode 6 Altitude Callouts

Mode 6 alerts for the following (Figure 16-50):

- Transition through preset approach minimums—System sounds MINIMUMS, MINIMUMS. The warning function is enabled between 1,000 feet and 10 feet radio altitude or DH minimums and when the corrected altitude exceeds the MDA value by 200 feet. The landing gear must be down for activation of the warning.
- Altitude callouts on approach—System generates annunciation for descent below predetermined altitudes. Aural ONE HUNDRED, FIFTY, and THIRTY indicate the transition through 100, 50, and 30 feet AGL. The last annunciated or transition altitude is memorized to prevent the repeat annunciation of a callout should the aircraft transition through that altitude again. Memory is cleared and reset once the aircraft climbs to an altitude greater than 1,000 feet or if a transition occurs from approach mode to takeoff mode. A "smart altitude callout" provides an aural FIVE HUNDRED at 500 feet radio altitude during a nonprecision approach. The callout is generated during a precision approach if the aircraft flight path deviates greater than ±2 dots of either glideslope or localizer. The callout is also generated during a backcourse approach.
- Excessive bank angles (Figure 16-51)—System alert is a function of the roll angle with respect to altitude above ground level. The alert envelope varies linearly from a 10° bank at 30 feet AGL to a 40° bank at 150 feet AGL to 55° of bank at 2,450 feet AGL. An aural BANK ANGLE, BANK ANGLE sounds. The alert sounds once and repeats if bank angle increases by 20%. The alert sounds continuously if bank angle is increased to 55°. The alert sounds until the bank angle is decreased below said value.

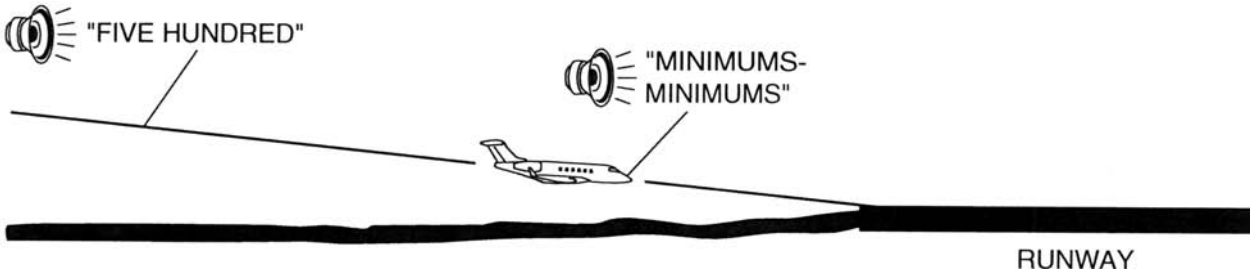

Figure 16-50. Mode 6 Warning

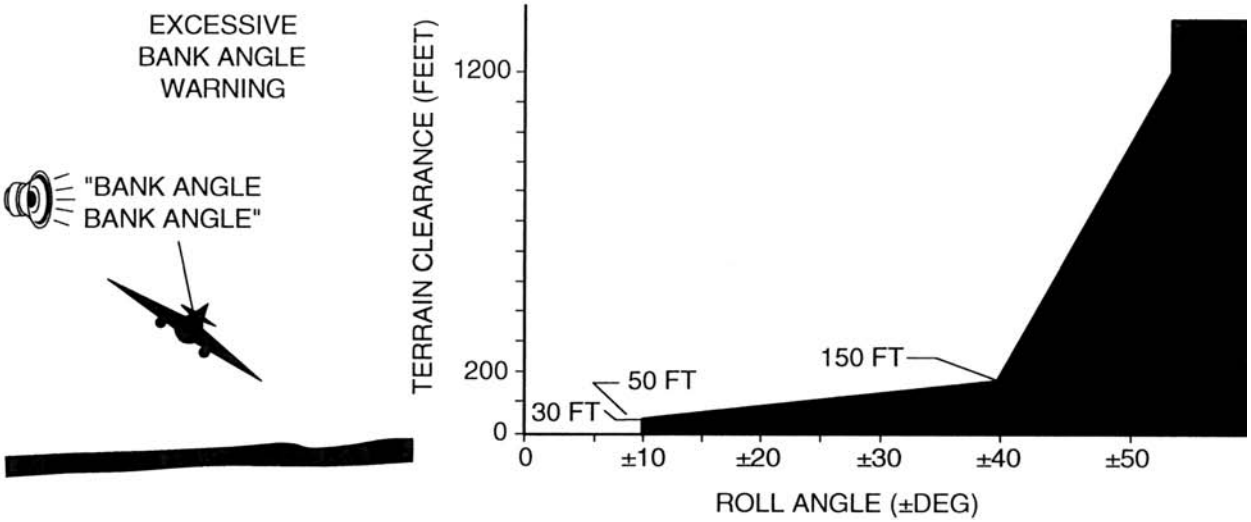

Figure 16-51. Mode 6 Warning—Excessive Bank Angles

Mode 7 Windshear Warning

Mode 7 warns when significant windshear is detected (Figure 16-52). Mode 7 is active during takeoff and landings phase of flight only between 10 and 1,500 feet AGL.

- Increasing performance shear (updraft/headwind)—Flight director display removed from display, WINDSHEAR warning flashes for five seconds, then remains steady. An aural WINDSHEAR WINDSHEAR sounds .
- Decreasing performance shear (downdraft/tailwind)—Flight director display removed from display, WINDSHEAR warning flashes for five seconds, then remains steady. An aural tone, WINDSHEAR WINDSHEAR sounds.

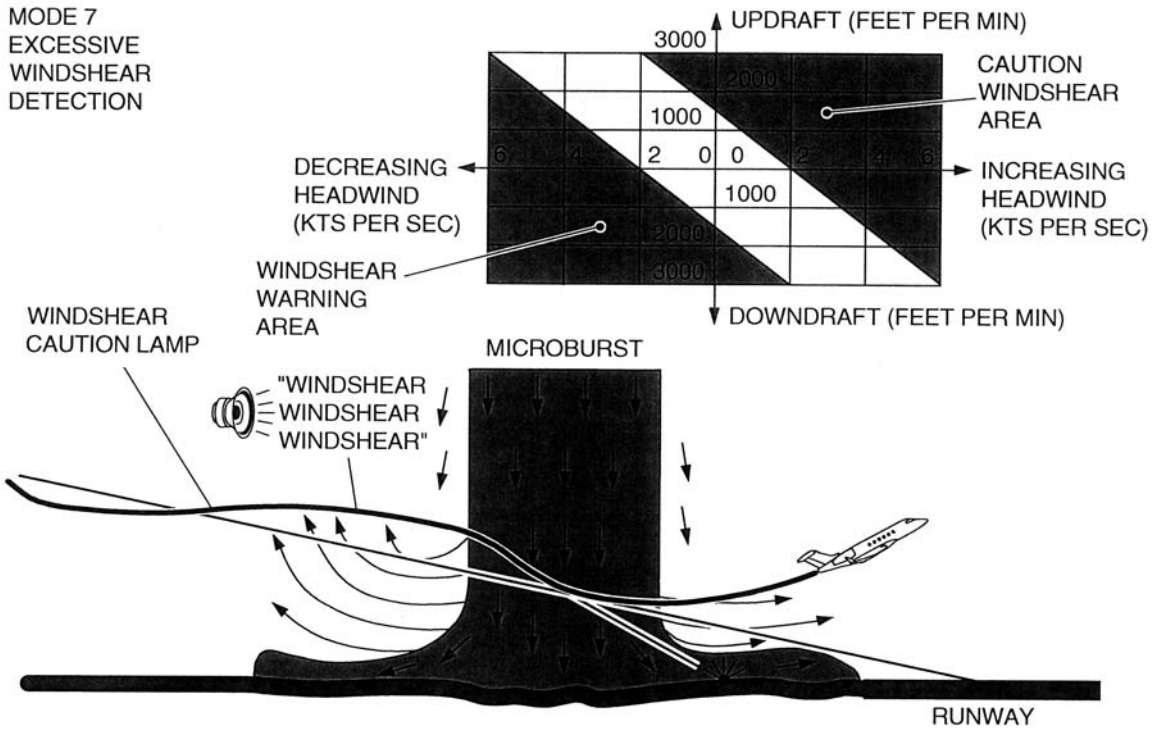

Figure 16-52. Mode 7 Warning

TERRAIN CLEARANCE FLOOR

The terrain clearance floor (TCF) function supplements the GPWS function to provide an additional terrain clearance alert envelope around airports (Figure 16-53). TCF criteria determine alert and warning envelopes.

TCF creates an increasing terrain clearance envelope around the intended airport runway directly related to the distance from the runway. Alerts are based on current aircraft location, nearest runway center point position, and radio altitude along with an internal database that includes all worldwide, hard-surfaced runways greater than 3,500 feet in length.

With penetration of the alert envelope, an aural TOO LOW TERRAIN sounds; amber GND PROX is displayed on the PFD.

The aural alert repeats twice and again thereafter if radio altitude value decreases by more than 20% from the altitude at which the initial warning was issued. The amber GND PROX remains displayed until the aircraft exits the alert envelope.

All terrain annunciations are displayed on the PFD and MFD.

WEATHER RADAR

The weather radar is an X-band color weather radar system for atmospheric moisture detection and ground mapping. Weather radar displays radar-detectable precipitation within ±60° of the flight path at a selectable range up to 300 nautical miles.

It also provides ground mapping and incorporates such features as autotilt, ground clutter suppression, range compensation, and path attenuation correction.

The system consists of a receiver transmitter antenna (RTA) and dual controllers. Radar information is normally displayed on the MFD in a MAP mode. The AHRS provides stabilization input to the RTA.

In the weather detection mode, storm intensity levels are displayed in four bright colors contrasted against a deep black background. Areas of detected turbulence are displayed in magenta.

Range marks and identifying numerics in contrasting colors evaluate the location of storm cells relative to the aircraft.Ground mapping (GMAP) improves resolution and identification of small ground targets at short ranges. The reflected signals from ground surfaces are displayed as green, yellow, red, or magenta (most to least reflective).

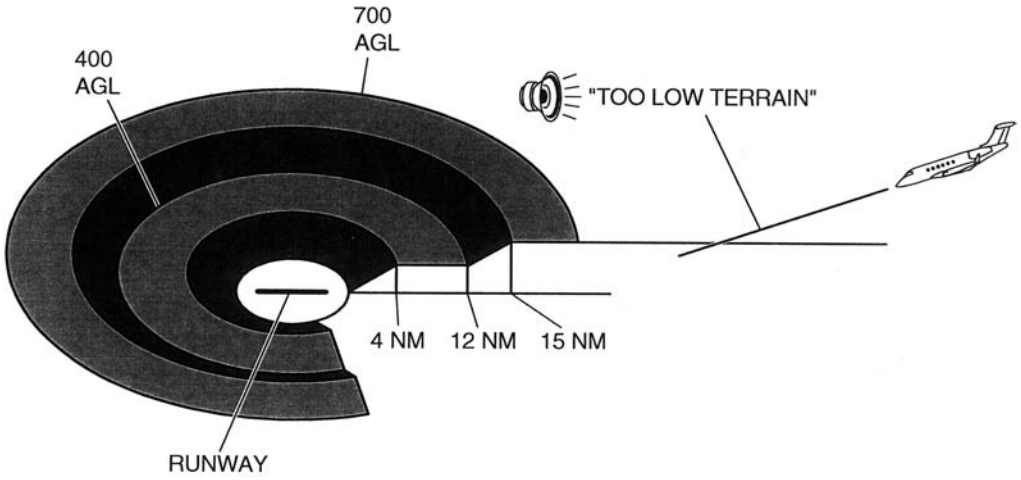

Figure 16-53. Terrain Clearance Floor

OPERATION

The radar menu on the PFD controls weather radar functions. The RADAR button on the DCP accesses the menu. Selection of the radar display is accomplished by pressing the TR/WX button on the DCP. Knobs on the DCP control range and tilt.

The menu has the following selections:

- STBY—First mode; antenna is stowed in tilt-up position and is neither transmitting nor scanning although power is applied. The radar is in this mode after system power-up or after mode is selected. This mode is automatically selected 60 seconds after the transition to ground has been performed.
- WX—Second selection; four-color weather display representing four different precipitation rates.
- WX-T—Third selection; four-color weather display mode plus turbulence mode (if TURB RTA installed)
- TURB—Fourth selection; turbulence only mode allows turbulence to be separated from heavy rainfall (if TURB RTA installed). After 30 seconds it reverts back to the previous selection.
- MAP—Fifth selection; typically used for detection and display of prominent and familiar ground features as an aid to navigation
- TEST—Sixth selection; a simulated target return creates a rainbow like pattern of colors on the display. While the radar is in this mode, the transmitter is turned off

Lighting Detection System

The optional lightning detection system maps the location of thunderstorm activity 360° around the aircraft to a distance of 200 nautical miles.

Lightning symbology is displayed as lightning bolt icons. The icons are color coded to identify different levels of intensity:

- Yellow—Light levels of thunderstorm cells (1 to 4 strikes)
- Red—Medium level cells (5 to 9 strikes)
- Magenta—Heavy level cells (more than 9 strikes)

Target Mode Message

The target mode message TGT changes from cyan to yellow to indicate a target alert.

A target alert is issued if either channel (pilot or copilot side) of the weather radar reports a target. The TGT message flashes for five seconds and then remains steady as long as the radar detects a target.

Sector Scan Mode

The sector scan mode is a reduced antenna azimuth scan mode that restricts mechanical scan angle used and processed by the RTA. This mode can be used with any other scanning mode of operation. It increases the radar update rate.

While in this mode, antenna scan range is maximum ±30º from the aircraft heading line. If either command channel is in target mode, sector scan is disabled.

Ground Clutter Suppression Mode

The ground clutter suppression (GCS) mode suppresses those radar returns that appear as ground clutter. This feature eases the interpretation of rainfall when viewed from higher altitudes by eliminating much of the display caused by ground returns.

Autotilt Mode

Autotilt automatically adjusts the antenna tilt angle to keep the radar scanning approximately the same region of space when the aircraft climbs and descends. It reduces the number of times the aircrew has to adjust the TILT control whenever the aircraft altitude or radar range setting changes.

Autotilt may be selected on or off when the RADAR menu is active or anytime the radar tilt value is shown on the onside display. Autotilt may be enabled continuously because the system always uses the current manual tilt setting as the starting point.

RADAR ANTENNA

The antenna sweep (Figure 16-54) is selectable for either 120º (60º each side of the aircraft) or 60º (30º each side). The antenna tilt is adjusted between –15º (down) and +15º (up). The antenna maintains its stabilization with respect to the horizon regardless of the aircraft attitude (within –15 to +15º).

Figure 16-54. Radar Antenna

FLIGHT MANAGEMENT SYSTEM (FMS)

The Rockwell Collins FMS-5000 Flight Management System single or dual FMS is a fully integrated navigation and flight management system with the following features:

- Enroute, terminal, and non-precision approach lateral and vertical navigation with automatic transition to precision approach
- Flight plan management
- Multisensor navigation
- Maps and text data display
- Performance management

The system is integrated with a GPS receiver that processes transmissions from multiple GPS satellites simultaneously to calculate navigation solutions based on information from all satellites available.

A minimum of four satellites with acceptable geometry (or three satellites plus calibrated barometric altitude) are required to calculate a navigation solution. The computed GPS position, velocity, and time are inputs to FMS, which then integrates the data into the flight plan-based navigation solution. AHRS, ADC, DME, and VOR systems also supply data to the FMS.

The FMS provides necessary controls for all input sensors when appropriate via the CDU. When a single FMS system is installed, the CDU on the right side of the center pedestal controls it. When two FMS systems are installed, each CDU controls its onside FMS (Figure 16-55).

The FMS can be initialized with waypoints and destination selected by a variety of means. SID, STAR, and airways are accommodated. A great circle route is calculated between waypoints for enroute lateral navigation (LNAV).

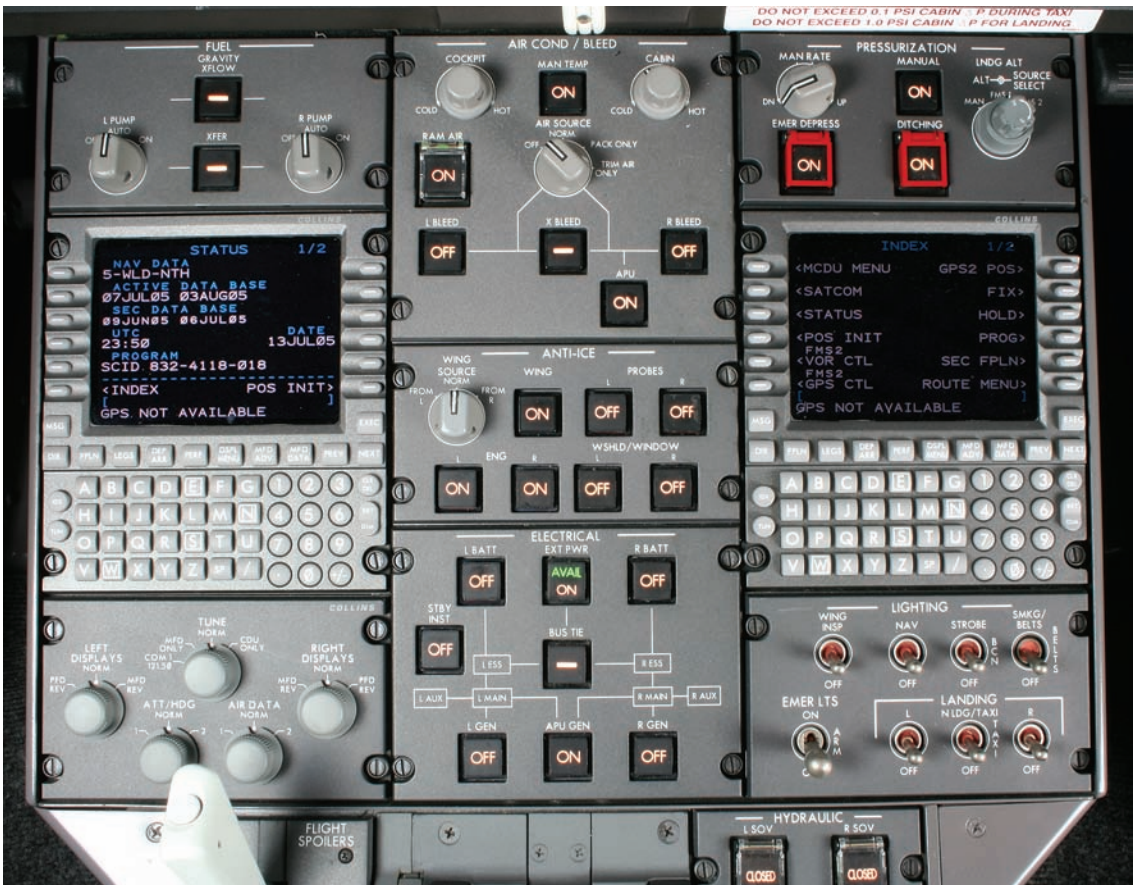

Figure 16-55. Flight Management System

Roll steering is provided to the flight control system (FCS). A sophisticated interface with the FCS allows the FMS vertical navigation (VNAV) function to select various FCS vertical modes of navigation. This sophisticated VNAV interface is often referred to as coupled VNAV. The VNAV and LNAV capability can be advisory only if the FMS is not coupled. The FMS provides vertical steering when required by the FCS.

FMS interfaces with EFIS to display conventional navigation information, state-of-the art map presentation, performance, and optional V speed data.

Refer to the *Rockwell Collins Pro Line 21 Avionics System Challenger 300 Operator's Guide* for a detailed description and operation of the flight management system.

DEAD RECKONING

When no navigation sensor data is available for the FMS, the system begins navigating in the dead reckoning (DR) mode.

In this mode, the FMS estimates its position based only on the last known position, heading, and airspeed. To identify this mode, FMS DR is annunciated on the MFD and on the PFD if the navigation source is FMS. It also shows on the CDU message line and MESSAGES page.

CALCULATED VSPEEDS

With the VSPEEDS feature, the pilot can set or adjust takeoff and approach speeds on the PFD. The reference speeds are displayed on the airspeed tape. FMS calculated VSPEEDS are an option on the Challenger 300. Setting and adjustment is with the REFS menu and DCP. Vspeeds are grouped on the REFS menu pages into takeoff speeds and approach speeds.

The pilot may accept the default or FMS-calculated VSPEEDS value or set a different value. The PFDs show the reference speed as a digital readout on the speed reference table at the bottom of the airspeed tape. It also sets a reference bug for each separate VSPEED at the appropriate speed on the airspeed scale.

Manually set VSPEED values show in cyan characters, FMS calculated VSPEEDS show in magenta characters. VSPEEDS can be a combination of FMS calculated and manually set values.

The FMS, however, does not compare actual aircraft data against the data manually input by the pilot on the CDU TAKEOFF REFERENCE or CDU APPROACH REFERENCE pages.

It is necessary for the pilot to verify and validate aircraft configuration and environmental conditions input into the FMS reflect the correct conditions for takeoff or approach.

After actual takeoff or approach configuration has been achieved, but before posting, the crew should verify inputs entered into the FMS for computation reflect actual or intended takeoff or approach conditions.

A summary of the takeoff performance data displays on the MFD TAKEOFF REFERENCE page. A summary of the approach performance data is presented on the MFD APPROACH REFERENCE page. These pages can be accessed by selecting the CDU MFD DATA key while the corresponding CDU takeoff or approach reference page is displayed. It may also be accessed by pressing the CDU MFD DATA key followed by the MFD MENU key and selecting the desired page.

To manually exit the REFS menu, push another menu button on the DCP. The menu is automatically removed 20 seconds after the last activity of the MENU/DATA/PUSH SELECT knob or another menu or list button is pushed.

FMS/GPS CONTROL PAGE

The pilot monitors the FMS aircraft position in relationship with GPS on the GPS control page. The position differential (POS DIFF) is shown in direction and magnitude from the FMS position.

When enabled, the FMS uses the GPS position information as a sensor.

Select the appropriate line key to disable GPS input in the FMS. When disabled, the GPS receiver cannot supply position information to the FMS.

GLOBAL POSITIONING SYSTEM

The global positioning system (GPS) determines aircraft position and provides supplementary information to FMS, TAWS, and the clock. The GPS calculates latitude, longitude, altitude, accurate time, date, true heading, and groundspeed.

GPS is a space-based navigation system that consists of 26 satellites at an altitude of approximately 10,900 nm and an orbital period of 12 hr. Each satellite transmits a signal on the L1 (1575.42MHz-for general aviation use) and L2 (1227.6MHz-for P-code/military use only) frequencies.

The signal contains digital data that measures line-of-sight range and computes position and time at the receiver. Pre-departure verification of GPS availability is required for GPS as a primary means of navigation before each flight.

Four or more available satellites allow the receiver to autonomously compute the position integrity. The position can be calculated (with the required integrity) on the basis of the three satellites data available in addition to an air data altitude.

The system permanently performs the receiver autonomous integrity monitoring (RAIM) process that represents the method of detecting and isolating satellite errors with redundant satellite measurements. Five satellites are required to detect a satellite error; six satellites are required to isolate the error to an individual satellite and remove it from the navigation solution.

The system supports enroute (including VNAV), terminal, and non-precision approach (except localizer, localizer directional aid, and simplified directional functionality) capability. The system provides current position, velocity, and time to FMS and TAWS.

PREDICTED RAIM

If GPS is going to be used for navigation, the satellite RAIM can be checked for constellation accuracy. RAIM ensures the GPS solution (satellite computation) meets the required accuracy. The accuracy levels are as follows:

- 4 nm for oceanic/remote
- 2 nm for enroute
- 1 nm for terminal
- 0.3 nm for final approach

Predicted approach RAIM for destination is displayed on the CDU along with arrival time.

The pilot can enter the ETA in the FMS and the predicted APPR RAIM is calculated. If not available, UNAVAIL is displayed on the CDU.

REQUIRED NAVIGATION PERFORMANCE

Required navigation performance (RNP) is a statement of the navigation performance accuracy necessary for operation within a defined airspace. The pilot enters the RNP value on the FMS PROGRESS page.

The FMS computes its expected position accuracy based on the sensors in use. The expected position accuracy (POS ACCURACY) is also displayed on the PROGRESS page.

When flying in RNP airspace, the FMS position error should be less than the RNP value 95% of the time. If the expected position accuracy error is more than the RNP value, a message LOW POS ACCURACY is displayed on the CDU. Navigation by other means must be utilized.

SATELLITE DESELECT

Up to eight individual satellites that are scheduled to be out of service may be deselected. The FMS ignores data from these satellites and does not include them in the predicted RAIM computations.

EICAS MESSAGES

Table 16-5 lists the EICAS messages associated with the avionics system, a brief explanation of the message, and whether the message is inhibited during takeoff and/or landing.

Table 16-5. EICAS MESSAGES

MESSAGE	INHIBITS	MEANING	AURAL WARNING
FLIGHT INSTRUMENTS			
EFIS COMPARATOR INOP	TO/LAND	The EFIS comparator is unable to compare one or more of the following parameters: altitude, airspeed, roll attitude, pitch attitude, heading, radio altitude, flight director, localizer, or glideslope.	
EFIS MISCOMPARE		There is a mismatch between the onside and cross-side data. Accompanied by a PFD annunciation ALT, IAS, ROL, PIT, HDG, LOC, GS, RA, or FD.	
L IAPS FAIL R IAPS FAIL	TO/LAND	The respective integrated processing system has failed.	
PFD X-TALK FAIL	TO/LAND	Communication between the PFDs has failed. REFs menu pages 1, 2, and 3 are not synchronized. The EFIS comparator will be inoperative and is unable to compare one or more of the following parameters: altitude, airspeed, roll attitude, pitch attitude, heading, radio altitude, flight director, localizer, or glideslope.	
CAS MISCOMPARE		There has been a miscompare of Warning, Caution, Advisory, Status, or Aurals for greater than 20 seconds. All current CAS messages are displayed and aurals are sounded.	
DCU FAN FAIL	TO/LAND	The avionics data concentrator unit fan has failed.	
DCU FAULT	TO/LAND	Channel A or B in the data concentrator unit has failed; the yaw damper may fail. The rudder travel limiter monitoring may be inoperative.	
IAPS FAN FAULT	TO/LAND	The IAPS is indicating an overtemperature condition or fan failure. Opening avionics rack doors and/or lowering cabin and cockpit temperatures may aid in cooling.	
MFD X-TALK FAIL	TO/LAND	Communication between the MFDs has failed, and cross-side tuning is not available.	
RDC FAULT	TO/LAND	Channel A or B of the remote data concentrator has failed with no loss of functionality.	

Table 16-5. EICAS MESSAGES (Cont)

MESSAGE	INHIBITS	MEANING	AURAL WARNING
AUTOMATIC FLIGHT CONTROL SYSTEM			
CONFIG AILERON TRIM CONFIG AUTOPILOT CONFIG FLAPS CONFIG RUDDER TRIM CONFIG SPOILERS CONFIG STAB TRIM	TO	The aircraft is on the ground, and the takeoff parameters (autopilot, flaps, spoilers, and trims in any axis) are not properly configured for takeoff. Illumination of the respective red CAS is accompanied by the takeoff CONFIGURATION voice warning.	"Configuration"
AFCS MESSAGES FAIL		Monitoring and indication of the autopilot modes may be unreliable.	
AP HOLDING LWD AP HOLDING RWD AP HOLDING NOSE DOWN AP HOLDING NOSE UP	TO	The autopilot is holding control force in the direction indicated.	
AP STAB TRIM FAIL	TO	The autopilot is unable to make a trim correction to the horizontal stabilizer.	
FD MODE CHANGE		An indirect mode change has occurred within the flight director. An example of an indirect mode change would be NAV or APPR mode changing to ROLL with a navigation source or frequency change.	
YAW DAMPER FAIL	TO/LAND	The yaw damper has failed.	
FD 1 FAIL FD 2 FAIL	TO/LAND	The respective flight director has failed accompanied by an FD flag on the PFD.	
COMMUNICATIONS			
CVR FAIL	TO/LAND	The cockpit voice recorder has failed.	
FDR FAIL	TO/LAND	The flight data recorder has failed.	
FDR FAULT	TO/LAND	The longitudinal, lateral, or normal accelerations parameters in the flight data recorder are inoperative. It may be possible to clear this message.	
SELCAL HF 1 SELCAL HF 2	TO/LAND	The SELCAL code has been received on HF 1 or HF 2.	"SELCAL"
SELCAL VHF 1 SELCAL VHF 2 SELCAL VHF 3	TO/LAND	The SELCAL code has been received on VHF 1, VHF 2, or VHF 3.	"SELCAL"
SELCAL DATALINK	TO/LAND	The SELCAL code has been received on DATALINK.	"SELCAL"
ELT ON		Pilot status that ELT is transmitting.	

Table 16-5. EICAS MESSAGES (Cont)

MESSAGE	INHIBITS	MEANING	AURAL WARNING
NAVIGATION			
TAWS BASIC FAIL	TO/LAND	Some of the basic modes (Mode 1 through 6) of the terrain awareness warning system have failed.	
TAWS SYSTEM FAIL	TO/LAND	The terrain awareness warning system has failed.	
TAWS TERR FAIL	TO/LAND	The terrain function of the terrain awareness system has failed.	
TAWS TERR NOT AVAIL	TO/LAND	The TAWS terrain data base has no data for the current location.	
TAWS WINDSHEAR FAIL	TO/LAND	The windshear function of the terrain awareness warning system has failed.	
TAWS FLAPS OFF		The flap warning function of the terrain awareness warning system has been selected OFF by the crew.	
TAWS GS WARN OFF		The glideslope warning function of the terrain awareness warning system has been selected OFF.	
TAWS TERR OFF		The terrain warning function of the terrain awareness warning system has been selected OFF.	

QUESTIONS

1. The primary pitot-static system supports:
   a. The integrated standby instrument
   b. Air data computers 1 and 2 and the integrated standby instrument
   c. Air data computers 1 and 2
   d. The cabin pressurization system

2. The altimeter barometer knob is located on the:
   a. On the display control unit of each pilot station
   b. Compass panel just above each pilot radio panel
   c. On the pressurization control panel
   d. Next to the PFD altimeter display

3. By selecting the ADC reversion switch to the #1 position:
   a. Standby instrument information is routed to the pilot PFD
   b. Standby instrument information is routed to the copilot PFD
   c. The data from air data computer 1 is shut off
   d. Both PFDs receive data from only air data computer 1

4. Which of the following is not interfaced with the attitude heading and reference system:
   a. Stall protection system
   b. Weather radar
   c. Integrated standby instrument
   d. Terrain awareness warning system

5. Selecting the compass to DG mode:
   a. Heading computations are slaved to the attitude heading computer and flux detectors
   b. Removes magnetic flux detector information from the attitude heading computer
   c. Should be used for long term heading reference
   d. Allows heading reference with GPS updates

6. Crew control of the EFIS system consists of:
   a. Two display control panels and two flight guidance control panels
   b. Pilot and copilot flight guidance panels and a single display control panel
   c. One flight guidance panel and one display control panel
   d. Pilot and copilot display control panels and a single flight guidance panel on the glare shield

7. The slip/skid indicator is:
   a. A “caged ball” at the bottom of the PFD
   b. On electronic display at the bottom of the MFD
   c. A small rectangle below the roll pointer driven by lateral acceleration
   d. There is no slip/skid indicator

8. The airspeed trend vector:
   a. Indicates the airspeed predicted in the next 10 seconds
   b. Is a cyan line on the airspeed indicator
   c. Is not affected by aircraft attitude
   d. Is pilot selectable on the FMS performance page

9. VOR/localizer displays on the horizontal situation indicator are:

a. Green pointer or CDI for onside information, amber for cross side information
b. Magenta bearing pointer and green CDI
c. Green ADF pointers and amber CDI needle
d. Green for onside bearing pointers and CDI, magenta bearing pointers and CDI needles for onside information

10. The autopilot engaged indication is:

a. A cyan AUATOPILOT ENGAGED message on EICAS
b. A light illuminated in the A/P switch on the flight guidance panel
c. A white AUTOPILOT NOT ENGAGED message removed from EICAS
d. A green AP on the top of the PFD

11. The flight guidance mode goes to half bank automatically when:

a. Engaging the autopilot above 15,000'
b. Climbing through 31,600'
c. Extending flaps
d. There is an engine failure

12. To automatically tune COM1 to 121.5:

a. Select the tune reversion switch to the COM1 121.5 position
b. Select the center toggle switch on the audio panel to the EMERGENCY position
c. Tune 7700 on the transponder
d. The emergency frequency must be manually selected

13. The default lateral mode of the flight director is:

a. Heading
b. ROLL
c. Half bank
d. Takeoff

14. The autopilot may be disconnected by all of the following except:

a. Pressing TOGA
b. Pressing the AP button on the FGP
c. Lowering the AP/YD DISC bar on the FGP
d. Pressing FD on the FGP

15. Manually entered data is depicted on the flight displays in _____ and FMS supplied data is depicted in _____.

a. Cyan/Magenta
b. Magenta/Cyan
c. Amber/Magenta
d. Green/Magenta

CHAPTER 17
MISCELLANEOUS SYSTEMS

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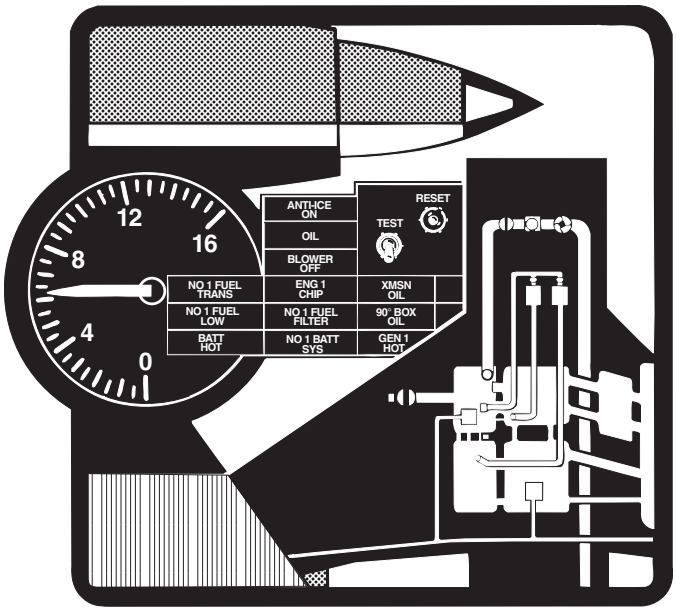
CHAPTER 17
MISCELLANEOUS SYSTEMS



INTRODUCTION

This chapter discusses emergency equipment available on the Challenger 300. The oxygen system includes a cylinder to store oxygen, a distribution system for both passengers and crew, and a therapeutic mask. Additional emergency equipment includes smoke goggles, portable breathing equipment, life vests, crash axe, flashlights, first aid kit, and portable fire extinguishers.

OXYGEN SYSTEM

Oxygen is stored in gaseous form in one or two cylinders that deliver the oxygen at a reduced pressure to the electro pneumatic actuating valve (EPAV). The EPAV then supplies oxygen to the crew masks, passenger drop out boxes, and therapeutic mask (Figure 17-1).

When fully charged, the oxygen system pressure is 1,850 psi measured at the fill port. The quantity, measured in liters, is continuously monitored and displayed on the EICAS and SUMMARY synoptic pages.

Based on the number of cylinders, the EPAV converts the pressure signal into liters of oxygen for display of oxygen quantity. When quantity of cylinder is less than 700 liters, the readout changes to amber; the OXYGEN QUANTITY LOW caution message displays. The message is based on temperature-corrected pressure.

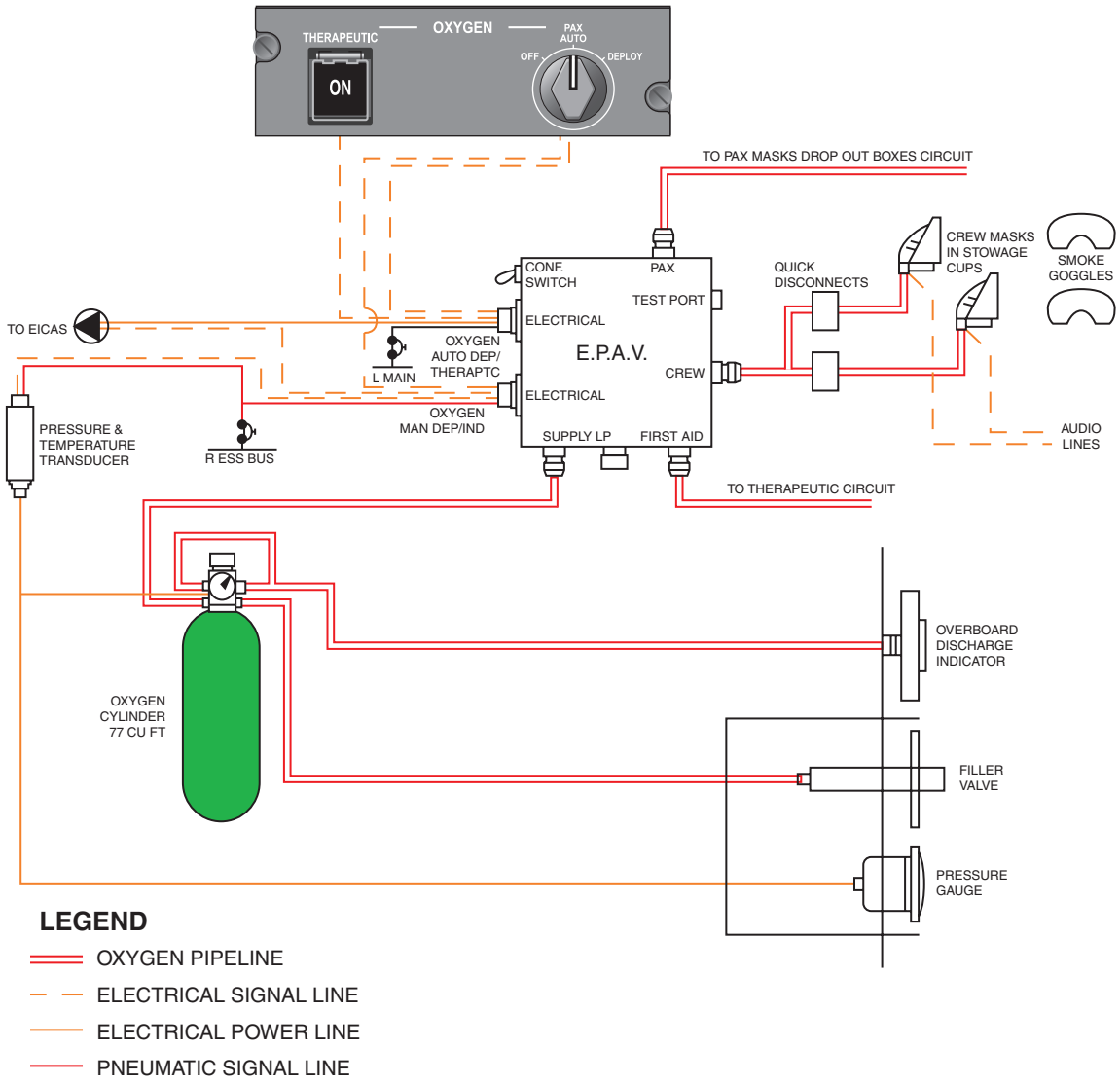


Figure 17-1. Oxygen System—Standard Configuration

OXYGEN CYLINDER

The basic oxygen system includes one 77 cu ft (2,183 liters) cylinder. A second 115 cu ft (5,458 liters) cylinder is available as an option for long distance flight capability.

The cylinder is a composite cylinder with a pressure-reducing regulator directly on top. The entire unit is stored inside a dedicated compartment in the lavatory section (right side).

The cylinder also includes safety relief valves (one on the high-pressure line and another on the reduced pressure line). The valves are connected to discharge lines and to the overboard discharge indicator.

An on/off toggle manually operates the regulator, which reduces high-pressure oxygen in the cylinder to a suitable lower pressure.

Overboard Discharge Indicator

The shutoff and pressure regulator system incorporates a pressure relief valve. If excessive oxygen pressure occurs, the valve discharges content of the oxygen cylinder overboard.

When contents are discharged overboard, the green overboard discharge indicator ruptures. The indicator is above the oxygen service panel on the right side of the aircraft.

ELECTROPNEUMATIC ACTUATING VALVE (EPAV)

The EPAV controls the supply of oxygen for the passenger oxygen system and gives system data to the crewmembers through the engine indication and crew alerting system (EICAS). It attaches to the aircraft structure above the oxygen cylinders.

The EPAV receives ambient temperature data and oxygen cylinder pressure from the pressure/temperature transducer. It calculates this data and supplies an analog signal of the cylinder pressure to EICAS.

The EPAV has two pressure switches for each inlet supply circuit to show if the line is pressurized. This data is also supplied to EICAS. Three other pressure switches supply the status of the therapeutic and passenger circuits.

Operation

Two inlet ports supply the EPAV with oxygen from the cylinder(s). One inlet is sealed if only one cylinder is available. The toggle switch on the lower right hand side of the EPAV selects the number of oxygen cylinders in the aircraft.

The three outlets supply the crewmembers, therapeutic, and passenger circuits. A test port is available to simulate cabin altitude for test functions. All these pneumatic connections on the EPAV have a different type and dimension of connector to prevent incorrect connections.

Electrical power is not necessary to supply the crew circuit. Crew and passenger circuits are fully isolated to ensure oxygen necessary for the crew is available at all times.

OXYGEN SERVICE PANEL

The oxygen service panel is on the right side of the fuselage directly forward of the right engine (Figure 17-2). The panel has a filler valve and pressure gauge. Replenishment of the oxygen system is a maintenance function.

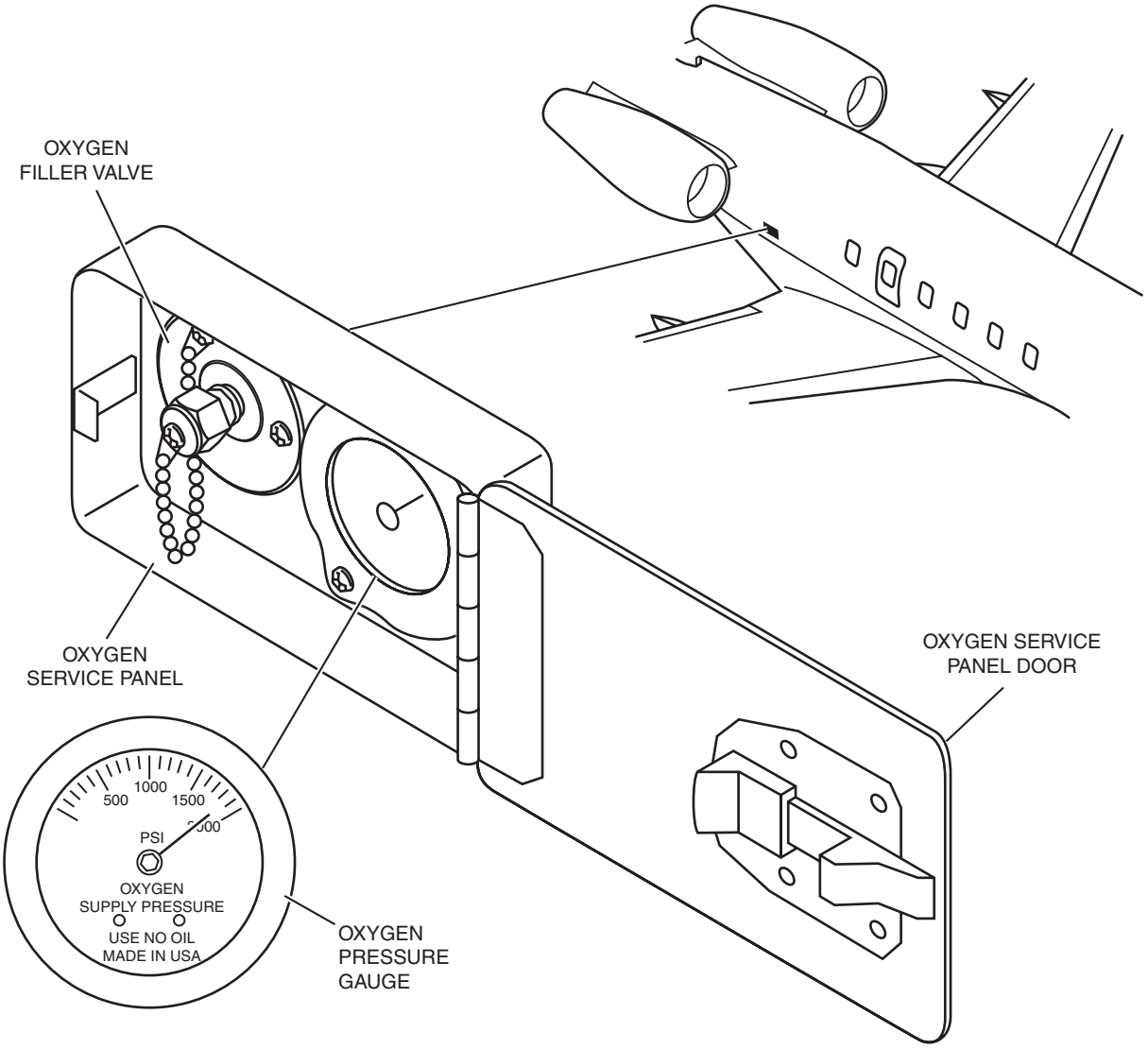


Figure 17-2. Oxygen Service Panel

COCKPIT OXYGEN SYSTEM

The cockpit oxygen system consists of two stowage containers attached to the crew seats and two quick-donning type oxygen masks.

When supplemental oxygen is needed or when the air contains toxic fumes, each crewmember has access to individual quick-donning masks in a container behind each crew station. A manifold system delivers oxygen to the crew oxygen masks.

A regulator attached to each oxygen mask provides three selectable supply modes.

Smoke Goggles

Smoke goggles used with the EROS crew oxygen mask have a vent-valve that provides smoke and toxic gas protection (Figure 17-3). The goggles are in storage bins on the side console outboard of each crew station.

Composed of a polycarbonate molded lens, the goggles have antimisting and scratch resistant coatings. The goggles should be kept in a protective bag to minimize inadvertent scratching.

The goggles also have an adjustable headband and flexible silicone molded seal so corrective eyewear or sunglasses may be worn.

Crew Oxygen Mask

The crew oxygen mask (Figure 17-3) is quick-donning with an oxygen regulator, an inflatable harness, and a microphone. The face piece has a venting system on the bridge of the nosepiece that opens automatically when smoke goggles are worn to ensure smoke protection. The masks are stowed in accessible stowage cups over each crewmember outboard shoulder.

The crew oxygen masks are only required to function (oxygen flow and test) at –5°C and warmer. If the cabin has been allowed to cold soak below this temperature, it may be necessary to warm the cabin prior to testing masks during the preflight inspection.

At the bottom of the mask is the control knob with the following controls:

- NORMAL (N)—Oxygen supplied is a mixture of ambient air and pressurized oxygen; in this position, the operator can turn the flow control knob to adjust the flow
- 100%—Pure oxygen is supplied
- EMERGENCY—Mask supplies constant flow of pure oxygen at a positive pressure. At cabin altitudes above 35,000 ft, this occurs automatically regardless of knob position
- Press-to-test button—Oxygen momentarily supplied to the mask; hose flow indicator changes color

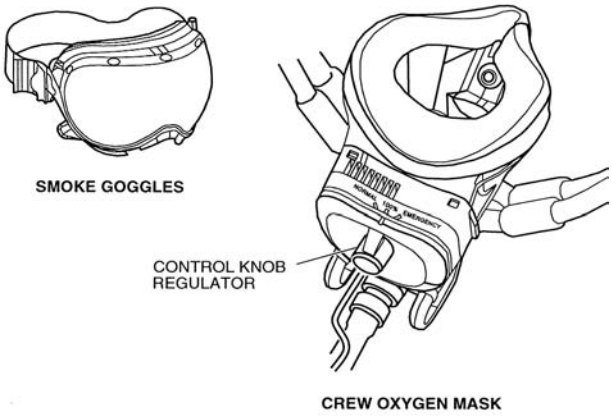


Figure 17-3. Crew Oxygen Mask

Extract the oxygen mask from the stowage box by gripping the plates of the regulator that protrude out of the box. When the two red tabs on the mask are squeezed, the harness inflation valve opens; the harness inflates (Figure 17-4). When the tabs are released, the harness deflates. The mask then holds tightly against the operator's face.

Microphone Control

When the 02 MASK/NORM switch on the associated audio control panel is selected to 02 MASK, the microphone in the mask is activated.

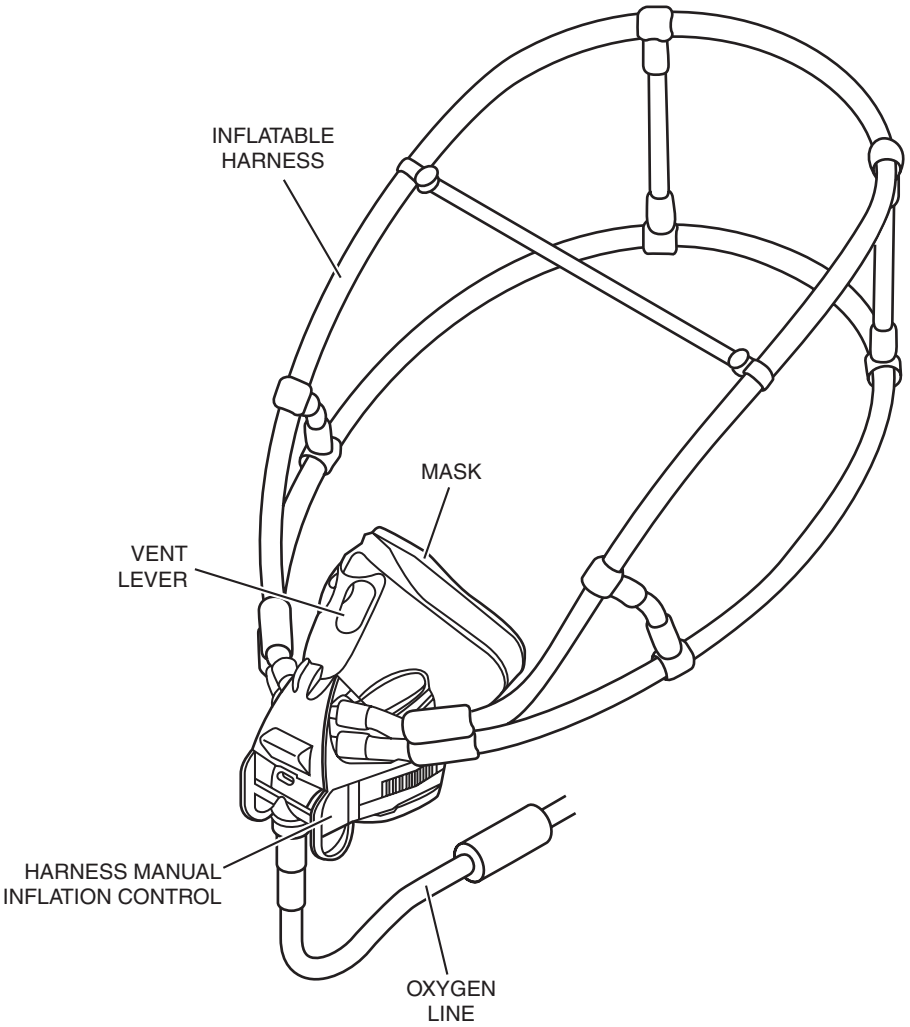


Figure 17-4. Oxygen Mask Inflation

Stowage and Harness Folding Instructions

When stowing the mask, do not stuff the harness into the nosepiece cavity; this could impede quick donning.

1. Insert mask so that the face piece goes in the cup under the retaining tabs as detailed in Figure A of Figure 17-5.
2. Once the face piece is in the cup, rotate the top of the mask out until the face piece is resting against the retaining tabs as detailed in Figure B. The mask should be in an upright position ready for clicking home.
3. Push the mask in the cup until it clicks home on both sides of the cup as detailed in Figure C.

NOTE

Failure to properly perform step 2 before pushing the regulator into place may result in possible damage to the face piece.

Cold Weather Storage

If the aircraft is to be parked for an extended period at ambient temperatures of –5°C (23°F) or below, the following is recommended:

- Oxygen turned off
- Crew masks disconnected and stowed in a heated room or cabin warmed to at least +15°C (59°F) before use.

PASSENGER OXYGEN SYSTEM

The same oxygen cylinder supplies passenger and crew oxygen. Passenger masks automatically deploy during cabin depressurization. They can, however, be manually deployed at any time with the OXYGEN control panel. Manual deployment greatly increases oxygen consumption.

When the passenger masks are deployed (automatically or manually), a PAX OXYGEN ON status message appears. If a failure in the passenger oxygen system is detected, a PAX OXYGEN FAIL caution message appears.

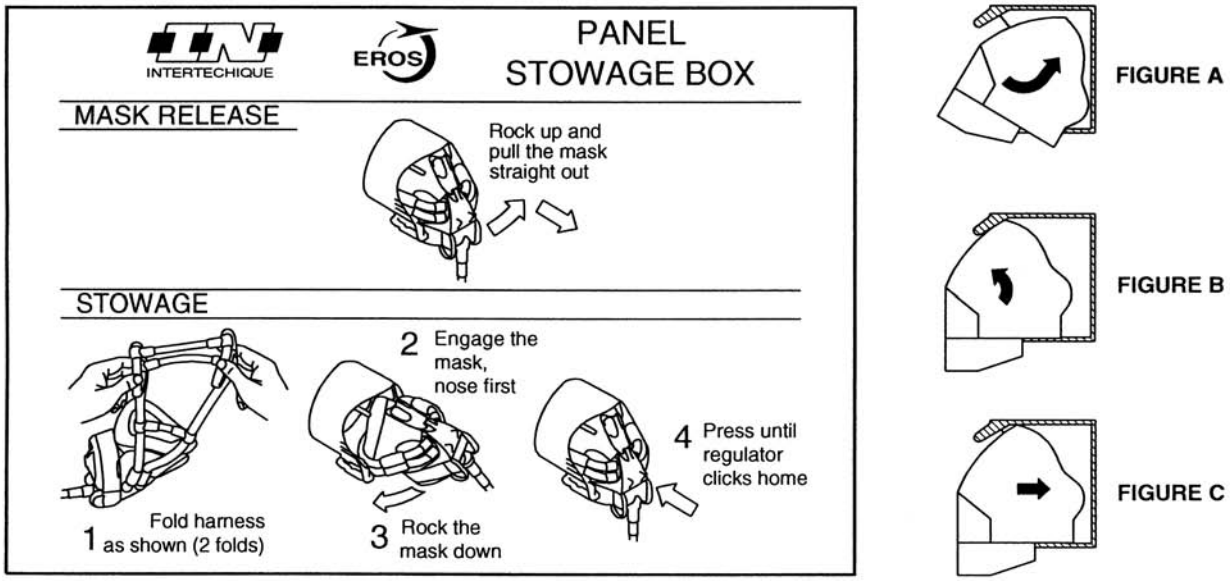


Figure 17-5. Stowage and Harness Folding

OXYGEN Panel

A guarded THERAPEUTIC pushbutton and a three-position PAX switch are on the OXYGEN panel on the lower right side of the pedestal. (Figure 17-6)

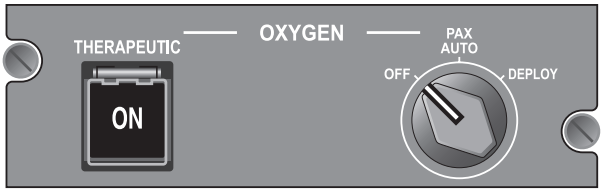


Figure 17-6. OXYGEN Panel

The panel controls the passenger oxygen system by sending outputs to the EPAV. Electrical power is necessary for the EPAV to supply passenger and therapeutic circuits. The left main bus supplies the AUTO and therapeutic modes while the right essential bus supplies the DEPLOY mode.

The rotary PAX switch has a detent that requires it be pulled and turned to set OFF and AUTO. Positions and consequences are as follows:

- AUTO—Passenger masks automatically deploy if cabin altitude climbs to 14,500 ft ±500 ft; flow continues until cabin altitude drops below 9,500 ft ±500 ft.
- DEPLOY—Manually opens passenger oxygen valve for flow to passenger masks; deploys passenger masks at any cabin altitude
- OFF—Oxygen not available to passenger distribution system regardless of cabin altitude

The THERAPEUTIC pushbutton supplies low-pressure oxygen to the therapeutic oxygen outlet in the passenger cabin. The outlet is approximately midway in the cabin on the right side.

Mask Containers

Each mask container consists of a door, two masks, and a latch mechanism (Figure 17-7). Containers are above each pair of passenger seats.

Figure 17-7. Mask Container

A mask container is also located in the lavatory on the bulkhead.

The latch mechanism can be operated manually or electrically. When the latch mechanism is released, the door opens and the masks drop down.

Passenger Masks

The passenger oxygen mask consists of a soft silicone rubber face piece with a reservoir air bag. The reservoir bag incorporates a green chamber that inflates when oxygen flows to the mask.

When the oxygen masks drop, passengers should don masks and pull the mask lanyard to initiate oxygen flow. The mask must be placed over nose and mouth. It is held in place with an elastic strap (Figure 17-8).

The masks provide a constant flow of oxygen to the passengers.

OXYGEN DURATION TABLES

Tables 17-1 and 17-2 are examples of the tables available in the *QRH* that are used to establish the time remaining for oxygen available or oxygen requirements for preflight.

TIME REMAINING

To establish the time remaining for the oxygen available:

1. Select the Oxygen Quantity—Final Altitude table for appropriate altitude.
2. Enter table at the number of passengers on board.
3. Go down to the quantity available.
4. Read left to the time in hours and minutes.

Prior to each flight, the pilot should plan oxygen requirements to ensure sufficient oxygen for all occupants in case a pressurization failure occurs. Additional oxygen may be required to ensure that both the oxygen duration and the fuel range requirements are met.

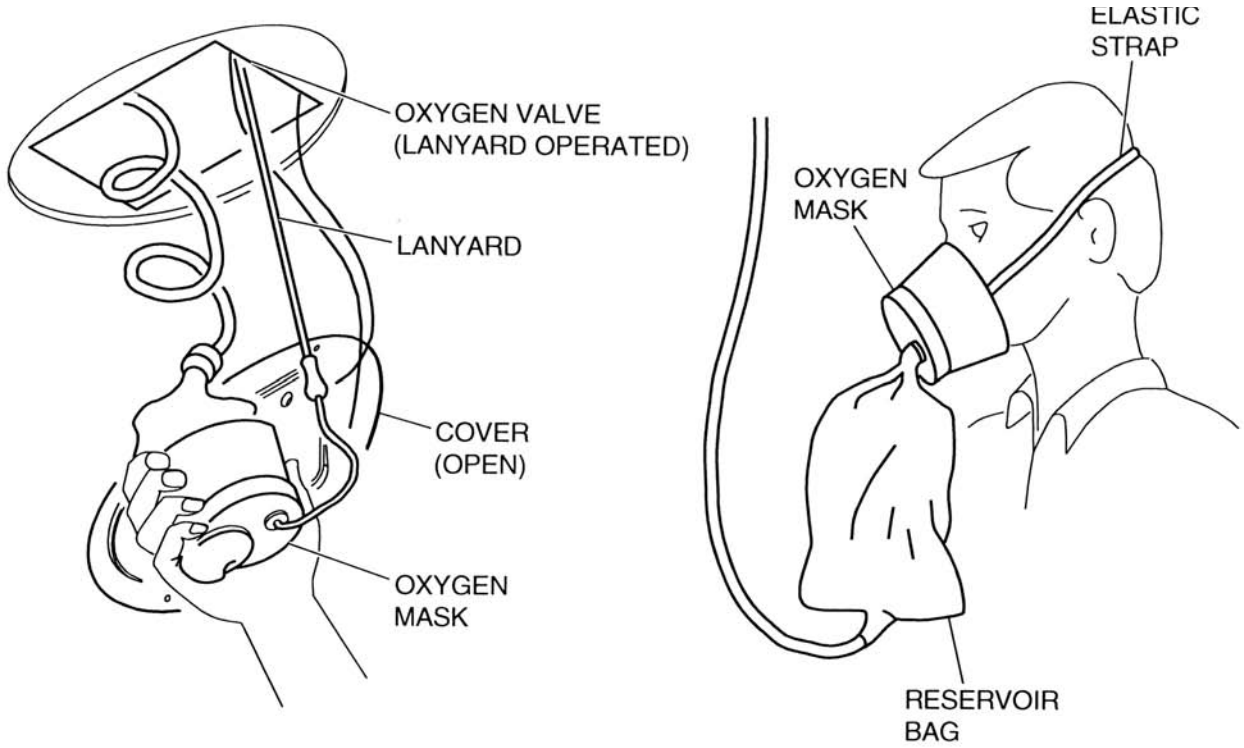


Figure 17-8. Passenger Masks

Table 17-1. OXYGEN QUANTITY (LITERS)—ONE PILOT DURING NORMAL CRUISE

TIME (H:MIN)	41,000 FT OR ABOVE PART 91		35,000 FT OR ABOVE PART 135	
	NORMAL	100%	NORMAL	100%
0:30	101	408	121	439
1:00	202	815	241	878
1:30	304	1223	362	1317
2:00	405	1631	483	1756
2:30	506	2038	603	2195
3:00	607	2446	724	2634
3:30	708	2854	845	3073
4:00	810	3261	965	3512
4:30	911	3669	1086	3951
5:00	1012	4077	1207	4389
5:30	1113	4484	1327	4828
6:00	1214	4892	1448	—
6:30	1316	—	1569	—
7:00	1417	—	1689	—
7:30	1518	—	1810	—
8:00	1619	—	1931	

OXYGEN QUANTITY (LITERS)—EMERGENCY DESCENT AND RECOVERY (AUTO MODE)

FINAL ALTITUDE (FEET)	NUMBER OF PASSENGERS ON BOARD									
	0	1	2	3	4	5	6	7	8	9
10,000	156	183	209	236	263	289	316	342	369	396
15,000	156	182	209	235	261	288	314	340	367	393
19,000	161	187	213	239	265	291	317	344	370	396
20,000	161	188	214	241	267	294	320	346	373	399
25,000	164	191	218	245	272	299	326	353	380	407

NOTE:
BOTH MASKS (PILOT AND COPILOT) ARE SET TO 100% MODE ONLY DURING DESCENT.

Table 17-2. OXYGEN QUANTITY (LITERS)—FINAL ALTITUDE (AUTO MODE) (10,000 FT. CABIN ALTITUDE)

10,000 FT CABIN ALTITUDE

TIME (H:MIN)	NUMBER OF PASSENGERS ON BOARD									
	0	1	2	3	4	5	6	7	8	9
0.30	**132** 713	**169** 750	**206** 787	**244** 824	**281** 861	**318** 899	**355** 939	**392** 973	**430** 1010	**467** 1047
1:00	**264** 1435	**338** 1500	**413** 1574	**487** 1649	**562** 1723	**636** 1797	**710** 1872	**785** 1946	**859** 2020	**933** 2095
1:30	**396** 2138	**508** 2250	**619** 2361	**731** 2473	**842** 2584	**954** 2696	**1065** 2808	**1177** 2919	**1289** 3031	**1400** 3142
2:00	**528** 2851	**677** 3000	**826** 3148	**974** 3297	**1123** 3446	**1272** 3595	**1421** 3743	**1569** 3892	**1718** 4041	**1867** 4190
2:30	**660** 3564	**846** 3749	**1032** 3935	**1218** 4121	**1404** 4307	**1590** 4493	**1776** 4679	**1962** 4865	**2148** -	**2333** -
3:00	**792** 4276	**1015** 4499	**1238** 4722	**1461** 4946	**1685** -	**1908** -	**2131** -	**2354** -	**2577** -	**2800** -
3:30	**924** 4989	**1184** -	**1445** -	**1705** -	**1965** -	**2226** -	**2486** -	**2746** -	**3007** -	**3267** -
4:00	**1056** -	**1354** -	**1651** -	**1949** -	**2246** -	**2544** -	**2841** -	**3139** -	**3436** -	**3734** -
4:30	**1188** -	**1523** -	**1857** -	**2192** -	**2527** -	**2861** -	**3196** -	**3531** -	**3866** -	**4200** -
5:00	**1320** -	**1692** -	**2064** -	**2436** -	**2808** -	**3179** -	**3551** -	**3923** -	**4295** -	**4667** -
5:30	**1452** -	**1861** -	**2270** -	**2679** -	**3088** -	**3497** -	**3906** -	**4316** -	**4725** -	-
6:00	**1584** -	**2030** -	**2477** -	**2923** -	**3369** -	**3815** -	**4262** -	**4708** -	-	-
6:30	**1716** -	**2199** -	**2683** -	**3166** -	**3650** -	**4133** -	**4617** -	-	-	-
7:00	**1848** -	**2369** -	**2889** -	**3410** -	**3931** -	**4451** -	**4972** -	-	-	-
7:30	**1980** -	**2538** -	**3096** -	**3653** -	**4211** -	**4769** -	-	-	-	-
8:00	**2112** -	**2707** -	**3302** -	**3897** -	**4492** -	-	-	-	-	-

NOTES:

XXXX—MASKS SET TO NORMAL

XXXX—MASKS SET TO 100%

PREFLIGHT REQUIREMENTS

Use the following steps to establish oxygen requirements for preflight:

1. Select the Oxygen Quantity—One Pilot Normal Cruise table.

2. Use the column for the mode to be set on the mask (Normal or 100%).

3. Establish oxygen quantity (Q Normal Cruise) required for time aircraft intended to fly above respective altitude (FL350 or FL41O) prior to the equal time point.

4. Select the Oxygen Quantity—Emergency Descent and Recovery table (take into account the number of passengers on board and the safe altitude to be chosen for finishing the flight).

5. Determine oxygen quantity (Q Descent and Recovery) required for descent and recovery); tables are for automatic passenger mask deployment (PAX OXY switch in AUTO) and for manual passenger mask deployment (PAX OXY switch in DEPLOY).

6. Select the Oxygen Quantity—Final Altitude table.

7. Determine the oxygen quantity (Q Final Altitude) applicable to the time remaining to complete the flight; tables are for automatic passenger mask deployment (PAX OXY switch in AUTO) and for manual passenger mask deployment (PAX OXY switch in DEPLOY).

Total oxygen quantity required for the mission is the following:

- Q Total=Q Normal Cruise+Q Descent & Recovery+Q Final Altitude

WARNING

Prolonged operation above 20,000 ft cabin altitude may result in decompression sickness.

The number (quantity) found in Q total should be smaller than the actual quantity available on the aircraft. Otherwise the aircraft oxygen system needs to be serviced. Note that Q Minimum=700 liters.

Q Minimum < Q Total < OXY QTY displayed

The oxygen duration tables for EPAV in AUTO mode provide oxygen consumption data that assumes an automatic deployment of the passenger masks. The oxygen duration tables for EPAV in Manual DEPLOY mode provide oxygen consumption data that assume the PAX OXYGEN switch is selected to DEPLOY.

In AUTO mode, the flow is accurately controlled to meter the flow to the precise flow rate required. This optimizes oxygen consumption and provides increased duration.

The manual DEPLOY mode allows flight planning and dispatch when the AUTO mode has failed. In manual DEPLOY mode, the flow is not regulated accurately so the flow rate is higher and duration is decreased.

On aircraft 20025 and subsequent, aircraft may be operated in accordance with either AUTO or manual DEPLOY mode tables as required.

On aircraft 20006 through 20024 modified by SB 100-35-01, aircraft that have the improved EPAV installation modification may be operated in accordance with either AUTO or manual DEPLOY mode tables as required.

On aircraft 20006 through 20024 not modified by SB 100-34-01, aircraft that do not have the EPAV installation modification must be operated in accordance with the manual DEPLOY mode tables only.

NOTE

Without the improved installation, the EPAV AUTO function is susceptible to failure. Therefore, flight planning must not utilize the AUTO mode tables.

EMERGENCY EQUIPMENT

The Challenger 300 is equipped with safety equipment essential to the safety of passengers and crew.

The flight deck is equipped with the following:

- Two flashlights
- One portable breathing equipment
- One crash axe behind the copilot seat (Figure 17-9)
- One fire extinguisher
- Two life vests

Figure 17-9. Crash Axe

The passenger cabin is equipped with the following:

- One first aid kit
- One flashlight
- Two fire extinguishers (lavatory and forward closet)
- One life vest under each seat
- One portable breathing equipment

PORTABLE FIRE EXTINGUISHER

The hand-operated fire extinguisher in the flight compartment contains Halon 1211, which is effective on electrical, oil, and arid fuel fires (Figure 17-10). It is suitable for use in cold weather.

To operate the fire extinguisher:

- Remove from stowage bracket
- Hold extinguisher upright in either hand
- Slide locking pin down with thumb
- Aim nozzle toward base of fire
- Press lever

Discharge stops when lever is released.

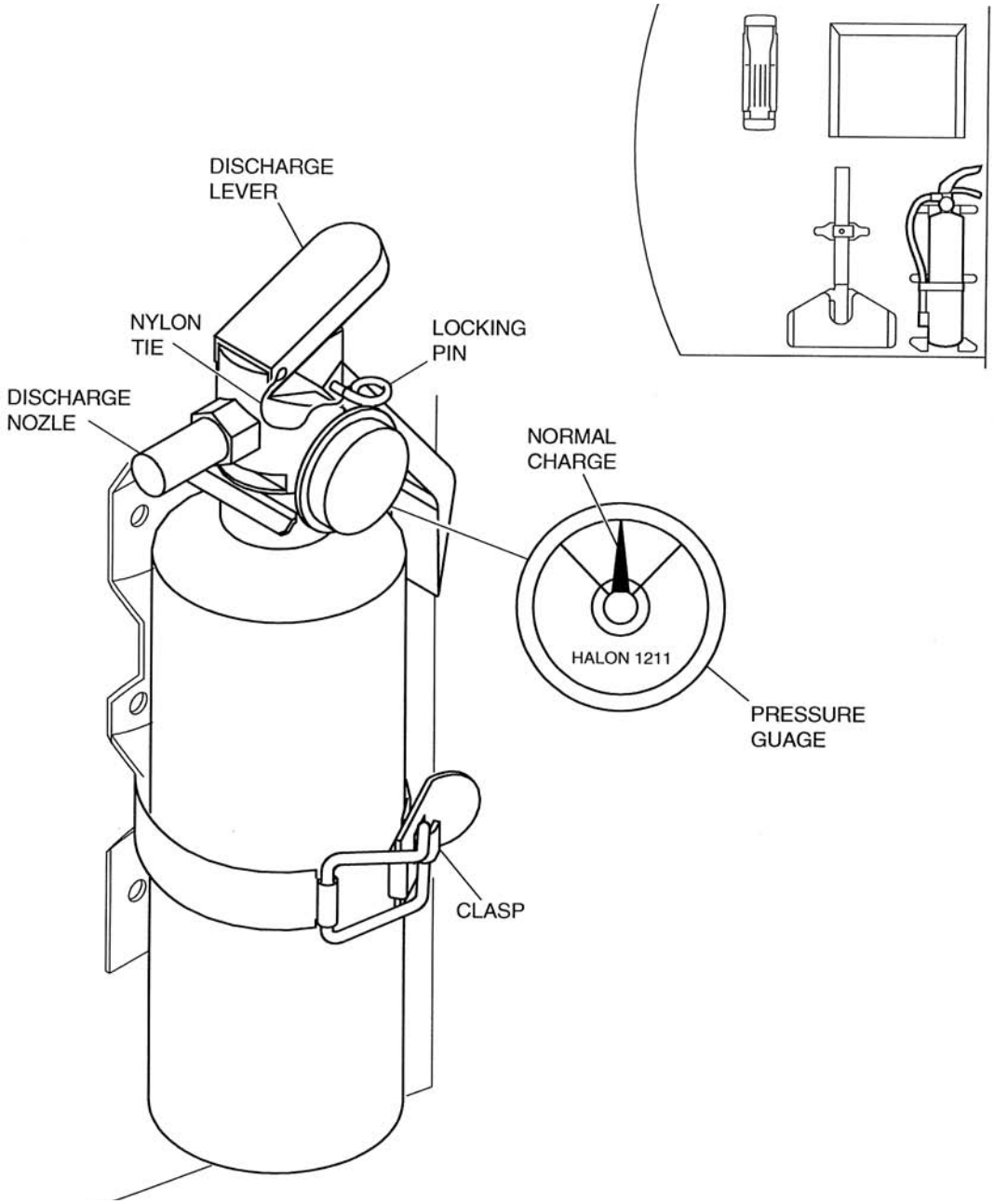


Figure 17-10. Hand-Operated Fire Extinguisher

Ventilate the compartment promptly after successfully extinguishing the fire. This reduces gases produced by fire and Halon.

If the discharge lever is held in the ON position, the extinguisher is fully discharged in 10 seconds.

WARNING

If a fire extinguisher is discharged in the flight compartment, all flight crew must wear oxygen masks with EMERGENCY selected. Crew exposure to high levels of Halon vapor may result in dizziness, impaired coordination, and reduced mental sharpness.

The fire extinguisher is effective in fighting Class A, B, and C fires.

PORTABLE BREATHING EQUIPMENT

Portable breathing equipment (PBE) is available for a crewmember fighting a cabin fire. The PBE protects the user's eyes and respiratory system from the harmful atmosphere that may be generated by a cabin fire.

The PBE consists of a hood with a visor that is placed over the head and sealed around the neck. An oxygen-generating canister provides breathing oxygen. PBEs are vacuum-sealed in a bag stored in a box. The PBE is mounted on the bulkhead behind the pilot seat. Some aircraft may have a second one stowed in a cabinet in the lavatory.

The PBE is a throwaway unit that must be replaced whenever the vacuum seal is broken. It is imperative that the vacuum seal be maintained because oxygen-generating chemicals react with moisture.

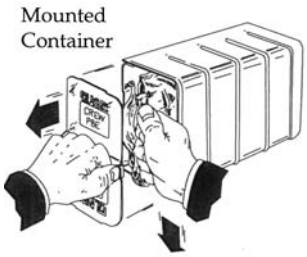
Duration of oxygen production is nominally 15 minutes depending upon work rate and size of the user. Useful life of a sealed PBE is 10 years from the date of manufacture.

Donning the PBE

1. Remove mask from container.

   a. On portable container, lift single latch on cover and lift. Remove sealed bag from the container.

   b. On mounted container, grasp red access handle firmly and pull forcibly to disengage cover. When cover is removed, immediately drop it. The vacuum-sealed bag does not need to be removed from the container to open. The packaged unit may be removed from the stowage container prior to opening and carried to a remote location for use.



STEP 1

2. To remove the PBE, locate red I.D. tag and pull sharply to tear open the vacuum-sealed bag. Reach into the bag and firmly grasp the PBE. Pull it straight out of the bag. If necessary hold the bag with the opposite hand.

STEP 2

3. Place both hands inside the neck seal opening: palms face each other and PBE visor faces downward with oxygen canister resting on the tip of the hands.

STEP 3

4. With top of the head bent forward, guide the PBE neck seal over the top of the head and down over the face. Use hands to shield the face from the mask cone.

STEP 4

5. With both hands, grasp adjustment straps at the lower corners of the visor and pull outward sharply to actuate starter candle. Within one to five seconds, a rushing noise of oxygen entering the hood is heard and inflation should be evident.

STEP 5

WARNING

Human hair is highly flammable. Hair that protrudes through the neck seal could ignite if brought into direct contact with flame.

6. With straps still in hand and head bent forward, pull backward to secure the oronasal mask cone high on the nose for a tight seal.

STEP 6

7. If wearing glasses, adjust their position to rest on the tip of the oronasal mask cone by moving the sides of the frame through the hood fabric. Do not attempt to adjust through the neck seal as this will result in infiltration of the surrounding atmosphere into the interior of the hood.

STEP 7

8. When the neck seal is positioned at the neck and the oxygen-generating canister is resting on the nape of the neck, remove hands. Ensure clothing is not trapped in the seal and hair does not protrude between the seal and the neck. Pull protective neck shield down to cover the collar and upper shoulder area.

STEP 8

Following actuation, the hood will inflate over a 15 to 20 second period. The starter candle ceases flowing. The only sound will be a slight rustling of the fabric on each inhalation and exhalation.

Dependent upon breathing rate, there will be a slight exhalation resistance as the exhaled breath is forced through the oxygen-generating canister. Inhalation resistance will be almost unrecognizable since inhalation is directly from the interior of the hood through a diaphragm type check valve located at the base of the oronasal mask.

The visor should remain clear of fogging or misting. Both the chemical air regeneration process and transfer of body heat during the re-breathing cycle produce heat. Heat build-up within the hood is normal and dependent upon the amount of work performed.

There should be no irritating or strong unusual odors within the hood. Operational duration depends upon the amount of work performed by the user.

If the PBE is worn to exhaustion of the chemical regeneration system, a gradual reduction in the expended volume of the hood occurs until the hood collapses tightly around the head at the end of a full inhalation. Additionally, as the canister loses its effectiveness, there is a rapid buildup of heat and moisture in the hood. At this point, the wearer should immediately retire to a safe breathing area clear of flame and toxic fumes and remove the device.

Removing PBE

1. Go to a safe area away from immediate contact with fire, open flame, and/or toxic fumes.

2. With both hands, reach for the two lower corners of the visor area and push forward on the metal tabs of the strap buckles to release tension.

3. Place both hands under the neck seal in the forward area and pull up. Guide the oronasal cone and neck seal over the face/glasses until the PBE is clear.

4. Place expended PBE to cool in a safe place away from fire or exposure to water.

Disposal

The expended PBE still contains unreacted oxidizing material and strong alkali materials. At the completion of flight, it must be turned over to maintenance for authorized disposal.

CAUTION

This device produces oxygen that vigorously accelerates combustion. Do not intentionally expose the device to direct flame contact. Do not remove in the immediate presence of fire or flame. Because hair is now saturated with oxygen, do not smoke or become exposed to fire or flame immediately after removing.

Malfunctions

Users should be trained to recognize abnormal conditions that could signify malfunction or failure of the equipment to properly operate.

Failure of Starter Candle

If the starter candle fails to actuate when the adjustment strap is pulled, an additional sharp pull on the strap may be sufficient to dislodge the lanyard pin and actuate the device. If the device still fails to actuate, the hood will continue to function, although the initial purge capability is lost.

Sticking fingers into the neck seal to allow a large lung inhalation may be required to enable sufficient breathing volume until the chemical-regeneration system begins producing a surplus of oxygen.

Inadequate Mask Seal

Absence of a tight seal of the oronasal cone to the face may result in excess leakage of the exhaled breath into the hood. This short-circuits the oxygen-generating canister. A build-up of CO2 within the rebreathing volume in the hood occurs. Excessive CO2 is normally indicated by breathing distress such as rapid and labored breathing accompanied by a general feeling of insufficient ability to get one's breath.

Presence of moisture or fogging on the visor and the sensation of air escaping from the mask, particularly around the nose and eyes, are indications of an improper fit. Adjustment of the mask straps and mask position to minimize leakage should alleviate the problem.

If the perception of breathing distress persists, quickly go to a safe area and remove the PBE. If needed, don alternate breathing equipment.

Loss of Infiltration Seal

Combustion of most aircraft cabin interior materials generates strong irritants as smoke and toxic fumes. Eye and respiratory discomfort after the hood is donned indicates an ineffective infiltration seal.

Verify seal is in contact with the skin or the neck and does not have clothing, jewelry or hair trapped in the seal or between seal and the neck. If the condition persists or a tear exists in the neck seal, go quickly to a safe area. If needed, don alternate breathing equipment.

LIFE VESTS

Life vests for crew and passengers are standard emergency equipment on the Challenger 300.

Flight crew life vests are under the pilot and copilot seats. Passenger life vests are in a compartment under each passenger seat.

Pulling the red CO_2 release tab inflates the life vests (Figure 17-11). An oral inflation tube is also available if the CO_2 cartridge does not inflate the vest.

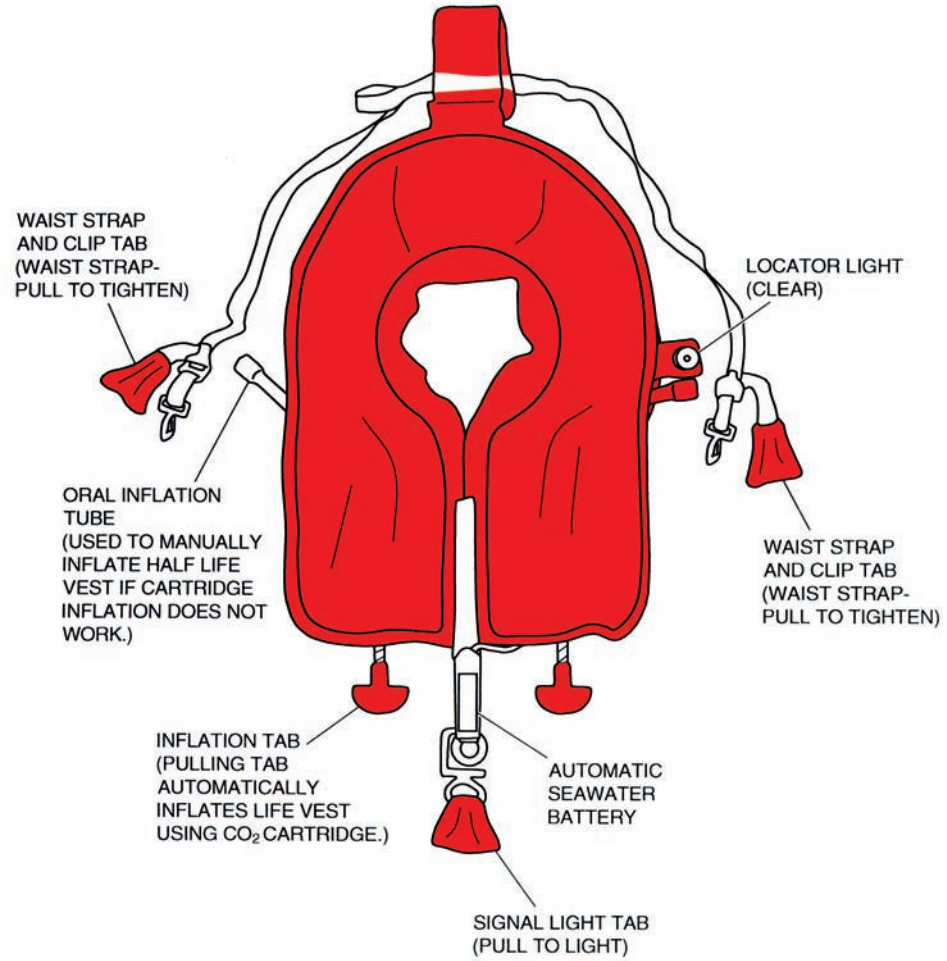


Figure 17-11. Life Vest

LIFE RAFTS

Two four-person life rafts are optional equipment. The rafts are either on the bottom shelf of the galley's crew closet or in the aft pyramid cabinet (Figure 17-12).

Refer to *Air Cruisers Company Operator's Guide* for further information.

Figure 17-12. Stored Optional Life Rafts

EICAS MESSAGES

Table 17-3 lists the EICAS messages associated with the oxygen system, a brief explanation of the message, and whether the message is inhibited during takeoff and/or landing.

Table 17-3. EICAS MESSAGES

MESSAGE	INHIBITS	MEANING	AURAL WARNING
NAVIGATION			
OXYGEN QUANTITY LOW	TO/LAND	Oxygen is less than 700 liters.	
OXYGEN VALVE CLOSED	TO/LAND	The oxygen bottle valve is closed, or there is a miscompare in the number of bottles installed and the number of bottles selected on the electro-pneumatic actuating valve unit. This message only occurs on the ground.	
PAX OXYGEN AUTO FAIL	TO/LAND	Passenger oxygen system has failed to deploy with the cabin altitude greater than 15,000 ft and the pax oxygen system in AUTO. Either the pax masks have not deployed, or the pax oxygen system is not pressurized.	
PAX OXYGEN OFF		The passenger oxygen switch has been selected OFF.	
PAX OXYGEN ON		Pressure has been detected in the passenger oxygen lines.	

QUESTIONS

1. Under normal operation, the oxygen system delivers oxygen from the cylinder directly to:

a. The EPAV
b. Flight crew oxygen masks
c. Passenger oxygen masks
d. Therapeutic oxygen masks

2. When fully charged, oxygen system pressure should be:

a. >700 liters
b. 1,600 psi
c. 1,850 psi
d. 2,000 to 2,200 psi

3. The oxygen service point is located:

a. In the cargo hold
b. On the right side of the fuselage directly aft of the wing
c. In the battery bay
d. In the aft equip bay

4. What must the flight crew do if a fire extinguisher is discharged in the flight compartment?

a. All flight crew members must wear oxygen masks with 100% oxygen selected
b. All flight crew members must wear oxygen masks with EMERGENCY selected
c. The PIC must wear an oxygen mask
d. All flight crew members must wear protective breathing equipment (PBEs)

APPENDIX

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APPENDIX

ABBREVIATIONS AND ACRONYMS

The following abbreviations may be used in cockpit displays, the flight management system, or in other descriptions throughout this manual. Abbreviations may be further explained in the chapters where they are used.

A

A/I—Anti-ice

AP—Autopilot

a/c—Aircraft (tables only)

AC—Alternating Current

ACM—Air Cycle Machine

ACP—Audio Control Panel

ACU—Air Conditioning Unit

ACU—Antenna Control Unit

ACV—Air Control Valve

ADC—Air Data Computer

ADDR—Address

ADF—Automatic Direction Finder

ADI—Attitude Director Indicator

ADS—Air Data System

AFCS—Automatic Flight Control System

AFD—Adaptive Flight Display

AFM—Airplane Flight Manual

AGL—Above Ground Level

AHC—Attitude Heading Computer

AHRS—Attitude and Heading Reference System

AIL—Aileron

ALD—Actual Landing Distance

ALTN—Alternate

ALIGN—Aligning, Alignment

ALT—Altitude, Altimeter

ALTN—Alternate

ANNUN—Annunciation

AOA—Angle of Attack

APC—APU Contactor

APPR—Approach Mode

APR—Automatic Power Reserve

APSTC—APU Start Contactor

APU—Auxiliary Power Unit

ASCB—Avionics Standard Communication Bus

ASEL—Altitude Preselect Mode

ATC—Air Traffic Control

ATS—Air Turbine Starter

ATT—Attitude

AUX—Auxiliary

AUXC—Auxiliary Contactor

AVAIL—Available

B

B/CRS—Back Course

BARO—Barometric

BATC—Battery Contactor

BATT—Battery

BCN—Beacon

BCU—Brake Control Unit

BRK—Brake

BTC—Bus Tie Contactor

C

CAS—Crew Alerting System

CAT—Category

CBP—Circuit Breaker Panel

CDL—Configuration Deviation List

CDU—Control Display Unit

CG—Center of Gravity

CLB—Climb

COM, or COMM—Communication (Radio)

CONFIG—Configuration

CTR—Center

CTRL—Control

CVR—Cockpit Voice Recorder

D

dB—decibel

DBU—Data Base Unit

DC—Direct Current

DCMP—Direct Current Motor Pump

DCP—Display Control Panel

DCPC—Direct Current Power Center

DCU—Data Concentrator Unit

Delta P—Differential Pressure

DECEL—Decelerate

DECR—Decrease

DET—Detection

DEFL—Defuel

DEG—Degree

DEGRAD—Degrade

DEPR—Depressurize

DEPT—Depart

DEST—Destination

DET—Detector

DEV—Deviation

DFDR—Digital Flight Data Recorder

DG—Directional Gyro

DH—Decision Height

DIFF—Differential

DIM—Dimming

DIR or DCT—Direct

DIS—Distance (to waypoint), Disconnect

DISC—Disconnect

DISCH—Discharge

DISP—Dispatch

DIST—Distance

DME—Distance Measuring Equipment

DN—Down

DOT—Department of Transport

DR—Door

DSPY—Display

DU—Display Unit

E

EAS—Equivalent Airspeed

ECU—Environmental Control Unit, Electronic Control Unit, External Compensation Unit, Engine Control Unit

ECS—Environmental Control System

ED—Electronic Display

EDCC—External DC Contactor

EDP—Engine Driven Pump

EFIS—Electronic Flight Instrument System

EGPWS—Enhanced Ground Proximity Warning System (including wind-shear)

EGT—Exhaust Gas Temperature

EI—Engine Instrument

EICAS—Engine Indicating and Crew Alerting System

EL—Elevation

ELEC—Electrical

ELEV—Elevator or Elevation

ELT—Emergency Locator Transmitter

EMER—Emergency

ENG—Engine

EPR—Engine Pressure Ratio

EQUIP—Equipment

ERP—Eye Reference Position (datum)

ESS—Essential

ESSC—Essential Power Contactor

ET—Elapsed Time

ETA—Estimated Time of Arrival

ETP—Equal Time Point

EVAC—Evacuation

EXH—Exhaust

EXT—External or Extend

EXTIN—Extinguish(ed)

EXT PWR—External Power

F

F/CTL—Flight Control

F/D, or FD—Flight Director

FAA—Federal Aviation Administration (USA)

FAIL—Failure

FADEC—Full Authority Digital Engine Control

FCOM—Flight Crew Operating Manual

FCU—Flap Control Unit

FCV—Flow Control Valve

FDR—Flight Data Recorder

FDU—Flux Detector Unit

FEED—Feeder

FF, F/F—Fuel Flow

FGC—Flight Guidance Computer

FGP—Flight Guidance Panel

FHOC—Fuel Heater/Oil Cooler

FIREX BTL—Fire Bottle

FIREX—Fire Extinguisher

FIREX-CU—Fire Detection and Extinguishing Control Unit

FL—Flight Level

FLC—Flight Level Change (airspeed hold mode)

FLD—Field or Factored Landing Distance

FLT—Flight

FLT DIR—Flight Director

FLUOR—Fluorescent

FMC—Flight Management Computer

FMS—Flight Management System

FMU—Fuel Metering Unit

FMV—Fuel Metering Valve

FOD—Foreign Object Damage

FPM—Feet Per Minute

FPU—Flap Power Unit

FREQ—Frequency

FRMT—Format

ft—Feet, Foot

FUSE—Fuselage

FW—Fire Wall

FWD—Forward

G

G (+/-)—Receiver Gain

G/S or GS—Ground Speed/Glideslope

GA—Go-Around

gal—Gallon

GALY—Galley

GCU—Generator Control Unit

GCS—Ground Clutter Suppression

GEN—Generator

GES—Ground Earth Station

GLC—Generator Line Contactor

GLD—Ground Lift Dumping

GMAP—Ground Mapping

GMT—Greenwich Mean Time

GND—Ground

GP—FMS Glidepath

GPM—Gallons Per Minute

GPS—Global Positioning System

GPWS—Ground Proximity Warning System

GR or GEAR—Landing Gear

GRAV—Gravity

GUIDE—Guidance

GW—Gross Weight

H

HACKV—Hot Air Check Valve

HARSOV—Hot Air Shutoff Valve

HDG—Heading

HDPH—Headphone

HEAT—Heater

HF—High Frequency (3–30 MHz)

Hg—Mercury

HI—High

HLDR—Holder

HMDG—Hydraulic Motor-Driven Generator

HOR, HORIZ—Horizontal

HP—High Pressure

HPA—Hecto Pascal

HPV—High Pressure Valve

HSI—Horizontal Situation Indicator

HSTECU—Horizontal Stabilizer Trim Electronic Control Unit

HTR—Heater

HUD—Heads-up display

HYD—Hydraulic

Hz—Hertz

I

I/B or INBD—Inboard

I/O—Input/Output

IAPS—Integrated Avionics Processor System

IAS—Indicated Airspeed (knots), Integrated Air System

IASC—Integrated Air System Controller

ICAO—International Civil Aviation Organization

ICC—IAPS Card Cage

ICS—Idle Corrected Speed, Intercommunications System

ID or IDENT—Identification

IEC—IAPS Environmental Controller

IFR—Instrument Flight Rules

IGN—Ignition

ILS—Instrument Landing System

IM—ILS Inner Marker

IMC—Instrument Meteorological Conditions

IMP—Imperial

in—Inch(es)

INCR—Increase

IND—Indication, Indicator

INFLT—In Flight

IGV—Inlet Guide Vanes

INHB or INHIB—Inhibit

inHg—Inches of Mercury

INOP—Inoperative

INPH—Interphone

INSP—Inspection

INST(S), INSTR—Instrument(s)

INT—Internal, Integral, Intersection

INTEG—Integral

Intercom—Intercommunication

IOC—Input/Output Concentrator

IP—Intermediate Pressure

ISA—International Standard Atmosphere

ISI—Integrated Standby Instrument

ISO—International Standard Organization

ISOL—Isolation, Isolated

ITT—Interstage Turbine Temperature

IRS—Inertial Reference System

IRU—Inertial Reference Unit

J

JAA—Joint Aviation Authorities

K

K, kt, kts—Knots

KIAS—Knots Indicated Airspeed

KTAS—Knots True Airspeed

kg—Kilogram

kHz—Kilo Hertz

kPa—Kilo Pascal

kW—Kilo Watts

L

LAT/LONG—Latitude/Longitude

L/G or LG—Landing Gear

L—Left

LAPC—Left APU Contactor

LAV—Lavatory

lb—pounds

LCV—Load Control Valve

LDG—Landing

LDG GR—Landing Gear

LDU—Lamp Driver Unit

LE—Leading Edge

LEV—Level

LFE—Landing Field Elevation

LGLC—Left Generator Line Contactor

LGW—Landing Gross Weight

LH—Left Hand

LIM—Limit

LK—Leak

LN—Left Nose

LNAV—Lateral Navigation

LNDG ALT—Landing Altitude

LO—Low

LOC—Localizer

LOGO—Logo Graphics

LOM—Compass Locator at Outer Marker

LP—Low Pressure

LPM—Liter Per Minute

LPT—Low Pressure Turbine

LR—Left Rear

LRC—Long Range Cruise

LRN—Long Range Navigation

LRU—Line Replaceable Unit

LSB—Lower Side Band

LSC—Low Speed Cue

LSK—Line Select Key

LSS—Lighting Sensor System

LTG(s)—Light(s)

LTS—Lights

LW—Left Wing

LWD—Left Wing Down

LWR—Lower

LX—Lighting

M

M—Mach Number

m—Meter

mB—Millibars

MAA—Maximum Authorized IFR Altitude

MAC—Mean Aerodynamic Chord

MAG—Magnetic

MAINT—Maintenance

MALF—Malfunction

MAN—Manual

MAP—Ground Map (WXR)

MAZ—MLS Azimuth

MCA—Minimum Crossing Altitude

MCL—Maximum Climb

MCL—Maximum Climb

MCP—MFD Control Panel

MCT—Maximum Continuous Thrust

MDA—Minimum Descent Altitude

MDC—Maintenance Diagnostic Computer

MEA—Minimum Enroute IFR Altitude

MECH—Mechanic

MED—Medium

MEL—Minimum Equipment List

MF—Multifunction

MFD—Multifunction Display

MFS—Multifunction Spoilers

MGP—MLS Glideslope

MHz—Mega Hertz (freq range)

Mi—Mach indicated

mi—Miles

MIC—Microphone

mils—0.001 of an inch

MIN—Minimum

MISCMP—Miscompare

MKR—Marker

MLG—Main Landing Gear

MLS—Microwave Landing System

MLW—Maximum Landing Weight

MM—Middle Marker

MMEL—Master Minimum Equipment List

M_{MO}—Maximum Operating Speed in Mach Numbers

MOCA—Minimum Obstruction Clearance Altitude

MOD—Module

MON—Monitor

MPH—Miles per Hour

MRA—Minimum Reception Altitude

MRS—Manual Release System

MSG—Message

MSL—Mean Sea Level

MSW—Master Disconnect Switch

MTG—Miles to Go

MTOW—Maximum Take Off Weight

MZFW—Maximum Zero Fuel Weight

MISC

%—Percent

&—and

°C—Degrees Centigrade

°F—Degrees Fahrenheit

N

N/A—Not Applicable

N/W—Nose Wheel

N_2—High Pressure Rotor RPM

NAV—Navigation

NAVAID—Navigational Aid

NAVSRC—Navigation Source

ND or NDN—Nose Down

NDB (ADF)—Nondirectional Beacon (Automatic Direction Finder)

NEG—Negative

NEUT—Neutral

NL—Nose Left

NLG or N LDG—Nose Landing Gear

NM—Nautical Mile

No.—Number

NOPT—No Procedure Turn Required

NORM—Normal

NOSE, N/W—Nosewheel

NR—Nose Right

NU or NUP—Nose Up

NWS—Nose Wheel Steering

O

O/S—Overspeed

OAT—Outside Air Temperature

OB, or OUTBD—Outboard

OBS—Observer

OEI—One Engine Inoperative

OEW—Operating Empty Weight

OM—Outer Marker

OT—Other Traffic

OUTBD—Outboard

OVBD—Overboard

OVHT—Overheat

OVLD—Overload

OVTEMP—Over Temperature

OXY, O2—Oxygen

OZC—Ozone Converter

P

P/S—Pitot/Static

P or PRESS—Pressure, Pressurization

PA—Passenger Announcement

PACK—Air-Conditioning Unit

PAX, PASS—Passenger

PBA—Pushbutton Annunciator

PBE—Portable/Protective Breathing Equipment

PCU—Power Control Unit

PFD—Primary Flight Display

PFS—Pitch Feel System

PIT—Pitch

PLT—Pilot

PMA—Permanent Magnet Alternator

POS—Position

PPH—Pounds per Hour

PRI or PRIM—Primary

PROC—Procedure

PROT—Protection

PROX—Proximity

PSEU—Proximity Sensing Electronic Unit

psi—Pounds per Square Inch

psid—Pounds per Square Inch Differential

psig—Pounds per Square Inch Gauge

PSS—Proximity Sensing System

PTT—Push to Talk

Q

QFE—Local Station Pressure

QNH—Altimeter Setting

QTY—Quantity

R

R/D—Refuel/Defuel

R/T, RT—Receiver-Transmitter

R—Right

RA—Resolution Advisory (TCAS)

RA, RADALT—Radio Altitude

RAIM—Receiver Autonomous Integrity Monitoring

RCCB—Remote Controlled Circuit Breaker

RCDR—Recorder

RCS—Radio Communication System

RCVR—Receiver

RDC—Remote Data Concentrator

RDCP—Refuel/Defuel Control Panel

RDR—Radar

RECOG—Recognition

REF(s)—Reference(s)

RET—Retract

REV—Reverse or Reversion

RIU—Radio Interface Unit

RH—Right Hand

RMI—Radio Magnetic Indicator

ROL—Roll

ROLS—Remote Oil Level Sensor

ROT—Rotation

rpm—Revolutions per minute

RTA—Receiver Transmitter Antenna

RTE—Route

RTO—Rejected Take Off

RUD—Rudder

RVDT—Rotary Variable Differential Transducer

RVR—Runway Visual Range

RVSM—Reduced Vertical Separation Minimum

RWD—Right Wing Down

RWY—Runway

S

S, STAT—Status

SAT—Static Air Temperature

SBY, STBY—Standby

SCAV—Scavenge

SCU—Steering Control Unit

SCV—Surge Control Valve

SEC—Secondary

SDU—Satellite Data Unit

SECU—Spoiler Electronic Control Unit

SEL—Select, Selector

SELCAL—Selective Calling

SENS—Sensitivity, Sensor

SERV, SVCE—Service

SID—Standard Instrument Departure

SLD—Super-cooled Large Droplet

SMKG—Smoking

SOV—Shutoff Valve

SP, SPD—Speed

SPC—Secondary Power Center

SPKR—Speaker

SPS—Stall Protection System

SQ—Squelch

SSB—Single Side Band

STA—Station

STAB—Stabilizer

STBY—Standby

STD—Standard

SYNC—Synchronization, Synchronous

SYS, SYST—System

T

TO/GA—Takeoff/Go Around

T/R—Thrust Reverser

T2—Temperature, inlet duct sensor

TA—Traffic Advisory (TCAS)

TACAN—UHF Tactical Air Navigation Aid

TAS—True Air Speed

TAT—Total Air Temperature

TAWS—Terrain Awareness Warning System

TCAS—Traffic Alert and Collision Avoidance System

TCF—Terrain Clearance Floor

TCV—Temperature Control Valve

TEMP—Temperature

TLA—Thrust Lever Angle

TO—Takeoff

TOC—Top of Climb

TOD—Top of Descent

TRB, TURB—Turbulence

TRK—Track

U

ULD—Underwater Locating Device

US—United States

USB—Upper Side Band

USG—United States Gallons

V

V/L—VOR/Localizer

V/S—Vertical Speed

V—Volt

VERT—Vertical

VFR—Visual Flight Rules

VHF—Very High Frequency (30-300 MHz)

VNAV—Vertical Navigation System

Vol—Volume

VOR—VHF Omnidirectional Range Station

VORTAC—VOR and TACAN Co-located

VS—Vertical Speed Mode

VSI—Vertical Speed Indicator

W

W/C—Wind Component

W/S—Windshear

W or WARN—Warning

WAI—Wing Anti-ice

WGT—Weight

WOW—Weight-on-Wheels

WPT(s)—Waypoints

WSHLD—Windshield

Wt—Weight

WX—Weather

WXR—Weather Radar

X

X—Cross Transfer

XFR or XFER—Transfer

XBLEED—Cross Bleed

XFLOW—Crossflow

XMIT—Transmit

XPNDR—Transponder

XTK—Crosstrack

Y

YD or Y/D—Yaw Damper

Z

ZFW—Zero Fuel Weight

CONVERSION FACTORS

Tables APP-1 through APP-6 give conversion factors that may be used in the manual.

Table APP-1. CONVERSION FACTORS

CONVERSION TABLE (Standard to Metric [multiply])
(Metric to Standard [divide])

standard	factor	metric
in	2.54	cm
in	25.4	mm
in^2	6.4516	cm^2
oz	28.3495	g
fl oz	29.574	ml
U.S. gal	3.7854	liters
U.S. gal/min	3.7854	liters/min
psi	6.8948	kPa
ft	0.3048	m
ft	30.48	cm
lb	0.4536	kg
lb/min	0.4536	kg/min
lbf	4.4482	N
lbf in	0.1130	Nm
lbf ft	1.3558	Nm
in Hg	3.3864	kPa

Table APP-2. TEMPERATURE CONVERSION

- To convert from Celsius to Fahrenheit, find, in 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 bold face columns, the number representing the Fahrenheit 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 APP-3. LINEAR CONVERSION

- 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**	15091.7	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**	32808.0
1005.9	**3300**	10826.6	2042.2	**6700**	21981.4	3352.8	**11000**	36088.8
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 APP-4. VOLUME CONVERSION—LITERS/GALLONS

- Liters to U.S. Gallons - find liters in the bold face column and read the equivalent number of U.S. gallons in the adjacent GALLONS column.
- U.S. Gallons to Liters - find U.S. gallons in the bold face column and read the equivalent number of liters in the adjacent LITERS column.

LITERS	◄ ►	GALLONS	LITERS	◄ ►	GALLONS	LITERS	◄ ►	GALLONS	LITERS	◄ ►	GALLONS
18.9	**5**	1.3	7760.1	**2050**	541.6	15520.2	**4100**	1083.1	23280.3	**6150**	1624.7
189.3	**50**	13.2	7949.4	**2100**	554.8	15709.5	**4150**	1096.3	23469.5	**6200**	1637.9
378.5	**100**	26.4	8138.6	**2150**	568.0	15898.7	**4200**	1109.5	23658.8	**6250**	1651.1
567.8	**150**	39.6	8327.9	**2200**	581.2	16088.0	**4250**	1122.7	23848.1	**6300**	1664.3
757.1	**200**	52.8	8517.2	**2250**	594.4	16277.3	**4300**	1135.9	24037.4	**6350**	1677.5
946.4	**250**	66.0	8706.4	**2300**	607.6	16466.5	**4350**	1149.1	24226.6	**6400**	1690.7
1135.6	**300**	79.3	8895.7	**2350**	620.8	16655.8	**4400**	1162.4	24415.9	**6450**	1703.9
1324.9	**350**	92.5	9085.0	**2400**	634.0	16845.1	**4450**	1175.6	24605.2	**6500**	1717.1
1514.2	**400**	105.7	9274.3	**2450**	647.2	17034.3	**4500**	1188.8	24794.4	**6550**	1730.3
1703.4	**450**	118.9	9463.5	**2500**	660.4	17223.6	**4550**	1202.0	24983.7	**6600**	1743.5
1892.7	**500**	132.1	9652.8	**2550**	673.6	17412.9	**4600**	1215.2	25173.0	**6650**	1756.7
2082.0	**550**	145.3	9842.1	**2600**	686.8	17602.2	**4650**	1228.4	25362.3	**6700**	1770.0
2271.2	**600**	158.5	10031.3	**2650**	700.1	17791.4	**4700**	1241.6	25551.5	**6750**	1783.2
2460.5	**650**	171.7	10220.6	**2700**	713.3	17980.7	**4750**	1254.8	25740.8	**6800**	1796.4
2649.8	**700**	184.9	10409.9	**2750**	726.5	18170.0	**4800**	1268.0	25930.1	**6850**	1809.6
2839.1	**750**	198.1	10599.2	**2800**	739.7	18359.2	**4850**	1281.2	26119.3	**6900**	1822.8
3028.3	**800**	211.3	10788.4	**2850**	752.9	18548.5	**4900**	1294.4	26308.6	**6950**	1836.0
3217.6	**850**	224.5	10977.7	**2900**	766.1	18737.8	**4950**	1307.7	26497.9	**7000**	1849.2
3406.9	**900**	237.8	11167.0	**2950**	779.3	18927.1	**5000**	1320.9	26687.1	**7050**	1862.4
3596.1	**950**	251.0	11356.2	**3000**	792.5	19116.3	**5050**	1334.1	26876.4	**7100**	1875.6
3785.4	**1000**	264.2	11545.5	**3050**	805.7	19305.6	**5100**	1347.3	27065.7	**7150**	1888.8
3974.7	**1050**	277.4	11734.8	**3100**	818.9	19494.9	**5150**	1360.5	27255.0	**7200**	1902.0
4164.0	**1100**	290.6	11924.0	**3150**	832.1	19684.1	**5200**	1373.7	27444.2	**7250**	1915.2
4353.2	**1150**	303.8	12113.3	**3200**	845.4	19873.4	**5250**	1386.9	27633.5	**7300**	1928.5
4542.5	**1200**	317.0	12302.6	**3250**	858.6	20062.7	**5300**	1400.1	27822.8	**7350**	1941.7
4731.8	**1250**	330.2	12491.9	**3300**	871.8	20251.9	**5350**	1413.3	28012.0	**7400**	1954.9
4921.0	**1300**	343.4	12681.1	**3350**	885.0	20441.2	**5400**	1426.5	28201.3	**7450**	1968.1
5110.3	**1350**	356.6	12870.4	**3400**	898.2	20630.5	**5450**	1439.7	28390.6	**7500**	1981.3
5299.6	**1400**	369.8	13059.7	**3450**	911.4	20819.8	**5500**	1452.9	28579.9	**7550**	1994.5
5488.8	**1450**	383.0	13248.9	**3500**	924.6	21009.0	**5550**	1466.2	28769.1	**7600**	2007.7
5678.1	**1500**	396.3	13438.2	**3550**	937.8	21198.3	**5600**	1479.4	28958.4	**7650**	2020.9
5867.4	**1550**	409.5	13627.5	**3600**	951.0	21387.6	**5650**	1492.6	29147.7	**7700**	2034.1
6056.7	**1600**	422.7	13816.8	**3650**	964.2	21576.8	**5700**	1505.8	29336.9	**7750**	2047.3
6245.9	**1650**	435.9	14006.0	**3700**	977.4	21766.1	**5750**	1519.0	29526.2	**7800**	2060.5
6435.2	**1700**	449.1	14195.3	**3750**	990.6	21955.4	**5800**	1532.2	29715.5	**7850**	2073.8
6624.5	**1750**	462.3	14384.6	**3800**	1003.9	22144.7	**5850**	1545.4	29904.7	**7900**	2087.0
6813.7	**1800**	475.5	14573.8	**3850**	1017.1	22333.9	**5900**	1558.6	30094.0	**7950**	2100.2
7003.0	**1850**	488.7	14763.1	**3900**	1030.3	22523.2	**5950**	1571.8	30283.3	**8000**	2113.4
7192.3	**1900**	501.9	14952.4	**3950**	1043.5	22712.5	**6000**	1585.0			
7381.6	**1950**	515.1	15141.6	**4000**	1056.7	22901.7	**6050**	1598.2			
7570.8	**2000**	528.3	15330.9	**4050**	1069.9	23091.0	**6100**	1611.4			

Table APP-5. VOLUME CONVERSION—POUNDS/GALLONS

- Pounds to Gallons - find pounds in the bold face column and read the equivalent number of gallons in the adjacent GALLONS column.
- Gallons to Pounds - find gallons in the bold face column and read the equivalent number of pounds in the adjacent POUNDS column.

POUNDS	◄ ►	GALLONS	POUNDS	◄ ►	GALLONS	POUNDS	◄ ►	GALLONS	POUNDS	◄ ►	GALLONS
6.7	**1**	0.15	27470	**4100**	614.9	54940	**8200**	1229.9	82410	**12300**	1844.9
670	**100**	14.9	28140	**4200**	629.9	55610	**8300**	1244.9	83080	**12400**	1859.9
1340	**200**	29.9	28810	**4300**	644.9	56280	**8400**	1259.9	83750	**12500**	1874.9
2010	**300**	44.9	29480	**4400**	659.9	56950	**8500**	1274.9	84420	**12600**	1889.9
2680	**400**	59.9	30150	**4500**	674.9	57620	**8600**	1289.9	85090	**12700**	1904.9
3350	**500**	74.9	30820	**4600**	689.9	58290	**8700**	1304.9	85760	**12800**	1919.9
4020	**600**	89.9	31490	**4700**	704.9	58960	**8800**	1319.9	86430	**12900**	1934.9
4690	**700**	104.9	32160	**4800**	719.9	59630	**8900**	1334.9	87100	**13000**	1949.9
5360	**800**	119.9	32830	**4900**	734.9	60300	**9000**	1349.9	87770	**13100**	1964.9
6030	**900**	134.9	33500	**5000**	749.9	60970	**9100**	1364.9	88440	**13200**	1979.9
6700	**1000**	149.9	34170	**5100**	764.9	61640	**9200**	1379.9	89110	**13300**	1994.9
7370	**1100**	164.9	34840	**5200**	779.9	62310	**9300**	1394.9	89780	**13400**	2009.9
8040	**1200**	179.9	35510	**5300**	794.9	62980	**9400**	1409.9	90450	**13500**	2024.9
8710	**1300**	194.9	36180	**5400**	809.9	63650	**9500**	1424.9	91120	**13600**	2039.9
9380	**1400**	209.9	36850	**5500**	824.9	64320	**9600**	1439.9	91790	**13700**	2054.9
10050	**1500**	224.9	37520	**5600**	839.9	64990	**9700**	1454.9	92460	**13800**	2069.9
10720	**1600**	239.9	38190	**5700**	854.9	65660	**9800**	1469.9	93130	**13900**	2084.9
11390	**1700**	254.9	38860	**5800**	869.9	66330	**9900**	1484.9	93800	**14000**	2099.9
12060	**1800**	269.9	39530	**5900**	884.9	67000	**10000**	1499.9	94470	**14100**	2114.9
12730	**1900**	284.9	40200	**6000**	899.9	67670	**10100**	1514.9			
13400	**2000**	299.9	40870	**6100**	914.9	68340	**10200**	1529.9			
14070	**2100**	314.9	41540	**6200**	929.9	69010	**10300**	1544.9			
14740	**2200**	329.9	42210	**6300**	944.9	69680	**10400**	1559.9			
15410	**2300**	344.9	42880	**6400**	959.9	70350	**10500**	1574.9			
16080	**2400**	359.9	43550	**6500**	974.9	71020	**10600**	1589.9			
16750	**2500**	374.9	44220	**6600**	989.9	71690	**10700**	1604.9			
17420	**2600**	389.9	44890	**6700**	1004.9	72360	**10800**	1619.9			
18090	**2700**	404.9	45560	**6800**	1019.9	73030	**10900**	1634.9			
18760	**2800**	419.9	46230	**6900**	1034.9	73700	**11000**	1649.9			
19430	**2900**	434.9	46900	**7000**	1049.9	74370	**11100**	1664.9			
20100	**3000**	449.9	47570	**7100**	1064.9	75040	**11200**	1679.9			
20770	**3100**	464.9	48240	**7200**	1079.9	75710	**11300**	1694.9			
21440	**3200**	479.9	48910	**7300**	1094.9	76380	**11400**	1709.9			
22110	**3300**	494.9	49580	**7400**	1109.9	77050	**11500**	1724.9			
22780	**3400**	509.9	50250	**7500**	1124.9	77720	**11600**	1739.9			
23450	**3500**	524.9	50920	**7600**	1139.9	78390	**11700**	1754.9			
24120	**3600**	539.9	51590	**7700**	1154.9	79060	**11800**	1769.9			
24790	**3700**	554.9	52260	**7800**	1169.9	79730	**11900**	1784.9			
25460	**3800**	569.9	52930	**7900**	1184.9	80400	**12000**	1799.9			
26130	**3900**	584.9	53600	**8000**	1199.9	81070	**12100**	1814.9			
26800	**4000**	599.9	54270	**8100**	1214.9	81740	**12200**	1829.9			

Table APP-6. WEIGHT CONVERSION

- 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**	2182.6
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	1587.6	**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	3402.0	**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	3855.6	**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	4989.6	**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

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CHAPTER 4

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CHALLENGER 300 PERFORMANCE MANUAL

VOLUME 1

AFM PERFORMANCE

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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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CHAPTER 1
INTRODUCTION TO PERFORMANCE DATA

STANDARD PERFORMANCE CONDITIONS

This chapter presents the performance information of the Challenger 300 Model BD100-1A10 airplane, fitted with two AS907-1-1A engines.

All performance in this section is based on flight test data and the following performance conditions:

1. Minimum guaranteed rated thrust including installation, bleed air, and accessory losses.
2. Full temperature and altitude accountability within the operational limits for which the airplane is certified.

NOTE: - Should OAT or altitude be below the lowest value shown on the performance charts, use performance at the lowest value shown.

- Performance data may be interpolated, or use the next higher weight, temperature and/or altitude.

3. Wing flap positions are as follows:
   Takeoff ..... 10° and 20°
   Final Segment ..... 0°
   En Route ..... 0°
   Approach ..... 10°
   Landing ..... 30°
4. Thrust settings (N_1) from the appropriate tables and as indicated by the N_1 bugs.
5. All takeoff and landing performance is based on a paved, hard runway surface.
6. Automatic Ground Lift Dumping operational.
7. Wet runway takeoff performance accounts for the use of thrust reversers down to 40 KIAS, followed by idle reverse down to a complete stop.
8. ICAO standard atmosphere conditions (ISA), with corrections for non-standard conditions, when applicable.
9. Maximum nominal brake operating pressure of 3000 psi.
10. Wind speed is measured at a height of 10 meters (33 feet) above the surface.
11. For weights below 28 000 lb (12 700 kg), use performance data for a weight of 28 000 lb (12 700 kg).
12. The performance data have been certified based on the following:
    a. A minimum takeoff safety speed (V_2) of 1.17 of the stall speed (V_{SR}) for flap 20°, and of 1.19 for flap 10°.
    b. A minimum landing reference speed (V_{REF}) of 1.23 V_{SR}.

STANDARD PERFORMANCE CONDITIONS (CONT)

ENGINE-OUT TAKEOFF — ACCELERATE GO

1. Set thrust lever to takeoff (TO) thrust detent, then release the brakes.
2. The pilot recognizes the engine failure at V_1.
3. Continue to accelerate to V_R and rotate smoothly toward the flight director single engine pitch attitude. Adjust pitch attitude to achieve V_2 at a height of 35 feet above the runway. Adjust pitch attitude as necessary to maintain V_2.
4. Retract the landing gear when a positive rate of climb is established.

CAUTION: Do not extrapolate above limits shown in charts (2% up and down runway gradient, and 10 knot tailwind)

ENGINE-OUT TAKEOFF — ACCELERATE STOP

1. Set thrust lever to takeoff (TO) thrust detent, then release the brakes.
2. The pilot recognizes the engine failure and reduces both thrust levers to IDLE at V_1.
3. Simultaneously, initiate maximum braking.
4. Deploy thrust reversers, if necessary.
5. Spoilers are automatically deployed (Ground Lift Dumping).
6. Select Idle Reverse Thrust at 40 KIAS.
7. Maintain maximum braking until airplane comes to a complete stop.

MULTI-ENGINE TAKEOFF

1. Set thrust levers to takeoff (TO) thrust detent, then release the brakes.
2. Rotate smoothly at V_R toward the flight director all engine pitch attitude. Adjust pitch attitude to achieve a minimum of V_2 + 10 KIAS at a height of 35 feet above the runway. Adjust pitch attitude as necessary to maintain the speed reached at 35 feet.
3. Retract the landing gear when a positive rate of climb is established.

ROLLING TAKEOFF

NOTE: Add 100 feet (30 meters) to the scheduled takeoff field length when using the following procedure.

- **From Runway Centerline**
  1. Brakes — Release.
  2. Thrust Levers — Promptly Select TO thrust.
  3. Follow the performance takeoff procedure.

NOTE: If the takeoff weight is being determined from a specified runway length, subtract 100 feet (30 meters) from the available runway distance.

LANDING

1. Approach at VREF with flaps and gear down using thrust to maintain a 3 degree glideslope.
2. Briskly reduce the thrust levers to IDLE at 50 feet above the runway threshold.
3. A firm touchdown with minimal flare should be accomplished.
4. Apply maximum braking after nosewheel touchdown until airplane comes to a complete stop.
5. Deploy thrust reversers, if necessary.
6. Spoilers are automatically deployed (Ground Lift Dumping).
7. Select Idle Reverse Thrust at 40 KIAS.

VARIABLE FACTORS AFFECTING PERFORMANCE

Some performance data presented in this section exceed the weight/temperature/altitude limits established in the LIMITATIONS section of this manual. These data are presented for reference only.

Details of variables affecting performance are given with the charts to which they apply. Conditions which relate to all performance calculations are:

1. Effect of humidity.
2. Winds, for which graphical correction is presented on the correction charts, are to be taken as the reported winds. Factors for 50% headwind component and 150% tailwind component have been applied as prescribed in pertinent regulations.

ENGINE BLEED CONFIGURATIONS

Performance data is presented for the following engine bleed configurations:

1. Engine Bleed OFF (Zero engine bleed)
2. Engine Bleed ON (ECS is ON and Anti-Ice is OFF)
3. Engine Bleed ON, Engine Anti-Ice and Wing Anti-Ice ON (ECS is ON and all Anti-Ice devices are ON)

Three other engine bleed configurations are available for dispatch. For the following configurations, use performance data from configuration 3 above:

- Engine Bleed ON, Engine Anti-Ice ON
- Engine Anti-Ice ON
- Engine Anti-Ice and Wing Anti-Ice ON

APU USAGE

All performance information presented are valid for both APU ON or APU OFF. There are no performance penalties associated with APU usage.

DEFINITIONS

These definitions apply to terms used throughout this manual.

AIRSPEEDS

CAS	Calibrated Airspeed — The airspeed indicator reading corrected for instrument and position error. KCAS is calibrated airspeed expressed in knots.
IAS	Indicated Airspeed — 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 — The Mach number reading corrected for instrument and position error.
MI	Indicated Mach Number — The Machmeter reading as installed in the airplane. Zero instrument error is assumed for presentations in this manual.
VA	Maneuvering Speed — VA is the highest speed that full aileron and rudder control can be applied without overstressing the aircraft.
VEF	Engine Failure Speed — The speed at which the engine actually fails during a takeoff roll.
VFE	Maximum Flap Extended Speed — The maximum speed permissible with the wing flaps in a prescribed extended position.
VFTO	Final Takeoff Climb Speed - The speed attained at the end of the flight path acceleration segment during a continued takeoff following an engine failure, and is the speed scheduled for the final segment climb.
VLE	Maximum Landing Gear Extended Speed — The maximum speed at which the aircraft can be flown with the landing gear extended.
VLO	Maximum Landing Gear Operating Speed — The maximum speed at which the landing gear can be extended or retracted.
VMO/MMO	Maximum Operating Limit Speed — The speed that may not be deliberately exceeded in any flight condition except where specifically authorized for flight test or pilot training. VMO is expressed in knots. MMO is expressed in Mach number.

DEFINITIONS (Cont)

V_{MCA}	Minimum Control Speed, Air — The minimum flight speed at which the airplane is controllable with up to 5° of bank when one engine suddenly becomes inoperative and the remaining engine is operating at APR thrust.
V_{MCG}	Minimum Control Speed, Ground — The minimum speed on the ground at which control can be maintained using aerodynamic controls alone and wings level, when one engine suddenly becomes inoperative and the remaining engine is operating at APR thrust.
V_{MCL}	Minimum Control Speed, Landing — The minimum flight speed during landing approach at which the airplane is controllable with up to 5° of bank when one engine suddenly becomes inoperative and the remaining engine is operating at APR thrust. Roll rate requirements can also have an impact on V_{MCL}.
V_1	Takeoff Decision Speed — The speed at which the distance to continue the takeoff to 35 feet (15 feet for wet and contaminated runways) or the distance to stop will not exceed the scheduled takeoff distance.
V_{1MCG}	Minimum V_1 limited by control on the ground - The takeoff decision speed following an engine failure at V_{MCG}. V_1 may not be less than V_{1MCG}.
V_R	Rotation Speed — The speed at which rotation is initiated during takeoff to attain takeoff performance.
V_2	Takeoff Safety Speed — The actual speed at 35 feet above the runway surface as demonstrated in flight during single-engine takeoff.
V_{GA}	Go-Around Speed (approach climb) — The airspeed used for approach climb gradient (airplane in the approach configuration).
V_{REF}	Landing Approach Speed — The airspeed used for landing climb gradient (airplane in the landing configuration) and the airspeed used for approach and landing.
V_{SR}	Reference Stall Speed - The reference stall speed upon which all performance data is based.

DEFINITIONS (Cont)

DISTANCES

Accelerate-Stop Distance

The accelerate-stop distance is the horizontal distance from brake release to the point at which the airplane comes to a complete stop on a takeoff during which the pilot rejects the takeoff at or below V1.

Engine-Out Accelerate-Go Distance

The engine-out accelerate-go distance is the horizontal distance from brake release to the point at which the airplane attains a height of 35 feet (15 feet for wet and contaminated runways) above the runway surface, on a takeoff during which one engine fails, recognition occurs at or above V1 and the pilot elects to continue.

Takeoff Field Length

The takeoff field lengths presented in the TAKEOFF DATA charts in this section are based on a smooth, 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:

1. 115% of the all-engine takeoff distance from start to a height of 35 feet above the runway surface.
2. The accelerate-stop distance.
3. The engine-out accelerate-go distance.

No specific identification is made on the charts as to which of the above distances governs a specific case. V1 is selected to balance the accelerate-stop distance with the engine-out accelerate-go distance, when applicable.

Actual Landing Distance

The actual landing distances presented in the LANDING DATA charts in this section are based on a smooth, paved runway. The actual landing distance is equal to the horizontal distance from a point 50 feet above the touchdown point on the runway surface to the point at which the airplane would come to a full stop on the runway.

Factored Landing Distance

The factored dry landing distances presented in the LANDING DATA charts in this section are equal to the actual landing distance divided by 0.60 (multiplied by 1.67). The wet landing distance is the factored dry landing distance multiplied by 1.15.

DEFINITIONS (Cont)

METEOROLOGICAL

ISA	International Standard Atmosphere.
OAT	Outside ambient air temperature obtained from ground meteorological sources.
SAT	Static Air Temperature — The total air temperature obtained from onboard temperature measurement adjusted for compressibility effects.
Altitude	All altitudes given in this section are pressure altitudes unless otherwise stated.
Wind	The wind velocities, in knots, recorded as variables in the charts of this section are to be understood as the headwind or tailwind components of the actual winds at 33 feet (10 meters) above the runway surface (reported tower winds).
Demonstrated Crosswind	The demonstrated crosswind velocity is the velocity of the reported tower winds (measured at a 33 feet (10 meter) height) for which adequate control of the airplane during takeoff and landing (including the use of thrust reversers) was actually demonstrated on a dry runway during certification tests.

MISCELLANEOUS

Position Error Correction	Position Error Correction — A correction applied to indicated airspeed, Mach number or altitude to eliminate the effect of the location of the static pressure source on the instrument reading. 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.

DEFINITIONS (Cont)

Maximum Takeoff Brake Energy	The brake energy with maximum effort braking at weights associated with the takeoff brake energies shown on the TAKEOFF WEIGHT LIMITS charts. Distances expressed on the TAKEOFF DATA charts will be achieved if the takeoff is aborted at V1. However, after the stop, wheel fuse plugs may release and brake and tire damage will occur.
Maximum Landing Brake Energy	The brake energy with maximum effort braking at weights associated with the landing brake energies shown on the LANDING WEIGHT LIMITS charts. Stopping distances expressed on the LANDING DATA chart will be achieved. Landings in which brake energy is kept below this value can be accomplished without wheel fuse plug release or tire damage. Maximum effort stops in which brake energy exceeds this value may cause excessive brake wear, and after the stop, may cause wheel fuse plug release and tire damage.
Runway Gradient	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	The ratio of the change in height during a portion of the climb to the horizontal distance traversed in the same time interval.
Reference Climb Gradient	The Reference Climb Gradient is used in the takeoff flight path obstacle clearance analysis (first and second segments). The Reference Climb Gradient is equal to the net second segment climb gradient.
Gross Climb Gradient	The climb gradient that the airplane can actually achieve given ideal conditions.
Net Climb Gradient	The gross climb gradient reduced by 0.8% during the takeoff phase and 1.1% en route.
Uncorrected Data	Uncorrected data refers to performance data valid for specified conditions of pressure altitude, ambient temperature and weight, but which has not gone through the applicable correction charts. For example, dry runway takeoff data that has to be corrected for reported wind and runway gradient effects.
Corrected Data	Corrected Data refers to performance data which accounts for all applicable corrections. For example, uncorrected dry runway takeoff data that has been corrected for reported wind and runway gradient effects.

CERTIFICATED NOISE LEVELS

The noise levels of the BD-100 aircraft are in compliance with the requirements of:

- AMW516, change 516-07
- FAR 36 Amendment 36-24, Stage 3
- JAR 36 (Issue May 1997)
- ICAO Annex 16, Chapter 3 and
- ICAO Annex 16, Chapter 4.

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

The thrust cutback aircraft conditions relate only to the noise certification demonstration procedure and are not necessarily intended for use in normal operation.

These noise values are stated for reference conditions of standard atmospheric pressure at sea level, 25 °C ambient temperature, 70% relative humidity, and zero wind.

AIRCRAFT CONFIGURATION

TAKEOFF

Flyover and lateral noise levels were determined for the following conditions:

EFFECTIVITY

For aircraft 20002 thru 20050 ***not*** incorporating Service Bulletin 100-11-01 (Replacement of Airspeed Limits Placard for MTOW Increase to 38 850 lb/ 17 622 kg), the Maximum take-off weight is 38 500 lb (17 463 kg).

Maximum take-off weight ..... 38 850 lb (17 622 kg)
Climb speed ..... V_2+10 KIAS
Flaps setting ..... 10°
APU ..... off
Air-conditioning pack ..... on
Wing and engine anti-ice ..... off
Normal take-off thrust (both engines operating), cutback nominally at 2250 ft to 3280 lb FNC per engine (approximately 70.9% N_1 corrected thrust).

LANDING

Approach noise levels were determined for the following conditions:

Glideslope ..... 3 degrees
Landing gear ..... Down
Landing weight ..... 33 750 lb (15 309 kg)
Approach speed ..... V_{REF}+10 KIAS
Flaps setting ..... 30°
APU ..... On
Air-conditioning pack ..... On
Wing and engine anti-icing ..... Off

CERTIFICATED NOISE LEVELS

The demonstrated effective perceived noise levels (EPNdB), noise limits of and margins of compliance to FAR 36 Stage 3, and ICAO Chapter 3 and 4 are listed below:

Measurement Points	Actual Noise Level in EPNdB	Maximum Allowable Requirement (EPNdB)	Margins (EPNdB)
Flyover	75.3	89.0	13.7
Lateral	87.6	94.0	6.4
Approach	89.6	98.0	8.4

ICAO Annex 16, Volume 1, Chapter 4, Amendment 7 compliance has been demonstrated with a 18.5 dB margin.

EFFECTIVITY

For aircraft 20002 thru 20050 ***not*** incorporating Service Bulletin 100-11-01 (Replacement of Airspeed Limits Placard for MTOW Increase to 38 850 lb/17 622 kg), the above Noise Levels are applicable.

CERTIFICATED NOISE LEVELS (Cont)

The demonstrated effective perceived noise levels (EPNdB), noise limits of and margins of compliance to FAR 36 Stage 3, and ICAO Chapter 3 and 4 are listed below:

Measurement Points	Actual Noise Level in EPNdB	Maximum Allowable Requirement (EPNdB)	Margins (EPNdB)
Flyover	75.5	89.0	13.5
Lateral	87.6	94.0	6.4
Approach	89.6	98.0	8.4

ICAO Annex 16, Volume 1, Chapter 4, Amendment 7 compliance has been demonstrated with a 18.3 dB margin.

EFFECTIVITY

For aircraft 20051, and subsequent, and aircraft incorporating Service Bulletin 100-11-01 (Replacement of Airspeed Limits Placard for MTOW Increase to 38 850 lb/17 622 kg), the above Noise Levels are applicable.

MINIMUM CONTROL SPEED AIR V_{MCA}

The values of V_{MCA} for each takeoff flap configuration are:

V_{MCA}

- Flaps 10° ..... 106 KIAS
- Flaps 20° ..... 102 KIAS

MINIMUM CONTROL SPEED GROUND V_{MCG}

The value of V_{MCG} for all takeoff flap configurations is:

V_{MCG} ..... 111 KIAS

MINIMUM V_1 LIMITED BY CONTROL ON THE GROUND V_{1MCG}

The value of V_{1MCG} for all takeoff flap configurations is:

V_{1MCG} ..... 116 KIAS

MINIMUM CONTROL SPEED LANDING V_{MCL}

The values of V_{MCL} for the different flap configurations are:

V_{MCL}

- Flaps 10° ..... 108 KIAS
- Flaps 20° ..... 106 KIAS
- Flaps 30° ..... 102 KIAS

MAXIMUM CROSSWIND

The maximum demonstrated crosswind component for takeoff is 28 kts and for landing is 24 kts, and is not considered limiting. Landings have been performed at an approach speed of VREF + 1/2 of the gust to a maximum of 10 kts.

MAXIMUM TAILWIND

The maximum tailwind component for takeoff and landing (at 33 feet [10 meter] tower height) is 10 knots.

RELATION OF TEMPERATURE (°C) TO ISA

ALTITUDE ~ 1000 FT	-50°C	-40°C	-30°C	-20°C	-10°C	ISA	+10°C	+20°C	+30°C
51	-106.5	-96.5	-86.5	-76.5	-66.5	-56.5	-46.5	-36.5	-26.5
37	-106.5	-96.5	-86.5	-76.5	-66.5	-56.5	-46.5	-36.5	-26.5
35	-104.2	-94.2	-84.2	-74.2	-64.2	-54.2	-44.2	-34.2	-24.2
33	-100.3	-90.3	-80.3	-70.3	-60.3	-50.3	-40.3	-30.3	-20.3
31	-96.3	-86.3	-76.3	-66.3	-56.3	-46.3	-36.3	-26.3	-16.3
30	-94.4	-84.4	-74.4	-64.4	-54.4	-44.4	-34.4	-24.4	-14.4
29	-92.4	-82.4	-72.4	-62.4	-52.4	-42.4	-32.4	-22.4	-12.4
28	-90.4	-80.4	-70.4	-60.4	-50.4	-40.4	-30.4	-20.4	-10.4
27	-88.4	-78.4	-68.4	-58.4	-48.4	-38.4	-28.4	-18.4	-8.4
26	-86.5	-76.5	-66.5	-56.5	-46.5	-36.5	-26.5	-16.5	-6.5
25	-84.5	-74.5	-64.5	-54.5	-44.5	-34.5	-24.5	-14.5	-4.5
24	-82.5	-72.5	-62.5	-52.5	-42.5	-32.5	-22.5	-12.5	-2.5
23	-80.5	-70.5	-60.5	-50.5	-40.5	-30.5	-20.5	-10.5	-0.5
22	-78.6	-68.6	-58.6	-48.6	-38.6	-28.6	-18.6	-8.6	1.4
21	-76.6	-66.6	-56.6	-46.6	-36.6	-26.6	-16.6	-6.6	3.4
20	-74.6	-64.6	-54.6	-44.6	-34.6	-24.6	-14.6	-4.6	5.4
19	-72.6	-62.6	-52.6	-42.6	-32.6	-22.6	-12.6	-2.6	7.4
18	-70.6	-60.6	-50.6	-40.6	-30.6	-20.6	-10.6	-0.6	9.4
16	-66.7	-56.7	-46.7	-36.7	-26.7	-16.7	-6.7	3.3	13.3
14	-62.7	-52.7	-42.7	-32.7	-22.7	-12.7	-2.7	7.3	17.3
12	-58.8	-48.8	-38.8	-28.8	-18.8	-8.8	1.2	11.2	21.2
10	-54.8	-44.8	-34.8	-24.8	-14.8	-4.8	5.2	15.2	25.2
8	-50.8	-40.8	-30.8	-20.8	-10.8	-0.8	9.2	19.2	29.2
6	-46.9	-36.9	-26.9	-16.9	-6.9	3.1	13.1	23.1	33.1
4	-42.9	-32.9	-22.9	-12.9	-2.9	7.1	17.1	27.1	37.1
2	-39.0	-29.0	-19.0	-9.0	1.0	11.0	21.0	31.0	41.0
S.L.	-35.0	-25.0	-15.0	-5.0	5.0	15.0	25.0	35.0	45.0
	-50°C	-40°C	-30°C	-20°C	-10°C	ISA	+10°C	+20°C	+30°C

Figure 1-01. (06-01-01)

TEMPERATURE CONVERSION

- To convert from Celsius to Fahrenheit, find, in 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 bold face columns, the number representing the Fahrenheit 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

Figure 1-02. (06-01-02)

LINEAR CONVERSION

- 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	15091.7	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	32808.0
1005.9	3300	10826.6	2042.2	6700	21981.4	3352.8	11000	36088.8
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

Figure 1-03. (06-01-03)

VOLUME CONVERSION—Liters/U.S. Gallons

- Liters to U.S. Gallons - find liters in the bold face column and read the equivalent number of U.S. gallons in the adjacent GALLONS column.
- U.S. Gallons to Liters - find U.S. gallons in the bold face column and read the equivalent number of liters in the adjacent LITERS column.

LITERS		GALLONS	LITERS		GALLONS	LITERS		GALLONS	LITERS		GALLONS
18.9	5	1.3	7760.1	2050	541.6	15520.2	4100	1083.1	23280.3	6150	1624.7
189.3	50	13.2	7949.4	2100	554.8	15709.5	4150	1096.3	23469.5	6200	1637.9
378.5	100	26.4	8138.6	2150	568.0	15898.7	4200	1109.5	23658.8	6250	1651.1
567.8	150	39.6	8327.9	2200	581.2	16088.0	4250	1122.7	23848.1	6300	1664.3
757.1	200	52.8	8517.2	2250	594.4	16277.3	4300	1135.9	24037.4	6350	1677.5
946.4	250	66.0	8706.4	2300	607.6	16466.5	4350	1149.1	24226.6	6400	1690.7
1135.6	300	79.3	8895.7	2350	620.8	16655.8	4400	1162.4	24415.9	6450	1703.9
1324.9	350	92.5	9085.0	2400	634.0	16845.1	4450	1175.6	24605.2	6500	1717.1
1514.2	400	105.7	9274.3	2450	647.2	17034.3	4500	1188.8	24794.4	6550	1730.3
1703.4	450	118.9	9463.5	2500	660.4	17223.6	4550	1202.0	24983.7	6600	1743.5
1892.7	500	132.1	9652.8	2550	673.6	17412.9	4600	1215.2	25173.0	6650	1756.7
2082.0	550	145.3	9842.1	2600	686.8	17602.2	4650	1228.4	25362.3	6700	1770.0
2271.2	600	158.5	10031.3	2650	700.1	17791.4	4700	1241.6	25551.5	6750	1783.2
2460.5	650	171.7	10220.6	2700	713.3	17980.7	4750	1254.8	25740.8	6800	1796.4
2649.8	700	184.9	10409.9	2750	726.5	18170.0	4800	1268.0	25930.1	6850	1809.6
2839.1	750	198.1	10599.2	2800	739.7	18359.2	4850	1281.2	26119.3	6900	1822.8
3028.3	800	211.3	10788.4	2850	752.9	18548.5	4900	1294.4	26308.6	6950	1836.0
3217.6	850	224.5	10977.7	2900	766.1	18737.8	4950	1307.7	26497.9	7000	1849.2
3406.9	900	237.8	11167.0	2950	779.3	18927.1	5000	1320.9	26687.1	7050	1862.4
3596.1	950	251.0	11356.2	3000	792.5	19116.3	5050	1334.1	26876.4	7100	1875.6
3785.4	1000	264.2	11545.5	3050	805.7	19305.6	5100	1347.3	27065.7	7150	1888.8
3974.7	1050	277.4	11734.8	3100	818.9	19494.9	5150	1360.5	27255.0	7200	1902.0
4164.0	1100	290.6	11924.0	3150	832.1	19684.1	5200	1373.7	27444.2	7250	1915.2
4353.2	1150	303.8	12113.3	3200	845.4	19873.4	5250	1386.9	27633.5	7300	1928.5
4542.5	1200	317.0	12302.6	3250	858.6	20062.7	5300	1400.1	27822.8	7350	1941.7
4731.8	1250	330.2	12491.9	3300	871.8	20251.9	5350	1413.3	28012.0	7400	1954.9
4921.0	1300	343.4	12681.1	3350	885.0	20441.2	5400	1426.5	28201.3	7450	1968.1
5110.3	1350	356.6	12870.4	3400	898.2	20630.5	5450	1439.7	28390.6	7500	1981.3
5299.6	1400	369.8	13059.7	3450	911.4	20819.8	5500	1452.9	28579.9	7550	1994.5
5488.8	1450	383.0	13248.9	3500	924.6	21009.0	5550	1466.2	28769.1	7600	2007.7
5678.1	1500	396.3	13438.2	3550	937.8	21198.3	5600	1479.4	28958.4	7650	2020.9
5867.4	1550	409.5	13627.5	3600	951.0	21387.6	5650	1492.6	29147.7	7700	2034.1
6056.7	1600	422.7	13816.8	3650	964.2	21576.8	5700	1505.8	29336.9	7750	2047.3
6245.9	1650	435.9	14006.0	3700	977.4	21766.1	5750	1519.0	29526.2	7800	2060.5
6435.2	1700	449.1	14195.3	3750	990.6	21955.4	5800	1532.2	29715.5	7850	2073.8
6624.5	1750	462.3	14384.6	3800	1003.9	22144.7	5850	1545.4	29904.7	7900	2087.0
6813.7	1800	475.5	14573.8	3850	1017.1	22333.9	5900	1558.6	30094.0	7950	2100.2
7003.0	1850	488.7	14763.1	3900	1030.3	22523.2	5950	1571.8	30283.3	8000	2113.4
7192.3	1900	501.9	14952.4	3950	1043.5	22712.5	6000	1585.0			
7381.6	1950	515.1	15141.6	4000	1056.7	22901.7	6050	1598.2			
7570.8	2000	528.3	15330.9	4050	1069.9	23091.0	6100	1611.4			

Figure 1-04. (06-01-04)

VOLUME CONVERSION—Pounds/U.S. Gallons

- Pounds to U.S. Gallons - find pounds in the bold face column and read the equivalent number of U.S. gallons in the adjacent GALLONS column.
- U.S. Gallons to Pounds - find U.S. gallons in the bold face column and read the equivalent number of pounds in the adjacent POUNDS column.

POUNDS	◀ ▶	GALLONS	POUNDS	◀ ▶	GALLONS	POUNDS	◀ ▶	GALLONS	POUNDS	◀ ▶	GALLONS
6.75	1	0.15	27675	4100	607.4	55350	8200	1214.8	83025	12300	1822.2
675	100	14.8	28350	4200	622.2	56025	8300	1229.6	83700	12400	1837.0
1350	200	29.6	29025	4300	637.0	56700	8400	1244.4	84375	12500	1851.9
2025	300	44.4	29700	4400	651.9	57375	8500	1259.3	85050	12600	1866.7
2700	400	59.3	30375	4500	666.7	58050	8600	1274.1	85725	12700	1881.5
3375	500	74.1	31050	4600	681.5	58725	8700	1288.9	86400	12800	1896.3
4050	600	88.9	31725	4700	696.3	59400	8800	1303.7	87075	12900	1911.1
4725	700	103.7	32400	4800	711.1	60075	8900	1318.5	87750	13000	1925.9
5400	800	118.5	33075	4900	725.9	60750	9000	1333.3	88425	13100	1940.7
6075	900	133.3	33750	5000	740.7	61425	9100	1348.1	89100	13200	1955.6
6750	1000	148.1	34425	5100	755.6	62100	9200	1363.0	89775	13300	1970.4
7425	1100	163.0	35100	5200	770.4	62775	9300	1377.8	90450	13400	1985.2
8100	1200	177.8	35775	5300	785.2	63450	9400	1392.6	91125	13500	2000.0
8775	1300	192.6	36450	5400	800.0	64125	9500	1407.4	91800	13600	2014.8
9450	1400	207.4	37125	5500	814.8	64800	9600	1422.2	92475	13700	2029.6
10125	1500	222.2	37800	5600	829.6	65475	9700	1437.0	93150	13800	2044.4
10800	1600	237.0	38475	5700	844.4	66150	9800	1451.9	93825	13900	2059.3
11475	1700	251.9	39150	5800	859.3	66825	9900	1466.7	94500	14000	2074.1
12150	1800	266.7	39825	5900	874.1	67500	10000	1481.5	95175	14100	2088.9
12825	1900	281.5	40500	6000	888.9	68175	10100	1496.3			
13500	2000	296.3	41175	6100	903.7	68850	10200	1511.1			
14175	2100	311.1	41850	6200	918.5	69525	10300	1525.9			
14850	2200	325.9	42525	6300	933.3	70200	10400	1540.7			
15525	2300	340.7	43200	6400	948.1	70875	10500	1555.6			
16200	2400	355.6	43875	6500	963.0	71550	10600	1570.4			
16875	2500	370.4	44550	6600	977.8	72225	10700	1585.2			
17550	2600	385.2	45225	6700	992.6	72900	10800	1600.0			
18225	2700	400.0	45900	6800	1007.4	73575	10900	1614.8			
18900	2800	414.8	46575	6900	1022.2	74250	11000	1629.6			
19575	2900	429.6	47250	7000	1037.0	74925	11100	1644.4			
20250	3000	444.4	47925	7100	1051.9	75600	11200	1659.3			
20925	3100	459.3	48600	7200	1066.7	76275	11300	1674.1			
21600	3200	474.1	49275	7300	1081.5	76950	11400	1688.9			
22275	3300	488.9	49950	7400	1096.3	77625	11500	1703.7			
22950	3400	503.7	50625	7500	1111.1	78300	11600	1718.5			
23625	3500	518.5	51300	7600	1125.9	78975	11700	1733.3			
24300	3600	533.3	51975	7700	1140.7	79650	11800	1748.1			
24975	3700	548.1	52650	7800	1155.6	80325	11900	1763.0			
25650	3800	563.0	53325	7900	1170.4	81000	12000	1777.8			
26325	3900	577.8	54000	8000	1185.2	81675	12100	1792.6			
27000	4000	592.6	54675	8100	1200.0	82350	12200	1807.4			

Figure 1-05. (06-01-05)

WEIGHT CONVERSION

- 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	2182.6
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	1587.6	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	3402.0	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	3855.6	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	4989.6	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

Figure 1-06. (06-01-06)

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AIRSPEED AND ALTITUDE POSITION ERRORS PRIMARY FLIGHT DISPLAY

Note: There are no position errors at Flaps 0°.

AIRSPEED POSITION ERROR CORRECTION ΔV			
INDICATED AIRSPEED (KIAS)	FLAPS / GEAR UP OR DOWN 10°	20°	30°
100	0.5	1.0	1.0
120	0.5	1.0	1.0
140	0.5	1.0	1.0
160	0.5	0.3	0.1
180	0.3	0.0	–0.3
200	0.2	0.0	
210	0.2	0.0	

Calibrated Airspeed = Indicated Airspeed + ΔV (knots)
A positive value indicates that the indicator reads low

ALTITUDE POSITION ERROR CORRECTION ΔH			
INDICATED AIRSPEED (KIAS)	FLAPS / GEAR UP OR DOWN 10°	20°	30°
100	10	13	15
120	10	13	15
140	10	13	15
160	9	4	2
180	7	1	–4
200	7	1	
210	7	1	

CALPRI_BD100_11AUG03

Calibrated Pressure Altitude = Indicated Pressure Altitude + ΔH (ft)
A positive value indicates that the altimeter reads low

Figure 1-07. (06-01-07)

AIRSPEED AND ALTITUDE POSITION ERRORS STANDBY INDICATOR

Note: There are no position errors at Flaps 0°.

AIRSPEED POSITION ERROR CORRECTION ΔV					
INDICATED AIRSPEED (KIAS)	FLAPS / GEAR 10°/ UP	10°/ DOWN	20°/ UP	20°/ DOWN	30°/ DOWN
100	0.5	−0.3	0.6	−0.1	0.1
120	0.5	−0.3	0.6	−0.1	0.1
140	0.5	−0.4	0.6	−0.4	−0.5
160	0.5	−0.6	0.1	−0.9	−1.4
180	0.2	−0.9	−0.5	−1.6	−2.8
200	−0.1	−1.3	−1.1	−2.3	
210	−0.3	−1.5	−1.5	−2.7	

Calibrated Airspeed = Indicated Airspeed + ΔV (knots)
A positive value indicates that the indicator reads low

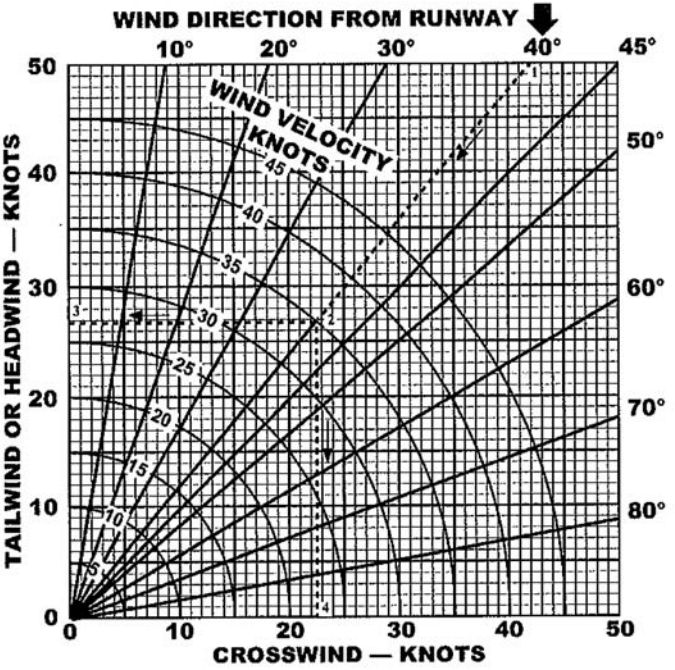
ALTITUDE POSITION ERROR CORRECTION ΔH					
AIRSPEED (KIAS)	FLAPS / GEAR 10°/ UP	10°/ DOWN	20°/ UP	20°/ DOWN	30°/ DOWN
100	8	−2	8	0	2
120	8	−2	8	0	2
140	8	−3	8	−5	−4
160	8	−9	5	−15	−20
180	6	−16	−5	−30	−47
200	1	−26	−20	−49	
210	−2	−32	−28	−61	

CALSTB_BD100_11AUG03

Calibrated Pressure Altitude = Indicated Pressure Altitude + ΔH (ft)
A positive value indicates that the altimeter reads low

Figure 1-08. (06-01-08)

WIND COMPONENTS



CONDITIONS:

- Wind Velocity ..... 35 Knots
- Wind Direction ..... 300°
- Runway Heading ..... 340°

EXAMPLE:

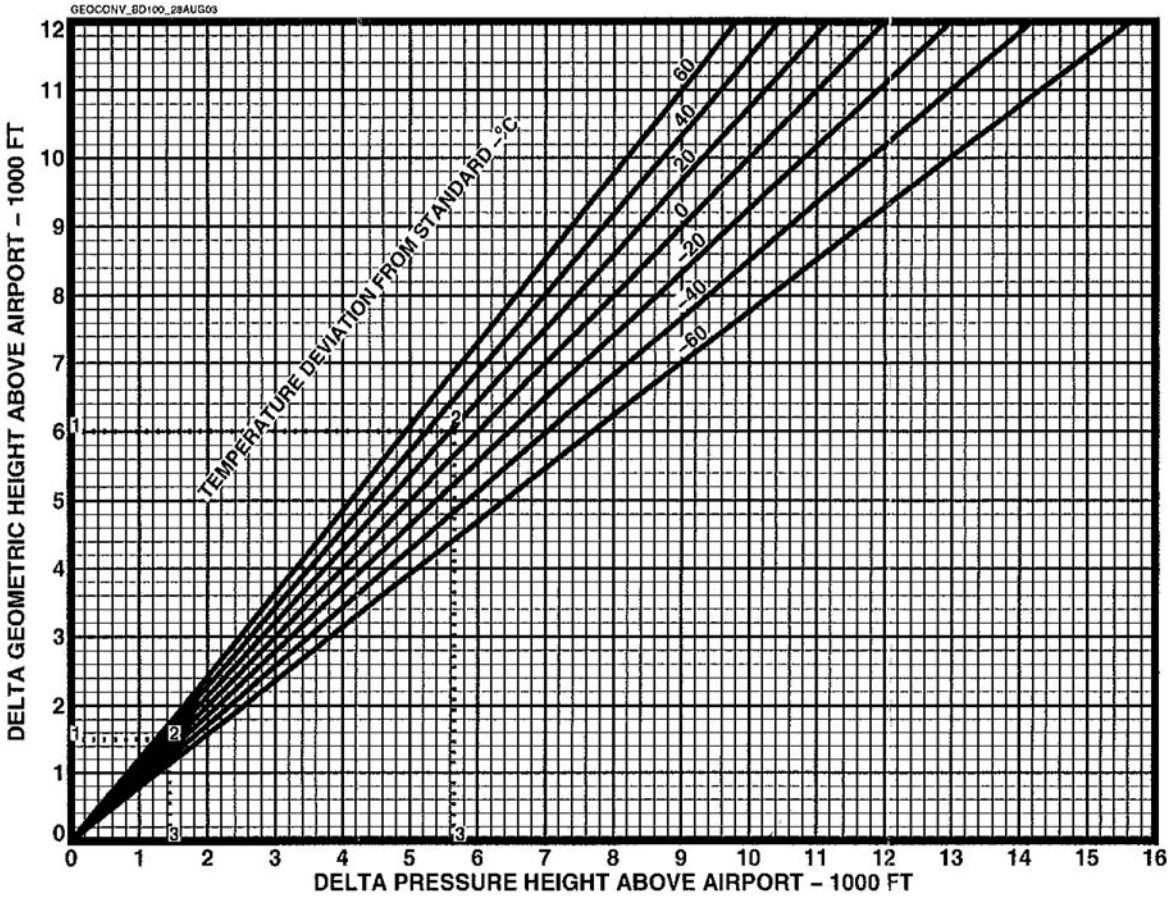
1. Wind Direction from Runway (See Note) ..... 40°
2. Wind Velocity ..... 35 Knots
3. Headwind Component ..... 26.7 Knots
4. Crosswind Component ..... 22.5 Knots

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 1-09. (06-01-09)

FlightSafety international
CHALLENGER 300 PERFORMANCE MANUAL

GEOMETRIC HEIGHT TO PRESSURE HEIGHT CONVERSION



EXAMPLES:

1. Delta Geometric Height Above Airport.....6000 ft	1. Delta Geometric Height Above Airport.....1500 ft
2. Temperature Deviation.....ISA + 17°C	2. Temperature Deviation.....ISA + 15°C
3. Delta Pressure Height Above Airport.....5650 ft	3. Delta Pressure Height Above Airport.....1430 ft

Figure 1-10. (06-01-10)

FOR TRAINING PURPOSES ONLY

FlightSafety international
CHALLENGER 300 PERFORMANCE MANUAL

STALL SPEEDS

EXAMPLE:

1. Weight.....36 400 lb (16 510 kg)
2. Flap Setting.....10° / UP
3. Stall Speed..... 115 KCAS

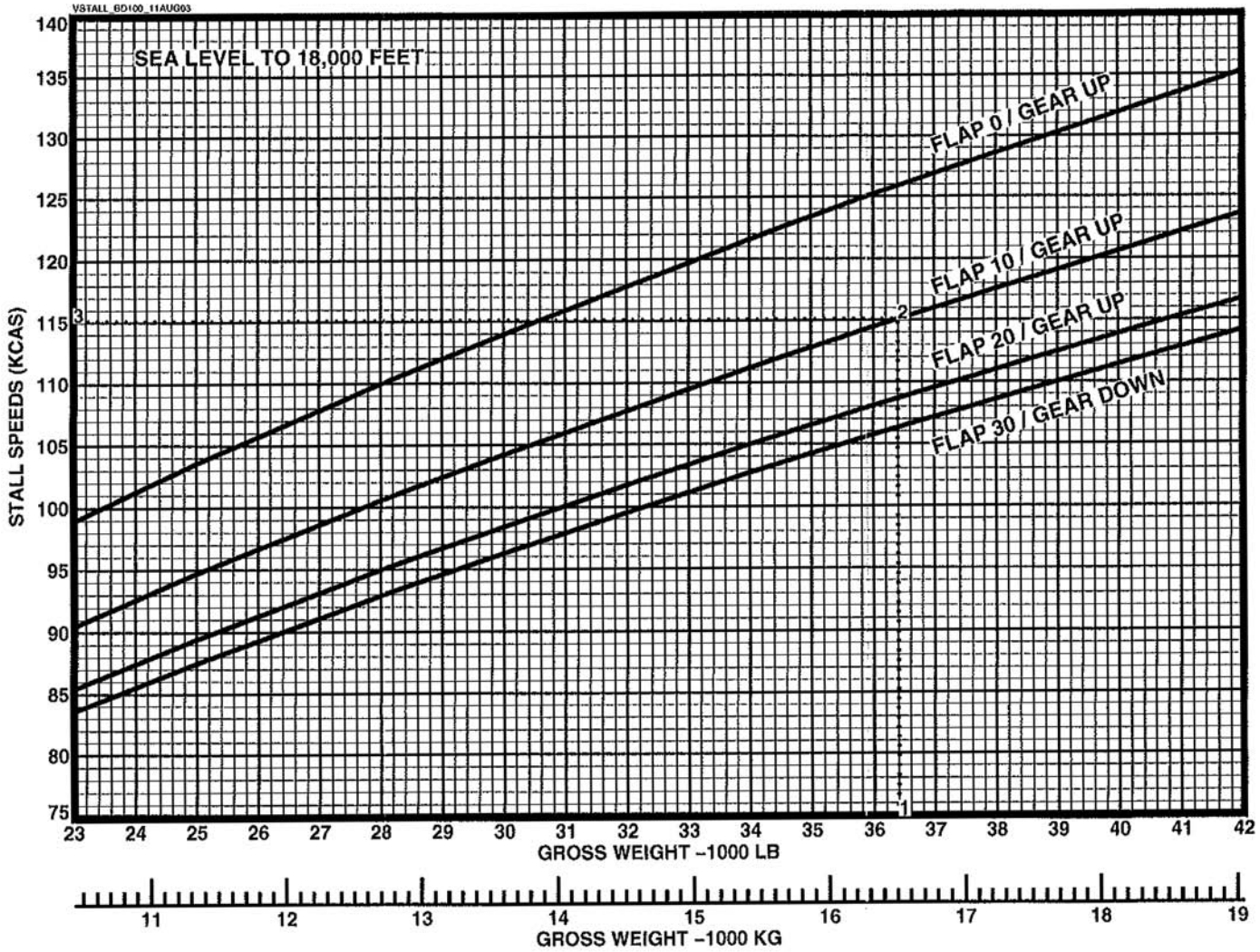
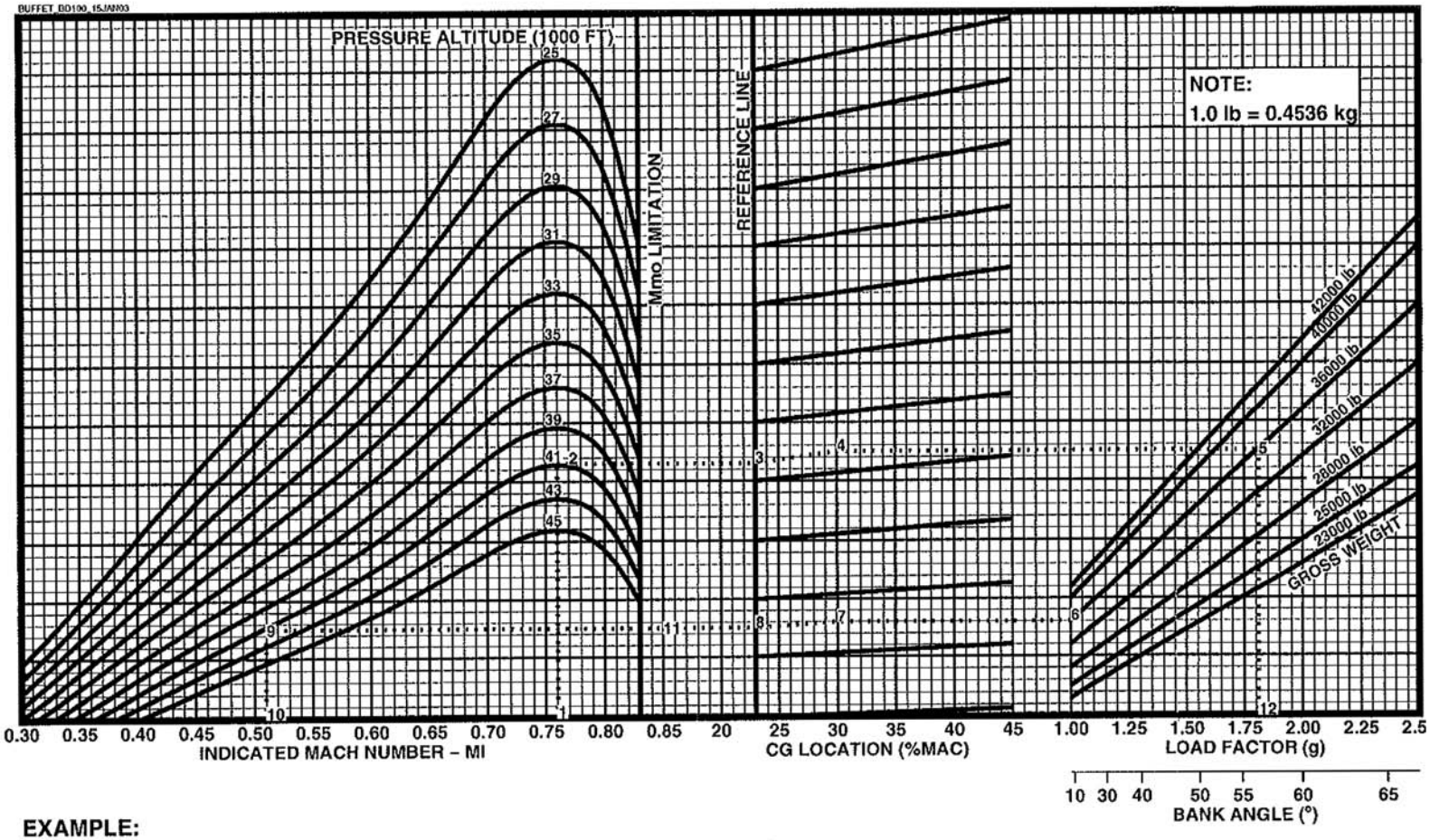


Figure 1-11. (06-01-11)

FlightSafety international
CHALLENGER 300 PERFORMANCE MANUAL

BUFFET BOUNDARY



EXAMPLE:

1. Mach Number.....0.76
2. Altitude.....41 000 ft
3. CG Reference Line
4. CG.....30% MAC
5. Weight.....36 000 lb (16 330 kg)
6. For 1 "G" Flight
7. CG.....30% MAC
8. CG Reference Line
9. Altitude.....41 000 ft
10. Low Speed Buffet Mach.....0.51
11. High Speed Buffet Mach.....Above Mmo
12. For Maneuvering Flight
    Bank Angle = 57°
    Load Factor = 1.81

Figure 1-12. (06-01-12)

FOR TRAINING PURPOSES ONLY

THRUST CHARTS

Engine fan speed N1 settings for the AS-907 engine, required for various ambient temperatures (Outside Air Temperature, OAT, for ground operations, and Static Air Temperature, SAT, for flight operations) and pressure altitudes, are presented in the following pages. These data correspond to the N1 thrust settings as calculated by the Full Authority Digital Engine Control (FADEC), for ground and flight operations.

The following data are provided to the flight crew as a means of verifying the accuracy of the thrust set by the FADEC for the particular phase of flight.

Twenty-one (21) tables are presented (2 pages per table) for varying conditions of ambient temperature (OAT or SAT as applicable) and pressure altitude, each for a specific configuration:

Figure 06-10-01 to figure 06-10-06 provide the thrust settings for takeoff. Tables are provided for various engine bleed configurations, and are valid for airplane speeds between 0 and 60 KIAS. A tolerance of +/-0.5% N1 is allowable for those tables.

Figure 06-10-07 to figure 06-10-12 provide the thrust settings for all-engine go-around. Tables are provided for various engine bleed configurations. A tolerance of +/- 0.4% N1 is allowable for those tables.

Figure 06-10-13 to figure 06-10-18 provide the thrust settings for single-engine go-around. Tables are provided for various engine bleed configurations. A tolerance of +/- 0.4% N1 is allowable for those tables.

Figure 06-10-19 to figure 06-10-21 provide the thrust settings for single-engine climb at the en route climb speed. Tables are provided for various engine bleed configurations. A tolerance of +/- 0.2% N1 is allowable for those tables.

TAKEOFF THRUST SETTING TO (ALL ENGINES) ENGINE BLEED OFF

THRUST SETTING – %N1									
OAT	ALTITUDE – FT								
°C	–1000	0	1000	2000	3000	4000	5000	6000	7000
50	83.9	83.7							
48	84.5	84.3	84.1						
46	85.1	84.9	84.7	84.4					
44	85.6	85.4	85.2	85.0	84.8				
42	86.2	86.0	85.8	85.6	85.3	85.1			
40	86.8	86.5	86.3	86.2	85.9	85.7	85.4		
38	87.4	87.1	86.9	86.7	86.5	86.2	86.0	85.6	
36	87.9	87.6	87.4	87.3	87.0	86.8	86.6	86.2	85.8
34	87.9	88.1	87.8	87.7	87.5	87.2	87.0	86.8	86.4
32	87.6	88.4	88.3	88.1	87.9	87.6	87.4	87.3	87.0
30	87.3	88.6	88.7	88.5	88.3	88.1	87.8	87.7	87.6
28	87.0	88.3	89.1	88.9	88.7	88.6	88.3	88.1	88.0
26	86.7	88.0	89.2	89.4	89.2	89.1	88.9	88.7	88.5
24	86.4	87.7	88.9	89.7	89.7	89.5	89.4	89.2	89.0
22	86.1	87.3	88.6	89.9	90.0	90.0	89.9	89.7	89.6
20	85.8	87.0	88.3	89.6	90.3	90.3	90.3	90.2	90.0
18	85.5	86.7	88.0	89.3	90.5	90.6	90.6	90.6	90.4
16	85.2	86.4	87.7	88.9	90.2	90.9	90.9	90.9	90.8
14	84.9	86.1	87.4	88.6	89.9	91.1	91.2	91.1	91.1
12	84.6	85.8	87.1	88.3	89.5	90.8	91.4	91.4	91.4
10	84.2	85.5	86.7	88.0	89.2	90.4	91.6	91.6	91.6
8	83.9	85.2	86.4	87.7	88.9	90.1	91.3	91.9	91.9
6	83.6	84.9	86.1	87.3	88.6	89.8	91.0	92.1	92.1
4	83.3	84.6	85.8	87.0	88.2	89.4	90.7	92.0	92.3
2	83.0	84.2	85.5	86.7	87.9	89.1	90.3	91.6	92.6
0	82.7	83.9	85.2	86.4	87.6	88.8	90.0	91.3	92.6
–2	82.4	83.6	84.8	86.1	87.3	88.4	89.7	91.0	92.3
–4	82.1	83.3	84.5	85.8	86.9	88.1	89.3	90.6	91.9
–6	81.8	83.0	84.2	85.4	86.6	87.8	89.0	90.3	91.6
–8	81.5	82.7	83.9	85.1	86.3	87.5	88.7	89.9	91.3
–10	81.2	82.4	83.6	84.8	86.0	87.1	88.3	89.6	90.9
–12	80.9	82.1	83.3	84.5	85.7	86.8	88.0	89.3	90.6
–14	80.6	81.8	82.9	84.1	85.3	86.5	87.7	88.9	90.2
–16	80.3	81.4	82.6	83.8	85.0	86.2	87.3	88.6	89.9
–18	80.0	81.1	82.3	83.5	84.7	85.8	87.0	88.3	89.6
–20	79.6	80.8	82.0	83.2	84.3	85.5	86.6	87.9	89.2
–22	79.3	80.5	81.7	82.8	84.0	85.2	86.3	87.6	88.9
–24	78.9	80.1	81.3	82.5	83.7	84.8	86.0	87.2	88.5
–26	78.6	79.8	81.0	82.2	83.3	84.5	85.6	86.9	88.2
–28	78.2	79.4	80.6	81.8	83.0	84.2	85.3	86.6	87.8
–30	77.9	79.1	80.3	81.5	82.7	83.8	84.9	86.2	87.5
–32	77.6	78.7	79.9	81.2	82.3	83.5	84.6	85.9	87.1
–34	77.2	78.4	79.6	80.8	82.0	83.1	84.2	85.5	86.8
–36	76.9	78.0	79.2	80.5	81.6	82.8	83.9	85.1	86.4
–38	76.5	77.7	78.9	80.1	81.3	82.4	83.6	84.8	86.0
–40	76.2	77.3	78.5	79.8	81.0	82.1	83.2	84.4	85.7
–42									

N1TABLES_TO_OFF_OFF_1_GD100_08AUG03

Figure 1-13. (06-10-01 Sheet 1 of 2)

TAKEOFF THRUST SETTING TO (ALL ENGINES) ENGINE BLEED OFF

THRUST SETTING – %N1 – (Continued)								
OAT °C	ALTITUDE – FT							
	8000	9000	10000	11000	12000	13000	14000	15000
50								
48								
46								
44								
42								
40								
38								
36								
34	86.0							
32	86.7	86.2						
30	87.3	86.9	86.5					
28	87.8	87.5	87.1	86.9				
26	88.4	88.1	87.8	87.5	87.3			
24	88.9	88.7	88.4	88.2	87.9	87.7		
22	89.4	89.3	89.0	88.8	88.6	88.3	88.0	
20	89.9	89.8	89.7	89.4	89.2	88.9	88.6	88.4
18	90.4	90.3	90.2	90.0	89.7	89.5	89.2	89.0
16	90.7	90.7	90.7	90.4	90.3	90.0	89.8	89.5
14	91.1	91.0	91.1	90.9	90.7	90.6	90.3	90.1
12	91.4	91.4	91.3	91.2	91.1	90.9	90.8	90.6
10	91.6	91.6	91.6	91.5	91.4	91.3	91.2	91.1
8	91.9	91.9	91.9	91.8	91.7	91.6	91.5	91.4
6	92.1	92.1	92.1	92.1	92.0	91.9	91.8	91.7
4	92.3	92.3	92.4	92.3	92.2	92.2	92.1	92.0
2	92.6	92.6	92.6	92.6	92.5	92.4	92.3	92.2
0	92.7	92.7	92.6	92.6	92.5	92.5	92.4	92.4
–2	92.7	92.7	92.6	92.6	92.5	92.5	92.4	92.4
–4	92.7	92.7	92.6	92.6	92.5	92.5	92.4	92.4
–6	92.7	92.7	92.6	92.6	92.5	92.5	92.4	92.4
–8	92.6	92.7	92.6	92.6	92.5	92.5	92.4	92.4
–10	92.3	92.7	92.6	92.6	92.5	92.5	92.4	92.4
–12	91.9	92.7	92.6	92.6	92.5	92.5	92.4	92.4
–14	91.6	92.7	92.6	92.6	92.5	92.5	92.4	92.4
–16	91.2	92.6	92.6	92.6	92.5	92.5	92.4	92.4
–18	90.9	92.2	92.6	92.6	92.5	92.5	92.4	92.4
–20	90.6	91.9	92.6	92.6	92.5	92.5	92.4	92.4
–22	90.2	91.5	92.6	92.6	92.5	92.5	92.4	92.4
–24	89.9	91.2	92.5	92.6	92.5	92.5	92.4	92.4
–26	89.5	90.8	92.2	92.3	92.3	92.2	92.2	92.4
–28	89.2	90.5	91.8	91.9	91.9	91.9	91.8	92.1
–30	88.8	90.1	91.5	91.6	91.6	91.6	91.6	91.7
–32	88.4	89.8	91.1	91.2	91.2	91.2	91.3	91.3
–34	88.1	89.4	90.8	90.8	90.9	90.9	90.9	91.0
–36	87.7	89.1	90.4	90.5	90.5	90.5	90.6	90.6
–38	87.4	88.7	90.0	90.1	90.1	90.2	90.2	90.2
–40	87.0	88.3	89.7	89.7	89.8	89.8	89.8	89.9
–42								89.5

NITABLES TO OFF OFF 2 BD100.08AUG03

Figure 1-13. (06-10-01 Sheet 2 of 2)

TAKEOFF THRUST SETTING TO (ALL ENGINES) ENGINE BLEED OFF, ENGINE A/I ON

THRUST SETTING – %N1									
OAT °C	ALTITUDE – FT								
	–1000	0	1000	2000	3000	4000	5000	6000	7000
10	84.2	85.5	86.7	88.0	89.2	90.4	91.2	91.2	91.2
8	83.9	85.2	86.4	87.7	88.9	90.1	91.3	91.4	91.4
6	83.6	84.9	86.1	87.3	88.6	89.8	91.0	91.7	91.7
4	83.3	84.6	85.8	87.0	88.2	89.4	90.7	91.9	91.9
2	83.0	84.2	85.5	86.7	87.9	89.1	90.3	91.6	92.1
0	82.7	83.9	85.2	86.4	87.6	88.8	90.0	91.3	92.4
–2	82.4	83.6	84.8	86.1	87.3	88.4	89.7	91.0	92.3
–4	82.1	83.3	84.5	85.8	86.9	88.1	89.3	90.6	91.9
–6	81.8	83.0	84.2	85.4	86.6	87.8	89.0	90.3	91.6
–8	81.5	82.7	83.9	85.1	86.3	87.5	88.7	89.9	91.3
–10	81.2	82.4	83.6	84.8	86.0	87.1	88.3	89.6	90.9
–12	80.9	82.1	83.3	84.5	85.7	86.8	88.0	89.3	90.6
–14	80.6	81.8	82.9	84.1	85.3	86.5	87.7	88.9	90.2
–16	80.3	81.4	82.6	83.8	85.0	86.2	87.3	88.6	89.9
–18	80.0	81.1	82.3	83.5	84.7	85.8	87.0	88.3	89.6
–20	79.6	80.8	82.0	83.2	84.3	85.5	86.6	87.9	89.2
–22	79.3	80.5	81.7	82.8	84.0	85.2	86.3	87.6	88.9
–24	78.9	80.1	81.3	82.5	83.7	84.8	86.0	87.2	88.5
–26	78.6	79.8	81.0	82.2	83.3	84.5	85.6	86.9	88.2
–28	78.2	79.4	80.6	81.8	83.0	84.2	85.3	86.6	87.8
–30	77.9	79.1	80.3	81.5	82.7	83.8	84.9	86.2	87.5
–32	77.6	78.7	79.9	81.2	82.3	83.5	84.6	85.9	87.1
–34	77.2	78.4	79.6	80.8	82.0	83.1	84.2	85.5	86.8
–36	76.9	78.0	79.2	80.5	81.6	82.8	83.9	85.1	86.4
–38	76.5	77.7	78.9	80.1	81.3	82.4	83.6	84.8	86.0
–40	76.2	77.3	78.5	79.8	81.0	82.1	83.2	84.4	85.7
–42									

N1TABLES_TO_OFF_ENG_1_BD100_08AUG03

Figure 1-14. (06-10-02 Sheet 1 of 2)

TAKEOFF THRUST SETTING
TO (ALL ENGINES)
ENGINE BLEED OFF, ENGINE A/I ON

THRUST SETTING – %N1 – (Continued)								
OAT °C	ALTITUDE – FT							
	8000	9000	10000	11000	12000	13000	14000	15000
10	91.2	91.1	91.1	90.9	90.7	90.5	90.2	90.1
8	91.4	91.4	91.4	91.2	91.0	90.8	90.6	90.4
6	91.6	91.6	91.6	91.4	91.3	91.1	90.9	90.7
4	91.9	91.9	91.9	91.7	91.5	91.3	91.1	90.9
2	92.1	92.1	92.1	92.0	91.8	91.6	91.4	91.2
0	92.3	92.3	92.3	92.2	92.0	91.8	91.6	91.4
–2	92.7	92.6	92.6	92.5	92.3	92.1	91.9	91.7
–4	92.7	92.7	92.6	92.6	92.5	92.5	92.2	92.0
–6	92.7	92.7	92.6	92.6	92.5	92.5	92.4	92.3
–8	92.6	92.7	92.6	92.6	92.5	92.5	92.4	92.4
–10	92.3	92.7	92.6	92.6	92.5	92.5	92.4	92.4
–12	91.9	92.7	92.6	92.6	92.5	92.5	92.4	92.4
–14	91.6	92.7	92.6	92.6	92.5	92.5	92.4	92.4
–16	91.2	92.6	92.6	92.6	92.5	92.5	92.4	92.4
–18	90.9	92.2	92.6	92.6	92.5	92.5	92.4	92.4
–20	90.6	91.9	92.6	92.6	92.5	92.5	92.4	92.4
–22	90.2	91.5	92.6	92.6	92.5	92.5	92.4	92.4
–24	89.9	91.2	92.5	92.6	92.5	92.5	92.4	92.4
–26	89.5	90.8	92.2	92.3	92.3	92.2	92.2	92.4
–28	89.2	90.5	91.8	91.9	91.9	91.9	91.8	92.1
–30	88.8	90.1	91.5	91.6	91.6	91.6	91.6	91.7
–32	88.4	89.8	91.1	91.2	91.2	91.2	91.3	91.3
–34	88.1	89.4	90.8	90.8	90.9	90.9	90.9	91.0
–36	87.7	89.1	90.4	90.5	90.5	90.5	90.6	90.6
–38	87.4	88.7	90.0	90.1	90.1	90.2	90.2	90.2
–40	87.0	88.3	89.7	89.7	89.8	89.8	89.8	89.9
–42								89.5

NITABLES_TO_OFF_ENG_2_BD100_08AUG03

Figure 1-14. (06-10-02 Sheet 2 of 2)

TAKEOFF THRUST SETTING TO (ALL ENGINES) ENGINE BLEED OFF, ENGINE AND WING A/I ON

THRUST SETTING – %N1									
OAT °C	ALTITUDE – FT								
	–1000	0	1000	2000	3000	4000	5000	6000	7000
10	84.2	85.5	86.7	87.9	87.8	87.6	87.5	87.4	87.2
8	83.9	85.2	86.4	87.7	88.1	88.0	87.8	87.7	87.6
6	83.6	84.9	86.1	87.3	88.4	88.3	88.1	88.0	87.9
4	83.3	84.6	85.8	87.0	88.2	88.6	88.5	88.3	88.2
2	83.0	84.2	85.5	86.7	87.9	88.9	88.8	88.7	88.5
0	82.7	83.9	85.2	86.4	87.6	88.8	89.2	89.1	88.9
–2	82.4	83.6	84.8	86.1	87.3	88.4	89.7	89.4	89.3
–4	82.1	83.3	84.5	85.8	86.9	88.1	89.3	89.9	89.7
–6	81.8	83.0	84.2	85.4	86.6	87.8	89.0	90.3	90.1
–8	81.5	82.7	83.9	85.1	86.3	87.5	88.7	89.9	90.5
–10	81.2	82.4	83.6	84.8	86.0	87.1	88.3	89.6	90.9
–12	80.9	82.1	83.3	84.5	85.7	86.8	88.0	89.3	90.6
–14	80.6	81.8	82.9	84.1	85.3	86.5	87.7	88.9	90.2
–16	80.3	81.4	82.6	83.8	85.0	86.2	87.3	88.6	89.9
–18	80.0	81.1	82.3	83.5	84.7	85.8	87.0	88.3	89.6
–20	79.6	80.8	82.0	83.2	84.3	85.5	86.6	87.9	89.2
–22	79.3	80.5	81.7	82.8	84.0	85.2	86.3	87.6	88.9
–24	78.9	80.1	81.3	82.5	83.7	84.8	86.0	87.2	88.5
–26	78.6	79.8	81.0	82.2	83.3	84.5	85.6	86.9	88.2
–28	78.2	79.4	80.6	81.8	83.0	84.2	85.3	86.6	87.8
–30	77.9	79.1	80.3	81.5	82.7	83.8	84.9	86.2	87.5
–32	77.6	78.7	79.9	81.2	82.3	83.5	84.6	85.9	87.1
–34	77.2	78.4	79.6	80.8	82.0	83.1	84.2	85.5	86.8
–36	76.9	78.0	79.2	80.5	81.6	82.8	83.9	85.1	86.4
–38	76.5	77.7	78.9	80.1	81.3	82.4	83.6	84.8	86.0
–40	76.2	77.3	78.5	79.8	81.0	82.1	83.2	84.4	85.7
–42									

N1TABLES_TO_OFF_1WG_1_BD100_08AUG03

Figure 1-15. (06-10-03 Sheet 1 of 2)

TAKEOFF THRUST SETTING
TO (ALL ENGINES)
ENGINE BLEED OFF, ENGINE AND WING A/I ON

THRUST SETTING – %N1 – (Continued)								
OAT	ALTITUDE – FT							
°C	8000	9000	10000	11000	12000	13000	14000	15000
10	87.0	86.7	86.4	86.0	85.6	85.2	84.7	84.2
8	87.4	87.2	86.9	86.5	86.1	85.7	85.3	84.8
6	87.7	87.6	87.3	86.9	86.5	86.2	85.8	85.4
4	88.1	87.9	87.7	87.4	87.0	86.6	86.3	85.9
2	88.4	88.3	88.1	87.8	87.5	87.2	86.8	86.4
0	88.8	88.6	88.5	88.2	87.9	87.7	87.3	86.9
–2	89.2	89.0	88.8	88.6	88.4	88.0	87.7	87.4
–4	89.6	89.4	89.1	88.9	88.7	88.4	88.1	87.8
–6	89.9	89.7	89.5	89.2	89.0	88.8	88.5	88.1
–8	90.3	90.1	89.9	89.7	89.4	89.1	88.8	88.5
–10	90.8	90.6	90.3	90.1	89.8	89.5	89.2	88.9
–12	91.2	91.0	90.8	90.5	90.3	89.9	89.6	89.3
–14	91.6	91.4	91.3	91.0	90.7	90.4	90.1	89.8
–16	91.2	91.9	91.7	91.4	91.2	90.9	90.5	90.2
–18	90.9	92.2	92.2	91.9	91.6	91.4	91.0	90.7
–20	90.6	91.9	92.6	92.4	92.1	91.9	91.5	91.1
–22	90.2	91.5	92.6	92.6	92.5	92.4	92.1	91.6
–24	89.9	91.2	92.5	92.6	92.5	92.5	92.4	92.1
–26	89.5	90.8	92.2	92.3	92.3	92.2	92.2	92.4
–28	89.2	90.5	91.8	91.9	91.9	91.9	91.8	92.1
–30	88.8	90.1	91.5	91.6	91.6	91.6	91.6	91.7
–32	88.4	89.8	91.1	91.2	91.2	91.2	91.3	91.3
–34	88.1	89.4	90.8	90.8	90.9	90.9	90.9	91.0
–36	87.7	89.1	90.4	90.5	90.5	90.5	90.6	90.6
–38	87.4	88.7	90.0	90.1	90.1	90.2	90.2	90.2
–40	87.0	88.3	89.7	89.7	89.8	89.8	89.8	89.9
–42								89.5

N1TABLES_TO_OFF_(WG_2_BD100_08AUG03

Figure 1-15. (06-10-03 Sheet 2 of 2)

TAKEOFF THRUST SETTING TO (ALL ENGINES) ENGINE BLEED ON

THRUST SETTING – %N1									
OAT	ALTITUDE – FT								
°C	–1000	0	1000	2000	3000	4000	5000	6000	7000
50	83.5	83.2							
48	84.1	83.8	83.6						
46	84.7	84.4	84.2	83.9					
44	85.2	85.0	84.8	84.5	84.2				
42	85.7	85.5	85.3	85.1	84.8	84.5			
40	86.3	86.1	85.9	85.7	85.4	85.1	84.8		
38	87.0	86.6	86.4	86.2	86.0	85.7	85.4	85.0	
36	87.4	87.2	86.9	86.8	86.5	86.2	86.0	85.6	85.2
34	87.7	87.6	87.4	87.2	87.0	86.7	86.5	86.2	85.8
32	87.6	87.9	87.8	87.6	87.4	87.1	86.9	86.7	86.5
30	87.3	88.3	88.2	88.0	87.8	87.6	87.2	87.2	87.0
28	87.0	88.3	88.6	88.4	88.2	88.1	87.8	87.6	87.5
26	86.7	88.0	88.9	88.9	88.7	88.5	88.3	88.1	87.9
24	86.4	87.7	88.9	89.2	89.2	89.0	88.9	88.7	88.5
22	86.1	87.3	88.6	89.5	89.5	89.5	89.3	89.2	89.0
20	85.8	87.0	88.3	89.6	89.8	89.8	89.8	89.6	89.5
18	85.5	86.7	88.0	89.3	90.1	90.1	90.1	90.1	89.9
16	85.2	86.4	87.7	88.9	90.2	90.4	90.4	90.3	90.3
14	84.9	86.1	87.4	88.6	89.9	90.6	90.7	90.6	90.6
12	84.6	85.8	87.1	88.3	89.5	90.8	90.9	90.9	90.8
10	84.2	85.5	86.7	88.0	89.2	90.4	91.1	91.1	91.1
8	83.9	85.2	86.4	87.7	88.9	90.1	91.3	91.3	91.3
6	83.6	84.9	86.1	87.3	88.6	89.8	91.0	91.6	91.6
4	83.3	84.6	85.8	87.0	88.2	89.4	90.7	91.8	91.8
2	83.0	84.2	85.5	86.7	87.9	89.1	90.3	91.6	92.0
0	82.7	83.9	85.2	86.4	87.6	88.8	90.0	91.3	92.3
–2	82.4	83.6	84.8	86.1	87.3	88.4	89.7	91.0	92.3
–4	82.1	83.3	84.5	85.8	86.9	88.1	89.3	90.6	91.9
–6	81.8	83.0	84.2	85.4	86.6	87.8	89.0	90.3	91.6
–8	81.5	82.7	83.9	85.1	86.3	87.5	88.7	89.9	91.3
–10	81.2	82.4	83.6	84.8	86.0	87.1	88.3	89.6	90.9
–12	80.9	82.1	83.3	84.5	85.7	86.8	88.0	89.3	90.6
–14	80.6	81.8	82.9	84.1	85.3	86.5	87.7	88.9	90.2
–16	80.3	81.4	82.6	83.8	85.0	86.2	87.3	88.6	89.9
–18	80.0	81.1	82.3	83.5	84.7	85.8	87.0	88.3	89.6
–20	79.6	80.8	82.0	83.2	84.3	85.5	86.6	87.9	89.2
–22	79.3	80.5	81.7	82.8	84.0	85.2	86.3	87.6	88.9
–24	78.9	80.1	81.3	82.5	83.7	84.8	86.0	87.2	88.5
–26	78.6	79.8	81.0	82.2	83.3	84.5	85.6	86.9	88.2
–28	78.2	79.4	80.6	81.8	83.0	84.2	85.3	86.6	87.8
–30	77.9	79.1	80.3	81.5	82.7	83.8	84.9	86.2	87.5
–32	77.6	78.7	79.9	81.2	82.3	83.5	84.6	85.9	87.1
–34	77.2	78.4	79.6	80.8	82.0	83.1	84.2	85.5	86.8
–36	76.9	78.0	79.2	80.5	81.6	82.8	83.9	85.1	86.4
–38	76.5	77.7	78.9	80.1	81.3	82.4	83.6	84.8	86.0
–40	76.2	77.3	78.5	79.8	81.0	82.1	83.2	84.4	85.7
–42									

Figure 1-16. (06-10-04 Sheet 1 of 2)

TAKEOFF THRUST SETTING
TO (ALL ENGINES)
ENGINE BLEED ON

THRUST SETTING – %N1 – (Continued)								
OAT °C	ALTITUDE – FT							
	8000	9000	10000	11000	12000	13000	14000	15000
50								
48								
46								
44								
42								
40								
38								
36								
34	85.4							
32	86.1	85.7						
30	86.7	86.3	85.9					
28	87.3	86.9	86.5	86.3				
26	87.8	87.5	87.2	86.9	86.6			
24	88.3	88.1	87.8	87.6	87.3	87.0		
22	88.8	88.7	88.4	88.2	87.9	87.6	87.3	
20	89.4	89.2	89.1	88.8	88.5	88.2	87.9	87.6
18	89.8	89.7	89.6	89.3	89.1	88.8	88.5	88.1
16	90.2	90.1	90.1	89.8	89.6	89.3	89.0	88.7
14	90.5	90.5	90.5	90.3	90.1	89.9	89.6	89.2
12	90.8	90.8	90.8	90.6	90.5	90.3	90.1	89.8
10	91.1	91.0	91.0	90.9	90.8	90.6	90.4	90.3
8	91.3	91.3	91.3	91.2	91.1	91.0	90.8	90.6
6	91.6	91.5	91.5	91.4	91.4	91.2	91.1	90.9
4	91.8	91.8	91.8	91.7	91.6	91.5	91.3	91.2
2	92.0	92.0	92.0	92.0	91.8	91.7	91.6	91.4
0	92.3	92.2	92.2	92.2	92.1	92.0	91.8	91.7
–2	92.6	92.5	92.5	92.5	92.4	92.3	92.1	91.9
–4	92.7	92.7	92.6	92.6	92.5	92.5	92.4	92.2
–6	92.7	92.7	92.6	92.6	92.5	92.5	92.4	92.4
–8	92.6	92.7	92.6	92.6	92.5	92.5	92.4	92.4
–10	92.3	92.7	92.6	92.6	92.5	92.5	92.4	92.4
–12	91.9	92.7	92.6	92.6	92.5	92.5	92.4	92.4
–14	91.6	92.7	92.6	92.6	92.5	92.5	92.4	92.4
–16	91.2	92.6	92.6	92.6	92.5	92.5	92.4	92.4
–18	90.9	92.2	92.6	92.6	92.5	92.5	92.4	92.4
–20	90.6	91.9	92.6	92.6	92.5	92.5	92.4	92.4
–22	90.2	91.5	92.6	92.6	92.5	92.5	92.4	92.4
–24	89.9	91.2	92.5	92.6	92.5	92.5	92.4	92.4
–26	89.5	90.8	92.2	92.3	92.3	92.2	92.2	92.4
–28	89.2	90.5	91.8	91.9	91.9	91.9	91.8	92.1
–30	88.8	90.1	91.5	91.6	91.6	91.6	91.6	91.7
–32	88.4	89.8	91.1	91.2	91.2	91.2	91.3	91.3
–34	88.1	89.4	90.8	90.8	90.9	90.9	90.9	91.0
–36	87.7	89.1	90.4	90.5	90.5	90.5	90.6	90.6
–38	87.4	88.7	90.0	90.1	90.1	90.2	90.2	90.2
–40	87.0	88.3	89.7	89.7	89.8	89.8	89.8	89.9
–42								89.5

N1TABLES_TO_LO_OFF_2_BD100_08AUG03

Figure 1-16. (06-10-04 Sheet 2 of 2)

TAKEOFF THRUST SETTING TO (ALL ENGINES) ENGINE BLEED ON, ENGINE A/I ON

THRUST SETTING – %N1									
OAT °C	ALTITUDE – FT								
	–1000	0	1000	2000	3000	4000	5000	6000	7000
10	84.2	85.5	86.7	88.0	89.2	90.4	90.7	90.7	90.6
8	83.9	85.2	86.4	87.7	88.9	90.1	91.0	90.9	90.9
6	83.6	84.9	86.1	87.3	88.6	89.8	91.0	91.2	91.1
4	83.3	84.6	85.8	87.0	88.2	89.4	90.7	91.4	91.3
2	83.0	84.2	85.5	86.7	87.9	89.1	90.3	91.6	91.6
0	82.7	83.9	85.2	86.4	87.6	88.8	90.0	91.3	91.9
–2	82.4	83.6	84.8	86.1	87.3	88.4	89.7	91.0	92.2
–4	82.1	83.3	84.5	85.8	86.9	88.1	89.3	90.6	91.9
–6	81.8	83.0	84.2	85.4	86.6	87.8	89.0	90.3	91.6
–8	81.5	82.7	83.9	85.1	86.3	87.5	88.7	89.9	91.3
–10	81.2	82.4	83.6	84.8	86.0	87.1	88.3	89.6	90.9
–12	80.9	82.1	83.3	84.5	85.7	86.8	88.0	89.3	90.6
–14	80.6	81.8	82.9	84.1	85.3	86.5	87.7	88.9	90.2
–16	80.3	81.4	82.6	83.8	85.0	86.2	87.3	88.6	89.9
–18	80.0	81.1	82.3	83.5	84.7	85.8	87.0	88.3	89.6
–20	79.6	80.8	82.0	83.2	84.3	85.5	86.6	87.9	89.2
–22	79.3	80.5	81.7	82.8	84.0	85.2	86.3	87.6	88.9
–24	78.9	80.1	81.3	82.5	83.7	84.8	86.0	87.2	88.5
–26	78.6	79.8	81.0	82.2	83.3	84.5	85.6	86.9	88.2
–28	78.2	79.4	80.6	81.8	83.0	84.2	85.3	86.6	87.8
–30	77.9	79.1	80.3	81.5	82.7	83.8	84.9	86.2	87.5
–32	77.6	78.7	79.9	81.2	82.3	83.5	84.6	85.9	87.1
–34	77.2	78.4	79.6	80.8	82.0	83.1	84.2	85.5	86.8
–36	76.9	78.0	79.2	80.5	81.6	82.8	83.9	85.1	86.4
–38	76.5	77.7	78.9	80.1	81.3	82.4	83.6	84.8	86.0
–40	76.2	77.3	78.5	79.8	81.0	82.1	83.2	84.4	85.7
–42									

N1TABLES_TO_LO_ENG_1_BD100_08AUG03

Figure 1-17. (06-10-05 Sheet 1 of 2)

TAKEOFF THRUST SETTING
TO (ALL ENGINES)
ENGINE BLEED ON, ENGINE A/I ON

THRUST SETTING – %N1 – (Continued)								
OAT °C	ALTITUDE – FT							
	8000	9000	10000	11000	12000	13000	14000	15000
10	90.6	90.6	90.6	90.3	90.1	89.8	89.5	89.2
8	90.8	90.8	90.8	90.6	90.4	90.1	89.8	89.5
6	91.1	91.1	91.1	90.8	90.7	90.4	90.1	89.8
4	91.3	91.3	91.3	91.1	90.9	90.7	90.4	90.1
2	91.6	91.6	91.5	91.4	91.1	90.9	90.6	90.4
0	91.8	91.8	91.8	91.6	91.4	91.2	90.9	90.6
–2	92.1	92.0	92.0	91.9	91.7	91.5	91.2	90.9
–4	92.5	92.4	92.3	92.2	92.1	91.8	91.5	91.2
–6	92.7	92.7	92.6	92.5	92.4	92.2	91.9	91.5
–8	92.6	92.7	92.6	92.6	92.5	92.5	92.2	91.9
–10	92.3	92.7	92.6	92.6	92.5	92.5	92.4	92.3
–12	91.9	92.7	92.6	92.6	92.5	92.5	92.4	92.4
–14	91.6	92.7	92.6	92.6	92.5	92.5	92.4	92.4
–16	91.2	92.6	92.6	92.6	92.5	92.5	92.4	92.4
–18	90.9	92.2	92.6	92.6	92.5	92.5	92.4	92.4
–20	90.6	91.9	92.6	92.6	92.5	92.5	92.4	92.4
–22	90.2	91.5	92.6	92.6	92.5	92.5	92.4	92.4
–24	89.9	91.2	92.5	92.6	92.5	92.5	92.4	92.4
–26	89.5	90.8	92.2	92.3	92.3	92.2	92.2	92.4
–28	89.2	90.5	91.8	91.9	91.9	91.9	91.8	92.1
–30	88.8	90.1	91.5	91.6	91.6	91.6	91.6	91.7
–32	88.4	89.8	91.1	91.2	91.2	91.2	91.3	91.3
–34	88.1	89.4	90.8	90.8	90.9	90.9	90.9	91.0
–36	87.7	89.1	90.4	90.5	90.5	90.5	90.6	90.6
–38	87.4	88.7	90.0	90.1	90.1	90.2	90.2	90.2
–40	87.0	88.3	89.7	89.7	89.8	89.8	89.8	89.9
–42								89.5

N1TABLES_TO_LO_ENG_2_BD100_08AUG03

Figure 1-17. (06-10-05 Sheet 2 of 2)

TAKEOFF THRUST SETTING TO (ALL ENGINES) ENGINE BLEED ON, ENGINE AND WING A/I ON

THRUST SETTING – %N1									
OAT °C	ALTITUDE – FT								
	–1000	0	1000	2000	3000	4000	5000	6000	7000
10	84.2	85.5	86.7	87.4	87.3	87.1	87.0	86.9	86.7
8	83.9	85.2	86.4	87.7	87.6	87.5	87.3	87.2	87.0
6	83.6	84.9	86.1	87.3	87.9	87.8	87.6	87.5	87.3
4	83.3	84.6	85.8	87.0	88.2	88.1	87.9	87.8	87.7
2	83.0	84.2	85.5	86.7	87.9	88.4	88.3	88.2	88.0
0	82.7	83.9	85.2	86.4	87.6	88.8	88.7	88.6	88.4
–2	82.4	83.6	84.8	86.1	87.3	88.4	89.2	88.9	88.8
–4	82.1	83.3	84.5	85.8	86.9	88.1	89.3	89.4	89.2
–6	81.8	83.0	84.2	85.4	86.6	87.8	89.0	89.8	89.6
–8	81.5	82.7	83.9	85.1	86.3	87.5	88.7	89.9	90.0
–10	81.2	82.4	83.6	84.8	86.0	87.1	88.3	89.6	90.4
–12	80.9	82.1	83.3	84.5	85.7	86.8	88.0	89.3	90.6
–14	80.6	81.8	82.9	84.1	85.3	86.5	87.7	88.9	90.2
–16	80.3	81.4	82.6	83.8	85.0	86.2	87.3	88.6	89.9
–18	80.0	81.1	82.3	83.5	84.7	85.8	87.0	88.3	89.6
–20	79.6	80.8	82.0	83.2	84.3	85.5	86.6	87.9	89.2
–22	79.3	80.5	81.7	82.8	84.0	85.2	86.3	87.6	88.9
–24	78.9	80.1	81.3	82.5	83.7	84.8	86.0	87.2	88.5
–26	78.6	79.8	81.0	82.2	83.3	84.5	85.6	86.9	88.2
–28	78.2	79.4	80.6	81.8	83.0	84.2	85.3	86.6	87.8
–30	77.9	79.1	80.3	81.5	82.7	83.8	84.9	86.2	87.5
–32	77.6	78.7	79.9	81.2	82.3	83.5	84.6	85.9	87.1
–34	77.2	78.4	79.6	80.8	82.0	83.1	84.2	85.5	86.8
–36	76.9	78.0	79.2	80.5	81.6	82.8	83.9	85.1	86.4
–38	76.5	77.7	78.9	80.1	81.3	82.4	83.6	84.8	86.0
–40	76.2	77.3	78.5	79.8	81.0	82.1	83.2	84.4	85.7
–42									

NITABLES_TO_LO_IWG_1_BD100_08AUG03

Figure 1-18. (06-10-06 Sheet 1 of 2)

TAKEOFF THRUST SETTING
TO (ALL ENGINES)
ENGINE BLEED ON, ENGINE AND WING A/I ON

THRUST SETTING – %N1 – (Continued)								
OAT °C	ALTITUDE – FT							
	8000	9000	10000	11000	12000	13000	14000	15000
10	86.4	86.1	85.8	85.4	84.9	84.5	83.9	83.4
8	86.8	86.6	86.3	85.9	85.4	85.0	84.5	84.0
6	87.2	87.0	86.7	86.3	85.9	85.5	85.0	84.5
4	87.5	87.3	87.2	86.8	86.4	86.0	85.5	85.1
2	87.9	87.7	87.5	87.2	86.9	86.5	86.0	85.6
0	88.2	88.1	87.9	87.7	87.3	87.0	86.6	86.1
–2	88.6	88.4	88.2	88.0	87.8	87.4	87.0	86.6
–4	89.0	88.8	88.5	88.3	88.1	87.8	87.3	86.9
–6	89.4	89.2	88.9	88.6	88.4	88.1	87.7	87.3
–8	89.8	89.6	89.4	89.1	88.8	88.5	88.1	87.7
–10	90.2	90.0	89.8	89.5	89.2	88.8	88.5	88.1
–12	90.7	90.5	90.2	89.9	89.7	89.3	88.9	88.6
–14	91.1	90.9	90.7	90.4	90.1	89.8	89.4	89.0
–16	91.2	91.3	91.2	90.9	90.6	90.2	89.8	89.4
–18	90.9	91.8	91.6	91.3	91.0	90.7	90.3	89.9
–20	90.6	91.9	92.1	91.8	91.5	91.2	90.8	90.3
–22	90.2	91.5	92.6	92.3	92.0	91.7	91.3	90.8
–24	89.9	91.2	92.5	92.6	92.4	92.2	91.9	91.3
–26	89.5	90.8	92.2	92.3	92.3	92.2	92.2	91.9
–28	89.2	90.5	91.8	91.9	91.9	91.9	91.8	92.1
–30	88.8	90.1	91.5	91.6	91.6	91.6	91.6	91.7
–32	88.4	89.8	91.1	91.2	91.2	91.2	91.3	91.3
–34	88.1	89.4	90.8	90.8	90.9	90.9	90.9	91.0
–36	87.7	89.1	90.4	90.5	90.5	90.5	90.6	90.6
–38	87.4	88.7	90.0	90.1	90.1	90.2	90.2	90.2
–40	87.0	88.3	89.7	89.7	89.8	89.8	89.8	89.9
–42								89.5

N1TABLES_TO_LO_1WG_2_BD100_08AUG03

Figure 1-18. (06-10-06 Sheet 2 of 2)

GO-AROUND THRUST SETTING TO (ALL ENGINES) ENGINE BLEED OFF

THRUST SETTING – %N1									
SAT	ALTITUDE – FT								
°C	–1000	0	1000	2000	3000	4000	5000	6000	7000
50	83.5	83.3							
48	84.1	83.9	83.7						
46	84.6	84.4	84.2	84.0					
44	85.2	85.0	84.8	84.5	84.3				
42	85.7	85.5	85.3	85.1	84.8	84.6			
40	86.2	86.0	85.8	85.6	85.4	85.1	84.9		
38	86.8	86.6	86.3	86.2	85.9	85.7	85.4	85.1	
36	87.3	87.1	86.8	86.7	86.4	86.2	86.0	85.6	85.3
34	87.6	87.6	87.3	87.1	86.9	86.7	86.5	86.1	85.8
32	87.3	88.0	87.8	87.6	87.4	87.2	86.9	86.7	86.3
30	87.0	88.2	88.2	88.0	87.8	87.6	87.4	87.2	86.9
28	86.7	87.9	88.6	88.4	88.2	88.0	87.8	87.6	87.4
26	86.4	87.6	88.9	88.7	88.6	88.5	88.2	88.1	87.9
24	86.1	87.3	88.6	89.2	89.0	89.0	88.7	88.6	88.4
22	85.8	87.0	88.3	89.6	89.5	89.5	89.3	89.1	88.9
20	85.5	86.7	88.0	89.3	89.9	89.8	89.9	89.6	89.4
18	85.2	86.4	87.7	88.9	90.2	90.2	90.2	90.2	89.9
16	84.9	86.1	87.4	88.6	89.9	90.6	90.6	90.5	90.5
14	84.6	85.8	87.1	88.3	89.6	90.7	90.8	90.8	90.8
12	84.2	85.5	86.8	88.0	89.2	90.4	91.1	91.1	91.0
10	83.9	85.2	86.4	87.7	88.9	90.1	91.3	91.3	91.3
8	83.6	84.9	86.1	87.4	88.6	89.8	90.9	91.6	91.5
6	83.3	84.6	85.8	87.1	88.3	89.4	90.6	91.8	91.8
4	83.0	84.3	85.5	86.7	87.9	89.1	90.3	91.6	92.0
2	82.7	83.9	85.2	86.4	87.6	88.8	90.0	91.2	92.3
0	82.4	83.6	84.9	86.1	87.3	88.5	89.6	90.9	92.2
–2	82.1	83.3	84.6	85.8	87.0	88.1	89.3	90.6	91.8
–4	81.8	83.0	84.2	85.5	86.7	87.8	89.0	90.2	91.5
–6	81.5	82.7	83.9	85.2	86.3	87.5	88.6	89.9	91.2
–8	81.2	82.4	83.6	84.8	86.0	87.2	88.3	89.6	90.8
–10	80.9	82.1	83.3	84.5	85.7	86.8	88.0	89.2	90.5
–12	80.6	81.8	83.0	84.2	85.4	86.5	87.6	88.9	90.1
–14	80.3	81.5	82.7	83.9	85.0	86.2	87.3	88.5	89.8
–16	80.0	81.2	82.3	83.6	84.7	85.8	87.0	88.2	89.4
–18	79.7	80.9	82.0	83.2	84.4	85.5	86.6	87.9	89.1
–20	79.3	80.6	81.7	82.9	84.1	85.2	86.3	87.5	88.8
–22	79.0	80.2	81.4	82.6	83.7	84.8	86.0	87.2	88.4
–24	78.7	79.9	81.1	82.3	83.4	84.5	85.6	86.8	88.1
–26	78.3	79.5	80.7	81.9	83.1	84.2	85.3	86.5	87.7
–28	78.0	79.2	80.4	81.6	82.8	83.9	85.0	86.2	87.4
–30	77.7	78.8	80.0	81.2	82.4	83.5	84.6	85.8	87.0
–32	77.3	78.5	79.7	80.9	82.1	83.2	84.3	85.5	86.7
–34	77.0	78.1	79.3	80.6	81.7	82.8	83.9	85.1	86.3
–36	76.6	77.8	79.0	80.2	81.4	82.5	83.6	84.8	86.0
–38	76.3	77.4	78.6	79.9	81.1	82.1	83.2	84.4	85.6
–40	75.9	77.1	78.3	79.5	80.7	81.8	82.9	84.0	85.2
–42									

N1TABLES_GAAEO_OFF_OFF_1_BD100_08AUG03

Figure 1-19. (06-10-07 Sheet 1 of 2)

GO-AROUND THRUST SETTING
TO (ALL ENGINES)
ENGINE BLEED OFF

THRUST SETTING – %N1 – (Continued)									
SAT	ALTITUDE – FT								
°C	8000	9000	10000	11000	12000	13000	14000	15000	16000
50									
48									
46									
44									
42									
40									
38									
36									
34	85.5								
32	86.0	85.7							
30	86.6	86.2	85.9						
28	87.1	86.8	86.5	86.2					
26	87.6	87.3	87.0	86.8	86.4				
24	88.2	87.9	87.6	87.4	87.1	86.7			
22	88.7	88.5	88.2	88.0	87.7	87.4	87.0		
20	89.3	89.1	88.8	88.6	88.3	88.0	87.7	87.4	
18	89.8	89.7	89.4	89.2	88.9	88.6	88.3	88.0	87.9
16	90.3	90.2	90.0	89.7	89.5	89.2	88.9	88.7	88.5
14	90.7	90.6	90.5	90.3	90.0	89.7	89.4	89.2	89.1
12	91.0	91.0	90.9	90.7	90.6	90.3	90.0	89.7	89.6
10	91.3	91.2	91.2	91.1	91.0	90.8	90.5	90.2	90.1
8	91.5	91.5	91.5	91.4	91.3	91.2	91.0	90.7	90.5
6	91.8	91.8	91.8	91.7	91.6	91.5	91.3	91.2	90.9
4	92.0	92.0	92.0	91.9	91.8	91.7	91.6	91.5	91.3
2	92.2	92.2	92.2	92.2	92.1	92.0	91.9	91.8	91.7
0	92.5	92.4	92.4	92.4	92.3	92.2	92.1	92.0	91.9
–2	92.7	92.7	92.6	92.6	92.5	92.5	92.4	92.3	92.2
–4	92.7	92.7	92.6	92.6	92.5	92.5	92.4	92.4	92.4
–6	92.4	92.7	92.6	92.6	92.5	92.5	92.4	92.4	92.7
–8	92.1	92.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–10	91.7	92.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–12	91.4	92.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–14	91.1	92.3	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–16	90.7	92.0	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–18	90.4	91.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–20	90.0	91.3	92.6	92.6	92.5	92.5	92.4	92.4	92.8
–22	89.7	90.9	92.2	92.3	92.3	92.3	92.3	92.4	92.4
–24	89.3	90.6	91.9	92.0	92.0	91.9	91.9	92.1	92.0
–26	89.0	90.2	91.5	91.6	91.6	91.5	91.5	91.7	91.7
–28	88.6	89.9	91.2	91.2	91.3	91.2	91.1	91.3	91.3
–30	88.3	89.5	90.8	90.9	90.9	90.9	90.8	91.0	91.0
–32	87.9	89.2	90.4	90.5	90.6	90.5	90.6	90.6	90.6
–34	87.6	88.8	90.1	90.2	90.2	90.2	90.2	90.3	90.2
–36	87.2	88.5	89.7	89.8	89.8	89.8	89.8	89.9	89.8
–38	86.8	88.1	89.4	89.4	89.5	89.5	89.5	89.5	89.4
–40	86.5	87.7	89.0	89.1	89.1	89.1	89.1	89.2	89.0
–42								88.8	88.7

N1TABLES GAAEO_OFF_OFF_2_BD100_08AUG03

Figure 1-19. (06-10-07 Sheet 2 of 2)

GO-AROUND THRUST SETTING
TO (ALL ENGINES)
ENGINE BLEED OFF, ENGINE A/I ON

THRUST SETTING – %N1									
SAT °C	ALTITUDE – FT								
	–1000	0	1000	2000	3000	4000	5000	6000	7000
10	83.9	85.2	86.4	87.7	88.9	90.1	90.9	90.9	90.8
8	83.6	84.9	86.1	87.4	88.6	89.8	90.9	91.1	91.1
6	83.3	84.6	85.8	87.1	88.3	89.4	90.6	91.4	91.3
4	83.0	84.3	85.5	86.7	87.9	89.1	90.3	91.6	91.6
2	82.7	83.9	85.2	86.4	87.6	88.8	90.0	91.2	91.8
0	82.4	83.6	84.9	86.1	87.3	88.5	89.6	90.9	92.1
–2	82.1	83.3	84.6	85.8	87.0	88.1	89.3	90.6	91.8
–4	81.8	83.0	84.2	85.5	86.7	87.8	89.0	90.2	91.5
–6	81.5	82.7	83.9	85.2	86.3	87.5	88.6	89.9	91.2
–8	81.2	82.4	83.6	84.8	86.0	87.2	88.3	89.6	90.8
–10	80.9	82.1	83.3	84.5	85.7	86.8	88.0	89.2	90.5
–12	80.6	81.8	83.0	84.2	85.4	86.5	87.6	88.9	90.1
–14	80.3	81.5	82.7	83.9	85.0	86.2	87.3	88.5	89.8
–16	80.0	81.2	82.3	83.6	84.7	85.8	87.0	88.2	89.4
–18	79.7	80.9	82.0	83.2	84.4	85.5	86.6	87.9	89.1
–20	79.3	80.6	81.7	82.9	84.1	85.2	86.3	87.5	88.8
–22	79.0	80.2	81.4	82.6	83.7	84.8	86.0	87.2	88.4
–24	78.7	79.9	81.1	82.3	83.4	84.5	85.6	86.8	88.1
–26	78.3	79.5	80.7	81.9	83.1	84.2	85.3	86.5	87.7
–28	78.0	79.2	80.4	81.6	82.8	83.9	85.0	86.2	87.4
–30	77.7	78.8	80.0	81.2	82.4	83.5	84.6	85.8	87.0
–32	77.3	78.5	79.7	80.9	82.1	83.2	84.3	85.5	86.7
–34	77.0	78.1	79.3	80.6	81.7	82.8	83.9	85.1	86.3
–36	76.6	77.8	79.0	80.2	81.4	82.5	83.6	84.8	86.0
–38	76.3	77.4	78.6	79.9	81.1	82.1	83.2	84.4	85.6
–40	75.9	77.1	78.3	79.5	80.7	81.8	82.9	84.0	85.2
–42									

N1TABLES_GAAEO_OFF_ENG_1_BD100_08AUG03

Figure 1-20. (06-10-08 Sheet 1 of 2)

GO-AROUND THRUST SETTING
TO (ALL ENGINES)
ENGINE BLEED OFF, ENGINE A/I ON

THRUST SETTING – %N1 – (Continued)									
SAT	ALTITUDE – FT								
°C	8000	9000	10000	11000	12000	13000	14000	15000	16000
10	90.8	90.8	90.8	90.6	90.4	90.2	89.9	89.6	89.3
8	91.1	91.1	91.0	90.9	90.7	90.6	90.4	90.1	89.8
6	91.3	91.3	91.3	91.2	91.0	90.9	90.8	90.6	90.2
4	91.6	91.5	91.5	91.4	91.3	91.2	91.0	90.9	90.6
2	91.8	91.8	91.8	91.7	91.5	91.4	91.3	91.2	90.9
0	92.0	92.0	92.0	91.9	91.8	91.7	91.6	91.4	91.2
–2	92.3	92.2	92.2	92.2	92.1	91.9	91.8	91.7	91.4
–4	92.6	92.5	92.4	92.4	92.3	92.2	92.1	91.9	91.7
–6	92.4	92.7	92.6	92.6	92.5	92.5	92.4	92.3	92.0
–8	92.1	92.7	92.6	92.6	92.5	92.5	92.4	92.4	92.3
–10	91.7	92.7	92.6	92.6	92.5	92.5	92.4	92.4	92.7
–12	91.4	92.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–14	91.1	92.3	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–16	90.7	92.0	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–18	90.4	91.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–20	90.0	91.3	92.6	92.6	92.5	92.5	92.4	92.4	92.8
–22	89.7	90.9	92.2	92.3	92.3	92.3	92.3	92.4	92.4
–24	89.3	90.6	91.9	92.0	92.0	91.9	91.9	92.1	92.0
–26	89.0	90.2	91.5	91.6	91.6	91.5	91.5	91.7	91.7
–28	88.6	89.9	91.2	91.2	91.3	91.2	91.1	91.3	91.3
–30	88.3	89.5	90.8	90.9	90.9	90.9	90.8	91.0	91.0
–32	87.9	89.2	90.4	90.5	90.6	90.5	90.6	90.6	90.6
–34	87.6	88.8	90.1	90.2	90.2	90.2	90.2	90.3	90.2
–36	87.2	88.5	89.7	89.8	89.8	89.8	89.8	89.9	89.8
–38	86.8	88.1	89.4	89.4	89.5	89.5	89.5	89.5	89.4
–40	86.5	87.7	89.0	89.1	89.1	89.1	89.1	89.2	89.0
–42								88.8	88.7

N1TABLES_GAAEO_OFF_ENG_2_BD100_08AUG03

Figure 1-20. (06-10-08 Sheet 2 of 2)

GO-AROUND THRUST SETTING TO (ALL ENGINES) ENGINE BLEED OFF, ENGINE AND WING A/I ON

THRUST SETTING – %N1									
SAT °C	ALTITUDE – FT								
	–1000	0	1000	2000	3000	4000	5000	6000	7000
10	83.9	85.2	86.4	87.7	87.7	87.4	87.2	87.1	86.9
8	83.6	84.9	86.1	87.4	87.9	87.8	87.5	87.4	87.2
6	83.3	84.6	85.8	87.1	88.2	88.0	87.8	87.7	87.5
4	83.0	84.3	85.5	86.7	87.9	88.3	88.2	88.0	87.8
2	82.7	83.9	85.2	86.4	87.6	88.6	88.5	88.3	88.2
0	82.4	83.6	84.9	86.1	87.3	88.5	88.8	88.7	88.5
–2	82.1	83.3	84.6	85.8	87.0	88.1	89.3	89.0	88.9
–4	81.8	83.0	84.2	85.5	86.7	87.8	89.0	89.5	89.2
–6	81.5	82.7	83.9	85.2	86.3	87.5	88.6	89.9	89.8
–8	81.2	82.4	83.6	84.8	86.0	87.2	88.3	89.6	90.2
–10	80.9	82.1	83.3	84.5	85.7	86.8	88.0	89.2	90.5
–12	80.6	81.8	83.0	84.2	85.4	86.5	87.6	88.9	90.1
–14	80.3	81.5	82.7	83.9	85.0	86.2	87.3	88.5	89.8
–16	80.0	81.2	82.3	83.6	84.7	85.8	87.0	88.2	89.4
–18	79.7	80.9	82.0	83.2	84.4	85.5	86.6	87.9	89.1
–20	79.3	80.6	81.7	82.9	84.1	85.2	86.3	87.5	88.8
–22	79.0	80.2	81.4	82.6	83.7	84.8	86.0	87.2	88.4
–24	78.7	79.9	81.1	82.3	83.4	84.5	85.6	86.8	88.1
–26	78.3	79.5	80.7	81.9	83.1	84.2	85.3	86.5	87.7
–28	78.0	79.2	80.4	81.6	82.8	83.9	85.0	86.2	87.4
–30	77.7	78.8	80.0	81.2	82.4	83.5	84.6	85.8	87.0
–32	77.3	78.5	79.7	80.9	82.1	83.2	84.3	85.5	86.7
–34	77.0	78.1	79.3	80.6	81.7	82.8	83.9	85.1	86.3
–36	76.6	77.8	79.0	80.2	81.4	82.5	83.6	84.8	86.0
–38	76.3	77.4	78.6	79.9	81.1	82.1	83.2	84.4	85.6
–40	75.9	77.1	78.3	79.5	80.7	81.8	82.9	84.0	85.2
–42									

N1TABLES_GAAEO_OFF_1WG_1_BD100_08AUG03

Figure 1-21. (06-10-09 Sheet 1 of 2)

GO-AROUND THRUST SETTING
TO (ALL ENGINES)
ENGINE BLEED OFF, ENGINE AND WING A/I ON

THRUST SETTING – %N1 – (Continued)									
SAT °C	ALTITUDE – FT								
	8000	9000	10000	11000	12000	13000	14000	15000	16000
10	86.7	86.4	86.1	85.7	85.2	84.8	84.3	83.9	83.3
8	87.1	86.9	86.6	86.2	85.7	85.3	84.9	84.4	83.9
6	87.4	87.3	87.1	86.7	86.2	85.8	85.4	85.0	84.5
4	87.7	87.6	87.5	87.1	86.7	86.3	85.9	85.5	85.1
2	88.0	87.9	87.8	87.6	87.2	86.8	86.4	86.0	85.6
0	88.3	88.2	88.1	87.9	87.6	87.3	86.9	86.5	86.1
–2	88.7	88.6	88.4	88.3	88.0	87.7	87.4	87.0	86.5
–4	89.1	89.0	88.8	88.6	88.4	88.1	87.8	87.4	87.1
–6	89.5	89.4	89.2	89.0	88.8	88.5	88.1	87.7	87.5
–8	90.0	89.8	89.7	89.4	89.2	88.8	88.4	88.1	87.8
–10	90.5	90.3	90.1	89.9	89.6	89.2	88.8	88.4	88.2
–12	91.0	90.8	90.6	90.3	89.9	89.6	89.1	88.8	88.6
–14	91.1	91.3	91.1	90.7	90.3	90.0	89.6	89.2	88.9
–16	90.7	91.7	91.5	91.1	90.8	90.4	90.0	89.6	89.3
–18	90.4	91.7	91.9	91.6	91.2	90.8	90.4	90.1	89.8
–20	90.0	91.3	92.4	92.0	91.7	91.3	90.9	90.5	90.2
–22	89.7	90.9	92.2	92.3	92.1	91.8	91.4	90.9	90.7
–24	89.3	90.6	91.9	92.0	92.0	91.9	91.9	91.4	91.1
–26	89.0	90.2	91.5	91.6	91.6	91.5	91.5	91.7	91.6
–28	88.6	89.9	91.2	91.2	91.3	91.2	91.1	91.3	91.3
–30	88.3	89.5	90.8	90.9	90.9	90.9	90.8	91.0	91.0
–32	87.9	89.2	90.4	90.5	90.6	90.5	90.6	90.6	90.6
–34	87.6	88.8	90.1	90.2	90.2	90.2	90.2	90.3	90.2
–36	87.2	88.5	89.7	89.8	89.8	89.8	89.8	89.9	89.8
–38	86.8	88.1	89.4	89.4	89.5	89.5	89.5	89.5	89.4
–40	86.5	87.7	89.0	89.1	89.1	89.1	89.1	89.2	89.0
–42								88.8	88.7

N1TABLES_GAAEO_OFF_1WG_2_BD100_08AUG03

Figure 1-21. (06-10-09 Sheet 2 of 2)

GO-AROUND THRUST SETTING TO (ALL ENGINES) ENGINE BLEED ON

THRUST SETTING – %N1									
SAT °C	ALTITUDE – FT								
	–1000	0	1000	2000	3000	4000	5000	6000	7000
50	83.1	82.8							
48	83.7	83.4	83.2						
46	84.2	84.0	83.7	83.5					
44	84.7	84.5	84.3	84.1	83.8				
42	85.2	85.0	84.8	84.6	84.3	84.1			
40	85.8	85.6	85.3	85.1	84.9	84.6	84.3		
38	86.4	86.1	85.9	85.7	85.4	85.2	84.9	84.5	
36	86.9	86.6	86.4	86.2	85.9	85.7	85.4	85.1	84.7
34	87.3	87.1	86.9	86.7	86.4	86.2	85.9	85.6	85.2
32	87.3	87.5	87.3	87.1	86.9	86.7	86.4	86.1	85.8
30	87.0	87.9	87.7	87.5	87.3	87.1	86.9	86.6	86.3
28	86.7	87.9	88.1	87.9	87.8	87.5	87.3	87.1	86.8
26	86.4	87.6	88.5	88.2	88.1	88.0	87.7	87.6	87.3
24	86.1	87.3	88.6	88.7	88.5	88.5	88.2	88.0	87.9
22	85.8	87.0	88.3	89.1	89.0	89.0	88.8	88.5	88.4
20	85.5	86.7	88.0	89.3	89.4	89.3	89.4	89.1	88.9
18	85.2	86.4	87.7	88.9	89.8	89.7	89.7	89.7	89.4
16	84.9	86.1	87.4	88.6	89.9	90.1	90.0	90.0	89.9
14	84.6	85.8	87.1	88.3	89.6	90.3	90.3	90.3	90.2
12	84.2	85.5	86.8	88.0	89.2	90.4	90.6	90.5	90.5
10	83.9	85.2	86.4	87.7	88.9	90.1	90.8	90.8	90.8
8	83.6	84.9	86.1	87.4	88.6	89.8	90.9	91.0	91.0
6	83.3	84.6	85.8	87.1	88.3	89.4	90.6	91.3	91.2
4	83.0	84.3	85.5	86.7	87.9	89.1	90.3	91.5	91.5
2	82.7	83.9	85.2	86.4	87.6	88.8	90.0	91.2	91.7
0	82.4	83.6	84.9	86.1	87.3	88.5	89.6	90.9	92.0
–2	82.1	83.3	84.6	85.8	87.0	88.1	89.3	90.6	91.8
–4	81.8	83.0	84.2	85.5	86.7	87.8	89.0	90.2	91.5
–6	81.5	82.7	83.9	85.2	86.3	87.5	88.6	89.9	91.2
–8	81.2	82.4	83.6	84.8	86.0	87.2	88.3	89.6	90.8
–10	80.9	82.1	83.3	84.5	85.7	86.8	88.0	89.2	90.5
–12	80.6	81.8	83.0	84.2	85.4	86.5	87.6	88.9	90.1
–14	80.3	81.5	82.7	83.9	85.0	86.2	87.3	88.5	89.8
–16	80.0	81.2	82.3	83.6	84.7	85.8	87.0	88.2	89.4
–18	79.7	80.9	82.0	83.2	84.4	85.5	86.6	87.9	89.1
–20	79.3	80.6	81.7	82.9	84.1	85.2	86.3	87.5	88.8
–22	79.0	80.2	81.4	82.6	83.7	84.8	86.0	87.2	88.4
–24	78.7	79.9	81.1	82.3	83.4	84.5	85.6	86.8	88.1
–26	78.3	79.5	80.7	81.9	83.1	84.2	85.3	86.5	87.7
–28	78.0	79.2	80.4	81.6	82.8	83.9	85.0	86.2	87.4
–30	77.7	78.8	80.0	81.2	82.4	83.5	84.6	85.8	87.0
–32	77.3	78.5	79.7	80.9	82.1	83.2	84.3	85.5	86.7
–34	77.0	78.1	79.3	80.6	81.7	82.8	83.9	85.1	86.3
–36	76.6	77.8	79.0	80.2	81.4	82.5	83.6	84.8	86.0
–38	76.3	77.4	78.6	79.9	81.1	82.1	83.2	84.4	85.6
–40	75.9	77.1	78.3	79.5	80.7	81.8	82.9	84.0	85.2
–42									

NITABLES_GAAEO_LO_OFF_1_BD100_08AUG03

Figure 1-22. (06-10-10 Sheet 1 of 2)

GO-AROUND THRUST SETTING
TO (ALL ENGINES)
ENGINE BLEED ON

THRUST SETTING – %N1 – (Continued)									
SAT	ALTITUDE – FT								
°C	8000	9000	10000	11000	12000	13000	14000	15000	16000
50									
48									
46									
44									
42									
40									
38									
36									
34	84.9								
32	85.4	85.1							
30	86.0	85.7	85.3						
28	86.5	86.2	85.9	85.6					
26	87.1	86.8	86.4	86.2	85.8				
24	87.6	87.3	87.0	86.7	86.4	86.1			
22	88.2	87.9	87.6	87.3	87.1	86.7	86.4		
20	88.7	88.5	88.2	87.9	87.7	87.4	87.0	86.7	
18	89.2	89.1	88.8	88.6	88.3	88.0	87.7	87.3	87.2
16	89.7	89.6	89.4	89.1	88.9	88.5	88.2	88.0	87.7
14	90.2	90.0	89.9	89.7	89.4	89.1	88.8	88.5	88.3
12	90.4	90.4	90.3	90.1	89.9	89.6	89.3	89.1	88.8
10	90.7	90.7	90.6	90.5	90.3	90.2	89.8	89.6	89.3
8	91.0	90.9	90.9	90.8	90.7	90.5	90.3	90.0	89.8
6	91.2	91.2	91.2	91.1	91.0	90.8	90.7	90.5	90.2
4	91.4	91.4	91.4	91.3	91.2	91.1	91.0	90.8	90.6
2	91.7	91.7	91.6	91.6	91.4	91.3	91.2	91.1	90.9
0	91.9	91.9	91.9	91.8	91.7	91.6	91.5	91.4	91.2
–2	92.2	92.1	92.1	92.1	92.0	91.9	91.7	91.6	91.4
–4	92.5	92.4	92.3	92.3	92.3	92.2	92.0	91.9	91.7
–6	92.4	92.7	92.6	92.6	92.5	92.5	92.3	92.2	92.0
–8	92.1	92.7	92.6	92.6	92.5	92.5	92.4	92.4	92.3
–10	91.7	92.7	92.6	92.6	92.5	92.5	92.4	92.4	92.7
–12	91.4	92.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–14	91.1	92.3	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–16	90.7	92.0	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–18	90.4	91.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–20	90.0	91.3	92.6	92.6	92.5	92.5	92.4	92.4	92.8
–22	89.7	90.9	92.2	92.3	92.3	92.3	92.3	92.4	92.4
–24	89.3	90.6	91.9	92.0	92.0	91.9	91.9	92.1	92.0
–26	89.0	90.2	91.5	91.6	91.6	91.5	91.5	91.7	91.7
–28	88.6	89.9	91.2	91.2	91.3	91.2	91.1	91.3	91.3
–30	88.3	89.5	90.8	90.9	90.9	90.9	90.8	91.0	91.0
–32	87.9	89.2	90.4	90.5	90.6	90.5	90.6	90.6	90.6
–34	87.6	88.8	90.1	90.2	90.2	90.2	90.2	90.3	90.2
–36	87.2	88.5	89.7	89.8	89.8	89.8	89.8	89.9	89.8
–38	86.8	88.1	89.4	89.4	89.5	89.5	89.5	89.5	89.4
–40	86.5	87.7	89.0	89.1	89.1	89.1	89.1	89.2	89.0
–42								88.8	88.7

NITABLES_GAAEO_LO_OFF_2_BD100_08AUG03

Figure 1-22. (06-10-10 Sheet 2 of 2)

GO-AROUND THRUST SETTING
TO (ALL ENGINES)
ENGINE BLEED ON, ENGINE A/I ON

THRUST SETTING – %N1									
SAT °C	ALTITUDE – FT								
	–1000	0	1000	2000	3000	4000	5000	6000	7000
10	83.9	85.2	86.4	87.7	88.9	90.1	90.4	90.3	90.3
8	83.6	84.9	86.1	87.4	88.6	89.8	90.7	90.6	90.6
6	83.3	84.6	85.8	87.1	88.3	89.4	90.6	90.9	90.8
4	83.0	84.3	85.5	86.7	87.9	89.1	90.3	91.1	91.0
2	82.7	83.9	85.2	86.4	87.6	88.8	90.0	91.2	91.3
0	82.4	83.6	84.9	86.1	87.3	88.5	89.6	90.9	91.5
–2	82.1	83.3	84.6	85.8	87.0	88.1	89.3	90.6	91.8
–4	81.8	83.0	84.2	85.5	86.7	87.8	89.0	90.2	91.5
–6	81.5	82.7	83.9	85.2	86.3	87.5	88.6	89.9	91.2
–8	81.2	82.4	83.6	84.8	86.0	87.2	88.3	89.6	90.8
–10	80.9	82.1	83.3	84.5	85.7	86.8	88.0	89.2	90.5
–12	80.6	81.8	83.0	84.2	85.4	86.5	87.6	88.9	90.1
–14	80.3	81.5	82.7	83.9	85.0	86.2	87.3	88.5	89.8
–16	80.0	81.2	82.3	83.6	84.7	85.8	87.0	88.2	89.4
–18	79.7	80.9	82.0	83.2	84.4	85.5	86.6	87.9	89.1
–20	79.3	80.6	81.7	82.9	84.1	85.2	86.3	87.5	88.8
–22	79.0	80.2	81.4	82.6	83.7	84.8	86.0	87.2	88.4
–24	78.7	79.9	81.1	82.3	83.4	84.5	85.6	86.8	88.1
–26	78.3	79.5	80.7	81.9	83.1	84.2	85.3	86.5	87.7
–28	78.0	79.2	80.4	81.6	82.8	83.9	85.0	86.2	87.4
–30	77.7	78.8	80.0	81.2	82.4	83.5	84.6	85.8	87.0
–32	77.3	78.5	79.7	80.9	82.1	83.2	84.3	85.5	86.7
–34	77.0	78.1	79.3	80.6	81.7	82.8	83.9	85.1	86.3
–36	76.6	77.8	79.0	80.2	81.4	82.5	83.6	84.8	86.0
–38	76.3	77.4	78.6	79.9	81.1	82.1	83.2	84.4	85.6
–40	75.9	77.1	78.3	79.5	80.7	81.8	82.9	84.0	85.2
–42									

N1TABLES_GAAEO_LO_ENG_1_BD100_08AUG03

Figure 1-23. (06-10-11 Sheet 1 of 2)

GO-AROUND THRUST SETTING
TO (ALL ENGINES)
ENGINE BLEED ON, ENGINE A/I ON

THRUST SETTING – %N1 – (Continued)									
SAT °C	ALTITUDE – FT								
	8000	9000	10000	11000	12000	13000	14000	15000	16000
10	90.3	90.2	90.2	89.9	89.8	89.6	89.2	88.9	88.6
8	90.5	90.5	90.4	90.3	90.1	90.0	89.8	89.4	89.0
6	90.8	90.8	90.7	90.6	90.4	90.3	90.1	89.9	89.4
4	91.0	91.0	91.0	90.8	90.7	90.5	90.4	90.2	89.8
2	91.2	91.2	91.2	91.1	90.9	90.8	90.7	90.5	90.2
0	91.5	91.4	91.4	91.3	91.2	91.0	90.9	90.8	90.4
–2	91.8	91.7	91.6	91.6	91.4	91.3	91.2	91.0	90.7
–4	92.0	92.0	91.8	91.8	91.7	91.6	91.5	91.3	91.0
–6	92.3	92.3	92.2	92.1	92.0	91.9	91.8	91.6	91.2
–8	92.1	92.6	92.6	92.4	92.3	92.2	92.1	91.9	91.6
–10	91.7	92.7	92.6	92.6	92.5	92.5	92.4	92.3	91.9
–12	91.4	92.7	92.6	92.6	92.5	92.5	92.4	92.4	92.3
–14	91.1	92.3	92.6	92.6	92.5	92.5	92.4	92.4	92.7
–16	90.7	92.0	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–18	90.4	91.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–20	90.0	91.3	92.6	92.6	92.5	92.5	92.4	92.4	92.8
–22	89.7	90.9	92.2	92.3	92.3	92.3	92.3	92.4	92.4
–24	89.3	90.6	91.9	92.0	92.0	91.9	91.9	92.1	92.0
–26	89.0	90.2	91.5	91.6	91.6	91.5	91.5	91.7	91.7
–28	88.6	89.9	91.2	91.2	91.3	91.2	91.1	91.3	91.3
–30	88.3	89.5	90.8	90.9	90.9	90.9	90.8	91.0	91.0
–32	87.9	89.2	90.4	90.5	90.6	90.5	90.6	90.6	90.6
–34	87.6	88.8	90.1	90.2	90.2	90.2	90.2	90.3	90.2
–36	87.2	88.5	89.7	89.8	89.8	89.8	89.8	89.9	89.8
–38	86.8	88.1	89.4	89.4	89.5	89.5	89.5	89.5	89.4
–40	86.5	87.7	89.0	89.1	89.1	89.1	89.1	89.2	89.0
–42								88.8	88.7

N1TABLES_GAAEO_LO_ENG_2_BD100_08AUG03

Figure 1-23. (06-10-11 Sheet 2 of 2)

GO-AROUND THRUST SETTING
TO (ALL ENGINES)
ENGINE BLEED ON, ENGINE AND WING A/I ON

THRUST SETTING – %N1									
SAT °C	ALTITUDE – FT								
	–1000	0	1000	2000	3000	4000	5000	6000	7000
10	83.9	85.2	86.4	87.3	87.2	86.9	86.7	86.6	86.4
8	83.6	84.9	86.1	87.4	87.4	87.3	87.0	86.9	86.7
6	83.3	84.6	85.8	87.1	87.7	87.6	87.3	87.2	87.0
4	83.0	84.3	85.5	86.7	87.9	87.8	87.7	87.5	87.3
2	82.7	83.9	85.2	86.4	87.6	88.1	88.0	87.8	87.6
0	82.4	83.6	84.9	86.1	87.3	88.5	88.3	88.1	88.0
–2	82.1	83.3	84.6	85.8	87.0	88.1	88.8	88.5	88.3
–4	81.8	83.0	84.2	85.5	86.7	87.8	89.0	89.0	88.7
–6	81.5	82.7	83.9	85.2	86.3	87.5	88.6	89.5	89.2
–8	81.2	82.4	83.6	84.8	86.0	87.2	88.3	89.6	89.7
–10	80.9	82.1	83.3	84.5	85.7	86.8	88.0	89.2	90.2
–12	80.6	81.8	83.0	84.2	85.4	86.5	87.6	88.9	90.1
–14	80.3	81.5	82.7	83.9	85.0	86.2	87.3	88.5	89.8
–16	80.0	81.2	82.3	83.6	84.7	85.8	87.0	88.2	89.4
–18	79.7	80.9	82.0	83.2	84.4	85.5	86.6	87.9	89.1
–20	79.3	80.6	81.7	82.9	84.1	85.2	86.3	87.5	88.8
–22	79.0	80.2	81.4	82.6	83.7	84.8	86.0	87.2	88.4
–24	78.7	79.9	81.1	82.3	83.4	84.5	85.6	86.8	88.1
–26	78.3	79.5	80.7	81.9	83.1	84.2	85.3	86.5	87.7
–28	78.0	79.2	80.4	81.6	82.8	83.9	85.0	86.2	87.4
–30	77.7	78.8	80.0	81.2	82.4	83.5	84.6	85.8	87.0
–32	77.3	78.5	79.7	80.9	82.1	83.2	84.3	85.5	86.7
–34	77.0	78.1	79.3	80.6	81.7	82.8	83.9	85.1	86.3
–36	76.6	77.8	79.0	80.2	81.4	82.5	83.6	84.8	86.0
–38	76.3	77.4	78.6	79.9	81.1	82.1	83.2	84.4	85.6
–40	75.9	77.1	78.3	79.5	80.7	81.8	82.9	84.0	85.2
–42									

NITABLES_GAAEO_LO_1WG_1_BD100_08AUG03

Figure 1-24. (06-10-12 Sheet 1 of 2)

GO-AROUND THRUST SETTING
TO (ALL ENGINES)
ENGINE BLEED ON, ENGINE AND WING A/I ON

THRUST SETTING – %N1 – (Continued)									
SAT °C	ALTITUDE – FT								
	8000	9000	10000	11000	12000	13000	14000	15000	16000
10	86.2	85.9	85.5	85.0	84.6	84.1	83.7	83.2	82.5
8	86.6	86.3	86.0	85.6	85.1	84.7	84.2	83.8	83.1
6	86.9	86.7	86.5	86.1	85.6	85.2	84.7	84.3	83.7
4	87.2	87.0	86.9	86.5	86.1	85.7	85.2	84.8	84.3
2	87.5	87.4	87.2	86.9	86.6	86.2	85.7	85.3	84.8
0	87.8	87.7	87.5	87.3	87.0	86.7	86.2	85.8	85.3
–2	88.2	88.0	87.9	87.7	87.4	87.1	86.7	86.3	85.8
–4	88.6	88.4	88.2	88.0	87.8	87.5	87.1	86.7	86.3
–6	89.0	88.8	88.7	88.4	88.2	87.9	87.5	87.1	86.7
–8	89.5	89.2	89.1	88.8	88.6	88.2	87.8	87.4	87.1
–10	90.0	89.7	89.5	89.3	88.9	88.5	88.2	87.8	87.4
–12	90.5	90.2	90.0	89.7	89.3	88.9	88.5	88.2	87.8
–14	90.9	90.7	90.5	90.1	89.7	89.3	88.9	88.5	88.2
–16	90.7	91.2	90.9	90.6	90.2	89.8	89.3	89.0	88.6
–18	90.4	91.6	91.4	91.0	90.6	90.2	89.8	89.4	89.1
–20	90.0	91.3	91.8	91.4	91.1	90.7	90.3	89.8	89.5
–22	89.7	90.9	92.2	91.9	91.5	91.2	90.8	90.3	90.0
–24	89.3	90.6	91.9	92.0	92.0	91.7	91.3	90.7	90.4
–26	89.0	90.2	91.5	91.6	91.6	91.5	91.5	91.3	90.9
–28	88.6	89.9	91.2	91.2	91.3	91.2	91.1	91.3	91.3
–30	88.3	89.5	90.8	90.9	90.9	90.9	90.8	91.0	91.0
–32	87.9	89.2	90.4	90.5	90.6	90.5	90.6	90.6	90.6
–34	87.6	88.8	90.1	90.2	90.2	90.2	90.2	90.3	90.2
–36	87.2	88.5	89.7	89.8	89.8	89.8	89.8	89.9	89.8
–38	86.8	88.1	89.4	89.4	89.5	89.5	89.5	89.5	89.4
–40	86.5	87.7	89.0	89.1	89.1	89.1	89.1	89.2	89.0
–42								88.8	88.7

NITABLES_GAAEO_LO_1WG_2_BD100_08AUG03

Figure 1-24. (06-10-12 Sheet 2 of 2)

GO-AROUND THRUST SETTING
APR (SINGLE ENGINE)
ENGINE BLEED OFF

THRUST SETTING – %N1									
SAT	ALTITUDE – FT								
°C	–1000	0	1000	2000	3000	4000	5000	6000	7000
50	86.0	85.7							
48	86.6	86.3	86.1						
46	87.1	86.9	86.7	86.4					
44	87.5	87.4	87.2	87.0	86.7				
42	87.9	87.8	87.7	87.6	87.3	87.0			
40	88.2	88.2	88.2	88.1	87.8	87.5	87.3		
38	88.1	88.5	88.6	88.5	88.3	88.0	87.8	87.5	
36	87.8	88.8	88.9	88.9	88.7	88.5	88.2	88.0	87.7
34	87.6	88.8	89.2	89.2	89.2	88.9	88.7	88.5	88.2
32	87.3	88.5	89.5	89.6	89.5	89.4	89.1	89.0	88.7
30	87.0	88.2	89.5	89.9	89.9	89.8	89.6	89.5	89.3
28	86.7	87.9	89.2	90.2	90.2	90.2	90.0	89.9	89.8
26	86.4	87.6	88.9	90.2	90.5	90.5	90.4	90.3	90.3
24	86.1	87.3	88.6	89.9	90.8	90.8	90.8	90.7	90.6
22	85.8	87.0	88.3	89.6	90.8	91.0	91.0	91.0	90.9
20	85.5	86.7	88.0	89.3	90.5	91.3	91.3	91.3	91.2
18	85.2	86.4	87.7	88.9	90.2	91.4	91.6	91.5	91.5
16	84.9	86.1	87.4	88.6	89.9	91.1	91.9	91.8	91.8
14	84.6	85.8	87.1	88.3	89.6	90.7	91.9	92.1	92.0
12	84.2	85.5	86.8	88.0	89.2	90.4	91.6	92.3	92.3
10	83.9	85.2	86.4	87.7	88.9	90.1	91.3	92.5	92.5
8	83.6	84.9	86.1	87.4	88.6	89.8	90.9	92.2	92.8
6	83.3	84.6	85.8	87.1	88.3	89.4	90.6	91.9	92.8
4	83.0	84.3	85.5	86.7	87.9	89.1	90.3	91.6	92.8
2	82.7	83.9	85.2	86.4	87.6	88.8	90.0	91.2	92.5
0	82.4	83.6	84.9	86.1	87.3	88.5	89.6	90.9	92.2
–2	82.1	83.3	84.6	85.8	87.0	88.1	89.3	90.6	91.8
–4	81.8	83.0	84.2	85.5	86.7	87.8	89.0	90.2	91.5
–6	81.5	82.7	83.9	85.2	86.3	87.5	88.6	89.9	91.2
–8	81.2	82.4	83.6	84.8	86.0	87.2	88.3	89.6	90.8
–10	80.9	82.1	83.3	84.5	85.7	86.8	88.0	89.2	90.5
–12	80.6	81.8	83.0	84.2	85.4	86.5	87.6	88.9	90.1
–14	80.3	81.5	82.7	83.9	85.0	86.2	87.3	88.5	89.8
–16	80.0	81.2	82.3	83.6	84.7	85.8	87.0	88.2	89.4
–18	79.7	80.9	82.0	83.2	84.4	85.5	86.6	87.9	89.1
–20	79.3	80.6	81.7	82.9	84.1	85.2	86.3	87.5	88.8
–22	79.0	80.2	81.4	82.6	83.7	84.8	86.0	87.2	88.4
–24	78.7	79.9	81.1	82.3	83.4	84.5	85.6	86.8	88.1
–26	78.3	79.5	80.7	81.9	83.1	84.2	85.3	86.5	87.7
–28	78.0	79.2	80.4	81.6	82.8	83.9	85.0	86.2	87.4
–30	77.7	78.8	80.0	81.2	82.4	83.5	84.6	85.8	87.0
–32	77.3	78.5	79.7	80.9	82.1	83.2	84.3	85.5	86.7
–34	77.0	78.1	79.3	80.6	81.7	82.8	83.9	85.1	86.3
–36	76.6	77.8	79.0	80.2	81.4	82.5	83.6	84.8	86.0
–38	76.3	77.4	78.6	79.9	81.1	82.1	83.2	84.4	85.6
–40	75.9	77.1	78.3	79.5	80.7	81.8	82.9	84.0	85.2
–42									

N1TABLES_GAOEI_OFF_OFF_1_BD100_08AUG03

Figure 1-25. (06-10-13 Sheet 1 of 2)

GO-AROUND THRUST SETTING
APR (SINGLE ENGINE)
ENGINE BLEED OFF

THRUST SETTING – %N1 – (Continued)									
SAT	ALTITUDE – FT								
°C	8000	9000	10000	11000	12000	13000	14000	15000	16000
50									
48									
46									
44									
42									
40									
38									
36									
34	87.9								
32	88.5	88.2							
30	89.0	88.7	88.4						
28	89.6	89.3	89.0	88.8					
26	90.1	89.9	89.7	89.4	89.1				
24	90.6	90.4	90.2	90.0	89.7	89.4			
22	90.9	90.9	90.7	90.5	90.3	90.0	89.7		
20	91.2	91.2	91.2	90.9	90.8	90.6	90.2	90.0	
18	91.5	91.4	91.4	91.3	91.2	91.0	90.8	90.5	90.3
16	91.7	91.7	91.7	91.6	91.5	91.3	91.2	91.0	90.8
14	92.0	92.0	91.9	91.9	91.8	91.7	91.5	91.4	91.2
12	92.2	92.2	92.2	92.1	92.1	91.9	91.8	91.7	91.6
10	92.5	92.5	92.5	92.4	92.3	92.2	92.1	92.0	91.9
8	92.7	92.7	92.6	92.6	92.5	92.5	92.4	92.3	92.2
6	92.7	92.7	92.6	92.6	92.5	92.5	92.4	92.4	92.4
4	92.7	92.7	92.6	92.6	92.5	92.5	92.4	92.4	92.7
2	92.7	92.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
0	92.7	92.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–2	92.7	92.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–4	92.7	92.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–6	92.4	92.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–8	92.1	92.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–10	91.7	92.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–12	91.4	92.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–14	91.1	92.3	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–16	90.7	92.0	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–18	90.4	91.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–20	90.0	91.3	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–22	89.7	90.9	92.2	92.4	92.5	92.5	92.4	92.4	93.0
–24	89.3	90.6	91.9	92.1	92.3	92.4	92.4	92.4	93.0
–26	89.0	90.2	91.5	91.7	91.9	92.0	92.1	92.4	92.7
–28	88.6	89.9	91.2	91.4	91.6	91.7	91.7	92.2	92.3
–30	88.3	89.5	90.8	91.0	91.2	91.3	91.5	91.8	92.0
–32	87.9	89.2	90.4	90.7	90.9	91.0	91.2	91.4	91.6
–34	87.6	88.8	90.1	90.3	90.5	90.7	90.9	91.1	91.2
–36	87.2	88.5	89.7	89.9	90.2	90.3	90.5	90.7	90.8
–38	86.8	88.1	89.4	89.6	89.8	90.0	90.1	90.3	90.4
–40	86.5	87.7	89.0	89.2	89.4	89.6	89.8	90.0	90.0
–42								89.6	89.7

N1TABLES_GADEI_OFF_OFF_2_BD100_08AUG03

Figure 1-25. (06-10-13 Sheet 2 of 2)

GO-AROUND THRUST SETTING
APR (SINGLE ENGINE)
ENGINE BLEED OFF, ENGINE A/I ON

THRUST SETTING – %N1									
SAT °C	ALTITUDE – FT								
	–1000	0	1000	2000	3000	4000	5000	6000	7000
10	83.9	85.2	86.4	87.7	88.9	90.1	91.3	92.1	92.1
8	83.6	84.9	86.1	87.4	88.6	89.8	90.9	92.2	92.3
6	83.3	84.6	85.8	87.1	88.3	89.4	90.6	91.9	92.6
4	83.0	84.3	85.5	86.7	87.9	89.1	90.3	91.6	92.8
2	82.7	83.9	85.2	86.4	87.6	88.8	90.0	91.2	92.5
0	82.4	83.6	84.9	86.1	87.3	88.5	89.6	90.9	92.2
–2	82.1	83.3	84.6	85.8	87.0	88.1	89.3	90.6	91.8
–4	81.8	83.0	84.2	85.5	86.7	87.8	89.0	90.2	91.5
–6	81.5	82.7	83.9	85.2	86.3	87.5	88.6	89.9	91.2
–8	81.2	82.4	83.6	84.8	86.0	87.2	88.3	89.6	90.8
–10	80.9	82.1	83.3	84.5	85.7	86.8	88.0	89.2	90.5
–12	80.6	81.8	83.0	84.2	85.4	86.5	87.6	88.9	90.1
–14	80.3	81.5	82.7	83.9	85.0	86.2	87.3	88.5	89.8
–16	80.0	81.2	82.3	83.6	84.7	85.8	87.0	88.2	89.4
–18	79.7	80.9	82.0	83.2	84.4	85.5	86.6	87.9	89.1
–20	79.3	80.6	81.7	82.9	84.1	85.2	86.3	87.5	88.8
–22	79.0	80.2	81.4	82.6	83.7	84.8	86.0	87.2	88.4
–24	78.7	79.9	81.1	82.3	83.4	84.5	85.6	86.8	88.1
–26	78.3	79.5	80.7	81.9	83.1	84.2	85.3	86.5	87.7
–28	78.0	79.2	80.4	81.6	82.8	83.9	85.0	86.2	87.4
–30	77.7	78.8	80.0	81.2	82.4	83.5	84.6	85.8	87.0
–32	77.3	78.5	79.7	80.9	82.1	83.2	84.3	85.5	86.7
–34	77.0	78.1	79.3	80.6	81.7	82.8	83.9	85.1	86.3
–36	76.6	77.8	79.0	80.2	81.4	82.5	83.6	84.8	86.0
–38	76.3	77.4	78.6	79.9	81.1	82.1	83.2	84.4	85.6
–40	75.9	77.1	78.3	79.5	80.7	81.8	82.9	84.0	85.2
–42									

N1TABLES_GAOEI_OFF_ENG__BD100_08AUG03

Figure 1-26. (06-10-14 Sheet 1 of 2)

GO-AROUND THRUST SETTING
APR (SINGLE ENGINE)
ENGINE BLEED OFF, ENGINE A/I ON

THRUST SETTING – %N1 – (Continued)									
SAT °C	ALTITUDE – FT								
	8000	9000	10000	11000	12000	13000	14000	15000	16000
10	92.1	92.0	92.0	91.9	91.8	91.7	91.5	91.4	91.1
8	92.3	92.3	92.2	92.2	92.0	91.9	91.8	91.7	91.4
6	92.6	92.5	92.5	92.4	92.3	92.2	92.1	91.9	91.7
4	92.7	92.7	92.6	92.6	92.5	92.4	92.3	92.2	91.9
2	92.7	92.7	92.6	92.6	92.5	92.5	92.4	92.4	92.2
0	92.7	92.7	92.6	92.6	92.5	92.5	92.4	92.4	92.5
–2	92.7	92.7	92.6	92.6	92.5	92.5	92.4	92.4	92.8
–4	92.7	92.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–6	92.4	92.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–8	92.1	92.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–10	91.7	92.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–12	91.4	92.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–14	91.1	92.3	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–16	90.7	92.0	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–18	90.4	91.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–20	90.0	91.3	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–22	89.7	90.9	92.2	92.4	92.5	92.5	92.4	92.4	93.0
–24	89.3	90.6	91.9	92.1	92.3	92.4	92.4	92.4	93.0
–26	89.0	90.2	91.5	91.7	91.9	92.0	92.1	92.4	92.7
–28	88.6	89.9	91.2	91.4	91.6	91.7	91.7	92.2	92.3
–30	88.3	89.5	90.8	91.0	91.2	91.3	91.5	91.8	92.0
–32	87.9	89.2	90.4	90.7	90.9	91.0	91.2	91.4	91.6
–34	87.6	88.8	90.1	90.3	90.5	90.7	90.9	91.1	91.2
–36	87.2	88.5	89.7	89.9	90.2	90.3	90.5	90.7	90.8
–38	86.8	88.1	89.4	89.6	89.8	90.0	90.1	90.3	90.4
–40	86.5	87.7	89.0	89.2	89.4	89.6	89.8	90.0	90.0
–42								89.6	89.7

N1TABLES_GAOEI_OFF_ENG_2_BD100_08AUG03

Figure 1-26. (06-10-14 Sheet 2 of 2)

GO-AROUND THRUST SETTING
APR (SINGLE ENGINE)
ENGINE BLEED OFF, ENGINE AND WING A/I ON

THRUST SETTING – %N1									
SAT °C	ALTITUDE – FT								
	–1000	0	1000	2000	3000	4000	5000	6000	7000
10	83.9	85.2	86.4	87.7	87.7	87.4	87.2	87.1	86.9
8	83.6	84.9	86.1	87.4	87.9	87.8	87.5	87.4	87.2
6	83.3	84.6	85.8	87.1	88.2	88.0	87.8	87.7	87.5
4	83.0	84.3	85.5	86.7	87.9	88.3	88.2	88.0	87.8
2	82.7	83.9	85.2	86.4	87.6	88.6	88.5	88.3	88.2
0	82.4	83.6	84.9	86.1	87.3	88.5	88.8	88.7	88.5
–2	82.1	83.3	84.6	85.8	87.0	88.1	89.3	89.0	88.9
–4	81.8	83.0	84.2	85.5	86.7	87.8	89.0	89.5	89.2
–6	81.5	82.7	83.9	85.2	86.3	87.5	88.6	89.9	89.8
–8	81.2	82.4	83.6	84.8	86.0	87.2	88.3	89.6	90.2
–10	80.9	82.1	83.3	84.5	85.7	86.8	88.0	89.2	90.5
–12	80.6	81.8	83.0	84.2	85.4	86.5	87.6	88.9	90.1
–14	80.3	81.5	82.7	83.9	85.0	86.2	87.3	88.5	89.8
–16	80.0	81.2	82.3	83.6	84.7	85.8	87.0	88.2	89.4
–18	79.7	80.9	82.0	83.2	84.4	85.5	86.6	87.9	89.1
–20	79.3	80.6	81.7	82.9	84.1	85.2	86.3	87.5	88.8
–22	79.0	80.2	81.4	82.6	83.7	84.8	86.0	87.2	88.4
–24	78.7	79.9	81.1	82.3	83.4	84.5	85.6	86.8	88.1
–26	78.3	79.5	80.7	81.9	83.1	84.2	85.3	86.5	87.7
–28	78.0	79.2	80.4	81.6	82.8	83.9	85.0	86.2	87.4
–30	77.7	78.8	80.0	81.2	82.4	83.5	84.6	85.8	87.0
–32	77.3	78.5	79.7	80.9	82.1	83.2	84.3	85.5	86.7
–34	77.0	78.1	79.3	80.6	81.7	82.8	83.9	85.1	86.3
–36	76.6	77.8	79.0	80.2	81.4	82.5	83.6	84.8	86.0
–38	76.3	77.4	78.6	79.9	81.1	82.1	83.2	84.4	85.6
–40	75.9	77.1	78.3	79.5	80.7	81.8	82.9	84.0	85.2
–42									

NITABLES_GAOEI_OFF_2WG_1_BD100_08AUG03

Figure 1-27. (06-10-15 Sheet 1 of 2)

GO-AROUND THRUST SETTING
APR (SINGLE ENGINE)
ENGINE BLEED OFF, ENGINE AND WING A/I ON

THRUST SETTING – %N1 – (Continued)									
SAT °C	ALTITUDE – FT								
	8000	9000	10000	11000	12000	13000	14000	15000	16000
10	86.7	86.4	86.1	85.7	85.2	84.8	84.3	83.9	83.3
8	87.1	86.9	86.6	86.2	85.7	85.3	84.9	84.4	83.9
6	87.4	87.3	87.1	86.7	86.2	85.8	85.4	85.0	84.5
4	87.7	87.6	87.5	87.1	86.7	86.3	85.9	85.5	85.1
2	88.0	87.9	87.8	87.6	87.2	86.8	86.4	86.0	85.6
0	88.3	88.2	88.1	87.9	87.6	87.3	86.9	86.5	86.1
–2	88.7	88.6	88.4	88.3	88.0	87.7	87.4	87.0	86.5
–4	89.1	89.0	88.8	88.6	88.4	88.1	87.8	87.5	87.1
–6	89.5	89.4	89.2	89.0	88.8	88.5	88.2	88.0	87.6
–8	90.0	89.8	89.7	89.4	89.2	88.9	88.7	88.4	88.1
–10	90.5	90.3	90.1	89.9	89.6	89.3	89.1	88.9	88.6
–12	91.0	90.8	90.6	90.3	90.1	89.8	89.5	89.3	89.0
–14	91.1	91.3	91.1	90.8	90.6	90.3	90.0	89.8	89.4
–16	90.7	91.8	91.6	91.3	91.1	90.8	90.5	90.2	89.9
–18	90.4	91.7	92.0	91.8	91.6	91.4	91.0	90.7	90.4
–20	90.0	91.3	92.5	92.4	92.2	91.9	91.6	91.2	90.9
–22	89.7	90.9	92.2	92.4	92.5	92.5	92.2	91.7	91.4
–24	89.3	90.6	91.9	92.1	92.3	92.4	92.4	92.3	92.0
–26	89.0	90.2	91.5	91.7	91.9	92.0	92.1	92.4	92.6
–28	88.6	89.9	91.2	91.4	91.6	91.7	91.7	92.2	92.3
–30	88.3	89.5	90.8	91.0	91.2	91.3	91.5	91.8	92.0
–32	87.9	89.2	90.4	90.7	90.9	91.0	91.2	91.4	91.6
–34	87.6	88.8	90.1	90.3	90.5	90.7	90.9	91.1	91.2
–36	87.2	88.5	89.7	89.9	90.2	90.3	90.5	90.7	90.8
–38	86.8	88.1	89.4	89.6	89.8	90.0	90.1	90.3	90.4
–40	86.5	87.7	89.0	89.2	89.4	89.6	89.8	90.0	90.0
–42								89.6	89.7

N1TABLES_GAOEI_OFF_2WG_2_BD100_08AUG03

Figure 1-27. (06-10-15 Sheet 2 of 2)

GO-AROUND THRUST SETTING
APR (SINGLE ENGINE)
ENGINE BLEED ON

THRUST SETTING – %N1									
SAT	ALTITUDE – FT								
°C	–1000	0	1000	2000	3000	4000	5000	6000	7000
50	85.2	84.9							
48	85.8	85.5	85.2						
46	86.3	86.1	85.8	85.5					
44	86.7	86.6	86.4	86.1	85.8				
42	87.1	87.0	86.9	86.7	86.3	86.1			
40	87.4	87.4	87.3	87.2	86.9	86.6	86.3		
38	87.7	87.7	87.7	87.6	87.4	87.1	86.8	86.5	
36	87.8	88.0	88.0	88.0	87.8	87.6	87.3	87.0	86.7
34	87.6	88.4	88.4	88.4	88.3	88.0	87.8	87.5	87.2
32	87.3	88.5	88.7	88.7	88.6	88.4	88.2	88.0	87.7
30	87.0	88.2	89.1	89.0	89.0	88.8	88.6	88.5	88.3
28	86.7	87.9	89.2	89.3	89.3	89.2	89.1	89.0	88.8
26	86.4	87.6	88.9	89.6	89.6	89.6	89.5	89.4	89.3
24	86.1	87.3	88.6	89.9	89.9	89.9	89.8	89.7	89.6
22	85.8	87.0	88.3	89.6	90.2	90.1	90.1	90.1	89.9
20	85.5	86.7	88.0	89.3	90.4	90.4	90.4	90.3	90.2
18	85.2	86.4	87.7	88.9	90.2	90.7	90.7	90.6	90.5
16	84.9	86.1	87.4	88.6	89.9	90.9	90.9	90.9	90.8
14	84.6	85.8	87.1	88.3	89.6	90.7	91.2	91.1	91.1
12	84.2	85.5	86.8	88.0	89.2	90.4	91.4	91.4	91.3
10	83.9	85.2	86.4	87.7	88.9	90.1	91.3	91.6	91.6
8	83.6	84.9	86.1	87.4	88.6	89.8	90.9	91.8	91.8
6	83.3	84.6	85.8	87.1	88.3	89.4	90.6	91.9	92.0
4	83.0	84.3	85.5	86.7	87.9	89.1	90.3	91.6	92.3
2	82.7	83.9	85.2	86.4	87.6	88.8	90.0	91.2	92.5
0	82.4	83.6	84.9	86.1	87.3	88.5	89.6	90.9	92.2
–2	82.1	83.3	84.6	85.8	87.0	88.1	89.3	90.6	91.8
–4	81.8	83.0	84.2	85.5	86.7	87.8	89.0	90.2	91.5
–6	81.5	82.7	83.9	85.2	86.3	87.5	88.6	89.9	91.2
–8	81.2	82.4	83.6	84.8	86.0	87.2	88.3	89.6	90.8
–10	80.9	82.1	83.3	84.5	85.7	86.8	88.0	89.2	90.5
–12	80.6	81.8	83.0	84.2	85.4	86.5	87.6	88.9	90.1
–14	80.3	81.5	82.7	83.9	85.0	86.2	87.3	88.5	89.8
–16	80.0	81.2	82.3	83.6	84.7	85.8	87.0	88.2	89.4
–18	79.7	80.9	82.0	83.2	84.4	85.5	86.6	87.9	89.1
–20	79.3	80.6	81.7	82.9	84.1	85.2	86.3	87.5	88.8
–22	79.0	80.2	81.4	82.6	83.7	84.8	86.0	87.2	88.4
–24	78.7	79.9	81.1	82.3	83.4	84.5	85.6	86.8	88.1
–26	78.3	79.5	80.7	81.9	83.1	84.2	85.3	86.5	87.7
–28	78.0	79.2	80.4	81.6	82.8	83.9	85.0	86.2	87.4
–30	77.7	78.8	80.0	81.2	82.4	83.5	84.6	85.8	87.0
–32	77.3	78.5	79.7	80.9	82.1	83.2	84.3	85.5	86.7
–34	77.0	78.1	79.3	80.6	81.7	82.8	83.9	85.1	86.3
–36	76.6	77.8	79.0	80.2	81.4	82.5	83.6	84.8	86.0
–38	76.3	77.4	78.6	79.9	81.1	82.1	83.2	84.4	85.6
–40	75.9	77.1	78.3	79.5	80.7	81.8	82.9	84.0	85.2
–42									

NITABLES_GAOEI_HI_OFF_1_BD100_08AUG03

Figure 1-28. (06-10-16 Sheet 1 of 2)

GO-AROUND THRUST SETTING
APR (SINGLE ENGINE)
ENGINE BLEED ON

THRUST SETTING – %N1 – (Continued)									
SAT	ALTITUDE – FT								
°C	8000	9000	10000	11000	12000	13000	14000	15000	16000
50									
48									
46									
44									
42									
40									
38									
36									
34	86.8								
32	87.4	87.1							
30	88.0	87.7	87.3						
28	88.5	88.3	87.9	87.6					
26	89.1	88.8	88.6	88.2	87.9				
24	89.6	89.3	89.1	88.9	88.6	88.2			
22	89.9	89.8	89.6	89.4	89.2	88.8	88.5		
20	90.2	90.1	90.1	89.8	89.6	89.4	89.0	88.8	
18	90.4	90.4	90.3	90.2	90.0	89.8	89.6	89.3	89.0
16	90.7	90.7	90.6	90.5	90.4	90.2	90.0	89.8	89.4
14	91.0	90.9	90.9	90.8	90.7	90.5	90.3	90.2	89.9
12	91.2	91.2	91.2	91.0	90.9	90.8	90.6	90.5	90.2
10	91.5	91.5	91.4	91.3	91.2	91.1	90.9	90.8	90.5
8	91.8	91.7	91.7	91.6	91.4	91.3	91.2	91.1	90.8
6	92.0	92.0	91.9	91.8	91.7	91.6	91.5	91.3	91.1
4	92.2	92.2	92.2	92.0	91.9	91.8	91.7	91.6	91.3
2	92.5	92.5	92.4	92.3	92.2	92.1	92.0	91.8	91.6
0	92.7	92.7	92.6	92.6	92.5	92.3	92.2	92.1	91.9
–2	92.7	92.7	92.6	92.6	92.5	92.5	92.4	92.4	92.2
–4	92.7	92.7	92.6	92.6	92.5	92.5	92.4	92.4	92.5
–6	92.4	92.7	92.6	92.6	92.5	92.5	92.4	92.4	92.9
–8	92.1	92.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–10	91.7	92.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–12	91.4	92.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–14	91.1	92.3	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–16	90.7	92.0	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–18	90.4	91.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–20	90.0	91.3	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–22	89.7	90.9	92.2	92.4	92.5	92.5	92.4	92.4	93.0
–24	89.3	90.6	91.9	92.1	92.3	92.4	92.4	92.4	93.0
–26	89.0	90.2	91.5	91.7	91.9	92.0	92.1	92.4	92.7
–28	88.6	89.9	91.2	91.4	91.6	91.7	91.7	92.2	92.3
–30	88.3	89.5	90.8	91.0	91.2	91.3	91.5	91.8	92.0
–32	87.9	89.2	90.4	90.7	90.9	91.0	91.2	91.4	91.6
–34	87.6	88.8	90.1	90.3	90.5	90.7	90.9	91.1	91.2
–36	87.2	88.5	89.7	89.9	90.2	90.3	90.5	90.7	90.8
–38	86.8	88.1	89.4	89.6	89.8	90.0	90.1	90.3	90.4
–40	86.5	87.7	89.0	89.2	89.4	89.6	89.8	90.0	90.0
–42								89.6	89.7

N1TABLES_GAOEI_HI_OFF_2_BD100_08AUG03

Figure 1-28. (06-10-16 Sheet 2 of 2)

GO-AROUND THRUST SETTING
APR (SINGLE ENGINE)
ENGINE BLEED ON, ENGINE A/I ON

THRUST SETTING – %N1									
SAT °C	ALTITUDE – FT								
	–1000	0	1000	2000	3000	4000	5000	6000	7000
10	83.9	85.2	86.4	87.7	88.9	90.1	91.2	91.2	91.1
8	83.6	84.9	86.1	87.4	88.6	89.8	90.9	91.4	91.4
6	83.3	84.6	85.8	87.1	88.3	89.4	90.6	91.6	91.6
4	83.0	84.3	85.5	86.7	87.9	89.1	90.3	91.6	91.8
2	82.7	83.9	85.2	86.4	87.6	88.8	90.0	91.2	92.1
0	82.4	83.6	84.9	86.1	87.3	88.5	89.6	90.9	92.2
–2	82.1	83.3	84.6	85.8	87.0	88.1	89.3	90.6	91.8
–4	81.8	83.0	84.2	85.5	86.7	87.8	89.0	90.2	91.5
–6	81.5	82.7	83.9	85.2	86.3	87.5	88.6	89.9	91.2
–8	81.2	82.4	83.6	84.8	86.0	87.2	88.3	89.6	90.8
–10	80.9	82.1	83.3	84.5	85.7	86.8	88.0	89.2	90.5
–12	80.6	81.8	83.0	84.2	85.4	86.5	87.6	88.9	90.1
–14	80.3	81.5	82.7	83.9	85.0	86.2	87.3	88.5	89.8
–16	80.0	81.2	82.3	83.6	84.7	85.8	87.0	88.2	89.4
–18	79.7	80.9	82.0	83.2	84.4	85.5	86.6	87.9	89.1
–20	79.3	80.6	81.7	82.9	84.1	85.2	86.3	87.5	88.8
–22	79.0	80.2	81.4	82.6	83.7	84.8	86.0	87.2	88.4
–24	78.7	79.9	81.1	82.3	83.4	84.5	85.6	86.8	88.1
–26	78.3	79.5	80.7	81.9	83.1	84.2	85.3	86.5	87.7
–28	78.0	79.2	80.4	81.6	82.8	83.9	85.0	86.2	87.4
–30	77.7	78.8	80.0	81.2	82.4	83.5	84.6	85.8	87.0
–32	77.3	78.5	79.7	80.9	82.1	83.2	84.3	85.5	86.7
–34	77.0	78.1	79.3	80.6	81.7	82.8	83.9	85.1	86.3
–36	76.6	77.8	79.0	80.2	81.4	82.5	83.6	84.8	86.0
–38	76.3	77.4	78.6	79.9	81.1	82.1	83.2	84.4	85.6
–40	75.9	77.1	78.3	79.5	80.7	81.8	82.9	84.0	85.2
–42									

N1TABLES_GAOEI_HI_ENG_1_BD100_08AUG03

Figure 1-29. (06-10-17 Sheet 1 of 2)

GO-AROUND THRUST SETTING
APR (SINGLE ENGINE)
ENGINE BLEED ON, ENGINE A/I ON

THRUST SETTING – %N1 – (Continued)									
SAT °C	ALTITUDE – FT								
	8000	9000	10000	11000	12000	13000	14000	15000	16000
10	91.1	91.0	91.0	90.8	90.6	90.5	90.3	90.2	89.8
8	91.3	91.2	91.2	91.1	90.9	90.8	90.6	90.4	90.1
6	91.6	91.5	91.4	91.3	91.2	91.0	90.9	90.7	90.3
4	91.8	91.8	91.7	91.5	91.4	91.3	91.2	91.0	90.6
2	92.1	92.0	92.0	91.8	91.6	91.5	91.4	91.2	90.9
0	92.3	92.3	92.3	92.1	91.9	91.8	91.7	91.5	91.2
–2	92.6	92.6	92.5	92.4	92.3	92.1	91.9	91.8	91.4
–4	92.7	92.7	92.6	92.6	92.5	92.4	92.3	92.1	91.8
–6	92.4	92.7	92.6	92.6	92.5	92.5	92.4	92.4	92.1
–8	92.1	92.7	92.6	92.6	92.5	92.5	92.4	92.4	92.5
–10	91.7	92.7	92.6	92.6	92.5	92.5	92.4	92.4	92.9
–12	91.4	92.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–14	91.1	92.3	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–16	90.7	92.0	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–18	90.4	91.7	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–20	90.0	91.3	92.6	92.6	92.5	92.5	92.4	92.4	93.0
–22	89.7	90.9	92.2	92.4	92.5	92.5	92.4	92.4	93.0
–24	89.3	90.6	91.9	92.1	92.3	92.4	92.4	92.4	93.0
–26	89.0	90.2	91.5	91.7	91.9	92.0	92.1	92.4	92.7
–28	88.6	89.9	91.2	91.4	91.6	91.7	91.7	92.2	92.3
–30	88.3	89.5	90.8	91.0	91.2	91.3	91.5	91.8	92.0
–32	87.9	89.2	90.4	90.7	90.9	91.0	91.2	91.4	91.6
–34	87.6	88.8	90.1	90.3	90.5	90.7	90.9	91.1	91.2
–36	87.2	88.5	89.7	89.9	90.2	90.3	90.5	90.7	90.8
–38	86.8	88.1	89.4	89.6	89.8	90.0	90.1	90.3	90.4
–40	86.5	87.7	89.0	89.2	89.4	89.6	89.8	90.0	90.0
–42								89.6	89.7

N1TABLES_GAOEI_HI_ENG_2_BD100_08AUG03

Figure 1-29. (06-10-17 Sheet 2 of 2)

GO-AROUND THRUST SETTING
APR (SINGLE ENGINE)
ENGINE BLEED ON, ENGINE AND WING A/I ON

THRUST SETTING – %N1									
SAT °C	ALTITUDE – FT								
	–1000	0	1000	2000	3000	4000	5000	6000	7000
10	83.9	85.2	86.4	87.0	86.8	86.6	86.3	86.1	86.0
8	83.6	84.9	86.1	87.2	87.1	86.9	86.7	86.4	86.3
6	83.3	84.6	85.8	87.1	87.3	87.2	87.0	86.8	86.6
4	83.0	84.3	85.5	86.7	87.6	87.4	87.3	87.1	86.9
2	82.7	83.9	85.2	86.4	87.6	87.8	87.6	87.4	87.2
0	82.4	83.6	84.9	86.1	87.3	88.2	87.9	87.7	87.6
–2	82.1	83.3	84.6	85.8	87.0	88.1	88.4	88.1	87.9
–4	81.8	83.0	84.2	85.5	86.7	87.8	88.9	88.6	88.3
–6	81.5	82.7	83.9	85.2	86.3	87.5	88.6	89.1	88.8
–8	81.2	82.4	83.6	84.8	86.0	87.2	88.3	89.6	89.3
–10	80.9	82.1	83.3	84.5	85.7	86.8	88.0	89.2	89.8
–12	80.6	81.8	83.0	84.2	85.4	86.5	87.6	88.9	90.1
–14	80.3	81.5	82.7	83.9	85.0	86.2	87.3	88.5	89.8
–16	80.0	81.2	82.3	83.6	84.7	85.8	87.0	88.2	89.4
–18	79.7	80.9	82.0	83.2	84.4	85.5	86.6	87.9	89.1
–20	79.3	80.6	81.7	82.9	84.1	85.2	86.3	87.5	88.8
–22	79.0	80.2	81.4	82.6	83.7	84.8	86.0	87.2	88.4
–24	78.7	79.9	81.1	82.3	83.4	84.5	85.6	86.8	88.1
–26	78.3	79.5	80.7	81.9	83.1	84.2	85.3	86.5	87.7
–28	78.0	79.2	80.4	81.6	82.8	83.9	85.0	86.2	87.4
–30	77.7	78.8	80.0	81.2	82.4	83.5	84.6	85.8	87.0
–32	77.3	78.5	79.7	80.9	82.1	83.2	84.3	85.5	86.7
–34	77.0	78.1	79.3	80.6	81.7	82.8	83.9	85.1	86.3
–36	76.6	77.8	79.0	80.2	81.4	82.5	83.6	84.8	86.0
–38	76.3	77.4	78.6	79.9	81.1	82.1	83.2	84.4	85.6
–40	75.9	77.1	78.3	79.5	80.7	81.8	82.9	84.0	85.2
–42									

N1TABLES_GAOEI_HI_2WG_1_BD100_08AUG03

Figure 1-30. (06-10-18 Sheet 1 of 2)

GO-AROUND THRUST SETTING
APR (SINGLE ENGINE)
ENGINE BLEED ON, ENGINE AND WING A/I ON

THRUST SETTING – %N1 – (Continued)									
SAT °C	ALTITUDE – FT								
	8000	9000	10000	11000	12000	13000	14000	15000	16000
10	85.7	85.4	85.0	84.6	84.1	83.6	83.2	82.6	81.9
8	86.1	85.9	85.5	85.1	84.6	84.1	83.7	83.2	82.5
6	86.4	86.3	86.0	85.6	85.1	84.7	84.2	83.8	83.1
4	86.7	86.6	86.4	86.1	85.6	85.2	84.7	84.3	83.7
2	87.1	86.9	86.8	86.5	86.1	85.7	85.2	84.8	84.2
0	87.4	87.2	87.1	86.8	86.5	86.1	85.7	85.3	84.7
–2	87.8	87.6	87.4	87.2	86.9	86.6	86.2	85.8	85.2
–4	88.2	88.0	87.8	87.5	87.3	87.0	86.7	86.3	85.8
–6	88.5	88.4	88.2	87.9	87.7	87.4	87.1	86.8	86.3
–8	89.1	88.8	88.6	88.4	88.1	87.8	87.5	87.3	86.8
–10	89.6	89.3	89.1	88.8	88.6	88.2	88.0	87.7	87.2
–12	90.1	89.8	89.6	89.3	89.0	88.7	88.4	88.2	87.7
–14	90.6	90.3	90.1	89.8	89.5	89.2	88.9	88.6	88.1
–16	90.7	90.8	90.5	90.3	90.1	89.7	89.4	89.1	88.6
–18	90.4	91.3	91.0	90.8	90.6	90.3	89.9	89.6	89.1
–20	90.0	91.3	91.5	91.3	91.1	90.9	90.5	90.0	89.6
–22	89.7	90.9	92.2	91.8	91.6	91.4	91.1	90.6	90.1
–24	89.3	90.6	91.9	92.1	92.1	92.0	91.7	91.1	90.7
–26	89.0	90.2	91.5	91.7	91.9	92.0	92.1	91.8	91.3
–28	88.6	89.9	91.2	91.4	91.6	91.7	91.7	92.2	91.9
–30	88.3	89.5	90.8	91.0	91.2	91.3	91.5	91.8	92.0
–32	87.9	89.2	90.4	90.7	90.9	91.0	91.2	91.4	91.6
–34	87.6	88.8	90.1	90.3	90.5	90.7	90.9	91.1	91.2
–36	87.2	88.5	89.7	89.9	90.2	90.3	90.5	90.7	90.8
–38	86.8	88.1	89.4	89.6	89.8	90.0	90.1	90.3	90.4
–40	86.5	87.7	89.0	89.2	89.4	89.6	89.8	90.0	90.0
–42								89.6	89.7

NITABLES_GAOEI_HI_2WG_2_GD100_08AUG03

Figure 1-30. (06-10-18 Sheet 2 of 2)

CLIMB THRUST SETTING—ENROUTE SPEED
CLB (SINGLE ENGINE)
ENGINE BLEED ON

THRUST SETTING – %N1									
SAT °C	ALTITUDE – FT								
	0	2000	4000	6000	8000	10000	12000	14000	16000
50	82.2								
48	82.8								
46	83.4	82.9							
44	83.9	83.4							
42	84.4	83.9	83.4						
40	84.9	84.4	83.9						
38	85.4	85.0	84.4	83.8					
36	85.9	85.5	84.9	84.3					
34	86.4	86.0	85.4	84.8	84.1				
32	86.8	86.5	86.0	85.3	84.6				
30	87.2	86.9	86.4	85.8	85.1	84.4			
28	87.6	87.2	86.8	86.3	85.6	84.9			
26	87.4	87.5	87.2	86.7	86.2	85.4	84.8		
24	87.1	88.0	87.7	87.1	86.7	85.9	85.3		
22	86.8	88.4	88.2	87.7	87.2	86.6	86.0	85.1	
20	86.5	88.8	88.6	88.2	87.8	87.2	86.6	85.7	
18	86.2	88.7	89.0	88.8	88.3	87.8	87.2	86.3	86.1
16	85.9	88.4	89.3	89.1	88.8	88.4	87.8	87.0	86.7
14	85.6	88.1	89.6	89.4	89.3	88.9	88.4	87.6	87.3
12	85.3	87.8	89.8	89.7	89.6	89.3	88.9	88.1	87.8
10	85.0	87.5	89.8	90.0	89.8	89.7	89.3	88.6	88.3
8	84.7	87.1	89.5	90.2	90.1	90.0	89.7	89.1	88.8
6	84.3	86.8	89.2	90.5	90.3	90.2	90.0	89.6	89.2
4	84.0	86.5	88.8	90.8	90.6	90.5	90.3	89.9	89.7
2	83.7	86.2	88.5	90.8	90.8	90.7	90.6	90.2	90.0
0	83.4	85.9	88.2	90.5	91.1	91.0	90.8	90.5	90.3
–2	83.1	85.6	87.8	90.2	91.3	91.2	91.0	90.8	90.6
–4	82.8	85.2	87.5	89.8	91.6	91.5	91.3	91.0	90.8
–6	82.5	84.9	87.2	89.5	91.8	91.7	91.5	91.3	91.1
–8	82.2	84.6	86.9	89.2	91.6	92.0	91.8	91.6	91.4
–10	81.9	84.3	86.6	88.8	91.3	92.3	92.1	91.9	91.8
–12	81.6	84.0	86.2	88.5	90.9	92.6	92.5	92.2	92.1
–14	81.3	83.7	85.9	88.2	90.6	92.6	92.5	92.4	92.5
–16	81.0	83.3	85.6	87.8	90.3	92.6	92.5	92.4	92.8
–18	80.7	83.0	85.2	87.5	89.9	92.4	92.5	92.4	92.7
–20	80.3	82.7	84.9	87.2	89.6	92.1	92.2	92.0	92.3
–22	80.0	82.4	84.6	86.8	89.2	91.7	91.8	91.6	91.9
–24	79.7	82.1	84.3	86.5	88.9	91.4	91.5	91.2	91.6
–26	79.3	81.7	83.9	86.1	88.5	91.0	91.1	90.8	91.2
–28	79.0	81.4	83.6	85.8	88.2	90.7	90.8	90.4	90.9
–30	78.6	81.1	83.2	85.5	87.8	90.3	90.4	90.2	90.5
–32	78.3	80.7	82.9	85.1	87.5	90.0	90.0	89.9	90.1
–34	77.9	80.4	82.6	84.8	87.2	89.6	89.7	89.6	89.7
–36	77.6	80.0	82.2	84.4	86.8	89.2	89.3	89.2	89.3
–38	77.2	79.7	81.9	84.0	86.4	88.9	89.0	88.9	89.0
–40	76.9	79.3	81.5	83.7	86.0	88.5	88.6	88.5	88.6
–42									88.2

N:\TABLES_CLBOEI_HI_OFF_1_GD100_08AUG03

Figure 1-31. (06-10-19 Sheet 1 of 2)

CLIMB THRUST SETTING—ENROUTE SPEED
CLB (SINGLE ENGINE)
ENGINE BLEED ON

THRUST SETTING – %N1 – (Continued)

SAT °C	ALTITUDE – FT								
	18000	20000	25000	27000	29000	31000	35000	40000	45000
18									
16									
14	86.9								
12	87.4								
10	87.9	87.5							
8	88.3	87.9							
6	88.7	88.3							
4	89.1	88.6							
2	89.5	88.9							
0	89.8	89.2	87.9						
–2	90.1	89.5	88.3						
–4	90.4	89.8	88.6	88.1					
–6	90.7	90.1	88.9	88.4					
–8	91.0	90.4	89.2	88.7	88.2				
–10	91.3	90.7	89.4	89.0	88.4				
–12	91.6	91.0	89.8	89.3	88.7	88.2			
–14	92.0	91.4	90.1	89.6	89.1	88.4			
–16	92.4	91.8	90.4	89.9	89.4	88.8			
–18	92.7	92.2	90.8	90.2	89.7	89.1			
–20	92.3	92.2	91.2	90.6	90.1	89.4	88.0		
–22	92.0	91.9	91.6	91.0	90.4	89.8	88.3		
–24	91.6	91.5	92.1	91.4	90.8	90.1	88.6		
–26	91.3	91.2	92.6	91.9	91.3	90.5	89.0		
–28	90.9	90.8	93.0	92.4	91.7	91.0	89.3		
–30	90.6	90.5	93.3	92.9	92.2	91.5	89.7	87.7	
–32	90.2	90.1	93.0	93.5	92.8	91.9	90.2	88.0	
–34	89.8	89.8	92.6	93.7	93.3	92.5	90.6	88.3	
–36	89.4	89.4	92.2	93.3	93.7	93.0	91.1	88.6	
–38	89.0	89.0	91.9	93.0	93.3	93.5	91.7	89.0	
–40	88.6	88.7	91.5	92.6	92.9	93.1	92.2	89.4	87.0
–42	88.2	88.3	91.1	92.2	92.5	92.7	92.8	89.9	87.3
–44	87.8	87.9	90.8	91.9	92.1	92.3	92.8	90.4	87.7
–46	87.5	87.6	90.4	91.5	91.7	91.9	92.4	91.0	88.0
–48		87.2	90.0	91.1	91.3	91.5	92.0	91.6	88.5
–50			89.6	90.7	90.9	91.1	91.6	92.2	89.0
–52			89.3	90.3	90.4	90.7	91.2	92.0	89.5
–54			88.9	89.8	90.0	90.3	90.8	91.6	90.0
–56			88.5	89.4	89.6	89.8	90.3	91.1	90.1
–58				89.0	89.2	89.4	89.9	90.7	89.7
–60					88.8	89.0	89.5	90.3	89.3
–62						88.6	89.1	89.9	88.9
–64						88.2	88.7	89.4	88.5
–66							88.2	89.0	88.1
–68							87.8	88.6	87.7
–70							87.4	88.2	87.3
–72									86.9
–74									86.5

NITABLES_CLBOEI_HI_OFF_2_BD100_08AUG03

Figure 1-31. (06-10-19 Sheet 2 of 2)

CLIMB THRUST SETTING—ENROUTE SPEED CLB (SINGLE ENGINE) ENGINE BLEED ON, ENGINE A/I ON

THRUST SETTING – %N1								
SAT °C	ALTITUDE – FT							
	0	2000	4000	6000	8000	10000	12000	14000
10	85.0	87.5	89.7	89.6	89.4	89.2	88.8	88.2
8	84.7	87.1	89.5	89.8	89.7	89.5	89.2	88.7
6	84.3	86.8	89.2	90.1	89.9	89.8	89.5	89.1
4	84.0	86.5	88.8	90.3	90.2	90.0	89.8	89.4
2	83.7	86.2	88.5	90.5	90.4	90.3	90.1	89.8
0	83.4	85.9	88.2	90.5	90.7	90.5	90.3	90.0
–2	83.1	85.6	87.8	90.2	90.9	90.8	90.6	90.3
–4	82.8	85.2	87.5	89.8	91.1	91.0	90.8	90.6
–6	82.5	84.9	87.2	89.5	91.4	91.3	91.1	90.8
–8	82.2	84.6	86.9	89.2	91.6	91.6	91.3	91.1
–10	81.9	84.3	86.6	88.8	91.3	91.9	91.7	91.4
–12	81.6	84.0	86.2	88.5	90.9	92.3	92.0	91.7
–14	81.3	83.7	85.9	88.2	90.6	92.6	92.4	92.1
–16	81.0	83.3	85.6	87.8	90.3	92.6	92.5	92.4
–18	80.7	83.0	85.2	87.5	89.9	92.4	92.5	92.4
–20	80.3	82.7	84.9	87.2	89.6	92.1	92.2	92.0
–22	80.0	82.4	84.6	86.8	89.2	91.7	91.8	91.6
–24	79.7	82.1	84.3	86.5	88.9	91.4	91.5	91.2
–26	79.3	81.7	83.9	86.1	88.5	91.0	91.1	90.8
–28	79.0	81.4	83.6	85.8	88.2	90.7	90.8	90.4
–30	78.6	81.1	83.2	85.5	87.8	90.3	90.4	90.2
–32	78.3	80.7	82.9	85.1	87.5	90.0	90.0	89.9
–34	77.9	80.4	82.6	84.8	87.2	89.6	89.7	89.6
–36	77.6	80.0	82.2	84.4	86.8	89.2	89.3	89.2
–38	77.2	79.7	81.9	84.0	86.4	88.9	89.0	88.9
–40	76.9	79.3	81.5	83.7	86.0	88.5	88.6	88.5
–42								
–44								
–46								
–48								
–50								
–52								
–54								
–56								
–58								
–60								
–62								
–64								
–66								
–68								
–70								

Figure 1-32. (06-10-20 Sheet 1 of 2)

CLIMB THRUST SETTING—ENROUTE SPEED
CLB (SINGLE ENGINE)
ENGINE BLEED ON, ENGINE A/I ON

THRUST SETTING – %N1 – (Continued)								
SAT °C	ALTITUDE – FT							
	16000	18000	20000	25000	27000	29000	31000	35000
10	87.7	87.1	86.4					
8	88.2	87.5	86.8					
6	88.6	87.9	87.2					
4	89.1	88.3	87.6					
2	89.4	88.6	87.9					
0	89.7	89.0	88.2	86.4				
-2	90.0	89.3	88.5	86.7				
-4	90.3	89.6	88.8	87.0	86.3			
-6	90.6	89.8	89.1	87.3	86.7			
-8	90.9	90.2	89.3	87.6	87.0	86.3		
-10	91.2	90.5	89.6	87.9	87.3	86.6		
-12	91.6	90.8	90.0	88.2	87.6	86.9	86.2	
-14	91.9	91.2	90.3	88.5	87.9	87.2	86.6	
-16	92.3	91.6	90.7	88.8	88.2	87.6	86.9	
-18	92.7	92.0	91.2	89.2	88.6	87.9	87.2	
-20	92.3	92.3	91.6	89.6	88.9	88.3	87.5	86.0
-22	91.9	92.0	91.9	90.1	89.4	88.6	87.9	86.3
-24	91.6	91.6	91.5	90.6	89.8	89.1	88.3	86.6
-26	91.2	91.3	91.2	91.0	90.3	89.5	88.7	87.0
-28	90.9	90.9	90.8	91.5	90.8	90.0	89.1	87.3
-30	90.5	90.6	90.5	92.0	91.3	90.5	89.6	87.7
-32	90.1	90.2	90.1	92.5	91.8	91.0	90.1	88.2
-34	89.7	89.8	89.8	92.6	92.4	91.6	90.7	88.6
-36	89.3	89.4	89.4	92.2	92.9	92.2	91.2	89.2
-38	89.0	89.0	89.0	91.9	93.0	92.8	91.8	89.7
-40	88.6	88.6	88.7	91.5	92.6	92.9	92.4	90.3
-42	88.2	88.2	88.3	91.1	92.2	92.5	92.7	90.9
-44		87.8	87.9	90.8	91.9	92.1	92.3	91.5
-46		87.5	87.6	90.4	91.5	91.7	91.9	92.1
-48			87.2	90.0	91.1	91.3	91.5	92.0
-50				89.6	90.7	90.9	91.1	91.6
-52				89.3	90.3	90.4	90.7	91.2
-54				88.9	89.8	90.0	90.3	90.8
-56				88.5	89.4	89.6	89.8	90.3
-58					89.0	89.2	89.4	89.9
-60						88.8	89.0	89.5
-62							88.6	89.1
-64							88.2	88.7
-66								88.2
-68								87.8
-70								87.4

N1TABLES_CLBOEI_HI_ENG_2_BD100_08AUG03

Figure 1-32. (06-10-20 Sheet 2 of 2)

CLIMB THRUST SETTING—ENROUTE SPEED CLB (SINGLE ENGINE) ENGINE BLEED ON, ENGINE AND WING A/I ON

SAT °C	THRUST SETTING – %N1 ALTITUDE – FT							
	0	2000	4000	6000	8000	10000	12000	14000
10	85.0	85.5	85.1	84.6	84.1	83.4	82.3	80.9
8	84.7	85.9	85.4	84.9	84.5	83.9	82.9	81.7
6	84.3	86.2	85.8	85.3	84.8	84.4	83.5	82.3
4	84.0	86.5	86.1	85.6	85.1	84.8	84.1	83.0
2	83.7	86.2	86.4	85.9	85.5	85.1	84.6	83.6
0	83.4	85.9	86.7	86.2	85.8	85.4	85.0	84.1
–2	83.1	85.6	87.1	86.5	86.1	85.7	85.3	84.6
–4	82.8	85.2	87.4	86.9	86.4	86.0	85.6	85.1
–6	82.5	84.9	87.2	87.3	86.7	86.3	85.9	85.4
–8	82.2	84.6	86.9	87.7	87.2	86.7	86.2	85.7
–10	81.9	84.3	86.6	88.1	87.6	87.1	86.6	86.0
–12	81.6	84.0	86.2	88.5	88.1	87.5	87.0	86.4
–14	81.3	83.7	85.9	88.2	88.5	88.0	87.4	86.8
–16	81.0	83.3	85.6	87.8	89.0	88.5	87.9	87.3
–18	80.7	83.0	85.2	87.5	89.5	89.0	88.4	87.7
–20	80.3	82.7	84.9	87.2	89.6	89.5	88.9	88.2
–22	80.0	82.4	84.6	86.8	89.2	90.1	89.4	88.8
–24	79.7	82.1	84.3	86.5	88.9	90.6	89.9	89.3
–26	79.3	81.7	83.9	86.1	88.5	91.0	90.6	90.0
–28	79.0	81.4	83.6	85.8	88.2	90.7	90.8	90.4
–30	78.6	81.1	83.2	85.5	87.8	90.3	90.4	90.2
–32	78.3	80.7	82.9	85.1	87.5	90.0	90.0	89.9
–34	77.9	80.4	82.6	84.8	87.2	89.6	89.7	89.6
–36	77.6	80.0	82.2	84.4	86.8	89.2	89.3	89.2
–38	77.2	79.7	81.9	84.0	86.4	88.9	89.0	88.9
–40	76.9	79.3	81.5	83.7	86.0	88.5	88.6	88.5
–42								
–44								
–46								
–48								
–50								
–52								
–54								
–56								
–58								
–60								
–62								
–64								
–66								
–68								
–70								

N1TABLES CLBOEI HI 2WG 1 6D4100 09AUG03

Figure 1-33. (06-10-21 Sheet 1 of 2)

CLIMB THRUST SETTING—ENROUTE SPEED
CLB (SINGLE ENGINE)
ENGINE BLEED ON, ENGINE AND WING A/I ON

THRUST SETTING – %N1 – (Continued)								
SAT °C	ALTITUDE – FT							
	16000	18000	20000	25000	27000	29000	31000	35000
10	79.8	78.3	76.6					
8	80.6	79.1	77.4					
6	81.3	79.8	78.3					
4	82.0	80.6	79.0					
2	82.6	81.3	79.7					
0	83.1	82.0	80.4	74.6				
–2	83.7	82.5	81.1	75.5				
–4	84.1	83.0	81.8	76.4	73.6			
–6	84.6	83.4	82.3	77.2	74.5			
–8	85.1	83.9	82.7	78.1	75.3	72.6		
–10	85.4	84.4	83.2	78.9	76.1	73.4		
–12	85.8	84.9	83.7	79.8	77.0	74.2	70.4	
–14	86.2	85.3	84.2	80.6	77.8	74.9	71.3	
–16	86.6	85.7	84.7	81.1	78.6	75.7	72.2	
–18	87.1	86.2	85.1	81.5	79.5	76.6	73.1	
–20	87.6	86.6	85.6	82.0	80.1	77.4	74.0	67.2
–22	88.0	87.1	86.0	82.4	80.6	78.2	74.9	68.1
–24	88.5	87.6	86.5	82.9	81.2	78.9	75.9	69.0
–26	89.1	88.0	87.0	83.5	81.9	79.7	76.8	70.0
–28	89.6	88.6	87.5	84.0	82.5	80.4	77.7	70.9
–30	90.2	89.2	88.0	84.5	83.1	81.2	78.5	71.9
–32	90.1	89.8	88.6	85.1	83.6	82.0	79.3	73.0
–34	89.7	89.8	89.2	85.6	84.2	82.6	80.2	74.1
–36	89.3	89.4	89.4	86.3	84.7	83.2	81.1	75.0
–38	89.0	89.0	89.0	87.0	85.3	83.7	81.8	75.8
–40	88.6	88.6	88.7	87.7	85.9	84.3	82.3	76.7
–42	88.2	88.2	88.3	88.3	86.6	84.8	82.9	77.6
–44		87.8	87.9	88.9	87.2	85.4	83.5	78.5
–46		87.5	87.6	89.3	87.7	86.0	84.1	79.1
–48			87.2	89.7	88.1	86.5	84.5	79.7
–50				89.6	88.4	86.8	85.0	80.2
–52				89.3	88.8	87.1	85.4	80.7
–54				88.9	89.1	87.5	85.7	81.2
–56				88.5	89.4	87.8	86.0	81.4
–58					89.0	88.3	86.4	81.7
–60						88.8	86.9	82.0
–62							87.4	82.4
–64							88.0	82.8
–66								83.4
–68								84.0
–70								84.6

Figure 1-33. (06-10-21 Sheet 2 of 2)

TAKEOFF

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CHAPTER 2 TAKEOFF

USE OF TAKEOFF CHARTS

Figure 06-20-02 provides a schematic of the takeoff weight determination procedure. The takeoff weight is the lowest weight based on the most restrictive limitation:

1. Field Length Weight Limitation
2. Climb Weight Limitation
3. Maximum Brake Energy Weight Limitation
4. Takeoff Flight Path Weight Limitation (Obstacle Clearance)
5. Maximum Structural Takeoff Weight

Once the scheduled takeoff weight is determined, the corresponding takeoff speeds (V_1, V_R and V_2) can be calculated taking into consideration applicable speed limitations. The following paragraphs provide more information on each takeoff weight limitation.

NOTE:
- Maximum tire speed (182 kts) is not limiting takeoff performance.
- All takeoff performance data presented in this section is based on the APR ARMED configuration.

TAKEOFF WEIGHT LIMIT CHARTS

These charts present the information necessary to determine the maximum allowable takeoff weight as limited by gross climb performance or brake energy limits. The maximum takeoff weight is determined for airport pressure altitude and ambient temperature.The climb limitations portion of the charts do not specify the limiting climb segment, only that any one or a combination of the climb segments (first, second, final, approach or landing) are limiting.

The brake energy weight limitation portion of the charts provides the takeoff weight limited by maximum kinetic energy in a rejected takeoff. Corrections for runway gradient and reported winds are included. Different charts are presented for the takeoff flap settings (Flap 10° and 20°) and the various engine bleed configurations.

The following procedure is to be used to determine the takeoff weight limit:

1. Select the appropriate takeoff weight limit chart based on takeoff flap setting and engine bleed configuration.
2. From the airport pressure altitude and ambient temperature, determine the climb weight limit.
3. From the airport pressure altitude and ambient temperature, determine the uncorrected maximum brake energy weight limit. Apply corrections for reported tower wind and runway gradient. The resulting weight is the corrected maximum brake energy weight limit.
4. Compare the weight limits determined in steps 2 and 3 and select the lowest weight. This is the resulting takeoff weight limit.

TAKEOFF DATA TABLES

Uncorrected takeoff speeds and field lengths are presented in takeoff data tables for both dry and wet runway conditions. A different table is presented for each airport pressure altitude from Sea Level to 10 000 feet in 1000 feet intervals. Different sets of tables are provided for the various engine bleed configurations and takeoff flap settings (10° or 20°). Each table presents V_1, V_R, V_2 and takeoff field length TOFL for a range of takeoff weights and ambient temperatures. V_{FTO} is also presented for convenience. Dedicated correction charts are provided to correct V_1, V_R and takeoff field length for various effects.

TAKEOFF FIELD LENGTH

Takeoff Field Length is determined using the following procedure:

1. For the specified engine bleed configuration, takeoff flap setting and runway surface condition, find the appropriate set of takeoff data tables.
2. For the specified airport pressure altitude, select the two tables that will allow interpolation of data (altitude lower and altitude higher than the specified altitude). Conservatively, takeoff data of the higher altitude table can be used.
3. For the specified aircraft takeoff weight and ambient temperature, determine the uncorrected takeoff field length.
4. Find the applicable takeoff field length correction chart based on takeoff flap setting and runway surface condition.
5. Using the uncorrected takeoff field length from step 3, apply corrections for reported tower wind, runway gradient and the number of operable thrust reversers (if applicable). The resulting distance is the corrected takeoff field length.

The takeoff data tables and takeoff field length correction charts may be used to determine either of the following:

1. The takeoff field length required given the pressure altitude, airplane weight, ambient temperature, reported wind, runway gradient and number of operable thrust reversers (if applicable). The above procedure and the example on the correction charts illustrate determination of takeoff field length required.
2. The maximum airplane takeoff weight corresponding to a specific runway length. In this case, the applicable correction chart and table must be used in the **opposite direction** as described above. Therefore, the starting point is the specified runway length which is used as the corrected takeoff field length. Corrections for the number of operable thrust reversers (if applicable), runway gradient and reported wind are removed to obtain the uncorrected distance. Finally, the maximum takeoff weight is interpolated from pressure altitude, ambient temperature and uncorrected distance in the takeoff data table.

TAKEOFF SPEEDS

Takeoff speeds are determined for the applicable airport pressure altitude, takeoff weight, ambient temperature, reported wind, runway gradient and number of operable thrust reversers (if applicable). Speed limitations must be considered in calculating corrected V1 and VR speeds.

The following takeoff speeds are required:

V1 = Takeoff Decision Speed
VR = Takeoff Rotation Speed
V2 = Takeoff Safety Speed

The following procedure must be used in determining the takeoff speeds:

1. Select the appropriate set of takeoff data tables based on the takeoff flap, runway surface condition and engine bleed configuration.
2. For the specified airport pressure altitude, find the two tables that will allow interpolation of data (lower and higher altitude table). Conservatively, takeoff data of the higher altitude can be used.
3. Determine the uncorrected V1 and VR speeds and the V2 speed as a function of ambient temperature and airplane takeoff weight. The resulting V2 speed does not require any corrections.
4. Find the applicable VR correction chart based on takeoff flap setting.

NOTE: The VR correction is applicable for all runway surface conditions.

5. Using the uncorrected VR speed from step 3, correct VR for runway gradient effect. The corrected VR cannot be less than V1MCG. If the corrected VR is less than 116 KIAS, use VR=116 KIAS.
6. Find the applicable V1 correction chart based on takeoff flap setting and runway surface condition.
7. Using the uncorrected V1 speed from step 3, correct V1 for reported tower wind, runway gradient and the number of operable thrust reversers (if applicable). If the corrected V1 is less than 116 KIAS then V1MCG is limiting. In this case, use V1=116 KIAS.

NOTE: If the uncorrected V1 is lower than the minimum shown on the V1 correction chart, the corrected V1 is 116 KIAS.

8. The corrected V1 must be compared with VR. If the corrected V1 is higher than VR, then use V1=VR.

NOTE:
- Takeoff speeds and takeoff field length can be determined using the same altitude table(s) for specified airport pressure altitude, takeoff flap setting and runway surface conditions.
- If corrections on V1 and VR are not required, the uncorrected V1 and VR speeds determined in step 3 can be used directly provided that they are not limited by V1MCG. Table shading represents the V1 and/or VR speeds that are below minimum. In this case, use a speed of 116 KIAS for V1 and/or VR.

STABILIZER TRIM SETTING FOR TAKEOFF

Determine the required stabilizer trim setting for takeoff using the appropriate Stabilizer Trim Setting chart (Flap 10° or flap 20°), as a function of aircraft weight and CG position.

TAKEOFF FROM WET RUNWAYS

A runway is considered to be wet when it has a shiny appearance due to a thin layer of water on it, but without significant areas of standing water.

NOTE: A runway with greater than 0.125 inch (3 mm) of standing water would be a contaminated runway.

When operating on wet runways, ground handling characteristics will not be as good as can be achieved on dry runways. The variability of surface conditions and crosswinds should be taken into consideration.

Takeoff performance on a wet runway is determined from the applicable wet runway takeoff data tables and correction charts using the same methodology as described in the TAKEOFF DATA paragraph above.

Wet runway takeoff field length and takeoff speeds correction charts include a correction for the number of thrust reversers available at dispatch.

NOTE: The wet runway takeoff field length cannot be lower than the dry runway takeoff field length for the same conditions. If the wet runway takeoff field length is lower than the dry runway takeoff field length, use the dry runway takeoff field length.

STANDARD PERFORMANCE CONDITIONS

All wet runway takeoff performance in this section is based on the following performance conditions:

- Braking - Maximum until full stop
- Automatic Ground Lift Dumping - ARMED
- Thrust Reversers — Maximum Reverse until 40 KIAS then set to Reverse Idle until full stop

TAKEOFF FROM CONTAMINATED RUNWAYS

Refer to the CONTAMINATED RUNWAY DATA supplement.

TAKEOFF FLIGHT PATH CHARTS

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 are illustrated on the TAKEOFF PROFILE figure 06-20-03. Different takeoff profiles are required according to the gross level-off height above the runway. If the gross level-off height is lower than 1500 feet (400 feet minimum), then a final segment climb is required. The gross flight path represents the actual climb and acceleration performance of the airplane. The net flight path is obtained by reducing the gross climb performance by a climb gradient of 0.8% and by reducing the gross acceleration, during the level flight acceleration segment, by 0.008 g. The net takeoff flight path must clear all obstacles by a minimum of 35 feet.

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 35 feet height at the end of the takeoff run (Reference Zero) to the height at the end of gear retraction. It is flown at V2 speed with the operating engine at APR thrust.
Second Segment	Segment beginning at the end of gear retraction (end of first segment) and continuing to level-off height at V2 speed. For obstacle clearance, maintain second segment climb (gear up, flaps at takeoff setting, operating engine at APR thrust, and V2) until reaching obstacle clearance altitude. This procedure will produce the performance shown in the Takeoff Flight Path charts.
Transition (Level Acceleration) Segment	Segment beginning at the end of second segment and representing the acceleration at level-off height. It includes the acceleration from V2 to transition speed (V2+15 KIAS for flaps 10° and V2+25 KIAS for flaps 20°), flap retraction, and continued acceleration to 170 KIAS (final segment/en route climb speed). The operating engine is at APR thrust during this segment.
Final Segment (if required)	This segment begins at the end of the transition segment and ends at 1500 feet above the runway. Final segment climb is based on gear UP, flaps UP, operating engine at Maximum Continuous thrust (CLB setting) and 170 KIAS final segment speed.

The gross level-off height is selected before takeoff. It must not be less than 400 feet and not greater than the maximum gross level-off height. The maximum gross level-off height is attained when the takeoff thrust time limit (10 minutes) expires at the end of the acceleration segment (see figure 06-20-03). In addition, the pressure altitude corresponding to the gross level-off height must not exceed the maximum altitude with flaps extended.

TAKEOFF FLIGHT PATH CHARTS (Cont)

The configurations referred to by name in the charts correspond to the following settings:

Configuration	Engines Operating	Thrust Setting	Flap Setting	Gear
1st Segment Takeoff Climb	1	APR	10° or 20°	Down
2nd Segment Takeoff Climb	1	APR	10° or 20°	Up
Transition (Level Acceleration)	1	APR	10° or 20° to 0°	Up
Final Segment Climb	1	CLB	0°	Up
En Route Climb	1	CLB	0°	Up
Approach Climb	1	APR	10°	Up
Landing Climb	2	TO	30°	Down

CLOSE-IN AND DISTANT FLIGHT PATH CHARTS

The TAKEOFF FLIGHT PATH Charts presented in this manual are separated into CLOSE-IN and DISTANT flight paths for the flap 10° and flap 20° configurations. The CLOSE-IN TAKEOFF FLIGHT PATH Chart facilitates determination of required gradients for horizontal distance less than 10000 feet (3050 m, 1.65 nautical miles) from Reference Zero. The DISTANT TAKEOFF FLIGHT PATH Chart facilitates determination of required gradients up to 100 000 feet (30 500 m, 16.5 nautical miles) from Reference Zero. On these charts, the flight path lines represent the net climb performance of the aircraft for different values of reference climb gradient. The origin of each line is Reference Zero. The net flight path lines intersect the corresponding gross height lines. The 35 feet clearance between the obstacle and the net flight path is accounted for on the charts. The distant takeoff flight path chart includes the maximum gross level-off height limitation. For a specified reference climb gradient intersecting the limiting curve, the maximum gross level-off height is calculated by interpolating between gross level-off height curves.

TAKEOFF FLIGHT PATH CHARTS (Cont)

REFERENCE CLIMB GRADIENT CHARTS

The reference climb gradient is the gradient used in the takeoff flight path obstacle clearance analysis up to level-off height. The reference climb gradient is equal to the second segment net climb gradient of the aircraft. The Net Flight Path of the aircraft is calculated based on the value of the reference climb gradient for both the first and second segment climbs.

Reference climb gradient tables are presented for both flap 10° and flap 20° takeoffs and for the various engine bleed configurations. Uncorrected reference climb gradients are determined for the temperature and pressure altitude of the departure airport and airplane takeoff weight. The uncorrected reference climb gradient is then corrected for gross level-off height and reported winds.

Use the following procedure when calculating the reference climb gradient:

1. Select the appropriate uncorrected reference climb gradient table based on takeoff flap setting and engine bleed configuration.
2. For specified airport pressure altitude, ambient temperature and takeoff weight, interpolate for the uncorrected reference climb gradient.
3. Select the appropriate reference climb gradient correction chart based on takeoff flap setting.
4. Correct the uncorrected reference climb gradient from step 2 for gross level-off height and reported tower wind effects. The resulting gradient is the corrected reference climb gradient.

DISTANCE TO ACCELERATE FROM V_2 TO FINAL SEGMENT SPEED

The horizontal distance to accelerate from V_2 to final segment speed V_{FTO} is provided as a function of the corrected reference climb gradient. Different tables are provided depending on the initial takeoff flap setting. Transition speed is defined as V_2+15 KIAS for a Flap 10° takeoff, and as V_2+25 KIAS for a Flap 20° takeoff. The acceleration distance provided is based on the following assumptions:

1. After completion of the second segment climb, the airplane is accelerated from V_2 to the applicable transition speed.
2. Upon reaching the transition speed, takeoff flaps are retracted to 0°.
3. While the flaps are retracting, the airplane continues to accelerate to V_{FTO} airspeed (170 KIAS).
4. The transition segment is complete when the flaps are fully retracted and V_{FTO} has been reached.

NOTE: V_{FTO} is equal to the enroute climb speed at takeoff altitudes.

TAKEOFF FLIGHT PATH CHARTS (Cont)

NET FINAL SEGMENT CLIMB GRADIENT

A final segment climb is required when the gross level-off height is less than 1500 feet. Net final segment climb gradient tables are provided for two engine bleed configurations. The net final segment climb gradient is presented for the actual pressure altitude and ambient temperature at the height considered during the final segment.

Use the following procedure to determine the net final segment climb gradient:

1. Determine the pressure altitude at the considered height. The geometric height to pressure height conversion chart can be used to determine the pressure height. The pressure height is then added to the airport pressure altitude to find the actual pressure altitude.
2. Determine the ambient temperature at the considered height. The ambient temperature can be calculated assuming a temperature loss of 2 °C per 1000 feet above the airport runway surface. The airport ambient temperature is used as a starting point.
3. Select the appropriate table based on engine bleed configuration.
4. Interpolate for the net final segment climb gradient using the pressure altitude and ambient temperature at the considered height. The initial takeoff weight is used in the calculation.

NOTE: For obstacle clearance calculations, an averaged net final segment climb gradient is determined. This is done by taking the average of the net final segment gradients at the beginning and at the end of the final segment.

DETERMINATION OF TAKEOFF FLIGHT PATH FOR OBSTACLE CLEARANCE

The weight used to determine the takeoff flight path is defined as the airplane weight at the beginning of 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 ambient temperature, pressure altitude, runway gradient and reported wind.
2. From the applicable TAKEOFF DATA table and correction chart, determine the highest weight at which a takeoff may be made using the available runway length, number of operable thrust reversers (if applicable), runway gradient, reported wind, airport pressure altitude

TAKEOFF FLIGHT PATH CHARTS (Cont)

and ambient temperature. The lower of this weight and the weight from Step 1 is the first trial takeoff weight.

3. Determine the horizontal distance of the obstacle from reference zero.
4. From the applicable TAKEOFF FLIGHT PATH Chart, depending on where the critical obstacle is located (Close or Distant obstacle), determine the required reference climb gradient for obstacle clearance. The gross level-off height is also determined at this stage. For most obstacle clearance cases, best performance is obtained by selecting a gross level-off height that ensures that all obstacles are cleared during the first or second segments.
5. From the applicable REFERENCE CLIMB GRADIENT Table and Correction Chart, determine the aircraft climb gradient performance. Note that the reference climb gradient is directly dependant on selected gross level-off height.

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.
   • If step 5 (climb gradient performance) is less than step 4 (required gradient), obstacle clearance is unsatisfactory and procedures must be repeated using a lower 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 iterative process is required to find the exact minimum gradient and maximum weight for obstacle clearance.

NOTE: For ***non***-standard temperature conditions, the indicated altitude when obstacle clearance has been achieved may be determined from the GEOMETRIC HEIGHT TO PRESSURE HEIGHT CONVERSION chart.

7. From the DISTANCE TO ACCELERATE FROM V_2 TO FINAL SEGMENT SPEED table, determine the level acceleration distance (transition segment). This distance is added to that determined at the end of the second segment.
8. If the gross level-off height is less than 1500 feet, a final segment climb is required. The net final segment climb gradient is determined using the appropriate engine bleed configuration. It is calculated as the average of the gradient at the start and at the end of the final segment. The final segment distance is then calculated using the resulting final segment gradient.

TAKEOFF FLIGHT PATH EXAMPLES

This section presents examples of how the takeoff flight path charts described above are used in determining a typical flight path. Unless otherwise stated, all distances are measured from the reference zero, defined as the end of the takeoff distance at a height of 35 ft above the takeoff surface.

EXAMPLE A: DETERMINATION OF THE NET TAKEOFF FLIGHT PATH

Associated Conditions:

Aircraft weight	= 30 000 lb (13 610 kg)
Airport pressure altitude	= 1000 ft
Ambient temperature	= 30 °C (ISA + 17 °C)
Reported wind	= 10 knots (headwind)
Flaps	= 10°
Engine bleed	= On
Obstacle distance	= 77 000 ft (23 470 m)
Obstacle height	= 5350 ft above the takeoff surface

Figure 06-22-41 shows that an obstacle clearance reference climb gradient of not less than 7% and a gross level-off height of not less than 6000 ft are required in order to clear the obstacle. Figure 06-22-41 also shows that the maximum gross level-off height under these conditions is 7200 ft. The gross level-off height used must therefore be not less than 6000 ft and not more than 7200 ft. A gross level-off height of 6000 ft will be used in this example to maximize the allowable takeoff weight.

Figures 06-22-37 and 06-22-39 show that for a gross level-off height of 6000 ft and the associated conditions above, the actual obstacle clearance reference climb gradient is 7%. It can therefore be concluded that the airplane will clear the obstacle. The gross level-off height (geometric height) of 6000 ft derived from Figure 06-22-41 is used to determine the level flight acceleration pressure height using Figure 06-01-10, which for an ISA + 17 °C day is 5650 ft. Since the airport pressure altitude is 1000 ft in this example, the level-off pressure altitude is:

1000 ft + 5650 ft = 6650 ft

Once the obstacle clearance reference climb gradient has been determined, Figure 06-24-42 can be used to determine the net acceleration distance, which in this case is 27 870 ft (8500 m). The total distance from reference zero is therefore:

77 000 ft + 27 870 ft = 104 870 ft
(23 470 m + 8500 m = 31 970 m)

Since the level-off height of 6000 ft is well above 1500 ft, a final segment climb is not required in this example.

EXAMPLE B: CALCULATIONS INVOLVING FINAL SEGMENT CLIMB

Associated Conditions:

Aircraft weight	= 32 000 lb (14 515 kg)
Airport pressure altitude	= 5000 ft
Ambient temperature	= 20°C (ISA + 15 °C)
Reported wind	= 10 knots (headwind)
Flaps	= 20°
Engine bleed	= Off
Obstacle distance	= 8800 ft (2680 m)
Obstacle height	= 495 ft above the takeoff surface

Figure 06-24-40 shows that the obstacle clearance reference climb gradient required for the above conditions is 6% and that the minimum gross level-off height required to clear the obstacle by 35 ft is 600 ft. Figure 06-24-41 shows that the maximum gross level-off height is 5600 ft. The gross level-off height must therefore not be less than 600 ft and not greater than 5600 ft. A gross level-off height of 600 ft will be used to maximize the allowable takeoff weight.

Figures 06-24-36 and 06-24-39 show that for a gross level-off height of 600 ft and the associated conditions above, the actual obstacle clearance reference climb gradient is 6%. It can therefore be concluded that the airplane will clear the obstacle.

For a gross level-off height of 600 ft, the pressure height above the airport is obtained from Figure 06-01-10 and is found to be 570 ft for an ISA + 15 °C day. Since the airport pressure altitude is 5000 ft, the level-off pressure altitude is:

5000 ft + 570 ft = 5570 ft

With an obstacle clearance reference climb gradient of 6%, Figure 06-24-42 can be used to determine the net acceleration distance. In this case it is 34 200 ft (10 425 m).

Since the gross level-off height is less than 1500 ft, a final segment is required. A temperature loss of 1 °C is assumed for the climb to a gross height of 600 ft. An additional temperature loss of 2 °C is assumed for the climb to a gross height of 1500 ft. The final segment net climb gradient is determined as follows:

1. In this example, Engine Bleed ON must be selected for the final segment climb. Using Figure 06-25-01 with an aircraft weight of 32 000 lb (14 515 kg), a temperature of 19 °C, and Figure 06-25-03 for a headwind of 10 knots, the final segment net climb gradient for a pressure altitude of 5570 ft is found to be 6.6%. This is the gradient at the beginning of the final segment.
2. Using Figure 06-01-10 for a gross height of 1500 ft, the pressure height above the airport is found to be 1430 ft for an ISA + 15 °C day. Since the airport pressure altitude is 5000 ft, the pressure altitude at the end of the final segment is: 5000 ft + 1430 ft = 6430 ft

EXAMPLE B: CALCULATIONS INVOLVING FINAL SEGMENT CLIMB (Cont)

3. Using Figure 06-25-01 with an aircraft weight of 32 000 lb (14 515 kg), a temperature of 17 °C, and Figure 06-25-03 for a headwind of 10 knots, the final segment net climb gradient for a pressure altitude of 6430 ft is found to be 6.3%. This is the gradient at the end of the final segment.
4. The final segment net climb gradient is found by calculating the average of the gradients at the beginning and the end of the final segment, using the following equation:
   final segment net climb gradient = (gradient at beginning of final segment + gradient at end of final segment)/2
   In this case:
   Final segment net climb gradient = (6.6 + 6.3)/2 = 6.45%
5. The final segment distance is calculated as follows:
   Final Segment Distance = (Delta Gross Height/Gross Gradient)x100
   where Gross Gradient = Net Gradient + 0.8%
   Final Segment Distance = ((1500 - 600)/(6.45 + 0.8)) x 100 = 12 420 ft (3785 m)
   The total distance from reference zero becomes:
   8800 ft + 34 200 ft + 12 420 ft = 55 420 ft
   (2680 m + 10 425 m + 3785 m = 16 890 m)

GRADIENT LOSS IN A STEADY TURN

The gradient loss in a steady turn is tabulated below for a 15° bank angle.

For bank angles less than 15°, the gradient loss may be considered proportional to bank angle.

FLAP	GRADIENT LOSS (%)
0°	0.27
10°	0.36
20°	0.40

STABILIZER TRIM SETTING FOR TAKEOFF FLAPS = 10°

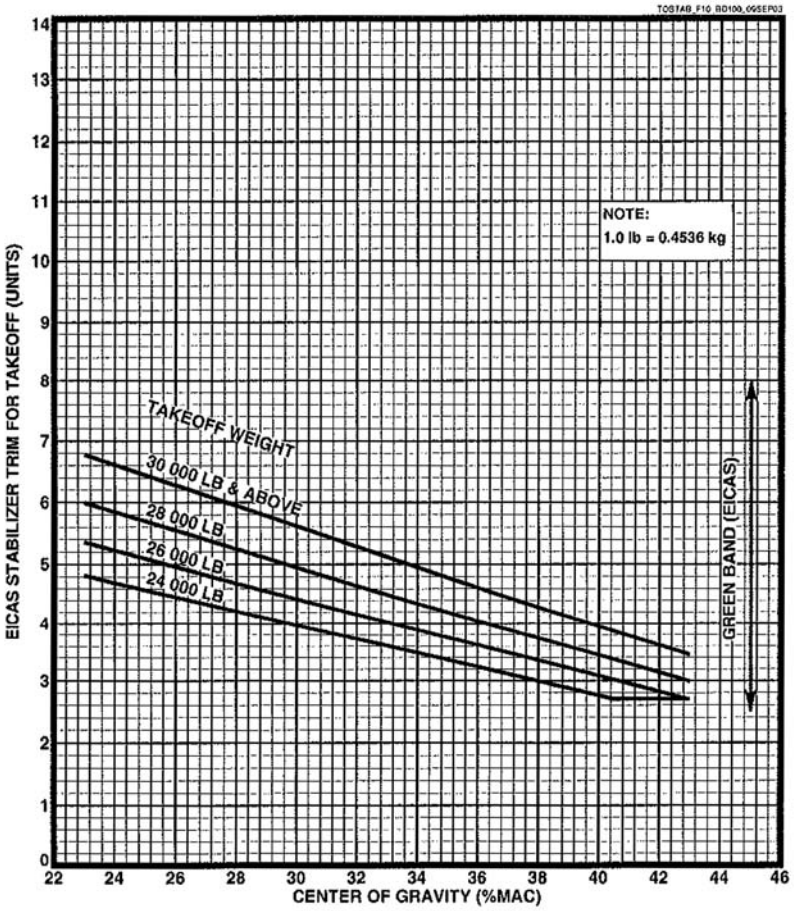


Figure 2-01. (06-20-01)

STABILIZER TRIM SETTING FOR TAKEOFF FLAPS = 20°

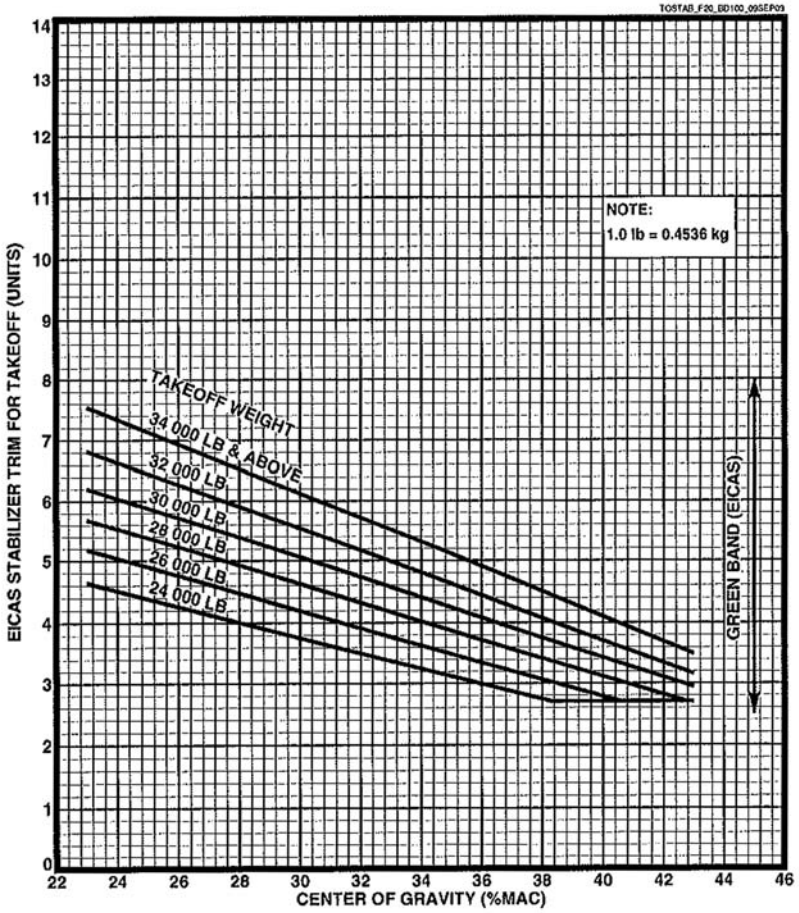


Figure 2-02. (06-20-01)

TAKEOFF WEIGHT DETERMINATION

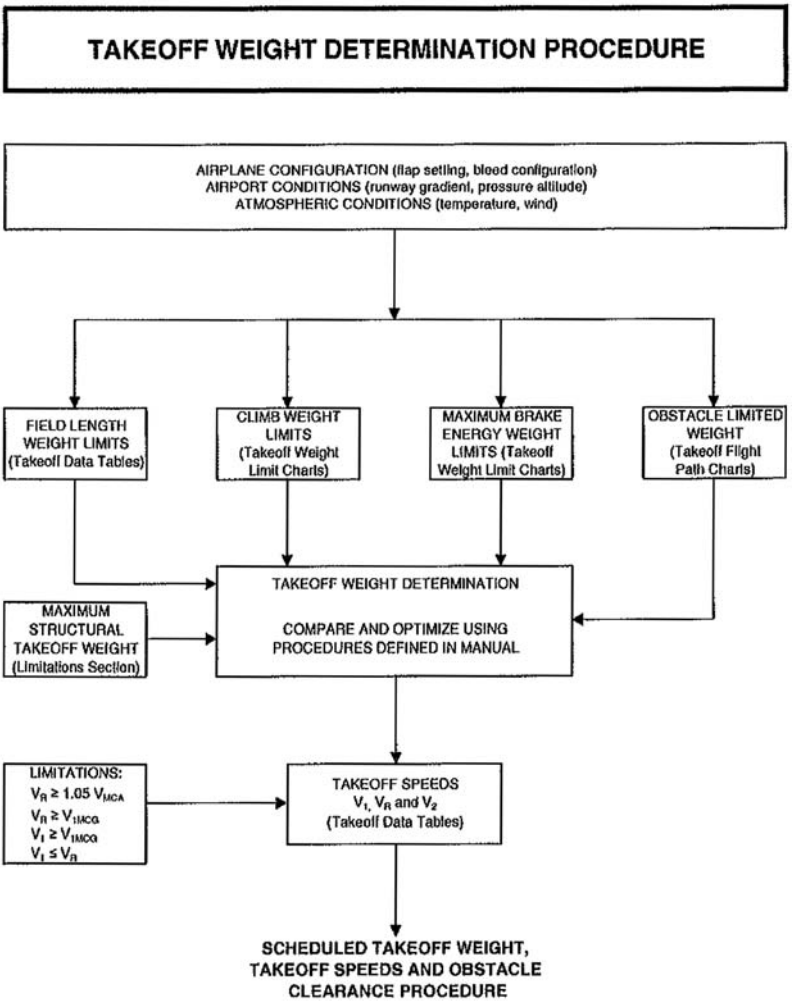


Figure 2-03. (06-20-02)

TAKEOFF FLIGHT PATH (HEIGHT LESS THAN 1500 FT)

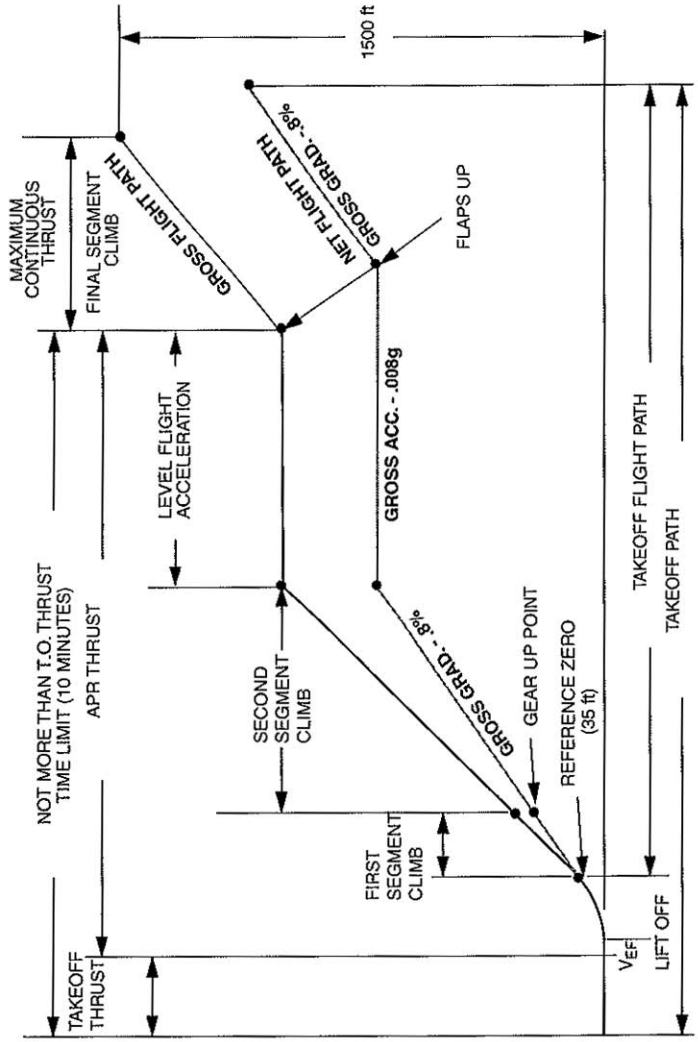


Figure 2-04. (06-20-03 Sheet 1 of 2)

TAKEOFF FLIGHT PATH (HEIGHT GREATER THAN 1500 FT)

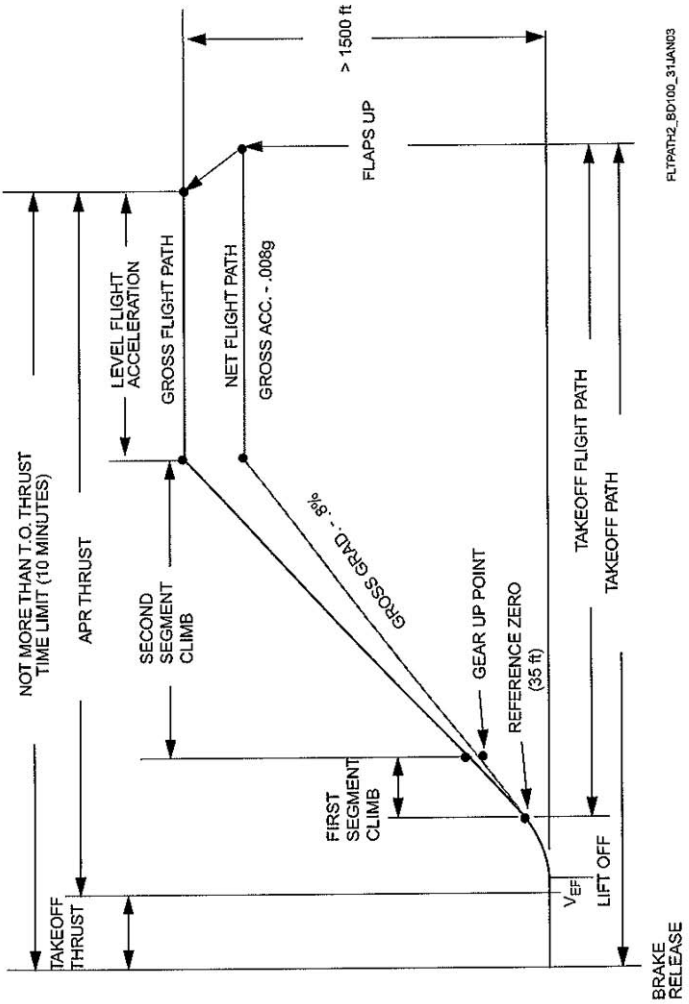
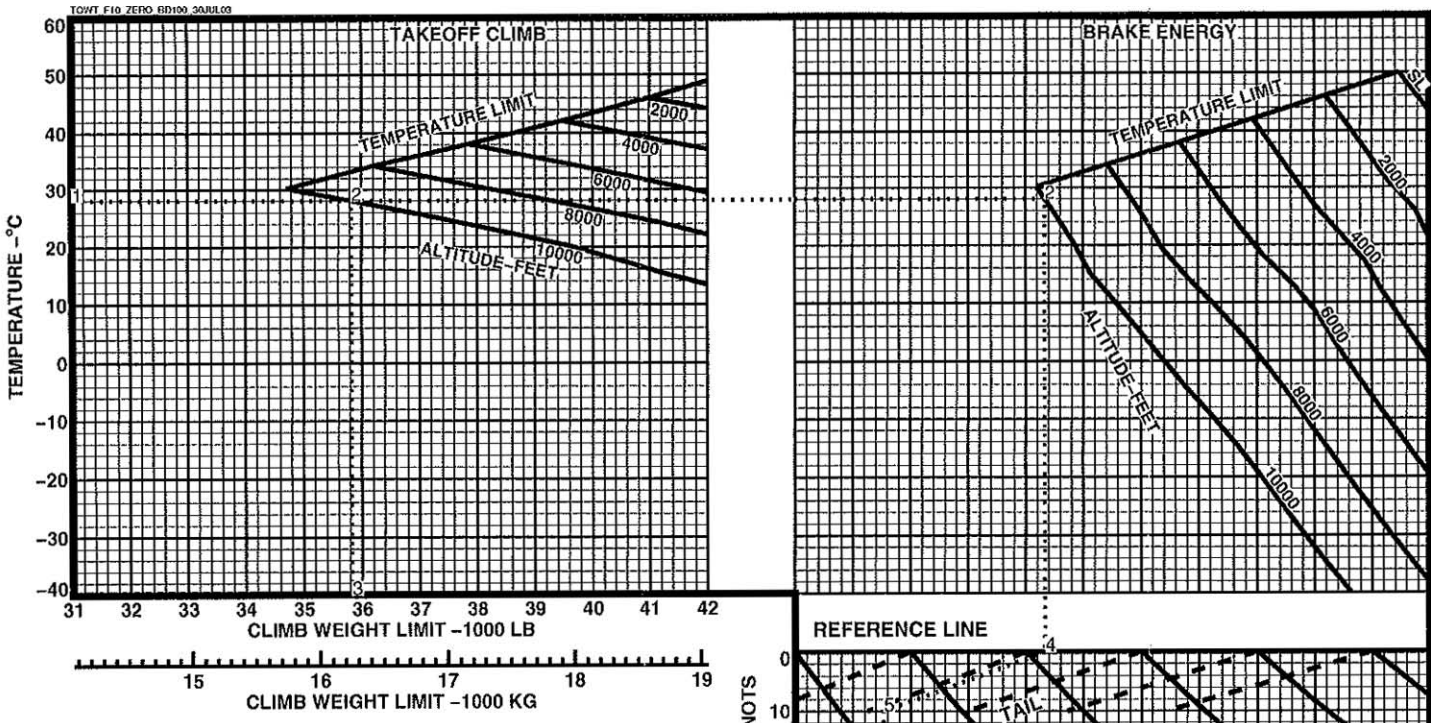


Figure 2-04. (06-20-03 Sheet 2 of 2)

FlightSafety international
CHALLENGER 300 PERFORMANCE MANUAL

TAKEOFF WEIGHT LIMIT
FLAPS 10°
ENGINE BLEED OFF



EXAMPLE:

1. Temperature.....28°C
2. Altitude.....10 000 ft
3. Climb Weight Limit.....35 820 lb (16 250 kg)
4. Wind Reference Line
5. Tailwind.....10 kt
6. Gradient Reference Line
7. Runway Gradient.....1.0% DN
8. Brake Energy Weight Limit.....35 640 lb (16 170 kg)

The most limiting condition is Brake Energy
* Takeoff Weight Limit.....35 640 lb (16 170 kg)

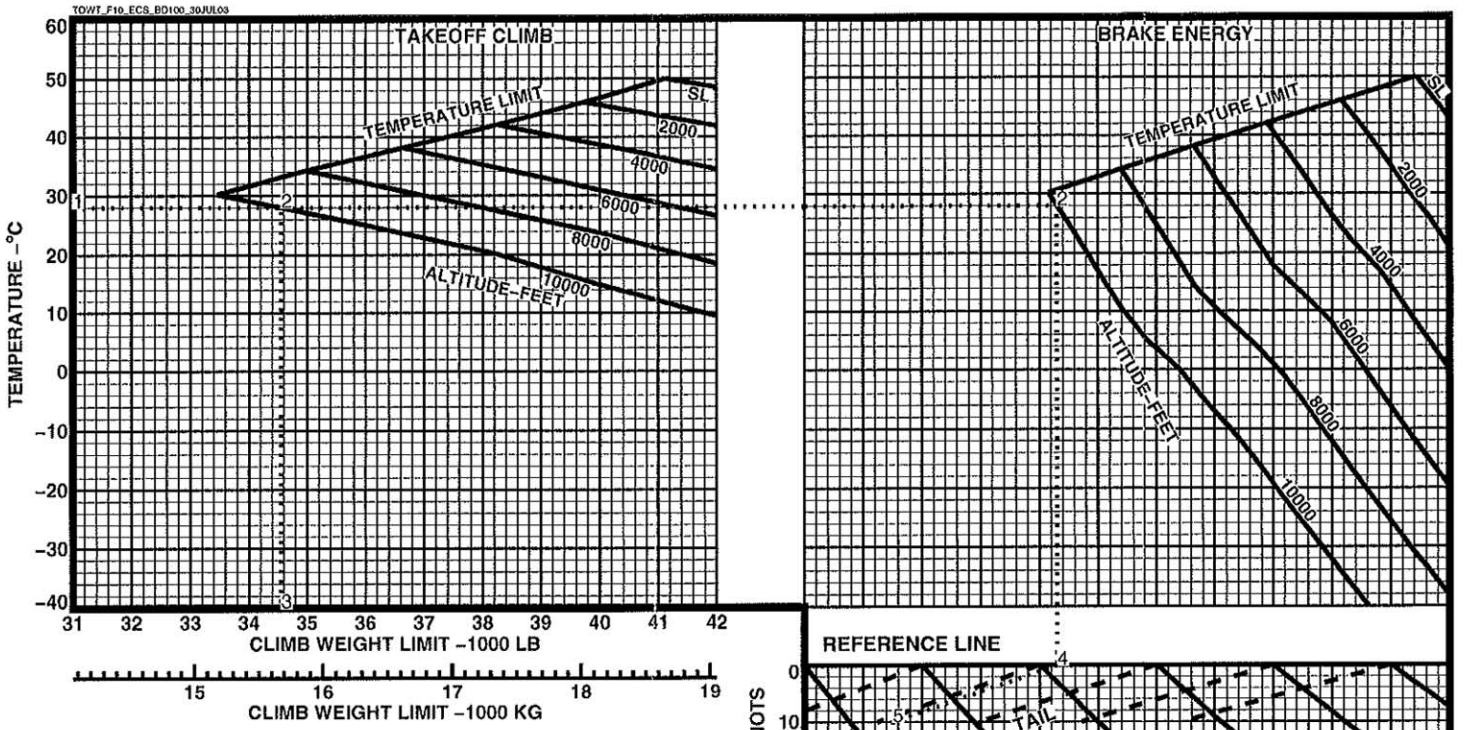
NOTE: The value obtained from this chart may not be the limiting weight. Takeoff Weight is also limited by the maximum certified takeoff weight, the takeoff weight for the runway length available and the obstacle clearance considerations.

Figure 2-05. (06-21-01)

FOR TRAINING PURPOSES ONLY

FlightSafety international
CHALLENGER 300 PERFORMANCE MANUAL

TAKEOFF WEIGHT LIMIT
FLAPS 10°
ENGINE BLEED ON



EXAMPLE:

1. Temperature.....28°C
2. Altitude.....10 000 ft
3. Climb Weight Limit.....34 550 lb (15 670 kg)
4. Wind Reference Line
5. Tailwind.....10 kt
6. Gradient Reference Line
7. Runway Gradient.....1.0% DN
8. Brake Energy Weight Limit.....35 610 lb (16 150 kg)

The most limiting condition is Takeoff Climb
* Takeoff Weight Limit.....34 550 lb (15 670 kg)

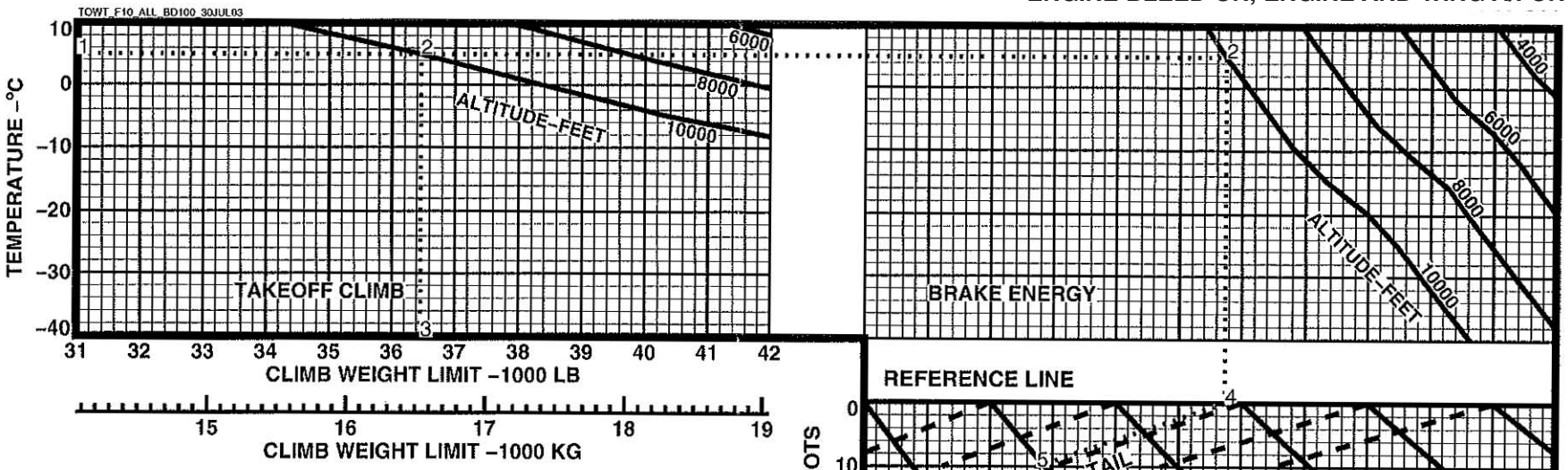
NOTE: The value obtained from this chart may not be the limiting weight. Takeoff Weight is also limited by the maximum certified takeoff weight, the takeoff weight for the runway length available and the obstacle clearance considerations.

Figure 2-06. (06-21-02)

FOR TRAINING PURPOSES ONLY

FlightSafety international
CHALLENGER 300 PERFORMANCE MANUAL

TAKEOFF WEIGHT LIMIT
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON



EXAMPLE:

1. Temperature.....5°C
2. Altitude.....10 000 ft
3. Climb Weight Limit.....36 460 lb (16 540 kg)
4. Wind Reference Line
5. Tailwind.....10 kt
6. Gradient Reference Line
7. Runway Gradient.....1.0% DN
8. Brake Energy Weight Limit.....36 850 lb (16 710 kg)

The most limiting condition is Takeoff Climb
* Takeoff Weight Limit.....36 460 lb (16 540 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 the obstacle clearance considerations.

Figure 2-07. (06-21-03)

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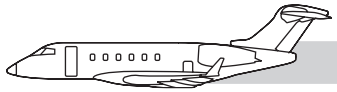
FlightSafety international
CHALLENGER 300 PERFORMANCE MANUAL
FOR TRAINING PURPOSES ONLY

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED OFF

ALTITUDE SEA LEVEL
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
28000	V_1	108	108	108	108	108	107	107	107	107	107	107	108	108	110
	V_R	111	111	111	111	111	111	111	111	111	111	111	111	111	112
	V_2	127	127	127	126	126	126	126	126	126	126	125	125	124	123
	TOFL	2790	2890	2990	3100	3210	3310	3370	3420	3470	3530	3660	3840	4040	4280
30000	V_1	111	111	111	111	111	111	111	111	111	111	111	112	114	116
	V_R	114	114	114	114	114	114	114	115	115	115	116	115	116	117
	V_2	126	126	125	125	125	125	125	125	125	125	124	124	123	123
	TOFL	2890	2990	3090	3200	3320	3430	3480	3540	3590	3650	3790	3990	4200	4460
32000	V_1	117	117	117	117	117	117	117	117	117	117	117	118	120	121
	V_R	119	119	119	119	119	120	120	120	120	120	120	121	121	122
	V_2	127	127	127	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3030	3130	3230	3340	3460	3580	3630	3690	3750	3810	3970	4290	4640	5070
34000	V_1	123	123	122	122	122	122	122	122	122	122	122	123	125	126
	V_R	124	124	124	124	124	124	124	125	125	125	125	125	126	127
	V_2	131	131	131	131	131	131	131	131	131	131	131	131	131	131
	TOFL	3410	3530	3640	3770	3900	4030	4100	4170	4230	4300	4500	4850	5250	5740
36000	V_1	128	128	127	127	127	127	127	127	127	127	127	128	130	131
	V_R	129	129	129	129	129	129	129	129	129	129	129	130	131	131
	V_2	135	135	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	3810	3940	4070	4220	4370	4510	4590	4660	4740	4810	5040	5440	5900	6490
38000	V_1	133	132	132	132	132	132	132	132	132	132	132	133	134	136
	V_R	133	133	133	133	133	133	133	134	134	134	134	134	135	136
	V_2	139	139	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4230	4370	4520	4680	4850	5010	5090	5180	5260	5340	5610	6070	6610	7440
38650	V_1	134	134	134	134	134	134	134	134	134	134	134	135	136	137
	V_R	135	135	135	135	135	135	135	135	135	135	135	136	137	137
	V_2	140	140	140	140	140	140	140	140	140	140	140	140	140	140
	TOFL	4410	4560	4710	4890	5060	5230	5320	5400	5490	5580	5870	6340	6930	7980

TODATASL_DRY_F10_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-08. (06-21-04)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED OFF

ALTITUDE 1000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	48
28000	V_1	108	108	108	108	107	107	107	107	107	107	108	108	109	111
	V_R	111	111	111	111	111	111	111	111	111	111	111	111	112	112
	V_2	127	127	126	126	126	126	126	126	126	125	125	124	123	123
	TOFL	2880	2980	3090	3200	3310	3420	3480	3530	3590	3710	3870	4070	4290	4450
30000	V_1	111	111	111	111	111	111	111	111	111	111	112	114	115	116
	V_R	114	114	114	114	114	115	115	115	115	115	115	116	117	118
	V_2	126	125	125	125	125	125	125	125	124	124	124	123	123	123
	TOFL	2970	3080	3190	3310	3420	3540	3600	3650	3710	3840	4020	4230	4470	4650
32000	V_1	117	117	117	117	117	117	117	117	117	117	118	119	121	121
	V_R	119	119	119	119	119	120	120	120	120	120	120	121	122	122
	V_2	127	127	127	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3110	3220	3330	3450	3570	3690	3750	3810	3870	4020	4290	4630	5030	5310
34000	V_1	122	122	122	122	122	122	122	122	122	122	123	124	126	126
	V_R	124	124	124	124	124	125	125	125	125	125	125	126	127	127
	V_2	131	131	131	131	131	131	131	131	131	131	131	131	131	131
	TOFL	3510	3630	3750	3890	4030	4160	4230	4300	4370	4540	4850	5240	5700	6010
36000	V_1	128	128	127	127	127	127	127	127	127	127	128	129	131	131
	V_R	129	129	129	129	129	129	129	129	129	129	130	131	131	132
	V_2	135	135	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	3920	4060	4200	4350	4500	4660	4730	4810	4890	5100	5450	5880	6420	6810
38000	V_1	132	132	132	132	132	132	132	132	132	132	133	134	135	136
	V_R	133	133	133	133	133	133	134	134	134	134	134	135	135	136
	V_2	139	139	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4350	4500	4660	4830	5000	5170	5260	5340	5430	5670	6070	6570	7200	7920
38850	V_1	134	134	134	134	134	134	134	134	134	134	135	136	137	138
	V_R	135	135	135	135	135	135	135	135	135	135	136	137	137	138
	V_2	140	140	140	140	140	140	140	140	140	140	140	140	140	140
	TOFL	4540	4700	4860	5040	5220	5400	5490	5580	5670	5920	6340	6890	7650	8490

TODATA1K_DRY_F10_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-09. (06-21-05)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED OFF

ALTITUDE 2000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	46
28000	V_1	108	108	108	107	107	107	107	107	107	107	108	109	111	111
	V_R	111	111	111	111	111	111	111	111	111	111	111	112	113	113
	V_2	127	126	126	126	126	126	126	125	125	125	124	123	122	122
	TOFL	2970	3080	3190	3310	3420	3540	3600	3650	3760	3920	4100	4310	4570	4620
30000	V_1	111	111	111	111	111	111	111	111	111	112	113	115	116	117
	V_R	114	114	114	114	115	116	116	115	115	115	116	117	118	118
	V_2	125	125	125	125	125	125	125	124	124	124	123	123	123	123
	TOFL	3070	3180	3300	3420	3540	3660	3720	3780	3890	4070	4260	4490	4780	4870
32000	V_1	117	117	117	117	116	116	116	116	117	117	119	120	122	122
	V_R	119	119	119	119	120	120	120	120	120	120	121	122	123	123
	V_2	127	127	127	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3200	3320	3440	3560	3680	3810	3870	3930	4060	4310	4630	5000	5460	5560
34000	V_1	122	122	122	122	122	122	122	122	122	123	124	125	126	127
	V_R	124	124	124	124	125	125	125	125	125	125	126	127	127	127
	V_2	131	131	131	131	131	131	131	131	131	131	131	131	131	131
	TOFL	3610	3740	3880	4020	4160	4300	4370	4440	4590	4880	5240	5670	6180	6310
36000	V_1	127	127	127	127	127	127	127	127	127	128	129	130	132	132
	V_R	129	129	129	129	129	129	129	129	129	130	130	131	132	132
	V_2	135	135	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4030	4180	4340	4490	4650	4810	4890	4970	5150	5480	5880	6370	7000	7140
38000	V_1	132	132	132	132	132	132	132	132	132	132	133	135	136	136
	V_R	133	133	133	133	133	134	134	134	134	134	135	135	136	136
	V_2	139	139	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4470	4640	4810	4990	5170	5340	5430	5520	5730	6100	6560	7160	8160	8440
38850	V_1	134	134	134	134	134	134	134	134	134	134	135	137	138	138
	V_R	135	135	135	135	135	135	135	135	136	136	136	137	138	138
	V_2	140	140	140	140	140	140	140	140	140	140	140	140	140	140
	TOFL	4670	4850	5020	5210	5390	5580	5670	5770	5980	6380	6870	7500	8730	9020

TODATA2K_DRY_F10_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-10. (06-21-06)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED OFF

ALTITUDE 3000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C												
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	44
28000	V_1	108	108	107	107	107	107	107	107	107	108	108	110	111
	V_R	111	111	111	111	111	111	111	111	111	111	112	112	113
	V_2	126	126	126	126	126	125	125	125	125	124	124	123	122
	TOFL	3060	3180	3300	3420	3540	3660	3720	3810	3970	4150	4350	4590	4810
30000	V_1	111	111	111	111	111	111	111	111	112	113	114	116	117
	V_R	114	114	114	115	116	115	115	115	115	116	117	117	118
	V_2	125	125	125	125	125	124	124	124	124	123	123	123	123
	TOFL	3170	3290	3410	3540	3660	3790	3850	3940	4110	4310	4530	4780	5100
32000	V_1	117	117	117	116	116	116	116	116	117	118	120	121	122
	V_R	119	119	119	120	120	120	120	120	120	121	122	122	123
	V_2	127	127	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3300	3430	3550	3680	3810	3940	4000	4110	4340	4660	5010	5430	5830
34000	V_1	122	122	122	122	122	122	122	122	123	124	125	126	127
	V_R	124	124	124	125	125	125	125	125	125	126	126	127	128
	V_2	131	131	131	131	131	131	131	131	131	131	131	131	131
	TOFL	3720	3860	4010	4150	4300	4450	4520	4640	4910	5270	5670	6150	6640
36000	V_1	127	127	127	127	127	127	127	127	128	129	130	131	132
	V_R	129	129	129	129	129	129	129	130	130	130	131	132	132
	V_2	135	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4160	4320	4490	4650	4810	4980	5060	5200	5510	5920	6380	6960	7600
38000	V_1	132	132	132	132	132	132	132	132	132	133	134	136	136
	V_R	133	133	133	134	134	134	134	134	134	135	135	136	136
	V_2	139	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4620	4800	4980	5160	5340	5530	5620	5780	6140	6600	7150	7890	8990
38850	V_1	134	134	134	134	134	134	134	134	134	135	136	138	138
	V_R	135	135	135	135	135	136	136	136	136	136	137	138	138
	V_2	141	141	141	141	141	141	141	141	141	141	141	141	141
	TOFL	4820	5010	5200	5390	5580	5770	5870	6040	6420	6900	7500	8460	9600

TODATA3K_DRY_F10_ZERO_IMP_6D100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-11. (06-21-07)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED OFF

ALTITUDE 4000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C												
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	42
28000	V_1	108	108	107	107	107	107	107	107	107	108	110	111	112
	V_R	111	111	111	111	111	111	111	111	111	111	112	113	113
	V_2	126	126	126	126	125	125	125	125	124	124	123	122	122
	TOFL	3170	3290	3410	3540	3660	3790	3860	4010	4200	4400	4630	4890	5020
30000	V_1	111	111	111	111	111	111	111	111	113	114	115	117	117
	V_R	114	114	115	115	115	115	115	115	116	117	117	118	118
	V_2	125	125	125	125	124	124	124	124	123	123	123	123	123
	TOFL	3280	3400	3530	3660	3790	3920	4000	4160	4360	4580	4820	5180	5360
32000	V_1	117	117	117	117	116	116	116	117	118	119	121	122	122
	V_R	119	120	120	120	120	120	120	120	121	122	122	123	123
	V_2	127	127	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3420	3550	3680	3810	3950	4080	4160	4370	4690	5040	5440	5910	6120
34000	V_1	122	122	122	122	122	122	122	122	124	125	126	127	128
	V_R	124	124	125	125	125	125	125	125	126	126	127	128	128
	V_2	131	131	131	131	131	131	131	131	131	131	131	131	131
	TOFL	3850	4000	4150	4300	4460	4610	4700	4950	5300	5710	6160	6720	6980
36000	V_1	127	127	127	127	127	127	127	127	128	130	131	132	132
	V_R	129	129	129	129	129	130	130	130	130	131	132	132	132
	V_2	135	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4310	4480	4650	4820	4990	5160	5270	5550	5950	6420	6950	7620	8160
38000	V_1	132	132	132	132	132	132	132	132	133	134	135	136	137
	V_R	133	133	134	134	134	134	134	134	135	135	136	136	137
	V_2	139	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4780	4970	5160	5350	5540	5730	5860	6180	6630	7180	7810	9030	9600
38850	V_1	134	134	134	134	134	134	134	134	135	136	137	138	138
	V_R	135	135	135	135	136	136	136	136	136	137	137	138	138
	V_2	141	141	141	141	141	141	141	141	141	141	141	141	141
	TOFL	4990	5190	5390	5590	5790	5990	6120	6460	6940	7530	8310	9640	10220

TODATA4K_ORY_F10_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-12. (06-21-08)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED OFF

ALTITUDE 5000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40		
28000	V_1	108	107	107	107	107	107	107	107	108	109	111	112		
	V_R	111	111	111	111	111	111	111	111	111	112	113	114		
	V_2	126	126	126	125	125	125	125	124	124	123	122	121		
	TOFL	3280	3410	3540	3670	3800	3930	4070	4230	4450	4690	4920	5230		
30000	V_1	111	111	111	111	111	111	111	112	114	115	116	118		
	V_R	114	115	115	115	115	115	115	116	117	117	118	119		
	V_2	125	125	125	124	124	124	124	123	123	123	123	123		
	TOFL	3390	3520	3660	3790	3930	4060	4220	4390	4630	4880	5170	5630		
32000	V_1	117	117	117	117	117	116	117	118	119	120	122	123		
	V_R	120	120	120	120	120	120	120	121	122	122	123	124		
	V_2	127	127	127	127	127	127	127	127	127	127	127	127		
	TOFL	3540	3680	3820	3950	4090	4230	4420	4710	5070	5480	5900	6440		
34000	V_1	122	122	122	122	122	122	122	123	124	126	127	128		
	V_R	124	125	125	125	125	125	125	126	126	127	128	128		
	V_2	132	132	132	132	132	132	132	132	132	132	132	132		
	TOFL	3990	4150	4310	4460	4620	4780	5000	5320	5740	6200	6690	7360		
36000	V_1	127	127	127	127	127	127	127	128	129	130	132	133		
	V_R	129	129	129	130	130	130	130	130	131	132	132	133		
	V_2	135	135	135	135	135	135	135	135	135	135	135	135		
	TOFL	4470	4640	4820	5000	5180	5350	5610	5970	6450	6990	7590	8740		
38000	V_1	132	132	132	132	132	132	132	133	134	135	136	137		
	V_R	133	134	134	134	134	134	134	135	135	136	136	137		
	V_2	139	139	139	139	139	139	139	139	139	139	139	139		
	TOFL	4960	5150	5350	5550	5750	5950	6240	6650	7210	7860	8830	10240		
38850	V_1	134	134	134	134	134	134	134	135	136	137	138	139		
	V_R	135	135	136	136	136	136	136	136	137	137	138	139		
	V_2	141	141	141	141	141	141	141	141	141	141	141	141		
	TOFL	5180	5380	5590	5800	6000	6210	6520	6950	7560	8260	9440	10890		

TODATASK_DRY_F10_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-13. (06-21-09)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED OFF

ALTITUDE 6000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C											
		-40	-30	-20	-10	0	10	15	20	25	30	35	38
28000	V_1	107	107	107	107	107	107	107	108	109	110	112	113
	V_R	111	111	111	111	111	111	111	111	112	113	114	114
	V_2	126	126	125	125	125	125	124	124	123	122	121	121
	TOFL	3390	3520	3660	3790	3930	4140	4300	4500	4730	4990	5270	5480
30000	V_1	111	111	111	111	111	111	112	113	115	116	117	118
	V_R	115	115	115	115	115	115	116	117	117	118	119	119
	V_2	125	125	124	124	124	124	123	123	123	123	123	123
	TOFL	3510	3650	3790	3920	4070	4290	4470	4670	4920	5200	5640	5940
32000	V_1	117	117	116	116	116	117	118	119	120	121	122	123
	V_R	120	120	120	120	120	120	121	122	122	123	124	124
	V_2	127	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3660	3800	3940	4090	4230	4490	4770	5100	5490	5940	6440	6820
34000	V_1	122	122	122	122	122	122	123	124	125	126	128	129
	V_R	125	125	125	125	125	125	126	126	127	128	128	129
	V_2	132	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4130	4280	4450	4610	4780	5080	5390	5770	6220	6730	7360	7880
36000	V_1	127	127	127	127	127	127	128	129	130	131	133	133
	V_R	129	129	130	130	130	130	130	131	131	132	133	133
	V_2	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4620	4800	4980	5170	5350	5700	6050	6480	7000	7630	8570	9410
38000	V_1	132	132	132	132	132	132	133	134	135	136	137	137
	V_R	134	134	134	134	134	134	135	135	136	136	137	137
	V_2	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5130	5330	5530	5740	5950	6340	6740	7230	7860	8720	10070	10970
38850	V_1	134	134	134	134	134	134	135	136	137	138	138	139
	V_R	135	135	136	136	136	136	136	137	137	138	138	139
	V_2	141	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5360	5560	5780	5990	6210	6620	7040	7580	8250	9330	10720	11650

TODATA6K_DRY_F10_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-14. (06-21-10)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED OFF

ALTITUDE 7000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	36		
28000	V_1	107	107	107	107	106	107	107	109	110	111	113	113		
	V_R	111	111	111	111	111	111	112	112	113	114	114	114		
	V_2	126	126	125	125	125	124	124	123	122	122	121	121		
	TOFL	3510	3640	3780	3930	4070	4380	4560	4770	5040	5320	5660	5730		
30000	V_1	111	111	111	111	111	112	113	115	116	117	118	118		
	V_R	115	115	115	115	115	116	117	117	118	119	119	119		
	V_2	125	125	124	124	124	123	123	123	123	123	123	123		
	TOFL	3630	3770	3920	4060	4210	4540	4730	4970	5250	5650	6160	6270		
32000	V_1	117	116	116	116	116	118	119	120	121	122	124	124		
	V_R	120	120	120	120	120	121	122	122	123	123	124	124		
	V_2	128	128	128	128	128	128	128	128	128	128	128	128		
	TOFL	3780	3920	4070	4220	4370	4830	5150	5520	5960	6460	7080	7220		
34000	V_1	122	122	122	122	122	123	124	125	126	127	129	129		
	V_R	125	125	125	125	125	126	126	127	127	128	129	129		
	V_2	132	132	132	132	132	132	132	132	132	132	132	132		
	TOFL	4260	4420	4600	4770	4940	5470	5820	6250	6750	7360	8230	8510		
36000	V_1	127	127	127	127	127	128	129	130	131	133	133	133		
	V_R	129	129	130	130	130	130	131	131	132	133	133	133		
	V_2	135	135	135	135	135	135	135	135	135	135	135	135		
	TOFL	4770	4960	5150	5340	5540	6130	6540	7020	7630	8400	9800	10100		
38000	V_1	132	132	132	132	132	133	133	135	136	137	137	137		
	V_R	134	134	134	134	134	135	135	136	136	137	137	137		
	V_2	139	139	139	139	139	139	139	139	139	139	139	139		
	TOFL	5300	5500	5720	5930	6150	6830	7280	7880	8610	9900	11410	11730		
38850	V_1	134	134	134	134	134	134	136	137	138	138	139	139		
	V_R	136	136	136	136	136	136	137	137	138	138	139	139		
	V_2	141	141	141	141	141	141	141	141	141	141	141	141		
	TOFL	5530	5750	5970	6200	6430	7140	7640	8260	9180	10550	12110	12440		

TODATA7K_DRY_F10_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-15. (06-21-11)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED OFF

ALTITUDE 8000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-30	-20	-10	0	10	15	20	25	30	34
28000	V_1	107	107	107	106	107	107	108	110	111	112	114
	V_R	111	111	111	111	111	112	112	113	113	114	115
	V_2	126	125	125	125	125	124	123	122	122	121	120
	TOFL	3630	3770	3920	4060	4280	4630	4830	5080	5370	5700	6010
30000	V_1	111	111	111	111	111	113	114	115	117	118	119
	V_R	115	115	115	115	116	117	117	118	118	119	120
	V_2	125	124	124	124	124	123	123	123	123	123	123
	TOFL	3750	3900	4050	4200	4440	4810	5030	5290	5660	6160	6620
32000	V_1	116	116	116	116	117	119	120	121	122	123	124
	V_R	120	120	120	120	121	122	122	123	123	124	124
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	3900	4050	4210	4360	4660	5220	5570	5970	6470	7060	7630
34000	V_1	122	122	122	122	122	124	125	126	127	128	129
	V_R	125	125	125	125	126	126	127	127	128	129	129
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4400	4570	4750	4930	5260	5900	6300	6760	7350	8090	9170
36000	V_1	127	127	127	127	127	129	130	131	132	133	133
	V_R	129	130	130	130	130	131	131	132	132	133	133
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	4930	5120	5320	5520	5900	6630	7070	7640	8360	9600	10830
38000	V_1	132	132	132	132	132	133	134	136	137	137	138
	V_R	134	134	134	134	134	135	136	136	137	137	138
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5470	5690	5910	6140	6560	7380	7920	8610	9720	11210	12530
38650	V_1	134	134	134	133	134	135	136	138	138	139	139
	V_R	136	136	136	136	136	137	137	138	138	139	139
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5720	5940	6180	6410	6850	7730	8310	9070	10370	11910	13270

TODATA6K_DRY_F10_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-16. (06-21-12)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED OFF

ALTITUDE 9000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-30	-20	-10	0	10	15	20	25	30	32
28000	V_1	107	107	107	106	107	108	110	111	112	113	114
	V_R	112	112	112	112	112	112	113	113	114	115	115
	V_2	125	125	125	125	124	123	122	122	121	120	120
	TOFL	3780	3930	4080	4260	4530	4910	5130	5410	5740	6130	6300
30000	V_1	111	111	111	111	112	114	115	116	117	119	119
	V_R	115	115	116	116	117	117	118	118	119	120	120
	V_2	124	124	124	124	123	123	123	123	123	123	123
	TOFL	3910	4070	4230	4410	4700	5110	5350	5680	6160	6730	7020
32000	V_1	117	116	116	117	118	120	121	122	123	124	125
	V_R	120	120	121	121	122	122	123	123	124	124	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	4070	4240	4400	4610	5040	5640	6020	6480	7040	7770	8170
34000	V_1	122	122	122	122	123	125	126	127	128	129	129
	V_R	125	125	125	126	126	127	128	128	129	129	129
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4600	4780	4970	5200	5690	6380	6810	7350	8070	9240	9860
36000	V_1	127	127	127	127	128	130	131	132	133	133	134
	V_R	130	130	130	130	131	131	132	132	133	133	134
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	5150	5360	5560	5830	6370	7160	7680	8340	9390	10930	11600
38000	V_1	132	132	132	132	133	134	135	137	137	138	138
	V_R	134	134	134	134	135	136	136	137	137	138	138
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5720	5950	6180	6480	7090	8020	8640	9580	11000	12660	13380
38850	V_1	134	134	134	134	135	136	138	138	139	139	139
	V_R	136	136	136	136	137	137	138	138	139	139	139
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5970	6210	6460	6760	7410	8400	9110	10230	11700	13410	14160

TODATA9K_DRY_F10_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-17. (06-21-13)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED OFF

ALTITUDE 10000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C									
		-40	-30	-20	-10	0	10	15	20	25	30
26000	V_1	107	107	107	107	108	109	111	112	113	114
	V_R	112	112	112	112	112	113	113	114	115	115
	V_2	125	125	125	124	123	122	122	121	121	120
	TOFL	3940	4100	4280	4510	4800	5210	5450	5780	6160	6600
30000	V_1	111	111	111	112	114	115	116	117	118	120
	V_R	116	116	116	116	117	118	118	119	120	120
	V_2	124	124	124	123	123	123	123	123	123	123
	TOFL	4080	4250	4430	4670	4980	5430	5700	6160	6720	7430
32000	V_1	117	117	117	118	119	120	121	122	124	125
	V_R	121	121	121	121	122	123	123	124	124	125
	V_2	128	128	128	128	128	128	128	128	128	128
	TOFL	4290	4460	4650	4980	5440	6090	6500	7040	7740	8830
34000	V_1	122	122	122	123	124	126	126	128	129	130
	V_R	125	126	126	126	127	128	128	128	129	130
	V_2	132	132	132	132	132	132	132	132	132	132
	TOFL	4840	5030	5250	5620	6140	6890	7370	8030	8980	10580
36000	V_1	127	127	127	128	129	130	131	133	133	134
	V_R	130	130	130	131	131	132	132	133	133	134
	V_2	136	136	136	136	136	136	136	136	136	136
	TOFL	5420	5640	5880	6300	6890	7760	8350	9180	10670	12400
38000	V_1	132	132	132	133	134	135	137	137	137	138
	V_R	134	134	135	135	136	136	137	137	137	138
	V_2	139	139	139	139	139	139	139	139	139	139
	TOFL	6020	6270	6530	7000	7680	8710	9510	10780	12400	14270
38850	V_1	134	134	134	134	136	137	138	139	139	140
	V_R	136	136	136	137	137	138	138	139	139	140
	V_2	141	141	141	141	141	141	141	141	141	141
	TOFL	6280	6540	6820	7310	8050	9190	10160	11480	13160	15090

TODATA10K_DRY_F10_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-18. (06-21-14)

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DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON

ALTITUDE SEA LEVEL
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
28000	V_1	109	108	108	108	108	108	107	107	107	107	108	108	109	111
	V_R	111	111	111	111	111	111	111	111	111	111	111	111	111	112
	V_2	127	127	126	126	126	126	126	126	126	126	125	124	124	123
	TOFL	2800	2890	2990	3100	3210	3320	3370	3420	3480	3550	3690	3880	4080	4330
30000	V_1	111	111	111	111	111	111	111	111	111	111	112	113	115	116
	V_R	114	114	114	114	114	114	114	115	115	115	115	116	117	118
	V_2	126	125	125	125	125	125	125	125	125	124	124	123	123	123
	TOFL	2890	2990	3090	3210	3320	3430	3480	3540	3600	3670	3820	4020	4250	4550
32000	V_1	117	117	117	117	117	117	117	117	117	117	118	119	120	122
	V_R	119	119	119	119	119	120	120	120	120	120	120	121	122	123
	V_2	127	127	127	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3040	3140	3240	3350	3470	3580	3640	3700	3760	3840	4060	4380	4740	5180
34000	V_1	123	123	122	122	122	122	122	122	122	122	123	124	125	127
	V_R	124	124	124	124	124	124	125	125	125	125	125	126	126	127
	V_2	131	131	131	131	131	131	131	131	131	131	131	131	131	131
	TOFL	3420	3530	3650	3780	3910	4040	4110	4170	4240	4330	4590	4950	5360	5880
36000	V_1	128	128	128	128	127	127	127	127	127	127	128	129	130	132
	V_R	129	129	129	129	129	129	129	129	129	129	130	130	131	132
	V_2	135	135	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	3820	3950	4080	4230	4370	4520	4600	4670	4750	4850	5150	5550	6030	6650
38000	V_1	133	132	132	132	132	132	132	132	132	132	133	134	135	136
	V_R	133	133	133	133	133	133	133	134	134	134	134	135	135	136
	V_2	139	139	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4240	4380	4520	4690	4850	5020	5100	5190	5270	5390	5730	6190	6760	7880
38850	V_1	135	134	134	134	134	134	134	134	134	134	135	136	137	138
	V_R	135	135	135	135	135	135	135	135	135	135	136	136	137	138
	V_2	140	140	140	140	140	140	140	140	140	140	140	140	140	140
	TOFL	4420	4570	4720	4890	5070	5240	5330	5420	5500	5630	5990	6490	7080	8430

TODATASL_DRY_F10_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-19. (06-21-15)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 1000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	48
28000	V_1	108	108	108	108	107	107	107	107	107	107	108	108	110	111
	V_R	111	111	111	111	111	111	111	111	111	111	111	111	112	113
	V_2	127	127	126	126	126	126	126	126	125	125	124	124	123	122
	TOFL	2880	2980	3090	3200	3310	3420	3480	3540	3590	3740	3910	4100	4340	4500
30000	V_1	111	111	111	111	111	111	111	111	111	112	113	114	116	117
	V_R	114	114	114	114	114	115	115	115	115	116	116	117	117	118
	V_2	126	125	125	125	125	125	125	125	124	124	123	123	123	123
	TOFL	2980	3090	3200	3310	3430	3540	3600	3660	3720	3870	4060	4270	4520	4760
32000	V_1	117	117	117	117	117	117	117	117	117	117	119	120	121	122
	V_R	119	119	119	119	120	120	120	120	120	120	121	122	122	123
	V_2	127	127	127	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3120	3230	3340	3460	3580	3700	3750	3820	3880	4090	4390	4730	5140	5430
34000	V_1	123	122	122	122	122	122	122	122	122	123	124	125	126	127
	V_R	124	124	124	124	124	125	125	125	125	125	126	126	127	127
	V_2	131	131	131	131	131	131	131	131	131	131	131	131	131	131
	TOFL	3510	3640	3760	3900	4030	4170	4240	4310	4380	4620	4960	5350	5820	6170
36000	V_1	128	128	127	127	127	127	127	127	127	128	129	130	131	132
	V_R	129	129	129	129	129	129	129	129	129	130	130	131	132	132
	V_2	135	135	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	3930	4070	4210	4360	4510	4670	4740	4820	4900	5180	5560	6010	6580	7080
38000	V_1	132	132	132	132	132	132	132	132	132	132	133	135	136	136
	V_R	133	133	133	133	133	134	134	134	134	134	134	135	136	136
	V_2	139	139	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4360	4510	4670	4840	5010	5180	5270	5350	5440	5760	6200	6730	7560	8390
38850	V_1	134	134	134	134	134	134	134	134	134	134	135	137	137	138
	V_R	135	135	135	135	135	135	135	135	135	136	136	137	137	138
	V_2	140	140	140	140	140	140	140	140	140	140	140	140	140	140
	TOFL	4540	4710	4870	5050	5230	5410	5500	5590	5690	6020	6490	7050	8110	8960

TODATAIK_DRY_F10_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-20. (06-21-16)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 2000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	46
28000	V_1	108	108	108	107	107	107	107	107	107	108	108	110	111	112
	V_R	111	111	111	111	111	111	111	111	111	111	111	112	113	113
	V_2	127	126	126	126	126	126	126	125	125	125	124	123	122	122
	TOFL	2970	3080	3190	3310	3420	3540	3600	3660	3790	3950	4140	4360	4620	4680
30000	V_1	111	111	111	111	111	111	111	111	111	113	114	116	117	117
	V_R	114	114	114	114	115	115	115	115	115	116	116	117	118	118
	V_2	125	125	125	125	125	125	124	124	124	123	123	123	123	123
	TOFL	3070	3180	3300	3420	3540	3660	3720	3780	3920	4100	4300	4540	4900	4990
32000	V_1	117	117	117	117	117	117	117	117	117	118	120	121	122	122
	V_R	119	119	119	120	120	120	120	120	120	121	121	122	123	123
	V_2	127	127	127	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3210	3330	3440	3570	3690	3820	3880	3940	4120	4410	4740	5120	5590	5690
34000	V_1	122	122	122	122	122	122	122	122	122	124	125	126	127	128
	V_R	124	124	124	124	125	125	125	125	125	126	126	127	128	128
	V_2	131	131	131	131	131	131	131	131	131	131	131	131	131	131
	TOFL	3610	3750	3880	4020	4160	4310	4380	4450	4660	4990	5350	5790	6350	6480
36000	V_1	128	127	127	127	127	127	127	127	127	129	130	131	132	132
	V_R	129	129	129	129	129	129	129	129	130	130	131	131	132	132
	V_2	135	135	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4040	4190	4340	4500	4660	4820	4900	4980	5220	5600	6010	6540	7300	7570
38000	V_1	132	132	132	132	132	132	132	132	132	133	134	135	136	136
	V_R	133	133	133	133	134	134	134	134	134	134	135	136	136	136
	V_2	139	139	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4480	4650	4820	5000	5180	5350	5440	5540	5810	6230	6720	7330	8640	8930
38650	V_1	134	134	134	134	134	134	134	134	134	135	136	137	138	138
	V_R	135	135	135	135	135	135	135	136	136	136	137	137	138	138
	V_2	140	140	140	140	140	140	140	140	140	140	140	140	140	140
	TOFL	4680	4850	5030	5220	5400	5590	5680	5780	6070	6510	7050	7860	9220	9520

TODATA2K_DRY_F10_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-21. (06-21-17)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 3000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C												
		–40	–30	–20	–10	0	10	15	20	25	30	35	40	44
28000	V_1	108	108	107	107	107	107	107	107	107	108	109	111	112
	V_R	111	111	111	111	111	111	111	111	111	111	112	113	113
	V_2	126	126	126	126	126	125	125	125	125	124	123	122	122
	TOFL	3070	3180	3300	3420	3540	3660	3720	3840	4000	4190	4390	4640	4870
30000	V_1	111	111	111	111	111	111	111	111	112	114	115	116	118
	V_R	114	114	114	115	115	115	115	115	116	116	117	118	118
	V_2	125	125	125	125	125	124	124	124	124	123	123	123	123
	TOFL	3170	3290	3410	3540	3660	3790	3850	3970	4150	4350	4570	4870	5230
32000	V_1	117	117	117	117	117	116	116	117	118	119	120	122	123
	V_R	119	119	120	120	120	120	120	120	121	121	122	123	123
	V_2	127	127	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3310	3430	3560	3690	3820	3950	4010	4160	4440	4770	5130	5560	5970
34000	V_1	122	122	122	122	122	122	122	122	123	124	126	127	128
	V_R	124	124	124	125	125	125	125	125	126	126	127	127	128
	V_2	131	131	131	131	131	131	131	131	131	131	131	131	131
	TOFL	3730	3870	4020	4160	4310	4450	4530	4700	5020	5390	5800	6300	6810
36000	V_1	127	127	127	127	127	127	127	127	128	129	130	132	132
	V_R	129	129	129	129	129	129	130	130	130	131	131	132	132
	V_2	135	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4170	4330	4490	4660	4820	4990	5070	5270	5630	6050	6530	7130	8100
38000	V_1	132	132	132	132	132	132	132	132	133	134	135	136	137
	V_R	133	133	133	134	134	134	134	134	134	135	136	136	137
	V_2	139	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4630	4810	4990	5170	5350	5540	5630	5860	6270	6750	7330	8380	9500
38850	V_1	134	134	134	134	134	134	134	134	135	136	137	138	138
	V_R	135	135	135	135	135	136	136	136	136	137	137	138	138
	V_2	141	141	141	141	141	141	141	141	141	141	141	141	141
	TOFL	4830	5010	5210	5400	5590	5780	5880	6120	6550	7080	7710	8960	10110

TODATA3K_DRY_F10_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-22. (06-21-18)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 4000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C												
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	42
28000	V_1	108	108	107	107	107	107	107	107	108	109	110	112	112
	V_R	111	111	111	111	111	111	111	111	111	112	113	113	114
	V_2	126	126	126	126	125	125	125	125	124	123	122	122	121
	TOFL	3170	3290	3420	3540	3670	3790	3890	4050	4230	4450	4680	4950	5080
30000	V_1	111	111	111	111	111	111	111	112	113	115	116	117	118
	V_R	114	114	115	115	115	115	115	116	116	117	118	119	119
	V_2	125	125	125	125	124	124	124	124	123	123	123	123	123
	TOFL	3280	3410	3530	3660	3790	3920	4030	4200	4400	4630	4880	5300	5490
32000	V_1	117	117	117	117	117	117	117	118	119	120	121	123	123
	V_R	119	120	120	120	120	120	120	121	121	122	123	123	124
	V_2	127	127	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3430	3550	3690	3820	3950	4090	4210	4470	4800	5160	5570	6050	6290
34000	V_1	122	122	122	122	122	122	122	123	124	125	126	128	128
	V_R	124	124	125	125	125	125	125	126	126	127	127	128	128
	V_2	131	131	131	131	131	131	131	131	131	131	131	131	131
	TOFL	3860	4010	4160	4310	4460	4620	4760	5060	5420	5840	6300	6900	7220
36000	V_1	127	127	127	127	127	127	127	128	129	130	131	132	133
	V_R	129	129	129	129	130	130	130	130	131	131	132	132	133
	V_2	135	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4320	4490	4660	4830	5000	5170	5330	5670	6080	6560	7140	8120	8660
38000	V_1	132	132	132	132	132	132	132	133	134	135	136	137	137
	V_R	133	133	134	134	134	134	134	134	135	135	136	137	137
	V_2	139	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4790	4980	5170	5360	5550	5740	5930	6310	6780	7370	8230	9540	10120
38850	V_1	134	134	134	134	134	134	134	135	136	137	138	138	139
	V_R	135	135	135	135	136	136	136	136	137	137	138	138	139
	V_2	141	141	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5000	5200	5400	5600	5800	6000	6200	6590	7110	7720	8810	10160	10750

TODATA4K_DRY_F10_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-23. (06-21-19)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 5000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C											
		-40	-30	-20	-10	0	10	15	20	25	30	35	40
28000	V_1	108	107	107	107	107	107	107	108	109	110	112	113
	V_R	111	111	111	111	111	111	111	111	112	113	113	114
	V_2	126	126	126	125	125	125	125	124	123	122	122	121
	TOFL	3280	3410	3540	3670	3800	3950	4110	4270	4500	4740	4980	5300
30000	V_1	111	111	111	111	111	111	112	113	114	116	117	118
	V_R	114	115	115	115	115	115	116	116	117	118	118	119
	V_2	125	125	125	124	124	124	124	123	123	123	123	123
	TOFL	3390	3530	3660	3800	3930	4090	4260	4440	4680	4940	5290	5770
32000	V_1	117	117	117	117	117	117	118	119	120	121	122	124
	V_R	120	120	120	120	120	120	121	121	122	123	123	124
	V_2	127	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3550	3680	3820	3960	4100	4280	4520	4820	5190	5610	6040	6620
34000	V_1	122	122	122	122	122	122	123	124	125	126	127	129
	V_R	124	125	125	125	125	125	126	126	127	127	128	129
	V_2	132	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4000	4150	4310	4470	4630	4830	5110	5440	5870	6350	6880	7760
36000	V_1	127	127	127	127	127	127	128	129	130	131	132	133
	V_R	129	129	129	130	130	130	130	131	131	132	132	133
	V_2	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4480	4650	4830	5010	5190	5410	5730	6100	6600	7180	7930	9250
38000	V_1	132	132	132	132	132	132	133	133	135	136	137	137
	V_R	134	134	134	134	134	134	134	135	135	136	137	137
	V_2	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4970	5160	5360	5560	5760	6020	6370	6790	7400	8150	9350	10770
38850	V_1	134	134	134	134	134	134	134	135	137	138	138	139
	V_R	135	135	136	136	136	136	136	137	137	138	138	139
	V_2	141	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5190	5390	5600	5810	6020	6290	6660	7120	7760	8730	9960	11430

TODATA5K_DRY_F10_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-24. (06-21-20)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 6000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C											
		-40	-30	-20	-10	0	10	15	20	25	30	35	38
28000	V_1	107	107	107	107	107	107	107	108	110	111	113	113
	V_R	111	111	111	111	111	111	111	112	113	113	114	114
	V_2	126	126	125	125	125	125	124	123	123	122	121	121
	TOFL	3400	3530	3660	3800	3930	4180	4340	4540	4760	5040	5340	5550
30000	V_1	111	111	111	111	111	112	113	114	116	117	118	119
	V_R	115	115	115	115	115	116	116	117	118	118	119	119
	V_2	125	125	124	124	124	124	123	123	123	123	123	123
	TOFL	3510	3650	3790	3930	4070	4330	4510	4720	4980	5330	5780	6090
32000	V_1	117	117	117	117	116	117	119	120	121	122	123	124
	V_R	120	120	120	120	120	121	121	122	123	123	124	124
	V_2	127	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3670	3800	3950	4090	4240	4590	4880	5220	5620	6080	6620	7000
34000	V_1	122	122	122	122	122	123	124	125	126	127	128	129
	V_R	125	125	125	125	125	126	126	127	127	128	128	129
	V_2	132	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4140	4290	4460	4620	4790	5190	5520	5900	6370	6910	7610	8400
36000	V_1	127	127	127	127	127	128	129	130	131	132	133	133
	V_R	129	129	130	130	130	130	131	131	132	132	133	133
	V_2	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4630	4810	4990	5180	5360	5820	6190	6620	7190	7850	9100	9950
38000	V_1	132	132	132	132	132	132	133	134	136	136	137	137
	V_R	134	134	134	134	134	134	135	135	136	136	137	137
	V_2	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5140	5340	5540	5750	5960	6470	6890	7420	8080	9250	10620	11530
38850	V_1	134	134	134	134	134	134	135	136	138	138	139	139
	V_R	135	136	136	136	136	136	137	137	138	138	139	139
	V_2	141	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5370	5570	5790	6000	6220	6760	7220	7770	8600	9870	11280	12220

TODATA6K_DRY_F10_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-25. (06-21-21)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 7000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C											
		–40	–30	–20	–10	0	10	15	20	25	30	35	36
28000	V_1	107	107	107	107	106	107	108	110	111	112	113	114
	V_R	111	111	111	111	111	111	112	113	113	114	115	116
	V_2	126	126	125	125	125	124	123	123	122	121	120	120
	TOFL	3510	3650	3790	3930	4080	4420	4600	4830	5090	5390	5740	5810
30000	V_1	111	111	111	111	111	113	114	115	116	118	119	119
	V_R	115	115	116	115	115	116	117	118	118	119	120	120
	V_2	125	124	124	124	124	123	123	123	123	123	123	123
	TOFL	3630	3770	3920	4060	4230	4590	4780	5020	5350	5790	6320	6450
32000	V_1	117	116	116	116	116	118	120	121	122	123	124	125
	V_R	120	120	120	120	120	121	122	123	123	124	124	125
	V_2	128	128	128	128	128	128	128	128	128	128	128	128
	TOFL	3790	3930	4080	4230	4400	4950	5270	5650	6100	6620	7270	7480
34000	V_1	122	122	122	122	122	124	125	126	127	128	129	129
	V_R	125	125	125	125	125	126	127	127	128	128	129	129
	V_2	132	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4270	4430	4600	4770	4970	5600	5960	6390	6920	7570	8770	9050
36000	V_1	127	127	127	127	127	129	130	131	132	133	133	133
	V_R	129	130	130	130	130	131	131	132	132	133	133	133
	V_2	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4780	4960	5160	5350	5570	6280	6690	7210	7850	8940	10370	10670
38000	V_1	132	132	132	132	132	133	134	135	136	137	137	138
	V_R	134	134	134	134	134	135	135	136	136	137	137	138
	V_2	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5310	5510	5730	5940	6190	6990	7480	8090	9110	10470	12000	12320
38850	V_1	134	134	134	134	134	135	136	138	138	139	139	139
	V_R	136	136	136	136	136	137	137	138	138	139	139	139
	V_2	141	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5540	5750	5980	6210	6470	7320	7840	8520	9730	11130	12710	13050

TODATA7K_DRY_F10_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-26. (06-21-22)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 8000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-30	-20	-10	0	10	15	20	25	30	34
28000	V_1	107	107	107	106	107	108	109	111	112	113	114
	V_R	111	111	111	111	111	112	113	113	114	114	115
	V_2	126	125	125	125	124	123	123	122	121	121	120
	TOFL	3630	3770	3920	4070	4320	4680	4890	5130	5440	5780	6090
30000	V_1	111	111	111	111	112	114	115	116	117	118	120
	V_R	115	115	115	115	116	117	118	118	119	119	120
	V_2	125	124	124	124	123	123	123	123	123	123	123
	TOFL	3750	3900	4060	4210	4470	4860	5080	5370	5810	6320	6830
32000	V_1	116	116	116	116	117	119	120	121	122	124	125
	V_R	120	120	120	120	121	122	123	123	124	124	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	3910	4060	4210	4370	4720	5350	5700	6120	6630	7270	8100
34000	V_1	122	122	122	122	123	125	126	126	128	129	129
	V_R	125	125	125	125	126	127	127	128	128	129	129
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4410	4580	4760	4940	5330	6050	6450	6930	7570	8580	9740
36000	V_1	127	127	127	127	128	129	130	132	133	133	134
	V_R	130	130	130	130	130	131	132	132	133	133	134
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	4940	5130	5330	5530	5980	6780	7260	7850	8770	10180	11430
38000	V_1	132	132	132	132	132	134	135	136	137	137	138
	V_R	134	134	134	134	135	136	136	136	137	137	138
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5480	5700	5920	6150	6650	7580	8140	9010	10300	11810	13160
38850	V_1	134	134	134	134	134	136	137	138	139	139	139
	V_R	136	136	136	136	136	137	138	138	139	139	139
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5720	5950	6190	6420	6950	7950	8580	9630	10960	12530	13920

TODAT48K_DRY_F10_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-27. (06-21-23)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 9000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-30	-20	-10	0	10	15	20	25	30	32
28000	V_1	107	107	107	106	107	109	110	112	113	114	114
	V_R	112	112	112	112	112	113	113	114	114	115	115
	V_2	125	125	125	125	124	123	122	121	121	120	120
	TOFL	3780	3930	4080	4260	4570	4960	5190	5480	5820	6220	6390
30000	V_1	111	111	111	111	113	115	116	117	118	119	120
	V_R	115	115	115	116	117	118	118	119	119	120	120
	V_2	124	124	124	124	123	123	123	123	123	123	123
	TOFL	3910	4070	4230	4420	4740	5170	5420	5820	6320	6950	7220
32000	V_1	117	117	116	117	118	120	121	122	123	125	125
	V_R	120	120	121	121	122	123	123	124	124	125	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	4080	4240	4410	4620	5100	5780	6170	6640	7260	8170	8750
34000	V_1	122	122	122	122	124	125	126	127	129	129	130
	V_R	125	125	125	126	126	127	128	128	129	129	130
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4610	4790	4970	5210	5760	6540	6980	7570	8370	9830	10460
36000	V_1	127	127	127	127	128	130	131	133	133	134	134
	V_R	130	130	130	130	131	132	132	133	133	134	134
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	5160	5360	5570	5840	6470	7350	7900	8640	9980	11550	12230
38000	V_1	132	132	132	132	133	135	136	137	137	138	138
	V_R	134	134	134	134	135	136	136	137	137	138	138
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5730	5960	6190	6490	7200	8240	9000	10170	11610	13300	14040
38850	V_1	134	134	134	134	135	137	138	139	139	140	140
	V_R	136	136	136	136	137	138	138	139	139	140	140
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5980	6220	6470	6780	7520	8680	9620	10830	12320	14070	14830

TODATA9K_DRY_F10_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-28. (06-21-24)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 10000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C									
		–40	–30	–20	–10	0	10	15	20	25	30
28000	V_1	107	107	107	107	108	110	111	112	114	115
	V_R	112	112	112	112	112	113	114	114	115	116
	V_2	125	125	125	124	123	122	121	121	120	119
	TOFL	3950	4110	4280	4510	4840	5270	5520	5850	6250	6710
30000	V_1	111	111	111	112	114	116	117	118	119	121
	V_R	116	116	116	116	117	118	119	119	120	121
	V_2	124	124	124	123	123	123	123	123	123	123
	TOFL	4090	4250	4430	4680	5030	5490	5850	6320	6910	7700
32000	V_1	117	117	117	118	119	121	122	123	124	125
	V_R	121	121	121	121	122	123	124	124	125	125
	V_2	128	128	128	128	128	128	128	128	128	128
	TOFL	4300	4470	4660	4990	5510	6250	6660	7240	7980	9430
34000	V_1	122	122	122	123	124	126	127	128	129	130
	V_R	125	126	126	126	127	128	128	129	129	130
	V_2	132	132	132	132	132	132	132	132	132	132
	TOFL	4850	5040	5260	5630	6230	7070	7590	8290	9580	11210
36000	V_1	128	127	127	128	129	131	133	133	134	134
	V_R	130	130	130	131	131	132	133	133	134	134
	V_2	136	136	136	136	136	136	136	136	136	136
	TOFL	5430	5650	5890	6310	6990	7990	8640	9770	11300	13060
38000	V_1	132	132	132	133	134	136	137	137	138	138
	V_R	134	134	135	135	136	136	137	137	138	138
	V_2	139	139	139	139	139	139	139	139	139	139
	TOFL	6030	6280	6540	7010	7810	9040	10110	11400	13060	14960
38850	V_1	134	134	134	134	136	138	139	139	139	140
	V_R	136	136	136	137	137	138	139	139	139	140
	V_2	141	141	141	141	141	141	141	141	141	141
	TOFL	6290	6550	6830	7320	8180	9650	10770	12110	13830	15800

TODATA10K_DRY_F10_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-29. (06-21-25)

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DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE SEA LEVEL
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	108	108	108	108	108	108	108	108	108	107	107
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	127	127	127	127	126	126	126	126	126	126	126
	TOFL	2810	2860	2910	2960	3010	3060	3120	3170	3220	3280	3330
30000	V_1	111	111	111	111	111	111	111	111	111	111	111
	V_R	114	114	114	114	114	114	114	114	114	114	114
	V_2	126	125	125	125	125	125	125	125	125	125	125
	TOFL	2900	2950	3010	3060	3110	3170	3220	3280	3330	3390	3450
32000	V_1	117	117	117	117	117	117	117	117	117	117	117
	V_R	119	119	119	119	119	119	119	119	119	120	120
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3050	3100	3150	3200	3250	3310	3360	3420	3480	3540	3600
34000	V_1	123	123	123	122	122	122	122	122	122	122	122
	V_R	124	124	124	124	124	124	124	124	124	124	124
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	3430	3490	3550	3600	3660	3730	3790	3860	3920	3990	4060
36000	V_1	128	128	128	128	128	127	127	127	127	127	127
	V_R	129	129	129	129	129	129	129	129	129	129	129
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	3830	3900	3960	4030	4090	4170	4240	4310	4390	4460	4540
38000	V_1	133	132	132	132	132	132	132	132	132	132	132
	V_R	133	133	133	133	133	133	133	133	133	133	133
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4250	4320	4400	4470	4540	4620	4700	4780	4870	4950	5040
38850	V_1	134	134	134	134	134	134	134	134	134	134	134
	V_R	135	135	135	135	135	135	135	135	135	135	135
	V_2	140	140	140	140	140	140	140	140	140	140	140
	TOFL	4430	4510	4590	4660	4730	4820	4910	5000	5080	5170	5260

TCDATASL_DRY_F10_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-30. (06-21-26)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 1000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	108	108	108	108	108	108	108	107	107	107	107
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	127	127	126	126	126	126	126	126	126	126	126
	TOFL	2890	2940	3000	3050	3100	3160	3210	3270	3330	3380	3440
30000	V_1	111	111	111	111	111	111	111	111	111	111	111
	V_R	114	114	114	114	114	114	114	114	114	114	115
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	2990	3040	3100	3150	3210	3270	3320	3380	3440	3500	3560
32000	V_1	117	117	117	117	117	117	117	117	117	117	117
	V_R	119	119	119	119	119	119	119	119	120	120	120
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3130	3180	3240	3290	3350	3410	3470	3530	3590	3650	3710
34000	V_1	123	122	122	122	122	122	122	122	122	122	122
	V_R	124	124	124	124	124	124	124	124	124	125	125
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	3520	3590	3650	3710	3770	3840	3910	3980	4040	4110	4180
36000	V_1	128	128	128	127	127	127	127	127	127	127	127
	V_R	129	129	129	129	129	129	129	129	129	129	129
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	3940	4010	4080	4150	4220	4300	4370	4450	4530	4600	4680
38000	V_1	132	132	132	132	132	132	132	132	132	132	132
	V_R	133	133	133	133	133	133	133	133	133	133	134
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4370	4450	4520	4600	4680	4770	4850	4940	5020	5110	5200
38850	V_1	134	134	134	134	134	134	134	134	134	134	134
	V_R	135	135	135	135	135	135	135	135	135	135	135
	V_2	140	140	140	140	140	140	140	140	140	140	140
	TOFL	4560	4640	4720	4800	4880	4970	5060	5150	5240	5330	5420

TODATA1K_DRY_F10_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-31. (06-21-27)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 2000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
28000	V_1	108	108	108	108	108	108	107	107	107	107	107
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	127	126	126	126	126	126	126	126	126	126	125
	TOFL	2980	3030	3090	3150	3200	3260	3320	3380	3430	3490	3570
30000	V_1	111	111	111	111	111	111	111	111	111	111	111
	V_R	114	114	114	114	114	114	114	114	115	115	115
	V_2	125	125	125	125	125	125	125	125	125	125	124
	TOFL	3080	3140	3190	3250	3310	3370	3430	3490	3550	3610	3700
32000	V_1	117	117	117	117	117	117	117	117	117	117	117
	V_R	119	119	119	119	119	119	120	120	120	120	120
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3220	3280	3330	3390	3450	3510	3580	3640	3700	3760	3900
34000	V_1	122	122	122	122	122	122	122	122	122	122	123
	V_R	124	124	124	124	124	124	124	125	125	125	125
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	3620	3690	3760	3820	3890	3960	4030	4100	4180	4250	4390
36000	V_1	128	128	127	127	127	127	127	127	127	127	128
	V_R	129	129	129	129	129	129	129	129	129	129	130
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4050	4130	4200	4280	4360	4430	4510	4590	4670	4750	4910
38000	V_1	132	132	132	132	132	132	132	132	132	132	132
	V_R	133	133	133	133	133	133	133	133	134	134	134
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4490	4580	4660	4740	4830	4920	5010	5100	5190	5280	5450
38850	V_1	134	134	134	134	134	134	134	134	134	134	134
	V_R	135	135	135	135	135	135	135	135	135	135	136
	V_2	140	140	140	140	140	140	140	140	140	140	140
	TOFL	4690	4780	4860	4950	5040	5140	5230	5320	5420	5510	5690

TODATA2K_DRY_F10_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-32. (06-21-28)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 3000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	108	108	108	108	107	107	107	107	107	107	108
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	126	126	126	126	126	126	126	126	126	125	124
	TOFL	3070	3130	3180	3250	3310	3370	3430	3490	3550	3630	3770
30000	V_1	111	111	111	111	111	111	111	111	111	111	113
	V_R	114	114	114	114	114	114	115	115	115	115	116
	V_2	125	125	125	125	125	125	125	125	125	124	123
	TOFL	3180	3240	3300	3360	3420	3480	3550	3610	3670	3750	3910
32000	V_1	117	117	117	117	117	117	117	117	117	117	118
	V_R	119	119	119	119	120	120	120	120	120	120	121
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3310	3380	3440	3500	3570	3630	3700	3760	3830	3950	4210
34000	V_1	122	122	122	122	122	122	122	122	122	123	124
	V_R	124	124	124	124	124	125	125	125	125	125	126
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	3740	3810	3880	3950	4020	4100	4170	4240	4320	4450	4740
36000	V_1	127	127	127	127	127	127	127	127	127	128	129
	V_R	129	129	129	129	129	129	129	129	129	130	130
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4180	4260	4340	4420	4500	4580	4670	4750	4830	4980	5300
38000	V_1	132	132	132	132	132	132	132	132	132	132	133
	V_R	133	133	133	133	133	134	134	134	134	134	135
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4630	4720	4810	4900	5000	5090	5180	5270	5370	5530	5890
38850	V_1	134	134	134	134	134	134	134	134	134	134	135
	V_R	135	135	135	135	135	135	135	135	135	136	136
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	4840	4930	5020	5120	5220	5310	5410	5500	5600	5770	6160

TODATA3K_DRY_F10_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-33. (06-21-29)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 4000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
26000	V_1	108	108	108	107	107	107	107	107	107	108	108
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	126	126	126	126	126	126	126	125	125	124	124
	TOFL	3170	3240	3300	3360	3420	3480	3550	3610	3680	3830	3990
30000	V_1	111	111	111	111	111	111	111	111	111	113	114
	V_R	114	114	114	115	115	115	115	115	115	116	117
	V_2	125	125	125	125	125	125	125	124	124	123	123
	TOFL	3280	3350	3410	3470	3540	3600	3670	3730	3810	3970	4140
32000	V_1	117	117	117	117	117	117	117	117	117	118	120
	V_R	119	119	120	120	120	120	120	120	120	121	122
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3430	3500	3560	3630	3690	3760	3830	3890	3990	4260	4550
34000	V_1	122	122	122	122	122	122	122	122	122	124	125
	V_R	124	124	124	125	125	125	125	125	125	126	126
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	3870	3940	4020	4090	4170	4240	4320	4390	4500	4800	5120
36000	V_1	127	127	127	127	127	127	127	127	127	129	130
	V_R	129	129	129	129	129	129	129	129	130	130	131
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4330	4410	4490	4580	4660	4750	4830	4920	5040	5370	5730
38000	V_1	132	132	132	132	132	132	132	132	132	133	134
	V_R	133	133	133	134	134	134	134	134	134	135	135
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4800	4890	4990	5080	5180	5270	5370	5460	5590	5970	6400
38650	V_1	134	134	134	134	134	134	134	134	134	135	136
	V_R	135	135	135	135	135	135	136	136	136	136	137
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5010	5110	5200	5300	5400	5500	5600	5710	5840	6240	6700

TODATA4K_DRY_F10_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-34. (06-21-30)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 5000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	108	108	107	107	107	107	107	107	108	108	109
	V_R	111	111	111	111	111	111	111	111	111	111	112
	V_2	126	126	126	126	126	125	125	125	124	124	123
	TOFL	3280	3350	3410	3480	3540	3610	3670	3730	3880	4050	4220
30000	V_1	111	111	111	111	111	111	111	111	112	114	115
	V_R	114	115	115	115	115	115	115	115	116	117	117
	V_2	125	125	125	125	125	124	124	124	123	123	123
	TOFL	3400	3460	3530	3600	3660	3730	3800	3860	4020	4200	4390
32000	V_1	117	117	117	117	117	117	117	117	118	119	121
	V_R	120	120	120	120	120	120	120	120	121	122	122
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3550	3620	3690	3760	3830	3900	3970	4040	4310	4610	4910
34000	V_1	122	122	122	122	122	122	122	122	124	125	126
	V_R	125	125	125	125	125	125	125	125	126	126	127
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4010	4080	4160	4240	4320	4400	4480	4560	4860	5190	5540
36000	V_1	127	127	127	127	127	127	127	127	128	129	131
	V_R	129	129	129	129	129	130	130	130	130	131	131
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4480	4570	4660	4750	4830	4920	5010	5100	5440	5810	6230
38000	V_1	132	132	132	132	132	132	132	132	133	134	135
	V_R	134	134	134	134	134	134	134	134	135	135	136
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4970	5070	5170	5270	5370	5470	5570	5670	6040	6480	6960
38850	V_1	134	134	134	134	134	134	134	134	135	136	137
	V_R	135	135	135	135	136	136	136	136	136	137	137
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5190	5290	5390	5500	5600	5710	5810	5920	6310	6790	7420

TODATA5K_DRY_F10_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-35. (06-21-31)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 6000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
28000	V_1	107	107	107	107	107	107	107	107	108	109	111
	V_R	111	111	111	111	111	111	111	111	111	112	113
	V_2	126	126	126	126	125	125	125	125	124	123	122
	TOFL	3400	3460	3530	3590	3660	3730	3790	3910	4100	4290	4480
30000	V_1	111	111	111	111	111	111	111	112	114	115	116
	V_R	115	115	115	115	115	115	115	116	117	117	118
	V_2	125	125	125	124	124	124	124	124	123	123	123
	TOFL	3510	3580	3650	3720	3790	3860	3930	4050	4250	4460	4680
32000	V_1	117	117	117	117	117	117	117	118	119	120	122
	V_R	120	120	120	120	120	120	120	121	122	122	123
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3670	3740	3810	3880	3950	4020	4100	4310	4650	4980	5320
34000	V_1	122	122	122	122	122	122	122	123	124	126	127
	V_R	125	125	125	125	125	125	125	126	126	127	128
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4140	4220	4300	4380	4460	4540	4620	4860	5250	5620	6000
36000	V_1	127	127	127	127	127	127	127	128	129	130	132
	V_R	129	129	129	129	130	130	130	130	131	131	132
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4640	4720	4810	4900	5000	5090	5180	5430	5870	6310	6780
38000	V_1	132	132	132	132	132	132	132	133	134	135	136
	V_R	134	134	134	134	134	134	134	134	135	136	136
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5150	5240	5340	5440	5550	5650	5750	6040	6540	7060	7900
38850	V_1	134	134	134	134	134	134	134	135	136	137	138
	V_R	135	135	136	136	136	136	136	136	137	137	138
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5370	5470	5580	5680	5790	5900	6010	6300	6850	7460	8440

TODATA6K_DRY_F10_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-36. (06-21-32)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 7000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
28000	V_1	107	107	107	107	107	107	107	108	109	110	112
	V_R	111	111	111	111	111	111	111	111	112	113	113
	V_2	126	126	125	125	125	125	125	124	123	122	122
	TOFL	3510	3580	3650	3720	3790	3860	3950	4140	4350	4550	4770
30000	V_1	111	111	111	111	111	111	111	113	116	116	117
	V_R	115	115	115	115	115	115	116	117	117	118	119
	V_2	125	125	124	124	124	124	124	123	123	123	123
	TOFL	3630	3700	3770	3840	3920	3990	4090	4300	4520	4740	5060
32000	V_1	117	117	117	117	116	116	117	119	120	121	122
	V_R	120	120	120	120	120	120	121	122	122	123	123
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	3790	3860	3930	4000	4080	4160	4300	4670	5030	5390	5750
34000	V_1	122	122	122	122	122	122	123	124	125	126	128
	V_R	125	125	125	125	125	125	125	126	127	128	128
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4270	4350	4430	4520	4610	4690	4850	5270	5670	6080	6540
36000	V_1	127	127	127	127	127	127	128	129	130	132	133
	V_R	129	129	130	130	130	130	130	131	131	132	133
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4780	4870	4970	5060	5160	5260	5430	5900	6360	6860	7600
38000	V_1	132	132	132	132	132	132	132	134	135	136	137
	V_R	134	134	134	134	134	134	134	135	136	136	137
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5310	5410	5520	5620	5730	5840	6030	6560	7120	7930	8940
38850	V_1	134	134	134	134	134	134	134	136	137	138	138
	V_R	136	136	136	136	136	136	136	137	137	138	138
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5550	5650	5760	5870	5990	6100	6300	6870	7480	8480	9520

TODATA7K_DRY_F10_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-37. (06-21-33)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 8000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	107	107	107	107	107	107	107	109	110	111	113
	V_R	111	111	111	111	111	111	111	112	113	113	114
	V_2	126	125	125	125	125	125	124	123	122	122	121
	TOFL	3630	3700	3770	3840	3920	3990	4180	4400	4620	4840	5090
30000	V_1	111	111	111	111	111	111	113	115	116	117	118
	V_R	115	115	115	115	115	115	116	117	118	119	119
	V_2	125	124	124	124	124	124	123	123	123	123	123
	TOFL	3750	3830	3900	3980	4050	4130	4340	4570	4800	5130	5490
32000	V_1	116	116	116	116	116	116	118	120	121	122	123
	V_R	120	120	120	120	120	120	121	122	123	123	124
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	3910	3980	4060	4140	4220	4310	4670	5060	5450	5830	6270
34000	V_1	122	122	122	122	122	122	124	125	126	127	129
	V_R	125	125	125	125	125	125	126	127	128	128	129
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4410	4490	4580	4670	4760	4860	5270	5710	6150	6620	7260
36000	V_1	127	127	127	127	127	127	129	130	131	133	133
	V_R	130	130	130	130	130	130	131	131	132	133	133
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	4940	5030	5130	5230	5330	5450	5890	6400	6940	7630	8660
38000	V_1	132	132	132	132	132	132	133	135	136	137	137
	V_R	134	134	134	134	134	134	135	136	136	137	137
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5490	5590	5700	5820	5930	6050	6550	7160	7930	8980	10080
38850	V_1	134	134	134	134	134	134	135	137	138	138	139
	V_R	136	136	136	136	136	136	137	137	138	138	139
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5730	5840	5960	6070	6190	6320	6850	7500	8480	9570	10700

TODATA8K_DRY_F10_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-38. (06-21-34)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 9000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
28000	V_1	107	107	107	107	107	107	108	110	111	112	114
	V_R	112	112	112	112	112	112	112	113	113	114	115
	V_2	125	125	125	125	125	124	123	122	122	121	120
	TOFL	3780	3860	3930	4010	4080	4230	4440	4670	4910	5160	5450
30000	V_1	111	111	111	111	111	112	114	116	117	118	119
	V_R	115	115	115	115	116	116	117	118	119	119	120
	V_2	124	124	124	124	124	123	123	123	123	123	123
	TOFL	3910	3990	4070	4150	4230	4380	4610	4860	5190	5560	6000
32000	V_1	117	117	117	117	117	118	120	121	122	123	125
	V_R	120	120	120	120	121	121	122	123	123	124	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	4080	4160	4250	4330	4410	4670	5070	5490	5900	6350	6910
34000	V_1	122	122	122	122	122	123	125	126	127	129	129
	V_R	125	125	125	125	125	126	127	128	128	129	129
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4610	4700	4790	4880	4980	5270	5720	6190	6700	7260	8370
36000	V_1	127	127	127	127	127	128	130	131	133	133	133
	V_R	130	130	130	130	130	131	131	132	133	133	133
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	5160	5260	5370	5470	5580	5900	6410	6980	7640	8680	9860
38000	V_1	132	132	132	132	132	133	134	136	137	137	138
	V_R	134	134	134	134	134	135	136	136	137	137	138
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5730	5840	5960	6080	6200	6550	7150	7860	9010	10110	11370
38850	V_1	134	134	134	134	134	135	136	138	138	139	139
	V_R	136	136	136	136	136	137	137	138	138	139	139
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5980	6100	6220	6350	6470	6840	7490	8420	9600	10730	12030

TODATA9K_DRY_F10_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-39. (06-21-35)

DRY RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 10000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

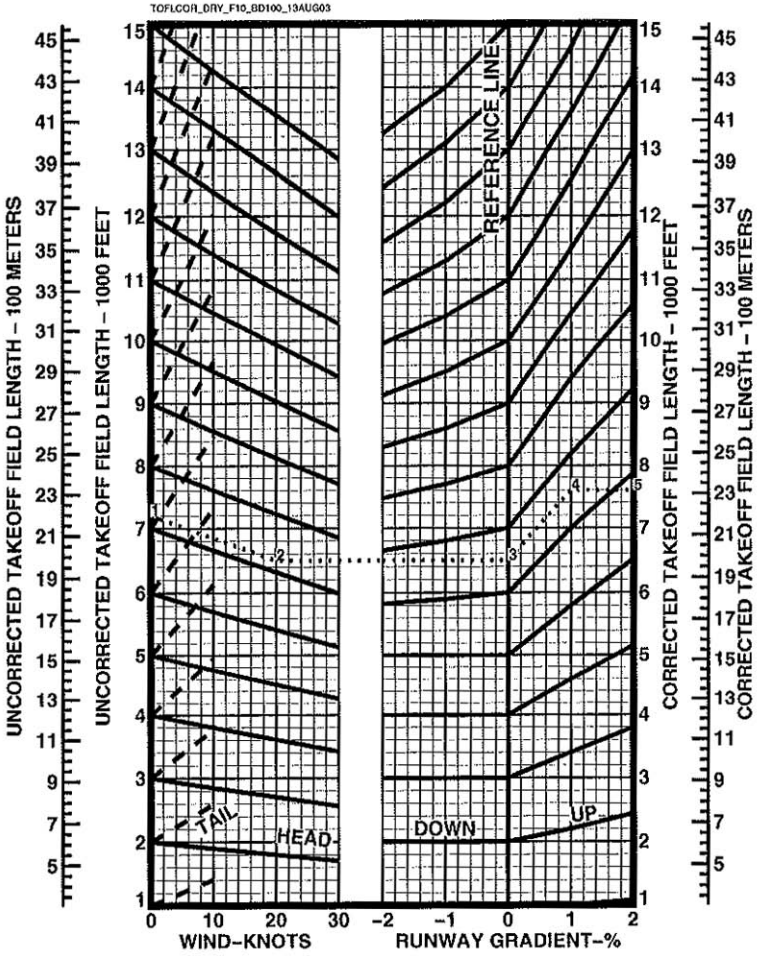
WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	107	107	107	107	107	108	109	111	112	113	114
	V_R	112	112	112	112	112	112	113	113	114	115	115
	V_2	125	125	125	125	124	123	123	122	121	120	120
	TOFL	3950	4030	4110	4190	4300	4490	4730	4990	5240	5520	5850
30000	V_1	111	111	111	111	112	113	115	117	118	119	120
	V_R	116	116	116	116	116	117	118	119	119	120	120
	V_2	124	124	124	124	123	123	123	123	123	123	123
	TOFL	4090	4170	4250	4340	4460	4660	4920	5250	5630	6040	6590
32000	V_1	117	117	117	117	118	119	121	122	123	124	125
	V_R	121	121	121	121	121	122	123	123	124	124	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	4300	4380	4470	4560	4730	5070	5510	5970	6420	6930	8020
34000	V_1	122	122	122	122	123	124	126	127	128	129	130
	V_R	125	126	126	126	126	127	127	128	129	129	130
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4850	4950	5050	5140	5340	5720	6220	6760	7320	8300	9570
36000	V_1	128	128	127	127	128	129	131	132	133	133	134
	V_R	130	130	130	130	130	131	132	133	133	133	134
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	5430	5540	5650	5760	5980	6410	6990	7660	8710	9800	11160
38000	V_1	132	132	132	132	132	134	135	137	137	138	138
	V_R	134	134	134	134	135	135	136	137	137	138	138
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	6030	6160	6280	6400	6640	7140	7840	9000	10160	11330	12780
38850	V_1	134	134	134	134	134	136	138	138	139	139	140
	V_R	136	136	136	136	136	137	138	138	139	139	140
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	6300	6430	6560	6690	6940	7480	8260	9590	10780	11990	13490

TODATA10K_DRY_F10_ALL_IMP_BO100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-40. (06-21-36)

DRY RUNWAY TAKEOFF FIELD LENGTH CORRECTION CHART FLAPS 10°

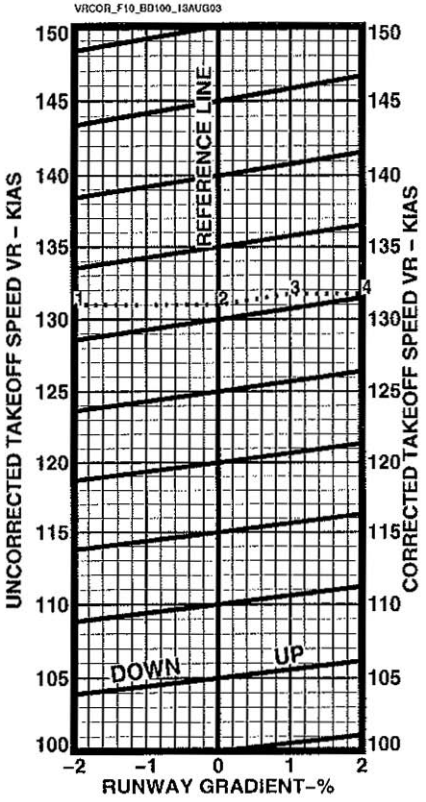


EXAMPLE:

1. Uncorrected Takeoff Field Length (from table).....7200 ft (2200 m)
2. Headwind.....20 kt
3. Runway Gradient Reference Line
4. Runway Gradient.....1.0% UP
5. Corrected Takeoff Field Length.....7600 ft (2320 m)

Figure 2-41. (06-21-37)

TAKEOFF SPEEDS
CORRECTION CHART FOR VR
FLAPS 10°



EXAMPLE:

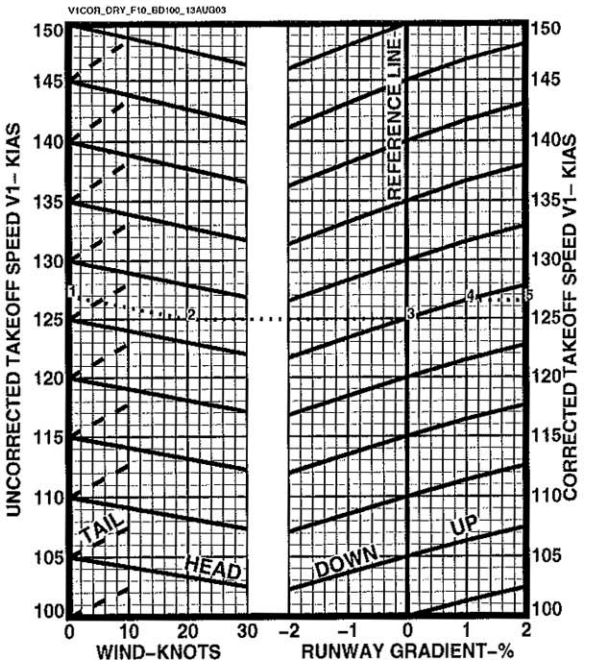
1. Uncorrected Takeoff Speed (from table).....131 kias
2. Runway Gradient Reference Line
3. Runway Gradient.....1.0% UP
4. Corrected Takeoff Speed.....132 kias

NOTE:

V1mcg is limiting when the corrected VR is less than 116 kias. In this case, use VR=116 kias.

Figure 2-42. (06-21-38)

DRY RUNWAY TAKEOFF SPEEDS CORRECTION CHART FOR V1 FLAPS 10°



EXAMPLE:

1. Uncorrected Takeoff Speed (from table).....127 kias
2. Headwind.....20 kt
3. Runway Gradient Reference Line
4. Runway Gradient.....1.0% UP
5. Corrected Takeoff Speed.....126 kias

NOTES:

1. V1mcg is limiting when the corrected V1 is less than 116 kias. In this case, use V1=116 kias.
2. If the corrected V1 exceeds VR for the appropriate conditions, use V1=VR.

Figure 2-43. (06-21-39)

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WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED OFF

ALTITUDE SEA LEVEL
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
28000	V_1	99	98	98	98	98	97	97	97	97	97	97	98	100	102
	V_R	111	111	111	111	111	111	111	111	111	111	111	111	111	112
	V_2	127	127	127	126	126	126	126	126	126	126	125	125	124	123
	TOFL	3340	3470	3590	3730	3870	4010	4080	4150	4220	4290	4460	4660	4890	5150
30000	V_1	102	102	101	101	101	101	101	101	101	101	102	104	105	108
	V_R	114	114	114	114	114	114	114	116	115	115	115	115	116	117
	V_2	126	126	125	125	125	125	125	125	125	125	124	124	123	123
	TOFL	3450	3580	3720	3860	4010	4150	4230	4300	4380	4450	4630	4840	5080	5360
32000	V_1	108	108	108	108	108	108	108	108	108	108	108	109	111	113
	V_R	119	119	119	119	119	120	120	120	120	120	120	121	121	122
	V_2	127	127	127	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3560	3700	3840	3990	4140	4300	4370	4450	4530	4600	4790	5020	5280	5580
34000	V_1	114	114	114	114	113	113	113	113	113	113	113	115	117	119
	V_R	124	124	124	124	124	124	124	125	125	125	125	125	126	127
	V_2	131	131	131	131	131	131	131	131	131	131	131	131	131	131
	TOFL	3670	3820	3960	4120	4280	4440	4520	4600	4680	4760	4950	5200	5540	6080
36000	V_1	119	119	119	119	119	119	119	119	119	119	119	120	122	124
	V_R	129	129	129	129	129	129	129	129	129	129	129	130	131	131
	V_2	135	135	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4000	4150	4290	4450	4620	4780	4870	4950	5030	5120	5340	5760	6260	6890
38000	V_1	124	124	124	124	124	124	124	124	124	124	124	125	127	129
	V_R	133	133	133	133	133	133	133	134	134	134	134	134	135	136
	V_2	139	139	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4460	4630	4790	4970	5160	5350	5440	5530	5630	5720	5980	6460	7030	7770
38850	V_1	127	126	126	126	126	126	126	126	126	126	126	127	129	131
	V_R	135	135	135	135	135	135	135	135	135	135	135	136	137	137
	V_2	140	140	140	140	140	140	140	140	140	140	140	140	140	140
	TOFL	4670	4840	5010	5200	5400	5600	5690	5790	5890	5990	6260	6770	7380	8170

TODATASL_WET_F10_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-44. (06-22-01)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED OFF

ALTITUDE 1000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	48
28000	V_1	98	98	98	97	97	97	97	97	97	97	98	99	101	102
	V_R	111	111	111	111	111	111	111	111	111	111	111	111	112	112
	V_2	127	127	126	126	126	126	126	126	126	125	125	124	123	123
	TOFL	3450	3590	3720	3860	4010	4160	4230	4310	4380	4530	4720	4940	5190	5360
30000	V_1	102	101	101	101	101	101	101	101	101	101	103	105	107	108
	V_R	114	114	114	114	114	115	115	115	115	115	115	116	117	118
	V_2	126	125	125	125	125	125	125	125	124	124	124	123	123	123
	TOFL	3570	3710	3850	4000	4150	4310	4380	4460	4540	4700	4900	5130	5400	5580
32000	V_1	108	108	108	107	107	107	107	107	107	107	109	111	113	114
	V_R	119	119	119	119	119	120	120	120	120	120	120	121	122	122
	V_2	127	127	127	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3680	3830	3980	4140	4300	4450	4540	4620	4700	4860	5080	5330	5620	5810
34000	V_1	114	114	113	113	113	113	113	113	113	113	114	116	118	119
	V_R	124	124	124	124	124	125	125	125	125	125	125	126	127	127
	V_2	131	131	131	131	131	131	131	131	131	131	131	131	131	131
	TOFL	3800	3950	4110	4270	4440	4600	4690	4770	4850	5030	5260	5530	6030	6390
36000	V_1	119	119	119	119	119	119	118	118	118	118	120	121	123	125
	V_R	129	129	129	129	129	129	129	129	129	129	130	131	131	132
	V_2	135	135	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4120	4280	4430	4600	4770	4950	5030	5120	5210	5400	5780	6250	6830	7240
38000	V_1	124	124	124	124	124	123	123	123	123	123	125	126	128	130
	V_R	133	133	133	133	133	133	134	134	134	134	134	135	135	136
	V_2	139	139	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4600	4760	4950	5140	5330	5530	5620	5720	5820	6050	6480	7020	7680	8180
38850	V_1	126	126	126	126	126	126	126	125	125	125	127	128	130	132
	V_R	135	135	135	135	135	135	135	135	135	135	136	137	137	138
	V_2	140	140	140	140	140	140	140	140	140	140	140	140	140	140
	TOFL	4810	5000	5180	5380	5580	5790	5890	5990	6090	6330	6790	7360	8080	8610

TODATA1K_WET_F10_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-45. (06-22-02)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED OFF

ALTITUDE 2000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	46
28000	V_1	98	98	97	97	97	97	97	97	97	97	99	100	102	103
	V_R	111	111	111	111	111	111	111	111	111	111	111	112	113	113
	V_2	127	126	126	126	126	126	126	125	125	125	124	123	122	122
	TOFL	3570	3710	3860	4010	4160	4310	4390	4470	4600	4790	5000	5240	5510	5570
30000	V_1	101	101	101	101	101	101	101	101	101	102	104	106	108	109
	V_R	114	114	114	114	115	115	115	115	115	115	116	117	118	118
	V_2	125	125	125	125	125	125	125	124	124	124	123	123	123	123
	TOFL	3690	3840	3990	4150	4310	4470	4550	4630	4770	4970	5190	5450	5750	5810
32000	V_1	108	107	107	107	107	107	107	107	107	108	110	112	114	114
	V_R	119	119	119	119	120	120	120	120	120	120	121	122	123	123
	V_2	127	127	127	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3810	3970	4130	4290	4460	4620	4710	4790	4940	5160	5390	5660	5980	6050
34000	V_1	113	113	113	113	113	113	113	113	113	114	116	117	119	120
	V_R	124	124	124	124	125	125	125	125	125	125	126	127	127	127
	V_2	131	131	131	131	131	131	131	131	131	131	131	131	131	131
	TOFL	3930	4090	4260	4430	4600	4780	4860	4950	5110	5340	5590	6010	6580	6710
36000	V_1	119	119	119	119	118	118	118	118	118	119	121	123	125	125
	V_R	129	129	129	129	129	129	129	129	129	130	130	131	132	132
	V_2	135	135	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4250	4420	4590	4760	4940	5120	5210	5300	5470	5820	6260	6800	7470	7620
38000	V_1	124	124	124	124	123	123	123	123	123	124	126	127	130	130
	V_R	133	133	133	133	133	134	134	134	134	134	135	135	136	136
	V_2	139	139	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4740	4930	5120	5320	5520	5720	5820	5920	6120	6510	7020	7640	8440	8620
38850	V_1	126	126	126	126	125	125	125	125	125	126	128	130	132	132
	V_R	135	135	135	135	135	135	135	135	136	136	136	137	138	138
	V_2	140	140	140	140	140	140	140	140	140	140	140	140	140	140
	TOFL	4960	5160	5360	5570	5780	5990	6100	6200	6410	6830	7370	8020	8870	9060

TODATA2K_WET_F10_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-46. (06-22-03)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED OFF

ALTITUDE 3000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C												
		–40	–30	–20	–10	0	10	15	20	25	30	35	40	44
28000	V_1	96	97	97	97	97	97	97	97	97	98	100	102	103
	V_R	111	111	111	111	111	111	111	111	111	111	112	112	113
	V_2	126	126	126	126	126	125	125	125	125	124	124	123	122
	TOFL	3700	3850	4000	4160	4320	4480	4560	4670	4860	5070	5300	5560	5810
30000	V_1	101	101	101	101	101	101	101	101	102	104	106	108	109
	V_R	114	114	114	116	116	116	116	116	116	116	117	117	118
	V_2	125	125	125	125	125	124	124	124	124	123	123	123	123
	TOFL	3830	3980	4140	4310	4480	4640	4730	4850	5050	5270	5520	5800	6060
32000	V_1	107	107	107	107	107	107	107	107	108	110	111	113	115
	V_R	119	119	119	120	120	120	120	120	120	121	122	122	123
	V_2	127	127	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3950	4120	4290	4460	4630	4800	4890	5020	5230	5470	5730	6030	6310
34000	V_1	113	113	113	113	113	113	113	113	114	115	117	119	120
	V_R	124	124	124	125	125	125	125	125	125	126	126	127	128
	V_2	131	131	131	131	131	131	131	131	131	131	131	131	131
	TOFL	4080	4250	4430	4600	4780	4960	5050	5180	5410	5670	6020	6550	7070
36000	V_1	119	119	119	118	118	118	118	118	119	120	122	124	126
	V_R	129	129	129	129	129	129	129	130	130	130	131	132	132
	V_2	135	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4390	4570	4760	4940	5120	5310	5400	5540	5860	6300	6810	7430	8030
38000	V_1	124	124	123	123	123	123	123	123	124	125	127	129	131
	V_R	133	133	133	134	134	134	134	134	134	135	135	136	136
	V_2	139	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4910	5110	5310	5520	5730	5930	6040	6200	6570	7070	7650	8370	9090
38850	V_1	126	126	126	125	125	125	125	125	126	127	129	131	133
	V_R	135	135	135	135	135	136	136	136	136	136	137	138	138
	V_2	141	141	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5130	5350	5560	5780	5990	6210	6320	6490	6880	7410	8030	8810	9560

TODATA3K_WET_F10_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-46. (06-22-04)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED OFF

ALTITUDE 4000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C												
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	42
28000	V_1	97	97	97	97	97	96	96	97	98	99	101	103	104
	V_R	111	111	111	111	111	111	111	111	111	111	112	113	113
	V_2	126	126	126	126	125	125	125	125	124	124	123	122	122
	TOFL	3840	4000	4160	4320	4490	4660	4750	4940	5150	5380	5630	5930	6060
30000	V_1	101	101	101	101	101	101	101	102	103	105	107	109	110
	V_R	114	114	115	115	115	115	115	116	116	117	117	118	118
	V_2	125	125	125	125	124	124	124	124	123	123	123	123	123
	TOFL	3970	4130	4310	4480	4650	4830	4930	5120	5350	5600	5870	6180	6330
32000	V_1	107	107	107	107	107	107	107	108	109	111	113	115	115
	V_R	119	120	120	120	120	120	120	120	121	122	122	123	123
	V_2	127	127	127	127	127	127	127	127	127	127	127	127	127
	TOFL	4100	4280	4450	4630	4810	4990	5100	5310	5550	5820	6100	6440	6590
34000	V_1	113	113	113	113	113	113	113	113	115	116	118	120	121
	V_R	124	124	125	125	125	125	125	125	126	126	127	128	128
	V_2	131	131	131	131	131	131	131	131	131	131	131	131	131
	TOFL	4230	4420	4600	4790	4970	5160	5270	5490	5740	6070	6570	7170	7450
36000	V_1	119	119	118	118	118	118	118	119	120	122	123	125	126
	V_R	129	129	129	129	129	130	130	130	130	131	132	132	132
	V_2	135	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4560	4750	4940	5130	5330	5520	5640	5920	6350	6860	7440	8150	8490
38000	V_1	124	124	123	123	123	123	123	123	125	127	128	130	131
	V_R	133	133	134	134	134	134	134	134	135	135	136	136	137
	V_2	139	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5100	5300	5520	5730	5950	6170	6300	6620	7120	7710	8370	9220	9610
38850	V_1	126	126	126	125	125	125	125	126	127	129	131	133	133
	V_R	135	135	135	135	136	136	136	136	136	137	137	138	138
	V_2	141	141	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5330	5550	5780	6000	6230	6460	6600	6940	7470	8090	8810	9700	10110

TODATA4K_WET_F10_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-47. (06-22-05)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED OFF

ALTITUDE 5000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C											
		-40	-30	-20	-10	0	10	15	20	25	30	35	40
28000	V_1	97	97	97	97	96	96	96	98	99	101	103	104
	V_R	111	111	111	111	111	111	111	111	111	112	113	114
	V_2	126	126	126	125	125	125	125	124	124	123	122	121
	TOFL	3990	4150	4320	4490	4670	4840	5020	5210	5460	5720	5990	6330
30000	V_1	101	101	101	101	101	101	101	103	105	107	108	110
	V_R	114	115	115	115	115	115	115	116	117	117	118	119
	V_2	125	125	125	124	124	124	124	123	123	123	123	123
	TOFL	4120	4300	4480	4660	4840	5020	5210	5410	5680	5960	6240	6610
32000	V_1	107	107	107	107	107	107	107	109	110	112	114	116
	V_R	120	120	120	120	120	120	120	121	122	122	123	124
	V_2	127	127	127	127	127	127	127	127	127	127	127	127
	TOFL	4260	4450	4630	4820	5010	5200	5400	5610	5900	6200	6500	6890
34000	V_1	113	113	113	113	113	113	113	114	116	118	119	121
	V_R	124	125	125	125	125	125	125	126	126	127	128	128
	V_2	132	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4400	4590	4780	4980	5170	5370	5580	5810	6120	6620	7170	7860
36000	V_1	119	119	118	118	118	118	118	120	121	123	125	127
	V_R	129	129	129	130	130	130	130	130	131	132	132	133
	V_2	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4740	4940	5140	5340	5540	5740	5990	6390	6910	7500	8130	8980
38000	V_1	124	123	123	123	123	123	123	125	126	128	130	132
	V_R	133	134	134	134	134	134	134	135	135	136	136	137
	V_2	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5300	5510	5740	5960	6190	6410	6700	7160	7750	8430	9200	10170
38850	V_1	126	126	125	125	125	125	125	127	128	130	132	134
	V_R	135	135	136	136	136	136	136	136	137	137	138	139
	V_2	141	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5540	5770	6010	6240	6480	6720	7020	7510	8140	8860	9670	10710

TODATA5K_WET_F10_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-48. (06-22-06)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED OFF

ALTITUDE 6000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C											
		-40	-30	-20	-10	0	10	15	20	25	30	35	38
28000	V_1	97	97	97	96	96	96	97	98	100	102	104	105
	V_R	111	111	111	111	111	111	111	111	112	113	114	114
	V_2	126	126	125	125	125	125	124	124	123	122	121	121
	TOFL	4140	4310	4490	4670	4850	5120	5310	5530	5800	6090	6400	6620
30000	V_1	101	101	101	101	101	101	103	105	106	108	110	111
	V_R	115	115	115	115	115	115	116	117	117	118	119	119
	V_2	125	125	124	124	124	124	123	123	123	123	123	123
	TOFL	4280	4460	4650	4840	5030	5310	5520	5750	6040	6350	6680	6920
32000	V_1	107	107	107	107	107	107	109	110	112	113	115	117
	V_R	120	120	120	120	120	120	121	122	122	123	124	124
	V_2	127	127	127	127	127	127	127	127	127	127	127	127
	TOFL	4430	4620	4810	5010	5200	5500	5720	5970	6280	6600	6970	7280
34000	V_1	113	113	113	113	113	113	114	116	117	119	121	122
	V_R	125	125	125	125	125	125	126	126	127	128	128	129
	V_2	132	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4570	4770	4970	5170	5380	5690	5920	6190	6650	7210	7870	8350
36000	V_1	119	118	118	118	118	118	119	121	122	124	126	128
	V_R	129	129	130	130	130	130	130	131	131	132	133	133
	V_2	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4920	5110	5320	5530	5740	6090	6490	6960	7530	8180	8980	9540
38000	V_1	123	123	123	123	123	123	124	126	127	129	131	133
	V_R	134	134	134	134	134	134	135	135	136	136	137	137
	V_2	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5490	5710	5950	6180	6410	6820	7270	7800	8450	9240	10160	10820
38850	V_1	126	125	125	125	125	125	126	128	129	131	133	135
	V_R	135	135	136	136	136	136	136	137	137	138	138	139
	V_2	141	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5750	5980	6220	6470	6710	7140	7610	8190	8870	9720	10690	11360

TODATA6K_WET_F10_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-49. (06-22-07)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED OFF

ALTITUDE 7000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C											
		-40	-30	-20	-10	0	10	15	20	25	30	35	38
28000	V_1	97	96	96	96	96	97	98	100	101	103	105	106
	V_R	111	111	111	111	111	111	112	112	113	114	114	114
	V_2	126	126	125	125	125	124	124	123	122	122	121	121
	TOFL	4290	4470	4660	4850	5040	5420	5620	5870	6170	6480	6850	6930
30000	V_1	101	101	101	101	101	103	104	106	107	109	111	111
	V_R	115	115	115	115	115	116	117	117	118	119	119	119
	V_2	125	125	124	124	124	123	123	123	123	123	123	123
	TOFL	4450	4640	4830	5030	5230	5630	5850	6110	6430	6770	7170	7250
32000	V_1	107	107	107	107	107	108	110	111	113	115	117	117
	V_R	120	120	120	120	120	121	122	122	123	123	124	124
	V_2	128	128	128	128	128	128	128	128	128	128	128	128
	TOFL	4600	4800	5000	5200	5410	5830	6070	6350	6690	7050	7560	7710
34000	V_1	113	113	113	113	113	114	115	117	118	120	122	123
	V_R	125	125	125	125	125	126	126	127	127	128	129	129
	V_2	132	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4750	4950	5170	5380	5590	6040	6290	6690	7240	7890	8690	8870
36000	V_1	118	118	118	118	118	119	121	122	124	126	128	128
	V_R	129	129	130	130	130	130	131	131	132	133	133	133
	V_2	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	5090	5290	5510	5730	5950	6580	7040	7570	8210	8980	9930	10140
38000	V_1	123	123	123	123	123	124	126	127	129	131	133	133
	V_R	134	134	134	134	134	135	135	136	136	137	137	137
	V_2	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5680	5910	6160	6400	6650	7370	7890	8500	9250	10160	11220	11470
38650	V_1	125	125	125	125	125	126	128	129	131	133	135	135
	V_R	136	136	136	136	136	136	137	137	138	138	139	139
	V_2	141	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5950	6190	6450	6700	6960	7720	8270	8920	9730	10690	11820	12070

TODATA7K_WET_F10_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-50. (06-22-08)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED OFF

ALTITUDE 8000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		–40	–30	–20	–10	0	10	15	20	25	30	34
28000	V_1	96	96	96	96	96	98	100	101	103	105	106
	V_R	111	111	111	111	111	112	112	113	113	114	115
	V_2	126	125	125	125	125	124	123	122	122	121	120
	TOFL	4460	4650	4840	5040	5320	5730	5960	6240	6570	6930	7260
30000	V_1	101	101	101	101	102	104	106	107	109	110	112
	V_R	115	115	115	115	116	117	117	118	118	119	120
	V_2	125	124	124	124	124	123	123	123	123	123	123
	TOFL	4620	4820	5020	5230	5520	5960	6210	6500	6860	7250	7600
32000	V_1	107	107	107	107	108	110	111	113	114	116	118
	V_R	120	120	120	120	121	122	122	123	123	124	124
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	4780	4980	5200	5410	5710	6190	6450	6760	7140	7570	8170
34000	V_1	113	113	112	112	113	115	117	118	120	122	123
	V_R	125	125	125	125	126	126	127	127	128	129	129
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4930	5150	5370	5590	5910	6410	6760	7280	7910	8670	9420
36000	V_1	118	118	118	118	118	120	122	123	125	127	129
	V_R	129	130	130	130	130	131	131	132	132	133	133
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	5260	5480	5710	5930	6350	7140	7650	8250	8980	9910	10770
38000	V_1	123	123	123	123	123	125	127	128	130	132	134
	V_R	134	134	134	134	134	135	136	136	137	137	138
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5880	6130	6380	6640	7100	8000	8590	9280	10160	11220	12190
38850	V_1	125	125	125	125	125	127	129	131	132	134	136
	V_R	136	136	136	136	136	137	137	138	138	139	139
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	6160	6410	6680	6950	7440	8390	9010	9760	10690	11790	12830

TODATA8K_WET_F10_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-51. (06-22-09)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED OFF

ALTITUDE 9000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-30	-20	-10	0	10	15	20	25	30	32
28000	V_1	96	96	96	96	97	99	101	102	104	106	107
	V_R	112	112	112	112	112	112	113	113	114	115	115
	V_2	125	125	125	125	124	123	122	122	121	120	120
	TOFL	4660	4860	5070	5300	5630	6080	6330	6650	7010	7430	7610
30000	V_1	101	101	101	101	103	105	107	108	110	112	113
	V_R	115	115	115	116	117	117	118	118	119	120	120
	V_2	124	124	124	124	123	123	123	123	123	123	123
	TOFL	4830	5040	5250	5500	5840	6320	6600	6930	7330	7780	7980
32000	V_1	107	107	107	107	109	111	112	114	115	117	118
	V_R	120	120	121	121	122	122	123	123	124	124	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	4990	5210	5440	5690	6060	6570	6860	7220	7640	8320	8690
34000	V_1	113	113	113	113	114	116	118	119	121	123	124
	V_R	125	125	125	126	126	127	128	128	129	129	129
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	5160	5390	5620	5880	6270	6860	7350	7930	8660	9590	10010
36000	V_1	118	118	118	118	120	122	123	125	126	129	129
	V_R	130	130	130	130	131	131	132	132	133	133	134
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	5510	5740	5980	6280	6890	7750	8320	9000	9890	10970	11430
38000	V_1	123	123	123	123	125	127	128	130	132	133	134
	V_R	134	134	134	134	135	136	136	137	137	138	138
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	6160	6420	6690	7020	7710	8700	9350	10180	11190	12420	12970
38850	V_1	125	125	125	125	127	129	130	132	134	136	136
	V_R	136	136	136	136	137	137	138	138	139	139	139
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	6450	6720	7000	7350	8080	9130	9840	10700	11790	13070	13650

TODATA9K_WET_F10_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-52. (06-22-10)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED OFF

ALTITUDE 10000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C									
		-40	-30	-20	-10	0	10	15	20	25	30
28000	V_1	97	96	96	97	98	101	102	104	105	107
	V_R	112	112	112	112	112	113	113	114	115	115
	V_2	125	125	125	124	123	122	122	121	121	120
	TOFL	4880	5090	5320	5610	5960	6450	6720	7090	7510	7990
30000	V_1	101	101	101	103	105	106	108	109	111	113
	V_R	116	116	116	116	117	118	118	119	120	120
	V_2	124	124	124	123	123	123	123	123	123	123
	TOFL	5060	5280	5520	5820	6200	6720	7010	7400	7860	8370
32000	V_1	108	107	107	109	110	112	114	115	117	119
	V_R	121	121	121	121	122	123	123	124	124	125
	V_2	128	128	128	128	128	128	128	128	128	128
	TOFL	5230	5470	5710	6040	6430	6980	7300	7720	8300	9230
34000	V_1	113	113	113	114	116	118	119	120	122	125
	V_R	125	126	126	126	127	128	128	128	129	130
	V_2	132	132	132	132	132	132	132	132	132	132
	TOFL	5410	5650	5910	6250	6660	7440	7980	8660	9550	10650
36000	V_1	118	118	118	119	121	123	124	126	128	130
	V_R	130	130	130	131	131	132	132	133	133	134
	V_2	136	136	136	136	136	136	136	136	136	136
	TOFL	5820	6070	6340	6810	7490	8430	9050	9870	10920	12170
38000	V_1	123	123	123	124	126	128	129	131	133	135
	V_R	134	134	135	135	136	136	137	137	137	138
	V_2	139	139	139	139	139	139	139	139	139	139
	TOFL	6500	6780	7080	7620	8390	9460	10220	11170	12360	13800
38850	V_1	126	125	125	126	128	130	132	133	135	137
	V_R	136	136	136	137	137	138	138	139	139	140
	V_2	141	141	141	141	141	141	141	141	141	141
	TOFL	6810	7100	7420	7980	8790	9950	10740	11740	13020	14530

TODATA10K_WET_F10_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-53. (06-22-11)

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WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON

ALTITUDE SEA LEVEL
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
28000	V_1	99	98	98	98	98	97	97	97	97	97	98	99	100	103
	V_R	111	111	111	111	111	111	111	111	111	111	111	111	111	112
	V_2	127	127	126	126	126	126	126	126	126	126	125	124	124	123
	TOFL	3340	3470	3600	3730	3870	4010	4080	4150	4230	4310	4490	4700	4920	5190
30000	V_1	102	102	102	102	102	101	101	101	101	102	103	105	106	109
	V_R	114	114	114	114	114	114	114	115	115	115	115	116	117	118
	V_2	126	125	125	125	125	125	125	125	125	124	124	123	123	123
	TOFL	3450	3580	3720	3860	4010	4160	4230	4300	4380	4470	4660	4880	5130	5410
32000	V_1	108	108	108	108	108	108	108	108	108	108	109	110	112	114
	V_R	119	119	119	119	119	120	120	120	120	120	120	121	122	123
	V_2	127	127	127	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3560	3700	3840	3990	4140	4300	4380	4450	4530	4630	4820	5060	5330	5630
34000	V_1	114	114	114	114	114	113	113	113	113	113	114	116	118	120
	V_R	124	124	124	124	124	124	125	125	125	125	125	126	126	127
	V_2	131	131	131	131	131	131	131	131	131	131	131	131	131	131
	TOFL	3670	3820	3960	4120	4280	4440	4520	4600	4680	4780	4990	5240	5670	6240
36000	V_1	120	119	119	119	119	119	119	119	119	119	120	121	123	125
	V_R	129	129	129	129	129	129	129	129	129	129	130	130	131	132
	V_2	135	135	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4010	4150	4300	4460	4630	4800	4880	4960	5050	5150	5470	5900	6420	7070
38000	V_1	125	124	124	124	124	124	124	124	124	124	124	126	128	130
	V_R	133	133	133	133	133	133	133	134	134	134	134	135	135	136
	V_2	139	139	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4470	4640	4800	4980	5170	5360	5450	5540	5640	5760	6120	6610	7210	7990
38850	V_1	127	126	126	126	126	126	126	126	126	126	127	128	130	132
	V_R	135	135	135	135	135	135	135	135	135	135	136	136	137	138
	V_2	140	140	140	140	140	140	140	140	140	140	140	140	140	140
	TOFL	4680	4850	5020	5220	5410	5610	5710	5800	5900	6030	6410	6930	7570	8410

TODATASL_WET_F10_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-54. (06-22-12)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 1000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	48
28000	V_1	98	98	98	98	97	97	97	97	97	97	99	100	102	103
	V_R	111	111	111	111	111	111	111	111	111	111	111	111	112	113
	V_2	127	127	126	126	126	126	126	126	125	125	124	124	123	122
	TOFL	3450	3590	3720	3870	4010	4160	4230	4310	4380	4560	4750	4970	5230	5400
30000	V_1	102	102	101	101	101	101	101	101	101	102	104	106	108	109
	V_R	114	114	114	114	114	115	115	115	115	115	116	117	117	118
	V_2	126	125	125	125	125	125	125	125	124	124	123	123	123	123
	TOFL	3570	3710	3850	4000	4160	4310	4390	4460	4540	4730	4940	5170	5450	5640
32000	V_1	108	108	108	108	108	108	108	107	107	108	110	112	113	115
	V_R	119	119	119	119	120	120	120	120	120	120	121	122	122	123
	V_2	127	127	127	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3690	3830	3980	4140	4300	4460	4540	4620	4700	4900	5120	5370	5670	5870
34000	V_1	114	114	113	113	113	113	113	113	113	114	115	117	119	120
	V_R	124	124	124	124	124	125	125	125	125	125	126	126	127	127
	V_2	131	131	131	131	131	131	131	131	131	131	131	131	131	131
	TOFL	3800	3950	4110	4270	4440	4600	4690	4770	4860	5070	5300	5670	6190	6560
36000	V_1	119	119	119	119	119	119	119	119	118	119	121	122	124	126
	V_R	129	129	129	129	129	129	129	129	129	130	130	131	132	132
	V_2	135	135	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4130	4290	4440	4610	4780	4960	5040	5130	5220	5500	5920	6410	7020	7450
38000	V_1	124	124	124	124	124	124	124	124	123	124	126	127	129	131
	V_R	133	133	133	133	133	134	134	134	134	134	134	135	136	136
	V_2	139	139	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4610	4790	4960	5150	5350	5540	5640	5730	5830	6160	6630	7200	7900	8420
38850	V_1	126	126	126	126	126	126	126	126	126	126	128	129	131	133
	V_R	135	135	135	135	135	135	135	135	135	136	136	137	137	138
	V_2	140	140	140	140	140	140	140	140	140	140	140	140	140	140
	TOFL	4820	5010	5190	5390	5600	5800	5900	6000	6110	6450	6950	7550	8310	8860

TODATA1K_WET_F10_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-55. (06-22-13)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 2000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		–40	–30	–20	–10	0	10	15	20	25	30	35	40	45	48
28000	V_1	98	98	97	97	97	97	97	97	97	98	99	101	103	104
	V_R	111	111	111	111	111	111	111	111	111	111	111	112	113	113
	V_2	127	126	126	126	126	126	126	125	125	125	124	123	122	122
	TOFL	3570	3720	3860	4010	4160	4320	4390	4470	4630	4820	5030	5280	5570	5630
30000	V_1	101	101	101	101	101	101	101	101	102	104	105	107	109	110
	V_R	114	114	114	114	115	115	115	115	115	116	116	117	118	118
	V_2	125	125	125	125	125	125	124	124	124	123	123	123	123	123
	TOFL	3690	3840	3990	4150	4310	4470	4550	4630	4810	5010	5230	5500	5810	5870
32000	V_1	108	108	107	107	107	107	107	107	108	109	111	113	115	115
	V_R	119	119	119	120	120	120	120	120	120	121	121	122	123	123
	V_2	127	127	127	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3810	3970	4130	4290	4460	4630	4710	4800	4980	5200	5430	5720	6050	6120
34000	V_1	114	113	113	113	113	113	113	113	113	115	117	118	120	121
	V_R	124	124	124	124	125	125	125	125	125	126	126	127	128	128
	V_2	131	131	131	131	131	131	131	131	131	131	131	131	131	131
	TOFL	3930	4100	4260	4440	4610	4780	4870	4960	5150	5380	5680	6160	6770	6900
36000	V_1	119	119	119	119	119	118	118	118	119	120	122	124	126	126
	V_R	129	129	129	129	129	129	129	129	130	130	131	131	132	132
	V_2	135	135	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4260	4430	4600	4770	4950	5130	5220	5310	5550	5960	6420	6980	7690	7850
38000	V_1	124	124	124	124	124	123	123	123	124	125	127	128	131	131
	V_R	133	133	133	133	134	134	134	134	134	134	135	136	136	136
	V_2	139	139	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4750	4940	5130	5330	5530	5730	5830	5940	6210	6680	7210	7850	8690	8880
38850	V_1	126	126	126	126	126	125	125	125	126	127	129	131	133	133
	V_R	135	135	135	135	135	135	135	136	136	136	137	137	138	138
	V_2	140	140	140	140	140	140	140	140	140	140	140	140	140	140
	TOFL	4970	5170	5370	5580	5790	6000	6110	6220	6510	7000	7560	8260	9140	9340

TODATA2K_WET_F10_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-56. (06-22-14)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 3000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C												
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	44
28000	V_1	98	97	97	97	97	97	97	97	98	99	101	103	104
	V_R	111	111	111	111	111	111	111	111	111	111	112	113	113
	V_2	126	126	126	126	126	125	125	125	125	124	123	122	122
	TOFL	3700	3850	4000	4160	4320	4480	4560	4710	4900	5110	5340	5610	5870
30000	V_1	101	101	101	101	101	101	101	101	103	105	107	109	110
	V_R	114	114	114	115	115	115	115	115	116	116	117	118	118
	V_2	125	125	125	125	125	124	124	124	124	123	123	123	123
	TOFL	3830	3990	4150	4310	4480	4640	4730	4880	5080	5310	5560	5850	6130
32000	V_1	108	107	107	107	107	107	107	108	109	111	112	114	116
	V_R	119	119	120	120	120	120	120	120	121	121	122	123	123
	V_2	127	127	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3950	4120	4290	4460	4630	4810	4890	5050	5270	5520	5780	6090	6380
34000	V_1	113	113	113	113	113	113	113	113	115	116	118	120	121
	V_R	124	124	124	125	125	125	125	125	126	126	127	127	128
	V_2	131	131	131	131	131	131	131	131	131	131	131	131	131
	TOFL	4080	4250	4430	4610	4790	4970	5060	5230	5450	5720	6180	6730	7270
36000	V_1	119	119	119	118	118	118	118	118	120	121	123	125	127
	V_R	129	129	129	129	129	129	130	130	130	131	131	132	132
	V_2	135	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4400	4580	4760	4950	5130	5320	5410	5620	6010	6470	6990	7630	8290
38000	V_1	124	124	124	123	123	123	123	123	125	126	128	130	132
	V_R	133	133	133	134	134	134	134	134	134	135	136	136	137
	V_2	139	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4920	5120	5320	5530	5740	5950	6050	6290	6730	7250	7860	8630	9370
38850	V_1	126	126	126	126	125	125	125	125	127	128	130	132	134
	V_R	135	135	135	135	135	136	136	136	136	137	137	138	138
	V_2	141	141	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5140	5360	5570	5790	6010	6220	6330	6580	7050	7610	8260	9070	9860

TODATA3K_WET_F10_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-57. (06-22-15)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 4000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C												
		–40	–30	–20	–10	0	10	15	20	25	30	35	40	42
28000	V_1	97	97	97	97	97	97	97	97	99	100	102	104	105
	V_R	111	111	111	111	111	111	111	111	111	112	113	113	114
	V_2	126	126	126	126	125	125	125	125	124	123	122	122	121
	TOFL	3840	4000	4160	4320	4490	4660	4790	4970	5180	5430	5680	5980	6120
30000	V_1	101	101	101	101	101	101	101	103	105	106	108	110	111
	V_R	114	114	115	115	116	115	115	116	116	117	118	119	119
	V_2	125	125	125	125	124	124	124	124	123	123	123	123	123
	TOFL	3970	4140	4310	4480	4650	4830	4970	5160	5390	5650	5920	6250	6390
32000	V_1	108	107	107	107	107	107	107	109	110	112	114	116	116
	V_R	119	120	120	120	120	120	120	121	121	122	123	123	124
	V_2	127	127	127	127	127	127	127	127	127	127	127	127	127
	TOFL	4100	4280	4460	4640	4820	5000	5140	5350	5590	5870	6160	6510	6700
34000	V_1	113	113	113	113	113	113	113	114	116	117	119	121	122
	V_R	124	124	125	125	125	125	125	126	126	127	127	128	128
	V_2	131	131	131	131	131	131	131	131	131	131	131	131	131
	TOFL	4240	4420	4600	4790	4980	5160	5320	5530	5790	6230	6750	7370	7670
36000	V_1	119	119	119	118	118	118	118	120	121	123	124	126	127
	V_R	129	129	129	129	130	130	130	130	131	131	132	132	133
	V_2	135	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4570	4760	4950	5140	5340	5530	5690	6060	6520	7040	7650	8410	8760
38000	V_1	124	124	124	123	123	123	123	124	126	128	129	132	132
	V_R	133	133	134	134	134	134	134	134	135	135	136	137	137
	V_2	139	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5110	5320	5530	5750	5960	6180	6370	6790	7310	7920	8630	9500	9910
38850	V_1	126	126	126	125	125	125	125	127	128	130	132	134	134
	V_R	135	135	135	135	136	136	136	136	137	137	138	138	139
	V_2	141	141	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5340	5560	5790	6020	6240	6470	6670	7110	7660	8300	9080	10000	10440

TODATA4K_WET_F10_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-58. (06-22-16)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 5000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C											
		–40	–30	–20	–10	0	10	15	20	25	30	35	40
26000	V_1	97	97	97	97	97	98	97	98	100	102	104	105
	V_R	111	111	111	111	111	111	111	111	112	113	113	114
	V_2	126	126	126	125	125	125	125	124	123	122	122	121
	TOFL	3990	4150	4320	4500	4670	4880	5060	5250	5500	5770	6040	6390
30000	V_1	101	101	101	101	101	101	102	104	106	108	109	111
	V_R	114	115	115	115	115	115	116	116	117	118	118	119
	V_2	125	125	125	124	124	124	124	123	123	123	123	123
	TOFL	4130	4300	4480	4660	4840	5060	5250	5450	5730	6020	6300	6680
32000	V_1	108	107	107	107	107	107	108	110	111	113	115	117
	V_R	120	120	120	120	120	120	121	121	122	123	123	124
	V_2	127	127	127	127	127	127	127	127	127	127	127	127
	TOFL	4260	4450	4630	4820	5010	5230	5440	5660	5950	6260	6570	7070
34000	V_1	113	113	113	113	113	113	114	115	117	119	120	122
	V_R	124	125	125	125	125	125	126	126	127	127	128	129
	V_2	132	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4400	4590	4790	4980	5180	5410	5630	5860	6270	6800	7370	8110
36000	V_1	119	119	119	118	118	118	119	121	122	124	126	128
	V_R	129	129	129	130	130	130	130	131	131	132	132	133
	V_2	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4750	4940	5150	5350	5550	5790	6140	6560	7090	7710	8380	9260
38000	V_1	124	124	123	123	123	123	124	126	127	129	131	133
	V_R	134	134	134	134	134	134	134	135	135	136	137	137
	V_2	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5310	5520	5750	5970	6200	6480	6870	7340	7960	8690	9470	10490
38850	V_1	126	126	126	125	125	125	126	128	129	131	133	135
	V_R	135	135	136	136	136	136	136	137	137	138	138	139
	V_2	141	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5550	5780	6020	6260	6490	6790	7190	7700	8350	9130	9970	11020

TODATA5K_WET_F10_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-59. (06-22-17)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 6000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C												
		-40	-30	-20	-10	0	10	15	20	25	30	35	38	
28000	V_1	97	97	97	96	96	97	98	99	101	103	105	106	
	V_R	111	111	111	111	111	111	111	112	113	113	114	114	
	V_2	126	126	125	125	125	125	124	123	123	122	121	121	
	TOFL	4140	4310	4490	4670	4850	5160	5350	5580	5850	6140	6460	6690	
30000	V_1	101	101	101	101	101	102	104	106	107	109	111	112	
	V_R	115	115	115	115	115	116	116	117	118	118	119	119	
	V_2	125	125	124	124	124	124	123	123	123	123	123	123	
	TOFL	4280	4470	4650	4840	5030	5350	5560	5800	6090	6410	6750	7000	
32000	V_1	107	107	107	107	107	108	110	111	113	114	116	117	
	V_R	120	120	120	120	120	121	121	122	123	123	124	124	
	V_2	127	127	127	127	127	127	127	127	127	127	127	127	
	TOFL	4430	4620	4810	5010	5210	5550	5770	6020	6330	6670	7080	7490	
34000	V_1	113	113	113	113	113	114	115	117	118	120	122	123	
	V_R	125	125	125	125	125	126	126	127	127	128	128	129	
	V_2	132	132	132	132	132	132	132	132	132	132	132	132	
	TOFL	4580	4770	4970	5180	5380	5740	5970	6320	6830	7420	8120	8620	
36000	V_1	119	118	118	118	118	119	121	122	123	125	127	129	
	V_R	129	129	130	130	130	130	131	131	132	132	133	133	
	V_2	135	135	135	135	135	135	135	135	135	135	135	135	
	TOFL	4930	5120	5330	5540	5750	6240	6660	7140	7730	8430	9260	9850	
38000	V_1	124	123	123	123	123	124	125	127	128	130	132	133	
	V_R	134	134	134	134	134	134	135	135	136	136	137	137	
	V_2	139	139	139	139	139	139	139	139	139	139	139	139	
	TOFL	5500	5720	5960	6190	6430	6980	7460	8010	8700	9530	10480	11130	
38850	V_1	126	125	125	125	125	126	128	129	131	133	134	135	
	V_R	135	136	136	136	136	136	137	137	138	138	139	139	
	V_2	141	141	141	141	141	141	141	141	141	141	141	141	
	TOFL	5760	5990	6240	6480	6730	7310	7820	8410	9150	10020	11040	11710	

TODATA6K_WET_F10_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-60. (06-22-18)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 7000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C											
		-40	-30	-20	-10	0	10	15	20	25	30	35	38
28000	V_1	97	97	96	96	96	98	99	101	102	104	106	107
	V_R	111	111	111	111	111	111	112	113	113	114	115	115
	V_2	126	126	125	125	125	124	123	123	122	121	120	120
	TOFL	4300	4480	4670	4850	5060	5460	5670	5920	6230	6550	6930	7010
30000	V_1	101	101	101	101	101	104	105	107	108	110	112	112
	V_R	115	115	115	115	115	116	117	118	118	119	120	120
	V_2	125	124	124	124	124	123	123	123	123	123	123	123
	TOFL	4450	4640	4830	5030	5250	5670	5890	6170	6490	6840	7250	7340
32000	V_1	107	107	107	107	107	110	111	113	114	116	118	118
	V_R	120	120	120	120	120	121	122	123	123	124	124	125
	V_2	128	128	128	128	128	128	128	128	128	128	128	128
	TOFL	4600	4800	5000	5210	5430	5880	6120	6410	6760	7130	7790	7960
34000	V_1	113	113	113	113	113	115	117	118	119	121	123	124
	V_R	125	125	125	125	125	126	127	127	128	128	129	129
	V_2	132	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4750	4960	5170	5380	5620	6090	6400	6880	7450	8130	8980	9160
36000	V_1	118	118	118	118	118	120	122	123	125	127	129	129
	V_R	129	130	130	130	130	131	131	132	132	133	133	133
	V_2	135	135	135	135	135	135	135	135	135	135	135	135
	TOFL	5100	5300	5520	5740	5980	6760	7230	7780	8450	9280	10250	10470
38000	V_1	123	123	123	123	123	125	127	128	130	132	134	134
	V_R	134	134	134	134	134	135	135	136	136	137	137	138
	V_2	139	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5690	5920	6170	6410	6690	7580	8110	8740	9550	10490	11590	11840
38850	V_1	125	125	125	125	125	127	129	130	132	134	136	136
	V_R	136	136	136	136	136	137	137	138	138	139	139	139
	V_2	141	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5960	6200	6460	6710	7000	7940	8500	9190	10040	11040	12200	12460

TODATA7K_WET_F10_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-61. (06-22-19)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 8000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-30	-20	-10	0	10	15	20	25	30	34
28000	V_1	96	96	96	96	96	99	101	102	104	106	107
	V_R	111	111	111	111	111	112	113	113	114	114	115
	V_2	126	125	125	125	124	123	123	122	121	121	120
	TOFL	4460	4650	4850	5040	5360	5780	6010	6300	6640	7010	7350
30000	V_1	101	101	101	101	102	105	107	108	110	111	113
	V_R	115	115	115	115	116	117	118	118	119	119	120
	V_2	125	124	124	124	123	123	123	123	123	123	123
	TOFL	4620	4820	5020	5230	5560	6010	6260	6570	6930	7330	7700
32000	V_1	107	107	107	107	108	111	112	114	115	117	119
	V_R	120	120	120	120	121	122	123	123	124	124	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	4780	4990	5200	5410	5760	6240	6510	6830	7220	7800	8460
34000	V_1	113	113	113	112	113	116	118	119	121	123	124
	V_R	125	125	125	125	126	127	127	128	128	129	129
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4930	5150	5370	5590	5960	6500	6950	7480	8140	8970	9740
36000	V_1	118	118	118	118	119	122	123	124	126	128	130
	V_R	130	130	130	130	130	131	132	132	133	133	134
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	5270	5490	5720	5950	6430	7340	7870	8490	9280	10240	11110
38000	V_1	123	123	123	123	124	127	128	130	131	133	135
	V_R	134	134	134	134	135	136	136	136	137	137	138
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5890	6140	6390	6650	7190	8240	8830	9580	10490	11570	12590
38850	V_1	125	125	125	125	126	129	130	132	133	135	137
	V_R	136	136	136	136	136	137	138	138	139	139	139
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	6170	6420	6690	6960	7530	8630	9280	10070	11040	12190	13250

TODATASK_WET_F10_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-62. (06-22-20)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 9000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-30	-20	-10	0	10	15	20	25	30	32
28000	V_1	96	96	96	96	97	100	102	103	105	107	108
	V_R	112	112	112	112	112	113	113	114	114	115	115
	V_2	125	125	125	125	124	123	122	121	121	120	120
	TOFL	4660	4860	5070	5300	5670	6130	6390	6710	7090	7520	7710
30000	V_1	101	101	101	101	103	106	108	109	111	113	114
	V_R	115	115	115	116	117	118	118	119	119	120	120
	V_2	124	124	124	124	123	123	123	123	123	123	123
	TOFL	4830	5040	5250	5500	5890	6380	6660	7000	7410	7870	8080
32000	V_1	107	107	107	107	109	112	113	115	117	119	120
	V_R	120	120	121	121	122	123	123	124	124	125	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	5000	5220	5440	5690	6110	6630	6930	7290	7800	8610	8990
34000	V_1	113	113	113	113	115	118	119	120	122	124	125
	V_R	125	125	125	126	126	127	128	128	129	129	130
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	5160	5390	5620	5890	6330	7060	7560	8170	8950	9920	10360
36000	V_1	118	118	118	118	120	123	124	126	128	130	130
	V_R	130	130	130	130	131	132	132	133	133	134	134
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	5520	5760	5990	6290	6980	7980	8570	9300	10220	11360	11830
38000	V_1	123	123	123	123	125	128	129	131	133	134	135
	V_R	134	134	134	134	135	136	136	137	137	138	138
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	6170	6430	6700	7030	7820	8960	9660	10510	11570	12840	13390
38850	V_1	125	125	125	125	127	130	131	133	135	137	137
	V_R	136	136	136	136	137	138	138	139	139	140	140
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	6460	6730	7010	7360	8190	9420	10160	11040	12160	13510	14110

TODATA9K_WET_F10_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-63. (06-22-21)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 10000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C									
		-40	-30	-20	-10	0	10	15	20	25	30
28000	V_1	97	96	96	97	99	102	103	105	106	108
	V_R	112	112	112	112	112	113	114	114	115	116
	V_2	125	125	125	124	123	122	121	121	120	119
	TOFL	4880	5090	5320	5610	6010	6510	6790	7160	7600	8090
30000	V_1	102	102	102	103	105	108	109	110	112	114
	V_R	116	116	116	116	117	118	119	119	120	121
	V_2	124	124	124	123	123	123	123	123	123	123
	TOFL	5060	5280	5520	5830	6250	6780	7080	7460	7950	8480
32000	V_1	108	108	108	109	110	113	115	116	118	120
	V_R	121	121	121	121	122	123	124	124	125	125
	V_2	128	128	128	128	128	128	128	128	128	128
	TOFL	5240	5470	5720	6040	6490	7050	7370	7800	8570	9560
34000	V_1	113	113	113	114	116	119	120	121	124	126
	V_H	125	126	126	126	127	128	128	129	129	130
	V_2	132	132	132	132	132	132	132	132	132	132
	TOFL	5410	5650	5910	6250	6720	7670	8220	8940	8880	11030
36000	V_1	119	118	118	119	121	124	125	127	129	131
	V_R	130	130	130	131	131	132	133	133	134	134
	V_2	136	136	136	136	136	136	136	136	136	136
	TOFL	5830	6080	6350	6830	7580	8890	9350	10200	11300	12590
38000	V_1	124	123	123	124	126	129	131	132	134	136
	V_R	134	134	135	135	136	136	137	137	138	138
	V_2	139	139	139	139	139	139	139	139	139	139
	TOFL	6510	6800	7100	7630	8500	9790	10350	11540	12790	14270
38850	V_1	126	125	125	126	128	131	133	134	136	138
	V_R	136	136	136	137	137	138	139	139	139	140
	V_2	141	141	141	141	141	141	141	141	141	141
	TOFL	6820	7110	7430	8000	8920	10290	11090	12150	13470	15050

TODATA10X_WET_F10_ECS_IMP_BU100_0702R04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-64. (06-22-22)

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WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE SEA LEVEL
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	99	98	98	98	98	98	98	98	98	97	97
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	127	127	127	127	126	126	126	126	126	126	126
	TOFL	3350	3410	3480	3540	3600	3670	3740	3810	3880	3950	4020
30000	V_1	102	102	102	102	102	102	102	102	102	102	102
	V_R	114	114	114	114	114	114	114	114	114	114	114
	V_2	126	125	125	125	125	125	125	125	125	125	125
	TOFL	3460	3530	3590	3660	3730	3800	3870	3940	4010	4090	4160
32000	V_1	108	108	108	108	108	108	108	108	108	108	108
	V_R	119	119	119	119	119	119	119	119	119	120	120
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3570	3640	3710	3780	3850	3920	4000	4070	4150	4230	4310
34000	V_1	114	114	114	114	114	114	114	114	114	114	114
	V_R	124	124	124	124	124	124	124	124	124	124	124
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	3680	3750	3830	3900	3970	4050	4130	4210	4290	4370	4450
36000	V_1	120	119	119	119	119	119	119	119	119	119	119
	V_R	129	129	129	129	129	129	129	129	129	129	129
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4020	4090	4160	4240	4310	4390	4470	4560	4640	4720	4810
38000	V_1	125	124	124	124	124	124	124	124	124	124	124
	V_R	133	133	133	133	133	133	133	133	133	133	133
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4480	4570	4650	4730	4810	4900	4990	5090	5180	5280	5370
38850	V_1	127	127	126	126	126	126	126	126	126	126	126
	V_R	135	135	135	135	135	135	135	135	135	135	135
	V_2	140	140	140	140	140	140	140	140	140	140	140
	TOFL	4690	4780	4860	4950	5030	5130	5230	5320	5420	5520	5620

TODATASL_WET_F10_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-65. (06-22-23)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 1000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
28000	V_1	98	98	98	98	98	98	97	97	97	97	97
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	127	127	126	126	126	126	126	126	126	126	126
	TOFL	3460	3530	3600	3660	3730	3800	3870	3940	4020	4090	4160
30000	V_1	102	102	102	101	101	101	101	101	101	101	101
	V_R	114	114	114	114	114	114	114	114	114	114	115
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	3580	3650	3720	3790	3860	3930	4010	4080	4160	4240	4310
32000	V_1	108	108	108	108	108	108	108	108	108	108	108
	V_R	119	119	119	119	119	119	119	119	120	120	120
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3690	3770	3840	3910	3990	4060	4140	4220	4300	4380	4460
34000	V_1	114	114	114	114	114	114	113	113	113	113	113
	V_R	124	124	124	124	124	124	124	124	124	125	125
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	3810	3880	3960	4040	4120	4200	4280	4360	4440	4530	4610
36000	V_1	119	119	119	119	119	119	119	119	119	119	119
	V_R	129	129	129	129	129	129	129	129	129	129	129
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4140	4220	4290	4370	4450	4540	4620	4710	4790	4880	4970
38000	V_1	124	124	124	124	124	124	124	124	124	124	124
	V_R	133	133	133	133	133	133	133	133	133	133	134
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4620	4710	4800	4880	4970	5070	5160	5260	5360	5450	5550
38850	V_1	126	126	126	126	126	126	126	126	126	126	126
	V_R	135	135	135	135	135	135	135	135	135	135	135
	V_2	140	140	140	140	140	140	140	140	140	140	140
	TOFL	4830	4930	5020	5110	5200	5300	5400	5510	5610	5710	5810

TODATA1K_WET_F10_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-66. (06-22-24)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 2000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
28000	V_1	98	98	98	98	97	97	97	97	97	97	97
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	127	126	126	126	126	126	126	126	126	126	125
	TOFL	3580	3650	3720	3790	3870	3940	4010	4090	4170	4240	4340
30000	V_1	101	101	101	101	101	101	101	101	101	101	102
	V_R	114	114	114	114	114	114	114	114	115	115	115
	V_2	125	125	125	125	125	125	125	125	125	125	124
	TOFL	3700	3770	3850	3920	4000	4080	4160	4240	4320	4400	4500
32000	V_1	108	108	108	108	108	108	107	107	107	107	108
	V_R	119	119	119	119	119	119	120	120	120	120	120
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3820	3900	3970	4050	4130	4220	4300	4380	4460	4550	4660
34000	V_1	114	114	113	113	113	113	113	113	113	113	114
	V_R	124	124	124	124	124	124	124	125	125	125	125
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	3940	4020	4100	4180	4270	4350	4440	4530	4610	4700	4810
36000	V_1	119	119	119	119	119	119	119	119	119	119	119
	V_R	129	129	129	129	129	129	129	129	129	129	130
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4270	4350	4430	4520	4610	4680	4780	4870	4960	5050	5240
38000	V_1	124	124	124	124	124	124	124	124	124	124	124
	V_R	133	133	133	133	133	133	133	133	134	134	134
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4760	4860	4950	5050	5140	5240	5340	5440	5540	5640	5850
38850	V_1	126	126	126	126	126	126	126	126	126	126	126
	V_R	135	135	135	135	135	135	135	135	135	135	136
	V_2	140	140	140	140	140	140	140	140	140	140	140
	TOFL	4980	5080	5180	5280	5380	5490	5590	5700	5800	5910	6130

TODATA2K_WET_F10_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-67. (06-22-25)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 3000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	98	98	97	97	97	97	97	97	97	97	98
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	126	126	126	126	126	126	126	126	126	125	124
	TOFL	3710	3780	3860	3930	4010	4090	4170	4250	4330	4420	4590
30000	V_1	101	101	101	101	101	101	101	101	101	102	104
	V_R	114	114	114	114	114	114	115	115	115	115	116
	V_2	125	125	125	125	125	125	125	125	125	124	123
	TOFL	3830	3910	3990	4070	4150	4230	4320	4400	4480	4580	4760
32000	V_1	108	108	108	107	107	107	107	107	107	108	110
	V_R	119	119	119	119	120	120	120	120	120	120	121
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3960	4040	4120	4210	4290	4380	4460	4550	4640	4740	4930
34000	V_1	113	113	113	113	113	113	113	113	113	114	115
	V_R	124	124	124	124	124	125	125	125	125	125	126
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	4080	4170	4260	4340	4430	4520	4610	4700	4790	4900	5100
36000	V_1	119	119	119	119	119	119	119	118	118	119	121
	V_R	129	129	129	129	129	129	129	129	129	130	130
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4410	4500	4590	4680	4770	4870	4960	5050	5140	5320	5690
38000	V_1	124	124	124	124	124	124	124	123	123	124	126
	V_R	133	133	133	133	133	134	134	134	134	134	135
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4920	5030	5130	5230	5330	5440	5540	5640	5750	5940	6360
38850	V_1	126	126	126	126	126	126	126	126	125	126	128
	V_R	135	135	135	135	135	135	135	135	135	136	136
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5150	5260	5370	5470	5580	5690	5800	5910	6020	6220	6660

TODATA3K_WET_F10_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-68. (06-22-26)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 4000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	98	97	97	97	97	97	97	97	97	98	99
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	126	126	126	126	126	126	126	125	125	124	124
	TOFL	3840	3920	4000	4080	4160	4240	4330	4410	4500	4670	4860
30000	V_1	101	101	101	101	101	101	101	101	102	104	106
	V_R	114	114	114	115	115	115	115	116	115	116	117
	V_2	125	125	125	125	125	125	125	124	124	123	123
	TOFL	3980	4060	4140	4220	4310	4400	4480	4570	4670	4850	5050
32000	V_1	108	108	107	107	107	107	107	107	108	110	111
	V_R	119	119	120	120	120	120	120	120	120	121	122
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	4110	4190	4280	4370	4460	4550	4640	4730	4830	5020	5230
34000	V_1	113	113	113	113	113	113	113	113	113	115	117
	V_R	124	124	124	125	125	125	125	125	125	126	126
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	4240	4330	4420	4510	4610	4700	4790	4890	4990	5190	5490
36000	V_1	119	119	119	119	119	119	118	118	119	120	122
	V_R	129	129	129	129	129	129	129	129	130	130	131
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4580	4670	4770	4860	4960	5050	5150	5250	5380	5770	6190
38000	V_1	124	124	124	124	124	124	123	123	124	125	127
	V_R	133	133	133	134	134	134	134	134	134	135	135
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5110	5220	5320	5430	5540	5650	5750	5860	6020	6450	6920
38850	V_1	126	126	126	126	126	126	126	125	126	127	129
	V_R	135	135	135	135	135	135	136	136	136	136	137
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5350	5460	5570	5680	5800	5910	6020	6140	6300	6760	7250

TODATA4K_WET_F10_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-69. (06-22-27)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 5000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	97	97	97	97	97	97	97	97	98	99	101
	V_R	111	111	111	111	111	111	111	111	111	111	112
	V_2	126	126	126	126	126	125	125	125	124	124	123
	TOFL	3990	4070	4150	4240	4330	4410	4500	4590	4750	4950	5150
30000	V_1	101	101	101	101	101	101	101	101	103	105	107
	V_R	114	116	116	116	116	116	116	116	116	117	117
	V_2	125	125	125	125	125	124	124	124	123	123	123
	TOFL	4130	4210	4300	4390	4480	4570	4660	4750	4930	5140	5350
32000	V_1	108	108	107	107	107	107	107	107	109	111	113
	V_R	120	120	120	120	120	120	120	120	121	122	122
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	4270	4360	4450	4540	4640	4730	4820	4920	5110	5330	5560
34000	V_1	113	113	113	113	113	113	113	113	116	117	118
	V_R	125	125	125	125	125	125	125	125	126	126	127
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4410	4500	4600	4690	4790	4890	4980	5080	5280	5570	5970
36000	V_1	119	119	119	119	119	118	118	118	120	122	123
	V_R	129	129	129	129	129	130	130	130	130	131	131
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4750	4850	4950	5050	5150	5250	5350	5450	5850	6280	6730
38000	V_1	124	124	124	124	124	123	123	123	125	127	128
	V_R	134	134	134	134	134	134	134	134	135	135	136
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5310	5420	5530	5650	5760	5870	5980	6100	6540	7030	7550
38850	V_1	126	126	126	126	126	126	125	125	127	129	130
	V_R	135	135	135	135	136	136	136	136	136	137	137
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5560	5680	5790	5910	6030	6150	6260	6380	6840	7360	7930

TODATA5K_WET_F10_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-70. (06-22-28)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 6000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	97	97	97	97	97	97	96	97	99	101	102
	V_R	111	111	111	111	111	111	111	111	111	112	113
	V_2	126	126	126	126	125	125	125	125	124	123	122
	TOFL	4140	4220	4310	4400	4490	4580	4670	4810	5030	5240	5460
30000	V_1	101	101	101	101	101	101	101	103	105	107	108
	V_R	115	115	115	115	115	115	115	116	117	117	118
	V_2	125	125	125	124	124	124	124	124	123	123	123
	TOFL	4290	4380	4470	4560	4650	4750	4840	4990	5220	5450	5690
32000	V_1	107	107	107	107	107	107	107	109	111	112	114
	V_R	120	120	120	120	120	120	120	121	122	122	123
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	4430	4530	4620	4720	4820	4910	5010	5160	5410	5660	5910
34000	V_1	113	113	113	113	113	113	113	114	116	118	119
	V_R	125	125	125	125	125	125	125	126	126	127	128
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4580	4680	4770	4870	4980	5080	5180	5340	5630	6060	6490
36000	V_1	119	119	118	118	118	118	118	120	122	123	125
	V_R	129	129	129	129	130	130	130	130	131	131	132
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4930	5030	5130	5230	5340	5440	5550	5850	6350	6840	7340
38000	V_1	124	124	123	123	123	123	123	124	126	128	130
	V_R	134	134	134	134	134	134	134	134	135	136	136
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5510	5620	5730	5850	5960	6080	6200	6540	7110	7660	8270
38850	V_1	126	126	125	125	125	125	125	127	129	130	132
	V_R	135	135	136	136	136	136	136	136	137	137	138
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5770	5880	6000	6120	6240	6370	6490	6840	7440	8040	8680

TODATA6K_WET_F10_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-71. (06-22-29)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 7000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	97	97	97	96	96	96	97	98	100	102	104
	V_R	111	111	111	111	111	111	111	111	112	113	113
	V_2	126	126	125	125	125	125	125	124	123	122	122
	TOFL	4300	4380	4480	4570	4670	4760	4880	5100	5330	5570	5810
30000	V_1	101	101	101	101	101	101	102	104	106	108	110
	V_R	116	116	115	115	115	115	116	117	117	118	119
	V_2	125	125	124	124	124	124	124	123	123	123	123
	TOFL	4450	4540	4640	4740	4830	4930	5050	5300	5540	5790	6050
32000	V_1	107	107	107	107	107	107	108	110	112	114	115
	V_R	120	120	120	120	120	120	121	122	122	123	123
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	4600	4700	4800	4900	5000	5100	5230	5490	5750	6020	6300
34000	V_1	113	113	113	113	113	113	113	116	118	119	121
	V_R	125	125	125	125	125	125	125	126	127	128	128
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4750	4850	4960	5060	5170	5270	5410	5680	6120	6590	7080
36000	V_1	118	118	118	118	118	118	119	121	123	124	126
	V_R	129	129	130	130	130	130	130	131	131	132	133
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	5100	5200	5310	5410	5520	5630	5840	6380	6910	7450	8030
38000	V_1	123	123	123	123	123	123	124	126	128	130	131
	V_R	134	134	134	134	134	134	134	135	136	136	137
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5700	5810	5930	6050	6170	6300	6530	7140	7740	8380	9040
38850	V_1	125	125	125	125	125	125	126	128	130	132	133
	V_R	136	136	136	136	136	136	136	137	137	138	138
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5970	6080	6210	6340	6460	6590	6840	7480	8120	8800	9500

TODATA7K_WET_F10_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-72. (06-22-30)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 8000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
28000	V_1	96	96	96	96	96	96	98	100	102	104	105
	V_R	111	111	111	111	111	111	111	112	113	113	114
	V_2	126	125	125	125	125	125	124	123	122	122	121
	TOFL	4460	4550	4650	4750	4850	4950	5170	5410	5660	5920	6190
30000	V_1	101	101	101	101	101	101	104	106	108	109	111
	V_R	115	115	115	115	115	115	116	117	118	119	119
	V_2	125	124	124	124	124	124	123	123	123	123	123
	TOFL	4620	4720	4820	4920	5020	5130	5360	5630	5890	6170	6460
32000	V_1	107	107	107	107	107	107	110	112	113	115	117
	V_R	120	120	120	120	120	120	121	122	123	123	124
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	4780	4880	4990	5090	5200	5310	5560	5840	6120	6410	6790
34000	V_1	113	113	113	113	113	113	115	117	119	120	122
	V_R	125	125	125	125	125	125	126	127	128	128	129
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4940	5040	5150	5260	5370	5490	5750	6170	6670	7180	7760
36000	V_1	118	118	118	118	118	118	120	122	124	126	128
	V_R	130	130	130	130	130	130	131	131	132	133	133
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	5280	5380	5500	5610	5720	5850	6370	6960	7540	8150	8820
38000	V_1	123	123	123	123	123	123	125	127	129	131	133
	V_R	134	134	134	134	134	134	135	136	136	137	137
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5900	6010	6140	6270	6400	6540	7130	7800	8480	9180	9940
38850	V_1	125	125	125	125	125	125	127	129	131	133	135
	V_R	136	136	136	136	136	136	137	137	138	138	139
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	6170	6300	6430	6560	6700	6850	7470	8170	8910	9640	10440

TODATA8K_WET_F10_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-73. (06-22-31)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 9000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	96	96	96	96	96	97	99	101	103	105	106
	V_R	112	112	112	112	112	112	112	113	113	114	115
	V_2	125	125	125	125	125	124	123	122	122	121	120
	TOFL	4660	4760	4860	4970	5070	5240	5490	5750	6020	6300	6620
30000	V_1	101	101	101	101	101	103	105	107	109	111	112
	V_R	115	115	115	115	116	116	117	118	119	119	120
	V_2	124	124	124	124	124	123	123	123	123	123	123
	TOFL	4830	4930	5040	5150	5260	5440	5700	5980	6280	6580	6920
32000	V_1	107	107	107	107	107	109	111	113	115	116	118
	V_R	120	120	120	120	121	121	122	123	123	124	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	5000	5110	5220	5330	5440	5630	5910	6220	6530	6880	7460
34000	V_1	113	113	113	113	113	114	117	118	120	122	124
	V_R	125	125	125	125	125	126	127	128	128	129	129
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	5160	5280	5390	5510	5620	5820	6170	6720	7280	7850	8550
36000	V_1	118	118	118	118	118	120	122	124	126	127	129
	V_R	130	130	130	130	130	131	131	132	133	133	133
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	5530	5640	5760	5880	6000	6370	6970	7600	8250	8930	9730
38000	V_1	123	123	123	123	123	124	127	129	131	132	134
	V_R	134	134	134	134	134	135	136	136	137	137	138
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	6170	6300	6440	6570	6700	7130	7800	8540	9300	10060	10960
38850	V_1	125	125	125	125	125	127	129	131	133	134	136
	V_R	136	136	136	136	136	137	137	138	138	139	139
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	6460	6600	6740	6880	7020	7460	8180	8970	9760	10570	11510

TODATA9K_WET_F10_ALL_IMP_BO100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-74. (06-22-32)

WET RUNWAY TAKEOFF DATA
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 10000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

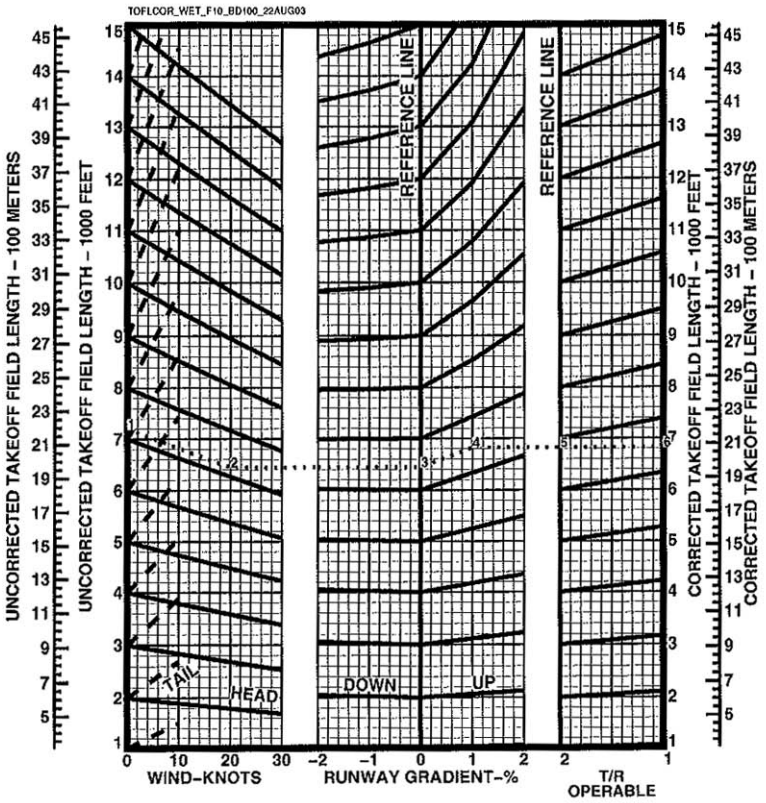
WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	97	97	98	98	97	98	101	103	105	106	108
	V_R	112	112	112	112	112	112	113	113	114	115	115
	V_2	125	125	125	125	124	123	123	122	121	120	120
	TOFL	4880	4990	5090	5200	5350	5560	5840	6130	6420	6730	7100
30000	V_1	102	102	102	102	102	104	107	109	110	112	114
	V_R	116	116	116	116	116	117	118	119	119	120	120
	V_2	124	124	124	124	123	123	123	123	123	123	123
	TOFL	5060	5170	5280	5400	5550	5780	6070	6380	6690	7030	7420
32000	V_1	108	108	108	108	108	110	112	114	116	118	120
	V_R	121	121	121	121	121	122	123	123	124	124	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	5240	5350	5470	5590	5750	5990	6310	6640	6970	7520	8240
34000	V_1	113	113	113	113	114	116	118	120	122	123	125
	V_R	125	126	126	126	126	127	127	128	129	129	130
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	5410	5530	5660	5780	5950	6200	6750	7360	7950	8620	9450
36000	V_1	119	119	118	118	119	121	123	125	127	129	130
	V_R	130	130	130	130	130	131	132	133	133	133	134
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	5830	5960	6080	6210	6460	6970	7630	8340	9050	9800	10750
38000	V_1	124	123	123	123	124	126	128	130	132	134	135
	V_R	134	134	134	134	135	135	136	137	137	138	138
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	6520	6660	6800	6940	7220	7800	8550	9400	10200	11050	12110
38850	V_1	126	126	125	125	126	128	130	133	134	136	137
	V_R	136	136	136	136	136	137	138	138	139	139	140
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	6820	6970	7120	7270	7560	8170	8990	9870	10710	11610	12730

TODATA10K_WET_F10_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-75. (06-22-33)

WET RUNWAY TAKEOFF FIELD LENGTHS CORRECTION CHART FLAPS 10°

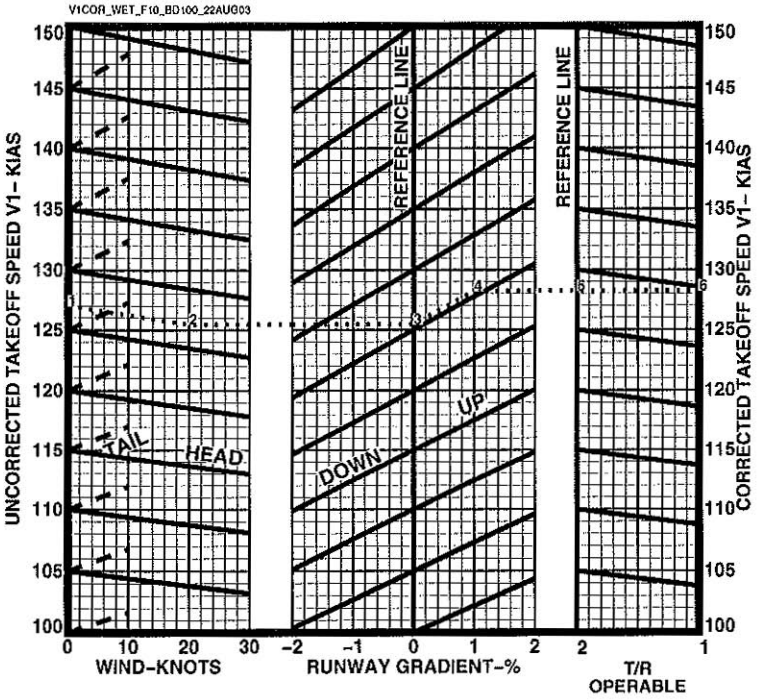


EXAMPLE:

1. Uncorrected Takeoff Field Length (from table).....7200 ft (2200 m)
2. Headwind.....20 kt
3. Runway Gradient Reference Line
4. Runway Gradient.....1.0% UP
5. Two Thrust Reversers
6. Corrected Takeoff Field Length.....6820 ft (2080 m)

Figure 2-76. (06-22-34)

WET RUNWAY TAKEOFF SPEEDS CORRECTION CHART FOR V1 FLAPS 10°



EXAMPLE:

1. Uncorrected Takeoff Speed (from table).....127 kias
2. Headwind.....20 kt
3. Runway Gradient Reference Line
4. Runway Gradient.....1.0% UP
5. Two Thrust Reversers
6. Corrected Takeoff Speed.....128 kias

NOTES:

1. V1mcg is limiting when the corrected V1 is less than 116 kias. In this case, use V1=116 kias.
2. If the corrected V1 exceeds VR for the appropriate conditions, use V1

Figure 2-77. (06-22-35)

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REFERENCE CLIMB GRADIENT
FLAPS 10°
ENGINE BLEED OFF

UNCORRECTED REFERENCE CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
SEA LEVEL	28000	10.3	10.4	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.3	9.5	8.5	7.3
	30000	8.9	9.0	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.0	8.2	7.2	6.2
	32000	7.7	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.8	7.0	6.2	5.2
	34000	6.7	6.8	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.8	6.1	5.3	4.3
	36000	5.8	5.9	5.9	6.0	6.0	6.0	6.0	6.0	5.9	6.0	5.9	5.2	4.4	3.5
	38000	5.0	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	4.4	3.7	2.8
	38850	4.7	4.7	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.1	3.4	2.6
1000	28000	10.4	10.4	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.4	9.7	8.8	7.7	6.6
	30000	9.0	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	8.4	7.5	6.5	5.5
	32000	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.2	6.4	5.5	4.5
	34000	6.8	6.8	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.2	5.5	4.6	3.7
	36000	5.9	5.9	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	5.4	4.7	3.9	3.0
	38000	5.1	5.1	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.1	4.6	3.9	3.1	2.3
	38850	4.8	4.8	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.8	4.3	3.6	2.9	2.1
2000	28000	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	9.9	9.0	8.1	7.0	5.9
	30000	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	8.5	7.7	6.8	5.8	4.8
	32000	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.4	6.6	5.8	4.9	3.9
	34000	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.4	5.7	4.9	4.0	3.1
	36000	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	5.5	4.9	4.1	3.3	2.4
	38000	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	4.7	4.1	3.4	2.6	1.8
	38850	4.8	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.4	3.8	3.1	2.3	1.5
3000	28000	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.0	9.2	8.3	7.3	6.3	
	30000	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	8.7	7.9	7.0	6.1	5.2	
	32000	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.5	6.8	6.0	5.2	4.2	
	34000	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.5	5.8	5.1	4.3	3.4	
	36000	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	5.7	5.0	4.3	3.5	2.7	
	38000	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	4.9	4.2	3.6	2.8	2.1	
	38850	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.5	3.9	3.3	2.6	1.8	
4000	28000	10.4	10.5	10.5	10.5	10.5	10.5	10.5	10.1	9.3	8.5	7.5	6.6	5.6	
	30000	9.1	9.1	9.1	9.1	9.1	9.1	9.1	8.8	8.0	7.2	6.3	5.4	4.5	
	32000	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.6	6.9	6.2	5.4	4.5	3.6	
	34000	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.6	6.0	5.2	4.5	3.7	2.9	
	36000	6.0	6.0	6.0	6.0	6.0	6.0	6.0	5.7	5.1	4.4	3.7	3.0	2.2	
	38000	5.2	5.2	5.2	5.2	5.2	5.2	5.2	4.9	4.3	3.7	3.0	2.3	1.6	
	38850	4.8	4.8	4.9	4.9	4.9	4.9	4.9	4.6	4.0	3.4	2.7	2.0	1.3	
5000	28000	10.4	10.5	10.5	10.5	10.5	10.5	10.3	9.4	8.6	7.7	6.8	5.9	4.9	
	30000	9.1	9.1	9.1	9.1	9.1	9.1	8.9	8.1	7.4	6.5	5.7	4.8	3.9	
	32000	7.9	7.9	7.9	7.9	7.9	7.9	7.7	7.0	6.3	5.5	4.7	3.9	3.1	
	34000	6.9	6.9	6.9	6.9	6.9	6.9	6.7	6.0	5.4	4.6	3.9	3.1	2.3	
	36000	5.9	6.0	6.0	6.0	6.0	6.0	5.8	5.2	4.6	3.8	3.1	2.4	1.7	
	38000	5.1	5.2	5.2	5.2	5.2	5.2	5.0	4.4	3.9	3.1	2.5	1.8	1.1	
	38850	4.8	4.8	4.8	4.8	4.8	4.8	4.7	4.1	3.6	2.9	2.2	1.5	0.8	

REFCLB1_F10_ZERO_IMP_BDI00_23FEB04

Figures in shaded area are above engine temperature limits and are for interpolation only.

Figure 2-78. (06-22-36 Sheet 1 of 2)

REFERENCE CLIMB GRADIENT
FLAPS 10°
ENGINE BLEED OFF

UNCORRECTED REFERENCE CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C											
		–40	–30	–20	–10	0	10	15	20	25	30	35	40
6000	28000	10.5	10.5	10.5	10.5	10.5	10.3	9.5	8.7	7.9	7.0	6.1	5.1
	30000	9.1	9.1	9.1	9.1	9.1	8.9	8.2	7.4	6.7	5.9	5.0	4.1
	32000	7.9	7.9	7.9	7.9	7.9	7.8	7.1	6.4	5.7	4.9	4.1	3.3
	34000	6.9	6.9	6.9	6.9	6.9	6.8	6.1	5.5	4.8	4.1	3.3	2.6
	36000	6.0	6.0	6.0	6.0	6.0	5.9	5.3	4.6	4.0	3.3	2.6	1.9
	38000	5.2	5.2	5.2	5.2	5.2	5.1	4.5	3.9	3.3	2.7	2.0	1.3
	38850	4.8	4.9	4.9	4.9	4.9	4.7	4.2	3.6	3.0	2.4	1.7	1.0
7000	28000	10.5	10.6	10.5	10.5	10.5	9.6	8.8	8.0	7.3	6.3	5.4	4.4
	30000	9.1	9.2	9.2	9.1	9.1	8.3	7.5	6.8	6.1	5.2	4.4	3.5
	32000	7.9	8.0	8.0	8.0	7.9	7.2	6.5	5.8	5.1	4.3	3.5	2.6
	34000	6.9	7.0	7.0	6.9	6.9	6.2	5.5	4.9	4.3	3.5	2.7	1.9
	36000	6.0	6.0	6.0	6.0	6.0	5.3	4.7	4.1	3.5	2.8	2.0	1.3
	38000	5.2	5.2	5.2	5.2	5.2	4.6	4.0	3.4	2.8	2.2	1.4	0.7
	38850	4.9	4.9	4.9	4.9	4.9	4.3	3.7	3.1	2.6	1.9	1.2	0.5
8000	28000	10.5	10.5	10.5	10.5	9.9	8.9	8.1	7.4	6.6	5.7	4.7	
	30000	9.1	9.1	9.1	9.1	8.6	7.6	6.9	6.2	5.5	4.6	3.7	
	32000	8.0	8.0	8.0	8.0	7.5	6.5	5.9	5.2	4.6	3.7	2.9	
	34000	6.9	7.0	7.0	6.9	6.5	5.6	5.0	4.4	3.7	2.9	2.1	
	36000	6.0	6.1	6.0	6.0	5.6	4.8	4.2	3.6	3.0	2.3	1.5	
	38000	5.2	5.2	5.2	5.2	4.8	4.0	3.5	2.9	2.4	1.6	0.9	
	38850	4.9	4.9	4.9	4.9	4.5	3.8	3.2	2.7	2.1	1.4	0.7	
9000	28000	10.4	10.4	10.4	10.1	9.2	8.2	7.4	6.7	5.9	5.0	4.0	
	30000	9.0	9.0	9.0	8.7	7.9	7.0	6.3	5.6	4.9	4.0	3.1	
	32000	7.8	7.8	7.8	7.6	6.8	5.9	5.3	4.7	4.0	3.1	2.3	
	34000	6.8	6.8	6.8	6.6	5.9	5.0	4.4	3.9	3.2	2.4	1.6	
	36000	5.9	5.9	5.9	5.8	5.0	4.2	3.7	3.1	2.5	1.7	1.0	
	38000	5.1	5.1	5.2	5.0	4.3	3.5	3.0	2.5	1.9	1.1	0.4	
	38850	4.8	4.8	4.8	4.7	4.0	3.3	2.7	2.2	1.6	0.9	0.2	
10000	28000	9.9	9.9	9.9	9.4	8.4	7.5	6.8	6.1	5.3	4.3	3.3	
	30000	8.6	8.6	8.6	8.0	7.2	6.3	5.7	5.0	4.3	3.3	2.4	
	32000	7.5	7.5	7.5	7.0	6.2	5.4	4.7	4.1	3.4	2.5	1.7	
	34000	6.5	6.5	6.5	6.0	5.3	4.5	3.9	3.4	2.6	1.8	1.0	
	36000	5.6	5.6	5.6	5.2	4.5	3.7	3.2	2.7	2.0	1.2	0.4	
	38000	4.9	4.9	4.9	4.5	3.8	3.1	2.5	2.0	1.4	0.6	–0.1	
	38850	4.6	4.6	4.6	4.2	3.5	2.8	2.3	1.8	1.1	0.4	–0.3	

REFCLB2_F10_ZERO_IMP_BD100_23FEB04

Figures in shaded area are above engine temperature limits and are for interpolation only.

Figure 2-78. (06-22-36 Sheet 2 of 2)

REFERENCE CLIMB GRADIENT
FLAPS 10°
ENGINE BLEED ON

UNCORRECTED REFERENCE CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C													
		–40	–30	–20	–10	0	10	15	20	25	30	35	40	45	50
SEA LEVEL	28000	10.2	10.3	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	9.8	9.0	8.0	6.8
	30000	8.9	8.9	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.5	7.7	6.8	5.7
	32000	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.3	6.6	5.8	4.7
	34000	6.7	6.7	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.3	5.7	4.9	3.9
	36000	5.8	5.8	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.5	4.8	4.1	3.1
	38000	5.0	5.0	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	4.7	4.1	3.3	2.5
	38850	4.7	4.7	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.4	3.8	3.1	2.2
1000	28000	10.3	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.1	9.2	8.3	7.2	6.1
	30000	9.0	9.0	9.1	9.1	9.1	9.1	9.1	9.1	9.1	8.7	7.8	7.0	6.1	5.0
	32000	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.5	6.8	6.0	5.1	4.1
	34000	6.8	6.8	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.5	5.8	5.1	4.2	3.3
	36000	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.7	5.0	4.3	3.5	2.6
	38000	5.0	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	4.9	4.2	3.5	2.8	2.0
	38850	4.7	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.6	3.9	3.3	2.5	1.7
2000	28000	10.4	10.4	10.5	10.5	10.5	10.5	10.5	10.5	10.2	9.4	8.5	7.6	6.5	5.4
	30000	9.0	9.1	9.1	9.1	9.1	9.1	9.1	9.1	8.8	8.0	7.2	6.4	5.4	4.3
	32000	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.7	6.9	6.2	5.4	4.4	3.5
	34000	6.8	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.7	6.0	5.3	4.5	3.6	2.7
	36000	5.9	5.9	6.0	6.0	6.0	6.0	6.0	6.0	5.8	5.1	4.4	3.7	2.9	2.0
	38000	5.1	5.1	5.2	5.2	5.2	5.2	5.2	5.2	5.0	4.3	3.7	3.0	2.2	1.4
	38850	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.7	4.0	3.4	2.7	2.0	1.2
3000	28000	10.4	10.5	10.5	10.5	10.5	10.5	10.5	10.3	9.5	8.7	7.8	6.8	5.8	
	30000	9.1	9.1	9.1	9.1	9.1	9.1	9.1	8.9	8.1	7.4	6.6	5.7	4.7	
	32000	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.7	7.0	6.3	5.5	4.7	3.8	
	34000	6.8	6.9	6.9	6.9	6.9	6.9	6.9	6.7	6.1	5.4	4.7	3.9	3.0	
	36000	5.9	6.0	6.0	6.0	6.0	6.0	6.0	5.8	5.2	4.6	3.9	3.1	2.3	
	38000	5.1	5.2	5.2	5.2	5.2	5.2	5.2	5.0	4.4	3.8	3.2	2.5	1.7	
	38850	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.7	4.1	3.5	2.9	2.2	1.5	
4000	28000	10.4	10.4	10.4	10.4	10.4	10.4	10.3	9.6	8.8	7.9	7.0	6.1	5.1	
	30000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.3	7.5	6.7	5.9	5.0	4.1	
	32000	7.8	7.9	7.9	7.9	7.9	7.9	7.8	7.2	6.4	5.7	4.9	4.1	3.2	
	34000	6.8	6.8	6.8	6.8	6.9	6.8	6.8	6.2	5.5	4.8	4.1	3.3	2.5	
	36000	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.3	4.7	4.0	3.3	2.6	1.8	
	38000	5.1	5.1	5.1	5.1	5.1	5.1	5.1	4.5	3.9	3.3	2.6	1.9	1.2	
	38850	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.2	3.6	3.0	2.4	1.7	1.0	
5000	28000	10.4	10.4	10.4	10.4	10.4	10.3	9.7	8.9	8.1	7.2	6.3	5.4	4.5	
	30000	9.0	9.0	9.0	9.0	9.0	9.0	8.4	7.6	6.9	6.1	5.2	4.3	3.5	
	32000	7.8	7.9	7.8	7.9	7.9	7.8	7.2	6.5	5.9	5.1	4.3	3.5	2.7	
	34000	6.8	6.8	6.8	6.8	6.8	6.8	6.3	5.6	5.0	4.2	3.5	2.7	2.0	
	36000	5.9	5.9	5.9	5.9	5.9	5.9	5.4	4.8	4.2	3.4	2.8	2.0	1.3	
	38000	5.1	5.1	5.1	5.1	5.1	5.1	4.6	4.0	3.5	2.8	2.1	1.4	0.7	
	38850	4.8	4.8	4.8	4.8	4.8	4.8	4.3	3.7	3.2	2.5	1.9	1.2	0.5	

REFCLB1_F10_ECS_IMP_BD100_23FEB04

Figures in shaded area are above engine temperature limits and are for interpolation only.

Figure 2-79. (06-22-37 Sheet 1 of 2)

REFERENCE CLIMB GRADIENT
FLAPS 10°
ENGINE BLEED ON

UNCORRECTED REFERENCE CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C											
		–40	–30	–20	–10	0	10	15	20	25	30	35	40
6000	28000	10.4	10.5	10.5	10.5	10.4	9.7	8.9	8.2	7.4	6.5	5.6	4.7
	30000	9.0	9.1	9.1	9.1	9.1	8.4	7.7	6.9	6.2	5.4	4.5	3.7
	32000	7.9	7.9	7.9	7.9	7.9	7.3	6.6	5.9	5.2	4.5	3.7	2.9
	34000	6.8	6.9	6.9	6.9	6.9	6.3	5.7	5.0	4.4	3.7	2.9	2.1
	36000	5.9	6.0	6.0	6.0	6.0	5.4	4.8	4.2	3.6	2.9	2.2	1.5
	38000	5.1	5.2	5.2	5.2	5.2	4.7	4.1	3.5	2.9	2.3	1.6	0.9
	38850	4.8	4.8	4.8	4.8	4.8	4.4	3.8	3.2	2.7	2.0	1.4	0.7
7000	28000	10.5	10.5	10.5	10.5	10.4	9.0	8.2	7.5	6.7	5.8	4.9	3.9
	30000	9.1	9.1	9.1	9.1	9.0	7.7	7.0	6.3	5.6	4.8	3.9	3.0
	32000	7.9	7.9	7.9	7.9	7.9	6.7	6.0	5.3	4.7	3.9	3.1	2.2
	34000	6.9	6.9	6.9	6.9	6.8	5.7	5.1	4.5	3.8	3.1	2.3	1.5
	36000	6.0	6.0	6.0	6.0	6.0	4.9	4.3	3.7	3.1	2.4	1.7	0.9
	38000	5.2	5.2	5.2	5.2	5.1	4.1	3.6	3.0	2.4	1.8	1.1	0.4
	38850	4.9	4.9	4.9	4.9	4.8	3.8	3.3	2.7	2.2	1.5	0.9	0.2
8000	28000	10.5	10.5	10.5	10.5	9.9	8.3	7.5	6.8	6.1	5.1	4.2	
	30000	9.1	9.1	9.1	9.1	8.5	7.1	6.4	5.7	5.0	4.1	3.2	
	32000	7.9	7.9	7.9	7.9	7.4	6.0	5.4	4.8	4.1	3.3	2.5	
	34000	6.9	6.9	6.9	6.9	6.4	5.1	4.5	3.9	3.3	2.5	1.7	
	36000	6.0	6.0	6.0	6.0	5.6	4.3	3.7	3.2	2.6	1.9	1.1	
	38000	5.2	5.2	5.2	5.2	4.8	3.6	3.1	2.5	2.0	1.3	0.6	
	38850	4.9	4.9	4.9	4.9	4.5	3.3	2.8	2.3	1.7	1.0	0.4	
9000	28000	10.3	10.3	10.3	10.1	9.1	7.6	6.9	6.2	5.4	4.5	3.5	
	30000	8.9	8.9	8.9	8.7	7.8	6.4	5.7	5.1	4.4	3.5	2.6	
	32000	7.8	7.8	7.8	7.6	6.8	5.4	4.8	4.2	3.5	2.7	1.8	
	34000	6.8	6.8	6.8	6.6	5.8	4.6	4.0	3.4	2.8	2.0	1.2	
	36000	5.9	5.9	5.9	5.7	5.0	3.8	3.2	2.7	2.1	1.3	0.6	
	38000	5.1	5.1	5.1	5.0	4.2	3.1	2.6	2.1	1.5	0.8	0.1	
	38850	4.8	4.8	4.8	4.7	3.9	2.8	2.3	1.8	1.2	0.6	–0.2	
10000	28000	9.9	9.9	9.9	9.3	8.4	6.9	6.2	5.6	4.8	3.8	2.8	
	30000	8.5	8.5	8.5	8.0	7.2	5.8	5.2	4.5	3.8	2.9	2.0	
	32000	7.4	7.4	7.4	6.9	6.1	4.9	4.2	3.7	3.0	2.1	1.3	
	34000	6.5	6.5	6.5	6.0	5.2	4.0	3.5	2.9	2.2	1.4	0.6	
	36000	5.6	5.6	5.6	5.2	4.4	3.3	2.7	2.2	1.6	0.8	0.1	
	38000	4.8	4.8	4.8	4.4	3.7	2.6	2.1	1.6	1.0	0.3	–0.4	
	38850	4.5	4.5	4.5	4.1	3.4	2.4	1.9	1.4	0.8	0.1	–0.6	

REFCLB2_F10_ECS_IMP_BD100_28FEB04

Figures in shaded area are above engine temperature limits and are for interpolation only.

Figure 2-79. (06-22-37 Sheet 2 of 2)

REFERENCE CLIMB GRADIENT
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

UNCORRECTED REFERENCE CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
SEA LEVEL	28000	10.2	10.2	10.3	10.3	10.4	10.4	10.4	10.4	10.4	10.4	10.4
	30000	8.8	8.9	8.9	8.9	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	32000	7.6	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8
	34000	6.6	6.7	6.7	6.7	6.8	6.8	6.8	6.8	6.8	6.8	6.8
	36000	5.7	5.8	5.8	5.8	5.9	5.9	5.9	5.9	5.9	5.9	5.9
	38000	4.9	5.0	5.0	5.0	5.1	5.1	5.1	5.1	5.1	5.1	5.1
	38850	4.6	4.6	4.7	4.7	4.8	4.8	4.8	4.8	4.8	4.8	4.8
1000	28000	10.3	10.3	10.3	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4
	30000	8.9	8.9	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	32000	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8
	34000	6.7	6.7	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
	36000	5.8	5.8	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
	38000	5.0	5.0	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1
	38850	4.7	4.7	4.7	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
2000	28000	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	9.9
	30000	9.0	9.0	9.0	9.0	9.1	9.1	9.1	9.1	9.1	9.0	8.5
	32000	7.8	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.4
	34000	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.9	6.9	6.9	6.4
	36000	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.5
	38000	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	4.7
	38850	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.4
3000	28000	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	9.9	9.1
	30000	9.0	9.0	9.0	9.1	9.0	9.0	9.0	9.1	9.0	8.6	7.8
	32000	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.4	6.7
	34000	6.8	6.8	6.8	6.8	6.8	6.8	6.9	6.9	6.9	6.4	5.7
	36000	5.9	5.9	5.9	5.9	5.9	5.9	5.9	6.0	5.9	5.6	4.9
	38000	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	4.8	4.2
	38850	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.5	3.9
4000	28000	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.1	9.1	8.3
	30000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.7	7.8	7.0
	32000	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.6	6.7	6.0
	34000	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.6	5.8	5.1
	36000	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.7	5.0	4.3
	38000	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	4.9	4.2	3.6
	38850	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.6	3.9	3.3
5000	28000	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.3	9.2	8.3	7.5
	30000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.9	7.9	7.1	6.3
	32000	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	6.8	6.1	5.3
	34000	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	5.9	5.2	4.5
	36000	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.0	4.4	3.7
	38000	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	4.3	3.6	3.0
	38850	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.7	4.0	3.4	2.8

REFCLB1_F10_ALL_IMP_BD100_23FEB04

Figure 2-80. (06-22-38 Sheet 1 of 2)

REFERENCE CLIMB GRADIENT
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

UNCORRECTED REFERENCE CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
6000	28000	10.4	10.4	10.4	10.4	10.4	10.4	10.4	9.5	8.5	7.6	6.8
	30000	9.0	9.0	9.1	9.0	9.0	9.0	9.0	8.2	7.2	6.4	5.7
	32000	7.8	7.9	7.9	7.9	7.9	7.9	7.8	7.1	6.2	5.4	4.7
	34000	6.8	6.8	6.9	6.9	6.9	6.9	6.8	6.1	5.3	4.5	3.9
	36000	5.9	5.9	6.0	6.0	6.0	5.9	5.9	5.3	4.5	3.8	3.2
	38000	5.1	5.1	5.1	5.1	5.1	5.1	5.1	4.5	3.7	3.1	2.5
	38850	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.2	3.4	2.8	2.2
7000	28000	10.5	10.5	10.5	10.5	10.5	10.5	9.9	8.7	7.7	6.9	6.1
	30000	9.1	9.1	9.1	9.1	9.1	9.1	8.6	7.4	6.5	5.7	5.0
	32000	7.9	7.9	7.9	7.9	7.9	7.9	7.4	6.4	5.5	4.8	4.1
	34000	6.9	6.9	6.9	6.9	6.9	6.9	6.5	5.4	4.6	4.0	3.3
	36000	6.0	6.0	6.0	6.0	6.0	6.0	5.6	4.6	3.9	3.2	2.6
	38000	5.2	5.2	5.2	5.2	5.2	5.2	4.8	3.9	3.2	2.6	2.0
	38850	4.8	4.9	4.9	4.9	4.9	4.9	4.5	3.6	2.9	2.3	1.8
8000	28000	10.5	10.5	10.5	10.5	10.5	10.3	9.1	7.9	7.0	6.2	5.4
	30000	9.1	9.1	9.1	9.1	9.1	8.9	7.8	6.7	5.8	5.1	4.4
	32000	7.9	7.9	7.9	7.9	7.9	7.8	6.7	5.7	4.9	4.2	3.5
	34000	6.9	6.9	6.9	6.9	6.9	6.8	5.7	4.8	4.0	3.4	2.8
	36000	6.0	6.0	6.0	6.0	6.0	5.9	4.9	4.0	3.3	2.7	2.1
	38000	5.2	5.2	5.2	5.2	5.2	5.1	4.2	3.3	2.6	2.1	1.5
	38850	4.9	4.9	4.9	4.9	4.9	4.8	3.9	3.0	2.4	1.8	1.3
9000	28000	10.3	10.3	10.3	10.3	10.3	9.4	8.2	7.2	6.3	5.5	4.7
	30000	8.9	8.9	8.9	8.9	8.9	8.1	7.0	6.0	5.2	4.5	3.7
	32000	7.8	7.8	7.8	7.8	7.8	7.0	6.0	5.0	4.3	3.6	2.9
	34000	6.8	6.8	6.8	6.8	6.8	6.1	5.1	4.2	3.5	2.9	2.2
	36000	5.9	5.9	5.9	5.9	5.9	5.2	4.3	3.4	2.8	2.2	1.6
	38000	5.1	5.1	5.1	5.1	5.1	4.4	3.5	2.8	2.1	1.6	1.0
	38850	4.8	4.8	4.8	4.8	4.8	4.1	3.3	2.5	1.9	1.3	0.8
10000	28000	9.9	9.9	9.9	9.9	9.6	8.6	7.4	6.4	5.6	4.9	4.0
	30000	8.5	8.5	8.5	8.5	8.2	7.3	6.3	5.3	4.6	3.9	3.1
	32000	7.4	7.4	7.4	7.4	7.2	6.3	5.3	4.4	3.7	3.1	2.3
	34000	6.5	6.5	6.5	6.5	6.2	5.4	4.4	3.6	2.9	2.3	1.6
	36000	5.6	5.6	5.6	5.6	5.4	4.5	3.7	2.9	2.3	1.7	1.0
	38000	4.8	4.8	4.8	4.8	4.6	3.8	3.0	2.2	1.7	1.1	0.5
	38850	4.5	4.5	4.5	4.5	4.3	3.5	2.7	2.0	1.4	0.9	0.3

REFCLB2_F10_ALL_IMP_BD100_23FEB04

Figure 2-80. (06-22-38 Sheet 2 of 2)

FlightSafety international
CHALLENGER 300 PERFORMANCE MANUAL

REFERENCE CLIMB GRADIENT CORRECTION CHART FLAPS 10°

EXAMPLE:

1. Uncorrected Reference Climb Gradient (from table).....8.7%
2. Gross Level–off Height.....6000 ft
3. Wind Reference Line
4. Headwind.....10 kt
5. Corrected Reference Climb Gradient.....7.0%

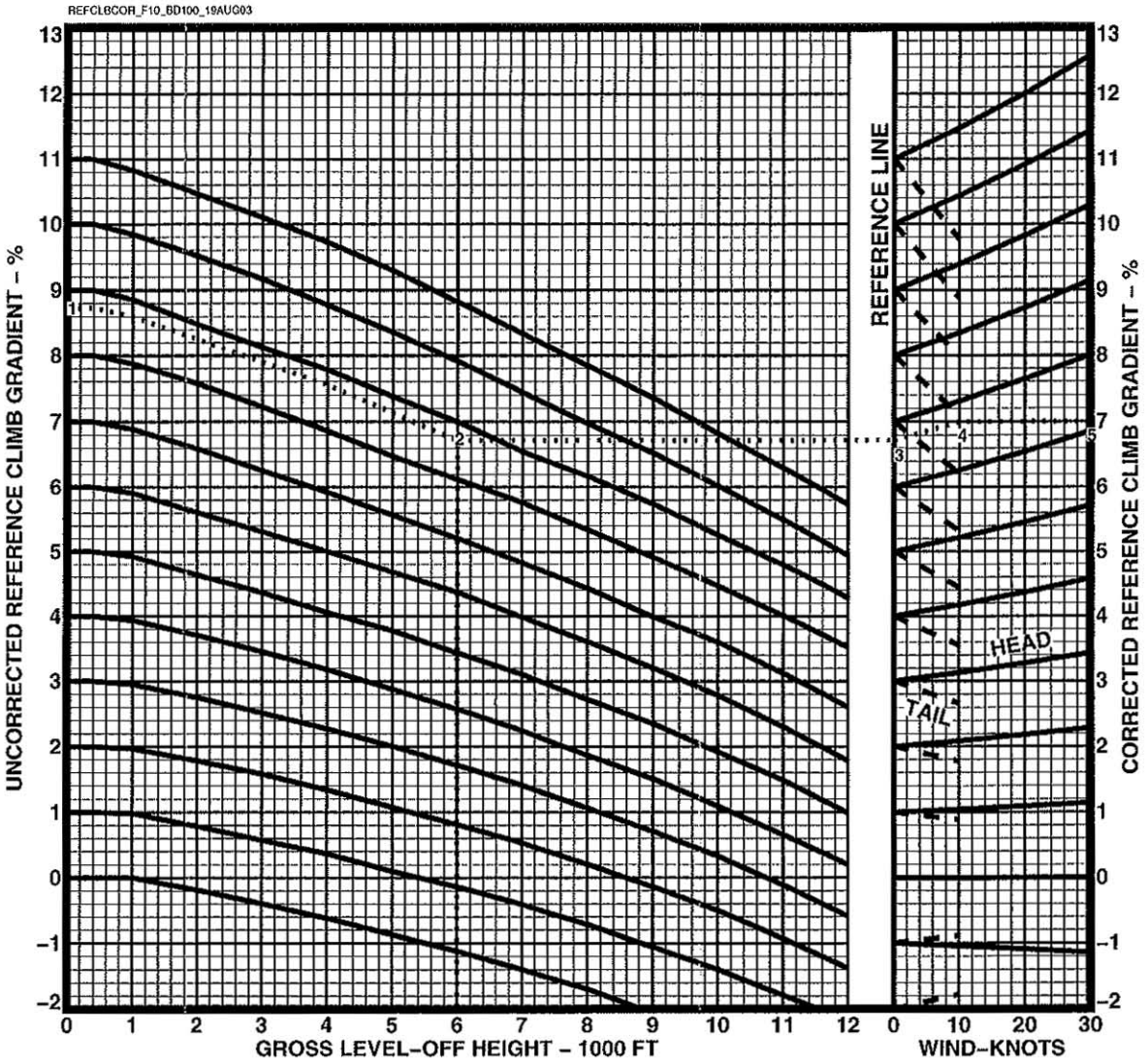

Figure 2-81. (06-22-39)

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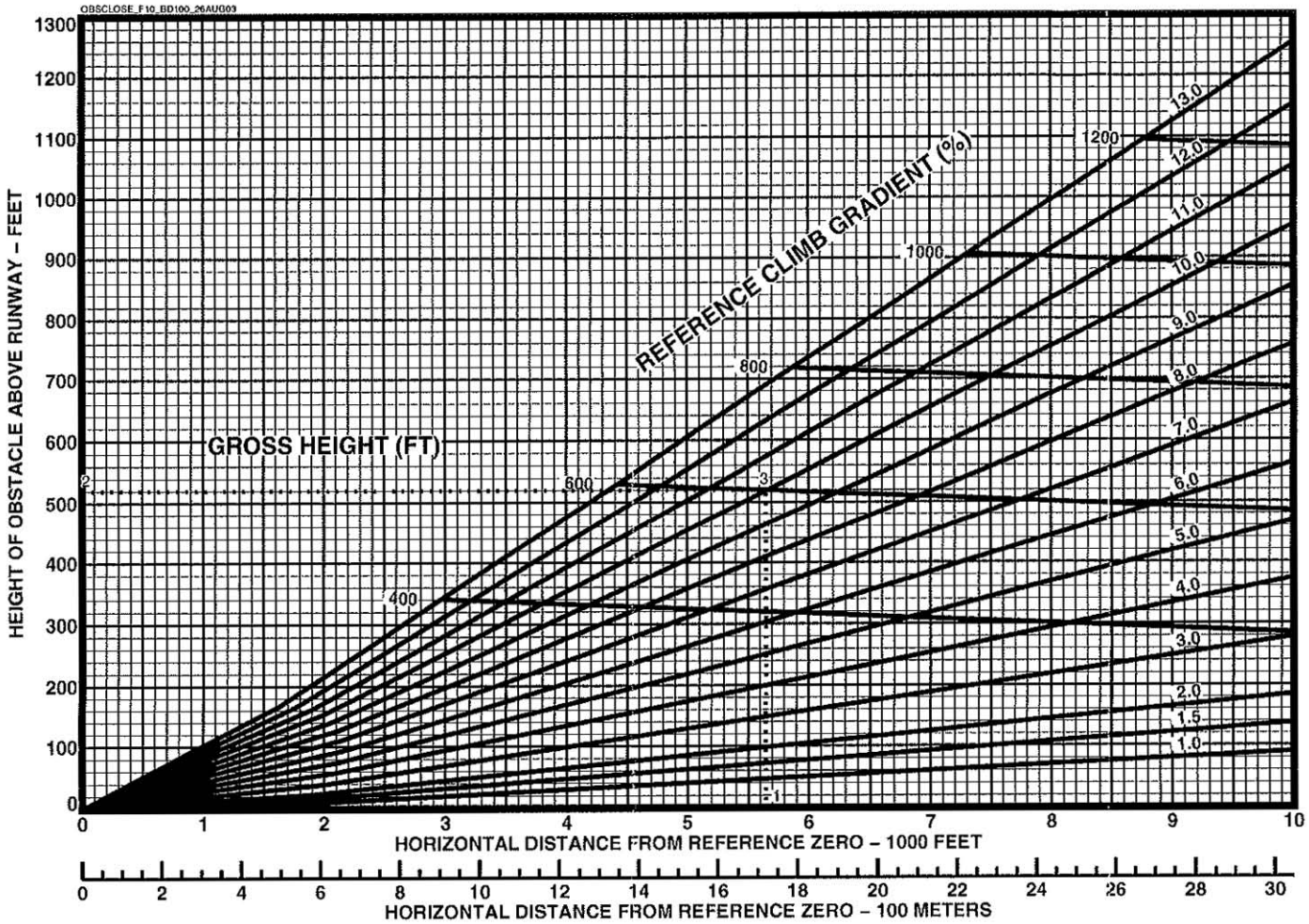
CLOSE-IN TAKEOFF FLIGHT PATH
FLAPS 10°



EXAMPLE:

1. Obstacle Distance
   (Horizontal from Reference Zero).....5650 ft (1720 m)
2. Obstacle Height
   (Above runway surface).....520 ft
3. Required Reference Climb Gradient.....10.0 %
   Gross Height.....600 ft

NOTE: To determine the indicated altitude when obstacle clearance has been achieved, consult the GEOMETRIC HEIGHT TO PRESSURE HEIGHT CONVERSION chart.

Figure 2-82. (06-22-40)

FOR TRAINING PURPOSES ONLY

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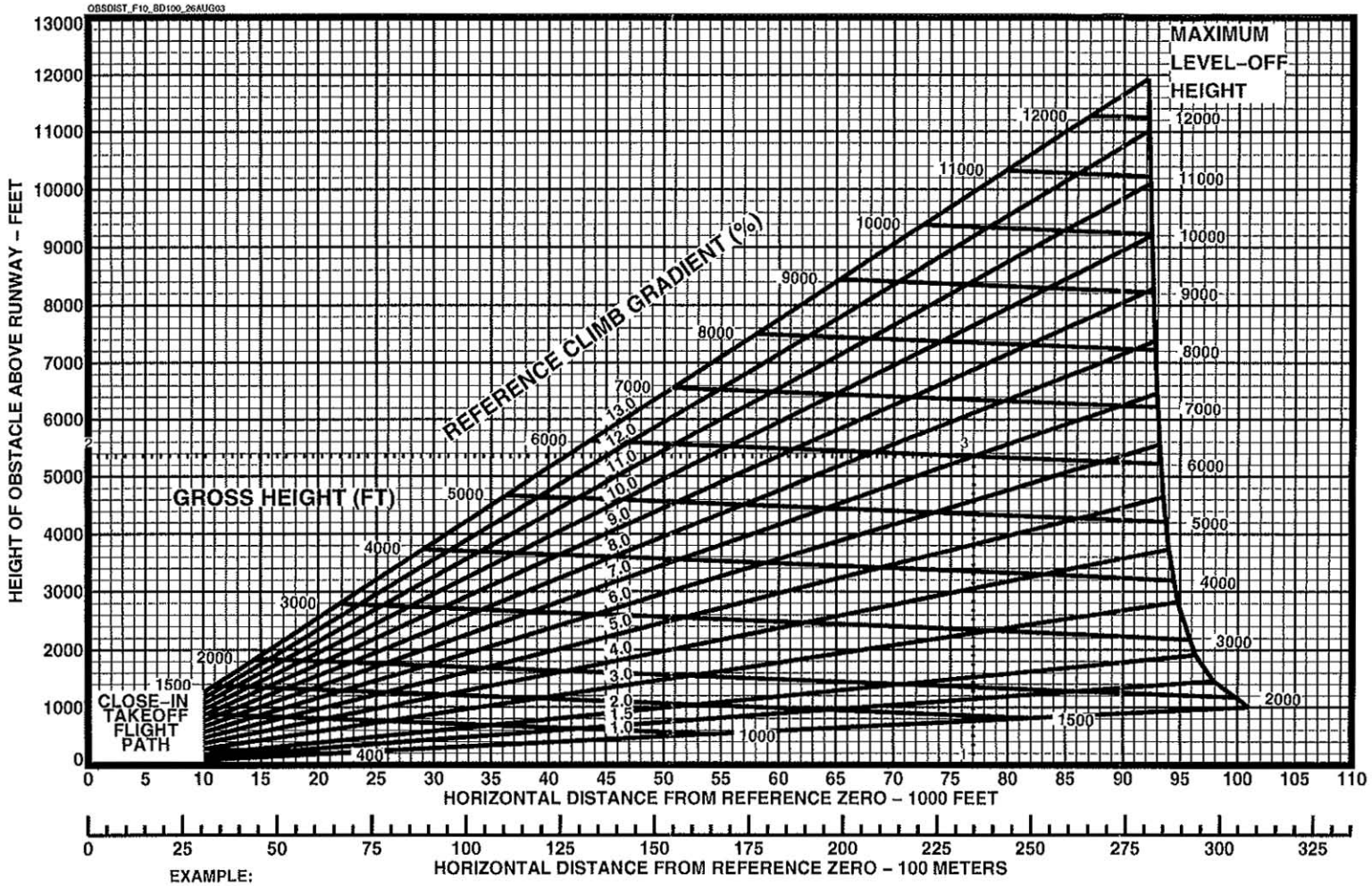
DISTANT TAKEOFF FLIGHT PATH
FLAPS 10°



EXAMPLE:

1. Obstacle Distance
   (Horizontal from Reference Zero).....77000 ft (23470 m)
2. Obstacle Height
   (Above runway surface).....5350 ft
3. Required Reference Climb Gradient.....7.0%
   Gross Level–Off Height.....6000 ft

NOTE: To determine the indicated altitude when obstacle clearance has been achieved, consult the GEOMETRIC HEIGHT TO PRESSURE HEIGHT CONVERSION chart.

Figure 2-83. (06-22-41)

FOR TRAINING PURPOSES ONLY

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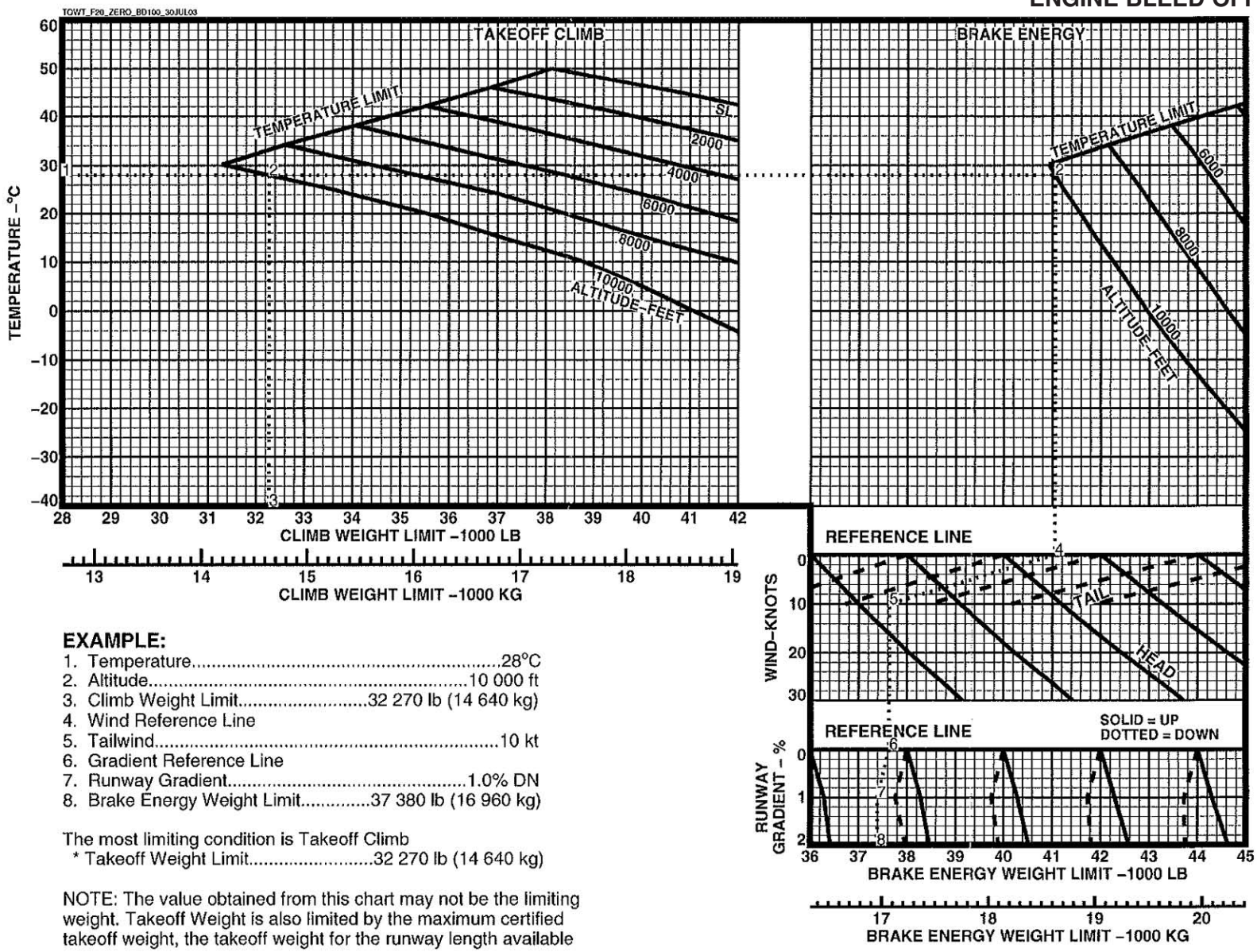
TAKEOFF WEIGHT LIMIT
FLAPS 20°
ENGINE BLEED OFF



EXAMPLE:

1. Temperature.....28°C
2. Altitude.....10 000 ft
3. Climb Weight Limit.....32 270 lb (14 640 kg)
4. Wind Reference Line
5. Tailwind.....10 kt
6. Gradient Reference Line
7. Runway Gradient.....1.0% DN
8. Brake Energy Weight Limit.....37 380 lb (16 960 kg)

The most limiting condition is Takeoff Climb
* Takeoff Weight Limit.....32 270 lb (14 640 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

Figure 2-84. (06-23-01)

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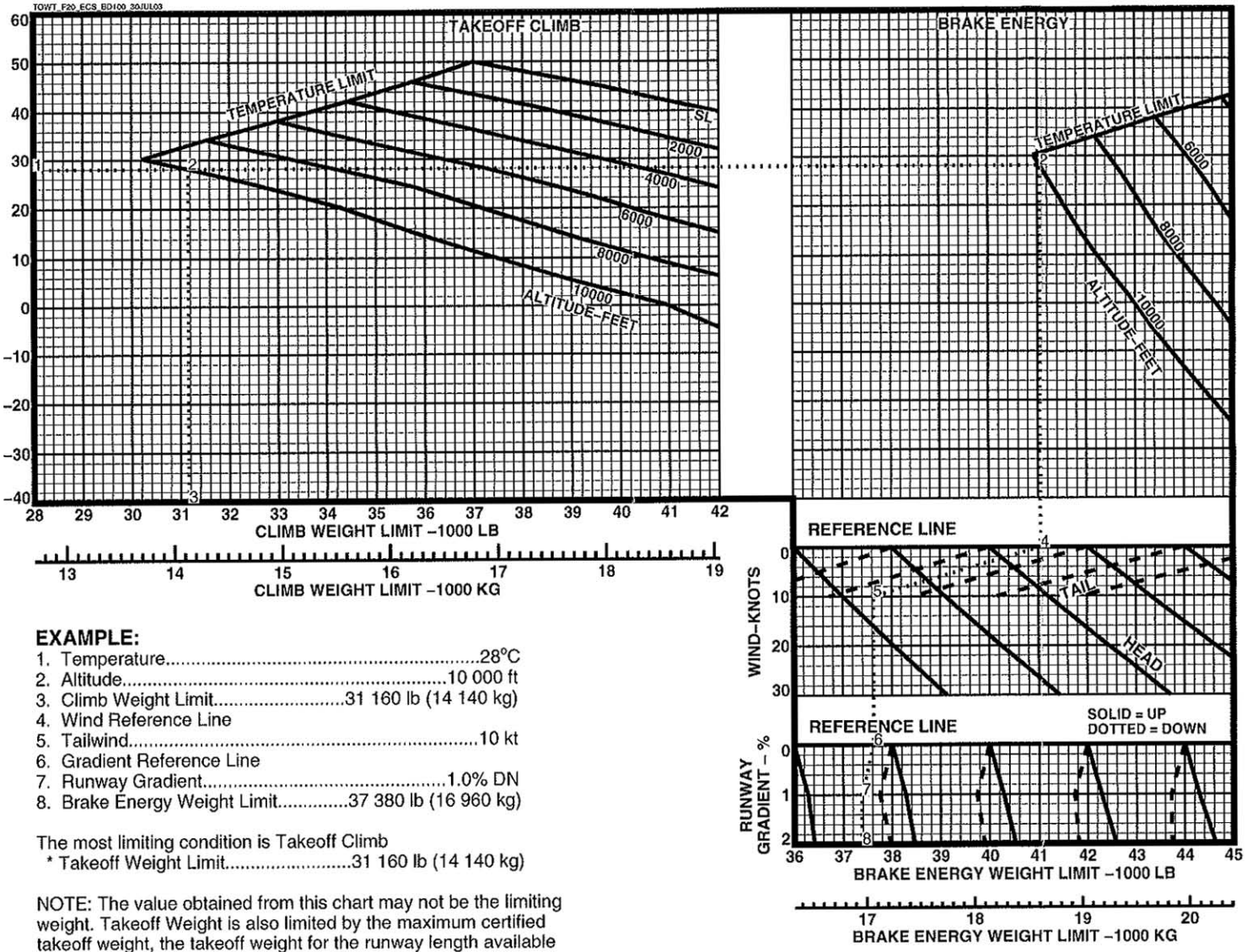
TAKEOFF WEIGHT LIMIT
FLAPS 20°
ENGINE BLEED ON



EXAMPLE:

1. Temperature.....28°C
2. Altitude.....10 000 ft
3. Climb Weight Limit.....31 160 lb (14 140 kg)
4. Wind Reference Line
5. Tailwind.....10 kt
6. Gradient Reference Line
7. Runway Gradient.....1.0% DN
8. Brake Energy Weight Limit.....37 380 lb (16 960 kg)

The most limiting condition is Takeoff Climb
* Takeoff Weight Limit.....31 160 lb (14 140 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 the obstacle clearance considerations.

Figure 2-85. (06-23-02)

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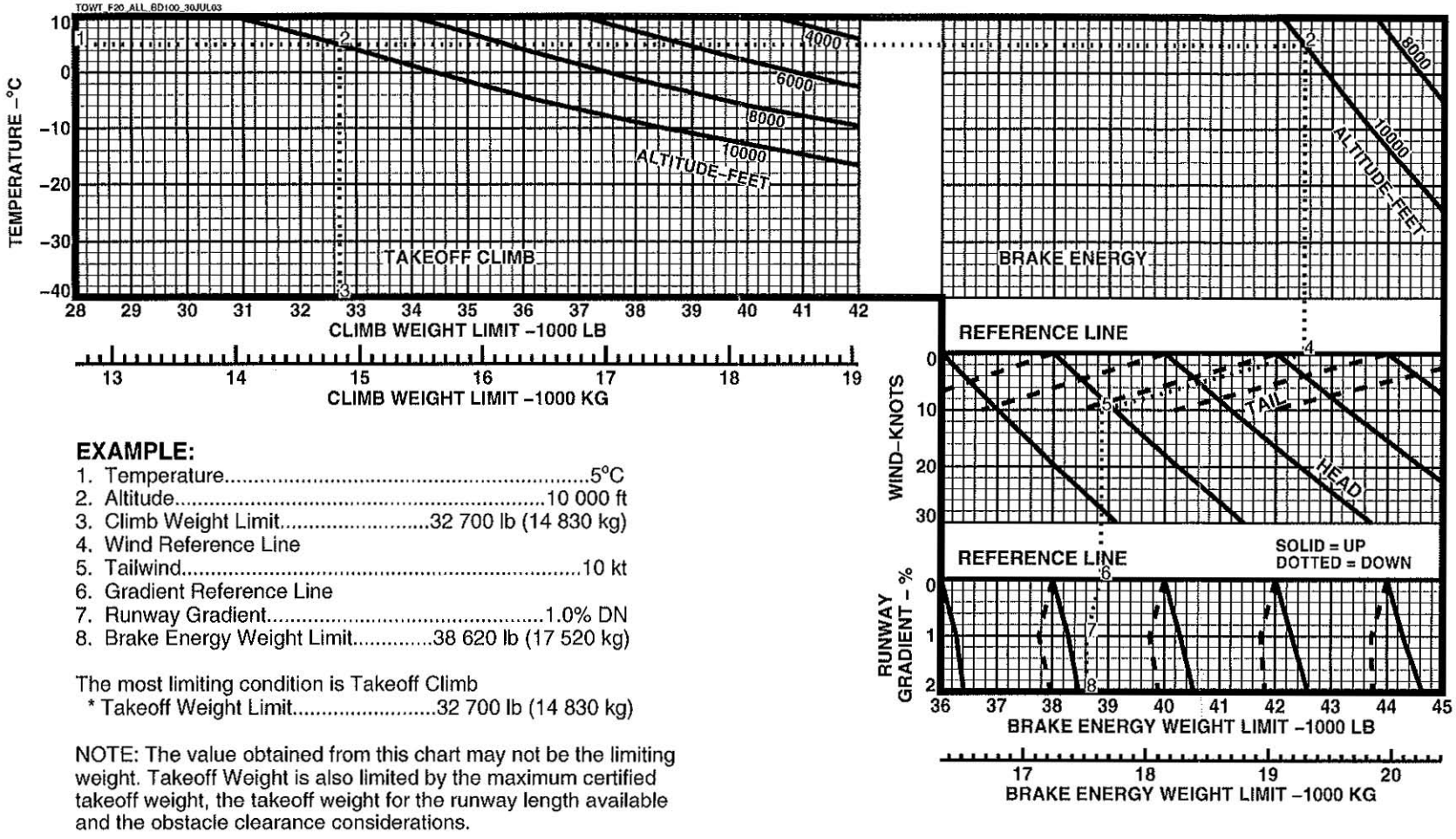
TAKEOFF WEIGHT LIMIT
FLAPS 20°
ENGINE BLEED ON, ENGINE WING AND A/I ON



EXAMPLE:

1. Temperature.....5°C
2. Altitude.....10 000 ft
3. Climb Weight Limit.....32 700 lb (14 830 kg)
4. Wind Reference Line
5. Tailwind.....10 kt
6. Gradient Reference Line
7. Runway Gradient.....1.0% DN
8. Brake Energy Weight Limit.....38 620 lb (17 520 kg)

The most limiting condition is Takeoff Climb
* Takeoff Weight Limit.....32 700 lb (14 830 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 the obstacle clearance considerations.

Figure 2-86. (06-23-03)

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DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED OFF

ALTITUDE SEA LEVEL
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
28000	V_1	105	105	104	104	104	104	104	104	104	103	104	104	105	106
	V_R	107	107	107	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	125	125	124	124	124	124	124	124	123	122	121
	TOFL	2840	2940	3040	3150	3260	3370	3420	3470	3530	3580	3720	3910	4110	4360
30000	V_1	106	106	106	106	106	106	106	106	106	106	106	107	107	109
	V_R	108	108	108	108	108	109	109	109	109	109	109	109	109	109
	V_2	124	124	124	124	123	123	123	123	123	123	123	122	121	121
	TOFL	2930	3040	3140	3250	3370	3480	3540	3590	3650	3710	3850	4050	4280	4550
32000	V_1	111	111	111	111	111	111	111	110	110	110	111	111	112	114
	V_R	112	112	112	112	112	112	112	112	112	112	112	112	113	114
	V_2	123	123	123	123	122	122	122	122	122	122	122	121	121	120
	TOFL	3030	3140	3240	3360	3480	3590	3650	3710	3770	3830	3990	4200	4440	4730
34000	V_1	116	115	116	115	115	115	115	115	115	115	115	116	117	119
	V_R	116	116	116	116	116	116	116	116	116	116	116	117	118	119
	V_2	122	122	122	122	122	121	121	121	121	121	121	121	121	121
	TOFL	3120	3240	3350	3470	3590	3710	3770	3830	3890	3950	4120	4360	4710	5280
36000	V_1	120	120	120	120	120	120	120	120	120	120	120	121	122	123
	V_R	120	120	120	120	120	121	121	121	121	121	121	121	122	123
	V_2	125	125	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	3470	3570	3680	3810	3940	4070	4140	4200	4270	4330	4540	4890	5370	6160
38000	V_1	124	124	124	124	124	124	124	124	124	124	124	125	126	127
	V_R	124	124	124	124	124	125	125	125	125	125	125	125	126	127
	V_2	128	128	128	128	128	128	128	128	128	128	128	128	128	128
	TOFL	3910	4010	4110	4240	4380	4520	4590	4670	4740	4810	5050	5500	6190	7050
38850	V_1	126	126	126	126	126	126	126	126	126	126	126	127	128	128
	V_R	126	126	126	126	126	126	126	126	126	126	126	127	128	128
	V_2	130	130	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4130	4240	4340	4470	4610	4750	4810	4890	4970	5040	5290	5830	6550	7440

TODATASL_DRY_F20_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-86. (06-23-04)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED OFF

ALTITUDE 1000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	48
28000	V_1	105	104	104	104	104	104	103	103	103	103	104	105	106	106
	V_R	107	107	107	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	125	124	124	124	124	124	124	123	123	122	121
	TOFL	2920	3030	3140	3250	3360	3480	3530	3590	3650	3770	3940	4140	4370	4530
30000	V_1	106	106	106	106	106	106	106	106	106	106	107	107	108	109
	V_R	108	108	108	108	109	109	109	109	109	109	109	109	109	110
	V_2	124	124	124	123	123	123	123	123	123	123	122	122	121	120
	TOFL	3020	3130	3240	3360	3480	3590	3650	3710	3770	3900	4080	4300	4550	4730
32000	V_1	111	111	111	111	111	110	110	110	110	110	111	112	113	114
	V_R	112	112	112	112	112	112	112	112	113	113	112	113	114	114
	V_2	123	123	123	122	122	122	122	122	122	122	121	121	120	119
	TOFL	3120	3230	3350	3470	3590	3710	3770	3830	3900	4040	4230	4460	4730	4920
34000	V_1	115	115	115	115	115	115	115	115	115	115	116	117	118	119
	V_R	116	116	116	116	116	116	116	116	116	116	117	118	118	119
	V_2	122	122	122	122	122	122	122	122	122	122	122	122	122	122
	TOFL	3220	3340	3460	3580	3710	3830	3900	3960	4020	4170	4380	4700	5160	5590
36000	V_1	120	120	120	120	120	120	120	120	120	120	120	122	123	123
	V_R	120	120	120	120	120	121	121	121	121	121	121	122	123	123
	V_2	125	125	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	3550	3670	3790	3930	4060	4200	4260	4330	4400	4580	4890	5300	5990	6490
38000	V_1	124	124	124	124	124	124	124	124	124	124	125	126	126	127
	V_R	124	124	124	124	125	125	125	125	125	125	125	126	126	127
	V_2	128	128	128	128	128	128	128	128	128	128	128	128	128	128
	TOFL	3990	4100	4210	4360	4510	4660	4740	4810	4890	5100	5470	6090	6880	7420
38850	V_1	126	126	126	126	126	126	126	126	126	126	127	127	128	129
	V_R	126	126	126	126	126	126	126	126	126	126	127	127	128	129
	V_2	130	130	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4210	4330	4450	4590	4730	4880	4960	5040	5120	5340	5760	6450	7260	7830

TODATA1K_DRY_F20_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-87. (06-23-05)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED OFF

ALTITUDE 2000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	46
26000	V_1	104	104	104	104	104	103	103	103	103	104	104	105	106	106
	V_R	107	107	107	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	124	124	124	124	124	124	123	123	122	121	121
	TOFL	3010	3130	3240	3360	3480	3590	3650	3710	3820	3980	4170	4390	4650	4710
30000	V_1	106	106	106	106	106	106	106	106	106	106	107	108	109	110
	V_R	108	108	108	109	109	109	109	109	109	109	109	109	110	110
	V_2	124	124	124	123	123	123	123	123	123	122	122	121	120	120
	TOFL	3110	3230	3350	3470	3590	3720	3780	3840	3950	4130	4330	4570	4850	4920
32000	V_1	111	111	111	111	110	110	110	110	110	111	112	113	114	115
	V_R	112	112	112	112	112	112	113	113	113	113	113	114	114	115
	V_2	123	123	123	122	122	122	122	122	122	122	121	120	119	119
	TOFL	3220	3340	3460	3590	3710	3840	3900	3960	4090	4280	4490	4750	5060	5150
34000	V_1	115	115	115	115	115	115	115	115	115	116	117	118	119	119
	V_R	116	116	116	116	116	116	116	116	116	117	117	118	119	119
	V_2	122	122	122	122	122	122	122	122	122	122	122	122	122	122
	TOFL	3320	3440	3570	3700	3830	3960	4030	4090	4220	4430	4710	5100	5740	5900
36000	V_1	120	120	120	120	120	120	120	119	120	120	121	122	123	123
	V_R	120	120	120	120	121	121	121	121	121	121	122	122	123	123
	V_2	125	125	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	3650	3780	3920	4050	4190	4330	4400	4470	4630	4920	5300	5850	6670	6840
38000	V_1	124	124	124	124	124	124	124	124	124	125	126	126	127	127
	V_R	124	124	124	125	125	125	125	125	125	125	126	126	127	127
	V_2	129	129	129	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4070	4200	4340	4500	4650	4810	4890	4970	5150	5500	6010	6740	7620	7810
38850	V_1	126	126	126	126	126	126	126	126	126	127	127	128	129	129
	V_R	126	126	126	126	126	126	126	126	127	127	127	128	129	129
	V_2	130	130	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4300	4430	4570	4710	4870	5040	5120	5200	5390	5750	6370	7130	8030	8230

TODATA2K_DRY_F20_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-88. (06-23-06)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED OFF

ALTITUDE 3000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C												
		–40	–30	–20	–10	0	10	15	20	25	30	35	40	44
28000	V_1	104	104	104	104	103	103	103	103	103	104	105	106	106
	V_R	107	107	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	124	124	124	124	124	124	123	123	122	121	120
	TOFL	3110	3230	3350	3470	3590	3720	3780	3870	4030	4220	4430	4670	4910
30000	V_1	106	106	106	106	106	106	106	106	106	107	108	109	110
	V_R	108	108	109	109	109	109	109	109	109	109	109	110	110
	V_2	124	124	123	123	123	123	123	123	122	122	121	120	120
	TOFL	3220	3340	3470	3590	3720	3840	3910	4000	4180	4380	4600	4870	5120
32000	V_1	111	111	111	110	110	110	110	110	111	111	113	114	115
	V_R	112	112	112	112	113	113	113	113	113	113	114	114	115
	V_2	123	123	122	122	122	122	122	122	122	121	120	120	119
	TOFL	3320	3450	3580	3710	3840	3970	4040	4140	4330	4540	4780	5070	5410
34000	V_1	115	115	115	115	115	115	115	115	115	116	118	119	119
	V_R	116	116	116	116	116	116	117	117	117	117	118	119	119
	V_2	122	122	122	122	122	122	122	122	122	122	122	122	122
	TOFL	3430	3560	3690	3830	3960	4100	4170	4280	4480	4730	5100	5600	6250
36000	V_1	120	120	120	120	120	119	119	119	120	121	122	123	123
	V_R	120	120	120	121	121	121	121	121	121	122	122	123	123
	V_2	125	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	3760	3900	4050	4190	4340	4480	4550	4670	4950	5320	5780	6530	7220
38000	V_1	124	124	124	124	124	124	124	124	125	126	126	127	127
	V_R	124	124	125	125	125	125	125	125	125	126	126	127	127
	V_2	129	129	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4180	4330	4490	4650	4810	4970	5050	5190	5530	5980	6670	7480	8230
38850	V_1	126	126	126	126	126	126	126	126	127	127	128	128	129
	V_R	126	126	126	126	126	127	127	127	127	127	128	128	129
	V_2	130	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4410	4560	4700	4870	5040	5210	5290	5440	5790	6340	7050	7890	8670

TODATA3K_DRY_F20_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-89. (06-23-07)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED OFF

ALTITUDE 4000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C												
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	42
28000	V_1	104	104	104	103	103	103	103	103	104	105	106	106	106
	V_R	107	107	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	124	124	124	124	124	124	123	123	122	121	121	120
	TOFL	3220	3340	3470	3590	3720	3850	3930	4080	4260	4480	4710	4990	5120
30000	V_1	106	106	106	106	106	106	106	106	107	107	109	110	110
	V_R	108	109	109	109	109	109	109	109	109	109	110	110	111
	V_2	124	123	123	123	123	123	123	122	122	121	120	120	119
	TOFL	3330	3460	3590	3720	3850	3980	4060	4230	4430	4660	4910	5210	5340
32000	V_1	111	111	110	110	110	110	110	110	111	112	113	115	115
	V_R	112	112	112	113	113	113	113	113	113	114	114	115	115
	V_2	123	122	122	122	122	122	122	122	121	120	120	119	119
	TOFL	3440	3570	3700	3840	3980	4110	4200	4380	4590	4840	5110	5450	5710
34000	V_1	115	115	115	115	115	115	115	116	116	117	119	119	120
	V_R	116	116	116	116	116	117	117	117	117	118	119	119	120
	V_2	122	122	122	122	122	122	122	122	122	122	122	122	122
	TOFL	3550	3680	3820	3960	4110	4250	4340	4530	4760	5120	5560	6280	6620
36000	V_1	120	120	120	120	120	119	119	120	121	122	123	123	124
	V_R	120	121	121	121	121	121	121	121	122	122	123	123	124
	V_2	125	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	3890	4040	4190	4340	4490	4640	4740	4980	5350	5790	6460	7270	7640
38000	V_1	124	124	124	124	124	124	124	124	126	126	127	127	128
	V_R	125	125	125	125	125	125	125	125	126	126	127	127	128
	V_2	129	129	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4320	4480	4650	4820	4990	5150	5260	5560	5990	6640	7410	8290	8680
38850	V_1	126	126	126	126	126	126	126	126	127	128	128	129	129
	V_R	126	126	126	126	127	127	127	127	127	128	128	129	129
	V_2	130	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4550	4700	4870	5050	5220	5400	5510	5820	6320	7030	7820	8730	9140

TODATA4K_DRY_F20_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-90. (06-23-08)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED OFF

ALTITUDE 5000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		–40	–30	–20	–10	0	10	15	20	25	30	35	40		
28000	V_1	104	104	103	103	103	103	103	104	104	105	106	107		
	V_R	107	107	107	107	107	107	107	107	107	107	107	107		
	V_2	124	124	124	124	124	124	123	123	122	121	121	120		
	TOFL	3330	3460	3590	3720	3860	3990	4140	4300	4530	4770	5020	5340		
30000	V_1	106	106	106	106	106	106	106	106	107	108	109	111		
	V_R	109	109	109	109	109	109	109	109	109	109	110	111		
	V_2	123	123	123	123	123	123	123	122	121	121	120	119		
	TOFL	3440	3580	3710	3850	3990	4130	4290	4470	4710	4970	5230	5580		
32000	V_1	111	111	110	110	110	110	110	111	112	113	115	116		
	V_R	112	112	113	113	113	113	113	113	113	114	115	116		
	V_2	122	122	122	122	122	122	122	121	120	120	119	118		
	TOFL	3560	3700	3840	3980	4120	4260	4440	4630	4890	5170	5450	6040		
34000	V_1	115	115	115	115	115	115	115	116	117	118	119	120		
	V_R	116	116	116	117	117	117	117	117	118	119	119	120		
	V_2	122	122	122	122	122	122	122	122	122	122	122	122		
	TOFL	3670	3820	3960	4110	4260	4400	4590	4790	5150	5590	6190	7010		
36000	V_1	120	120	120	120	120	119	120	121	122	123	123	124		
	V_R	121	121	121	121	121	121	121	122	122	123	123	124		
	V_2	125	125	125	125	125	125	125	125	125	125	125	125		
	TOFL	4030	4190	4340	4500	4650	4810	5030	5360	5820	6430	7180	8070		
38000	V_1	124	124	124	124	124	124	124	125	126	127	127	128		
	V_R	125	125	125	125	125	125	125	126	126	127	127	128		
	V_2	129	129	129	129	129	129	129	129	129	129	129	129		
	TOFL	4480	4650	4820	5000	5170	5350	5610	6000	6610	7390	8190	9170		
38850	V_1	126	126	126	126	126	126	126	127	128	128	129	129		
	V_R	126	126	127	127	127	127	127	127	128	128	129	129		
	V_2	130	130	130	130	130	130	130	130	130	130	130	130		
	TOFL	4700	4870	5050	5230	5420	5600	5880	6290	7000	7800	8630	9650		

TODATA5K_ORY_F20_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-91. (06-23-09)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED OFF

ALTITUDE 6000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C											
		-40	-30	-20	-10	0	10	15	20	25	30	35	38
28000	V_1	104	103	103	103	103	103	103	104	105	106	106	107
	V_R	107	107	107	107	107	107	107	107	107	107	107	108
	V_2	124	124	124	124	124	123	123	122	121	121	120	120
	TOFL	3450	3580	3720	3850	3990	4210	4380	4570	4810	5080	5380	5590
30000	V_1	106	106	106	106	106	106	106	107	108	109	110	111
	V_R	109	109	109	109	109	109	109	109	109	110	111	111
	V_2	123	123	123	123	123	122	122	121	121	120	119	119
	TOFL	3560	3700	3840	3980	4130	4360	4540	4750	5010	5300	5620	5850
32000	V_1	111	110	110	110	110	110	111	112	113	114	115	116
	V_R	112	113	113	113	113	113	113	114	114	115	116	116
	V_2	122	122	122	122	122	122	121	120	120	119	119	118
	TOFL	3680	3820	3970	4120	4270	4510	4700	4930	5210	5520	5970	6420
34000	V_1	116	115	115	115	115	116	116	117	118	119	120	120
	V_R	116	116	117	117	117	117	117	118	118	119	120	120
	V_2	122	122	122	122	122	122	122	122	122	122	122	122
	TOFL	3800	3950	4100	4250	4410	4660	4870	5170	5600	6150	6930	7460
36000	V_1	120	120	120	119	119	120	120	122	123	123	124	124
	V_R	121	121	121	121	121	121	122	122	123	123	124	124
	V_2	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4170	4320	4480	4650	4810	5110	5420	5840	6380	7140	8000	8570
38000	V_1	124	124	124	124	124	124	125	126	127	127	128	128
	V_R	125	125	125	125	125	125	126	126	127	127	128	128
	V_2	129	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4630	4800	4980	5160	5340	5690	6080	6600	7330	8160	9090	9720
38850	V_1	126	126	126	126	126	126	127	128	128	129	129	130
	V_R	126	126	127	127	127	127	127	128	128	129	129	130
	V_2	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4850	5020	5220	5400	5600	5970	6370	6990	7740	8600	9570	10230

TODATA6K_DRY_F20_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-92. (06-23-10)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED OFF

ALTITUDE 7000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C											
		–40	–30	–20	–10	0	10	15	20	25	30	35	38
28000	V_1	103	103	103	103	103	103	104	105	105	106	107	108
	V_R	107	107	107	107	107	107	107	107	107	107	108	108
	V_2	124	124	124	124	124	123	122	121	121	120	119	119
	TOFL	3560	3700	3840	3990	4130	4450	4630	4860	5130	5420	5780	5850
30000	V_1	106	106	106	106	106	106	107	108	109	110	111	111
	V_R	109	109	109	109	109	109	109	109	110	111	111	111
	V_2	123	123	123	123	123	122	121	121	120	119	119	119
	TOFL	3690	3830	3980	4120	4270	4610	4810	5050	5350	5670	6050	6170
32000	V_1	110	110	110	110	110	111	112	113	114	115	116	116
	V_R	113	113	113	113	113	113	114	114	115	116	116	116
	V_2	122	122	122	122	122	121	120	120	119	119	118	118
	TOFL	3810	3950	4110	4260	4420	4780	4990	5250	5570	5910	6660	6820
34000	V_1	115	115	115	115	115	116	117	118	119	120	120	120
	V_R	116	116	117	117	117	117	118	118	119	120	120	120
	V_2	122	122	122	122	122	122	122	122	122	122	122	122
	TOFL	3930	4080	4240	4400	4560	4950	5220	5620	6090	6860	7740	7930
36000	V_1	120	119	119	119	119	120	121	123	123	124	124	124
	V_R	121	121	121	121	121	122	122	123	123	124	124	124
	V_2	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4300	4460	4630	4800	4970	5500	5890	6350	7080	7920	8890	9100
38000	V_1	124	124	124	124	124	125	126	127	127	128	128	128
	V_R	125	125	125	125	125	126	126	127	127	128	128	128
	V_2	129	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4770	4950	5140	5330	5520	6160	6610	7300	8090	9010	10070	10300
38850	V_1	126	126	126	126	126	127	128	128	129	129	130	130
	V_R	126	127	127	127	127	127	128	128	129	129	130	130
	V_2	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	5000	5180	5380	5580	5780	6450	7000	7720	8540	9490	10590	10830

TODATA7K_DRY_F20_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-93. (06-23-11)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED OFF

ALTITUDE 8000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-30	-20	-10	0	10	15	20	25	30	34
28000	V_1	103	103	103	103	103	104	105	105	106	107	108
	V_R	107	107	107	107	107	107	107	107	107	108	108
	V_2	124	124	124	124	123	122	121	121	120	120	119
	TOFL	3690	3830	3980	4130	4350	4710	4920	5170	5470	5820	6140
30000	V_1	106	106	106	106	106	107	108	109	110	111	112
	V_R	109	109	109	109	109	109	109	110	111	111	112
	V_2	123	123	123	123	122	121	121	120	120	119	118
	TOFL	3810	3960	4110	4270	4500	4890	5110	5380	5710	6080	6560
32000	V_1	110	110	110	110	110	112	113	114	115	116	116
	V_R	113	113	113	113	113	114	114	115	115	116	116
	V_2	122	122	122	122	121	120	120	119	119	118	118
	TOFL	3940	4090	4250	4410	4660	5070	5310	5600	5960	6570	7250
34000	V_1	116	116	115	114	116	116	118	119	119	120	121
	V_R	116	117	117	117	117	118	119	119	119	120	121
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4060	4230	4390	4560	4820	5290	5660	6110	6770	7640	8420
36000	V_1	119	119	119	119	120	121	123	123	124	124	125
	V_R	121	121	121	121	122	122	123	123	124	124	125
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4440	4610	4780	4960	5300	5960	6400	7040	7840	8790	9640
38000	V_1	124	124	124	124	124	126	127	127	128	128	128
	V_R	125	125	125	125	125	126	127	127	128	128	128
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4920	5110	5310	5510	5900	6680	7310	8050	8930	9970	10910
38850	V_1	126	126	126	126	126	128	128	129	129	130	130
	V_R	127	127	127	127	127	128	128	129	129	130	130
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	5160	5350	5560	5770	6180	7050	7730	8500	9410	10490	11470

TODATA6K_DRY_F20_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-94. (06-23-12)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED OFF

ALTITUDE 9000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-30	-20	-10	0	10	15	20	25	30	32
28000	V_1	103	103	103	103	103	104	105	106	107	108	109
	V_R	107	107	107	107	107	107	107	107	108	108	109
	V_2	124	124	123	123	122	122	121	120	120	119	119
	TOFL	3840	3990	4150	4330	4600	4990	5230	5510	5860	6260	6440
30000	V_1	106	106	106	106	106	107	108	109	111	112	112
	V_R	109	109	109	109	109	109	110	111	111	112	112
	V_2	123	123	123	122	121	121	120	120	119	118	118
	TOFL	3970	4130	4290	4480	4770	5190	5440	5750	6120	6620	6970
32000	V_1	110	110	110	110	111	112	113	115	116	116	116
	V_R	113	113	113	113	113	114	115	115	116	116	116
	V_2	122	122	122	121	121	120	119	119	118	118	118
	TOFL	4100	4270	4430	4630	4940	5390	5660	5990	6480	7320	7710
34000	V_1	115	115	115	116	116	117	119	119	120	121	121
	V_R	117	117	117	117	118	119	119	119	120	121	121
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4240	4410	4580	4790	5120	5720	6150	6720	7540	8510	8940
36000	V_1	120	119	119	119	121	122	123	124	124	125	125
	V_R	121	121	121	121	122	123	123	124	124	125	125
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4640	4820	5000	5240	5730	6470	7050	7780	8690	9750	10220
38000	V_1	124	124	124	124	125	127	127	127	128	128	129
	V_R	125	125	125	125	126	127	127	127	128	128	129
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	5150	5350	5550	5820	6410	7350	8060	8870	9870	11040	11560
38850	V_1	126	126	126	126	127	128	129	129	130	130	130
	V_R	127	127	127	127	128	128	129	129	130	130	130
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	5390	5600	5820	6100	6720	7770	8510	9350	10390	11610	12150

TODATA9K_ORY_F20_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-95. (06-23-13)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED OFF

ALTITUDE 10000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C									
		-40	-30	-20	-10	0	10	15	20	25	30
28000	V_1	103	103	103	103	104	105	105	106	107	109
	V_R	107	107	107	107	107	107	107	108	108	109
	V_2	123	123	123	123	122	121	120	120	119	118
	TOFL	4010	4170	4340	4580	4880	5300	5550	5890	6290	6760
30000	V_1	106	106	106	106	107	108	109	110	112	112
	V_R	109	109	109	109	109	110	111	111	112	112
	V_2	122	122	122	122	121	120	120	119	119	118
	TOFL	4150	4320	4500	4750	5060	5520	5790	6150	6590	7400
32000	V_1	110	110	110	111	112	113	114	116	116	117
	V_R	113	113	113	113	114	115	115	116	116	117
	V_2	122	121	121	121	120	119	119	118	118	118
	TOFL	4290	4460	4650	4910	5250	5740	6030	6420	7190	8200
34000	V_1	115	115	115	116	117	118	119	120	120	121
	V_R	117	117	117	118	118	119	119	120	120	121
	V_2	122	122	122	122	122	122	122	122	122	122
	TOFL	4430	4610	4810	5090	5510	6220	6700	7450	8380	9480
36000	V_1	120	120	120	120	122	123	124	124	125	125
	V_R	121	121	122	122	123	123	124	124	125	125
	V_2	125	125	125	125	125	125	125	125	125	125
	TOFL	4870	5070	5280	5650	6220	7070	7760	8590	9620	10840
38000	V_1	124	124	124	125	127	127	127	128	128	129
	V_R	125	125	126	126	127	127	127	128	128	129
	V_2	129	129	129	129	129	129	129	129	129	129
	TOFL	5420	5640	5880	6320	6980	8090	8840	9760	10900	12250
38850	V_1	126	126	126	127	128	129	129	129	130	
	V_R	127	127	127	128	128	129	129	129	130	
	V_2	130	130	130	130	130	130	130	130	130	
	TOFL	5680	5910	6160	6620	7380	8540	9320	10280	11470	

TODATA10X_DRY_F20_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-96. (06-23-14)

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DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON

ALTITUDE SEA LEVEL
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
28000	V_1	105	105	104	104	104	104	104	104	104	104	104	105	106	106
	V_R	107	107	107	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	125	124	124	124	124	124	124	124	123	122	121
	TOFL	2840	2940	3040	3150	3260	3370	3420	3480	3530	3600	3750	3940	4150	4410
30000	V_1	106	106	106	106	106	106	106	106	106	106	106	107	108	110
	V_R	108	108	108	108	108	109	109	109	109	109	109	109	109	110
	V_2	124	124	124	124	123	123	123	123	123	123	123	122	121	120
	TOFL	2930	3040	3140	3260	3370	3480	3540	3600	3650	3730	3890	4090	4320	4600
32000	V_1	111	111	111	111	111	111	111	111	111	110	111	112	113	114
	V_R	112	112	112	112	112	112	112	112	112	112	112	113	114	114
	V_2	123	123	123	123	122	122	122	122	122	122	122	121	120	119
	TOFL	3030	3140	3250	3360	3480	3600	3660	3710	3770	3850	4020	4240	4490	4840
34000	V_1	116	115	115	115	115	115	115	115	115	115	116	117	118	119
	V_R	116	116	116	116	116	116	116	116	116	116	117	117	118	119
	V_2	122	122	122	122	121	121	121	121	121	121	121	121	121	121
	TOFL	3130	3240	3350	3470	3590	3710	3770	3840	3900	3980	4160	4450	4840	5530
36000	V_1	120	120	120	120	120	120	120	120	120	120	120	122	122	123
	V_R	120	120	120	120	120	121	121	121	121	121	121	122	122	123
	V_2	125	125	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	3480	3580	3690	3820	3950	4080	4140	4210	4270	4370	4630	5010	5600	6420
38000	V_1	124	124	124	124	124	124	124	124	124	124	125	126	126	127
	V_R	124	124	124	124	125	125	125	125	125	125	125	126	126	127
	V_2	128	128	128	128	128	128	128	128	128	128	128	128	128	128
	TOFL	3920	4030	4120	4250	4390	4530	4610	4680	4750	4860	5170	5730	6440	7320
38850	V_1	126	126	126	126	126	126	126	126	126	126	127	127	128	129
	V_R	126	126	126	126	126	126	126	126	126	126	127	127	128	129
	V_2	130	130	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4140	4250	4350	4490	4630	4760	4830	4900	4980	5080	5450	6070	6810	7720

TODATASL_DRY_F20_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-97. (06-23-15)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 1000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		–40	–30	–20	–10	0	10	15	20	25	30	35	40	45	48
28000	V_1	105	104	104	104	104	104	104	103	103	104	104	105	106	107
	V_R	107	107	107	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	125	124	124	124	124	124	124	123	122	121	121
	TOFL	2930	3030	3140	3250	3370	3480	3530	3590	3650	3800	3970	4180	4420	4580
30000	V_1	106	106	106	106	106	106	106	106	106	106	107	108	109	110
	V_R	108	108	108	108	109	109	109	109	109	109	109	109	110	110
	V_2	124	124	124	123	123	123	123	123	123	123	122	121	120	120
	TOFL	3020	3130	3240	3360	3480	3600	3650	3710	3770	3940	4120	4340	4600	4780
32000	V_1	111	111	111	111	111	111	110	110	110	111	112	113	114	115
	V_R	112	112	112	112	112	112	112	112	113	112	113	113	114	115
	V_2	123	123	123	122	122	122	122	122	122	122	121	120	120	119
	TOFL	3120	3240	3350	3470	3590	3720	3780	3840	3900	4070	4270	4510	4790	5080
34000	V_1	116	116	116	116	116	116	116	116	116	116	116	118	119	119
	V_R	116	116	116	116	116	116	116	116	116	116	117	117	118	119	119
	V_2	122	122	122	122	122	122	122	122	122	122	122	122	122	122
	TOFL	3220	3340	3460	3580	3710	3840	3900	3960	4030	4210	4460	4810	5360	5840
36000	V_1	120	120	120	120	120	120	120	120	120	120	121	122	123	123
	V_R	120	120	120	120	121	121	121	121	121	121	122	122	123	123
	V_2	125	125	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	3560	3680	3800	3940	4070	4210	4270	4340	4410	4660	5010	5510	6250	6760
38000	V_1	124	124	124	124	124	124	124	124	124	125	126	126	127	127
	V_R	124	124	124	124	125	125	125	125	125	125	126	126	127	127
	V_2	128	128	128	128	128	128	128	128	128	128	128	128	128	128
	TOFL	4010	4120	4230	4370	4520	4670	4750	4820	4900	5190	5680	6350	7150	7710
38850	V_1	126	126	126	126	126	126	126	126	126	127	127	128	128	129
	V_R	126	126	126	126	126	126	126	126	126	127	127	128	128	129
	V_2	130	130	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4230	4340	4460	4600	4740	4890	4970	5050	5130	5440	6020	6710	7540	8120

TODATA1K_DRY_F20_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-98. (06-23-16)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 2000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	46
28000	V_1	104	104	104	104	104	103	103	103	103	104	105	106	106	107
	V_R	107	107	107	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	124	124	124	124	124	124	123	122	121	121	120
	TOFL	3020	3130	3240	3360	3480	3600	3650	3710	3850	4020	4210	4440	4710	4770
30000	V_1	108	108	108	108	108	108	108	108	108	107	107	109	110	110
	V_R	108	108	108	109	109	109	109	109	109	109	109	109	110	110
	V_2	124	124	123	123	123	123	123	123	123	122	121	121	120	120
	TOFL	3120	3230	3350	3470	3600	3720	3780	3840	3990	4170	4370	4620	4920	4980
32000	V_1	111	111	111	111	110	110	110	110	111	111	112	114	115	115
	V_R	112	112	112	112	112	112	113	113	113	113	113	114	115	115
	V_2	123	123	122	122	122	122	122	122	122	121	120	120	119	119
	TOFL	3220	3340	3460	3590	3710	3840	3900	3970	4120	4320	4540	4800	5210	5340
34000	V_1	115	115	115	115	115	115	115	115	115	116	117	118	119	119
	V_R	116	116	116	116	116	116	116	116	117	117	118	118	119	119
	V_2	122	122	122	122	122	122	122	122	122	122	122	122	122	122
	TOFL	3320	3450	3570	3700	3830	3970	4030	4100	4260	4490	4810	5270	6010	6180
36000	V_1	120	120	120	120	120	120	120	120	120	121	122	123	123	124
	V_R	120	120	120	121	121	121	121	121	121	122	122	123	123	124
	V_2	125	125	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	3650	3790	3920	4060	4200	4340	4410	4480	4690	5030	5450	6120	6950	7130
38000	V_1	124	124	124	124	124	124	124	124	124	126	126	127	127	127
	V_R	124	124	124	125	125	125	125	125	125	126	126	127	127	127
	V_2	129	129	129	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4090	4220	4350	4510	4670	4820	4900	4980	5230	5640	6280	7020	7910	8110
38850	V_1	126	126	126	126	126	126	126	126	126	127	128	128	129	129
	V_R	126	126	126	126	126	126	126	127	127	127	128	128	129	129
	V_2	130	130	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4310	4450	4580	4730	4890	5050	5130	5220	5480	5980	6640	7410	8340	8540

TODATA2K_ORY_F20_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-99. (06-23-17)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 3000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C												
		–40	–30	–20	–10	0	10	15	20	25	30	35	40	44
28000	V_1	104	104	104	104	103	103	103	103	104	105	105	106	107
	V_R	107	107	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	124	124	124	124	124	124	123	122	122	121	120
	TOFL	3110	3230	3350	3480	3600	3720	3780	3900	4070	4260	4470	4730	4970
30000	V_1	106	106	106	106	106	106	106	106	107	107	108	109	111
	V_R	108	108	109	109	109	109	109	109	109	109	109	110	111
	V_2	124	124	123	123	123	123	123	123	122	121	121	120	119
	TOFL	3220	3340	3470	3590	3720	3850	3910	4040	4220	4430	4650	4930	5190
32000	V_1	111	111	111	110	110	110	110	110	111	112	113	115	115
	V_R	112	112	112	112	113	113	113	113	113	113	114	115	115
	V_2	123	123	122	122	122	122	122	122	121	121	120	119	119
	TOFL	3320	3450	3580	3710	3840	3970	4040	4180	4370	4590	4840	5130	5640
34000	V_1	115	115	115	115	115	115	115	115	116	117	118	119	120
	V_R	116	116	116	116	116	116	117	117	117	118	118	119	120
	V_2	122	122	122	122	122	122	122	122	122	122	122	122	122
	TOFL	3430	3560	3700	3830	3970	4100	4170	4320	4520	4840	5230	5870	6530
36000	V_1	120	120	120	120	120	120	119	120	121	122	123	123	124
	V_R	120	120	121	121	121	121	121	121	121	122	123	123	124
	V_2	125	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	3770	3910	4050	4200	4340	4490	4560	4740	5060	5460	6060	6810	7520
38000	V_1	124	124	124	124	124	124	124	124	125	126	127	127	128
	V_R	124	124	125	125	125	125	125	125	125	126	127	127	128
	V_2	129	129	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4190	4340	4500	4660	4820	4980	5070	5280	5660	6250	6950	7770	8540
38850	V_1	126	126	126	126	126	126	126	126	127	128	128	129	129
	V_R	126	126	126	126	126	127	127	127	127	128	128	129	129
	V_2	130	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4420	4570	4720	4880	5050	5220	5310	5520	5970	6610	7340	8190	8990

TODATA3K_DRY_F20_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-100. (06-23-18)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 4000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C												
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	42
28000	V_1	104	104	104	103	103	103	103	104	104	105	106	107	107
	V_R	107	107	107	107	107	107	107	107	107	107	107	107	108
	V_2	125	124	124	124	124	124	124	123	122	122	121	120	120
	TOFL	3220	3350	3470	3600	3720	3850	3960	4110	4300	4520	4760	5050	5180
30000	V_1	106	106	106	106	106	106	106	106	107	108	109	111	111
	V_R	108	109	109	109	109	109	109	109	109	109	110	111	111
	V_2	124	123	123	123	123	123	123	122	121	121	120	119	119
	TOFL	3330	3460	3590	3720	3850	3980	4100	4270	4470	4710	4970	5270	5420
32000	V_1	111	111	111	110	110	110	110	111	112	113	114	116	115
	V_R	112	112	112	113	113	113	113	113	113	114	115	115	115
	V_2	122	122	122	122	122	122	122	121	121	120	119	119	118
	TOFL	3440	3570	3710	3840	3980	4120	4240	4420	4640	4890	5170	5670	5960
34000	V_1	115	115	115	115	115	115	115	116	117	118	119	120	120
	V_R	116	116	116	116	117	117	117	117	118	118	119	120	120
	V_2	122	122	122	122	122	122	122	122	122	122	122	122	122
	TOFL	3550	3690	3830	3970	4110	4250	4380	4570	4870	5260	5810	6570	6910
36000	V_1	120	120	120	120	120	120	120	120	122	123	123	124	124
	V_R	120	121	121	121	121	121	121	121	122	123	123	124	124
	V_2	125	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	3900	4050	4200	4350	4500	4650	4790	5090	5490	6030	6750	7580	7940
38000	V_1	124	124	124	124	124	124	124	125	126	126	127	128	128
	V_R	125	125	125	125	125	125	125	125	126	126	127	128	128
	V_2	129	129	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4330	4490	4660	4830	5000	5170	5330	5700	6230	6930	7710	8610	9010
38850	V_1	126	126	126	126	126	126	126	127	128	128	129	129	129
	V_R	126	126	126	126	127	127	127	127	128	128	129	129	129
	V_2	130	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4570	4720	4880	5060	5230	5410	5590	5970	6600	7320	8130	9060	9480

TODATA4K_DRY_F20_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-101. (06-23-19)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 5000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C											
		-40	-30	-20	-10	0	10	15	20	25	30	35	40
28000	V_1	104	104	103	103	103	103	103	104	105	106	106	107
	V_R	107	107	107	107	107	107	107	107	107	107	107	108
	V_2	124	124	124	124	124	124	123	122	122	121	120	120
	TOFL	3330	3460	3590	3730	3860	4020	4170	4340	4570	4820	5070	5410
30000	V_1	106	106	106	106	106	106	106	107	108	109	110	111
	V_R	109	109	109	109	109	109	109	109	109	110	111	111
	V_2	123	123	123	123	123	123	122	121	121	120	119	119
	TOFL	3450	3580	3720	3850	3990	4160	4320	4510	4760	5030	5300	5700
32000	V_1	111	111	110	110	110	110	111	112	113	114	115	116
	V_R	112	112	113	113	113	113	113	113	114	114	115	116
	V_2	122	122	122	122	122	122	121	121	120	119	119	118
	TOFL	3560	3700	3840	3980	4120	4300	4480	4670	4940	5230	5590	6300
34000	V_1	115	115	115	115	115	115	116	117	118	119	119	120
	V_R	116	116	116	117	117	117	117	118	118	119	119	120
	V_2	122	122	122	122	122	122	122	122	122	122	122	122
	TOFL	3670	3820	3970	4110	4260	4440	4630	4890	5280	5780	6480	7310
36000	V_1	120	120	120	120	120	120	120	121	123	123	124	124
	V_R	121	121	121	121	121	121	121	122	123	123	124	124
	V_2	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4040	4190	4350	4500	4660	4860	5140	5500	6000	6720	7480	8390
38000	V_1	124	124	124	124	124	124	125	126	126	127	128	128
	V_R	125	125	125	125	125	125	125	126	126	127	128	128
	V_2	129	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4490	4660	4830	5010	5180	5410	5750	6200	6900	7690	8510	9500
38850	V_1	126	126	126	126	126	126	127	128	128	129	129	130
	V_R	126	126	127	127	127	127	127	128	128	129	129	130
	V_2	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4710	4880	5060	5240	5430	5670	6020	6570	7300	8110	8960	9990

TODATA5K_DRY_F20_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-102. (06-23-20)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 6000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C											
		-40	-30	-20	-10	0	10	15	20	25	30	35	38
28000	V_1	104	103	103	103	103	103	104	105	105	106	107	108
	V_R	107	107	107	107	107	107	107	107	107	107	108	108
	V_2	124	124	124	124	124	123	122	122	121	120	120	119
	TOFL	3450	3580	3720	3860	3990	4240	4420	4620	4870	5140	5450	5670
30000	V_1	106	106	106	106	106	106	107	108	109	110	111	112
	V_R	109	109	109	109	109	109	109	109	110	110	111	112
	V_2	123	123	123	123	123	122	121	121	120	120	119	119
	TOFL	3570	3700	3850	3990	4130	4400	4580	4800	5070	5360	5690	6060
32000	V_1	111	110	110	110	110	111	112	113	114	115	116	116
	V_R	112	113	113	113	113	113	113	114	114	115	116	116
	V_2	122	122	122	122	122	121	121	120	119	119	118	118
	TOFL	3680	3830	3970	4120	4270	4550	4750	4980	5270	5590	6240	6690
34000	V_1	115	115	116	115	115	115	116	118	119	119	120	120
	V_R	116	116	117	117	117	117	118	118	119	119	120	120
	V_2	122	122	122	122	122	122	122	122	122	122	122	122
	TOFL	3800	3950	4100	4260	4410	4710	4950	5310	5750	6440	7240	7780
36000	V_1	120	120	120	120	119	120	121	122	123	124	124	124
	V_R	121	121	121	121	121	122	122	123	123	124	124	124
	V_2	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4180	4330	4490	4650	4820	5220	5570	5990	6670	7450	8320	8910
38000	V_1	124	124	124	124	124	125	126	126	127	127	128	128
	V_R	125	125	125	125	125	126	126	126	127	127	128	128
	V_2	129	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4640	4810	4990	5170	5350	5840	6250	6890	7640	8480	9430	10080
38850	V_1	126	126	126	126	126	127	128	128	129	129	130	130
	V_R	126	127	127	127	127	127	128	128	129	129	130	130
	V_2	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4860	5030	5230	5420	5610	6110	6620	7280	8060	8930	9920	10600

TODATA6K_ORY_F20_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-103. (06-23-21)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 7000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C												
		–40	–30	–20	–10	0	10	15	20	25	30	35	38	
28000	V_1	103	103	103	103	103	104	105	105	106	107	108	108	
	V_R	107	107	107	107	107	107	107	107	107	108	108	108	
	V_2	124	124	124	124	123	122	122	121	120	120	119	119	
	TOFL	3570	3700	3850	3990	4150	4490	4680	4910	5190	5500	5860	5940	
30000	V_1	106	106	106	106	106	107	107	108	109	111	112	112	
	V_R	109	109	109	109	109	109	109	110	110	111	112	112	
	V_2	123	123	123	123	123	121	121	120	120	119	118	118	
	TOFL	3690	3830	3980	4130	4290	4660	4860	5110	5410	5740	6290	6450	
32000	V_1	110	110	110	110	110	111	112	113	115	116	116	116	
	V_R	113	113	113	113	113	113	114	114	115	116	116	116	
	V_2	122	122	122	122	122	121	120	120	119	118	118	118	
	TOFL	3810	3960	4110	4260	4440	4830	5050	5320	5640	6180	6950	7130	
34000	V_1	115	115	115	115	115	116	117	119	119	120	120	121	
	V_R	116	117	117	117	117	118	118	119	119	120	120	121	
	V_2	122	122	122	122	122	122	122	122	122	122	122	122	
	TOFL	3930	4090	4240	4400	4580	5030	5360	5770	6380	7170	8070	8260	
36000	V_1	120	120	119	119	119	121	122	123	123	124	125	125	
	V_R	121	121	121	121	121	122	123	123	123	124	125	125	
	V_2	125	125	125	125	125	125	125	125	125	125	125	125	
	TOFL	4310	4470	4640	4810	5000	5650	6050	6650	7390	8260	9240	9450	
38000	V_1	124	124	124	124	124	126	126	127	127	128	128	128	
	V_R	125	125	125	125	125	126	126	127	127	128	128	128	
	V_2	129	129	129	129	129	129	129	129	129	129	129	129	
	TOFL	4780	4960	5150	5340	5560	6330	6920	7620	8430	9370	10450	10680	
38850	V_1	126	126	126	126	126	128	128	129	129	129	130	130	
	V_R	127	127	127	127	127	128	128	129	129	129	130	130	
	V_2	130	130	130	130	130	130	130	130	130	130	130	130	
	TOFL	5010	5190	5390	5590	5820	6680	7310	8040	8880	9860	10980	11230	

TODATA7K_DRY_F20_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-104. (06-23-22)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 8000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	34			
28000	V_1	103	103	103	103	103	104	105	106	106	108	109			
	V_R	107	107	107	107	107	107	107	107	108	108	109			
	V_2	124	124	124	124	123	122	121	121	120	119	119			
	TOFL	3690	3830	3980	4130	4390	4760	4970	5230	5540	5900	6230			
30000	V_1	106	106	106	106	106	107	108	109	110	112	112			
	V_R	109	109	109	109	109	109	110	110	111	112	112			
	V_2	123	123	123	123	122	121	120	120	119	119	118			
	TOFL	3810	3960	4120	4270	4540	4940	5170	5450	5790	6200	6860			
32000	V_1	110	110	110	110	110	112	113	114	115	116	117			
	V_R	113	113	113	113	113	114	114	115	115	116	117			
	V_2	122	122	122	122	121	120	120	119	118	118	118			
	TOFL	3940	4090	4250	4410	4700	5130	5380	5670	6100	6860	7580			
34000	V_1	116	115	116	115	115	117	118	119	120	120	121			
	V_R	117	117	117	117	117	118	119	119	120	120	121			
	V_2	122	122	122	122	122	122	122	122	122	122	122			
	TOFL	4070	4230	4390	4560	4870	5430	5820	6350	7100	7980	8770			
36000	V_1	120	119	119	119	120	122	123	123	124	124	125			
	V_R	121	121	121	121	122	123	123	123	124	124	125			
	V_2	125	125	125	125	125	125	125	125	125	125	125			
	TOFL	4440	4610	4790	4970	5360	6130	6670	7360	8180	9150	10020			
38000	V_1	124	124	124	124	124	126	127	127	128	128	129			
	V_R	125	125	125	125	126	126	127	127	128	128	129			
	V_2	129	129	129	129	129	129	129	129	129	129	129			
	TOFL	4930	5120	5320	5520	5990	6980	7640	8390	9290	10360	11320			
38850	V_1	126	126	126	126	126	128	129	129	129	130				
	V_R	127	127	127	127	127	128	129	129	129	130				
	V_2	130	130	130	130	130	130	130	130	130	130				
	TOFL	5170	5360	5570	5780	6270	7380	8060	8840	9780	10890				

TODAT48K_DRY_F20_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-105. (06-23-23)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 9000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-30	-20	-10	0	10	15	20	25	30	32
28000	V_1	103	103	103	103	104	105	105	106	107	109	109
	V_R	107	107	107	107	107	107	107	108	108	109	109
	V_2	124	124	123	123	122	121	121	120	119	119	118
	TOFL	3840	3990	4150	4330	4640	5050	5290	5580	5940	6350	6580
30000	V_1	106	106	106	106	106	108	109	110	111	112	112
	V_R	109	109	109	109	109	110	110	111	111	112	112
	V_2	123	123	122	122	121	120	120	119	119	118	118
	TOFL	3970	4130	4290	4480	4820	5250	5510	5830	6210	6930	7290
32000	V_1	110	110	110	110	111	113	114	115	116	117	117
	V_R	113	113	113	113	113	114	115	115	116	117	117
	V_2	122	122	122	121	121	120	119	119	118	118	118
	TOFL	4110	4270	4440	4640	4990	5460	5730	6070	6770	7670	8060
34000	V_1	115	115	115	115	116	118	119	120	120	121	121
	V_R	117	117	117	117	118	119	119	120	120	121	121
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4240	4410	4580	4790	5170	5900	6360	7050	7890	8880	9310
36000	V_1	120	120	119	119	121	123	123	124	124	125	125
	V_R	121	121	121	121	122	123	123	124	124	125	125
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4640	4820	5010	5250	5810	6720	7380	8130	9050	10150	10630
38000	V_1	124	124	124	124	126	127	127	128	128	129	
	V_R	125	125	125	125	126	127	127	128	128	129	
	V_2	129	129	129	129	129	129	129	129	129	129	
	TOFL	5150	5360	5560	5840	6500	7700	8410	9230	10260	11460	
38850	V_1	126	126	126	126	128	129	129	129	130		
	V_R	127	127	127	127	128	129	129	129	130		
	V_2	130	130	130	130	130	130	130	130	130		
	TOFL	5400	5610	5830	6110	6820	8120	8860	9720	10790		

TODATA9K_DRY_F20_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-106. (06-23-24)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 10000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C									
		-40	-30	-20	-10	0	10	15	20	25	30
28000	V_1	103	103	103	103	104	105	106	107	108	109
	V_R	107	107	107	107	107	107	108	108	109	109
	V_2	123	123	123	123	122	121	120	119	119	118
	TOFL	4010	4170	4350	4580	4920	5370	5620	5970	6390	7000
30000	V_1	106	106	106	106	107	109	110	111	112	113
	V_R	109	109	109	109	109	110	111	111	112	113
	V_2	122	122	122	122	121	120	119	119	118	118
	TOFL	4150	4320	4500	4750	5110	5590	5870	6240	6810	7730
32000	V_1	110	110	110	111	112	114	115	116	116	117
	V_R	113	113	113	113	114	115	115	116	116	117
	V_2	122	121	121	121	120	119	119	118	118	118
	TOFL	4290	4470	4660	4920	5310	5820	6110	6700	7540	8560
34000	V_1	115	115	115	116	117	119	120	120	121	121
	V_R	117	117	117	118	118	119	120	120	121	121
	V_2	122	122	122	122	122	122	122	122	122	122
	TOFL	4430	4620	4810	5090	5580	6410	7040	7800	8750	9880
36000	V_1	120	120	120	120	122	124	124	124	125	125
	V_R	121	121	122	122	123	124	124	124	125	125
	V_2	125	125	125	125	125	125	125	125	125	125
	TOFL	4880	5080	5290	5660	6310	7420	8110	8960	10020	11260
38000	V_1	124	124	124	125	127	127	128	128	129	
	V_R	125	125	126	126	127	127	128	128	129	
	V_2	129	129	129	129	129	129	129	129	129	
	TOFL	5440	5650	5890	6330	7110	8460	9210	10150	11330	
38850	V_1	126	126	126	127	128	129	129	130	130	
	V_R	127	127	127	128	128	129	129	130	130	
	V_2	130	130	130	130	130	130	130	130	130	
	TOFL	5690	5920	6170	6640	7520	8920	9690	10680	11910	

TODATA10K_DRY_F20_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-107. (06-23-25)

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DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE SEA LEVEL
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	105	105	104	104	104	104	104	104	104	104	104
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	125	125	125	125	125	124	124	124
	TOFL	2850	2900	2960	3010	3060	3110	3170	3220	3280	3330	3390
30000	V_1	106	106	106	106	106	106	106	106	106	106	106
	V_R	108	108	108	108	108	108	108	108	108	108	109
	V_2	124	124	124	124	124	124	124	123	123	123	123
	TOFL	2950	3000	3050	3110	3160	3220	3270	3330	3390	3440	3500
32000	V_1	111	111	111	111	111	111	111	111	111	111	111
	V_R	112	112	112	112	112	112	112	112	112	112	112
	V_2	123	123	123	123	123	123	123	122	122	122	122
	TOFL	3040	3100	3150	3210	3260	3320	3380	3440	3500	3560	3610
34000	V_1	116	116	116	116	116	116	116	116	116	116	116
	V_R	116	116	116	116	116	116	116	116	116	116	116
	V_2	122	122	122	122	122	122	122	121	121	121	121
	TOFL	3140	3190	3250	3310	3360	3420	3490	3550	3610	3670	3730
36000	V_1	120	120	120	120	120	120	120	120	120	120	120
	V_R	120	120	120	120	120	120	120	120	120	121	121
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	3490	3540	3590	3640	3700	3760	3830	3900	3960	4030	4090
38000	V_1	124	124	124	124	124	124	124	124	124	124	124
	V_R	124	124	124	124	124	124	124	124	125	125	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	3940	3990	4040	4090	4140	4200	4270	4330	4400	4480	4550
38850	V_1	126	126	126	126	126	126	126	126	126	126	126
	V_R	126	126	126	126	126	126	126	126	126	126	126
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4150	4210	4260	4310	4360	4430	4500	4570	4640	4710	4780

TODATASL_DRY_F20_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-108. (06-23-26)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 1000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
28000	V_1	104	104	104	104	104	104	104	104	104	104	103
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	125	125	125	125	124	124	124	124
	TOFL	2940	2990	3040	3100	3150	3210	3270	3320	3380	3440	3490
30000	V_1	106	106	106	106	106	106	106	106	106	106	106
	V_R	108	108	108	108	108	108	108	108	109	109	109
	V_2	124	124	124	124	124	124	123	123	123	123	123
	TOFL	3030	3090	3150	3200	3260	3320	3370	3430	3490	3550	3610
32000	V_1	111	111	111	111	111	111	111	111	111	110	110
	V_R	112	112	112	112	112	112	112	112	112	112	112
	V_2	123	123	123	123	123	122	122	122	122	122	122
	TOFL	3130	3190	3250	3300	3360	3420	3480	3550	3610	3670	3730
34000	V_1	115	115	115	115	115	115	115	115	115	115	115
	V_R	116	116	116	116	116	116	116	116	116	116	116
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	3230	3290	3350	3410	3470	3530	3600	3660	3720	3790	3850
36000	V_1	120	120	120	120	120	120	120	120	120	120	120
	V_R	120	120	120	120	120	120	120	120	121	121	121
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	3570	3630	3690	3750	3810	3880	3950	4010	4080	4150	4220
38000	V_1	124	124	124	124	124	124	124	124	124	124	124
	V_R	124	124	124	124	124	124	125	125	125	125	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	4020	4070	4130	4180	4240	4310	4380	4460	4530	4610	4690
38850	V_1	126	126	126	126	126	126	126	126	126	126	126
	V_R	126	126	126	126	126	126	126	126	126	126	126
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4240	4300	4360	4410	4470	4550	4620	4690	4760	4830	4910

TODATA1K_DRY_F20_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-109. (06-23-27)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 2000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	104	104	104	104	104	104	104	104	104	103	104
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	125	125	124	124	124	124	124	124
	TOFL	3020	3080	3140	3200	3250	3310	3370	3430	3490	3550	3630
30000	V_1	106	106	106	106	106	106	106	106	106	106	106
	V_R	108	108	108	108	108	109	109	109	109	109	109
	V_2	124	124	124	124	123	123	123	123	123	123	123
	TOFL	3120	3180	3240	3300	3360	3420	3480	3550	3610	3670	3760
32000	V_1	111	111	111	111	111	111	111	110	110	110	111
	V_R	112	112	112	112	112	112	112	112	112	112	112
	V_2	123	123	123	123	122	122	122	122	122	122	122
	TOFL	3230	3290	3350	3410	3470	3540	3600	3660	3730	3790	3880
34000	V_1	116	116	116	116	116	116	116	116	116	116	116
	V_R	116	116	116	116	116	116	116	116	116	116	117
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	3330	3390	3450	3520	3580	3650	3710	3780	3850	3910	4010
36000	V_1	120	120	120	120	120	120	120	120	120	120	120
	V_R	120	120	120	120	120	120	121	121	121	121	121
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	3660	3730	3800	3860	3930	4000	4070	4140	4210	4280	4420
38000	V_1	124	124	124	124	124	124	124	124	124	124	125
	V_R	124	124	124	124	125	125	125	125	125	125	125
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4100	4160	4230	4290	4370	4440	4520	4600	4680	4760	4930
38850	V_1	126	126	126	126	126	126	126	126	126	126	127
	V_R	126	126	126	126	126	126	126	126	126	126	127
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4330	4390	4460	4520	4600	4670	4740	4820	4900	4980	5170

TODATA2K_DRY_F20_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-110. (06-23-28)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 3000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	104	104	104	104	104	104	104	103	103	104	104
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	124	124	124	124	124	124	124	123
	TOFL	3120	3180	3240	3300	3360	3420	3480	3540	3610	3680	3830
30000	V_1	106	106	106	106	106	106	106	106	106	106	107
	V_R	108	108	108	109	109	109	109	109	109	109	109
	V_2	124	124	123	123	123	123	123	123	123	123	122
	TOFL	3220	3290	3350	3410	3470	3540	3600	3660	3730	3810	3970
32000	V_1	111	111	111	111	111	110	110	110	110	111	111
	V_R	112	112	112	112	112	112	112	112	113	113	113
	V_2	123	123	122	122	122	122	122	122	122	122	121
	TOFL	3330	3390	3460	3520	3590	3650	3720	3790	3850	3940	4110
34000	V_1	115	115	115	115	115	115	115	115	115	116	116
	V_R	116	116	116	116	116	116	116	116	116	117	117
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	3440	3500	3570	3640	3700	3770	3840	3910	3980	4070	4270
36000	V_1	120	120	120	120	120	120	120	120	120	120	121
	V_R	120	120	120	120	121	121	121	121	121	121	122
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	3780	3850	3920	3990	4060	4130	4210	4280	4350	4480	4790
38000	V_1	124	124	124	124	124	124	124	124	124	125	126
	V_R	124	124	125	125	125	125	125	125	125	125	126
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4200	4270	4350	4430	4510	4590	4670	4750	4830	5000	5420
38850	V_1	126	126	126	126	126	126	126	126	126	127	127
	V_R	126	126	126	126	126	126	126	126	126	127	127
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4430	4510	4580	4650	4730	4810	4890	4980	5060	5230	5740

TODATA3K_DRY_F20_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-111. (06-23-29)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 4000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
28000	V_1	104	104	104	104	104	104	103	103	103	104	105
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	124	124	124	124	124	124	124	124	123	122
	TOFL	3230	3290	3350	3410	3480	3540	3600	3670	3740	3890	4050
30000	V_1	106	106	106	106	106	106	106	106	106	107	107
	V_R	108	109	109	109	109	109	109	109	109	109	109
	V_2	123	123	123	123	123	123	123	123	123	122	121
	TOFL	3330	3400	3460	3530	3590	3660	3720	3790	3870	4030	4210
32000	V_1	111	111	111	111	111	110	110	110	110	111	112
	V_R	112	112	112	112	112	112	113	113	113	113	113
	V_2	122	122	122	122	122	122	122	122	122	121	120
	TOFL	3440	3510	3580	3640	3710	3780	3850	3920	4000	4170	4360
34000	V_1	115	115	115	115	115	115	115	115	115	116	117
	V_R	116	116	116	116	116	116	116	116	117	117	118
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	3550	3620	3690	3760	3830	3900	3970	4040	4130	4330	4620
36000	V_1	120	120	120	120	120	120	120	120	120	121	122
	V_R	120	121	121	121	121	121	121	121	121	122	122
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	3910	3980	4050	4130	4200	4280	4350	4430	4530	4850	5240
38000	V_1	125	124	124	124	124	124	124	124	124	126	126
	V_R	125	125	125	125	125	125	125	125	125	126	126
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4340	4420	4500	4580	4670	4750	4840	4920	5050	5460	6040
38850	V_1	126	126	126	126	126	126	126	126	126	127	128
	V_R	126	126	126	126	126	126	127	127	127	127	128
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4580	4650	4720	4800	4890	4980	5070	5150	5280	5790	6380

TODATA4K_DRY_F20_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-112. (06-23-30)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 5000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	104	104	104	104	104	103	103	103	104	105	105
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	124	124	124	124	124	124	124	124	123	122	121
	TOFL	3340	3400	3470	3530	3600	3660	3730	3790	3940	4110	4290
30000	V_1	106	106	106	106	106	106	106	106	107	107	108
	V_R	109	109	109	109	109	109	109	109	109	109	109
	V_2	123	123	123	123	123	123	123	123	122	121	121
	TOFL	3450	3520	3580	3650	3720	3790	3860	3920	4080	4270	4460
32000	V_1	111	111	111	111	110	110	110	110	111	112	113
	V_R	112	112	112	112	113	113	113	113	113	113	114
	V_2	122	122	122	122	122	122	122	122	121	120	120
	TOFL	3560	3630	3700	3770	3840	3910	3980	4060	4220	4420	4630
34000	V_1	115	115	115	115	115	115	115	115	116	117	119
	V_R	116	116	116	116	116	117	117	117	117	118	119
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	3680	3750	3820	3890	3970	4040	4110	4190	4380	4680	5040
36000	V_1	120	120	120	120	120	120	120	120	121	122	123
	V_R	121	121	121	121	121	121	121	121	122	122	123
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4040	4120	4200	4280	4350	4430	4510	4590	4900	5290	5850
38000	V_1	125	124	124	124	124	124	124	124	126	126	127
	V_R	125	125	125	125	125	125	125	125	126	126	127
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4490	4580	4660	4750	4840	4930	5010	5100	5490	6090	6700
38850	V_1	126	126	126	126	126	126	126	126	127	128	128
	V_R	126	126	126	127	127	127	127	127	127	128	128
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4720	4800	4880	4970	5070	5160	5250	5340	5820	6440	7060

TODATASK_DRY_F20_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-113. (06-23-31)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 6000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	104	104	104	103	103	103	103	104	105	105	106
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	124	124	124	124	124	124	124	123	122	121	121
	TOFL	3450	3520	3580	3650	3720	3790	3850	3970	4170	4360	4560
30000	V_1	106	106	106	106	106	106	106	106	107	108	109
	V_R	109	109	109	109	109	109	109	109	109	109	110
	V_2	123	123	123	123	123	123	123	122	121	121	120
	TOFL	3570	3630	3700	3770	3850	3920	3990	4110	4320	4530	4740
32000	V_1	111	111	110	110	110	110	110	111	112	113	115
	V_R	112	112	113	113	113	113	113	113	113	114	115
	V_2	122	122	122	122	122	122	122	121	120	120	119
	TOFL	3680	3750	3830	3900	3970	4050	4120	4250	4480	4700	4930
34000	V_1	115	115	115	116	115	115	115	116	117	119	119
	V_R	116	116	116	117	117	117	117	117	118	119	119
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	3800	3880	3950	4030	4100	4180	4260	4400	4720	5090	5610
36000	V_1	120	120	120	120	120	120	120	120	122	123	123
	V_R	121	121	121	121	121	121	121	122	122	123	123
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4180	4250	4330	4410	4500	4580	4660	4880	5320	5900	6490
38000	V_1	124	124	124	124	124	124	124	125	126	127	127
	V_R	125	125	125	125	125	125	125	126	126	127	127
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4640	4730	4810	4900	4990	5090	5180	5460	6100	6750	7390
38850	V_1	126	126	126	126	126	126	126	127	128	128	129
	V_R	126	126	127	127	127	127	127	127	128	128	129
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4860	4950	5040	5140	5230	5330	5420	5720	6450	7120	7780

TODATASK_ORY_F20_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-114. (06-23-32)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 7000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	104	103	103	103	103	103	103	104	105	106	106
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	124	124	124	124	124	124	123	122	121	121	120
	TOFL	3560	3630	3700	3770	3840	3920	4010	4210	4420	4630	4850
30000	V_1	106	106	106	106	106	106	106	107	108	109	110
	V_R	109	109	109	109	109	109	109	109	109	110	111
	V_2	123	123	123	123	123	123	122	121	121	120	119
	TOFL	3690	3760	3830	3900	3980	4050	4150	4370	4590	4820	5060
32000	V_1	110	110	110	110	110	110	110	112	113	114	115
	V_R	113	113	113	113	113	113	113	113	114	115	115
	V_2	122	122	122	122	122	122	121	121	120	119	119
	TOFL	3810	3880	3960	4030	4110	4190	4290	4520	4760	5010	5380
34000	V_1	115	115	115	115	115	115	115	117	118	119	120
	V_R	116	116	117	117	117	117	117	118	119	119	120
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	3930	4010	4080	4160	4240	4320	4430	4740	5130	5650	6230
36000	V_1	120	120	120	120	120	119	120	122	123	123	124
	V_R	121	121	121	121	121	121	121	122	123	123	124
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4310	4390	4470	4560	4640	4720	4880	5330	5900	6540	7170
38000	V_1	124	124	124	124	124	124	125	126	127	127	128
	V_R	125	125	125	125	125	125	125	126	127	127	128
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4790	4870	4960	5060	5150	5250	5440	6050	6760	7450	8130
38850	V_1	126	126	126	126	126	126	127	128	128	129	129
	V_R	127	127	127	127	127	127	127	128	128	129	129
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	5010	5100	5200	5300	5400	5500	5690	6410	7140	7840	8550

TODATA7K_ORY_F20_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-115. (06-23-33)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 8000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	103	103	103	103	103	103	104	105	106	106	107
	V_R	107	107	107	107	107	107	107	107	107	107	108
	V_2	124	124	124	124	124	124	123	122	121	120	120
	TOFL	3690	3760	3830	3900	3980	4060	4250	4470	4700	4930	5180
30000	V_1	106	106	106	106	106	106	107	108	109	110	111
	V_R	109	109	109	109	109	109	109	109	110	111	111
	V_2	123	123	123	123	123	123	122	121	120	119	119
	TOFL	3810	3880	3960	4040	4120	4200	4410	4640	4890	5140	5410
32000	V_1	110	110	110	110	110	110	111	113	114	115	116
	V_R	113	113	113	113	113	113	113	114	115	115	116
	V_2	122	122	122	122	122	122	121	120	119	119	118
	TOFL	3940	4010	4090	4170	4250	4340	4560	4820	5080	5410	5970
34000	V_1	115	115	115	115	115	115	116	118	119	120	120
	V_R	117	117	117	117	117	117	118	118	119	120	120
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4060	4140	4230	4310	4390	4480	4730	5160	5660	6280	6920
36000	V_1	120	119	119	119	119	119	121	123	123	124	124
	V_R	121	121	121	121	121	121	122	123	123	124	124
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4450	4530	4620	4710	4790	4890	5310	5870	6560	7230	7930
38000	V_1	124	124	124	124	124	124	126	127	127	128	128
	V_R	125	125	125	125	125	125	126	127	127	128	128
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4940	5020	5120	5220	5320	5440	5940	6740	7480	8200	8960
38850	V_1	126	126	126	126	126	126	128	128	129	129	130
	V_R	127	127	127	127	127	127	128	128	129	129	130
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	5170	5260	5370	5470	5580	5690	6280	7120	7880	8620	9410

TODATA8K_DRY_F20_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-116. (06-23-34)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 9000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	103	103	103	103	103	103	104	105	106	107	108
	V_R	107	107	107	107	107	107	107	107	107	108	108
	V_2	124	124	124	124	123	123	122	121	120	120	119
	TOFL	3840	3920	3990	4070	4150	4290	4520	4750	5000	5260	5560
30000	V_1	106	106	106	106	106	106	107	109	110	111	112
	V_R	109	109	109	109	109	109	109	110	111	111	112
	V_2	123	123	123	123	122	122	121	120	119	119	118
	TOFL	3970	4050	4130	4210	4290	4450	4690	4940	5210	5490	6020
32000	V_1	110	110	110	110	110	111	112	114	115	116	116
	V_R	113	113	113	113	113	113	114	115	115	116	116
	V_2	122	122	122	122	122	121	120	119	119	118	118
	TOFL	4100	4190	4270	4350	4440	4600	4860	5140	5430	6000	6660
34000	V_1	115	115	115	115	115	116	117	119	120	120	121
	V_R	117	117	117	117	117	118	118	119	120	120	121
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4240	4330	4410	4500	4580	4760	5150	5630	6300	6960	7700
36000	V_1	120	120	120	119	119	120	122	123	124	124	125
	V_R	121	121	121	121	121	122	123	123	124	124	125
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4640	4730	4830	4920	5010	5290	5800	6540	7270	7970	8780
38000	V_1	124	124	124	124	124	125	127	127	128	128	129
	V_R	125	125	125	125	125	126	127	127	128	128	129
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	5160	5260	5360	5470	5570	5920	6640	7470	8250	9010	9890
38850	V_1	126	126	126	126	126	127	128	129	129	130	130
	V_R	127	127	127	127	127	127	128	129	129	130	130
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	5400	5510	5620	5720	5830	6200	7020	7870	8680	9470	10380

TODATA9K_DRY_F20_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-117. (06-23-35)

DRY RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 10000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	103	103	103	103	103	104	105	106	107	108	109
	V_R	107	107	107	107	107	107	107	107	108	108	109
	V_2	123	123	123	123	123	122	121	120	120	119	118
	TOFL	4010	4090	4170	4250	4370	4560	4810	5070	5340	5630	6060
30000	V_1	106	106	106	106	106	107	108	110	111	112	112
	V_R	109	109	109	109	109	109	110	111	111	112	112
	V_2	122	122	122	122	122	121	120	120	119	118	118
	TOFL	4150	4230	4320	4400	4530	4730	5000	5290	5570	6000	6710
32000	V_1	110	110	110	110	111	112	113	115	116	116	117
	V_R	113	113	113	113	113	114	115	115	116	116	117
	V_2	122	121	121	121	121	120	119	119	118	118	118
	TOFL	4290	4380	4470	4550	4690	4900	5190	5500	6030	6650	7430
34000	V_1	115	115	115	115	116	117	119	120	120	121	121
	V_R	117	117	117	117	117	118	119	120	120	121	121
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4430	4530	4620	4710	4850	5140	5630	6310	7000	7700	8550
36000	V_1	120	120	120	120	120	122	123	124	124	125	125
	V_R	121	121	121	122	122	122	123	124	124	125	125
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4880	4980	5080	5170	5370	5790	6470	7280	8020	8780	9720
38000	V_1	124	124	124	124	125	126	127	128	128	128	
	V_R	125	125	125	125	126	126	127	128	128	128	
	V_2	129	129	129	129	129	129	129	129	129	129	
	TOFL	5440	5550	5660	5760	6000	6530	7400	8270	9070	9900	
38850	V_1	126	126	126	126	127	128	129	129	130	130	
	V_R	127	127	127	127	127	128	129	129	130	130	
	V_2	130	130	130	130	130	130	130	130	130	130	
	TOFL	5690	5810	5920	6040	6280	6910	7800	8700	9530	10390	

TODATA10K_DRY_F20_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-118. (06-23-36)

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WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED OFF

ALTITUDE SEA LEVEL
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		–40	–30	–20	–10	0	10	15	20	25	30	35	40	45	50
28000	V_1	95	95	95	94	94	94	94	94	94	94	94	95	97	98
	V_R	107	107	107	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	125	125	124	124	124	124	124	124	123	122	121
	TOFL	3360	3490	3610	3750	3890	4030	4100	4170	4250	4320	4480	4700	4920	5190
30000	V_1	97	97	97	97	97	97	97	97	97	97	97	98	99	101
	V_R	108	108	108	108	108	109	109	109	109	109	109	109	109	109
	V_2	124	124	124	124	123	123	123	123	123	123	123	122	121	121
	TOFL	3470	3600	3740	3880	4030	4180	4250	4330	4400	4480	4650	4880	5130	5410
32000	V_1	102	102	102	102	102	102	102	102	101	101	102	103	104	106
	V_R	112	112	112	112	112	112	112	112	112	112	112	112	113	114
	V_2	123	123	123	123	122	122	122	122	122	122	122	121	121	120
	TOFL	3580	3720	3860	4020	4170	4320	4400	4480	4550	4630	4820	5060	5320	5640
34000	V_1	107	107	107	106	106	106	106	106	106	106	106	108	109	112
	V_R	116	116	116	116	116	116	116	116	116	116	116	117	118	119
	V_2	122	122	122	122	122	121	121	121	121	121	121	121	121	121
	TOFL	3700	3840	3990	4150	4310	4470	4550	4630	4710	4790	4990	5240	5520	5850
36000	V_1	112	112	112	112	112	111	111	111	111	111	111	113	114	117
	V_R	120	120	120	120	120	121	121	121	121	121	121	121	122	123
	V_2	125	125	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	3810	3960	4120	4280	4440	4610	4690	4770	4860	4940	5150	5420	5720	6170
38000	V_1	117	117	116	116	116	116	116	116	116	116	116	117	119	122
	V_R	124	124	124	124	124	125	125	125	125	125	125	125	126	127
	V_2	128	128	128	128	128	128	128	128	128	128	128	128	128	128
	TOFL	3990	4130	4270	4430	4600	4760	4840	4920	5010	5090	5320	5740	6290	6970
38850	V_1	119	119	118	118	118	118	118	118	118	118	118	120	122	124
	V_R	126	126	126	126	126	126	126	126	126	126	126	127	128	128
	V_2	130	130	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4170	4320	4470	4640	4810	4980	5070	5150	5240	5330	5560	6030	6610	7320

TODATASL_WET_F20_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-119. (06-24-01)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED OFF

ALTITUDE 1000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	48
28000	V_1	95	95	94	94	94	94	94	94	94	94	95	96	97	98
	V_R	107	107	107	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	125	124	124	124	124	124	124	123	123	122	121
	TOFL	3470	3610	3740	3890	4030	4180	4250	4330	4400	4550	4750	4970	5230	5410
30000	V_1	97	97	97	97	97	97	97	97	97	97	98	99	100	102
	V_R	108	108	108	108	109	109	109	109	109	109	109	109	109	110
	V_2	124	124	124	123	123	123	123	123	123	123	122	122	121	120
	TOFL	3590	3730	3870	4020	4180	4330	4410	4490	4560	4730	4930	5170	5450	5640
32000	V_1	102	102	102	102	102	101	101	101	101	101	102	104	106	107
	V_R	112	112	112	112	112	112	112	112	113	113	112	113	114	114
	V_2	123	123	123	122	122	122	122	122	122	122	121	121	120	119
	TOFL	3710	3850	4000	4160	4320	4480	4560	4640	4720	4890	5120	5370	5670	5870
34000	V_1	107	107	106	106	106	106	106	106	106	106	107	109	111	112
	V_R	116	116	116	116	116	116	116	116	116	116	117	118	118	119
	V_2	122	122	122	122	122	122	122	122	122	122	122	122	122	122
	TOFL	3820	3980	4140	4300	4470	4630	4710	4800	4880	5060	5300	5570	5890	6100
36000	V_1	112	112	112	111	111	111	111	111	111	111	112	114	116	117
	V_R	120	120	120	120	120	121	121	121	121	121	121	122	123	123
	V_2	125	125	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	3940	4100	4270	4440	4610	4780	4870	4950	5040	5230	5480	5770	6100	6500
38000	V_1	117	116	116	116	116	116	116	116	116	116	117	119	121	122
	V_R	124	124	124	124	125	125	125	125	125	125	125	126	126	127
	V_2	128	128	128	128	128	128	128	128	128	128	128	128	128	128
	TOFL	4110	4260	4410	4580	4750	4930	5020	5100	5190	5390	5750	6260	6890	7330
38850	V_1	119	118	118	118	118	118	118	118	118	118	119	121	123	124
	V_R	126	126	126	126	126	126	126	126	126	126	127	127	128	129
	V_2	130	130	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4300	4460	4620	4800	4970	5150	5240	5330	5420	5630	6030	6580	7230	7700

TODATAIK_WET_F20_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-120. (06-24-02)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED OFF

ALTITUDE 2000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	46
28000	V_1	95	94	94	94	94	94	93	93	93	94	96	97	98	98
	V_R	107	107	107	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	124	124	124	124	124	124	123	123	122	121	121
	TOFL	3590	3730	3880	4030	4180	4340	4410	4490	4630	4820	5030	5280	5560	5630
30000	V_1	97	97	97	97	97	97	96	96	97	97	98	100	102	102
	V_R	108	108	108	109	109	109	109	109	109	109	109	109	110	110
	V_2	124	124	124	123	123	123	123	123	123	122	122	121	120	120
	TOFL	3710	3860	4020	4170	4330	4490	4570	4650	4800	5010	5230	5500	5800	5870
32000	V_1	102	102	102	101	101	101	101	101	101	102	103	105	107	107
	V_R	112	112	112	112	112	112	113	113	113	113	113	114	114	115
	V_2	123	123	123	122	122	122	122	122	122	122	121	120	119	119
	TOFL	3830	3990	4150	4320	4480	4650	4730	4820	4970	5190	5430	5710	6040	6120
34000	V_1	106	106	106	106	106	106	106	106	106	107	108	110	112	113
	V_R	116	116	116	116	116	116	116	116	116	117	117	118	119	119
	V_2	122	122	122	122	122	122	122	122	122	122	122	122	122	122
	TOFL	3960	4120	4290	4460	4630	4810	4890	4980	5140	5370	5630	5930	6280	6360
36000	V_1	112	112	111	111	111	111	111	111	111	112	113	115	117	118
	V_R	120	120	120	120	121	121	121	121	121	121	122	122	123	123
	V_2	125	125	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4080	4250	4430	4600	4780	4960	5050	5140	5310	5550	5830	6150	6690	6830
38000	V_1	116	116	116	116	116	116	116	116	116	117	118	120	122	123
	V_R	124	124	124	125	125	125	125	125	125	125	126	126	127	127
	V_2	129	129	129	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4230	4400	4570	4740	4930	5110	5210	5300	5470	5790	6250	6840	7550	7710
38850	V_1	118	118	118	118	118	118	118	118	118	118	120	122	124	125
	V_R	126	126	126	126	126	126	126	126	127	127	127	128	129	129
	V_2	130	130	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4430	4600	4780	4960	5140	5330	5420	5510	5700	6060	6570	7190	7930	8100

TODATA2K_WET_F20_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-121. (06-24-03)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED OFF

ALTITUDE 3000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C												
		–40	–30	–20	–10	0	10	15	20	25	30	35	40	44
28000	V_1	94	94	94	94	93	93	93	93	94	95	96	98	98
	V_R	107	107	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	124	124	124	124	124	124	123	123	122	121	120
	TOFL	3720	3870	4020	4180	4340	4500	4580	4700	4890	5110	5340	5610	5860
30000	V_1	97	97	97	97	96	96	96	96	97	98	99	101	102
	V_R	108	108	109	109	109	109	109	109	109	109	109	110	110
	V_2	124	124	123	123	123	123	123	123	122	122	121	120	120
	TOFL	3850	4000	4170	4330	4500	4670	4750	4870	5080	5310	5560	5850	6120
32000	V_1	102	102	101	101	101	101	101	101	102	103	104	106	108
	V_R	112	112	112	112	113	113	113	113	113	113	114	114	116
	V_2	123	123	122	122	122	122	122	122	122	121	120	120	119
	TOFL	3970	4140	4310	4480	4660	4830	4920	5040	5260	5510	5780	6080	6380
34000	V_1	106	106	106	106	106	106	106	106	107	108	110	111	113
	V_R	116	116	116	116	116	116	117	117	117	117	118	119	119
	V_2	122	122	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4100	4280	4450	4630	4810	4990	5080	5210	5450	5710	5980	6330	6640
36000	V_1	111	111	111	111	111	111	111	111	112	113	115	117	118
	V_R	120	120	120	121	121	121	121	121	121	122	122	123	123
	V_2	125	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4230	4410	4600	4780	4970	5150	5250	5380	5630	5910	6210	6640	7200
38000	V_1	116	116	116	116	116	116	116	116	116	118	120	122	123
	V_R	124	124	125	125	125	125	125	125	125	126	126	127	127
	V_2	129	129	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4380	4550	4740	4930	5120	5310	5410	5550	5830	6280	6840	7490	8120
38850	V_1	118	118	118	118	118	118	118	117	118	120	122	124	125
	V_R	126	126	126	126	126	127	127	127	127	127	128	128	129
	V_2	130	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4580	4760	4950	5140	5330	5520	5620	5770	6110	6600	7190	7880	8540

TODATA3K_WET_F20_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-122. (06-24-04)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED OFF

ALTITUDE 4000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C												
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	42
28000	V_1	94	94	94	93	93	93	93	94	95	96	97	98	99
	V_R	107	107	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	124	124	124	124	124	124	123	123	122	121	121	120
	TOFL	3860	4020	4180	4340	4510	4680	4780	4960	5180	5420	5680	5980	6120
30000	V_1	97	97	97	96	96	96	96	97	98	99	100	102	103
	V_R	108	109	109	109	109	109	109	109	109	109	110	110	111
	V_2	124	123	123	123	123	123	123	122	122	121	120	120	119
	TOFL	3990	4160	4330	4500	4680	4850	4950	5150	5380	5640	5920	6240	6390
32000	V_1	102	101	101	101	101	101	101	101	103	104	106	108	108
	V_R	112	112	112	113	113	113	113	113	113	114	114	115	115
	V_2	123	122	122	122	122	122	122	122	121	120	120	119	119
	TOFL	4130	4300	4480	4660	4840	5020	5130	5340	5580	5860	6160	6510	6670
34000	V_1	106	106	106	106	106	106	106	106	108	109	111	113	114
	V_R	116	116	116	116	116	117	117	117	117	118	119	119	120
	V_2	122	122	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4260	4440	4630	4810	5000	5190	5300	5530	5780	6080	6400	6770	6940
36000	V_1	111	111	111	111	111	111	111	111	113	114	116	118	119
	V_R	120	121	121	121	121	121	121	121	122	122	123	123	124
	V_2	125	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4400	4590	4780	4970	5160	5360	5470	5710	5980	6300	6650	7300	7600
38000	V_1	116	116	116	116	116	116	115	116	117	119	121	123	124
	V_R	125	125	125	125	125	125	125	125	126	126	127	127	128
	V_2	129	129	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4540	4730	4920	5120	5320	5520	5650	5890	6320	6880	7500	8240	8580
38850	V_1	118	118	118	118	118	117	117	118	119	121	123	125	126
	V_R	126	126	126	126	127	127	127	127	127	128	128	129	129
	V_2	130	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4750	4950	5140	5340	5540	5740	5860	6160	6640	7220	7880	8660	9010

TODATA4K_WET_F20_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-123. (06-24-05)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED OFF

ALTITUDE 5000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C												
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	
28000	V_1	94	94	94	93	93	93	93	94	96	97	98	99	
	V_R	107	107	107	107	107	107	107	107	107	107	107	107	
	V_2	124	124	124	124	124	124	123	123	122	121	121	120	
	TOFL	4010	4170	4340	4520	4690	4860	5050	5240	5500	5770	6040	6390	
30000	V_1	97	97	96	96	96	96	96	97	98	100	102	103	
	V_R	109	109	109	109	109	109	109	109	109	109	110	111	
	V_2	123	123	123	123	123	123	123	122	121	121	120	119	
	TOFL	4150	4320	4500	4680	4860	5040	5240	5450	5720	6010	6300	6680	
32000	V_1	101	101	101	101	101	101	101	102	104	105	107	109	
	V_R	112	112	113	113	113	113	113	113	113	114	115	115	
	V_2	122	122	122	122	122	122	122	121	120	120	119	118	
	TOFL	4290	4470	4660	4850	5030	5220	5430	5650	5940	6250	6560	6970	
34000	V_1	106	106	106	106	106	106	106	107	109	110	112	114	
	V_R	116	116	116	117	117	117	117	117	118	119	119	120	
	V_2	122	122	122	122	122	122	122	122	122	122	122	122	
	TOFL	4430	4620	4810	5010	5200	5400	5620	5850	6160	6490	6820	7260	
36000	V_1	111	111	111	111	111	111	111	112	114	116	118	119	
	V_R	121	121	121	121	121	121	121	122	122	123	123	124	
	V_2	125	125	125	125	125	125	125	125	125	125	125	125	
	TOFL	4570	4770	4970	5170	5370	5570	5800	6050	6380	6730	7290	8030	
38000	V_1	116	116	116	116	116	115	116	117	119	121	122	124	
	V_R	125	125	125	125	125	125	125	126	126	127	127	128	
	V_2	129	129	129	129	129	129	129	129	129	129	129	129	
	TOFL	4720	4910	5120	5330	5540	5750	5990	6360	6910	7550	8220	9060	
38850	V_1	118	118	118	118	118	117	118	119	121	123	124	126	
	V_R	126	126	127	127	127	127	127	127	128	128	129	129	
	V_2	130	130	130	130	130	130	130	130	130	130	130	130	
	TOFL	4940	5140	5340	5550	5760	5970	6230	6680	7270	7930	8630	9500	

TODATASK_WET_F20_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-124. (06-24-06)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED OFF

ALTITUDE 6000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C											
		-40	-30	-20	-10	0	10	15	20	25	30	35	38
28000	V_1	94	93	93	93	93	93	94	95	96	98	99	100
	V_R	107	107	107	107	107	107	107	107	107	107	107	108
	V_2	124	124	124	124	124	123	123	122	121	121	120	120
	TOFL	4160	4330	4510	4690	4870	5150	5340	5570	5840	6140	6460	6690
30000	V_1	97	96	96	96	96	96	97	98	100	101	103	104
	V_R	109	109	109	109	109	109	109	109	109	110	111	111
	V_2	123	123	123	123	123	122	122	121	121	120	119	119
	TOFL	4310	4490	4680	4860	5050	5340	5550	5790	6080	6400	6750	7000
32000	V_1	101	101	101	101	101	101	102	103	105	106	108	110
	V_R	112	113	113	113	113	113	113	114	114	115	115	116
	V_2	122	122	122	122	122	122	121	120	120	119	119	118
	TOFL	4460	4640	4840	5030	5230	5530	5760	6010	6330	6670	7040	7310
34000	V_1	106	106	106	106	106	106	107	109	110	112	114	115
	V_R	116	116	117	117	117	117	117	118	118	119	120	120
	V_2	122	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4600	4800	5000	5200	5410	5730	5960	6230	6570	6930	7330	7610
36000	V_1	111	111	111	111	111	111	112	114	115	117	119	120
	V_R	121	121	121	121	121	121	122	122	123	123	124	124
	V_2	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4750	4950	5160	5370	5580	5920	6160	6450	6810	7320	8030	8520
38000	V_1	116	116	116	116	115	115	117	118	120	122	124	125
	V_R	125	125	125	125	125	125	126	126	127	127	128	128
	V_2	129	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4900	5100	5320	5540	5760	6110	6450	6950	7560	8260	9060	9600
38850	V_1	118	118	118	117	117	117	119	120	122	124	126	126
	V_R	126	126	127	127	127	127	127	128	128	129	129	130
	V_2	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	5120	5320	5530	5750	5960	6340	6770	7310	7940	8670	9520	10080

TODATA6K_WET_F20_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-125. (06-24-07)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED OFF

ALTITUDE 7000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C											
		–40	–30	–20	–10	0	10	15	20	25	30	35	36
28000	V_1	93	93	93	93	93	94	95	96	97	98	100	100
	V_R	107	107	107	107	107	107	107	107	107	107	108	108
	V_2	124	124	124	124	124	123	122	121	121	120	119	119
	TOFL	4310	4500	4680	4870	5060	5440	5660	5910	6220	6540	6930	7010
30000	V_1	96	96	96	96	96	97	98	99	101	102	104	105
	V_R	109	109	109	109	109	109	109	109	110	111	111	111
	V_2	123	123	123	123	123	122	121	121	120	119	119	119
	TOFL	4470	4660	4860	5050	5250	5660	5880	6160	6480	6830	7250	7340
32000	V_1	101	101	101	101	101	102	103	105	106	108	110	110
	V_R	113	113	113	113	113	113	114	114	115	115	116	116
	V_2	122	122	122	122	122	121	120	120	119	119	118	118
	TOFL	4620	4820	5030	5230	5440	5870	6110	6400	6750	7120	7570	7660
34000	V_1	106	106	106	106	106	107	108	110	111	113	115	116
	V_R	116	116	117	117	117	117	118	118	119	120	120	120
	V_2	122	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4780	4980	5190	5410	5620	6070	6330	6640	7010	7410	7890	7990
36000	V_1	111	111	111	111	111	112	113	115	116	118	120	121
	V_R	121	121	121	121	121	122	122	123	123	124	124	124
	V_2	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4930	5140	5360	5580	5800	6280	6550	6880	7330	8030	8860	9040
38000	V_1	116	116	115	115	115	116	118	120	121	123	125	125
	V_R	125	125	125	125	125	126	126	127	127	128	128	128
	V_2	129	129	129	129	129	129	129	129	129	129	129	129
	TOFL	5080	5300	5530	5750	5990	6540	7020	7600	8270	9060	9980	10190
38850	V_1	118	117	117	117	117	118	120	122	123	125	127	127
	V_R	126	127	127	127	127	127	128	128	129	129	130	130
	V_2	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	5290	5500	5730	5950	6180	6860	7380	7980	8690	9530	10500	10710

TODATA7K_WET_F20_ZERO_IMP_DD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-126. (06-24-08)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED OFF

ALTITUDE 8000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-30	-20	-10	0	10	15	20	25	30	34
28000	V_1	93	93	93	93	93	95	96	97	98	99	101
	V_R	107	107	107	107	107	107	107	107	107	108	108
	V_2	124	124	124	124	123	122	121	121	120	120	119
	TOFL	4480	4670	4870	5060	5340	5770	6000	6290	6630	7000	7350
30000	V_1	96	96	96	96	96	98	99	100	102	104	105
	V_R	109	109	109	109	109	109	109	110	111	111	112
	V_2	123	123	123	123	122	121	121	120	120	119	118
	TOFL	4640	4840	5040	5250	5540	6000	6250	6550	6920	7320	7700
32000	V_1	101	101	101	101	101	103	104	106	107	109	111
	V_R	113	113	113	113	113	114	114	115	115	116	116
	V_2	122	122	122	122	121	120	120	119	119	118	118
	TOFL	4800	5010	5220	5430	5740	6220	6490	6820	7210	7640	8040
34000	V_1	106	106	105	105	106	108	109	111	113	116	116
	V_R	116	117	117	117	117	118	119	119	119	120	121
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4960	5180	5400	5620	5940	6450	6740	7080	7500	7960	8420
36000	V_1	111	111	111	110	111	113	114	116	118	120	121
	V_R	121	121	121	121	122	122	123	123	124	124	125
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	5120	5340	5570	5800	6140	6680	6980	7360	8030	8840	9610
38000	V_1	115	115	115	115	116	118	119	121	122	124	126
	V_R	125	125	125	125	125	126	127	127	128	128	128
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	5280	5510	5740	5980	6330	7120	7670	8300	9060	10000	10820
38850	V_1	117	117	117	117	118	120	121	123	124	126	127
	V_R	127	127	127	127	127	128	128	129	129	130	130
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	5470	5700	5930	6160	6610	7480	8050	8720	9530	10480	11370

TODATA6K_WET_F20_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-127. (06-24-09)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED OFF

ALTITUDE 9000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-30	-20	-10	0	10	15	20	25	30	32
28000	V_1	93	93	93	93	94	96	97	97	99	101	102
	V_R	107	107	107	107	107	107	107	107	108	108	109
	V_2	124	124	123	123	122	122	121	120	120	119	119
	TOFL	4680	4880	5090	5320	5650	6110	6380	6700	7080	7510	7710
30000	V_1	96	96	96	96	97	99	100	102	103	105	106
	V_R	109	109	109	109	109	109	110	111	111	112	112
	V_2	123	123	123	122	121	121	120	120	119	118	118
	TOFL	4850	5060	5280	5520	5870	6360	6650	6990	7400	7870	8080
32000	V_1	101	101	101	101	102	104	105	107	109	111	111
	V_R	113	113	113	113	113	114	115	115	116	116	116
	V_2	122	122	122	121	121	120	119	119	118	118	118
	TOFL	5020	5240	5460	5720	6090	6610	6910	7280	7720	8220	8450
34000	V_1	106	106	106	106	107	109	111	112	114	116	117
	V_R	117	117	117	117	118	119	119	119	120	121	121
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	5190	5420	5650	5910	6310	6860	7180	7570	8040	8580	8930
36000	V_1	111	111	111	111	112	114	116	117	119	121	122
	V_R	121	121	121	121	122	123	123	124	124	125	125
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	5360	5590	5830	6110	6520	7110	7440	8050	8820	9760	10160
38000	V_1	116	115	115	115	117	119	121	122	124	125	126
	V_R	125	125	125	125	126	127	127	127	128	128	129
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	5520	5770	6010	6300	6850	7760	8370	9080	9970	11010	11480
38850	V_1	117	117	117	117	119	121	123	124	126	127	128
	V_R	127	127	127	127	128	128	129	129	130	130	130
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	5730	5970	6220	6530	7190	8160	8790	9530	10490	11580	12090

TODATA9K_WET_F20_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-128. (06-24-10)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED OFF

ALTITUDE 10000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C									
		-40	-30	-20	-10	0	10	15	20	25	30
28000	V_1	93	93	93	94	95	96	97	98	100	102
	V_R	107	107	107	107	107	107	107	108	108	109
	V_2	123	123	123	123	122	121	120	120	119	118
	TOFL	4900	5110	5340	5630	5990	6490	6770	7150	7590	8090
30000	V_1	96	96	96	97	98	100	101	103	104	107
	V_R	109	109	109	109	109	110	111	111	112	112
	V_2	122	122	122	122	121	120	120	119	119	118
	TOFL	5080	5300	5540	5850	6230	6760	7060	7470	7940	8480
32000	V_1	101	101	101	102	104	105	107	108	110	112
	V_R	113	113	113	113	114	115	115	116	116	117
	V_2	122	121	121	121	120	119	119	118	118	118
	TOFL	5260	5490	5740	6070	6470	7030	7360	7790	8300	8870
34000	V_1	106	106	106	107	109	110	112	113	116	117
	V_R	117	117	117	118	118	119	119	120	120	121
	V_2	122	122	122	122	122	122	122	122	122	122
	TOFL	5440	5680	5940	6280	6700	7300	7650	8110	8650	9480
36000	V_1	111	111	111	112	114	116	117	119	120	122
	V_R	121	121	122	122	123	123	124	124	125	125
	V_2	125	125	125	125	125	125	125	125	125	125
	TOFL	5620	5870	6140	6490	6940	7570	8090	8810	9720	10800
38000	V_1	116	116	116	117	118	120	122	123	125	127
	V_R	125	125	126	126	127	127	127	128	128	129
	V_2	129	129	129	129	129	129	129	129	129	129
	TOFL	5790	6050	6330	6770	7480	8460	9120	9940	10970	12210
38850	V_1	118	118	118	119	121	122	124	125	127	
	V_R	127	127	127	128	128	129	129	129	130	
	V_2	130	130	130	130	130	130	130	130	130	
	TOFL	6050	6310	6590	7100	7850	8890	9570	10450	11540	

TODATA10K_WET_F20_ZERO_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-129. (06-24-11)

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WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON

ALTITUDE SEA LEVEL
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
28000	V_1	95	95	95	94	94	94	94	94	94	94	95	96	97	99
	V_R	107	107	107	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	125	124	124	124	124	124	124	124	123	122	121
	TOFL	3360	3490	3620	3750	3890	4030	4110	4180	4250	4340	4510	4730	4960	5240
30000	V_1	97	97	97	97	97	97	97	97	97	97	97	99	100	102
	V_R	108	108	108	108	108	109	109	109	109	109	109	109	109	110
	V_2	124	124	124	124	123	123	123	123	123	123	123	122	121	120
	TOFL	3470	3610	3740	3890	4030	4180	4250	4330	4400	4500	4680	4920	5170	5460
32000	V_1	102	102	102	102	102	102	102	102	102	102	102	104	105	107
	V_R	112	112	112	112	112	112	112	112	112	112	112	113	114	114
	V_2	123	123	123	123	122	122	122	122	122	122	122	121	120	119
	TOFL	3590	3720	3870	4020	4170	4330	4400	4480	4560	4660	4850	5100	5370	5690
34000	V_1	107	107	107	107	106	106	106	106	106	106	107	109	110	113
	V_R	116	116	116	116	116	116	116	116	116	116	117	117	118	119
	V_2	122	122	122	122	121	121	121	121	121	121	121	121	121	121
	TOFL	3700	3840	3990	4150	4310	4470	4550	4630	4710	4810	5020	5290	5570	5910
36000	V_1	112	112	112	112	112	112	111	111	111	111	112	114	116	118
	V_R	120	120	120	120	120	121	121	121	121	121	121	122	122	123
	V_2	125	125	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	3810	3970	4120	4280	4450	4610	4690	4780	4860	4970	5190	5470	5780	6350
38000	V_1	117	117	117	116	116	116	116	116	116	116	117	118	120	123
	V_R	124	124	124	124	125	125	125	125	125	125	125	126	126	127
	V_2	128	128	128	128	128	128	128	128	128	128	128	128	128	128
	TOFL	4000	4140	4280	4440	4610	4770	4850	4940	5020	5130	5440	5900	6460	7160
38850	V_1	119	119	118	118	118	118	118	118	118	118	119	121	123	125
	V_R	126	126	126	126	126	126	126	126	126	126	127	127	128	129
	V_2	130	130	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4180	4330	4480	4650	4820	4990	5080	5170	5250	5370	5700	6200	6790	7520

TODATASL_WET_F20_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-130. (06-24-12)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 1000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		–40	–30	–20	–10	0	10	15	20	25	30	35	40	45	48
28000	V_1	95	95	94	94	94	94	94	94	94	94	95	97	98	99
	V_R	107	107	107	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	125	124	124	124	124	124	124	123	122	121	121
	TOFL	3470	3610	3740	3890	4030	4180	4260	4330	4410	4590	4780	5010	5280	5450
30000	V_1	97	97	97	97	97	97	97	97	97	97	98	99	101	102
	V_R	108	108	108	108	109	109	109	109	109	109	109	109	110	110
	V_2	124	124	124	123	123	123	123	123	123	123	122	121	120	120
	TOFL	3590	3730	3870	4030	4180	4330	4410	4490	4570	4760	4970	5210	5500	5690
32000	V_1	102	102	102	102	102	101	101	101	101	102	103	105	107	108
	V_R	112	112	112	112	112	112	112	112	113	112	113	113	114	116
	V_2	123	123	123	122	122	122	122	122	122	122	121	120	120	119
	TOFL	3710	3850	4010	4170	4320	4480	4560	4640	4730	4930	5160	5420	5720	5930
34000	V_1	107	107	106	106	106	106	106	106	106	107	108	110	112	113
	V_R	116	116	116	116	116	116	116	116	116	117	117	118	119	119
	V_2	122	122	122	122	122	122	122	122	122	122	122	122	122	122
	TOFL	3830	3980	4140	4300	4470	4630	4720	4800	4890	5100	5340	5620	5940	6170
36000	V_1	112	112	112	112	111	111	111	111	111	112	113	115	117	118
	V_R	120	120	120	120	121	121	121	121	121	121	122	122	123	123
	V_2	125	125	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	3940	4110	4270	4440	4610	4780	4870	4950	5040	5270	5530	5820	6280	6680
38000	V_1	117	117	116	116	116	116	116	116	116	116	118	120	122	123
	V_R	124	124	124	124	125	125	125	125	125	125	126	126	127	127
	V_2	128	128	128	128	128	128	128	128	128	128	128	128	128	128
	TOFL	4120	4270	4420	4590	4760	4930	5020	5110	5200	5470	5910	6440	7080	7530
38850	V_1	119	119	118	118	118	118	118	118	118	118	120	122	124	125
	V_R	126	126	126	126	126	126	126	126	126	127	127	128	128	129
	V_2	130	130	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4310	4470	4630	4810	4980	5160	5250	5340	5430	5730	6210	6760	7440	7910

TODATA1K_WET_F20_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-131. (06-24-13)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 2000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	46
28000	V_1	95	94	94	94	94	94	93	93	94	95	96	97	99	99
	V_R	107	107	107	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	124	124	124	124	124	124	123	122	121	121	120
	TOFL	3590	3740	3880	4030	4180	4340	4420	4490	4660	4850	5070	5320	5620	5680
30000	V_1	97	97	97	97	97	97	97	97	97	98	99	101	102	103
	V_R	108	108	108	109	109	109	109	109	109	109	109	109	110	110
	V_2	124	124	123	123	123	123	123	123	123	122	121	121	120	120
	TOFL	3710	3860	4020	4180	4340	4500	4580	4660	4830	5040	5270	5540	5860	5930
32000	V_1	102	102	102	102	101	101	101	101	102	103	104	106	108	108
	V_R	112	112	112	112	112	112	113	113	113	113	113	114	115	115
	V_2	123	123	122	122	122	122	122	122	122	121	120	120	119	119
	TOFL	3840	3990	4160	4320	4490	4650	4740	4820	5010	5230	5480	5770	6110	6180
34000	V_1	107	106	106	106	106	106	106	106	106	108	109	111	113	114
	V_R	116	116	116	116	116	116	116	116	117	117	118	118	119	119
	V_2	122	122	122	122	122	122	122	122	122	122	122	122	122	122
	TOFL	3960	4120	4290	4460	4640	4810	4900	4980	5180	5420	5680	5990	6350	6430
36000	V_1	112	112	111	111	111	111	111	111	111	113	114	116	118	119
	V_R	120	120	120	121	121	121	121	121	121	122	122	123	123	124
	V_2	125	125	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4080	4250	4430	4610	4780	4960	5050	5150	5350	5600	5880	6240	6890	7040
38000	V_1	117	116	116	116	116	116	116	116	116	117	119	121	123	124
	V_R	124	124	124	125	125	125	125	125	125	126	126	127	127	127
	V_2	129	129	129	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4240	4410	4580	4750	4930	5120	5210	5310	5520	5930	6440	7030	7770	7940
38850	V_1	118	118	118	118	118	118	118	118	118	120	121	123	125	126
	V_R	126	126	126	126	126	126	126	127	127	127	128	128	129	129
	V_2	130	130	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4440	4610	4790	4970	5160	5340	5430	5530	5780	6230	6770	7390	8160	8340

TODATA2K_WET_F20_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-132. (06-24-14)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 4000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C												
		–40	–30	–20	–10	0	10	15	20	25	30	35	40	44
28000	V_1	94	94	94	94	94	93	93	93	96	96	97	98	99
	V_R	107	107	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	124	124	124	124	124	124	123	122	122	121	120
	TOFL	3720	3870	4030	4180	4340	4500	4580	4730	4920	5150	5380	5660	5930
30000	V_1	97	97	97	97	97	96	96	97	98	99	100	102	103
	V_R	108	108	109	109	109	109	109	109	109	109	109	110	111
	V_2	124	124	123	123	123	123	123	123	122	121	121	120	119
	TOFL	3850	4010	4170	4340	4500	4670	4750	4910	5120	5350	5610	5910	6190
32000	V_1	102	102	101	101	101	101	101	101	102	104	105	107	109
	V_R	112	112	112	112	113	113	113	113	113	113	114	115	115
	V_2	123	123	122	122	122	122	122	122	121	121	120	119	119
	TOFL	3980	4140	4310	4490	4660	4830	4920	5080	5300	5560	5830	6150	6450
34000	V_1	106	106	106	106	106	106	106	106	108	109	111	113	114
	V_R	116	116	116	116	116	116	117	117	117	118	118	119	120
	V_2	122	122	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4100	4280	4460	4640	4810	4990	5080	5260	5490	5760	6050	6390	6720
36000	V_1	112	111	111	111	111	111	111	111	112	114	116	118	119
	V_R	120	120	121	121	121	121	121	121	121	122	123	123	124
	V_2	125	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4230	4420	4600	4780	4970	5160	5250	5430	5680	5960	6270	6840	7420
38000	V_1	116	116	116	116	116	116	116	116	117	119	121	123	124
	V_R	124	124	125	125	125	125	125	125	125	126	127	127	128
	V_2	129	129	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4390	4560	4740	4930	5120	5320	5410	5600	5980	6470	7040	7710	8360
38850	V_1	118	118	118	118	118	118	118	118	119	121	123	124	126
	V_R	126	126	126	126	126	127	127	127	127	128	128	129	129
	V_2	130	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4590	4770	4960	5150	5340	5530	5630	5850	6280	6800	7390	8100	8790

TODATA3K_WET_F20_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-133. (06-24-15)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 4000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C												
		–40	–30	–20	–10	0	10	15	20	25	30	35	40	42
28000	V_1	94	94	94	94	93	93	93	94	95	97	98	99	100
	V_R	107	107	107	107	107	107	107	107	107	107	107	107	108
	V_2	125	124	124	124	124	124	124	123	122	122	121	120	120
	TOFL	3860	4020	4180	4350	4510	4680	4810	5000	5220	5460	5730	6040	6180
30000	V_1	97	97	97	97	96	96	96	97	98	100	101	103	104
	V_R	108	109	109	109	109	109	109	109	109	109	110	111	111
	V_2	124	123	123	123	123	123	123	122	121	121	120	119	119
	TOFL	3990	4160	4330	4510	4680	4850	4990	5190	5420	5690	5970	6310	6460
32000	V_1	102	101	101	101	101	101	101	102	104	105	107	109	110
	V_R	112	112	112	113	113	113	113	113	113	114	115	115	115
	V_2	122	122	122	122	122	122	122	121	121	120	119	119	118
	TOFL	4130	4300	4480	4660	4840	5020	5170	5380	5630	5910	6220	6580	6740
34000	V_1	106	106	106	106	106	106	106	107	109	110	112	114	115
	V_R	116	116	116	116	117	117	117	117	118	118	119	120	120
	V_2	122	122	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4260	4450	4630	4820	5000	5190	5350	5570	5830	6140	6460	6850	7020
36000	V_1	112	111	111	111	111	111	111	112	114	115	117	119	120
	V_R	120	121	121	121	121	121	121	121	122	123	123	124	124
	V_2	125	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4400	4590	4780	4970	5170	5360	5520	5760	6040	6360	6850	7520	7830
38000	V_1	116	116	116	116	116	116	116	117	118	120	122	124	124
	V_R	125	125	125	125	125	125	125	125	126	126	127	128	128
	V_2	129	129	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4550	4740	4930	5130	5330	5530	5700	6030	6510	7080	7720	8480	8830
38850	V_1	118	118	118	118	118	118	118	119	121	122	124	126	126
	V_R	126	126	126	126	127	127	127	127	128	128	129	129	129
	V_2	130	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4760	4960	5150	5350	5550	5750	5920	6320	6840	7440	8110	8910	9260

TODATA4K_WET_F20_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-134. (06-24-16)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 5000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C											
		–40	–30	–20	–10	0	10	15	20	25	30	35	40
26000	V_1	94	94	94	93	93	93	94	95	96	97	99	100
	V_R	107	107	107	107	107	107	107	107	107	107	107	108
	V_2	124	124	124	124	124	124	123	122	122	121	120	120
	TOFL	4010	4170	4350	4520	4690	4900	5080	5280	5540	5820	6100	6460
30000	V_1	97	97	97	96	96	96	97	98	99	101	103	104
	V_R	109	109	109	109	109	109	109	109	109	110	111	111
	V_2	123	123	123	123	123	123	122	121	121	120	119	119
	TOFL	4150	4330	4500	4680	4870	5080	5280	5490	5770	6070	6360	6760
32000	V_1	102	101	101	101	101	101	102	103	105	106	108	110
	V_R	112	112	113	113	113	113	113	113	114	114	115	116
	V_2	122	122	122	122	122	122	121	121	120	119	119	118
	TOFL	4290	4470	4660	4850	5040	5260	5470	5690	6000	6310	6630	7050
34000	V_1	106	106	106	106	106	106	107	108	110	111	114	115
	V_R	116	116	116	117	117	117	117	118	118	119	119	120
	V_2	122	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4430	4620	4820	5010	5210	5440	5660	5900	6220	6560	6900	7350
36000	V_1	111	111	111	111	111	111	112	113	115	117	119	120
	V_R	121	121	121	121	121	121	121	122	123	123	124	124
	V_2	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4570	4770	4970	5170	5370	5620	5850	6100	6440	6900	7500	8270
38000	V_1	116	116	116	116	116	116	117	118	120	122	123	125
	V_R	125	125	125	125	125	125	125	126	126	127	128	128
	V_2	129	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4730	4920	5120	5330	5540	5800	6100	6540	7120	7770	8460	9310
38850	V_1	118	118	118	118	118	118	118	120	122	124	125	127
	V_R	126	126	127	127	127	127	127	128	128	129	129	130
	V_2	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4950	5150	5360	5560	5770	6030	6390	6870	7480	8160	8890	9790

TODATA6K_WET_F20_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-135. (06-24-17)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 6000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C											
		-40	-30	-20	-10	0	10	15	20	25	30	35	38
28000	V_1	94	94	93	93	93	94	95	96	97	98	100	101
	V_R	107	107	107	107	107	107	107	107	107	107	108	108
	V_2	124	124	124	124	124	123	122	122	121	120	120	119
	TOFL	4160	4330	4510	4690	4870	5180	5380	5610	5890	6200	6530	6770
30000	V_1	97	96	96	96	96	97	98	99	101	102	104	105
	V_R	109	109	109	109	109	109	109	109	110	110	111	112
	V_2	123	123	123	123	123	122	121	121	120	120	119	119
	TOFL	4310	4490	4680	4870	5060	5380	5590	5840	6140	6470	6830	7080
32000	V_1	101	101	101	101	101	102	103	104	106	107	110	111
	V_R	112	113	113	113	113	113	113	114	114	115	116	116
	V_2	122	122	122	122	122	121	121	120	119	119	118	118
	TOFL	4460	4650	4840	5040	5230	5580	5800	6070	6390	6740	7120	7400
34000	V_1	108	106	106	106	106	107	108	110	111	113	115	116
	V_R	116	116	117	117	117	117	118	118	119	119	120	120
	V_2	122	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4610	4800	5000	5210	5410	5770	6010	6290	6630	7010	7420	7710
36000	V_1	111	111	111	111	111	112	113	115	116	118	120	121
	V_R	121	121	121	121	121	122	122	123	123	124	124	124
	V_2	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4750	4950	5160	5370	5590	5970	6220	6520	6910	7540	8270	8780
38000	V_1	116	116	116	116	115	116	118	120	121	123	124	125
	V_R	125	125	125	125	125	126	126	126	127	127	128	128
	V_2	129	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4900	5110	5320	5540	5760	6200	6640	7160	7790	8500	9330	9890
38850	V_1	118	118	118	118	117	118	120	122	123	125	126	127
	V_R	126	127	127	127	127	127	128	128	129	129	130	130
	V_2	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	5130	5330	5550	5760	5980	6490	6970	7520	8180	8930	9790	10390

TODATA6K_WET_F20_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-136. (06-24-18)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 7000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C											
		–40	–30	–20	–10	0	10	15	20	25	30	35	36
28000	V_1	93	93	93	93	93	95	96	97	98	99	101	101
	V_R	107	107	107	107	107	107	107	107	107	108	108	108
	V_2	124	124	124	124	123	122	122	121	120	120	119	119
	TOFL	4320	4500	4690	4880	5080	5480	5700	5960	6280	6610	7010	7090
30000	V_1	96	96	96	96	96	98	99	100	102	103	105	106
	V_R	109	109	109	109	109	109	109	110	110	111	112	112
	V_2	123	123	123	123	123	121	121	120	120	119	118	118
	TOFL	4470	4660	4860	5050	5270	5700	5930	6210	6550	6910	7340	7430
32000	V_1	101	101	101	101	101	103	104	106	107	109	111	111
	V_R	113	113	113	113	113	113	114	114	115	116	116	116
	V_2	122	122	122	122	122	121	120	120	119	118	118	118
	TOFL	4630	4820	5030	5230	5460	5910	6160	6460	6820	7210	7660	7760
34000	V_1	106	106	106	106	106	108	109	111	112	114	116	117
	V_R	116	117	117	117	117	118	118	119	119	120	120	121
	V_2	122	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4780	4980	5200	5410	5640	6130	6390	6710	7090	7500	8020	8190
36000	V_1	111	111	111	111	111	113	114	116	118	119	121	121
	V_R	121	121	121	121	121	122	123	123	123	124	125	125
	V_2	125	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4930	5140	5360	5580	5830	6340	6620	6950	7560	8280	9130	9320
38000	V_1	116	116	115	115	115	118	119	121	122	124	126	126
	V_R	125	125	125	125	125	126	126	127	127	128	128	128
	V_2	129	129	129	129	129	129	129	129	129	129	129	129
	TOFL	5080	5300	5530	5760	6010	6740	7240	7830	8520	9340	10290	10500
38850	V_1	118	118	117	117	117	120	121	123	124	126	127	128
	V_R	127	127	127	127	127	128	128	129	129	129	130	130
	V_2	130	130	130	130	130	130	130	130	130	130	130	130
	TOFL	5300	5510	5740	5960	6220	7080	7610	8220	8950	9820	10810	11040

TODATA7K_WET_F20_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-137. (06-24-19)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 8000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-30	-20	-10	0	10	15	20	25	30	34
28000	V_1	93	93	93	93	93	96	97	97	99	100	102
	V_R	107	107	107	107	107	107	107	107	108	108	109
	V_2	124	124	124	124	123	122	121	121	120	119	119
	TOFL	4480	4670	4870	5070	5380	5810	6050	6340	6700	7080	7440
30000	V_1	96	96	96	96	97	99	100	101	103	105	106
	V_R	109	109	109	109	109	109	110	110	111	112	112
	V_2	123	123	123	123	122	121	120	120	119	119	118
	TOFL	4640	4840	5050	5250	5590	6050	6310	6620	7000	7410	7800
32000	V_1	101	101	101	101	101	104	105	107	108	110	112
	V_R	113	113	113	113	113	114	114	115	115	116	117
	V_2	122	122	122	122	121	120	120	119	118	118	118
	TOFL	4800	5010	5220	5440	5790	6280	6560	6890	7290	7740	8150
34000	V_1	106	106	106	105	106	109	110	112	114	116	117
	V_R	117	117	117	117	117	118	119	119	120	120	121
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4960	5180	5400	5620	5990	6510	6800	7160	7590	8070	8690
36000	V_1	111	111	111	111	111	114	116	117	119	121	122
	V_R	121	121	121	121	122	123	123	123	124	124	125
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	5120	5350	5570	5800	6190	6740	7050	7590	8290	9130	9880
38000	V_1	116	115	115	115	116	119	121	122	123	125	126
	V_R	125	125	125	125	126	126	127	127	128	128	129
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	5280	5510	5750	5980	6390	7350	7900	8550	9350	10280	11160
38850	V_1	118	117	117	117	118	121	123	124	125	127	
	V_R	127	127	127	127	127	128	129	129	129	130	
	V_2	130	130	130	130	130	130	130	130	130	130	
	TOFL	5480	5710	5940	6180	6690	7720	8300	8980	9820	10810	

TODATA8K_WET_F20_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-138. (06-24-20)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 6000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		–40	–30	–20	–10	0	10	15	20	25	30	32			
28000	V_1	93	93	93	93	94	96	97	98	100	102	103			
	V_R	107	107	107	107	107	107	107	108	108	109	109			
	V_2	124	124	123	123	122	121	121	120	119	119	118			
	TOFL	4680	4880	5090	5320	5700	6170	6440	6770	7160	7610	7810			
30000	V_1	96	96	96	96	97	100	101	102	104	106	107			
	V_R	109	109	109	109	109	110	110	111	111	112	112			
	V_2	123	123	122	122	121	120	120	119	119	118	118			
	TOFL	4850	5060	5280	5520	5920	6420	6710	7060	7490	7970	8190			
32000	V_1	101	101	101	101	102	105	106	108	110	112	113			
	V_R	113	113	113	113	113	114	115	115	116	117	117			
	V_2	122	122	122	121	121	120	119	119	118	118	118			
	TOFL	5020	5240	5470	5720	6150	6680	6980	7360	7820	8340	8570			
34000	V_1	106	106	106	106	108	110	112	113	115	117	118			
	V_R	117	117	117	117	118	119	119	120	120	121	121			
	V_2	122	122	122	122	122	122	122	122	122	122	122			
	TOFL	5190	5420	5650	5920	6370	6930	7260	7660	8140	8850	9230			
36000	V_1	111	111	111	111	112	116	117	118	120	122	122			
	V_R	121	121	121	121	122	123	123	124	124	125	125			
	V_2	125	125	125	125	125	125	125	125	125	125	125			
	TOFL	5360	5600	5830	6110	6580	7180	7670	8310	9110	10060	10500			
38000	V_1	116	115	116	115	117	120	122	123	125	126				
	V_R	125	125	125	125	126	127	127	128	128	129				
	V_2	129	129	129	129	129	129	129	129	129	129				
	TOFL	5520	5770	6020	6310	6940	8020	8630	9360	10300	11360				
38850	V_1	118	117	117	117	119	122	124	125	126					
	V_R	127	127	127	127	128	129	129	129	130					
	V_2	130	130	130	130	130	130	130	130	130					
	TOFL	5740	5990	6230	6540	7290	8420	9060	9830	10800					

TODATA9K_WET_F20_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-139. (06-24-21)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 10000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C									
		-40	-30	-20	-10	0	10	15	20	25	30
28000	V_1	93	93	93	94	95	97	98	99	101	103
	V_R	107	107	107	107	107	107	108	108	109	109
	V_2	123	123	123	123	122	121	120	119	119	118
	TOFL	4900	5120	5340	5640	6040	6550	6840	7230	7680	8200
30000	V_1	97	96	96	97	98	101	102	104	105	108
	V_R	109	109	109	109	109	110	111	111	112	113
	V_2	122	122	122	122	121	120	119	119	118	118
	TOFL	5080	5310	5550	5850	6290	6830	7140	7560	8050	8600
32000	V_1	101	101	101	102	104	106	108	109	111	113
	V_R	113	113	113	113	114	116	116	116	116	117
	V_2	122	121	121	121	120	119	119	118	118	118
	TOFL	5260	5500	5750	6070	6530	7110	7440	7880	8410	9010
34000	V_1	106	106	106	107	109	112	113	115	116	118
	V_R	117	117	117	118	118	119	120	120	121	121
	V_2	122	122	122	122	122	122	122	122	122	122
	TOFL	5440	5680	5940	6280	6770	7380	7730	8210	8810	9780
36000	V_1	111	111	111	112	114	117	118	120	121	123
	V_R	121	121	122	122	123	124	124	124	125	125
	V_2	125	125	125	125	125	125	125	125	125	125
	TOFL	5620	5870	6140	6500	7010	7770	8350	9100	10040	11150
38000	V_1	116	116	116	117	119	122	123	124	126	
	V_R	125	125	126	126	127	127	128	128	129	
	V_2	129	129	129	129	129	129	129	129	129	
	TOFL	5800	6060	6340	6780	7580	8740	9400	10260	11330	
38850	V_1	118	118	118	119	121	124	125	126	128	
	V_R	127	127	127	128	128	129	129	130	130	
	V_2	130	130	130	130	130	130	130	130	130	
	TOFL	6070	6320	6600	7110	7960	9180	9880	10800	11910	

TODATA10K_WET_F20_ECS_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-140. (06-24-22)

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WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE SEA LEVEL
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	95	95	95	95	95	94	94	94	94	94	94
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	125	125	125	125	125	124	124	124
	TOFL	3370	3430	3490	3560	3620	3690	3760	3830	3900	3970	4040
30000	V_1	97	97	97	97	97	97	97	97	97	97	97
	V_R	108	108	108	108	108	108	108	108	108	108	109
	V_2	124	124	124	124	124	124	124	123	123	123	123
	TOFL	3480	3550	3610	3680	3750	3820	3890	3970	4040	4110	4190
32000	V_1	102	102	102	102	102	102	102	102	102	102	102
	V_R	112	112	112	112	112	112	112	112	112	112	112
	V_2	123	123	123	123	123	123	123	122	122	122	122
	TOFL	3590	3660	3730	3800	3870	3950	4020	4100	4180	4250	4330
34000	V_1	107	107	107	107	107	107	107	107	107	106	106
	V_R	116	116	116	116	116	116	116	116	116	116	116
	V_2	122	122	122	122	122	122	122	121	121	121	121
	TOFL	3710	3780	3850	3920	4000	4080	4160	4240	4320	4400	4480
36000	V_1	112	112	112	112	112	112	112	112	112	112	112
	V_R	120	120	120	120	120	120	120	120	120	121	121
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	3820	3890	3970	4050	4120	4210	4290	4370	4450	4540	4620
38000	V_1	117	117	117	117	117	117	116	116	116	116	116
	V_R	124	124	124	124	124	124	124	124	125	125	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	4010	4080	4150	4220	4290	4370	4450	4540	4620	4700	4780
38850	V_1	119	119	119	119	119	118	118	118	118	118	118
	V_R	126	126	126	126	126	126	126	126	126	126	126
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4190	4270	4340	4420	4490	4570	4660	4750	4830	4920	5000

TODATASL_WET_F20_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-141. (06-24-23)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 1000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	95	95	95	94	94	94	94	94	94	94	94
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	125	125	125	125	124	124	124	124
	TOFL	3480	3550	3610	3680	3750	3820	3890	3970	4040	4110	4190
30000	V_1	97	97	97	97	97	97	97	97	97	97	97
	V_R	108	108	108	108	108	108	108	108	109	109	109
	V_2	124	124	124	124	124	124	123	123	123	123	123
	TOFL	3600	3670	3740	3810	3880	3960	4030	4110	4190	4260	4340
32000	V_1	102	102	102	102	102	102	102	102	102	102	101
	V_R	112	112	112	112	112	112	112	112	112	112	112
	V_2	123	123	123	123	123	122	122	122	122	122	122
	TOFL	3710	3790	3860	3930	4010	4090	4170	4250	4330	4410	4490
34000	V_1	107	107	107	107	106	106	106	106	106	106	106
	V_R	116	116	116	116	116	116	116	116	116	116	116
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	3830	3910	3980	4060	4140	4230	4310	4390	4470	4560	4640
36000	V_1	112	112	112	112	112	112	112	112	111	111	111
	V_R	120	120	120	120	120	120	120	120	121	121	121
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	3950	4030	4110	4190	4270	4360	4440	4530	4620	4700	4790
38000	V_1	117	117	117	116	116	116	116	116	116	116	116
	V_R	124	124	124	124	124	124	125	125	125	125	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	4130	4200	4280	4350	4430	4520	4600	4690	4770	4860	4940
38850	V_1	119	119	119	118	118	118	118	118	118	118	118
	V_R	126	126	126	126	126	126	126	126	126	126	126
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4320	4400	4480	4560	4640	4730	4810	4900	4990	5080	5170

TODATA1K_WET_F20_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-142. (06-24-24)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 2000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
28000	V_1	95	94	94	94	94	94	94	94	94	94	94
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	125	125	124	124	124	124	124	124
	TOFL	3600	3670	3740	3810	3890	3960	4040	4110	4190	4270	4370
30000	V_1	97	97	97	97	97	97	97	97	97	97	97
	V_R	108	108	108	108	108	109	109	109	109	109	109
	V_2	124	124	124	124	123	123	123	123	123	123	123
	TOFL	3720	3800	3870	3940	4020	4100	4180	4260	4340	4420	4530
32000	V_1	102	102	102	102	102	102	102	101	101	101	102
	V_R	112	112	112	112	112	112	112	112	112	112	112
	V_2	123	123	123	123	122	122	122	122	122	122	122
	TOFL	3840	3920	4000	4080	4160	4240	4330	4410	4490	4570	4690
34000	V_1	107	107	106	106	106	106	106	106	106	106	107
	V_R	116	116	116	116	116	116	116	116	116	116	117
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	3960	4050	4130	4210	4300	4380	4470	4550	4640	4730	4840
36000	V_1	112	112	112	112	112	111	111	111	111	111	112
	V_R	120	120	120	120	120	120	121	121	121	121	121
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4090	4170	4260	4350	4430	4520	4610	4700	4790	4880	5000
38000	V_1	117	116	116	116	116	116	116	116	116	116	117
	V_R	124	124	124	124	125	125	125	125	125	125	125
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4250	4330	4420	4500	4580	4670	4760	4850	4940	5030	5210
38850	V_1	119	118	118	118	118	118	118	118	118	118	119
	V_R	126	126	126	126	126	126	126	126	126	126	127
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4450	4530	4620	4710	4800	4890	4980	5070	5170	5260	5450

TODATA2K_WET_F20_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-143. (06-24-25)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 3000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	94	94	94	94	94	94	94	94	94	94	95
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	124	124	124	124	124	124	124	123
	TOFL	3730	3800	3880	3950	4030	4110	4190	4270	4350	4440	4620
30000	V_1	97	97	97	97	97	97	97	97	97	97	98
	V_R	108	108	108	109	109	109	109	109	109	109	109
	V_2	124	124	123	123	123	123	123	123	123	123	122
	TOFL	3850	3930	4010	4090	4170	4260	4340	4420	4510	4610	4790
32000	V_1	102	102	102	102	101	101	101	101	101	102	103
	V_R	112	112	112	112	112	112	112	112	113	113	113
	V_2	123	123	122	122	122	122	122	122	122	122	121
	TOFL	3980	4060	4150	4230	4320	4400	4490	4580	4660	4770	4960
34000	V_1	106	106	106	106	106	106	106	106	106	107	108
	V_R	116	116	116	116	116	116	116	116	116	117	117
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4110	4200	4280	4370	4460	4550	4640	4730	4820	4930	5140
36000	V_1	112	112	111	111	111	111	111	111	111	112	113
	V_R	120	120	120	120	121	121	121	121	121	121	122
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4240	4330	4420	4510	4600	4700	4790	4880	4970	5090	5310
38000	V_1	116	116	116	116	116	116	116	116	116	116	118
	V_R	124	124	125	125	125	125	125	125	125	125	126
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4390	4480	4570	4660	4750	4840	4940	5030	5130	5290	5670
38850	V_1	118	118	118	118	118	118	118	118	118	118	120
	V_R	126	126	126	126	126	126	126	126	126	127	127
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4600	4690	4780	4870	4970	5070	5160	5260	5350	5540	5950

TODATA3K_WET_F20_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-144. (06-24-26)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 4000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	94	94	94	94	94	94	94	93	94	95	96
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	124	124	124	124	124	124	124	124	123	122
	TOFL	3860	3940	4020	4100	4180	4270	4350	4430	4520	4700	4890
30000	V_1	97	97	97	97	97	97	97	97	97	98	99
	V_R	108	109	109	109	109	109	109	109	109	109	109
	V_2	123	123	123	123	123	123	123	123	123	122	121
	TOFL	4000	4080	4160	4250	4340	4420	4510	4600	4690	4880	5080
32000	V_1	102	102	102	101	101	101	101	101	101	103	104
	V_R	112	112	112	112	112	112	113	113	113	113	113
	V_2	122	122	122	122	122	122	122	122	122	121	120
	TOFL	4130	4220	4310	4400	4490	4580	4670	4760	4860	5050	5270
34000	V_1	106	106	106	106	106	106	106	106	106	108	110
	V_R	116	116	116	116	116	116	116	116	117	117	118
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4270	4360	4450	4540	4630	4730	4820	4910	5020	5230	5460
36000	V_1	112	111	111	111	111	111	111	111	111	113	115
	V_R	120	121	121	121	121	121	121	121	121	122	122
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4400	4500	4590	4690	4780	4880	4980	5070	5180	5400	5650
38000	V_1	116	116	116	116	116	116	116	116	116	118	120
	V_R	125	125	125	125	125	125	125	125	125	126	126
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4560	4650	4740	4830	4930	5030	5130	5230	5350	5750	6200
38850	V_1	118	118	118	118	118	118	118	118	118	120	122
	V_R	126	126	126	126	126	126	127	127	127	127	128
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4770	4870	4960	5060	5160	5260	5360	5460	5600	6030	6500

TODATA4K_WET_F20_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-145. (06-24-27)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 5000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
28000	V_1	94	94	94	94	94	93	93	93	95	96	97
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	124	124	124	124	124	124	124	124	123	122	121
	TOFL	4010	4090	4180	4260	4350	4430	4520	4610	4780	4980	5180
30000	V_1	97	97	97	97	97	97	97	98	98	99	100
	V_R	109	109	109	109	109	109	109	109	109	109	109
	V_2	123	123	123	123	123	123	123	123	122	121	121
	TOFL	4150	4240	4330	4420	4510	4600	4690	4780	4960	5170	5390
32000	V_1	102	102	101	101	101	101	101	101	103	104	106
	V_R	112	112	112	112	113	113	113	113	113	113	114
	V_2	122	122	122	122	122	122	122	122	121	120	120
	TOFL	4290	4380	4480	4570	4660	4760	4850	4940	5140	5360	5600
34000	V_1	106	106	106	106	106	106	106	106	108	109	111
	V_R	116	116	116	116	116	117	117	117	117	118	119
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4430	4530	4620	4720	4820	4920	5010	5110	5320	5560	5800
36000	V_1	112	111	111	111	111	111	111	111	113	114	116
	V_R	121	121	121	121	121	121	121	121	122	122	123
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4570	4670	4770	4870	4970	5070	5170	5280	5490	5750	6030
38000	V_1	116	116	116	116	116	116	116	116	118	119	121
	V_R	125	125	125	125	125	125	125	125	126	126	127
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4730	4830	4920	5020	5130	5230	5340	5440	5810	6290	6770
38850	V_1	118	118	118	118	118	118	118	118	120	121	123
	V_R	126	126	126	127	127	127	127	127	127	128	128
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4950	5050	5150	5260	5360	5470	5570	5670	6100	6600	7100

TODATA5K_WET_F20_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-146. (06-24-28)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 6000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	94	94	94	93	93	93	93	94	96	97	98
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	124	124	124	124	124	124	124	123	122	121	121
	TOFL	4160	4250	4330	4420	4510	4600	4690	4830	5060	5280	5500
30000	V_1	97	97	97	96	96	96	96	97	99	100	102
	V_R	109	109	109	109	109	109	109	109	109	109	110
	V_2	123	123	123	123	123	123	123	122	121	121	120
	TOFL	4310	4400	4490	4590	4680	4770	4870	5010	5250	5490	5730
32000	V_1	101	101	101	101	101	101	101	102	104	106	107
	V_R	112	112	113	113	113	113	113	113	113	114	115
	V_2	122	122	122	122	122	122	122	121	120	120	119
	TOFL	4460	4550	4650	4750	4840	4940	5040	5190	5450	5700	5960
34000	V_1	106	106	106	106	106	106	106	107	109	111	112
	V_R	116	116	116	117	117	117	117	117	118	119	119
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4610	4700	4800	4900	5000	5110	5210	5370	5640	5910	6180
36000	V_1	111	111	111	111	111	111	111	112	114	116	118
	V_R	121	121	121	121	121	121	121	122	122	123	123
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4750	4850	4960	5080	5170	5270	5380	5550	5840	6120	6590
38000	V_1	116	116	116	116	116	116	116	117	119	121	122
	V_R	125	125	125	125	125	125	125	126	126	127	127
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4910	5000	5110	5220	5330	5430	5540	5810	6350	6870	7400
38850	V_1	118	118	118	118	118	118	118	119	121	123	124
	V_R	126	126	127	127	127	127	127	127	128	128	129
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	5130	5230	5340	5440	5550	5660	5770	6090	6660	7210	7760

TODATA6K_WET_F20_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-147. (06-24-29)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 7000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	94	93	93	93	93	93	93	95	97	98	99
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	124	124	124	124	124	124	123	122	121	121	120
	TOFL	4320	4410	4500	4590	4690	4780	4900	5130	5360	5600	5850
30000	V_1	96	96	96	96	96	96	97	98	100	101	103
	V_R	109	109	109	109	109	109	109	109	109	110	111
	V_2	123	123	123	123	123	123	122	121	121	120	119
	TOFL	4470	4570	4660	4760	4860	4960	5080	5330	5580	5840	6100
32000	V_1	101	101	101	101	101	101	101	103	105	107	108
	V_R	113	113	113	113	113	113	113	113	114	115	115
	V_2	122	122	122	122	122	122	121	121	120	119	119
	TOFL	4630	4720	4830	4930	5030	5130	5260	5520	5790	6070	6350
34000	V_1	106	106	106	106	106	106	106	109	110	112	114
	V_R	116	116	117	117	117	117	117	118	119	119	120
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4780	4880	4990	5090	5200	5300	5440	5720	6000	6300	6600
36000	V_1	111	111	111	111	111	111	111	114	116	117	119
	V_R	121	121	121	121	121	121	121	122	123	123	124
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4930	5040	5150	5260	5370	5470	5620	5910	6220	6680	7190
38000	V_1	116	116	116	116	116	116	116	119	120	122	123
	V_R	125	125	125	125	125	125	125	126	127	127	128
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	5090	5190	5310	5420	5530	5650	5800	6370	6940	7500	8080
38850	V_1	118	118	118	118	117	117	118	121	122	124	125
	V_R	127	127	127	127	127	127	127	128	128	129	129
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	5310	5410	5520	5630	5740	5860	6070	6690	7280	7870	8480

TODATA7K_WET_F20_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-148. (06-24-30)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 8000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	93	93	93	93	93	93	95	96	97	98	100
	V_R	107	107	107	107	107	107	107	107	107	107	108
	V_2	124	124	124	124	124	124	123	122	121	120	120
	TOFL	4480	4580	4670	4770	4870	4970	5190	5440	5700	5960	6240
30000	V_1	96	96	96	96	96	96	98	99	101	103	104
	V_R	109	109	109	109	109	109	109	109	110	111	111
	V_2	123	123	123	123	123	123	122	121	120	119	119
	TOFL	4640	4740	4840	4950	5050	5150	5390	5660	5940	6220	6520
32000	V_1	101	101	101	101	101	101	103	105	106	108	110
	V_R	113	113	113	113	113	113	113	114	115	115	116
	V_2	122	122	122	122	122	122	121	120	119	119	118
	TOFL	4800	4910	5010	5120	5230	5330	5590	5880	6170	6470	6790
34000	V_1	106	106	106	106	106	106	108	110	112	114	115
	V_R	117	117	117	117	117	117	118	118	119	120	120
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4960	5070	5180	5290	5400	5510	5780	6090	6400	6720	7060
36000	V_1	111	111	111	111	111	111	113	115	117	119	120
	V_R	121	121	121	121	121	121	122	123	123	124	124
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	5120	5230	5350	5460	5580	5690	5980	6300	6750	7300	7880
38000	V_1	116	115	115	115	115	115	118	120	122	123	125
	V_R	125	125	125	125	125	125	126	127	127	128	128
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	5280	5390	5510	5630	5750	5870	6340	6980	7590	8200	8850
38850	V_1	118	117	117	117	117	117	120	122	124	125	126
	V_R	127	127	127	127	127	127	128	128	129	129	130
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	5490	5600	5710	5830	5950	6080	6660	7320	7960	8600	9280

TODATA8K_WET_F20_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-149. (06-24-31)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 9000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	93	93	93	93	93	94	96	97	98	100	101
	V_R	107	107	107	107	107	107	107	107	107	108	108
	V_2	124	124	124	124	123	123	122	121	120	120	119
	TOFL	4680	4780	4880	4990	5090	5260	5520	5790	6070	6350	6680
30000	V_1	96	96	96	96	96	97	99	101	102	104	106
	V_R	109	109	109	109	109	109	109	110	111	111	112
	V_2	123	123	123	123	122	122	121	120	119	119	118
	TOFL	4850	4960	5070	5170	5280	5460	5730	6020	6320	6630	6990
32000	V_1	101	101	101	101	101	102	104	106	108	109	111
	V_R	113	113	113	113	113	113	114	115	115	116	116
	V_2	122	122	122	122	122	121	120	119	119	118	118
	TOFL	5020	5130	5240	5360	5470	5660	5950	6260	6580	6910	7290
34000	V_1	106	106	106	106	106	107	109	111	113	115	116
	V_R	117	117	117	117	117	118	118	119	120	120	121
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	5190	5310	5420	5540	5650	5860	6160	6490	6840	7190	7650
36000	V_1	111	111	111	111	111	112	114	117	118	120	121
	V_R	121	121	121	121	121	122	123	123	124	124	125
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	5360	5480	5600	5720	5840	6050	6380	6800	7390	7980	8670
38000	V_1	116	116	115	115	115	117	119	121	123	124	126
	V_R	125	125	125	125	125	126	127	127	128	128	129
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	5530	5650	5770	5900	6020	6330	6970	7640	8300	8970	9730
38850	V_1	118	118	117	117	117	119	121	123	125	126	128
	V_R	127	127	127	127	127	127	128	129	129	130	130
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	5750	5870	5990	6110	6230	6640	7320	8010	8710	9410	10220

TODATA9K_WET_F20_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-150. (06-24-32)

WET RUNWAY TAKEOFF DATA
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 10000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

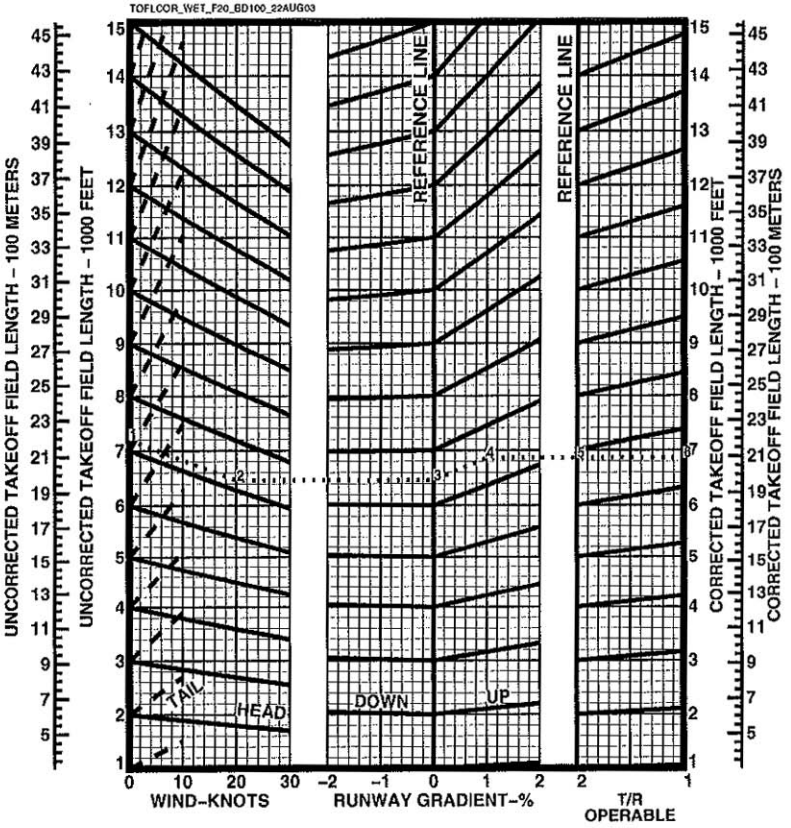
WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	93	93	93	93	94	95	97	98	99	101	103
	V_R	107	107	107	107	107	107	107	107	108	108	109
	V_2	123	123	123	123	123	122	121	120	120	119	118
	TOFL	4900	5010	5120	5220	5370	5590	5870	6170	6470	6790	7170
30000	V_1	97	97	96	98	97	98	100	102	104	105	107
	V_R	109	109	109	109	109	109	110	111	111	112	112
	V_2	122	122	122	122	122	121	120	120	119	118	118
	TOFL	5080	5200	5310	5420	5580	5810	6110	6430	6750	7090	7510
32000	V_1	101	101	101	101	102	103	106	107	109	111	113
	V_R	113	113	113	113	113	114	115	115	116	116	117
	V_2	122	121	121	121	121	120	119	119	118	118	118
	TOFL	5270	5380	5500	5610	5780	6030	6350	6690	7030	7400	7840
34000	V_1	106	106	106	106	107	109	111	113	115	116	118
	V_R	117	117	117	117	117	118	119	120	120	121	121
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	5440	5570	5690	5810	5980	6240	6580	6950	7310	7710	8430
36000	V_1	111	111	111	111	112	114	116	118	120	121	122
	V_R	121	121	121	122	122	122	123	124	124	125	125
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	5620	5750	5870	6000	6180	6460	6820	7460	8080	8740	9550
38000	V_1	116	116	116	116	116	118	121	123	124	125	
	V_R	125	125	125	125	126	126	127	128	128	128	
	V_2	129	129	129	129	129	129	129	129	129	129	
	TOFL	5800	5930	6060	6190	6420	6950	7660	8390	9090	9820	
38850	V_1	118	118	118	118	118	121	123	125	126	127	
	V_R	127	127	127	127	127	128	129	129	130	130	
	V_2	130	130	130	130	130	130	130	130	130	130	
	TOFL	6070	6200	6330	6460	6720	7300	8030	8800	9530	10300	

TODATA10K_WET_F20_ALL_IMP_BD100_07MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure 2-151. (06-24-33)

WET RUNWAY TAKEOFF FIELD LENGTH CORRECTION CHART FLAPS 20°

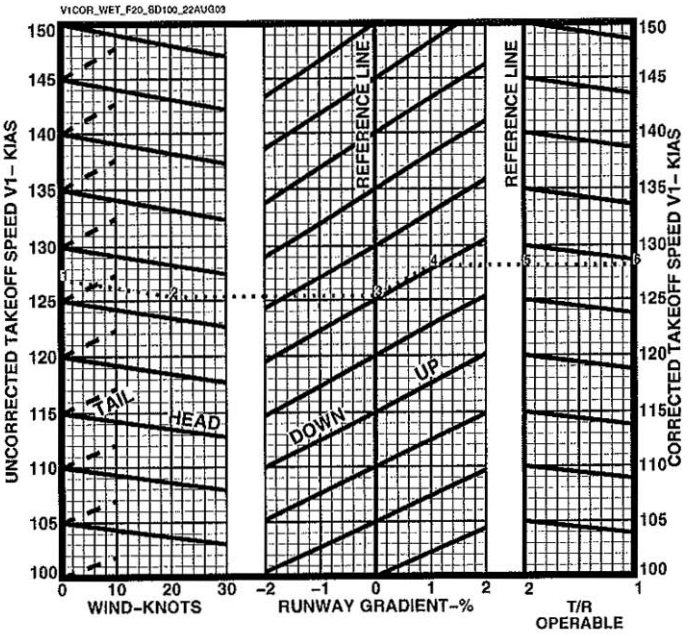


EXAMPLE:

1. Uncorrected Takeoff Field Length (from table).....7200 ft (2200 m)
2. Headwind.....20 kt
3. Runway Gradient Reference Line
4. Runway Gradient.....1.0% UP
5. Two Thrust Reversers
6. Corrected Takeoff Field Length.....6870 ft (2100 m)

Figure 2-152. (06-24-34)

WET RUNWAY TAKEOFF SPEED CORRECTION CHART FOR V1 FLAPS 20°



EXAMPLE:

1. Uncorrected Takeoff Speed (from table).....127 kias
2. Headwind.....20 kt
3. Runway Gradient Reference Line
4. Runway Gradient.....1.0% UP
5. Two Thrust Reversers
6. Corrected Takeoff Speed.....128 kias

NOTES:

1. V1mcg is limiting when the corrected V1 is less than 116 kias. In this case, use V1=116 kias.
2. If the corrected V1 exceeds VR for the appropriate conditions, use V1=

Figure 2-153. (06-24-35)

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REFERENCE CLIMB GRADIENT
FLAPS 20°
ENGINE BLEED OFF

UNCORRECTED REFERENCE CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C													
		–40	–30	–20	–10	0	10	15	20	25	30	35	40	45	50
SEA LEVEL	28000	8.9	9.0	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.0	8.1	7.2	6.0
	30000	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.7	6.9	6.0	5.0
	32000	6.5	6.6	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.6	5.8	5.0	4.0
	34000	5.5	5.5	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.5	4.8	4.0	3.1
	36000	4.6	4.6	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.6	4.0	3.2	2.3
	38000	3.8	3.8	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.8	3.2	2.5	1.6
	38850	3.4	3.5	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.5	2.9	2.2	1.3
1000	28000	9.0	9.0	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	8.3	7.4	6.4	6.3
	30000	7.7	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.8	7.1	6.3	5.3	4.3
	32000	6.6	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.0	5.2	4.3	3.3
	34000	5.5	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.0	4.2	3.4	2.5
	36000	4.6	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.1	3.4	2.6	1.7
	38000	3.8	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.3	2.7	1.9	1.1
	38850	3.5	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.0	2.4	1.6	0.8
2000	28000	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	8.5	7.7	6.8	5.7	4.6
	30000	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.3	6.5	5.6	4.6	3.6
	32000	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.2	5.4	4.6	3.7	2.7
	34000	5.6	5.6	5.7	5.7	5.7	5.7	5.7	5.7	5.6	5.2	4.4	3.7	2.8	1.9
	36000	4.7	4.7	4.7	4.7	4.8	4.8	4.8	4.7	4.7	4.3	3.6	2.9	2.0	1.2
	38000	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.5	2.9	2.2	1.4	0.6
	38850	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.2	2.6	1.9	1.1	0.3
3000	28000	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	8.7	7.9	7.0	6.0	5.0	
	30000	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.5	6.7	5.9	4.9	4.0	
	32000	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.3	5.6	4.8	3.9	3.0	
	34000	5.6	5.6	5.6	5.7	5.7	5.7	5.7	5.6	5.3	4.6	3.9	3.1	2.2	
	36000	4.7	4.7	4.7	4.7	4.8	4.8	4.8	4.7	4.4	3.8	3.1	2.3	1.5	
	38000	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.6	3.0	2.3	1.6	0.8	
	38850	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.3	2.7	2.0	1.3	0.6	
4000	28000	9.1	9.1	9.1	9.1	9.1	9.1	9.1	8.8	8.0	7.2	6.2	5.3	4.3	
	30000	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.6	6.8	6.0	5.2	4.3	3.3	
	32000	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.4	5.7	5.0	4.1	3.3	2.4	
	34000	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.4	4.7	4.0	3.2	2.5	1.6	
	36000	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.5	3.9	3.2	2.5	1.7	1.0	
	38000	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.7	3.1	2.5	1.8	1.1	0.3	
	38850	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.4	2.8	2.2	1.5	0.8	0.1	
5000	28000	9.0	9.1	9.1	9.1	9.1	9.1	8.9	8.1	7.3	6.5	5.5	4.6	3.7	
	30000	7.8	7.8	7.8	7.8	7.8	7.8	7.7	6.9	6.2	5.4	4.5	3.6	2.7	
	32000	6.7	6.7	6.7	6.7	6.7	6.7	6.5	5.8	5.1	4.3	3.5	2.7	1.9	
	34000	5.6	5.6	5.6	5.6	5.6	5.6	5.5	4.8	4.2	3.4	2.6	1.9	1.1	
	36000	4.7	4.7	4.7	4.7	4.7	4.7	4.6	3.9	3.3	2.6	1.9	1.2	0.4	
	38000	3.9	3.9	3.9	3.9	3.9	3.9	3.8	3.2	2.6	1.9	1.2	0.6	–0.2	
	38850	3.6	3.6	3.6	3.6	3.6	3.6	3.5	2.9	2.3	1.6	1.0	0.3	–0.4	

REFCLB1_F20_ZERO_IMP_BD100_23FEB04

Figures in shaded area are above engine temperature limits and are for interpolation only.

Figure 2-154. (06-24-36 Sheet 1 of 2)

REFERENCE CLIMB GRADIENT
FLAPS 20°
ENGINE BLEED OFF

UNCORRECTED REFERENCE CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C											
		–40	–30	–20	–10	0	10	15	20	25	30	35	40
6000	28000	9.1	9.1	9.1	9.1	9.1	8.9	8.2	7.4	6.6	5.8	4.8	3.9
	30000	7.8	7.9	7.9	7.9	7.9	7.7	7.0	6.2	5.5	4.7	3.8	2.9
	32000	6.7	6.7	6.7	6.7	6.7	6.5	5.9	5.2	4.5	3.7	2.9	2.0
	34000	5.6	5.7	5.6	5.6	5.6	5.5	4.9	4.2	3.6	2.9	2.1	1.3
	36000	4.7	4.8	4.7	4.7	4.7	4.6	4.0	3.4	2.8	2.1	1.4	0.6
	38000	3.9	3.9	3.9	3.9	3.9	3.8	3.2	2.7	2.1	1.4	0.7	0.0
	38850	3.6	3.6	3.6	3.6	3.6	3.5	2.9	2.4	1.8	1.2	0.5	–0.2
7000	28000	9.1	9.2	9.2	9.2	9.1	8.3	7.5	6.7	6.0	5.1	4.1	3.2
	30000	7.9	7.9	7.9	7.9	7.8	7.1	6.3	5.6	4.9	4.1	3.2	2.3
	32000	6.7	6.8	6.8	6.8	6.7	6.0	5.2	4.6	3.9	3.1	2.3	1.4
	34000	5.7	5.7	5.7	5.7	5.6	4.9	4.3	3.7	3.0	2.3	1.5	0.7
	36000	4.8	4.8	4.8	4.8	4.7	4.1	3.5	2.9	2.3	1.6	0.8	0.1
	38000	4.0	4.0	4.0	4.0	3.9	3.3	2.7	2.2	1.6	0.9	0.2	–0.5
	38850	3.6	3.7	3.7	3.7	3.6	3.0	2.4	1.9	1.3	0.7	0.0	–0.7
8000	28000	9.2	9.2	9.2	9.2	8.6	7.6	6.8	6.1	5.3	4.4	3.5	
	30000	7.9	7.9	7.9	7.9	7.4	6.4	5.7	5.0	4.3	3.4	2.5	
	32000	6.7	6.8	6.8	6.7	6.2	5.3	4.6	4.0	3.3	2.5	1.7	
	34000	5.7	5.7	5.7	5.7	5.2	4.4	3.7	3.1	2.5	1.7	0.9	
	36000	4.8	4.8	4.8	4.8	4.3	3.5	2.9	2.4	1.8	1.0	0.3	
	38000	4.0	4.0	4.0	4.0	3.6	2.8	2.2	1.7	1.1	0.4	–0.3	
	38850	3.7	3.7	3.7	3.7	3.3	2.5	1.9	1.4	0.9	0.2	–0.5	
9000	28000	9.0	9.0	9.0	8.8	7.9	6.9	6.2	5.5	4.7	3.7	2.8	
	30000	7.8	7.8	7.8	7.5	6.7	5.8	5.1	4.4	3.7	2.8	1.9	
	32000	6.6	6.6	6.6	6.4	5.6	4.7	4.1	3.4	2.7	1.9	1.0	
	34000	5.5	5.5	5.5	5.4	4.6	3.8	3.2	2.6	1.9	1.2	0.4	
	36000	4.7	4.7	4.7	4.5	3.8	3.0	2.4	1.9	1.2	0.5	–0.3	
	38000	3.9	3.9	3.9	3.7	3.0	2.3	1.7	1.2	0.6	–0.1	–0.8	
	38850	3.6	3.6	3.6	3.4	2.7	2.0	1.5	1.0	0.4	–0.3	–1.0	
10000	28000	8.6	8.6	8.6	8.0	7.1	6.2	5.5	4.9	4.0	3.1	2.1	
	30000	7.4	7.4	7.4	6.9	6.0	5.1	4.5	3.8	3.1	2.2	1.2	
	32000	6.3	6.3	6.3	5.8	4.9	4.1	3.5	2.9	2.2	1.3	0.4	
	34000	5.2	5.2	5.2	4.8	4.0	3.3	2.7	2.1	1.4	0.6	–0.2	
	36000	4.4	4.4	4.4	3.9	3.2	2.5	1.9	1.4	0.8	0.0	–0.8	
	38000	3.6	3.6	3.6	3.2	2.5	1.8	1.3	0.8	0.2	–0.6	–1.3	
	38850	3.3	3.3	3.3	2.9	2.2	1.5	1.0	0.5	–0.1	–0.8	–1.5	

REFCL62_F20_ZERO_IMP_SD100_23FEB04

Figures in shaded area are above engine temperature limits and are for interpolation only.

Figure 2-154. (06-24-36 Sheet 2 of 2)

REFERENCE CLIMB GRADIENT
FLAPS 20°
ENGINE BLEED ON

UNCORRECTED REFERENCE CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
SEA LEVEL	28000	8.8	8.9	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.4	7.6	6.7	5.5
	30000	7.6	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.2	6.5	5.6	4.5
	32000	6.5	6.5	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.1	5.4	4.5	3.5
	34000	5.4	5.5	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.1	4.4	3.6	2.7
	36000	4.5	4.6	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.2	3.6	2.8	1.9
	38000	3.7	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.4	2.8	2.1	1.2
	38850	3.4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.1	2.5	1.8	1.0
1000	28000	8.9	9.0	9.0	9.1	9.1	9.1	9.1	9.1	9.1	8.7	7.8	6.9	5.9	4.8
	30000	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.5	6.6	5.8	4.9	3.8
	32000	6.6	6.6	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.3	5.5	4.8	3.9	2.9
	34000	5.5	5.5	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.3	4.6	3.8	3.0	2.1
	36000	4.6	4.6	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.4	3.7	3.0	2.2	1.4
	38000	3.8	3.8	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.6	3.0	2.3	1.5	0.7
	38850	3.5	3.5	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.3	2.7	2.0	1.3	0.5
2000	28000	9.0	9.0	9.1	9.1	9.1	9.1	9.1	9.1	8.8	8.0	7.2	6.3	5.2	4.1
	30000	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.6	6.8	6.0	5.2	4.2	3.2
	32000	6.6	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.5	5.7	5.0	4.2	3.2	2.3
	34000	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.4	4.7	4.0	3.3	2.4	1.5
	36000	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.5	3.9	3.2	2.5	1.7	0.8
	38000	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.7	3.1	2.5	1.8	1.0	0.2
	38850	3.5	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.4	2.8	2.2	1.5	0.7	0.0
3000	28000	9.0	9.1	9.1	9.1	9.1	9.1	9.1	8.9	8.1	7.3	6.5	5.5	4.5	
	30000	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.7	6.9	6.2	5.4	4.5	3.5	
	32000	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.5	5.8	5.1	4.3	3.5	2.6	
	34000	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.5	4.8	4.2	3.4	2.6	1.8	
	36000	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.6	4.0	3.3	2.6	1.9	1.1	
	38000	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.8	3.2	2.6	1.9	1.2	0.5	
	38850	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.5	2.9	2.3	1.7	1.0	0.2	
4000	28000	9.0	9.0	9.0	9.1	9.1	9.1	9.0	8.3	7.5	6.6	5.7	4.8	3.9	
	30000	7.8	7.8	7.8	7.8	7.8	7.8	7.7	7.1	6.3	5.5	4.7	3.8	2.9	
	32000	6.6	6.6	6.7	6.7	6.7	6.7	6.6	5.9	5.2	4.5	3.7	2.9	2.0	
	34000	5.6	5.6	5.6	5.6	5.6	5.6	5.5	4.9	4.3	3.6	2.8	2.0	1.3	
	36000	4.7	4.7	4.7	4.7	4.7	4.7	4.6	4.1	3.4	2.8	2.1	1.3	0.6	
	38000	3.9	3.9	3.9	3.9	3.9	3.9	3.8	3.3	2.7	2.1	1.4	0.7	0.0	
	38850	3.5	3.6	3.6	3.6	3.6	3.6	3.5	3.0	2.4	1.8	1.1	0.5	-0.2	
5000	28000	9.0	9.0	9.0	9.0	9.0	9.0	8.4	7.6	6.8	5.9	5.0	4.1	3.2	
	30000	7.8	7.8	7.8	7.8	7.8	7.7	7.2	6.4	5.7	4.9	4.0	3.2	2.3	
	32000	6.6	6.6	6.6	6.6	6.6	6.6	6.0	5.3	4.6	3.9	3.0	2.3	1.5	
	34000	5.6	5.6	5.6	5.6	5.6	5.5	5.0	4.3	3.7	3.0	2.2	1.5	0.7	
	36000	4.7	4.7	4.7	4.7	4.7	4.6	4.1	3.5	2.9	2.2	1.5	0.8	0.1	
	38000	3.9	3.9	3.9	3.9	3.9	3.8	3.4	2.8	2.2	1.5	0.9	0.2	-0.5	
	38850	3.5	3.6	3.6	3.6	3.6	3.5	3.1	2.5	1.9	1.3	0.6	0.0	-0.7	

REFCLB1_F20_ECS_IMP_BD100_23FEB04

Figures in shaded area are above engine temperature limits and are for interpolation only.

Figure 2-155. (06-24-37 Sheet 1 of 2)

REFERENCE CLIMB GRADIENT
FLAPS 20°
ENGINE BLEED ON

UNCORRECTED REFERENCE CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C											
		–40	–30	–20	–10	0	10	15	20	25	30	35	40
6000	28000	9.0	9.1	9.1	9.1	9.1	8.4	7.6	6.9	6.1	5.3	4.3	3.4
	30000	7.8	7.8	7.8	7.8	7.8	7.2	6.5	5.7	5.0	4.2	3.4	2.5
	32000	6.6	6.7	6.7	6.7	6.7	6.1	5.4	4.7	4.0	3.3	2.4	1.6
	34000	5.6	5.6	5.6	5.6	5.6	5.1	4.4	3.8	3.1	2.4	1.7	0.9
	36000	4.7	4.7	4.7	4.7	4.7	4.2	3.6	3.0	2.4	1.7	1.0	0.3
	38000	3.9	3.9	3.9	3.9	3.9	3.4	2.8	2.3	1.7	1.0	0.4	–0.3
	38850	3.6	3.6	3.6	3.6	3.6	3.1	2.5	2.0	1.4	0.8	0.1	–0.6
7000	28000	9.1	9.1	9.1	9.1	9.1	7.7	6.9	6.2	5.5	4.6	3.7	2.7
	30000	7.9	7.9	7.9	7.9	7.8	6.5	5.8	5.1	4.4	3.6	2.7	1.8
	32000	6.7	6.7	6.7	6.7	6.6	5.4	4.8	4.1	3.5	2.7	1.8	1.0
	34000	5.6	5.7	5.7	5.7	5.6	4.5	3.8	3.2	2.6	1.9	1.1	0.3
	36000	4.7	4.8	4.8	4.8	4.7	3.6	3.0	2.5	1.9	1.2	0.4	–0.3
	38000	3.9	4.0	3.9	3.9	3.9	2.9	2.3	1.8	1.2	0.5	–0.2	–0.8
	38850	3.6	3.6	3.6	3.6	3.6	2.6	2.0	1.5	1.0	0.3	–0.4	–1.0
8000	28000	9.1	9.1	9.1	9.1	8.5	7.0	6.3	5.6	4.8	3.9	3.0	
	30000	7.9	7.9	7.9	7.9	7.3	5.9	5.2	4.5	3.8	3.0	2.1	
	32000	6.7	6.7	6.7	6.7	6.2	4.8	4.2	3.5	2.9	2.1	1.2	
	34000	5.6	5.7	5.6	5.6	5.2	3.9	3.3	2.7	2.1	1.3	0.5	
	36000	4.7	4.8	4.8	4.7	4.3	3.1	2.5	2.0	1.4	0.6	–0.1	
	38000	3.9	4.0	3.9	3.9	3.5	2.4	1.8	1.3	0.7	0.0	–0.7	
	38850	3.6	3.6	3.6	3.6	3.2	2.1	1.5	1.0	0.5	–0.2	–0.8	
9000	28000	9.0	9.0	9.0	8.7	7.8	6.3	5.6	4.9	4.2	3.2	2.3	
	30000	7.7	7.7	7.7	7.5	6.6	5.2	4.6	3.9	3.2	2.3	1.4	
	32000	6.6	6.6	6.6	6.4	5.5	4.2	3.6	3.0	2.3	1.5	0.6	
	34000	5.5	5.5	5.5	5.3	4.6	3.3	2.7	2.2	1.5	0.8	–0.1	
	36000	4.6	4.6	4.6	4.5	3.7	2.6	2.0	1.5	0.8	0.1	–0.6	
	38000	3.8	3.8	3.8	3.7	3.0	1.9	1.3	0.8	0.2	–0.5	–1.1	
	38850	3.5	3.5	3.5	3.4	2.7	1.6	1.1	0.6	0.0	–0.7	–1.3	
10000	28000	8.5	8.6	8.6	8.0	7.1	5.7	5.0	4.3	3.5	2.6	1.6	
	30000	7.3	7.3	7.3	6.8	6.0	4.6	4.0	3.4	2.6	1.7	0.8	
	32000	6.2	6.2	6.2	5.7	4.9	3.6	3.0	2.4	1.7	0.9	0.0	
	34000	5.2	5.2	5.2	4.7	4.0	2.8	2.2	1.7	1.0	0.2	–0.6	
	36000	4.3	4.3	4.3	3.9	3.2	2.0	1.5	1.0	0.4	–0.4	–1.1	
	38000	3.6	3.6	3.6	3.1	2.5	1.4	0.9	0.4	–0.2	–0.9	–1.6	
	38850	3.3	3.3	3.3	2.9	2.2	1.1	0.6	0.2	–0.5	–1.1	–1.8	

REFCLB2_F20_ECS_JMP_BD100_23FEB04

Figures in shaded area are above engine temperature limits and are for interpolation only.

Figure 2-155. (06-24-37 Sheet 2 of 2)

REFERENCE CLIMB GRADIENT
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

UNCORRECTED REFERENCE CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
SEA LEVEL	28000	8.8	8.8	8.9	8.9	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	30000	7.6	7.6	7.6	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7
	32000	6.4	6.5	6.5	6.5	6.6	6.6	6.6	6.6	6.6	6.6	6.6
	34000	5.4	5.4	5.4	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
	36000	4.5	4.5	4.5	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
	38000	3.7	3.7	3.7	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
	38850	3.4	3.4	3.4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
1000	28000	8.9	8.9	8.9	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	30000	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.7
	32000	6.5	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
	34000	5.5	5.5	5.5	5.5	5.6	5.6	5.6	5.6	5.6	5.6	5.5
	36000	4.6	4.6	4.6	4.6	4.7	4.7	4.7	4.7	4.7	4.7	4.6
	38000	3.8	3.8	3.8	3.8	3.9	3.9	3.9	3.9	3.9	3.9	3.8
	38850	3.4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
2000	28000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.1	9.1	9.1	8.5
	30000	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.3
	32000	6.6	6.6	6.6	6.6	6.7	6.7	6.7	6.7	6.7	6.7	6.2
	34000	5.5	5.5	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.1
	36000	4.6	4.6	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.3
	38000	3.8	3.8	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.5
	38850	3.5	3.5	3.5	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.2
3000	28000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.1	9.1	8.6	7.7
	30000	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.3	6.5
	32000	6.6	6.6	6.6	6.7	6.7	6.7	6.7	6.7	6.7	6.2	5.5
	34000	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.2	4.5
	36000	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.3	3.6
	38000	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.5	2.9
	38850	3.5	3.5	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.2	2.6
4000	28000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.7	7.8	6.9
	30000	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.5	6.6	5.8
	32000	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.4	5.5	4.8
	34000	5.5	5.5	5.6	5.6	5.6	5.6	5.6	5.6	5.3	4.5	3.8
	36000	4.6	4.6	4.7	4.7	4.7	4.7	4.7	4.7	4.4	3.7	3.0
	38000	3.8	3.8	3.9	3.9	3.9	3.9	3.9	3.9	3.7	3.0	2.3
	38850	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.3	2.7	2.0
5000	28000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.9	7.9	7.0	6.2
	30000	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.7	6.7	5.9	5.1
	32000	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	5.6	4.8	4.1
	34000	5.5	5.5	5.6	5.5	5.6	5.6	5.6	5.5	4.6	3.9	3.2
	36000	4.6	4.6	4.7	4.7	4.7	4.7	4.7	4.6	3.8	3.1	2.5
	38000	3.8	3.8	3.9	3.8	3.9	3.9	3.9	3.8	3.0	2.4	1.8
	38850	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	2.7	2.1	1.5

REFCLB1_F20_ALL_IMP_BD100_23FEB04

Figure 2-156. (06-24-38 Sheet 1 of 2)

REFERENCE CLIMB GRADIENT
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

UNCORRECTED REFERENCE CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
6000	28000	9.0	9.0	9.1	9.1	9.1	9.1	9.0	8.2	7.1	6.3	5.5
	30000	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.0	6.0	5.2	4.5
	32000	6.6	6.7	6.7	6.7	6.7	6.7	6.6	5.9	5.0	4.2	3.5
	34000	5.6	5.6	5.6	5.6	5.6	5.6	5.6	4.9	4.0	3.3	2.6
	36000	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.0	3.2	2.5	1.9
	38000	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.3	2.5	1.8	1.3
	38850	3.5	3.6	3.6	3.6	3.6	3.6	3.6	3.0	2.2	1.6	1.0
7000	28000	9.1	9.1	9.1	9.1	9.1	9.1	8.6	7.4	6.4	5.6	4.8
	30000	7.8	7.9	7.9	7.9	7.9	7.9	7.4	6.2	5.3	4.5	3.8
	32000	6.7	6.7	6.7	6.7	6.7	6.7	6.2	5.2	4.3	3.6	2.9
	34000	5.6	5.6	5.6	5.6	5.6	5.6	5.2	4.2	3.4	2.7	2.1
	36000	4.7	4.7	4.7	4.7	4.7	4.7	4.3	3.4	2.6	2.0	1.4
	38000	3.9	3.9	3.9	3.9	3.9	3.9	3.5	2.6	1.9	1.3	0.8
	38850	3.6	3.6	3.6	3.6	3.6	3.6	3.2	2.4	1.7	1.1	0.5
8000	28000	9.1	9.1	9.1	9.1	9.1	9.0	7.7	6.6	5.7	4.9	4.2
	30000	7.8	7.9	7.9	7.9	7.9	7.7	6.6	5.5	4.6	3.9	3.2
	32000	6.7	6.7	6.7	6.7	6.7	6.6	5.5	4.5	3.7	3.0	2.3
	34000	5.6	5.6	5.6	5.6	5.6	5.5	4.5	3.6	2.8	2.2	1.5
	36000	4.7	4.7	4.7	4.7	4.7	4.6	3.7	2.8	2.1	1.4	0.9
	38000	3.9	3.9	3.9	3.9	3.9	3.8	2.9	2.1	1.4	0.8	0.3
	38850	3.6	3.6	3.6	3.6	3.6	3.5	2.6	1.8	1.1	0.6	0.0
9000	28000	8.9	8.9	8.9	9.0	8.9	8.1	6.9	5.9	5.0	4.3	3.5
	30000	7.7	7.7	7.7	7.7	7.7	6.9	5.8	4.8	4.0	3.3	2.5
	32000	6.6	6.6	6.6	6.6	6.5	5.8	4.8	3.8	3.1	2.4	1.7
	34000	5.5	5.5	5.5	5.5	5.5	4.8	3.8	3.0	2.2	1.6	1.0
	36000	4.6	4.6	4.6	4.6	4.6	3.9	3.0	2.2	1.5	0.9	0.3
	38000	3.8	3.8	3.8	3.8	3.8	3.2	2.3	1.5	0.9	0.3	–0.3
	38850	3.5	3.5	3.5	3.5	3.5	2.9	2.0	1.3	0.6	0.1	–0.5
10000	28000	8.5	8.5	8.5	8.6	8.2	7.3	6.1	5.2	4.4	3.6	2.8
	30000	7.3	7.3	7.3	7.3	7.0	6.1	5.1	4.1	3.4	2.7	1.9
	32000	6.2	6.2	6.2	6.2	5.9	5.1	4.1	3.2	2.5	1.8	1.1
	34000	5.2	5.2	5.2	5.2	4.9	4.1	3.2	2.4	1.7	1.1	0.4
	36000	4.3	4.3	4.3	4.3	4.1	3.3	2.4	1.6	1.0	0.4	–0.2
	38000	3.6	3.6	3.6	3.6	3.3	2.6	1.7	1.0	0.4	–0.1	–0.7
	38850	3.3	3.3	3.3	3.3	3.0	2.3	1.5	0.8	0.2	–0.4	–0.9

REFCL82_F20_ALL_IMP_BD100_23FEB04

Figure 2-156. (06-24-38 Sheet 2 of 2)

FlightSafety international
CHALLENGER 300 PERFORMANCE MANUAL

REFERENCE CLIMB GRADIENT CORRECTION CHART FLAPS 20°

EXAMPLE:

1. Uncorrected Reference Climb Gradient (from table).....5.8%
2. Gross Level–off Height.....600 ft
3. Wind Reference Line
4. Headwind.....10 kt
5. Corrected Reference Climb Gradient.....6.0%

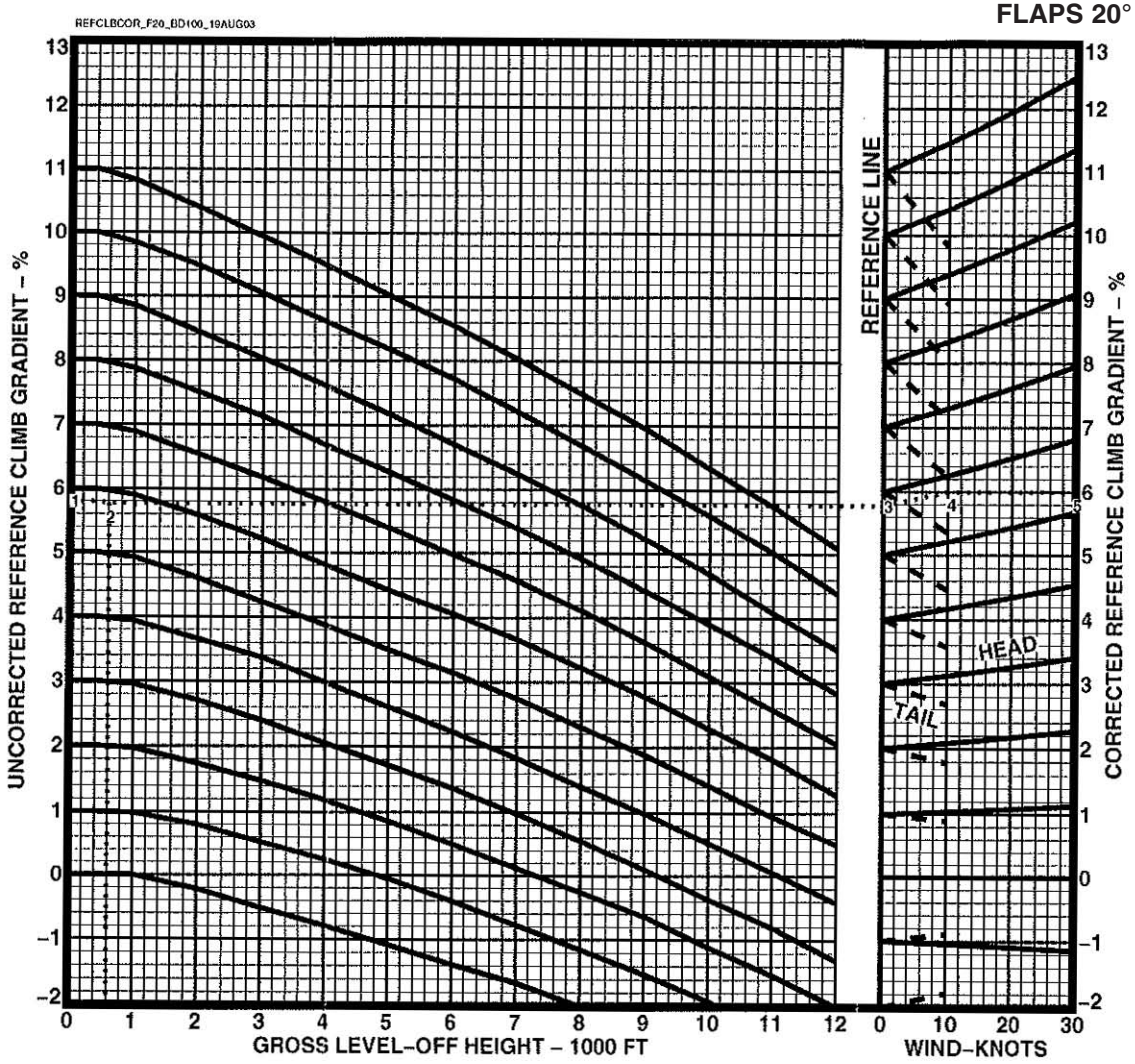
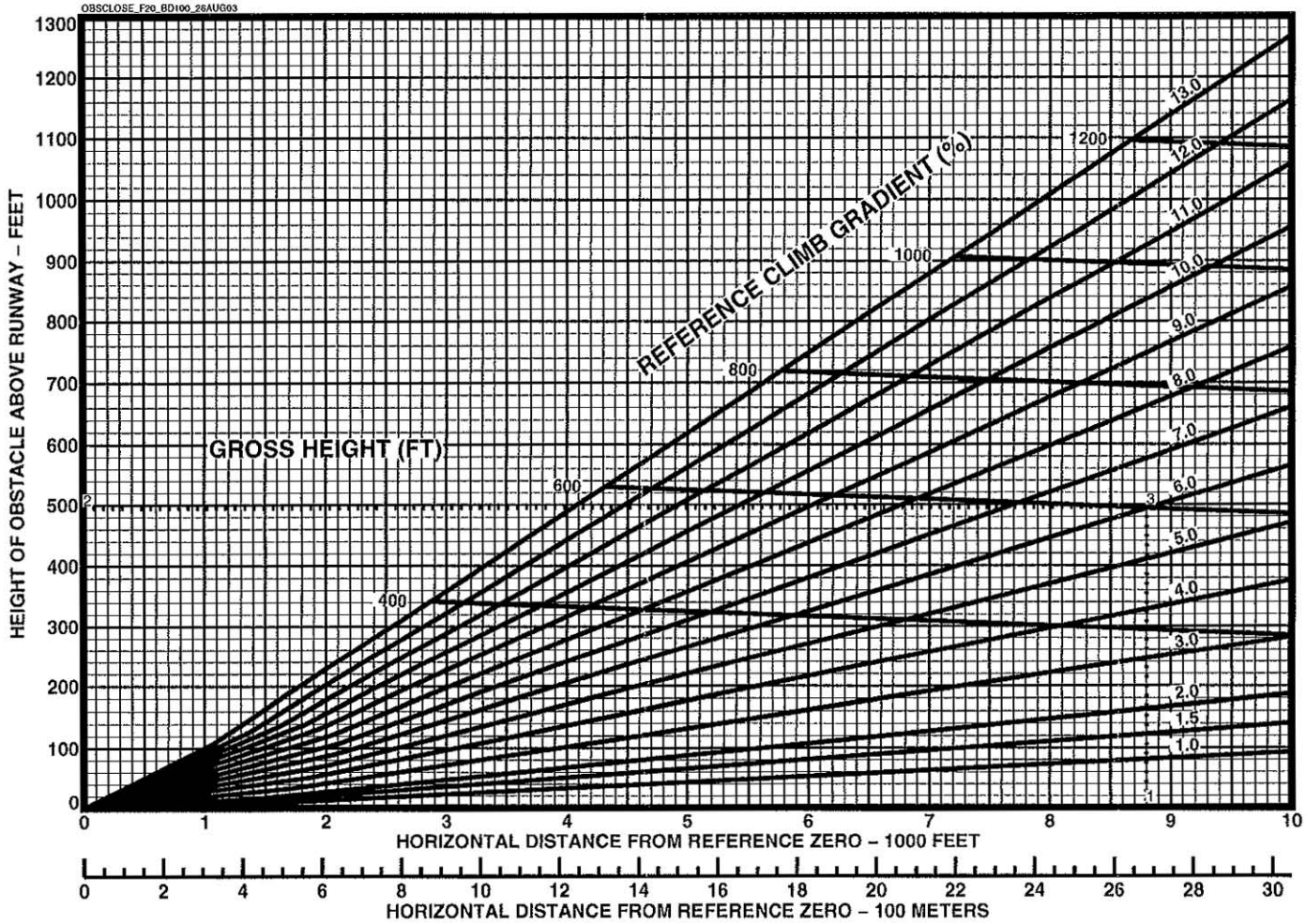


Figure 2-157. (06-24-39)

FOR TRAINING PURPOSES ONLY

FlightSafety international
CHALLENGER 300 PERFORMANCE MANUAL

CLOSE-IN TAKEOFF FLIGHT PATH
FLAPS 20°



EXAMPLE:

1. Obstacle Distance
   (Horizontal from Reference Zero).....8800 ft (2680 m)
2. Obstacle Height
   (Above runway surface).....495 ft
3. Required Reference Climb Gradient.....6.0 %
   Gross Height.....600 ft

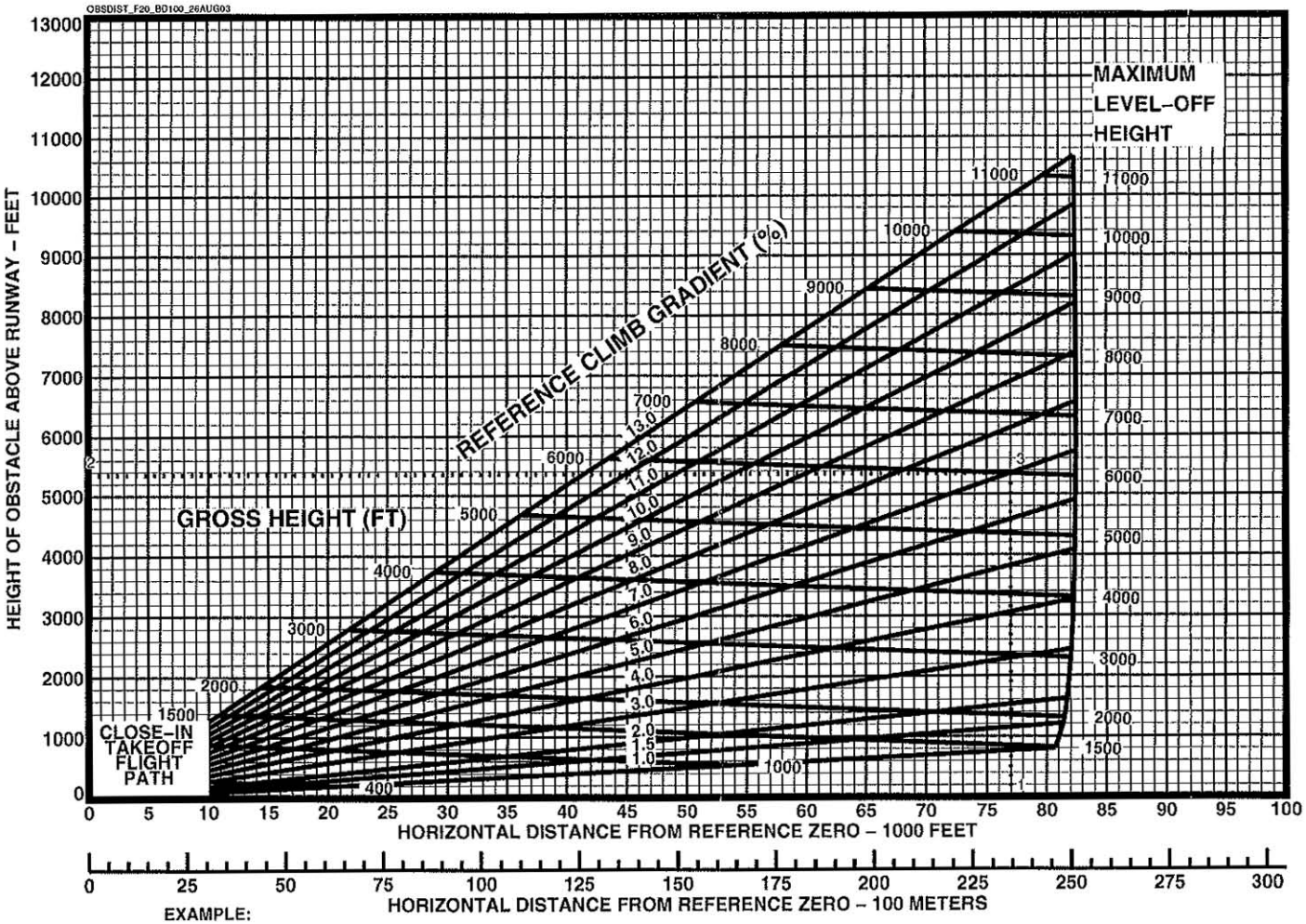
NOTE: To determine the indicated altitude when obstacle clearance has been achieved, consult the GEOMETRIC HEIGHT TO PRESSURE HEIGHT CONVERSION chart.

Figure 2-158. (06-24-40)

FOR TRAINING PURPOSES ONLY

FlightSafety international
CHALLENGER 300 PERFORMANCE MANUAL

DISTANCE TAKEOFF FLIGHT PATH
FLAPS 20°



EXAMPLE:

1. Obstacle Distance
   (Horizontal from Reference Zero).....77000 ft (23470 m)
2. Obstacle Height
   (Above runway surface).....5350 ft
3. Required Reference Climb Gradient.....7.0%
   Gross Level–Off Height.....6000 ft

NOTE: To determine the indicated altitude when obstacle clearance has been achieved, consult the GEOMETRIC HEIGHT TO PRESSURE HEIGHT CONVERSION chart.

Figure 2-159. (06-24-41)

FOR TRAINING PURPOSES ONLY

TRANSITION SEGMENT
DISTANCE TO ACCELERATE FROM V2 TO FINAL SEGMENT SPEED

FLAPS – 10°, GEAR – UP

Initial Speed.....V2
Initial Flaps.....10°
Transition Speed.....V2+15 KIAS
Final Flaps.....0°
Final Speed.....Final Segment Speed = 170 KIAS

FLAPS 10° DISTANCE TO ACCELERATE FROM V2 TO FINAL SEGMENT SPEED – 1000 FT											
CORRECTED REFERENCE CLIMB GRADIENT – %											
1	2	3	4	5	6	7	8	9	10	11	12
85.73	60.48	48.84	41.34	35.83	31.48	27.87	24.76	22.00	19.49	17.16	14.94

FLAPS – 20°, GEAR – UP

Initial Speed.....V2
Initial Flaps.....20°
Transition Speed.....V2+25 KIAS
Final Flaps.....0°
Final Speed.....Final Segment Speed = 170 KIAS

FLAPS 20° DISTANCE TO ACCELERATE FROM V2 TO FINAL SEGMENT SPEED – 1000 FT											
CORRECTED REFERENCE CLIMB GRADIENT – %											
1	2	3	4	5	6	7	8	9	10	11	12
106.39	66.86	53.19	44.84	38.86	34.20	30.36	27.08	24.18	21.56	19.13	16.83

ACCDIST_F10F20_ZERO_IMP_BD100_20AUG03

Note: The Final Segment Speed is equal to the Enroute Climb Speed.
At takeoff altitudes, this speed is always 170 KIAS.

Figure 2-160. (06-24-42)

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NET FINAL SEGMENT CLIMB GRADIENT AND SPEED
SINGLE ENGINE
ENGINE BLEED ON

NET FINAL SEGMENT CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C													
		-40	-30	-20	-10	0	10	15	20	25	30	35	40	45	50
SEA LEVEL	28000	10.5	10.6	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.2	9.2	8.1	7.0	5.9
	30000	9.3	9.4	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.1	8.2	7.1	6.1	5.1
	32000	8.3	8.4	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.1	7.2	6.3	5.3	4.4
	34000	7.4	7.5	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.2	6.4	5.5	4.6	3.7
	36000	6.6	6.7	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.4	5.6	4.8	4.0	3.1
	38000	5.9	5.9	6.0	6.0	6.0	6.0	6.0	6.0	6.0	5.7	4.9	4.1	3.4	2.6
	38850	5.6	5.6	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.4	4.7	3.9	3.1	2.3
1000	28000	10.6	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.3	9.4	8.4	7.4	6.3	5.3
	30000	9.5	9.5	9.6	9.6	9.6	9.6	9.6	9.6	9.2	8.4	7.4	6.5	5.5	4.5
	32000	8.5	8.5	8.6	8.6	8.6	8.6	8.6	8.6	8.2	7.4	6.6	5.7	4.7	3.8
	34000	7.5	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.3	6.6	5.8	4.9	4.0	3.2
	36000	6.7	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.5	5.8	5.1	4.2	3.4	2.6
	38000	6.0	6.0	6.1	6.1	6.1	6.1	6.1	6.1	5.8	5.1	4.4	3.6	2.8	2.1
	38850	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.5	4.8	4.1	3.4	2.6	1.9
2000	28000	10.7	10.7	10.8	10.8	10.8	10.8	10.8	10.6	9.6	8.7	7.7	6.7	5.6	4.6
	30000	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.5	8.5	7.7	6.8	5.8	4.8	3.9
	32000	8.5	8.6	8.6	8.6	8.6	8.6	8.6	8.5	7.6	6.8	5.9	5.0	4.1	3.3
	34000	7.6	7.7	7.7	7.7	7.7	7.7	7.7	7.6	6.7	6.0	5.2	4.3	3.5	2.7
	36000	6.8	6.8	6.9	6.9	6.9	6.9	6.9	6.7	5.9	5.3	4.5	3.7	2.9	2.1
	38000	6.0	6.1	6.1	6.1	6.1	6.1	6.1	6.0	5.2	4.6	3.8	3.1	2.3	1.6
	38850	5.7	5.8	5.8	5.8	5.8	5.8	5.8	5.7	4.9	4.3	3.6	2.9	2.1	1.4
3000	28000	10.7	10.7	10.7	10.7	10.7	10.7	10.6	9.9	8.9	7.9	7.0	5.9	5.0	
	30000	9.6	9.6	9.6	9.6	9.6	9.6	9.4	8.8	7.9	7.0	6.1	5.1	4.2	
	32000	8.5	8.6	8.6	8.6	8.6	8.6	8.4	7.8	7.0	6.1	5.3	4.4	3.5	
	34000	7.6	7.7	7.7	7.7	7.7	7.7	7.5	7.0	6.1	5.4	4.6	3.8	2.9	
	36000	6.8	6.8	6.8	6.8	6.8	6.8	6.7	6.2	5.4	4.7	3.9	3.1	2.4	
	38000	6.0	6.1	6.1	6.1	6.1	6.1	6.0	5.5	4.7	4.0	3.3	2.6	1.8	
	38850	5.7	5.8	5.8	5.8	5.8	5.8	5.7	5.2	4.4	3.8	3.1	2.4	1.6	
4000	28000	10.7	10.7	10.7	10.7	10.7	10.7	10.1	9.1	8.1	7.2	6.2	5.3	4.3	
	30000	9.6	9.6	9.6	9.6	9.6	9.6	9.0	8.1	7.2	6.3	5.4	4.5	3.6	
	32000	8.5	8.6	8.6	8.6	8.6	8.6	8.0	7.2	6.3	5.5	4.7	3.8	3.0	
	34000	7.6	7.7	7.7	7.7	7.7	7.7	7.1	6.4	5.5	4.8	4.0	3.2	2.4	
	36000	6.8	6.8	6.8	6.8	6.8	6.8	6.3	5.6	4.8	4.1	3.4	2.6	1.9	
	38000	6.0	6.1	6.1	6.1	6.1	6.1	5.6	4.9	4.2	3.5	2.8	2.1	1.4	
	38850	5.7	5.8	5.8	5.8	5.8	5.8	5.3	4.6	3.9	3.2	2.6	1.9	1.2	
5000	28000	10.7	10.7	10.7	10.7	10.7	10.1	9.3	8.4	7.4	6.5	5.5	4.6	3.7	
	30000	9.5	9.6	9.6	9.6	9.6	9.0	8.3	7.5	6.5	5.7	4.7	3.9	3.0	
	32000	8.5	8.6	8.6	8.6	8.6	8.1	7.4	6.6	5.7	4.9	4.0	3.2	2.4	
	34000	7.6	7.6	7.6	7.6	7.6	7.2	6.5	5.8	4.9	4.2	3.4	2.6	1.9	
	36000	6.8	6.8	6.8	6.8	6.8	6.4	5.8	5.1	4.2	3.6	2.8	2.1	1.4	
	38000	6.0	6.1	6.1	6.1	6.1	5.6	5.1	4.4	3.6	3.0	2.3	1.6	0.9	
	38850	5.7	5.7	5.7	5.7	5.7	5.3	4.8	4.1	3.4	2.7	2.1	1.4	0.7	

FTOCLB1_F0_ECS_MP_BD100_25FEB04

Figures in shaded area are beyond engine temperature limits and are for interpolation only.

Final Segment Climb Speed = 170 kias

Gross Gradient = Net Gradient + 0.8%

Figure 2-161. (06-25-01 Sheet 1 of 2)

NET FINAL SEGMENT CLIMB GRADIENT AND SPEED
SINGLE ENGINE
ENGINE BLEED ON

NET FINAL SEGMENT CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C											
		–40	–30	–20	–10	0	10	15	20	25	30	35	40
6000	28000	10.6	10.7	10.7	10.7	10.7	9.4	8.6	7.7	6.7	5.8	4.8	3.9
	30000	9.5	9.6	9.6	9.6	9.6	8.4	7.6	6.7	5.8	5.0	4.1	3.3
	32000	8.5	8.5	8.5	8.5	8.5	7.4	6.7	5.9	5.0	4.3	3.5	2.7
	34000	7.6	7.6	7.6	7.6	7.6	6.6	5.9	5.2	4.3	3.6	2.8	2.1
	36000	6.8	6.8	6.8	6.8	6.8	5.8	5.2	4.5	3.7	3.0	2.3	1.6
	38000	6.0	6.0	6.0	6.0	6.0	5.1	4.5	3.8	3.1	2.5	1.8	1.1
	38850	5.7	5.7	5.7	5.7	5.7	4.8	4.3	3.6	2.9	2.2	1.6	0.9
7000	28000	10.7	10.7	10.7	10.7	10.3	8.7	7.9	6.9	6.0	5.1	4.2	3.3
	30000	9.6	9.6	9.6	9.6	9.2	7.7	7.0	6.1	5.2	4.3	3.5	2.7
	32000	8.5	8.6	8.6	8.6	8.2	6.8	6.1	5.3	4.5	3.6	2.9	2.1
	34000	7.6	7.7	7.7	7.7	7.3	6.0	5.4	4.6	3.8	3.0	2.3	1.6
	36000	6.8	6.8	6.8	6.8	6.5	5.3	4.7	3.9	3.2	2.5	1.8	1.1
	38000	6.0	6.1	6.1	6.1	5.8	4.6	4.0	3.3	2.6	1.9	1.3	0.7
	38850	5.7	5.8	5.8	5.8	5.5	4.3	3.8	3.1	2.4	1.7	1.1	0.5
8000	28000	10.8	10.8	10.8	10.7	9.6	8.0	7.2	6.2	5.3	4.4	3.6	
	30000	9.6	9.6	9.6	9.6	8.6	7.1	6.3	5.4	4.5	3.7	2.9	
	32000	8.6	8.6	8.6	8.6	7.6	6.2	5.5	4.7	3.8	3.1	2.3	
	34000	7.7	7.7	7.7	7.7	6.8	5.4	4.8	4.0	3.2	2.5	1.8	
	36000	6.9	6.9	6.9	6.8	6.0	4.7	4.1	3.4	2.6	1.9	1.3	
	38000	6.1	6.1	6.1	6.1	5.3	4.1	3.5	2.8	2.1	1.4	0.8	
	38850	5.8	5.8	5.8	5.8	5.0	3.8	3.3	2.6	1.9	1.2	0.6	
9000	28000	10.7	10.7	10.7	10.5	8.9	7.4	6.5	5.6	4.6	3.8	3.0	
	30000	9.5	9.5	9.5	9.4	7.9	6.5	5.7	4.8	3.9	3.1	2.4	
	32000	8.5	8.5	8.5	8.4	7.0	5.7	4.9	4.1	3.3	2.5	1.8	
	34000	7.6	7.6	7.6	7.5	6.2	4.9	4.2	3.5	2.7	2.0	1.3	
	36000	6.8	6.8	6.8	6.6	5.4	4.2	3.6	2.9	2.1	1.4	0.8	
	38000	6.0	6.0	6.0	5.9	4.7	3.6	3.0	2.3	1.6	1.0	0.4	
	38850	5.7	5.7	5.7	5.6	4.5	3.4	2.8	2.1	1.4	0.8	0.2	
10000	28000	10.6	10.6	10.6	9.9	8.2	6.7	5.9	4.9	3.9	3.2	2.4	
	30000	9.5	9.5	9.5	8.8	7.2	5.9	5.1	4.2	3.3	2.5	1.8	
	32000	8.5	8.5	8.5	7.9	6.4	5.1	4.4	3.5	2.6	2.0	1.3	
	34000	7.6	7.6	7.5	7.0	5.6	4.4	3.7	2.9	2.1	1.5	0.8	
	36000	6.7	6.7	6.7	6.2	4.9	3.8	3.1	2.3	1.6	1.0	0.4	
	38000	6.0	6.0	6.0	5.5	4.2	3.2	2.6	1.8	1.1	0.5	0.0	
	38850	5.7	5.7	5.7	5.2	4.0	2.9	2.3	1.6	0.9	0.4	–0.2	

FTOCLB2_FO_ECS_IMP_BD100_25FEB04

Figures in shaded area are beyond engine temperature limits and are for interpolation only.

Final Segment Climb Speed = 170 kias

Gross Gradient = Net Gradient + 0.8%

Figure 2-161. (06-25-01 Sheet 2 of 2)

NET FINAL SEGMENT CLIMB GRADIENT AND SPEED
SINGLE ENGINE
ENGINE BLEED ON, ENGINE AND WING A/I ON

NET FINAL SEGMENT CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
SEA LEVEL	28000	10.4	10.5	10.5	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6
	30000	9.3	9.3	9.4	9.4	9.5	9.5	9.5	9.5	9.5	9.5	9.5
	32000	8.3	8.3	8.4	8.4	8.5	8.5	8.5	8.5	8.5	8.5	8.5
	34000	7.4	7.4	7.5	7.5	7.6	7.6	7.6	7.6	7.6	7.6	7.6
	36000	6.6	6.6	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
	38000	5.8	5.9	5.9	5.9	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	38850	5.5	5.6	5.6	5.6	5.7	5.7	5.7	5.7	5.7	5.7	5.7
1000	28000	10.5	10.6	10.6	10.6	10.7	10.7	10.7	10.7	10.7	10.7	10.3
	30000	9.4	9.4	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.2
	32000	8.4	8.4	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.2
	34000	7.5	7.5	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.3
	36000	6.7	6.7	6.7	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.5
	38000	5.9	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	5.7
	38850	5.6	5.6	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.4
2000	28000	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.5	9.6
	30000	9.5	9.5	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.4	8.5
	32000	8.5	8.5	8.5	8.6	8.6	8.6	8.6	8.6	8.6	8.4	7.6
	34000	7.6	7.6	7.6	7.7	7.7	7.7	7.7	7.7	7.7	7.5	6.7
	36000	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.7	5.9
	38000	6.0	6.0	6.0	6.1	6.1	6.1	6.1	6.1	6.1	5.9	5.2
	38850	5.7	5.7	5.7	5.8	5.8	5.8	5.8	5.8	5.8	5.6	4.9
3000	28000	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.5	9.7	8.8
	30000	9.5	9.5	9.6	9.6	9.6	9.6	9.6	9.6	9.4	8.6	7.8
	32000	8.5	8.5	8.5	8.6	8.6	8.6	8.6	8.6	8.4	7.7	6.9
	34000	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.5	6.8	6.1
	36000	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.6	6.0	5.3
	38000	6.0	6.0	6.0	6.1	6.1	6.1	6.1	6.1	5.9	5.3	4.7
	38850	5.7	5.7	5.7	5.8	5.7	5.7	5.7	5.7	5.6	5.0	4.4
4000	28000	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	9.8	8.9	8.0
	30000	9.5	9.5	9.6	9.6	9.6	9.6	9.6	9.6	8.8	7.9	7.1
	32000	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	7.8	7.0	6.2
	34000	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	6.9	6.2	5.5
	36000	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.1	5.4	4.8
	38000	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	5.4	4.7	4.1
	38850	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.1	4.5	3.8
5000	28000	10.6	10.7	10.7	10.7	10.7	10.7	10.7	10.0	9.0	8.1	7.3
	30000	9.5	9.5	9.5	9.5	9.5	9.5	9.5	8.9	8.0	7.2	6.4
	32000	8.5	8.5	8.5	8.5	8.5	8.5	8.5	7.9	7.1	6.3	5.6
	34000	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.1	6.2	5.5	4.9
	36000	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.3	5.5	4.8	4.2
	38000	6.0	6.0	6.0	6.0	6.0	6.0	6.0	5.5	4.8	4.2	3.6
	38850	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.2	4.5	3.9	3.3

FTOCLB1_F0_ALL_IMP_BD100_25FEB04

Final Segment Climb Speed = 170 kias

Gross Gradient = Net Gradient + 0.8%

Figure 2-162. (06-25-02 Sheet 1 of 2)

NET FINAL SEGMENT CLIMB GRADIENT AND SPEED
SINGLE ENGINE
ENGINE BLEED ON, ENGINE AND WING A/I ON

NET FINAL SEGMENT CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
6000	28000	10.6	10.6	10.7	10.7	10.7	10.7	10.2	9.2	8.2	7.4	6.6
	30000	9.5	9.5	9.5	9.5	9.5	9.5	9.1	8.1	7.2	6.5	5.7
	32000	8.5	8.5	8.5	8.5	8.5	8.5	8.1	7.2	6.4	5.7	5.0
	34000	7.6	7.6	7.6	7.6	7.6	7.6	7.2	6.4	5.6	4.9	4.3
	36000	6.7	6.8	6.8	6.8	6.8	6.8	6.4	5.6	4.9	4.3	3.6
	38000	6.0	6.0	6.0	6.0	6.0	6.0	5.7	4.9	4.2	3.6	3.0
	38850	5.7	5.7	5.7	5.7	5.7	5.7	5.4	4.6	4.0	3.4	2.8
7000	28000	10.7	10.7	10.7	10.7	10.7	10.4	9.4	8.3	7.5	6.7	5.9
	30000	9.5	9.6	9.6	9.6	9.6	9.3	8.3	7.4	6.6	5.8	5.1
	32000	8.5	8.6	8.6	8.6	8.6	8.3	7.4	6.5	5.7	5.0	4.4
	34000	7.6	7.6	7.6	7.6	7.6	7.4	6.6	5.7	5.0	4.3	3.7
	36000	6.8	6.8	6.8	6.8	6.8	6.6	5.8	5.0	4.3	3.7	3.1
	38000	6.0	6.1	6.1	6.1	6.0	5.9	5.1	4.3	3.7	3.1	2.5
	38850	5.7	5.7	5.7	5.7	5.7	5.6	4.8	4.1	3.4	2.9	2.3
8000	28000	10.7	10.8	10.7	10.7	10.7	9.7	8.6	7.6	6.8	6.0	5.2
	30000	9.6	9.6	9.6	9.6	9.5	8.6	7.6	6.6	5.9	5.2	4.4
	32000	8.6	8.6	8.6	8.6	8.5	7.7	6.7	5.8	5.1	4.4	3.8
	34000	7.7	7.7	7.7	7.7	7.6	6.8	5.9	5.1	4.4	3.8	3.1
	36000	6.8	6.9	6.8	6.8	6.8	6.0	5.2	4.4	3.8	3.2	2.6
	38000	6.1	6.1	6.1	6.1	6.0	5.3	4.5	3.8	3.2	2.6	2.0
	38850	5.8	5.8	5.8	5.8	5.7	5.0	4.2	3.5	2.9	2.4	1.8
9000	28000	10.6	10.7	10.6	10.6	10.1	8.9	7.8	6.9	6.1	5.3	4.5
	30000	9.5	9.5	9.5	9.5	9.0	7.9	6.8	6.0	5.2	4.6	3.8
	32000	8.5	8.5	8.5	8.5	8.0	7.0	6.0	5.2	4.5	3.9	3.2
	34000	7.6	7.6	7.6	7.6	7.2	6.2	5.2	4.5	3.8	3.2	2.6
	36000	6.8	6.8	6.8	6.8	6.4	5.4	4.6	3.9	3.2	2.7	2.1
	38000	6.0	6.0	6.0	6.0	5.6	4.7	3.9	3.3	2.7	2.1	1.6
	38850	5.7	5.7	5.7	5.7	5.3	4.5	3.7	3.0	2.4	1.9	1.3
10000	28000	10.6	10.6	10.6	10.4	9.3	8.1	7.0	6.2	5.4	4.7	3.9
	30000	9.4	9.4	9.4	9.3	8.2	7.1	6.1	5.3	4.6	4.0	3.2
	32000	8.4	8.4	8.4	8.3	7.3	6.3	5.3	4.6	3.9	3.3	2.6
	34000	7.5	7.5	7.5	7.4	6.5	5.5	4.6	3.9	3.3	2.7	2.1
	36000	6.7	6.7	6.7	6.6	5.7	4.8	4.0	3.3	2.7	2.2	1.5
	38000	6.0	6.0	6.0	5.9	5.0	4.1	3.3	2.7	2.2	1.7	1.1
	38850	5.7	5.7	5.7	5.6	4.7	3.9	3.1	2.5	2.0	1.5	0.9

FTOCL02_F0_ALL_IMP_BD100_25FEB04

Final Segment Climb Speed = 170 kias

Gross Gradient = Net Gradient + 0.8%

Figure 2-162. (06-25-02 Sheet 2 of 2)

NET FINAL SEGMENT CLIMB GRADIENT AND SPEED CORRECTION CHART
FLAPS 0°

EXAMPLE:

1. Uncorrected Final Segment Net Climb Gradient (from table).....6.4%
2. Headwind.....10 kt
3. Corrected Final Segment Net Climb Gradient.....6.6%

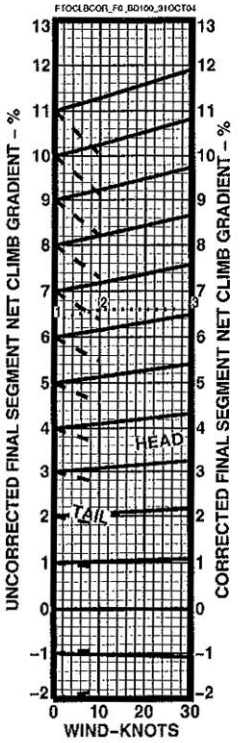

Figure 2-163. (06-25-03)

ENROUTE

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CHAPTER 3
ENROUTE

USE OF EN ROUTE TABLES

This section presents net En Route climb gradient tables as a function of pressure altitude, airplane weight and ambient temperature. Different tables are provided for the following engine bleed configurations:

- Engine Bleed ON
- Engine Bleed ON, Wing Anti-Ice and Engine Anti-Ice ON

The net En Route climb gradients are based on the following assumptions:

1. One engine at maximum continuous thrust (CLB setting).
2. Flaps retracted and landing gear UP.
3. En Route climb speed schedule.

The En Route climb speed schedule is also presented as a function of pressure altitude.

Use the following procedure when calculating the En Route climb gradient:

1. Select the appropriate net En Route climb gradient table based on the engine bleed configuration.
2. For specified pressure altitude, ambient temperature and airplane weight, interpolate for the net En Route climb gradient.

NOTE: If ice accretion is suspected on unprotected surfaces, reduce the En Route climb gradient determined from the tables by 2.9%.

NET ENROUTE CLIMB GRADIENT AND SPEED
SINGLE ENGINE
ENGINE BLEED ON

NET EN ROUTE CLIMB GRADIENT – %													
		TEMPERATURE – °C											
ALT FT	WT LB	–60	–50	–40	–30	–20	–10	0	10	20	30	40	50
SEA LEVEL	28000		10.2	10.2	10.3	10.4	10.4	10.4	10.4	10.4	9.9	7.8	5.6
	30000		9.0	9.0	9.1	9.2	9.2	9.2	9.2	9.2	8.8	6.8	4.8
	32000		8.0	8.0	8.1	8.2	8.2	8.2	8.2	8.2	7.8	6.0	4.1
	34000		7.1	7.1	7.2	7.3	7.3	7.3	7.3	7.3	6.9	5.2	3.4
	36000		6.3	6.3	6.4	6.5	6.5	6.5	6.5	6.5	6.1	4.5	2.8
	38000		5.6	5.6	5.6	5.7	5.7	5.7	5.7	5.7	5.4	3.8	2.3
	38850		5.3	5.3	5.3	5.4	5.4	5.4	5.4	5.4	5.1	3.6	2.0
5000	28000		10.4	10.4	10.4	10.4	10.4	10.4	9.8	8.1	6.2	4.3	2.4
	30000		9.2	9.2	9.3	9.3	9.3	9.3	8.7	7.2	5.4	3.6	1.8
	32000		8.2	8.2	8.3	8.3	8.3	8.3	7.8	6.3	4.6	2.9	1.3
	34000		7.3	7.3	7.3	7.3	7.3	7.3	6.9	5.5	3.9	2.3	0.8
	36000		6.5	6.5	6.5	6.5	6.5	6.5	6.1	4.8	3.3	1.8	0.3
	38000		5.7	5.7	5.8	5.8	5.8	5.8	5.3	4.1	2.7	1.3	–0.1
	38850		5.4	5.4	5.4	5.4	5.4	5.4	5.0	3.8	2.4	1.1	–0.3
10000	28000		10.3	10.3	10.3	10.3	9.6	7.9	6.4	4.6	2.9	1.3	
	30000		9.2	9.2	9.2	9.2	8.5	6.9	5.6	3.9	2.2	0.8	
	32000		8.2	8.2	8.2	8.2	7.6	6.1	4.8	3.2	1.7	0.4	
	34000		7.3	7.3	7.3	7.2	6.7	5.3	4.1	2.6	1.2	–0.1	
	36000		6.4	6.4	6.4	6.4	5.9	4.6	3.5	2.0	0.7	–0.5	
	38000		5.7	5.7	5.7	5.7	5.2	3.9	2.9	1.5	0.2	–0.9	
	38850		5.4	5.4	5.4	5.4	4.9	3.7	2.6	1.3	0.1	–1.0	
15000	28000		7.0	6.9	6.9	7.0	6.1	4.7	3.2	1.6	0.0		
	30000		6.1	6.1	6.0	6.1	5.3	3.9	2.6	1.1	–0.4		
	32000		5.3	5.3	5.2	5.3	4.5	3.3	2.0	0.6	–0.8		
	34000		4.5	4.5	4.5	4.5	3.8	2.6	1.5	0.2	–1.2		
	36000		3.9	3.9	3.8	3.9	3.2	2.1	1.0	–0.3	–1.5		
	38000		3.3	3.2	3.2	3.3	2.6	1.6	0.5	–0.7	–1.8		
	38850		3.0	3.0	3.0	3.0	2.4	1.4	0.3	–0.8	–2.0		
20000	28000		4.1	4.1	4.1	4.1	2.9	1.8	0.8	–0.3			
	30000		3.4	3.4	3.4	3.4	2.3	1.3	0.3	–0.7			
	32000		2.8	2.8	2.8	2.8	1.8	0.8	–0.1	–1.1			
	34000		2.2	2.2	2.2	2.2	1.2	0.3	–0.5	–1.4			
	36000		1.7	1.7	1.7	1.7	0.8	–0.1	–0.9	–1.8			
	38000		1.2	1.2	1.2	1.2	0.3	–0.5	–1.3	–2.1			
	38850		1.0	1.0	1.0	1.0	0.1	–0.7	–1.4	–2.2			
25000	28000	2.2	2.2	2.2	2.2	1.5	0.5	–0.4	–1.2				
	30000	1.7	1.7	1.7	1.7	1.0	0.0	–0.7	–1.5				
	32000	1.2	1.2	1.2	1.2	0.5	–0.4	–1.1	–1.8				
	34000	0.7	0.7	0.7	0.7	0.1	–0.8	–1.4	–2.1				
	36000	0.3	0.3	0.3	0.3	–0.3	–1.1	–1.7	–2.4				
	38000	–0.1	–0.1	–0.2	–0.1	–0.7	–1.4	–2.0	–2.6				
	38850	–0.3	–0.3	–0.3	–0.3	–0.9	–1.6	–2.2	–2.8				

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Figures in shaded area are beyond engine temperature limits

and are for interpolation only.

Gross Gradient = Net Gradient + 1.1%

Figure 03-01. (06-30-01 Sheet 1 of 2)

NET ENROUTE CLIMB GRADIENT AND SPEED
SINGLE ENGINE
ENGINE BLEED ON

NET EN ROUTE CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C								
		–75	–70	–60	–50	–40	–30	–20	–10	0
30000	28000		0.4	0.4	0.5	0.5	0.2	–0.7	–1.4	–2.1
	30000		0.0	0.0	0.1	0.1	–0.2	–1.0	–1.7	–2.3
	32000		–0.4	–0.4	–0.3	–0.3	–0.6	–1.3	–2.0	–2.6
	34000		–0.7	–0.7	–0.7	–0.6	–1.0	–1.6	–2.2	–2.8
	36000		–1.1	–1.1	–1.0	–1.0	–1.3	–1.9	–2.5	–3.0
	38000		–1.4	–1.4	–1.3	–1.3	–1.6	–2.2	–2.7	–3.2
	38850		–1.5	–1.5	–1.5	–1.4	–1.7	–2.3	–2.8	–3.3
35000	28000	–1.1	–1.1	–1.0	–1.0	–1.1	–1.7	–2.4	–2.9	
	30000	–1.3	–1.3	–1.3	–1.3	–1.4	–2.0	–2.6	–3.1	
	32000	–1.6	–1.6	–1.6	–1.6	–1.7	–2.2	–2.8	–3.3	
	34000	–1.8	–1.9	–1.8	–1.8	–1.9	–2.4	–3.0	–3.4	
	36000	–2.1	–2.1	–2.1	–2.1	–2.2	–2.7	–3.1	–3.6	
	38000	–2.4	–2.4	–2.3	–2.3	–2.4	–2.9	–3.3	–3.7	
	38850	–2.5	–2.5	–2.4	–2.4	–2.5	–2.9	–3.4	–3.8	
40000	28000	–2.1	–2.1	–2.1	–2.1	–2.5	–3.0	–3.5		
	30000	–2.3	–2.3	–2.3	–2.3	–2.7	–3.2	–3.6		
	32000	–2.5	–2.5	–2.4	–2.5	–2.8	–3.3	–3.7		
	34000	–2.6	–2.6	–2.6	–2.6	–3.0	–3.4	–3.8		
	36000	–2.8	–2.8	–2.8	–2.8	–3.1	–3.5	–3.9		
	38000	–3.0	–3.0	–3.0	–3.0	–3.3	–3.7	–4.0		
	38850	–3.0	–3.0	–3.0	–3.0	–3.3	–3.7	–4.0		
45000	28000	–2.9	–2.9	–2.9	–3.1	–3.6	–3.9			
	30000	–3.1	–3.1	–3.1	–3.2	–3.7	–4.0			
	32000	–3.2	–3.2	–3.2	–3.3	–3.7	–4.0			
	34000	–3.3	–3.3	–3.3	–3.5	–3.8	–4.1			
	36000	–3.4	–3.4	–3.4	–3.6	–3.9	–4.2			
	38000	–3.5	–3.5	–3.5	–3.7	–4.0	–4.3			
	38850	–3.6	–3.6	–3.6	–3.7	–4.0	–4.3			

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Figures in shaded area are beyond engine temperature limits and are for interpolation only.

Gross Gradient = Net Gradient + 1.1%

EN ROUTE CLIMB SPEED SCHEDULE

ALT (FT)	SL	25,000	30,000	35,000	40,000	45,000
Venr (KIAS)	170	170	175	180	185	190

Figure 03-01. (06-30-01 Sheet 2 of 2)

NET ENROUTE CLIMB GRADIENT AND SPEED
SINGLE ENGINE
ENGINE BLEED ON, ENGINE AND WING A/I ON

NET EN ROUTE CLIMB GRADIENT – %									
		TEMPERATURE – °C							
ALT FT	WT LB	–60	–50	–40	–30	–20	–10	0	10
SEA LEVEL	28000		10.1	10.1	10.2	10.3	10.3	10.3	10.3
	30000		9.0	9.0	9.1	9.2	9.2	9.2	9.2
	32000		8.0	8.0	8.1	8.2	8.2	8.2	8.2
	34000		7.1	7.1	7.2	7.3	7.3	7.3	7.3
	36000		6.3	6.3	6.4	6.4	6.4	6.4	6.4
	38000		5.5	5.5	5.6	5.7	5.7	5.7	5.7
	38850		5.2	5.2	5.3	5.4	5.4	5.4	5.4
5000	28000		10.3	10.3	10.4	10.4	10.4	8.7	7.0
	30000		9.2	9.2	9.2	9.2	9.2	7.7	6.1
	32000		8.2	8.2	8.2	8.2	8.2	6.8	5.3
	34000		7.3	7.3	7.3	7.3	7.3	5.9	4.6
	36000		6.5	6.5	6.5	6.5	6.5	5.2	3.9
	38000		5.7	5.7	5.7	5.7	5.7	4.5	3.3
	38850		5.4	5.4	5.4	5.4	5.4	4.2	3.0
10000	28000		10.3	10.3	10.3	9.0	6.7	5.1	3.6
	30000		9.1	9.1	9.1	7.9	5.8	4.3	2.9
	32000		8.1	8.1	8.1	7.0	5.0	3.6	2.3
	34000		7.2	7.2	7.2	6.2	4.3	3.0	1.8
	36000		6.4	6.4	6.4	5.4	3.7	2.4	1.2
	38000		5.7	5.7	5.7	4.7	3.0	1.9	0.8
	38850		5.4	5.4	5.4	4.4	2.8	1.7	0.6
15000	28000		7.0	6.9	6.9	5.0	3.4	2.0	0.4
	30000		6.1	6.0	6.0	4.2	2.7	1.4	–0.1
	32000		5.3	5.2	5.2	3.6	2.1	0.9	–0.5
	34000		4.5	4.5	4.5	2.9	1.6	0.4	–0.9
	36000		3.9	3.9	3.8	2.4	1.1	0.0	–1.2
	38000		3.3	3.2	3.2	1.8	0.6	–0.4	–1.6
	38850		3.0	3.0	3.0	1.6	0.4	–0.6	–1.7
20000	28000		4.1	4.1	3.2	1.7	0.4	–0.8	–2.1
	30000		3.4	3.4	2.6	1.1	–0.1	–1.2	–2.4
	32000		2.8	2.8	2.0	0.7	–0.5	–1.5	–2.6
	34000		2.2	2.2	1.5	0.2	–0.9	–1.8	–2.9
	36000		1.7	1.7	1.0	–0.2	–1.2	–2.1	–3.1
	38000		1.2	1.2	0.5	–0.6	–1.6	–2.4	–3.4
	38850		1.0	1.0	0.3	–0.8	–1.7	–2.6	–3.5
25000	28000	2.2	2.2	1.4	–0.0	–1.1	–2.1	–3.2	–4.2
	30000	1.7	1.6	0.9	–0.4	–1.5	–2.4	–3.4	–4.3
	32000	1.2	1.1	0.4	–0.8	–1.8	–2.7	–3.6	–4.5
	34000	0.7	0.7	0.0	–1.2	–2.1	–2.9	–3.8	–4.6
	36000	0.3	0.2	–0.4	–1.5	–2.3	–3.1	–4.0	–4.8
	38000	–0.2	–0.2	–0.8	–1.8	–2.6	–3.4	–4.2	–4.9
	38850	–0.3	–0.4	–0.9	–1.9	–2.7	–3.5	–4.2	–5.0

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Figures in shaded area are beyond engine temperature limits and are for interpolation only.

Gross Gradient = Net Gradient + 1.1%

Figure 03-02. (06-30-02 Sheet 1 of 2)

NET ENROUTE CLIMB GRADIENT AND SPEED
SINGLE ENGINE
ENGINE BLEED ON, ENGINE AND WING A/I ON

NET EN ROUTE CLIMB GRADIENT – %										
		TEMPERATURE – °C								
ALT FT	WT LB	–75	–70	–60	–50	–40	–30	–20	–10	0
30000	28000		0.3	0.2	–0.4	–1.4	–2.5	–3.5	–4.3	–5.0
	30000		–0.1	–0.2	–0.8	–1.7	–2.7	–3.6	–4.4	–5.0
	32000		–0.4	–0.5	–1.1	–2.0	–2.9	–3.8	–4.5	–5.1
	34000		–0.8	–0.9	–1.4	–2.3	–3.1	–4.0	–4.6	–5.2
	36000		–1.1	–1.2	–1.7	–2.5	–3.3	–4.1	–4.7	–5.2
	38000		–1.4	–1.5	–2.0	–2.7	–3.5	–4.3	–4.8	–5.3
	38850		–1.6	–1.6	–2.1	–2.8	–3.6	–4.3	–4.9	–5.4
35000	28000	–1.4	–1.4	–2.2	–2.9	–3.7	–4.5	–5.1	–5.6	
	30000	–1.7	–1.7	–2.4	–3.1	–3.8	–4.6	–5.1	–5.6	
	32000	–1.9	–1.9	–2.7	–3.2	–3.9	–4.6	–5.1	–5.6	
	34000	–2.2	–2.2	–2.9	–3.4	–4.1	–4.7	–5.2	–5.6	
	36000	–2.4	–2.4	–3.0	–3.5	–4.2	–4.8	–5.3	–5.7	
	38000	–2.6	–2.6	–3.2	–3.7	–4.3	–4.9	–5.3	–5.7	
	38850	–2.7	–2.7	–3.3	–3.8	–4.4	–4.9	–5.4	–5.8	

ENRCLB2_F0_ALL_IMP_BD100_29APR04

Figures in shaded area are beyond engine temperature limits and are for interpolation only.

Gross Gradient = Net Gradient + 1.1%

EN ROUTE CLIMB SPEED SCHEDULE

ALT (FT)	SL	25,000	30,000	35,000	40,000	45,000
Venr (KIAS)	170	170	175	180	185	190

Figure 03-02. (06-30-02 Sheet 2 of 2)

APPROACH/LANDING

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CHAPTER 4
APPROACH/LANDING

APPROACH AND LANDING CHARTS

The tables and charts on the following pages present performance data that allows calculation of the maximum landing weight, landing speeds and distances. Approach climb and landing climb performance is also provided.

MAXIMUM LANDING WEIGHT

Landings must be made within the limitations of the maximum landing weight as governed by the LANDING WEIGHT LIMIT charts and by the performance determined from the LANDING DATA tables and correction charts. The heaviest weight at which the aircraft can land is the **lowest** of the following weights:

1. The maximum landing weight (structural limit for landing).
2. The landing weight limit for airport pressure altitude, ambient temperature, runway gradient and reported wind as determined from the LANDING WEIGHT LIMIT charts. The landing weight may be limited by climb requirements or by maximum permissible quick turnaround landing weight.
3. The maximum landing weight for the runway and ambient conditions as determined from the LANDING DATA tables and correction charts.

LANDING WEIGHT LIMIT CHARTS

Landing weight limit charts are presented for the various engine bleed configurations. The landing weight limit charts present the information necessary to determine the maximum allowable landing weight as limited by climb performance or brake energy limits. The climb weight limit is based on approach climb and landing climb requirements (approach climb is limiting). The weight limit based on brake energy is also referred to as the maximum permissible quick turn-around landing weight. It is the landing weight that will cause the brakes to reach maximum fusible plug energy levels.

NOTE: After landing at a weight exceeding the quick turn-around landing weight, a minimum waiting time of 40 minutes must be observed, followed by an inspection of the wheels, brakes, tires, and landing gear in accordance with the Airplane Maintenance Manual. After landing at a weight equal to or less than the quick turn-around landing weight, a brake cooling time, determined in accordance with the method described in TURN-AROUND TIME - COOLING OF WHEELS, BRAKES, AND TIRES in this chapter must be observed before takeoff.

LANDING WEIGHT LIMIT CHARTS (Cont)

The following procedure is to be used to determine the landing weight limit:

1. Select the appropriate landing weight limit chart based on engine bleed configuration.
2. From the airport pressure altitude and ambient temperature conditions, determine the climb weight limit.
3. From the airport pressure altitude and ambient temperature conditions, determine the uncorrected brake energy weight limit. Apply corrections for reported tower wind and runway gradient. The resulting weight is the corrected brake energy weight limit.
4. Compare the weight limits determined in steps 2 and 3 and select the lowest weight. This is the resulting landing weight limit.

NOTE: If ice accretion is suspected on unprotected surfaces, reduce the landing weight limited by climb requirements (landing weight limit chart) by 15.4%.

LANDING DATA TABLES AND CHARTS

The LANDING DATA tables present different landing distances based on applicable regulations and runway surface condition. They also present go-around speeds (V_{GA}) and landing approach speeds (V_{REF}). The landing data is determined as a function of airport pressure altitude and airplane weight at the landing destination. Correction charts are provided for the effect of reported winds on landing distances.

The tables may be used to determine either of the following:

1. The landing distance required given the airplane weight, pressure altitude and reported wind.
2. The maximum landing weight corresponding to a specific runway length. Landing weight for runway length available may be determined by working through the tables and charts in the **opposite direction** as finding landing distance. In this case, the required runway length is used as the corrected landing distance. Uncorrected landing distance is obtained by removing the reported wind effect. Finally, the landing weight is interpolated from the pressure altitude and uncorrected landing distance in the landing data table. Landing weight determined in this manner may not be the limiting landing weight. Refer to the MAXIMUM LANDING WEIGHT section in this chapter.

LANDING AND APPROACH SPEEDS

The go-around speed VGA (approach climb) and the landing approach speed VREF (reference speed) are determined from the LANDING DATA tables by interpolation for the specified airplane weight and airport pressure altitude at the landing destination.

ACTUAL LANDING DISTANCE

The Actual Landing Distances (ALD) presented in the LANDING DATA tables are based on **minimum** landing distances determined in accordance with the Airworthiness requirements. The actual landing distance is measured from a point 50 feet above the end of the runway, with an airspeed of VREF and Flaps 30°, until full stop on a smooth, dry, hard-surfaced runway. Actual landing distances are based on ISA temperature conditions and assume zero runway gradient. The DRY RUNWAY ACTUAL LANDING DISTANCE CORRECTION CHART shows the effect of reported wind on actual landing distance.

Use the following procedure to determine the actual landing distance:

1. Determine the uncorrected actual landing distance ALD for specified airplane landing weight and destination airport pressure altitude.
2. Using the Dry Runway Actual Landing Distance Correction Chart, correct the uncorrected actual landing distance for tower reported wind effect. The resulting distance is the corrected actual landing distance.

FACTORED LANDING DISTANCE

The Factored Landing Distance (FLD) is also presented in the LANDING DATA tables. The factored landing distance includes factors for operational rules which require use of 60% of the available runway. It is provided as a function of airport pressure altitude and weight. Factored landing distance is used when required by applicable regulations. The DRY AND WET RUNWAY FACTORED LANDING DISTANCE CORRECTION CHART shows the effect of reported wind on factored landing distance.

Use the following procedure to determine the factored landing distance:

1. Determine the uncorrected factored landing distance FLD for specified airplane landing weight and destination airport pressure altitude.
2. Using the Dry and Wet Runway Factored Landing Distance Correction Chart, correct the uncorrected factored landing distance for tower reported wind effect. The resulting distance is the corrected factored landing distance.

LANDING ON WET RUNWAY

The LANDING DATA tables also present the wet runway landing distance (FLD WET). Operational rules may require that for wet or slippery runway surfaces, the runway length available be at least 115% of the factored landing distance. The wet runway distance is presented as a function of airport pressure altitude and weight. The DRY AND WET RUNWAY FACTORED LANDING DISTANCE CORRECTION CHART shows the effect of reported wind on the wet runway landing distance.

Use the following procedure to determine the wet runway landing distance:

1. Determine the uncorrected wet runway landing distance FLD WET for specified landing weight and destination airport pressure altitude.
2. Using the Dry and Wet Runway Factored Landing Distance Correction Chart, correct the uncorrected wet runway landing distance for tower reported wind effect. The resulting distance is the corrected wet runway landing distance.

LANDING ON CONTAMINATED RUNWAY

Refer to the CONTAMINATED RUNWAY DATA supplement.

APPROACH CLIMB AND LANDING CLIMB GRADIENT

The APPROACH CLIMB GRADIENT and LANDING CLIMB GRADIENT tables use the destination airport pressure altitude, ambient temperature and airplane landing weight conditions. Different charts are provided for the various engine bleed configurations. Corrections are provided for reported wind during the approach and landing climb phases of flight (if available).

The gradients will be achieved using the speeds shown in the LANDING DATA tables. Approach climb gradient performance is based on one engine operating, Flaps 10°, gear UP and applicable V_{GA} speed. Landing climb gradient performance is based on both engines operating, Flaps 30°, gear DOWN and applicable V_{REF} speed.

APPROACH CLIMB AND LANDING CLIMB GRADIENT (Cont)

A similar procedure is used to determine the approach climb and the landing climb gradients:

1. Select the appropriate uncorrected approach/landing climb gradient table based on the engine bleed configuration.
2. For specified landing airport pressure altitude, ambient temperature and weight, interpolate for the uncorrected approach/landing climb gradient.
3. Select the appropriate correction chart (approach or landing climb gradient correction chart).
4. Correct the uncorrected approach/landing climb gradient from step 2 for reported tower wind effects. The resulting gradient is the corrected approach/landing climb gradient.

NOTE: If ice accretion is suspected on unprotected surfaces, reduce the Approach Climb Gradient by 1.9% and the Landing Climb Gradient by 2.8%, as determined from the appropriate tables and correction charts.

APPROACH CLIMB GRADIENT
FLAPS 10°
ENGINE BLEED OFF

UNCORRECTED APPROACH CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C													
		–40	–30	–20	–10	0	10	15	20	25	30	35	40	45	50
SEA LEVEL	28000	11.0	11.0	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	10.3	9.3	8.1
	30000	9.6	9.7	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.0	8.1	7.0
	32000	8.5	8.6	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	7.9	7.1	6.0
	33750	7.6	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.1	6.2	5.3
	34000	7.5	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	6.9	6.1	5.2
	36000	6.6	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.1	5.3	4.4
	38000	5.8	5.8	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.3	4.6	3.7
	38850	5.5	5.5	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.0	4.3	3.4
1000	28000	11.0	11.1	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	10.5	9.6	8.6	7.4
	30000	9.7	9.8	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.2	8.4	7.4	6.3
	32000	8.6	8.6	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.1	7.3	6.4	5.4
	33750	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.2	6.5	5.6	4.7
	34000	7.6	7.6	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.1	6.4	5.5	4.6
	36000	6.7	6.7	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.2	5.5	4.7	3.8
	38000	5.9	5.9	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	5.4	4.8	4.0	3.2
	38850	5.5	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.1	4.5	3.7	2.9
2000	28000	11.1	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	10.7	9.8	8.9	7.8	6.7
	30000	9.8	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.4	8.6	7.7	6.7	5.7
	32000	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.3	7.5	6.7	5.7	4.8
	33750	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.4	6.7	5.9	5.0	4.1
	34000	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.3	6.6	5.8	4.9	4.0
	36000	6.7	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.4	5.7	5.0	4.1	3.3
	38000	5.9	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	5.6	5.0	4.3	3.5	2.6
	38850	5.6	5.6	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.3	4.7	4.0	3.2	2.4
3000	28000	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	10.9	10.0	9.1	8.2	7.1	
	30000	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.6	8.8	7.9	7.0	6.0	
	32000	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.4	7.7	6.9	6.0	5.1	
	33750	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.5	6.8	6.1	5.3	4.4	
	34000	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.4	6.7	6.0	5.2	4.3	
	36000	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.5	5.9	5.2	4.4	3.6	
	38000	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	5.7	5.1	4.4	3.7	2.9	
	38850	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.4	4.8	4.1	3.4	2.7	
4000	28000	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.0	10.2	9.3	8.4	7.4	6.4	
	30000	9.8	9.9	9.9	9.9	9.9	9.9	9.9	9.7	8.9	8.1	7.2	6.3	5.4	
	32000	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.5	7.8	7.0	6.2	5.4	4.5	
	33750	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.6	7.0	6.2	5.5	4.6	3.8	
	34000	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.5	6.8	6.1	5.4	4.5	3.7	
	36000	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.6	6.0	5.3	4.6	3.8	3.0	
	38000	6.0	6.0	6.0	6.0	6.0	6.0	6.0	5.8	5.2	4.6	3.9	3.2	2.4	
	38850	5.6	5.7	5.7	5.7	5.7	5.7	5.7	5.5	4.9	4.3	3.6	2.9	2.2	
5000	28000	11.1	11.1	11.1	11.1	11.2	11.2	11.1	10.3	9.5	8.6	7.6	6.7	5.8	
	30000	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.0	8.3	7.4	6.5	5.7	4.8	
	32000	8.7	8.7	8.7	8.7	8.7	8.7	8.6	7.9	7.2	6.4	5.6	4.8	3.9	
	33750	7.8	7.8	7.8	7.8	7.8	7.8	7.7	7.0	6.4	5.6	4.8	4.1	3.3	
	34000	7.6	7.7	7.7	7.7	7.7	7.7	7.6	6.9	6.3	5.5	4.8	4.0	3.2	
	36000	6.7	6.8	6.8	6.8	6.8	6.8	6.7	6.1	5.5	4.7	4.0	3.3	2.5	
	38000	5.9	6.0	6.0	6.0	6.0	6.0	5.9	5.3	4.7	4.0	3.3	2.6	1.9	
	38850	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.0	4.4	3.7	3.1	2.4	1.7	

APPCLB1_F10_ZERO_IMP_BD100_23FEB04

Figures in shaded area are above engine temperature limits and are for interpolation only.

Figure 04-01. (06-41-01 Sheet 1 of 2)

APPROACH CLIMB GRADIENT
FLAPS 10°
ENGINE BLEED OFF

UNCORRECTED APPROACH CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C											
		–40	–30	–20	–10	0	10	15	20	25	30	35	40
6000	28000	11.1	11.2	11.2	11.2	11.2	11.1	10.4	9.6	8.8	7.9	6.9	6.0
	30000	9.8	9.9	9.9	9.9	9.9	9.8	9.1	8.3	7.6	6.8	5.9	5.0
	32000	8.7	8.7	8.7	8.7	8.7	8.6	8.0	7.3	6.6	5.8	5.0	4.1
	33750	7.8	7.8	7.8	7.8	7.8	7.7	7.1	6.5	5.8	5.0	4.3	3.5
	34000	7.7	7.7	7.7	7.7	7.7	7.6	7.0	6.3	5.7	4.9	4.2	3.4
	36000	6.8	6.8	6.8	6.8	6.8	6.7	6.1	5.5	4.9	4.2	3.4	2.7
	38000	5.9	6.0	6.0	6.0	6.0	5.9	5.4	4.8	4.2	3.5	2.8	2.1
	38850	5.6	5.7	5.7	5.7	5.7	5.6	5.1	4.5	3.9	3.2	2.6	1.9
7000	28000	11.2	11.2	11.2	11.2	11.2	10.5	9.6	8.9	8.1	7.2	6.2	5.3
	30000	9.9	9.9	9.9	9.9	9.9	9.2	8.4	7.7	7.0	6.1	5.2	4.3
	32000	8.7	8.8	8.8	8.8	8.8	8.1	7.4	6.7	6.0	5.2	4.3	3.5
	33750	7.8	7.9	7.9	7.9	7.9	7.2	6.5	5.9	5.2	4.5	3.7	2.9
	34000	7.7	7.7	7.7	7.7	7.7	7.1	6.4	5.8	5.1	4.4	3.6	2.8
	36000	6.8	6.8	6.8	6.8	6.8	6.2	5.6	5.0	4.4	3.6	2.9	2.1
	38000	6.0	6.0	6.0	6.0	6.0	5.4	4.8	4.3	3.7	3.0	2.3	1.6
	38850	5.7	5.7	5.7	5.7	5.7	5.1	4.5	4.0	3.4	2.7	2.0	1.4
8000	28000	11.3	11.3	11.3	11.3	10.8	9.7	8.9	8.2	7.4	6.5	5.5	
	30000	9.9	10.0	10.0	9.9	9.5	8.5	7.8	7.1	6.4	5.5	4.6	
	32000	8.8	8.8	8.8	8.8	8.4	7.4	6.7	6.1	5.4	4.6	3.7	
	33750	7.9	7.9	7.9	7.9	7.5	6.6	6.0	5.3	4.7	3.9	3.1	
	34000	7.8	7.8	7.8	7.8	7.4	6.5	5.8	5.2	4.6	3.8	3.0	
	36000	6.9	6.9	6.9	6.9	6.5	5.7	5.0	4.5	3.9	3.1	2.3	
	38000	6.0	6.1	6.0	6.0	5.7	4.9	4.3	3.8	3.2	2.5	1.8	
	38850	5.7	5.7	5.7	5.7	5.4	4.6	4.0	3.5	3.0	2.2	1.5	
9000	28000	11.1	11.1	11.1	11.0	10.0	9.0	8.3	7.6	6.8	5.8	4.8	
	30000	9.8	9.8	9.8	9.7	8.8	7.9	7.2	6.5	5.7	4.8	3.9	
	32000	8.7	8.7	8.7	8.6	7.7	6.8	6.2	5.6	4.8	4.0	3.1	
	33750	7.8	7.8	7.8	7.7	6.9	6.0	5.4	4.8	4.1	3.3	2.5	
	34000	7.7	7.7	7.7	7.6	6.8	5.9	5.3	4.7	4.0	3.2	2.4	
	36000	6.8	6.8	6.8	6.7	6.0	5.1	4.5	4.0	3.3	2.6	1.8	
	38000	6.0	6.0	6.0	5.9	5.2	4.4	3.8	3.3	2.7	2.0	1.3	
	38850	5.7	5.7	5.7	5.6	4.9	4.1	3.6	3.1	2.5	1.8	1.0	
10000	28000	10.9	10.9	10.8	10.3	9.3	8.4	7.6	7.0	6.1	5.1	4.1	
	30000	9.6	9.6	9.6	9.0	8.1	7.3	6.6	5.9	5.1	4.2	3.3	
	32000	8.5	8.5	8.4	7.9	7.1	6.3	5.6	5.0	4.3	3.4	2.5	
	33750	7.6	7.6	7.6	7.1	6.3	5.5	4.9	4.3	3.6	2.8	1.9	
	34000	7.5	7.5	7.5	7.0	6.2	5.4	4.8	4.2	3.5	2.7	1.8	
	36000	6.6	6.6	6.6	6.1	5.4	4.6	4.0	3.5	2.8	2.0	1.3	
	38000	5.8	5.8	5.8	5.4	4.7	3.9	3.4	2.9	2.2	1.5	0.7	
	38850	5.5	5.5	5.5	5.1	4.4	3.7	3.1	2.6	2.0	1.3	0.5	

APPCLB2_F10_ZERO_IMP_BD100_23FEB04

Figures in shaded area are above engine temperature limits and are for interpolation only.

Figure 04-01. (06-41-01 Sheet 2 of 2)

APPROACH CLIMB GRADIENT
FLAPS 10°
ENGINE BLEED ON

UNCORRECTED APPROACH CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C													
		–40	–30	–20	–10	0	10	15	20	25	30	35	40	45	50
SEA LEVEL	28000	10.9	11.0	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	10.6	9.8	8.8	7.6
	30000	9.6	9.7	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.3	8.5	7.7	6.5
	32000	8.5	8.5	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.2	7.5	6.6	5.6
	33750	7.6	7.6	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.3	6.6	5.8	4.8
	34000	7.4	7.5	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.2	6.5	5.7	4.7
	36000	6.5	6.6	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.3	5.7	4.9	4.0
	38000	5.7	5.8	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.5	4.9	4.2	3.3
	38850	5.4	5.5	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.2	4.6	3.9	3.1
1000	28000	11.0	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	10.9	10.0	9.1	8.1	6.9
	30000	9.7	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.6	8.7	7.9	6.9	5.9
	32000	8.5	8.6	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.4	7.6	6.8	6.0	5.0
	33750	7.6	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.5	6.8	6.0	5.2	4.2
	34000	7.5	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.4	6.7	5.9	5.1	4.1
	36000	6.6	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.5	5.8	5.1	4.3	3.4
	38000	5.8	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.7	5.1	4.4	3.6	2.8
	38850	5.5	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.4	4.8	4.1	3.4	2.5
2000	28000	11.1	11.1	11.2	11.2	11.2	11.2	11.2	11.2	11.0	10.2	9.3	8.4	7.3	6.2
	30000	9.8	9.8	9.8	9.8	9.9	9.9	9.9	9.9	9.7	8.9	8.1	7.2	6.2	5.2
	32000	8.6	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.6	7.8	7.0	6.2	5.3	4.3
	33750	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.7	7.0	6.2	5.5	4.6	3.7
	34000	7.6	7.6	7.7	7.7	7.7	7.7	7.7	7.7	7.5	6.8	6.1	5.4	4.5	3.6
	36000	6.7	6.7	6.8	6.8	6.8	6.8	6.8	6.8	6.6	6.0	5.3	4.6	3.7	2.9
	38000	5.9	5.9	6.0	6.0	6.0	6.0	6.0	6.0	5.8	5.2	4.6	3.9	3.1	2.3
	38850	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.5	4.9	4.3	3.6	2.8	2.0
3000	28000	11.1	11.2	11.2	11.2	11.2	11.2	11.2	11.1	10.3	9.5	8.6	7.6	6.6	
	30000	9.8	9.8	9.9	9.9	9.9	9.9	9.9	9.8	9.0	8.3	7.4	6.6	5.6	
	32000	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.6	7.9	7.2	6.4	5.6	4.7	
	33750	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.7	7.1	6.4	5.6	4.8	4.0	
	34000	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.6	7.0	6.3	5.5	4.8	3.9	
	36000	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.7	6.1	5.4	4.7	4.0	3.2	
	38000	5.9	6.0	6.0	6.0	6.0	6.0	6.0	5.9	5.3	4.7	4.0	3.3	2.6	
	38850	5.6	5.6	5.6	5.7	5.7	5.7	5.7	5.6	5.0	4.4	3.8	3.1	2.3	
4000	28000	11.1	11.1	11.1	11.1	11.1	11.1	11.1	10.4	9.6	8.8	7.9	6.9	5.9	
	30000	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.2	8.4	7.6	6.7	5.9	4.9	
	32000	8.6	8.7	8.7	8.7	8.7	8.7	8.7	8.0	7.3	6.6	5.8	4.9	4.1	
	33750	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.2	6.5	5.8	5.0	4.2	3.4	
	34000	7.6	7.7	7.7	7.7	7.7	7.7	7.7	7.1	6.4	5.7	4.9	4.1	3.3	
	36000	6.7	6.8	6.8	6.8	6.8	6.8	6.8	6.2	5.6	4.9	4.2	3.4	2.7	
	38000	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.4	4.8	4.2	3.5	2.8	2.1	
	38850	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.1	4.5	3.9	3.2	2.5	1.8	
5000	28000	11.1	11.1	11.1	11.1	11.1	11.1	10.5	9.7	8.9	8.1	7.1	6.2	5.3	
	30000	9.8	9.8	9.8	9.8	9.8	9.8	9.3	8.5	7.8	6.9	6.1	5.2	4.4	
	32000	8.6	8.6	8.6	8.6	8.6	8.6	8.1	7.4	6.7	5.9	5.1	4.3	3.5	
	33750	7.7	7.7	7.7	7.7	7.7	7.7	7.3	6.6	6.0	5.2	4.4	3.7	2.9	
	34000	7.6	7.6	7.6	7.6	7.6	7.6	7.2	6.5	5.8	5.1	4.3	3.6	2.8	
	36000	6.7	6.7	6.7	6.7	6.7	6.7	6.3	5.7	5.0	4.3	3.6	2.9	2.2	
	38000	5.9	5.9	5.9	5.9	5.9	5.9	5.5	4.9	4.3	3.6	3.0	2.3	1.6	
	38850	5.6	5.6	5.6	5.6	5.6	5.6	5.2	4.6	4.0	3.3	2.7	2.0	1.4	

APPCLB1_F10_ECS_IMP_BD100_23FEB04

Figures in shaded area are above engine temperature limits and are for interpolation only.

Figure 04-02. (06-41-02 Sheet 1 of 2)

APPROACH CLIMB GRADIENT
FLAPS 10°
ENGINE BLEED ON

UNCORRECTED APPROACH CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C											
		-40	-30	-20	-10	0	10	15	20	25	30	35	40
6000	28000	11.1	11.1	11.1	11.1	11.1	10.6	9.8	9.0	8.2	7.4	6.4	5.5
	30000	9.8	9.8	9.8	9.8	9.8	9.3	8.6	7.8	7.1	6.3	5.4	4.6
	32000	8.6	8.7	8.7	8.7	8.7	8.2	7.5	6.8	6.1	5.3	4.5	3.7
	33750	7.7	7.8	7.8	7.8	7.8	7.3	6.7	6.0	5.4	4.6	3.8	3.1
	34000	7.6	7.7	7.7	7.7	7.7	7.2	6.5	5.9	5.2	4.5	3.7	3.0
	36000	6.7	6.8	6.8	6.8	6.8	6.3	5.7	5.1	4.5	3.8	3.1	2.3
	38000	5.9	5.9	5.9	5.9	5.9	5.5	5.0	4.4	3.8	3.1	2.4	1.8
	38850	5.6	5.6	5.6	5.6	5.6	5.2	4.7	4.1	3.5	2.9	2.2	1.5
7000	28000	11.2	11.2	11.2	11.2	11.2	9.9	9.1	8.3	7.6	6.7	5.7	4.8
	30000	9.8	9.9	9.9	9.9	9.9	8.6	7.9	7.2	6.5	5.6	4.8	3.9
	32000	8.7	8.7	8.7	8.7	8.7	7.6	6.9	6.2	5.5	4.7	3.9	3.1
	33750	7.8	7.8	7.8	7.8	7.8	6.7	6.1	5.4	4.8	4.0	3.3	2.5
	34000	7.7	7.7	7.7	7.7	7.7	6.6	6.0	5.3	4.7	3.9	3.2	2.4
	36000	6.8	6.8	6.8	6.8	6.8	5.8	5.1	4.6	4.0	3.2	2.5	1.8
	38000	6.0	6.0	6.0	6.0	6.0	5.0	4.4	3.9	3.3	2.6	1.9	1.2
	38850	5.6	5.7	5.7	5.7	5.7	4.7	4.1	3.6	3.0	2.4	1.7	1.0
8000	28000	11.2	11.2	11.2	11.2	10.7	9.1	8.4	7.7	6.9	6.0	5.0	
	30000	9.9	9.9	9.9	9.9	9.5	8.0	7.3	6.6	5.9	5.0	4.1	
	32000	8.7	8.8	8.8	8.7	8.3	6.9	6.3	5.6	5.0	4.1	3.3	
	33750	7.8	7.9	7.9	7.9	7.5	6.1	5.5	4.9	4.3	3.5	2.7	
	34000	7.7	7.7	7.7	7.7	7.3	6.0	5.4	4.8	4.2	3.4	2.6	
	36000	6.8	6.8	6.8	6.8	6.5	5.2	4.6	4.1	3.5	2.7	2.0	
	38000	6.0	6.0	6.0	6.0	5.7	4.5	3.9	3.4	2.8	2.1	1.4	
	38850	5.7	5.7	5.7	5.7	5.4	4.2	3.6	3.1	2.6	1.9	1.2	
9000	28000	11.1	11.1	11.1	11.0	10.0	8.4	7.7	7.0	6.2	5.3	4.3	
	30000	9.8	9.8	9.8	9.7	8.8	7.3	6.6	6.0	5.2	4.4	3.5	
	32000	8.7	8.7	8.7	8.6	7.7	6.3	5.7	5.1	4.4	3.5	2.7	
	33750	7.8	7.8	7.8	7.7	6.8	5.5	4.9	4.4	3.7	2.9	2.1	
	34000	7.7	7.7	7.7	7.6	6.7	5.4	4.8	4.3	3.6	2.8	2.0	
	36000	6.8	6.8	6.8	6.7	5.9	4.7	4.1	3.6	2.9	2.2	1.4	
	38000	6.0	6.0	6.0	5.9	5.1	4.0	3.4	2.9	2.3	1.6	0.9	
	38850	5.7	5.7	5.7	5.6	4.8	3.7	3.2	2.7	2.1	1.4	0.7	
10000	28000	10.8	10.8	10.8	10.2	9.3	7.8	7.1	6.4	5.6	4.6	3.6	
	30000	9.5	9.5	9.5	9.0	8.1	6.7	6.0	5.4	4.6	3.7	2.8	
	32000	8.4	8.4	8.4	7.9	7.1	5.7	5.1	4.6	3.8	3.0	2.1	
	33750	7.5	7.5	7.5	7.1	6.3	5.0	4.4	3.9	3.2	2.3	1.5	
	34000	7.4	7.4	7.4	6.9	6.2	4.9	4.3	3.8	3.1	2.3	1.5	
	36000	6.6	6.6	6.6	6.1	5.4	4.2	3.6	3.1	2.4	1.7	0.9	
	38000	5.8	5.8	5.8	5.3	4.6	3.5	3.0	2.5	1.8	1.1	0.4	
	38850	5.5	5.5	5.5	5.0	4.3	3.2	2.7	2.3	1.6	0.9	0.2	

APPCLB2_F10_ECS_IMP_BD100_23FEB04

Figures in shaded area are above engine temperature limits and are for interpolation only.

Figure 04-02. (06-41-02 Sheet 2 of 2)

APPROACH CLIMB GRADIENT
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

UNCORRECTED APPROACH CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
SEA LEVEL	28000	10.9	10.9	11.0	11.0	11.1	11.1	11.1	11.1	11.1	11.1	11.1
	30000	9.6	9.6	9.6	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7
	32000	8.4	8.5	8.5	8.5	8.6	8.6	8.6	8.6	8.6	8.6	8.6
	33750	7.5	7.6	7.6	7.6	7.7	7.7	7.7	7.7	7.7	7.7	7.7
	34000	7.4	7.4	7.5	7.5	7.6	7.6	7.6	7.6	7.6	7.6	7.6
	36000	6.5	6.5	6.6	6.6	6.7	6.7	6.7	6.7	6.7	6.7	6.7
	38000	5.7	5.7	5.8	5.8	5.9	5.9	5.9	5.9	5.9	5.9	5.9
	38850	5.4	5.4	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
1000	28000	11.0	11.0	11.0	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1
	30000	9.7	9.7	9.7	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8
	32000	8.5	8.5	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6
	33750	7.6	7.6	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7
	34000	7.5	7.5	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6
	36000	6.6	6.6	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
	38000	5.8	5.8	5.8	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
	38850	5.5	5.5	5.5	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6
2000	28000	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	10.7
	30000	9.7	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.4
	32000	8.6	8.6	8.6	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.3
	33750	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.4
	34000	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.3
	36000	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.4
	38000	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.6
	38850	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.3
3000	28000	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	10.8	9.9
	30000	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.5	8.7
	32000	8.6	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.3	7.6
	33750	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.5	6.8
	34000	7.6	7.6	7.6	7.7	7.7	7.7	7.7	7.7	7.7	7.4	6.6
	36000	6.7	6.7	6.7	6.8	6.8	6.8	6.8	6.8	6.8	6.5	5.8
	38000	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.7	5.0
	38850	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.4	4.7
4000	28000	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	10.9	10.0	9.1
	30000	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.6	8.7	7.9
	32000	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.7	8.5	7.6	6.9
	33750	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.6	6.8	6.1
	34000	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.5	6.7	6.0
	36000	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.6	5.9	5.2
	38000	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.8	5.1	4.5
	38850	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.5	4.8	4.2
5000	28000	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	10.1	9.2	8.4
	30000	9.7	9.8	9.8	9.8	9.8	9.8	9.8	9.8	8.8	8.0	7.2
	32000	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	7.7	7.0	6.2
	33750	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	6.9	6.2	5.5
	34000	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	6.8	6.0	5.4
	36000	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	5.9	5.2	4.6
	38000	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.2	4.5	3.9
	38850	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	4.9	4.2	3.6

APPCLB1_F10_ALL_IMP_BD100_23FEB04

Figure 04-03. (06-41-03 Sheet 1 of 2)

APPROACH CLIMB GRADIENT
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

UNCORRECTED APPROACH CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
6000	28000	11.1	11.1	11.1	11.1	11.1	11.1	11.1	10.4	9.3	8.4	7.6
	30000	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.1	8.1	7.3	6.6
	32000	8.6	8.6	8.7	8.7	8.7	8.7	8.7	8.0	7.1	6.3	5.6
	33750	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.1	6.3	5.5	4.9
	34000	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.0	6.1	5.4	4.8
	36000	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.2	5.3	4.6	4.0
	38000	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.4	4.6	4.0	3.4
	38850	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.1	4.3	3.7	3.1
7000	28000	11.1	11.2	11.2	11.2	11.2	11.2	10.8	9.5	8.6	7.7	7.0
	30000	9.8	9.9	9.9	9.9	9.9	9.9	9.5	8.3	7.4	6.6	5.9
	32000	8.7	8.7	8.7	8.7	8.7	8.7	8.3	7.3	6.4	5.7	5.0
	33750	7.8	7.8	7.8	7.8	7.8	7.8	7.5	6.4	5.6	4.9	4.3
	34000	7.7	7.7	7.7	7.7	7.7	7.7	7.4	6.3	5.5	4.8	4.2
	36000	6.8	6.8	6.8	6.8	6.8	6.8	6.5	5.5	4.7	4.1	3.5
	38000	5.9	6.0	6.0	6.0	6.0	6.0	5.7	4.8	4.0	3.4	2.9
	38850	5.6	5.7	5.7	5.7	5.7	5.6	5.4	4.5	3.8	3.2	2.6
8000	28000	11.2	11.2	11.2	11.2	11.2	11.1	9.9	8.7	7.8	7.0	6.3
	30000	9.9	9.9	9.9	9.9	9.9	9.8	8.7	7.6	6.7	6.0	5.3
	32000	8.7	8.8	8.7	8.7	8.7	8.7	7.6	6.6	5.8	5.1	4.4
	33750	7.8	7.9	7.8	7.8	7.8	7.8	6.7	5.8	5.0	4.4	3.7
	34000	7.7	7.7	7.7	7.7	7.7	7.7	6.6	5.7	4.9	4.3	3.6
	36000	6.8	6.8	6.8	6.8	6.8	6.8	5.8	4.9	4.2	3.6	3.0
	38000	6.0	6.0	6.0	6.0	6.0	5.9	5.0	4.2	3.5	2.9	2.4
	38850	5.7	5.7	5.7	5.7	5.7	5.6	4.7	3.9	3.2	2.7	2.1
9000	28000	11.1	11.1	11.1	11.1	11.1	10.3	9.1	8.0	7.1	6.4	5.6
	30000	9.8	9.8	9.8	9.8	9.8	9.0	7.9	6.9	6.1	5.4	4.6
	32000	8.7	8.7	8.7	8.7	8.7	7.9	6.8	5.9	5.2	4.5	3.8
	33750	7.8	7.8	7.8	7.8	7.8	7.1	6.0	5.2	4.4	3.8	3.2
	34000	7.7	7.7	7.7	7.7	7.7	6.9	5.9	5.1	4.4	3.7	3.1
	36000	6.8	6.8	6.8	6.8	6.8	6.1	5.1	4.3	3.6	3.0	2.4
	38000	6.0	6.0	6.0	6.0	6.0	5.3	4.4	3.6	3.0	2.4	1.9
	38850	5.6	5.7	5.7	5.7	5.7	5.0	4.1	3.4	2.7	2.2	1.6
10000	28000	10.8	10.8	10.8	10.8	10.4	9.4	8.3	7.3	6.5	5.7	4.9
	30000	9.5	9.5	9.5	9.5	9.2	8.2	7.1	6.2	5.5	4.8	4.0
	32000	8.4	8.4	8.4	8.4	8.1	7.2	6.2	5.3	4.6	3.9	3.2
	33750	7.5	7.5	7.5	7.5	7.2	6.4	5.4	4.6	3.9	3.3	2.6
	34000	7.4	7.4	7.4	7.4	7.1	6.2	5.3	4.5	3.8	3.2	2.5
	36000	6.5	6.5	6.5	6.5	6.3	5.4	4.5	3.8	3.1	2.6	1.9
	38000	5.8	5.8	5.8	5.8	5.5	4.7	3.8	3.1	2.5	2.0	1.3
	38850	5.5	5.5	5.5	5.4	5.2	4.4	3.6	2.8	2.3	1.7	1.1

APPCLB2_F10_ALL_IMP_BD100_23FEB04

Figure 04-03. (06-41-03 Sheet 2 of 2)

APPROACH CLIMB GRADIENT CORRECTION CHART FLAPS 10°

EXAMPLE:

1. Uncorrected Approach Climb Gradient (from table).....7.2 %
2. Headwind.....20 kt
3. Corrected Approach Climb Gradient..... 7.8 %

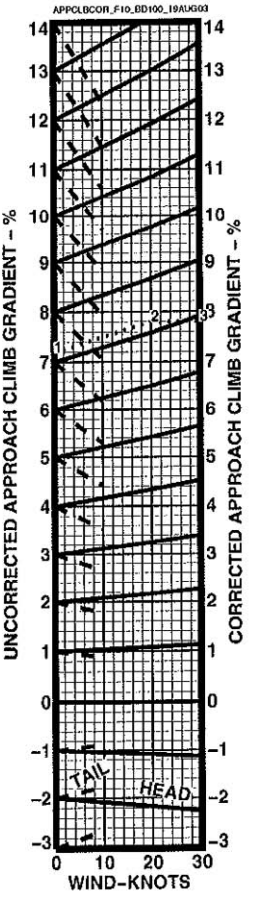

Figure 04-04. (06-41-04)

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LANDING CLIMB GRADIENT
FLAPS 30°
ENGINE BLEED OFF

UNCORRECTED LANDING CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C													
		–40	–30	–20	–10	0	10	15	20	25	30	35	40	45	50
SEA LEVEL	28000	27.3	27.5	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	25.7	23.2	20.8	18.3
	30000	24.4	24.6	24.8	24.8	24.8	24.8	24.8	24.8	24.8	24.8	22.9	20.5	18.3	16.0
	32000	21.8	22.0	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	20.4	18.2	16.1	14.0
	33750	19.8	20.0	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	18.5	16.4	14.5	12.5
	34000	19.6	19.7	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	18.2	16.2	14.2	12.3
	36000	17.6	17.7	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	16.3	14.4	12.6	10.7
	38000	15.8	16.0	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	14.6	12.8	11.1	9.3
	38850	15.1	15.3	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4	13.9	12.2	10.5	8.8
1000	28000	27.6	27.7	27.9	27.9	27.9	27.9	27.9	27.9	27.9	26.2	23.9	21.6	19.2	16.8
	30000	24.6	24.7	24.9	24.9	24.9	24.9	24.9	24.9	24.9	23.3	21.2	19.0	16.8	14.6
	32000	22.0	22.1	22.3	22.3	22.3	22.3	22.3	22.3	22.3	20.8	18.8	16.8	14.8	12.7
	33750	20.0	20.1	20.3	20.3	20.3	20.3	20.3	20.3	20.3	18.9	17.0	15.1	13.2	11.2
	34000	19.7	19.9	20.0	20.0	20.0	20.0	20.0	20.0	20.0	18.6	16.8	14.9	13.0	11.1
	36000	17.7	17.9	18.0	18.0	18.0	18.0	18.0	18.0	18.0	16.7	15.0	13.2	11.4	9.6
	38000	16.0	16.1	16.2	16.2	16.2	16.2	16.2	16.2	16.2	15.0	13.3	11.7	10.0	8.3
	38850	15.3	15.4	15.5	15.5	15.5	15.5	15.5	15.5	15.5	14.3	12.7	11.1	9.4	7.8
2000	28000	27.8	27.8	27.9	27.9	27.9	27.9	27.9	27.9	26.6	24.5	22.3	20.0	17.7	15.4
	30000	24.8	24.9	24.9	24.9	24.9	24.9	24.9	24.9	23.7	21.7	19.7	17.6	15.4	13.3
	32000	22.2	22.3	22.3	22.3	22.3	22.3	22.3	22.3	21.2	19.3	17.4	15.5	13.5	11.5
	33750	20.2	20.3	20.3	20.3	20.3	20.3	20.3	20.3	19.2	17.5	15.7	13.8	11.9	10.1
	34000	19.9	20.0	20.0	20.1	20.1	20.1	20.1	20.1	19.0	17.2	15.5	13.6	11.7	9.9
	36000	17.9	18.0	18.0	18.0	18.1	18.1	18.1	18.1	17.0	15.4	13.7	12.0	10.2	8.5
	38000	16.2	16.2	16.3	16.3	16.3	16.3	16.3	16.3	15.3	13.7	12.2	10.5	8.9	7.3
	38850	15.5	15.5	15.6	15.6	15.6	15.6	15.6	15.6	14.6	13.1	11.6	10.0	8.4	6.8
3000	28000	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.2	25.0	22.8	20.7	18.5	16.2	
	30000	24.9	24.9	24.9	24.9	25.0	25.0	25.0	24.3	22.2	20.2	18.2	16.1	14.1	
	32000	22.3	22.3	22.3	22.3	22.4	22.4	22.4	21.7	19.7	17.9	16.0	14.1	12.2	
	33750	20.3	20.3	20.3	20.3	20.3	20.3	20.3	19.7	17.9	16.1	14.4	12.6	10.8	
	34000	20.0	20.0	20.1	20.1	20.1	20.1	20.1	19.5	17.6	15.9	14.1	12.4	10.6	
	36000	18.0	18.0	18.1	18.1	18.1	18.1	18.1	17.5	15.7	14.1	12.5	10.8	9.1	
	38000	16.2	16.3	16.3	16.3	16.3	16.3	16.3	15.8	14.1	12.6	11.0	9.4	7.9	
	38850	15.5	15.6	15.6	15.6	15.6	15.6	15.6	15.1	13.4	12.0	10.4	8.9	7.4	
4000	28000	27.8	27.8	27.9	27.9	27.9	27.9	27.6	25.6	23.4	21.2	19.1	16.9	14.8	
	30000	24.8	24.9	24.9	24.9	24.9	24.9	24.6	22.8	20.7	18.6	16.7	14.7	12.7	
	32000	22.2	22.3	22.3	22.3	22.3	22.3	22.0	20.3	18.3	16.5	14.7	12.8	11.0	
	33750	20.2	20.3	20.3	20.3	20.3	20.3	20.0	18.4	16.5	14.8	13.1	11.3	9.6	
	34000	20.0	20.0	20.0	20.0	20.0	20.0	19.8	18.1	16.3	14.5	12.9	11.2	9.4	
	36000	18.0	18.0	18.0	18.0	18.0	18.0	17.8	16.2	14.5	12.9	11.3	9.7	8.0	
	38000	16.2	16.2	16.2	16.2	16.2	16.2	16.0	14.6	12.9	11.4	9.9	8.4	6.8	
	38850	15.5	15.5	15.5	15.5	15.5	15.5	15.3	13.9	12.3	10.8	9.3	7.9	6.4	
5000	28000	27.7	27.8	27.8	27.8	27.8	27.8	26.0	24.2	21.6	19.6	17.6	15.5	13.3	
	30000	24.7	24.8	24.8	24.8	24.8	24.8	23.2	21.4	19.0	17.2	15.3	13.4	11.4	
	32000	22.2	22.2	22.2	22.2	22.2	22.2	20.7	19.1	16.8	15.1	13.4	11.6	9.7	
	33750	20.2	20.2	20.2	20.2	20.2	20.2	18.8	17.2	15.1	13.5	11.9	10.2	8.4	
	34000	19.9	19.9	19.9	19.9	19.9	19.9	18.5	17.0	14.8	13.3	11.7	10.0	8.3	
	36000	17.9	17.9	17.9	17.9	17.9	17.9	16.6	15.2	13.1	11.7	10.2	8.6	7.0	
	38000	16.1	16.2	16.2	16.2	16.2	16.2	14.9	13.5	11.6	10.3	8.8	7.3	5.8	
	38850	15.4	15.5	15.5	15.5	15.5	15.5	14.3	12.9	11.0	9.7	8.3	6.8	5.4	

LDGCL81_F30_ZERO_IMP_BD100_23FEB04

Figures in shaded area are above engine temperature limits and are for interpolation only.

Figure 04-05. (06-42-01 Sheet 1 of 2)

LANDING CLIMB GRADIENT
FLAPS 30°
ENGINE BLEED OFF

UNCORRECTED LANDING CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C											
		–40	–30	–20	–10	0	10	15	20	25	30	35	40
6000	28000	27.7	27.9	27.8	27.8	27.8	26.2	24.4	22.4	20.1	18.0	16.0	14.0
	30000	24.8	24.9	24.9	24.9	24.9	23.3	21.7	19.8	17.7	15.8	13.9	12.0
	32000	22.2	22.3	22.3	22.3	22.3	20.9	19.3	17.5	15.5	13.8	12.0	10.3
	33750	20.2	20.3	20.3	20.3	20.3	18.9	17.5	15.8	13.9	12.3	10.6	8.9
	34000	19.9	20.0	20.0	20.0	20.0	18.7	17.2	15.5	13.7	12.0	10.4	8.8
	36000	17.9	18.0	18.0	18.0	18.0	16.8	15.4	13.8	12.0	10.5	9.0	7.4
	38000	16.2	16.2	16.2	16.2	16.2	15.1	13.8	12.3	10.6	9.2	7.7	6.3
	38850	15.5	15.5	15.5	15.5	15.5	14.4	13.1	11.6	10.0	8.6	7.2	5.8
7000	28000	27.9	28.0	28.0	27.9	27.9	24.6	22.9	20.8	18.6	16.5	14.5	12.5
	30000	24.9	25.0	25.0	25.0	24.9	21.9	20.2	18.3	16.3	14.4	12.5	10.7
	32000	22.3	22.4	22.4	22.4	22.4	19.5	18.0	16.1	14.3	12.5	10.8	9.0
	33750	20.3	20.4	20.4	20.4	20.3	17.6	16.2	14.4	12.7	11.0	9.4	7.8
	34000	20.0	20.1	20.1	20.1	20.1	17.4	16.0	14.2	12.5	10.8	9.2	7.6
	36000	18.0	18.1	18.1	18.1	18.1	15.6	14.2	12.6	10.9	9.4	7.9	6.4
	38000	16.3	16.3	16.3	16.3	16.3	13.9	12.7	11.1	9.6	8.1	6.7	5.3
	38850	15.6	15.6	15.6	15.6	15.6	13.3	12.0	10.5	9.0	7.6	6.2	4.8
8000	28000	28.0	28.1	28.0	28.0	26.7	23.1	21.3	19.3	17.1	15.1	13.1	
	30000	25.0	25.1	25.0	25.0	23.8	20.4	18.8	16.9	14.9	13.0	11.2	
	32000	22.4	22.5	22.4	22.4	21.3	18.2	16.6	14.8	13.0	11.2	9.5	
	33750	20.4	20.4	20.4	20.4	19.3	16.4	14.9	13.2	11.5	9.8	8.2	
	34000	20.1	20.2	20.2	20.2	19.1	16.2	14.7	13.0	11.3	9.6	8.1	
	36000	18.1	18.2	18.2	18.1	17.1	14.4	13.0	11.4	9.8	8.2	6.8	
	38000	16.4	16.4	16.4	16.4	15.4	12.8	11.5	10.0	8.5	7.0	5.7	
	38850	15.7	15.7	15.7	15.7	14.7	12.2	11.0	9.5	8.0	6.5	5.2	
9000	28000	27.7	27.7	27.7	27.4	25.0	21.6	19.8	17.8	15.6	13.6	11.7	
	30000	24.8	24.8	24.8	24.5	22.2	19.1	17.4	15.5	13.5	11.7	9.9	
	32000	22.2	22.2	22.2	21.9	19.8	16.9	15.3	13.5	11.7	10.0	8.3	
	33750	20.2	20.2	20.2	20.0	18.0	15.2	13.7	12.0	10.3	8.7	7.1	
	34000	20.0	20.0	20.0	19.7	17.7	14.9	13.5	11.8	10.1	8.5	7.0	
	36000	18.0	18.0	18.0	17.8	15.9	13.3	11.9	10.3	8.7	7.2	5.7	
	38000	16.2	16.3	16.3	16.1	14.2	11.8	10.5	9.0	7.4	6.0	4.7	
	38850	15.6	15.6	15.6	15.4	13.6	11.2	9.9	8.4	6.9	5.6	4.3	
10000	28000	27.1	27.0	27.0	25.7	23.4	20.1	18.5	16.3	14.2	12.2	10.3	
	30000	24.2	24.2	24.1	22.9	20.8	17.7	16.2	14.1	12.2	10.4	8.6	
	32000	21.7	21.6	21.6	20.5	18.5	15.6	14.2	12.3	10.4	8.8	7.2	
	33750	19.7	19.7	19.7	18.6	16.7	14.0	12.6	10.8	9.1	7.5	6.0	
	34000	19.5	19.4	19.4	18.4	16.5	13.8	12.4	10.6	8.9	7.4	5.9	
	36000	17.5	17.5	17.5	16.5	14.7	12.2	10.8	9.2	7.6	6.1	4.7	
	38000	15.8	15.8	15.8	14.9	13.1	10.7	9.5	7.9	6.4	5.1	3.7	
	38850	15.1	15.1	15.1	14.2	12.5	10.2	8.9	7.4	5.9	4.6	3.3	

LDGCLB2_F30_ZERO_IMP_BD100_23FEB04

Figures in shaded area are above engine temperature limits and are for interpolation only.

Figure 04-05. (06-42-01 Sheet 2 of 2)

LANDING CLIMB GRADIENT
FLAPS 30°
ENGINE BLEED ON

UNCORRECTED LANDING CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C													
		–40	–30	–20	–10	0	10	15	20	25	30	35	40	45	50
SEA LEVEL	28000	27.3	27.5	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.3	25.1	22.6	20.2	17.8
	30000	24.3	24.5	24.7	24.7	24.7	24.7	24.7	24.7	24.7	24.4	22.3	19.9	17.7	15.5
	32000	21.8	21.9	22.1	22.1	22.1	22.1	22.1	22.1	22.1	21.8	19.8	17.7	15.6	13.5
	33750	19.8	19.9	20.1	20.1	20.1	20.1	20.1	20.1	20.1	19.8	17.9	15.9	13.9	12.0
	34000	19.5	19.7	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.6	17.7	15.7	13.7	11.8
	36000	17.5	17.7	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.6	15.8	13.9	12.1	10.3
	38000	15.8	15.9	16.1	16.1	16.1	16.1	16.1	16.1	16.1	15.8	14.1	12.4	10.6	9.0
	38850	15.1	15.2	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.1	13.5	11.8	10.1	8.4
1000	28000	27.5	27.6	27.8	27.8	27.8	27.8	27.8	27.8	27.7	25.5	23.3	21.0	18.6	16.3
	30000	24.5	24.7	24.8	24.8	24.8	24.8	24.8	24.8	24.7	22.7	20.6	18.5	16.3	14.1
	32000	21.9	22.1	22.2	22.2	22.2	22.2	22.2	22.2	22.1	20.2	18.3	16.3	14.3	12.2
	33750	19.9	20.1	20.2	20.2	20.2	20.2	20.2	20.2	20.1	18.3	16.5	14.6	12.7	10.8
	34000	19.7	19.8	19.9	19.9	19.9	19.9	20.0	19.9	19.9	18.1	16.3	14.4	12.5	10.6
	36000	17.7	17.8	17.9	17.9	17.9	17.9	17.9	17.9	17.9	16.2	14.5	12.7	10.9	9.2
	38000	15.9	16.0	16.2	16.2	16.2	16.2	16.2	16.2	16.1	14.5	12.9	11.2	9.6	7.9
	38850	15.2	15.4	15.5	15.5	15.5	15.5	15.5	15.5	15.4	13.8	12.3	10.6	9.0	7.4
2000	28000	27.7	27.8	27.9	27.9	27.9	27.9	27.9	27.8	26.0	23.8	21.6	19.4	17.1	14.8
	30000	24.7	24.8	24.9	24.9	24.9	24.9	24.9	24.8	23.1	21.1	19.1	17.0	14.9	12.8
	32000	22.1	22.2	22.3	22.3	22.3	22.3	22.3	22.2	20.6	18.7	16.9	14.9	13.0	11.0
	33750	20.1	20.2	20.3	20.3	20.3	20.3	20.3	20.2	18.7	16.9	15.2	13.3	11.5	9.6
	34000	19.9	19.9	20.0	20.0	20.0	20.0	20.0	20.0	18.4	16.7	14.9	13.1	11.3	9.4
	36000	17.9	17.9	18.0	18.0	18.0	18.0	18.0	18.0	16.5	14.9	13.2	11.5	9.8	8.1
	38000	16.1	16.2	16.2	16.2	16.2	16.2	16.2	16.2	14.8	13.3	11.7	10.1	8.5	6.9
	38850	15.4	15.5	15.5	15.5	15.5	15.5	15.5	15.5	14.1	12.6	11.1	9.6	8.0	6.4
3000	28000	27.8	27.8	27.9	27.9	27.9	27.9	27.9	26.5	24.3	22.2	20.0	17.9	15.6	
	30000	24.8	24.9	24.9	24.9	24.9	24.9	24.9	23.6	21.5	19.6	17.6	15.6	13.5	
	32000	22.2	22.3	22.3	22.3	22.3	22.3	22.3	21.1	19.2	17.3	15.5	13.6	11.7	
	33750	20.2	20.3	20.3	20.3	20.3	20.3	20.3	19.2	17.3	15.6	13.9	12.1	10.3	
	34000	20.0	20.0	20.0	20.0	20.0	20.0	20.0	18.9	17.1	15.4	13.6	11.9	10.1	
	36000	18.0	18.0	18.0	18.0	18.0	18.0	18.0	17.0	15.2	13.6	12.0	10.4	8.7	
	38000	16.2	16.2	16.2	16.2	16.3	16.3	16.3	15.3	13.6	12.1	10.6	9.0	7.4	
	38850	15.5	15.5	15.5	15.6	15.6	15.6	15.6	14.6	12.9	11.5	10.0	8.5	6.9	
4000	28000	27.7	27.8	27.8	27.8	27.8	27.8	26.9	24.9	22.7	20.5	18.5	16.4	14.2	
	30000	24.7	24.8	24.8	24.8	24.8	24.8	24.0	22.1	20.1	18.1	16.2	14.2	12.2	
	32000	22.2	22.2	22.2	22.2	22.2	22.2	21.4	19.7	17.8	15.9	14.1	12.3	10.4	
	33750	20.2	20.2	20.2	20.2	20.2	20.2	19.5	17.8	16.0	14.3	12.6	10.9	9.1	
	34000	19.9	19.9	19.9	20.0	20.0	20.0	19.2	17.6	15.8	14.0	12.4	10.7	8.9	
	36000	17.9	17.9	17.9	18.0	18.0	18.0	17.3	15.7	14.0	12.4	10.8	9.2	7.6	
	38000	16.1	16.2	16.2	16.2	16.2	16.2	15.6	14.1	12.4	10.9	9.5	7.9	6.4	
	38850	15.4	15.5	15.5	15.5	15.5	15.5	14.9	13.4	11.8	10.3	8.9	7.4	5.9	
5000	28000	27.7	27.7	27.7	27.7	27.7	27.1	25.3	23.5	20.9	18.9	17.0	14.9	12.8	
	30000	24.7	24.7	24.7	24.7	24.7	24.2	22.5	20.8	18.4	16.6	14.8	12.8	10.9	
	32000	22.1	22.1	22.1	22.1	22.1	21.7	20.1	18.5	16.3	14.6	12.9	11.1	9.2	
	33750	20.1	20.1	20.1	20.1	20.2	19.7	18.2	16.7	14.6	13.0	11.4	9.7	8.0	
	34000	19.8	19.9	19.9	19.9	19.9	19.4	18.0	16.4	14.3	12.8	11.2	9.5	7.8	
	36000	17.8	17.9	17.9	17.9	17.9	17.5	16.1	14.6	12.6	11.2	9.7	8.1	6.5	
	38000	16.1	16.1	16.1	16.1	16.1	15.7	14.4	13.0	11.2	9.8	8.4	6.9	5.4	
	38850	15.4	15.4	15.4	15.4	15.4	15.1	13.8	12.4	10.6	9.3	7.9	6.4	5.0	

LOGCLB1_F30_ECS_IMP_BD100_23FEB04

Figures in shaded area are above engine temperature limits and are for interpolation only.

Figure 04-06. (06-42-02 Sheet 1 of 2)

LANDING CLIMB GRADIENT
FLAPS 30°
ENGINE BLEED ON

UNCORRECTED LANDING CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C											
		-40	-30	-20	-10	0	10	15	20	25	30	35	40
6000	28000	27.7	27.8	27.8	27.8	27.8	25.5	23.7	21.7	19.5	17.4	15.4	13.4
	30000	24.7	24.8	24.8	24.8	24.8	22.7	21.0	19.2	17.1	15.2	13.4	11.5
	32000	22.1	22.2	22.2	22.2	22.2	20.2	18.7	16.9	15.0	13.3	11.5	9.8
	33750	20.1	20.2	20.2	20.2	20.2	18.3	16.9	15.2	13.4	11.8	10.1	8.5
	34000	19.9	20.0	20.0	20.0	20.0	18.1	16.7	15.0	13.2	11.6	9.9	8.3
	36000	17.9	18.0	18.0	18.0	18.0	16.2	14.9	13.3	11.6	10.1	8.5	7.0
	38000	16.1	16.2	16.2	16.2	16.2	14.5	13.3	11.8	10.1	8.7	7.3	5.9
	38850	15.4	15.5	15.5	15.5	15.5	13.9	12.6	11.2	9.6	8.2	6.8	5.4
7000	28000	27.8	27.9	27.9	27.9	27.6	23.9	22.2	20.1	18.0	15.9	14.0	12.0
	30000	24.8	24.9	24.9	24.9	24.6	21.2	19.6	17.7	15.7	13.8	12.0	10.2
	32000	22.3	22.3	22.3	22.3	22.0	18.9	17.4	15.5	13.7	12.0	10.3	8.6
	33750	20.3	20.3	20.3	20.3	20.1	17.1	15.7	13.9	12.2	10.5	8.9	7.3
	34000	20.0	20.1	20.1	20.0	19.8	16.8	15.4	13.7	12.0	10.3	8.8	7.2
	36000	18.0	18.1	18.0	18.0	17.8	15.0	13.7	12.1	10.4	8.9	7.4	6.0
	38000	16.2	16.3	16.3	16.3	16.0	13.4	12.2	10.6	9.1	7.6	6.3	4.9
	38850	15.5	15.6	15.6	15.6	15.4	12.8	11.6	10.0	8.6	7.2	5.8	4.5
8000	28000	28.0	28.0	28.0	28.0	25.9	22.4	20.6	18.6	16.5	14.5	12.5	
	30000	25.0	25.0	25.0	25.0	23.1	19.8	18.2	16.3	14.3	12.4	10.7	
	32000	22.4	22.4	22.4	22.4	20.6	17.5	16.1	14.3	12.4	10.7	9.0	
	33750	20.4	20.4	20.4	20.4	18.7	15.8	14.4	12.7	11.0	9.3	7.8	
	34000	20.1	20.1	20.1	20.1	18.4	15.6	14.2	12.5	10.8	9.1	7.6	
	36000	18.1	18.1	18.1	18.1	16.5	13.9	12.5	10.9	9.3	7.8	6.4	
	38000	16.3	16.4	16.3	16.3	14.9	12.3	11.1	9.6	8.0	6.6	5.3	
	38850	15.6	15.7	15.6	15.6	14.2	11.7	10.5	9.0	7.5	6.1	4.8	
9000	28000	27.6	27.7	27.7	27.3	24.2	20.9	19.1	17.1	15.0	13.1	11.2	
	30000	24.7	24.7	24.7	24.4	21.5	18.4	16.8	14.9	13.0	11.1	9.4	
	32000	22.2	22.2	22.2	21.9	19.2	16.3	14.8	13.0	11.2	9.5	7.9	
	33750	20.2	20.2	20.2	19.9	17.4	14.6	13.2	11.5	9.8	8.2	6.7	
	34000	19.9	19.9	19.9	19.7	17.1	14.4	13.0	11.3	9.6	8.0	6.5	
	36000	17.9	18.0	18.0	17.7	15.3	12.7	11.4	9.8	8.2	6.7	5.3	
	38000	16.2	16.2	16.2	16.0	13.7	11.3	10.0	8.5	7.0	5.6	4.3	
	38850	15.5	15.5	15.5	15.3	13.1	10.7	9.4	8.0	6.5	5.2	3.9	
10000	28000	27.0	27.0	26.9	25.6	22.7	19.4	17.8	15.7	13.6	11.7	9.8	
	30000	24.1	24.1	24.1	22.8	20.1	17.1	15.6	13.6	11.6	9.9	8.1	
	32000	21.6	21.6	21.6	20.4	17.8	15.0	13.6	11.7	9.9	8.3	6.7	
	33750	19.7	19.7	19.6	18.6	16.1	13.4	12.1	10.3	8.6	7.1	5.6	
	34000	19.4	19.4	19.4	18.3	15.9	13.2	11.9	10.1	8.4	6.9	5.4	
	36000	17.5	17.5	17.4	16.5	14.1	11.6	10.4	8.7	7.1	5.7	4.3	
	38000	15.8	15.7	15.7	14.8	12.6	10.2	9.0	7.5	5.9	4.6	3.4	
	38850	15.1	15.1	15.1	14.2	12.0	9.7	8.5	7.0	5.5	4.2	3.0	

LDGCLB2_F30_ECS_IMP_BD100_23FEB04

Figures in shaded area are above engine temperature limits and are for interpolation only.

Figure 04-06. (06-42-02 Sheet 2 of 2)

LANDING CLIMB GRADIENT
FLAPS 30°
ENGINE BLEED ON, ENGINE AND WING A/I ON

UNCORRECTED LANDING CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
SEA LEVEL	28000	27.2	27.3	27.4	27.5	27.6	27.6	27.6	27.6	27.6	27.6	27.6
	30000	24.3	24.3	24.4	24.6	24.7	24.7	24.7	24.7	24.7	24.7	24.7
	32000	21.7	21.8	21.9	22.0	22.1	22.1	22.1	22.1	22.1	22.1	22.1
	33750	19.7	19.8	19.9	20.0	20.1	20.1	20.1	20.1	20.1	20.1	20.1
	34000	19.5	19.5	19.6	19.7	19.8	19.8	19.8	19.8	19.8	19.8	19.8
	36000	17.5	17.5	17.6	17.7	17.8	17.8	17.8	17.8	17.8	17.8	17.8
	38000	15.7	15.8	15.9	15.9	16.0	16.0	16.0	16.0	16.0	16.0	16.0
	38850	15.0	15.1	15.2	15.3	15.3	15.3	15.3	15.4	15.4	15.4	15.3
1000	28000	27.4	27.5	27.6	27.7	27.7	27.7	27.7	27.7	27.8	27.7	27.8
	30000	24.5	24.5	24.6	24.7	24.8	24.8	24.8	24.8	24.8	24.8	24.8
	32000	21.9	22.0	22.0	22.1	22.2	22.2	22.2	22.2	22.2	22.2	22.2
	33750	19.9	20.0	20.0	20.1	20.2	20.2	20.2	20.2	20.2	20.2	20.2
	34000	19.6	19.7	19.8	19.8	19.9	19.9	19.9	19.9	19.9	19.9	19.9
	36000	17.6	17.7	17.8	17.8	17.9	17.9	17.9	17.9	17.9	17.9	17.9
	38000	15.9	15.9	16.0	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1
	38850	15.2	15.3	15.3	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4
2000	28000	27.6	27.7	27.7	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.3
	30000	24.7	24.7	24.7	24.8	24.8	24.8	24.8	24.8	24.8	24.8	24.4
	32000	22.1	22.1	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	21.8
	33750	20.1	20.1	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	19.8
	34000	19.8	19.8	19.9	19.9	19.9	19.9	20.0	20.0	20.0	20.0	19.6
	36000	17.8	17.8	17.9	17.9	17.9	17.9	17.9	18.0	18.0	18.0	17.6
	38000	16.1	16.1	16.1	16.2	16.2	16.2	16.2	16.2	16.2	16.2	15.9
	38850	15.4	15.4	15.4	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.2
3000	28000	27.7	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.4	25.5
	30000	24.8	24.8	24.8	24.8	24.8	24.8	24.8	24.8	24.8	24.5	22.7
	32000	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	21.9	20.3
	33750	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.0	18.4
	34000	19.9	19.9	19.9	20.0	20.0	20.0	20.0	20.0	20.0	19.7	18.1
	36000	17.9	17.9	17.9	18.0	18.0	18.0	18.0	18.0	18.0	17.7	16.2
	38000	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.0	14.6
	38850	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.3	13.9
4000	28000	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.8	27.6	25.6	23.7
	30000	24.7	24.7	24.8	24.8	24.8	24.8	24.8	24.8	24.6	22.8	21.0
	32000	22.1	22.1	22.2	22.2	22.2	22.2	22.2	22.2	22.0	20.4	18.7
	33750	20.1	20.1	20.2	20.2	20.2	20.2	20.2	20.2	20.0	18.5	16.9
	34000	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.8	18.2	16.7
	36000	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.8	16.4	14.9
	38000	16.1	16.1	16.1	16.2	16.2	16.2	16.2	16.2	16.0	14.7	13.3
	38850	15.4	15.4	15.5	15.5	15.5	15.5	15.5	15.5	15.3	14.0	12.7
5000	28000	27.6	27.6	27.7	27.7	27.7	27.7	27.7	27.7	25.9	23.9	22.0
	30000	24.6	24.7	24.7	24.7	24.7	24.7	24.7	24.7	23.0	21.2	19.5
	32000	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	20.6	18.9	17.3
	33750	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	18.7	17.1	15.5
	34000	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	18.4	16.8	15.3
	36000	17.8	17.8	17.9	17.8	17.9	17.8	17.9	17.9	16.5	15.0	13.6
	38000	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	14.9	13.4	12.1
	38850	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4	14.2	12.8	11.5

LDGCLB1,,F30_ALL_IMP_BD100_23FEB04

Figure 04-07. (06-42-03 Sheet 1 of 2)

LANDING CLIMB GRADIENT
FLAPS 30°
ENGINE BLEED ON, ENGINE AND WING A/I ON

UNCORRECTED LANDING CLIMB GRADIENT – %

ALT FT	WT LB	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
6000	28000	27.6	27.7	27.8	27.7	27.7	27.7	27.8	26.6	24.2	22.2	20.5
	30000	24.7	24.7	24.8	24.8	24.8	24.8	24.8	23.7	21.5	19.6	18.0
	32000	22.1	22.2	22.2	22.2	22.2	22.2	22.2	21.2	19.1	17.4	15.9
	33750	20.1	20.2	20.2	20.2	20.2	20.2	20.2	19.3	17.3	15.7	14.3
	34000	19.8	19.9	19.9	19.9	19.9	19.9	19.9	19.0	17.0	15.5	14.0
	36000	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.1	15.2	13.7	12.4
	38000	16.1	16.1	16.2	16.2	16.2	16.2	16.2	15.4	13.6	12.2	11.0
	38850	15.4	15.4	15.5	15.5	15.5	15.5	15.5	14.7	13.0	11.6	10.4
7000	28000	27.8	27.9	27.9	27.9	27.9	27.9	27.4	24.7	22.5	20.6	19.0
	30000	24.8	24.9	24.9	24.9	24.9	24.9	24.5	21.9	19.9	18.2	16.6
	32000	22.2	22.3	22.3	22.3	22.3	22.3	21.9	19.6	17.7	16.1	14.6
	33750	20.2	20.3	20.3	20.3	20.3	20.3	19.9	17.7	15.9	14.4	13.0
	34000	20.0	20.0	20.0	20.0	20.0	20.0	19.7	17.5	15.7	14.2	12.8
	36000	18.0	18.0	18.0	18.0	18.0	18.0	17.7	15.6	14.0	12.5	11.3
	38000	16.2	16.3	16.3	16.3	16.2	16.2	15.9	14.0	12.4	11.1	9.9
	38850	15.5	15.6	15.6	15.6	15.6	15.6	15.2	13.4	11.8	10.5	9.3
8000	28000	27.9	28.0	28.0	28.0	27.9	27.9	25.6	22.9	20.9	19.1	17.4
	30000	24.9	25.0	25.0	25.0	25.0	25.0	22.7	20.3	18.4	16.8	15.2
	32000	22.3	22.4	22.4	22.4	22.4	22.4	20.3	18.0	16.3	14.7	13.3
	33750	20.3	20.4	20.4	20.4	20.4	20.4	18.4	16.3	14.6	13.2	11.8
	34000	20.1	20.1	20.1	20.1	20.1	20.1	18.2	16.0	14.4	13.0	11.6
	36000	18.1	18.1	18.1	18.1	18.1	18.1	16.3	14.3	12.7	11.4	10.1
	38000	16.3	16.3	16.3	16.3	16.3	16.3	14.6	12.7	11.2	10.0	8.8
	38850	15.6	15.6	15.6	15.6	15.6	15.6	14.0	12.1	10.7	9.5	8.3
9000	28000	27.6	27.6	27.6	27.6	27.6	26.2	23.7	21.3	19.4	17.7	15.9
	30000	24.7	24.7	24.7	24.7	24.7	23.4	21.0	18.8	17.0	15.4	13.8
	32000	22.1	22.1	22.1	22.1	22.1	20.9	18.7	16.6	14.9	13.5	12.0
	33750	20.2	20.2	20.2	20.2	20.2	19.0	16.9	14.9	13.4	12.0	10.5
	34000	19.9	19.9	19.9	19.9	19.9	18.8	16.7	14.7	13.1	11.8	10.4
	36000	17.9	17.9	17.9	17.9	17.9	16.9	14.9	13.0	11.6	10.3	8.9
	38000	16.2	16.2	16.2	16.2	16.2	15.2	13.3	11.5	10.2	9.0	7.7
	38850	15.5	15.5	15.5	15.5	15.5	14.5	12.6	11.0	9.6	8.4	7.2
10000	28000	27.0	27.0	27.0	27.0	26.3	24.3	21.9	19.7	17.9	16.2	14.4
	30000	24.1	24.1	24.1	24.1	23.5	21.6	19.4	17.3	15.6	14.1	12.4
	32000	21.6	21.6	21.6	21.6	21.0	19.3	17.2	15.2	13.7	12.3	10.7
	33750	19.6	19.6	19.6	19.6	19.1	17.5	15.4	13.6	12.2	10.8	9.3
	34000	19.4	19.4	19.4	19.4	18.9	17.2	15.2	13.4	12.0	10.6	9.1
	36000	17.4	17.4	17.4	17.4	17.0	15.4	13.5	11.8	10.5	9.2	7.8
	38000	15.7	15.7	15.7	15.7	15.3	13.8	12.0	10.4	9.1	8.0	6.6
	38850	15.1	15.1	15.1	15.1	14.7	13.2	11.4	9.9	8.6	7.5	6.2

LDGCLB2_F30_ALL_IMP_SD100_23FEB04

Figure 04-07. (06-42-03 Sheet 1 of 2)

LANDING CLIMB GRADIENT CORRECTION CHART FLAPS 30°

LANDING CLIMB GRADIENT CORRECTION CHART FLAPS 30°

EXAMPLE:

1. Uncorrected Landing Climb Gradient (from table).....16.0 %
2. Headwind.....20 kt
3. Corrected Landing Climb Gradient..... 17.4 %

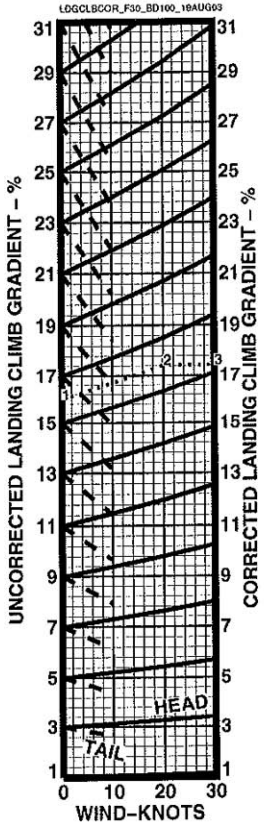
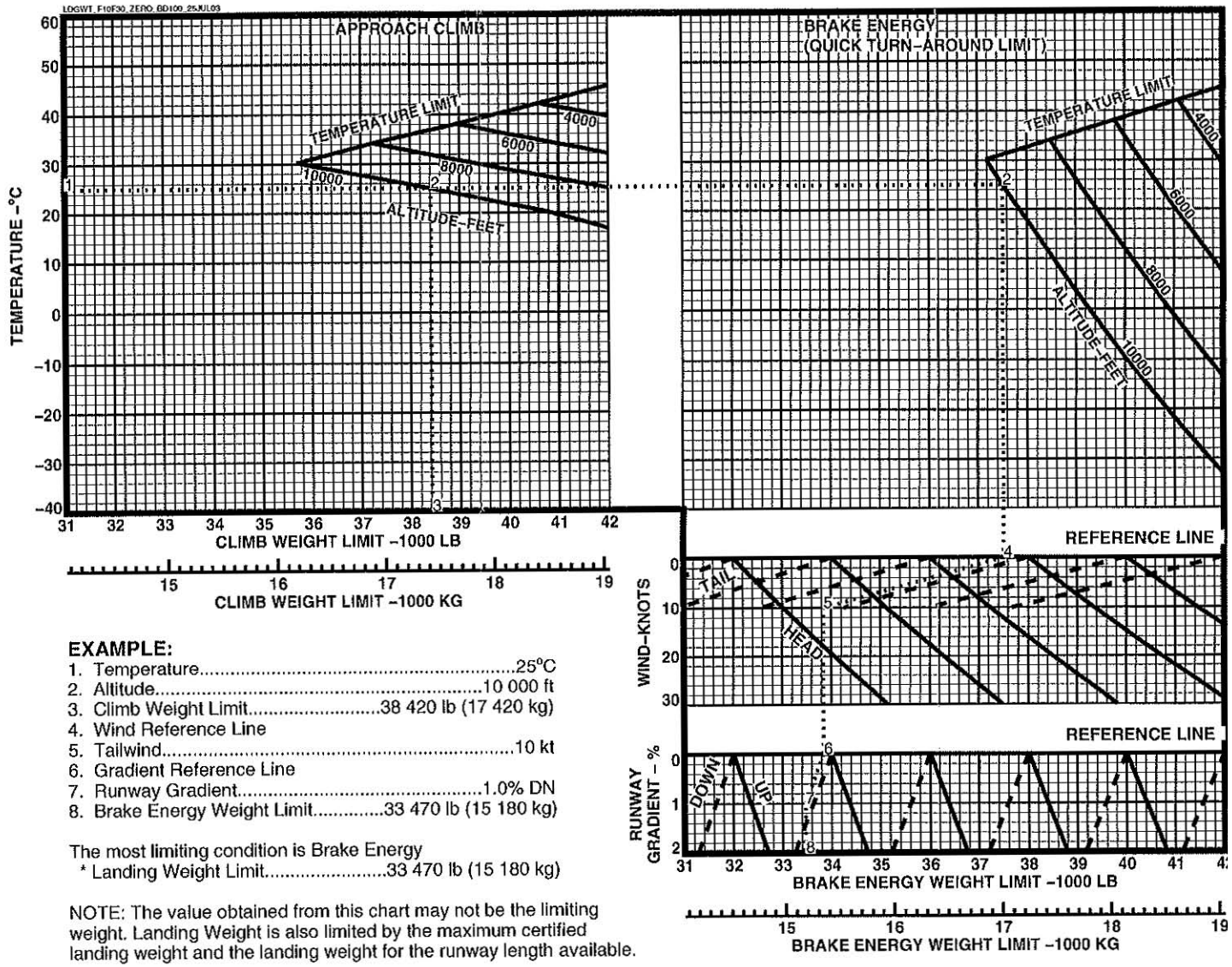


Figure 04-08. (06-42-04)

FlightSafety international
CHALLENGER 300 PERFORMANCE MANUAL

LANDING WEIGHT LIMIT
ENGINE BLEED OFF



EXAMPLE:

1. Temperature.....25°C
2. Altitude.....10 000 ft
3. Climb Weight Limit.....38 420 lb (17 420 kg)
4. Wind Reference Line
5. Tailwind.....10 kt
6. Gradient Reference Line
7. Runway Gradient.....1.0% DN
8. Brake Energy Weight Limit.....33 470 lb (15 180 kg)

The most limiting condition is Brake Energy
* Landing Weight Limit.....33 470 lb (15 180 kg)

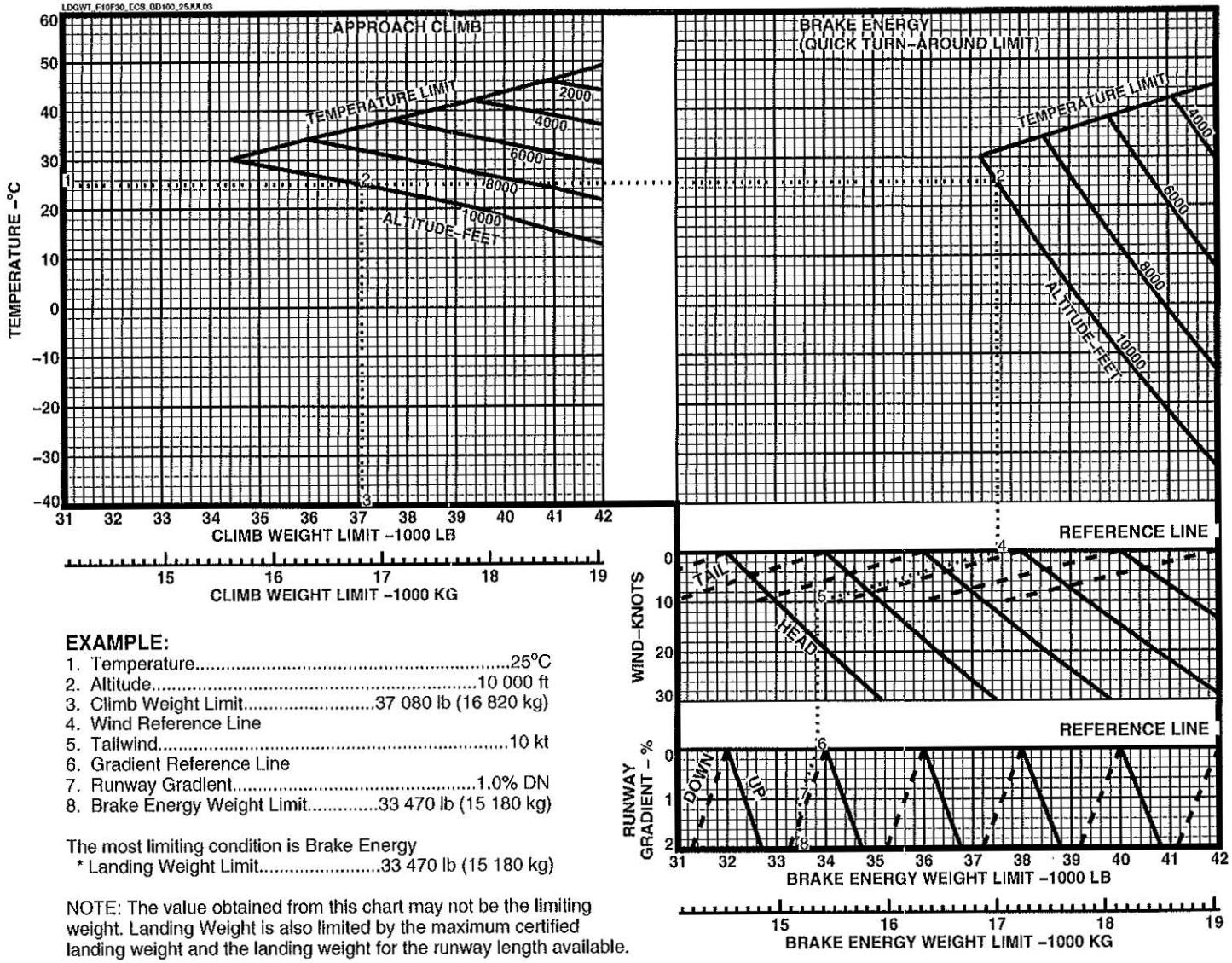
NOTE: The value obtained from this chart may not be the limiting weight. Landing Weight is also limited by the maximum certified landing weight and the landing weight for the runway length available.

Figure 04-09. (06-43-01)

FOR TRAINING PURPOSES ONLY

FlightSafety international
CHALLENGER 300 PERFORMANCE MANUAL

LANDING WEIGHT LIMIT
ENGINE BLEED ON



EXAMPLE:

1. Temperature.....25°C
2. Altitude.....10 000 ft
3. Climb Weight Limit.....37 080 lb (16 820 kg)
4. Wind Reference Line
5. Tailwind.....10 kt
6. Gradient Reference Line
7. Runway Gradient.....1.0% DN
8. Brake Energy Weight Limit.....33 470 lb (15 180 kg)

The most limiting condition is Brake Energy
* Landing Weight Limit.....33 470 lb (15 180 kg)

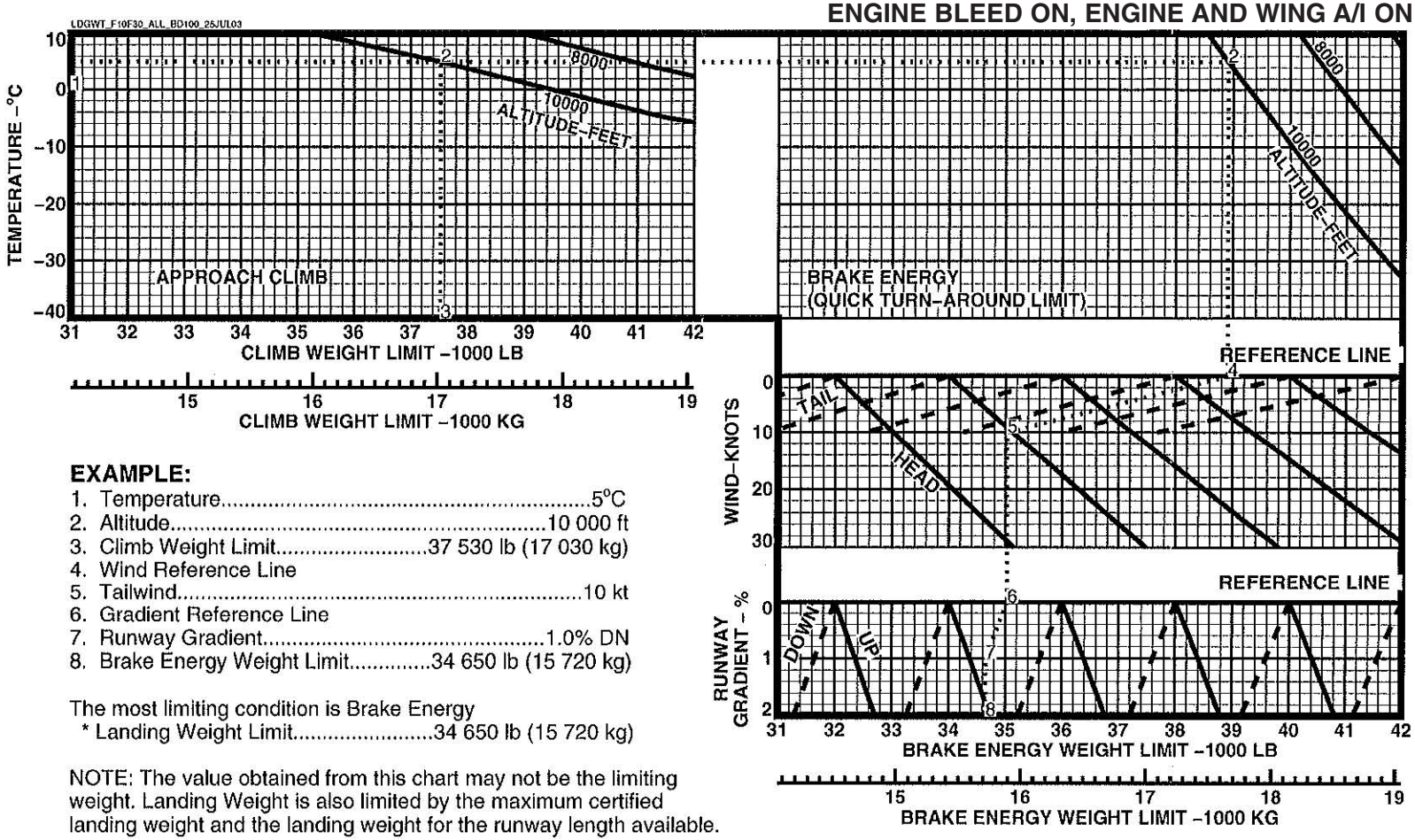
NOTE: The value obtained from this chart may not be the limiting weight. Landing Weight is also limited by the maximum certified landing weight and the landing weight for the runway length available.

Figure 04-10. (06-43-02)

FOR TRAINING PURPOSES ONLY

FlightSafety international
CHALLENGER 300 PERFORMANCE MANUAL

LANDING WEIGHT LIMIT
ENGINE BLEED ON, ENGINE AND WING A/I ON



EXAMPLE:

1. Temperature.....5°C
2. Altitude.....10 000 ft
3. Climb Weight Limit.....37 530 lb (17 030 kg)
4. Wind Reference Line
5. Tailwind.....10 kt
6. Gradient Reference Line
7. Runway Gradient.....1.0% DN
8. Brake Energy Weight Limit.....34 650 lb (15 720 kg)

The most limiting condition is Brake Energy
* Landing Weight Limit.....34 650 lb (15 720 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 length available.

Figure 04-11. (06-43-03)

FOR TRAINING PURPOSES ONLY

DRY AND WET RUNWAY LANDING DATA
APPROACH SPEEDS AND LANDING DISTANCES

APPROACH SPEEDS (KIAS) AND UNCORRECTED DISTANCES (FT)											
WT – LB DATA	ALTITUDE – FT										
28000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
V_{REF}	113	113	113	113	113	113	113	113	113	113	113
V_{GA}	119	119	119	119	119	119	119	119	119	119	119
ALD	2290	2340	2390	2440	2490	2540	2600	2660	2720	2790	2850
FLD	3820	3890	3970	4060	4150	4240	4330	4430	4530	4640	4750
FLD WET	4390	4480	4570	4670	4770	4870	4980	5100	5210	5330	5460
30000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
V_{REF}	117	117	117	117	117	117	117	117	117	117	117
V_{GA}	123	123	123	123	123	123	123	123	123	123	123
ALD	2400	2450	2500	2560	2610	2670	2730	2790	2860	2930	3000
FLD	4000	4080	4170	4260	4350	4450	4550	4650	4760	4880	5000
FLD WET	4600	4690	4790	4900	5000	5110	5230	5350	5480	5610	5740
32000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
V_{REF}	121	121	121	121	121	121	121	121	121	121	121
V_{GA}	127	127	127	127	127	127	127	128	128	128	128
ALD	2510	2560	2620	2680	2730	2800	2860	2930	3000	3070	3150
FLD	4180	4270	4360	4460	4550	4660	4760	4880	4990	5110	5240
FLD WET	4810	4900	5010	5120	5240	5350	5480	5610	5740	5880	6030
33750	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
V_{REF}	124	124	124	125	125	125	125	125	125	125	125
V_{GA}	131	131	131	131	131	131	131	131	131	131	131
ALD	2600	2660	2720	2780	2840	2910	2970	3050	3120	3200	3280
FLD	4340	4430	4530	4630	4730	4840	4950	5070	5200	5320	5460
FLD WET	4990	5090	5200	5320	5440	5570	5700	5830	5980	6120	6280

LDGDATA1_F30_IMP_BD100_16FEB04

Figure 04-12. (06-43-04 Sheet 1 of 2)

DRY AND WET RUNWAY LANDING DATA
APPROACH SPEEDS AND LANDING DISTANCES

APPROACH SPEEDS (KIAS) AND UNCORRECTED DISTANCES (FT)

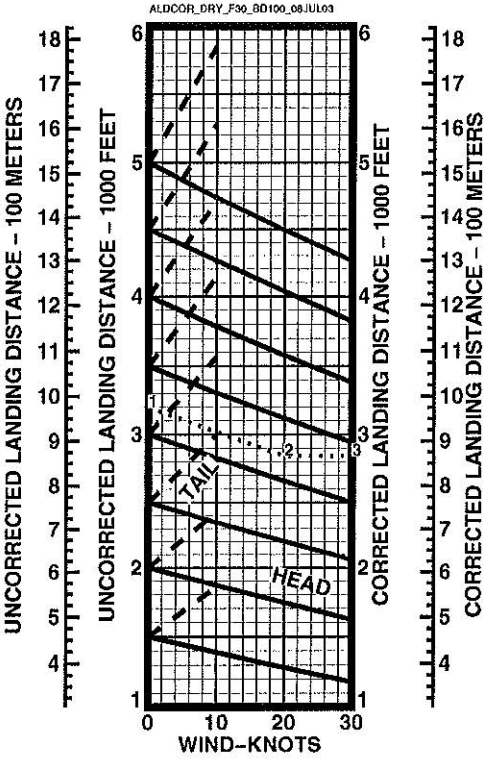
WT – LB DATA	ALTITUDE – FT										
34000	**0**	**1000**	**2000**	**3000**	**4000**	**5000**	**6000**	**7000**	**8000**	**9000**	**10000**
V_{REF}	125	125	126	126	125	125	125	126	126	126	125
V_{GA}	131	131	131	131	131	132	132	132	132	132	132
ALD	2620	2670	2730	2790	2860	2920	2990	3060	3140	3210	3300
FLD	4360	4450	4550	4650	4760	4870	4980	5100	5230	5360	5490
FLD WET	5010	5120	5230	5350	5470	5600	5730	5870	6010	6160	6320
36000	**0**	**1000**	**2000**	**3000**	**4000**	**5000**	**6000**	**7000**	**8000**	**9000**	**10000**
V_{REF}	129	129	129	129	129	129	129	129	129	129	129
V_{GA}	135	135	135	135	135	135	135	135	136	136	136
ALD	2730	2780	2850	2910	2980	3050	3120	3200	3280	3360	3450
FLD	4540	4640	4740	4850	4960	5080	5200	5330	5460	5600	5740
FLD WET	5220	5330	5450	5580	5710	5840	5980	6120	6280	6430	6600
38000	**0**	**1000**	**2000**	**3000**	**4000**	**5000**	**6000**	**7000**	**8000**	**9000**	**10000**
V_{REF}	132	132	132	132	132	132	132	132	132	132	132
V_{GA}	139	139	139	139	139	139	139	139	139	139	139
ALD	2830	2890	2960	3030	3100	3170	3250	3330	3410	3500	3590
FLD	4710	4820	4930	5040	5160	5280	5410	5540	5680	5830	5980
FLD WET	5420	5540	5660	5800	5930	6070	6220	6380	6540	6700	6880
38850	**0**	**1000**	**2000**	**3000**	**4000**	**5000**	**6000**	**7000**	**8000**	**9000**	**10000**
V_{REF}	134	134	134	134	134	134	134	134	134	134	134
V_{GA}	140	140	140	141	141	141	141	141	141	141	141
ALD	2880	2940	3000	3080	3150	3220	3300	3380	3470	3560	3650
FLD	4790	4890	5000	5120	5240	5370	5500	5640	5780	5930	6090
FLD WET	5510	5630	5750	5890	6030	6170	6320	6480	6650	6820	7000

LDGDATA2_F30_IMP_BD100_16FEB04

NOTE :
Shaded area indicate landing data above MLW.

Figure 04-12. (06-43-04 Sheet 2 of 2)

DRY RUNWAY ACTUAL LANDING DISTANCE CORRECTION CHART FLAPS 30°

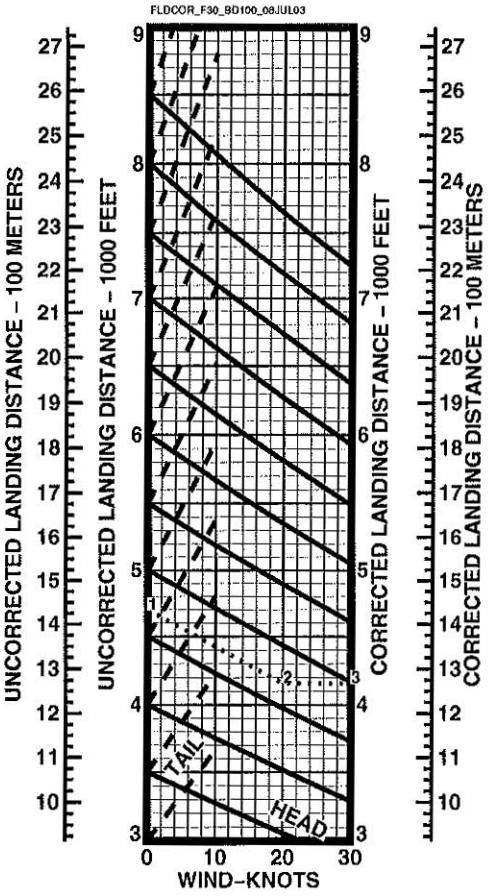


EXAMPLE:

1. Uncorrected Landing Distance
(from table).....3200 ft (980 m)
2. Headwind.....20 kt
3. Corrected Landing Distance.....2840 ft (870 m)

Figure 04-13. (06-43-05)

DRY AND WET RUNWAY FACTORED LANDING DISTANCE CORRECTION CHART



EXAMPLE:

1. Uncorrected Landing Distance (from table).....4700 ft (1440 m)
2. Headwind.....20 kt
3. Corrected Landing Distance.....4150 ft (1270 m)

Figure 04-14. (06-43-06)

TURN-AROUND TIME

COOLING OF WHEELS, BRAKES, AND TIRES CHARTS

The charts on the following pages present performance data that allows determination of the brake cooling time. Landing Brake Energy, Rejected Takeoff (RTO) Brake Energy (Flaps 10° and Flaps 20°), and Main Wheel Brake Cooling Time Charts are provided.

Landing and RTO Brake Energy Charts present brake energies for a range of weight and braking speeds or V1 speeds, with corrections for altitude, temperature, runway gradient, and wind.

Main Wheel Brake Cooling Time Charts present Brake Cooling Times to be observed between a landing or a low energy RTO and a subsequent takeoff.

DETERMINATION OF MAIN WHEEL BRAKE COOLING TIME

Brake Cooling Times are obtained from the applicable Main Wheel Brake Cooling Time Charts, using the landing or RTO brake energy and the required RTO brake energy for the subsequent takeoff.

Brake Cooling Times derived from the Main Wheel Brake Cooling Time Charts must be observed to ensure that brake energy limits are not exceeded during the next takeoff or in the event that the next takeoff is rejected.

The brake cooling times provided in the Main Wheel Brake Cooling Time Charts apply only to single landing / takeoff turn-around.

It is assumed that the airplane is operated in the approved takeoff or landing configuration.

When brake cooling time is desired, the following procedure may be used :

1. Determine the brake energy for specified airplane associated conditions from the Landing or RTO Brake Energy Charts. The brake application indicated airspeed (KIAS) should be used.
2. Using the RTO (Flaps 10° or Flaps 20°) Brake Energy Chart, determine the required RTO brake energy for specified airplane associated conditions. The V1 speed appropriate for the takeoff conditions should be used.
3. Determine the Brake Cooling Time, using the resulting brake energies from step 1 and 2 in the appropriate Main Wheel Brake Cooling Time Chart.

REPEATED TURN-AROUND OPERATIONS

For repeated turn-around operations, such as multi-segment flights or crew training, additional in-flight cooling may be required to avoid progressive temperature build-up of heat in the wheels, brakes, and tires.

NOTE: In-flight cooling of the brakes is required during crew training with multiple takeoff and landings if braking is used on the ground segments of the flight. For multi-segment flights with intermediate flight times of less than one hour, in-flight cooling of the brakes is also required.

A ten minute in-flight cooling period with the landing gear extended prior to landing on the second and subsequent turn-around, will allow the turn-around times to be used on a repeated basis.

NOTE: In-flight cooling does not replace the ground cooling requirements specified in the Main Wheel Brake Cooling Time Chart, but is additional cooling required for multiple turn-around operations.

SYSTEM MALFUNCTION

If a brake malfunction occurs during landing or RTO, or a landing is conducted at reduced flap angles, the brake energy expended derived from the Brake Energy Charts (as appropriate) may be increased significantly.

A minimum brake cooling time of 45 minutes must be observed to ensure that the fuse plug limit has not been exceeded. The system's defect must be rectified prior to the next flight, and the gear assembly, wheels, brakes, and tires visually inspected for damage.

FUSE PLUG RELEASE

If a fuse plug releases, the affected landing gear, wheels, brakes, tires, and the wheel speed sensors must be inspected in accordance with the procedures outlined in the Airplane Maintenance Manual, CH300 AMM, and any damage rectified before the next flight.

LANDING BRAKE ENERGY EXAMPLE

This section presents an example of how the Landing Brake Energy Chart is used in determining Landing Brake Energy. The braking speed equal to the indicated airspeed (KIAS) at the time the wheel brakes were first applied must be used.

(Continued)

Associated Conditions :

Aircraft weight	= 33 250 lb. (15 082 kg)
Braking speed	= 120 KIAS
Airport altitude	= 4000 ft
Ambient temperature	= 10 °C
Runway gradient	= + 2%
Reported wind	= 10 knots (headwind)

The Landing Brake Energy chart (Figure 06-50-03) shows a brake energy of 19.6 X 10^6 ft.lb.

RTO BRAKE ENERGY EXAMPLE

This section presents an example of how the RTO Brake Energy Charts are used in determining Rejected Takeoff Brake Energy.

The required RTO Brake Energy for the subsequent takeoff is determined from the applicable Brake Energy RTO Chart (Flaps 10° or Flaps 20°), using the V1 speed appropriate for the takeoff conditions.

The applicable Brake Energy RTO Chart (Flaps 10° or Flaps 20°) can also be used to determine the brake energy absorbed during a previous RTO. In this case, the indicated airspeed (KIAS) at the time the wheel brakes were first applied must be used instead of the V1 speed.

Associated Conditions :

Aircraft weight	= 33 250 lb. (15 082 kg)
Flaps	= 20°
V1 Speed	= 116 KIAS
Airport Altitude	= 4000 ft
Ambient temperature	= 10 °C
Runway gradient	= + 2%
Reported Wind	= 10 knots (headwind)

The RTO Flaps 20° Brake Energy Chart (Figure 06-50-02) shows a required RTO brake energy of 21.9 X 10^6 ft.lb.

MAIN WHEEL BRAKE COOLING TIME EXAMPLE

This section presents an example of how the Brake Cooling Time Charts are used in determining Brake Cooling Time.

Associated Conditions :

Landing Brake Energy	= 19.6 X 10^6 ft.lb
Required RTO Brake Energy	= 21.9 X 10^6 ft.lb

The Main Wheel Brake Cooling Time Chart (following a landing) (Figure 06-50-04) shows a brake cooling time of four minutes.

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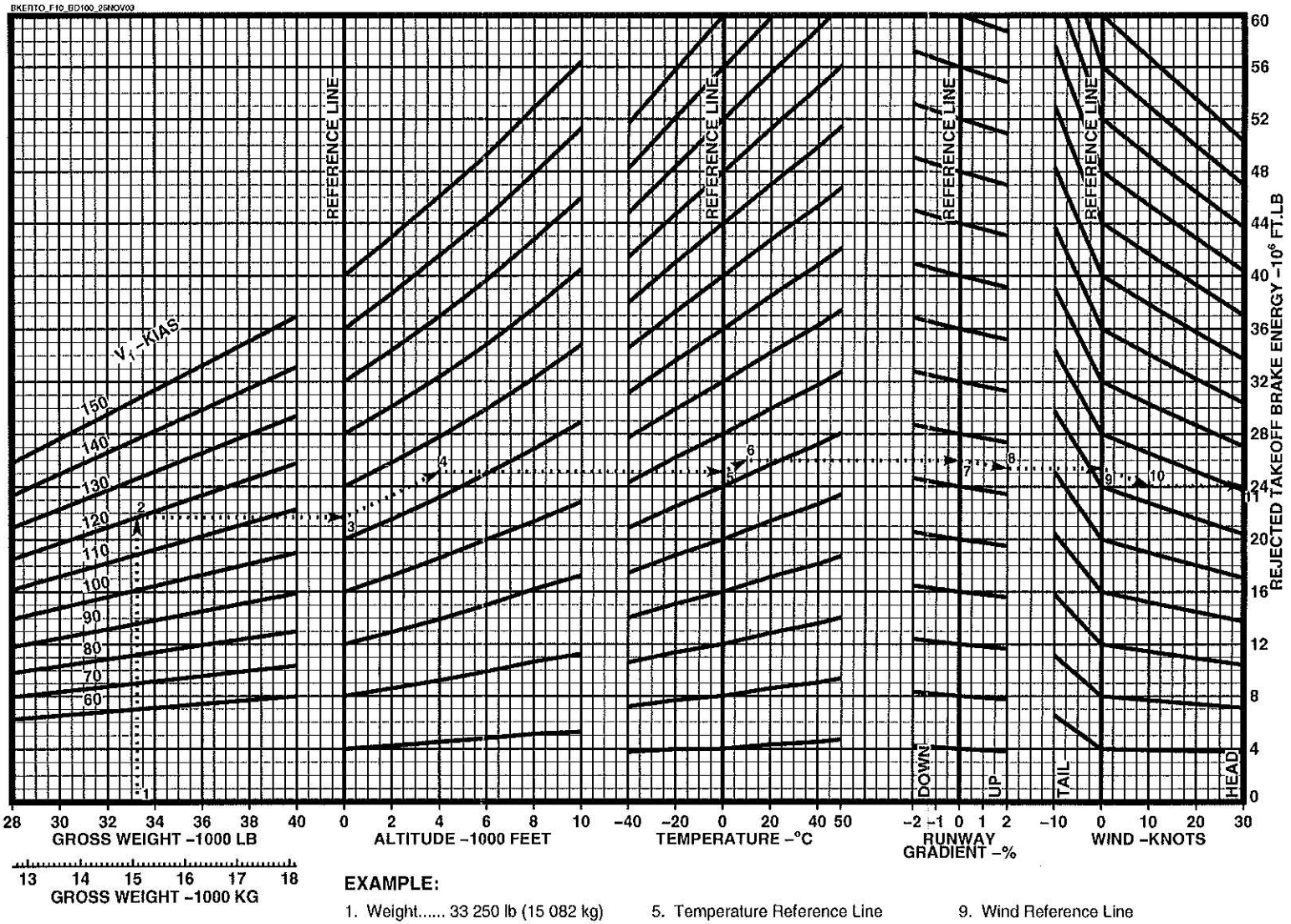
REJECTEDTAKEOFF BRAKE ENERGY
FLAPS 10°



EXAMPLE:

1. Weight..... 33 250 lb (15 082 kg)
2. V_1 Speed..... 120 kias
3. Altitude Reference Line
4. Altitude..... 4 000 ft
5. Temperature Reference Line
6. Temperature..... 10 °C
7. Runway Gradient Reference Line
8. Runway Gradient..... 2% UP
9. Wind Reference Line
10. Head Wind..... 10 kt
11. RTO Brake Energy.... 24.1 X 10^6 ft.lb

Figure 04-15. (06-50-01)

FOR TRAINING PURPOSES ONLY

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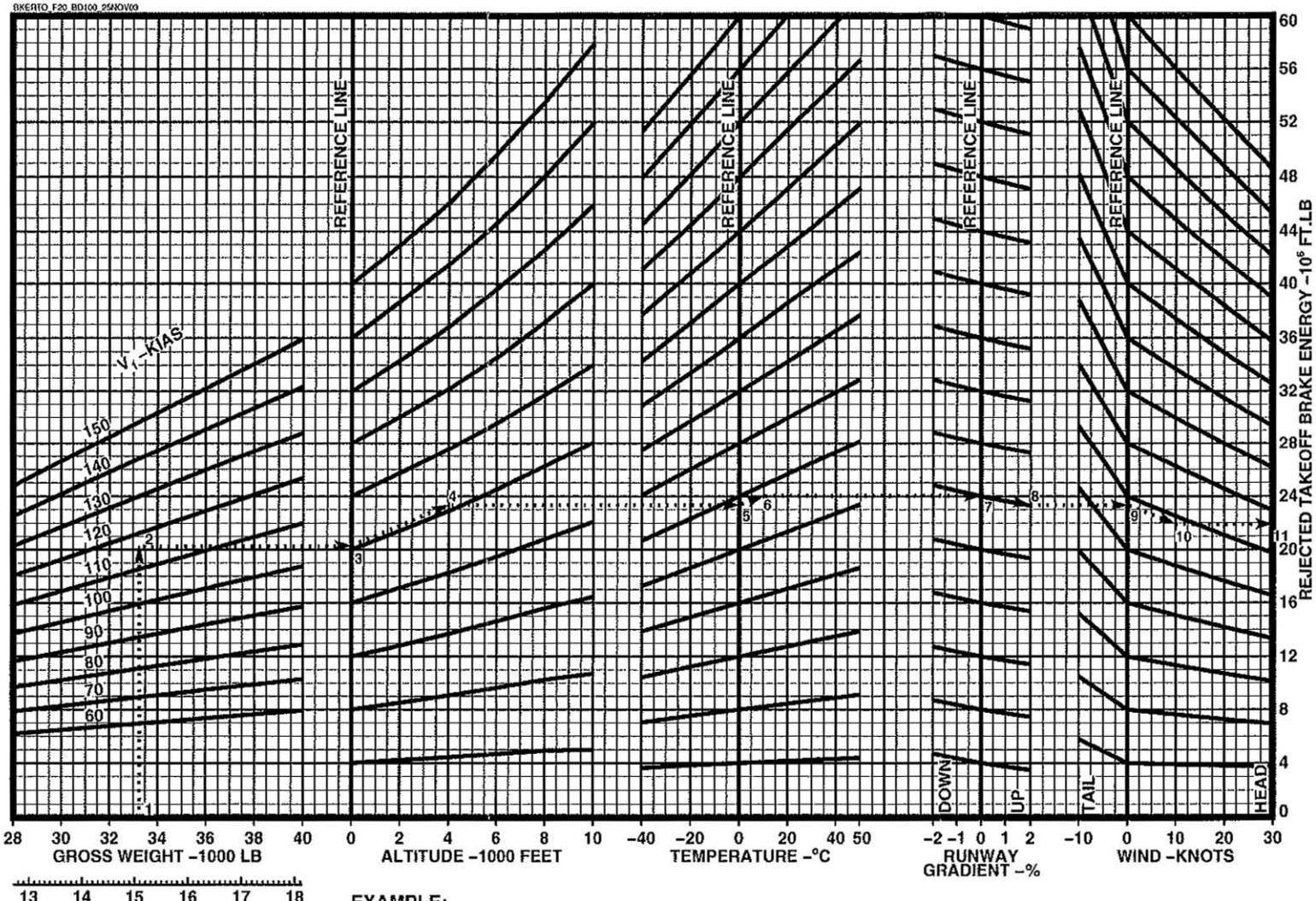
REJECTEDTAKEOFF BRAKE ENERGY
FLAPS 20°



EXAMPLE:

1. Weight..... 33 250 lb (15 082 kg)
2. V_1 Speed..... 116 kias
3. Altitude Reference Line
4. Altitude..... 4 000 ft
5. Temperature Reference Line
6. Temperature..... 10 °C
7. Runway Gradient Reference Line
8. Runway Gradient..... 2% UP
9. Wind Reference Line
10. Head Wind..... 10 kt
11. RTO Brake Energy.... 21.9 X 10^6 ft.lb

Figure 04-16. (06-50-02)

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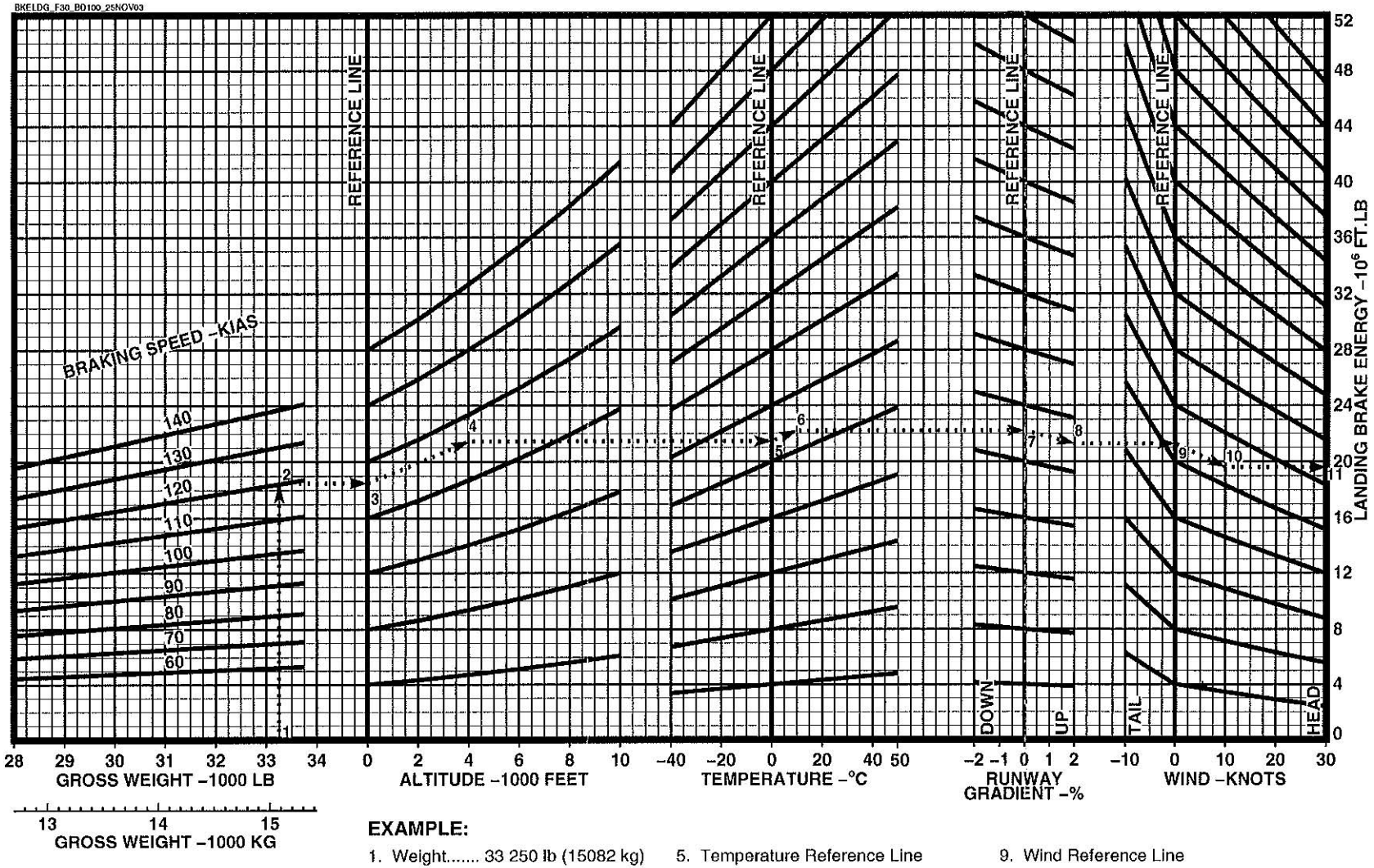
LANDING BRAKE ENERGY



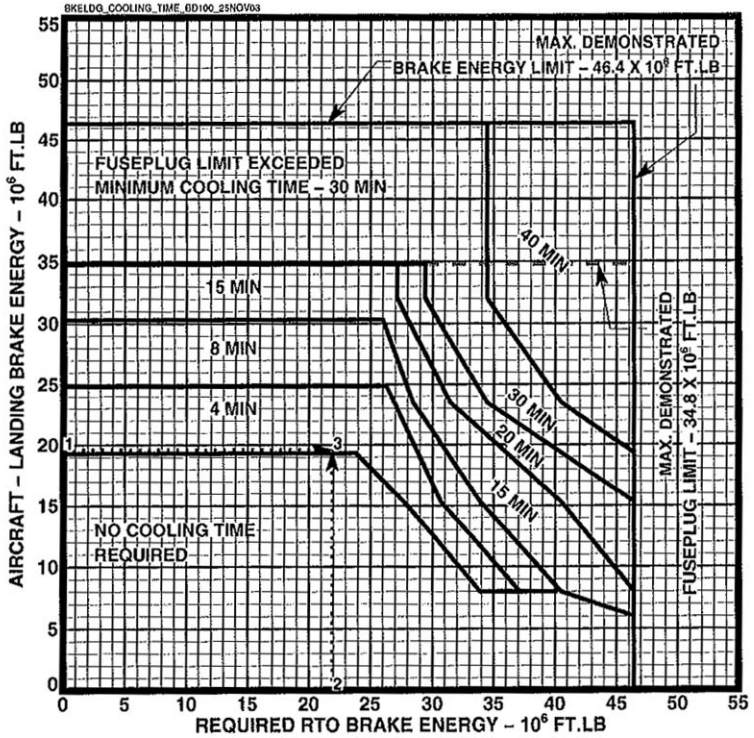
EXAMPLE:

1. Weight..... 33 250 lb (15082 kg)
2. Braking Speed..... 120 kias
3. Altitude Reference Line
4. Altitude..... 4 000 ft
5. Temperature Reference Line
6. Temperature..... 10 °C
7. Runway Gradient Reference Line
8. Runway Gradient..... 2% UP
9. Wind Reference Line
10. Head Wind..... 10 kt
11. Landing Brake Energy.. 19.6 X 10^6 ft.lb

Figure 04-17. (06-50-03)

FOR TRAINING PURPOSES ONLY

MAIN WHEEL BRAKE COOLING TIME FOLLOWING A LANDING

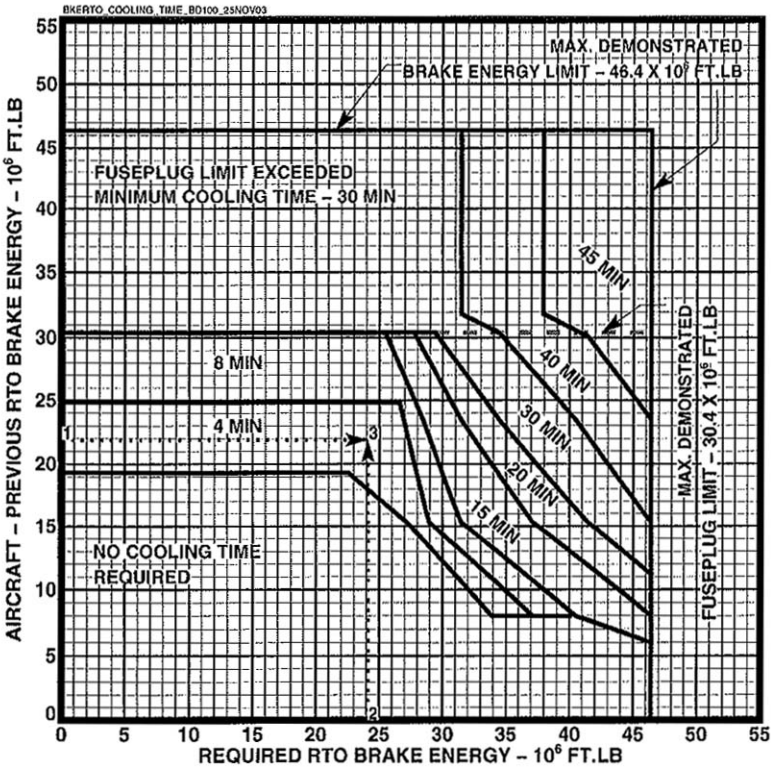


EXAMPLE:

1. Landing Brake Energy..... 19.6 X 10^6ft.lb
2. Required RTO Brake Energy..... 21.9 X 10^6ft.lb
3. Main Wheel Brake Cooling Time..... 4 min.

Figure 04-18. (06-50-04)

MAIN WHEEL BRAKE COOLING TIME FOLLOWING AN RTO



EXAMPLE:

1. Previous RTO Brake Energy..... 21.9 X 10^6ft.lb
2. Required RTO Brake Energy..... 24.1 X 10^6ft.lb
3. Main Wheel Brake Cooling Time..... 4 min.

Figure 04-19. (06-50-05)

CONTAMINATED RUNWAYS

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CONTAMINATED LANDING

CONTAMINATED RUNWAY LANDING DATA

Ice—Flaps 30°

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SUPPLEMENT 1
CONTAMINATED RUNWAYS

GENERAL

This supplement contains information and procedures for operation of the Challenger 300 Model BD100-1A10 airplane, fitted with two AS907-1-1A engines, on contaminated runways. The following information and procedures have been prepared by the manufacturer for use when operating on runway surfaces contaminated by standing water, slush, dry snow, wet snow, compacted snow or ice.

- This information has been prepared by the manufacturer and approved as guidance material to assist operators in developing suitable guidance, recommendations or instructions for use by their flight crews when operating on contaminated runway surface conditions.
- The data have been prepared using industry accepted calculations to determine the effects of contaminated runway surfaces on the accelerating ground roll and braking ground roll. **The effects of actual conditions may differ from those used to establish this data.**
- The level of safety is decreased when operating on contaminated runways, therefore, every effort should be made to ensure that the runway surface is cleared adequately of any significant precipitation.
- Contaminated runway performance data were calculated assuming that the runway is completely contaminated, with the contaminant (standing water, slush, or snow) to be of uniform depth and density.
- When operating on contaminated runways, ground handling characteristics will not be as good as can be achieved on dry runways. In particular, this is applicable in crosswind conditions and when using thrust reversers.

DEFINITION OF RUNWAY CONDITIONS

STANDING WATER, SLUSH, OR WET SNOW

A runway is considered to be contaminated when more than 25% of the runway surface area (whether in isolated areas or not), within the required length and width being used, is covered by more than 1/8 inch (3 mm) of standing water or its equivalent in slush or wet snow (see table below).

Standing Water	Slush	Wet Snow
1/8 in (3.2 mm)	1/8 in (3.2 mm)	1/4 in (6.4 mm)

Standing water is accumulated water on the runway surface caused by heavy rainfall or by poor drainage.

Slush is partly melted snow or ice with high water content such that it cannot significantly resist compression.

Wet snow is snow wherein water can be squeezed out when compressed by hand.

COMPACTED SNOW

A runway is considered to be contaminated by compacted snow when covered by snow which has been compacted into a solid mass which resists further compression and will hold together or break into lumps if picked up.

DRY SNOW

A runway is considered to be contaminated by dry snow when more than 25% of the runway surface area (whether in isolated areas or not), within the required length and width being used, is covered by more than 4/5 in (20 mm) of dry snow.

Dry snow is fresh snow with relatively little water content such that water cannot be squeezed out when compressed by hand.

ICE

A runway surface condition where braking action is expected to be very low, due to the presence of ice.

MAXIMUM CONTAMINANT DEPTHS

The maximum depths of runway contaminants covering an appreciable part of the runway are:

MAXIMUM CONTAMINANT DEPTHS		
CONTAMINANT	TAKEOFF	LANDING
STANDING WATER	0.25 in (6.4 mm)	0.50 in (12.7 mm)
SLUSH	0.25 in (6.4 mm)	0.50 in (12.7 mm)
WET SNOW	0.50 in (12.7 mm)	1.00 in (25.4 mm)
DRY SNOW	2.00 in (50.8 mm)	3.00 in (76.2 mm)

TAKEOFF FROM CONTAMINATED RUNWAYS

Distances for runways contaminated with standing water, slush, wet snow, dry snow, compacted snow or ice have been calculated assuming that the runway is completely contaminated. However, selection of the type and amount of contaminant should be based on the runway conditions where the high speed portion of the takeoff will occur and, in the case of an ice covered runway, where braking would be used during a rejected takeoff.

STANDARD PERFORMANCE CONDITIONS

All contaminated runway takeoff performance is based on the following performance conditions:

- Braking - Maximum until full stop
- APR - ARMED
- Automatic Ground Lift Dumping - ARMED
- Thrust Reversers - Maximum Reverse down to 40 KIAS, then set to Reverse Idle until full stop.

Contaminated runway charts are provided for the following conditions:

- Moderate contaminant depths of standing water, slush and wet snow.
- Heavy contaminant depths of standing water, slush and wet snow.
- Dry snow for 2.00 in (50.8 mm) depth.
- Compacted snow.
- Ice (wet or dry).

The following table provides equivalent depths for the different types of contaminants (moderate and heavy contaminant depths):

TAKEOFF CONTAMINANT DEPTHS		
CONTAMINANT	MODERATE	HEAVY
STANDING WATER	0.125 in (3.2 mm)	0.25 in (6.4 mm)
SLUSH	0.125 in (3.2 mm)	0.25 in (6.4 mm)
WET SNOW	0.25 in (6.4 mm)	0.50 in (12.7 mm)

NOTE: - If the runway is covered by 4/5 in (20 mm) or less of Dry Snow, the corresponding performance data for Compacted Snow shall be used.

- If the runway is covered by 1/4 in (6.4 mm) or less of Wet Snow, the corresponding performance data for Compacted Snow shall be used.

CONTAMINATED RUNWAY TAKEOFF DATA

The CONTAMINATED RUNWAY TAKEOFF DATA tables and associated correction charts are presented in the following pages. Different tables are provided for the applicable runway surface condition, engine bleed configuration and takeoff flap setting (10° or 20°). The uncorrected takeoff field lengths (TOFL) and uncorrected takeoff speeds (V_1, V_R and V_2) are shown in terms of airport pressure altitude, ambient temperature, and weight. Correction charts are included for the effect of reported tower wind, runway gradient and the number of operable thrust reversers at dispatch.

NOTE: Dispatch with only one thrust reverser available is not recommended on a ice covered runway.

For Ice, Compacted Snow, and Dry Snow contaminated runways, takeoff data is presented only for Engine Bleed On, Engine and Wing Anti-Ice On.

For Moderate and Heavy contaminant depths, use takeoff data for Engine Bleed On, Engine and Wing Anti-Ice On if ambient temperature is 10°C and below. For ambient temperatures above 10°C, use the takeoff data tables with Engine Bleed On.

TAKEOFF FIELD LENGTH ON CONTAMINATED RUNWAYS

To determine the takeoff field length on a contaminated runway, use the same procedure as described in the section USE OF TAKEOFF CHARTS, TAKEOFF DATA TABLES, TAKEOFF FIELD LENGTH in the Performance Chapter of the Airplane Flight Manual. Select the appropriate contaminated runway takeoff data table and contaminated runway takeoff field length correction chart based on runway surface condition, engine bleed and takeoff flap setting.

TAKEOFF SPEEDS ON CONTAMINATED RUNWAYS

To determine the takeoff speeds V_1, V_R and V_2 on a contaminated runway, use the same procedure as described in the section USE OF TAKEOFF CHARTS, TAKEOFF DATA TABLES, TAKEOFF SPEEDS in the Performance Chapter of the Airplane Flight Manual. Select the appropriate contaminated runway takeoff data table and contaminated runway takeoff speeds V_1 correction chart based on runway surface condition, engine bleed and takeoff flap setting.

NOTE:

- The uncorrected V_R takeoff speed must be corrected for runway gradient effect by using the applicable Takeoff Speed Correction Chart for V_R. Correction charts for each takeoff flap setting are located in the Takeoff Section, Performance Chapter of the Airplane Flight Manual. These charts are applicable for all runway surface conditions.
- The V_2 takeoff speeds obtained from the contaminated runway takeoff data tables do not require any corrections and can be used directly for takeoff performance.

ACTUAL LANDING DISTANCE ON CONTAMINATED RUNWAYS

The Airplane Flight Manual Contaminated Runways Supplement includes tables and correction charts to obtain the actual landing distance on a contaminated runway. The CONTAMINATED RUNWAY ACTUAL LANDING DISTANCE tables are provided for the following runway contaminants:

- Ice (wet or dry)
- Compacted Snow
- Dry Snow
- Standing Water, Slush, or Wet Snow

The actual landing distances presented are based on:

- Automatic Ground Lift Dumping - ARMED
- Braking - Maximum until full stop
- Thrust Reversers - Maximum Reverse down to 40 KIAS, then set to Reverse Idle until full stop.

Use the following procedure to determine the actual landing distance on a contaminated runway:

1. Select the Contaminated Runway Actual Landing Distance table based on the runway surface condition.
2. Determine the uncorrected actual landing distance as a function of pressure altitude and landing weight at the destination airport.
3. Select the corresponding Contaminated Runway Actual Landing Distance Correction Chart.
4. Correct the uncorrected actual landing distance of step 2 for reported wind, increment on VREF speed and the number of operable thrust reversers. The resulting landing distance is the corrected actual landing distance on the specified contaminated runway.

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CONTAMINATED TAKEOFF

CONTAMINATED RUNWAY TAKEOFF DATA
ICE
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE SEA LEVEL
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	70	70	70	70	70	70	70	70	70	70	70
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	127	127	127	127	126	126	126	126	126	126	126
	TOFL	5630	5730	5840	5940	6050	6160	6270	6370	6480	6590	6700
30000	V_1	75	74	74	74	74	74	74	74	74	74	74
	V_R	114	114	114	114	114	114	114	114	114	114	114
	V_2	126	125	125	125	125	125	125	125	125	125	125
	TOFL	5840	5950	6060	6170	6280	6390	6510	6620	6730	6850	6960
32000	V_1	82	82	82	82	82	82	82	82	82	82	82
	V_R	119	119	119	119	119	119	119	119	119	120	120
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	6050	6160	6280	6390	6510	6620	6740	6860	6980	7100	7210
34000	V_1	89	89	89	89	89	89	89	89	89	89	89
	V_R	124	124	124	124	124	124	124	124	124	124	124
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	6260	6370	6490	6610	6730	6850	6970	7100	7220	7340	7460
36000	V_1	97	96	96	96	96	96	96	96	96	96	96
	V_R	129	129	129	129	129	129	129	129	129	129	129
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	6460	6580	6700	6820	6950	7070	7200	7330	7450	7580	7710
38000	V_1	103	103	103	103	103	103	103	103	103	103	103
	V_R	133	133	133	133	133	133	133	133	133	133	133
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	6650	6780	6910	7030	7160	7290	7420	7550	7680	7810	7950
38850	V_1	106	106	106	106	105	105	106	106	106	106	106
	V_R	135	135	135	135	135	135	135	135	135	135	135
	V_2	140	140	140	140	140	140	140	140	140	140	140
	TOFL	6740	6870	7000	7120	7250	7380	7510	7650	7780	7910	8050

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NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-01. (07-01-11-01)

CONTAMINATED RUNWAY TAKEOFF DATA
ICE
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 1000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	70	70	70	70	69	69	69	69	69	69	69
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	127	127	126	126	126	126	126	126	126	126	126
	TOFL	5830	5940	6050	6160	6270	6380	6490	6610	6720	6830	6950
30000	V_1	74	74	74	74	74	74	74	74	74	74	74
	V_R	114	114	114	114	114	114	114	114	114	114	115
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	6050	6160	6280	6390	6510	6630	6750	6860	6980	7100	7220
32000	V_1	82	82	82	81	81	81	81	82	82	82	82
	V_R	119	119	119	119	119	119	119	119	120	120	120
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	6270	6390	6510	6630	6750	6870	6990	7110	7240	7360	7480
34000	V_1	89	89	89	89	89	89	89	89	89	89	89
	V_R	124	124	124	124	124	124	124	124	124	125	125
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	6480	6600	6730	6850	6980	7100	7230	7360	7480	7610	7740
36000	V_1	96	96	96	96	96	96	96	96	96	96	96
	V_R	129	129	129	129	129	129	129	129	129	129	129
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	6690	6820	6950	7070	7200	7330	7460	7600	7730	7860	7990
38000	V_1	103	103	103	102	102	102	102	102	103	103	103
	V_R	133	133	133	133	133	133	133	133	133	133	134
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	6890	7030	7160	7290	7420	7560	7690	7830	7970	8100	8240
38850	V_1	106	105	105	105	105	105	105	105	105	105	105
	V_R	135	135	135	135	135	135	135	135	135	135	135
	V_2	140	140	140	140	140	140	140	140	140	140	140
	TOFL	6980	7110	7250	7380	7520	7650	7790	7930	8070	8210	8340

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NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-02. (07-01-11-02)

CONTAMINATED RUNWAY TAKEOFF DATA
ICE
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 2000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C													
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10			
28000	V_1	69	69	69	69	69	69	69	69	69	69	70			
	V_R	111	111	111	111	111	111	111	111	111	111	111			
	V_2	127	126	126	126	126	126	126	126	126	126	125			
	TOFL	6040	6150	6270	6390	6500	6620	6740	6860	6970	7090	7230			
30000	V_1	74	74	74	74	74	74	74	74	74	74	76			
	V_R	114	114	114	114	114	114	114	114	115	115	115			
	V_2	125	125	125	125	125	125	125	125	125	125	124			
	TOFL	6270	6390	6510	6630	6750	6880	7000	7120	7240	7370	7510			
32000	V_1	81	81	81	81	81	81	81	81	81	81	83			
	V_R	119	119	119	119	119	119	120	120	120	120	120			
	V_2	127	127	127	127	127	127	127	127	127	127	127			
	TOFL	6490	6620	6750	6870	7000	7130	7250	7380	7510	7630	7790			
34000	V_1	89	89	89	88	89	89	89	89	89	89	90			
	V_R	124	124	124	124	124	124	124	125	125	125	125			
	V_2	131	131	131	131	131	131	131	131	131	131	131			
	TOFL	6710	6840	6970	7110	7240	7370	7500	7630	7760	7900	8060			
36000	V_1	96	96	96	96	96	96	96	96	96	96	97			
	V_R	129	129	129	129	129	129	129	129	129	129	130			
	V_2	135	135	135	135	135	135	135	135	135	135	135			
	TOFL	6930	7070	7200	7330	7470	7610	7740	7880	8020	8150	8320			
38000	V_1	102	102	102	102	102	102	102	102	102	102	104			
	V_R	133	133	133	133	133	133	133	133	134	134	134			
	V_2	139	139	139	139	139	139	139	139	139	139	139			
	TOFL	7140	7280	7420	7560	7700	7840	7980	8120	8270	8410	8580			
38850	V_1	105	105	105	105	105	105	105	105	105	105	107			
	V_R	135	135	135	135	135	135	135	135	135	135	136			
	V_2	140	140	140	140	140	140	140	140	140	140	140			
	TOFL	7230	7370	7510	7650	7800	7940	8080	8230	8370	8510	8690			

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NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-03. (07-01-11-03)

CONTAMINATED RUNWAY TAKEOFF DATA
ICE
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 3000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10			
28000	V_1	69	69	69	69	69	69	69	69	69	70	72			
	V_R	111	111	111	111	111	111	111	111	111	111	111			
	V_2	126	126	126	126	126	126	126	126	126	125	124			
	TOFL	6260	6380	6510	6630	6750	6870	6990	7110	7240	7370	7580			
30000	V_1	74	74	74	74	74	74	74	74	74	75	79			
	V_R	114	114	114	114	114	114	115	115	115	115	116			
	V_2	125	125	125	125	125	125	125	125	125	124	123			
	TOFL	6500	6630	6750	6880	7010	7140	7260	7390	7520	7660	7880			
32000	V_1	81	81	81	81	81	81	81	81	81	83	86			
	V_R	119	119	119	119	120	120	120	120	120	120	121			
	V_2	127	127	127	127	127	127	127	127	127	127	127			
	TOFL	6730	6870	7000	7130	7260	7400	7530	7660	7790	7940	8170			
34000	V_1	88	88	88	88	88	88	88	89	89	90	93			
	V_R	124	124	124	124	124	125	125	125	125	125	126			
	V_2	131	131	131	131	131	131	131	131	131	131	131			
	TOFL	6960	7100	7240	7370	7510	7650	7790	7920	8060	8220	8460			
36000	V_1	95	95	95	95	95	95	95	96	96	97	100			
	V_R	129	129	129	129	129	129	129	129	129	130	130			
	V_2	135	135	135	135	135	135	135	135	135	135	135			
	TOFL	7180	7330	7470	7610	7750	7900	8040	8180	8320	8490	8750			
38000	V_1	102	102	102	102	102	102	102	102	102	104	107			
	V_R	133	133	133	133	133	134	134	134	134	134	135			
	V_2	139	139	139	139	139	139	139	139	139	139	139			
	TOFL	7410	7550	7700	7850	7990	8140	8290	8430	8580	8750	9020			
38850	V_1	105	105	105	105	105	105	105	105	105	108	110			
	V_R	135	135	135	135	135	135	135	135	135	136	136			
	V_2	141	141	141	141	141	141	141	141	141	141	141			
	TOFL	7500	7650	7800	7940	8090	8240	8390	8540	8690	8860	9140			

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NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-04. (07-01-11-04)

CONTAMINATED RUNWAY TAKEOFF DATA
ICE
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 4000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	69	69	69	69	69	69	69	69	69	72	74
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	126	126	126	126	126	126	126	125	125	124	124
	TOFL	6500	6630	6750	6880	7010	7130	7260	7380	7520	7730	7960
30000	V_1	74	74	74	74	74	74	74	74	75	78	82
	V_R	114	114	114	115	115	115	115	115	115	116	117
	V_2	125	125	125	125	125	125	125	124	124	123	123
	TOFL	6750	6880	7010	7140	7280	7410	7540	7670	7810	8040	8280
32000	V_1	81	81	81	81	81	81	81	81	82	86	89
	V_R	119	119	120	120	120	120	120	120	120	121	122
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	6990	7130	7270	7400	7540	7680	7820	7950	8100	8340	8590
34000	V_1	88	88	88	88	88	88	89	89	89	93	96
	V_R	124	124	124	125	125	125	125	125	125	126	126
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	7230	7370	7510	7660	7800	7940	8090	8230	8380	8630	8900
36000	V_1	95	95	95	95	95	95	96	96	96	100	103
	V_R	129	129	129	129	129	129	129	129	130	130	131
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	7460	7610	7760	7900	8050	8200	8350	8500	8650	8920	9200
38000	V_1	102	102	102	102	102	102	102	102	103	106	110
	V_R	133	133	133	134	134	134	134	134	134	135	135
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	7690	7840	8000	8150	8300	8450	8610	8760	8920	9200	9500
38850	V_1	105	105	105	105	105	105	105	105	106	109	113
	V_R	135	135	135	135	135	135	136	136	136	136	137
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	7790	7940	8100	8250	8400	8560	8710	8870	9040	9320	9630

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NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-05. (07-01-11-05)

CONTAMINATED RUNWAY TAKEOFF DATA
ICE
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 5000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	69	69	69	69	69	69	69	69	71	74	77
	V_R	111	111	111	111	111	111	111	111	111	111	112
	V_2	126	126	126	126	126	125	125	125	124	124	123
	TOFL	6750	6880	7010	7150	7280	7410	7540	7670	7880	8120	8360
30000	V_1	74	74	74	74	74	74	74	74	78	81	84
	V_R	114	115	115	115	115	115	115	115	116	117	117
	V_2	125	125	125	125	125	124	124	124	123	123	123
	TOFL	7010	7150	7280	7420	7560	7700	7830	7970	8190	8450	8700
32000	V_1	81	81	81	81	81	81	81	81	85	89	92
	V_R	120	120	120	120	120	120	120	120	121	122	122
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	7260	7400	7550	7690	7830	7980	8120	8260	8500	8760	9040
34000	V_1	88	88	88	88	88	89	89	89	92	96	99
	V_R	125	125	125	125	125	125	125	125	126	126	127
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	7510	7660	7800	7950	8100	8250	8400	8550	8800	9080	9370
36000	V_1	95	95	95	95	95	95	96	96	99	103	106
	V_R	129	129	129	129	129	130	130	130	130	131	131
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	7750	7900	8060	8210	8370	8520	8670	8830	9090	9390	9690
38000	V_1	102	102	102	102	102	102	102	102	106	110	113
	V_R	134	134	134	134	134	134	134	134	135	135	136
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	7990	8150	8310	8470	8620	8780	8940	9100	9380	9690	10010
38850	V_1	105	105	105	105	105	105	105	105	109	112	116
	V_R	135	135	135	135	136	136	136	136	136	137	137
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	8090	8250	8410	8570	8730	8890	9050	9220	9500	9810	10140

TODATA5K_ICE_F10_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-06. (07-01-11-06)

CONTAMINATED RUNWAY TAKEOFF DATA
ICE
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 6000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	69	69	69	69	69	69	69	70	73	76	79
	V_R	111	111	111	111	111	111	111	111	111	112	113
	V_2	126	126	126	126	125	125	125	125	124	123	122
	TOFL	7010	7140	7280	7420	7550	7690	7830	8010	8270	8530	8800
30000	V_1	74	74	74	74	74	74	74	77	81	84	87
	V_R	115	115	115	115	115	115	115	116	117	117	118
	V_2	125	125	125	124	124	124	124	124	123	123	123
	TOFL	7280	7420	7560	7700	7850	7990	8130	8320	8600	8880	9160
32000	V_1	81	81	81	81	81	81	81	84	88	92	95
	V_R	120	120	120	120	120	120	120	121	122	122	123
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	7540	7690	7830	7980	8130	8280	8430	8630	8930	9220	9520
34000	V_1	88	88	88	88	88	88	88	91	95	99	102
	V_R	125	125	125	125	125	125	125	126	126	127	128
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	7800	7950	8100	8260	8410	8570	8720	8930	9250	9560	9870
36000	V_1	95	95	95	95	95	95	95	98	102	106	109
	V_R	129	129	129	129	130	130	130	130	131	131	132
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	8050	8210	8360	8520	8680	8840	9000	9230	9560	9880	10220
38000	V_1	102	102	102	102	102	102	102	105	109	113	116
	V_R	134	134	134	134	134	134	134	134	135	136	136
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	8300	8460	8620	8790	8950	9120	9280	9520	9870	10210	10580
38850	V_1	105	105	104	105	105	105	105	107	112	115	119
	V_R	135	135	136	136	136	136	136	136	137	137	138
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	8400	8560	8730	8900	9070	9230	9400	9640	9990	10340	11110

TODATA6K_ICE_F10_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-07. (07-01-11-07)

CONTAMINATED RUNWAY TAKEOFF DATA
ICE
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 7000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	68	68	68	68	68	68	69	72	76	79	82
	V_R	111	111	111	111	111	111	111	111	112	113	113
	V_2	126	126	125	125	125	125	125	124	123	122	122
	TOFL	7270	7410	7550	7700	7840	7980	8150	8410	8690	8970	9260
30000	V_1	73	73	73	74	74	74	75	80	83	87	90
	V_R	115	115	115	115	115	115	116	117	117	118	119
	V_2	125	125	124	124	124	124	124	123	123	123	123
	TOFL	7550	7700	7840	7990	8140	8290	8460	8750	9040	9340	9650
32000	V_1	81	81	81	81	81	81	82	87	91	94	97
	V_R	120	120	120	120	120	120	121	122	122	123	123
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	7820	7970	8130	8280	8440	8600	8770	9080	9390	9710	10030
34000	V_1	88	88	88	88	88	88	90	94	98	102	105
	V_R	125	125	125	125	125	125	125	126	127	128	128
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	8090	8250	8410	8570	8730	8890	9080	9400	9730	10070	10410
36000	V_1	95	95	95	95	95	95	97	101	105	109	112
	V_R	129	129	130	130	130	130	130	131	131	132	133
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	8350	8510	8680	8850	9010	9180	9380	9720	10070	10420	10780
38000	V_1	102	101	101	102	102	102	103	108	112	116	119
	V_R	134	134	134	134	134	134	134	135	136	136	137
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	8610	8780	8950	9120	9290	9460	9670	10030	10390	10770	11600
38850	V_1	104	104	104	104	104	104	106	111	115	119	122
	V_R	136	136	136	136	136	136	136	137	137	138	138
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	8720	8880	9060	9230	9410	9580	9790	10160	10530	11260	12190

TODATA7K_ICE_F10_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-08. (07-01-11-08)

CONTAMINATED RUNWAY TAKEOFF DATA
ICE
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 8000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	68	68	68	68	68	68	71	75	79	82	85
	V_R	111	111	111	111	111	111	111	112	113	113	114
	V_2	126	125	125	125	125	125	124	123	122	122	121
	TOFL	7540	7690	7840	7990	8140	8290	8550	8840	9140	9440	9760
30000	V_1	73	73	73	73	73	74	78	83	86	90	93
	V_R	115	115	115	115	115	115	116	117	118	119	119
	V_2	125	124	124	124	124	124	123	123	123	123	123
	TOFL	7830	7990	8140	8300	8450	8610	8890	9200	9520	9840	10180
32000	V_1	80	80	80	81	81	81	86	90	94	97	100
	V_R	120	120	120	120	120	120	121	122	123	123	124
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	8120	8280	8440	8600	8760	8930	9220	9550	9890	10230	10600
34000	V_1	88	88	88	88	88	88	93	97	101	104	108
	V_R	125	125	125	125	125	125	126	127	128	128	129
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	8390	8560	8730	8890	9060	9230	9550	9900	10260	10620	11000
36000	V_1	95	95	95	95	95	95	100	104	108	112	115
	V_R	130	130	130	130	130	130	131	131	132	133	133
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	8670	8840	9010	9180	9360	9530	9870	10240	10610	11000	11400
38000	V_1	101	101	101	101	101	102	106	111	115	119	122
	V_R	134	134	134	134	134	134	135	136	136	137	137
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	8930	9110	9290	9470	9650	9830	10180	10570	10970	11760	12760
38850	V_1	104	104	104	104	104	104	109	114	118	122	125
	V_R	136	136	136	136	136	136	137	137	138	138	139
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	9040	9220	9410	9590	9770	9950	10310	10710	11390	12350	13400

TODATA6K_ICE_F10_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-09. (07-01-11-09)

CONTAMINATED RUNWAY TAKEOFF DATA
ICE
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 9000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
28000	V_1	68	68	68	68	68	70	74	78	81	85	88
	V_R	112	112	112	112	112	112	112	113	113	114	115
	V_2	125	125	125	125	125	124	123	122	122	121	120
	TOFL	7860	8010	8170	8320	8470	8700	8990	9300	9620	9950	10320
30000	V_1	74	74	74	74	74	77	81	85	89	92	96
	V_R	115	115	115	115	116	116	117	118	119	119	120
	V_2	124	124	124	124	124	123	123	123	123	123	123
	TOFL	8160	8320	8480	8640	8810	9040	9350	9690	10030	10380	10770
32000	V_1	81	81	81	81	81	84	89	93	97	100	104
	V_R	120	120	120	120	121	121	122	123	123	124	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	8460	8630	8790	8960	9130	9370	9710	10060	10430	10800	11220
34000	V_1	88	88	88	88	88	91	96	100	104	107	111
	V_R	125	125	125	125	125	126	127	128	128	129	129
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	8750	8920	9100	9270	9450	9700	10060	10430	10820	11210	11660
36000	V_1	95	95	95	95	95	98	103	107	111	115	119
	V_R	130	130	130	130	130	131	131	132	133	133	133
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	9030	9210	9390	9570	9750	10030	10400	10800	11200	11620	12520
38000	V_1	101	102	102	102	102	105	110	114	118	122	125
	V_R	134	134	134	134	134	135	136	136	137	137	138
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	9310	9500	9680	9870	10060	10340	10740	11150	11910	12920	14110
38850	V_1	104	104	104	104	104	108	112	117	121	125	128
	V_R	136	136	136	136	136	137	137	138	138	139	139
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	9430	9620	9810	10000	10190	10470	10880	11460	12510	13570	14820

TODATA9K_ICE_F10_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-10. (07-01-11-10)

CONTAMINATED RUNWAY TAKEOFF DATA
ICE
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 10000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

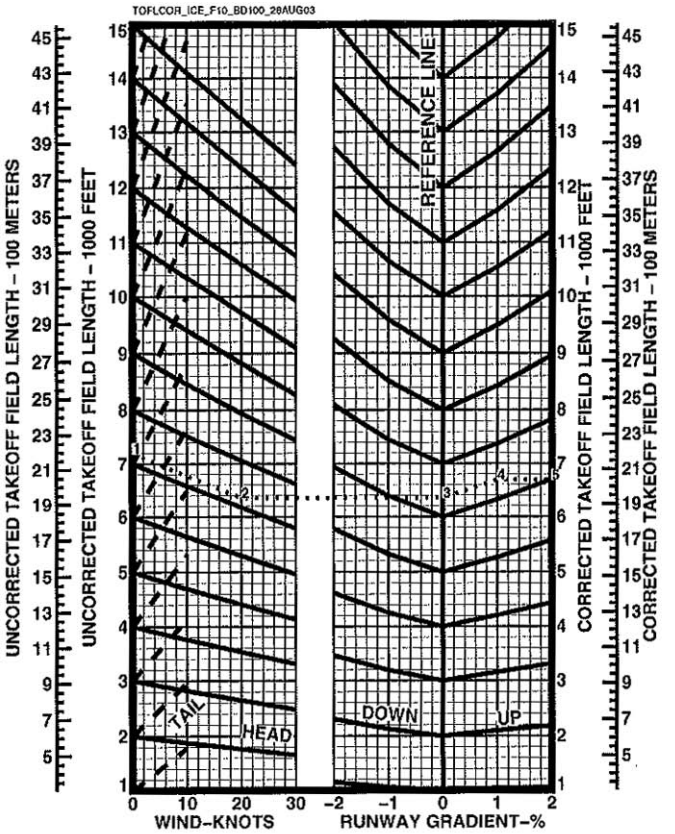
WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	69	69	69	69	70	72	77	81	84	87	91
	V_R	112	112	112	112	112	112	113	113	114	115	115
	V_2	125	125	125	125	124	123	123	122	121	120	120
	TOFL	8190	8350	8520	8680	8880	9140	9470	9810	10150	10510	10920
30000	V_1	75	75	75	75	76	80	84	88	92	95	99
	V_R	116	116	116	116	116	117	118	119	119	120	120
	V_2	124	124	124	124	123	123	123	123	123	123	123
	TOFL	8510	8680	8850	9020	9230	9510	9860	10220	10580	10970	11410
32000	V_1	82	82	82	82	83	87	92	96	99	103	107
	V_R	121	121	121	121	121	122	123	123	124	124	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	8820	9000	9180	9350	9570	9870	10240	10630	11010	11420	11900
34000	V_1	89	89	89	89	91	94	99	103	107	111	115
	V_R	125	126	126	126	126	127	127	128	129	129	130
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	9130	9310	9500	9680	9910	10220	10610	11020	11430	11860	12370
36000	V_1	96	96	96	96	97	101	106	110	114	118	122
	V_R	130	130	130	130	130	131	132	133	133	133	134
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	9430	9620	9810	10000	10240	10570	10980	11410	11840	12600	13870
38000	V_1	102	102	103	103	104	108	113	118	121	125	129
	V_R	134	134	134	134	135	135	136	137	137	138	138
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	9720	9920	10110	10310	10560	10910	11340	12020	13080	14210	15650
38850	V_1	105	105	105	105	107	111	116	120	124	127	131
	V_R	136	136	136	136	136	137	138	138	139	139	140
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	9850	10040	10240	10440	10690	11050	11490	12630	13740	14930	16440

TODATA10K_ICE_F10_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-11. (07-01-11-11)

CONTAMINATED RUNWAY TAKEOFF FIELD LENGTH
ICE
CORRECTION CHART
FLAPS 10°



EXAMPLE:

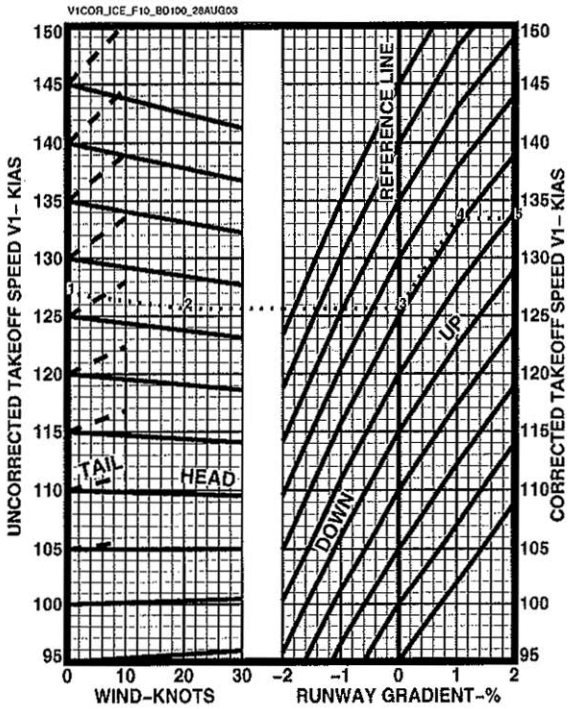
1. Uncorrected Takeoff Field Length (from table).....7200 ft (2200 m)
2. Headwind.....20 kt
3. Runway Gradient Reference Line
4. Runway Gradient.....1.0% UP
5. Corrected Takeoff Field Length.....6700 ft (2050 m)

NOTE:

Dispatch with only one thrust reverser operative is not recommended on icy runways.

Figure SUP1-12. (07-01-11-12)

CONTAMINATED RUNWAY TAKEOFF TAKEOFF SPEEDS ICE CORRECTION CHART FOR V1 FLAPS 10°



EXAMPLE:

1. Uncorrected Takeoff Speed (from table).....127 kias
2. Headwind.....20 kt
3. Runway Gradient Reference Line
4. Runway Gradient.....1.0% UP
5. Corrected Takeoff Speed.....133 kias

NOTES:

1. V1mcg is limiting when the corrected V1 is less than 116 kias. In this case, use V1=116 kias.
2. If the corrected V1 exceeds VR for the appropriate conditions, use V1=VR.
3. Dispatch with only one thrust reverser operative is not recommended on icy runways.

Figure SUP1-13. (07-01-11-13)

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CONTAMINATED RUNWAY TAKEOFF DATA
COMPACTED SNOW
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE SEA LEVEL
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	95	95	95	95	95	94	94	94	94	94	94
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	127	127	127	127	126	126	126	126	126	126	126
	TOFL	3580	3640	3700	3770	3830	3900	3970	4030	4100	4170	4240
30000	V_1	99	99	99	99	99	99	99	99	99	99	99
	V_R	114	114	114	114	114	114	114	114	114	114	114
	V_2	126	125	125	125	125	125	125	125	125	125	125
	TOFL	3700	3760	3830	3900	3960	4030	4100	4170	4240	4310	4380
32000	V_1	106	105	105	105	105	105	105	105	105	105	105
	V_R	119	119	119	119	119	119	119	119	119	120	120
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3820	3890	3960	4020	4090	4170	4240	4310	4380	4460	4530
34000	V_1	112	112	112	111	111	111	111	111	112	112	112
	V_R	124	124	124	124	124	124	124	124	124	124	124
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	3940	4010	4080	4150	4220	4300	4370	4450	4520	4600	4670
36000	V_1	117	117	117	117	117	117	117	117	117	117	117
	V_R	129	129	129	129	129	129	129	129	129	129	129
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4140	4220	4290	4360	4420	4510	4590	4670	4750	4830	4910
38000	V_1	123	123	123	123	123	123	123	123	123	123	123
	V_R	133	133	133	133	133	133	133	133	133	133	133
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4610	4690	4770	4850	4920	5010	5100	5190	5280	5370	5460
38850	V_1	125	125	125	125	125	125	125	125	125	125	125
	V_R	135	135	135	135	135	135	135	135	135	135	135
	V_2	140	140	140	140	140	140	140	140	140	140	140
	TOFL	4810	4900	4980	5060	5140	5240	5330	5430	5520	5620	5710

TODATASL_SNOWC_F10_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-14. (07-01-12-01)

CONTAMINATED RUNWAY TAKEOFF DATA
COMPACTED SNOW
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 1000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	95	95	95	94	94	94	94	94	94	94	94
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	127	127	126	126	126	126	126	126	126	126	126
	TOFL	3690	3760	3820	3890	3960	4030	4100	4170	4240	4310	4380
30000	V_1	99	99	99	99	99	99	99	99	99	99	99
	V_R	114	114	114	114	114	114	114	114	114	114	115
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	3810	3880	3950	4020	4090	4170	4240	4310	4380	4450	4530
32000	V_1	105	105	105	105	105	105	105	105	105	105	105
	V_R	119	119	119	119	119	119	119	119	120	120	120
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	3940	4010	4080	4150	4230	4300	4380	4450	4530	4600	4680
34000	V_1	112	111	111	111	111	111	111	111	111	111	112
	V_R	124	124	124	124	124	124	124	124	124	125	125
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	4060	4140	4210	4280	4360	4440	4520	4590	4670	4750	4830
36000	V_1	117	117	117	117	117	117	117	117	117	117	117
	V_R	129	129	129	129	129	129	129	129	129	129	129
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4260	4340	4410	4490	4570	4650	4730	4820	4900	4980	5070
38000	V_1	123	123	123	123	122	123	123	123	123	123	123
	V_R	133	133	133	133	133	133	133	133	133	133	134
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4740	4830	4910	4990	5080	5170	5270	5360	5450	5540	5640
38850	V_1	125	125	125	125	125	125	125	125	125	125	125
	V_R	135	135	135	135	135	135	135	135	135	135	135
	V_2	140	140	140	140	140	140	140	140	140	140	140
	TOFL	4950	5040	5130	5220	5310	5400	5500	5600	5700	5790	5890

TODATA1K_SNOWC_F10_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-15. (07-01-12-02)

CONTAMINATED RUNWAY TAKEOFF DATA
COMPACTED SNOW
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 2000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	94	94	94	94	94	94	94	94	94	94	95
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	127	126	126	126	126	126	126	126	126	126	125
	TOFL	3800	3880	3950	4020	4090	4160	4230	4310	4380	4450	4540
30000	V_1	98	98	98	98	99	99	99	99	99	99	100
	V_R	114	114	114	114	114	114	114	114	115	115	115
	V_2	125	125	125	125	125	125	125	125	125	125	124
	TOFL	3930	4010	4080	4160	4230	4300	4380	4450	4530	4600	4700
32000	V_1	105	105	105	105	105	105	105	105	105	105	106
	V_R	119	119	119	119	119	119	120	120	120	120	120
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	4060	4140	4220	4290	4370	4450	4520	4600	4680	4760	4860
34000	V_1	111	111	111	111	111	111	111	111	111	111	112
	V_R	124	124	124	124	124	124	124	125	125	125	125
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	4190	4270	4350	4430	4510	4590	4670	4750	4830	4910	5020
36000	V_1	117	117	117	117	117	117	117	117	117	117	118
	V_R	129	129	129	129	129	129	129	129	129	129	130
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4390	4470	4550	4630	4720	4800	4890	4980	5060	5150	5330
38000	V_1	123	122	122	122	122	122	122	122	123	123	123
	V_R	133	133	133	133	133	133	133	133	134	134	134
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	4880	4970	5060	5150	5250	5340	5440	5540	5630	5730	5930
38850	V_1	125	125	125	125	125	125	125	125	125	125	126
	V_R	135	135	135	135	135	135	135	135	135	135	136
	V_2	140	140	140	140	140	140	140	140	140	140	140
	TOFL	5100	5190	5290	5380	5480	5580	5680	5780	5890	5990	6200

TODATA2K_SNOWC_F10_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-16. (07-01-12-03)

CONTAMINATED RUNWAY TAKEOFF DATA
COMPACTED SNOW
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 3000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	94	94	94	94	94	94	94	94	94	95	96
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	126	126	126	126	126	126	126	126	126	125	124
	TOFL	3930	4000	4080	4150	4230	4300	4380	4450	4530	4620	4780
30000	V_1	98	98	98	99	99	99	99	99	99	100	102
	V_R	114	114	114	114	114	114	115	115	115	115	116
	V_2	125	125	125	125	125	125	125	125	125	124	123
	TOFL	4060	4140	4220	4300	4370	4450	4530	4610	4680	4780	4960
32000	V_1	105	105	105	105	105	105	105	105	105	106	108
	V_R	119	119	119	119	120	120	120	120	120	120	121
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	4200	4280	4360	4440	4520	4600	4680	4760	4840	4940	5130
34000	V_1	111	111	111	111	111	111	111	111	111	112	114
	V_R	124	124	124	124	124	125	125	125	125	125	126
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	4330	4410	4500	4580	4660	4750	4830	4910	5000	5100	5300
36000	V_1	117	117	117	117	117	117	117	117	117	118	120
	V_R	129	129	129	129	129	129	129	129	129	130	130
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4530	4610	4700	4790	4880	4970	5060	5150	5240	5410	5770
38000	V_1	122	122	122	122	122	122	122	122	123	123	125
	V_R	133	133	133	133	133	134	134	134	134	134	135
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5030	5130	5230	5330	5430	5530	5630	5730	5830	6020	6420
38850	V_1	125	125	125	125	125	125	125	125	125	125	127
	V_R	135	135	135	135	135	135	135	135	135	136	136
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5260	5360	5470	5570	5670	5780	5880	5980	6090	6290	6720

TODATA3K_SNOWC_F10_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-17. (07-01-12-04)

CONTAMINATED RUNWAY TAKEOFF DATA
COMPACTED SNOW
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 4000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
28000	V_1	94	94	94	94	94	94	94	94	94	96	97
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	126	126	126	126	126	126	126	125	125	124	124
	TOFL	4070	4140	4220	4300	4370	4450	4530	4610	4690	4860	5040
30000	V_1	99	99	99	99	99	99	99	99	99	102	104
	V_R	114	114	114	115	115	115	115	115	115	116	117
	V_2	125	125	125	125	125	125	125	124	124	123	123
	TOFL	4210	4290	4370	4450	4530	4610	4690	4770	4860	5030	5230
32000	V_1	105	105	105	105	105	105	105	105	106	108	110
	V_R	119	119	120	120	120	120	120	120	120	121	122
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	4340	4430	4510	4590	4680	4760	4840	4930	5020	5210	5410
34000	V_1	111	111	111	111	111	111	111	111	112	114	116
	V_R	124	124	124	125	125	125	125	125	125	126	126
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	4480	4570	4650	4740	4830	4910	5000	5080	5180	5380	5600
36000	V_1	117	117	117	117	117	117	117	117	118	120	121
	V_R	129	129	129	129	129	129	129	129	130	130	131
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4690	4780	4870	4960	5060	5150	5240	5340	5470	5850	6260
38000	V_1	122	122	122	123	123	123	123	123	123	125	127
	V_R	133	133	133	134	134	134	134	134	134	135	135
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5220	5320	5420	5520	5630	5730	5840	5940	6090	6510	6970
38850	V_1	125	125	125	125	125	125	125	125	125	127	129
	V_R	135	135	135	135	135	135	136	136	136	136	137
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5450	5560	5660	5770	5880	5990	6100	6210	6360	6810	7290

TODATA4K_SNOWC_F10_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-18. (07-01-12-05)

CONTAMINATED RUNWAY TAKEOFF DATA
COMPACTED SNOW
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 5000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	94	94	94	94	94	94	94	94	96	97	99
	V_R	111	111	111	111	111	111	111	111	111	111	112
	V_2	126	126	126	126	126	125	125	125	124	124	123
	TOFL	4210	4290	4370	4450	4530	4610	4690	4770	4930	5120	5320
30000	V_1	99	99	99	99	99	99	99	99	102	104	105
	V_R	114	115	115	115	115	115	115	115	116	117	117
	V_2	125	125	125	125	125	124	124	124	123	123	123
	TOFL	4350	4440	4520	4600	4690	4770	4850	4940	5110	5310	5520
32000	V_1	105	105	105	105	105	105	106	106	108	110	112
	V_R	120	120	120	120	120	120	120	120	121	122	122
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	4500	4580	4670	4760	4840	4930	5020	5100	5290	5500	5720
34000	V_1	111	111	111	111	112	112	112	112	114	116	117
	V_R	125	125	125	125	125	125	125	125	126	126	127
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4640	4730	4820	4910	5000	5090	5180	5270	5460	5690	6050
36000	V_1	117	117	117	117	117	117	117	117	119	121	123
	V_R	129	129	129	129	129	130	130	130	130	131	131
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4860	4960	5050	5150	5250	5340	5440	5540	5920	6350	6790
38000	V_1	123	123	123	123	123	123	123	123	125	126	128
	V_R	134	134	134	134	134	134	134	134	135	135	136
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5410	5520	5620	5730	5840	5950	6050	6160	6590	7070	7580
38850	V_1	125	125	125	125	125	125	125	125	127	129	130
	V_R	135	135	135	135	136	136	136	136	136	137	137
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5650	5770	5870	5990	6100	6210	6330	6440	6890	7390	7950

TODATA5K_SNOWC_F10_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-19. (07-01-12-06)

CONTAMINATED RUNWAY TAKEOFF DATA
COMPACTED SNOW
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 6000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	94	94	94	94	94	94	94	95	97	99	101
	V_R	111	111	111	111	111	111	111	111	111	112	113
	V_2	126	126	126	126	125	125	125	125	124	123	122
	TOFL	4350	4440	4520	4600	4680	4770	4850	4980	5200	5410	5620
30000	V_1	99	99	99	99	99	99	99	101	103	105	107
	V_R	115	115	115	115	115	115	115	116	117	117	118
	V_2	125	125	125	124	124	124	124	124	123	123	123
	TOFL	4500	4590	4670	4760	4850	4930	5020	5160	5390	5610	5840
32000	V_1	105	105	105	105	105	105	105	107	109	111	113
	V_R	120	120	120	120	120	120	120	121	122	122	123
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	4650	4740	4830	4920	5010	5100	5190	5340	5580	5820	6060
34000	V_1	111	111	111	111	111	111	112	113	115	117	119
	V_R	125	125	125	125	125	125	125	126	126	127	128
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4800	4890	4980	5080	5170	5260	5360	5510	5770	6130	6560
36000	V_1	117	117	117	117	117	117	117	119	121	123	124
	V_R	129	129	129	129	130	130	130	130	131	131	132
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	5030	5130	5220	5320	5420	5520	5620	5920	6410	6890	7380
38000	V_1	123	123	122	123	123	123	123	124	126	128	130
	V_R	134	134	134	134	134	134	134	134	135	136	136
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5600	5700	5810	5920	6040	6150	6260	6590	7140	7680	8270
38850	V_1	125	125	125	125	125	125	125	126	128	130	132
	V_R	135	135	136	136	136	136	136	136	137	137	138
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5850	5960	6070	6190	6310	6420	6540	6890	7470	8050	8670

TODATA6K_SNOWC_F10_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-20. (07-01-12-07)

CONTAMINATED RUNWAY TAKEOFF DATA
COMPACTED SNOW
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 7000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	94	94	94	94	94	94	94	96	99	101	102
	V_R	111	111	111	111	111	111	111	111	112	113	113
	V_2	126	126	125	125	125	125	125	124	123	122	122
	TOFL	4500	4580	4670	4760	4840	4930	5040	5260	5480	5710	5950
30000	V_1	99	99	99	99	99	99	100	103	105	107	109
	V_R	116	116	116	116	116	116	116	117	117	118	119
	V_2	125	125	124	124	124	124	124	123	123	123	123
	TOFL	4660	4740	4830	4920	5010	5100	5220	5450	5690	5940	6190
32000	V_1	105	105	105	105	105	105	106	109	111	113	115
	V_R	120	120	120	120	120	120	121	122	122	123	123
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	4810	4900	4990	5090	5180	5280	5390	5640	5900	6160	6430
34000	V_1	111	111	111	111	111	111	112	115	117	119	120
	V_R	125	125	125	125	125	125	125	126	127	128	128
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	4960	5060	5150	5250	5350	5440	5570	5840	6190	6650	7130
36000	V_1	117	117	117	117	117	117	118	121	122	124	126
	V_R	129	129	130	130	130	130	130	131	131	132	133
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	5200	5290	5390	5500	5600	5710	5910	6440	6960	7480	8050
38000	V_1	122	122	122	122	122	122	123	126	128	130	131
	V_R	134	134	134	134	134	134	134	135	136	136	137
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5780	5890	6000	6120	6240	6350	6580	7170	7760	8380	9020
38850	V_1	125	125	125	125	125	125	125	128	130	132	133
	V_R	136	136	136	136	136	136	136	137	137	138	138
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	6040	6150	6270	6390	6520	6640	6870	7500	8130	8780	9460

TODATA7K_SNOWC_F10_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-21. (07-01-12-08)

CONTAMINATED RUNWAY TAKEOFF DATA
COMPACTED SNOW
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 8000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	94	94	94	94	94	94	96	98	100	102	104
	V_R	111	111	111	111	111	111	111	112	113	113	114
	V_2	126	125	125	125	125	125	124	123	122	122	121
	TOFL	4650	4740	4830	4920	5010	5100	5320	5550	5800	6050	6310
30000	V_1	99	99	99	99	99	99	102	105	107	108	110
	V_R	115	115	115	115	115	115	116	117	118	119	119
	V_2	125	124	124	124	124	124	123	123	123	123	123
	TOFL	4810	4910	5000	5090	5190	5280	5510	5770	6030	6290	6580
32000	V_1	105	105	105	105	105	105	108	111	113	114	116
	V_R	120	120	120	120	120	120	121	122	123	123	124
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	4970	5070	5170	5260	5360	5460	5700	5970	6250	6540	6850
34000	V_1	111	111	111	111	111	112	114	117	118	120	122
	V_R	125	125	125	125	125	125	126	127	128	128	129
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	5130	5230	5330	5430	5530	5640	5890	6230	6720	7220	7780
36000	V_1	117	117	117	117	117	117	120	122	124	126	128
	V_R	130	130	130	130	130	130	131	131	132	133	133
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	5360	5460	5570	5680	5790	5920	6430	7000	7560	8150	8800
38000	V_1	122	122	122	122	122	123	125	127	129	131	133
	V_R	134	134	134	134	134	134	135	136	136	137	137
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5970	6080	6210	6330	6450	6580	7160	7810	8470	9140	9870
38850	V_1	125	125	125	125	125	125	127	129	132	133	135
	V_R	136	136	136	136	136	136	137	137	138	138	139
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	6240	6360	6480	6610	6740	6880	7480	8170	8870	9580	10350

TODATA8K_SNOWC_F10_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-22. (07-01-12-09)

CONTAMINATED RUNWAY TAKEOFF DATA
COMPACTED SNOW
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 9000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	94	94	94	94	94	95	97	100	102	104	106
	V_R	112	112	112	112	112	112	112	113	113	114	115
	V_2	125	125	125	125	125	124	123	122	122	121	120
	TOFL	4840	4930	5030	5120	5220	5380	5620	5870	6140	6410	6720
30000	V_1	99	99	99	99	99	101	104	106	108	110	112
	V_R	115	115	115	115	116	116	117	118	119	119	120
	V_2	124	124	124	124	124	123	123	123	123	123	123
	TOFL	5010	5110	5210	5300	5400	5570	5830	6110	6390	6680	7010
32000	V_1	105	105	105	106	106	107	110	112	114	116	118
	V_R	120	120	120	120	121	121	122	123	123	124	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	5180	5280	5380	5480	5580	5770	6040	6330	6640	6940	7500
34000	V_1	111	111	112	112	112	113	116	118	120	122	124
	V_R	125	125	125	125	125	126	127	128	128	129	129
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	5340	5450	5550	5660	5760	5960	6250	6770	7310	7870	8550
36000	V_1	117	117	117	117	117	119	121	124	126	127	129
	V_R	130	130	130	130	130	131	131	132	133	133	133
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	5600	5720	5830	5940	6050	6420	7000	7610	8250	8900	9680
38000	V_1	122	123	123	123	123	124	127	129	131	133	134
	V_R	134	134	134	134	134	135	136	136	137	137	138
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	6240	6360	6490	6610	6740	7150	7800	8520	9250	9990	10850
38850	V_1	125	125	125	125	125	126	129	131	133	135	136
	V_R	136	136	136	136	136	137	137	138	138	139	139
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	6520	6650	6780	6910	7040	7470	8160	8930	9690	10470	11370

TODATA9K_SNOWC_F10_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-23. (07-01-12-10)

CONTAMINATED RUNWAY TAKEOFF DATA
COMPACTED SNOW
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 10000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

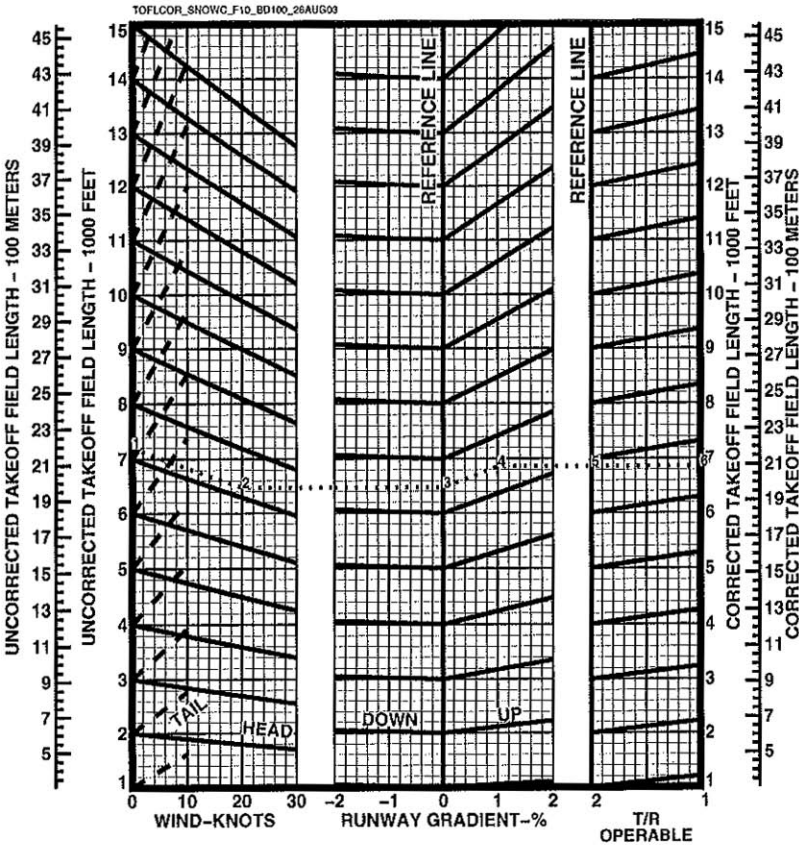
WT LB	DATA	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
26000	V_1	94	94	94	94	95	96	99	102	104	105	107
	V_R	112	112	112	112	112	112	113	113	114	115	115
	V_2	125	125	125	125	124	123	123	122	121	120	120
	TOFL	5050	5140	5240	5340	5480	5680	5950	6230	6510	6810	7170
30000	V_1	100	100	100	100	101	103	106	108	110	111	113
	V_R	116	116	116	116	116	117	118	119	119	120	120
	V_2	124	124	124	124	123	123	123	123	123	123	123
	TOFL	5230	5330	5430	5530	5680	5890	6180	6480	6780	7110	7490
32000	V_1	106	106	106	106	107	109	112	114	116	117	119
	V_R	121	121	121	121	121	122	123	123	124	124	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	5400	5510	5610	5720	5870	6100	6410	6730	7050	7550	8260
34000	V_1	112	112	112	112	113	116	118	120	121	123	125
	V_R	125	126	126	126	126	127	127	128	129	129	130
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	5580	5690	5800	5910	6070	6310	6790	7390	7970	8610	9420
36000	V_1	118	118	118	118	119	121	123	125	127	129	131
	V_R	130	130	130	130	130	131	132	133	133	133	134
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	5900	6020	6140	6260	6500	7000	7640	8320	9010	9740	10650
38000	V_1	123	123	123	123	124	126	128	131	132	134	135
	V_R	134	134	134	134	135	135	136	137	137	138	138
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	6570	6700	6830	6970	7240	7800	8520	9340	10110	10920	11940
38850	V_1	125	125	125	125	126	128	131	133	134	136	137
	V_R	136	136	136	136	136	137	138	138	139	139	140
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	6860	7000	7140	7280	7560	8150	8940	9780	10600	11450	12530

TODATA10K_SNOWC_F10_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-24. (07-01-12-11)

CONTAMINATED RUNWAY TAKEOFF FIELD LENGTH
COMPACTED SNOW
CORRECTION CHART
FLAPS 10°

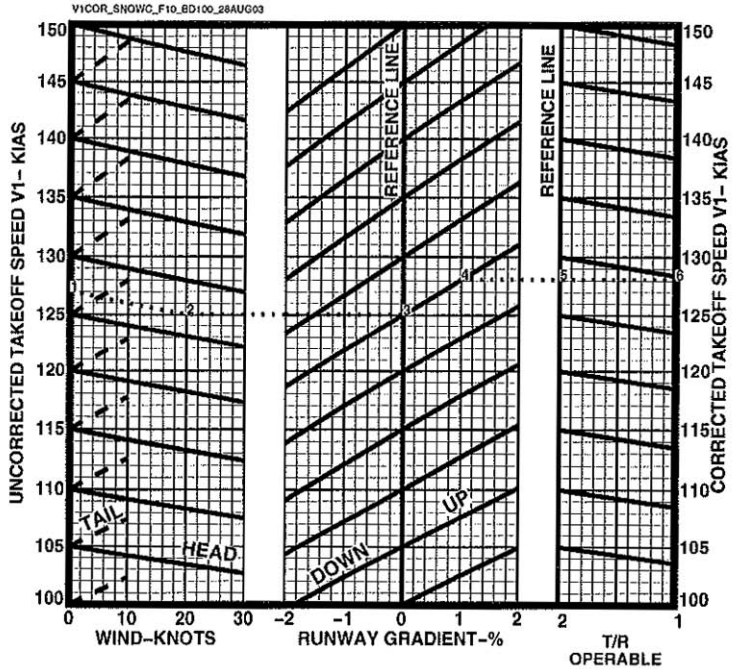


EXAMPLE:

1. Uncorrected Takeoff Field Length (from table).....7200 ft (2200 m)
2. Headwind.....20 kt
3. Runway Gradient Reference Line
4. Runway Gradient.....1.0% UP
5. Two Thrust Reversers
6. Corrected Takeoff Field Length.....6860 ft (2100 m)

Figure SUP1-25. (07-01-12-12)

CONTAMINATED RUNWAY TAKEOFF FIELD LENGTH
COMPACTED SNOW
CORRECTION CHART FOR V1
FLAPS 10°



EXAMPLE:

1. Uncorrected Takeoff Speed (from table).....127 kias
2. Headwind.....20 kt
3. Runway Gradient Reference Line
4. Runway Gradient.....1.0% UP
5. Two Thrust Reversers
6. Corrected Takeoff Speed.....128 kias

NOTES:

1. V1mcg is limiting when the corrected V1 is less than 116 kias. In this case, use V1=116 kias.
2. If the corrected V1 exceeds VR for the appropriate conditions, use V1=VR.

Figure SUP1-26. (07-01-12-13)

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CONTAMINATED RUNWAY TAKEOFF DATA
DRY SNOW
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE SEA LEVEL
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	111	111	111	111	111	111	111	111	111	111	111
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	127	127	127	127	126	126	126	126	126	126	126
	TOFL	4110	4180	4260	4330	4400	4480	4550	4630	4710	4780	4860
30000	V_1	114	114	114	114	114	114	114	114	114	114	114
	V_R	114	114	114	114	114	114	114	114	114	114	114
	V_2	126	125	125	125	125	125	125	125	125	125	125
	TOFL	4270	4350	4430	4500	4580	4660	4740	4820	4900	4980	5060
32000	V_1	119	119	119	119	119	119	119	119	119	120	120
	V_R	119	119	119	119	119	119	119	119	119	120	120
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	4620	4700	4790	4870	4960	5050	5150	5240	5340	5430	5520
34000	V_1	124	124	124	124	124	124	124	124	124	124	124
	V_R	124	124	124	124	124	124	124	124	124	124	124
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	5130	5220	5320	5410	5510	5610	5720	5820	5930	6030	6140
36000	V_1	129	129	129	129	129	129	129	129	129	129	129
	V_R	129	129	129	129	129	129	129	129	129	129	129
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	5670	5780	5880	5990	6090	6210	6320	6440	6560	6670	6790
38000	V_1	133	133	133	133	133	133	133	133	133	133	133
	V_R	133	133	133	133	133	133	133	133	133	133	133
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	6230	6350	6470	6580	6700	6820	6950	7080	7210	7340	7470
38850	V_1	135	135	135	135	135	135	135	135	135	135	135
	V_R	135	135	135	135	135	135	135	135	135	135	135
	V_2	140	140	140	140	140	140	140	140	140	140	140
	TOFL	6480	6610	6730	6850	6970	7100	7230	7370	7500	7640	7770

TODATASL_DRYSNOW_F10_ALL_IMP_BD100_26MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-27. (07-01-13-01)

CONTAMINATED RUNWAY TAKEOFF DATA
DRY SNOW
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 1000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	111	111	111	111	111	111	111	111	111	111	111
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	127	127	126	126	126	126	126	126	126	126	126
	TOFL	4240	4310	4390	4470	4540	4620	4700	4780	4860	4940	5020
30000	V_1	114	114	114	114	114	114	114	114	114	114	115
	V_R	114	114	114	114	114	114	114	114	114	114	115
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4410	4490	4570	4650	4730	4810	4890	4980	5060	5140	5220
32000	V_1	119	119	119	119	119	119	119	119	120	120	120
	V_R	119	119	119	119	119	119	119	119	120	120	120
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	4770	4860	4950	5040	5130	5230	5330	5420	5520	5620	5720
34000	V_1	124	124	124	124	124	124	124	124	124	125	125
	V_R	124	124	124	124	124	124	124	124	124	125	125
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	5290	5400	5500	5600	5700	5810	5920	6030	6130	6240	6350
36000	V_1	129	129	129	129	129	129	129	129	129	129	129
	V_R	129	129	129	129	129	129	129	129	129	129	129
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	5850	5970	6080	6190	6300	6420	6540	6660	6780	6910	7030
38000	V_1	133	133	133	133	133	133	133	133	133	133	134
	V_R	133	133	133	133	133	133	133	133	133	133	134
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	6430	6560	6680	6800	6930	7060	7200	7330	7460	7600	7730
38850	V_1	135	135	135	135	135	135	135	135	135	135	135
	V_R	135	135	135	135	135	135	135	135	135	135	135
	V_2	140	140	140	140	140	140	140	140	140	140	140
	TOFL	6690	6820	6950	7080	7210	7350	7490	7630	7770	7910	8050

TODATA1K_DRYSNOW_F10_ALL_IMP_BD100_26MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-28. (07-01-13-02)

CONTAMINATED RUNWAY TAKEOFF DATA
DRY SNOW
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 2000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	111	111	111	111	111	111	111	111	111	111	111
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	127	126	126	126	126	126	126	126	126	126	125
	TOFL	4370	4450	4530	4610	4690	4780	4860	4940	5020	5100	5220
30000	V_1	114	114	114	114	114	114	114	114	115	115	115
	V_R	114	114	114	114	114	114	114	114	115	115	115
	V_2	125	125	125	125	125	125	125	125	125	125	124
	TOFL	4550	4630	4710	4800	4880	4970	5060	5140	5230	5310	5430
32000	V_1	119	119	119	119	119	119	120	120	120	120	120
	V_R	119	119	119	119	119	119	120	120	120	120	120
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	4920	5020	5120	5210	5310	5420	5520	5620	5720	5820	5990
34000	V_1	124	124	124	124	124	124	124	125	125	125	125
	V_R	124	124	124	124	124	124	124	125	125	125	125
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	5470	5580	5680	5790	5900	6020	6130	6240	6350	6470	6660
36000	V_1	129	129	129	129	129	129	129	129	129	129	130
	V_R	129	129	129	129	129	129	129	129	129	129	130
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	6040	6170	6290	6400	6530	6650	6780	6900	7030	7150	7370
38000	V_1	133	133	133	133	133	133	133	133	134	134	134
	V_R	133	133	133	133	133	133	133	133	134	134	134
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	6640	6780	6910	7040	7180	7320	7460	7590	7730	7870	8110
38850	V_1	135	135	135	135	135	135	135	135	135	135	136
	V_R	135	135	135	135	135	135	135	135	135	135	136
	V_2	140	140	140	140	140	140	140	140	140	140	140
	TOFL	6910	7050	7190	7330	7470	7610	7760	7900	8050	8190	8440

TODATA2K_DRYSNOW_F10_ALL_IMP_BD100_26MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-29. (07-01-13-03)

CONTAMINATED RUNWAY TAKEOFF DATA
DRY SNOW
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 3000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	111	111	111	111	111	111	111	111	111	111	111
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	126	126	126	126	126	126	126	126	126	125	124
	TOFL	4510	4600	4680	4770	4850	4940	5020	5110	5190	5300	5510
30000	V_1	114	114	114	114	114	114	115	115	115	115	116
	V_R	114	114	114	114	114	114	115	115	115	115	116
	V_2	125	125	125	125	125	125	125	125	125	124	123
	TOFL	4700	4780	4870	4960	5050	5140	5230	5320	5410	5520	5740
32000	V_1	119	119	119	119	120	120	120	120	120	120	121
	V_R	119	119	119	119	120	120	120	120	120	120	121
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	5100	5200	5300	5410	5510	5610	5720	5820	5930	6080	6410
34000	V_1	124	124	124	124	124	125	125	125	125	125	126
	V_R	124	124	124	124	124	125	125	125	125	125	126
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	5660	5780	5890	6000	6120	6240	6360	6470	6590	6770	7140
36000	V_1	129	129	129	129	129	129	129	129	129	130	130
	V_R	129	129	129	129	129	129	129	129	129	130	130
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	6260	6380	6510	6640	6770	6900	7030	7160	7290	7490	7910
38000	V_1	133	133	133	133	133	134	134	134	134	134	135
	V_R	133	133	133	133	133	134	134	134	134	134	135
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	6880	7020	7160	7300	7450	7590	7730	7880	8020	8240	8730
38850	V_1	135	135	135	135	135	135	135	135	135	136	136
	V_R	135	135	135	135	135	135	135	135	135	136	136
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	7150	7300	7450	7600	7750	7900	8050	8200	8350	8580	9100

TODATA3K_DRYSNOW_F10_ALL_IMP_BD100_26MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-30. (07-01-13-04)

CONTAMINATED RUNWAY TAKEOFF DATA
DRY SNOW
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 4000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	111	111	111	111	111	111	111	111	111	111	111
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	126	126	126	126	126	126	126	125	125	124	124
	TOFL	4670	4760	4840	4930	5020	5110	5200	5290	5380	5590	5820
30000	V_1	114	114	114	115	115	115	115	115	115	116	117
	V_R	114	114	114	115	115	115	115	115	115	116	117
	V_2	125	125	125	125	125	125	125	124	124	123	123
	TOFL	4860	4950	5040	5130	5230	5320	5410	5500	5610	5830	6130
32000	V_1	119	119	120	120	120	120	120	120	120	121	122
	V_R	119	119	120	120	120	120	120	120	120	121	122
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	5290	5400	5500	5610	5720	5830	5940	6050	6180	6510	6880
34000	V_1	124	124	124	125	125	125	125	125	125	126	126
	V_R	124	124	124	125	125	125	125	125	125	126	126
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	5880	6000	6110	6230	6360	6480	6600	6720	6870	7250	7680
36000	V_1	129	129	129	129	129	129	129	129	130	130	131
	V_R	129	129	129	129	129	129	129	129	130	130	131
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	6500	6630	6760	6900	7030	7170	7300	7440	7610	8040	8530
38000	V_1	133	133	133	134	134	134	134	134	134	135	135
	V_R	133	133	133	134	134	134	134	134	134	135	135
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	7140	7290	7440	7580	7740	7880	8030	8180	8370	8870	9440
38850	V_1	135	135	135	135	135	135	136	136	136	136	137
	V_R	135	135	135	135	135	135	136	136	136	136	137
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	7430	7590	7740	7890	8050	8200	8360	8520	8710	9240	9840

TODATA4K_DRYSNOW_F10_ALL_IMP_BD100_26MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-31. (07-01-13-05)

CONTAMINATED RUNWAY TAKEOFF DATA
DRY SNOW
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 3=5000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10			
28000	V_1	111	111	111	111	111	111	111	111	111	111	112			
	V_R	111	111	111	111	111	111	111	111	111	111	112			
	V_2	126	126	126	126	126	125	125	125	124	124	123			
	TOFL	4830	4920	5010	5110	5200	5290	5380	5470	5680	5920	6170			
30000	V_1	114	115	115	115	115	115	115	115	116	117	117			
	V_R	114	115	115	115	115	115	115	115	116	117	117			
	V_2	125	125	125	125	125	124	124	124	123	123	123			
	TOFL	5030	5130	5220	5320	5410	5510	5610	5700	5920	6230	6580			
32000	V_1	120	120	120	120	120	120	120	120	121	122	122			
	V_R	120	120	120	120	120	120	120	120	121	122	122			
	V_2	127	127	127	127	127	127	127	127	127	127	127			
	TOFL	5490	5600	5710	5830	5940	6050	6170	6280	6610	6990	7390			
34000	V_1	125	125	125	125	125	125	125	125	126	126	127			
	V_R	125	125	125	125	125	125	125	125	126	126	127			
	V_2	132	132	132	132	132	132	132	132	132	132	132			
	TOFL	6100	6230	6350	6480	6600	6730	6860	6980	7360	7800	8280			
36000	V_1	129	129	129	129	129	130	130	130	130	131	131			
	V_R	129	129	129	129	129	130	130	130	130	131	131			
	V_2	135	135	135	135	135	135	135	135	135	135	135			
	TOFL	6750	6890	7020	7170	7310	7450	7590	7730	8160	8670	9230			
38000	V_1	134	134	134	134	134	134	134	134	135	135	136			
	V_R	134	134	134	134	134	134	134	134	135	135	136			
	V_2	139	139	139	139	139	139	139	139	139	139	139			
	TOFL	7420	7580	7730	7880	8040	8200	8350	8510	9000	9590	10240			
38850	V_1	135	135	135	135	136	136	136	136	136	137	137			
	V_R	135	135	135	135	136	136	136	136	136	137	137			
	V_2	141	141	141	141	141	141	141	141	141	141	141			
	TOFL	7720	7880	8040	8210	8370	8530	8690	8860	9380	10000	10690			

TODATA5K_DRYSNOW_F10_ALL_IMP_BD100_26MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-32. (07-01-13-06)

CONTAMINATED RUNWAY TAKEOFF DATA
DRY SNOW
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 6000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	111	111	111	111	111	111	111	111	111	112	113
	V_R	111	111	111	111	111	111	111	111	111	112	113
	V_2	126	126	126	126	125	125	125	125	124	123	122
	TOFL	5000	5090	5180	5280	5380	5470	5570	5730	6000	6270	6560
30000	V_1	115	115	115	115	115	115	115	116	117	117	118
	V_R	116	115	115	115	115	115	115	116	117	117	118
	V_2	125	125	125	124	124	124	124	124	123	123	123
	TOFL	5200	5300	5400	5500	5600	5700	5800	5970	6320	6690	7070
32000	V_1	120	120	120	120	120	120	120	121	122	122	123
	V_R	120	120	120	120	120	120	120	121	122	122	123
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	5700	5810	5920	6040	6160	6280	6390	6650	7080	7520	7970
34000	V_1	125	125	125	125	125	125	125	126	126	127	128
	V_R	125	125	125	125	125	125	125	126	126	127	128
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	6330	6450	6580	6710	6850	6980	7110	7400	7910	8410	8950
36000	V_1	129	129	129	129	130	130	130	130	131	131	132
	V_R	129	129	129	129	130	130	130	130	131	131	132
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	7000	7140	7280	7430	7570	7720	7870	8200	8790	9380	10010
38000	V_1	134	134	134	134	134	134	134	134	135	136	136
	V_R	134	134	134	134	134	134	134	134	135	136	136
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	7700	7850	8010	8170	8340	8500	8660	9040	9720	10400	11140
38850	V_1	135	135	136	136	136	136	136	136	137	137	138
	V_R	135	135	136	136	136	136	136	136	137	137	138
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	8010	8170	8340	8510	8680	8850	9010	9410	10130	10860	11650

TODATA6K_DRYSNOW_F10_ALL_IMP_BD100_26MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-33. (07-01-13-07)

CONTAMINATED RUNWAY TAKEOFF DATA
DRY SNOW
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 7000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
28000	V_1	111	111	111	111	111	111	111	111	112	113	113
	V_R	111	111	111	111	111	111	111	111	112	113	113
	V_2	126	126	125	125	125	125	125	124	123	122	122
	TOFL	5170	5260	5360	5460	5560	5660	5780	6070	6360	6670	6990
30000	V_1	116	115	116	116	115	116	116	117	117	118	119
	V_R	115	115	115	116	116	115	116	117	117	118	119
	V_2	125	125	124	124	124	124	124	123	123	123	123
	TOFL	5380	5480	5580	5690	5790	5890	6030	6380	6780	7190	7630
32000	V_1	120	120	120	120	120	120	121	122	122	123	123
	V_R	120	120	120	120	120	120	121	122	122	123	123
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	5900	6010	6130	6260	6380	6500	6690	7150	7620	8100	8620
34000	V_1	125	125	125	125	125	125	125	126	127	128	128
	V_R	125	125	125	125	125	125	125	126	127	128	128
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	6560	6680	6820	6960	7080	7230	7440	7970	8520	9080	9710
36000	V_1	129	129	130	130	130	130	130	131	131	132	133
	V_R	129	129	130	130	130	130	130	131	131	132	133
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	7250	7390	7540	7700	7850	8000	8240	8860	9500	10170	10900
38000	V_1	134	134	134	134	134	134	134	135	136	136	137
	V_R	134	134	134	134	134	134	134	135	136	136	137
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	7980	8130	8300	8470	8640	8810	9080	9790	10530	11310	12180
38850	V_1	136	136	136	136	136	136	136	137	137	138	138
	V_R	136	136	136	136	136	136	136	137	137	138	138
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	8300	8460	8640	8810	8990	9170	9450	10210	10990	11830	12760

TODATA7K_DRYSNOW_F10_ALL_IMP_BD100_26MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-34. (07-01-13-08)

CONTAMINATED RUNWAY TAKEOFF DATA
DRY SNOW
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 8000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	111	111	111	111	111	111	111	112	113	113	114
	V_R	111	111	111	111	111	111	111	112	113	113	114
	V_2	126	125	125	125	125	125	124	123	122	122	121
	TOFL	5340	5440	5540	5640	5750	5850	6120	6440	6760	7100	7480
30000	V_1	115	115	115	115	115	115	116	117	118	119	119
	V_R	115	115	115	115	115	115	116	117	118	119	119
	V_2	125	124	124	124	124	124	123	123	123	123	123
	TOFL	5560	5660	5770	5880	5990	6100	6420	6850	7290	7750	8260
32000	V_1	120	120	120	120	120	120	121	122	123	123	124
	V_R	120	120	120	120	120	120	121	122	123	123	124
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	6110	6230	6360	6490	6610	6750	7190	7690	8210	8760	9370
34000	V_1	125	125	125	125	125	125	126	127	128	128	129
	V_R	125	125	125	125	125	125	126	127	128	128	129
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	6790	6920	7070	7210	7350	7510	8010	8610	9220	9860	10600
36000	V_1	130	130	130	130	130	130	131	131	132	133	133
	V_R	130	130	130	130	130	130	131	131	132	133	133
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	7510	7660	7820	7980	8140	8310	8890	9590	10310	11070	11950
38000	V_1	134	134	134	134	134	134	135	136	136	137	137
	V_R	134	134	134	134	134	134	135	136	136	137	137
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	8260	8430	8610	8780	8960	9150	9810	10620	11460	12360	13410
38850	V_1	136	136	136	136	136	136	137	137	138	138	
	V_R	136	136	136	136	136	136	137	137	138	138	
	V_2	141	141	141	141	141	141	141	141	141	141	
	TOFL	8600	8770	8960	9140	9330	9520	10220	11090	11990	12950	

TODATA8K_DRYSNOW_F10_ALL_IMP_BD100_26MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-35. (07-01-13-09)

CONTAMINATED RUNWAY TAKEOFF DATA
DRY SNOW
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 9000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	112	112	112	112	112	112	112	113	113	114	115
	V_R	112	112	112	112	112	112	112	113	113	114	115
	V_2	125	125	125	125	125	124	123	122	122	121	120
	TOFL	5560	5660	5770	5880	5980	6190	6500	6850	7210	7590	8050
30000	V_1	115	115	115	115	116	116	117	118	119	119	120
	V_R	115	115	115	115	116	116	117	118	119	119	120
	V_2	124	124	124	124	124	123	123	123	123	123	123
	TOFL	5790	5900	6010	6130	6240	6470	6900	7370	7860	8380	9010
32000	V_1	120	120	120	120	121	121	122	123	123	124	125
	V_R	120	120	120	120	121	121	122	123	123	124	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	6390	6520	6650	6780	6920	7240	7740	8300	8890	9510	10270
34000	V_1	125	125	125	125	125	126	127	128	128	129	129
	V_R	125	125	125	125	125	126	127	128	128	129	129
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	7100	7250	7400	7540	7690	8060	8650	9310	10010	10750	11680
36000	V_1	130	130	130	130	130	131	131	132	133	133	133
	V_R	130	130	130	130	130	131	131	132	133	133	133
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	7850	8020	8180	8350	8520	8940	9630	10400	11230	12120	13240
38000	V_1	134	134	134	134	134	135	136	136	137	137	
	V_R	134	134	134	134	134	135	136	136	137	137	
	V_2	139	139	139	139	139	139	139	139	139	139	
	TOFL	8640	8830	9010	9190	9380	9860	10660	11570	12540	13600	
38850	V_1	136	136	136	136	136	137	137	138	138		
	V_R	136	136	136	136	136	137	137	138	138		
	V_2	141	141	141	141	141	141	141	141	141		
	TOFL	9000	9180	9380	9570	9760	10270	11120	12090	13140		

TODATA9K_DRYSNOW_F10_ALL_IMP_BD100_26MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-36. (07-01-13-10)

CONTAMINATED RUNWAY TAKEOFF DATA
DRY SNOW
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 10000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

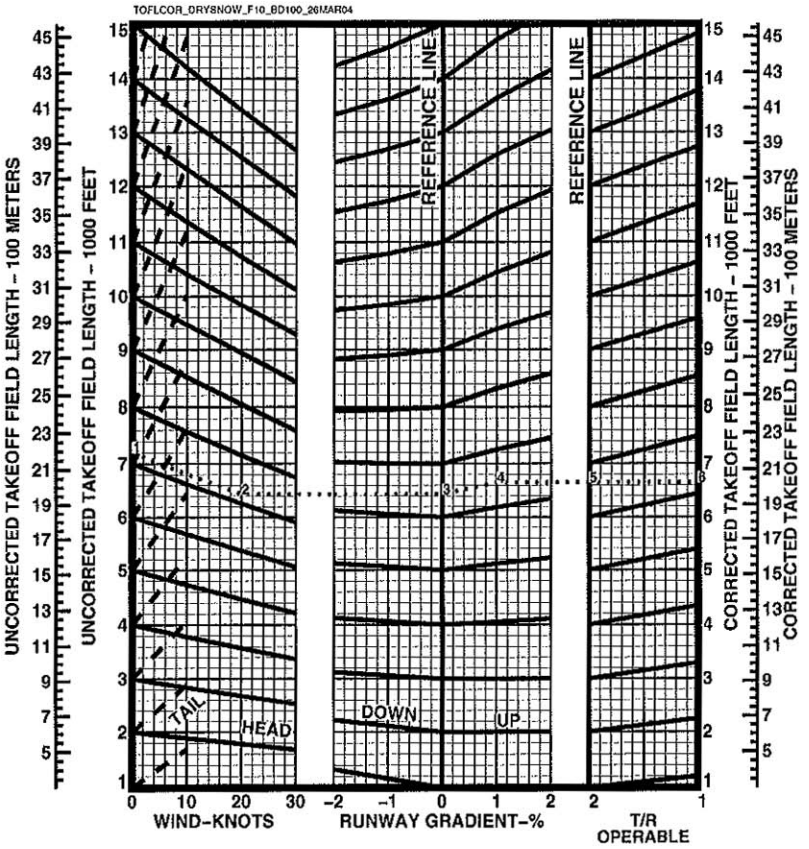
WT LB	DATA	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
28000	V_1	112	112	112	112	112	112	113	113	114	115	115
	V_R	112	112	112	112	112	112	113	113	114	115	115
	V_2	125	125	125	125	124	123	123	122	121	120	120
	TOFL	5800	5910	6020	6130	6300	6560	6920	7310	7710	8150	8710
30000	V_1	116	116	116	116	116	117	118	119	119	120	120
	V_R	116	116	116	116	116	117	118	119	119	120	120
	V_2	124	124	124	124	123	123	123	123	123	123	123
	TOFL	6040	6160	6280	6400	6580	6950	7440	7970	8510	9110	9890
32000	V_1	121	121	121	121	121	122	123	123	124	124	125
	V_R	121	121	121	121	121	122	123	123	124	124	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	6710	6850	6990	7130	7360	7790	8370	9000	9650	10380	11340
34000	V_1	125	126	126	126	126	127	127	128	129	129	130
	V_R	125	126	126	126	126	127	127	128	129	129	130
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	7460	7620	7780	7930	8200	8700	9380	10130	10910	11790	12970
36000	V_1	130	130	130	130	130	131	132	133	133	133	
	V_R	130	130	130	130	130	131	132	133	133	133	
	V_2	136	136	136	136	136	136	136	136	136	136	
	TOFL	8260	8440	8610	8790	9090	9670	10470	11370	12290	13350	
38000	V_1	134	134	134	134	135	135	136	137	137		
	V_R	134	134	134	134	135	135	136	137	137		
	V_2	139	139	139	139	139	139	139	139	139		
	TOFL	9100	9300	9490	9680	10020	10700	11630	12690	13790		
38850	V_1	136	136	136	136	136	137	138	138	139		
	V_R	136	136	136	136	136	137	138	138	139		
	V_2	141	141	141	141	141	141	141	141	141		
	TOFL	9470	9680	9880	10080	10440	11160	12150	13290	14480		

TODATA10K_DRYSNOW_F10_ALL_IMP_BD100_26MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-37. (07-01-13-11)

CONTAMINATED RUNWAY TAKEOFF FIELD LENGTH
DRY SNOW
CORRECTION CHART
FLAPS 10°

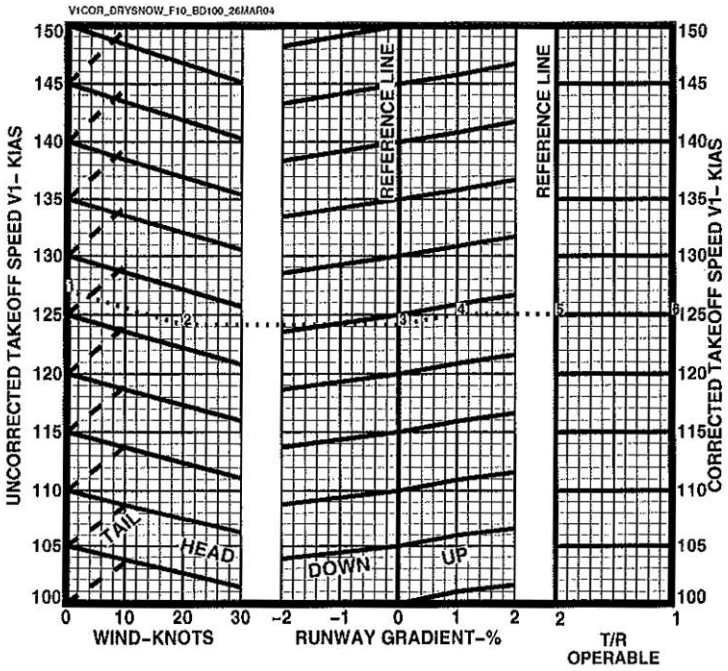


EXAMPLE:

1. Uncorrected Takeoff Field Length (from table).....7200 ft (2200 m)
2. Headwind.....20 kt
3. Runway Gradient Reference Line
4. Runway Gradient.....1.0% UP
5. Two Thrust Reversers
6. Corrected Takeoff Field Length.....6660 ft (2030 m)

Figure SUP1-38. (07-01-13-12)

CONTAMINATED RUNWAY TAKEOFF FIELD LENGTH
DRY SNOW
CORRECTION CHART FOR V1
FLAPS 10°



EXAMPLE:

1. Uncorrected Takeoff Speed (from table).....127 kias
2. Headwind.....20 kt
3. Runway Gradient Reference Line
4. Runway Gradient.....1.0% UP
5. Two Thrust Reversers
6. Corrected Takeoff Speed.....125 kias

NOTES:

1. V1mcg is limiting when the corrected V1 is less than 116 kias. In this case, use V1=116 kias.
2. If the corrected V1 exceeds VR for the appropriate conditions, use V1=VR.

Figure SUP1-39. (07-01-13-13)

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CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON

ALTITUDE SEA LEVEL
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C								
		10	15	20	25	30	35	40	45	50
28000	V_1	86	86	86	86	86	87	89	91	94
	V_R	111	111	111	111	111	111	111	111	112
	V_2	126	126	126	126	126	125	124	124	123
	TOFL	5270	5360	5450	5550	5660	5850	6080	6320	6610
30000	V_1	91	91	91	91	91	93	95	98	100
	V_R	114	114	115	115	115	115	116	117	118
	V_2	125	125	125	125	124	124	123	123	123
	TOFL	5460	5560	5650	5750	5870	6070	6320	6580	6890
32000	V_1	98	98	98	98	98	99	101	103	107
	V_R	120	120	120	120	120	120	121	122	123
	V_2	127	127	127	127	127	127	127	127	127
	TOFL	5650	5750	5850	5950	6070	6290	6550	6840	7160
34000	V_1	104	104	104	104	104	105	107	109	113
	V_R	124	125	125	125	125	125	126	126	127
	V_2	131	131	131	131	131	131	131	131	131
	TOFL	5830	5940	6050	6150	6280	6510	6780	7090	7440
36000	V_1	110	109	109	109	109	111	113	115	119
	V_R	129	129	129	129	129	130	130	131	132
	V_2	135	135	135	135	135	135	135	135	135
	TOFL	6020	6130	6240	6340	6470	6720	7020	7340	8040
38000	V_1	115	115	115	115	115	116	118	121	125
	V_R	133	133	134	134	134	134	135	135	136
	V_2	139	139	139	139	139	139	139	139	139
	TOFL	6200	6310	6430	6540	6670	6940	7490	8180	9090
38850	V_1	117	117	117	117	117	118	121	123	127
	V_R	135	135	135	135	135	136	136	137	138
	V_2	140	140	140	140	140	140	140	140	140
	TOFL	6390	6510	6620	6730	6870	7270	7860	8590	9570

TODATASL_WATER125_F10_ECS_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-40. (07-01-14-01)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 1000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C								
		10	15	20	25	30	35	40	45	48
28000	V_1	86	86	86	86	87	88	90	93	95
	V_R	111	111	111	111	111	111	111	112	113
	V_2	126	126	126	125	125	124	124	123	122
	TOFL	5470	5560	5660	5760	5960	6170	6410	6680	6870
30000	V_1	91	91	91	91	92	95	97	99	101
	V_R	115	115	115	115	115	116	117	117	118
	V_2	125	125	125	124	124	123	123	123	123
	TOFL	5670	5770	5870	5970	6190	6410	6670	6960	7160
32000	V_1	98	98	98	98	99	100	103	105	107
	V_R	120	120	120	120	120	121	122	122	123
	V_2	127	127	127	127	127	127	127	127	127
	TOFL	5870	5970	6070	6180	6410	6650	6920	7240	7450
34000	V_1	104	104	103	103	104	106	109	111	113
	V_R	125	125	125	125	125	126	126	127	127
	V_2	131	131	131	131	131	131	131	131	131
	TOFL	6060	6170	6270	6390	6630	6880	7180	7510	7740
36000	V_1	109	109	109	109	110	112	115	117	119
	V_R	129	129	129	129	130	130	131	132	132
	V_2	135	135	135	135	135	135	135	135	135
	TOFL	6250	6360	6480	6590	6840	7110	7420	7960	8470
38000	V_1	115	115	115	115	115	118	120	123	125
	V_R	134	134	134	134	134	134	135	136	136
	V_2	139	139	139	139	139	139	139	139	139
	TOFL	6440	6550	6670	6790	7060	7530	8170	8980	9590
38850	V_1	117	117	117	117	118	120	123	126	128
	V_R	135	135	135	135	136	136	137	137	138
	V_2	140	140	140	140	140	140	140	140	140
	TOFL	6610	6730	6850	6970	7320	7890	8570	9460	10100

TODATA1K_WATER125_F10_ECS_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-41. (07-01-14-02)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 2000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C								
		10	15	20	25	30	35	40	45	46
28000	V_1	86	86	86	86	88	90	92	95	96
	V_R	111	111	111	111	111	111	112	113	113
	V_2	126	126	125	125	125	124	123	122	122
	TOFL	5680	5780	5880	6060	6260	6500	6770	7080	7140
30000	V_1	91	91	91	92	94	96	98	101	102
	V_R	115	115	115	115	116	116	117	118	118
	V_2	125	124	124	124	123	123	123	123	123
	TOFL	5890	5990	6100	6290	6520	6770	7050	7380	7460
32000	V_1	98	98	98	98	100	102	104	107	108
	V_R	120	120	120	120	121	121	122	123	123
	V_2	127	127	127	127	127	127	127	127	127
	TOFL	6100	6200	6310	6520	6760	7020	7320	7680	7760
34000	V_1	103	103	103	103	106	108	110	114	114
	V_R	125	125	125	125	126	126	127	128	128
	V_2	131	131	131	131	131	131	131	131	131
	TOFL	6300	6410	6520	6740	7000	7270	7600	7980	8060
36000	V_1	109	109	109	109	111	114	116	120	120
	V_R	129	129	129	130	130	131	131	132	132
	V_2	135	135	135	135	135	135	135	135	135
	TOFL	6490	6610	6730	6960	7230	7530	7920	8740	8940
38000	V_1	114	114	114	115	117	119	122	126	126
	V_R	134	134	134	134	134	135	136	136	136
	V_2	139	139	139	139	139	139	139	139	139
	TOFL	6690	6810	6930	7180	7580	8180	8920	9900	10130
38850	V_1	117	117	117	117	119	122	125	128	129
	V_R	135	135	136	136	136	137	137	138	138
	V_2	140	140	140	140	140	140	140	140	140
	TOFL	6850	6970	7090	7390	7950	8590	9390	10420	10660

TODATA2K_WATER125_F10_ECS_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-42. (07-01-14-03)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 3000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C 10	15	20	25	30	35	40	44
28000	V_1	86	86	86	87	89	92	94	96
	V_R	111	111	111	111	111	112	113	113
	V_2	125	125	125	125	124	123	122	122
	TOFL	5900	6000	6170	6380	6620	6870	7160	7430
30000	V_1	91	91	91	93	95	98	100	102
	V_R	115	115	115	116	116	117	118	118
	V_2	124	124	124	124	123	123	123	123
	TOFL	6120	6220	6400	6630	6880	7150	7470	7760
32000	V_1	97	97	97	99	101	104	106	109
	V_R	120	120	120	121	121	122	123	123
	V_2	127	127	127	127	127	127	127	127
	TOFL	6330	6450	6640	6870	7140	7430	7770	8080
34000	V_1	103	103	103	105	107	110	112	115
	V_R	125	125	125	126	126	127	127	128
	V_2	131	131	131	131	131	131	131	131
	TOFL	6550	6660	6860	7110	7400	7710	8070	8400
36000	V_1	109	109	109	111	113	116	118	121
	V_R	129	130	130	130	131	131	132	132
	V_2	135	135	135	135	135	135	135	135
	TOFL	6750	6870	7080	7350	7660	7980	8680	9440
38000	V_1	114	114	114	117	119	121	124	127
	V_R	134	134	134	134	135	136	136	137
	V_2	139	139	139	139	139	139	139	139
	TOFL	6960	7090	7300	7640	8240	8940	9830	10700
38850	V_1	117	117	117	119	121	124	127	130
	V_R	136	136	136	136	137	137	138	138
	V_2	141	141	141	141	141	141	141	141
	TOFL	7100	7230	7480	8020	8650	9400	10340	11260

TODATA3K_WATER125_F10_ECS_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-43. (07-01-14-04)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 4000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C 10	15	20	25	30	35	40	42
28000	V_1	86	86	87	89	91	93	96	97
	V_R	111	111	111	111	112	113	113	114
	V_2	125	125	125	124	123	122	122	121
	TOFL	6130	6290	6490	6730	6990	7270	7600	7740
30000	V_1	91	91	93	95	97	99	102	103
	V_R	115	115	116	116	117	118	119	119
	V_2	124	124	124	123	123	123	123	123
	TOFL	6360	6530	6740	6990	7280	7580	7920	8080
32000	V_1	97	97	99	101	103	106	108	110
	V_R	120	120	121	121	122	123	123	124
	V_2	127	127	127	127	127	127	127	127
	TOFL	6590	6760	6990	7260	7560	7880	8250	8420
34000	V_1	103	103	105	107	109	112	115	116
	V_R	125	125	126	126	127	127	128	128
	V_2	131	131	131	131	131	131	131	131
	TOFL	6810	6990	7230	7520	7840	8180	8580	8760
36000	V_1	109	109	111	113	115	118	121	122
	V_R	130	130	130	131	131	132	132	133
	V_2	135	135	135	135	135	135	135	135
	TOFL	7030	7220	7470	7780	8120	8700	9580	9990
38000	V_1	114	114	116	118	121	124	127	128
	V_R	134	134	134	135	135	136	137	137
	V_2	139	139	139	139	139	139	139	139
	TOFL	7240	7440	7720	8310	9000	9830	10860	11320
38850	V_1	117	117	118	121	123	126	129	130
	V_R	136	136	136	137	137	138	138	139
	V_2	141	141	141	141	141	141	141	141
	TOFL	7390	7590	8090	8720	9460	10350	11430	11920

TODATA4K_WATER125_F10_ECS_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-44. (07-01-14-05)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 5000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C 10	15	20	25	30	35	40
28000	V_1	86	87	88	90	92	95	97
	V_R	111	111	111	112	113	113	114
	V_2	125	125	124	123	122	122	121
	TOFL	6410	6610	6830	7110	7400	7690	8070
30000	V_1	91	92	94	96	99	101	104
	V_R	115	116	116	117	118	118	119
	V_2	124	124	123	123	123	123	123
	TOFL	6650	6870	7100	7400	7710	8020	8430
32000	V_1	97	98	100	102	105	108	110
	V_R	120	121	121	122	123	123	124
	V_2	127	127	127	127	127	127	127
	TOFL	6890	7120	7360	7680	8020	8350	8790
34000	V_1	103	104	106	109	111	114	117
	V_R	125	126	126	127	127	128	129
	V_2	132	132	132	132	132	132	132
	TOFL	7120	7370	7630	7970	8320	8680	9250
36000	V_1	109	110	112	114	117	120	123
	V_R	130	130	131	131	132	132	133
	V_2	135	135	135	135	135	135	135
	TOFL	7350	7610	7890	8250	8770	9560	10580
38000	V_1	114	116	118	120	123	126	129
	V_R	134	134	135	135	136	137	137
	V_2	139	139	139	139	139	139	139
	TOFL	7580	7850	8370	9060	9900	10830	11990
38850	V_1	116	118	120	122	125	128	131
	V_R	136	136	137	137	138	138	139
	V_2	141	141	141	141	141	141	141
	TOFL	7730	8190	8780	9510	10420	11400	12620

TODATA5K_WATER125_F10_ECS_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-45. (07-01-14-06)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 6000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C						
		10	15	20	25	30	35	38
28000	V_1	87	88	90	92	94	97	98
	V_R	111	111	112	113	113	114	114
	V_2	125	124	123	123	122	121	121
	TOFL	6750	6970	7220	7510	7830	8180	8420
30000	V_1	92	94	96	98	100	103	105
	V_R	116	116	117	118	118	119	119
	V_2	124	123	123	123	123	123	123
	TOFL	7010	7240	7510	7830	8170	8540	8810
32000	V_1	98	100	102	104	107	110	111
	V_R	121	121	122	123	123	124	124
	V_2	127	127	127	127	127	127	127
	TOFL	7270	7520	7800	8140	8510	8900	9190
34000	V_1	104	106	108	110	113	116	118
	V_R	126	126	127	127	128	128	129
	V_2	132	132	132	132	132	132	132
	TOFL	7520	7780	8090	8440	8840	9260	9840
36000	V_1	110	112	114	116	119	122	124
	V_R	130	131	131	132	132	133	133
	V_2	135	135	135	135	135	135	135
	TOFL	7770	8050	8370	8800	9600	10580	11270
38000	V_1	115	118	120	122	125	128	130
	V_R	134	135	135	136	136	137	137
	V_2	139	139	139	139	139	139	139
	TOFL	8020	8500	9140	9920	10880	12000	12760
38850	V_1	118	120	122	125	128	131	132
	V_R	136	137	137	138	138	139	139
	V_2	141	141	141	141	141	141	141
	TOFL	8330	8920	9600	10440	11450	12630	13450

TODATA6K_WATER126_F10_ECS_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-46. (07-01-14-07)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 7000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C						
		10	15	20	25	30	35	36
28000	V_1	88	90	91	93	96	99	99
	V_R	111	112	113	113	114	115	115
	V_2	124	123	123	122	121	120	120
	TOFL	7110	7350	7630	7960	8310	8710	8800
30000	V_1	94	96	98	100	102	105	106
	V_R	116	117	118	118	119	120	120
	V_2	123	123	123	123	123	123	123
	TOFL	7390	7640	7950	8300	8670	9120	9210
32000	V_1	100	102	104	106	109	112	112
	V_R	121	122	123	123	124	124	125
	V_2	128	128	128	128	128	128	128
	TOFL	7670	7940	8260	8640	9040	9510	9610
34000	V_1	106	108	110	112	115	118	119
	V_R	126	127	127	128	128	129	129
	V_2	132	132	132	132	132	132	132
	TOFL	7940	8230	8570	8970	9400	10250	10470
36000	V_1	112	114	116	118	121	124	125
	V_R	131	131	132	132	133	133	133
	V_2	135	135	135	135	135	135	135
	TOFL	8220	8510	8880	9630	10590	11740	11990
38000	V_1	117	119	122	124	127	130	131
	V_R	135	135	136	136	137	137	138
	V_2	139	139	139	139	139	139	139
	TOFL	8640	9260	9990	10900	12010	13310	13600
38850	V_1	120	122	124	127	130	133	133
	V_R	137	137	138	138	139	139	139
	V_2	141	141	141	141	141	141	141
	TOFL	9060	9720	10510	11470	12640	14020	14330

TODATA7K_WATER125_F10_ECS_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-47. (07-01-14-08)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 8000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C					
		10	15	20	25	30	34
28000	V_1	89	91	93	95	98	100
	V_R	112	113	113	114	114	115
	V_2	123	123	122	121	121	120
	TOFL	7500	7760	8070	8440	8840	9200
30000	V_1	95	97	99	102	104	107
	V_R	117	118	118	119	119	120
	V_2	123	123	123	123	123	123
	TOFL	7800	8090	8410	8810	9240	9640
32000	V_1	102	104	106	108	111	113
	V_R	122	123	123	124	124	125
	V_2	128	128	128	128	128	128
	TOFL	8100	8400	8750	9180	9640	10060
34000	V_1	108	110	112	114	117	120
	V_R	127	127	128	128	129	129
	V_2	132	132	132	132	132	132
	TOFL	8400	8720	9090	9540	10240	11150
36000	V_1	114	116	118	120	124	126
	V_R	131	132	132	133	133	134
	V_2	136	136	136	136	136	136
	TOFL	8690	9030	9690	10590	11720	12770
38000	V_1	119	121	124	126	129	132
	V_R	136	136	136	137	137	138
	V_2	139	139	139	139	139	139
	TOFL	9410	10110	10960	12000	13290	14490
38850	V_1	122	124	126	129	132	134
	V_R	137	138	138	139	139	139
	V_2	141	141	141	141	141	141
	TOFL	9880	10630	11530	12640	14000	15270

TODATA8K_WATER125_F10_ECS_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-48. (07-01-14-09)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 9000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C 10	15	20	25	30	32
28000	V_1	91	93	95	97	100	101
	V_R	113	113	114	114	115	115
	V_2	123	122	121	121	120	120
	TOFL	7920	8210	8550	8970	9430	9630
30000	V_1	97	99	101	103	106	108
	V_R	118	118	119	119	120	120
	V_2	123	123	123	123	123	123
	TOFL	8250	8560	8930	9370	9870	10080
32000	V_1	103	105	107	110	113	114
	V_R	123	123	124	124	125	125
	V_2	128	128	128	128	128	128
	TOFL	8570	8900	9300	9770	10300	10540
34000	V_1	109	112	114	116	120	121
	V_R	127	128	128	129	129	130
	V_2	132	132	132	132	132	132
	TOFL	8890	9240	9670	10220	11360	11880
36000	V_1	115	118	120	123	126	127
	V_R	132	132	133	133	134	134
	V_2	136	136	136	136	136	136
	TOFL	9210	9800	10630	11690	13010	13600
38000	V_1	121	123	126	128	132	133
	V_R	136	136	137	137	138	138
	V_2	139	139	139	139	139	139
	TOFL	10270	11080	12030	13260	14770	15450
38850	V_1	124	126	128	131	134	135
	V_R	138	138	139	139	140	140
	V_2	141	141	141	141	141	141
	TOFL	10790	11650	12670	13970	15560	16320

TODATA9K_WATER125_F10_ECS_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-49. (07-01-14-10)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 10000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C				
		10	15	20	25	30
28000	V_1	92	94	96	99	102
	V_R	113	114	114	115	116
	V_2	122	121	121	120	119
	TOFL	8370	8680	9080	9550	10080
30000	V_1	99	101	103	105	109
	V_R	118	119	119	120	121
	V_2	123	123	123	123	123
	TOFL	8730	9050	9490	10000	10560
32000	V_1	105	107	109	112	115
	V_R	123	124	124	125	125
	V_2	128	128	128	128	128
	TOFL	9070	9430	9890	10430	11040
34000	V_1	111	113	115	118	122
	V_R	128	128	129	129	130
	V_2	132	132	132	132	132
	TOFL	9420	9800	10290	11300	12640
36000	V_1	117	120	122	125	128
	V_R	132	133	133	134	134
	V_2	136	136	136	136	136
	TOFL	9950	10720	11680	12950	14500
38000	V_1	123	125	128	131	134
	V_R	136	137	137	138	138
	V_2	139	139	139	139	139
	TOFL	11230	12130	13230	14700	16520
38850	V_1	126	128	130	133	136
	V_R	138	139	139	139	140
	V_2	141	141	141	141	141
	TOFL	11810	12760	13930	15490	17440

TODATA10K_WATER125_F10_ECS_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-50. (07-01-14-11)

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CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE SEA LEVEL
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	87	87	87	87	87	87	86	86	86	86	86
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	127	127	127	127	126	126	126	126	126	126	126
	TOFL	4320	4420	4520	4610	4710	4810	4900	5000	5090	5180	5270
30000	V_1	91	91	91	91	91	91	91	91	91	91	91
	V_R	114	114	114	114	114	114	114	114	114	114	114
	V_2	126	125	125	125	125	125	125	125	125	125	125
	TOFL	4470	4580	4680	4780	4880	4980	5080	5180	5270	5370	5470
32000	V_1	98	98	98	98	98	98	98	98	98	98	98
	V_R	119	119	119	119	119	119	119	119	119	120	120
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	4620	4730	4830	4940	5040	5150	5250	5350	5450	5550	5660
34000	V_1	105	105	105	104	104	104	104	104	105	105	104
	V_R	124	124	124	124	124	124	124	124	124	124	124
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	4760	4880	4990	5100	5200	5310	5420	5520	5630	5740	5840
36000	V_1	111	111	111	111	110	110	110	110	110	110	110
	V_R	129	129	129	129	129	129	129	129	129	129	129
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4910	5030	5140	5250	5360	5480	5590	5700	5810	5920	6020
38000	V_1	116	116	116	116	115	115	116	115	115	115	115
	V_R	133	133	133	133	133	133	133	133	133	133	133
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5080	5180	5290	5400	5520	5640	5750	5860	5980	6090	6200
38850	V_1	119	118	118	118	118	118	118	117	117	117	117
	V_R	135	135	135	135	135	135	135	135	135	135	135
	V_2	140	140	140	140	140	140	140	140	140	140	140
	TOFL	5330	5440	5540	5640	5730	5850	5960	6070	6180	6300	6410

TODATASL_WATER125_F10_ALL_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-51. (07-01-14-12)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 1000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
28000	V_1	87	87	87	86	86	86	86	86	86	86	86
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	127	127	126	126	126	126	126	126	126	126	126
	TOFL	4500	4600	4700	4800	4890	4990	5090	5180	5280	5380	5470
30000	V_1	91	91	91	91	91	91	91	91	91	91	91
	V_R	114	114	114	114	114	114	114	114	114	114	115
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4650	4760	4870	4970	5070	5170	5270	5370	5470	5570	5670
32000	V_1	98	98	98	98	98	98	98	98	98	98	98
	V_R	119	119	119	119	119	119	119	119	120	120	120
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	4810	4920	5030	5130	5240	5350	5450	5560	5660	5760	5870
34000	V_1	104	104	104	104	104	104	104	104	104	104	104
	V_R	124	124	124	124	124	124	124	124	124	125	125
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	4960	5070	5190	5300	5410	5520	5630	5740	5850	5950	6060
36000	V_1	111	111	110	110	110	110	110	110	109	109	109
	V_R	129	129	129	129	129	129	129	129	129	129	129
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	5110	5230	5350	5460	5580	5690	5800	5910	6030	6140	6250
38000	V_1	116	116	116	116	116	116	116	116	116	116	116
	V_R	133	133	133	133	133	133	133	133	133	133	134
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5260	5380	5500	5620	5740	5860	5970	6090	6210	6320	6440
38850	V_1	118	118	118	117	117	117	117	117	117	117	117
	V_R	135	135	135	135	135	135	135	135	135	135	135
	V_2	140	140	140	140	140	140	140	140	140	140	140
	TOFL	5500	5610	5720	5820	5930	6050	6160	6280	6390	6510	6630

TODATA1K_WATER125_F10_ALL_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-52. (07-01-14-13)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 2000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	86	86	86	86	86	86	86	86	86	86	87
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	127	126	126	126	126	126	126	126	126	126	125
	TOFL	4680	4780	4880	4990	5080	5180	5280	5380	5480	5580	5700
30000	V_1	91	91	91	91	91	91	91	91	91	91	92
	V_R	114	114	114	114	114	114	114	114	115	115	115
	V_2	125	125	125	125	125	125	125	125	125	125	124
	TOFL	4840	4950	5060	5160	5270	5370	5480	5580	5680	5790	5910
32000	V_1	98	98	98	98	98	98	98	98	98	98	99
	V_R	119	119	119	119	119	119	120	120	120	120	120
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	5010	5120	5230	5340	5450	5560	5660	5770	5880	5990	6120
34000	V_1	104	104	104	104	104	104	104	104	104	104	104
	V_R	124	124	124	124	124	124	124	125	125	125	125
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	5160	5280	5400	5510	5620	5730	5850	5960	6070	6190	6330
36000	V_1	110	110	110	110	110	109	109	109	109	109	110
	V_R	129	129	129	129	129	129	129	129	129	129	130
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	5320	5440	5570	5680	5800	5910	6030	6150	6260	6380	6530
38000	V_1	115	115	115	115	115	116	115	115	115	115	116
	V_R	133	133	133	133	133	133	133	133	134	134	134
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5470	5600	5730	5840	5970	6090	6210	6330	6460	6580	6730
38850	V_1	118	117	117	117	117	117	117	117	117	117	118
	V_R	135	135	135	135	135	135	135	135	135	135	136
	V_2	140	140	140	140	140	140	140	140	140	140	140
	TOFL	5680	5800	5910	6020	6140	6260	6380	6500	6620	6740	7010

TODATA2K_WATER125_F10_ALL_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-53. (07-01-14-14)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 3000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	86	86	86	86	86	86	86	86	86	87	88
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	126	126	126	126	126	126	126	126	126	125	124
	TOFL	4860	4970	5080	5180	5280	5380	5490	5590	5690	5810	6000
30000	V_1	91	91	91	91	91	91	91	91	91	92	95
	V_R	114	114	114	114	114	114	115	115	115	115	116
	V_2	125	125	125	125	125	125	125	125	125	124	123
	TOFL	5040	5150	5260	5360	5470	5580	5690	5800	5900	6030	6230
32000	V_1	98	98	98	98	98	98	98	98	98	99	101
	V_R	119	119	119	119	120	120	120	120	120	120	121
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	5210	5320	5430	5550	5660	5770	5890	6000	6110	6240	6460
34000	V_1	104	104	104	104	104	104	104	103	103	104	106
	V_R	124	124	124	124	124	125	125	125	125	125	126
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	5380	5500	5610	5730	5840	5960	6080	6200	6310	6450	6680
36000	V_1	110	110	109	109	109	109	109	109	109	110	112
	V_R	129	129	129	129	129	129	129	129	129	130	130
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	5540	5660	5780	5910	6030	6150	6270	6390	6520	6660	6900
38000	V_1	115	115	115	115	115	115	115	114	114	115	118
	V_R	133	133	133	133	133	134	134	134	134	134	135
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5700	5830	5950	6080	6210	6330	6460	6590	6710	6860	7280
38850	V_1	117	117	117	117	117	117	117	117	117	118	120
	V_R	135	135	135	135	135	135	135	135	135	136	136
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5880	6000	6120	6240	6370	6490	6620	6740	6870	7120	7630

TODATA3K_WATER125_F10_ALL_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-54. (07-01-14-15)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 4000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	86	86	86	86	86	86	86	86	86	88	90
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	126	126	126	126	126	126	126	125	125	124	124
	TOFL	5060	5170	5270	5380	5490	5600	5700	5810	5930	6120	6330
30000	V_1	91	91	91	91	91	91	91	91	92	94	96
	V_R	114	114	114	115	115	116	116	115	115	116	117
	V_2	125	125	125	125	125	125	125	124	124	123	123
	TOFL	5240	5350	5470	5580	5690	5800	5910	6030	6150	6350	6570
32000	V_1	98	98	98	98	98	98	98	98	98	100	102
	V_R	119	119	120	120	120	120	120	120	120	121	122
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	5420	5540	5650	5770	5890	6000	6120	6240	6370	6580	6820
34000	V_1	104	104	104	104	104	103	103	103	104	106	108
	V_R	124	124	124	125	125	125	125	125	125	126	126
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	5590	5710	5840	5960	6080	6200	6320	6440	6580	6810	7060
36000	V_1	110	109	109	109	109	109	109	109	109	112	114
	V_R	129	129	129	129	129	129	129	129	130	130	131
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	5770	5890	6020	6140	6270	6400	6530	6650	6790	7030	7300
38000	V_1	115	115	115	115	115	114	114	114	115	117	120
	V_R	133	133	133	134	134	134	134	134	134	135	135
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5930	6070	6200	6330	6460	6590	6720	6850	6990	7390	7950
38850	V_1	117	117	117	117	117	117	117	117	117	120	122
	V_R	135	135	135	135	135	135	136	136	136	136	137
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	6110	6240	6360	6490	6620	6750	6880	7010	7200	7750	8340

TODATA4K_WATER125_F10_ALL_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-55. (07-01-14-16)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 5000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	86	86	86	86	86	86	86	86	88	90	92
	V_R	111	111	111	111	111	111	111	111	111	111	112
	V_2	126	126	126	126	126	125	125	125	124	124	123
	TOFL	5260	5370	5480	5600	5710	5820	5930	6040	6230	6450	6670
30000	V_1	91	91	91	91	91	91	91	91	94	96	98
	V_R	114	115	115	115	115	115	115	115	116	117	117
	V_2	125	125	125	125	125	124	124	124	123	123	123
	TOFL	5450	5570	5680	5800	5920	6030	6150	6270	6470	6700	6940
32000	V_1	98	98	98	98	98	98	98	97	100	102	104
	V_R	120	120	120	120	120	120	120	120	121	122	122
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	5640	5760	5880	6000	6130	6250	6370	6490	6710	6950	7210
34000	V_1	104	104	104	104	103	103	103	103	106	108	110
	V_R	125	125	125	125	125	125	125	125	126	126	127
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	5820	5950	6070	6200	6330	6450	6580	6710	6940	7200	7470
36000	V_1	109	109	109	109	109	109	109	109	111	114	116
	V_R	129	129	129	129	129	130	130	130	130	131	131
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	6000	6130	6260	6400	6530	6660	6790	6920	7160	7440	7740
38000	V_1	115	115	115	115	114	114	114	114	117	119	122
	V_R	134	134	134	134	134	134	134	134	135	135	136
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	6180	6320	6450	6590	6730	6860	7000	7140	7490	8070	8690
38850	V_1	117	117	117	117	117	117	117	117	119	122	124
	V_R	135	135	135	135	136	136	136	136	136	137	137
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	6350	6480	6610	6750	6880	7020	7160	7290	7850	8470	9130

TODATA5K_WATER125_F10_ALL_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-56. (07-01-14-17)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 6000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	86	86	86	86	86	86	86	87	89	92	94
	V_R	111	111	111	111	111	111	111	111	111	112	113
	V_2	126	126	126	126	125	125	125	125	124	123	122
	TOFL	5470	5580	5700	5810	5930	6050	6170	6320	6570	6800	7050
30000	V_1	91	91	91	91	91	91	91	93	96	98	100
	V_R	115	115	115	116	115	115	115	116	117	117	118
	V_2	125	125	125	124	124	124	124	124	123	123	123
	TOFL	5670	5790	5910	6030	6150	6270	6400	6560	6820	7080	7340
32000	V_1	98	98	98	97	97	97	97	99	101	104	106
	V_R	120	120	120	120	120	120	120	121	122	122	123
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	5870	5990	6110	6240	6370	6500	6620	6800	7080	7350	7630
34000	V_1	104	103	103	103	103	103	103	105	108	110	112
	V_R	125	125	125	125	125	125	125	126	126	127	128
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	6060	6180	6320	6450	6580	6710	6840	7030	7330	7610	7910
36000	V_1	109	109	109	109	109	109	109	110	113	116	118
	V_R	129	129	129	129	130	130	130	130	131	131	132
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	6250	6380	6510	6650	6790	6920	7060	7260	7570	7880	8450
38000	V_1	115	114	114	114	114	114	114	116	119	121	124
	V_R	134	134	134	134	134	134	134	134	135	136	136
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	6430	6570	6710	6850	6990	7140	7280	7490	8160	8820	9540
38850	V_1	117	117	117	117	117	116	116	118	121	124	127
	V_R	135	135	136	136	136	136	136	136	137	137	138
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	6590	6720	6850	6980	7130	7270	7410	7850	8560	9270	10020

TODATA6K_WATER125_F10_ALL_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-57. (07-01-14-18)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 7000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	86	86	86	85	85	85	86	89	91	93	95
	V_R	111	111	111	111	111	111	111	111	112	113	113
	V_2	126	126	125	125	125	125	125	124	123	122	122
	TOFL	5680	5800	5920	6040	6160	6290	6420	6670	6930	7190	7460
30000	V_1	91	91	91	91	91	91	91	95	97	99	102
	V_R	116	116	116	116	116	116	116	117	117	118	119
	V_2	125	125	124	124	124	124	124	123	123	123	123
	TOFL	5890	6020	6140	6270	6390	6520	6670	6940	7210	7480	7770
32000	V_1	97	97	97	97	97	97	98	101	103	106	108
	V_R	120	120	120	120	120	120	121	122	122	123	123
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	6100	6220	6350	6490	6620	6750	6910	7190	7480	7780	8090
34000	V_1	103	103	103	103	103	103	104	107	109	112	114
	V_R	125	125	125	125	125	125	125	126	127	128	128
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	6300	6430	6570	6700	6840	6980	7140	7440	7750	8060	8390
36000	V_1	109	109	108	108	108	108	109	113	115	118	120
	V_R	129	129	130	130	130	130	130	131	131	132	133
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	6490	6630	6780	6920	7060	7200	7370	7690	8020	8580	9270
38000	V_1	114	114	114	114	114	114	115	118	121	124	126
	V_R	134	134	134	134	134	134	134	135	136	136	137
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	6690	6830	6980	7130	7270	7420	7600	8200	8920	9680	10460
38850	V_1	117	116	116	116	116	116	117	121	123	126	129
	V_R	136	136	136	136	136	136	136	137	137	138	138
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	6820	6950	7090	7240	7390	7530	7830	8600	9360	10170	11000

TODATA7K_WATER125_F10_ALL_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-58. (07-01-14-19)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 8000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	85	85	85	85	85	85	88	90	93	95	97
	V_R	111	111	111	111	111	111	111	112	113	113	114
	V_2	126	125	125	125	125	125	124	123	122	122	121
	TOFL	5910	6030	6160	6280	6410	6540	6780	7050	7320	7610	7910
30000	V_1	90	90	91	91	90	90	94	97	99	101	103
	V_R	115	115	115	115	115	115	116	117	118	119	119
	V_2	125	124	124	124	124	124	123	123	123	123	123
	TOFL	6120	6250	6390	6520	6650	6780	7040	7330	7630	7930	8250
32000	V_1	97	97	97	97	97	97	100	103	105	108	110
	V_R	120	120	120	120	120	120	121	122	123	123	124
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	6340	6470	6610	6750	6880	7020	7300	7610	7930	8240	8590
34000	V_1	103	102	102	102	102	102	106	109	111	114	116
	V_R	125	125	125	125	125	125	126	127	128	128	129
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	6540	6690	6830	6970	7110	7260	7550	7880	8220	8560	8950
36000	V_1	108	108	108	108	108	108	112	115	117	120	122
	V_R	130	130	130	130	130	130	131	131	132	133	133
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	6750	6900	7040	7200	7340	7500	7800	8150	8680	9410	10200
38000	V_1	114	114	114	114	114	114	117	120	123	126	128
	V_R	134	134	134	134	134	134	135	136	136	137	137
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	6950	7100	7260	7420	7570	7730	8180	8980	9790	10610	11510
38850	V_1	116	116	116	116	116	116	119	123	126	128	131
	V_R	136	136	136	136	136	136	137	137	138	138	139
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	7060	7200	7350	7500	7660	7830	8580	9420	10290	11160	12100

TODATA8K_WATER125_F10_ALL_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-59. (07-01-14-20)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 9000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
28000	V_1	86	86	86	85	85	87	89	92	94	97	99
	V_R	112	112	112	112	112	112	112	113	113	114	115
	V_2	125	125	125	125	125	124	123	122	122	121	120
	TOFL	6160	6300	6430	6560	6690	6890	7160	7450	7750	8060	8410
30000	V_1	91	91	91	90	90	93	96	98	101	103	106
	V_R	115	115	115	115	116	116	117	118	119	119	120
	V_2	124	124	124	124	124	123	123	123	123	123	123
	TOFL	6390	6530	6670	6810	6940	7150	7440	7760	8080	8410	8760
32000	V_1	97	97	97	97	97	99	102	105	107	109	112
	V_R	120	120	120	120	121	121	122	123	123	124	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	6620	6770	6910	7050	7200	7420	7730	8060	8400	8750	9150
34000	V_1	103	103	103	102	102	105	108	111	113	116	119
	V_R	125	125	125	125	125	126	127	128	128	129	129
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	6840	6990	7140	7290	7440	7670	8000	8350	8720	9090	9900
36000	V_1	108	108	108	108	108	110	114	117	120	122	125
	V_R	130	130	130	130	130	131	131	132	133	133	133
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	7060	7210	7370	7530	7680	7920	8280	8750	9520	10330	11280
38000	V_1	114	114	114	114	114	116	119	123	125	128	130
	V_R	134	134	134	134	134	135	136	136	137	137	138
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	7270	7430	7600	7760	7920	8180	8980	9850	10750	11670	12740
38850	V_1	116	116	116	116	116	118	122	125	128	130	133
	V_R	136	136	136	136	136	137	137	138	138	139	139
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	7390	7540	7700	7860	8020	8560	9420	10360	11300	12260	13400

TODATA9K_WATER125_F10_ALL_IMP_8D100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-60. (07-01-14-21)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 10000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

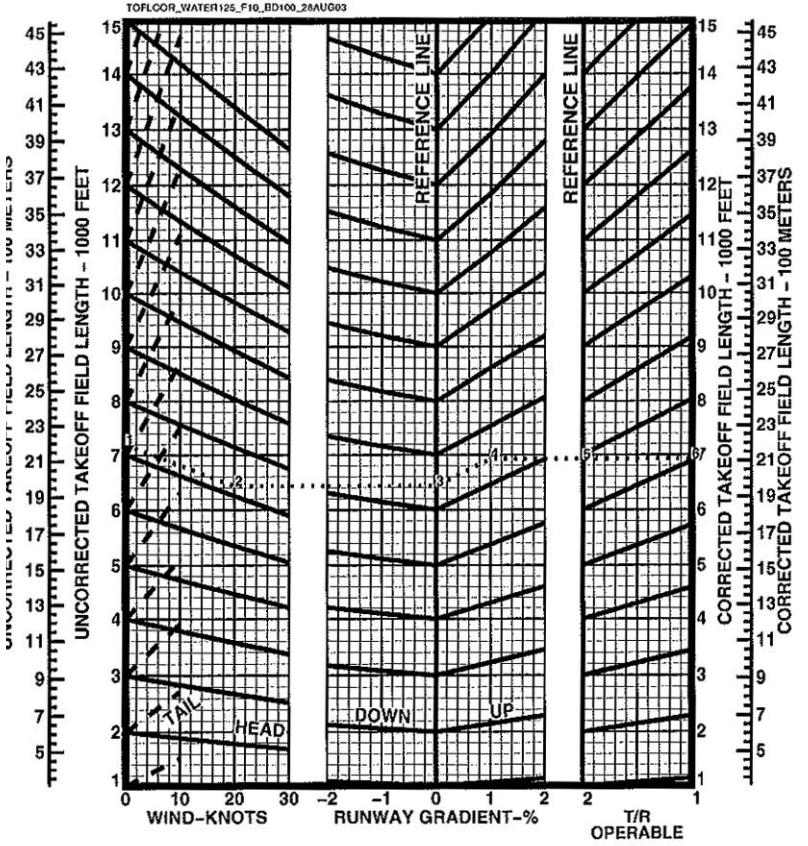
WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	86	86	86	85	86	88	91	94	96	98	101
	V_R	112	112	112	112	112	112	113	113	114	115	116
	V_2	125	125	125	125	124	123	123	122	121	120	120
	TOFL	6450	6580	6720	6860	7040	7280	7580	7900	8220	8560	8960
30000	V_1	91	91	91	91	92	95	98	100	103	105	108
	V_R	116	116	116	116	116	117	118	119	119	120	120
	V_2	124	124	124	124	123	123	123	123	123	123	123
	TOFL	6690	6840	6980	7120	7310	7560	7890	8230	8570	8940	9370
32000	V_1	97	97	97	97	98	101	104	107	109	111	114
	V_R	121	121	121	121	121	122	123	123	124	124	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	6930	7080	7230	7380	7570	7850	8200	8560	8920	9310	9770
34000	V_1	103	103	103	103	104	107	110	113	115	118	121
	V_R	125	126	126	126	126	127	127	128	129	129	130
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	7170	7320	7480	7630	7840	8130	8500	8890	9270	9980	10970
36000	V_1	109	109	109	109	110	113	116	119	122	124	127
	V_R	130	130	130	130	130	131	132	133	133	133	134
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	7400	7560	7720	7880	8100	8410	8790	9620	10470	11370	12510
38000	V_1	114	114	114	114	115	118	122	125	128	130	133
	V_R	134	134	134	134	135	135	136	137	137	138	138
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	7620	7790	7960	8130	8350	8960	9870	10870	11830	12840	14130
38850	V_1	117	117	117	117	118	121	124	127	130	132	135
	V_R	136	136	136	136	136	137	138	138	139	139	140
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	7810	7980	8140	8310	8660	9400	10370	11420	12430	13510	14890

TODATA10K_WATER125_F10_ALL_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-61. (07-01-14-22)

CONTAMINATED RUNWAY TAKEOFF FIELD LENGTH
MODERATE CONTAMINATION DEPTH
CORRECTION CHART
FLAPS 10°

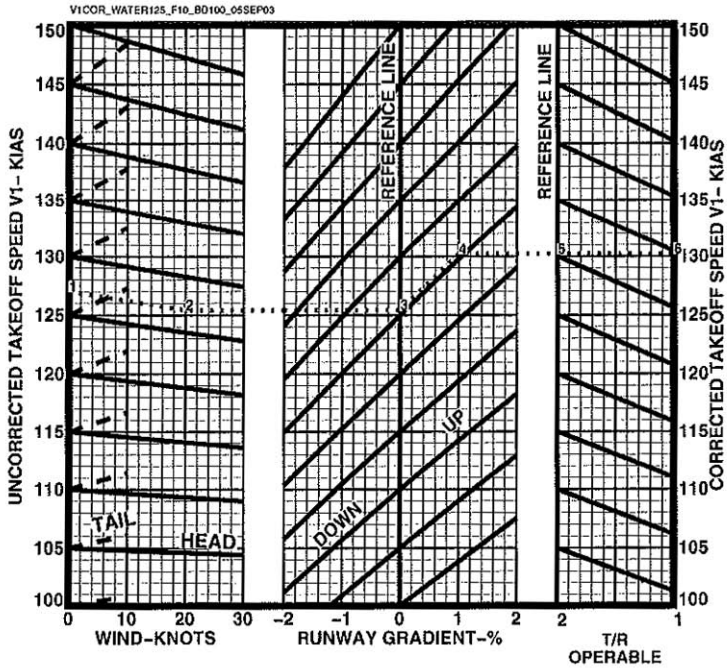


EXAMPLE:

1. Uncorrected Takeoff Field Length (from table).....7200 ft (2200 m)
2. Headwind.....20 kt
3. Runway Gradient Reference Line
4. Runway Gradient.....1.0% UP
5. Two Thrust Reversers
6. Corrected Takeoff Field Length.....6930 ft (2120 m)

Figure SUP1-62. (07-01-14-23)

CONTAMINATED RUNWAY TAKEOFF FIELD LENGTH
MODERATE CONTAMINATION DEPTH
CORRECTION CHART FOR V1
FLAPS 10°



EXAMPLE:

1. Uncorrected Takeoff Speed (from table).....127 kias
2. Headwind.....20 kt
3. Runway Gradient Reference Line
4. Runway Gradient.....1.0% UP
5. Two Thrust Reversers
6. Corrected Takeoff Speed.....130 kias

NOTES:

1. V1mcg is limiting when the corrected V1 is less than 116 kias. In this case, use V1=116 kias.
2. If the corrected V1 exceeds VR for the appropriate conditions, use V1=VR.

Figure SUP1-63. (07-01-14-24)

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CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON

ALTITUDE SEA LEVEL
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C								
		10	15	20	25	30	35	40	45	50
28000	V_1	87	87	87	87	87	88	89	91	95
	V_R	111	111	111	111	111	111	111	111	112
	V_2	126	126	126	126	126	125	124	124	123
	TOFL	5250	5340	5430	5520	5630	5820	6060	6300	6590
30000	V_1	92	92	92	92	92	93	96	98	101
	V_R	114	114	115	115	115	115	116	117	118
	V_2	125	125	125	125	124	124	123	123	123
	TOFL	5440	5540	5630	5730	5850	6050	6290	6560	6870
32000	V_1	99	99	99	99	99	100	102	104	107
	V_R	120	120	120	120	120	120	121	122	123
	V_2	127	127	127	127	127	127	127	127	127
	TOFL	5630	5730	5830	5930	6050	6270	6530	6820	7150
34000	V_1	105	104	104	104	104	105	107	110	113
	V_R	124	125	125	125	125	125	126	126	127
	V_2	131	131	131	131	131	131	131	131	131
	TOFL	5820	5920	6020	6130	6250	6490	6770	7070	7420
36000	V_1	110	110	110	110	110	111	113	116	119
	V_R	129	129	129	129	129	130	130	131	132
	V_2	135	135	135	135	135	135	135	135	135
	TOFL	6000	6110	6220	6330	6460	6700	7000	7320	8100
38000	V_1	116	116	115	115	115	117	119	122	125
	V_R	133	133	134	134	134	134	135	135	136
	V_2	139	139	139	139	139	139	139	139	139
	TOFL	6180	6290	6410	6520	6660	6980	7550	8250	9180
38850	V_1	118	118	118	118	118	119	121	124	128
	V_R	135	135	135	135	135	136	136	137	138
	V_2	140	140	140	140	140	140	140	140	140
	TOFL	6430	6550	6660	6770	6910	7330	7930	8660	9670

TODATASL_WATER25_F10_ECS_IMP_GD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-64. (07-01-15-01)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 1000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C								
		10	15	20	25	30	35	40	45	48
28000	V_1	87	87	87	87	87	89	91	94	96
	V_R	111	111	111	111	111	111	111	112	113
	V_2	126	126	126	125	125	124	124	123	122
	TOFL	5450	5540	5640	5730	5930	6140	6390	6660	6850
30000	V_1	92	92	92	92	93	95	97	100	102
	V_R	115	115	115	115	115	116	117	117	118
	V_2	125	125	125	124	124	123	123	123	123
	TOFL	5650	5750	5850	5950	6160	6390	6650	6940	7150
32000	V_1	98	98	98	98	99	101	103	106	108
	V_R	120	120	120	120	120	121	122	122	123
	V_2	127	127	127	127	127	127	127	127	127
	TOFL	5840	5950	6050	6160	6380	6620	6900	7220	7440
34000	V_1	104	104	104	104	105	107	109	112	114
	V_R	125	125	125	125	125	126	126	127	127
	V_2	131	131	131	131	131	131	131	131	131
	TOFL	6040	6150	6260	6360	6600	6860	7160	7500	7730
36000	V_1	110	110	110	110	110	113	115	118	120
	V_R	129	129	129	129	130	130	131	132	132
	V_2	135	135	135	135	135	135	135	135	135
	TOFL	6230	6340	6450	6570	6820	7100	7410	8030	8540
38000	V_1	115	115	115	115	116	118	121	124	126
	V_R	134	134	134	134	134	134	135	136	136
	V_2	139	139	139	139	139	139	139	139	139
	TOFL	6420	6530	6650	6770	7040	7580	8240	9070	9690
38850	V_1	118	118	118	118	118	121	123	126	129
	V_R	135	135	135	135	136	136	137	137	138
	V_2	140	140	140	140	140	140	140	140	140
	TOFL	6660	6770	6890	7010	7370	7960	8650	9540	10200

TODATA1K_WATER25_F10_ECS_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-65. (07-01-15-02)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 2000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C								
		10	15	20	25	30	35	40	45	46
28000	V_1	87	86	86	87	88	90	93	96	96
	V_R	111	111	111	111	111	111	112	113	113
	V_2	126	126	125	125	125	124	123	122	122
	TOFL	5650	5750	5850	6040	6250	6480	6750	7060	7120
30000	V_1	91	92	92	92	95	97	99	102	102
	V_R	115	115	115	115	116	116	117	118	118
	V_2	125	124	124	124	123	123	123	123	123
	TOFL	5870	5970	6070	6270	6500	6740	7030	7360	7440
32000	V_1	98	98	98	98	100	102	105	108	109
	V_R	120	120	120	120	121	121	122	123	123
	V_2	127	127	127	127	127	127	127	127	127
	TOFL	6070	6180	6290	6500	6740	7000	7310	7670	7750
34000	V_1	104	104	104	104	106	109	111	114	115
	V_R	125	125	125	125	126	126	127	128	128
	V_2	131	131	131	131	131	131	131	131	131
	TOFL	6270	6390	6500	6720	6970	7260	7590	7970	8050
36000	V_1	110	109	109	110	112	114	117	120	121
	V_R	129	129	129	130	130	131	131	132	132
	V_2	135	135	135	135	135	135	135	135	135
	TOFL	6480	6590	6710	6940	7210	7510	7990	8820	9020
38000	V_1	115	115	115	115	118	120	123	126	127
	V_R	134	134	134	134	134	135	136	136	136
	V_2	139	139	139	139	139	139	139	139	139
	TOFL	6670	6790	6920	7160	7630	8250	9000	10000	10230
38850	V_1	117	117	117	118	120	122	125	129	129
	V_R	135	135	136	136	136	137	137	138	138
	V_2	140	140	140	140	140	140	140	140	140
	TOFL	6890	7010	7140	7440	8010	8660	9480	10530	10770

TODATA2K_WATER25_F10_ECS_IMP_BD100_18MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-66. (07-01-15-03)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 3000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C 10	15	20	25	30	35	40	44
28000	V_1	86	86	87	88	90	92	94	97
	V_R	111	111	111	111	111	112	113	113
	V_2	125	125	125	125	124	123	122	122
	TOFL	5870	5980	6140	6350	6590	6850	7150	7420
30000	V_1	92	92	92	94	96	98	101	103
	V_R	115	115	115	116	116	117	118	118
	V_2	124	124	124	124	123	123	123	123
	TOFL	6090	6200	6380	6600	6860	7130	7450	7740
32000	V_1	98	98	98	100	102	104	107	109
	V_R	120	120	120	121	121	122	123	123
	V_2	127	127	127	127	127	127	127	127
	TOFL	6310	6420	6610	6850	7120	7410	7750	8070
34000	V_1	104	103	104	106	108	110	113	116
	V_R	125	125	125	126	126	127	127	128
	V_2	131	131	131	131	131	131	131	131
	TOFL	6520	6640	6840	7090	7380	7690	8050	8390
36000	V_1	109	109	110	112	114	116	119	122
	V_R	129	130	130	130	131	131	132	132
	V_2	135	135	135	135	135	135	135	135
	TOFL	6730	6850	7060	7330	7640	8010	8760	9540
38000	V_1	115	115	115	117	119	122	125	128
	V_R	134	134	134	134	135	136	136	137
	V_2	139	139	139	139	139	139	139	139
	TOFL	6940	7060	7280	7700	8300	9020	9920	10820
38850	V_1	117	117	117	120	122	124	128	130
	V_R	136	136	136	136	137	137	138	138
	V_2	141	141	141	141	141	141	141	141
	TOFL	7150	7280	7530	8080	8720	9480	10450	11390

TODATA3K_WATER25_F10_ECS_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-67. (07-01-15-04)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 4000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C 10	15	20	25	30	35	40	42
28000	V_1	86	86	88	89	92	94	96	97
	V_R	111	111	111	111	112	113	113	114
	V_2	125	125	125	124	123	122	122	121
	TOFL	6110	6260	6460	6700	6970	7250	7580	7730
30000	V_1	92	92	94	95	97	100	103	104
	V_R	115	115	116	116	117	118	119	119
	V_2	124	124	124	123	123	123	123	123
	TOFL	6340	6500	6710	6970	7260	7550	7910	8070
32000	V_1	98	98	99	101	104	106	109	110
	V_R	120	120	121	121	122	123	123	124
	V_2	127	127	127	127	127	127	127	127
	TOFL	6560	6730	6970	7240	7540	7860	8240	8410
34000	V_1	103	103	105	107	110	112	115	116
	V_R	125	125	126	126	127	127	128	128
	V_2	131	131	131	131	131	131	131	131
	TOFL	6780	6960	7210	7500	7820	8160	8560	8820
36000	V_1	109	109	111	113	116	118	122	123
	V_R	130	130	130	131	131	132	132	133
	V_2	135	135	135	135	135	135	135	135
	TOFL	7000	7190	7450	7760	8100	8780	9680	10100
38000	V_1	115	115	117	119	121	124	127	129
	V_R	134	134	134	135	135	136	137	137
	V_2	139	139	139	139	139	139	139	139
	TOFL	7220	7420	7770	8370	9080	9930	10970	11450
38850	V_1	117	117	119	121	124	127	130	131
	V_R	136	136	136	137	137	138	138	139
	V_2	141	141	141	141	141	141	141	141
	TOFL	7440	7640	8150	8790	9540	10450	11550	12040

TODATA4K_WATER25_F10_ECS_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-68. (07-01-15-05)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 5000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C						
		10	15	20	25	30	35	40
28000	V_1	86	87	89	91	93	96	98
	V_R	111	111	111	112	113	113	114
	V_2	125	125	124	123	122	122	121
	TOFL	6380	6580	6800	7080	7370	7670	8050
30000	V_1	92	93	95	97	99	102	105
	V_R	115	116	116	117	118	118	119
	V_2	124	124	123	123	123	123	123
	TOFL	6620	6840	7070	7370	7690	8000	8410
32000	V_1	98	99	101	103	106	108	111
	V_R	120	121	121	122	123	123	124
	V_2	127	127	127	127	127	127	127
	TOFL	6860	7090	7340	7660	8000	8340	8780
34000	V_1	103	105	107	109	112	115	117
	V_R	125	126	126	127	127	128	129
	V_2	132	132	132	132	132	132	132
	TOFL	7100	7340	7600	7950	8310	8660	9340
36000	V_1	109	111	113	115	118	121	124
	V_R	130	130	131	131	132	132	133
	V_2	135	135	135	135	135	135	135
	TOFL	7330	7590	7870	8230	8850	9660	10700
38000	V_1	115	116	119	121	124	127	130
	V_R	134	134	135	135	136	137	137
	V_2	139	139	139	139	139	139	139
	TOFL	7560	7870	8430	9140	9990	10950	12150
38850	V_1	117	119	121	123	126	129	132
	V_R	136	136	137	137	138	138	139
	V_2	141	141	141	141	141	141	141
	TOFL	7790	8250	8850	9600	10520	11520	12780

TODATA5K_WATER25_F10_ECS_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-69. (07-01-15-06)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 6000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C						
		10	15	20	25	30	35	38
28000	V_1	87	89	91	92	95	97	99
	V_R	111	111	112	113	113	114	114
	V_2	125	124	123	123	122	121	121
	TOFL	6720	6940	7190	7490	7810	8160	8410
30000	V_1	93	95	97	99	101	104	106
	V_R	116	116	117	118	118	119	119
	V_2	124	123	123	123	123	123	123
	TOFL	6980	7210	7480	7800	8150	8530	8790
32000	V_1	99	101	103	105	107	110	112
	V_R	121	121	122	123	123	124	124
	V_2	127	127	127	127	127	127	127
	TOFL	7240	7490	7770	8120	8490	8890	9180
34000	V_1	105	107	109	111	114	117	119
	V_R	126	126	127	127	128	128	129
	V_2	132	132	132	132	132	132	132
	TOFL	7500	7760	8060	8420	8820	9350	9950
36000	V_1	111	113	115	117	120	123	125
	V_R	130	131	131	132	132	133	133
	V_2	135	135	135	135	135	135	135
	TOFL	7750	8030	8340	8880	9700	10700	11390
38000	V_1	116	118	120	123	126	129	131
	V_R	134	135	135	136	136	137	137
	V_2	139	139	139	139	139	139	139
	TOFL	8000	8570	9220	10010	10990	12130	12930
38850	V_1	118	121	123	125	128	131	133
	V_R	136	137	137	138	138	139	139
	V_2	141	141	141	141	141	141	141
	TOFL	8390	8990	9680	10540	11580	12770	13620

TODATA6K_WATER25_F10_ECS_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-70. (07-01-15-07)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 7000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C						
		10	15	20	25	30	35	36
28000	V_1	88	90	92	94	97	99	100
	V_R	111	112	113	113	114	115	115
	V_2	124	123	123	122	121	120	120
	TOFL	7080	7320	7600	7930	8290	8700	8790
30000	V_1	94	96	98	100	103	106	107
	V_R	116	117	118	118	119	120	120
	V_2	123	123	123	123	123	123	123
	TOFL	7360	7620	7920	8280	8660	9100	9200
32000	V_1	100	102	105	107	109	112	113
	V_R	121	122	123	123	124	124	125
	V_2	128	128	128	128	128	128	128
	TOFL	7640	7910	8240	8620	9020	9500	9600
34000	V_1	106	109	111	113	116	119	120
	V_R	126	127	127	128	128	129	129
	V_2	132	132	132	132	132	132	132
	TOFL	7920	8210	8550	8950	9390	10370	10600
36000	V_1	112	115	117	119	122	125	126
	V_R	131	131	132	132	133	133	133
	V_2	135	135	135	135	135	135	135
	TOFL	8190	8490	8950	9720	10700	11870	12140
38000	V_1	118	120	122	125	128	131	132
	V_R	135	135	136	136	137	137	138
	V_2	139	139	139	139	139	139	139
	TOFL	8710	9340	10080	11020	12150	13480	13770
38850	V_1	120	123	125	127	130	133	134
	V_R	137	137	138	138	139	139	139
	V_2	141	141	141	141	141	141	141
	TOFL	9130	9810	10610	11600	12790	14200	14520

TODATA7K_WATER25_F10_ECS_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-71. (07-01-15-08)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 8000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C 10	15	20	25	30	34
28000	V_1	90	92	94	96	98	101
	V_R	112	113	113	114	114	115
	V_2	123	123	122	121	121	120
	TOFL	7470	7730	8040	8410	8820	9190
30000	V_1	96	98	100	102	105	107
	V_R	117	118	118	119	119	120
	V_2	123	123	123	123	123	123
	TOFL	7770	8050	8390	8790	9220	9620
32000	V_1	102	104	106	109	112	114
	V_R	122	123	123	124	124	125
	V_2	128	128	128	128	128	128
	TOFL	8070	8380	8730	9160	9620	10050
34000	V_1	108	110	113	115	118	121
	V_R	127	127	128	128	129	129
	V_2	132	132	132	132	132	132
	TOFL	8370	8690	9070	9530	10350	11280
36000	V_1	114	116	119	121	124	127
	V_R	131	132	132	133	133	134
	V_2	136	136	136	136	136	136
	TOFL	8670	9060	9780	10700	11860	12930
38000	V_1	120	122	125	127	130	133
	V_R	136	136	136	137	137	138
	V_2	139	139	139	139	139	139
	TOFL	9490	10200	11070	12140	13460	14700
38850	V_1	122	125	127	130	133	135
	V_R	137	138	138	139	139	139
	V_2	141	141	141	141	141	141
	TOFL	9960	10730	11650	12790	14180	15520

TODATA8K_WATER25_F10_ECS_IMP_BD100_16MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-72. (07-01-15-09)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 9000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C 10	15	20	25	30	32
28000	V_1	91	93	95	98	100	102
	V_R	113	113	114	114	115	115
	V_2	123	122	121	121	120	120
	TOFL	7890	8180	8530	8940	9410	9610
30000	V_1	98	100	102	104	107	108
	V_R	118	118	119	119	120	120
	V_2	123	123	123	123	123	123
	TOFL	8210	8530	8910	9350	9850	10070
32000	V_1	104	106	108	111	114	115
	V_R	123	123	124	124	125	125
	V_2	128	128	128	128	128	128
	TOFL	8540	8880	9280	9750	10300	10530
34000	V_1	110	112	114	117	120	122
	V_R	127	128	128	129	129	130
	V_2	132	132	132	132	132	132
	TOFL	8870	9220	9650	10330	11500	12020
36000	V_1	116	118	121	123	127	128
	V_R	132	132	133	133	134	134
	V_2	136	136	136	136	136	136
	TOFL	9200	9900	10740	11830	13170	13790
38000	V_1	122	124	127	129	132	134
	V_R	136	136	137	137	138	138
	V_2	139	139	139	139	139	139
	TOFL	10360	11190	12170	13430	14970	15710
38850	V_1	124	127	129	132	135	136
	V_R	138	138	139	139	140	140
	V_2	141	141	141	141	141	141
	TOFL	10890	11770	12820	14140	15820	16590

TODATA9K_WATER25_F10_ECS_IMP_BD100_16MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-73. (07-01-15-10)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON

ALTITUDE 10000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C				
		10	15	20	25	30
28000	V_1	93	95	97	99	103
	V_R	113	114	114	115	116
	V_2	122	121	121	120	119
	TOFL	8340	8650	9060	9530	10060
30000	V_1	99	102	103	106	109
	V_R	118	119	119	120	121
	V_2	123	123	123	123	123
	TOFL	8690	9030	9470	9980	10550
32000	V_1	106	108	110	113	116
	V_R	123	124	124	125	125
	V_2	128	128	128	128	128
	TOFL	9050	9400	9880	10420	11080
34000	V_1	112	114	116	119	123
	V_R	128	128	129	129	130
	V_2	132	132	132	132	132
	TOFL	9400	9780	10320	11430	12800
36000	V_1	118	120	123	126	129
	V_R	132	133	133	134	134
	V_2	136	136	136	136	136
	TOFL	10040	10830	11810	13110	14700
38000	V_1	124	126	128	131	135
	V_R	136	137	137	138	138
	V_2	139	139	139	139	139
	TOFL	11350	12260	13390	14900	16800
38850	V_1	126	129	131	134	137
	V_R	138	139	139	139	140
	V_2	141	141	141	141	141
	TOFL	11940	12900	14110	15700	17700

TODATA10K_WATER25_F10_ECS_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-74. (07-01-15-11)

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CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE SEA LEVEL
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	88	88	87	87	87	87	87	87	87	87	87
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	127	127	127	127	126	126	126	126	126	126	126
	TOFL	4310	4410	4500	4600	4690	4790	4880	4980	5070	5160	5250
30000	V_1	92	92	92	92	91	91	92	92	92	92	92
	V_R	114	114	114	114	114	114	114	114	114	114	114
	V_2	126	125	125	125	125	125	125	125	125	125	125
	TOFL	4460	4560	4660	4760	4860	4960	5060	5160	5250	5350	5440
32000	V_1	99	99	99	98	98	98	98	98	99	99	99
	V_R	119	119	119	119	119	119	119	119	119	120	120
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	4610	4710	4820	4920	5020	5130	5240	5330	5430	5540	5630
34000	V_1	105	105	105	105	105	105	105	105	105	105	105
	V_R	124	124	124	124	124	124	124	124	124	124	124
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	4750	4860	4970	5080	5190	5300	5400	5510	5610	5720	5820
36000	V_1	112	111	111	111	111	111	111	110	110	110	110
	V_R	129	129	129	129	129	129	129	129	129	129	129
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	4890	5010	5120	5230	5340	5460	5570	5680	5790	5900	6010
38000	V_1	117	117	116	116	116	116	116	116	116	116	116
	V_R	133	133	133	133	133	133	133	133	133	133	133
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5110	5210	5310	5410	5500	5620	5740	5850	5960	6070	6190
38850	V_1	119	119	119	118	118	118	118	118	118	118	118
	V_R	135	135	135	135	135	135	135	135	135	135	135
	V_2	140	140	140	140	140	140	140	140	140	140	140
	TOFL	5370	5470	5570	5670	5770	5880	5990	6110	6220	6330	6450

TODATASL_WATER25_F10_ALL_IMP_BD100_16MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-75. (07-01-15-12)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 1000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	87	87	87	87	87	87	87	87	87	87	87
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	127	127	126	126	126	126	126	126	126	126	126
	TOFL	4480	4580	4680	4780	4880	4970	5070	5160	5260	5350	5450
30000	V_1	92	91	91	91	91	91	91	91	92	92	92
	V_R	114	114	114	114	114	114	114	114	114	114	115
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4640	4740	4850	4950	5050	5150	5250	5350	5450	5550	5650
32000	V_1	98	98	98	98	98	98	98	98	98	98	98
	V_R	119	119	119	119	119	119	119	119	120	120	120
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	4790	4900	5010	5120	5220	5330	5430	5530	5640	5750	5850
34000	V_1	105	105	105	105	105	105	105	105	105	104	104
	V_R	124	124	124	124	124	124	124	124	124	125	125
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	4950	5060	5170	5280	5400	5500	5610	5720	5830	5940	6040
36000	V_1	111	111	111	111	110	110	110	110	110	110	110
	V_R	129	129	129	129	129	129	129	129	129	129	129
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	5100	5210	5330	5450	5560	5670	5790	5900	6010	6120	6240
38000	V_1	116	116	116	116	116	116	116	115	115	115	115
	V_R	133	133	133	133	133	133	133	133	133	133	134
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5280	5380	5490	5610	5720	5840	5960	6080	6190	6310	6430
38850	V_1	119	118	118	118	118	118	118	118	118	118	118
	V_R	135	135	135	135	135	135	135	135	135	135	135
	V_2	140	140	140	140	140	140	140	140	140	140	140
	TOFL	5540	5650	5750	5860	5970	6080	6200	6320	6430	6550	6670

TODATA1K_WATER25_F10_ALL_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-76. (07-01-15-13)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 2000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
28000	V_1	87	87	87	87	87	87	87	87	87	87	87
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	127	126	126	126	126	126	126	126	126	126	125
	TOFL	4660	4760	4860	4960	5060	5160	5260	5360	5460	5560	5680
30000	V_1	91	91	91	91	91	91	91	91	91	92	93
	V_R	114	114	114	114	114	114	114	114	115	115	116
	V_2	125	125	125	125	125	125	125	125	125	125	124
	TOFL	4820	4930	5040	5140	5250	5350	5450	5560	5660	5760	5890
32000	V_1	98	98	98	98	98	98	98	98	98	98	99
	V_R	119	119	119	119	119	119	120	120	120	120	120
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	4990	5100	5210	5320	5420	5530	5640	5750	5860	5960	6100
34000	V_1	105	105	105	105	105	105	104	104	104	104	105
	V_R	124	124	124	124	124	124	124	125	125	125	125
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	5140	5260	5380	5490	5600	5720	5830	5940	6050	6170	6310
36000	V_1	111	111	110	110	110	110	110	110	110	110	111
	V_R	129	129	129	129	129	129	129	129	129	129	130
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	5310	5420	5550	5660	5780	5900	6010	6130	6250	6360	6510
38000	V_1	116	116	116	115	115	115	115	115	115	115	116
	V_R	133	133	133	133	133	133	133	133	134	134	134
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5460	5590	5710	5830	5950	6070	6190	6310	6430	6560	6730
38850	V_1	118	118	118	118	118	118	118	118	118	117	119
	V_R	135	135	135	135	135	135	135	135	135	135	136
	V_2	140	140	140	140	140	140	140	140	140	140	140
	TOFL	5710	5830	5950	6060	6180	6300	6420	6540	6660	6780	7050

TODATA2K_WATER25_F10_ALL_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-77. (07-01-15-14)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 3000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	87	87	87	87	87	87	87	87	87	87	89
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	126	126	126	126	126	126	126	126	126	125	124
	TOFL	4850	4950	5050	5160	5260	5360	5460	5570	5670	5790	5980
30000	V_1	91	91	91	91	91	91	91	91	92	93	95
	V_R	114	114	114	114	114	114	115	115	115	115	116
	V_2	125	125	125	125	125	125	125	125	125	124	123
	TOFL	5020	5130	5240	5340	5450	5560	5660	5770	5880	6000	6210
32000	V_1	98	98	98	98	98	98	98	98	98	99	101
	V_R	119	119	119	119	120	120	120	120	120	120	121
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	5190	5310	5420	5530	5640	5750	5870	5970	6090	6220	6430
34000	V_1	105	105	105	105	104	104	104	104	104	105	107
	V_R	124	124	124	124	124	125	125	125	125	125	126
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	5360	5480	5590	5710	5830	5940	6060	6180	6290	6430	6650
36000	V_1	110	110	110	110	110	110	110	110	110	110	113
	V_R	129	129	129	129	129	129	129	129	129	130	130
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	5520	5650	5770	5880	6010	6130	6250	6370	6490	6640	6880
38000	V_1	116	116	116	116	116	116	116	116	116	116	118
	V_R	133	133	133	133	133	134	134	134	134	134	135
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5680	5810	5940	6060	6190	6320	6440	6560	6690	6840	7330
38850	V_1	118	118	118	118	118	117	117	117	117	118	121
	V_R	135	135	135	135	135	135	135	135	135	136	136
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	5910	6040	6160	6280	6410	6530	6660	6780	6910	7160	7690

TODATA3K_WATER25_F10_ALL_IMP_BD100_16MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-78. (07-01-15-15)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 4000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
28000	V_1	87	87	87	87	87	87	86	86	87	89	90
	V_R	111	111	111	111	111	111	111	111	111	111	111
	V_2	126	126	126	126	126	126	126	125	125	124	124
	TOFL	5040	5140	5250	5360	5470	5570	5680	5790	5900	6090	6300
30000	V_1	91	91	91	91	91	91	92	92	92	95	97
	V_R	114	114	114	115	115	115	115	115	115	116	117
	V_2	125	125	125	125	125	125	125	124	124	123	123
	TOFL	5220	5330	5440	5550	5670	5780	5890	6000	6120	6330	6550
32000	V_1	98	98	98	98	98	98	98	98	99	101	103
	V_R	119	119	120	120	120	120	120	120	120	121	122
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	5400	5520	5630	5750	5860	5980	6100	6210	6340	6560	6790
34000	V_1	105	105	104	104	104	104	104	104	104	107	109
	V_R	124	124	124	125	125	125	125	125	125	126	126
	V_2	131	131	131	131	131	131	131	131	131	131	131
	TOFL	5570	5700	5820	5940	6060	6180	6300	6420	6550	6790	7040
36000	V_1	110	110	110	110	110	110	110	109	110	112	115
	V_R	129	129	129	129	129	129	129	129	130	130	131
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	5750	5870	6000	6120	6250	6380	6500	6630	6760	7010	7280
38000	V_1	115	115	115	115	115	115	115	115	115	118	120
	V_R	133	133	133	134	134	134	134	134	134	135	135
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	5920	6050	6180	6310	6440	6570	6700	6830	6970	7440	8010
38850	V_1	118	118	118	118	117	117	117	117	118	120	123
	V_R	135	135	135	135	135	135	136	136	136	136	137
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	6150	6280	6400	6530	6660	6790	6920	7050	7250	7800	8400

TODATA4K_WATER25_F10_ALL_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-79. (07-01-15-16)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 5000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	87	87	87	87	86	86	86	86	88	90	93
	V_R	111	111	111	111	111	111	111	111	111	111	112
	V_2	126	126	126	126	126	125	125	125	124	124	123
	TOFL	5240	5350	5460	5570	5680	5790	5910	6010	6200	6420	6650
30000	V_1	91	91	91	92	92	92	92	92	94	97	99
	V_R	114	115	115	116	115	115	115	115	116	117	117
	V_2	125	125	125	125	125	124	124	124	123	123	123
	TOFL	5430	5550	5660	5780	5900	6010	6120	6240	6440	6680	6920
32000	V_1	98	98	98	98	98	98	98	98	100	103	105
	V_R	120	120	120	120	120	120	120	120	121	122	122
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	5610	5740	5860	5980	6100	6220	6340	6460	6680	6930	7190
34000	V_1	105	104	104	104	104	104	104	104	106	109	111
	V_R	125	125	125	125	125	125	125	125	126	126	127
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	5800	5930	6050	6180	6300	6430	6560	6680	6910	7170	7450
36000	V_1	110	110	110	110	110	110	109	109	112	114	117
	V_R	129	129	129	129	129	130	130	130	130	131	131
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	5980	6110	6240	6370	6510	6640	6770	6900	7140	7420	7800
38000	V_1	115	115	115	116	115	115	115	115	118	120	122
	V_R	134	134	134	134	134	134	134	134	135	135	136
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	6160	6290	6430	6570	6700	6840	6980	7110	7540	8130	8760
38850	V_1	118	118	117	117	117	117	117	117	120	122	125
	V_R	135	135	135	135	136	136	136	136	136	137	137
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	6390	6530	6660	6790	6930	7070	7200	7340	7910	8530	9210

TODATA5K_WATER25_F10_ALL_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-80. (07-01-15-17)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 6000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	87	86	86	86	86	86	86	88	90	92	94
	V_R	111	111	111	111	111	111	111	111	111	112	113
	V_2	126	126	126	126	125	125	125	125	124	123	122
	TOFL	5450	5560	5670	5790	5910	6020	6140	6290	6540	6780	7030
30000	V_1	91	91	91	91	91	92	92	93	96	98	100
	V_R	116	115	115	115	115	115	115	116	117	117	118
	V_2	125	125	125	124	124	124	124	124	123	123	123
	TOFL	5650	5760	5880	6000	6120	6250	6370	6540	6800	7060	7320
32000	V_1	98	98	98	98	98	98	98	99	102	104	107
	V_R	120	120	120	120	120	120	120	121	122	122	123
	V_2	127	127	127	127	127	127	127	127	127	127	127
	TOFL	5840	5960	6090	6220	6340	6470	6590	6780	7050	7330	7610
34000	V_1	104	104	104	104	104	103	103	105	108	111	113
	V_R	125	125	125	125	125	125	125	126	126	127	128
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	6030	6160	6290	6420	6560	6690	6820	7010	7300	7590	7890
36000	V_1	110	109	109	109	109	109	109	111	114	117	119
	V_R	129	129	129	129	130	130	130	130	131	131	132
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	6220	6360	6490	6630	6760	6900	7040	7240	7550	7920	8520
38000	V_1	115	115	115	115	115	115	115	117	120	122	125
	V_R	134	134	134	134	134	134	134	134	135	136	136
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	6410	6550	6690	6830	6970	7110	7250	7540	8220	8900	9620
38850	V_1	117	117	117	117	117	117	117	119	122	125	127
	V_R	135	135	136	136	136	136	136	136	137	137	138
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	6630	6760	6900	7040	7180	7320	7460	7900	8630	9350	10110

TODATA6K_WATER25_F10_ALL_IMP_BD100_16MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-81. (07-01-15-18)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 7000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	86	86	86	86	86	86	87	89	92	94	96
	V_R	111	111	111	111	111	111	111	111	112	113	113
	V_2	126	126	125	125	125	125	125	124	123	122	122
	TOFL	5660	5770	5890	6010	6130	6260	6400	6650	6900	7160	7430
30000	V_1	91	91	91	91	91	91	92	95	98	100	102
	V_R	115	115	115	115	115	115	116	117	117	118	119
	V_2	125	125	124	124	124	124	124	123	123	123	123
	TOFL	5870	5990	6110	6240	6370	6490	6640	6910	7180	7460	7750
32000	V_1	98	98	98	98	97	97	98	101	104	106	109
	V_R	120	120	120	120	120	120	121	122	122	123	123
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	6070	6200	6330	6460	6590	6720	6880	7160	7460	7750	8070
34000	V_1	104	103	103	103	103	103	104	107	110	113	116
	V_R	125	125	125	125	125	125	125	126	127	128	128
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	6270	6410	6540	6680	6820	6950	7110	7420	7730	8050	8370
36000	V_1	109	109	109	109	109	109	110	113	116	119	121
	V_R	129	129	130	130	130	130	130	131	131	132	133
	V_2	135	135	135	135	135	135	135	135	135	135	135
	TOFL	6470	6610	6750	6890	7040	7180	7350	7670	8000	8650	9350
38000	V_1	115	115	115	115	115	115	116	119	122	124	127
	V_R	134	134	134	134	134	134	134	135	136	136	137
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	6670	6810	6950	7100	7250	7400	7580	8260	8990	9760	10570
38850	V_1	117	117	117	117	117	117	118	121	124	127	129
	V_R	136	136	136	136	136	136	136	137	137	138	138
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	6860	6990	7140	7290	7440	7580	7880	8670	9440	10260	11110

TODATA7K_WATER25_F10_ALL_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-82. (07-01-15-19)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 8000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	86	86	86	86	86	86	88	91	93	95	98
	V_R	111	111	111	111	111	111	111	112	113	113	114
	V_2	126	125	125	125	125	125	124	123	122	122	121
	TOFL	5880	6000	6130	6250	6380	6510	6750	7020	7300	7580	7880
30000	V_1	91	91	91	91	91	91	94	97	100	102	104
	V_R	116	115	116	115	115	116	116	117	118	119	119
	V_2	125	124	124	124	124	124	123	123	123	123	123
	TOFL	6100	6230	6360	6490	6620	6750	7010	7300	7600	7910	8230
32000	V_1	98	97	97	97	97	97	100	103	106	108	111
	V_R	120	120	120	120	120	120	121	122	123	123	124
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	6310	6450	6580	6720	6850	7000	7270	7580	7900	8220	8570
34000	V_1	103	103	103	103	103	103	106	109	112	114	117
	V_R	125	125	125	125	125	125	126	127	128	128	129
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	6520	6660	6800	6940	7080	7230	7530	7860	8190	8540	9040
36000	V_1	109	109	109	109	109	109	112	115	118	121	123
	V_R	130	130	130	130	130	130	131	131	132	133	133
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	6730	6870	7020	7170	7310	7470	7780	8130	8750	9490	10300
38000	V_1	114	114	114	114	114	114	118	121	124	127	129
	V_R	134	134	134	134	134	134	135	136	136	137	137
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	6930	7080	7240	7390	7540	7700	8240	9050	9870	10720	11630
38850	V_1	117	117	117	117	117	117	120	123	126	129	131
	V_R	136	136	136	136	136	136	137	137	138	138	139
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	7100	7240	7400	7550	7710	7890	8640	9500	10380	11270	12240

TODATA8K_WATER25_F10_ALL_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-83. (07-01-15-20)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 9000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	86	86	86	86	86	87	90	93	95	97	100
	V_R	112	112	112	112	112	112	112	113	113	114	115
	V_2	125	125	125	125	125	124	123	122	122	121	120
	TOFL	6140	6270	6400	6530	6660	6850	7130	7420	7720	8040	8380
30000	V_1	92	92	91	91	91	93	96	99	102	104	106
	V_R	115	115	115	115	116	116	117	118	119	119	120
	V_2	124	124	124	124	124	123	123	123	123	123	123
	TOFL	6370	6500	6640	6780	6910	7120	7420	7730	8050	8390	8760
32000	V_1	98	97	97	97	97	99	102	105	108	110	113
	V_R	120	120	120	120	121	121	122	123	123	124	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	6590	6740	6880	7020	7160	7390	7700	8040	8380	8730	9130
34000	V_1	103	103	103	103	103	105	108	111	114	117	119
	V_R	125	125	125	125	125	126	127	128	128	129	129
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	6820	6960	7110	7260	7410	7640	7980	8330	8700	9150	10000
36000	V_1	109	109	109	109	109	111	114	117	120	123	126
	V_R	130	130	130	130	130	131	131	132	133	133	133
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	7040	7190	7340	7500	7650	7900	8250	8820	9610	10430	11400
38000	V_1	115	115	114	114	114	117	120	123	126	129	131
	V_R	134	134	134	134	134	135	136	136	137	137	138
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	7250	7410	7570	7730	7890	8230	9050	9940	10860	11780	12890
38850	V_1	117	117	117	117	117	119	122	126	129	131	134
	V_R	136	136	136	136	136	137	137	138	138	139	139
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	7440	7590	7750	7910	8070	8630	9490	10450	11420	12390	13540

TODATA9K_WATER25_F10_ALL_IMP_BD100_16MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-84. (07-01-15-21)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINATION DEPTH
FLAPS 10°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 10000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

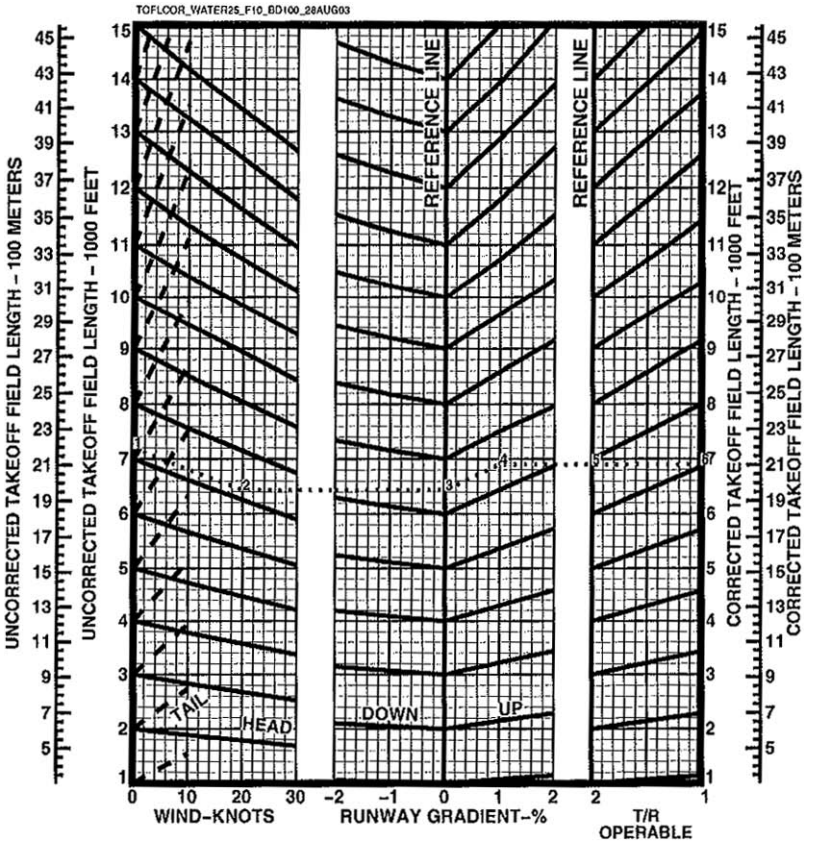
WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	87	87	87	86	86	89	92	95	97	99	102
	V_R	112	112	112	112	112	112	113	113	114	115	115
	V_2	125	125	125	125	124	123	123	122	121	120	120
	TOFL	6420	6560	6690	6830	7000	7240	7550	7870	8190	8530	8940
30000	V_1	92	92	92	92	93	95	98	101	103	106	108
	V_R	116	116	116	116	116	117	118	119	119	120	120
	V_2	124	124	124	124	123	123	123	123	123	123	123
	TOFL	6660	6810	6950	7090	7280	7530	7860	8200	8550	8920	9350
32000	V_1	98	98	98	98	99	101	104	107	110	112	115
	V_R	121	121	121	121	121	122	123	123	124	124	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	6900	7050	7200	7350	7540	7820	8170	8530	8900	9290	9760
34000	V_1	104	104	104	104	105	107	111	114	116	119	122
	V_R	125	126	126	126	126	127	127	128	129	129	130
	V_2	132	132	132	132	132	132	132	132	132	132	132
	TOFL	7140	7290	7450	7600	7810	8100	8470	8860	9270	10070	11080
36000	V_1	110	110	110	110	110	113	117	120	122	125	128
	V_R	130	130	130	130	130	131	132	133	133	133	134
	V_2	136	136	136	136	136	136	136	136	136	136	136
	TOFL	7370	7530	7690	7850	8070	8370	8850	9710	10570	11490	12650
38000	V_1	115	115	115	115	116	119	122	126	128	131	133
	V_R	134	134	134	134	135	135	136	137	137	138	138
	V_2	139	139	139	139	139	139	139	139	139	139	139
	TOFL	7600	7760	7930	8100	8330	9030	9950	10970	11950	12990	14340
38850	V_1	117	117	117	117	118	121	125	128	131	133	136
	V_R	136	136	136	136	136	137	138	138	139	139	140
	V_2	141	141	141	141	141	141	141	141	141	141	141
	TOFL	7860	8030	8200	8370	8730	9480	10470	11540	12560	13660	15100

TODATA10K_WATER26_F10_ALL_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-84. (07-01-15-22)

CONTAMINATED RUNWAY TAKEOFF FIELD LENGTH
HEAVY CONTAMINATION DEPTH
CORRECTION CHART
FLAPS 10°

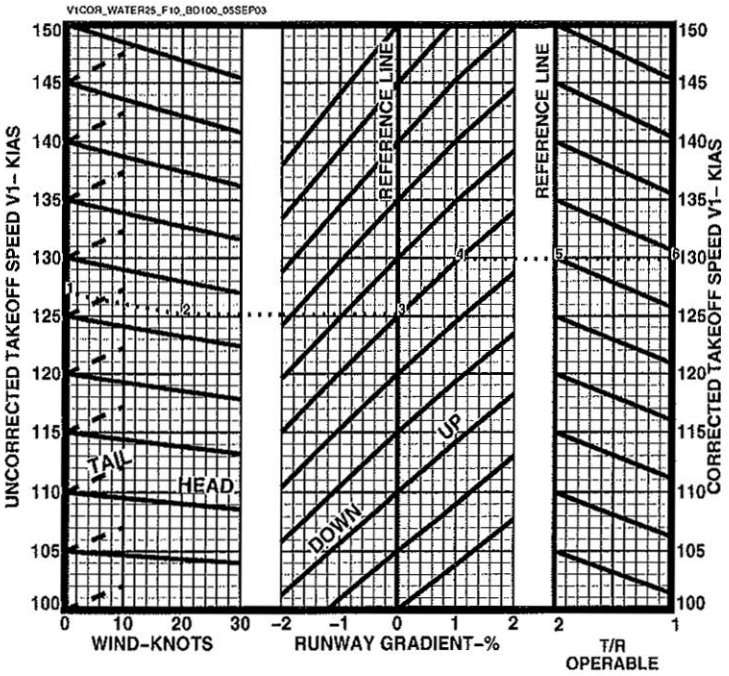


EXAMPLE:

1. Uncorrected Takeoff Field Length (from table).....7200 ft (2200 m)
2. Headwind.....20 kt
3. Runway Gradient Reference Line
4. Runway Gradient.....1.0% UP
5. Two Thrust Reversers
6. Corrected Takeoff Field Length.....6910 ft (2110 m)

Figure SUP1-86. (07-01-15-23)

CONTAMINATED RUNWAY TAKEOFF FIELD LENGTH
HEAVY CONTAMINATION DEPTH
CORRECTION CHART FOR V1
FLAPS 10°



EXAMPLE:

1. Uncorrected Takeoff Speed (from table).....127 kias
2. Headwind.....20 kt
3. Runway Gradient Reference Line
4. Runway Gradient.....1.0% UP
5. Two Thrust Reversers
6. Corrected Takeoff Speed.....130 kias

NOTES:

1. V1mcg is limiting when the corrected V1 is less than 116 kias. In this case, use V1=116 kias.
2. If the corrected V1 exceeds VR for the appropriate conditions, use V1=VR.

Figure SUP1-87. (07-01-15-24)

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CONTAMINATED RUNWAY TAKEOFF DATA
ICE
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON
ALTITUDE SEA LEVEL
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	68	68	68	68	67	67	67	67	67	67	67
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	125	125	125	125	125	124	124	124
	TOFL	5550	5650	5760	5860	5960	6070	6180	6290	6390	6500	6610
30000	V_1	71	71	71	71	71	71	71	71	71	71	71
	V_R	108	108	108	108	108	108	108	108	108	108	109
	V_2	124	124	124	124	124	124	124	123	123	123	123
	TOFL	5760	5870	5980	6090	6200	6310	6420	6530	6640	6760	6870
32000	V_1	77	77	77	77	77	77	77	77	77	77	77
	V_R	112	112	112	112	112	112	112	112	112	112	112
	V_2	123	123	123	123	123	123	123	122	122	122	122
	TOFL	5970	6090	6200	6310	6420	6540	6660	6770	6890	7010	7120
34000	V_1	83	83	83	83	82	83	83	83	83	83	83
	V_R	116	116	116	116	116	116	116	116	116	116	116
	V_2	122	122	122	122	122	122	122	121	121	121	121
	TOFL	6180	6300	6410	6530	6650	6770	6890	7010	7130	7250	7370
36000	V_1	90	90	89	89	89	89	89	89	89	89	89
	V_R	120	120	120	120	120	120	120	120	120	121	121
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	6380	6500	6630	6750	6860	6990	7120	7240	7370	7490	7620
38000	V_1	96	96	96	96	95	95	95	95	96	96	96
	V_R	124	124	124	124	124	124	124	124	125	125	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	6580	6710	6830	6960	7080	7210	7340	7470	7600	7730	7860
38850	V_1	99	99	98	98	98	98	98	98	98	98	98
	V_R	126	126	126	126	126	126	126	126	126	126	126
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	6660	6790	6920	7040	7170	7300	7430	7560	7700	7830	7960

TODATASL_ICE_F20_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-88. (07-01-21-01)

CONTAMINATED RUNWAY TAKEOFF DATA
ICE
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 1000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10			
28000	V_1	68	68	67	67	67	67	67	67	67	67	67			
	V_R	107	107	107	107	107	107	107	107	107	107	107			
	V_2	125	125	125	125	125	125	125	124	124	124	124			
	TOFL	5740	5860	5960	6070	6180	6290	6400	6520	6630	6740	6850			
30000	V_1	71	71	71	71	71	71	71	71	71	71	71			
	V_R	108	108	108	108	108	108	108	108	109	109	109			
	V_2	124	124	124	124	124	124	123	123	123	123	123			
	TOFL	5970	6080	6200	6310	6420	6540	6660	6770	6890	7000	7120			
32000	V_1	77	77	76	76	76	76	76	76	76	76	76			
	V_R	112	112	112	112	112	112	112	112	112	112	112			
	V_2	123	123	123	123	123	122	122	122	122	122	122			
	TOFL	6190	6310	6420	6540	6660	6780	6900	7020	7140	7260	7380			
34000	V_1	83	83	82	82	82	82	82	82	82	82	82			
	V_R	116	116	116	116	116	116	116	116	116	116	116			
	V_2	122	122	122	122	122	122	122	122	122	122	122			
	TOFL	6400	6520	6650	6770	6890	7020	7140	7270	7390	7520	7640			
36000	V_1	89	89	89	89	89	89	89	89	89	89	89			
	V_R	120	120	120	120	120	120	120	120	121	121	121			
	V_2	125	125	125	125	125	125	125	125	125	125	125			
	TOFL	6610	6740	6860	6990	7120	7250	7380	7510	7640	7770	7900			
38000	V_1	96	95	95	95	95	95	95	95	95	95	95			
	V_R	124	124	124	124	124	124	125	125	125	125	125			
	V_2	128	128	128	128	128	128	128	128	128	128	128			
	TOFL	6820	6950	7080	7210	7340	7470	7610	7740	7880	8010	8150			
38850	V_1	98	98	98	98	98	98	98	98	98	98	98			
	V_R	126	126	126	126	126	126	126	126	126	126	126			
	V_2	130	130	130	130	130	130	130	130	130	130	130			
	TOFL	6900	7040	7170	7300	7430	7570	7710	7840	7980	8120	8250			

TODATA1K_ICE_F20_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-89. (07-01-21-02)

CONTAMINATED RUNWAY TAKEOFF DATA
ICE
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON
ALTITUDE 2000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	67	67	67	67	67	67	67	67	67	67	68
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	125	125	124	124	124	124	124	124
	TOFL	5950	6070	6180	6290	6410	6530	6640	6760	6870	6990	7130
30000	V_1	70	70	70	70	70	70	70	70	70	70	72
	V_R	108	108	108	108	108	109	109	109	109	109	109
	V_2	124	124	124	124	123	123	123	123	123	123	123
	TOFL	6180	6300	6420	6540	6660	6780	6900	7020	7140	7260	7410
32000	V_1	76	76	76	76	76	76	76	76	76	76	77
	V_R	112	112	112	112	112	112	112	112	112	112	112
	V_2	123	123	123	123	122	122	122	122	122	122	122
	TOFL	6410	6530	6660	6780	6910	7030	7160	7280	7410	7530	7690
34000	V_1	82	82	82	82	82	82	82	82	82	82	84
	V_R	116	116	116	116	116	116	116	116	116	116	117
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	6630	6760	6890	7020	7150	7280	7410	7540	7670	7800	7960
36000	V_1	89	89	89	89	89	89	89	89	89	89	90
	V_R	120	120	120	120	120	120	121	121	121	121	121
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	6850	6980	7110	7250	7380	7520	7650	7790	7920	8060	8220
38000	V_1	95	95	95	95	95	95	95	95	95	95	97
	V_R	124	124	124	124	125	125	125	125	125	125	125
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	7060	7200	7340	7470	7610	7750	7890	8030	8170	8310	8490
38850	V_1	98	98	98	98	98	98	98	98	98	98	99
	V_R	126	126	126	126	126	126	126	126	126	126	127
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	7150	7290	7430	7570	7710	7850	7990	8130	8280	8420	8600

TODATA2K_ICE_F20_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-90. (07-01-21-03)

CONTAMINATED RUNWAY TAKEOFF DATA
ICE
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 3000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10			
28000	V_1	67	67	67	67	67	67	67	67	67	68	70			
	V_R	107	107	107	107	107	107	107	107	107	107	107			
	V_2	125	125	125	124	124	124	124	124	124	124	123			
	TOFL	6170	6290	6410	6530	6650	6770	6890	7010	7130	7270	7480			
30000	V_1	70	70	70	70	70	70	70	70	70	71	74			
	V_R	108	108	108	109	109	109	109	109	109	109	109			
	V_2	124	124	123	123	123	123	123	123	123	123	122			
	TOFL	6410	6540	6660	6790	6910	7040	7160	7290	7410	7560	7780			
32000	V_1	76	76	76	76	76	76	76	76	76	77	80			
	V_R	112	112	112	112	112	112	112	112	113	113	113			
	V_2	123	123	122	122	122	122	122	122	122	122	121			
	TOFL	6640	6780	6910	7040	7170	7300	7430	7560	7690	7840	8070			
34000	V_1	82	82	82	82	82	82	82	82	82	83	87			
	V_R	116	116	116	116	116	116	116	116	116	117	117			
	V_2	122	122	122	122	122	122	122	122	122	122	122			
	TOFL	6870	7010	7150	7280	7420	7550	7690	7820	7960	8110	8360			
36000	V_1	89	89	88	88	89	89	89	89	89	90	93			
	V_R	120	120	120	120	121	121	121	121	121	121	122			
	V_2	125	125	125	125	125	125	125	125	125	125	125			
	TOFL	7100	7240	7380	7520	7660	7800	7940	8080	8220	8380	8650			
38000	V_1	95	95	95	95	95	95	95	95	95	96	100			
	V_R	124	124	125	125	125	125	125	125	125	125	126			
	V_2	129	129	129	129	129	129	129	129	129	129	129			
	TOFL	7320	7470	7610	7760	7900	8050	8190	8340	8480	8650	8930			
38850	V_1	97	97	97	97	97	97	97	97	97	99	102			
	V_R	126	126	126	126	126	126	126	126	126	127	127			
	V_2	130	130	130	130	130	130	130	130	130	130	130			
	TOFL	7410	7560	7710	7850	8000	8150	8300	8440	8590	8760	9040			

TODATA3K_ICE_F20_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-91. (07-01-21-04)

CONTAMINATED RUNWAY TAKEOFF DATA
ICE
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON
ALTITUDE 4000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	67	67	67	67	67	67	67	67	67	70	72
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	124	124	124	124	124	124	124	124	123	122
	TOFL	6400	6530	6650	6780	6900	7030	7150	7280	7410	7630	7850
30000	V_1	70	70	70	70	70	70	70	70	71	73	76
	V_R	108	109	109	109	109	109	109	109	109	109	109
	V_2	123	123	123	123	123	123	123	123	123	122	121
	TOFL	6650	6780	6920	7040	7170	7310	7440	7570	7710	7930	8180
32000	V_1	76	76	76	76	76	76	76	76	77	79	82
	V_R	112	112	112	112	112	112	113	113	113	113	113
	V_2	122	122	122	122	122	122	122	122	122	121	120
	TOFL	6900	7030	7170	7300	7440	7580	7710	7850	7990	8230	8490
34000	V_1	82	82	82	82	82	82	82	82	83	86	89
	V_R	116	116	116	116	116	116	116	116	117	117	118
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	7140	7280	7420	7560	7700	7840	7980	8120	8270	8530	8800
36000	V_1	89	89	88	88	89	89	89	89	89	93	96
	V_R	120	121	121	121	121	121	121	121	121	122	122
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	7370	7520	7660	7810	7950	8100	8250	8390	8550	8820	9110
38000	V_1	95	95	95	95	95	95	95	95	96	99	103
	V_R	125	125	125	125	125	125	125	125	125	126	126
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	7600	7750	7900	8050	8200	8350	8510	8660	8820	9100	9400
38850	V_1	97	97	97	97	97	97	97	97	98	102	106
	V_R	126	126	126	126	126	126	127	127	127	127	128
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	7700	7850	8000	8160	8310	8460	8620	8770	8930	9220	9530

TODATA4K_ICE_F20_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-92. (07-01-21-05)

CONTAMINATED RUNWAY TAKEOFF DATA
ICE
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 5000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	67	67	67	67	67	67	67	66	69	72	74
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	124	124	124	124	124	124	124	124	123	122	121
	TOFL	6650	6780	6910	7040	7170	7300	7430	7560	7770	8010	8260
30000	V_1	70	70	70	70	70	70	70	70	73	75	78
	V_R	109	109	109	109	109	109	109	109	109	109	109
	V_2	123	123	123	123	123	123	123	123	122	121	121
	TOFL	6910	7050	7180	7320	7450	7590	7720	7860	8080	8340	8600
32000	V_1	76	76	76	76	76	76	76	76	79	82	85
	V_R	112	112	112	112	113	113	113	113	113	113	114
	V_2	122	122	122	122	122	122	122	122	121	120	120
	TOFL	7160	7300	7450	7590	7730	7870	8010	8150	8390	8660	8940
34000	V_1	82	82	82	82	82	82	82	82	86	89	92
	V_R	116	116	116	116	116	117	117	117	117	118	119
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	7410	7560	7700	7850	8000	8140	8290	8440	8690	8980	9270
36000	V_1	88	88	88	89	89	89	89	89	92	96	99
	V_R	121	121	121	121	121	121	121	121	122	122	123
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	7650	7810	7960	8110	8260	8410	8570	8720	8980	9280	9600
38000	V_1	95	95	95	95	95	95	95	95	99	103	106
	V_R	125	125	125	125	125	125	125	125	126	126	127
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	7890	8050	8210	8370	8520	8680	8840	8990	9270	9590	9920
38850	V_1	97	97	97	97	97	97	97	97	102	105	109
	V_R	126	126	126	127	127	127	127	127	127	128	128
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	7990	8150	8310	8470	8630	8790	8950	9110	9390	9720	10050

TODATA5K_ICE_F20_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-93. (07-01-21-06)

CONTAMINATED RUNWAY TAKEOFF DATA
ICE
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON
ALTITUDE 6000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	67	66	66	66	66	66	66	68	71	74	76
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	124	124	124	124	124	124	124	123	122	121	121
	TOFL	6900	7040	7170	7310	7440	7580	7710	7890	8160	8420	8690
30000	V_1	70	70	70	70	70	70	70	72	75	78	81
	V_R	109	109	109	109	109	109	109	109	109	109	110
	V_2	123	123	123	123	123	123	123	122	121	121	120
	TOFL	7170	7310	7450	7590	7740	7880	8020	8210	8490	8770	9060
32000	V_1	76	76	76	76	76	76	76	78	82	85	88
	V_R	112	112	113	113	113	113	113	113	113	114	115
	V_2	122	122	122	122	122	122	122	121	120	120	119
	TOFL	7440	7580	7730	7870	8020	8170	8320	8520	8820	9120	9420
34000	V_1	82	82	82	82	82	82	82	84	88	92	95
	V_R	116	116	116	117	117	117	117	117	118	119	119
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	7690	7840	8000	8150	8300	8450	8610	8820	9140	9450	9780
36000	V_1	88	88	88	88	88	88	88	91	95	99	102
	V_R	121	121	121	121	121	121	121	122	122	123	123
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	7950	8100	8260	8420	8580	8730	8890	9120	9450	9780	10130
38000	V_1	95	95	94	95	95	95	95	97	102	106	109
	V_R	125	125	125	125	125	125	125	126	126	127	127
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	8200	8360	8520	8680	8850	9010	9170	9410	9760	10110	10470
38850	V_1	97	97	97	97	97	97	97	100	105	108	112
	V_R	126	126	127	127	127	127	127	127	128	128	129
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	8300	8460	8630	8790	8960	9130	9290	9530	9890	10250	10610

TODATA6K_ICE_F20_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-94. (07-01-21-07)

CONTAMINATED RUNWAY TAKEOFF DATA
ICE
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 7000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
28000	V_1	66	66	66	66	66	66	67	70	73	76	78
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	124	124	124	124	124	124	123	122	121	121	120
	TOFL	7160	7300	7440	7580	7720	7860	8020	8300	8580	8860	9150
30000	V_1	70	70	70	70	70	70	71	74	77	80	84
	V_R	109	109	109	109	109	109	109	109	109	110	111
	V_2	123	123	123	123	123	123	122	121	121	120	119
	TOFL	7440	7580	7730	7880	8020	8170	8340	8630	8930	9240	9550
32000	V_1	76	76	76	76	76	76	77	81	84	88	91
	V_R	113	113	113	113	113	113	113	113	114	115	115
	V_2	122	122	122	122	122	122	121	121	120	119	119
	TOFL	7710	7860	8020	8170	8320	8480	8660	8960	9280	9600	9940
34000	V_1	82	81	82	82	82	82	83	87	91	95	98
	V_R	116	116	117	117	117	117	117	118	119	119	120
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	7980	8140	8300	8460	8610	8770	8960	9290	9620	9960	10320
36000	V_1	88	88	88	88	88	88	89	94	98	102	105
	V_R	121	121	121	121	121	121	121	122	123	123	124
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	8240	8410	8570	8740	8900	9060	9260	9600	9960	10320	10690
38000	V_1	94	94	94	94	94	94	96	101	105	109	112
	V_R	125	125	125	125	125	125	125	126	127	127	128
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	8500	8670	8840	9010	9180	9350	9550	9920	10290	10670	11060
38850	V_1	97	97	97	97	97	97	98	104	108	111	115
	V_R	127	127	127	127	127	127	127	128	128	129	129
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	8610	8780	8950	9120	9300	9470	9680	10050	10430	10820	11220

TODATA7K_ICE_F20_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-95. (07-01-21-08)

CONTAMINATED RUNWAY TAKEOFF DATA
ICE
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON
ALTITUDE 8000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	66	66	66	66	66	66	69	72	75	77	81
	V_R	107	107	107	107	107	107	107	107	107	107	108
	V_2	124	124	124	124	124	124	123	122	121	120	120
	TOFL	7430	7570	7720	7870	8010	8160	8430	8720	9030	9330	9660
30000	V_1	70	70	70	70	70	70	73	77	80	83	86
	V_R	109	109	109	109	109	109	109	109	110	111	111
	V_2	123	123	123	123	123	123	122	121	120	119	119
	TOFL	7720	7870	8020	8180	8330	8480	8770	9080	9410	9730	10080
32000	V_1	75	75	75	75	75	76	79	83	87	90	94
	V_R	113	113	113	113	113	113	113	114	115	115	116
	V_2	122	122	122	122	122	122	121	120	119	119	118
	TOFL	8000	8160	8320	8480	8640	8800	9100	9440	9780	10130	10500
34000	V_1	81	81	81	81	81	82	86	90	94	98	101
	V_R	117	117	117	117	117	117	118	118	119	120	120
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	8280	8440	8610	8780	8940	9110	9430	9780	10150	10520	10910
36000	V_1	88	88	88	88	88	88	93	97	101	105	108
	V_R	121	121	121	121	121	121	122	123	123	124	124
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	8560	8720	8890	9070	9240	9410	9750	10120	10510	10900	11320
38000	V_1	94	94	94	94	94	94	99	104	108	111	115
	V_R	125	125	125	125	125	125	126	127	127	128	128
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	8820	9000	9170	9350	9530	9710	10060	10460	10870	11280	11720
38850	V_1	97	96	97	97	97	97	102	107	111	114	117
	V_R	127	127	127	127	127	127	128	128	129	129	130
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	8930	9110	9290	9470	9650	9830	10200	10600	11020	11440	12100

TODATA8K_ICE_F20_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-96. (07-01-21-09)

CONTAMINATED RUNWAY TAKEOFF DATA
ICE
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 9000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
28000	V_1	66	66	66	66	66	68	71	74	77	80	84
	V_R	107	107	107	107	107	107	107	107	107	108	108
	V_2	124	124	124	124	123	123	122	121	120	120	119
	TOFL	7730	7890	8040	8190	8350	8570	8870	9180	9510	9850	10220
30000	V_1	70	70	70	70	70	72	76	79	83	86	90
	V_R	109	109	109	109	109	109	109	110	111	111	112
	V_2	123	123	123	123	122	122	121	120	119	119	118
	TOFL	8040	8200	8360	8520	8680	8910	9230	9570	9920	10280	10680
32000	V_1	76	76	76	76	76	78	82	86	90	94	97
	V_R	113	113	113	113	113	113	114	115	115	116	116
	V_2	122	122	122	122	122	121	120	119	119	118	118
	TOFL	8340	8500	8670	8840	9000	9250	9590	9950	10320	10700	11130
34000	V_1	82	82	82	82	82	85	89	93	97	101	105
	V_R	117	117	117	117	117	118	118	119	120	120	121
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	8630	8800	8970	9150	9320	9580	9940	10320	10720	11120	11570
36000	V_1	88	88	88	88	88	91	96	100	104	108	111
	V_R	121	121	121	121	121	122	123	123	124	124	125
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	8920	9080	9270	9450	9630	9900	10280	10690	11100	11530	12010
38000	V_1	94	94	94	94	94	97	103	107	111	114	118
	V_R	125	125	125	125	125	126	127	127	128	128	129
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	9200	9380	9570	9750	9930	10220	10620	11050	11490	11940	12730
38850	V_1	97	97	97	97	97	100	105	110	114	117	120
	V_R	127	127	127	127	127	127	128	129	129	130	130
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	9310	9500	9690	9870	10060	10350	10760	11200	11650	12240	13370

TODATA9K_ICE_F20_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-97. (07-01-21-10)

CONTAMINATED RUNWAY TAKEOFF DATA
ICE
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON
ALTITUDE 10000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

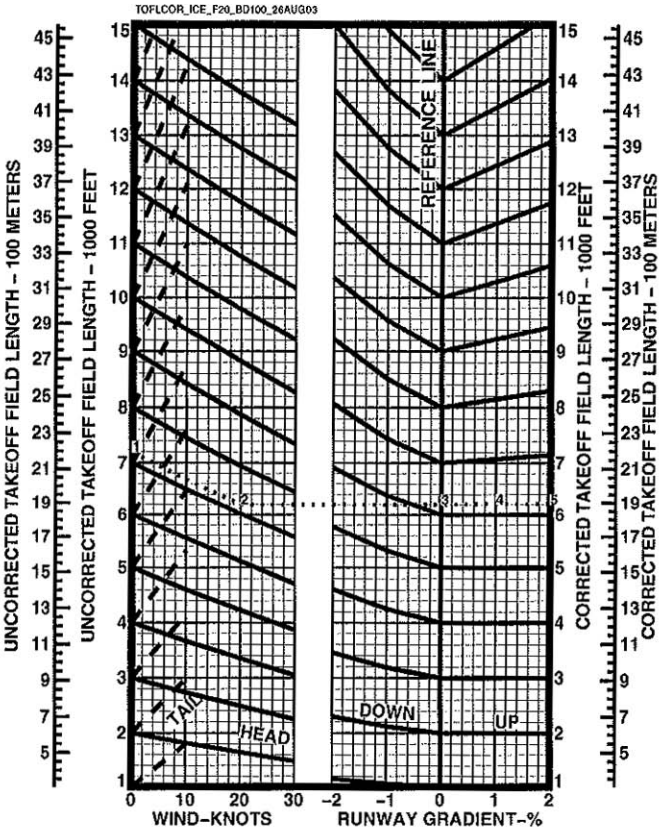
WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	67	67	67	67	68	70	73	76	80	83	87
	V_R	107	107	107	107	107	107	107	107	108	108	109
	V_2	123	123	123	123	123	122	121	120	120	119	118
	TOFL	8070	8230	8390	8550	8740	9010	9340	9690	10030	10400	10830
30000	V_1	71	71	71	71	72	74	78	82	85	89	93
	V_R	109	109	109	109	109	109	110	111	111	112	112
	V_2	122	122	122	122	122	121	120	120	119	118	118
	TOFL	8390	8550	8720	8890	9100	9380	9730	10100	10470	10870	11330
32000	V_1	76	76	76	76	77	81	85	89	93	97	101
	V_R	113	113	113	113	113	114	115	115	116	116	117
	V_2	122	121	121	121	121	120	119	119	118	118	118
	TOFL	8700	8880	9050	9220	9440	9740	10120	10510	10900	11320	11820
34000	V_1	83	83	83	83	84	88	92	97	100	104	108
	V_R	117	117	117	117	117	118	119	120	120	121	121
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	9010	9190	9370	9550	9780	10100	10490	10910	11330	11770	12300
36000	V_1	89	89	89	89	90	94	99	104	107	111	114
	V_R	121	121	121	122	122	122	123	124	124	125	125
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	9310	9500	9680	9870	10110	10440	10860	11310	11750	12220	12780
38000	V_1	95	95	95	95	97	101	106	110	114	117	
	V_R	125	125	125	125	126	126	127	128	128	128	
	V_2	129	129	129	129	129	129	129	129	129	129	
	TOFL	9600	9800	9990	10180	10430	10780	11230	11690	12160	12820	
38850	V_1	98	98	98	98	99	104	109	113	116	120	
	V_R	127	127	127	127	127	128	129	129	130	130	
	V_2	130	130	130	130	130	130	130	130	130	130	
	TOFL	9730	9920	10120	10320	10570	10930	11380	11860	12400	13450	

TODATA10K_ICE_F20_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-98. (07-01-21-11)

CONTAMINATED RUNWAY TAKEOFF FIELD LENGTH
ICE
CORRECTION CHART
FLAPS 20°



EXAMPLE:

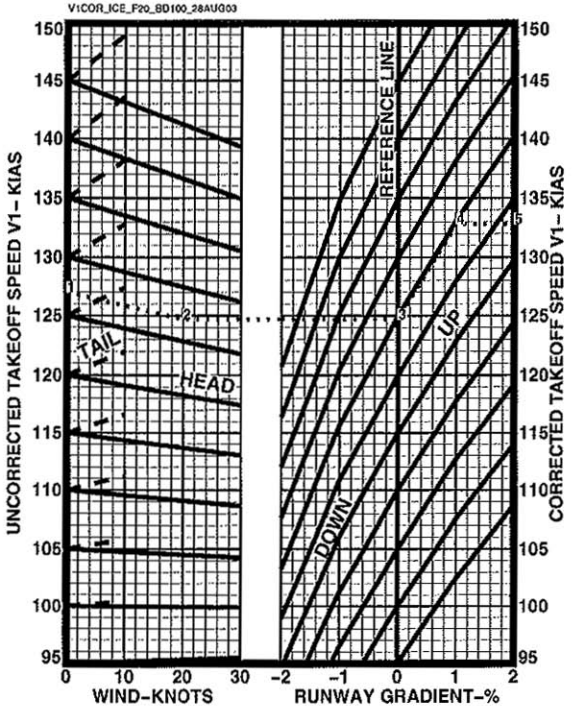
1. Uncorrected Takeoff Field Length (from table).....7200 ft (2200 m)
2. Headwind.....20 kt
3. Runway Gradient Reference Line
4. Runway Gradient.....1.0% UP
5. Corrected Takeoff Field Length.....6220 ft (1900 m)

NOTE:

Dispatch with only one thrust reverser operative is not recommended on icy runways.

Figure SUP1-99. (07-01-21-12)

CONTAMINATED TAKEOFF SPEEDS
ICE
CORRECTION CHART FOR VR
FLAPS 20°



EXAMPLE:

1. Uncorrected Takeoff Speed (from table).....127 kias
2. Headwind.....20 kt
3. Runway Gradient Reference Line
4. Runway Gradient.....1.0% UP
5. Corrected Takeoff Speed.....133 kias

NOTES:

1. V1mcg is limiting when the corrected V1 is less than 116 kias. In this case, use V1=116 kias.
2. If the corrected V1 exceeds VR for the appropriate conditions, use V1=VR.
3. Dispatch with only one thrust reverser operative is not recommended on icy runways.

Figure SUP1-100. (07-01-21-13)

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CONTAMINATED RUNWAY TAKEOFF DATA
COMPACTED SNOW
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON
ALTITUDE SEA LEVEL
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	91	91	91	91	91	91	91	91	91	91	91
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	125	125	125	125	125	124	124	124
	TOFL	3600	3660	3730	3790	3860	3920	3990	4060	4130	4190	4260
30000	V_1	94	94	94	94	94	94	94	94	94	94	94
	V_R	108	108	108	108	108	108	108	108	108	108	109
	V_2	124	124	124	124	124	124	124	123	123	123	123
	TOFL	3720	3790	3860	3920	3990	4060	4130	4200	4270	4340	4410
32000	V_1	99	99	99	99	99	99	99	99	99	99	99
	V_R	112	112	112	112	112	112	112	112	112	112	112
	V_2	123	123	123	123	123	123	123	122	122	122	122
	TOFL	3840	3910	3980	4050	4120	4190	4270	4340	4410	4490	4560
34000	V_1	105	104	104	104	104	104	104	104	104	104	104
	V_R	116	116	116	116	116	116	116	116	116	116	116
	V_2	122	122	122	122	122	122	122	121	121	121	121
	TOFL	3960	4040	4110	4180	4250	4330	4400	4480	4550	4630	4700
36000	V_1	110	110	110	110	110	110	110	110	110	110	110
	V_R	120	120	120	120	120	120	120	120	120	121	121
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4080	4160	4230	4310	4380	4460	4540	4610	4690	4770	4850
38000	V_1	115	115	116	115	115	116	116	116	116	116	116
	V_R	124	124	124	124	124	124	124	124	125	125	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	4200	4280	4360	4430	4510	4590	4670	4750	4830	4910	4990
38850	V_1	117	117	117	117	117	117	117	117	117	117	117
	V_R	126	126	126	126	126	126	126	126	126	126	126
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4330	4410	4480	4550	4620	4700	4790	4870	4950	5040	5120

TODATASL_SNOWC_F20_ALL_IMP_B0100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-101. (07-01-22-01)

CONTAMINATED RUNWAY TAKEOFF DATA
COMPACTED SNOW
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 1000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	91	91	91	91	91	91	91	91	91	91	91
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	125	125	125	125	124	124	124	124
	TOFL	3710	3780	3850	3910	3980	4050	4120	4190	4260	4330	4400
30000	V_1	94	94	94	94	94	94	94	94	94	94	94
	V_R	108	108	108	108	108	108	108	108	109	109	109
	V_2	124	124	124	124	124	124	123	123	123	123	123
	TOFL	3840	3910	3980	4050	4120	4190	4260	4340	4410	4480	4560
32000	V_1	99	99	99	99	99	99	99	99	99	99	99
	V_R	112	112	112	112	112	112	112	112	112	112	112
	V_2	123	123	123	123	123	122	122	122	122	122	122
	TOFL	3960	4040	4110	4180	4250	4330	4410	4480	4560	4630	4710
34000	V_1	104	104	104	104	104	104	104	104	104	104	104
	V_R	116	116	116	116	116	116	116	116	116	116	116
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4090	4160	4240	4310	4390	4470	4550	4630	4700	4780	4860
36000	V_1	110	110	110	110	110	110	110	110	110	110	110
	V_R	120	120	120	120	120	120	120	120	121	121	121
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4210	4290	4370	4450	4520	4600	4690	4770	4850	4930	5010
38000	V_1	115	115	115	115	115	115	115	115	115	115	115
	V_R	124	124	124	124	124	124	125	125	125	125	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	4340	4420	4500	4580	4660	4740	4820	4910	4990	5080	5160
38850	V_1	117	117	117	117	117	117	117	117	117	117	117
	V_R	126	126	126	126	126	126	126	126	126	126	126
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4450	4530	4610	4690	4770	4850	4940	5020	5110	5200	5280

TODATA1K_SNOWC_F20_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-102. (07-01-22-02)

CONTAMINATED RUNWAY TAKEOFF DATA
COMPACTED SNOW
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON
ALTITUDE 2000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	91	91	91	91	91	91	91	91	91	91	91
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	125	125	124	124	124	124	124	124
	TOFL	3830	3900	3970	4040	4110	4190	4260	4330	4400	4480	4570
30000	V_1	94	94	94	94	94	94	94	94	94	94	95
	V_R	108	108	108	108	108	109	109	109	109	109	109
	V_2	124	124	124	124	123	123	123	123	123	123	123
	TOFL	3960	4030	4110	4180	4260	4330	4410	4480	4560	4630	4740
32000	V_1	99	99	99	99	99	99	99	99	99	99	100
	V_R	112	112	112	112	112	112	112	112	112	112	112
	V_2	123	123	123	123	122	122	122	122	122	122	122
	TOFL	4090	4170	4240	4320	4400	4480	4550	4630	4710	4790	4900
34000	V_1	104	104	104	104	104	104	104	104	104	104	105
	V_R	116	116	116	116	116	116	116	116	116	116	117
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4220	4300	4380	4460	4540	4620	4700	4780	4860	4940	5050
36000	V_1	110	110	110	110	110	110	110	110	110	110	110
	V_R	120	120	120	120	120	120	121	121	121	121	121
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4350	4430	4510	4590	4680	4760	4840	4930	5010	5100	5210
38000	V_1	115	115	115	115	115	115	115	115	115	115	115
	V_R	124	124	124	124	125	125	125	125	125	125	125
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4470	4560	4640	4730	4810	4900	4990	5070	5160	5250	5370
38850	V_1	117	117	117	117	117	117	117	117	117	117	118
	V_R	126	126	126	126	126	126	126	126	126	126	127
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4580	4670	4750	4830	4920	5010	5100	5190	5280	5370	5560

TODATA2K_SNOWC_F20_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-103. (07-01-22-03)

CONTAMINATED RUNWAY TAKEOFF DATA
COMPACTED SNOW
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 3000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	91	91	91	91	91	91	91	91	91	91	93
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	124	124	124	124	124	124	124	123
	TOFL	3950	4030	4100	4180	4250	4330	4400	4480	4550	4650	4810
30000	V_1	94	94	94	94	94	94	94	94	94	95	96
	V_R	108	108	108	109	109	109	109	109	109	109	109
	V_2	124	124	123	123	123	123	123	123	123	123	122
	TOFL	4090	4170	4250	4320	4400	4480	4560	4640	4710	4810	4990
32000	V_1	99	99	99	99	99	99	99	99	99	100	101
	V_R	112	112	112	112	112	112	112	112	113	113	113
	V_2	123	123	122	122	122	122	122	122	122	122	121
	TOFL	4220	4310	4390	4470	4550	4630	4710	4790	4870	4970	5160
34000	V_1	104	104	104	104	104	104	104	104	104	105	107
	V_R	116	116	116	116	116	116	116	116	116	117	117
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4360	4440	4530	4610	4690	4780	4860	4950	5030	5140	5340
36000	V_1	109	109	109	109	109	109	110	110	110	110	112
	V_R	120	120	120	120	121	121	121	121	121	121	122
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4490	4580	4660	4750	4840	4920	5010	5100	5180	5300	5510
38000	V_1	115	115	115	115	115	115	115	115	115	115	117
	V_R	124	124	125	125	125	125	125	125	125	125	126
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4620	4710	4800	4890	4980	5070	5160	5250	5340	5450	5770
38850	V_1	117	117	117	117	117	117	117	117	117	117	119
	V_R	126	126	126	126	126	126	126	126	126	127	127
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4720	4820	4910	5000	5090	5180	5270	5360	5460	5640	6050

TODATA3K_SNOWC_F20_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-104. (07-01-22-04)

CONTAMINATED RUNWAY TAKEOFF DATA
COMPACTED SNOW
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON
ALTITUDE 4000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	91	91	91	91	91	91	91	91	91	93	94
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	124	124	124	124	124	124	124	124	123	122
	TOFL	4090	4170	4250	4320	4400	4480	4560	4640	4720	4890	5080
30000	V_1	94	94	94	94	94	94	94	94	94	96	97
	V_R	108	109	109	109	109	109	109	109	109	109	109
	V_2	123	123	123	123	123	123	123	123	123	122	121
	TOFL	4230	4310	4390	4470	4560	4640	4720	4800	4890	5070	5270
32000	V_1	99	99	99	99	99	99	99	99	99	101	103
	V_R	112	112	112	112	112	112	113	113	113	113	113
	V_2	122	122	122	122	122	122	122	122	122	121	120
	TOFL	4370	4460	4540	4620	4710	4790	4880	4960	5050	5250	5460
34000	V_1	104	104	104	104	104	104	104	104	105	107	108
	V_R	116	116	116	116	116	116	116	116	117	117	118
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4510	4600	4680	4770	4860	4950	5030	5120	5220	5420	5650
36000	V_1	110	110	110	110	110	110	110	110	110	112	114
	V_R	120	121	121	121	121	121	121	121	121	122	122
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4650	4740	4830	4920	5010	5100	5190	5280	5380	5600	5830
38000	V_1	115	115	115	115	115	115	115	115	115	117	119
	V_R	125	125	125	125	125	125	125	125	125	126	126
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4780	4880	4970	5060	5160	5250	5340	5440	5540	5850	6290
38850	V_1	117	117	117	117	117	117	117	117	117	119	121
	V_R	126	126	126	126	126	126	127	127	127	127	128
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	4900	4990	5080	5180	5270	5370	5460	5560	5700	6130	6590

TODATA4K_SNOWC_F20_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-105. (07-01-22-05)

CONTAMINATED RUNWAY TAKEOFF DATA
COMPACTED SNOW
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 5000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
28000	V_1	91	91	91	91	91	91	91	91	92	94	95
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	124	124	124	124	124	124	124	124	123	122	121
	TOFL	4230	4310	4380	4480	4560	4640	4720	4800	4970	5160	5360
30000	V_1	94	94	94	94	94	94	94	94	96	97	99
	V_R	109	109	109	109	109	109	109	109	109	109	109
	V_2	123	123	123	123	123	123	123	123	122	121	121
	TOFL	4380	4460	4550	4630	4720	4800	4880	4970	5150	5350	5570
32000	V_1	99	99	99	99	99	99	99	99	101	103	104
	V_R	112	112	112	112	113	113	113	113	113	113	114
	V_2	122	122	122	122	122	122	122	122	121	120	120
	TOFL	4530	4610	4700	4790	4870	4960	5050	5140	5320	5550	5770
34000	V_1	104	104	104	104	104	104	104	104	106	108	110
	V_R	116	116	116	116	116	117	117	117	117	118	119
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4670	4760	4850	4940	5030	5120	5210	5300	5500	5740	5980
36000	V_1	110	110	110	110	110	110	110	110	112	113	115
	V_R	121	121	121	121	121	121	121	121	122	122	123
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4810	4910	5000	5090	5190	5280	5370	5470	5680	5930	6180
38000	V_1	115	115	115	115	115	115	115	115	117	119	121
	V_R	125	125	125	125	125	125	125	125	126	126	127
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	4950	5050	5150	5240	5340	5440	5530	5630	5910	6370	6860
38850	V_1	117	117	117	117	117	117	117	117	119	121	123
	V_R	126	126	126	127	127	127	127	127	127	128	128
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	5070	5170	5270	5370	5470	5570	5670	5770	6190	6680	7180

TODATASK_SNOWC_F20_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-106. (07-01-22-06)

CONTAMINATED RUNWAY TAKEOFF DATA
COMPACTED SNOW
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON
ALTITUDE 6000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	91	91	91	90	90	90	90	92	93	95	96
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	124	124	124	124	124	124	124	123	122	121	121
	TOFL	4380	4460	4540	4630	4710	4800	4880	5010	5230	5450	5670
30000	V_1	94	94	94	94	94	94	94	95	97	98	100
	V_R	109	109	109	109	109	109	109	109	109	109	110
	V_2	123	123	123	123	123	123	123	122	121	121	120
	TOFL	4530	4620	4700	4790	4880	4970	5050	5190	5430	5660	5900
32000	V_1	99	99	99	99	99	99	99	100	102	104	106
	V_R	112	112	113	113	113	113	113	113	113	114	115
	V_2	122	122	122	122	122	122	122	121	120	120	119
	TOFL	4680	4770	4860	4950	5040	5130	5220	5370	5620	5870	6120
34000	V_1	104	104	104	104	104	104	104	106	108	110	112
	V_R	116	116	116	117	117	117	117	117	118	119	119
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4830	4920	5020	5110	5200	5300	5390	5550	5820	6080	6340
36000	V_1	110	110	110	110	110	110	110	111	113	115	117
	V_R	121	121	121	121	121	121	121	122	122	123	123
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4980	5080	5170	5270	5370	5460	5560	5730	6010	6280	6670
38000	V_1	116	115	115	115	115	115	115	116	118	120	122
	V_R	125	125	125	125	125	125	125	126	126	127	127
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	5130	5230	5320	5430	5530	5630	5730	5900	6430	6950	7460
38850	V_1	117	117	117	117	117	117	117	118	121	122	124
	V_R	126	126	127	127	127	127	127	127	128	128	129
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	5250	5340	5440	5550	5650	5750	5860	6170	6740	7270	7810

TODATA6K_SNOWC_F20_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-107. (07-01-22-07)

CONTAMINATED RUNWAY TAKEOFF DATA
COMPACTED SNOW
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 7000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
28000	V_1	90	90	90	90	90	90	91	93	95	96	97
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	124	124	124	124	124	124	123	122	121	121	120
	TOFL	4530	4610	4700	4790	4870	4960	5070	5300	5530	5760	6000
30000	V_1	94	94	94	94	94	94	94	96	98	100	102
	V_R	109	109	109	109	109	109	109	109	109	110	111
	V_2	123	123	123	123	123	123	122	121	121	120	119
	TOFL	4690	4770	4860	4950	5050	5140	5250	5490	5740	5990	6250
32000	V_1	99	99	99	99	99	99	100	102	104	106	107
	V_R	113	113	113	113	113	113	113	113	114	115	115
	V_2	122	122	122	122	122	122	121	121	120	119	119
	TOFL	4840	4930	5030	5120	5220	5310	5430	5690	5950	6220	6500
34000	V_1	104	104	104	104	104	104	105	107	109	111	113
	V_R	116	116	117	117	117	117	117	118	119	119	120
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	5000	5090	5190	5290	5380	5480	5610	5880	6160	6440	6740
36000	V_1	109	109	109	109	109	109	110	113	115	117	118
	V_R	121	121	121	121	121	121	121	122	123	123	124
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	5150	5250	5350	5450	5550	5650	5780	6070	6370	6760	7270
38000	V_1	114	114	114	114	114	114	115	118	120	122	123
	V_R	125	125	125	125	125	125	125	126	127	127	128
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	5300	5400	5510	5610	5720	5820	5960	6450	7010	7560	8130
38850	V_1	117	117	117	117	117	117	117	120	122	124	125
	V_R	127	127	127	127	127	127	127	128	128	129	129
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	5420	5510	5620	5720	5830	5940	6150	6750	7340	7910	8510

TODATA7K_SNOWC_F20_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-108. (07-01-22-08)

CONTAMINATED RUNWAY TAKEOFF DATA
COMPACTED SNOW
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON
ALTITUDE 8000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	90	90	90	90	90	90	92	94	96	97	99
	V_R	107	107	107	107	107	107	107	107	107	107	108
	V_2	124	124	124	124	124	124	123	122	121	120	120
	TOFL	4680	4770	4860	4950	5040	5140	5350	5600	5850	6100	6380
30000	V_1	94	94	94	94	94	94	96	98	100	101	103
	V_R	109	109	109	109	109	109	109	109	110	111	111
	V_2	123	123	123	123	123	123	122	121	120	119	119
	TOFL	4850	4940	5030	5130	5220	5320	5550	5810	6080	6350	6650
32000	V_1	99	99	99	99	99	99	101	103	105	107	109
	V_R	113	113	113	113	113	113	113	114	115	115	116
	V_2	122	122	122	122	122	122	121	120	119	119	118
	TOFL	5010	5100	5200	5300	5400	5500	5740	6020	6310	6600	6920
34000	V_1	104	104	104	104	104	104	107	109	111	113	115
	V_R	117	117	117	117	117	117	118	118	119	120	120
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	5170	5270	5370	5470	5570	5670	5940	6230	6540	6850	7180
36000	V_1	109	109	109	109	109	110	112	114	117	118	120
	V_R	121	121	121	121	121	121	122	123	123	124	124
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	5330	5430	5530	5640	5740	5850	6130	6440	6830	7360	7930
38000	V_1	114	114	114	114	114	115	117	120	122	123	125
	V_R	125	125	125	125	125	125	126	127	127	128	128
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	5480	5590	5700	5810	5910	6030	6420	7040	7640	8230	8870
38850	V_1	116	116	116	116	116	117	119	122	124	125	127
	V_R	127	127	127	127	127	127	128	128	129	129	130
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	5590	5690	5800	5920	6030	6160	6720	7370	7990	8620	9280

TODATA8K_SNOWC_F20_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-109. (07-01-22-09)

CONTAMINATED RUNWAY TAKEOFF DATA
COMPACTED SNOW
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 9000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	90	90	90	90	90	92	94	95	97	98	100
	V_R	107	107	107	107	107	107	107	107	107	108	108
	V_2	124	124	124	124	123	123	122	121	120	120	119
	TOFL	4870	4960	5060	5150	5250	5410	5660	5920	6200	6480	6800
30000	V_1	94	94	94	94	94	95	97	99	101	103	105
	V_R	109	109	109	109	109	109	109	110	111	111	112
	V_2	123	123	123	123	122	122	121	120	119	119	118
	TOFL	5040	5140	5240	5340	5430	5610	5870	6160	6450	6750	7090
32000	V_1	99	99	99	99	99	100	103	105	107	109	111
	V_R	113	113	113	113	113	113	114	115	115	116	116
	V_2	122	122	122	122	122	121	120	119	119	118	118
	TOFL	5210	5310	5420	5520	5620	5810	6090	6390	6700	7020	7390
34000	V_1	104	104	104	104	104	106	108	111	113	114	116
	V_R	117	117	117	117	117	118	118	119	120	120	121
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	5380	5490	5590	5700	5800	6000	6300	6620	6950	7290	7710
36000	V_1	110	110	110	110	110	111	114	116	118	120	121
	V_R	121	121	121	121	121	122	123	123	124	124	125
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	5550	5660	5770	5870	5980	6190	6510	6860	7440	8020	8700
38000	V_1	115	115	115	115	115	116	119	121	123	124	126
	V_R	125	125	125	125	125	126	127	127	128	128	129
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	5710	5830	5940	6050	6160	6400	7030	7680	8320	8970	9720
38850	V_1	117	117	117	117	117	118	121	123	125	126	128
	V_R	127	127	127	127	127	127	128	129	129	130	130
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	5840	5950	6070	6190	6300	6700	7360	8040	8720	9390	10180

TODATA9K_SNOWC_F20_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-110. (07-01-22-10)

CONTAMINATED RUNWAY TAKEOFF DATA
COMPACTED SNOW
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON
ALTITUDE 10000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

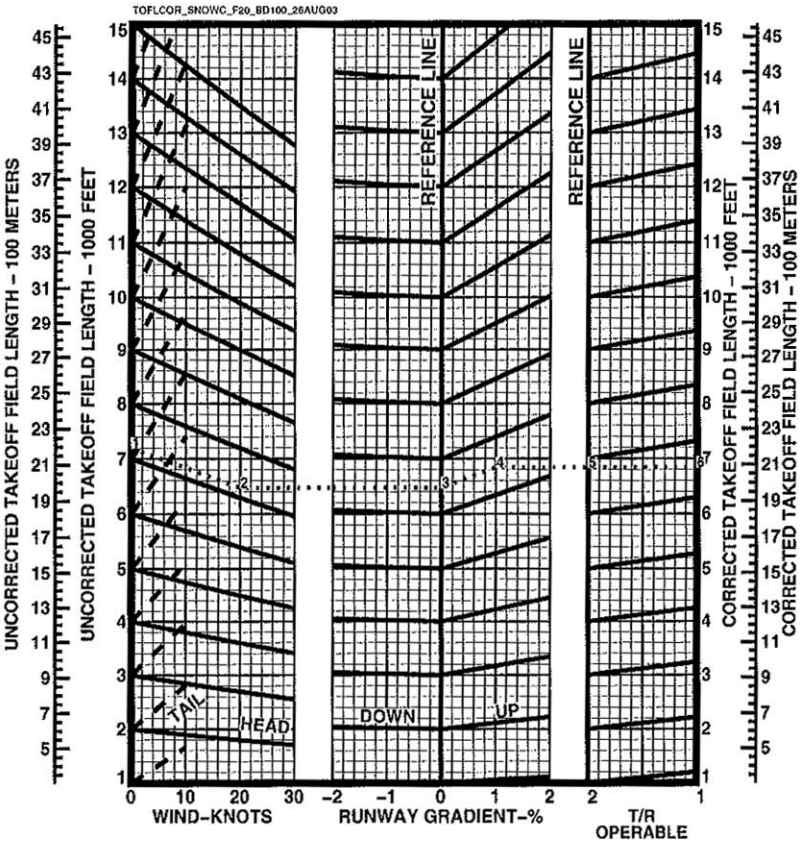
WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	91	91	91	91	91	93	95	96	98	100	102
	V_R	107	107	107	107	107	107	107	107	108	108	109
	V_2	123	123	123	123	123	122	121	120	120	119	118
	TOFL	5080	5180	5280	5370	5510	5720	6000	6290	6580	6890	7260
30000	V_1	94	94	94	94	95	96	99	101	103	105	107
	V_R	109	109	109	109	109	109	110	111	111	112	112
	V_2	122	122	122	122	122	121	120	120	119	118	118
	TOFL	5260	5360	5460	5570	5710	5940	6230	6540	6850	7190	7590
32000	V_1	99	99	100	100	100	102	104	107	109	110	112
	V_R	113	113	113	113	113	114	115	115	116	116	117
	V_2	122	121	121	121	121	120	119	119	118	118	118
	TOFL	5440	5550	5650	5760	5910	6150	6460	6800	7130	7490	7920
34000	V_1	105	105	105	105	106	108	110	112	114	116	118
	V_R	117	117	117	117	117	118	119	120	120	121	121
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	5620	5730	5840	5950	6110	6360	6700	7050	7400	7780	8470
36000	V_1	110	110	110	110	111	113	116	118	119	121	122
	V_R	121	121	121	122	122	122	123	124	124	125	125
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	5790	5910	6020	6140	6310	6570	6930	7510	8120	8760	9540
38000	V_1	115	115	115	115	116	118	121	123	124	126	
	V_R	125	125	125	125	126	126	127	128	128	128	
	V_2	129	129	129	129	129	129	129	129	129	129	
	TOFL	5970	6090	6210	6320	6500	7010	7690	8400	9080	9790	
38850	V_1	117	117	117	117	118	120	123	125	126	127	
	V_R	127	127	127	127	127	128	129	129	130	130	
	V_2	130	130	130	130	130	130	130	130	130	130	
	TOFL	6150	6270	6400	6520	6780	7340	8050	8800	9510	10240	

TODATA10K_SNOWC_F20_ALL_IMP_BD100_02MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-111. (07-01-22-11)

CONTAMINATED RUNWAY TAKEOFF FIELD LENGTH
COMPACTED SNOW
CORRECTION CHART
FLAPS 20°

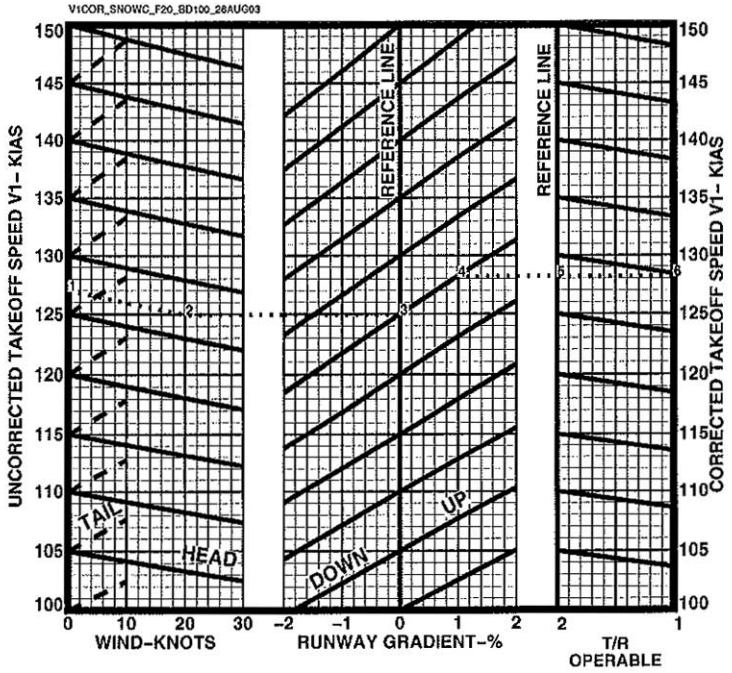


EXAMPLE:

1. Uncorrected Takeoff Field Length (from table).....7200 ft (2200 m)
2. Headwind.....20 kt
3. Runway Gradient Reference Line
4. Runway Gradient.....1.0% UP
5. Two Thrust Reversers
6. Corrected Takeoff Field Length.....6840 ft (2090 m)

Figure SUP1-112. (07-01-22-12)

CONTAMINATED TAKEOFF SPEEDS
COMPACTED SNOW
CORRECTION CHART FOR V1
FLAPS 20°



EXAMPLE:

1. Uncorrected Takeoff Speed (from table).....127 kias
2. Headwind.....20 kt
3. Runway Gradient Reference Line
4. Runway Gradient.....1.0% UP
5. Two Thrust Reversers
6. Corrected Takeoff Speed.....128 kias

NOTES:

1. V1mcg is limiting when the corrected V1 is less than 116 kias. In this case, use V1=116 kias.
2. If the corrected V1 exceeds VR for the appropriate conditions, use V1=VR.

Figure SUP1-113. (07-01-22-13)

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CONTAMINATED RUNWAY TAKEOFF DATA
DRY SNOW
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON
ALTITUDE SEA LEVEL
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10			
28000	V_1	107	107	107	107	107	107	107	107	107	107	107			
	V_R	107	107	107	107	107	107	107	107	107	107	107			
	V_2	125	125	125	125	125	125	125	125	124	124	124			
	TOFL	4120	4190	4260	4340	4410	4480	4560	4640	4720	4790	4870			
30000	V_1	108	108	108	108	108	108	108	108	108	108	109			
	V_R	108	108	108	108	108	108	108	108	108	108	109			
	V_2	124	124	124	124	124	124	124	123	123	123	123			
	TOFL	4280	4360	4440	4510	4590	4670	4750	4830	4910	4990	5070			
32000	V_1	112	112	112	112	112	112	112	112	112	112	112			
	V_R	112	112	112	112	112	112	112	112	112	112	112			
	V_2	123	123	123	123	123	123	123	122	122	122	122			
	TOFL	4450	4530	4610	4690	4760	4850	4930	5020	5100	5190	5270			
34000	V_1	116	116	116	116	116	116	116	116	116	116	116			
	V_R	116	116	116	116	116	116	116	116	116	116	116			
	V_2	122	122	122	122	122	122	122	121	121	121	121			
	TOFL	4610	4690	4780	4860	4940	5030	5120	5200	5290	5390	5480			
36000	V_1	120	120	120	120	120	120	120	120	120	121	121			
	V_R	120	120	120	120	120	120	120	120	120	121	121			
	V_2	125	125	125	125	125	125	125	125	125	125	125			
	TOFL	5060	5160	5250	5340	5440	5540	5640	5740	5850	5950	6050			
38000	V_1	124	124	124	124	124	124	124	124	125	125	125			
	V_R	124	124	124	124	124	124	124	124	125	125	125			
	V_2	128	128	128	128	128	128	128	128	128	128	128			
	TOFL	5560	5660	5770	5870	5970	6080	6190	6310	6420	6530	6650			
38850	V_1	126	126	126	126	126	126	126	126	126	126	126			
	V_R	126	126	126	126	126	126	126	126	126	126	126			
	V_2	130	130	130	130	130	130	130	130	130	130	130			
	TOFL	5780	5890	5990	6100	6200	6320	6440	6560	6670	6790	6910			

TODATASL_DRYSNOW_F20_ALL_IMP_BD100_26MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-114. (07-01-23-01)

CONTAMINATED RUNWAY TAKEOFF DATA
DRY SNOW
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 1000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
28000	V_1	107	107	107	107	107	107	107	107	107	107	107
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	125	125	125	125	124	124	124	124
	TOFL	4240	4320	4400	4470	4550	4630	4710	4790	4870	4950	5030
30000	V_1	108	108	108	108	108	108	108	108	109	109	109
	V_R	108	108	108	108	108	108	108	108	109	109	109
	V_2	124	124	124	124	124	124	123	123	123	123	123
	TOFL	4420	4500	4580	4660	4740	4820	4900	4990	5070	5150	5240
32000	V_1	112	112	112	112	112	112	112	112	112	112	112
	V_R	112	112	112	112	112	112	112	112	112	112	112
	V_2	123	123	123	123	123	122	122	122	122	122	122
	TOFL	4590	4670	4750	4840	4920	5010	5100	5180	5270	5360	5440
34000	V_1	116	116	116	116	116	116	116	116	116	116	116
	V_R	116	116	116	116	116	116	116	116	116	116	116
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4750	4840	4930	5010	5100	5190	5290	5380	5480	5570	5670
36000	V_1	120	120	120	120	120	120	120	120	121	121	121
	V_R	120	120	120	120	120	120	120	120	121	121	121
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	5230	5330	5420	5520	5620	5730	5830	5940	6050	6150	6260
38000	V_1	124	124	124	124	124	124	125	125	125	125	125
	V_R	124	124	124	124	124	124	125	125	125	125	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	5740	5850	5950	6060	6170	6290	6410	6520	6640	6760	6880
38850	V_1	126	126	126	126	126	126	126	126	126	126	126
	V_R	126	126	126	126	126	126	126	126	126	126	126
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	5960	6080	6190	6300	6420	6540	6660	6780	6900	7030	7150

TODATA1K_DRYSNOW_F20_ALL_IMP_BD100_26MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-115. (07-01-23-02)

CONTAMINATED RUNWAY TAKEOFF DATA
DRY SNOW
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON
ALTITUDE 2000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
28000	V_1	107	107	107	107	107	107	107	107	107	107	107
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	125	125	124	124	124	124	124	124
	TOFL	4380	4460	4540	4620	4700	4780	4870	4950	5030	5110	5230
30000	V_1	108	108	108	108	108	109	109	109	109	109	109
	V_R	108	108	108	108	108	109	109	109	109	109	109
	V_2	124	124	124	124	123	123	123	123	123	123	123
	TOFL	4560	4640	4720	4810	4900	4980	5070	5150	5240	5330	5450
32000	V_1	112	112	112	112	112	112	112	112	112	112	112
	V_R	112	112	112	112	112	112	112	112	112	112	112
	V_2	123	123	123	123	122	122	122	122	122	122	122
	TOFL	4730	4820	4910	5000	5090	5180	5270	5360	5450	5540	5670
34000	V_1	116	116	116	116	116	116	116	116	116	116	117
	V_R	116	116	116	116	116	116	116	116	116	116	117
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4900	5000	5090	5180	5270	5370	5470	5570	5670	5770	5940
36000	V_1	120	120	120	120	120	120	121	121	121	121	121
	V_R	120	120	120	120	120	120	121	121	121	121	121
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	5400	5500	5610	5710	5820	5930	6040	6150	6260	6370	6560
38000	V_1	124	124	124	124	125	125	125	125	125	125	125
	V_R	124	124	124	124	125	125	125	125	125	125	125
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	5920	6040	6160	6270	6390	6510	6630	6760	6880	7000	7210
38850	V_1	126	126	126	126	126	126	126	126	126	126	127
	V_R	126	126	126	126	126	126	126	126	126	126	127
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	6160	6280	6400	6520	6640	6770	6900	7020	7150	7280	7500

TODATA2K_DRYSNOW_F20_ALL_IMP_BD100_26MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-116. (07-01-23-03)

CONTAMINATED RUNWAY TAKEOFF DATA
DRY SNOW
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 3000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10			
28000	V_1	107	107	107	107	107	107	107	107	107	107	107			
	V_R	107	107	107	107	107	107	107	107	107	107	107			
	V_2	125	125	125	124	124	124	124	124	124	124	123			
	TOFL	4520	4610	4690	4780	4860	4950	5030	5120	5200	5310	5520			
30000	V_1	108	108	108	109	109	109	109	109	109	109	109			
	V_R	108	108	108	109	109	109	109	109	109	109	109			
	V_2	124	124	123	123	123	123	123	123	123	123	122			
	TOFL	4710	4800	4880	4970	5060	5150	5240	5330	5420	5540	5760			
32000	V_1	112	112	112	112	112	112	112	112	113	113	113			
	V_R	112	112	112	112	112	112	112	112	113	113	113			
	V_2	123	123	122	122	122	122	122	122	122	122	121			
	TOFL	4890	4980	5070	5170	5260	5350	5450	5540	5640	5760	6000			
34000	V_1	116	116	116	116	116	116	116	116	116	117	117			
	V_R	116	116	116	116	116	116	116	116	116	117	117			
	V_2	122	122	122	122	122	122	122	122	122	122	122			
	TOFL	5070	5170	5260	5360	5470	5570	5670	5770	5880	6030	6360			
36000	V_1	120	120	120	120	121	121	121	121	121	121	122			
	V_R	120	120	120	120	121	121	121	121	121	121	122			
	V_2	125	125	125	125	125	125	125	125	125	125	125			
	TOFL	5580	5700	5810	5920	6030	6150	6260	6380	6490	6670	7040			
38000	V_1	124	124	125	125	125	125	125	125	125	125	126			
	V_R	124	124	125	125	125	125	125	125	125	125	126			
	V_2	129	129	129	129	129	129	129	129	129	129	129			
	TOFL	6130	6250	6380	6500	6630	6750	6880	7000	7130	7320	7750			
38850	V_1	126	126	126	126	126	126	126	126	126	127	127			
	V_R	126	126	126	126	126	126	126	126	126	127	127			
	V_2	130	130	130	130	130	130	130	130	130	130	130			
	TOFL	6370	6500	6630	6760	6890	7020	7150	7280	7410	7620	8060			

TODATA3K_DRYSNOW_F20_ALL_IMP_BO100_26MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-117. (07-01-23-04)

CONTAMINATED RUNWAY TAKEOFF DATA
DRY SNOW
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON
ALTITUDE 4000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	107	107	107	107	107	107	107	107	107	107	107
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	124	124	124	124	124	124	124	124	123	122
	TOFL	4680	4770	4850	4940	5030	5120	5210	5300	5400	5610	5850
30000	V_1	108	109	109	109	109	109	109	109	109	109	109
	V_R	108	109	109	109	109	109	109	109	109	109	109
	V_2	123	123	123	123	123	123	123	123	123	122	121
	TOFL	4870	4960	5050	5150	5240	5330	5430	5520	5620	5850	6110
32000	V_1	112	112	112	112	112	112	113	113	113	113	113
	V_R	112	112	112	112	112	112	113	113	113	113	113
	V_2	122	122	122	122	122	122	122	122	122	121	120
	TOFL	5060	5160	5250	5350	5450	5540	5640	5740	5850	6090	6370
34000	V_1	116	116	116	116	116	116	116	116	117	117	118
	V_R	116	116	116	116	116	116	116	116	117	117	118
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	5250	5350	5460	5570	5670	5780	5890	5990	6130	6460	6820
36000	V_1	120	121	121	121	121	121	121	121	121	122	122
	V_R	120	121	121	121	121	121	121	121	121	122	122
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	5790	5910	6030	6140	6260	6380	6500	6620	6770	7150	7570
38000	V_1	125	125	125	125	125	125	125	125	125	126	126
	V_R	125	125	125	125	125	125	125	125	125	126	126
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	6360	6490	6620	6750	6880	7010	7140	7270	7440	7870	8360
38850	V_1	126	126	126	126	126	126	127	127	127	127	128
	V_R	126	126	126	126	126	126	127	127	127	127	128
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	6610	6750	6880	7020	7150	7290	7430	7560	7730	8190	8710

TODATA4K_DRYSNOW_F20_ALL_IMP_BD100_26MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-118. (07-01-23-05)

CONTAMINATED RUNWAY TAKEOFF DATA
DRY SNOW
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 5000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	107	107	107	107	107	107	107	107	107	107	107
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	124	124	124	124	124	124	124	124	123	122	121
	TOFL	4840	4930	5020	5120	5210	5300	5390	5480	5690	5940	6210
30000	V_1	109	109	109	109	109	109	109	109	109	109	109
	V_R	109	109	109	109	109	109	109	109	109	109	109
	V_2	123	123	123	123	123	123	123	123	122	121	121
	TOFL	5040	5140	5230	5330	5430	5520	5620	5720	5940	6210	6490
32000	V_1	112	112	112	112	113	113	113	113	113	113	114
	V_R	112	112	112	112	113	113	113	113	113	113	114
	V_2	122	122	122	122	122	122	122	122	121	120	120
	TOFL	5240	5340	5440	5540	5640	5740	5840	5940	6180	6470	6780
34000	V_1	116	116	116	116	116	117	117	117	117	118	119
	V_R	116	116	116	116	116	117	117	117	117	118	119
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	5450	5560	5670	5780	5890	6000	6110	6220	6550	6930	7340
36000	V_1	121	121	121	121	121	121	121	121	122	122	123
	V_R	121	121	121	121	121	121	121	121	122	122	123
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	6010	6140	6260	6380	6510	6630	6750	6880	7250	7690	8170
38000	V_1	125	125	125	125	125	125	125	125	126	126	127
	V_R	125	125	125	125	125	125	125	125	126	126	127
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	6600	6740	6870	7010	7150	7280	7420	7560	7980	8480	9040
38850	V_1	126	126	126	127	127	127	127	127	127	128	128
	V_R	126	126	126	127	127	127	127	127	127	128	128
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	6870	7010	7150	7290	7430	7570	7720	7860	8310	8850	9430

TODATASK_DRYSNOW_F20_ALL_IMP_BD100_26MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-119. (07-01-23-06)

CONTAMINATED RUNWAY TAKEOFF DATA
DRY SNOW
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON
ALTITUDE 6000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	107	107	107	107	107	107	107	107	107	107	107
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	124	124	124	124	124	124	124	123	122	121	121
	TOFL	5010	5100	5190	5290	5390	5480	5580	5740	6020	6310	6600
30000	V_1	109	109	109	109	109	109	109	109	109	109	110
	V_R	109	109	109	109	109	109	109	109	109	109	110
	V_2	123	123	123	123	123	123	123	122	121	121	120
	TOFL	5220	5310	5410	5510	5610	5710	5810	5990	6290	6600	6920
32000	V_1	112	112	113	113	113	113	113	113	113	114	115
	V_R	112	112	113	113	113	113	113	113	113	114	115
	V_2	122	122	122	122	122	122	122	121	120	120	119
	TOFL	5420	5520	5620	5730	5840	5940	6040	6230	6560	6880	7230
34000	V_1	116	116	116	117	117	117	117	117	118	119	119
	V_R	116	116	116	117	117	117	117	117	118	119	119
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	5650	5760	5870	5990	6100	6220	6330	6590	7030	7460	7920
36000	V_1	121	121	121	121	121	121	121	122	122	123	123
	V_R	121	121	121	121	121	121	121	122	122	123	123
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	6240	6360	6480	6610	6740	6870	7000	7280	7790	8300	8840
38000	V_1	125	125	125	125	125	125	125	126	126	127	127
	V_R	125	125	125	125	125	125	125	126	126	127	127
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	6850	6980	7120	7260	7410	7550	7690	8010	8600	9180	9810
38850	V_1	126	126	127	127	127	127	127	127	128	128	
	V_R	126	126	127	127	127	127	127	127	128	128	
	V_2	130	130	130	130	130	130	130	130	130	130	
	TOFL	7120	7260	7400	7550	7700	7850	8000	8340	8960	9580	

TODATA6K_DRYSNOW_F20_ALL_IMP_BD100_26MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-120. (07-01-23-07)

CONTAMINATED RUNWAY TAKEOFF DATA
DRY SNOW
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 7000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10			
28000	V_1	107	107	107	107	107	107	107	107	107	107	107			
	V_R	107	107	107	107	107	107	107	107	107	107	107			
	V_2	124	124	124	124	124	124	123	122	121	121	120			
	TOFL	5180	5270	5370	5470	5570	5670	5800	6090	6390	6710	7050			
30000	V_1	109	109	109	109	109	109	109	109	109	110	111			
	V_R	109	109	109	109	109	109	109	109	109	110	111			
	V_2	123	123	123	123	123	123	122	121	121	120	119			
	TOFL	5390	5490	5590	5700	5800	5910	6050	6360	6690	7030	7390			
32000	V_1	113	113	113	113	113	113	113	113	114	115	115			
	V_R	113	113	113	113	113	113	113	113	114	115	115			
	V_2	122	122	122	122	122	122	121	121	120	119	119			
	TOFL	5600	5710	5820	5930	6030	6140	6290	6620	6980	7340	7730			
34000	V_1	116	116	117	117	117	117	117	118	119	119	120			
	V_R	116	116	117	117	117	117	117	118	119	119	120			
	V_2	122	122	122	122	122	122	122	122	122	122	122			
	TOFL	5850	5960	6080	6200	6320	6440	6630	7090	7560	8050	8570			
36000	V_1	121	121	121	121	121	121	121	122	123	123	124			
	V_R	121	121	121	121	121	121	121	122	123	123	124			
	V_2	125	125	125	125	125	125	125	125	125	125	125			
	TOFL	6460	6580	6710	6850	6980	7120	7330	7850	8400	8970	9590			
38000	V_1	125	125	125	125	125	125	125	126	127	127				
	V_R	125	125	125	125	125	125	125	126	127	127				
	V_2	129	129	129	129	129	129	129	129	129	129				
	TOFL	7090	7230	7370	7520	7670	7820	8050	8660	9290	9960				
38850	V_1	127	127	127	127	127	127	127	128	128					
	V_R	127	127	127	127	127	127	127	128	128					
	V_2	130	130	130	130	130	130	130	130	130					
	TOFL	7370	7520	7670	7820	7980	8130	8380	9020	9690					

TODATA7K_DRYSNOW_F20_ALL_IMP_BD100_20MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-121. (07-01-23-08)

CONTAMINATED RUNWAY TAKEOFF DATA
DRY SNOW
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON
ALTITUDE 8000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	107	107	107	107	107	107	107	107	107	107	108
	V_R	107	107	107	107	107	107	107	107	107	107	108
	V_2	124	124	124	124	124	124	123	122	121	120	120
	TOFL	5350	5450	5550	5660	5760	5860	6140	6470	6810	7160	7550
30000	V_1	109	109	109	109	109	109	109	109	110	111	111
	V_R	109	109	109	109	109	109	109	109	110	111	111
	V_2	123	123	123	123	123	123	122	121	120	119	119
	TOFL	5570	5680	5790	5890	6000	6110	6410	6760	7130	7510	7930
32000	V_1	113	113	113	113	113	113	113	114	115	115	116
	V_R	113	113	113	113	113	113	113	114	115	115	116
	V_2	122	122	122	122	122	122	121	120	119	119	118
	TOFL	5790	5900	6020	6130	6240	6360	6680	7050	7450	7860	8310
34000	V_1	117	117	117	117	117	117	118	118	119	120	120
	V_R	117	117	117	117	117	117	118	118	119	120	120
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	6050	6170	6300	6420	6550	6680	7120	7630	8160	8710	9330
36000	V_1	121	121	121	121	121	121	122	123	123	124	
	V_R	121	121	121	121	121	121	122	123	123	124	
	V_2	125	125	125	125	125	125	125	125	125	125	
	TOFL	6690	6820	6960	7100	7240	7380	7890	8480	9090	9740	
38000	V_1	125	125	125	125	125	125	126	127	127		
	V_R	125	125	125	125	125	125	126	127	127		
	V_2	129	129	129	129	129	129	129	129	129		
	TOFL	7340	7490	7640	7800	7950	8110	8690	9380	10090		
38850	V_1	127	127	127	127	127	127	128	128	129		
	V_R	127	127	127	127	127	127	128	128	129		
	V_2	130	130	130	130	130	130	130	130	130		
	TOFL	7630	7790	7950	8110	8270	8440	9050	9780	10540		

TODATA6K_DRYSNOW_F20_ALL_IMP_BD100_26MAR04

NOTE :
Shaded region denotes that values are below minimum.
if no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-122. (07-01-23-09)

CONTAMINATED RUNWAY TAKEOFF DATA
DRY SNOW
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 9000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	107	107	107	107	107	107	107	107	107	108	108
	V_R	107	107	107	107	107	107	107	107	107	108	108
	V_2	124	124	124	124	123	123	122	121	120	120	119
	TOFL	5570	5680	5780	5890	6000	6200	6530	6880	7260	7660	8150
30000	V_1	109	109	109	109	109	109	109	110	111	111	112
	V_R	109	109	109	109	109	109	109	110	111	111	112
	V_2	123	123	123	123	122	122	121	120	119	119	118
	TOFL	5800	5920	6030	6140	6250	6470	6820	7210	7620	8050	8570
32000	V_1	113	113	113	113	113	113	114	115	115	116	116
	V_R	113	113	113	113	113	113	114	115	115	116	116
	V_2	122	122	122	122	122	121	120	119	119	118	118
	TOFL	6040	6150	6270	6390	6510	6740	7120	7530	7970	8440	9040
34000	V_1	117	117	117	117	117	118	118	119	120	120	
	V_R	117	117	117	117	117	118	118	119	120	120	
	V_2	122	122	122	122	122	122	122	122	122	122	
	TOFL	6330	6460	6590	6720	6850	7170	7680	8240	8830	9460	
36000	V_1	121	121	121	121	121	122	123	123	124		
	V_R	121	121	121	121	121	122	123	123	124		
	V_2	125	125	125	125	125	125	125	125	125		
	TOFL	6990	7130	7280	7420	7570	7930	8520	9180	9880		
38000	V_1	125	125	125	125	125	126	127	127			
	V_R	125	125	125	125	125	126	127	127			
	V_2	129	129	129	129	129	129	129	129			
	TOFL	7680	7840	8000	8160	8320	8730	9410	10180			
38850	V_1	127	127	127	127	127	127	128	129			
	V_R	127	127	127	127	127	127	128	129			
	V_2	130	130	130	130	130	130	130	130			
	TOFL	7990	8150	8320	8490	8650	9090	9810	10630			

TODATA9K_DRYSNOW_F20_ALL_IMP_BD100_26MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-123. (07-01-23-10)

CONTAMINATED RUNWAY TAKEOFF DATA
DRY SNOW
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON
ALTITUDE 10000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

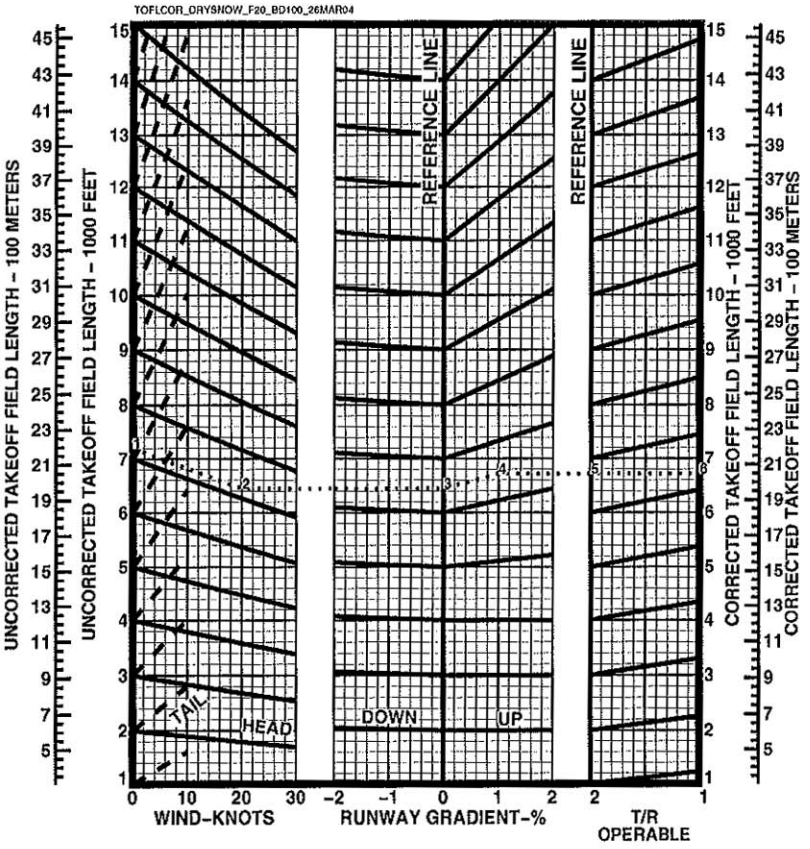
WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	107	107	107	107	107	107	107	107	108	108	109
	V_R	107	107	107	107	107	107	107	107	108	108	109
	V_2	123	123	123	123	123	122	121	120	120	119	118
	TOFL	5810	5920	6040	6150	6320	6590	6960	7360	7780	8240	8830
30000	V_1	109	109	109	109	109	109	110	111	111	112	112
	V_R	109	109	109	109	109	109	110	111	111	112	112
	V_2	122	122	122	122	122	121	120	120	119	118	118
	TOFL	6060	6180	6300	6420	6590	6890	7280	7720	8170	8670	9320
32000	V_1	113	113	113	113	113	114	115	115	116	116	
	V_R	113	113	113	113	113	114	115	115	116	116	
	V_2	122	121	121	121	121	120	119	119	118	118	
	TOFL	6310	6430	6550	6680	6870	7180	7610	8080	8560	9140	
34000	V_1	117	117	117	117	117	118	119	120	120	121	
	V_R	117	117	117	117	117	118	119	120	120	121	
	V_2	122	122	122	122	122	122	122	122	122	122	
	TOFL	6650	6790	6920	7060	7300	7720	8300	8940	9600	10340	
36000	V_1	121	121	121	122	122	122	123	124			
	V_R	121	121	121	122	122	122	123	124			
	V_2	125	125	125	125	125	125	125	125			
	TOFL	7350	7500	7650	7810	8070	8570	9240	10000			
38000	V_1	125	125	125	125	126	126	127				
	V_R	125	125	125	125	126	126	127				
	V_2	129	129	129	129	129	129	129				
	TOFL	8080	8250	8420	8590	8890	9460	10240				
38850	V_1	127	127	127	127	127	128	129				
	V_R	127	127	127	127	127	128	129				
	V_2	130	130	130	130	130	130	130				
	TOFL	8400	8580	8760	8930	9250	9850	10690				

TODATA10K_DRYSNOW_F20_ALL_IMP_BD100_26MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-124. (07-01-23-11)

CONTAMINATED RUNWAY TAKEOFF FIELD LENGTH
DRY SNOW
CORRECTION CHART
FLAPS 20°

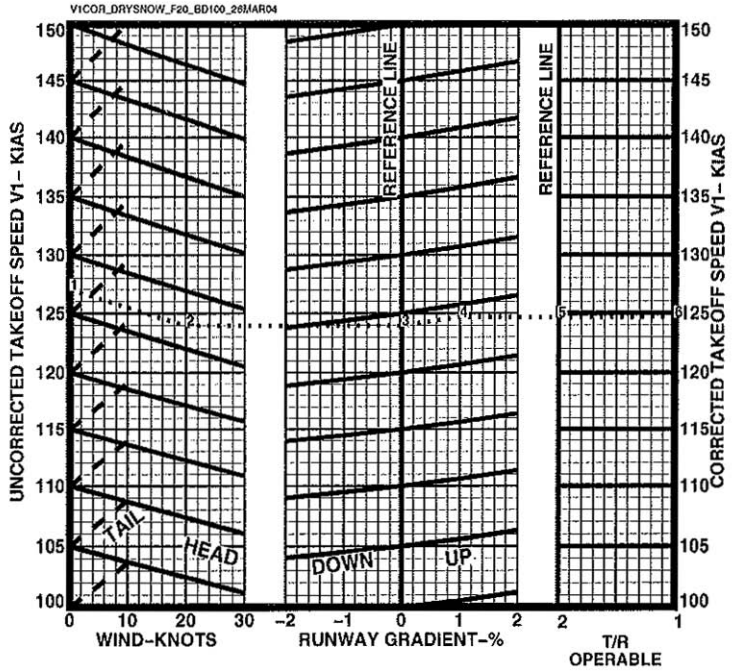


EXAMPLE:

1. Uncorrected Takeoff Field Length (from table).....7200 ft (2200 m)
2. Headwind.....20 kt
3. Runway Gradient Reference Line
4. Runway Gradient.....1.0% UP
5. Two Thrust Reversers
6. Corrected Takeoff Field Length.....6720 ft (2050 m)

Figure SUP1-125. (07-01-23-12)

CONTAMINATED TAKEOFF SPEEDS
DRY SNOW
CORRECTION CHART FOR V1
FLAPS 20°



EXAMPLE:

1. Uncorrected Takeoff Speed (from table).....127 kias
2. Headwind.....20 kt
3. Runway Gradient Reference Line
4. Runway Gradient.....1.0% UP
5. Two Thrust Reversers
6. Corrected Takeoff Speed.....125 kias

NOTES:

1. V1mcg is limiting when the corrected V1 is less than 116 kias. In this case, use V1=116 kias.
2. If the corrected V1 exceeds VR for the appropriate conditions, use V1=VR.

Figure SUP1-126. (07-01-23-13)

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CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON

ALTITUDE SEA LEVEL
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C								
		10	15	20	25	30	35	40	45	50
28000	V_1	83	83	83	83	83	84	86	88	90
	V_R	107	107	107	107	107	107	107	107	107
	V_2	124	124	124	124	124	124	123	122	121
	TOFL	5230	5330	5420	5510	5620	5810	6050	6300	6590
30000	V_1	87	87	87	87	87	88	89	91	94
	V_R	109	109	109	109	109	109	109	109	110
	V_2	123	123	123	123	123	123	122	121	120
	TOFL	5430	5530	5620	5710	5830	6040	6290	6560	6880
32000	V_1	92	92	92	92	92	93	95	97	100
	V_R	112	112	112	112	112	112	113	114	114
	V_2	122	122	122	122	122	122	121	120	119
	TOFL	5620	5720	5820	5920	6040	6260	6530	6820	7160
34000	V_1	97	97	98	98	98	99	101	103	106
	V_R	116	116	116	116	116	117	117	118	119
	V_2	121	121	121	121	121	121	121	121	121
	TOFL	5810	5910	6010	6120	6240	6480	6760	7080	7430
36000	V_1	103	103	103	103	103	104	106	108	112
	V_R	121	121	121	121	121	121	122	122	123
	V_2	125	125	125	125	125	125	125	125	125
	TOFL	5990	6100	6210	6310	6450	6690	6990	7320	7710
38000	V_1	108	108	108	108	108	109	111	114	117
	V_R	125	125	125	125	125	125	126	126	127
	V_2	128	128	128	128	128	128	128	128	128
	TOFL	6180	6290	6400	6510	6650	6910	7230	7580	8160
38850	V_1	110	110	110	110	110	111	113	116	120
	V_R	126	126	126	126	126	127	127	128	129
	V_2	130	130	130	130	130	130	130	130	130
	TOFL	6250	6370	6480	6590	6730	7000	7320	7720	8580

TODATASL_WATER125_F20_ECS_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-127. (07-01-24-01)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 1000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C								
		10	15	20	25	30	35	40	45	48
28000	V_1	83	83	83	83	84	86	87	89	91
	V_R	107	107	107	107	107	107	107	107	107
	V_2	124	124	124	124	124	123	122	121	121
	TOFL	5430	5520	5620	5720	5920	6130	6380	6660	6850
30000	V_1	87	87	87	87	87	89	91	93	95
	V_R	109	109	109	109	109	109	109	110	110
	V_2	123	123	123	123	123	122	121	120	120
	TOFL	5630	5730	5830	5930	6150	6380	6640	6950	7150
32000	V_1	92	92	92	92	92	94	97	99	101
	V_R	112	112	112	113	112	113	113	114	115
	V_2	122	122	122	122	122	121	120	120	119
	TOFL	5830	5940	6040	6140	6370	6620	6900	7230	7450
34000	V_1	97	97	97	97	98	100	102	105	107
	V_R	116	116	116	116	117	117	118	119	119
	V_2	122	122	122	122	122	122	122	122	122
	TOFL	6030	6130	6240	6360	6590	6850	7160	7500	7740
36000	V_1	103	103	103	102	103	105	107	111	113
	V_R	121	121	121	121	121	122	122	123	123
	V_2	125	125	125	125	125	125	125	125	125
	TOFL	6220	6330	6440	6560	6810	7090	7410	7780	8030
38000	V_1	108	108	107	107	108	110	113	116	118
	V_R	125	125	125	125	125	126	126	127	127
	V_2	128	128	128	128	128	128	128	128	128
	TOFL	6410	6530	6640	6760	7030	7320	7660	8070	8600
38850	V_1	110	110	110	110	110	113	115	118	120
	V_R	126	126	126	126	127	127	128	128	129
	V_2	130	130	130	130	130	130	130	130	130
	TOFL	6490	6610	6730	6850	7120	7420	7770	8480	9040

TODATA1K_WATER125_F20_ECS_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-128. (07-01-24-02)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 2000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C								
		10	15	20	25	30	35	40	45	46
28000	V_1	83	83	83	83	85	87	89	91	91
	V_R	107	107	107	107	107	107	107	107	107
	V_2	124	124	124	124	123	122	121	121	120
	TOFL	5640	5740	5840	6020	6240	6470	6740	7060	7130
30000	V_1	87	87	87	87	88	90	92	95	96
	V_R	109	109	109	109	109	109	109	110	110
	V_2	123	123	123	123	122	121	121	120	120
	TOFL	5850	5950	6060	6250	6490	6740	7030	7370	7450
32000	V_1	92	92	92	92	94	96	98	101	101
	V_R	112	113	113	113	113	113	114	115	115
	V_2	122	122	122	122	121	120	120	119	119
	TOFL	6060	6170	6270	6480	6730	7000	7310	7670	7750
34000	V_1	97	97	97	98	99	101	104	107	108
	V_R	116	116	116	117	117	118	118	119	119
	V_2	122	122	122	122	122	122	122	122	122
	TOFL	6260	6370	6490	6710	6970	7250	7590	7970	8060
36000	V_1	102	102	102	102	104	107	109	113	113
	V_R	121	121	121	121	122	122	123	123	124
	V_2	125	125	125	125	125	125	125	125	125
	TOFL	6460	6580	6700	6930	7200	7500	7860	8270	8370
38000	V_1	107	107	107	108	110	112	115	118	119
	V_R	125	125	125	125	126	126	127	127	127
	V_2	129	129	129	129	129	129	129	129	129
	TOFL	6660	6780	6910	7150	7440	7760	8130	8870	9070
38850	V_1	109	109	109	110	112	115	117	120	121
	V_R	126	126	127	127	127	128	128	129	129
	V_2	130	130	130	130	130	130	130	130	130
	TOFL	6740	6870	6990	7240	7540	7870	8420	9330	9530

TODATA2K_WATER125_F20_ECS_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-129. (07-01-24-03)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 3000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C							
		10	15	20	25	30	35	40	44
28000	V_1	83	83	83	85	86	88	90	92
	V_R	107	107	107	107	107	107	107	107
	V_2	124	124	124	123	122	122	121	120
	TOFL	5850	5960	6130	6340	6580	6840	7140	7420
30000	V_1	86	86	87	88	90	92	94	96
	V_R	109	109	109	109	109	109	110	111
	V_2	123	123	123	122	121	121	120	119
	TOFL	6080	6180	6360	6590	6850	7130	7450	7750
32000	V_1	92	92	92	94	96	97	100	102
	V_R	113	113	113	113	113	114	115	115
	V_2	122	122	122	121	121	120	119	119
	TOFL	6290	6400	6590	6840	7110	7410	7750	8080
34000	V_1	97	97	97	99	101	103	106	108
	V_R	116	117	117	117	118	118	119	120
	V_2	122	122	122	122	122	122	122	122
	TOFL	6510	6620	6820	7080	7370	7690	8060	8400
36000	V_1	102	102	102	104	106	109	112	114
	V_R	121	121	121	121	122	123	123	124
	V_2	125	125	125	125	125	125	125	125
	TOFL	6720	6840	7050	7320	7630	7960	8360	8720
38000	V_1	107	107	107	109	112	114	117	120
	V_R	125	125	125	125	126	127	127	128
	V_2	129	129	129	129	129	129	129	129
	TOFL	6920	7050	7270	7560	7890	8240	8810	9570
38850	V_1	109	109	109	112	114	117	119	122
	V_R	127	127	127	127	128	128	129	129
	V_2	130	130	130	130	130	130	130	130
	TOFL	7010	7140	7360	7660	8000	8430	9260	10060

TODATA3K_WATER125_F20_ECS_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-130. (07-01-24-04)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 4000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C							
		10	15	20	25	30	35	40	42
28000	V_1	83	83	84	86	88	90	91	92
	V_R	107	107	107	107	107	107	107	108
	V_2	124	124	123	122	122	121	120	120
	TOFL	6090	6240	6450	6690	6960	7240	7580	7730
30000	V_1	87	87	88	89	91	93	96	97
	V_R	109	109	109	109	109	110	111	111
	V_2	123	123	122	121	121	120	119	119
	TOFL	6320	6480	6700	6960	7240	7550	7910	8080
32000	V_1	92	92	93	95	97	99	102	103
	V_R	113	113	113	113	114	115	115	115
	V_2	122	122	121	121	120	119	119	118
	TOFL	6540	6720	6950	7220	7530	7860	8250	8420
34000	V_1	97	97	98	100	102	105	108	109
	V_R	117	117	117	118	118	119	120	120
	V_2	122	122	122	122	122	122	122	122
	TOFL	6770	6950	7200	7490	7820	8170	8580	8770
36000	V_1	102	102	104	106	108	111	114	115
	V_R	121	121	121	122	123	123	124	124
	V_2	125	125	125	125	125	125	125	125
	TOFL	6990	7180	7440	7750	8100	8470	8900	9100
38000	V_1	107	107	109	111	114	116	119	120
	V_R	125	125	125	126	126	127	128	128
	V_2	129	129	129	129	129	129	129	129
	TOFL	7210	7410	7680	8010	8370	8820	9710	10120
38850	V_1	109	109	111	113	116	119	121	122
	V_R	127	127	127	128	128	129	129	129
	V_2	130	130	130	130	130	130	130	130
	TOFL	7300	7500	7780	8110	8490	9270	10200	10650

TODATA4K_WATER125_F20_ECS_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-131. (07-01-24-05)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 5000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C						
		10	15	20	25	30	35	40
28000	V_1	83	84	86	87	89	91	93
	V_R	107	107	107	107	107	107	108
	V_2	124	123	122	122	121	120	120
	TOFL	6360	6560	6780	7070	7370	7670	8060
30000	V_1	87	88	89	91	93	95	97
	V_R	109	109	109	109	110	111	111
	V_2	123	122	121	121	120	119	119
	TOFL	6600	6830	7060	7360	7690	8010	8430
32000	V_1	92	93	94	96	98	101	104
	V_R	113	113	113	114	114	115	116
	V_2	122	121	121	120	119	119	118
	TOFL	6840	7080	7330	7650	8000	8340	8790
34000	V_1	97	98	100	102	104	107	110
	V_R	117	117	118	118	119	119	120
	V_2	122	122	122	122	122	122	122
	TOFL	7080	7330	7590	7940	8310	8670	9150
36000	V_1	102	103	105	107	110	113	116
	V_R	121	121	122	123	123	124	124
	V_2	125	125	125	125	125	125	125
	TOFL	7310	7580	7850	8220	8610	9000	9510
38000	V_1	107	108	111	113	116	118	121
	V_R	125	125	126	126	127	128	128
	V_2	129	129	129	129	129	129	129
	TOFL	7540	7820	8110	8500	8920	9690	10710
38850	V_1	109	111	113	115	118	121	123
	V_R	127	127	128	128	129	129	130
	V_2	130	130	130	130	130	130	130
	TOFL	7640	7920	8220	8620	9330	10190	11250

TODATA5K_WATER125_F20_ECS_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-132. (07-01-24-06)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 6000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C						
		10	15	20	25	30	35	38
28000	V_1	84	85	87	89	90	92	94
	V_R	107	107	107	107	107	108	108
	V_2	123	122	122	121	120	120	119
	TOFL	6700	6920	7180	7480	7810	8170	8420
30000	V_1	88	89	90	92	94	97	98
	V_R	109	109	109	110	110	111	112
	V_2	122	121	121	120	120	119	119
	TOFL	6960	7200	7470	7790	8150	8540	8810
32000	V_1	92	94	96	98	100	103	105
	V_R	113	113	114	114	115	116	116
	V_2	121	121	120	119	119	118	118
	TOFL	7220	7470	7760	8110	8480	8900	9190
34000	V_1	98	99	101	103	106	109	111
	V_R	117	118	118	119	119	120	120
	V_2	122	122	122	122	122	122	122
	TOFL	7480	7740	8050	8420	8820	9270	9580
36000	V_1	103	105	107	109	112	115	117
	V_R	122	122	123	123	124	124	124
	V_2	125	125	125	125	125	125	125
	TOFL	7730	8010	8340	8730	9160	9620	10060
38000	V_1	108	110	113	115	118	120	122
	V_R	126	126	126	127	127	128	128
	V_2	129	129	129	129	129	129	129
	TOFL	7980	8270	8620	9040	9730	10710	11370
38850	V_1	110	113	115	117	120	123	124
	V_R	127	128	128	129	129	130	130
	V_2	130	130	130	130	130	130	130
	TOFL	8090	8390	8740	9350	10240	11270	11980

TODATA6K_WATER125_F20_ECS_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-133. (07-01-24-07)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 7000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C						
		10	15	20	25	30	35	36
28000	V_1	85	87	88	89	91	94	94
	V_R	107	107	107	107	108	108	108
	V_2	122	122	121	120	120	119	119
	TOFL	7060	7300	7590	7920	8280	8710	8800
30000	V_1	89	90	92	94	96	99	99
	V_R	109	109	110	110	111	112	112
	V_2	121	121	120	120	119	118	118
	TOFL	7340	7600	7910	8270	8660	9110	9210
32000	V_1	94	95	97	99	102	105	106
	V_R	113	114	114	115	116	116	116
	V_2	121	120	120	119	118	118	118
	TOFL	7620	7900	8230	8610	9030	9520	9630
34000	V_1	99	101	103	105	108	111	112
	V_R	118	118	119	119	120	120	121
	V_2	122	122	122	122	122	122	122
	TOFL	7900	8190	8540	8950	9400	9910	10030
36000	V_1	105	107	109	111	114	117	118
	V_R	122	123	123	123	124	125	125
	V_2	125	125	125	125	125	125	125
	TOFL	8170	8480	8850	9290	9760	10480	10700
38000	V_1	110	112	115	117	120	122	123
	V_R	126	126	127	127	128	128	128
	V_2	129	129	129	129	129	129	129
	TOFL	8450	8770	9160	9750	10720	11850	12110
38850	V_1	112	115	117	119	122	124	125
	V_R	128	128	129	129	129	130	130
	V_2	130	130	130	130	130	130	130
	TOFL	8560	8890	9420	10260	11270	12470	12740

TODATA7K_WATER125_F20_ECS_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-134. (07-01-24-08)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 8000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C					
		10	15	20	25	30	34
28000	V_1	86	88	89	91	93	95
	V_R	107	107	107	108	108	109
	V_2	122	121	121	120	119	119
	TOFL	7450	7720	8030	8410	8820	9200
30000	V_1	90	91	93	95	98	100
	V_R	109	110	110	111	112	112
	V_2	121	120	120	119	119	118
	TOFL	7750	8040	8380	8790	9230	9640
32000	V_1	95	97	99	101	104	107
	V_R	114	114	115	115	116	117
	V_2	120	120	119	118	118	118
	TOFL	8060	8360	8730	9160	9640	10080
34000	V_1	101	103	105	107	110	113
	V_R	118	119	119	120	120	121
	V_2	122	122	122	122	122	122
	TOFL	8360	8680	9070	9530	10040	10510
36000	V_1	106	109	111	113	116	118
	V_R	123	123	123	124	124	125
	V_2	125	125	125	125	125	125
	TOFL	8650	9000	9410	9900	10470	11370
38000	V_1	112	114	116	119	121	124
	V_R	126	127	127	128	128	129
	V_2	129	129	129	129	129	129
	TOFL	8950	9310	9810	10720	11850	12880
38850	V_1	114	117	119	121	124	
	V_R	128	129	129	129	130	
	V_2	130	130	130	130	130	
	TOFL	9070	9530	10310	11270	12460	

TODATA8K_WATER125_F20_ECS_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-135. (07-01-24-09)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 9000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C					
		10	15	20	25	30	32
28000	V_1	87	89	90	92	95	96
	V_R	107	107	108	108	109	109
	V_2	121	121	120	119	119	118
	TOFL	7870	8160	8520	8950	9420	9630
30000	V_1	91	93	95	97	100	101
	V_R	110	110	111	111	112	112
	V_2	120	120	119	119	118	118
	TOFL	8200	8520	8900	9350	9870	10100
32000	V_1	97	99	101	103	106	108
	V_R	114	115	115	116	117	117
	V_2	120	119	119	118	118	118
	TOFL	8530	8870	9280	9760	10320	10560
34000	V_1	103	105	107	109	112	114
	V_R	119	119	120	120	121	121
	V_2	122	122	122	122	122	122
	TOFL	8850	9210	9650	10170	10760	11020
36000	V_1	108	111	113	115	118	119
	V_R	123	123	124	124	125	125
	V_2	125	125	125	125	125	125
	TOFL	9170	9550	10010	10570	11600	12110
38000	V_1	114	116	118	121	123	
	V_R	127	127	128	128	129	
	V_2	129	129	129	129	129	
	TOFL	9490	9920	10760	11820	13120	
38850	V_1	116	118	120	123		
	V_R	129	129	129	130		
	V_2	130	130	130	130		
	TOFL	9670	10420	11310	12420		

TODATA9K_WATER126_F20_ECS_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-136. (07-01-24-10)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 10000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C				
		10	15	20	25	30
28000	V_1	88	90	92	94	97
	V_R	107	108	108	109	109
	V_2	121	120	119	119	118
	TOFL	8320	8640	9060	9540	10090
30000	V_1	93	94	96	99	102
	V_R	110	111	111	112	113
	V_2	120	119	119	118	118
	TOFL	8680	9020	9470	9990	10580
32000	V_1	98	100	103	105	108
	V_R	115	115	116	116	117
	V_2	119	119	118	118	118
	TOFL	9040	9400	9880	10440	11070
34000	V_1	104	107	109	111	114
	V_R	119	120	120	121	121
	V_2	122	122	122	122	122
	TOFL	9390	9770	10290	10880	11560
36000	V_1	110	112	115	117	120
	V_R	124	124	124	125	125
	V_2	125	125	125	125	125
	TOFL	9730	10140	10690	11530	12890
38000	V_1	116	118	120	122	
	V_R	127	128	128	129	
	V_2	129	129	129	129	
	TOFL	10080	10840	11800	13060	
38850	V_1	118	120	122	125	
	V_R	129	129	130	130	
	V_2	130	130	130	130	
	TOFL	10570	11390	12410	13750	

TODATA10K_WATER125_F20_ECS_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-137. (07-01-24-11)

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CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON
ALTITUDE SEA LEVEL
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10			
28000	V_1	84	84	84	84	84	84	83	83	83	83	83			
	V_R	107	107	107	107	107	107	107	107	107	107	107			
	V_2	125	125	125	125	125	125	125	125	124	124	124			
	TOFL	4310	4400	4500	4590	4680	4780	4870	4970	5060	5150	5240			
30000	V_1	87	87	87	87	87	87	87	87	87	87	87			
	V_R	108	108	108	108	108	108	108	108	108	108	109			
	V_2	124	124	124	124	124	124	124	123	123	123	123			
	TOFL	4460	4560	4660	4750	4850	4950	5050	5150	5240	5340	5440			
32000	V_1	92	92	92	92	92	92	92	92	92	92	92			
	V_R	112	112	112	112	112	112	112	112	112	112	112			
	V_2	123	123	123	123	123	123	123	122	122	122	122			
	TOFL	4610	4710	4810	4910	5020	5120	5230	5330	5420	5520	5620			
34000	V_1	98	98	98	98	97	97	97	98	98	98	98			
	V_R	116	116	116	116	116	116	116	116	116	116	116			
	V_2	122	122	122	122	122	122	122	121	121	121	121			
	TOFL	4750	4860	4970	5080	5180	5290	5400	5500	5600	5710	5810			
36000	V_1	104	104	104	103	103	103	103	103	103	103	103			
	V_R	120	120	120	120	120	120	120	120	120	121	121			
	V_2	125	125	125	125	125	125	125	125	125	125	125			
	TOFL	4900	5010	5120	5230	5340	5460	5570	5680	5780	5890	6000			
38000	V_1	109	109	109	109	109	109	109	109	108	108	108			
	V_R	124	124	124	124	124	124	124	124	125	125	125			
	V_2	128	128	128	128	128	128	128	128	128	128	128			
	TOFL	5040	5160	5270	5390	5500	5620	5730	5840	5960	6070	6180			
38850	V_1	112	111	111	111	111	111	111	110	110	110	110			
	V_R	126	126	126	126	126	126	126	126	126	126	126			
	V_2	130	130	130	130	130	130	130	130	130	130	130			
	TOFL	5100	5220	5340	5450	5570	5690	5810	5920	6030	6140	6260			

TODATASL_WATER125_F20_ALL_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-138. (07-01-24-12)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 1000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	84	84	83	83	83	83	83	83	83	83	83
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	125	125	125	125	124	124	124	124
	TOFL	4470	4570	4670	4770	4860	4960	5060	5150	5250	5340	5430
30000	V_1	87	87	87	87	87	87	87	87	87	87	87
	V_R	108	108	108	108	108	108	108	108	109	109	109
	V_2	124	124	124	124	124	124	123	123	123	123	123
	TOFL	4630	4740	4840	4940	5040	5140	5240	5340	5440	5540	5640
32000	V_1	92	92	92	92	92	92	92	92	92	92	92
	V_R	112	112	112	112	112	112	112	112	112	112	112
	V_2	123	123	123	123	123	122	122	122	122	122	122
	TOFL	4790	4900	5010	5110	5220	5320	5420	5530	5630	5730	5840
34000	V_1	98	98	97	97	97	97	97	97	97	97	97
	V_R	116	116	116	116	116	116	116	116	116	116	116
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	4950	5050	5170	5270	5390	5500	5600	5710	5820	5920	6030
36000	V_1	103	103	103	103	103	103	103	103	103	103	103
	V_R	120	120	120	120	120	120	120	120	121	121	121
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	5100	5210	5330	5440	5550	5670	5780	5890	6000	6110	6230
38000	V_1	109	109	109	109	108	108	108	108	108	108	108
	V_R	124	124	124	124	124	124	125	125	125	125	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	5250	5370	5490	5600	5720	5840	5950	6070	6180	6300	6420
38850	V_1	111	111	111	111	110	110	110	110	110	110	110
	V_R	126	126	126	126	126	126	126	126	126	126	126
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	5310	5430	5550	5670	5790	5910	6030	6140	6260	6380	6490

TODATA1K_WATER125_F20_ALL_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-139. (07-01-24-13)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 2000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10			
28000	V_1	83	83	83	83	83	83	83	83	83	83	84			
	V_R	107	107	107	107	107	107	107	107	107	107	107			
	V_2	125	125	125	125	125	124	124	124	124	124	124			
	TOFL	4650	4750	4850	4950	5050	5150	5250	5350	5440	5540	5660			
30000	V_1	87	87	87	87	87	87	87	87	87	87	87			
	V_R	108	108	108	108	108	109	109	109	109	109	109			
	V_2	124	124	124	124	123	123	123	123	123	123	123			
	TOFL	4820	4920	5030	5130	5240	5340	5440	5540	5650	5750	5880			
32000	V_1	92	92	92	92	92	92	92	92	92	92	93			
	V_R	112	112	112	112	112	112	112	112	112	112	112			
	V_2	123	123	123	123	122	122	122	122	122	122	122			
	TOFL	4980	5090	5200	5310	5420	5530	5630	5740	5850	5950	6090			
34000	V_1	97	97	97	97	97	97	97	97	97	97	98			
	V_R	116	116	116	116	116	116	116	116	116	116	117			
	V_2	122	122	122	122	122	122	122	122	122	122	122			
	TOFL	5140	5260	5370	5490	5590	5710	5820	5930	6040	6150	6290			
36000	V_1	103	103	103	103	103	103	103	103	103	103	103			
	V_R	120	120	120	120	120	120	121	121	121	121	121			
	V_2	125	125	125	125	125	125	125	125	125	125	125			
	TOFL	5300	5420	5540	5660	5770	5890	6000	6120	6230	6350	6500			
38000	V_1	109	109	108	108	108	108	108	108	108	107	108			
	V_R	124	124	124	124	125	125	125	125	125	125	125			
	V_2	129	129	129	129	129	129	129	129	129	129	129			
	TOFL	5460	5580	5710	5820	5950	6070	6180	6300	6420	6550	6700			
38850	V_1	111	111	110	110	110	110	110	110	110	110	111			
	V_R	126	126	126	126	126	126	126	126	126	126	127			
	V_2	130	130	130	130	130	130	130	130	130	130	130			
	TOFL	5520	5650	5780	5900	6020	6140	6260	6380	6510	6630	6780			

TODATA2K_WATER12S_F20_ALL_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-140. (07-01-24-14)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 3000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10			
28000	V_1	83	83	83	83	83	83	83	83	83	84	86			
	V_R	107	107	107	107	107	107	107	107	107	107	107			
	V_2	125	125	125	124	124	124	124	124	124	124	123			
	TOFL	4830	4940	5040	5150	5250	5350	5450	5550	5650	5770	5960			
30000	V_1	86	86	86	86	86	86	86	87	87	87	89			
	V_R	108	108	108	109	109	109	109	109	109	109	109			
	V_2	124	124	123	123	123	123	123	123	123	123	122			
	TOFL	5010	5120	5230	5330	5440	5550	5650	5760	5870	5990	6190			
32000	V_1	92	92	92	92	92	92	92	92	92	93	94			
	V_R	112	112	112	112	112	112	112	112	113	113	113			
	V_2	123	123	122	122	122	122	122	122	122	122	121			
	TOFL	5180	5300	5410	5520	5630	5740	5850	5960	6070	6200	6420			
34000	V_1	97	97	97	97	97	97	97	97	97	98	100			
	V_R	116	116	116	116	116	116	116	116	116	117	117			
	V_2	122	122	122	122	122	122	122	122	122	122	122			
	TOFL	5350	5470	5590	5700	5820	5930	6050	6160	6280	6410	6640			
36000	V_1	103	103	103	103	103	103	103	103	102	103	105			
	V_R	120	120	120	120	121	121	121	121	121	121	122			
	V_2	125	125	125	125	125	125	125	125	125	125	125			
	TOFL	5520	5640	5760	5880	6000	6120	6240	6360	6480	6620	6870			
38000	V_1	108	108	108	108	108	108	108	107	107	108	110			
	V_R	124	124	125	125	125	125	125	125	125	125	126			
	V_2	129	129	129	129	129	129	129	129	129	129	129			
	TOFL	5680	5810	5930	6050	6180	6310	6430	6550	6680	6830	7080			
38850	V_1	110	110	110	110	110	110	110	110	109	110	113			
	V_R	126	126	126	126	126	126	126	126	126	127	127			
	V_2	130	130	130	130	130	130	130	130	130	130	130			
	TOFL	5750	5880	6000	6130	6260	6380	6510	6640	6760	6920	7180			

TODATA3K_WATER125_F20_ALL_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-141. (07-01-24-15)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 4000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	83	83	83	83	83	83	83	83	83	86	87
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	124	124	124	124	124	124	124	124	123	122
	TOFL	5030	5130	5240	5340	5450	5560	5660	5770	5880	6080	6290
30000	V_1	87	87	86	86	87	87	87	87	87	89	90
	V_R	108	109	109	109	109	109	109	109	109	109	109
	V_2	123	123	123	123	123	123	123	123	123	122	121
	TOFL	5210	5320	5430	5540	5650	5760	5880	5990	6100	6310	6540
32000	V_1	92	92	92	92	92	92	92	92	92	94	96
	V_R	112	112	112	112	112	112	113	113	113	113	113
	V_2	122	122	122	122	122	122	122	122	122	121	120
	TOFL	5390	5500	5620	5730	5850	5970	6080	6200	6320	6550	6780
34000	V_1	97	97	97	97	97	97	97	97	98	100	102
	V_R	116	116	116	116	116	116	116	116	117	117	118
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	5570	5690	5800	5920	6050	6170	6290	6410	6540	6770	7030
36000	V_1	103	103	103	103	103	103	102	102	103	105	107
	V_R	120	121	121	121	121	121	121	121	121	122	122
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	5740	5870	5990	6110	6240	6370	6490	6620	6750	7000	7270
38000	V_1	108	108	108	108	108	107	107	107	108	110	113
	V_R	125	125	125	125	125	125	125	125	125	126	126
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	5910	6040	6170	6300	6430	6560	6690	6820	6960	7220	7500
38850	V_1	110	110	110	110	110	110	110	109	110	112	115
	V_R	126	126	126	126	126	126	127	127	127	127	128
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	5980	6120	6250	6380	6510	6640	6770	6910	7050	7320	7610

TODATA4K_WATER125_F20_ALL_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-142. (07-01-24-16)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 5000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10			
28000	V_1	83	83	83	83	83	83	83	83	85	87	89			
	V_R	107	107	107	107	107	107	107	107	107	107	107			
	V_2	124	124	124	124	124	124	124	124	123	122	121			
	TOFL	5230	5340	5450	5550	5670	5780	5890	6000	6190	6410	6640			
30000	V_1	87	87	87	87	87	87	87	87	89	90	92			
	V_R	109	109	109	109	109	109	109	109	109	109	109			
	V_2	123	123	123	123	123	123	123	123	122	121	121			
	TOFL	5420	5530	5650	5760	5880	6000	6110	6220	6430	6660	6910			
32000	V_1	92	92	92	92	92	92	92	92	94	96	98			
	V_R	112	112	112	112	113	113	113	113	113	113	114			
	V_2	122	122	122	122	122	122	122	122	121	120	120			
	TOFL	5610	5730	5850	5970	6090	6210	6330	6450	6660	6910	7180			
34000	V_1	97	97	97	97	97	97	97	97	99	101	103			
	V_R	116	116	116	116	116	117	117	117	117	118	119			
	V_2	122	122	122	122	122	122	122	122	122	122	122			
	TOFL	5790	5920	6040	6160	6290	6420	6540	6670	6900	7160	7440			
36000	V_1	103	103	103	103	102	102	102	102	104	107	109			
	V_R	121	121	121	121	121	121	121	121	122	122	123			
	V_2	125	125	125	125	125	125	125	125	125	125	125			
	TOFL	5970	6100	6230	6360	6490	6620	6750	6880	7130	7410	7700			
38000	V_1	108	108	108	107	107	107	107	107	110	112	115			
	V_R	125	125	125	125	125	125	125	125	126	126	127			
	V_2	129	129	129	129	129	129	129	129	129	129	129			
	TOFL	6150	6290	6420	6560	6690	6830	6960	7100	7350	7650	7960			
38850	V_1	110	110	110	110	110	109	109	109	112	115	117			
	V_R	126	126	126	127	127	127	127	127	127	128	128			
	V_2	130	130	130	130	130	130	130	130	130	130	130			
	TOFL	6230	6370	6500	6640	6770	6910	7050	7190	7450	7750	8210			

TODATASK_WATER125_F20_ALL_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-143. (07-01-24-17)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 6000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10			
28000	V_1	83	83	83	83	83	83	83	84	87	88	90			
	V_R	107	107	107	107	107	107	107	107	107	107	107			
	V_2	124	124	124	124	124	124	124	123	122	121	121			
	TOFL	5430	5540	5660	5770	5890	6000	6120	6280	6520	6770	7010			
30000	V_1	86	86	86	86	86	86	86	88	90	92	94			
	V_R	109	109	109	109	109	109	109	109	109	109	110			
	V_2	123	123	123	123	123	123	123	122	121	121	120			
	TOFL	5630	5750	5870	5990	6110	6230	6350	6520	6780	7040	7310			
32000	V_1	92	92	92	92	92	92	92	93	96	97	99			
	V_R	112	112	113	113	113	113	113	113	113	114	115			
	V_2	122	122	122	122	122	122	122	121	120	120	119			
	TOFL	5830	5950	6080	6200	6330	6450	6580	6760	7040	7320	7600			
34000	V_1	97	97	97	97	97	97	97	98	101	103	105			
	V_R	116	116	116	117	117	117	117	117	118	119	119			
	V_2	122	122	122	122	122	122	122	122	122	122	122			
	TOFL	6020	6150	6280	6410	6540	6670	6800	6990	7290	7580	7890			
36000	V_1	103	103	102	102	102	102	102	104	106	109	111			
	V_R	121	121	121	121	121	121	121	122	122	123	123			
	V_2	125	125	125	125	125	125	125	125	125	125	125			
	TOFL	6210	6350	6480	6620	6750	6880	7020	7220	7540	7850	8170			
38000	V_1	108	107	107	107	107	107	107	109	112	115	117			
	V_R	125	125	125	125	125	125	125	126	126	127	127			
	V_2	129	129	129	129	129	129	129	129	129	129	129			
	TOFL	6400	6540	6680	6820	6960	7100	7240	7450	7790	8110	8560			
38850	V_1	110	109	109	109	109	109	109	111	114	117	119			
	V_R	126	126	127	127	127	127	127	127	128	128	129			
	V_2	130	130	130	130	130	130	130	130	130	130	130			
	TOFL	6480	6620	6760	6910	7050	7190	7330	7550	7890	8330	8990			

TODATA6K_WATER125_F20_ALL_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-144. (07-01-24-18)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 7000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	83	83	83	82	82	82	83	86	88	90	91
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	124	124	124	124	124	124	123	122	121	121	120
	TOFL	5640	5760	5870	5990	6110	6240	6370	6630	6890	7150	7430
30000	V_1	86	86	86	86	86	86	87	89	91	94	95
	V_R	109	109	109	109	109	109	109	109	109	110	111
	V_2	123	123	123	123	123	123	122	121	121	120	119
	TOFL	5850	5970	6100	6220	6350	6470	6620	6890	7170	7450	7750
32000	V_1	92	92	92	92	92	92	92	95	97	99	101
	V_R	113	113	113	113	113	113	113	113	114	115	115
	V_2	122	122	122	122	122	122	121	121	120	119	119
	TOFL	6060	6180	6310	6440	6570	6700	6860	7150	7440	7750	8060
34000	V_1	97	97	97	97	97	96	97	100	103	105	107
	V_R	116	116	117	117	117	117	117	118	119	119	120
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	6260	6390	6520	6660	6800	6930	7100	7400	7720	8040	8370
36000	V_1	102	102	102	102	102	102	102	106	108	111	113
	V_R	121	121	121	121	121	121	121	122	123	123	124
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	6460	6590	6740	6880	7010	7160	7330	7650	7990	8330	8680
38000	V_1	107	107	107	107	107	107	108	111	114	117	119
	V_R	125	125	125	125	125	125	125	126	127	127	128
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	6660	6800	6940	7090	7230	7380	7560	7900	8260	8680	9380
38850	V_1	109	109	109	109	109	109	110	113	116	119	121
	V_R	127	127	127	127	127	127	127	128	128	129	129
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	6740	6880	7030	7180	7330	7470	7650	8010	8410	9110	9840

TODATA7K_WATER126_F20_ALL_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-145. (07-01-24-19)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 8000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		–40	–35	–30	–25	–20	–15	–10	–5	0	5	10
28000	V_1	82	82	82	82	82	82	85	87	89	91	93
	V_R	107	107	107	107	107	107	107	107	107	107	108
	V_2	124	124	124	124	124	124	123	122	121	120	120
	TOFL	5860	5980	6110	6230	6350	6480	6730	7000	7280	7570	7880
30000	V_1	86	86	86	86	86	86	89	91	93	95	97
	V_R	109	109	109	109	109	109	109	109	110	111	111
	V_2	123	123	123	123	123	123	122	121	120	119	119
	TOFL	6080	6210	6340	6470	6600	6730	6990	7280	7590	7900	8230
32000	V_1	92	92	92	92	91	91	94	96	99	101	103
	V_R	113	113	113	113	113	113	113	114	115	115	116
	V_2	122	122	122	122	122	122	121	120	119	119	118
	TOFL	6290	6420	6560	6700	6830	6970	7250	7570	7890	8220	8570
34000	V_1	97	97	96	96	96	96	99	102	105	107	110
	V_R	117	117	117	117	117	117	118	118	119	120	120
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	6510	6640	6790	6930	7070	7210	7510	7840	8190	8540	8910
36000	V_1	102	102	102	101	101	101	105	108	111	113	116
	V_R	121	121	121	121	121	121	122	123	123	124	124
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	6710	6860	7000	7150	7300	7440	7760	8120	8480	8850	9250
38000	V_1	107	107	107	107	106	107	110	113	116	118	121
	V_R	125	125	125	125	125	125	126	127	127	128	128
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	6920	7070	7220	7370	7520	7680	8010	8390	8780	9510	10290
38850	V_1	109	109	109	109	109	109	112	116	118	121	123
	V_R	127	127	127	127	127	127	128	128	129	129	130
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	7000	7160	7310	7460	7620	7780	8120	8500	9220	9980	10810

TODATA6K_WATER125_F20_ALL_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-146. (07-01-24-20)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 9000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	83	83	83	83	82	84	87	89	90	92	94
	V_R	107	107	107	107	107	107	107	107	107	108	108
	V_2	124	124	124	124	123	123	122	121	120	120	119
	TOFL	6110	6250	6380	6510	6640	6830	7110	7410	7710	8030	8380
30000	V_1	86	86	86	86	86	88	90	92	95	97	99
	V_R	109	109	109	109	109	109	109	110	111	111	112
	V_2	123	123	123	123	122	122	121	120	119	119	118
	TOFL	6350	6480	6620	6750	6890	7100	7400	7710	8050	8380	8760
32000	V_1	92	92	92	91	91	93	95	98	100	103	106
	V_R	113	113	113	113	113	113	114	115	115	116	116
	V_2	122	122	122	122	122	121	120	119	119	118	118
	TOFL	6570	6720	6860	7000	7140	7360	7680	8020	8370	8730	9140
34000	V_1	97	97	96	96	96	98	101	104	107	109	112
	V_R	117	117	117	117	117	118	118	119	120	120	121
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	6800	6950	7090	7240	7390	7620	7960	8320	8700	9080	9510
36000	V_1	102	102	102	102	101	103	107	110	113	115	117
	V_R	121	121	121	121	121	122	123	123	124	124	125
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	7020	7170	7320	7470	7630	7880	8240	8620	9010	9420	10080
38000	V_1	107	107	107	107	107	109	112	115	118	120	123
	V_R	125	125	125	125	125	126	127	127	128	128	129
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	7230	7390	7550	7710	7870	8130	8510	8910	9630	10420	11370
38850	V_1	109	109	109	109	109	111	115	118	120	122	125
	V_R	127	127	127	127	127	127	128	129	129	130	130
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	7330	7490	7650	7810	7970	8240	8620	9280	10110	10950	11930

TODATA9K_WATER125_F20_ALL_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-147. (07-01-24-21)

CONTAMINATED RUNWAY TAKEOFF DATA
MODERATE CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 10000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

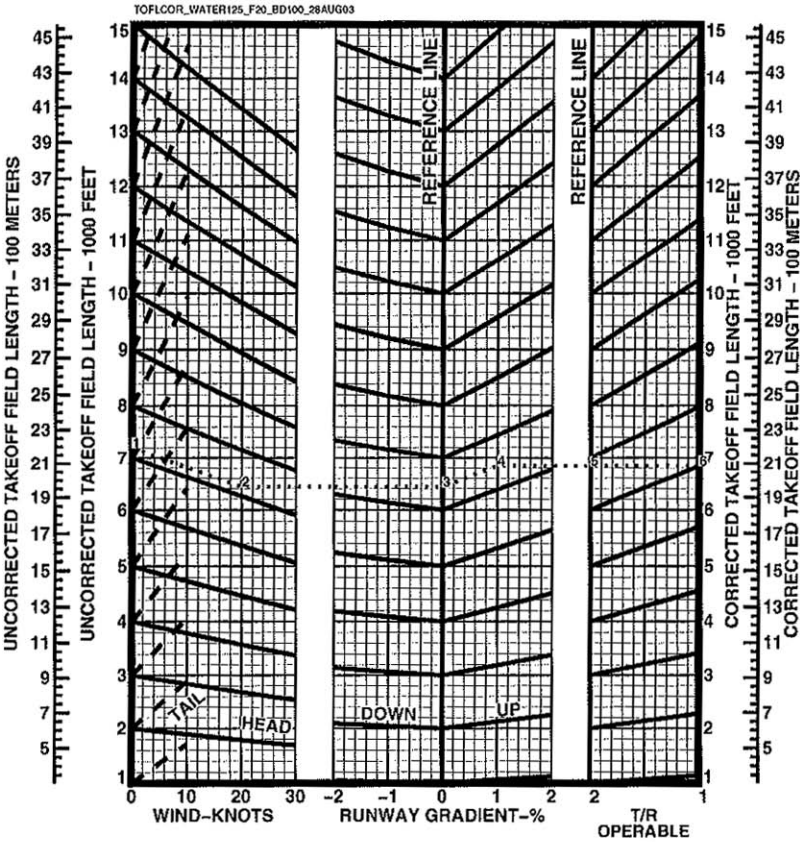
WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	83	83	83	83	84	86	88	90	92	94	96
	V_R	107	107	107	107	107	107	107	107	108	108	109
	V_2	123	123	123	123	123	122	121	120	120	119	118
	TOFL	6390	6530	6670	6800	6980	7220	7530	7850	8180	8530	8940
30000	V_1	87	87	87	87	88	89	92	94	96	99	102
	V_R	109	109	109	109	109	109	110	111	111	112	112
	V_2	122	122	122	122	122	121	120	120	119	118	118
	TOFL	6640	6780	6930	7070	7250	7510	7840	8190	8540	8910	9360
32000	V_1	92	92	92	92	92	94	97	100	103	105	108
	V_R	113	113	113	113	113	114	115	115	116	116	117
	V_2	122	121	121	121	121	120	119	119	118	118	118
	TOFL	6880	7030	7180	7330	7520	7800	8150	8530	8900	9290	9770
34000	V_1	97	97	97	97	98	100	103	106	109	111	114
	V_R	117	117	117	117	117	118	119	120	120	121	121
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	7120	7270	7430	7580	7780	8080	8450	8850	9250	9670	10180
36000	V_1	102	102	102	102	103	105	109	112	115	117	119
	V_R	121	121	121	122	122	122	123	124	124	125	125
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	7350	7510	7670	7830	8050	8360	8760	9180	9600	10170	11160
38000	V_1	107	107	107	107	108	111	115	118	120	122	
	V_R	125	125	125	125	126	126	127	128	128	128	
	V_2	129	129	129	129	129	129	129	129	129	129	
	TOFL	7580	7750	7920	8080	8300	8630	9060	9730	10560	11460	
38850	V_1	110	109	109	109	110	113	117	120	122	124	
	V_R	127	127	127	127	127	128	129	129	130	130	
	V_2	130	130	130	130	130	130	130	130	130	130	
	TOFL	7680	7850	8020	8190	8410	8750	9300	10210	11090	12040	

TODATA10K_WATER125_F20_ALL_IMP_BD100_05MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-148. (07-01-24-22)

CONTAMINATED RUNWAY TAKEOFF FIELD LENGTH
MODERATE CONTAMINANT DEPTH
CORRECTION CHART
FLAPS 20°

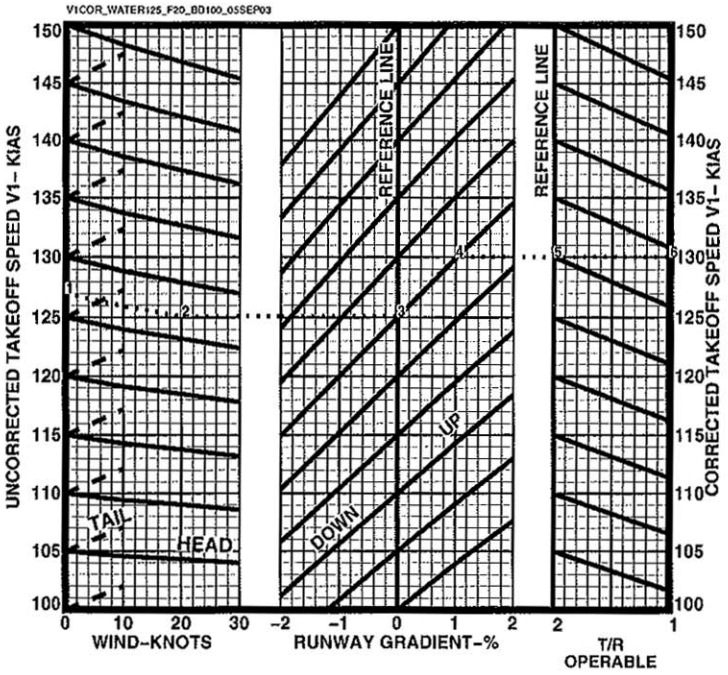


EXAMPLE:

1. Uncorrected Takeoff Field Length (from table).....7200 ft (2200 m)
2. Headwind.....20 kt
3. Runway Gradient Reference Line
4. Runway Gradient.....1.0% UP
5. Two Thrust Reversers
6. Corrected Takeoff Field Length.....6850 ft (2090 m)

Figure SUP1-149. (07-01-24-23)

CONTAMINATED TAKEOFF SPEEDS
MODERATE CONTAMINANT DEPTH
CORRECTION CHART FOR V1
FLAPS 20°



EXAMPLE:

1. Uncorrected Takeoff Speed (from table).....127 kias
2. Headwind.....20 kt
3. Runway Gradient Reference Line
4. Runway Gradient.....1.0% UP
5. Two Thrust Reversers
6. Corrected Takeoff Speed.....130 kias

NOTES:

1. V1mcg is limiting when the corrected V1 is less than 116 kias. In this case, use V1=116 kias.
2. If the corrected V1 exceeds VR for the appropriate conditions, use V1=VR.

Figure SUP1-150. (07-01-24-24)

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CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON

ALTITUDE SEA LEVEL
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C								
		10	15	20	25	30	35	40	45	50
28000	V_1	84	84	84	84	84	85	87	88	91
	V_R	107	107	107	107	107	107	107	107	107
	V_2	124	124	124	124	124	124	123	122	121
	TOFL	5220	5310	5400	5490	5600	5790	6020	6280	6580
30000	V_1	87	87	87	87	87	88	90	92	95
	V_R	109	109	109	109	109	109	109	109	110
	V_2	123	123	123	123	123	123	122	121	120
	TOFL	5410	5500	5600	5690	5810	6020	6270	6550	6860
32000	V_1	93	93	93	93	93	93	96	98	101
	V_R	112	112	112	112	112	112	113	114	114
	V_2	122	122	122	122	122	122	121	120	119
	TOFL	5600	5700	5800	5900	6020	6240	6510	6800	7140
34000	V_1	98	98	98	98	98	99	101	103	107
	V_R	116	116	116	116	116	117	117	118	119
	V_2	121	121	121	121	121	121	121	121	121
	TOFL	5790	5890	6000	6100	6220	6460	6750	7060	7420
36000	V_1	104	104	103	103	103	104	106	109	112
	V_R	121	121	121	121	121	121	122	122	123
	V_2	125	125	125	125	125	125	125	125	125
	TOFL	5970	6080	6190	6290	6430	6680	6980	7310	7700
38000	V_1	108	108	108	108	108	109	112	115	118
	V_R	125	125	125	125	125	125	126	126	127
	V_2	128	128	128	128	128	128	128	128	128
	TOFL	6160	6270	6380	6490	6630	6890	7210	7570	8230
38850	V_1	111	110	110	110	110	112	114	117	120
	V_R	126	126	126	126	126	127	127	128	129
	V_2	130	130	130	130	130	130	130	130	130
	TOFL	6240	6350	6460	6570	6710	6980	7310	7770	8650

TODATASL_WATER25_F20_ECS_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-151. (07-01-25-01)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 1000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C								
		10	15	20	25	30	35	40	45	50
28000	V_1	84	84	84	84	84	86	88	90	91
	V_R	107	107	107	107	107	107	107	107	107
	V_2	124	124	124	124	124	123	122	121	121
	TOFL	5410	5500	5600	5700	5900	6110	6360	6650	6840
30000	V_1	87	87	87	87	88	89	91	94	96
	V_R	109	109	109	109	109	109	109	110	110
	V_2	123	123	123	123	123	122	121	120	120
	TOFL	5610	5710	5810	5910	6120	6360	6620	6930	7140
32000	V_1	92	92	93	93	93	95	97	99	101
	V_R	112	112	112	113	112	113	113	114	115
	V_2	122	122	122	122	122	121	120	120	119
	TOFL	5810	5910	6020	6120	6350	6600	6880	7210	7430
34000	V_1	98	98	98	98	99	100	102	105	107
	V_R	116	116	116	116	117	117	118	119	119
	V_2	122	122	122	122	122	122	122	122	122
	TOFL	6010	6120	6220	6330	6570	6830	7140	7490	7730
36000	V_1	103	103	103	103	103	106	108	111	113
	V_R	121	121	121	121	121	122	122	123	123
	V_2	125	125	125	125	125	125	125	125	125
	TOFL	6200	6310	6430	6540	6790	7070	7390	7770	8020
38000	V_1	108	108	108	108	109	111	114	117	119
	V_R	125	125	125	125	125	126	126	127	127
	V_2	128	128	128	128	128	128	128	128	128
	TOFL	6390	6510	6620	6740	7010	7300	7650	8130	8670
38850	V_1	110	110	110	110	111	113	116	119	121
	V_R	126	126	126	126	127	127	128	128	129
	V_2	130	130	130	130	130	130	130	130	130
	TOFL	6480	6590	6710	6830	7100	7400	7750	8550	9120

TODATA1K_WATER25_F20_ECS_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-152. (07-01-25-02)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 2000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C								
		10	15	20	25	30	35	40	45	46
28000	V_1	83	83	83	84	86	87	89	91	92
	V_R	107	107	107	107	107	107	107	107	107
	V_2	124	124	124	124	123	122	121	121	120
	TOFL	5620	5710	5810	6000	6210	6450	6730	7040	7120
30000	V_1	87	87	87	87	89	91	93	96	96
	V_R	109	109	109	109	109	109	109	110	110
	V_2	123	123	123	123	122	121	121	120	120
	TOFL	5830	5930	6030	6230	6460	6710	7010	7360	7430
32000	V_1	92	92	92	93	94	96	98	101	102
	V_R	112	113	113	113	113	113	114	115	115
	V_2	122	122	122	122	121	120	120	119	119
	TOFL	6030	6140	6250	6460	6710	6980	7290	7660	7740
34000	V_1	98	98	98	98	100	102	104	107	108
	V_R	116	116	116	117	117	118	118	119	119
	V_2	122	122	122	122	122	122	122	122	122
	TOFL	6240	6350	6460	6690	6950	7240	7570	7970	8050
36000	V_1	103	103	103	103	105	107	110	113	114
	V_R	121	121	121	121	122	122	123	123	124
	V_2	125	125	125	125	125	125	125	125	125
	TOFL	6440	6560	6680	6910	7190	7490	7850	8270	8360
38000	V_1	108	108	108	108	110	113	116	119	119
	V_R	125	125	125	125	126	126	127	127	127
	V_2	129	129	129	129	129	129	129	129	129
	TOFL	6640	6760	6880	7130	7420	7740	8120	8950	9140
38850	V_1	110	110	110	110	113	115	118	121	122
	V_R	126	126	127	127	127	128	128	129	129
	V_2	130	130	130	130	130	130	130	130	130
	TOFL	6730	6850	6970	7220	7520	7850	8490	9410	9620

TODATA2K_WATER25_F20_ECS_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-153. (07-01-25-03)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 3000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C							
		10	15	20	25	30	35	40	44
28000	V_1	83	83	84	85	87	89	91	92
	V_R	107	107	107	107	107	107	107	107
	V_2	124	124	124	123	122	122	121	120
	TOFL	5830	5930	6100	6310	6560	6820	7120	7410
30000	V_1	87	87	87	89	90	92	95	97
	V_R	109	109	109	109	109	109	110	111
	V_2	123	123	123	122	121	121	120	119
	TOFL	6050	6160	6340	6570	6830	7110	7430	7740
32000	V_1	92	92	93	94	96	98	100	103
	V_R	113	113	113	113	113	114	115	115
	V_2	122	122	122	121	121	120	119	119
	TOFL	6270	6380	6570	6810	7090	7390	7740	8070
34000	V_1	98	97	98	99	101	103	106	109
	V_R	116	117	117	117	118	118	119	120
	V_2	122	122	122	122	122	122	122	122
	TOFL	6490	6600	6800	7060	7350	7670	8040	8390
36000	V_1	103	102	103	105	107	109	112	115
	V_R	121	121	121	121	122	123	123	124
	V_2	125	125	125	125	125	125	125	125
	TOFL	6700	6820	7030	7300	7610	7950	8350	8720
38000	V_1	108	108	108	110	112	115	118	120
	V_R	125	125	125	125	126	127	127	128
	V_2	129	129	129	129	129	129	129	129
	TOFL	6900	7030	7250	7540	7870	8230	8880	9660
38850	V_1	110	110	110	112	115	117	120	122
	V_R	127	127	127	127	128	128	129	129
	V_2	130	130	130	130	130	130	130	130
	TOFL	6980	7120	7340	7640	7980	8500	9340	10160

TODATA3K_WATER25_F20_ECS_IMP,,BD100_16MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-154. (07-01-25-04)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 4000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C							
		10	15	20	25	30	35	40	42
28000	V_1	83	83	85	87	88	90	92	93
	V_R	107	107	107	107	107	107	107	108
	V_2	124	124	123	122	122	121	120	120
	TOFL	6060	6210	6420	6660	6930	7220	7560	7710
30000	V_1	87	87	88	90	92	94	96	97
	V_R	109	109	109	109	109	110	111	111
	V_2	123	123	122	121	121	120	119	119
	TOFL	6290	6450	6680	6940	7230	7530	7900	8060
32000	V_1	92	92	94	95	97	100	102	104
	V_R	113	113	113	113	114	115	115	115
	V_2	122	122	121	121	120	119	119	118
	TOFL	6520	6690	6930	7200	7510	7850	8230	8410
34000	V_1	97	97	99	101	103	105	108	110
	V_R	117	117	117	118	118	119	120	120
	V_2	122	122	122	122	122	122	122	122
	TOFL	6740	6920	7180	7470	7800	8150	8570	8760
36000	V_1	102	102	104	106	109	111	114	115
	V_R	121	121	121	122	123	123	124	124
	V_2	125	125	125	125	125	125	125	125
	TOFL	6960	7150	7420	7730	8080	8450	8900	9100
38000	V_1	108	108	109	112	114	117	120	121
	V_R	125	125	125	126	126	127	128	128
	V_2	129	129	129	129	129	129	129	129
	TOFL	7180	7380	7660	7990	8360	8890	9800	10220
38850	V_1	110	110	112	114	117	119	122	123
	V_R	127	127	127	128	128	129	129	129
	V_2	130	130	130	130	130	130	130	130
	TOFL	7280	7480	7760	8100	8550	9350	10310	10730

TODATA4K_WATER25_F20_ECS_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-155. (07-01-25-05)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 5000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C						
		10	15	20	25	30	35	40
28000	V_1	83	85	86	88	90	91	93
	V_R	107	107	107	107	107	107	108
	V_2	124	123	122	122	121	120	120
	TOFL	6330	6540	6760	7040	7350	7650	8040
30000	V_1	87	88	90	91	93	96	98
	V_R	109	109	109	109	110	111	111
	V_2	123	122	121	121	120	119	119
	TOFL	6580	6800	7030	7340	7670	7990	8410
32000	V_1	92	93	95	97	99	101	104
	V_R	113	113	113	114	114	115	116
	V_2	122	121	121	120	119	119	118
	TOFL	6820	7050	7300	7630	7980	8330	8780
34000	V_1	97	98	100	102	105	108	111
	V_R	117	117	118	118	119	119	120
	V_2	122	122	122	122	122	122	122
	TOFL	7060	7300	7570	7920	8280	8660	9140
36000	V_1	102	104	106	108	111	114	116
	V_R	121	121	122	123	123	124	124
	V_2	125	125	125	125	125	125	125
	TOFL	7290	7550	7840	8200	8600	8990	9550
38000	V_1	108	109	111	114	116	119	122
	V_R	125	125	126	126	127	128	128
	V_2	129	129	129	129	129	129	129
	TOFL	7520	7800	8100	8490	8940	9780	10800
38850	V_1	110	111	114	116	119	121	124
	V_R	127	127	128	128	129	129	130
	V_2	130	130	130	130	130	130	130
	TOFL	7620	7900	8200	8610	9400	10280	11370

TODATA5K_WATER25_F20_ECS_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-156. (07-01-25-06)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 6000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C						
		10	15	20	25	30	35	38
28000	V_1	84	86	86	89	91	93	94
	V_R	107	107	107	107	107	108	108
	V_2	123	122	122	121	120	120	119
	TOFL	6670	6890	7150	7450	7790	8150	8410
30000	V_1	88	90	91	93	95	97	99
	V_R	109	109	109	110	110	111	112
	V_2	122	121	121	120	120	119	119
	TOFL	6940	7170	7440	7780	8130	8520	8800
32000	V_1	93	95	96	98	101	104	105
	V_R	113	113	114	114	115	116	116
	V_2	121	121	120	119	119	118	118
	TOFL	7190	7450	7740	8090	8470	8890	9190
34000	V_1	98	100	102	104	107	110	111
	V_R	117	118	118	119	119	120	120
	V_2	122	122	122	122	122	122	122
	TOFL	7460	7720	8030	8400	8810	9260	9570
36000	V_1	103	105	108	110	113	116	117
	V_R	122	122	123	123	124	124	124
	V_2	125	125	125	125	125	125	125
	TOFL	7710	7990	8320	8710	9150	9620	10160
38000	V_1	109	111	113	116	118	121	123
	V_R	126	126	126	127	127	128	128
	V_2	129	129	129	129	129	129	129
	TOFL	7960	8260	8600	9020	9820	10820	11500
38850	V_1	111	113	116	118	121	123	125
	V_R	127	128	128	129	129	130	130
	V_2	130	130	130	130	130	130	130
	TOFL	8060	8370	8720	9430	10330	11360	12100

TODATA6K_WATER25_F20_ECS_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-157. (07-01-25-07)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 7000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C						
		10	15	20	25	30	35	36
28000	V_1	86	87	89	90	92	94	95
	V_R	107	107	107	107	108	108	108
	V_2	122	122	121	120	120	119	119
	TOFL	7030	7270	7560	7900	8270	8690	8790
30000	V_1	89	91	92	94	97	99	100
	V_R	109	109	110	110	111	112	112
	V_2	121	121	120	120	119	118	118
	TOFL	7320	7580	7880	8250	8640	9100	9200
32000	V_1	94	96	98	100	103	106	106
	V_R	113	114	114	115	116	116	116
	V_2	121	120	120	119	118	118	118
	TOFL	7600	7880	8200	8590	9020	9510	9620
34000	V_1	100	102	104	106	109	112	112
	V_R	118	118	119	119	120	120	121
	V_2	122	122	122	122	122	122	122
	TOFL	7880	8170	8520	8930	9380	9910	10030
36000	V_1	105	107	110	112	115	118	118
	V_R	122	123	123	123	124	125	125
	V_2	125	125	125	125	125	125	125
	TOFL	8150	8460	8840	9270	9750	10590	10830
38000	V_1	111	113	115	117	120	123	123
	V_R	126	126	127	127	128	128	128
	V_2	129	129	129	129	129	129	129
	TOFL	8430	8750	9140	9840	10820	11980	12240
38850	V_1	113	115	118	120	122	125	126
	V_R	128	128	129	129	129	130	130
	V_2	130	130	130	130	130	130	130
	TOFL	8540	8870	9490	10350	11400	12610	12900

TODATA7K_WATER25_F20_ECS_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-158. (07-01-25-08)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 8000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C					
		10	15	20	25	30	34
28000	V_1	87	88	90	91	94	96
	V_R	107	107	107	108	108	109
	V_2	122	121	121	120	119	119
	TOFL	7420	7690	8010	8390	8810	9190
30000	V_1	90	92	94	96	98	101
	V_R	109	110	110	111	112	112
	V_2	121	120	120	119	119	118
	TOFL	7730	8020	8360	8770	9220	9640
32000	V_1	96	98	100	102	105	107
	V_R	114	114	115	115	116	117
	V_2	120	120	119	118	118	118
	TOFL	8030	8340	8710	9140	9630	10070
34000	V_1	101	103	106	108	111	113
	V_R	118	119	119	120	120	121
	V_2	122	122	122	122	122	122
	TOFL	8330	8660	9050	9520	10030	10510
36000	V_1	107	109	112	114	117	119
	V_R	123	123	123	124	124	125
	V_2	125	125	125	125	125	125
	TOFL	8630	8980	9390	9890	10570	11500
38000	V_1	113	115	117	119	122	124
	V_R	126	127	127	128	128	129
	V_2	129	129	129	129	129	129
	TOFL	8930	9290	9890	10820	11970	13050
38850	V_1	116	117	119	122	124	
	V_R	128	129	129	129	130	
	V_2	130	130	130	130	130	
	TOFL	9050	9600	10400	11380	12590	

TODATA8K_WATER26_F20_ECS_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-159. (07-01-25-09)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 9000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C 10	15	20	25	30	32
28000	V_1	88	89	91	93	96	97
	V_R	107	107	108	108	109	109
	V_2	121	121	120	119	119	118
	TOFL	7840	8140	8500	8930	9410	9620
30000	V_1	92	93	95	98	101	102
	V_R	110	110	111	111	112	112
	V_2	120	120	119	119	118	118
	TOFL	8170	8490	8880	9340	9860	10090
32000	V_1	97	99	101	104	107	108
	V_R	114	115	115	116	117	117
	V_2	120	119	119	118	118	118
	TOFL	8500	8840	9250	9750	10310	10560
34000	V_1	103	105	108	110	113	114
	V_R	119	119	120	120	121	121
	V_2	122	122	122	122	122	122
	TOFL	8830	9190	9630	10160	10760	11020
36000	V_1	109	111	113	116	119	120
	V_R	123	123	124	124	125	125
	V_2	125	125	125	125	125	125
	TOFL	9150	9530	10000	10560	11720	12240
38000	V_1	115	117	119	121	124	
	V_R	127	127	128	128	129	
	V_2	129	129	129	129	129	
	TOFL	9470	10000	10860	11960	13290	
38850	V_1	117	119	121	123		
	V_R	129	129	129	130		
	V_2	130	130	130	130		
	TOFL	9750	10510	11420	12570		

TODATA9K_WATER25_F20_ECS_IMP_BD100_16MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-160. (07-01-25-10)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON

ALTITUDE 10000
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C				
		10	15	20	25	30
28000	V_1	89	90	92	95	98
	V_R	107	108	108	109	109
	V_2	121	120	119	119	118
	TOFL	8290	8610	9030	9520	10080
30000	V_1	93	95	97	100	103
	V_R	110	111	111	112	113
	V_2	120	119	119	118	118
	TOFL	8650	8990	9450	9980	10580
32000	V_1	99	101	103	106	109
	V_R	115	115	116	116	117
	V_2	119	119	118	118	118
	TOFL	9010	9380	9860	10430	11070
34000	V_1	105	107	109	112	115
	V_R	119	120	120	121	121
	V_2	122	122	122	122	122
	TOFL	9360	9750	10270	10880	11570
36000	V_1	111	113	116	118	121
	V_R	124	124	124	125	125
	V_2	125	125	125	125	125
	TOFL	9720	10130	10680	11670	13050
38000	V_1	116	119	121	123	
	V_R	127	128	128	129	
	V_2	129	129	129	129	
	TOFL	10140	10940	11920	13210	
38850	V_1	119	121	123	125	
	V_R	129	129	130	130	
	V_2	130	130	130	130	
	TOFL	10660	11500	12560	13930	

TODATA10K_WATER25_F20_ECS_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-161. (07-01-25-11)

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CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE SEA LEVEL
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE - °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	86	84	84	84	84	84	84	84	84	84	84
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	125	125	125	125	125	124	124	124
	TOFL	4290	4390	4480	4570	4660	4760	4850	4950	5040	5130	5220
30000	V_1	87	87	87	87	87	87	87	87	87	87	87
	V_R	108	108	108	108	108	108	108	108	108	108	109
	V_2	124	124	124	124	124	124	124	123	123	123	123
	TOFL	4440	4540	4640	4740	4830	4930	5030	5130	5220	5320	5410
32000	V_1	93	93	93	93	93	93	93	93	93	93	93
	V_R	112	112	112	112	112	112	112	112	112	112	112
	V_2	123	123	123	123	123	123	123	122	122	122	122
	TOFL	4590	4700	4800	4900	5000	5100	5210	5310	5410	5500	5610
34000	V_1	98	98	98	98	98	98	98	98	98	98	98
	V_R	116	116	116	116	116	116	116	116	116	116	116
	V_2	122	122	122	122	122	122	122	121	121	121	121
	TOFL	4740	4850	4960	5060	5160	5270	5380	5490	5590	5690	5790
36000	V_1	104	104	104	104	104	104	104	104	104	104	104
	V_R	120	120	120	120	120	120	120	120	120	121	121
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	4890	5000	5110	5220	5330	5440	5550	5660	5760	5870	5980
38000	V_1	110	110	110	109	109	109	109	109	109	109	109
	V_R	124	124	124	124	124	124	124	124	125	125	125
	V_2	128	128	128	128	128	128	128	128	128	128	128
	TOFL	5030	5150	5260	5380	5490	5600	5720	5830	5940	6050	6170
38850	V_1	112	112	112	112	111	111	111	111	111	111	111
	V_R	126	126	126	126	126	126	126	126	126	126	126
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	5090	5210	5330	5440	5550	5670	5790	5900	6020	6130	6240

TODATASL_WATER25_F20_ALL_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-162. (07-01-25-12)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 1000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10			
28000	V_1	84	84	84	84	84	84	84	84	84	84	84			
	V_R	107	107	107	107	107	107	107	107	107	107	107			
	V_2	125	125	125	125	125	125	125	124	124	124	124			
	TOFL	4460	4550	4650	4750	4840	4940	5040	5130	5220	5320	5410			
30000	V_1	87	87	87	87	87	87	87	87	87	87	87			
	V_R	108	108	108	108	108	108	108	108	109	109	109			
	V_2	124	124	124	124	124	124	123	123	123	123	123			
	TOFL	4620	4720	4820	4920	5020	5130	5220	5320	5420	5520	5620			
32000	V_1	93	93	93	92	92	92	92	92	93	93	93			
	V_R	112	112	112	112	112	112	112	112	112	112	112			
	V_2	123	123	123	123	123	122	122	122	122	122	122			
	TOFL	4780	4880	4990	5090	5200	5300	5410	5510	5610	5710	5820			
34000	V_1	98	98	98	98	98	98	98	98	98	98	98			
	V_R	116	116	116	116	116	116	116	116	116	116	116			
	V_2	122	122	122	122	122	122	122	122	122	122	122			
	TOFL	4930	5040	5150	5260	5370	5480	5580	5690	5800	5910	6010			
36000	V_1	104	104	104	104	104	104	104	104	104	103	103			
	V_R	120	120	120	120	120	120	120	120	121	121	121			
	V_2	125	125	125	125	125	125	125	125	125	125	125			
	TOFL	5080	5200	5310	5420	5540	5650	5760	5870	5990	6100	6210			
38000	V_1	109	109	109	109	109	109	109	108	108	108	108			
	V_R	124	124	124	124	124	124	125	125	125	125	125			
	V_2	128	128	128	128	128	128	128	128	128	128	128			
	TOFL	5230	5350	5470	5590	5710	5820	5940	6050	6170	6290	6400			
38850	V_1	112	112	111	111	111	111	111	111	110	110	110			
	V_R	126	126	126	126	126	126	126	126	126	126	126			
	V_2	130	130	130	130	130	130	130	130	130	130	130			
	TOFL	5300	5420	5540	5660	5770	5900	6010	6130	6250	6360	6480			

TODATA1K_WATER25_F20_ALL_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-163. (07-01-25-13)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 2000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	84	84	84	84	84	84	84	84	84	84	85
	V_R	107	107	107	107	107	107	107	107	107	107	107
	V_2	125	125	125	125	125	124	124	124	124	124	124
	TOFL	4630	4730	4830	4930	5030	5130	5230	5320	5420	5520	5640
30000	V_1	87	87	87	87	87	87	87	87	87	87	88
	V_R	108	108	108	108	108	109	109	109	109	109	109
	V_2	124	124	124	124	123	123	123	123	123	123	123
	TOFL	4800	4910	5010	5120	5220	5320	5420	5530	5620	5730	5850
32000	V_1	92	92	92	92	92	92	92	92	92	92	93
	V_R	112	112	112	112	112	112	112	112	112	112	112
	V_2	123	123	123	123	122	122	122	122	122	122	122
	TOFL	4960	5070	5180	5290	5400	5510	5610	5720	5820	5930	6060
34000	V_1	98	98	98	98	98	98	98	98	98	98	99
	V_R	116	116	116	116	116	116	116	116	116	116	117
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	5120	5240	5350	5470	5580	5690	5800	5910	6020	6130	6280
36000	V_1	104	104	104	104	104	104	104	103	103	103	104
	V_R	120	120	120	120	120	120	121	121	121	121	121
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	5280	5400	5530	5640	5760	5870	5990	6100	6210	6330	6480
38000	V_1	109	109	109	109	109	108	108	108	108	108	109
	V_R	124	124	124	124	125	125	125	125	125	125	125
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	5440	5570	5690	5810	5930	6050	6170	6290	6410	6530	6680
38850	V_1	111	111	111	111	111	110	110	110	110	110	111
	V_R	126	126	126	126	126	126	126	126	126	126	127
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	5510	5640	5760	5880	6000	6130	6250	6370	6490	6610	6770

TODATA2K_WATER26_F20_ALL_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-164. (07-01-25-14)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 3000
FTV$_{FTO}$=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10			
28000	V_1	84	84	84	84	84	84	84	84	83	84	86			
	V_R	107	107	107	107	107	107	107	107	107	107	107			
	V_2	125	125	125	124	124	124	124	124	124	124	123			
	TOFL	4810	4920	5020	5120	5230	5330	5430	5530	5630	5750	5940			
30000	V_1	87	87	87	87	87	87	87	87	87	88	89			
	V_R	108	108	108	109	109	109	109	109	109	109	109			
	V_2	124	124	123	123	123	123	123	123	123	123	122			
	TOFL	4990	5100	5210	5310	5420	5520	5630	5740	5840	5970	6170			
32000	V_1	92	92	92	92	92	92	92	92	92	93	95			
	V_R	112	112	112	112	112	112	112	112	113	113	113			
	V_2	123	123	122	122	122	122	122	122	122	122	121			
	TOFL	5160	5280	5390	5500	5610	5720	5830	5940	6050	6180	6400			
34000	V_1	98	98	98	98	98	98	98	98	98	99	100			
	V_R	116	116	116	116	116	116	116	116	116	117	117			
	V_2	122	122	122	122	122	122	122	122	122	122	122			
	TOFL	5330	5450	5560	5680	5800	5910	6030	6140	6260	6390	6630			
36000	V_1	104	104	104	104	104	103	103	103	103	104	106			
	V_R	120	120	120	120	121	121	121	121	121	121	122			
	V_2	125	125	125	125	125	125	125	125	125	125	125			
	TOFL	5500	5620	5740	5860	5980	6100	6220	6340	6460	6600	6850			
38000	V_1	109	109	108	108	108	108	108	108	108	109	111			
	V_R	124	124	125	125	125	125	125	125	125	125	126			
	V_2	129	129	129	129	129	129	129	129	129	129	129			
	TOFL	5660	5790	5920	6040	6160	6290	6410	6540	6660	6810	7070			
38850	V_1	111	111	111	110	110	110	110	110	110	111	113			
	V_R	126	126	126	126	126	126	126	126	126	127	127			
	V_2	130	130	130	130	130	130	130	130	130	130	130			
	TOFL	5730	5860	5990	6110	6240	6370	6490	6620	6740	6900	7160			

TODATA3K_WATER25_F20_ALL_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-165. (07-01-25-15)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 4000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C												
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10		
28000	V_1	84	84	84	84	84	84	83	83	84	86	88		
	V_R	107	107	107	107	107	107	107	107	107	107	107		
	V_2	125	124	124	124	124	124	124	124	124	123	122		
	TOFL	5010	5110	5220	5320	5430	5530	5640	5740	5860	6050	6270		
30000	V_1	87	87	87	87	87	87	87	87	87	89	91		
	V_R	108	109	109	109	109	109	109	109	109	109	109		
	V_2	123	123	123	123	123	123	123	123	123	122	121		
	TOFL	5190	5300	5410	5520	5630	5740	5850	5960	6080	6290	6520		
32000	V_1	92	92	92	92	92	92	92	92	93	95	97		
	V_R	112	112	112	112	112	112	113	113	113	113	113		
	V_2	122	122	122	122	122	122	122	122	122	121	120		
	TOFL	5370	5490	5600	5720	5830	5950	6060	6170	6300	6520	6760		
34000	V_1	98	98	98	98	98	98	98	98	98	100	102		
	V_R	116	116	116	116	116	116	116	116	117	117	118		
	V_2	122	122	122	122	122	122	122	122	122	122	122		
	TOFL	5550	5670	5790	5910	6030	6150	6270	6390	6520	6750	7010		
36000	V_1	104	104	104	103	103	103	103	103	103	105	108		
	V_R	120	121	121	121	121	121	121	121	121	122	122		
	V_2	125	125	125	125	125	125	125	125	125	125	125		
	TOFL	5720	5850	5970	6100	6220	6340	6470	6590	6730	6980	7250		
38000	V_1	109	108	108	108	108	108	108	108	108	111	113		
	V_R	125	125	125	125	125	125	125	125	125	126	126		
	V_2	129	129	129	129	129	129	129	129	129	129	129		
	TOFL	5900	6030	6150	6280	6410	6540	6670	6800	6940	7200	7490		
38850	V_1	111	111	110	110	110	110	110	110	110	113	116		
	V_R	126	126	126	126	126	126	127	127	127	127	128		
	V_2	130	130	130	130	130	130	130	130	130	130	130		
	TOFL	5970	6100	6230	6360	6490	6620	6750	6880	7030	7300	7590		

TODATA4K_WATER25_F20_ALL_IMP_BD100_16MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-166. (07-01-25-16)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 5000
FTV_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10			
28000	V_1	84	84	83	83	83	83	83	83	86	87	89			
	V_R	107	107	107	107	107	107	107	107	107	107	107			
	V_2	124	124	124	124	124	124	124	124	123	122	121			
	TOFL	5200	5310	5420	5530	5640	5750	5860	5970	6160	6390	6620			
30000	V_1	87	87	87	87	87	87	87	87	89	91	93			
	V_R	109	109	109	109	109	109	109	109	109	109	109			
	V_2	123	123	123	123	123	123	123	123	122	121	121			
	TOFL	5400	5510	5620	5740	5850	5970	6090	6200	6400	6640	6890			
32000	V_1	92	92	92	92	92	92	92	92	94	96	98			
	V_R	112	112	112	112	113	113	113	113	113	113	114			
	V_2	122	122	122	122	122	122	122	122	121	120	120			
	TOFL	5580	5700	5820	5940	6060	6180	6300	6420	6640	6890	7160			
34000	V_1	98	98	98	98	98	98	98	98	100	102	104			
	V_R	116	116	116	116	116	117	117	117	117	118	119			
	V_2	122	122	122	122	122	122	122	122	122	122	122			
	TOFL	5770	5890	6020	6150	6270	6400	6520	6640	6870	7140	7420			
36000	V_1	104	103	103	103	103	103	103	103	105	107	110			
	V_R	121	121	121	121	121	121	121	121	122	122	123			
	V_2	125	125	125	125	125	125	125	125	125	125	125			
	TOFL	5960	6080	6210	6340	6470	6600	6730	6860	7110	7390	7680			
38000	V_1	108	108	108	108	108	108	108	108	110	113	115			
	V_R	125	125	125	125	125	125	125	125	126	126	127			
	V_2	129	129	129	129	129	129	129	129	129	129	129			
	TOFL	6140	6270	6410	6540	6670	6810	6940	7080	7340	7630	7940			
38850	V_1	110	110	110	110	110	110	110	110	113	115	118			
	V_R	126	126	126	127	127	127	127	127	127	128	128			
	V_2	130	130	130	130	130	130	130	130	130	130	130			
	TOFL	6210	6350	6480	6620	6760	6890	7030	7170	7430	7740	8260			

TODATA5K_WATER25_F20_ALL_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-167. (07-01-25-17)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 6000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10			
28000	V_1	83	83	83	83	83	83	83	85	87	89	90			
	V_R	107	107	107	107	107	107	107	107	107	107	107			
	V_2	124	124	124	124	124	124	124	123	122	121	121			
	TOFL	5410	5520	5630	5750	5860	5980	6090	6250	6500	6740	6990			
30000	V_1	87	87	87	87	87	87	87	88	90	93	94			
	V_R	109	109	109	109	109	109	109	109	109	109	110			
	V_2	123	123	123	123	123	123	123	122	121	121	120			
	TOFL	5610	5730	5850	5970	6090	6200	6320	6500	6760	7020	7290			
32000	V_1	92	92	92	92	92	92	92	94	96	98	100			
	V_R	112	112	113	113	113	113	113	113	113	114	115			
	V_2	122	122	122	122	122	122	122	121	120	120	119			
	TOFL	5810	5930	6050	6180	6300	6430	6550	6730	7020	7290	7580			
34000	V_1	98	98	98	98	97	97	97	99	101	104	106			
	V_R	116	116	116	117	117	117	117	117	118	119	119			
	V_2	122	122	122	122	122	122	122	122	122	122	122			
	TOFL	6000	6130	6260	6390	6520	6650	6780	6970	7270	7560	7870			
36000	V_1	103	103	103	103	103	102	102	104	107	110	112			
	V_R	121	121	121	121	121	121	121	122	122	123	123			
	V_2	125	125	125	125	125	125	125	125	125	125	125			
	TOFL	6200	6320	6460	6590	6730	6870	7000	7200	7520	7830	8150			
38000	V_1	108	108	108	108	108	108	108	109	112	115	117			
	V_R	125	125	125	125	125	125	125	126	126	127	127			
	V_2	129	129	129	129	129	129	129	129	129	129	129			
	TOFL	6380	6520	6660	6800	6940	7080	7220	7430	7770	8090	8620			
38850	V_1	110	110	110	110	110	110	110	112	115	117	120			
	V_R	126	126	127	127	127	127	127	127	128	128	129			
	V_2	130	130	130	130	130	130	130	130	130	130	130			
	TOFL	6460	6600	6740	6880	7020	7170	7310	7530	7870	8390	9060			

TODATA6K_WATER25_F20_ALL_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-168. (07-01-25-18)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 7000
FTV_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10			
28000	V_1	83	83	83	83	83	83	84	87	89	90	92			
	V_R	107	107	107	107	107	107	107	107	107	107	107			
	V_2	124	124	124	124	124	124	123	122	121	121	120			
	TOFL	5620	5730	5850	5970	6090	6210	6350	6600	6860	7130	7400			
30000	V_1	87	87	87	87	87	87	88	90	92	94	96			
	V_R	109	109	109	109	109	109	109	109	109	110	111			
	V_2	123	123	123	123	123	123	122	121	121	120	119			
	TOFL	5830	5950	6070	6190	6320	6440	6590	6860	7140	7430	7730			
32000	V_1	92	92	92	92	92	92	93	95	98	100	102			
	V_R	113	113	113	113	113	113	113	113	114	115	115			
	V_2	122	122	122	122	122	122	121	121	120	119	119			
	TOFL	6030	6160	6290	6420	6550	6680	6830	7120	7420	7730	8040			
34000	V_1	98	97	97	97	97	97	98	101	103	106	108			
	V_R	116	116	117	117	117	117	117	118	119	119	120			
	V_2	122	122	122	122	122	122	122	122	122	122	122			
	TOFL	6240	6370	6500	6640	6770	6910	7070	7380	7700	8020	8360			
36000	V_1	103	103	102	102	102	102	103	106	109	112	114			
	V_R	121	121	121	121	121	121	121	122	123	123	124			
	V_2	125	125	125	125	125	125	125	125	125	125	125			
	TOFL	6440	6570	6710	6850	6990	7130	7310	7630	7970	8310	8660			
38000	V_1	108	107	107	107	107	107	108	112	115	117	119			
	V_R	125	125	125	125	125	125	125	126	127	127	128			
	V_2	129	129	129	129	129	129	129	129	129	129	129			
	TOFL	6630	6780	6920	7070	7210	7360	7540	7880	8240	8740	9450			
38850	V_1	110	110	110	110	110	109	110	114	117	119	122			
	V_R	127	127	127	127	127	127	127	128	128	129	129			
	V_2	130	130	130	130	130	130	130	130	130	130	130			
	TOFL	6720	6860	7010	7160	7300	7450	7640	7990	8470	9190	9920			

TODATA7K_WATER25_F20_ALL_IMP_BD100_16MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-169. (07-01-25-19)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 8000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	83	83	83	83	83	83	86	88	90	91	93
	V_R	107	107	107	107	107	107	107	107	107	107	108
	V_2	124	124	124	124	124	124	123	122	121	120	120
	TOFL	5830	5950	6080	6200	6330	6450	6700	6980	7260	7550	7860
30000	V_1	87	87	87	87	87	87	89	91	94	96	98
	V_R	109	109	109	109	109	109	109	109	110	111	111
	V_2	123	123	123	123	123	123	122	121	120	119	119
	TOFL	6050	6180	6310	6440	6570	6700	6960	7260	7570	7870	8210
32000	V_1	92	92	92	92	92	92	94	97	99	102	104
	V_R	113	113	113	113	113	113	113	114	115	115	116
	V_2	122	122	122	122	122	122	121	120	119	119	118
	TOFL	6270	6400	6540	6670	6800	6940	7230	7540	7860	8200	8550
34000	V_1	97	97	97	97	97	97	100	103	105	108	110
	V_R	117	117	117	117	117	117	118	118	119	120	120
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	6480	6620	6760	6900	7040	7190	7480	7820	8160	8520	8890
36000	V_1	102	102	102	102	102	102	105	108	111	114	116
	V_R	121	121	121	121	121	121	122	123	123	124	124
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	6690	6830	6980	7130	7270	7420	7740	8100	8460	8830	9230
38000	V_1	107	107	107	107	107	107	110	114	117	119	121
	V_R	125	125	125	125	125	125	126	127	127	128	128
	V_2	129	129	129	129	129	129	129	129	129	129	129
	TOFL	6900	7050	7200	7350	7500	7660	7990	8370	8840	9580	10390
38850	V_1	110	109	109	109	109	109	113	116	119	121	123
	V_R	127	127	127	127	127	127	128	128	129	129	130
	V_2	130	130	130	130	130	130	130	130	130	130	130
	TOFL	6990	7130	7290	7440	7600	7750	8090	8520	9290	10060	10910

TODATA6K_WATER25_F20_ALL_IMP_BD100_15MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-170, (07-01-25-20)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 9000
FTV_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

WT LB	DATA	TEMPERATURE – °C													
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10			
28000	V_1	83	83	83	83	83	85	87	89	91	93	95			
	V_R	107	107	107	107	107	107	107	107	107	108	108			
	V_2	124	124	124	124	123	123	122	121	120	120	119			
	TOFL	6090	6220	6350	6480	6600	6800	7080	7380	7690	8000	8370			
30000	V_1	87	87	87	87	87	88	90	93	95	97	100			
	V_R	109	109	109	109	109	109	109	110	111	111	112			
	V_2	123	123	123	123	122	122	121	120	119	119	118			
	TOFL	6320	6460	6590	6720	6860	7070	7370	7690	8020	8360	8750			
32000	V_1	92	92	92	92	92	93	96	99	101	104	106			
	V_R	113	113	113	113	113	113	114	115	115	116	116			
	V_2	122	122	122	122	122	121	120	119	119	118	118			
	TOFL	6550	6690	6830	6970	7110	7330	7660	8000	8350	8710	9120			
34000	V_1	97	97	97	97	97	99	102	104	107	110	112			
	V_R	117	117	117	117	117	118	118	119	120	120	121			
	V_2	122	122	122	122	122	122	122	122	122	122	122			
	TOFL	6770	6920	7070	7210	7360	7600	7930	8300	8680	9060	9500			
36000	V_1	102	102	102	102	102	104	107	110	113	115	118			
	V_R	121	121	121	121	121	122	123	123	124	124	125			
	V_2	125	125	125	125	125	125	125	125	125	125	125			
	TOFL	7000	7150	7300	7450	7600	7850	8210	8600	8990	9400	10180			
38000	V_1	107	107	107	107	107	109	113	116	119	121	123			
	V_R	125	125	125	125	125	126	127	127	128	128	129			
	V_2	129	129	129	129	129	129	129	129	129	129	129			
	TOFL	7220	7370	7530	7690	7840	8100	8490	8900	9710	10520	11470			
38850	V_1	110	110	109	109	109	112	115	118	121	123	125			
	V_R	127	127	127	127	127	127	128	129	129	130	130			
	V_2	130	130	130	130	130	130	130	130	130	130	130			
	TOFL	7300	7460	7630	7780	7950	8210	8600	9350	10190	11050	12060			

TODATA9K_WATER25_F20_ALL_IMP_BD100_18MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-171. (07-01-25-21)

CONTAMINATED RUNWAY TAKEOFF DATA
HEAVY CONTAMINANT DEPTH
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON

ALTITUDE 10000 FT
V_{FTO}=170 KIAS

UNCORRECTED TAKEOFF SPEEDS (KIAS) AND FIELD LENGTH (FT)

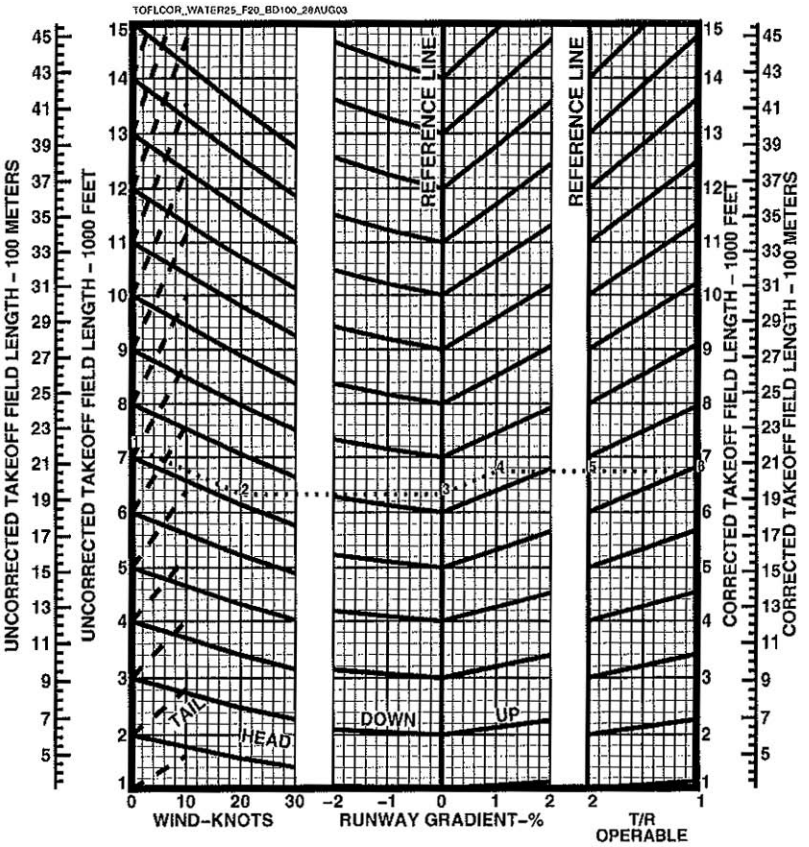
WT LB	DATA	TEMPERATURE – °C										
		-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
28000	V_1	84	84	84	84	84	86	88	90	92	94	97
	V_R	107	107	107	107	107	107	107	107	108	108	109
	V_2	123	123	123	123	123	122	121	120	120	119	118
	TOFL	6360	6500	6640	6770	6940	7190	7500	7830	8160	8510	8930
30000	V_1	88	88	88	88	88	89	92	95	97	99	102
	V_R	109	109	109	109	109	109	110	111	111	112	112
	V_2	122	122	122	122	122	121	120	120	119	118	118
	TOFL	6610	6760	6900	7040	7220	7480	7810	8170	8520	8900	9340
32000	V_1	93	92	92	92	93	95	98	101	103	106	108
	V_R	113	113	113	113	113	114	115	115	116	116	117
	V_2	122	121	121	121	121	120	119	119	118	118	118
	TOFL	6860	7000	7150	7300	7490	7770	8120	8500	8870	9280	9760
34000	V_1	98	97	97	97	98	101	104	107	109	112	114
	V_R	117	117	117	117	117	118	119	120	120	121	121
	V_2	122	122	122	122	122	122	122	122	122	122	122
	TOFL	7090	7250	7400	7550	7760	8050	8430	8830	9230	9660	10180
36000	V_1	103	103	103	103	103	106	110	113	115	117	120
	V_R	121	121	121	122	122	122	123	124	124	125	125
	V_2	125	125	125	125	125	125	125	125	125	125	125
	TOFL	7330	7490	7650	7800	8020	8330	8730	9160	9580	10260	11260
38000	V_1	108	108	108	108	109	112	115	118	121	123	
	V_R	125	125	125	125	126	126	127	128	128	128	
	V_2	129	129	129	129	129	129	129	129	129	129	
	TOFL	7560	7720	7890	8060	8280	8610	9030	9810	10660	11570	
38850	V_1	110	110	110	110	111	114	117	120	123	125	
	V_R	127	127	127	127	127	128	129	129	130	130	
	V_2	130	130	130	130	130	130	130	130	130	130	
	TOFL	7660	7820	7990	8160	8390	8720	9370	10300	11200	12140	

TODATA10K_WATER25_F20_ALL_IMP_BD100_16MAR04

NOTE :
Shaded region denotes that values are below minimum.
If no corrections are required, a minimum V_1 and V_R of 116 KIAS shall be used.

Figure SUP1-172. (07-01-25-22)

CONTAMINATED RUNWAY TAKEOFF FIELD LENGTH
HEAVY CONTAMINANT DEPTH
CORRECTION CHART
FLAPS 20°

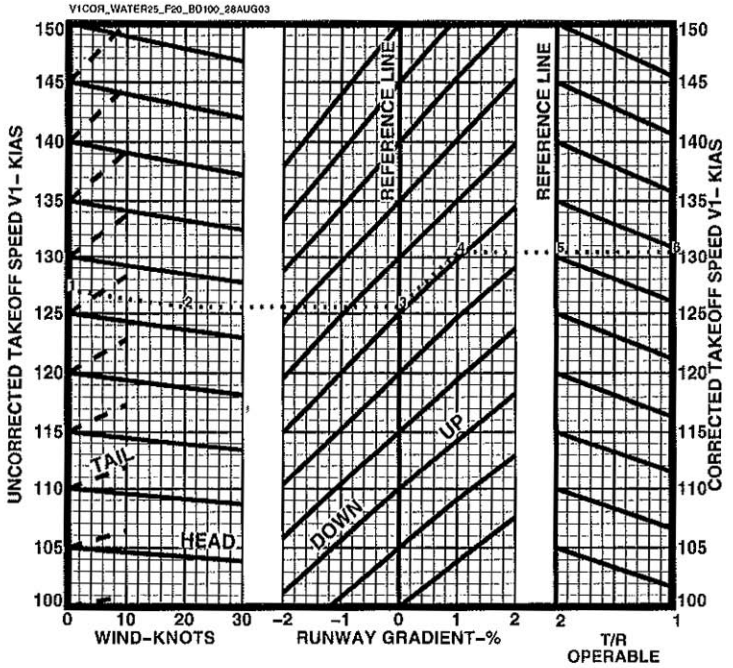


EXAMPLE:

1. Uncorrected Takeoff Field Length (from table).....7200 ft (2200 m)
2. Headwind.....20 kt
3. Runway Gradient Reference Line
4. Runway Gradient.....1.0% UP
5. Two Thrust Reversers
6. Corrected Takeoff Field Length.....6740 ft (2060 m)

Figure SUP1-173. (07-01-25-23)

CONTAMINATED TAKEOFF SPEEDS
HEAVY CONTAMINANT DEPTH
CORRECTION CHART FOR V1
FLAPS 20°



EXAMPLE:

1. Uncorrected Takeoff Speed (from table).....127 kias
2. Headwind.....20 kt
3. Runway Gradient Reference Line
4. Runway Gradient.....1.0% UP
5. Two Thrust Reversers
6. Corrected Takeoff Speed.....130 kias

NOTES:

1. V1mcg is limiting when the corrected V1 is less than 116 kias. In this case, use V1=116 kias.
2. If the corrected V1 exceeds VR for the appropriate conditions, use V1=VR.

Figure SUP1-174. (07-01-25-24)

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CONTAMINATED LANDING

CONTAMINATED RUNWAY
ICE
FLAPS 30°
ACTUAL LANDING DISTANCE

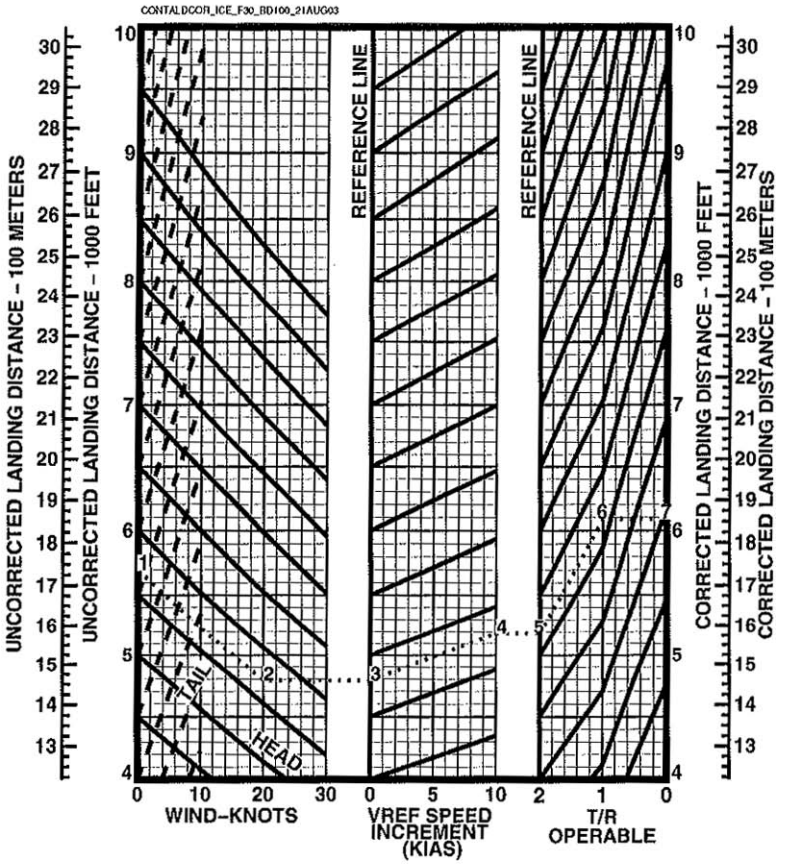
UNCORRECTED LANDING DISTANCE – FT

ALT FT	WT LB	ACTUAL DISTANCE	ALT FT	WT LB	ACTUAL DISTANCE
SEA LEVEL	28000	4740	6000	28000	5610
	30000	5010		30000	5930
	32000	5270		32000	6260
	33750	5500		33750	6540
	34000	5540		34000	6580
	36000	5800		36000	6910
	38000	6060		38000	7230
	38850	6170		38850	7360
1000	28000	4870	7000	28000	5770
	30000	5150		30000	6110
	32000	5420		32000	6450
	33750	5660		33750	6740
	34000	5700		34000	6780
	36000	5970		36000	7120
	38000	6240		38000	7450
	38850	6350		38850	7590
2000	28000	5000	8000	28000	5940
	30000	5290		30000	6290
	32000	5570		32000	6640
	33750	5820		33750	6950
	34000	5860		34000	6990
	36000	6140		36000	7340
	38000	6420		38000	7680
	38850	6540		38850	7820
3000	28000	5150	9000	28000	6120
	30000	5440		30000	6480
	32000	5740		32000	6840
	33750	5990		33750	7160
	34000	6030		34000	7210
	36000	6320		36000	7570
	38000	6610		38000	7920
	38850	6730		38850	8070
4000	28000	5300	10000	28000	6310
	30000	5600		30000	6680
	32000	5900		32000	7060
	33750	6170		33750	7380
	34000	6210		34000	7430
	36000	6510		36000	7800
	38000	6810		38000	8170
	38850	6940		38850	8320
5000	28000	5450			
	30000	5760			
	32000	6080			
	33750	6350			
	34000	6390			
	36000	6710			
	38000	7010			
	38850	7140			

CONTALD_ICE_F30_IMP_BD100_16FEB04

Figure SUP1-175. (07-01-31-01)

CONTAMINATED RUNWAY ACTUAL LANDING DISTANCE ICE CORRECTION CHART FLAPS 30°



EXAMPLE:

1. Uncorrected Landing Distance (from table).....5700 ft (1740 m)
2. Headwind.....20 kt
3. Vref Reference Line
4. Vref Speed Increment.....10 kias
5. Thrust Reverser Reference Line
6. One Thrust Reverser Operable
7. Corrected Landing Distance.....6080 ft (1860 m)

Figure SUP1-176. (07-01-31-02)

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CONTAMINATED RUNWAY
COMPACTED SNOW
FLAPS 30°
ACTUAL LANDING DISTANCE

UNCORRECTED LANDING DISTANCE – FT

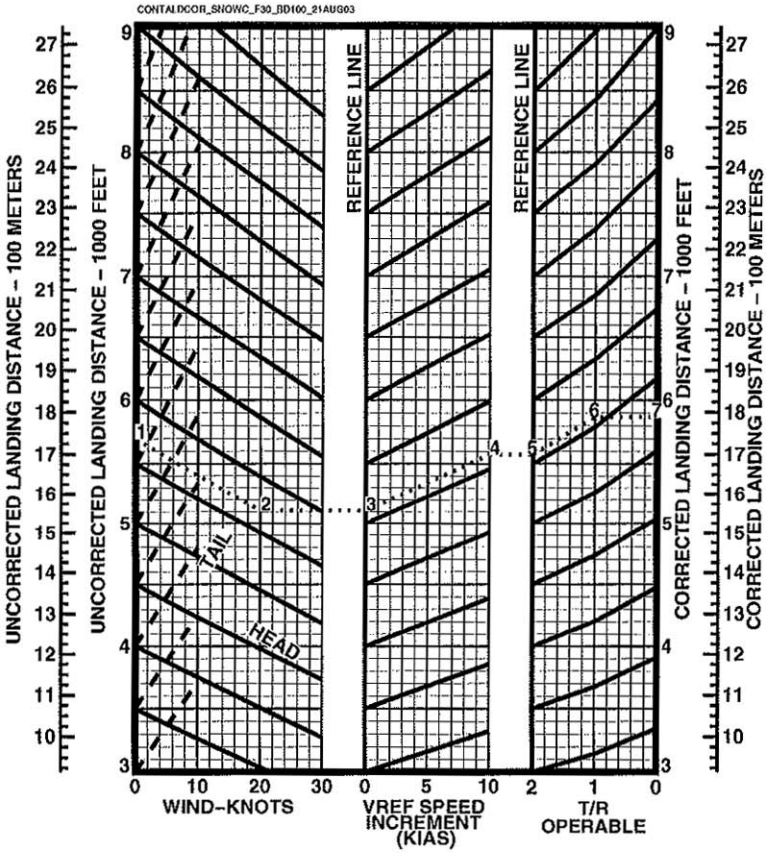
ALT FT	WT LB	ACTUAL DISTANCE	ALT FT	WT LB	ACTUAL DISTANCE
SEA LEVEL	28000	3130	6000	28000	3600
	30000	3290		30000	3790
	32000	3450		32000	3980
	33750	3590		33750	4150
	34000	3610		34000	4170
	36000	3770		36000	4360
	38000	3920		38000	4540
	38850	3990		38850	4610
1000	28000	3200	7000	28000	3690
	30000	3370		30000	3890
	32000	3530		32000	4080
	33750	3680		33750	4250
	34000	3700		34000	4280
	36000	3860		36000	4470
	38000	4020		38000	4650
	38850	4080		38850	4730
2000	28000	3280	8000	28000	3780
	30000	3450		30000	3990
	32000	3620		32000	4190
	33750	3760		33750	4360
	34000	3780		34000	4390
	36000	3950		36000	4580
	38000	4110		38000	4770
	38850	4180		38850	4850
3000	28000	3350	9000	28000	3880
	30000	3530		30000	4090
	32000	3700		32000	4290
	33750	3860		33750	4470
	34000	3880		34000	4500
	36000	4050		36000	4700
	38000	4210		38000	4900
	38850	4280		38850	4980
4000	28000	3430	10000	28000	3980
	30000	3610		30000	4190
	32000	3790		32000	4400
	33750	3950		33750	4590
	34000	3970		34000	4620
	36000	4150		36000	4820
	38000	4320		38000	5020
	38850	4390		38850	5110
5000	28000	3520			
	30000	3700			
	32000	3890			
	33750	4050			
	34000	4070			
	36000	4250			
	38000	4430			
	38850	4500			

CONTALD_SNOWC_F30_IMP_BD100_16FEB04

NOTE :
Shaded area indicate landing data above MLW.

Figure SUP1-177. (07-01-32-01)

CONTAMINATED RUNWAY ACTUAL LANDING DISTANCE COMPACTED SNOW CORRECTION CHART FLAPS 30°



EXAMPLE:

1. Uncorrected Landing Distance (from table).....5700 ft (1740 m)
2. Headwind.....20 kt
3. Vref Reference Line
4. Vref Speed Increment.....10 kias
5. Thrust Reverser Reference Line
6. One Thrust Reverser Operable
7. Corrected Landing Distance.....5860 ft (1790 m)

Figure SUP1-178. (07-01-32-02)

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CONTAMINATED RUNWAY
SLUSH/STANDING WATER/WET SNOW
FLAPS 30°
ACTUAL LANDING DISTANCE

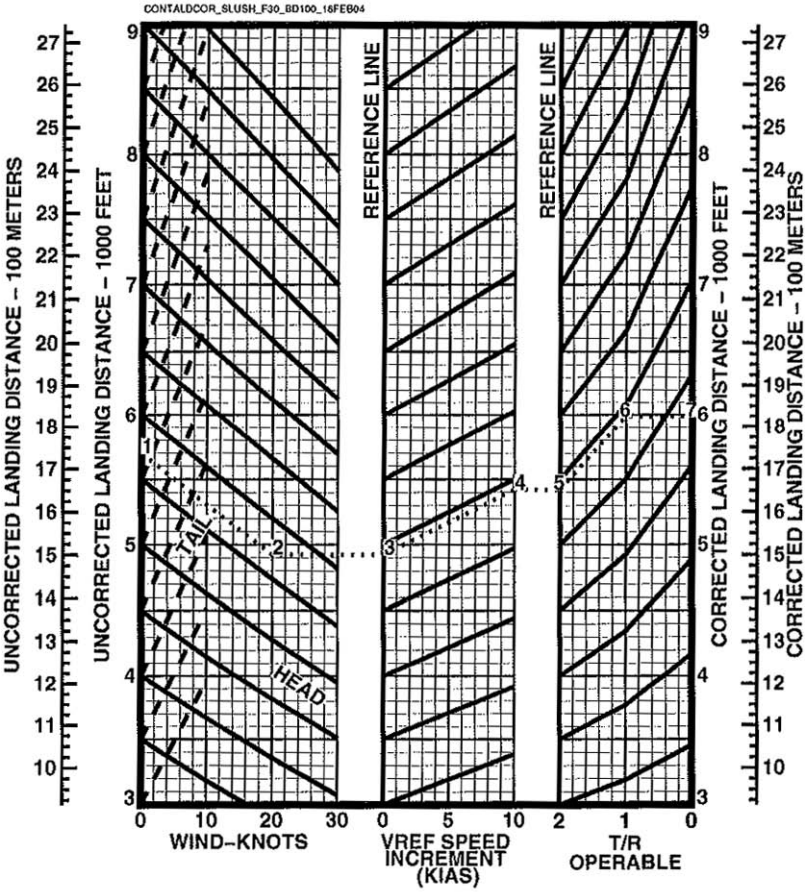
UNCORRECTED LANDING DISTANCE – FT					
ALT FT	WT LB	ACTUAL DISTANCE	ALT FT	WT LB	ACTUAL DISTANCE
SEA LEVEL	28000	3690	6000	28000	4360
	30000	3890		30000	4650
	32000	4110		32000	4920
	33750	4330		33750	5160
	34000	4360		34000	5190
	36000	4590		36000	5460
	38000	4800		38000	5730
	38850	4900		38850	5840
1000	28000	3780	7000	28000	4510
	30000	3990		30000	4790
	32000	4240		32000	5070
	33750	4460		33750	5320
	34000	4490		34000	5350
	36000	4720		36000	5630
	38000	4940		38000	5910
	38850	5040		38850	6020
2000	28000	3880	8000	28000	4640
	30000	4110		30000	4930
	32000	4370		32000	5230
	33750	4590		33750	5480
	34000	4620		34000	5520
	36000	4860		36000	5810
	38000	5090		38000	6090
	38850	5190		38850	6210
3000	28000	3980	9000	28000	4780
	30000	4240		30000	5080
	32000	4510		32000	5390
	33750	4720		33750	5650
	34000	4750		34000	5690
	36000	5000		36000	5990
	38000	5240		38000	6290
	38850	5340		38850	6410
4000	28000	4100	10000	28000	4930
	30000	4380		30000	5250
	32000	4640		32000	5550
	33750	4860		33750	5830
	34000	4900		34000	5870
	36000	5150		36000	6180
	38000	5400		38000	6480
	38850	5500		38850	6610
5000	28000	4230			
	30000	4520			
	32000	4780			
	33750	5010			
	34000	5040			
	36000	5300			
	38000	5560			
	38850	5670			

CONTALD_SLUSH_F30_IMP_BD100_18FEB04

NOTE :
Shaded area indicate landing data above MLW.

Figure SUP1-179. (07-01-33-01)

CONTAMINATED RUNWAY ACTUAL LANDING DISTANCE SLUSH/STANDING WATER/WET SNOW CORRECTION CHART FLAPS 30°



EXAMPLE:

1. Uncorrected Landing Distance (from table).....5700 ft (1740 m)
2. Headwind.....20 kt
3. Vref Reference Line
4. Vref Speed Increment.....10 kias

Figure SUP1-180. (07-01-33-02)

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CONTAMINATED RUNWAY
DRY SNOW
FLAPS 30°
ACTUAL LANDING DISTANCE

UNCORRECTED LANDING DISTANCE – FT

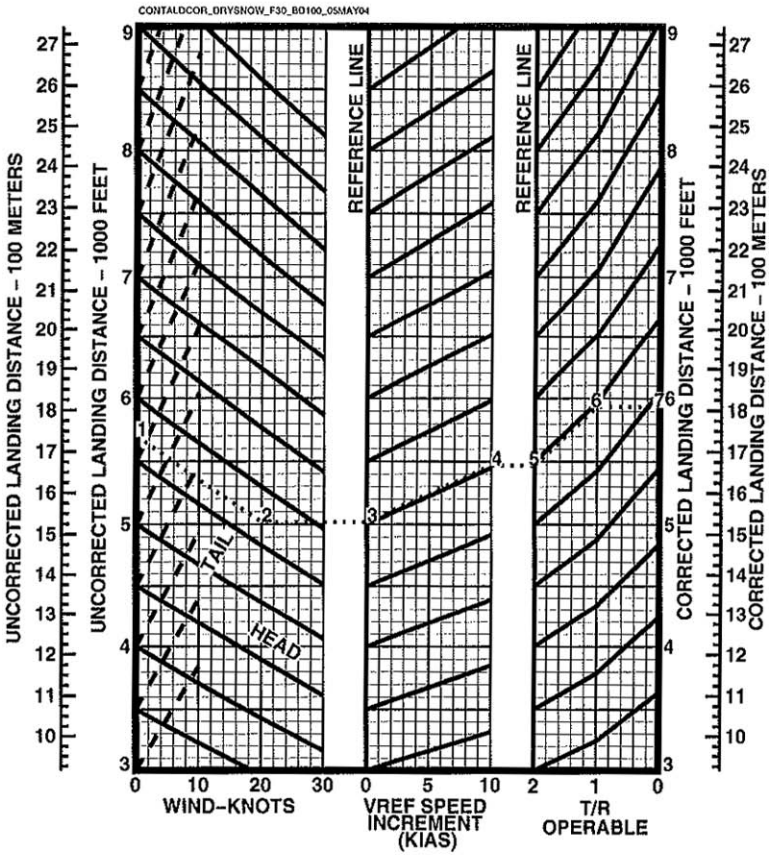
ALT FT	WT LB	ACTUAL DISTANCE	ALT FT	WT LB	ACTUAL DISTANCE
SEA LEVEL	28000	3620	6000	28000	4210
	30000	3810		30000	4440
	32000	4000		32000	4670
	33750	4170		33750	4870
	34000	4190		34000	4900
	36000	4380		36000	5130
	38000	4570		38000	5350
	38850	4650		38850	5440
1000	28000	3700	7000	28000	4320
	30000	3900		30000	4560
	32000	4100		32000	4790
	33750	4280		33750	5000
	34000	4300		34000	5030
	36000	4500		36000	5270
	38000	4690		38000	5490
	38850	4770		38850	5590
2000	28000	3800	8000	28000	4430
	30000	4000		30000	4680
	32000	4210		32000	4920
	33750	4390		33750	5140
	34000	4410		34000	5170
	36000	4610		36000	5410
	38000	4810		38000	5650
	38850	4890		38850	5750
3000	28000	3900	9000	28000	4550
	30000	4110		30000	4810
	32000	4320		32000	5060
	33750	4500		33750	5280
	34000	4530		34000	5310
	36000	4740		36000	5560
	38000	4940		38000	5800
	38850	5020		38850	5910
4000	28000	4000	10000	28000	4680
	30000	4210		30000	4940
	32000	4430		32000	5200
	33750	4620		33750	5430
	34000	4650		34000	5460
	36000	4860		36000	5720
	38000	5070		38000	5970
	38850	5160		38850	6070
5000	28000	4100			
	30000	4320			
	32000	4550			
	33750	4740			
	34000	4770			
	36000	4990			
	38000	5210			
	38850	5300			

CONTALD_DRYSNOW_F30_IMP_BD100_16FEB04

NOTE :
Shaded area indicate landing data above MLW.

Figure SUP1-181. (07-01-34-01)

CONTAMINATED RUNWAY ACTUAL LANDING DISTANCE
DRY SNOW
CORRECTION CHART
FLAPS 30°



EXAMPLE:

1. Uncorrected Landing Distance (from table).....5700 ft (1740 m)
2. Headwind.....20 kt
3. Vref Reference Line
4. Vref Speed Increment.....10 kias
5. Thrust Reverser Reference Line
6. One Thrust Reverser Operable
7. Corrected Landing Distance.....5930 ft (1810 m)

Figure SUP1-182. (07-01-34-02)

SUPPLEMENT 2

SUPPLEMENTAL INFORMATION FOR THE MMEL

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SUPPLEMENTAL INFORMATION FOR THE MMEL

INTRODUCTION

This supplement is only applicable when used in conjunction with a Minimum Equipment List (MEL) approved by the appropriate authority.

The data in this supplement provides performance corrections to be applied when dispatching with specific airplane systems inoperative.

These data complement or supersede data contained in the basic Airplane Flight Manual and its supplements. The following data must therefore be used in conjunction with the basic Airplane Flight Manual and its supplements.

LIMITATIONS

The limitations established in Chapter 2 are applicable, except as modified by the following:

Flight with Landing Gear Down

Category II Operations are prohibited.

Nosewheel Steering Inoperative

The maximum crosswind is 15 knots.

One AHRS Channel Inoperative

The maximum crosswind is 15 knots.

EMERGENCY PROCEDURES

The emergency procedures in Chapter 3 are applicable.

NORMAL PROCEDURES

The normal procedures in Chapter 4 are applicable.

NON-NORMAL PROCEDURES

The non-normal procedures in Chapter 5 are applicable.

PERFORMANCE

The performance data in Chapter 6 and Chapter 7 are applicable, except as modified by the following:

Flight Director Guidance or TOGA Switches Inoperative

Dispatch with one or both flight directors inoperative and/or with TOGA switches inoperative is conducted following the normal takeoff procedure using the target pitch attitude for takeoff specified in the following tables. The ΔV between V_2 and V_R for the specified conditions is used to find the target pitch attitude. Different pitch attitudes are provided depending on takeoff

flap setting, V_R value and the number of engines operating. Go-around procedure with one or both flight directors inoperative is conducted using a fixed target pitch attitude of 8 degrees.

Target Pitch Attitude for Takeoff Flaps 10

$\Delta V = (V_2 - V_R)$ (KIAS)	$V_R \leq 116$ KIAS		$V_R > 116$ KIAS	
	Single Engine Pitch Guidance (Degrees)	All Engine Pitch Guidance (Degrees)	Single Engine Pitch Guidance (Degrees)	All Engine Pitch Guidance (Degrees)
0	6.6	11.1	5.4	8.1
1	6.9	11.7	5.9	9.0
2	7.3	12.4	6.5	10.0
3	7.6	13.0	7.1	11.0
4	8.0	13.7	7.7	12.0
5	8.4	14.3	8.3	13.0
6	8.7	14.9	8.9	14.0
7	9.1	15.6	9.5	15.0
8	9.4	16.2	10.1	16.0
9	9.8	16.9	10.7	17.0
10	10.1	17.5	11.3	18.0
11	10.5	18.2	11.9	18.9
12	10.8	18.8	12.5	19.9
13	11.2	19.4	13.1	20.9
14	11.5	20.1	13.7	21.9
15 or more	11.9	20.7	13.7	21.9

Target Pitch Attitude for Takeoff Flaps 20

$\Delta V = (V_2 - V_R)$ (KIAS)	$V_R \leq 116$ KIAS		$V_R > 116$ KIAS	
	Single Engine Pitch Guidance (Degrees)	All Engine Pitch Guidance (Degrees)	Single Engine Pitch Guidance (Degrees)	All Engine Pitch Guidance (Degrees)
0	5.9	9.9	4.7	9.1
1	6.3	10.5	5.3	10.0
2	6.7	11.1	6.0	10.9
3	7.0	11.7	6.7	11.7
4	7.4	12.3	7.4	12.6
5	7.8	12.9	8.1	13.5
6	8.2	13.5	8.7	14.3
7	8.5	14.1	9.4	15.2
8	8.9	14.7	10.1	16.0
9	9.3	15.3	10.8	16.9
10	9.6	15.9	11.4	17.8
11	10.0	16.5	12.1	18.6
12	10.4	17.1	12.8	19.5
13	10.8	17.7	13.5	20.3
14	11.1	18.3	14.2	21.2
15 or more	11.5	18.3	14.2	21.2

Flight with Landing Gear Down

Takeoff Data

Performance corrections must be applied to the Corrected Takeoff Field Length and to the Corrected Takeoff Speeds when determining the required runway length, for dry, wet or contaminated runway operations, as follows:

Affected AFM Table/Chart	Effect of Flight with Landing Gear Down
Dry (or Wet or Contaminated) Takeoff Data - Flaps 10 or 20 - All Bleeds - All Altitudes	Increase the Corrected V_1, V_R and V_2 by 3 KIAS. Increase the Corrected Takeoff Field Length determined from the applicable AFM data, by 6.0%.

Performance corrections must be applied to the Actual Runway Length when determining the maximum takeoff weight limited by field length requirements, for dry, wet or contaminated runway operations, as presented in the following table. The Takeoff Field Length Correction chart and the Takeoff Data table must be used in the opposite direction to that used in determining Takeoff Field Length:

Affected AFM Table/Chart	Effect of Flight with Landing Gear Down
Dry (or Wet or Contaminated) Takeoff Data - Flaps 10 or 20 - All Bleeds - All Altitudes	Increase the Corrected V_1, V_R and V_2 by 3 KIAS. Reduce the Actual Runway Length, when using the applicable AFM data, by 6.0%.

Takeoff and Landing Weight Limited by Climb Requirements and Brake Energy

Takeoff Weight Limit, Landing Gear Down — The following Takeoff Weight Limit charts (figures 07-02-01 to 07-02-06) are applicable for flight with landing gear down. These charts present the information necessary to determine the maximum allowable takeoff weight as limited by gross climb performance or brake energy limits. Different charts are presented for the takeoff flap setting (Flap 10 and 20) and the various engine bleed configurations. The same procedure as described in Chapter 6, Use of Takeoff Charts, Takeoff Weight Limit Charts, shall be used to determine the takeoff weight limit for flight with landing gear down.

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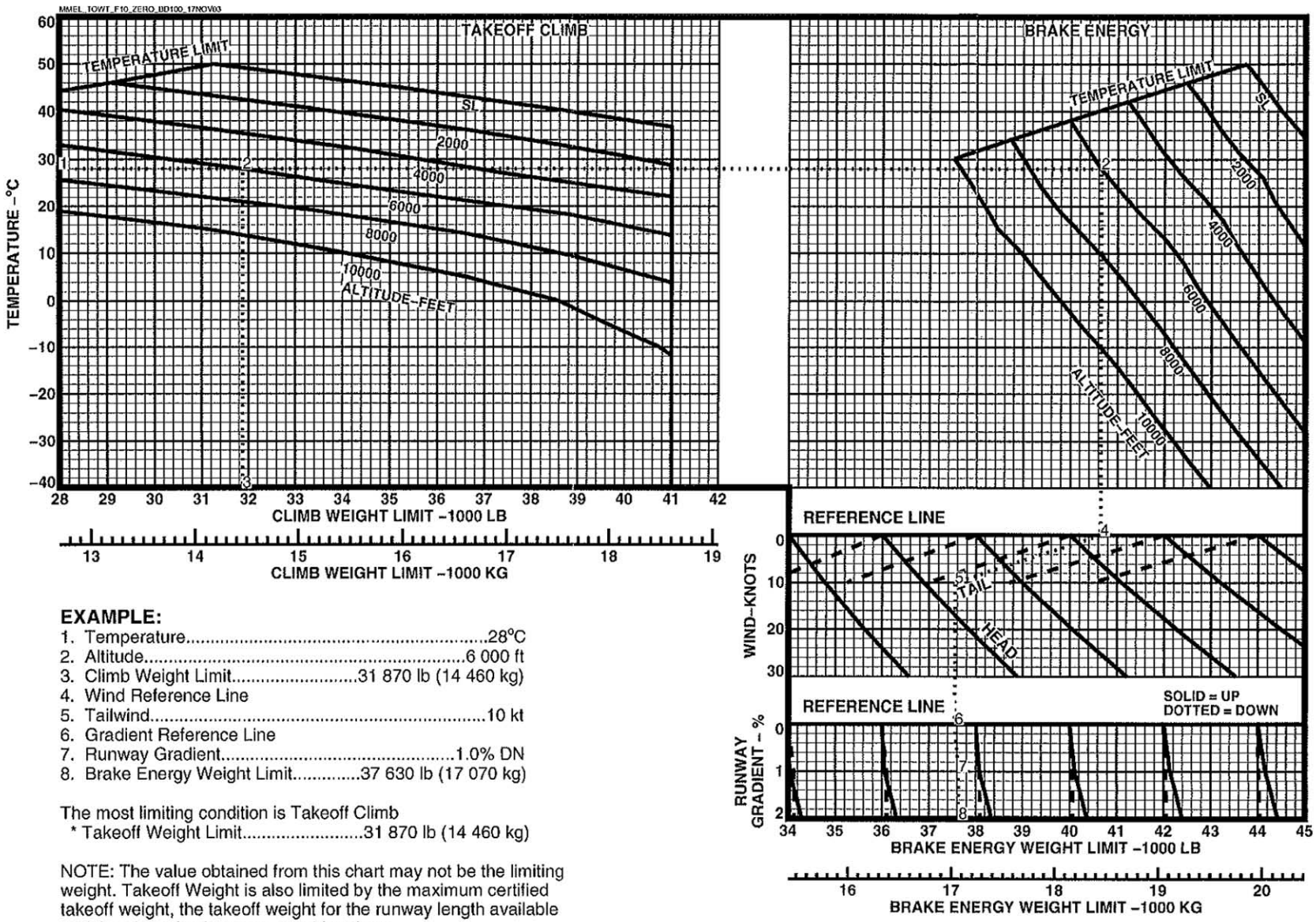
CHALLENGER 300 PERFORMANCE MANUAL

TAKEOFF WEIGHT LIMIT, LANDING GEAR DOWN
FLAPS 10°
ENGINE BLEED OFF



EXAMPLE:

1. Temperature.....28°C
2. Altitude.....6 000 ft
3. Climb Weight Limit.....31 870 lb (14 460 kg)
4. Wind Reference Line
5. Tailwind.....10 kt
6. Gradient Reference Line
7. Runway Gradient.....1.0% DN
8. Brake Energy Weight Limit.....37 630 lb (17 070 kg)

The most limiting condition is Takeoff Climb
* Takeoff Weight Limit.....31 870 lb (14 460 kg)

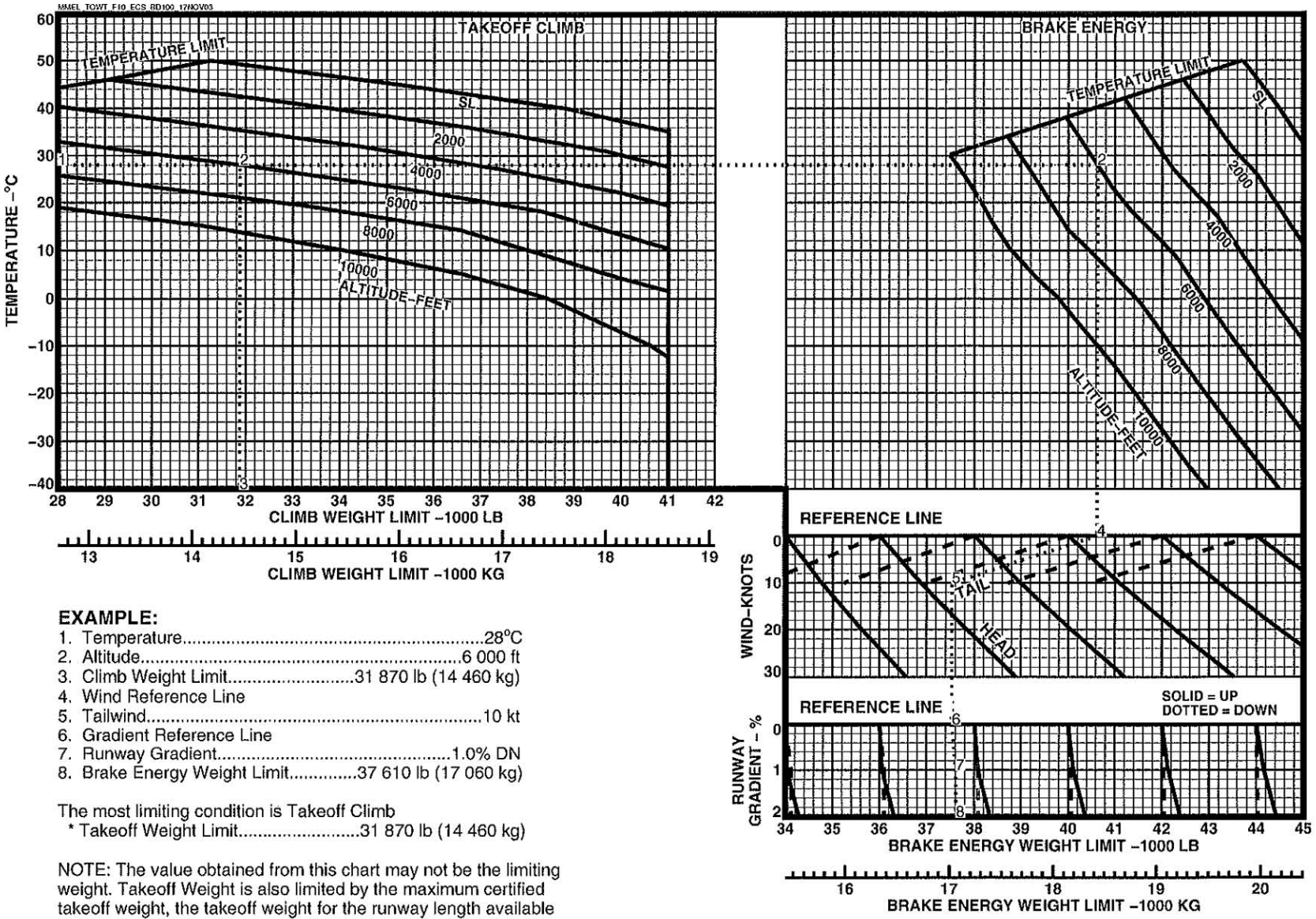
NOTE: The value obtained from this chart may not be the limiting weight. Takeoff Weight is also limited by the maximum certified takeoff weight, the takeoff weight for the runway length available and the obstacle clearance considerations.

Figure SUP2-01. (07-02-01)

FOR TRAINING PURPOSES ONLY

FlightSafety international
CHALLENGER 300 PERFORMANCE MANUAL

TAKEOFF WEIGHT LIMIT, LANDING GEAR DOWN
FLAPS 10°
ENGINE BLEED ON



EXAMPLE:

1. Temperature.....28°C
2. Altitude.....6 000 ft
3. Climb Weight Limit.....31 870 lb (14 460 kg)
4. Wind Reference Line
5. Tailwind.....10 kt
6. Gradient Reference Line
7. Runway Gradient.....1.0% DN
8. Brake Energy Weight Limit.....37 610 lb (17 060 kg)

The most limiting condition is Takeoff Climb
* Takeoff Weight Limit.....31 870 lb (14 460 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 the obstacle clearance considerations.

Figure SUP2-02. (07-02-02)

FOR TRAINING PURPOSES ONLY

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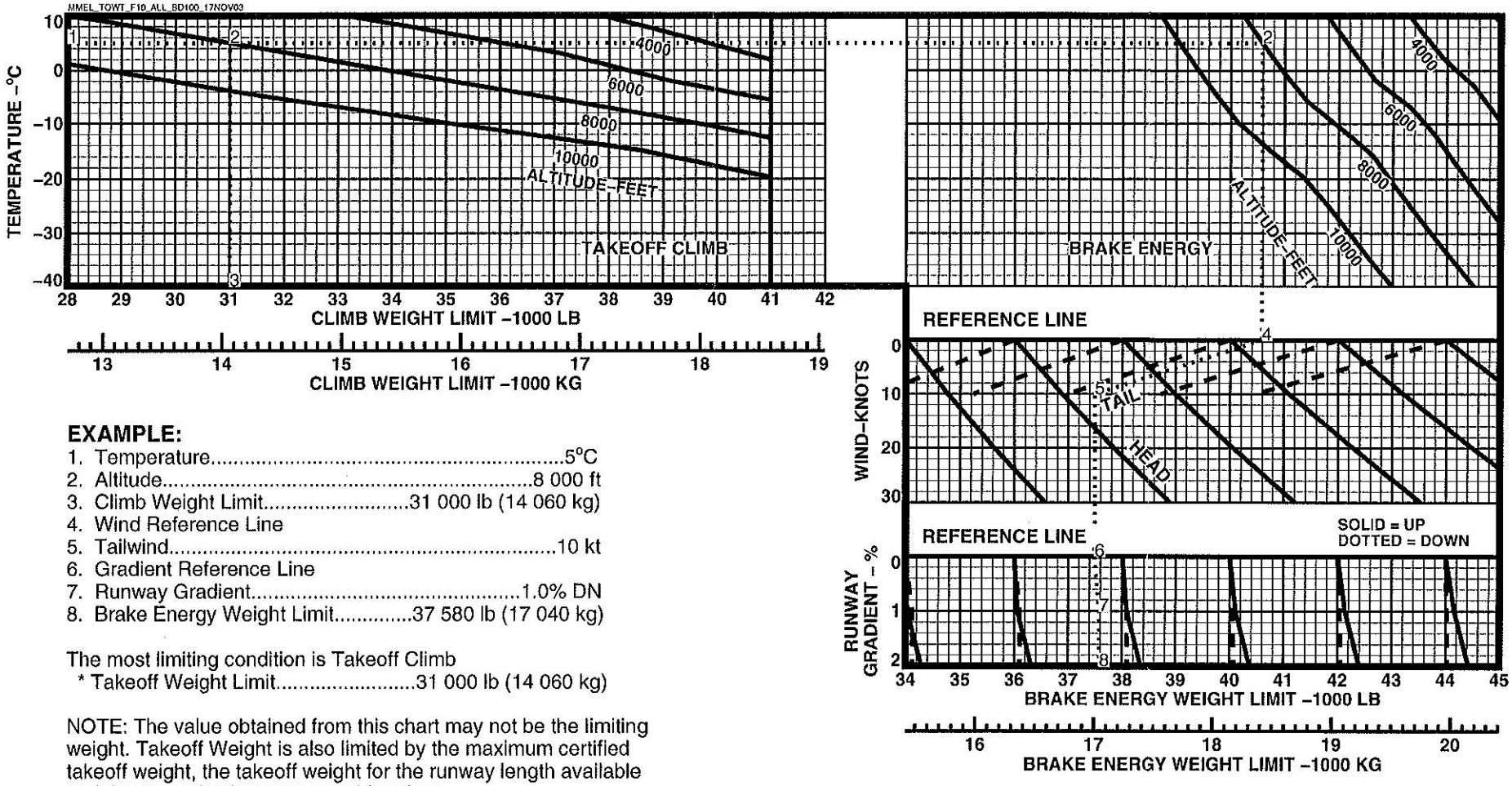
CHALLENGER 300 PERFORMANCE MANUAL

TAKEOFF WEIGHT LIMIT, LANDING GEAR DOWN FLAPS 10° ENGINE BLEED ON, ENGINE AND WING A/I ON



EXAMPLE:

1. Temperature.....5°C
2. Altitude.....8 000 ft
3. Climb Weight Limit.....31 000 lb (14 060 kg)
4. Wind Reference Line
5. Tailwind.....10 kt
6. Gradient Reference Line
7. Runway Gradient.....1.0% DN
8. Brake Energy Weight Limit.....37 580 lb (17 040 kg)

The most limiting condition is Takeoff Climb
* Takeoff Weight Limit.....31 000 lb (14 060 kg)

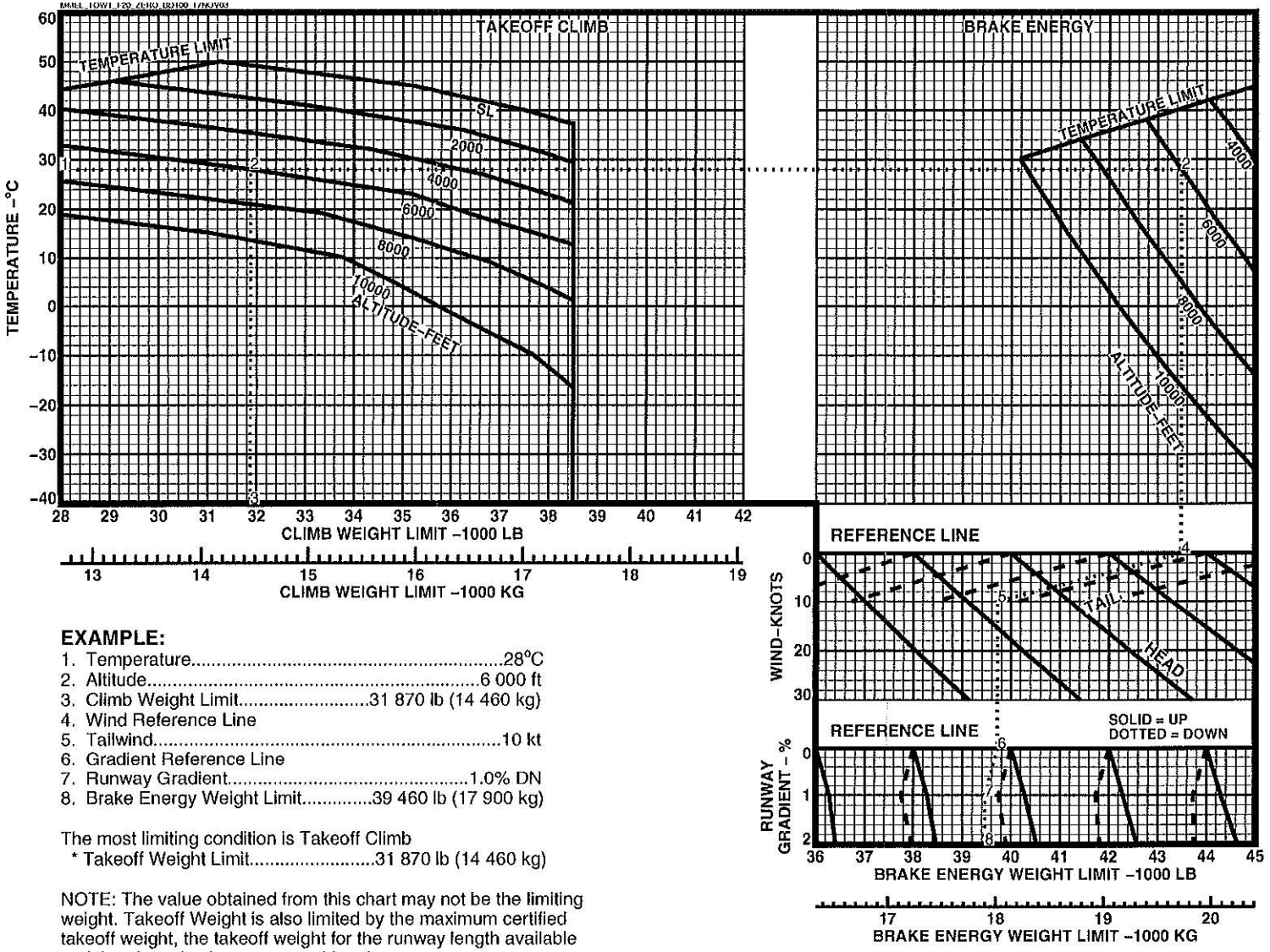
NOTE: The value obtained from this chart may not be the limiting weight. Takeoff Weight is also limited by the maximum certified takeoff weight, the takeoff weight for the runway length available and the obstacle clearance considerations.

Figure SUP2-03. (07-02-03)

FOR TRAINING PURPOSES ONLY

FlightSafety international
CHALLENGER 300 PERFORMANCE MANUAL

TAKEOFF WEIGHT LIMIT, LANDING GEAR DOWN
FLAPS 20°
ENGINE BLEED OFF



EXAMPLE:

1. Temperature.....28°C
2. Altitude.....6 000 ft
3. Climb Weight Limit.....31 870 lb (14 460 kg)
4. Wind Reference Line
5. Tailwind.....10 kt
6. Gradient Reference Line
7. Runway Gradient.....1.0% DN
8. Brake Energy Weight Limit.....39 460 lb (17 900 kg)

The most limiting condition is Takeoff Climb
* Takeoff Weight Limit.....31 870 lb (14 460 kg)

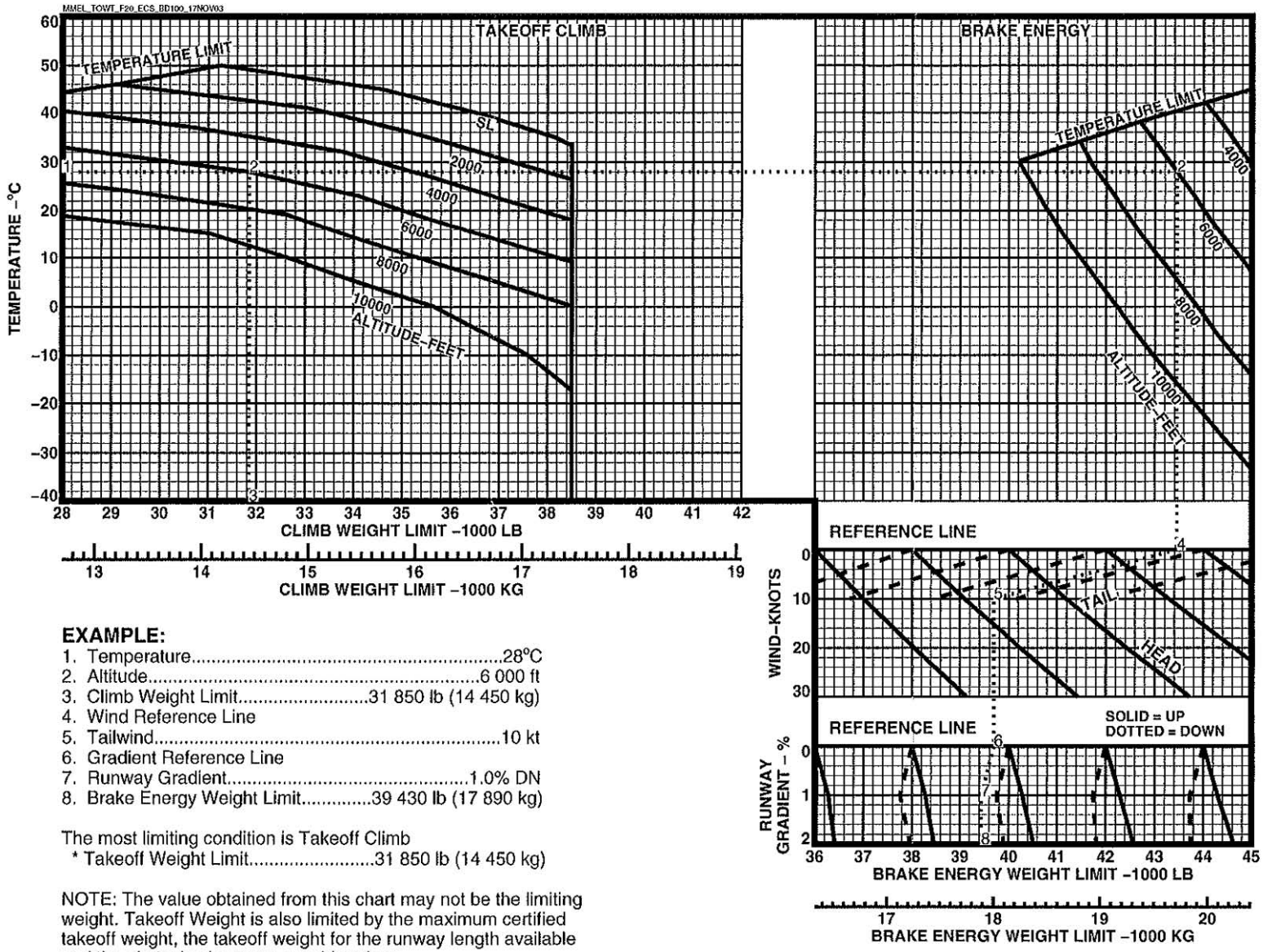
NOTE: The value obtained from this chart may not be the limiting weight. Takeoff Weight is also limited by the maximum certified takeoff weight, the takeoff weight for the runway length available and the obstacle clearance considerations.

Figure SUP2-04. (07-02-04)

FOR TRAINING PURPOSES ONLY

FlightSafety international
CHALLENGER 300 PERFORMANCE MANUAL

TAKEOFF WEIGHT LIMIT, LANDING GEAR DOWN FLAPS 20° ENGINE BLEED ON



EXAMPLE:

1. Temperature.....28°C
2. Altitude.....6 000 ft
3. Climb Weight Limit.....31 850 lb (14 450 kg)
4. Wind Reference Line
5. Tailwind.....10 kt
6. Gradient Reference Line
7. Runway Gradient.....1.0% DN
8. Brake Energy Weight Limit.....39 430 lb (17 890 kg)

The most limiting condition is Takeoff Climb
* Takeoff Weight Limit.....31 850 lb (14 450 kg)

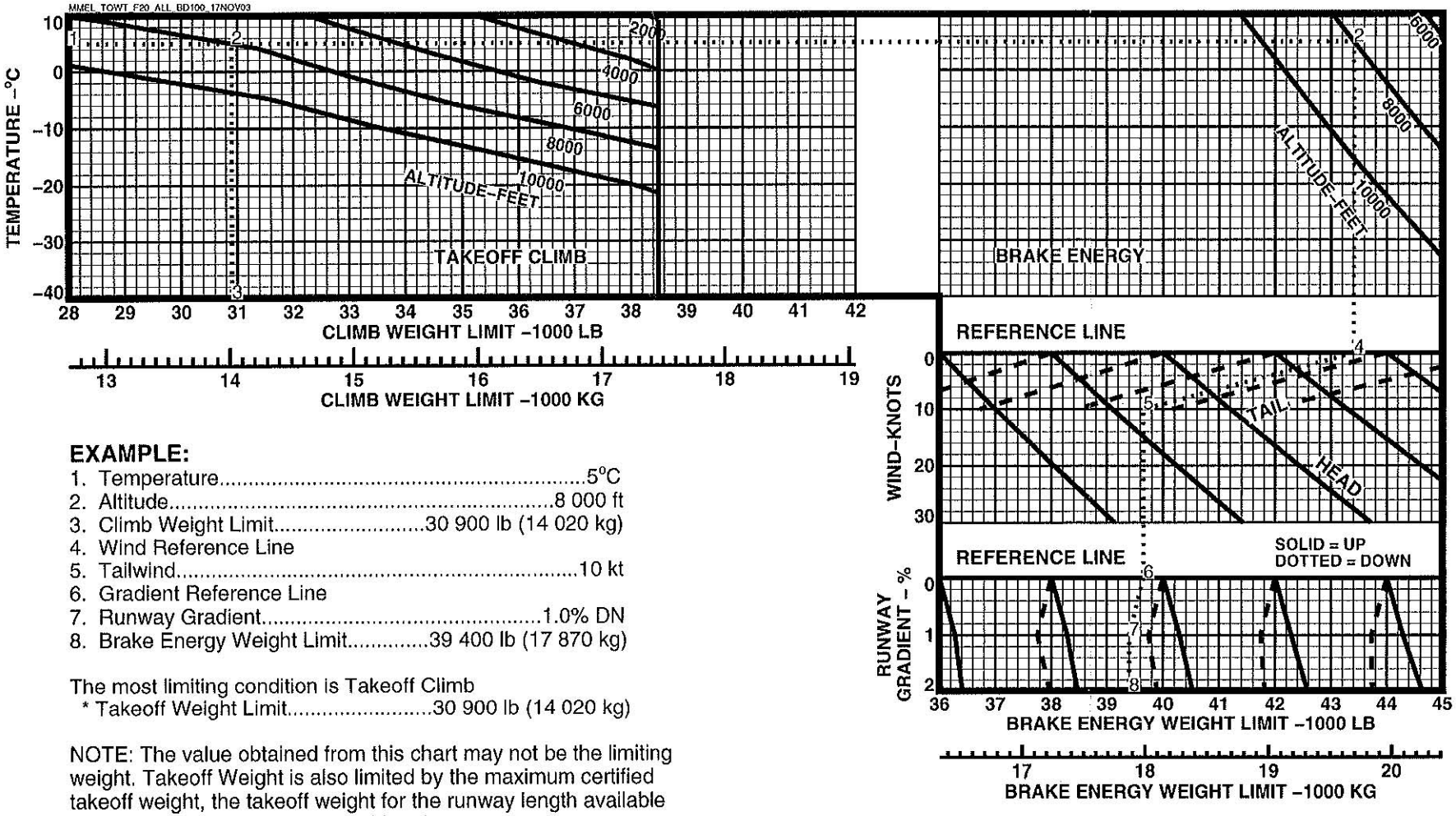
NOTE: The value obtained from this chart may not be the limiting weight. Takeoff Weight is also limited by the maximum certified takeoff weight, the takeoff weight for the runway length available and the obstacle clearance considerations.

Figure SUP2-05. (07-02-05)

FOR TRAINING PURPOSES ONLY

FlightSafety international
CHALLENGER 300 PERFORMANCE MANUAL

TAKEOFF WEIGHT LIMIT, LANDING GEAR DOWN
FLAPS 20°
ENGINE BLEED ON, ENGINE AND WING A/I ON



EXAMPLE:

1. Temperature.....5°C
2. Altitude.....8 000 ft
3. Climb Weight Limit.....30 900 lb (14 020 kg)
4. Wind Reference Line
5. Tailwind.....10 kt
6. Gradient Reference Line
7. Runway Gradient.....1.0% DN
8. Brake Energy Weight Limit.....39 400 lb (17 870 kg)

The most limiting condition is Takeoff Climb
* Takeoff Weight Limit.....30 900 lb (14 020 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 the obstacle clearance considerations.

Figure SUP2-06. (07-02-06)

FOR TRAINING PURPOSES ONLY

Landing Weight Limit, Landing Gear Down — Performance Corrections must be applied to the Maximum Allowable Landing Weight limited by Climb Requirements, as follows:

Affected AFM Table/Chart	Effect of Flight with Landing Gear Down
Landing Weight Limit - All Bleeds	Reduce the maximum allowable landing weight limited by climb requirements by 17%.

Climb Gradients and Landing Data

Performance corrections must be applied to the climb gradients and approach climb speed obtained from the AFM, as follows:

Affected AFM Table/Chart	Effect of Flight with Landing Gear Down
Reference Climb Gradient - Flaps 10 and 20 - All bleeds	Reduce the Corrected Reference Climb Gradient by 2.5%.

Affected AFM Table/Chart	Effect of Flight with Landing Gear Down
Net Final Segment Climb Gradient - All bleeds	Reduce the Net Final Segment Climb Gradient by 4.5%.

Affected AFM Table/Chart	Effect of Flight with Landing Gear Down
Net En Route Climb Gradient - All bleeds	Reduce the Net En Route Climb Gradient by 4.5%.

Affected AFM Table/Chart	Effect of Flight with Landing Gear Down
Approach Climb Gradient - All bleeds	Reduce the Corrected Approach Climb Gradient by 2.5%.

Affected AFM Table/Chart	Effect of Flight with Landing Gear Down
Dry and Wet Runway Landing Data	Increase the Approach Climb speed, VGA, by 3 KIAS.

Therefore the Reference Climb Gradient must be corrected with the above factor prior to reading these charts:

- Close-in Takeoff Flight Path — Flaps 10
- Distant Takeoff Flight Path — Flaps 10
- Close-in Takeoff Flight Path — Flaps 20
- Distant Takeoff Flight Path — Flaps 20
- Distance to Accelerate from V_2 to Final Segment speed (Flaps 10 and Flaps 20)

Nosewheel Steering Inoperative

In the event that the nosewheel steering system is inoperative at dispatch, takeoff performance corrections are required.

Performance corrections must be applied to the Corrected Takeoff Field Length when determining the required runway length, for dry and wet runway operations, as follows:

Affected AFM Table/Chart	Effect of Nosewheel Steering Inoperative
Dry (or Wet) Takeoff Data - Flaps 10 or 20 - All Bleeds - All Altitudes	Increase the Corrected Takeoff Field Length determined from the applicable AFM data, by 1.0%.

Performance corrections must be applied to the Actual Runway Length when determining the maximum takeoff weight limited by field length requirements, for dry and wet runway operations, as presented in the following table. The Takeoff Field Length Correction chart and the Takeoff Data table must be used in the opposite direction to that used in determining Takeoff Field Length:

Affected AFM Table/Chart	Effect of Nosewheel Steering Inoperative
Dry (or Wet) Takeoff Data - Flaps 10 or 20 - All Bleeds - All Altitudes	Reduce the Actual Runway Length, when using the applicable AFM data, by 1.0%.

Operation with One AHRS Channel Inoperative

Takeoff Data

Performance corrections must be applied to the Corrected Takeoff Field Length and to the Corrected Takeoff Speeds when determining the required runway length, for dry, wet or contaminated runway operations as follows:

Affected AFM Table/Chart	Effect of Flight with One AHRS Channel Inoperative
Dry (or Wet or Contaminated) Takeoff Data - Flaps 10 or 20 - All Bleeds - All Altitudes	Increase the Corrected V_1, V_R and V_2 by 5 KIAS. Increase the Corrected Takeoff Field Length determined from the applicable AFM data, by 10.0%.

Performance corrections must be applied to the Actual Runway Length when determining the maximum takeoff weight limited by field length requirements, for dry, wet or contaminated runway operations, as presented in the following table. The Takeoff Field Length Correction chart and the Takeoff Data table must be used in the opposite direction to that used in determining Takeoff Field Length:

Affected AFM Table/Chart	Effect of Flight with One AHRS Channel Inoperative
Dry (or Wet or Contaminated) Takeoff Data - Flaps 10 or 20 - All Bleeds - All Altitudes	Increase the Corrected V_1, V_R and V_2 by 5 KIAS. Reduce the Actual Runway Length, when using the applicable AFM data, by 10.0%.

Takeoff Weight Limited by Climb Requirements and Brake Energy

Performance corrections must be applied to the maximum allowable Takeoff Weight limited by Brake Energy as follows:

Affected AFM Table/Chart	Effect of Flight with One AHRS Channel Inoperative
Takeoff Weight Limit - Flaps 10 or 20 - All Bleeds	Reduce the maximum allowable Takeoff Weight limited by Brake Energy by 3.0%.

Landing Climb Gradient Data

Performance corrections must be applied to the Landing Climb Gradients as follows:

Affected AFM Table/Chart	Effect of Flight with One AHRS Channel Inoperative
Landing Climb Gradient - All Bleeds	Reduce the corrected Landing Climb Gradient by 1.0%.

Landing Weight Limited by Climb Requirements and Brake Energy

Performance corrections must be applied to the maximum allowable Landing Weight limited by Brake Energy (Quick Turn-Around Limit) as follows:

Affected AFM Table/Chart	Effect of Flight with One AHRS Channel Inoperative
Landing Weight Limit - All Bleeds	Reduce the maximum allowable Landing Weight limited by Brake Energy by 4.0%.

Landing Data

Performance corrections must be applied to the Landing Approach Speed, Go-Around Speed, and the corrected Landing Distances for dry, wet, or contaminated runway operations as follows:

Affected AFM Table/Chart	Effect of Flight with One AHRS Channel Inoperative
Dry and Wet Runway Landing Data, Contaminated Runway Actual Landing Distance.	Increase the Landing Approach Speed, V_{REF}, and the Approach Climb Speed, V_{GA}, by 5 KIAS. Increase the corrected Actual (ALD), Factored (FLD) and Wet Factored (FLD WET) Landing Distances, when using the applicable AFM data, by 10.0%.

Radio Altimeter Inoperative

Landing Data

Performance corrections must be applied to the corrected Landing Distance for dry, wet, or contaminated runway operations as follows:

Affected AFM Table/Chart	Effect of Radio Altimeter Inoperative
Dry and Wet Runway Landing Data, Contaminated Runway Actual Landing Distance.	Increase the corrected Actual (ALD), Factored (FLD) and Wet Factored (FLD WET) Landing Distances, when using the applicable AFM data, by 10.0%.

CATEGORY II OPERATIONS

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SUPPLEMENT 3
CATEGORY II OPERATIONS

INTRODUCTION

NOTE: - This Airplane Flight Manual Supplement does not constitute approval to conduct Category II operations.

- This Airplane Flight Manual supplement is only applicable to airplanes 20040 and subsequent and airplanes incorporating Service Bulletin 100-34-12, Installation of Rockwell Collins V.5.5 Software Upgrade.

The Bombardier Challenger 300 has been shown to meet the airworthiness requirements for Category II Operations contained in Appendix 1 of AC 120-29 and Subpart 2 of JAR-AWO Change 2. The data in this supplement must be used when conducting Category II operations.

These data complement or supersede data contained in the basic Airplane Flight Manual. This supplement must therefore be read in conjunction with the basic Airplane Flight Manual.

The effect of this Supplement on the basic Airplane Flight Manual is given below.

LIMITATIONS

The limitations in the Aircraft Flight Manual are applicable with the addition of the following:

1. Flaps must be at 30°.
2. The minimum decision height is 100 ft AGL.
3. Single engine AP coupled approaches are prohibited.
4. FD cross-pointers must be selected.
5. YD must be selected on.
6. Use of FMS computed approach speeds is prohibited.
7. Cat II approaches are prohibited if one or more of the following messages are displayed:
   - AFCS MESSAGES FAIL Caution
   - EFIS COMPARATOR INOP Caution
   - EFIS MISCOMPARE Caution.

An ILS approach to Category II minima must not be commenced or continued unless all required airborne equipment (specified in the Category II Required Equipment List below), and their ground installations are operating satisfactorily.

Category II Required Equipment List

Equipment	Requirement
YD	Must be operational
VHF NAV 1 & 2	Both must be operational
L/R PFD	One PFD available and operational for each side
PRI STAB Trim	Must be operational
Radio Altimeter	Must be operational, with display on both sides
AHRS 1 & 2	Both must be operational
ADC 1 & 2	Both must be operational
FD 1 & 2	Both must be operational
Hydraulics	L, R, & Aux systems must be operational
Electrical	Two generators on and sharing load, (Two engine generators, or one engine generator and the APU generator)

EMERGENCY PROCEDURES - *Not Affected.*

NORMAL PROCEDURES

APPROACH

A category II monitor is enabled when specific conditions have been met. When the category II monitor is enabled, deviations beyond 1/3 dot localizer or 1 dot glideslope will result in the respective pointer flashing amber.

The category II monitor is enabled when:

- The glideslope is captured
- The radio altitude is less than 600 ft
- The radio altitude is greater than RA MIN or 100 ft (whichever is greater)
- RA MIN is less than 200 ft and selected for display
- MIN ALERT is set to RA.

NON-NORMAL PROCEDURES

Engine Failure During Approach:

The approach may be continued IF the following procedure can be accomplished prior to 800 feet AGL:

1. Autopilot ..... Disconnect
2. Operating Engine Thrust Lever ..... Increase as required
3. Rudder Trim ..... As required
4. APU GEN ..... ON

If the above procedure cannot be accomplished prior to 800 feet AGL:

5. Conduct approach to Category I minima or go-around.
6. Refer to the following procedures as applicable:
   a. Engine Shutdown in Flight, NON-NORMAL Chapter
   b. Single Engine Landing, NON-NORMAL Chapter
   c. Single Engine Go-Around, NON-NORMAL Chapter.

PERFORMANCE

The performance data in the PERFORMANCE Chapter of the AFM are applicable, except as modified by the following:

MAXIMUM DEMONSTRATED WIND COMPONENTS

The maximum demonstrated wind components, measured at 10 meters (33 ft) tower height, for Category II operations are as follows:

Headwind ..... 19 kts
Crosswind ..... 20 kts
Tailwind ..... 10 kts

MAXIMUM ALLOWABLE LANDING WEIGHT

The maximum allowable landing weight is limited by the most restrictive of the following:

- Maximum certified landing weight of 33 750 lb (15 309 kg)
- Runway length available
- Climb requirements or brake energy limits.

PERFORMANCE (Cont)

Maximum Landing Weight Limited by Climb Requirements or Brake Energy

The landing weight limit charts for the various engine bleed configurations are presented in Figures 07-03-01-01, 07-03-01-02, and 07-03-01-03 in this supplement. These charts present the maximum allowable landing weight as limited by climb requirements or quick turn-around brake energy limits for Category II operations. The climb weight limit is defined by the approach and/or landing climb requirements (approach climb is limiting).

NOTE: If ice accretion is suspected on unprotected surfaces, reduce the landing weight limited by climb requirements by 14.9%.

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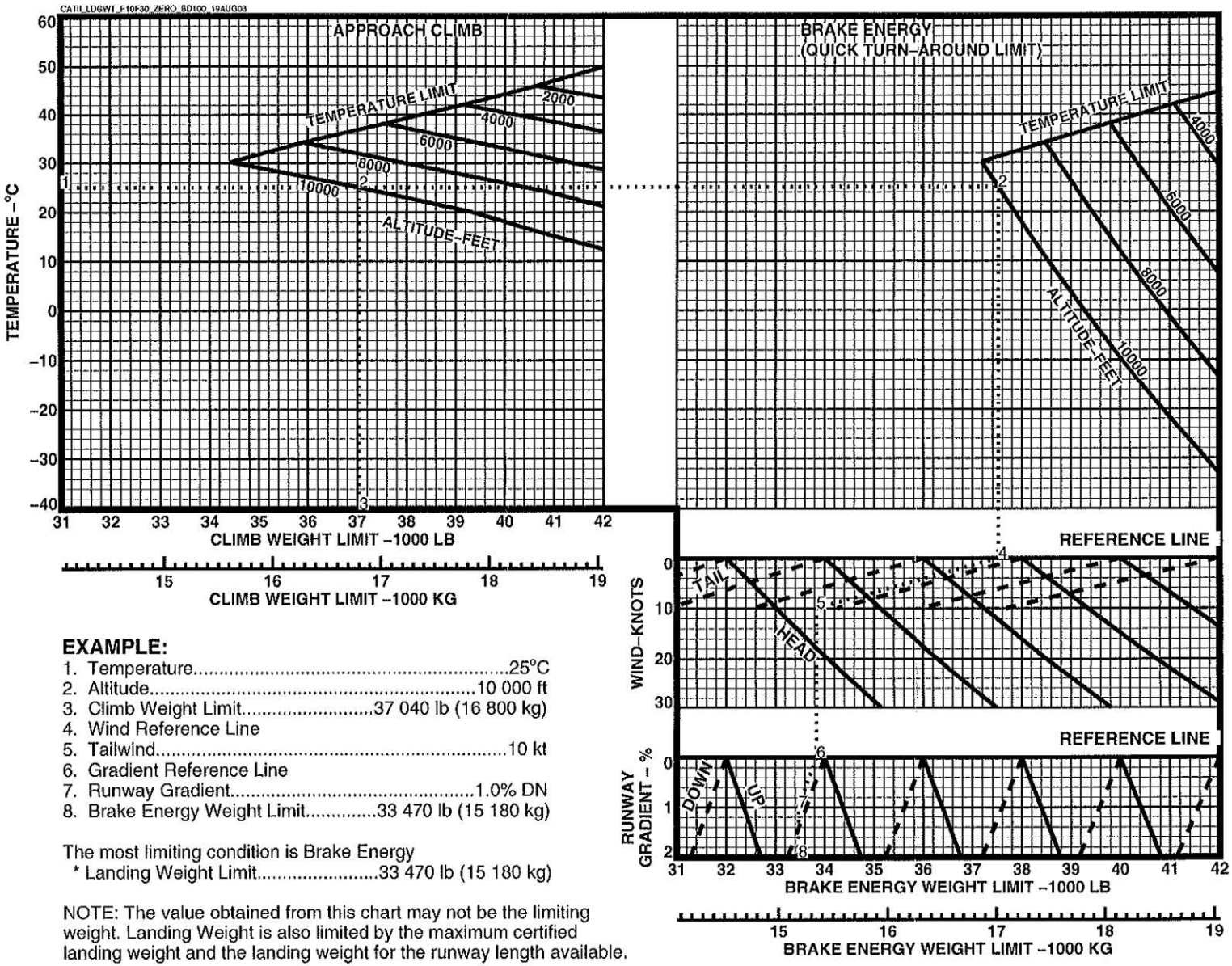
CAT II LANDING WEIGHT LIMIT
ENGINE BLEED OFF



EXAMPLE:

1. Temperature.....25°C
2. Altitude.....10 000 ft
3. Climb Weight Limit.....37 040 lb (16 800 kg)
4. Wind Reference Line
5. Tailwind.....10 kt
6. Gradient Reference Line
7. Runway Gradient.....1.0% DN
8. Brake Energy Weight Limit.....33 470 lb (15 180 kg)

The most limiting condition is Brake Energy
* Landing Weight Limit.....33 470 lb (15 180 kg)

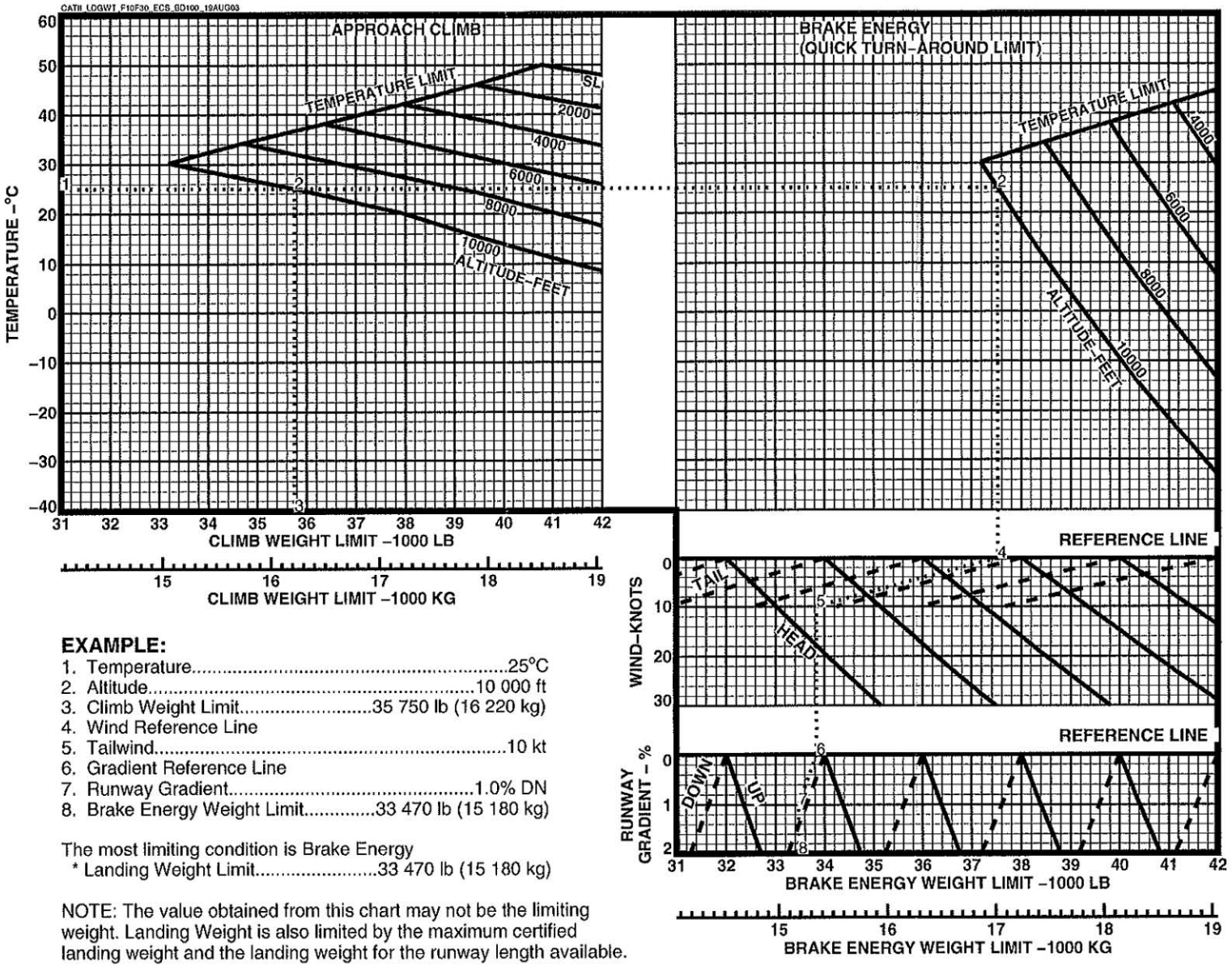
NOTE: The value obtained from this chart may not be the limiting weight. Landing Weight is also limited by the maximum certified landing weight and the landing weight for the runway length available.

Figure SUP3-01. (07-03-01-01)

FOR TRAINING PURPOSES ONLY

FlightSafety international
CHALLENGER 300 PERFORMANCE MANUAL

CAT II LANDING WEIGHT LIMIT
ENGINE BLEED ON



EXAMPLE:

1. Temperature.....25°C
2. Altitude.....10 000 ft
3. Climb Weight Limit.....35 750 lb (16 220 kg)
4. Wind Reference Line
5. Tailwind.....10 kt
6. Gradient Reference Line
7. Runway Gradient.....1.0% DN
8. Brake Energy Weight Limit.....33 470 lb (15 180 kg)

The most limiting condition is Brake Energy
* Landing Weight Limit.....33 470 lb (15 180 kg)

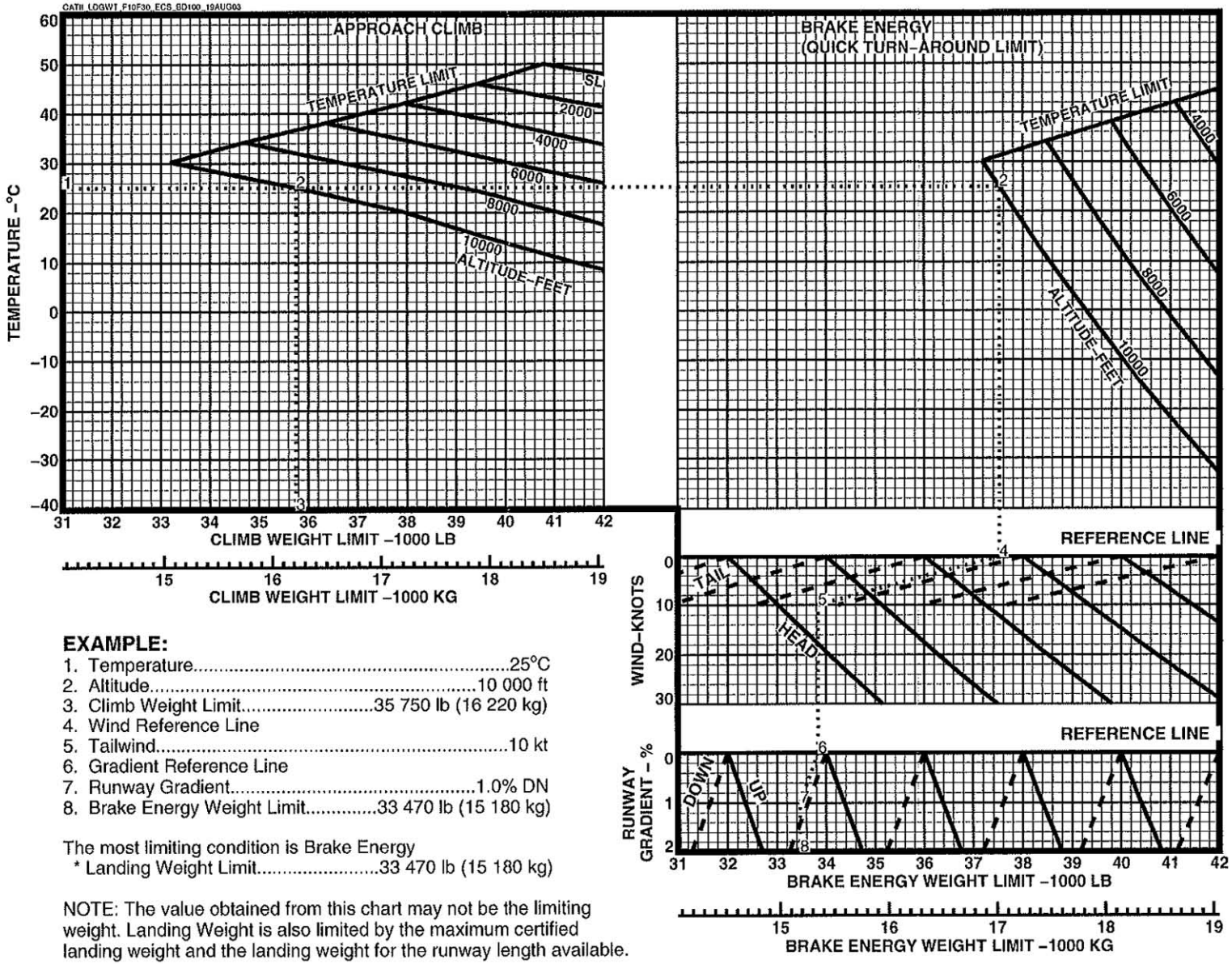
NOTE: The value obtained from this chart may not be the limiting weight. Landing Weight is also limited by the maximum certified landing weight and the landing weight for the runway length available.

Figure SUP3-02. (07-03-01-02)

FOR TRAINING PURPOSES ONLY

FlightSafety international
CHALLENGER 300 PERFORMANCE MANUAL

CAT II LANDING WEIGHT LIMIT
ENGINE BLEED ON, ENGINE AND WING A/I ON



EXAMPLE:

1. Temperature.....25°C
2. Altitude.....10 000 ft
3. Climb Weight Limit.....35 750 lb (16 220 kg)
4. Wind Reference Line
5. Tailwind.....10 kt
6. Gradient Reference Line
7. Runway Gradient.....1.0% DN
8. Brake Energy Weight Limit.....33 470 lb (15 180 kg)

The most limiting condition is Brake Energy
* Landing Weight Limit.....33 470 lb (15 180 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 length available.

Figure SUP3-03. (07-03-01-03)

FOR TRAINING PURPOSES ONLY

FlightSafety international

CHALLENGER 300 PERFORMANCE MANUAL

VOLUME 2

FLIGHT PLANNING AND WEIGHT AND BALANCE

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i–viii	0
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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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INTRODUCTION

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CHAPTER 1
INTRODUCTION

Introduction

The Flight Planning and Cruise Control Manual contains performance data for the operation of the Challenger 300 airplane equipped with two Honeywell AS907 engines and manufactured by Bombardier Inc.

All performance data contained in Flight Planning and Cruise Control Manual are governed by the limitations of the Airplane Flight Manual and are provided as advisory information only.

Scope Of Manual

Based on the data presentation standards, the performance data to be included in the Flight Planning and Cruise Control Manual has been divided into the following chapters:

It is permitted to interpolate linearly between airplane weight, altitude and/or temperature data. Shaded areas distinguish several variables by column.

At the beginning of each chapter there is a short descriptive text followed by a sample example illustrating the use of each chart.

(A) Operating Data

The Operating Data chapter presents data conversion charts.

(B) Flight Planning

The Flight Planning chapter presents simplified charts for a quick determination of fuel and time required for a fixed trip distance based on variable cruise altitude and speed conditions. Typical flight planning allowances and an alternate flight planning chart are also provided.

(C) Two Engine Performance

The Two Engine Performance chapter presents all necessary two engine operating performance information to be used for calculation of detailed flight plans. Data include altitude selection (climb and cruise ceilings), climb, acceleration, cruise (specific air range and cruise tables), descent and holding data.

(D) Single Engine Performance

The Single Engine Performance chapter presents performance data assuming engine failure during cruise. This chapter includes driftdown, altitude selection, cruise (specific air range and cruise tables), descent and holding.

(E) Special Operational Data

The Special Operational Data chapter provides two engine and single engine emergency descent data and gliding data.

Altitudes are flight levels unless otherwise noted.

Airspeed data presented in the Flight Planning and Cruise Control Manual are indicated airspeed (KIAS) in knots and indicated Mach number (MI) unless otherwise noted.

Indicated errors on altitude, airspeed and Mach number for the primary flight display are negligible. Therefore indicated airspeed can be read as calibrated airspeed (KCAS) and indicated Mach (MI) can be read as true Mach number (M or MT).

Aircraft performance data present in this manual are based on "average - new" engine / airframe combination at a reference center of gravity (C.G.) position of 30% of the mean aerodynamic chord (MAC) unless otherwise noted.

Abbreviations

The following abbreviations are found in the Flight Planning and Cruise Control Manual. Some abbreviations may also appear in lower case letters. Abbreviations having very limited usage are explained in the chapters where they are used.

- A -

A/I	Anti-ice
AFM	Airplane Flight Manual
AGL	Above Ground Level
ALT	Altitude
ATAS	Average True Airspeed
ATC	Air Traffic Control
AVG	Average

- B -

- C -

C(°) Degree Celsius
CAS Calibrated airspeed
CLB Climb
C.G. Center of Gravity

- D -

DEG Degree
DIST Distance (air)

- E -

ELEV Elevation
ENG Engine

- F -

F(°) Degree Fahrenheit
FF Fuel Flow
FL Flight Level
FPM Feet per minute
FT Feet (foot)

- G -

GND Ground

- H -

HR Hour

- I -

IAS	Indicated airspeed
ICAO	International Civil Aviation Organization
INOP	Inoperative
ISA	International Standard Atmosphere

- J -

- K -

KG	Kilogram
KM	Kilometer
KT(S)	Knot(s)

- L -

LB(S)	Pound(s)
LRC	Long Range Cruise

- M -

M/MT	Mach Number (True), meter
MI	Mach Number (Indicated)
MAC	Mean Aerodynamic Chord
MCR	Maximum Cruise thrust (power)
MCT	Maximum Continuous thrust
MIN	Minimum / minute
MMO	Maximum Operating speed limit (Mach)
MRC	Maximum Range Cruise
MTOW	Maximum Take-off Weight
MZFW	Maximum Zero Fuel Weight

- N -

NAM Nautical Air Mile
NBAA National Business Aircraft Association
NM Nautical mile

- O -

OAT Outside Air Temperature
OEI One Engine Inoperative
OWE Operating Weight Empty

- P -

PRESS Pressure
PSI Pound(s) per Square Inch

- Q -

- R -

ROC Rate of Climb
ROD Rate of Descent
RPM Revolutions per Minute
RWY Runway

- S -

S Second
SAR Specific Air Range
SAT Static Air Temperature
SEC Second
SFC Specific Fuel Consumption
SGR Specific Ground Range
SL Sea Level

- T -

TAS	True airspeed
TAT	Total Air Temperature
TEMP	Temperature
TO	Take-off
TOC	Top of Climb
TOD	Top of Descent

- U -

- V -

V_{MD}	Minimum Drag speed
V_{MO}	Maximum Operating speed limit (knots)
vs.	Versus

- W -

- X -

- Y -

- Z -

ZFW	Zero Fuel Weight

OPERATING DATA

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CHAPTER 2
OPERATING DATA

INTRODUCTION

This chapter contains data to determine such information as:

Conversion Data

- Wind component
- Pressure - True Altitude
- Differential Pressure vs. Aircraft and Cabin Altitude
- Airspeed and Temperature
- Ground Distance - Air Distance

(A) Wind Component

A chart to convert wind velocity into a headwind and crosswind component is shown on Figure 02-01-01 for wind velocities of up to 60 knots in 10 degree angle increments relative to runway heading.

Example:

Associated conditions

- Wind velocity = 35 kts (A)
- Wind direction * = 20 degrees (B)

* angle between wind and runway heading

Using example shown on Figure 02-01-01 the crosswind component is 12 kts (C) and headwind component is 32.9 kts (D).

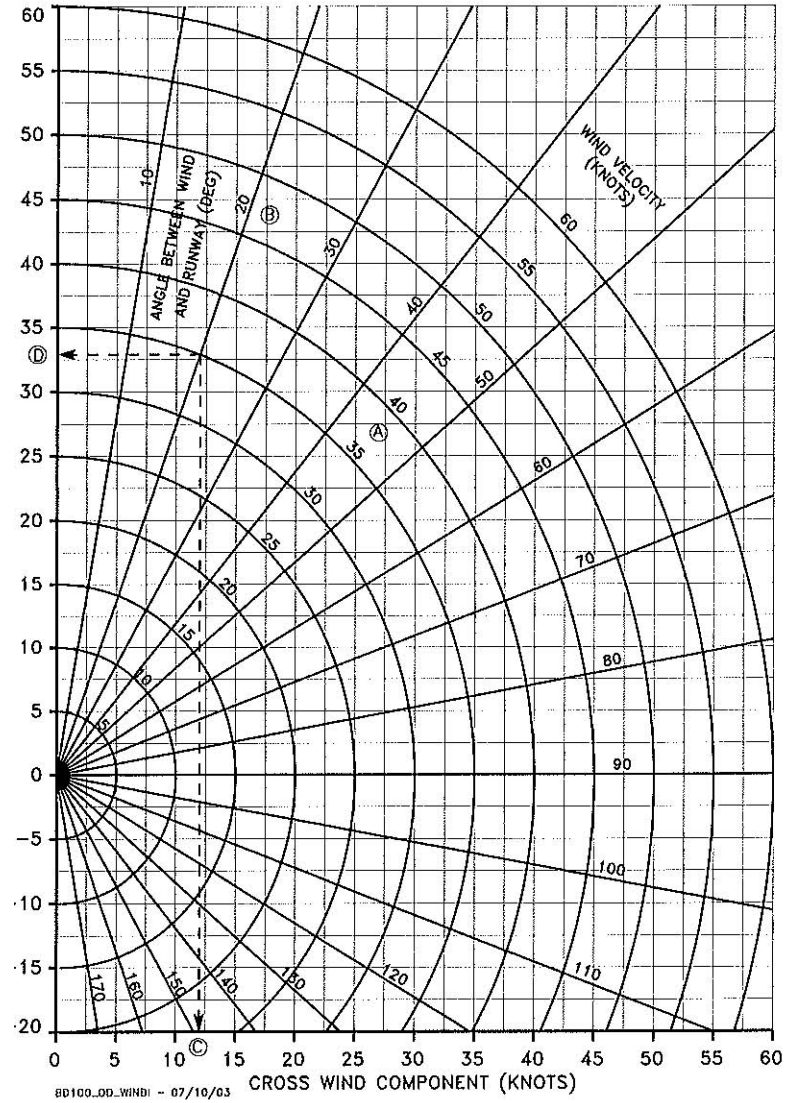

Figure 02-01-01. Wind Components Chart

(B) Pressure - True Altitude

The pressure altitude versus true altitude chart, Figure 02-01-02, shows the true altitude variation at reference pressure altitude for +/- 30°C temperature deviation from ISA.

Example:

Associated conditions

- Pressure altitude = 10 000 ft (A)
- Temperature deviation = ISA-20°C

Using example shown on Figure 02-01-02 the true altitude is 9250 ft (B).

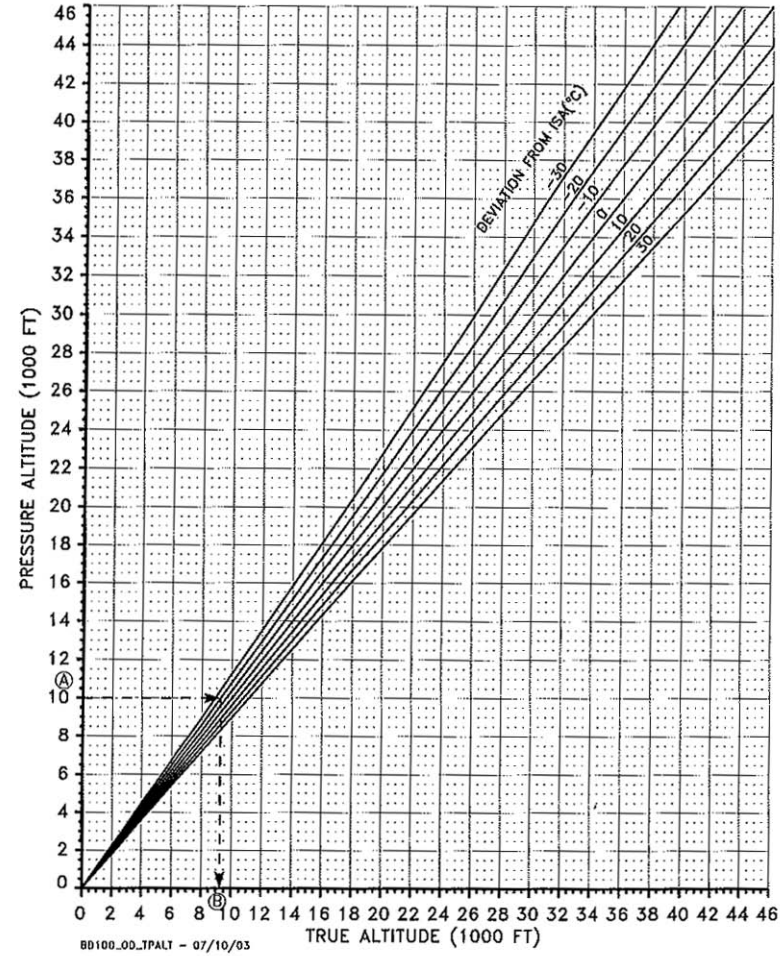

Figure 02-01-02. Pressure Altitude Versus True Altitude

(C) Differential Pressure vs. Aircraft and Cabin Altitudes

The differential pressure versus aircraft and cabin altitudes chart, Figure 02-01-03, shows the maximum allowable aircraft pressure altitude for a given cabin pressure altitude and cabin differential pressure.

Example:

Associated conditions

- Pressure altitude = 37 000 ft (A)
- Differential pressure = 8 psi

Using example shown on Figure 02-01-03 the cabin pressure altitude is 7450 ft (B).

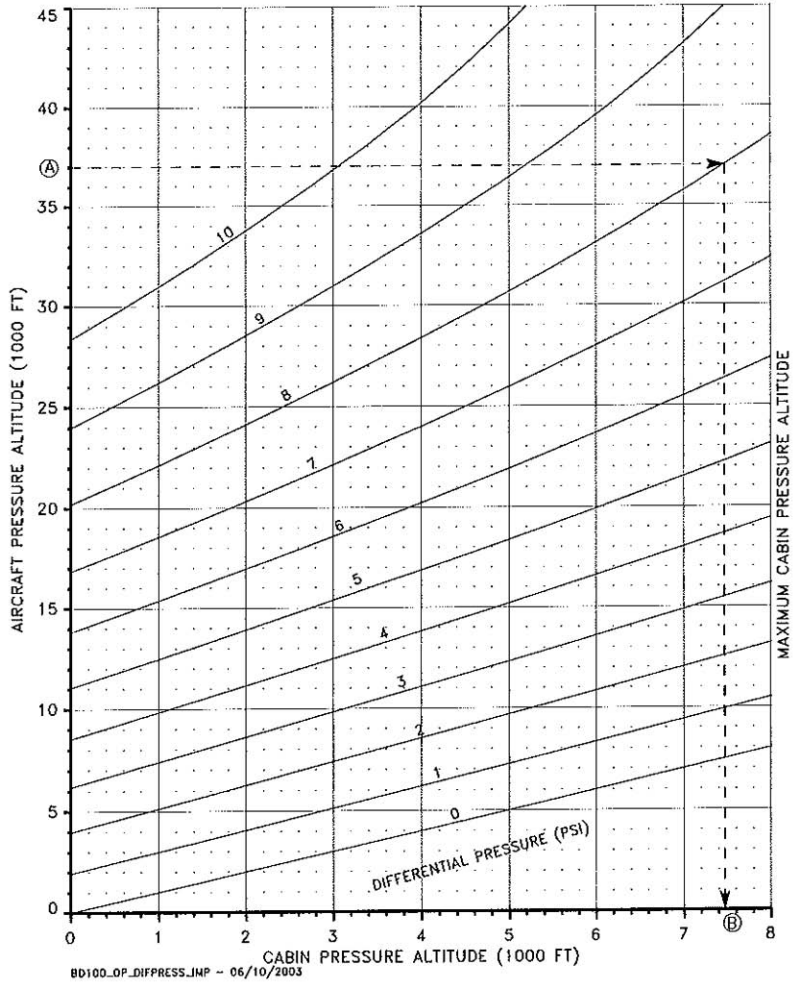

Figure 02-01-03. Differential Pressure Versus Aircraft and Cabin Altitudes Chart

(D) Airspeed and Temperature

The Airspeed and Temperature Conversion chart, Figure 02-01-04, provides TAT/SAT/Mach relationships vs. IAS/TAS for varying flight levels.

Example:

Associated conditions

- Mach number = 0.77 (A)
- Flight Level = FL 330 (B)
- Total air temperature = -10°C (C)

Using example shown on Figure 02-01-04 the following data are obtained:

- Indicated airspeed = 273 kts (D)
- True airspeed = 460 kts (E)
- Static air temperature = -38°C (F)

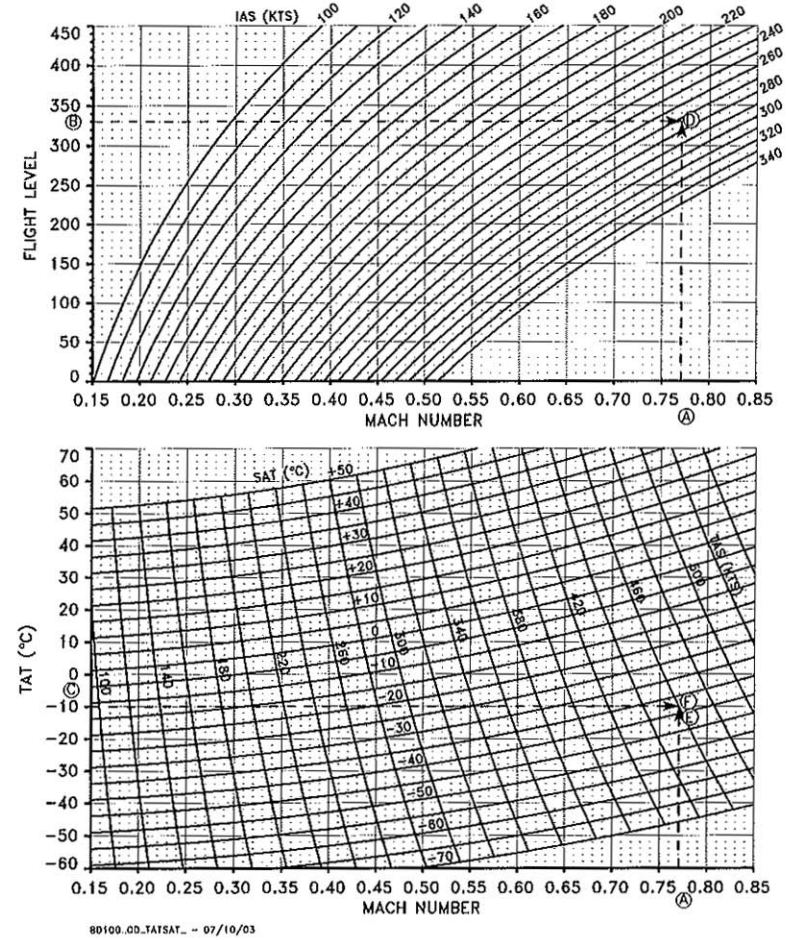

Figure 02-01-04. TAT–SAT–Mach Number Conversion Chart

(E) Ground Distance - Air Distance

Ground distance to air distance conversion charts are provided to enable air distance correction for winds during flight. The charts show air to ground distance relationship for average true airspeed from 300 to 500 kts and wind variation ranging from -160 kts to 160 kts in 20 kt increments. The following charts are presented:

Figure 02-01-05, Sheet 1, converts air to ground distance from 0 to 300 NAM.

Figure 02-01-05, Sheet 2, converts air to ground distance from 300 to 1000 NAM.

Figure 02-01-05, Sheet 3, converts air to ground distance from 1000 to 4500 NAM.

Example:

Associated conditions

- Avg. true airspeed = 330 kts (A)
- Avg. wind = -60 kts "headwind" (B)
- Air distance = 110 NAM (C)

Using example shown on Figure 02-01-05, Sheet 1, the equivalent ground distance is 90 nautical miles (D).

0 to 300 N.M.

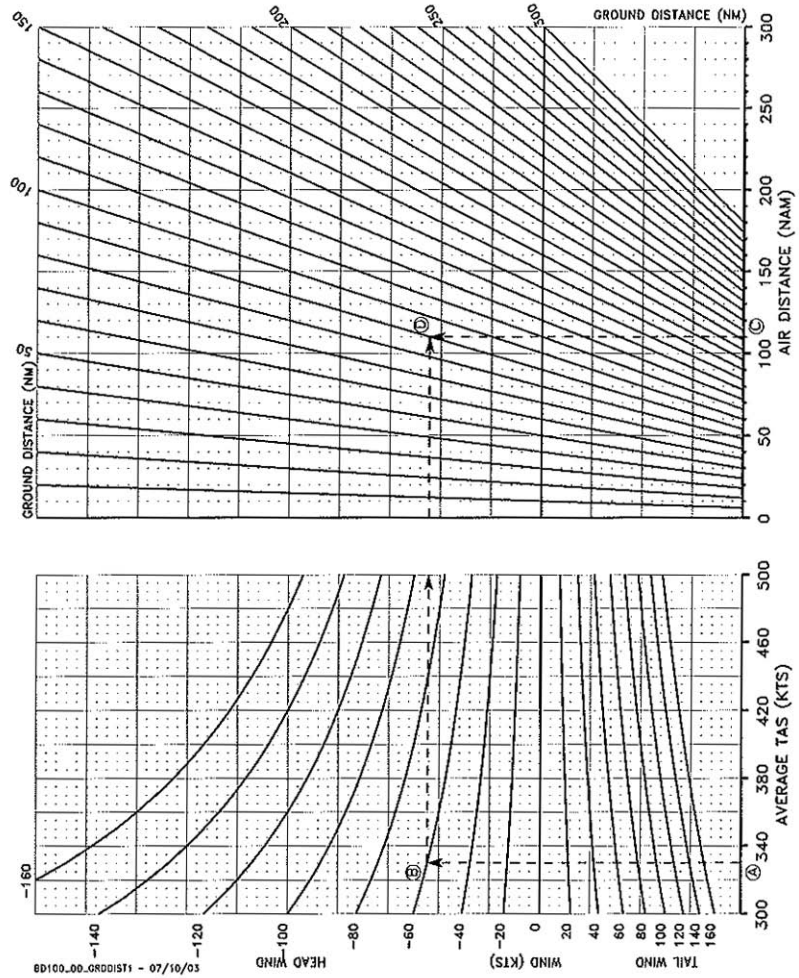

Figure 02-01-05. Ground Distance to Air Distance Conversion Chart (Sheet 1 of 3)

300 to 1,000 N.M.

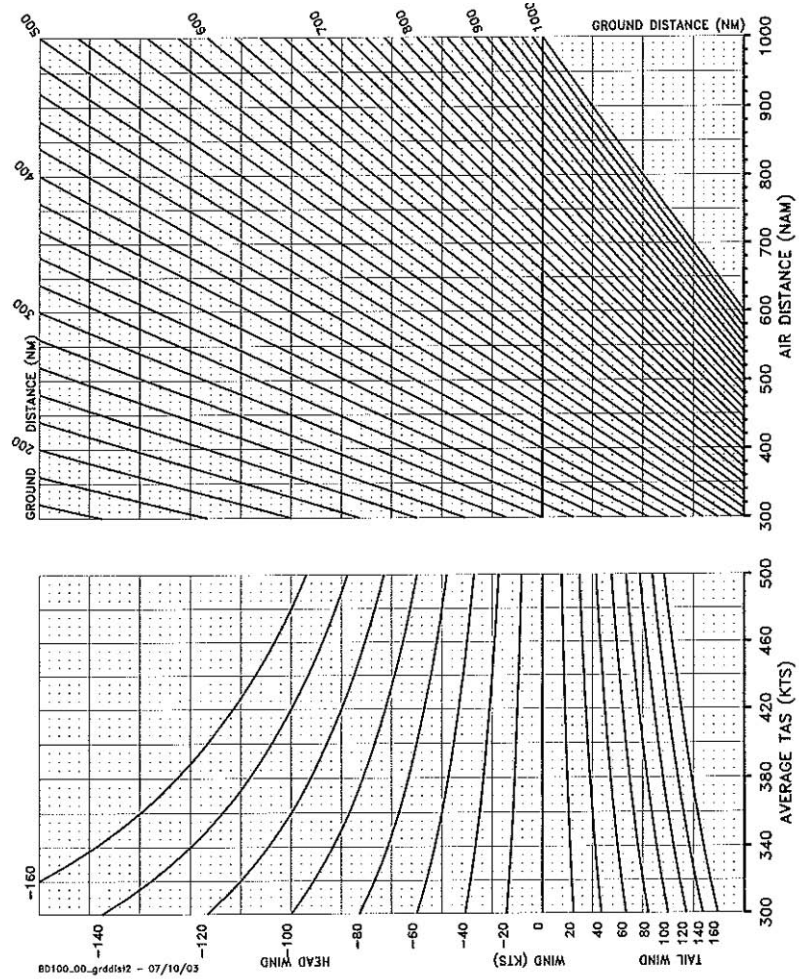

Figure 02-01-05. Ground Distance to Air Distance Conversion Chart (Sheet 2 of 3)

1,000 to 4,500 N.M.

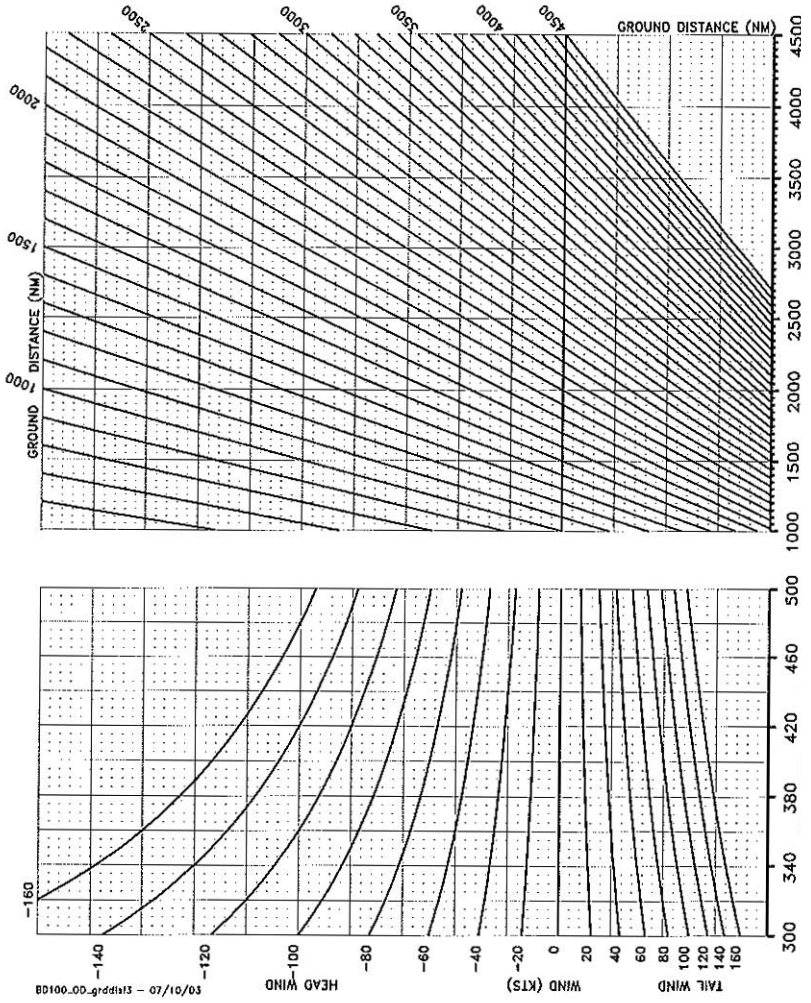

Figure 02-01-05. Ground Distance to Air Distance Conversion Chart (Sheet 3 of 3)

FLIGHT PLANNING

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CHAPTER 3
FLIGHT PLANNING

INTRODUCTION

The data contained in this chapter are provided for flight planning purposes.

SIMPLIFIED FLIGHT PLANNING CHARTS

Simplified flight planning charts enable the quick determination of required mission take-off weight, trip fuel and trip time as function of trip distance, landing weight, temperature and wind conditions. Charts are provided for 0.75, 0.78, 0.80, 0.82, 0.83 MI and LRC cruise speeds for pressure altitudes up to 45 000 ft (maximum certified altitude), landing weight from 24 000 lbs to 33 750 lbs (MLW) and winds ranging from 150 kts headwind to 100 kts tailwind.

Take-off weight calculations are based on the following flight profile and fixed allowances:

- Fixed take-off fuel /time allowances 100 lbs / 1 min.
- Climb from sea level at 250 KIAS / 0.75 MI speed schedule to the selected cruise altitude
- Cruise at selected cruise speed / altitude (maximum 3 cruise altitudes with 2000 ft step climb assumed)
- Descent at 0.75 MI / 250 KIAS speed schedule to sea level

Flight planning charts are based on International Standard Atmosphere (ISA) and a reference C.G. position of 30% MAC. The maximum take-off weight limit line (38 850 lbs MTOW) is identified on each chart. When using these charts for flight planning purposes reserve fuel must be considered in the landing weight calculation.

A correction factor to trip time for non-standard temperature is provided on each chart. Trip fuel values should be adjusted as follows: for every 10°C deviation from ISA, increase (higher temperature) or decrease (lower temperature) trip fuel by 2%. This correction factor assumes no flight profile changes (same final cruise altitude) between non-standard temperature and reference ISA cases. Altitude selection (climb and cruise ceilings) should be checked prior to use of the flight planning charts.

Block fuel correction factors for C.G. variation relative to 30% MAC reference position are provided below:

BLOCK FUEL CORRECTION FACTORS vs. C.G. POSITION.

C.G.	Range < 1000 NM	Range > 1000 NM
20%	2.5%	5.0%
25%	1.0%	1.5%
REF (30%)	-	-
35%	-0.5%	-0.5%
40%	-1.0%	-1.5%

Example:

Associated conditions

- Trip distance = 1200 n.m.
- Cruise speed = 0.75 MI
- Cruise altitude = 25 000 ft
- Average winds = -50 kts "headwind" (A)
- Enroute temperature = ISA+5°C (B)
- Landing weight = 27 000 lbs (C)

Using example shown on Figure 03-01-01, Sheet 1, the following data are obtained:

- Required take-off weight = 35 000 lbs (D)
- Trip time = 3.07 hrs (E)

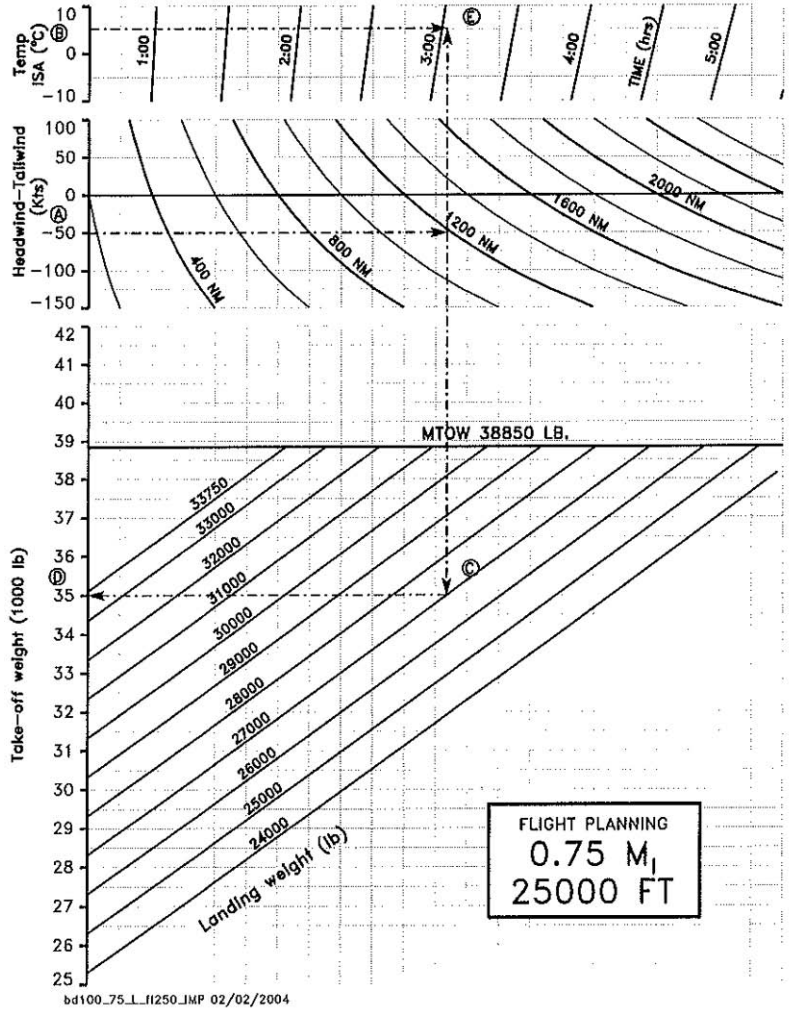

Figure 03-01-01. Simplified Flight Planning Charts—M 0.75 FL250–FL450 (Sheet 1 of 10)

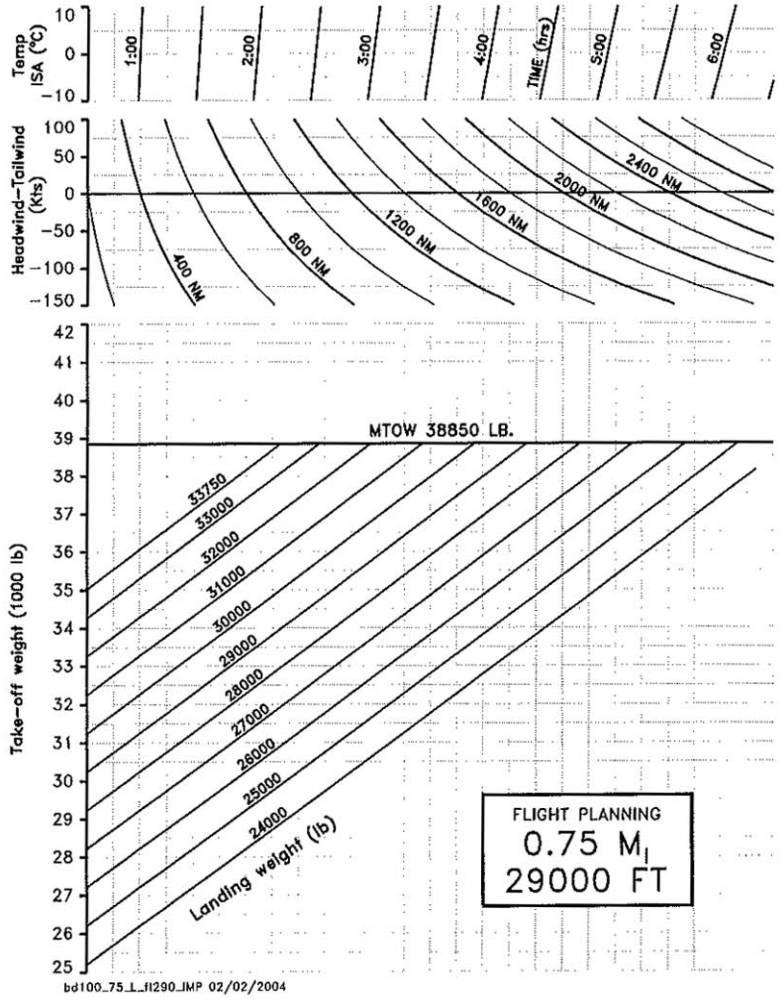

Figure 03-01-01. Simplified Flight Planning Charts—M 0.75 FL250–FL450 (Sheet 2 of 10)

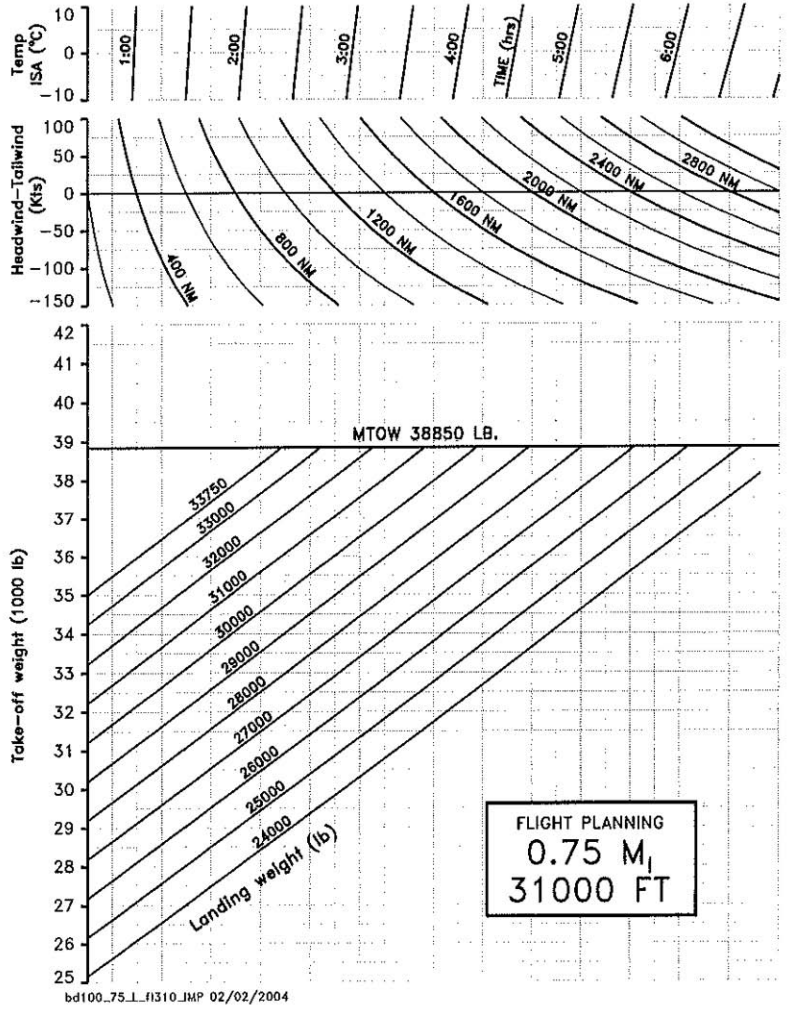

Figure 03-01-01. Simplified Flight Planning Charts—M 0.75 FL250–FL450 (Sheet 3 of 10)

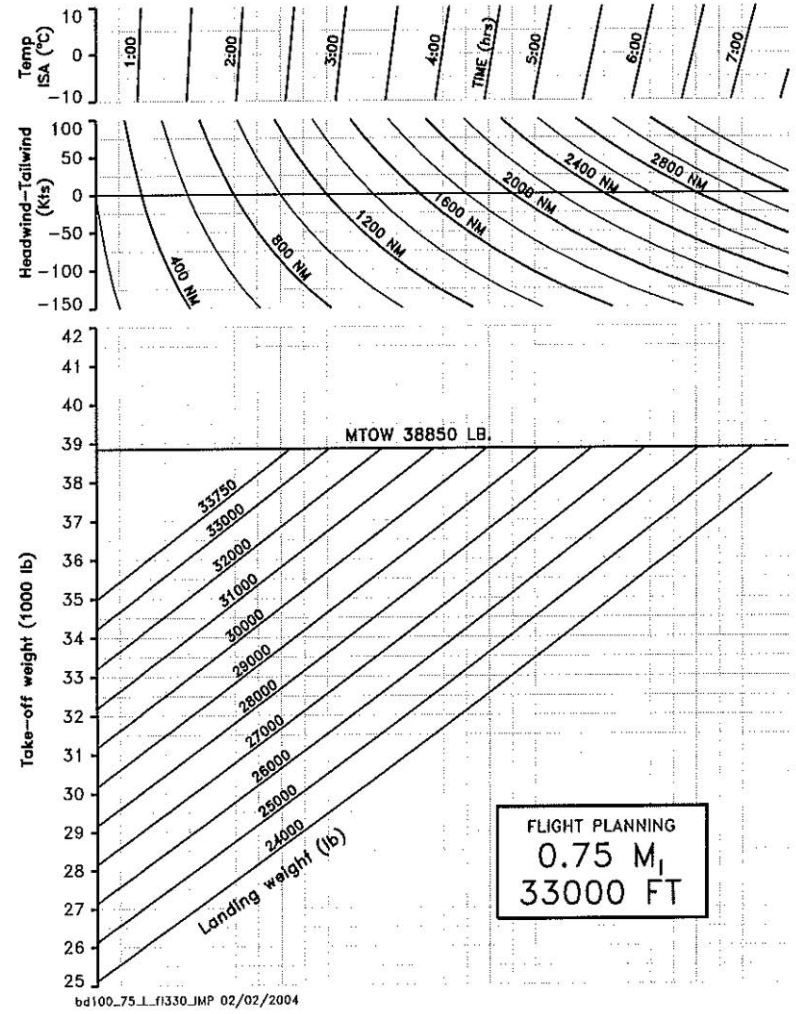

Figure 03-01-01. Simplified Flight Planning Charts—M 0.75 FL250–FL450 (Sheet 4 of 10)

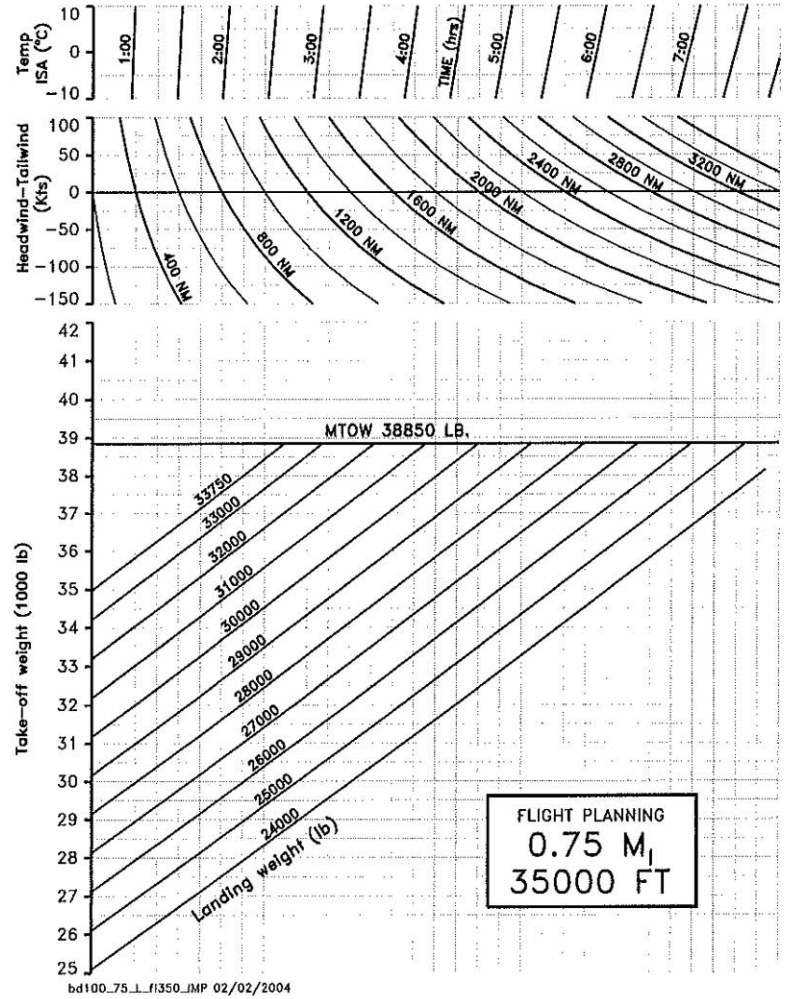

Figure 03-01-01. Simplified Flight Planning Charts—M 0.75 FL250–FL450 (Sheet 5 of 10)

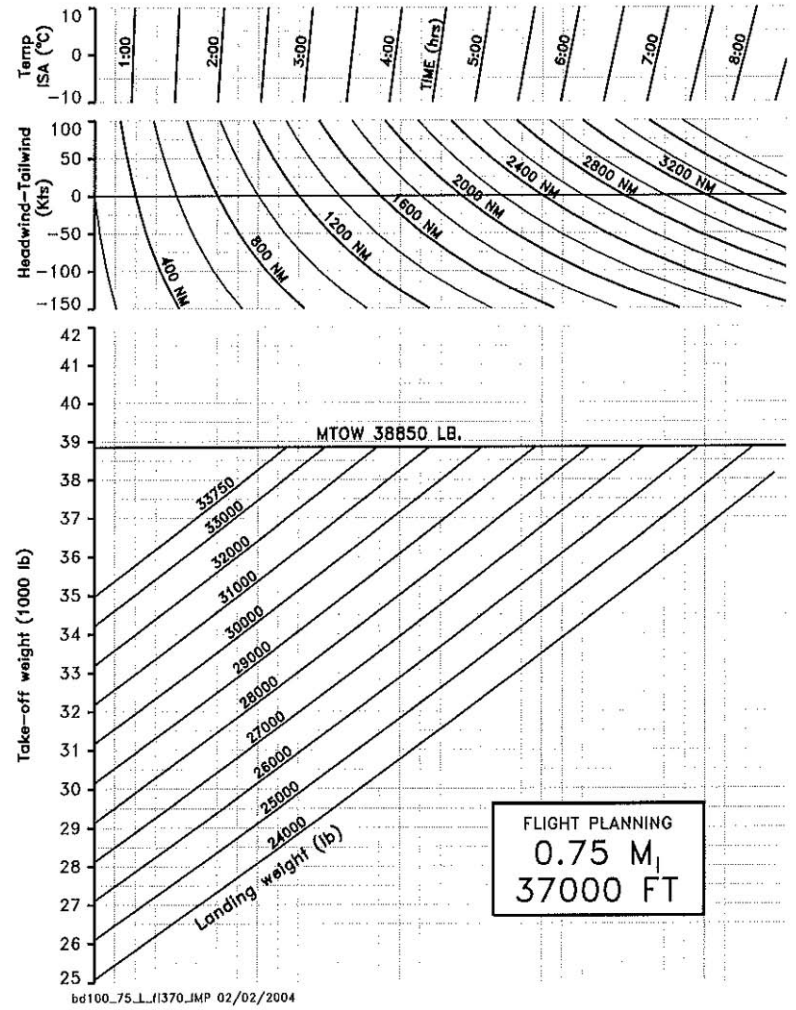

Figure 03-01-01. Simplified Flight Planning Charts—M 0.75 FL250–FL450 (Sheet 6 of 10)

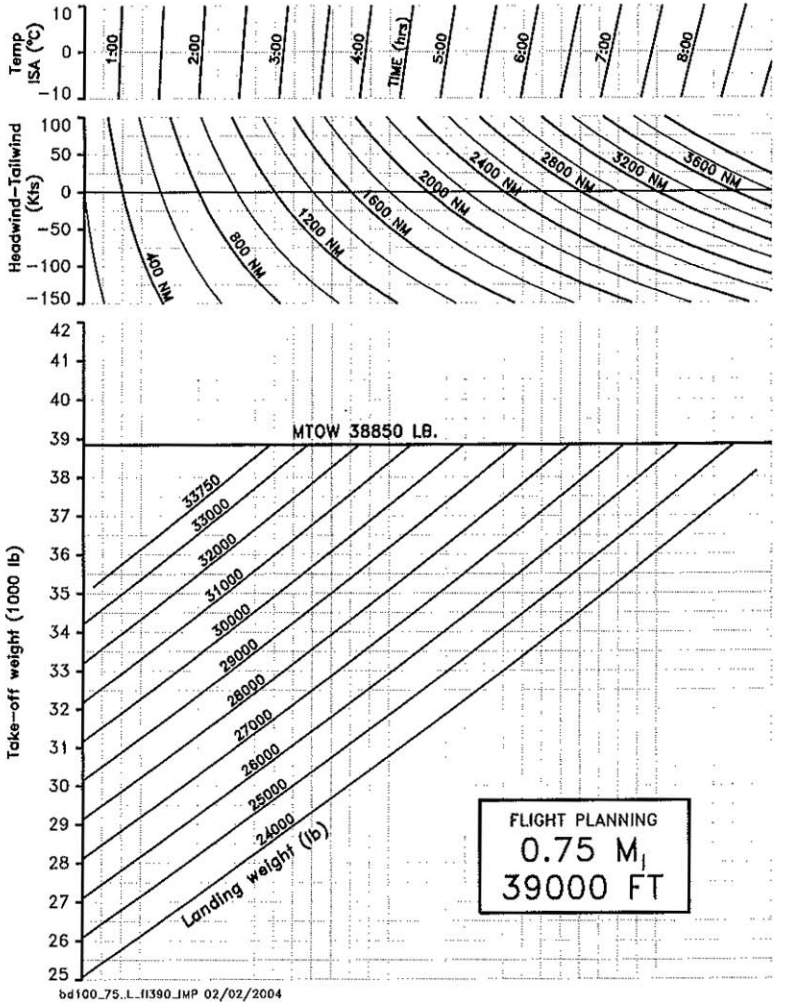

Figure 03-01-01. Simplified Flight Planning Charts—M 0.75 FL250–FL450 (Sheet 7 of 10)

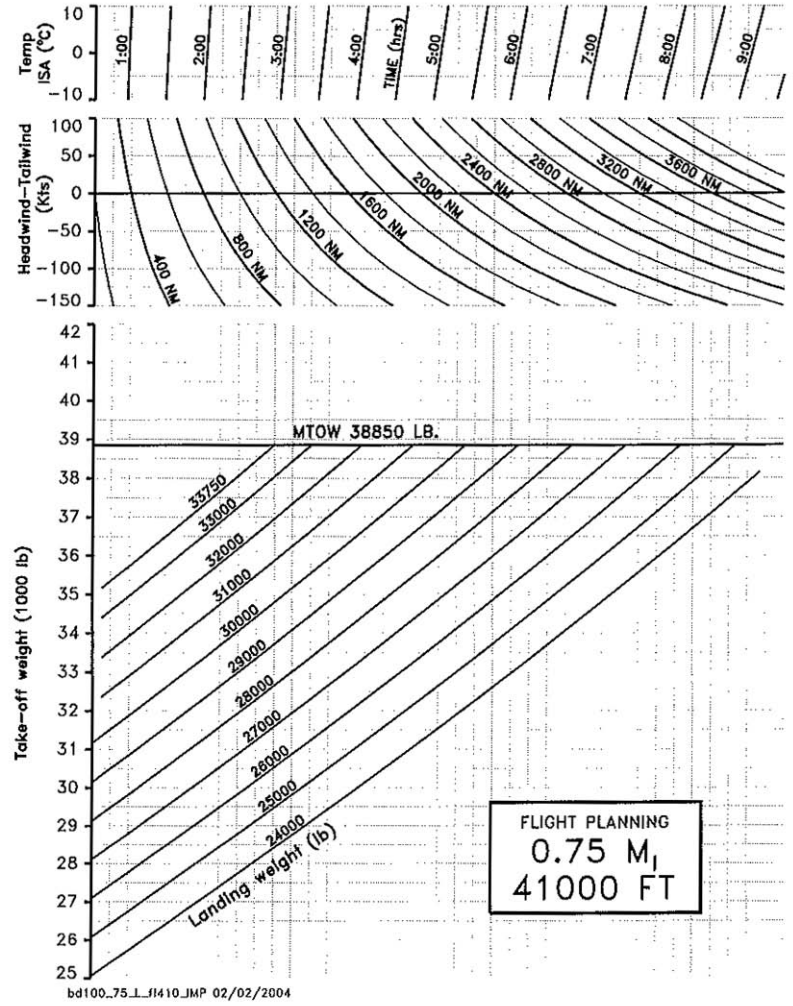

Figure 03-01-01. Simplified Flight Planning Charts—M 0.75 FL250–FL450 (Sheet 8 of 10)

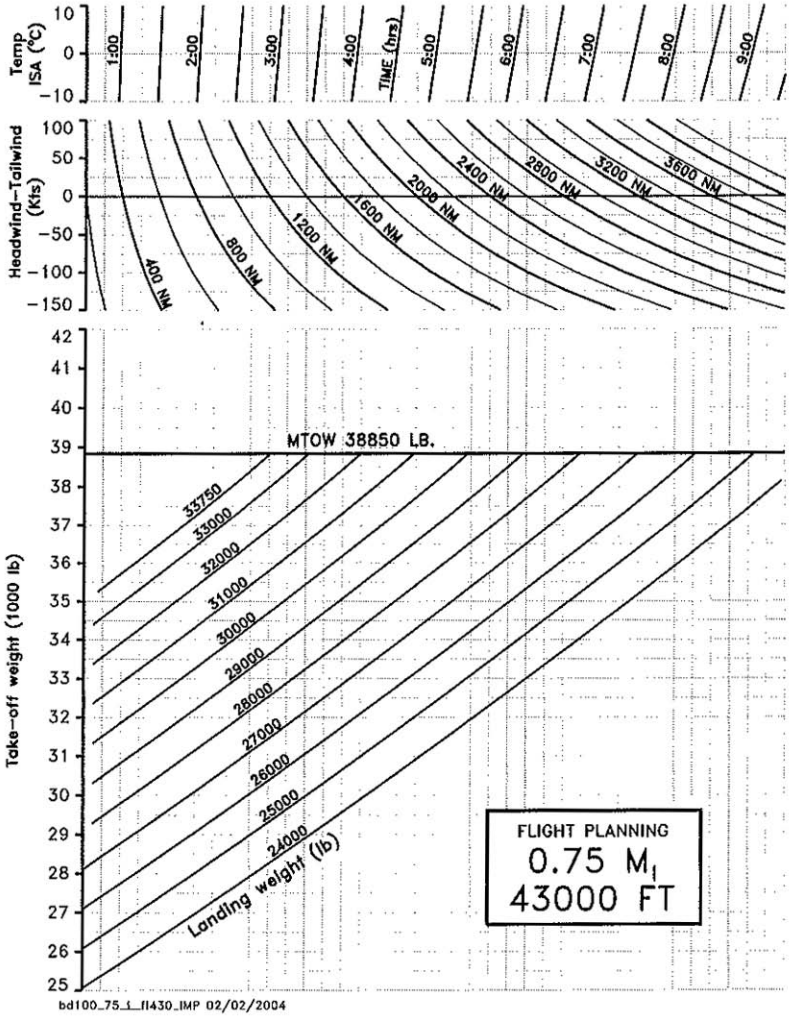

Figure 03-01-01. Simplified Flight Planning Charts—M 0.75 FL250–FL450 (Sheet 9 of 10)

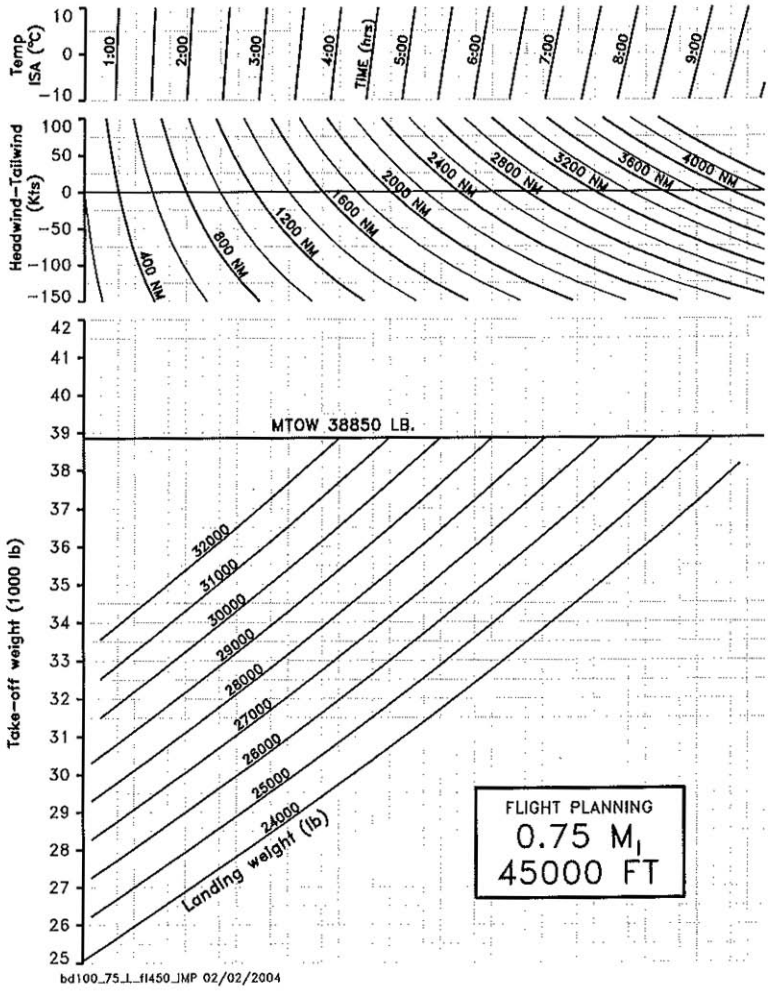

Figure 03-01-01. Simplified Flight Planning Charts—M 0.75 FL250–FL450 (Sheet 10 of 10)

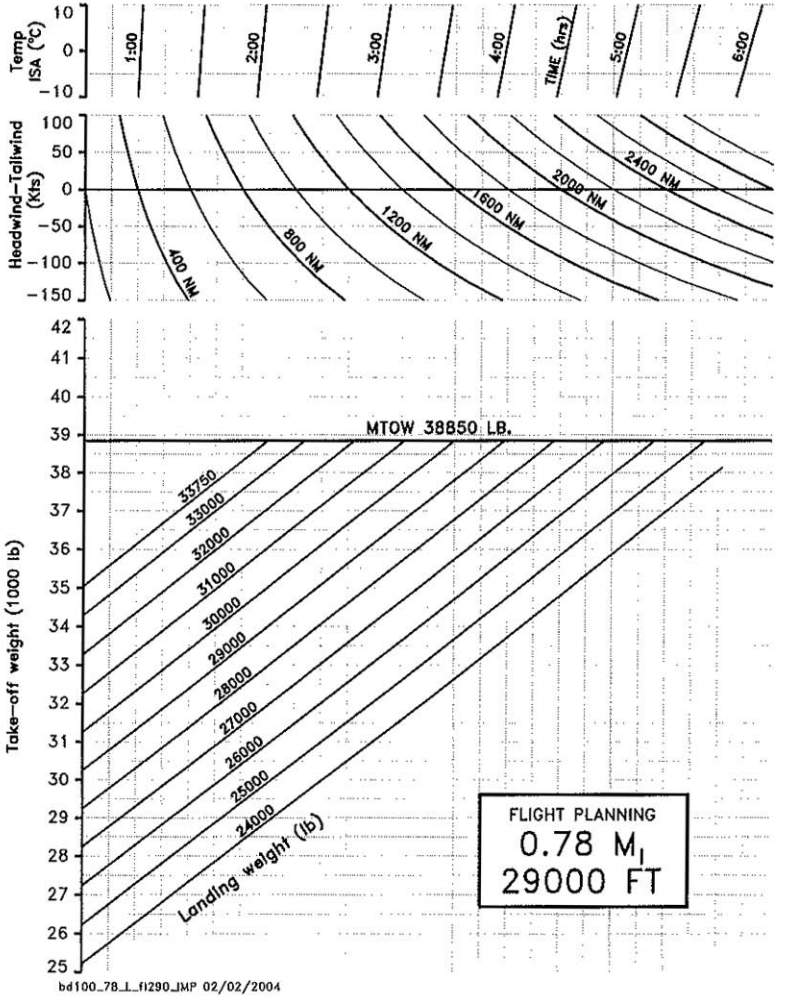

Figure 03-01-02. Simplified Flight Planning Charts—M 0.78 FL280–FL450 (Sheet 1 of 9)

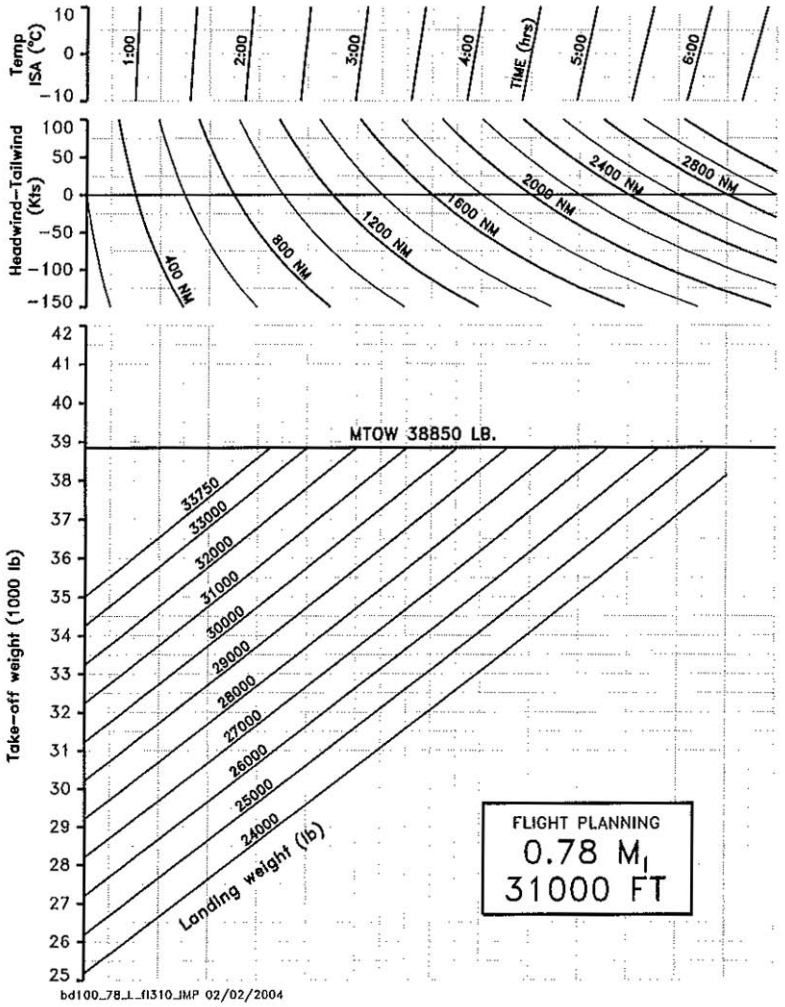

Figure 03-01-02. Simplified Flight Planning Charts—M 0.78 FL290–FL450 (Sheet 2 of 9)

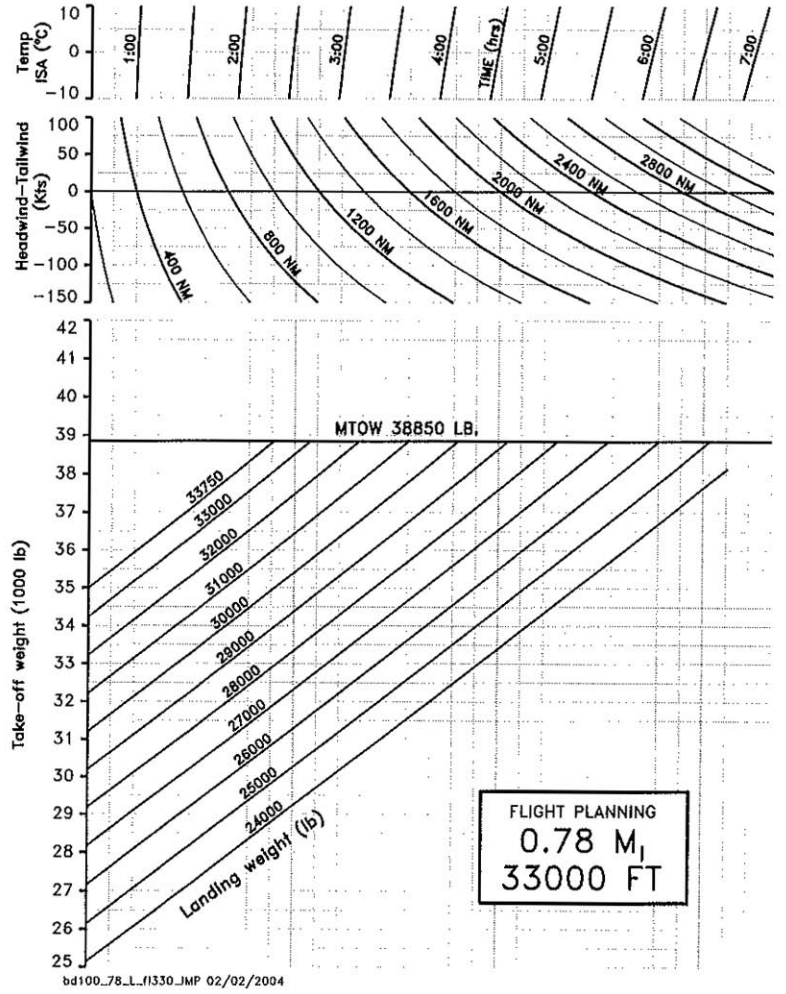

Figure 03-01-02. Simplified Flight Planning Charts—M 0.78 FL290–FL450 (Sheet 3 of 9)

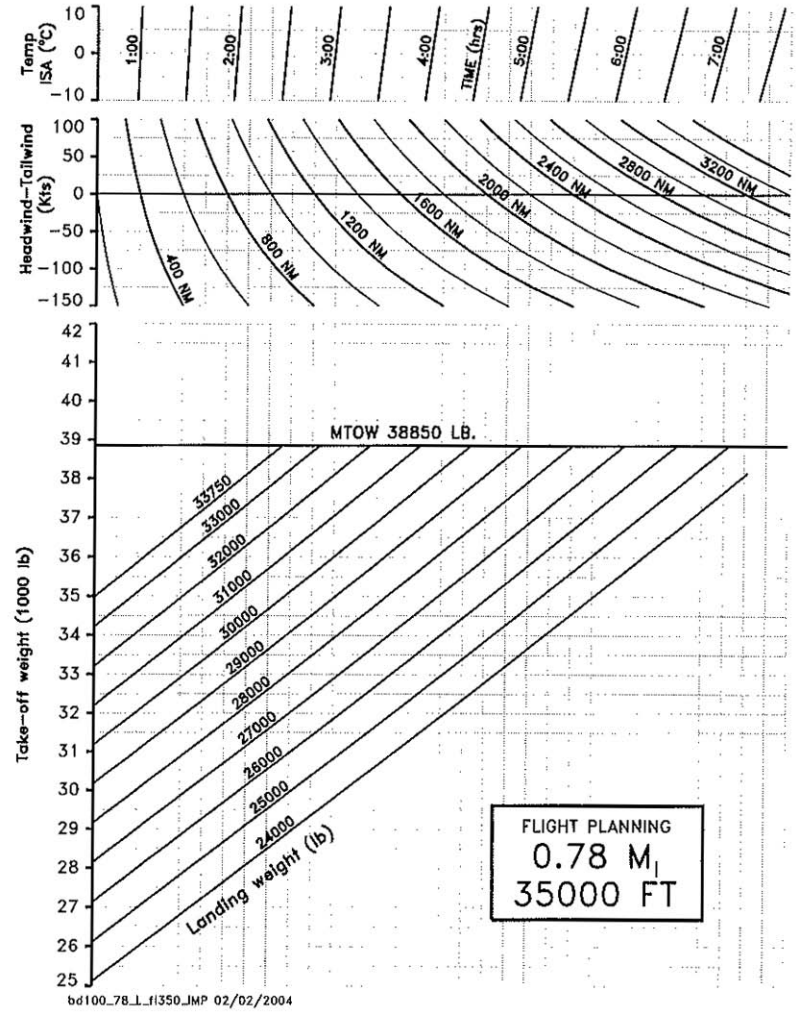

Figure 03-01-02. Simplified Flight Planning Charts—M 0.78 FL290–FL450 (Sheet 4 of 9)

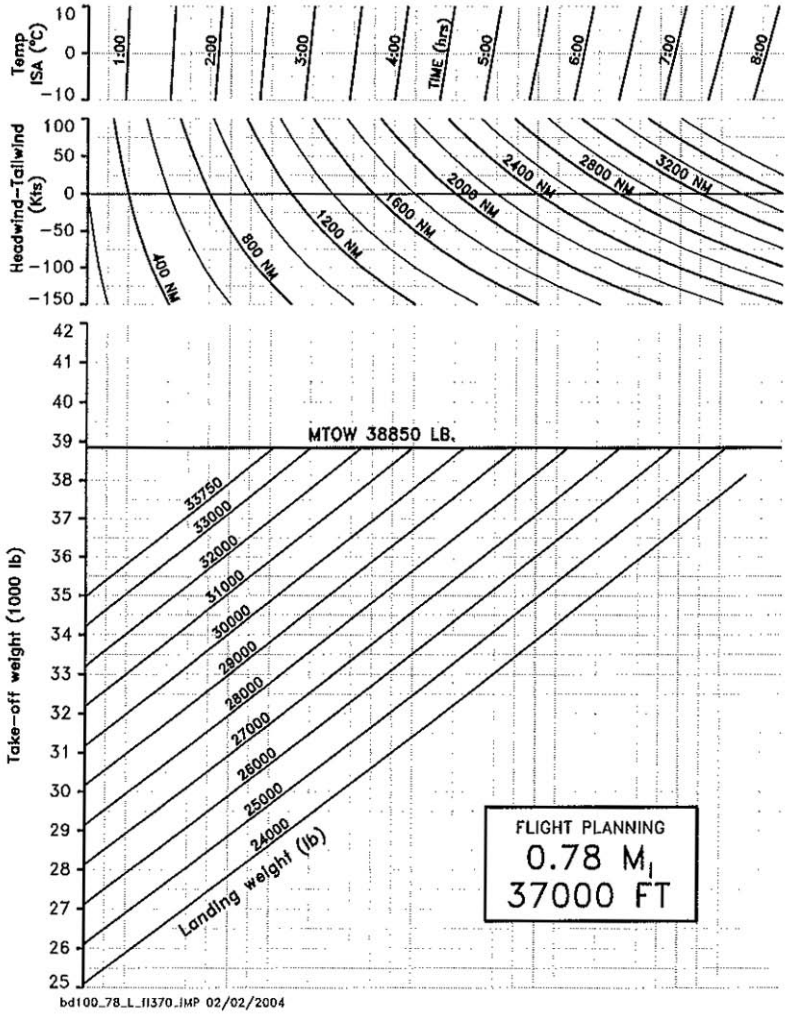

Figure 03-01-02. Simplified Flight Planning Charts—M 0.78 FL290–FL450 (Sheet 5 of 9)

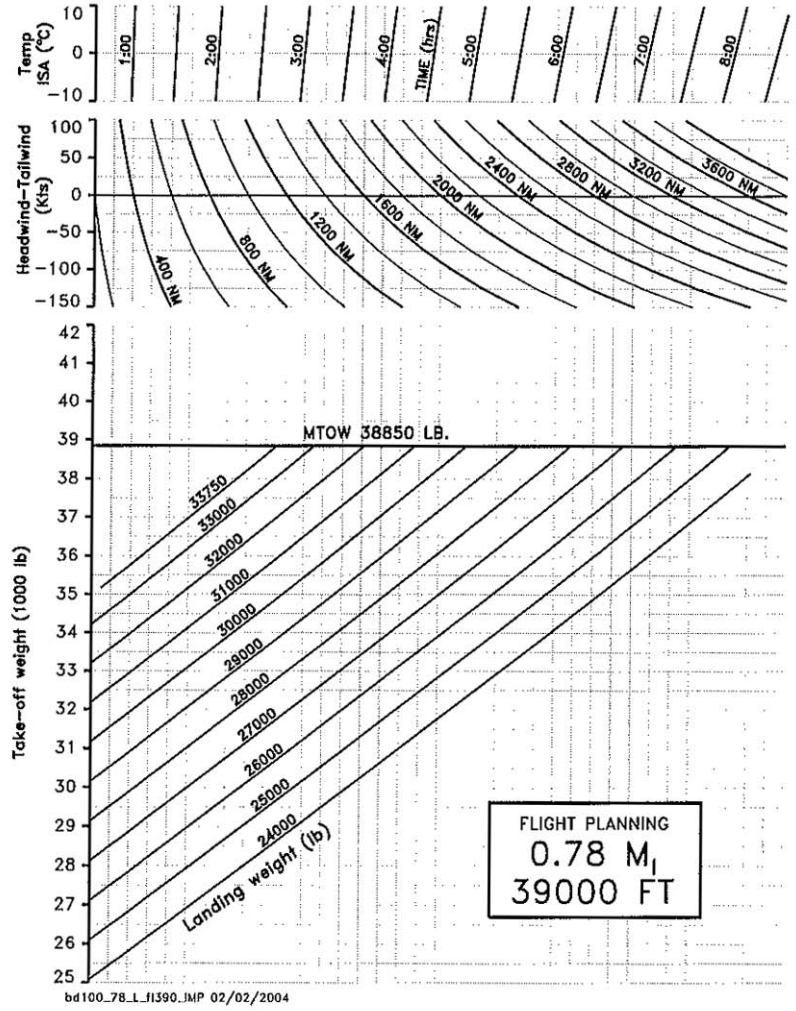

Figure 03-01-02. Simplified Flight Planning Charts—M 0.78 FL290–FL450 (Sheet 6 of 9)

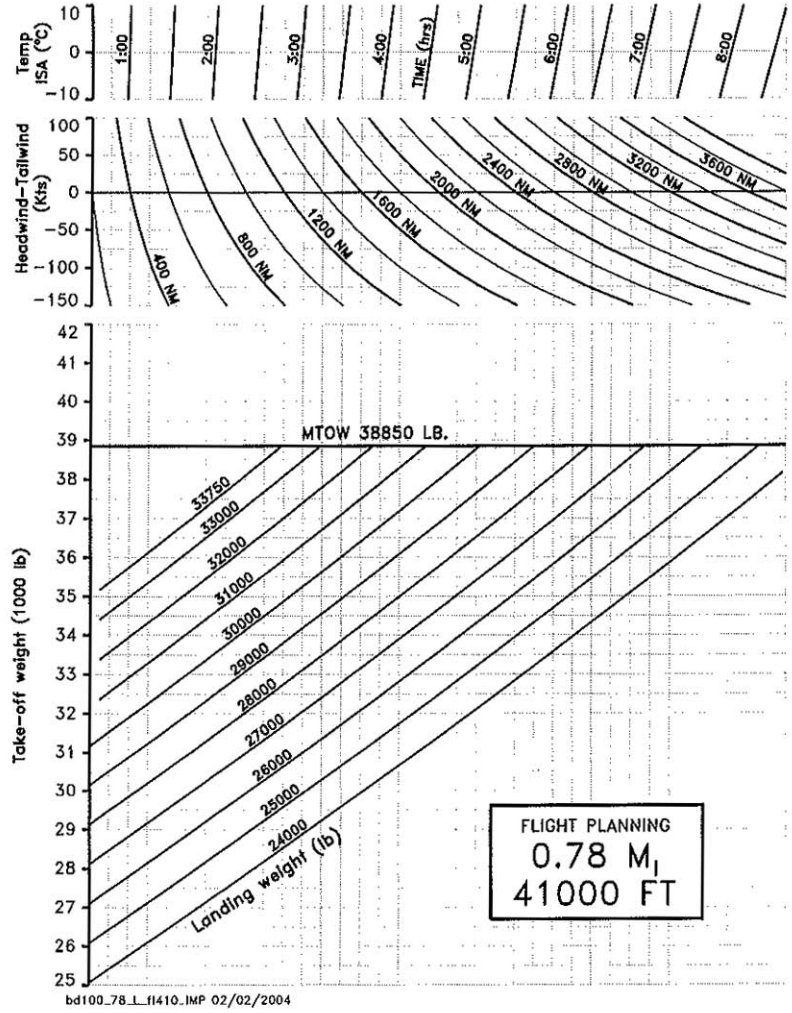

Figure 03-01-02. Simplified Flight Planning Charts—M 0.78 FL290–FL450 (Sheet 7 of 9)

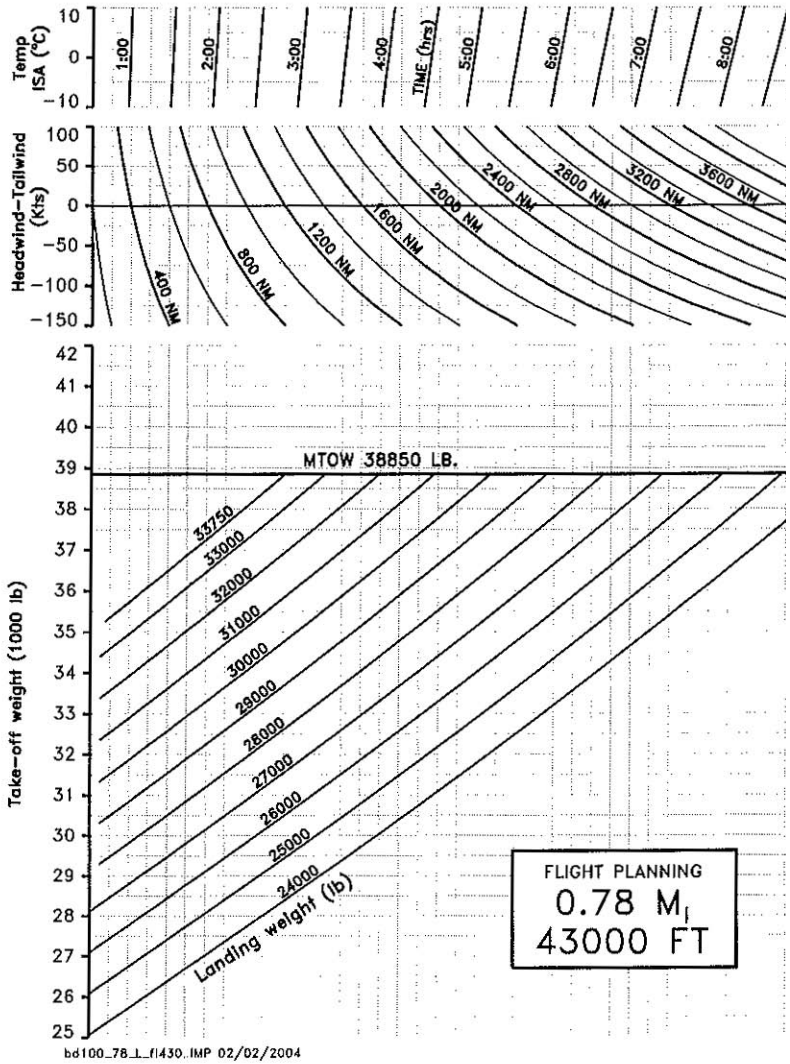

Figure 03-01-02. Simplified Flight Planning Charts—M 0.78 FL290–FL450 (Sheet 8 of 9)

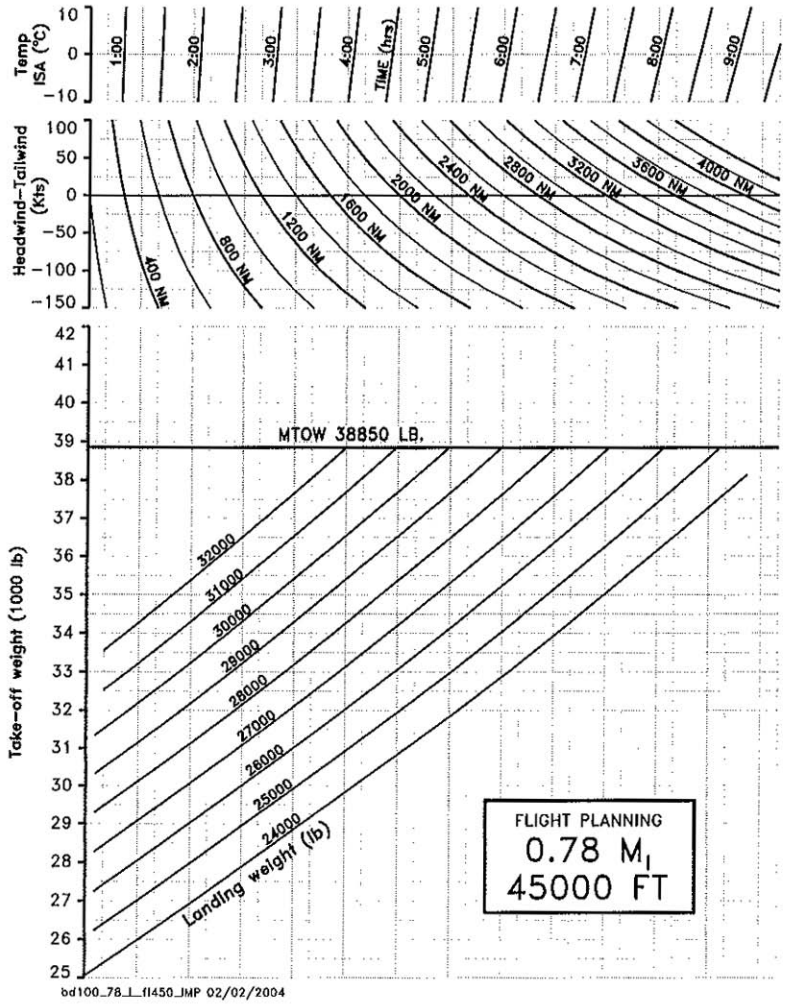

Figure 03-01-02. Simplified Flight Planning Charts—M 0.78 FL290–FL450 (Sheet 9 of 9)

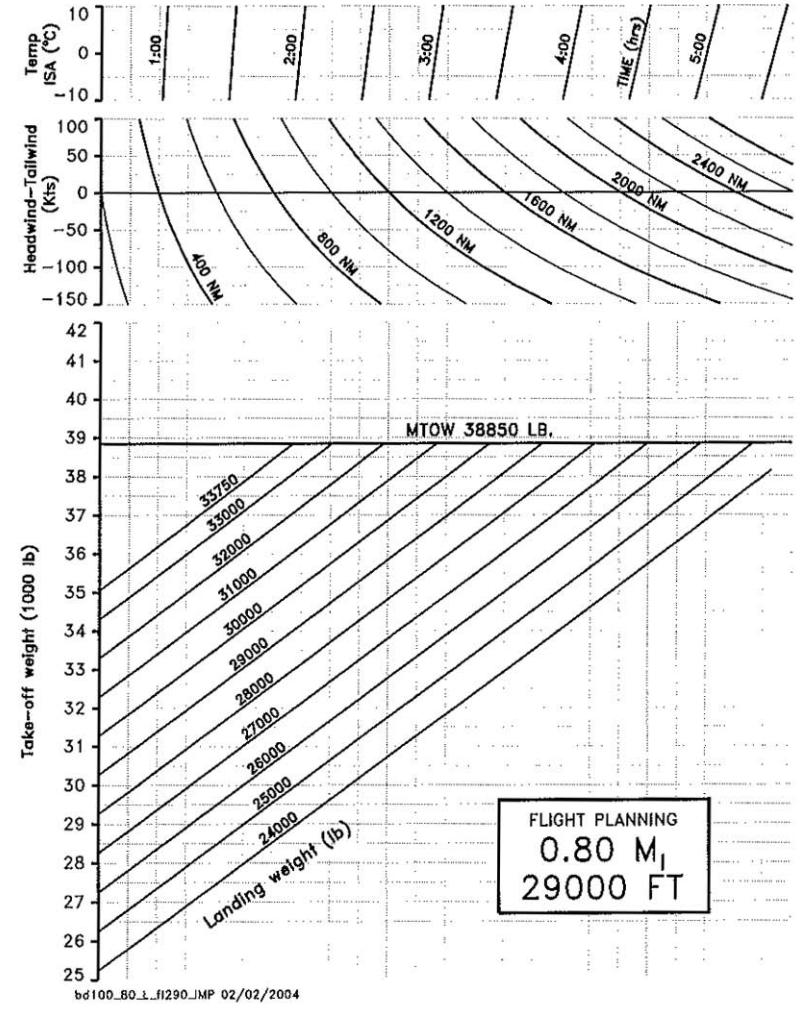

Figure 03-01-03. Simplified Flight Planning Charts—M 0.80 FL290–FL450 (Sheet 1 of 9)

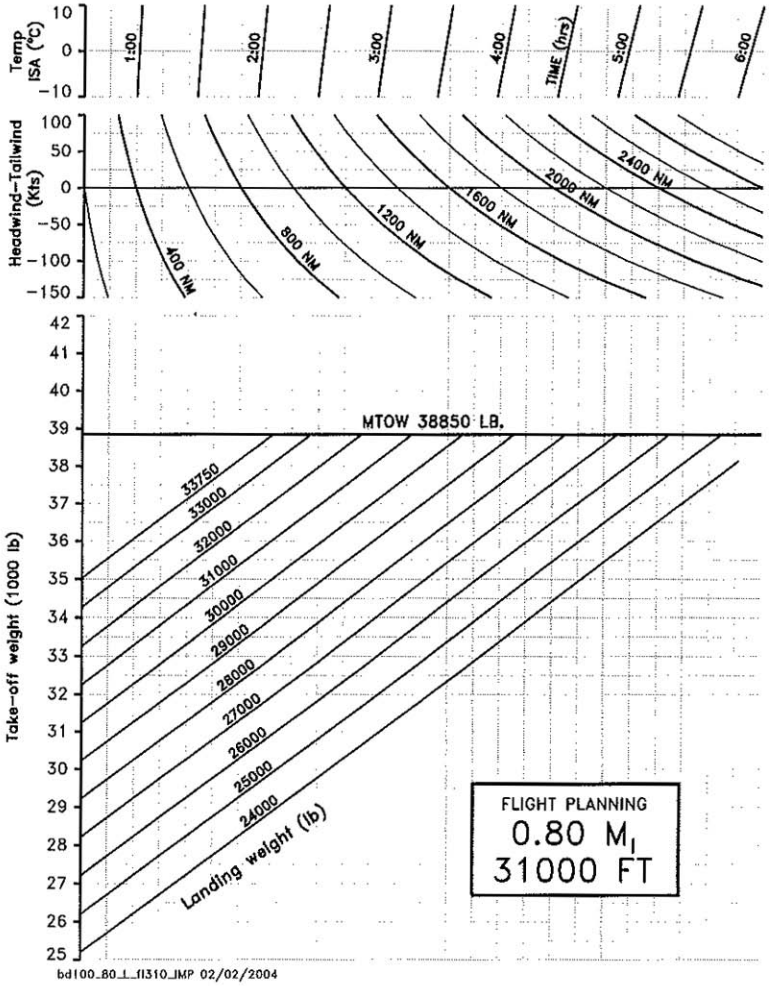

Figure 03-01-03. Simplified Flight Planning Charts—M 0.80 FL290–FL450 (Sheet 2 of 9)

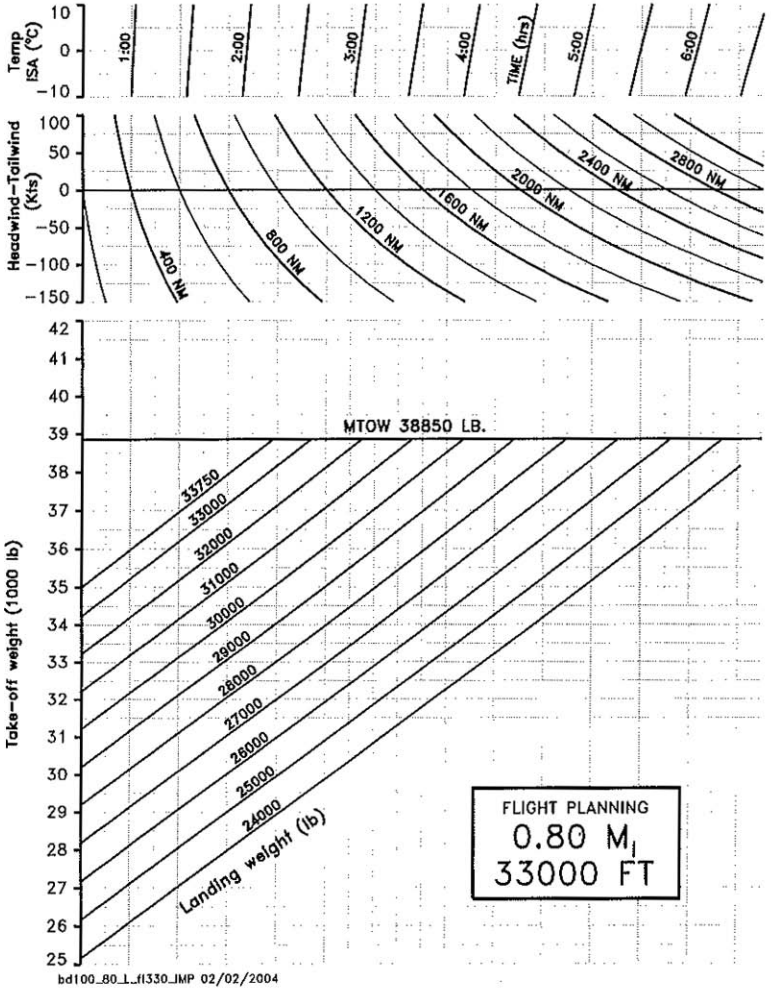

Figure 03-01-03. Simplified Flight Planning Charts—M 0.90 FL290–FL450 (Sheet 2 of 9)

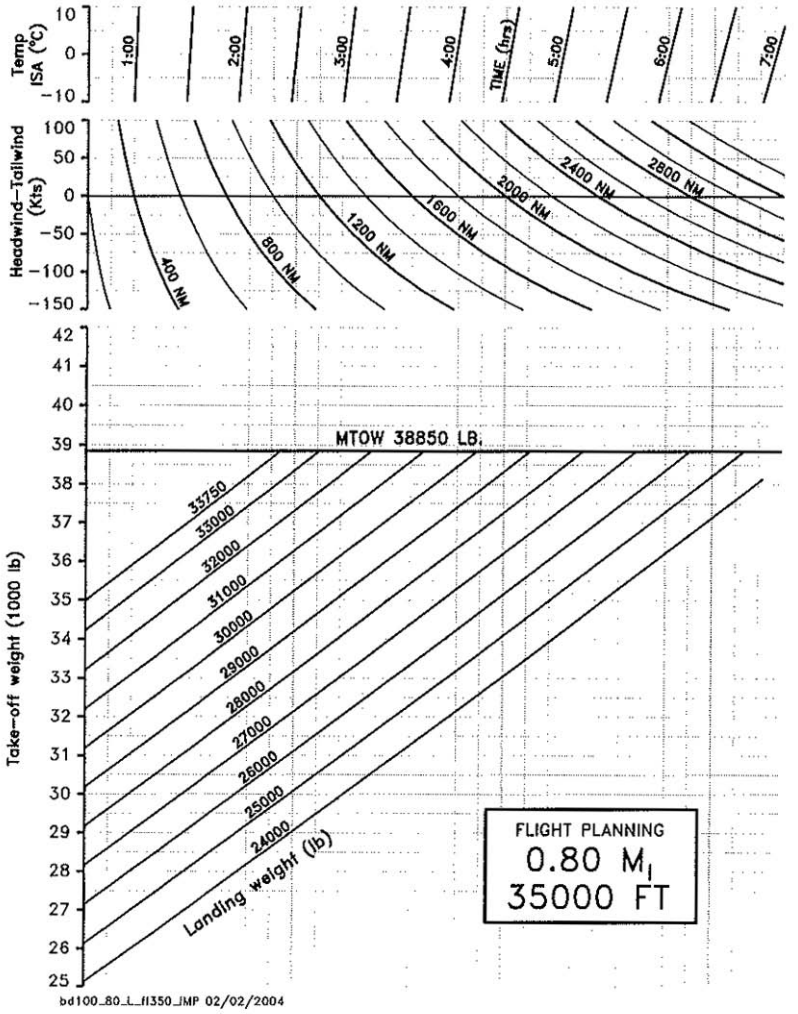

Figure 03-01-03. Simplified Flight Planning Charts—M 0.80 FL290–FL450 (Sheet 3 of 9)

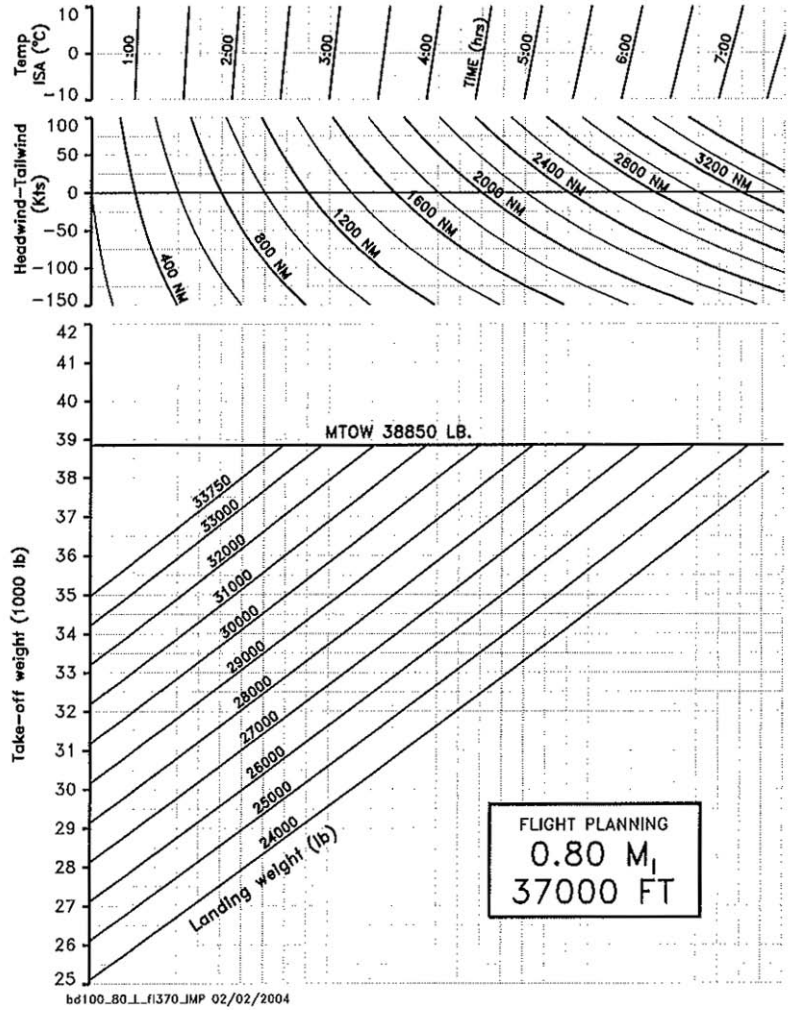

Figure 03-01-03. Simplified Flight Planning Charts—M 0.80 FL290–FL450 (Sheet 4 of 9)

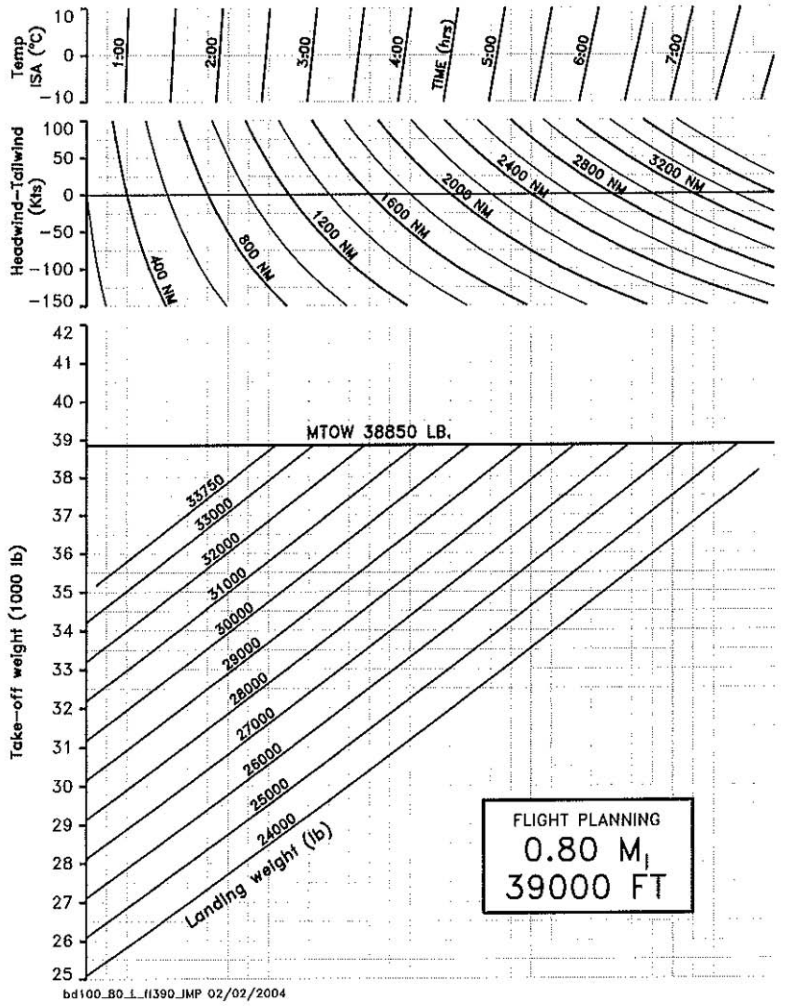

Figure 03-01-03. Simplified Flight Planning Charts—M 0.80 FL290–FL450 (Sheet 5 of 9)

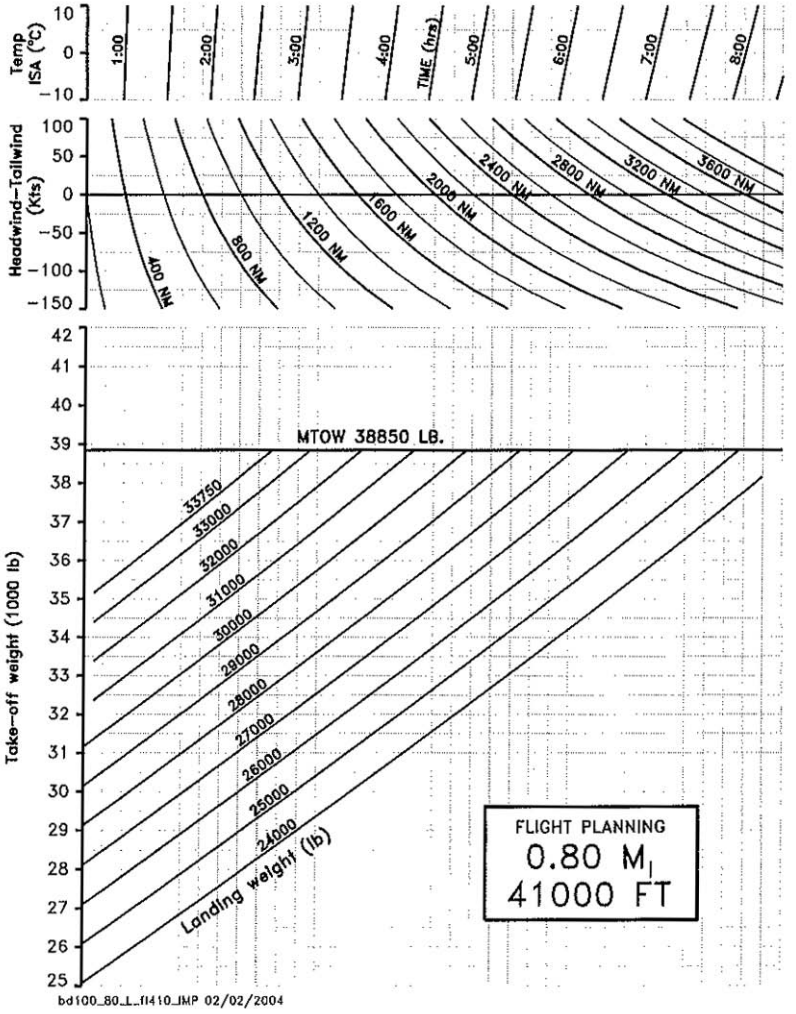

Figure 03-01-03. Simplified Flight Planning Charts—M 0.80 FL290–FL450 (Sheet 6 of 9)

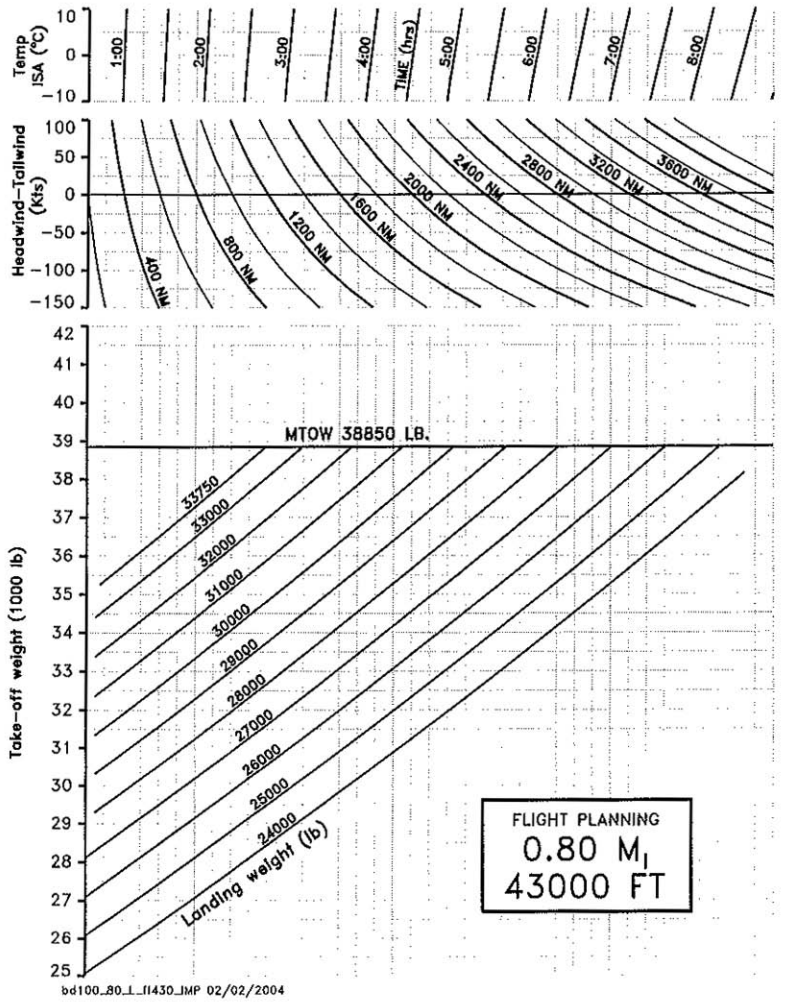

Figure 03-01-03. Simplified Flight Planning Charts—M 0.80 FL290–FL450 (Sheet 8 of 9)

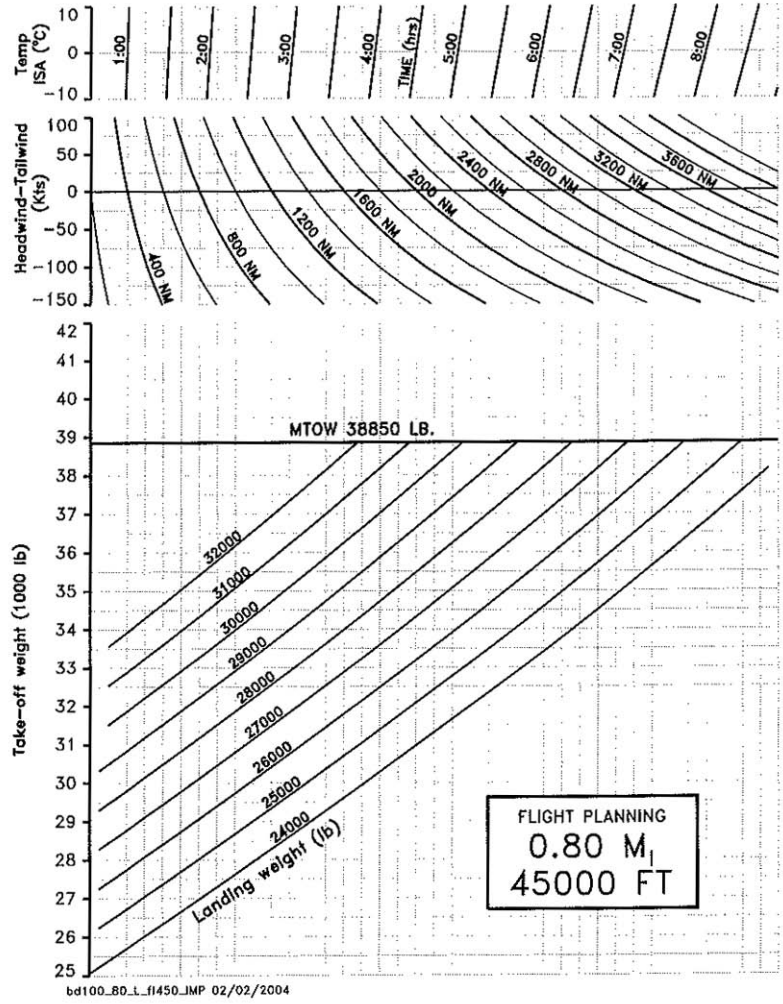

Figure 03-01-03. Simplified Flight Planning Charts—M 0.80 FL290–FL450 (Sheet 9 of 9)

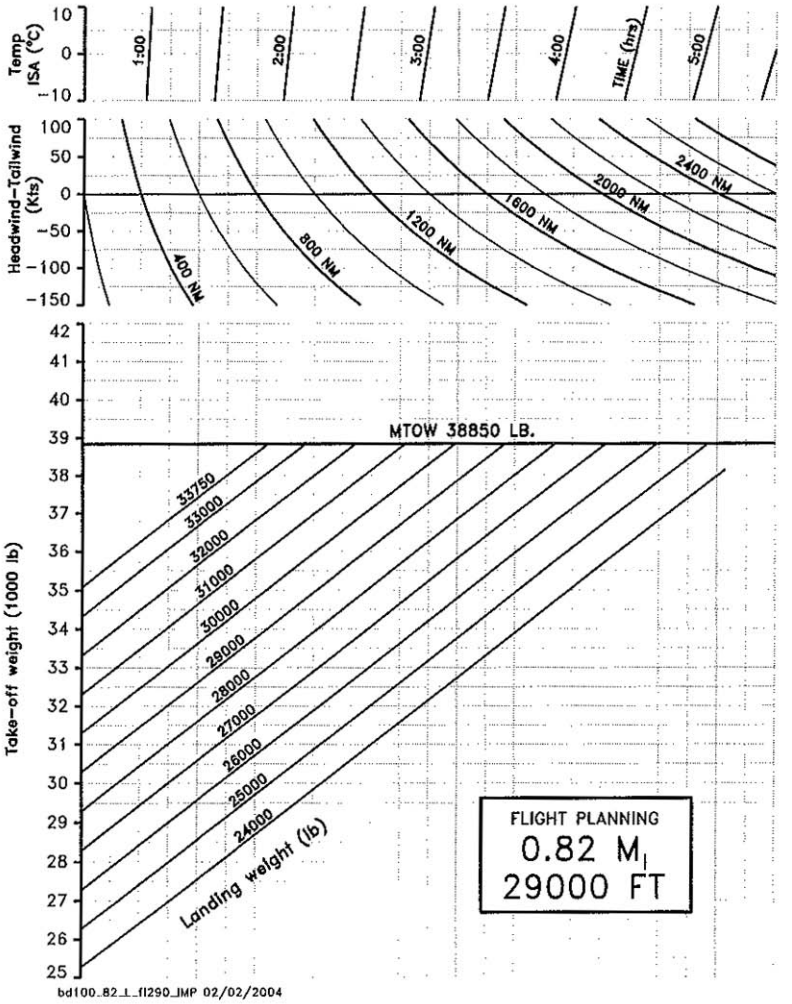

Figure 03-01-04. Simplified Flight Planning Charts—M 0.82 FL290–FL450 (Sheet 1 of 9)

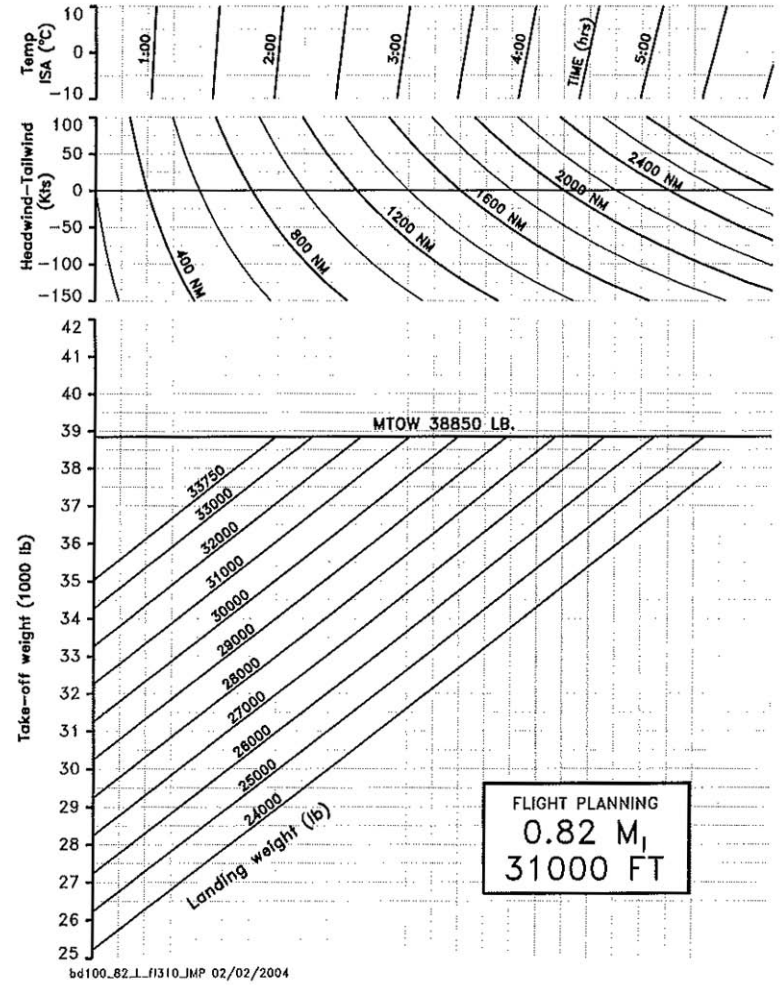

Figure 03-01-04. Simplified Flight Planning Charts—M 0.82 FL290–FL450 (Sheet 2 of 9)

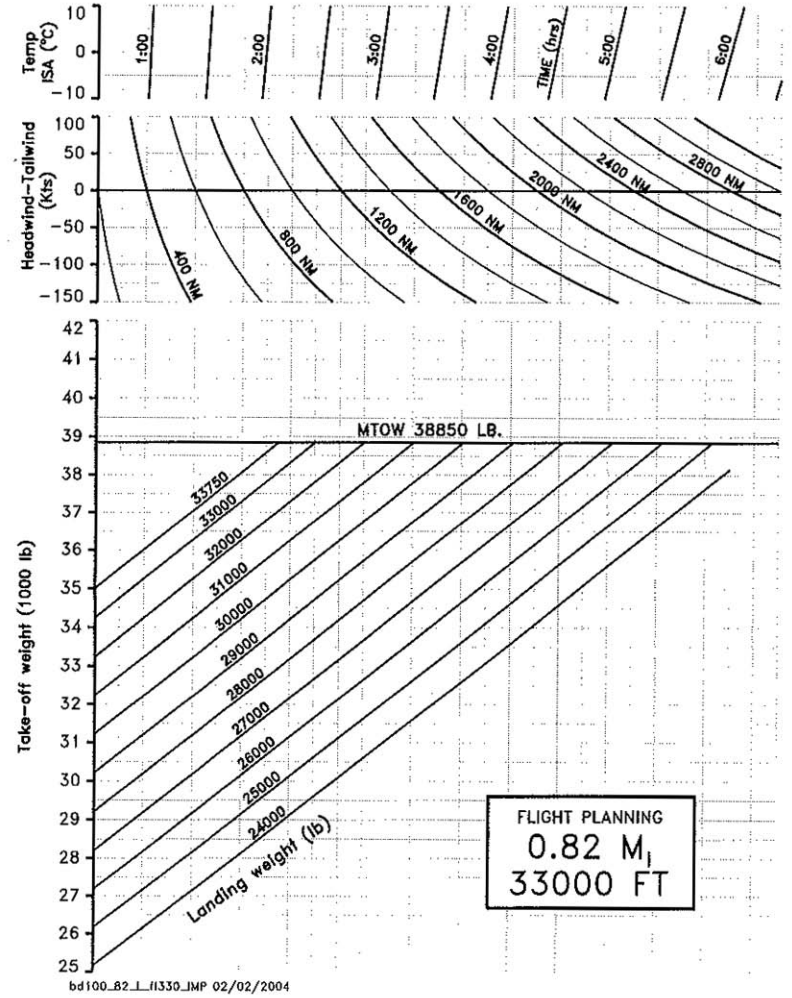

Figure 03-01-04. Simplified Flight Planning Charts—M 0.82 FL290–FL450 (Sheet 3 of 9)

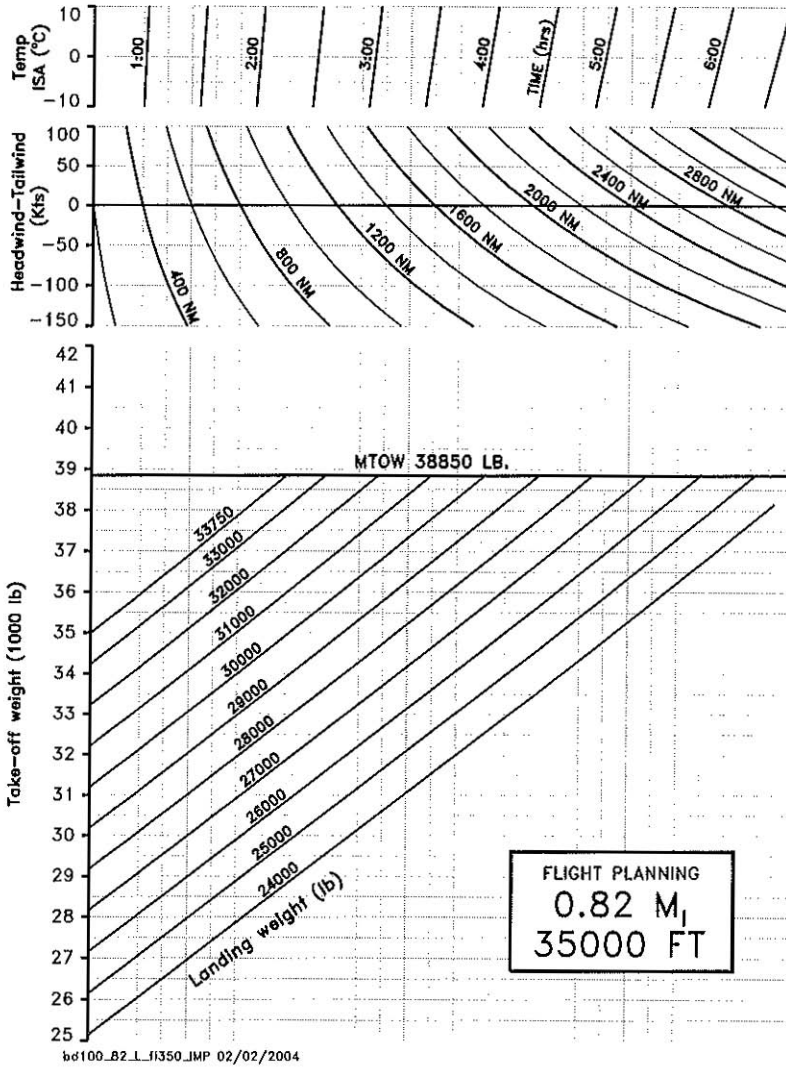

Figure 03-01-04. Simplified Flight Planning Charts—M 0.82 FL290–FL450 (Sheet 4 of 9)

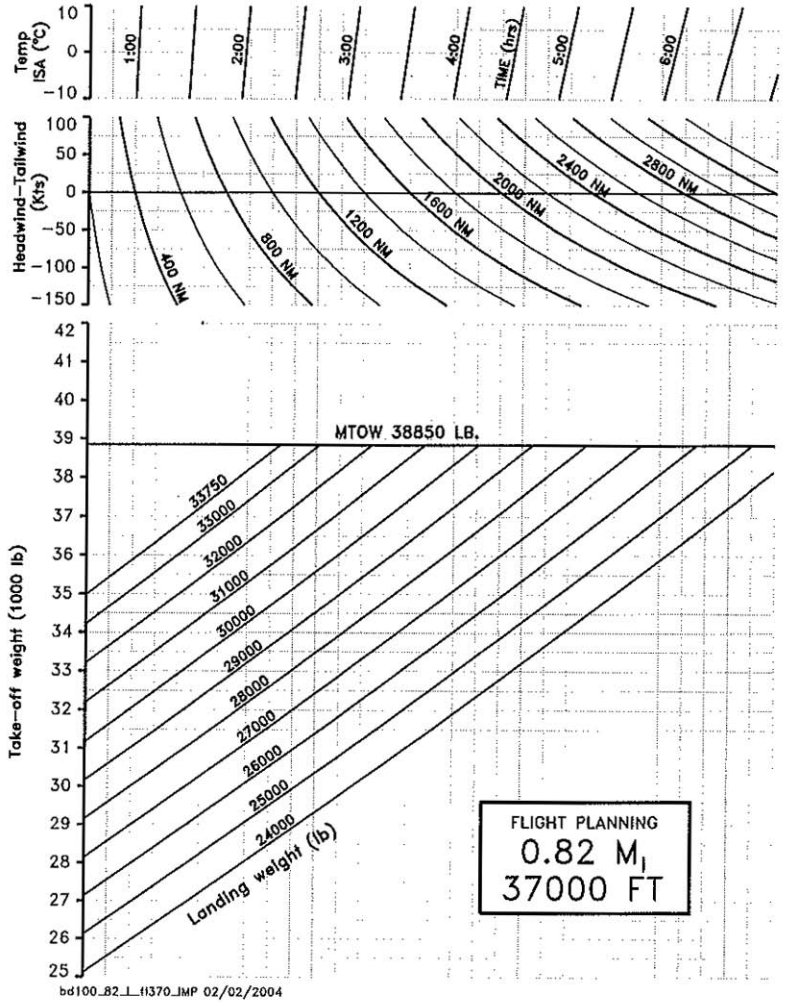

Figure 03-01-04. Simplified Flight Planning Charts—M 0.82 FL290–FL450 (Sheet 5 of 9)

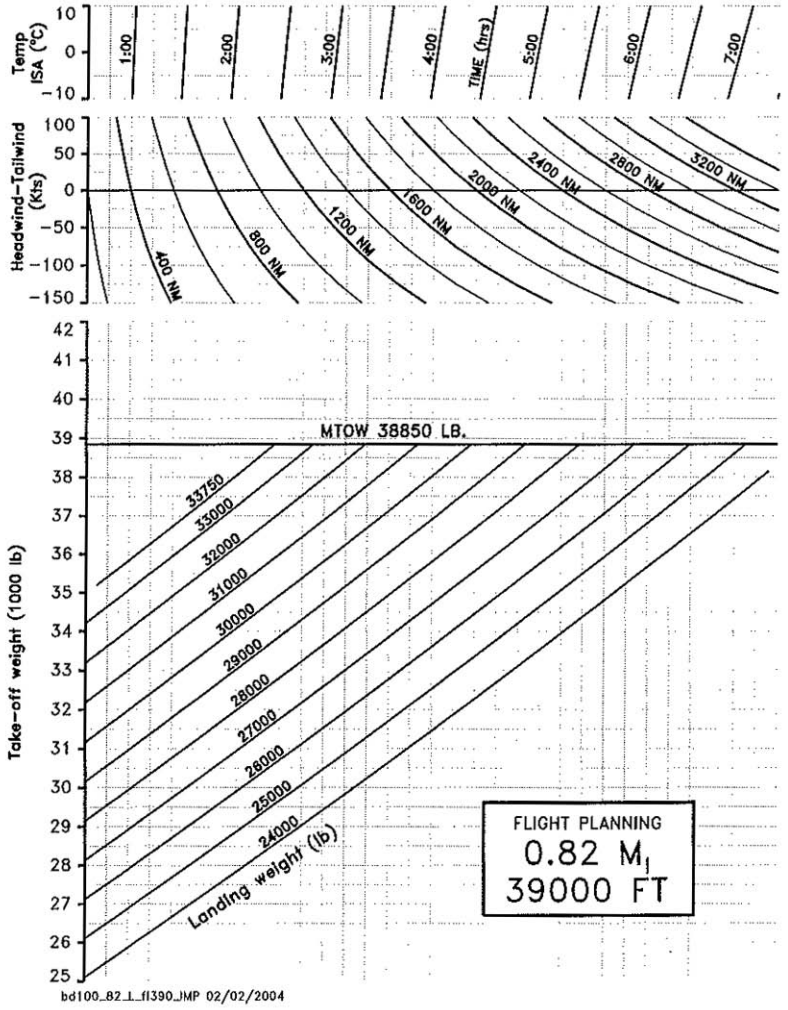

Figure 03-01-04. Simplified Flight Planning Charts—M 0.82 FL290–FL450 (Sheet 6 of 9)

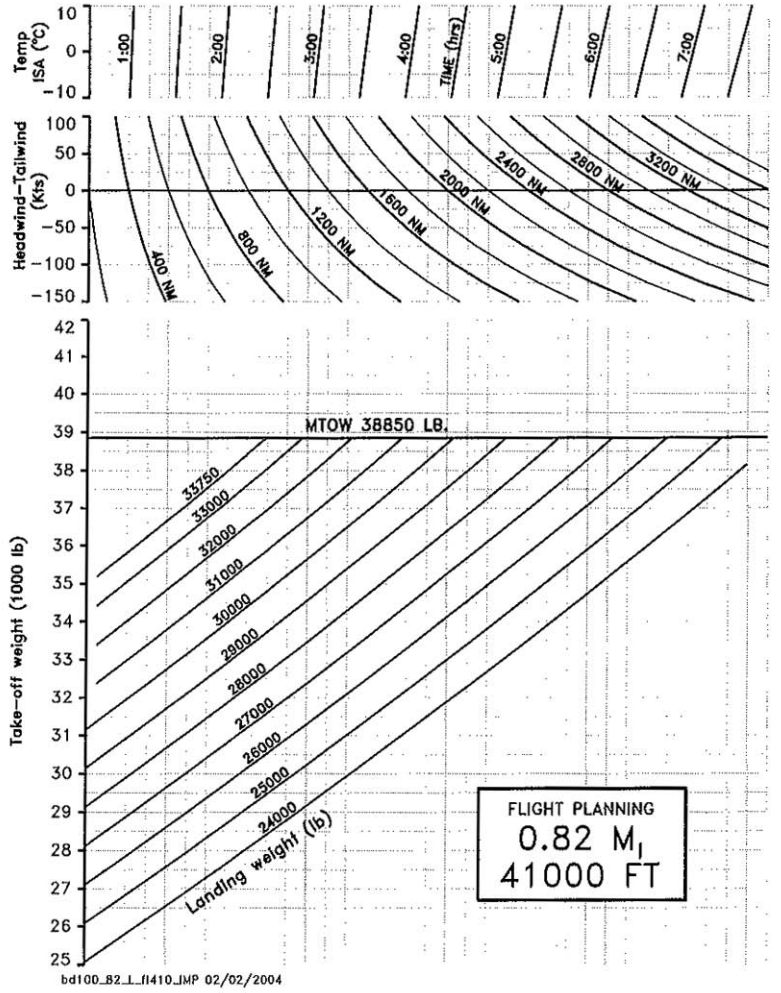

Figure 03-01-04. Simplified Flight Planning Charts—M 0.82 FL290–FL450 (Sheet 7 of 9)

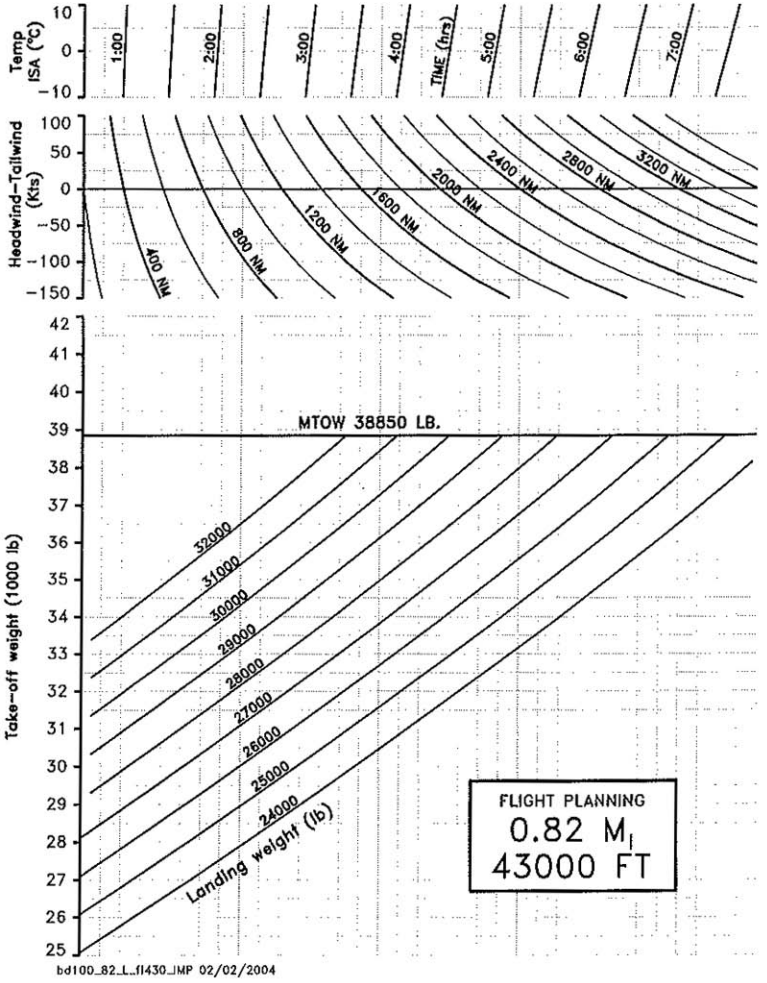

Figure 03-01-04. Simplified Flight Planning Charts—M 0.82 FL290–FL450 (Sheet 8 of 9)

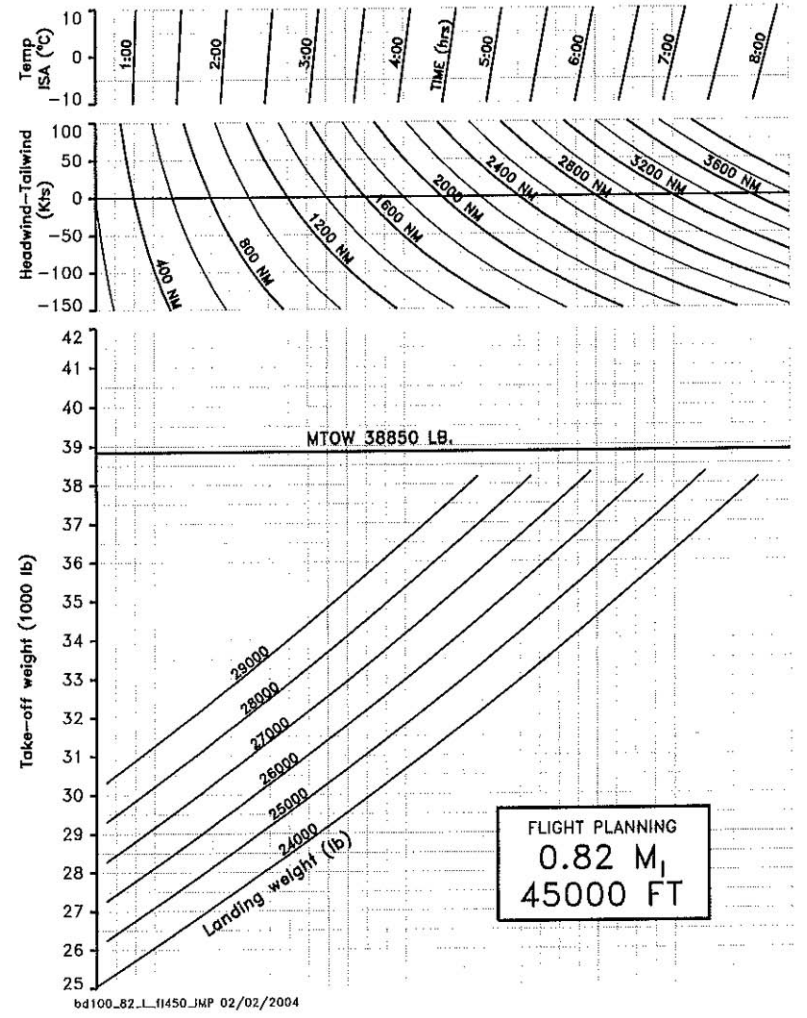

Figure 03-01-04. Simplified Flight Planning Charts—M 0.82 FL290–FL450 (Sheet 9 of 9)

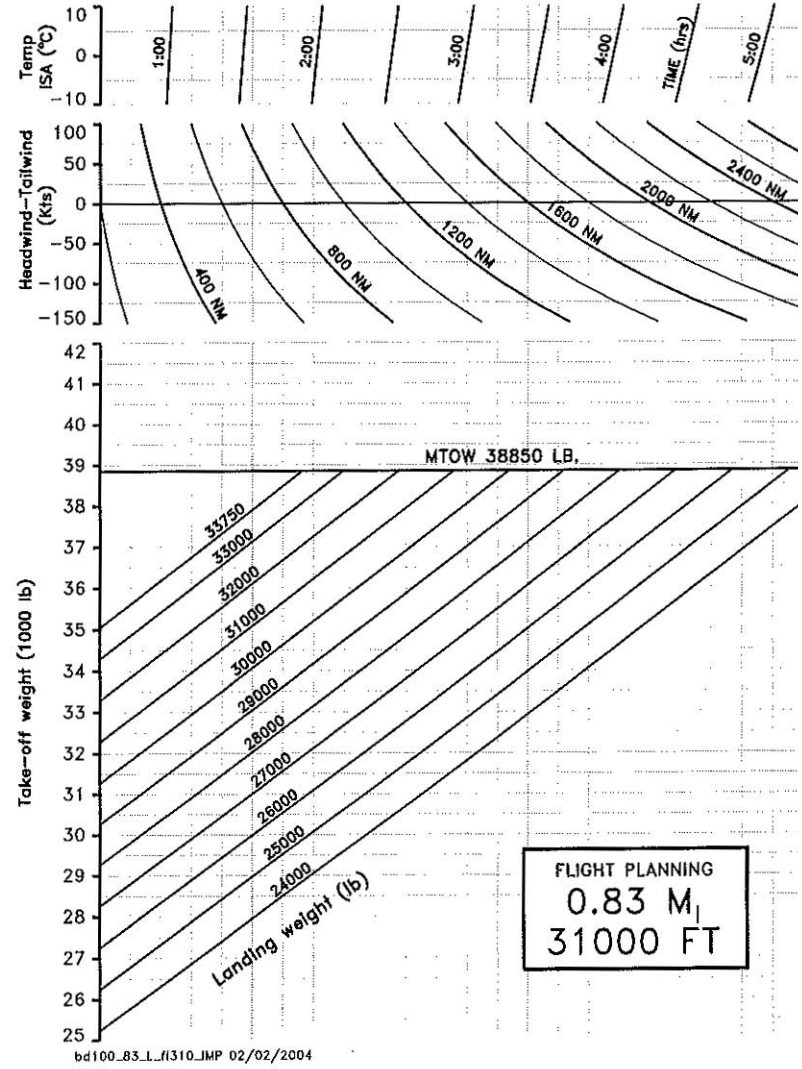

Figure 03-01-05. Simplified Flight Planning Charts—M 0.83 FL310–FL450 (Sheet 1 of 8)

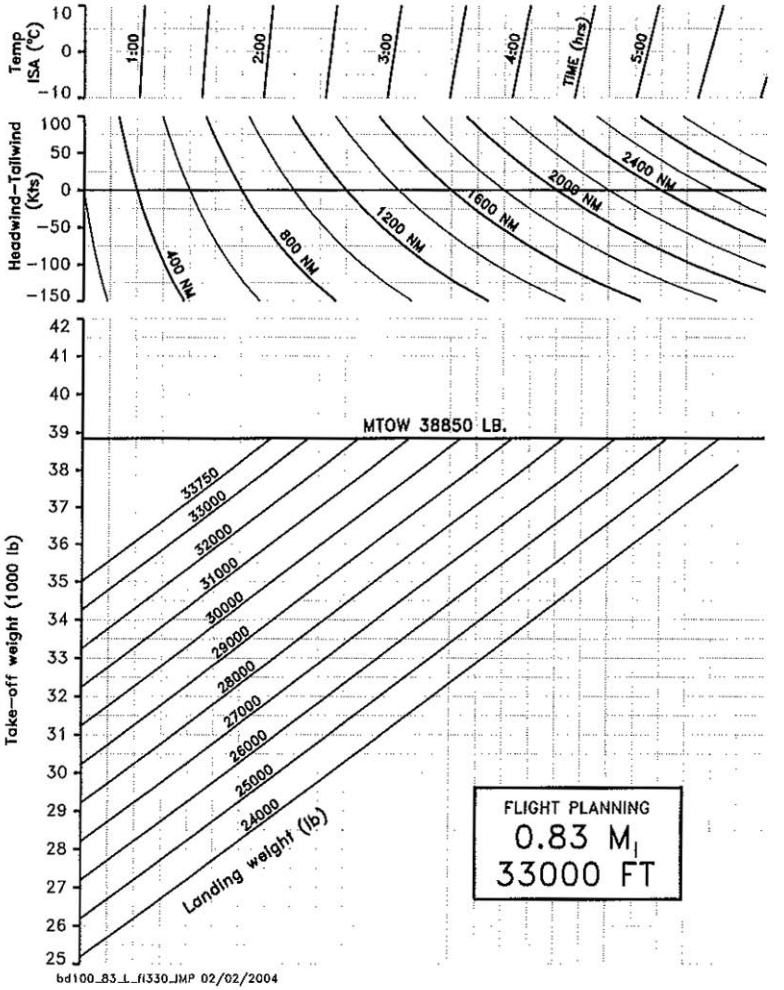

Figure 03-01-05. Simplified Flight Planning Charts—M 0.83 FL310–FL450 (Sheet 2 of 8)

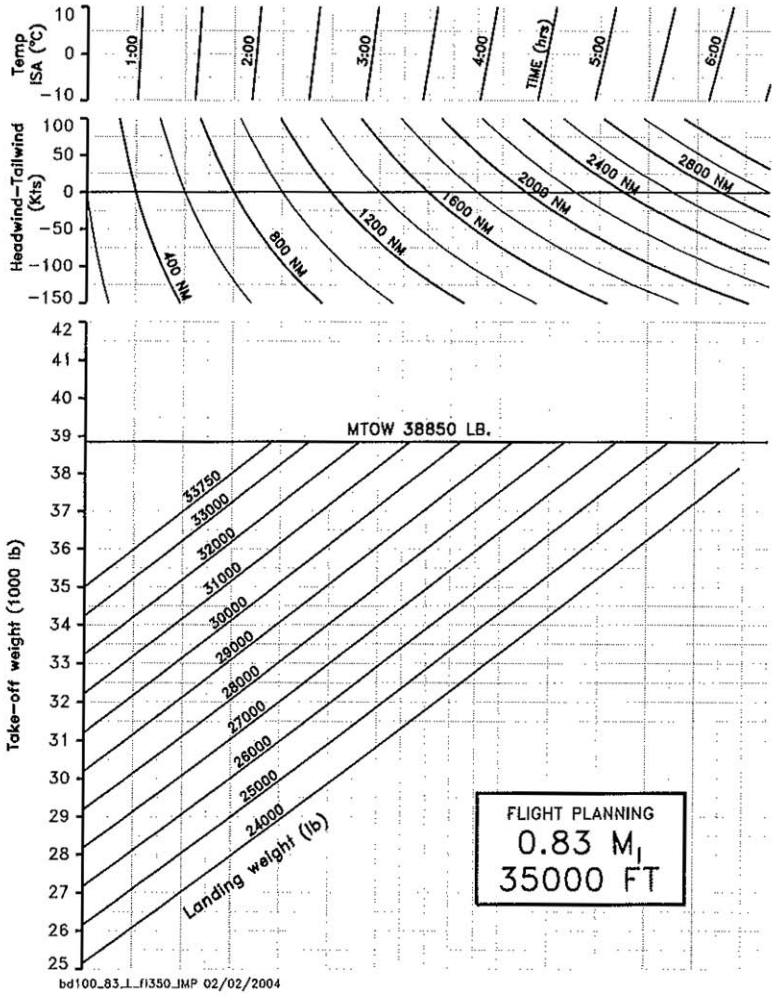

Figure 03-01-05. Simplified Flight Planning Charts—M 0.83 FL310–FL450 (Sheet 3 of 8)

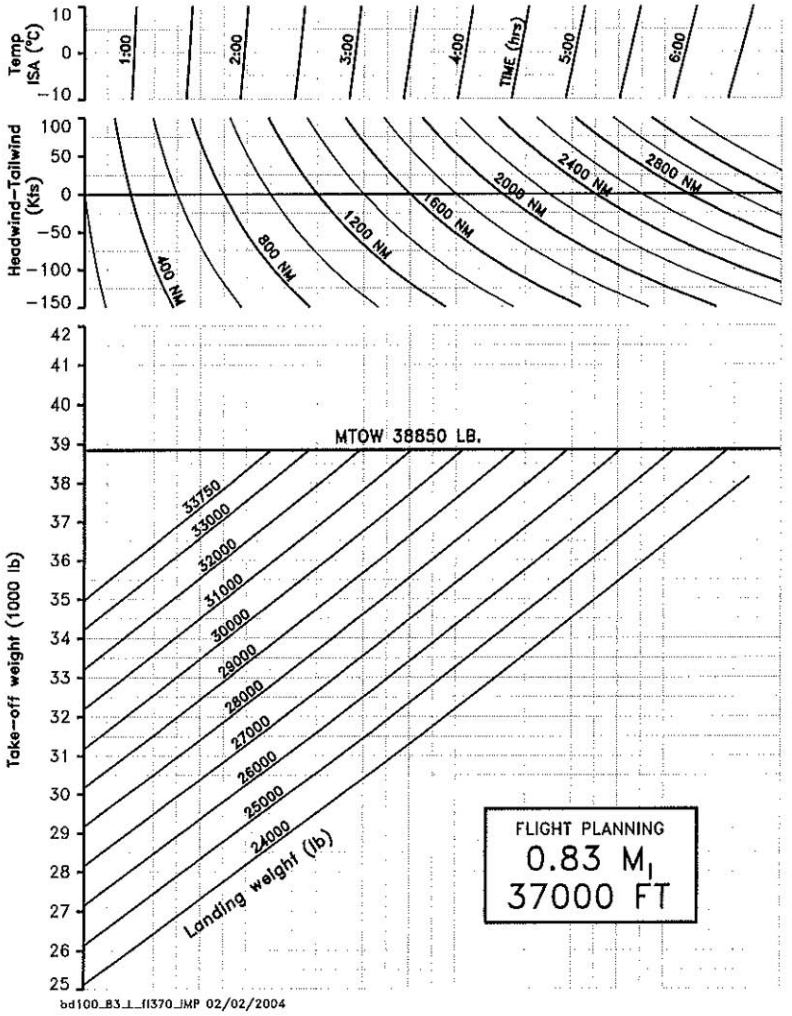

Figure 03-01-05. Simplified Flight Planning Charts—M 0.83 FL310–FL450 (Sheet 4 of 8)

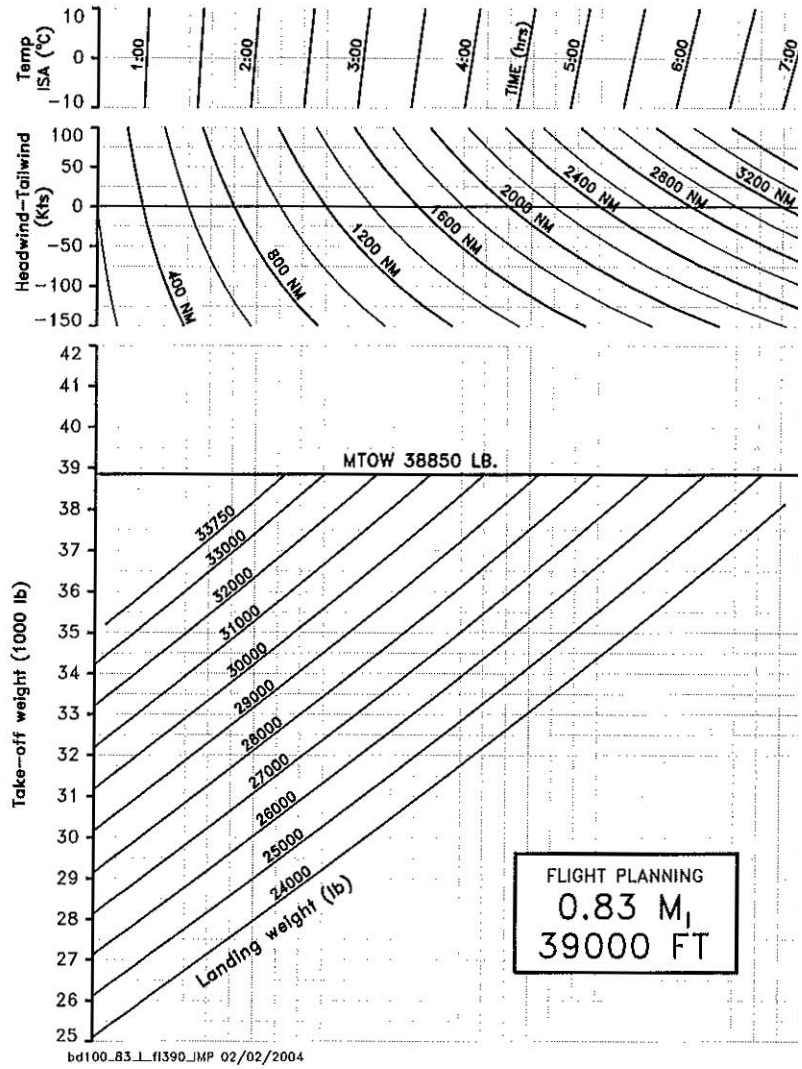

Figure 03-01-05. Simplified Flight Planning Charts—M 0.83 FL310–FL450 (Sheet 5 of 8)

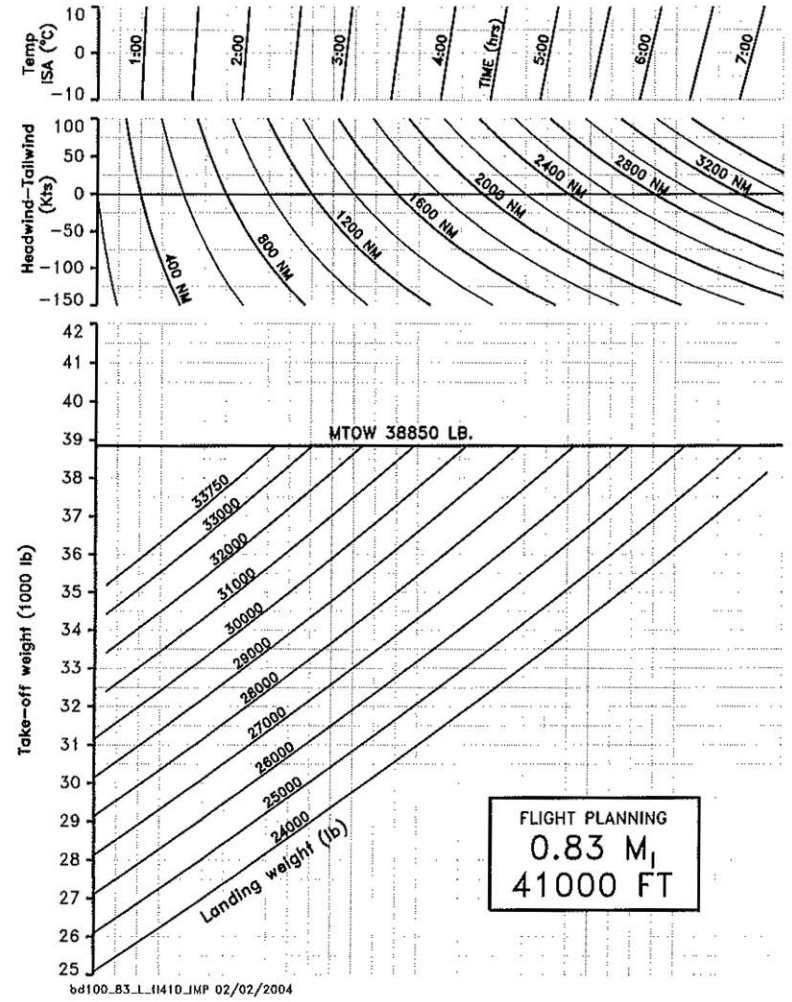

Figure 03-01-05. Simplified Flight Planning Charts—M 0.83 FL310–FL450 (Sheet 6 of 8)

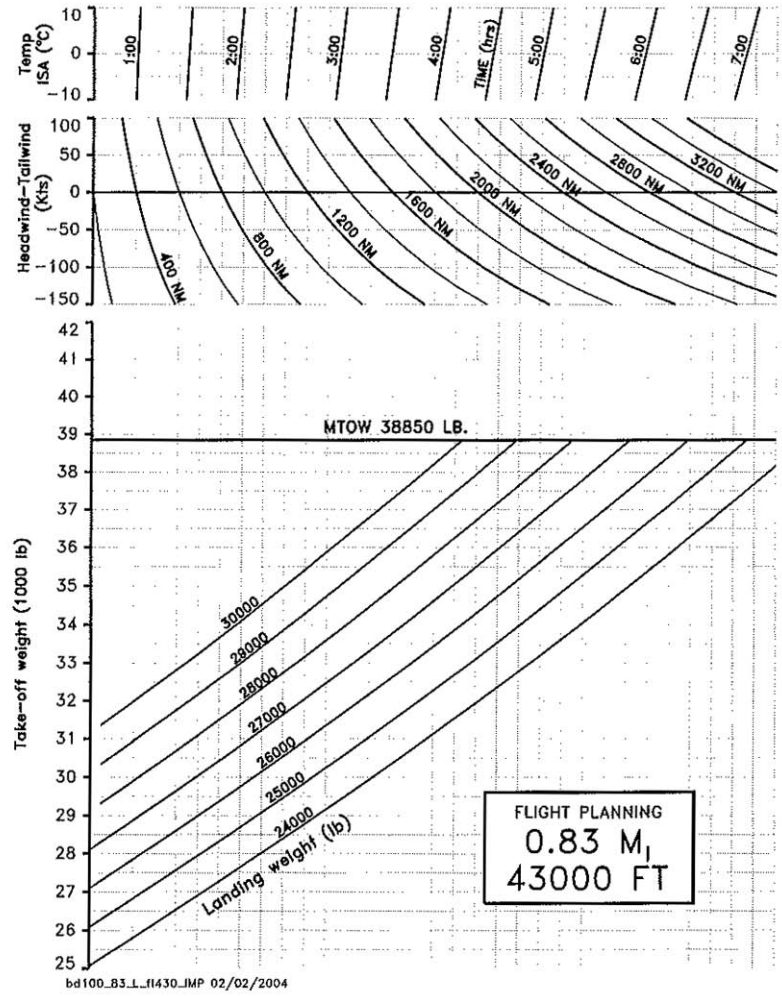

Figure 03-01-05. Simplified Flight Planning Charts—M 0.83 FL310–FL450 (Sheet 7 of 8)

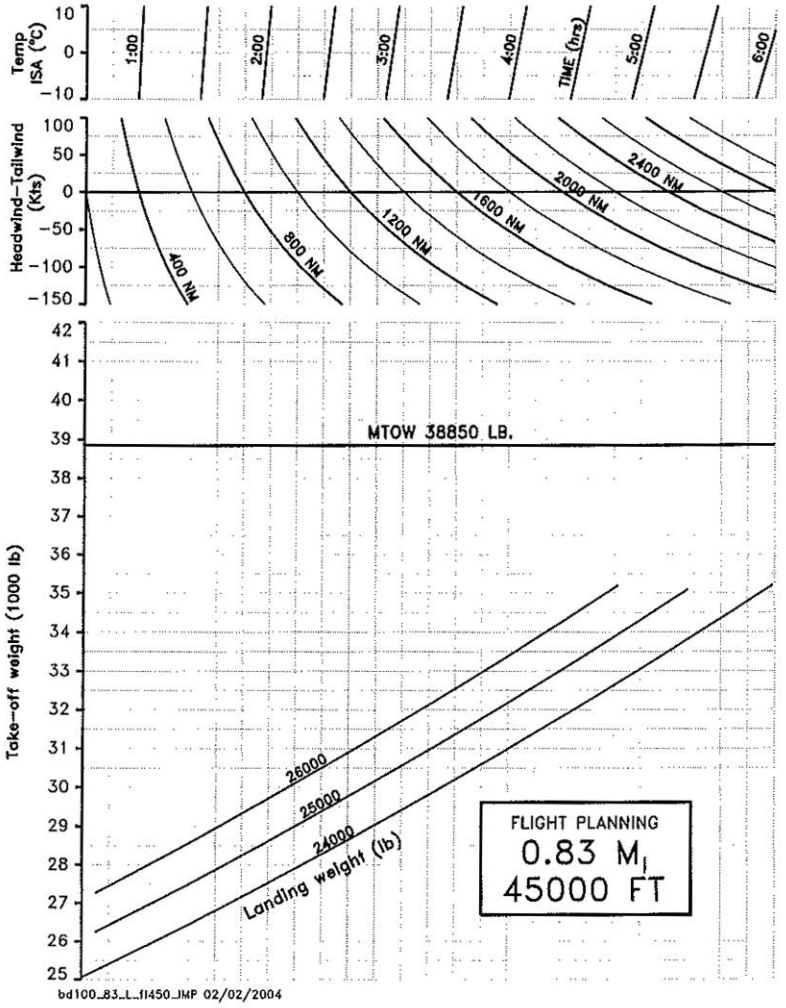

Figure 03-01-05. Simplified Flight Planning Charts—M 0.83 FL310–FL450 (Sheet 8 of 8)

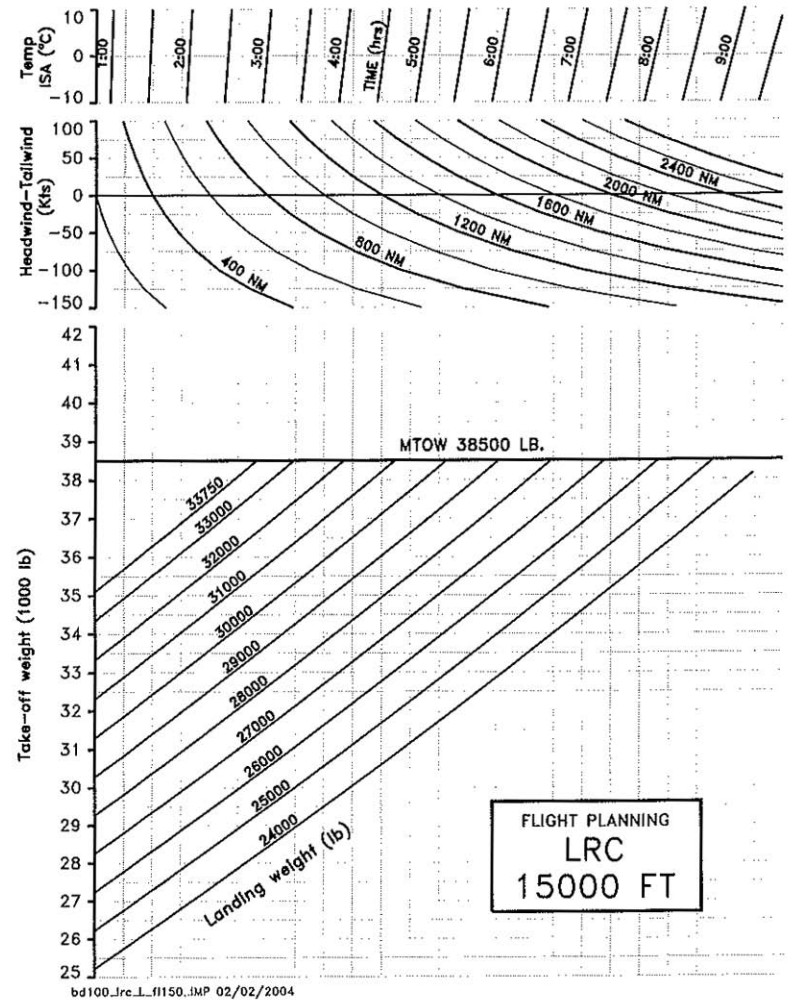

Figure 03-01-06. Simplified Flight Planning Charts—LRC FL150–FL450 (Sheet 1 of 12)

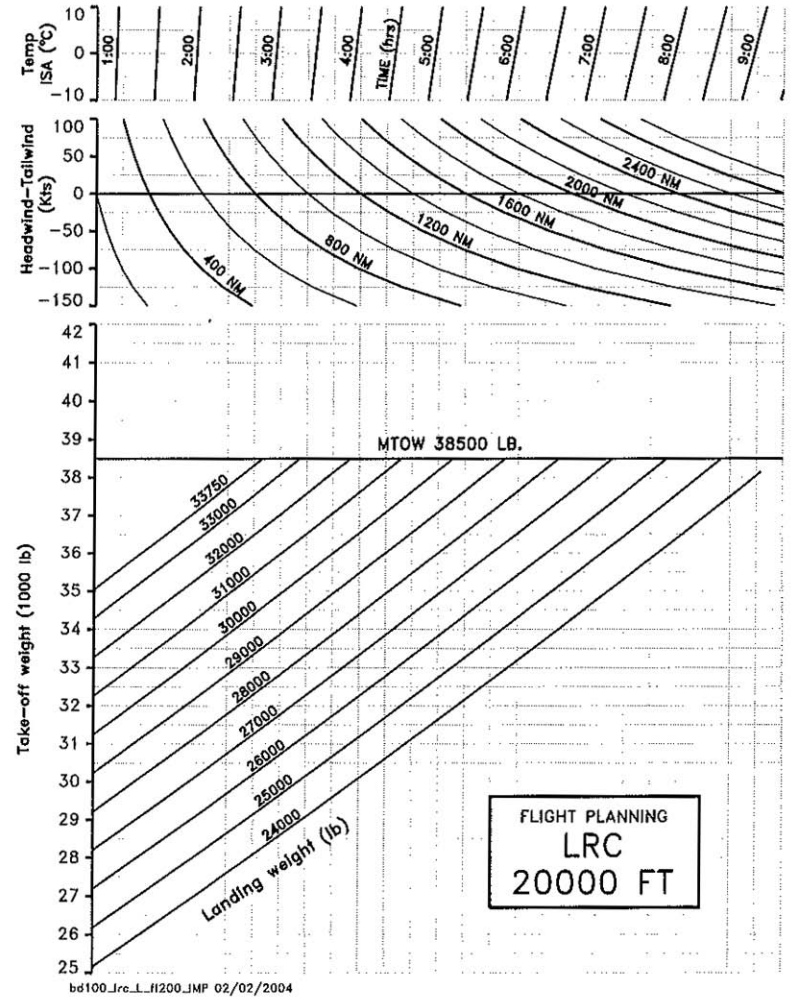

Figure 03-01-06. Simplified Flight Planning Charts—LRC FL150–FL450 (Sheet 2 of 12)

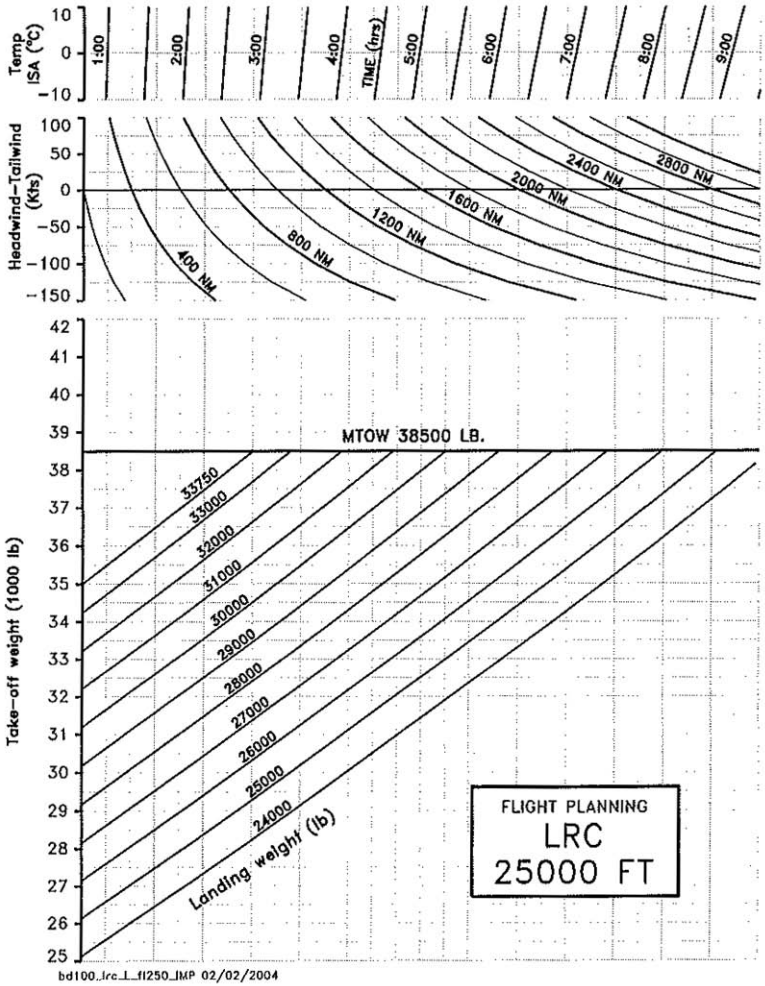

Figure 03-01-06. Simplified Flight Planning Charts—LRC FL150–FL450 (Sheet 3 of 12)

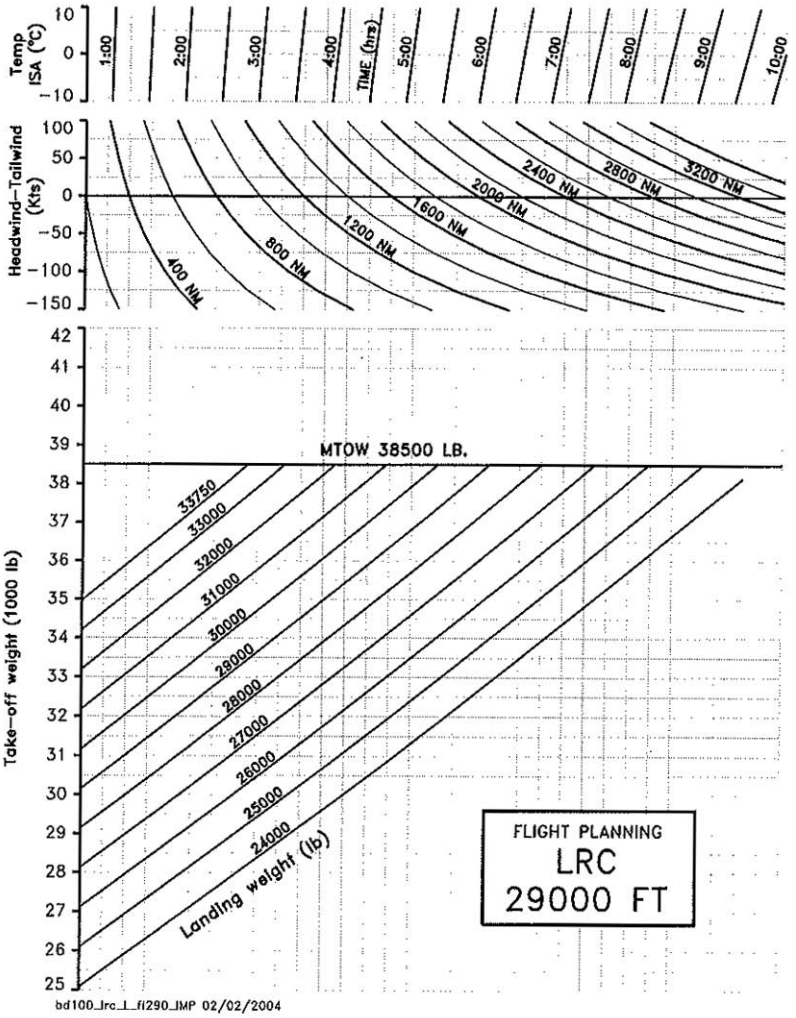

Figure 03-01-06. Simplified Flight Planning Charts—LRC FL150–FL450 (Sheet 4 of 12)

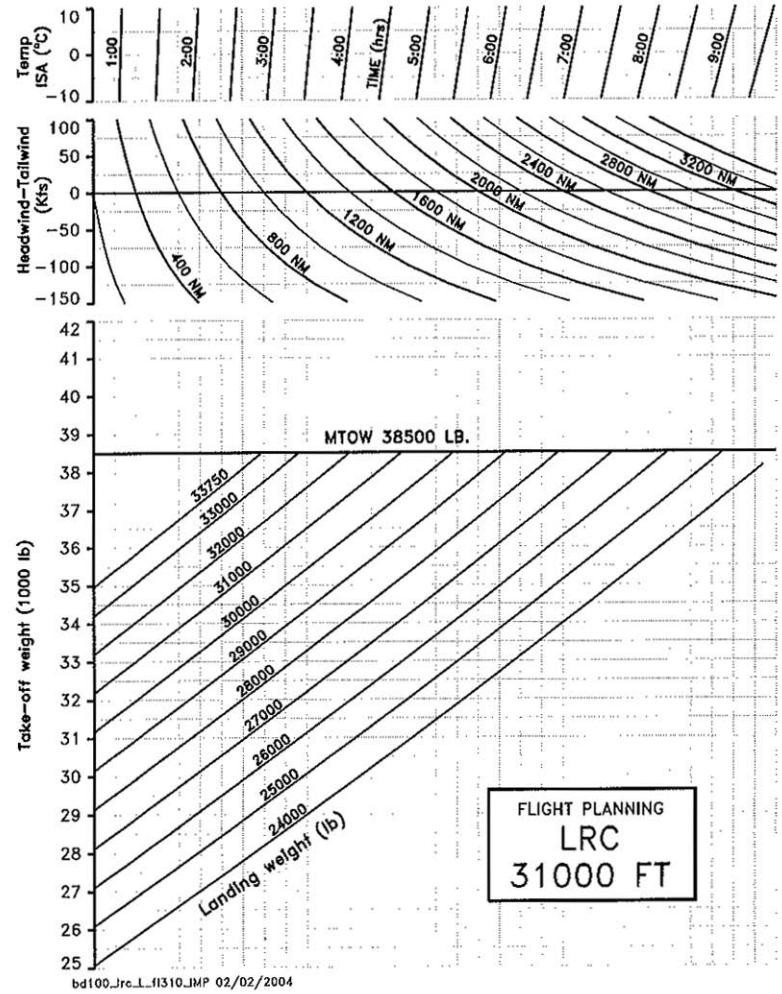

Figure 03-01-06. Simplified Flight Planning Charts—LRC FL150–FL450 (Sheet 5 of 12)

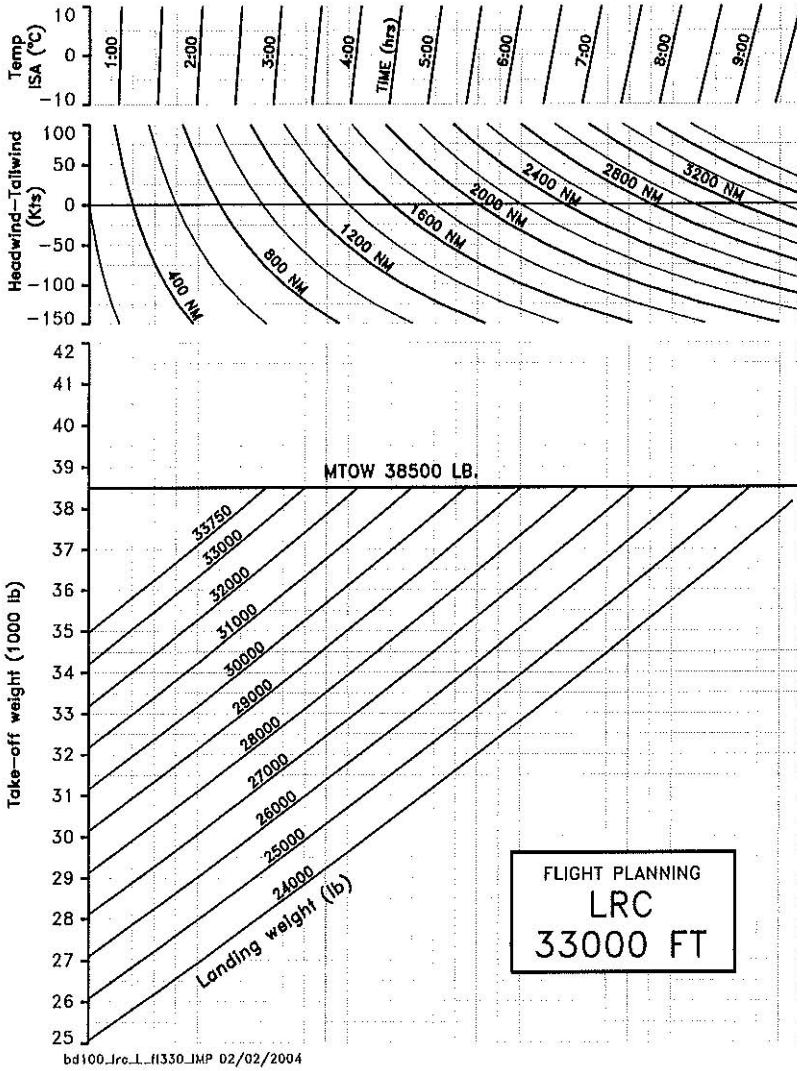

Figure 03-01-06. Simplified Flight Planning Charts—LRC FL150–FL450 (Sheet 6 of 12)

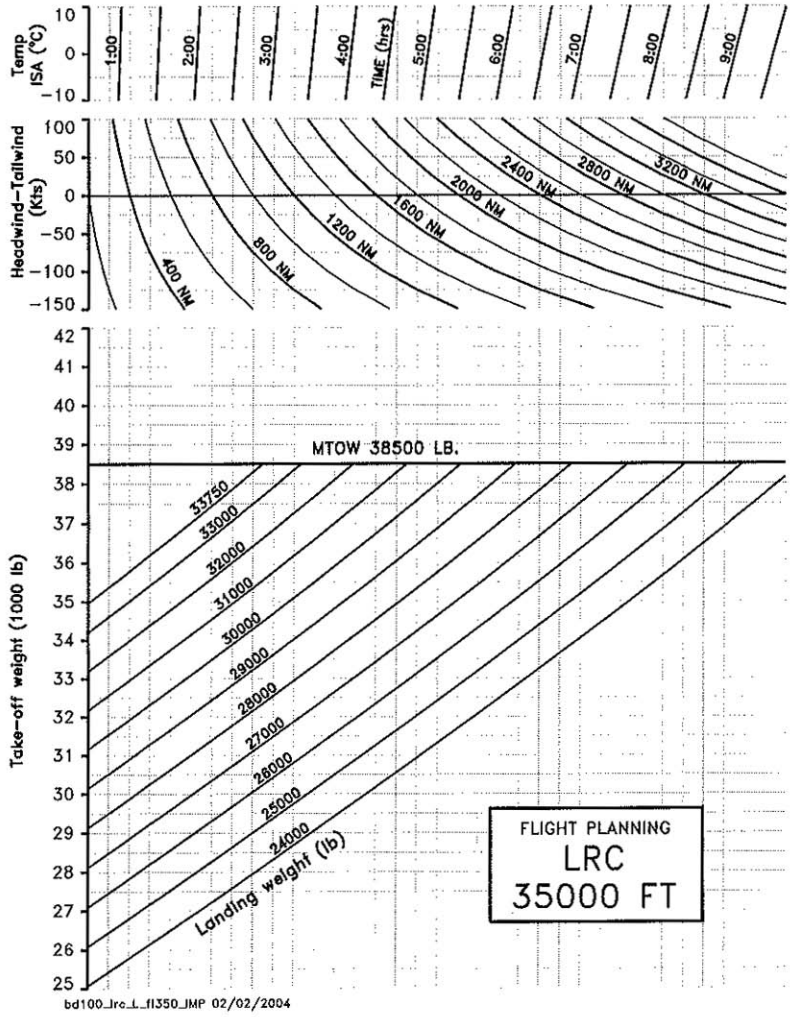

Figure 03-01-06. Simplified Flight Planning Charts—LRC FL150–FL450 (Sheet 7 of 12)

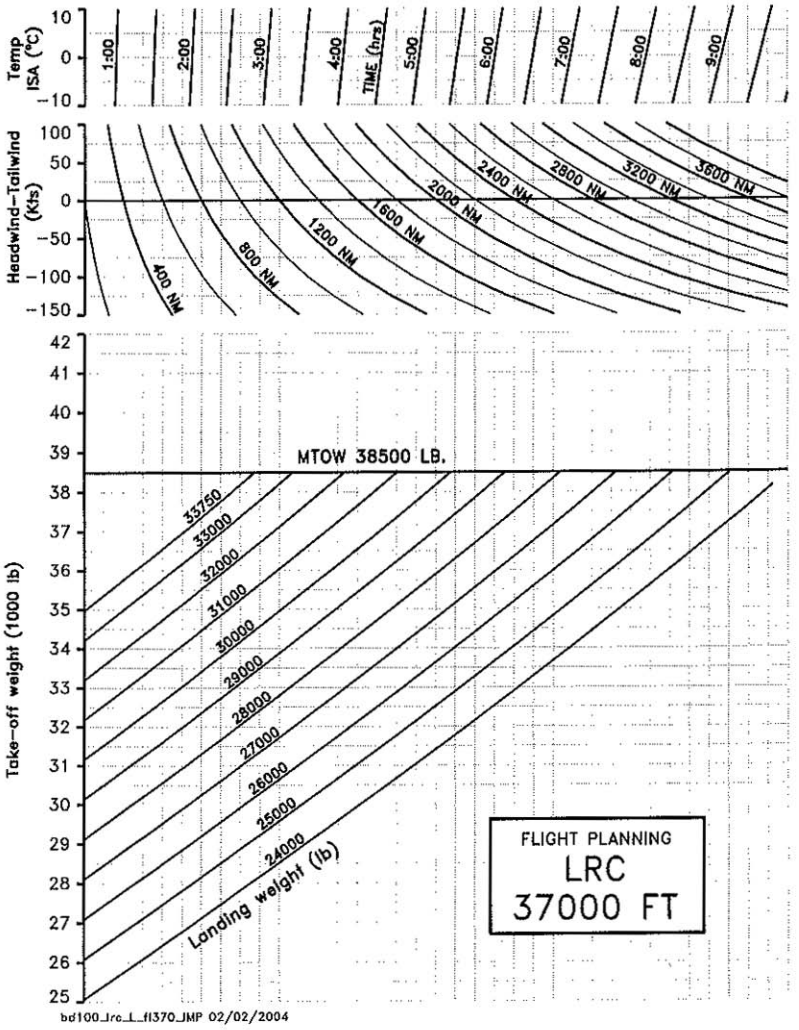

Figure 03-01-06. Simplified Flight Planning Charts—LRC FL150–FL450 (Sheet 8 of 12)

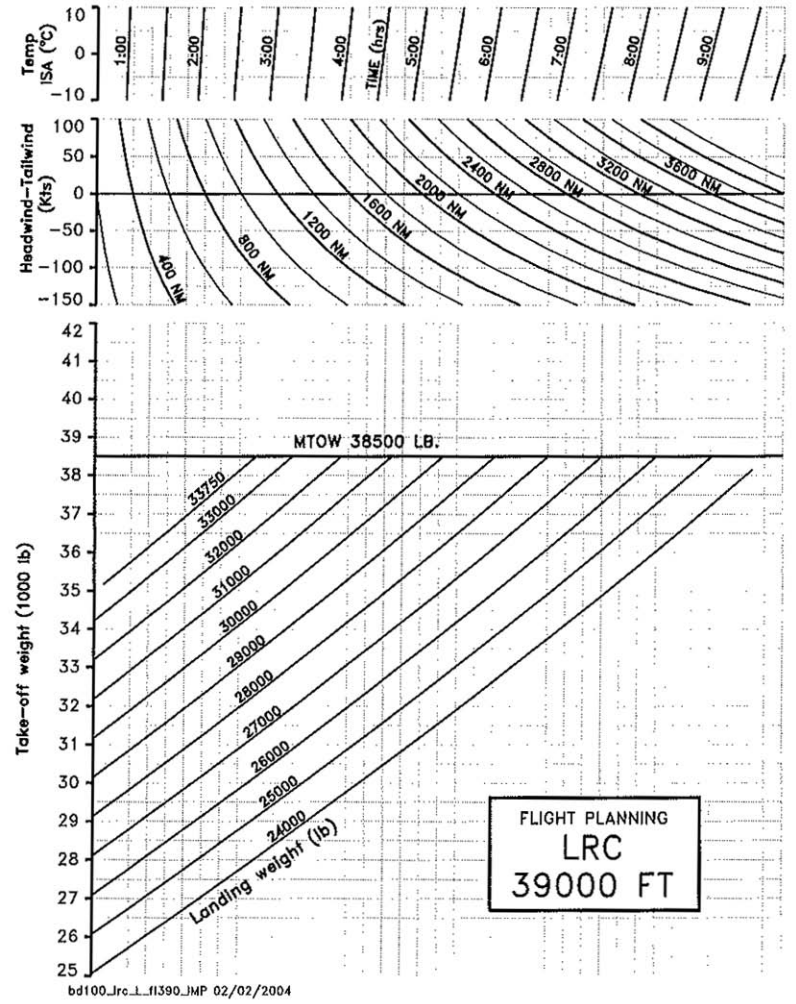

Figure 03-01-06. Simplified Flight Planning Charts—LRC FL150–FL450 (Sheet 9 of 12)

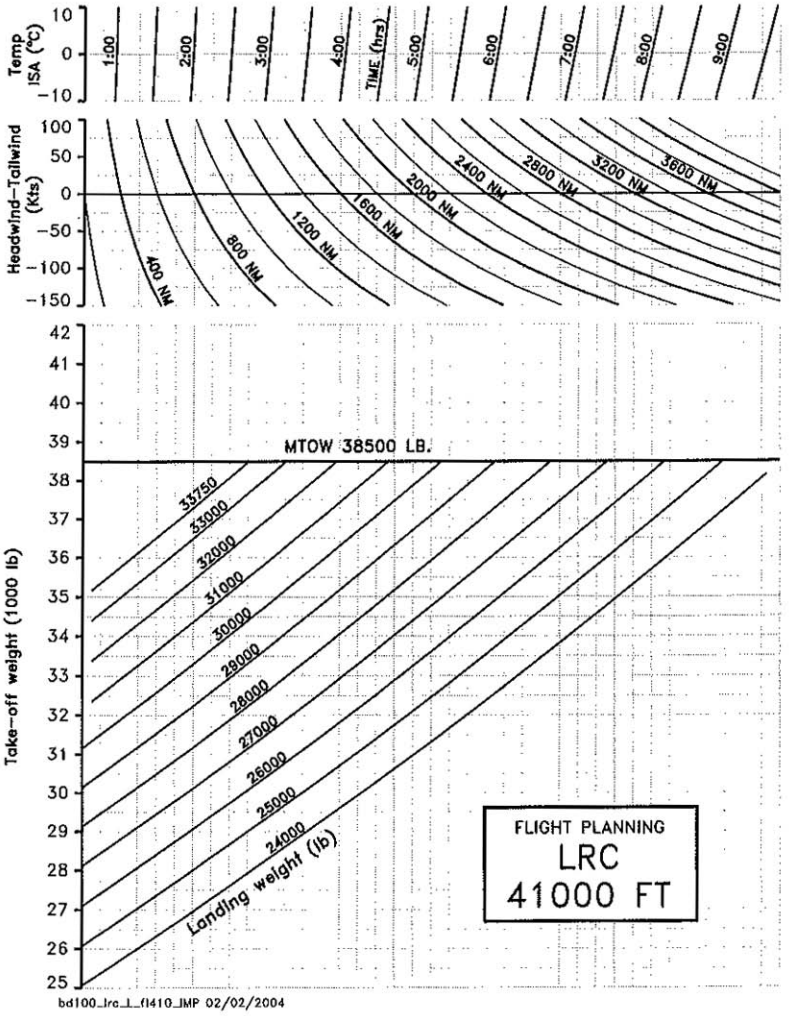

Figure 03-01-06. Simplified Flight Planning Charts—LRC FL150–FL450 (Sheet 10 of 12)

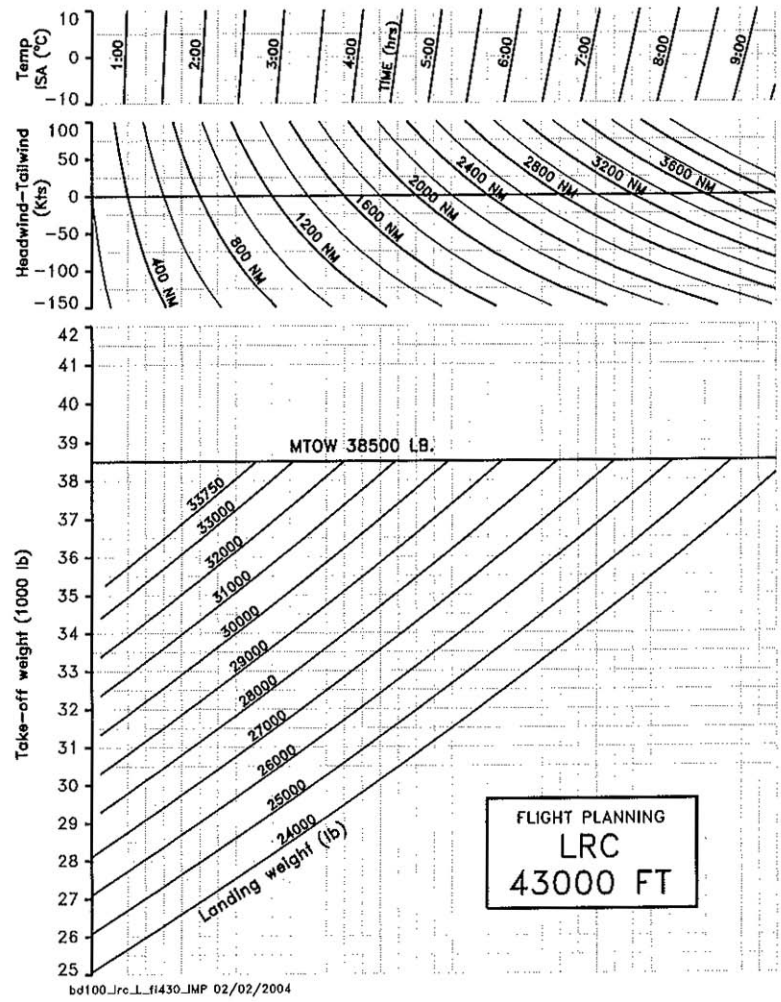

Figure 03-01-06. Simplified Flight Planning Charts—LRC FL150–FL450 (Sheet 11 of 12)

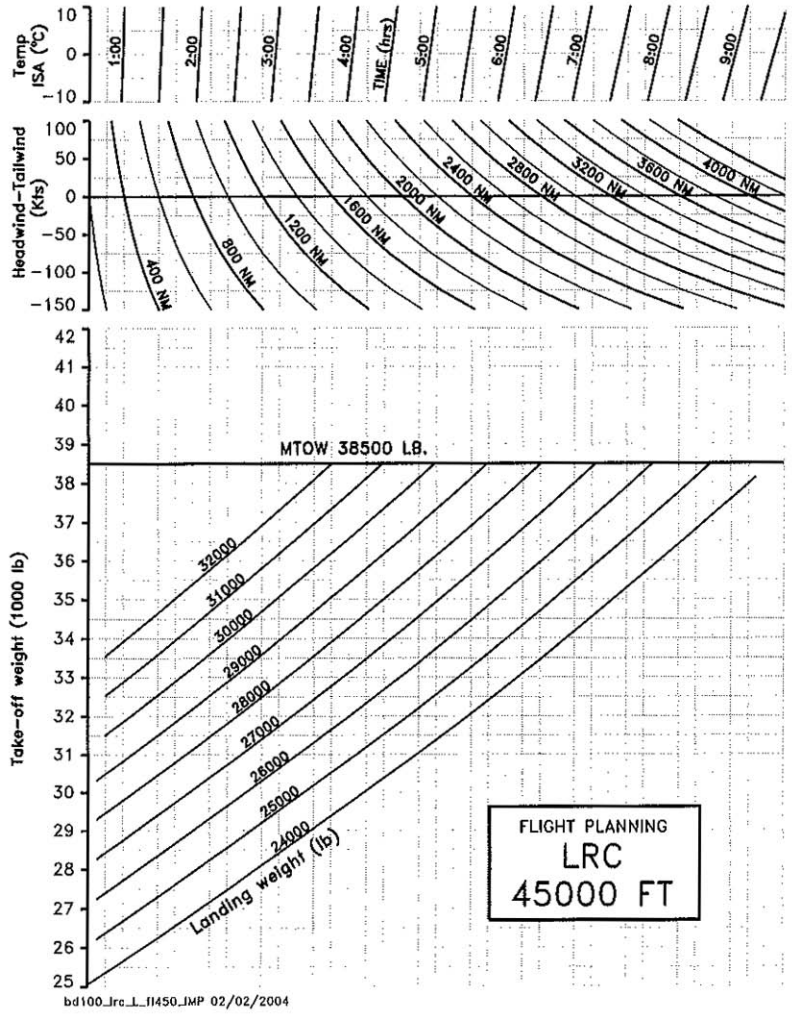

Figure 03-01-06. Simplified Flight Planning Charts—LRC FL150–FL450 (Sheet 12 of 12)

ALTERNATE FLIGHT PLANNING CHARTS

Alternate planning is provided by a reserve fuel chart that enables quick determination of time and fuel required to fly to an alternate airport after a missed approach at destination.

The reserve time and fuel chart is based on ISA conditions using the NBAA/ IFR mission format described below:

- Standard instrument approach with fuel assumed equal to 5 minutes loitering at 5000 ft
- Missed approach followed by climb out to 5000 ft (from sea level)
- Hold at loiter power at 5000 ft for 5 minutes while awaiting clearance
- Economy cruise to alternate (LRC speed, 0 to 500 n.m. alternate distance)
- Descent enroute to sea level at 3000 ft/min. maximum descent rate and land

Fuel and time data are presented as function of airplane zero fuel weight up to 27 000 lbs Maximum Zero Fuel Weight (MZFW) and alternate distances up to 500 nautical miles. Variable holding time at alternate of 0, 15, 30, 45 or 60 minutes and headwind - tailwind curves of up to 150 kts are also included on the chart. The recommended NBAA/IFR alternate distance and holding time are 200 n.m. and 30 minutes respectively.

Example:

Associated conditions

- Alternate distance = 200 n.m. (A)
- Average wind = 50 kts "tailwind" (B)
- Holding time = 45 min. (C)
- Aircraft zero fuel weight = 25 000 lbs (D)

Using example shown on Figure 03-01-07 the following data are obtained:

- Alternate fuel = 2070 lbs (E)
- Alternate time = 32.1 min. (F)

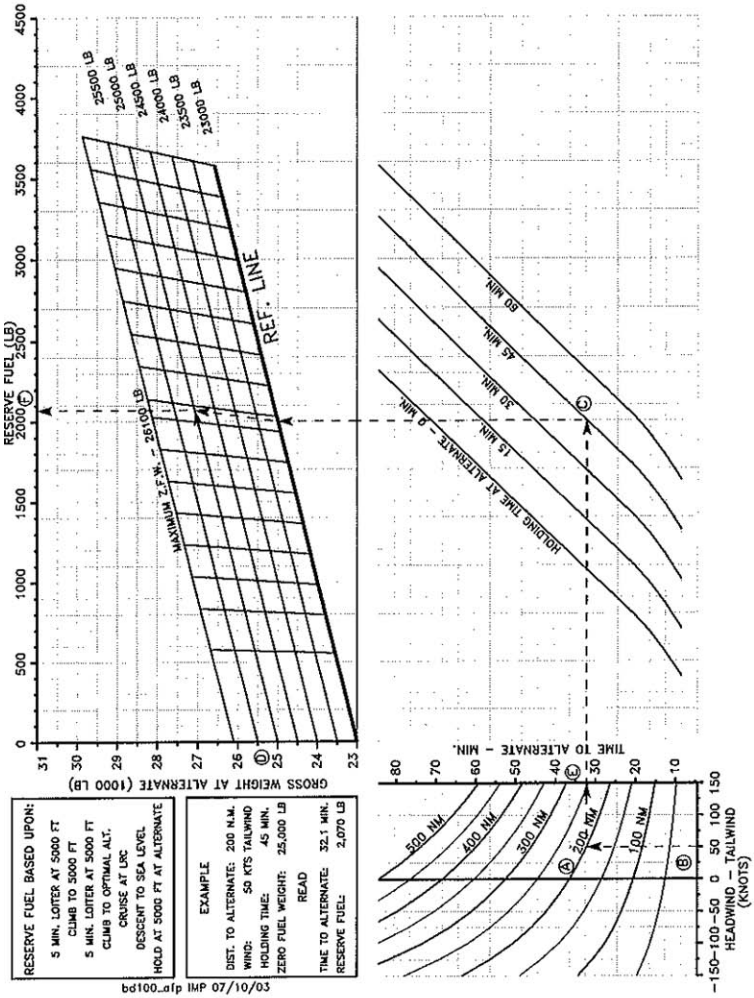

Figure 03-01-07. Alternate Flight Planning Chart

TWO ENGINE PERFORMANCE

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CHAPTER 4
TWO ENGINE PERFORMANCE

INTRODUCTION

This chapter provides two engine operating performance data and includes the following information:

- General cruise speeds
- Altitude selection
- Climb capability
- Climb performance
- Acceleration data
- Specific air range
- Cruise data
- Descent data
- Holding data

Where applicable, the performance information are presented for a number of speed schedules. A speed schedule is a combination of indicated airspeed (IAS), in knots and Mach number. A constant IAS applies to below the crossover altitude, while a constant Mach number applies to above the crossover altitude. The crossover altitude is the altitude at which the true airspeed (TAS), corresponding to the IAS, equals the TAS corresponding to the Mach number.

All performance data presented in this chapter are based on a center of gravity location of 30% MAC with engine bleed on and anti-ice off unless otherwise noted.

It is permitted to interpolate linearly between airplane weight, altitude and/or temperature values given in the tables. Shaded areas distinguish several variables by column.

GENERAL CRUISE SPEEDS

The general cruise speeds chart presents typical cruise speeds as a function of airplane gross weight and flight level. The following speed curves are presented: 1.0'g' and 1.3'g' load factor maneuver speeds (based on buffet speed limit at 30% C.G.), minimum drag speed (VMD), Long Range Cruise (LRC) speed and Maximum Range Cruise (MRC) speed for 100 kts headwind, zero wind and 100 kts tailwind.

The 1.0'g' and 1.3'g' buffet speeds are based on reference 30% C.G. position. Minimum drag speed, VMD, is invariant with temperature. At each combination of weight, altitude and wind component, there is one speed, MRC, where specific air range is maximum. As shown on the chart, MRC speed slightly increases with headwind and decreases with tailwind. The long-range cruise speed, LRC, is a considerably higher speed than MRC with a specific air range loss of only 1% (99% maximum SAR).

Example:

Associated conditions

- Aircraft gross weight = 32 000 lbs (A)
- Flight Level = FL 450 (B)

Using example shown on Figure 04-01-01 the following data are obtained:

- 1.0'g' Buffet speed = 0.54 MI (C)
- 1.3'g' Buffet speed = 0.64 MI (D)
- VMD speed = 0.69 MI (E)
- MRC speed @ 100 kts tailwind = 0.72 MI (F)
- MRC speed @ zero wind = 0.75 MI (G)
- MRC speed @ 100 kts headwind = 0.78 MI (H)
- LRC speed = 0.80 MI (I)

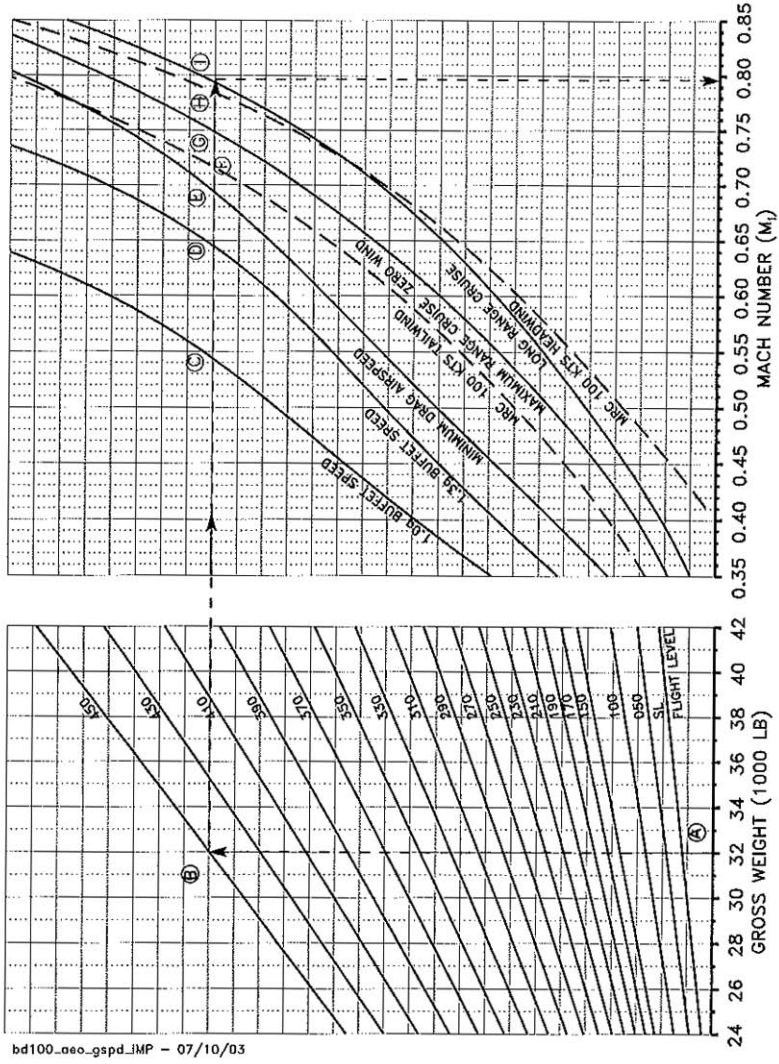

Figure 04-01-01. General Cruise Speeds

ALTITUDE SELECTION

Cruise altitude selection is governed by the lowest of either climb ceiling with Climb thrust or Maximum Cruise thrust (CLB).

(A) Climb Ceiling

All engine operating climb ceilings are presented in graphical form as a function of initial climb weight at sea level and aircraft gross weight at altitude for 100, 200 and 300 fpm climb rate (pressure altitude) for temperature conditions up to ISA+20°C.

Data are presented for the following climb speed schedules:

- 250 KIAS / 0.75 MI - Long Range (typical) speed schedule
- 250 / 280 KIAS / 0.80 MI

Data are based on the use of CLB thrust with engine bleed on and anti-ice off. All climb speed schedules incorporate a speed limit of 250 KIAS below 10 000 ft.

(B) Cruise Altitude

All engine-operating cruise ceiling (level flight speed capability) is the maximum sustainable altitude at given aircraft gross weight and cruise speed. Data are based on the use of MCR thrust with engine bleed on and anti-ice off. Cruise ceilings are given for 0.75, 0.78, 0.80, 0.82 and 0.83 MI and LRC for temperature conditions up to ISA+20°C.

Maneuver load capability limit altitude line, based on 0.3 'g' margins with buffet onset, is shown on each ceiling charts.

Climb ceiling and maximum cruise altitude correction factors for C.G. variation relative to 30% MAC reference position are provided below.

CLIMB CEILING CORRECTION FACTORS vs. C.G. POSITION.

C.G.	ALL CLIMB SPEEDS SCHEDULE
20%	-500 ft
25%	-250 ft
REF (30%)	-
35%	+100 ft
40%	+200 ft

CRUISE CEILING CORRECTION FACTORS vs. C.G. POSITION.

C.G.	CRUISE SPEED		
	LRC and Below Mach 0.80	Mach 0.82	Mach 0.83
20%	-500 ft	- 600 ft	- 700 ft
25%	-250 ft	- 300 ft	- 350 ft
REF (30%)	-	-	-
35%	+100 ft	+ 150 ft	+ 200 ft
40%	+200 ft	+ 300 ft	+ 400 ft

Example:

Associated conditions

- Initial climb weight @ SL = 38 000 lbs (A)
- Climb speed schedule = 250 KIAS / 0.75 MI
- Aircraft rate of climb = 100 fpm
- Target cruise speed = 0.75 MI
- Average temperature = ISA+15°C

Using example shown on Figure 04-01-02, Sheet 1, (initial weight at sea level), the climb ceiling is 42 220 ft (B). Entering Figure 04-01-04, Sheet 1, (aircraft gross weight at altitude), at the same flight level, speed and temperature, aircraft gross weight is 36 500 lbs (C).

Using example shown on Figure 04-01-06, and an aircraft gross weight of 36 500 lbs (C), the cruise ceiling is 42 510 ft (D). Therefore a cruise altitude not exceeding 42 220 ft (lowest between the climb and cruise ceiling altitude) can be selected.

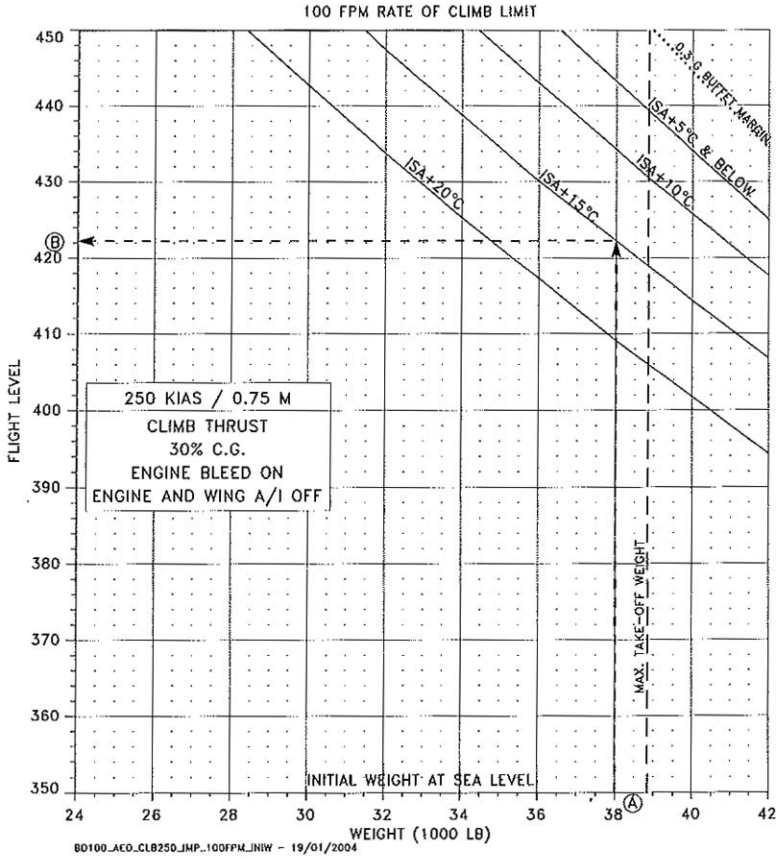

Figure 04-01-02. Initial Weight at Sea Level—250 KIAS/0.75 M (Sheet 1 of 3)

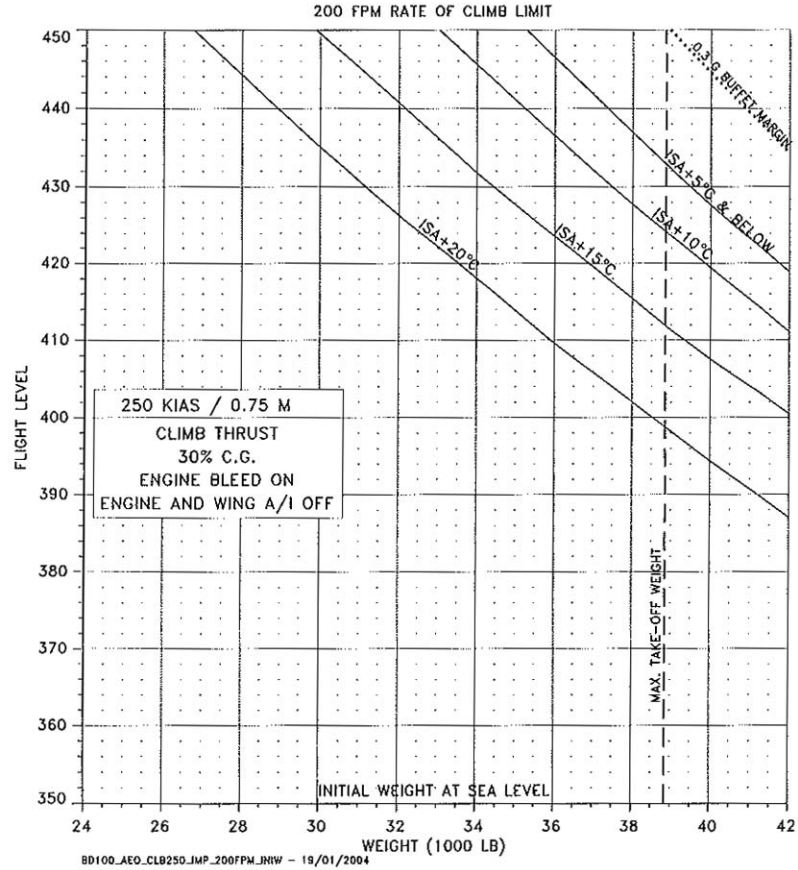

Figure 04-01-02. Initial Weight at Sea Level—250 KIAS/0.75 M (Sheet 2 of 3)

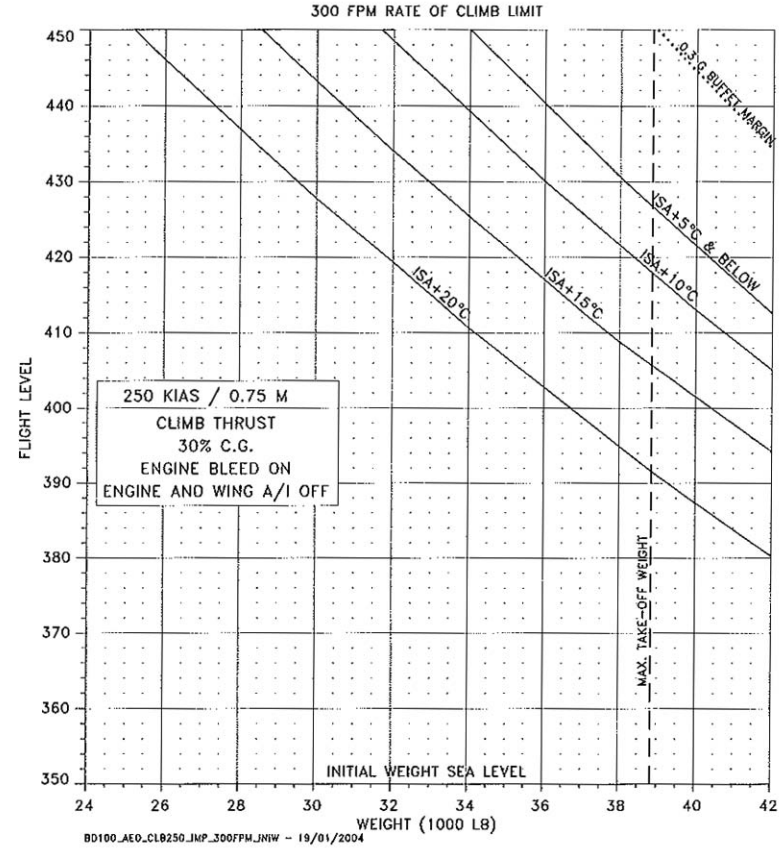

Figure 04-01-02. Initial Weight at Sea Level—250 KIAS/0.75 M (Sheet 3 of 3)

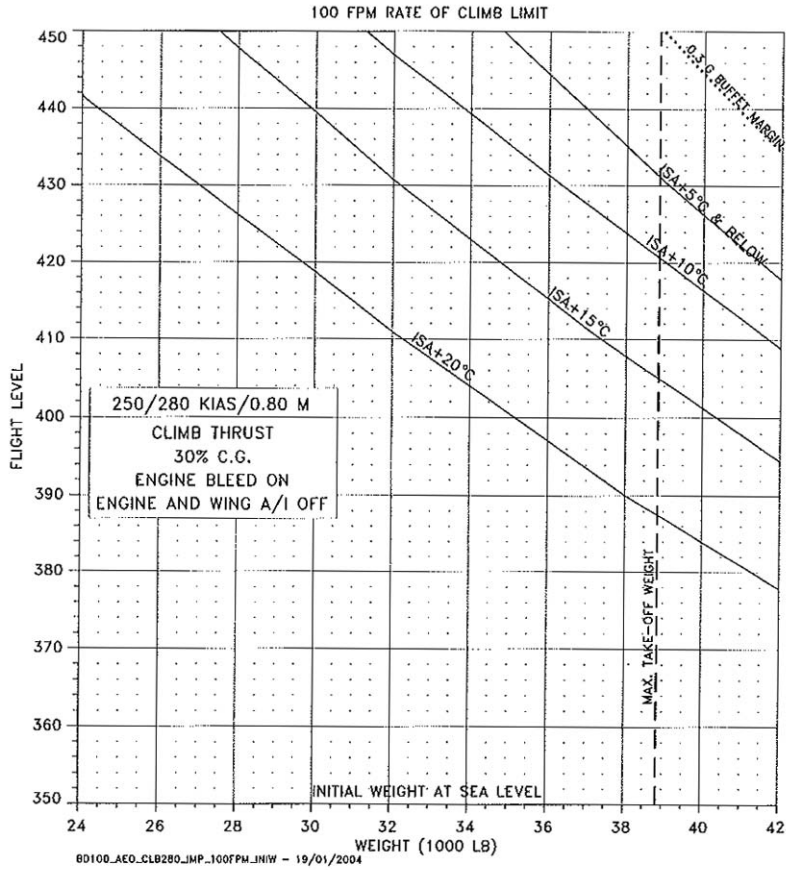

Figure 04-01-03. Initial Weight at Sea Level—250/280 KIAS/0.80 M (Sheet 1 of 3)

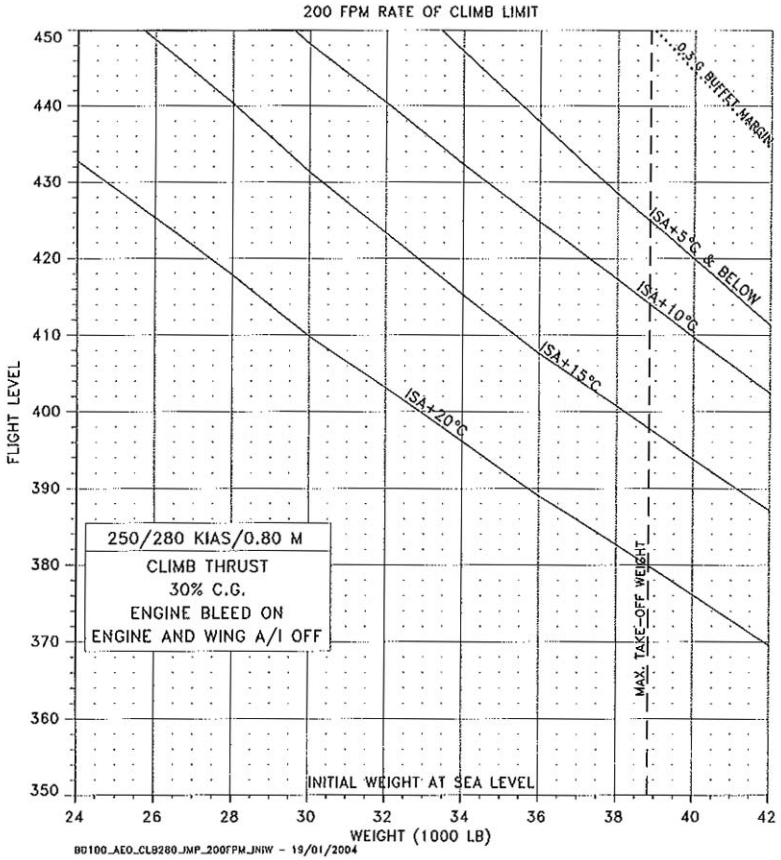

Figure 04-01-03. Initial Weight at Sea Level—250/280 KIAS/0.80 M (Sheet 2 of 3)

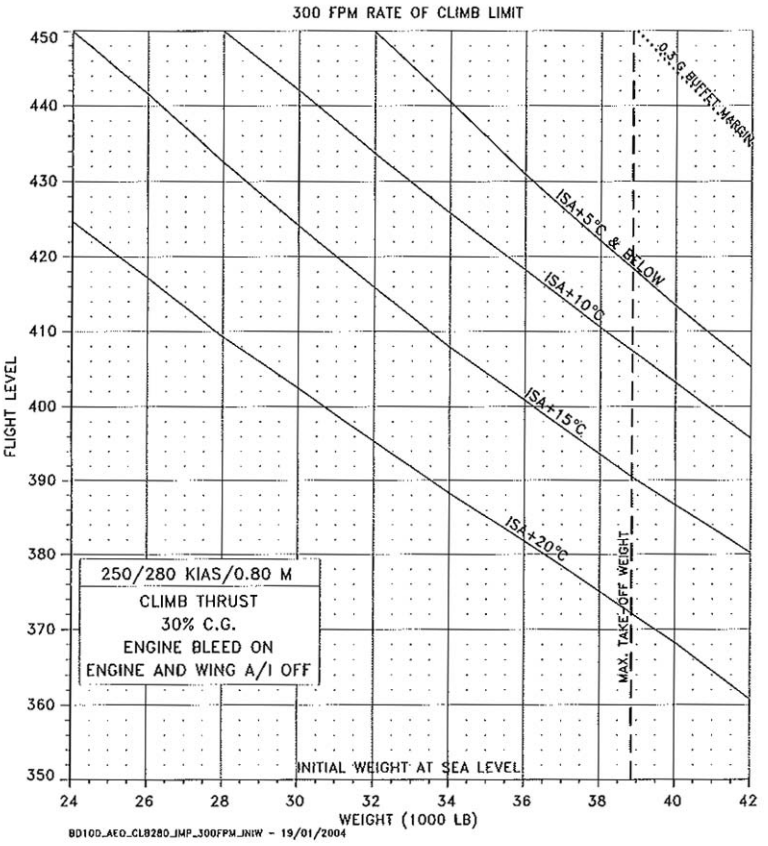

Figure 04-01-03. Initial Weight at Sea Level—250/280 KIAS/0.80 M (Sheet 3 of 3)

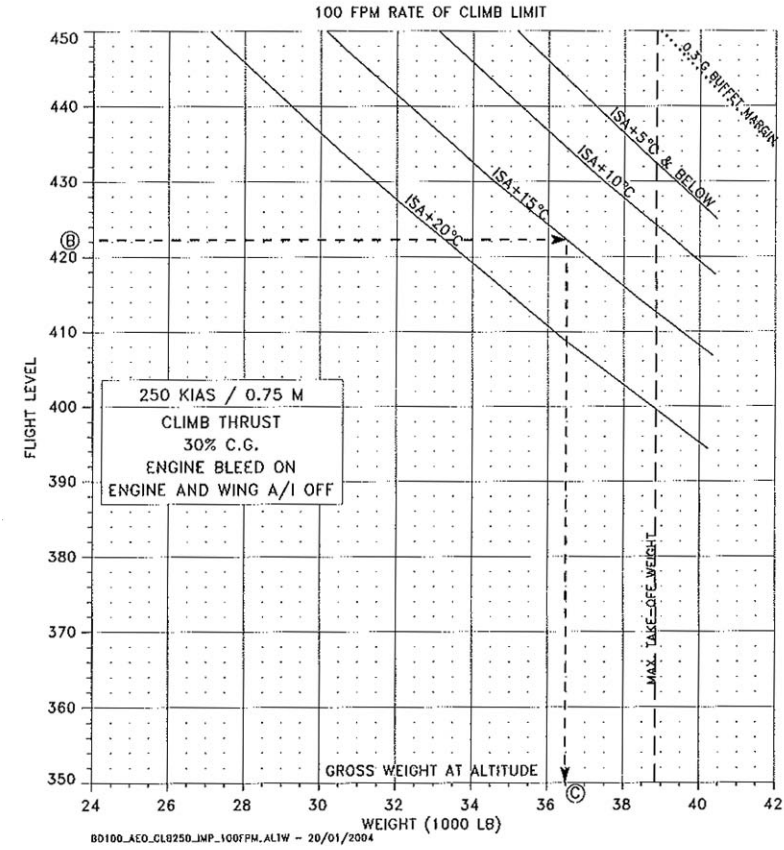

Figure 04-01-04. Gross Weight at Altitude— 250 KIAS/0.75 M (Sheet 1 of 3)

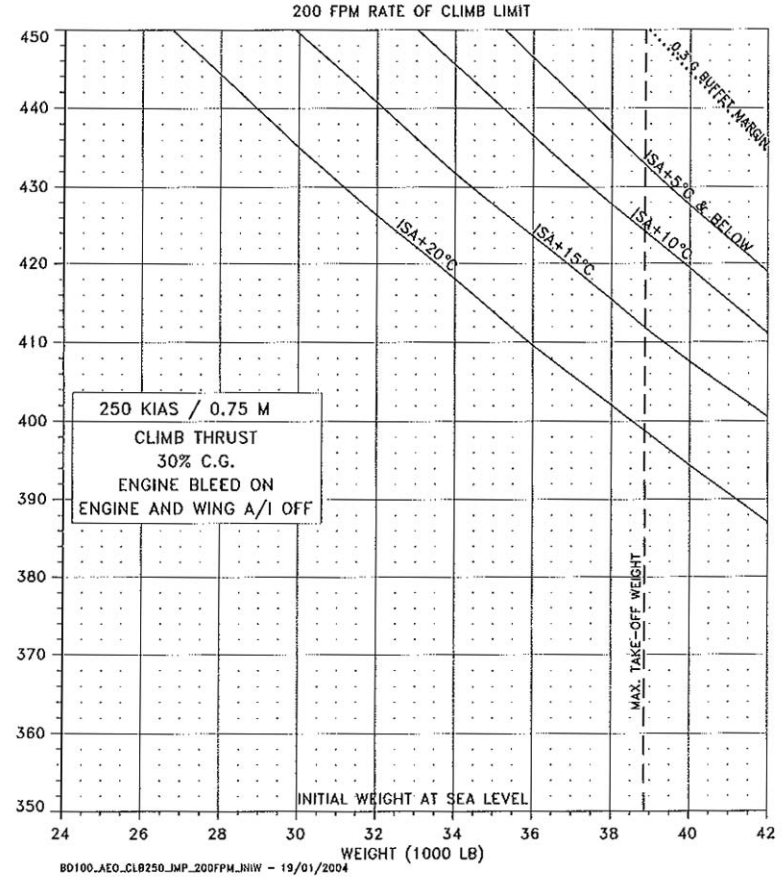

Figure 04-01-04. Gross Weight at Altitude— 250 KIAS/0.75 M (Sheet 2 of 3)

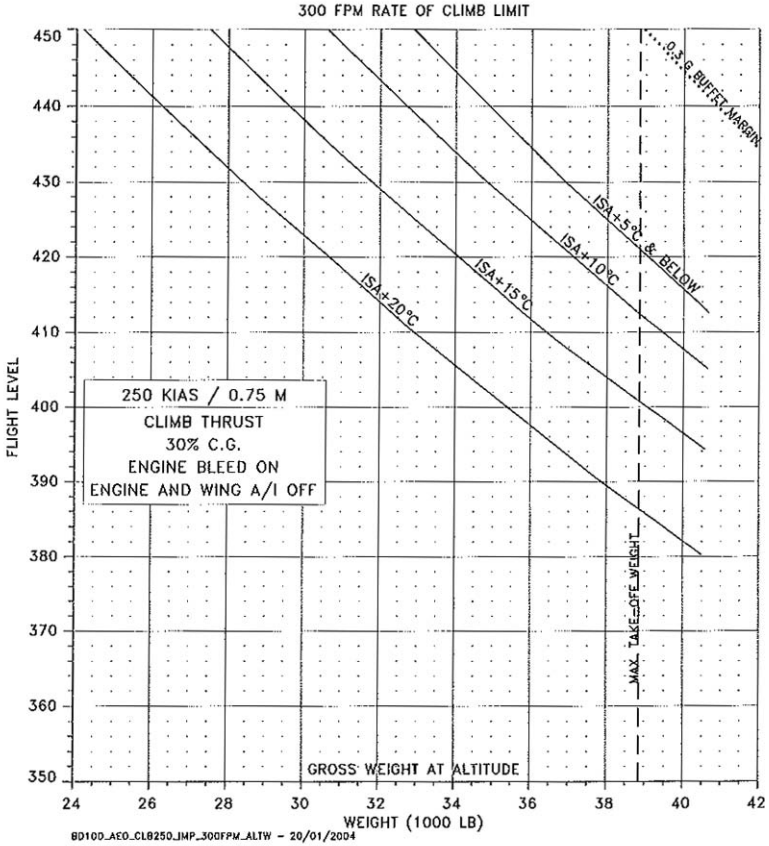

Figure 04-01-04. Gross Weight at Altitude— 250 KIAS/0.75 M (Sheet 3 of 3)

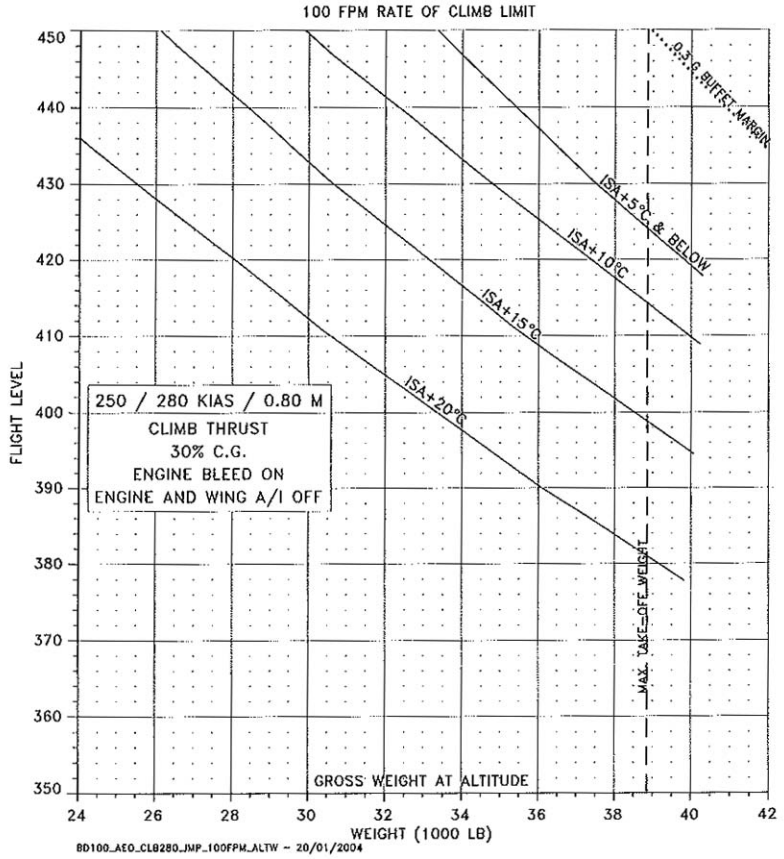

Figure 04-01-05. Gross Weight at Altitude— 250/280 KIAS/0.80 M (Sheet 1 of 3)

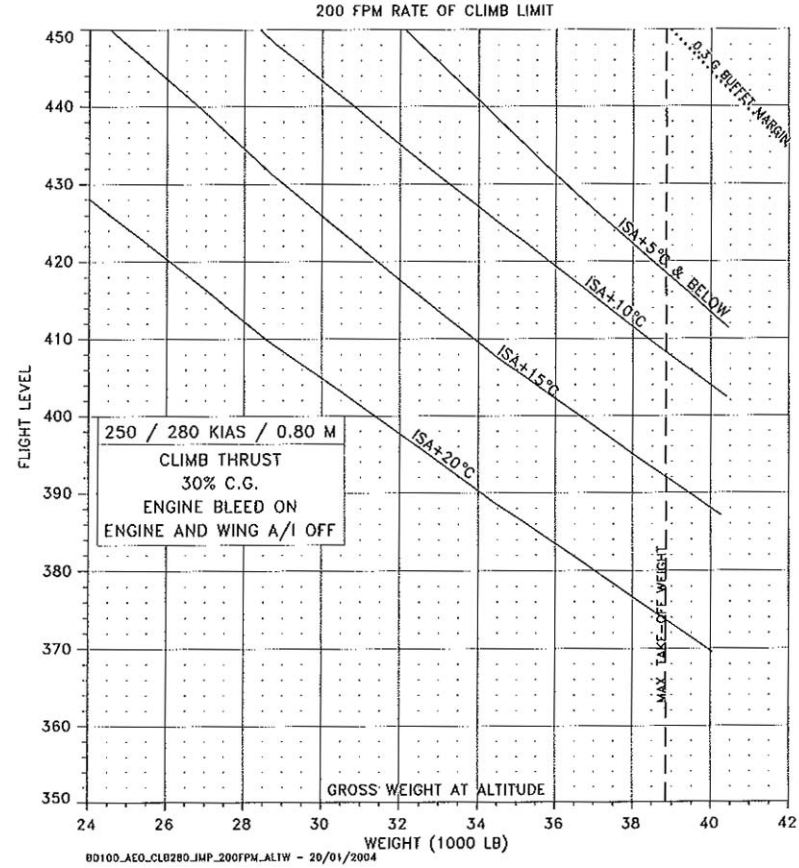

Figure 04-01-05. Gross Weight at Altitude— 250/280 KIAS/0.80 M (Sheet 2 of 3)

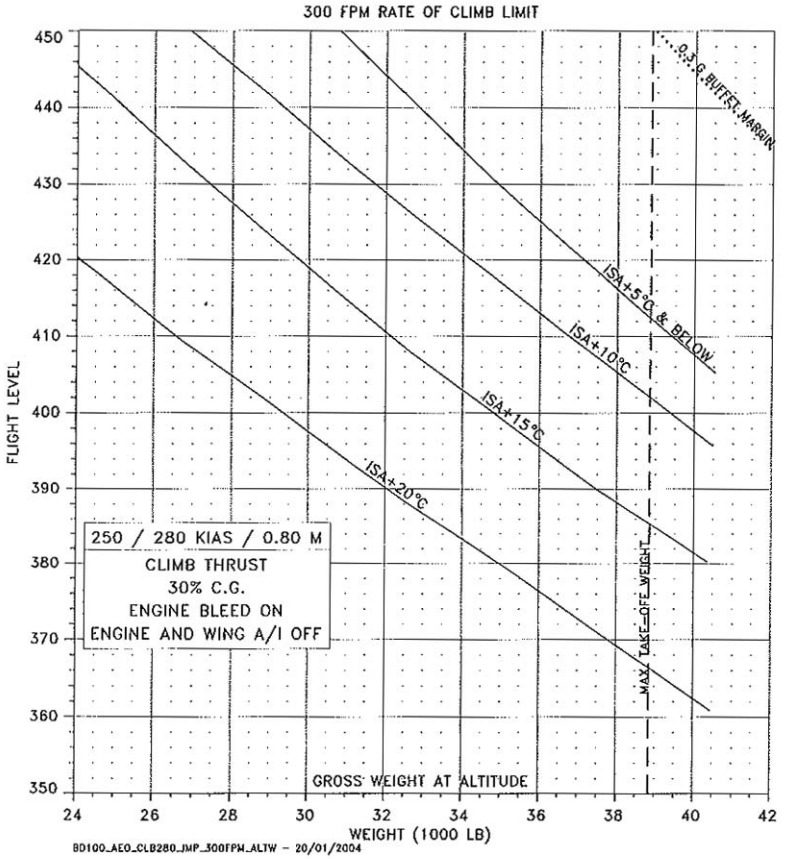

Figure 04-01-05. Gross Weight at Altitude— 250/280 KIAS/0.80 M (Sheet 3 of 3)

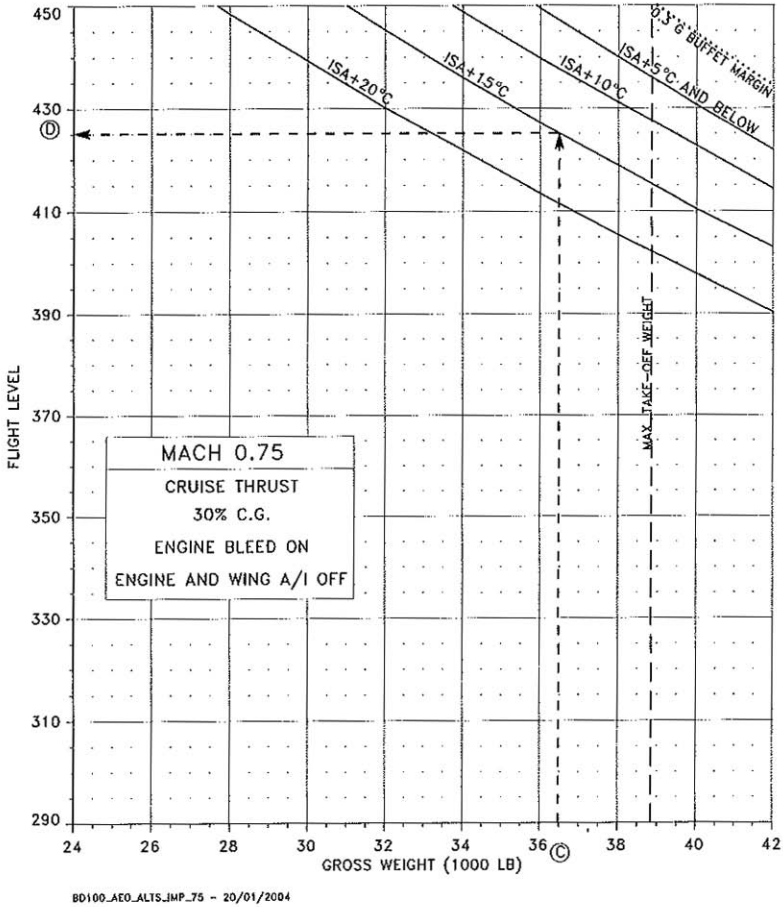

Figure 04-01-06. Cruise Altitude—Mach 0.75

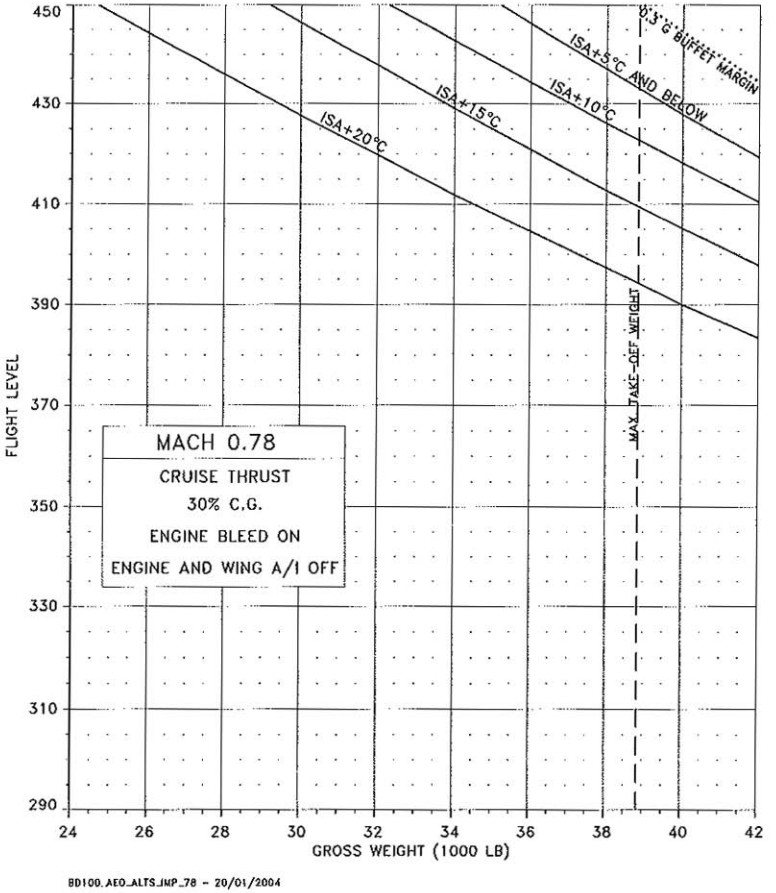

Figure 04-01-07. Cruise Altitude—Mach 0.78

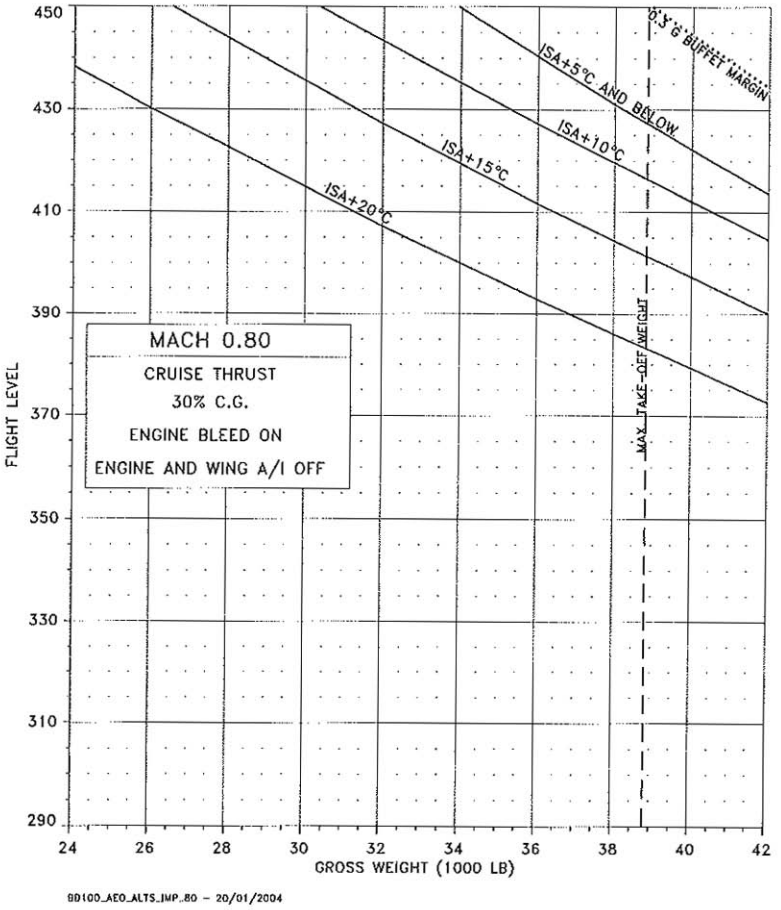

Figure 04-01-08. Cruise Altitude—Mach 0.80

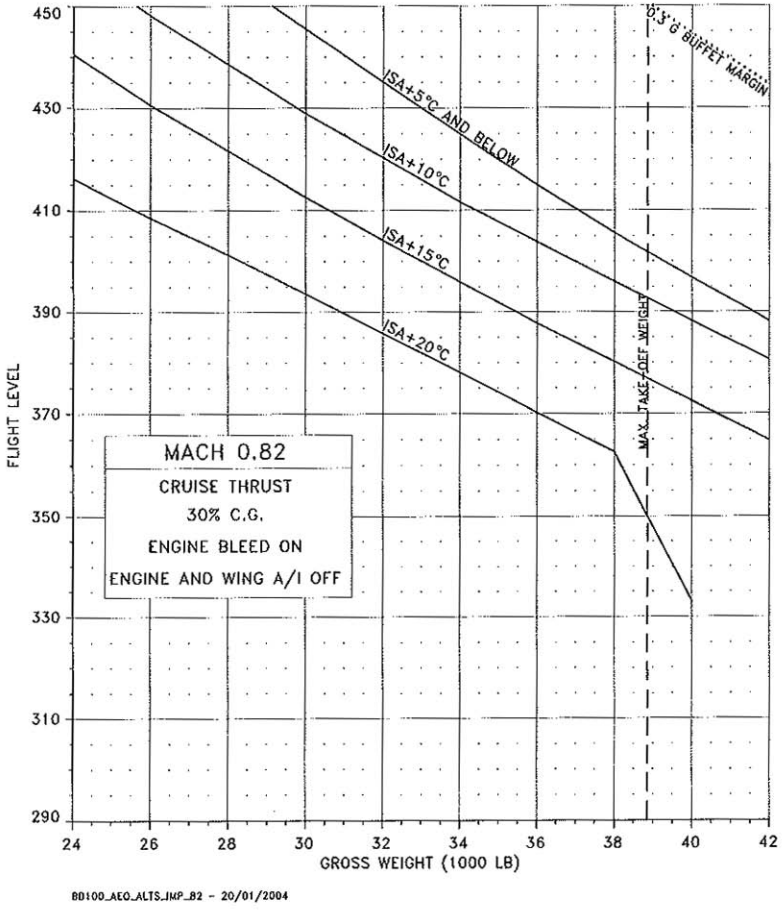

Figure 04-01-09. Cruise Altitude—Mach 0.82

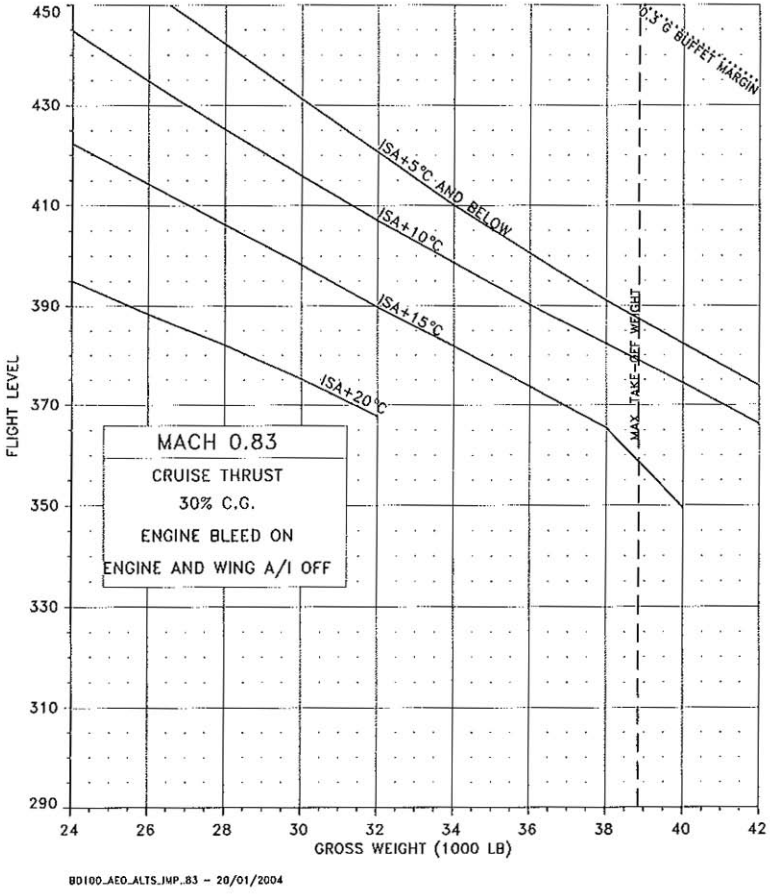

Figure 04-01-10. Cruise Altitude—Mach 0.83

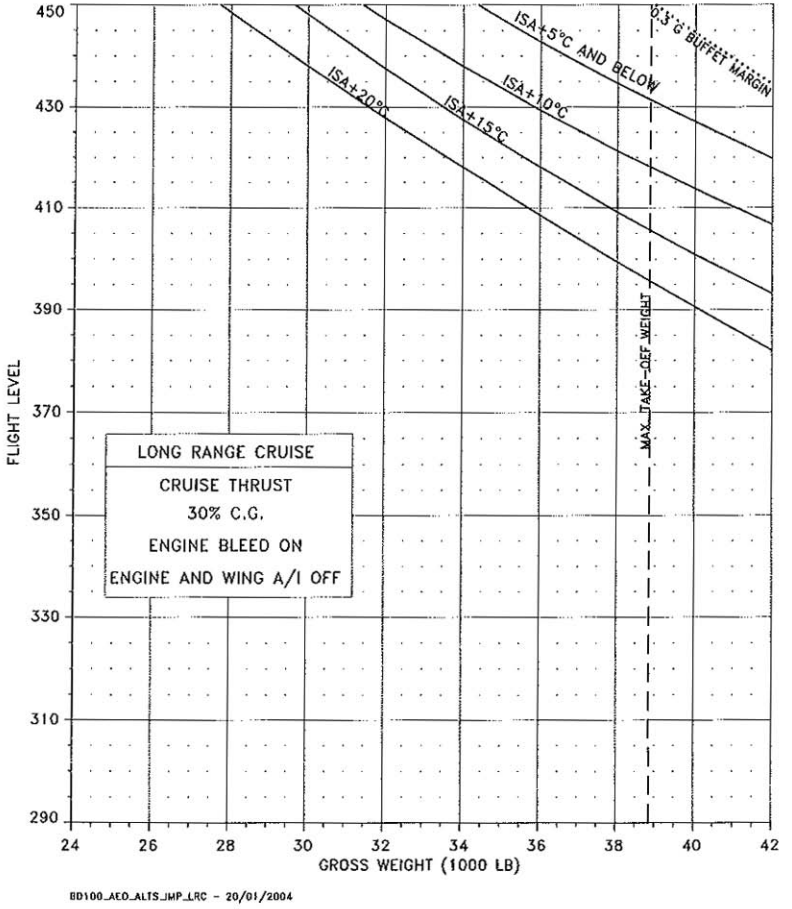

Figure 04-01-11. Long Range Cruise

CLIMB CAPABILITY

The all engine operating climb ceiling data are presented in graphical form as a function of initial climb weight at sea level for -10, 0, 5, 10 15 and 20°C temperature deviations from ISA.

Rate of climb data (pressure altitude) are presented for the following climb speed schedules:

- 250 KIAS / 0.75 MI -Long Range (typical) speed schedule
- 250 / 280 KIAS / 0.80 MI

Data are based on the use of CLB thrust with engine bleed on and anti-ice off. Climb speed schedules incorporate a speed limit of 250 KIAS below 10 000 ft.

Example:

Associated conditions

- Initial climb weight @ SL = 24 000 lbs
- Climb speed schedule = 250 KIAS / 0.75 MI
- Top of climb altitude = FL 200 (A)
- Average temperature = ISA-10°C

Using example shown on Figure 04-02-01, Sheet 1, aircraft climb rate capability is 5170 ft/min. (B).

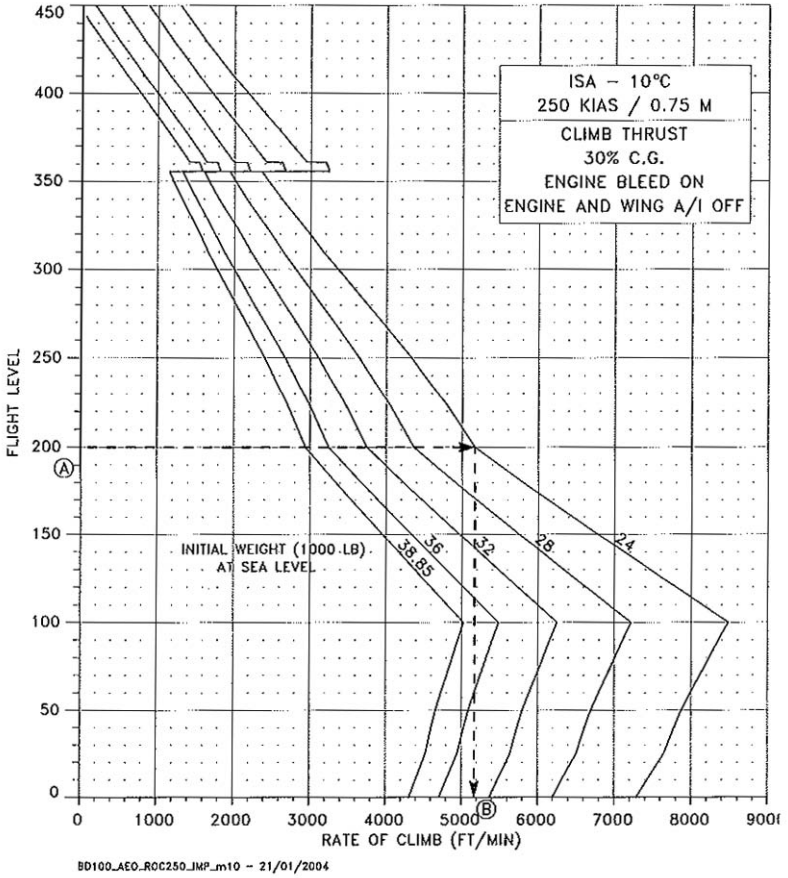

Figure 04-02-01. Climb Capability—250 KIAS/0.75 M (Sheet 1 of 6)

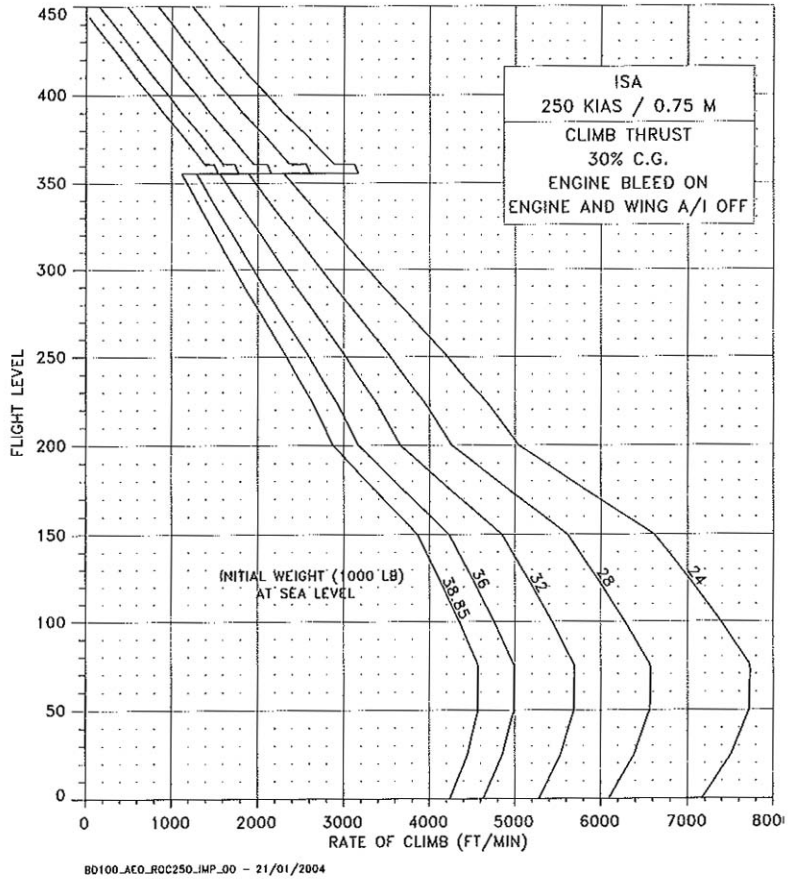

Figure 04-02-01. Climb Capability—250 KIAS/0.75 M (Sheet 2 of 6)

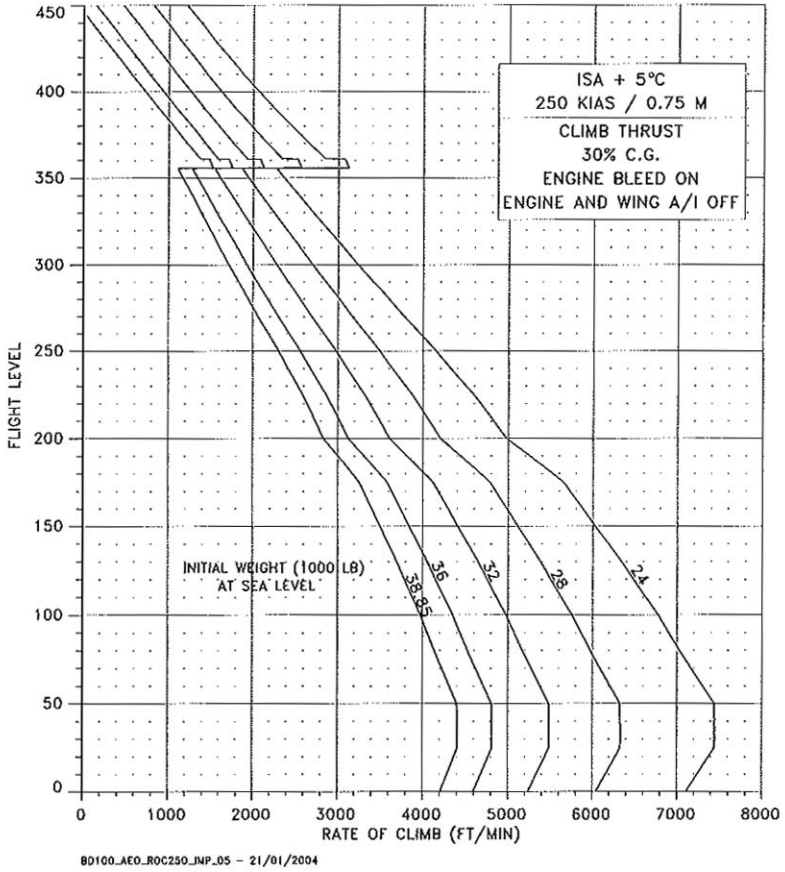

Figure 04-02-01. Climb Capability—250 KIAS/0.75 M (Sheet 3 of 6)

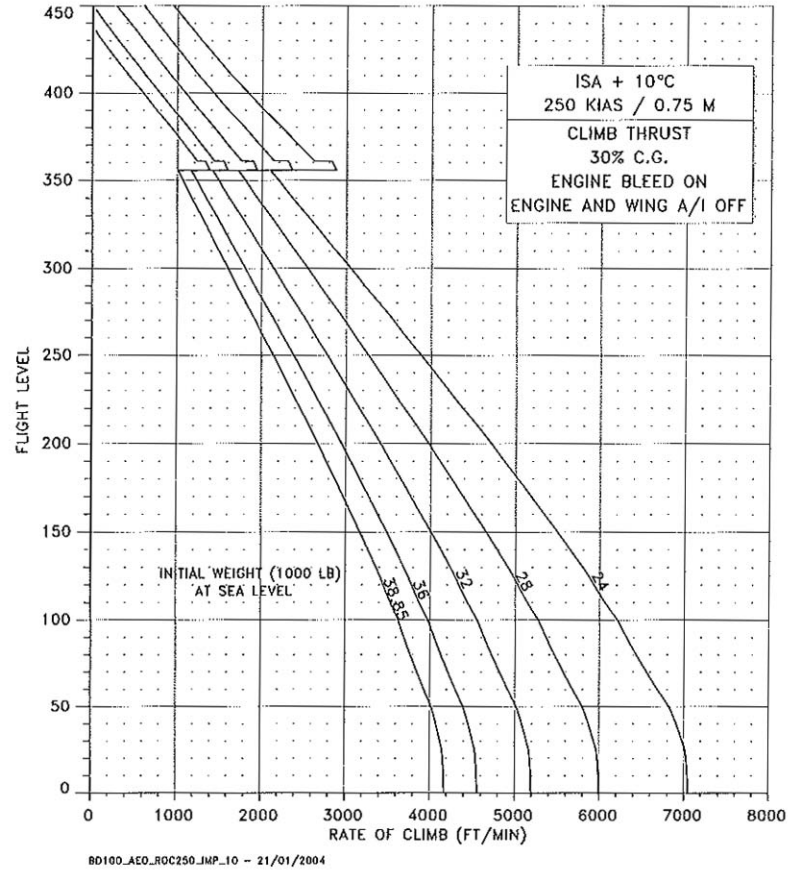

Figure 04-02-01. Climb Capability—250 KIAS/0.75 M (Sheet 4 of 6)

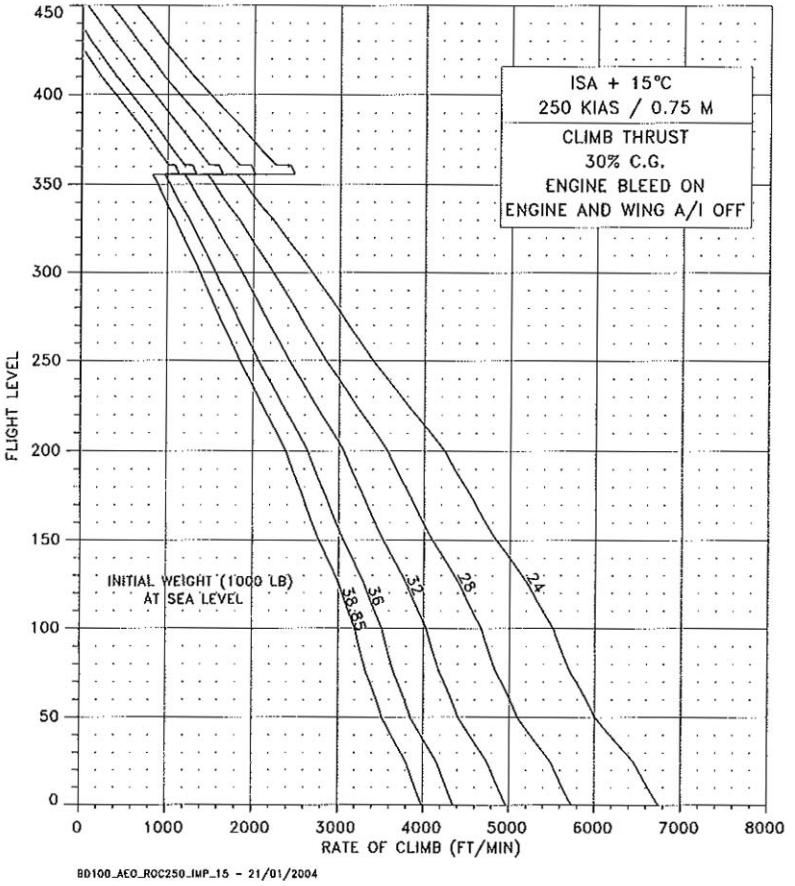

Figure 04-02-01. Climb Capability—250 KIAS/0.75 M (Sheet 5 of 6)

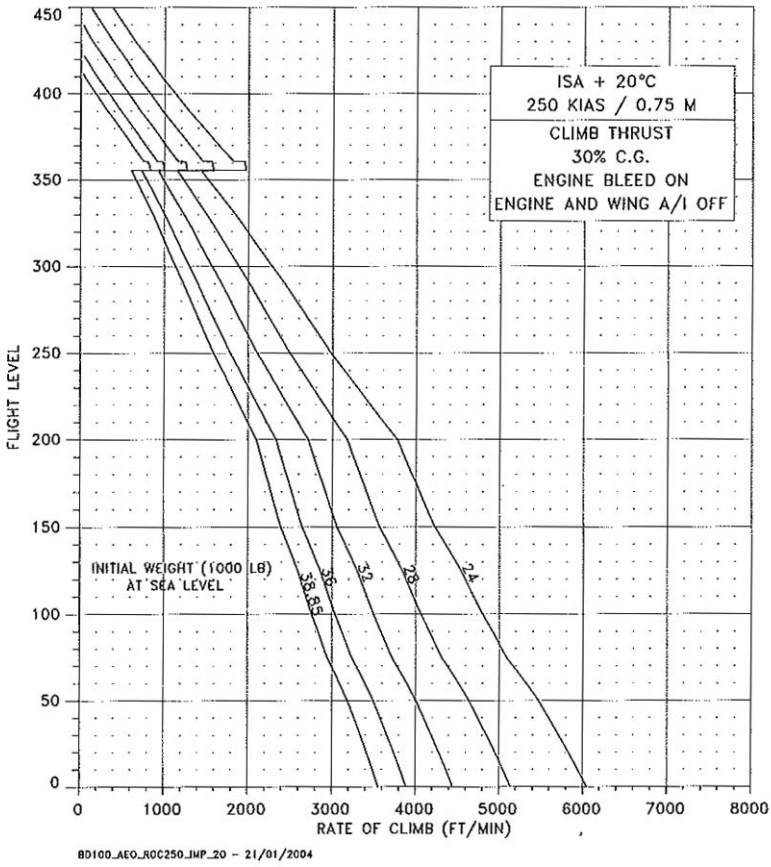

Figure 04-02-01. Climb Capability—250 KIAS/0.75 M (Sheet 6 of 6)

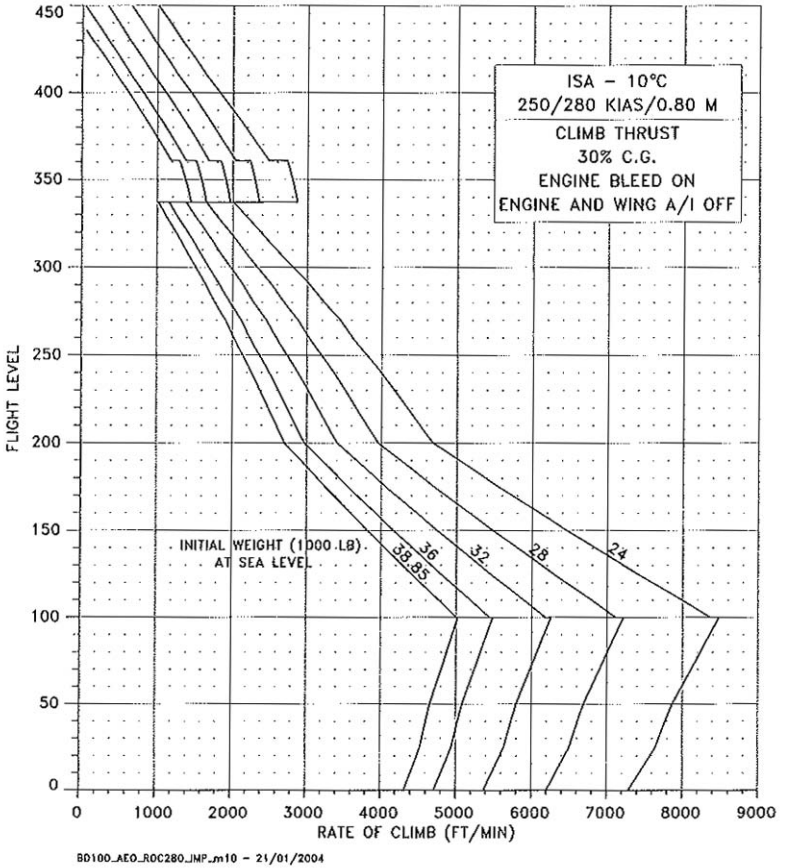

Figure 04-02-02. Climb Capability—250/280 KIAS/0.80 M (Sheet 1 of 6)

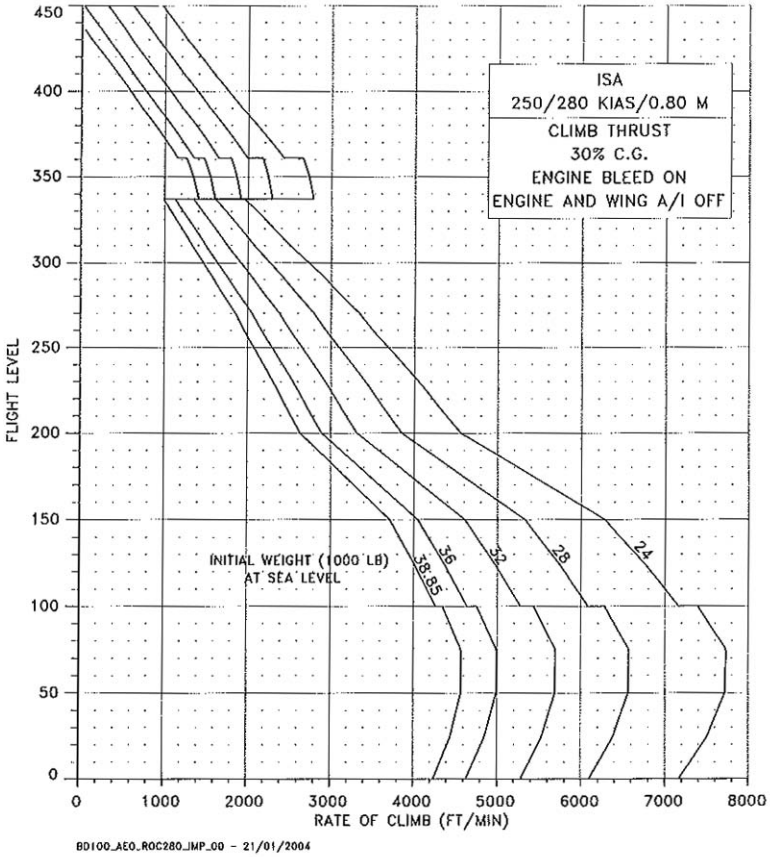

Figure 04-02-02. Climb Capability—250/280 KIAS/0.80 M (Sheet 2 of 6)

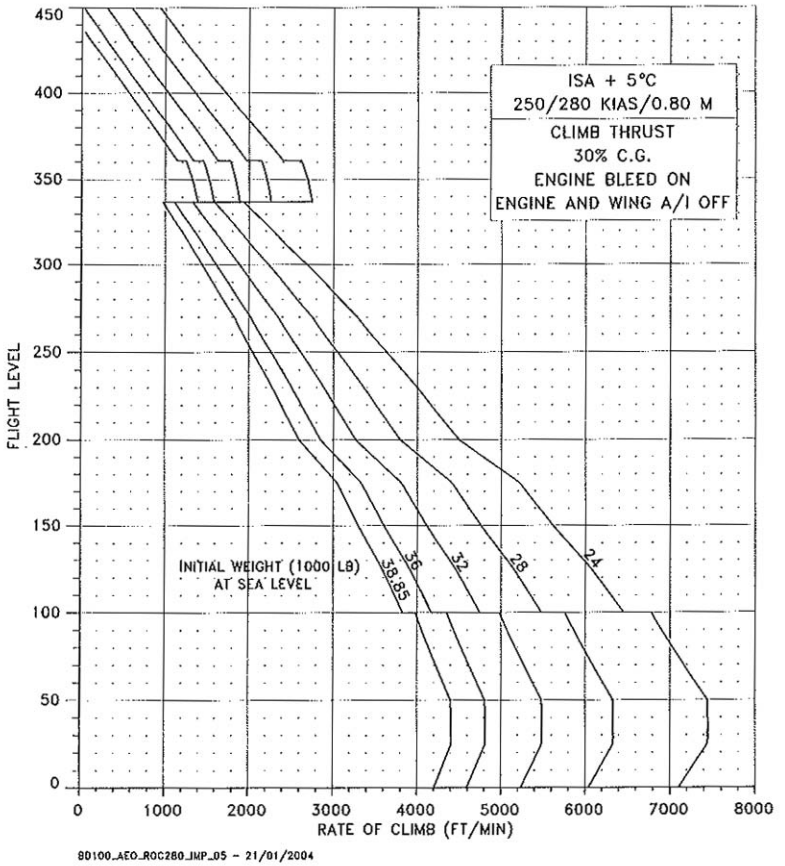

Figure 04-02-02. Climb Capability—250/280 KIAS/0.80 M (Sheet 3 of 6)

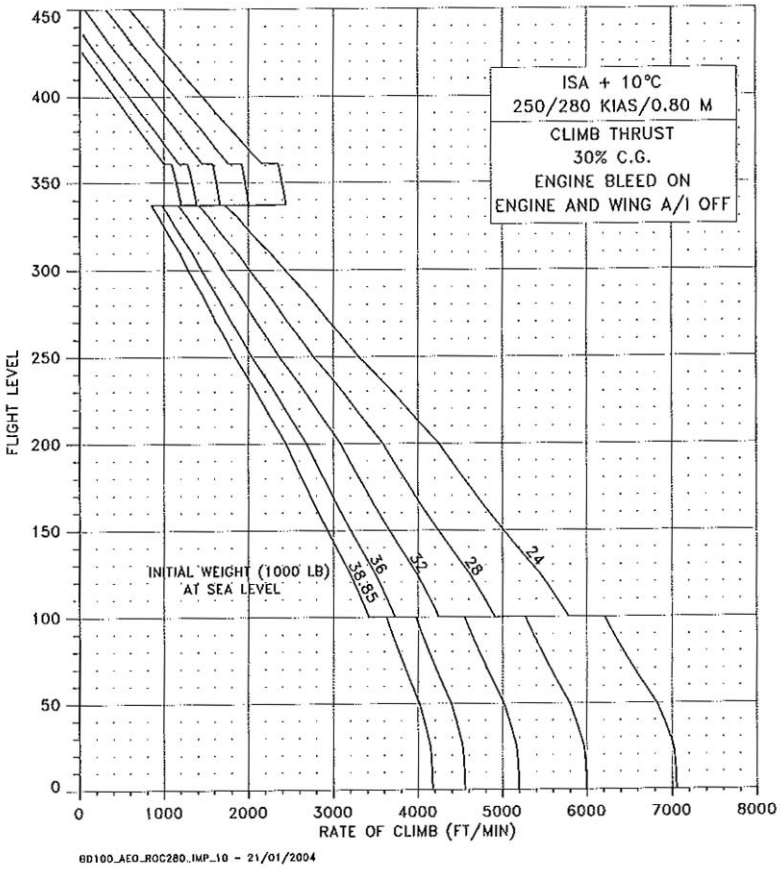

Figure 04-02-02. Climb Capability—250/280 KIAS/0.80 M (Sheet 4 of 6)

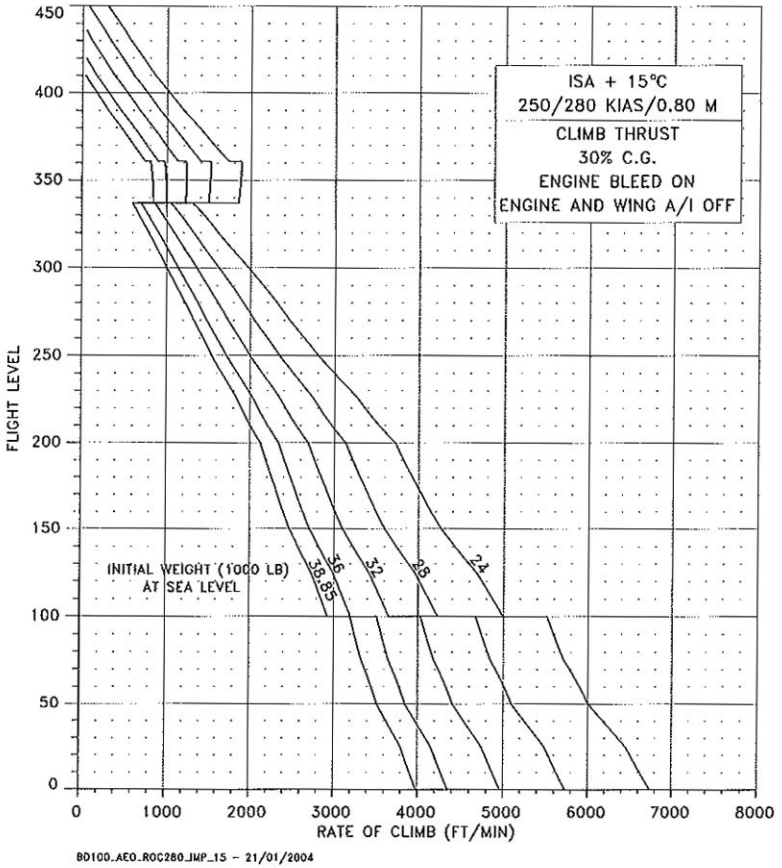

Figure 04-02-02. Climb Capability—250/280 KIAS/0.80 M (Sheet 5 of 6)

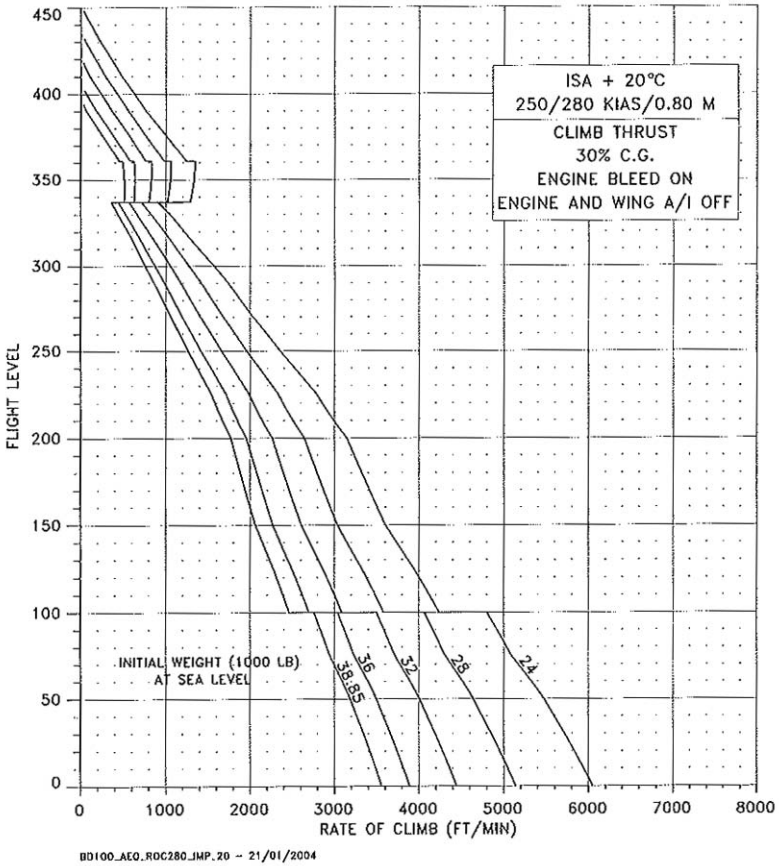

Figure 04-02-02. Climb Capability—250/280 KIAS/0.80 M (Sheet 6 of 6)

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CLIMB PERFORMANCE

All engine operating climb performance data are presented in tabular form as a function of initial climb weight for -10, 0, 5, 10, 15 and 20°C temperature deviations from ISA.

Climb performance data are presented for the following climb speed schedules:

- 250 KIAS / 0.75 MI - Long Range (typical) speed schedule
- 250 / 280 KIAS / 0.80 MI

Data are based on the use of CLB thrust with engine bleed on and anti-ice off. Climb speed schedules incorporate a speed limit of 250 KIAS below 10 000 ft.

Climb performance tables show the following data:

• TIME	Time in minutes
• DIST	Air distance in nautical miles
• FUEL	Fuel consumed in pounds
• ROC	Rate of climb in fpm (pressure altitude)
• ATAS	Average true airspeed in knots
• MACH	Indicated Mach number

At a selected climb speed schedule, the table is entered at an initial climb weight with average temperature conditions at given initial and final climb altitudes. Climb time, distance and fuel consumed are the difference between the values read at the initial and final altitudes. Airplane rate of climb and indicated Mach number at altitude are also given.

The climb distance represents the air distance (zero wind) covered and ATAS represents the average true airspeed from sea level to the point at which the top of climb altitude is reached. In wind conditions, the ground distance can be computed using the following equation:

Ground distance = [Air distance x (ATAS +/- Wind*) / ATAS]
* Wind convention "+" for Tailwind and "-" for Headwind

Time, distance and fuel correction factors for C.G. variation relative to 30% MAC reference position are provided below:

TIME, DISTANCE and FUEL CORRECTION FACTORS vs. C.G. POSITION.

CG	CLIMB SPEED SCHEDULE			
	250 KIAS / 0.75 M		250 / 280 KIAS / 0.80 M	
	Time and Fuel	Distance	Time and Fuel	Distance
20%	3.0 %	2.0 %	5.0 %	3.0 %
25%	2.0 %	1.0 %	2.0 %	2.0 %
REF (30%)	-	-	-	-
35%	0.0 %	0.0 %	-1.0 %	0.0 %
40%	-1.0 %	0.0 %	-2.0 %	-1.0 %

Example:

Associated conditions

- Top of climb altitude = FL 390 (A)
- Initial climb weight = 32 000 lbs (B)
- Climb speed schedule = 250 KIAS / 0.75 MI
- Average climb temperature = ISA-10°C
- Average climb wind = -30 kt (headwind)
- Initial altitude = Sea Level

Using Figure 04-03-01, Sheet 1, the following data are obtained: (C)

- Time = 11.8 min.
- Air distance = 70.0 NAM

Climb Performance

- Climb rate at FL 390 = 1504 ft/min.
- Avg true airspeed = 355 kts
- Indicated Mach = 0.75 MI

Ground distance = [Air distance x (ATAS +/- Wind*) / ATAS]
* Wind convention "+" for Tailwind and "-" for Headwind

Ground distance is estimated using equation given above:

- Ground distance = 64.1 n.m. [70.0 x (355-30)/355]

CLIMB 250 KIAS / 0.75 M

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	FROM SEA LEVEL TIME (MIN) FUEL (LB) DIST (NAM) ATAS (KTS) MACH ROC (FPM)

FLIGHT LEVEL	INITIAL CLIMB WEIGHT – 1000 LB									
	24		26		28		30		32 (B)	
450	11.8	612	13.1	676	14.6	744	16.3	821	18.4	911
	72.8	371	81.3	372	90.9	374	102.1	376	116.1	378
	0.750	1287	0.750	1075	0.750	874	0.750	682	0.750	501
430	10.4	574	11.5	630	12.6	690	13.9	754	15.4	825
	63.1	364	69.9	366	77.3	367	85.4	368	94.7	370
	0.750	1620	0.750	1401	0.750	1199	0.750	1009	0.750	828
410	9.3	539	10.2	591	11.2	645	12.2	702	13.3	762
	55.3	358	61.0	359	67.0	360	73.5	361	80.5	362
	0.750	1980	0.750	1744	0.750	1533	0.750	1341	0.750	1161
390 (A)	8.4	508	9.2	555	10.0	605	10.9	656	11.8	711
	48.9	351	53.8	352	58.8	353	64.2	354	70.0 (C)	355
	0.750	2373	0.750	2121	0.750	1894	0.750	1689	0.750	1504
370	7.6	478	8.3	522	9.0	568	9.8	615	10.6	665
	43.5	344	47.7	345	52.1	346	56.7	347	61.6	347
	0.750	2766	0.750	2494	0.750	2254	0.750	2037	0.750	1839
350	6.9	448	7.5	489	8.2	531	8.9	575	9.6	621
	38.5	336	42.2	337	46.0	338	50.0	339	54.2	339
	0.741	2449	0.741	2218	0.741	2015	0.741	1834	0.741	1671
330	6.1	414	6.7	452	7.2	490	7.8	530	8.5	572
	33.2	327	36.4	328	39.7	329	43.0	329	46.6	330
	0.711	2807	0.711	2549	0.711	2325	0.711	2125	0.711	1944
310	5.4	383	5.9	417	6.4	453	7.0	489	7.5	527
	28.8	318	31.5	319	34.3	320	37.2	321	40.2	321
	0.682	3169	0.682	2886	0.682	2640	0.682	2420	0.682	2220
290	4.8	353	5.3	385	5.7	417	6.2	450	6.7	485
	25.0	310	27.4	311	29.8	312	32.2	313	34.8	313
	0.655	3561	0.655	3251	0.655	2980	0.655	2737	0.655	2518
250	3.8	299	4.2	325	4.5	352	4.9	380	5.2	408
	18.8	295	20.6	297	22.4	297	24.2	298	26.1	299
	0.604	4333	0.604	3965	0.604	3647	0.604	3364	0.604	3112
200	2.8	235	3.0	256	3.3	277	3.5	298	3.8	320
	12.9	278	14.1	280	15.3	281	16.5	282	17.8	283
	0.547	5168	0.547	4738	0.547	4367	0.547	4041	0.547	3750
150	1.9	175	2.1	191	2.3	206	2.4	222	2.6	238
	8.5	264	9.3	265	10.1	267	10.9	268	11.7	268
	0.497	6779	0.497	6228	0.497	5753	0.497	5336	0.497	4967
100	1.3	118	1.4	129	1.5	139	1.6	150	1.7	161
	5.3	252	5.8	254	6.4	256	6.9	257	7.4	258
	0.452	8483	0.452	7803	0.452	7216	0.452	6705	0.452	6253
50	0.7	61	0.7	66	0.8	72	0.8	77	0.9	83
	2.7	244	2.9	245	3.2	247	3.4	248	3.7	249
	0.413	7867	0.413	7235	0.413	6691	0.413	6217	0.413	5798

BD100_AEO_CLB250_IMP_LW_M10 – 07/10/2003

Figure 04-03-01. Climb Performance—250 KIAS/0.75 M (Sheet 1 of 12)

CLIMB 250 KIAS / 0.75 M

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	FROM SEA LEVEL TIME (MIN) FUEL (LB) DIST (NAM) ATAS (KTS) MACH ROC (FPM)

FLIGHT LEVEL	INITIAL CLIMB WEIGHT – 1000 LB									
	34		36		38		40		42	
450	21.3 135.0 0.750	1022 381 329	25.8 165.9 0.750	1183 386 160						
430	17.0 105.5 0.750	904 372 655	19.1 118.9 0.750	997 374 490	21.7 136.4 0.750	1110 377 332	25.8 163.6 0.750	1267 381 175	36.4 237.3 0.750	1629 391 33
410	14.6 88.3 0.750	828 363 988	16.0 97.1 0.750	901 365 822	17.6 107.4 0.750	981 366 664	19.5 119.6 0.750	1074 368 514	21.9 135.1 0.750	1184 371 367
390	12.9 76.2 0.750	769 356 1330	14.0 83.0 0.750	831 357 1165	15.2 90.4 0.750	899 358 1007	16.5 98.8 0.750	972 359 855	18.0 108.3 0.750	1053 361 709
370	11.5 66.8 0.750	718 348 1659	12.4 72.4 0.750	774 349 1492	13.4 78.4 0.750	833 350 1335	14.5 85.0 0.750	897 351 1184	15.7 92.2 0.750	966 352 1039
350	10.3 58.6 0.741	669 340 1521	11.2 63.4 0.741	720 341 1384	12.0 68.4 0.741	774 342 1258	12.9 73.8 0.741	830 342 1139	13.9 79.7 0.741	891 343 1025
330	9.1 50.3 0.711	615 331 1780	9.8 54.3 0.711	661 331 1628	10.6 58.4 0.711	709 332 1489	11.3 62.8 0.711	759 333 1359	12.2 67.5 0.711	812 333 1237
310	8.1 43.4 0.682	566 322 2038	8.7 46.7 0.682	607 323 1871	9.3 50.2 0.682	650 323 1719	10.0 53.8 0.682	695 324 1579	10.7 57.7 0.682	743 324 1450
290	7.2 37.5 0.655	521 314 2317	7.7 40.3 0.655	558 315 2134	8.2 43.2 0.655	597 315 1969	8.8 46.2 0.655	637 316 1820	9.4 49.4 0.655	679 316 1682
250	5.6 28.0 0.604	437 300 2881	6.0 30.0 0.604	468 300 2671	6.4 32.1 0.604	500 301 2480	6.8 34.3 0.604	532 301 2306	7.3 36.6 0.604	566 301 2146
200	4.0 19.1 0.547	342 283 3487	4.3 20.4 0.547	366 284 3248	4.6 21.8 0.547	390 284 3030	4.9 23.2 0.547	415 285 2830	5.2 24.7 0.547	440 285 2647
150	2.8 12.6 0.497	255 269 4635	3.0 13.4 0.497	272 270 4335	3.2 14.3 0.497	289 270 4063	3.4 15.2 0.497	307 271 3815	3.6 16.2 0.497	326 271 3589
100	1.8 7.9 0.452	172 258 5849	2.0 8.5 0.452	183 259 5484	2.1 9.0 0.452	195 259 5154	2.2 9.6 0.452	207 260 4855	2.4 10.2 0.452	219 260 4582
50	1.0 4.0 0.413	88 249 5423	1.0 4.2 0.413	94 250 5085	1.1 4.5 0.413	100 250 4779	1.1 4.8 0.413	106 251 4501	1.2 5.1 0.413	113 251 4248

BD100_AEO_CLB250_IMP_HW_M10 – 07/10/2003

Figure 04-03-01. Climb Performance—250 KIAS/0.75 M (Sheet 2 of 12)

CLIMB 250 KIAS / 0.75 M

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	FROM SEA LEVEL TIME (MIN) FUEL (LB) DIST (NAM) ATAS (KTS) MACH ROC (FPM)

FLIGHT LEVEL	INITIAL CLIMB WEIGHT – 1000 LB									
	24		26		28		30		32	
450	12.2	648	13.6	715	15.1	788	16.9	870	19.1	965
	76.9	379	85.9	381	96.1	382	108.1	384	123.0	387
	0.750	1236	0.750	1031	0.750	837	0.750	652	0.750	476
430	10.7	607	11.9	667	13.1	730	14.4	798	15.9	873
	66.7	372	73.9	374	81.7	375	90.3	376	100.1	378
	0.750	1565	0.750	1352	0.750	1157	0.750	973	0.750	797
410	9.6	570	10.5	624	11.6	681	12.6	742	13.8	806
	58.4	365	64.4	366	70.8	368	77.6	369	85.0	370
	0.750	1912	0.750	1683	0.750	1479	0.750	1292	0.750	1118
390	8.6	536	9.5	586	10.3	639	11.3	693	12.2	751
	51.6	358	56.7	359	62.1	360	67.7	361	73.8	362
	0.750	2287	0.750	2044	0.750	1824	0.750	1626	0.750	1447
370	7.8	505	8.6	551	9.3	600	10.1	650	11.0	702
	45.9	351	50.3	352	54.9	353	59.8	354	64.9	354
	0.750	2699	0.750	2434	0.750	2200	0.750	1988	0.750	1795
350	7.1	473	7.8	516	8.4	561	9.2	607	9.9	655
	40.6	343	44.5	344	48.5	345	52.7	345	57.2	346
	0.741	2395	0.741	2169	0.741	1971	0.741	1795	0.741	1635
330	6.3	437	6.9	477	7.5	518	8.1	560	8.8	604
	35.2	333	38.5	334	41.9	335	45.5	336	49.2	337
	0.711	2743	0.711	2491	0.711	2273	0.711	2078	0.711	1901
310	5.6	404	6.2	441	6.7	478	7.2	516	7.8	556
	30.5	325	33.4	326	36.3	326	39.4	327	42.6	328
	0.682	3097	0.682	2821	0.682	2580	0.682	2366	0.682	2171
290	5.0	373	5.5	406	5.9	441	6.4	476	6.9	512
	26.5	316	29.0	317	31.5	318	34.2	319	36.9	320
	0.655	3454	0.655	3152	0.655	2889	0.655	2654	0.655	2441
250	4.0	315	4.3	343	4.7	371	5.1	401	5.5	431
	20.0	301	21.9	303	23.8	303	25.7	304	27.7	305
	0.604	4210	0.604	3852	0.604	3543	0.604	3268	0.604	3023
200	2.9	248	3.2	270	3.4	292	3.7	314	4.0	338
	13.8	284	15.0	286	16.3	287	17.7	288	19.0	288
	0.547	5041	0.547	4622	0.547	4260	0.547	3941	0.547	3657
150	2.0	185	2.2	201	2.4	218	2.6	234	2.8	251
	9.2	270	10.0	271	10.9	273	11.8	274	12.7	274
	0.497	6613	0.497	6075	0.497	5611	0.497	5205	0.497	4845
100	1.3	124	1.4	135	1.6	146	1.7	157	1.8	169
	5.7	258	6.2	260	6.8	261	7.3	262	7.9	263
	0.452	7385	0.452	6790	0.452	6276	0.452	5828	0.452	5432
50	0.7	63	0.7	69	0.8	75	0.8	80	0.9	86
	2.8	248	3.0	250	3.3	251	3.6	252	3.8	253
	0.413	7719	0.413	7099	0.413	6565	0.413	6100	0.413	5689

BD100_AEO_CLB250_IMP_LW_00 – 07/10/2003

Figure 04-03-01. Climb Performance—250 KIAS/0.75 M (Sheet 3 of 12)

CLIMB 250 KIAS / 0.75 M		
CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	FROM SEA LEVEL TIME (MIN) FUEL (LB) DIST (NAM) ATAS (KTS) MACH ROC (FPM)

FLIGHT LEVEL	INITIAL CLIMB WEIGHT – 1000 LB									
	34		36		38		40		42	
450	22.1 143.2 0.750	1085 390 309	26.9 176.8 0.750	1260 395 147						
430	17.6 111.6 0.750	958 380 629	19.8 125.8 0.750	1056 382 470	22.5 144.6 0.750	1177 385 316	26.8 173.9 0.750	1347 390 165	38.3 255.2 0.750	1746 400 30
410	15.1 93.3 0.750	876 371 951	16.5 102.6 0.750	953 373 790	18.2 113.4 0.750	1039 374 637	20.2 126.4 0.750	1137 376 491	22.6 143.0 0.750	1255 379 349
390	13.3 80.3 0.750	812 363 1279	14.4 87.5 0.750	878 364 1119	15.7 95.4 0.750	950 365 966	17.0 104.2 0.750	1027 367 819	18.6 114.3 0.750	1114 368 678
370	11.9 70.4 0.750	758 355 1619	12.9 76.3 0.750	817 356 1457	13.9 82.7 0.750	880 357 1304	15.0 89.6 0.750	948 358 1156	16.2 97.1 0.750	1020 359 1015
350	10.7 61.9 0.741	706 347 1488	11.5 66.9 0.741	760 348 1355	12.4 72.2 0.741	817 348 1231	13.4 77.9 0.741	877 349 1116	14.4 84.1 0.741	941 350 1005
330	9.5 53.2 0.711	650 337 1740	10.2 57.4 0.711	698 338 1592	10.9 61.8 0.711	749 339 1456	11.7 66.4 0.711	802 339 1330	12.6 71.4 0.711	858 340 1211
310	8.4 45.9 0.682	598 329 1993	9.0 49.4 0.682	642 329 1830	9.7 53.1 0.682	687 330 1681	10.4 57.0 0.682	735 330 1545	11.1 61.1 0.682	785 331 1419
290	7.4 39.7 0.655	550 320 2246	8.0 42.7 0.655	589 321 2069	8.6 45.8 0.655	630 321 1909	9.1 49.0 0.655	673 322 1764	9.8 52.4 0.655	718 322 1630
250	5.8 29.8 0.604	462 305 2799	6.3 31.9 0.604	494 306 2595	6.7 34.2 0.604	527 306 2409	7.1 36.5 0.604	562 307 2240	7.6 38.9 0.604	598 307 2084
200	4.2 20.4 0.547	361 289 3401	4.5 21.8 0.547	386 290 3168	4.8 23.3 0.547	412 290 2955	5.1 24.9 0.547	438 290 2760	5.5 26.4 0.547	465 291 2582
150	3.0 13.6 0.497	269 275 4521	3.2 14.5 0.497	287 276 4228	3.4 15.5 0.497	306 276 3962	3.6 16.5 0.497	325 277 3721	3.8 17.5 0.497	344 277 3500
100	1.9 8.4 0.452	181 264 5076	2.0 9.0 0.452	193 264 4755	2.2 9.6 0.452	205 265 4464	2.3 10.2 0.452	218 265 4200	2.5 10.9 0.452	231 266 3960
50	1.0 4.1 0.413	92 254 5321	1.0 4.4 0.413	98 255 4990	1.1 4.7 0.413	105 255 4689	1.2 5.0 0.413	111 255 4416	1.2 5.3 0.413	118 256 4168

BD100_AEO_CLB250_IMP_HW_00 – 07/10/2003

Figure 04-03-01. Climb Performance—250 KIAS/0.75 M (Sheet 4 of 12)

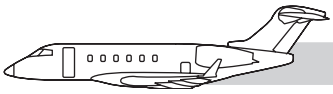
CLIMB 250 KIAS / 0.75 M

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	FROM SEA LEVEL TIME (MIN) FUEL (LB) DIST (NAM) ATAS (KTS) MACH ROC (FPM)

FLIGHT LEVEL	INITIAL CLIMB WEIGHT – 1000 LB									
	24		26		28		30		32	
450	12.5	668	13.9	738	15.5	813	17.3	898	19.6	997
	79.6	383	88.9	384	99.4	386	111.8	388	127.2	390
	0.750	1212	0.750	1010	0.750	820	0.750	637	0.750	464
430	11.0	626	12.2	688	13.4	753	14.8	824	16.3	901
	69.0	376	76.4	377	84.5	378	93.4	379	103.5	381
	0.750	1539	0.750	1329	0.750	1137	0.750	955	0.750	782
410	9.8	588	10.8	644	11.9	703	13.0	765	14.2	832
	60.5	369	66.7	370	73.2	371	80.3	372	88.0	373
	0.750	1879	0.750	1654	0.750	1452	0.750	1269	0.750	1097
390	8.9	553	9.7	605	10.6	658	11.6	715	12.6	774
	53.5	361	58.7	362	64.3	363	70.1	364	76.4	365
	0.750	2249	0.750	2010	0.750	1794	0.750	1598	0.750	1422
370	8.1	520	8.8	568	9.6	618	10.4	670	11.3	724
	47.5	354	52.2	355	56.9	356	62.0	356	67.3	357
	0.750	2654	0.750	2393	0.750	2163	0.750	1954	0.750	1764
350	7.3	488	8.0	532	8.7	578	9.4	626	10.2	676
	42.2	346	46.2	347	50.4	348	54.8	348	59.3	349
	0.741	2369	0.741	2145	0.741	1949	0.741	1775	0.741	1617
330	6.5	451	7.1	492	7.7	534	8.4	578	9.1	623
	36.6	336	40.1	337	43.6	338	47.3	339	51.2	339
	0.711	2712	0.711	2463	0.711	2247	0.711	2054	0.711	1880
310	5.8	417	6.4	455	6.9	493	7.5	533	8.1	574
	31.9	328	34.9	328	37.9	329	41.1	330	44.4	331
	0.682	3064	0.682	2792	0.682	2553	0.682	2341	0.682	2148
290	5.2	385	5.7	420	6.2	455	6.7	491	7.2	529
	27.8	319	30.4	320	33.0	321	35.8	322	38.6	322
	0.655	3419	0.655	3121	0.655	2861	0.655	2628	0.655	2417
250	4.2	325	4.5	354	4.9	384	5.3	414	5.7	445
	21.1	304	23.1	305	25.1	306	27.1	307	29.2	308
	0.604	4154	0.604	3801	0.604	3496	0.604	3224	0.604	2983
200	3.1	257	3.3	279	3.6	302	3.9	326	4.2	350
	14.7	288	16.1	289	17.5	290	18.9	291	20.3	292
	0.547	4980	0.547	4566	0.547	4208	0.547	3893	0.547	3613
150	2.2	192	2.4	208	2.5	225	2.7	243	2.9	261
	9.9	274	10.8	275	11.7	276	12.7	277	13.6	278
	0.497	6028	0.497	5536	0.497	5111	0.497	4738	0.497	4408
100	1.4	128	1.5	139	1.6	151	1.8	162	1.9	174
	6.0	261	6.6	263	7.2	264	7.7	265	8.3	266
	0.452	6780	0.452	6231	0.452	5758	0.452	5345	0.452	4978
50	0.7	65	0.7	71	0.8	76	0.9	82	0.9	88
	2.8	251	3.1	252	3.4	254	3.6	255	3.9	256
	0.413	7442	0.413	6843	0.413	6328	0.413	5879	0.413	5482

BD100_AEO_CLB250_IMP_LW_05 – 07/10/2003

Figure 04-03-01. Climb Performance—250 KIAS/0.75 M (Sheet 5 of 12)



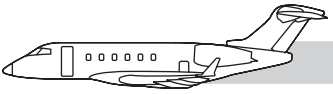
CLIMB 250 KIAS / 0.75 M

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	FROM SEA LEVEL TIME (MIN) FUEL (LB) DIST (NAM) ATAS (KTS) MACH ROC (FPM)

FLIGHT LEVEL	INITIAL CLIMB WEIGHT – 1000 LB									
	34		36		38		40		42	
450	22.6	1120	27.6	1303						
	148.2	393	183.3	399						
	0.750	301	0.750	141						
430	18.1	988	20.3	1090	23.1	1216	27.5	1393	39.4	1812
	115.4	383	130.1	385	149.6	389	180.1	393	265.4	404
	0.750	617	0.750	460	0.750	309	0.750	160	0.750	28
410	15.5	904	17.0	983	18.7	1072	20.7	1174	23.2	1296
	96.5	374	106.2	376	117.4	377	130.9	380	148.0	382
	0.750	933	0.750	775	0.750	624	0.750	480	0.750	340
390	13.6	838	14.8	906	16.1	980	17.5	1060	19.1	1149
	83.2	366	90.6	367	98.7	368	107.8	370	118.3	371
	0.750	1256	0.750	1099	0.750	948	0.750	804	0.750	665
370	12.2	782	13.2	843	14.3	908	15.4	978	16.7	1053
	73.0	358	79.1	359	85.7	360	92.8	361	100.6	362
	0.750	1591	0.750	1431	0.750	1280	0.750	1136	0.750	996
350	11.0	729	11.9	784	12.8	843	13.8	905	14.8	972
	64.2	350	69.4	350	74.9	351	80.9	352	87.2	353
	0.741	1472	0.741	1340	0.741	1219	0.741	1105	0.741	995
330	9.8	670	10.5	721	11.3	773	12.1	828	13.0	887
	55.3	340	59.7	341	64.3	341	69.1	342	74.3	343
	0.711	1721	0.711	1575	0.711	1440	0.711	1315	0.711	1198
310	8.7	617	9.3	663	10.0	710	10.7	759	11.5	811
	47.9	331	51.6	332	55.4	332	59.5	333	63.7	333
	0.682	1972	0.682	1812	0.682	1664	0.682	1530	0.682	1405
290	7.7	568	8.3	609	8.9	652	9.5	696	10.1	743
	41.6	323	44.7	324	48.0	324	51.4	324	54.9	325
	0.655	2224	0.655	2049	0.655	1890	0.655	1747	0.655	1615
250	6.1	477	6.5	511	7.0	546	7.5	582	7.9	620
	31.4	308	33.7	309	36.0	309	38.5	310	41.1	310
	0.604	2761	0.604	2560	0.604	2377	0.604	2210	0.604	2056
200	4.5	375	4.8	400	5.1	427	5.4	455	5.8	483
	21.8	292	23.3	293	24.9	293	26.6	294	28.3	294
	0.547	3359	0.547	3129	0.547	2919	0.547	2727	0.547	2550
150	3.2	279	3.4	298	3.6	317	3.8	337	4.0	358
	14.6	279	15.7	279	16.7	280	17.8	280	18.9	280
	0.497	4110	0.497	3840	0.497	3595	0.497	3372	0.497	3169
100	2.0	186	2.1	199	2.3	211	2.4	225	2.6	238
	8.9	267	9.6	267	10.2	268	10.8	268	11.5	269
	0.452	4650	0.452	4353	0.452	4084	0.452	3839	0.452	3616
50	1.0	94	1.1	100	1.1	107	1.2	114	1.3	120
	4.2	256	4.5	257	4.8	257	5.1	258	5.4	268
	0.413	5127	0.413	4806	0.413	4516	0.413	4252	0.413	4012

BD100_AEO_CLB250_IMP_HW_05 – 07/10/2003

Figure 04-03-01. Climb Performance—250 KIAS/0.75 M (Sheet 6 of 12)



CLIMB 250 KIAS / 0.75 M

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	FROM SEA LEVEL TIME (MIN) FUEL (LB) DIST (NAM) ATAS (KTS) MACH ROC (FPM)

FLIGHT LEVEL	INITIAL CLIMB WEIGHT – 1000 LB									
	24		26		28		30		32	
450	13.8	712	15.5	789	17.4	875	19.7	974	22.9	1099
	89.6	388	100.7	390	113.7	392	129.8	395	152.0	398
	0.750	947	0.750	767	0.750	596	0.750	431	0.750	275
430	12.0	662	13.3	728	14.7	800	16.3	877	18.1	964
	76.4	381	84.9	382	94.1	383	104.6	385	116.8	387
	0.750	1284	0.750	1095	0.750	922	0.750	756	0.750	597
410	10.7	619	11.7	679	12.9	742	14.1	809	15.4	881
	66.3	373	73.2	374	80.6	375	88.5	376	97.3	378
	0.750	1638	0.750	1432	0.750	1248	0.750	1079	0.750	921
390	9.6	580	10.5	635	11.5	692	12.5	753	13.6	816
	58.3	366	64.1	367	70.2	367	76.7	368	83.7	369
	0.750	2024	0.750	1803	0.750	1602	0.750	1421	0.750	1256
370	8.7	545	9.5	596	10.3	649	11.2	704	12.2	762
	51.7	358	56.8	359	62.0	360	67.5	360	73.4	361
	0.750	2428	0.750	2185	0.750	1970	0.750	1775	0.750	1597
350	7.9	511	8.6	558	9.4	606	10.2	657	11.0	710
	45.8	350	50.2	350	54.8	351	59.6	352	64.6	353
	0.741	2197	0.741	1987	0.741	1803	0.741	1640	0.741	1491
330	7.0	472	7.7	515	8.3	559	9.0	605	9.8	653
	39.8	340	43.5	341	47.4	342	51.5	342	55.7	343
	0.711	2538	0.711	2303	0.711	2099	0.711	1917	0.711	1751
310	6.3	436	6.8	476	7.4	516	8.0	558	8.7	602
	34.6	331	37.9	332	41.2	333	44.7	333	48.3	334
	0.682	2877	0.682	2619	0.682	2393	0.682	2193	0.682	2010
290	5.6	403	6.1	439	6.7	476	7.2	514	7.8	554
	30.2	323	33.1	324	36.0	325	39.0	325	42.1	326
	0.655	3218	0.655	2936	0.655	2689	0.655	2468	0.655	2268
250	4.5	340	4.9	371	5.3	402	5.7	433	6.2	466
	23.1	308	25.2	309	27.4	310	29.6	311	31.9	311
	0.604	3883	0.604	3551	0.604	3264	0.604	3009	0.604	2781
200	3.3	268	3.6	292	3.9	316	4.2	340	4.5	366
	16.2	292	17.7	293	19.2	294	20.7	295	22.3	295
	0.547	4710	0.547	4317	0.547	3977	0.547	3678	0.547	3412
150	2.3	200	2.5	217	2.8	235	3.0	253	3.2	272
	10.8	278	11.8	279	12.9	280	13.9	281	15.0	281
	0.497	5492	0.497	5041	0.497	4651	0.497	4310	0.497	4006
100	1.5	133	1.6	145	1.7	157	1.9	169	2.0	181
	6.6	265	7.2	267	7.8	268	8.4	269	9.1	269
	0.452	6211	0.452	5706	0.452	5271	0.452	4890	0.452	4553
50	0.7	67	0.8	73	0.8	79	0.9	85	1.0	91
	3.0	254	3.3	255	3.6	257	3.9	258	4.2	258
	0.413	6821	0.413	6271	0.413	5797	0.413	5383	0.413	5017

BD100_AEO_CLB250_IMP_LW_10 – 07/10/2003

Figure 04-03-01. Climb Performance—250 KIAS/0.75 M (Sheet 7 of 12)

CLIMB 250 KIAS / 0.75 M

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	FROM SEA LEVEL TIME (MIN) FUEL (LB) DIST (NAM) ATAS (KTS) MACH ROC (FPM)

FLIGHT LEVEL	INITIAL CLIMB WEIGHT – 1000 LB									
	34		36		38		40		42	
450	28.1 189.1 0.750	1283 403 128								
430	20.3 131.8 0.750	1065 389 445	23.2 151.5 0.750	1189 392 301	27.4 181.6 0.750	1359 397 163	37.7 255.1 0.750	1713 407 38		
410	16.9 107.1 0.750	960 379 768	18.7 118.5 0.750	1048 381 821	20.7 132.1 0.750	1148 383 480	23.2 149.1 0.750	1268 386 346	26.6 172.6 0.750	1420 389 217
390	14.8 91.3 0.750	885 370 1102	16.1 99.7 0.750	958 371 955	17.5 108.9 0.750	1039 373 813	19.2 119.5 0.750	1127 374 677	21.0 131.7 0.750	1227 376 545
370	13.2 79.7 0.750	823 362 1435	14.3 86.5 0.750	889 363 1285	15.5 93.9 0.750	959 364 1143	16.8 101.9 0.750	1034 365 1006	18.2 110.8 0.750	1116 366 874
350	11.9 70.0 0.741	766 353 1354	12.8 75.7 0.741	825 354 1230	13.8 81.9 0.741	888 355 1114	14.9 88.4 0.741	955 356 1007	16.1 95.6 0.741	1027 357 902
330	10.5 60.2 0.711	704 344 1601	11.3 65.0 0.711	757 344 1462	12.2 70.1 0.711	813 345 1334	13.1 75.5 0.711	873 345 1215	14.1 81.2 0.711	935 346 1104
310	9.4 52.2 0.682	648 335 1842	10.1 56.2 0.682	696 335 1690	10.8 60.5 0.682	746 336 1550	11.6 65.0 0.682	799 336 1421	12.4 69.7 0.682	855 337 1303
290	8.3 45.4 0.655	596 326 2085	9.0 48.8 0.655	639 327 1918	9.6 52.4 0.655	685 327 1767	10.3 56.2 0.655	732 328 1631	11.0 60.1 0.655	782 328 1505
250	6.6 34.4 0.604	500 312 2572	7.1 36.9 0.604	536 312 2382	7.6 39.5 0.604	573 312 2208	8.1 42.2 0.604	611 313 2050	8.6 45.1 0.604	651 313 1905
200	4.9 24.0 0.547	392 296 3171	5.2 25.7 0.547	419 296 2952	5.6 27.5 0.547	448 297 2751	5.9 29.3 0.547	477 297 2568	6.3 31.2 0.547	507 297 2400
150	3.4 16.1 0.497	291 282 3732	3.6 17.2 0.497	311 282 3484	3.9 18.3 0.497	332 283 3258	4.1 19.5 0.497	353 283 3053	4.4 20.8 0.497	375 284 2865
100	2.2 9.7 0.452	194 270 4250	2.3 10.4 0.452	207 270 3975	2.5 11.1 0.452	220 271 3726	2.6 11.8 0.452	234 271 3500	2.8 12.6 0.452	249 272 3293
50	1.0 4.5 0.413	98 259 4689	1.1 4.8 0.413	104 260 4394	1.2 5.1 0.413	111 260 4125	1.3 5.4 0.413	118 260 3881	1.3 5.8 0.413	125 261 3659

BD100_AEO_CLB250_IMP_HW_10 – 07/10/2003

Figure 04-03-01. Climb Performance—250 KIAS/0.75 M (Sheet 8 of 12)

CLIMB 250 KIAS / 0.75 M

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	FROM SEA LEVEL TIME (MIN) FUEL (LB) DIST (NAM) ATAS (KTS) MACH ROC (FPM)

FLIGHT LEVEL	INITIAL CLIMB WEIGHT – 1000 LB									
	24		26		28		30		32	
450	16.6	793	18.8	887	21.6	997	25.6	1143	33.8	1401
	109.3	396	124.8	398	144.4	401	173.1	405	232.5	412
	0.750	636	0.750	483	0.750	335	0.750	193	0.750	62
430	14.0	725	15.6	801	17.4	884	19.5	978	22.0	1088
	90.5	387	101.1	389	113.2	390	127.3	392	145.0	395
	0.750	956	0.750	794	0.750	644	0.750	499	0.750	359
410	12.2	671	13.5	738	14.9	809	16.4	885	18.0	969
	77.3	379	85.6	380	94.5	381	104.4	383	115.5	384
	0.750	1300	0.750	1121	0.750	960	0.750	813	0.750	673
390	10.9	626	12.0	687	13.1	750	14.3	817	15.6	889
	67.3	371	74.2	372	81.4	373	89.2	374	97.7	375
	0.750	1690	0.750	1495	0.750	1318	0.750	1157	0.750	1010
370	9.8	587	10.8	642	11.8	700	12.8	761	13.9	825
	59.4	363	65.3	364	71.5	365	78.0	365	85.0	366
	0.750	2071	0.750	1857	0.750	1667	0.750	1493	0.750	1334
350	8.9	548	9.7	599	10.6	652	11.5	708	12.5	766
	52.5	354	57.6	355	62.9	356	68.5	357	74.4	357
	0.741	1900	0.741	1714	0.741	1550	0.741	1404	0.741	1271
330	7.9	505	8.7	552	9.4	600	10.2	650	11.1	703
	45.4	345	49.8	345	54.3	346	59.0	347	64.0	347
	0.711	2227	0.711	2016	0.711	1833	0.711	1669	0.711	1520
310	7.1	466	7.7	509	8.4	552	9.1	598	9.8	646
	39.5	336	43.3	336	47.2	337	51.2	338	55.4	338
	0.682	2532	0.682	2301	0.682	2099	0.682	1918	0.682	1753
290	6.3	429	6.9	468	7.5	508	8.1	550	8.8	593
	34.5	327	37.7	328	41.1	329	44.5	329	48.1	330
	0.655	2829	0.655	2577	0.655	2357	0.655	2158	0.655	1979
250	5.0	361	5.5	394	6.0	427	6.4	461	6.9	496
	26.2	312	28.6	313	31.1	314	33.7	314	36.4	315
	0.604	3397	0.604	3103	0.604	2849	0.604	2622	0.604	2418
200	3.7	283	4.1	309	4.4	335	4.7	361	5.1	388
	18.4	296	20.1	297	21.8	298	23.6	298	25.4	299
	0.547	4238	0.547	3882	0.547	3574	0.547	3302	0.547	3059
150	2.6	211	2.8	229	3.1	248	3.3	268	3.6	288
	12.3	282	13.4	283	14.6	284	15.8	284	17.0	285
	0.497	4843	0.497	4442	0.497	4096	0.497	3791	0.497	3520
100	1.7	140	1.8	153	1.9	165	2.1	178	2.3	191
	7.4	269	8.1	270	8.8	271	9.5	272	10.2	273
	0.452	5513	0.452	5063	0.452	4673	0.452	4333	0.452	4030
50	0.8	70	0.8	76	0.9	83	1.0	89	1.1	96
	3.4	258	3.7	259	4.0	260	4.3	261	4.6	261
	0.413	6004	0.413	5516	0.413	5097	0.413	4730	0.413	4405

BD100_AEO_CLB250_IMP_LW_15 – 07/10/2003

Figure 04-03-01. Climb Performance—250 KIAS/0.75 M (Sheet 9 of 12)

CLIMB 250 KIAS / 0.75 M		
CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	FROM SEA LEVEL TIME (MIN) FUEL (LB) DIST (NAM) ATAS (KTS) MACH ROC (FPM)

FLIGHT LEVEL	INITIAL CLIMB WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430	25.5 169.4 0.750	1227 399 226	31.4 211.4 0.750	1441 405 101						
410	20.0 128.4 0.750	1063 386 537	22.3 144.1 0.750	1171 388 405	25.2 164.3 0.750	1302 391 279	29.4 193.6 0.750	1478 395 160	37.7 253.3 0.750	1790 404 51
390	17.1 107.1 0.750	967 376 872	18.7 117.5 0.750	1052 377 739	20.5 129.4 0.750	1146 379 610	22.6 143.3 0.750	1253 381 487	25.1 160.3 0.750	1377 383 367
370	15.1 92.6 0.750	894 367 1188	16.4 100.9 0.750	968 368 1053	17.9 109.9 0.750	1048 369 924	19.4 119.9 0.750	1135 370 800	21.2 131.3 0.750	1231 372 680
350	13.5 80.8 0.741	828 358 1148	14.7 87.7 0.741	895 359 1035	15.9 95.2 0.741	966 360 931	17.2 103.2 0.741	1042 361 834	18.6 112.1 0.741	1125 362 739
330	12.0 69.3 0.711	758 348 1384	12.9 75.0 0.711	818 349 1258	13.9 81.1 0.711	880 349 1142	15.0 87.6 0.711	947 350 1034	16.2 94.6 0.711	1018 351 931
310	10.6 59.9 0.682	696 339 1602	11.4 64.7 0.682	749 339 1463	12.3 69.7 0.682	805 340 1336	13.2 75.1 0.682	864 340 1219	14.2 80.8 0.682	927 341 1111
290	9.4 52.0 0.655	638 330 1813	10.2 56.0 0.655	686 331 1662	10.9 60.3 0.655	736 331 1525	11.7 64.7 0.655	789 332 1401	12.5 69.5 0.655	845 332 1287
250	7.5 39.2 0.604	533 315 2232	8.0 42.1 0.604	572 316 2061	8.6 45.1 0.604	613 316 1905	9.2 48.3 0.604	655 316 1763	9.8 51.7 0.604	699 317 1632
200	5.5 27.3 0.547	416 299 2840	5.9 29.3 0.547	446 300 2639	6.3 31.3 0.547	477 300 2456	6.7 33.5 0.547	508 300 2288	7.1 35.7 0.547	541 301 2134
150	3.8 18.2 0.497	308 285 3275	4.1 19.5 0.497	330 286 3053	4.4 20.9 0.497	352 286 2850	4.7 22.3 0.497	375 286 2666	5.0 23.7 0.497	399 287 2497
100	2.4 11.0 0.452	205 273 3758	2.6 11.8 0.452	219 274 3511	2.7 12.6 0.452	233 274 3287	2.9 13.4 0.452	248 274 3083	3.1 14.2 0.452	264 275 2897
50	1.1 5.0 0.413	102 262 4113	1.2 5.3 0.413	109 263 3849	1.3 5.7 0.413	116 263 3610	1.4 6.0 0.413	124 263 3392	1.5 6.4 0.413	131 264 3194

BD100_AEO_CLB250_IMP_HW_15 – 07/10/2003

Figure 04-03-01. Climb Performance—250 KIAS/0.75 M (Sheet 10 of 12)

CLIMB 250 KIAS / 0.75 M		
CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	FROM SEA LEVEL TIME (MIN) FUEL (LB) DIST (NAM) ATAS (KTS) MACH ROC (FPM)

FLIGHT LEVEL	INITIAL CLIMB WEIGHT – 1000 LB									
	24		26		28		30		32	
450	21.1	922	24.7	1054	30.5	1242				
	142.4	406	168.4	409	210.1	414				
	0.750	373	0.750	244	0.750	120				
430	17.1	820	19.2	914	21.8	1021	25.0	1150	29.9	1326
	112.6	396	127.4	397	145.2	400	168.1	403	202.7	407
	0.750	655	0.750	518	0.750	389	0.750	266	0.750	146
410	14.6	749	16.2	827	18.0	912	20.0	1005	22.3	1111
	93.9	386	104.6	388	116.5	389	130.0	391	146.1	393
	0.750	963	0.750	812	0.750	675	0.750	548	0.750	427
390	12.8	692	14.1	761	15.5	834	17.0	912	18.7	997
	80.5	378	89.1	379	98.2	380	108.2	381	119.3	382
	0.750	1289	0.750	1127	0.750	977	0.750	840	0.750	714
370	11.4	643	12.6	706	13.8	771	15.0	840	16.4	914
	70.3	369	77.4	370	85.0	371	93.1	372	101.9	373
	0.750	1642	0.750	1462	0.750	1300	0.750	1152	0.750	1015
350	10.3	597	11.3	654	12.3	713	13.4	775	14.6	842
	61.5	360	67.6	361	74.0	361	80.8	362	88.1	363
	0.741	1524	0.741	1367	0.741	1228	0.741	1104	0.741	991
330	9.1	547	9.9	598	10.8	651	11.8	707	12.8	766
	52.8	349	57.9	350	63.3	351	68.9	351	74.9	352
	0.711	1842	0.711	1662	0.711	1505	0.711	1364	0.711	1234
310	8.1	502	8.8	549	9.6	597	10.4	647	11.3	700
	45.7	340	50.0	341	54.6	341	59.3	342	64.3	343
	0.682	2132	0.682	1933	0.682	1758	0.682	1601	0.682	1456
290	7.2	461	7.8	504	8.5	547	9.2	592	10.0	640
	39.7	332	43.4	332	47.3	333	51.3	333	55.6	334
	0.655	2429	0.655	2208	0.655	2015	0.655	1840	0.655	1680
250	5.7	386	6.2	421	6.7	457	7.3	494	7.9	533
	30.0	316	32.8	317	35.7	318	38.7	318	41.8	318
	0.604	2979	0.604	2718	0.604	2491	0.604	2288	0.604	2107
200	4.2	303	4.6	330	5.0	358	5.4	386	5.8	416
	21.0	300	23.0	301	25.0	301	27.0	302	29.1	302
	0.547	3774	0.547	3454	0.547	3177	0.547	2932	0.547	2713
150	3.0	224	3.2	245	3.5	265	3.8	286	4.0	307
	14.1	286	15.4	287	16.7	287	18.1	288	19.5	288
	0.497	4225	0.497	3873	0.497	3567	0.497	3298	0.497	3059
100	1.8	149	2.0	162	2.2	175	2.3	189	2.5	203
	8.4	273	9.2	274	10.0	275	10.8	275	11.6	276
	0.452	4802	0.452	4406	0.452	4064	0.452	3764	0.452	3498
50	0.9	74	0.9	81	1.0	87	1.1	94	1.2	101
	3.8	261	4.1	262	4.5	263	4.8	264	5.2	264
	0.413	5472	0.413	5026	0.413	4641	0.413	4305	0.413	4006

BD100_AEO_CLB250_IMP_LW_20 – 07/10/2003

Figure 04-03-01. Climb Performance—250 KIAS/0.75 M (Sheet 11 of 12)

CLIMB 250 KIAS / 0.75 M		
CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	FROM SEA LEVEL TIME (MIN) FUEL (LB) DIST (NAM) ATAS (KTS) MACH ROC (FPM)

FLIGHT LEVEL	INITIAL CLIMB WEIGHT - 1000 LB									
	34		36		38		40		42	
450										
430	40.5 281.2 0.750	1670 416 39								
410	25.2 166.1 0.750	1237 396 309	29.1 193.8 0.750	1398 399 194	35.6 240.8 0.750	1644 405 87				
390	20.6 132.0 0.750	1092 384 596	22.8 146.6 0.750	1198 385 481	25.4 164.3 0.750	1321 388 368	28.7 186.7 0.750	1470 391 260	33.2 218.4 0.750	1666 395 166
370	17.9 111.6 0.750	995 374 890	19.6 122.4 0.750	1083 375 772	21.5 134.5 0.750	1180 376 661	23.6 148.3 0.750	1288 378 552	26.0 164.5 0.750	1412 380 446
350	15.8 96.1 0.741	913 364 885	17.2 104.8 0.741	991 365 788	18.8 114.3 0.741	1074 366 698	20.4 124.9 0.741	1165 367 614	22.3 136.7 0.741	1266 368 530
330	13.8 81.4 0.711	829 353 1116	15.0 88.4 0.711	897 353 1006	16.2 95.9 0.711	969 354 904	17.6 104.1 0.711	1046 355 808	19.1 113.1 0.711	1130 356 718
310	12.2 69.7 0.682	756 343 1323	13.2 75.5 0.682	816 344 1201	14.2 81.7 0.682	879 344 1088	15.4 88.3 0.682	947 345 984	16.6 95.4 0.682	1019 346 888
290	10.8 60.1 0.655	690 334 1533	11.6 64.9 0.655	744 335 1399	12.5 70.1 0.655	800 335 1276	13.5 75.5 0.655	860 336 1166	14.5 81.3 0.655	923 336 1063
250	8.5 45.0 0.604	574 319 1939	9.1 48.5 0.604	616 319 1785	9.8 52.1 0.604	661 320 1644	10.5 55.9 0.604	708 320 1516	11.2 60.0 0.604	758 320 1397
200	6.2 31.3 0.547	446 303 2514	6.7 33.7 0.547	479 303 2332	7.1 36.1 0.547	513 303 2165	7.6 38.6 0.547	548 304 2012	8.1 41.3 0.547	585 304 1872
150	4.3 20.9 0.497	330 289 2841	4.7 22.4 0.497	353 289 2644	5.0 24.0 0.497	378 289 2463	5.3 25.6 0.497	403 290 2298	5.7 27.3 0.497	429 290 2147
100	2.7 12.5 0.452	218 276 3257	2.9 13.3 0.452	233 277 3039	3.1 14.3 0.452	249 277 2839	3.3 15.2 0.452	265 277 2658	3.5 16.2 0.452	282 277 2493
50	1.3 5.6 0.413	108 265 3739	1.4 6.0 0.413	116 265 3496	1.4 6.4 0.413	123 266 3275	1.5 6.8 0.413	131 266 3075	1.6 7.2 0.413	139 266 2892

BD100_AEO_CLB250_IMP_HW_20 - 07/10/2003

Figure 04-03-01. Climb Performance—250 KIAS/0.75 M (Sheet 12 of 12)

CLIMB 250 / 280 KIAS / 0.80 M		
CLIMB THRUST **ENGINE BLEED ON** **ENGINE AND WING A/I OFF**	ISA – 10 C 30% C.G.	**FROM SEA LEVEL** TIME (MIN) FUEL (LB) DIST (NAM) ATAS (KTS) MACH ROC (FPM)

FLIGHT LEVEL	INITIAL CLIMB WEIGHT – 1000 LB									
	24		26		28		30		32	
450	13.5	705	15.1	781	16.9	863	19.1	958	21.9	1072
	91.2	405	102.2	406	114.9	408	130.3	410	150.3	412
	0.800	1005	0.800	822	0.800	647	0.800	484	0.800	334
430	11.8	655	13.0	721	14.4	791	15.9	866	17.6	950
	78.3	398	86.8	400	96.1	401	106.5	402	118.5	404
	0.800	1323	0.800	1135	0.800	959	0.800	791	0.800	633
410	10.4	613	11.5	672	12.6	734	13.8	799	15.1	868
	68.2	392	75.3	393	82.7	394	90.7	395	99.4	396
	0.800	1651	0.800	1456	0.800	1275	0.800	1106	0.800	945
390	9.3	574	10.3	629	11.2	685	12.2	743	13.2	804
	60.1	386	66.1	386	72.3	387	78.9	388	85.8	389
	0.800	2001	0.800	1789	0.800	1601	0.800	1427	0.800	1264
370	8.4	538	9.2	588	10.1	640	10.9	693	11.8	749
	53.2	379	58.4	380	63.8	380	69.4	381	75.2	382
	0.800	2335	0.800	2105	0.800	1903	0.800	1722	0.800	1555
350	7.7	505	8.4	552	9.1	600	9.9	649	10.7	700
	47.4	372	52.0	373	56.8	373	61.6	374	66.7	375
	0.800	2801	0.800	2534	0.800	2301	0.800	2097	0.800	1912
330	6.9	468	7.5	511	8.2	555	8.8	600	9.5	646
	41.4	363	45.4	363	49.5	364	53.7	365	58.0	366
	0.789	2167	0.789	1959	0.789	1782	0.789	1627	0.789	1488
310	6.0	427	6.6	466	7.1	506	7.7	546	8.3	588
	35.3	352	38.6	353	42.0	353	45.5	354	49.1	355
	0.757	2588	0.757	2351	0.757	2148	0.757	1971	0.757	1814
290	5.3	391	5.8	426	6.3	462	6.8	498	7.3	536
	30.2	341	33.0	342	35.9	343	38.9	344	41.9	344
	0.727	3037	0.727	2763	0.727	2528	0.727	2323	0.727	2142
250	4.1	326	4.5	355	4.9	384	5.3	414	5.6	444
	22.2	323	24.3	324	26.4	325	28.5	325	30.7	326
	0.672	3804	0.672	3476	0.672	3196	0.672	2952	0.672	2738
200	3.0	253	3.2	275	3.5	297	3.7	320	4.0	343
	14.8	300	16.1	301	17.5	302	18.9	303	20.3	304
	0.610	4684	0.610	4291	0.610	3955	0.610	3663	0.610	3406
150	2.0	187	2.2	204	2.4	220	2.6	237	2.8	254
	9.5	278	10.3	279	11.2	280	12.1	281	13.0	282
	0.555	6463	0.555	5935	0.555	5482	0.555	5091	0.555	4745
100	1.3	118	1.4	129	1.5	139	1.6	150	1.7	161
	5.3	252	5.8	254	6.4	256	6.9	257	7.4	258
	0.452	8483	0.452	7803	0.452	7216	0.452	6705	0.452	6253
50	0.7	61	0.7	66	0.8	72	0.8	77	0.9	83
	2.7	244	2.9	245	3.2	247	3.4	248	3.7	249
	0.413	7867	0.413	7235	0.413	6691	0.413	6217	0.413	5798

BD100_AEO_CLB280_IMP_LW_M10 – 07/10/2003

Figure 04-03-02. Climb Performance—250/280 KIAS/0.80 M (Sheet 1 of 12)

CLIMB 250 / 280 KIAS / 0.80 M		
CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	FROM SEA LEVEL TIME (MIN) FUEL (LB) DIST (NAM) ATAS (KTS) MACH ROC (FPM)

FLIGHT LEVEL	INITIAL CLIMB WEIGHT – 1000 LB									
	34		36		38		40		42	
450	26.0 180.4 0.800	1227 416 182	36.9 260.6 0.800	1573 424 35						
430	19.6 132.8 0.800	1045 406 487	22.2 151.0 0.800	1158 408 347	25.9 177.4 0.800	1308 412 201	33.8 235.6 0.800	1594 418 56		
410	16.5 109.1 0.800	944 397 792	18.1 120.2 0.800	1027 399 649	20.0 133.3 0.800	1121 401 515	22.3 149.5 0.800	1232 403 382	25.3 171.5 0.800	1372 406 245
390	14.4 93.3 0.800	869 390 1109	15.6 101.5 0.800	938 391 961	16.9 110.7 0.800	1014 392 821	18.5 121.1 0.800	1098 394 689	20.2 133.2 0.800	1192 395 565
370	12.8 81.4 0.800	806 383 1399	13.8 88.0 0.800	867 384 1252	14.8 95.1 0.800	933 384 1112	16.0 103.0 0.800	1003 386 976	17.3 111.8 0.800	1080 387 848
350	11.5 72.0 0.800	752 376 1743	12.4 77.6 0.800	808 376 1585	13.3 83.5 0.800	866 377 1435	14.3 90.0 0.800	928 378 1292	15.4 97.0 0.800	995 379 1155
330	10.2 62.5 0.789	694 366 1364	11.0 67.1 0.789	744 367 1252	11.8 72.1 0.789	796 367 1147	12.6 77.4 0.789	851 368 1049	13.5 83.1 0.789	910 369 957
310	8.9 52.8 0.757	630 355 1673	9.6 56.6 0.757	674 356 1544	10.2 60.6 0.757	721 356 1425	10.9 64.9 0.757	769 357 1314	11.7 69.5 0.757	820 357 1209
290	7.8 44.9 0.727	574 345 1981	8.4 48.2 0.727	613 345 1835	8.9 51.5 0.727	655 346 1701	9.5 55.0 0.727	698 346 1577	10.2 58.7 0.727	743 347 1461
250	6.0 32.9 0.672	475 326 2545	6.5 35.2 0.672	508 327 2370	6.9 37.5 0.672	541 327 2209	7.3 40.0 0.672	575 328 2059	7.8 42.6 0.672	611 328 1920
200	4.3 21.8 0.610	367 304 3176	4.6 23.2 0.610	392 305 2970	4.9 24.8 0.610	417 305 2781	5.2 26.3 0.610	442 305 2607	5.5 28.0 0.610	469 306 2444
150	3.0 14.0 0.555	272 283 4439	3.2 14.9 0.555	290 283 4166	3.4 15.9 0.555	308 283 3917	3.6 16.9 0.555	327 284 3689	3.8 17.9 0.555	346 284 3481
100	1.8 7.9 0.452	172 258 5849	2.0 8.5 0.452	183 259 5484	2.1 9.0 0.452	195 259 5154	2.2 9.6 0.452	207 260 4855	2.4 10.2 0.452	219 260 4582
50	1.0 4.0 0.413	88 249 5423	1.0 4.2 0.413	94 250 5085	1.1 4.5 0.413	100 250 4779	1.1 4.8 0.413	106 251 4501	1.2 5.1 0.413	113 251 4248

BD100_AEO_CLB280_IMP_HW_M10 – 07/10/2003

Figure 04-03-02. Climb Performance—250/280 KIAS/0.80 M (Sheet 2 of 12)

CLIMB 250 / 280 KIAS / 0.80 M

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	FROM SEA LEVEL TIME (MIN) FUEL (LB) DIST (NAM) ATAS (KTS) MACH ROC (FPM)

FLIGHT LEVEL	INITIAL CLIMB WEIGHT – 1000 LB									
	24		26		28		30		32	
450	14.1	750	15.7	830	17.6	919	19.9	1021	22.8	1144
	96.9	414	108.6	415	122.3	417	138.9	419	160.5	422
	0.800	959	0.800	783	0.800	614	0.800	457	0.800	311
430	12.2	696	13.5	766	15.0	840	16.5	921	18.3	1010
	83.1	407	92.2	408	102.0	409	113.1	411	125.9	413
	0.800	1263	0.800	1083	0.800	914	0.800	751	0.800	599
410	10.8	650	11.9	713	13.1	779	14.3	848	15.6	922
	72.3	400	79.8	401	87.7	402	96.1	403	105.4	405
	0.800	1587	0.800	1399	0.800	1225	0.800	1062	0.800	906
390	9.7	608	10.6	666	11.6	726	12.7	788	13.7	853
	63.6	394	70.0	394	76.6	395	83.5	396	90.9	397
	0.800	1927	0.800	1723	0.800	1541	0.800	1373	0.800	1215
370	8.7	570	9.6	623	10.4	678	11.3	735	12.3	794
	56.3	386	61.9	387	67.6	388	73.5	389	79.7	390
	0.800	2280	0.800	2055	0.800	1858	0.800	1681	0.800	1519
350	8.0	535	8.7	585	9.5	635	10.3	688	11.1	742
	50.3	379	55.2	380	60.2	381	65.4	382	70.7	382
	0.800	2729	0.800	2468	0.800	2242	0.800	2043	0.800	1863
330	7.1	496	7.8	542	8.5	588	9.2	636	9.9	685
	44.0	370	48.3	371	52.6	372	57.0	372	61.6	373
	0.789	2112	0.789	1909	0.789	1737	0.789	1585	0.789	1451
310	6.3	452	6.9	494	7.4	536	8.0	579	8.7	623
	37.5	359	41.1	360	44.7	360	48.4	361	52.2	362
	0.757	2503	0.757	2274	0.757	2077	0.757	1905	0.757	1754
290	5.5	414	6.0	451	6.6	489	7.1	528	7.6	567
	32.1	348	35.2	349	38.2	350	41.4	351	44.6	351
	0.727	2939	0.727	2674	0.727	2446	0.727	2248	0.727	2073
250	4.3	344	4.7	375	5.1	406	5.5	438	5.9	470
	23.7	329	25.9	330	28.2	331	30.4	332	32.8	332
	0.672	3689	0.672	3371	0.672	3099	0.672	2862	0.672	2654
200	3.1	267	3.4	291	3.7	315	3.9	339	4.2	364
	15.9	306	17.4	308	18.8	309	20.3	309	21.9	310
	0.610	4559	0.610	4177	0.610	3850	0.610	3565	0.610	3315
150	2.2	198	2.4	216	2.6	234	2.8	251	3.0	270
	10.3	285	11.3	286	12.3	287	13.3	288	14.2	289
	0.555	6279	0.555	5766	0.555	5326	0.555	4946	0.555	4610
100	1.3	124	1.4	135	1.6	146	1.7	157	1.8	169
	5.7	258	6.2	260	6.8	261	7.3	262	7.9	263
	0.452	7385	0.452	6790	0.452	6276	0.452	5828	0.452	5432
50	0.7	63	0.7	69	0.8	75	0.8	80	0.9	86
	2.8	248	3.0	250	3.3	251	3.6	252	3.8	253
	0.413	7719	0.413	7099	0.413	6565	0.413	6100	0.413	5689

BD100_AEO_CLB280_IMP_LW_00 – 07/10/2003

Figure 04-03-02. Climb Performance—250/280 KIAS/0.80 M (Sheet 3 of 12)

CLIMB 250 / 280 KIAS / 0.80 M		
CLIMB THRUST **ENGINE BLEED ON** **ENGINE AND WING A/I OFF**	ISA 30% C.G.	**FROM SEA LEVEL** TIME (MIN) FUEL (LB) DIST (NAM) ATAS (KTS) MACH ROC (FPM)

FLIGHT LEVEL	INITIAL CLIMB WEIGHT – 1000 LB									
	34		36		38		40		42	
450	27.3 193.7 0.800	1314 426 166	39.7 287.4 0.800	1717 435 29						
430	20.5 141.3 0.800	1112 415 458	23.2 161.0 0.800	1234 417 323	27.1 189.9 0.800	1398 421 183	36.0 257.2 0.800	1727 429 47		
410	17.1 115.7 0.800	1002 406 758	18.8 127.6 0.800	1091 407 619	20.7 141.5 0.800	1191 409 489	23.2 158.9 0.800	1310 412 362	26.4 182.6 0.800	1462 415 229
390	14.9 98.8 0.800	921 398 1066	16.2 107.5 0.800	995 399 922	17.6 117.2 0.800	1076 400 787	19.1 128.2 0.800	1165 402 659	21.0 141.0 0.800	1265 404 539
370	13.2 86.2 0.800	855 391 1367	14.3 93.2 0.800	920 391 1223	15.4 100.8 0.800	989 392 1087	16.6 109.1 0.800	1064 393 954	18.0 118.4 0.800	1145 395 829
350	12.0 76.3 0.800	798 383 1699	12.9 82.3 0.800	856 384 1546	13.8 88.6 0.800	918 385 1399	14.9 95.4 0.800	984 385 1261	16.0 102.9 0.800	1055 386 1127
330	10.7 66.3 0.789	736 374 1330	11.4 71.3 0.789	789 374 1220	12.3 76.6 0.789	844 375 1119	13.1 82.2 0.789	903 375 1023	14.1 88.2 0.789	965 376 933
310	9.3 56.1 0.757	668 362 1617	10.0 60.2 0.757	715 363 1492	10.7 64.5 0.757	764 363 1377	11.4 69.0 0.757	815 364 1269	12.2 73.9 0.757	870 364 1168
290	8.2 47.8 0.727	608 352 1916	8.7 51.3 0.727	650 352 1774	9.3 54.8 0.727	694 353 1645	10.0 58.6 0.727	740 353 1525	10.6 62.5 0.727	788 354 1412
250	6.3 35.1 0.672	503 333 2467	6.8 37.6 0.672	538 333 2297	7.2 40.1 0.672	573 334 2141	7.7 42.7 0.672	609 334 1996	8.2 45.5 0.672	648 334 1860
200	4.5 23.4 0.610	389 310 3091	4.8 25.0 0.610	415 311 2891	5.1 26.7 0.610	441 311 2707	5.5 28.4 0.610	469 312 2537	5.8 30.1 0.610	497 312 2378
150	3.2 15.3 0.555	288 289 4313	3.4 16.3 0.555	307 290 4047	3.6 17.4 0.555	327 290 3805	3.8 18.4 0.555	347 290 3584	4.0 19.6 0.555	368 291 3380
100	1.9 8.4 0.452	181 264 5076	2.0 9.0 0.452	193 264 4755	2.2 9.6 0.452	205 265 4464	2.3 10.2 0.452	218 265 4200	2.5 10.9 0.452	231 266 3960
50	1.0 4.1 0.413	92 254 5321	1.0 4.4 0.413	98 255 4990	1.1 4.7 0.413	105 255 4689	1.2 5.0 0.413	111 255 4416	1.2 5.3 0.413	118 256 4168

BD100_AEO_CLB280_IMP_HW_00 – 07/10/2003

Figure 04-03-02. Climb Performance—250/280 KIAS/0.80 M (Sheet 4 of 12)

CLIMB 250 / 280 KIAS / 0.80 M

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	FROM SEA LEVEL TIME (MIN) FUEL (LB) DIST (NAM) ATAS (KTS) MACH ROC (FPM)

FLIGHT LEVEL	INITIAL CLIMB WEIGHT – 1000 LB									
	24		26		28		30		32	
450	14.4	776	16.1	859	18.1	951	20.5	1057	23.5	1186
	100.5	417	112.7	419	126.9	421	144.1	423	166.8	426
	0.800	934	0.800	761	0.800	595	0.800	441	0.800	298
430	12.6	720	13.9	793	15.4	870	17.0	953	18.8	1045
	86.2	411	95.6	412	105.9	413	117.4	414	130.7	416
	0.800	1237	0.800	1060	0.800	893	0.800	733	0.800	584
410	11.2	672	12.3	737	13.5	806	14.7	877	16.1	954
	75.1	404	82.8	405	91.0	406	99.8	407	109.4	408
	0.800	1554	0.800	1370	0.800	1198	0.800	1038	0.800	885
390	10.0	629	11.0	689	12.0	751	13.0	815	14.2	882
	66.1	397	72.7	398	79.6	398	86.8	399	94.4	400
	0.800	1890	0.800	1689	0.800	1510	0.800	1345	0.800	1190
370	9.0	589	9.9	645	10.8	702	11.7	760	12.7	821
	58.6	390	64.4	390	70.3	391	76.5	392	82.9	393
	0.800	2247	0.800	2026	0.800	1831	0.800	1657	0.800	1497
350	8.2	553	9.0	605	9.8	658	10.6	712	11.5	768
	52.4	382	57.5	383	62.7	384	68.1	385	73.7	385
	0.800	2691	0.800	2434	0.800	2211	0.800	2014	0.800	1837
330	7.4	513	8.1	561	8.8	609	9.5	659	10.3	709
	46.0	373	50.4	374	54.9	374	59.5	375	64.3	376
	0.789	2084	0.789	1884	0.789	1714	0.789	1565	0.789	1432
310	6.5	469	7.1	511	7.7	555	8.4	600	9.0	645
	39.3	362	43.0	363	46.8	363	50.7	364	54.7	364
	0.757	2473	0.757	2246	0.757	2052	0.757	1882	0.757	1732
290	5.8	429	6.3	467	6.8	507	7.4	547	7.9	588
	33.8	351	37.0	352	40.2	353	43.5	354	46.9	354
	0.727	2891	0.727	2630	0.727	2406	0.727	2210	0.727	2038
250	4.5	357	5.0	389	5.4	422	5.8	455	6.2	488
	25.2	332	27.5	333	29.9	334	32.3	335	34.7	335
	0.672	3636	0.672	3322	0.672	3054	0.672	2821	0.672	2616
200	3.3	278	3.6	303	3.9	328	4.2	353	4.5	379
	17.1	310	18.7	312	20.3	312	22.0	313	23.6	314
	0.610	4498	0.610	4121	0.610	3798	0.610	3517	0.610	3270
150	2.3	206	2.5	225	2.7	243	3.0	262	3.2	281
	11.3	289	12.3	290	13.4	291	14.4	292	15.5	293
	0.555	5616	0.555	5154	0.555	4759	0.555	4416	0.555	4114
100	1.4	128	1.5	139	1.6	151	1.8	162	1.9	174
	6.0	261	6.6	263	7.2	264	7.7	265	8.3	266
	0.452	6780	0.452	6231	0.452	5758	0.452	5345	0.452	4978
50	0.7	65	0.7	71	0.8	76	0.9	82	0.9	88
	2.8	251	3.1	252	3.4	254	3.6	255	3.9	256
	0.413	7442	0.413	6843	0.413	6328	0.413	5879	0.413	5482

BD100_AEO_CLB280_IMP_LW_05 – 07/10/2003

Figure 04-03-02. Climb Performance—250/280 KIAS/0.80 M (Sheet 5 of 12)

CLIMB 250 / 280 KIAS / 0.80 M		
CLIMB THRUST **ENGINE BLEED ON** **ENGINE AND WING A/I OFF**	ISA + 5 C 30% C.G.	**FROM SEA LEVEL** TIME (MIN) FUEL (LB) DIST (NAM) ATAS (KTS) MACH ROC (FPM)

FLIGHT LEVEL	INITIAL CLIMB WEIGHT – 1000 LB									
	34		36		38		40		42	
450	28.2 201.8 0.800	1365 430 156	41.7 305.3 0.800	1807 439 25						
430	21.0 146.7 0.800	1151 418 445	23.8 167.2 0.800	1279 421 312	27.9 197.5 0.800	1451 425 176	37.3 269.2 0.800	1801 433 44		
410	17.6 120.1 0.800	1037 409 740	19.3 132.4 0.800	1129 411 603	21.4 146.9 0.800	1234 413 476	23.8 164.9 0.800	1357 415 350	27.2 189.7 0.800	1515 419 221
390	15.3 102.6 0.800	953 401 1044	16.6 111.6 0.800	1030 402 902	18.1 121.7 0.800	1113 404 769	19.7 133.1 0.800	1205 405 643	21.6 146.3 0.800	1309 407 525
370	13.7 89.7 0.800	885 394 1347	14.7 96.9 0.800	952 394 1206	15.9 104.8 0.800	1024 395 1071	17.2 113.4 0.800	1101 396 940	18.6 123.0 0.800	1186 397 817
350	12.4 79.5 0.800	826 386 1675	13.3 85.7 0.800	887 387 1524	14.3 92.3 0.800	951 387 1380	15.4 99.4 0.800	1020 388 1244	16.5 107.1 0.800	1093 389 1113
330	11.0 69.3 0.789	762 376 1312	11.9 74.5 0.789	817 377 1204	12.7 80.0 0.789	875 378 1104	13.6 85.8 0.789	935 378 1010	14.6 92.1 0.789	1000 379 921
310	9.7 58.8 0.757	692 365 1598	10.4 63.1 0.757	741 365 1474	11.1 67.6 0.757	792 366 1361	11.8 72.4 0.757	846 366 1254	12.7 77.4 0.757	902 367 1154
290	8.5 50.3 0.727	631 355 1884	9.1 53.9 0.727	674 355 1744	9.7 57.7 0.727	720 355 1617	10.4 61.6 0.727	768 356 1499	11.1 65.8 0.727	818 356 1388
250	6.7 37.3 0.672	523 336 2431	7.1 39.9 0.672	559 336 2264	7.6 42.5 0.672	595 337 2110	8.1 45.3 0.672	634 337 1967	8.6 48.3 0.672	674 337 1833
200	4.8 25.3 0.610	405 314 3049	5.2 27.0 0.610	432 315 2851	5.5 28.8 0.610	460 315 2670	5.8 30.6 0.610	489 315 2502	6.2 32.5 0.610	519 315 2346
150	3.4 16.6 0.555	300 293 3846	3.6 17.7 0.555	320 294 3606	3.9 18.9 0.555	341 294 3388	4.1 20.1 0.555	362 295 3188	4.3 21.3 0.555	384 295 3004
100	2.0 8.9 0.452	186 267 4650	2.1 9.6 0.452	199 267 4353	2.3 10.2 0.452	211 268 4084	2.4 10.8 0.452	225 268 3839	2.6 11.5 0.452	238 269 3616
50	1.0 4.2 0.413	94 256 5127	1.1 4.5 0.413	100 257 4806	1.1 4.8 0.413	107 257 4516	1.2 5.1 0.413	114 258 4252	1.3 5.4 0.413	120 258 4012

BD100_AEO_CLB280_IMP_HW_05 – 07/10/2003

Figure 04-03-02. Climb Performance—250/280 KIAS/0.80 M (Sheet 6 of 12)

CLIMB 250 / 280 KIAS / 0.80 M

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	FROM SEA LEVEL TIME (MIN) FUEL (LB) DIST (NAM) ATAS (KTS) MACH ROC (FPM)

FLIGHT LEVEL	INITIAL CLIMB WEIGHT – 1000 LB									
	24		26		28		30		32	
450	17.0	859	19.2	961	22.1	1080	26.3	1238	34.5	1514
	120.3	426	137.0	427	158.5	430	189.8	434	253.2	440
	0.800	583	0.800	439	0.800	299	0.800	170	0.800	55
430	14.3	782	15.9	864	17.6	952	19.7	1051	22.2	1165
	99.3	417	110.7	419	123.4	420	138.3	422	156.7	424
	0.800	922	0.800	770	0.800	627	0.800	487	0.800	355
410	12.4	723	13.7	795	15.1	871	16.6	951	18.2	1037
	84.9	410	93.9	411	103.5	412	113.9	413	125.5	414
	0.800	1272	0.800	1110	0.800	959	0.800	816	0.800	679
390	11.1	674	12.1	739	13.3	807	14.5	877	15.8	951
	74.1	402	81.6	403	89.5	404	97.7	405	106.6	406
	0.800	1619	0.800	1440	0.800	1280	0.800	1132	0.800	991
370	9.9	630	10.9	690	11.9	751	12.9	815	14.0	881
	65.4	395	71.9	396	78.6	396	85.6	397	92.9	398
	0.800	1986	0.800	1785	0.800	1608	0.800	1450	0.800	1304
350	9.0	590	9.9	646	10.8	703	11.7	761	12.7	822
	58.4	387	64.1	388	70.0	389	76.1	390	82.4	390
	0.800	2399	0.800	2165	0.800	1962	0.800	1783	0.800	1621
330	8.1	546	8.9	597	9.7	649	10.5	702	11.3	757
	51.1	378	56.0	378	61.1	379	66.3	380	71.7	380
	0.789	1879	0.789	1695	0.789	1539	0.789	1402	0.789	1279
310	7.1	497	7.8	543	8.5	590	9.2	638	9.9	687
	43.6	366	47.8	367	52.0	368	56.4	368	60.8	369
	0.757	2254	0.757	2045	0.757	1865	0.757	1708	0.757	1570
290	6.3	454	6.9	495	7.5	538	8.1	581	8.7	625
	37.5	356	41.0	357	44.6	357	48.3	358	52.1	358
	0.727	2618	0.727	2379	0.727	2173	0.727	1994	0.727	1836
250	5.0	377	5.4	411	5.9	445	6.3	480	6.8	516
	27.9	337	30.4	338	33.1	338	35.7	339	38.5	339
	0.672	3301	0.672	3013	0.672	2768	0.672	2554	0.672	2366
200	3.6	293	4.0	319	4.3	345	4.6	372	5.0	400
	19.1	315	20.8	316	22.6	317	24.4	317	26.3	318
	0.610	4248	0.610	3891	0.610	3585	0.610	3318	0.610	3084
150	2.5	216	2.8	236	3.0	255	3.2	275	3.5	295
	12.5	294	13.6	295	14.8	296	16.0	296	17.2	297
	0.555	5010	0.555	4595	0.555	4239	0.555	3932	0.555	3660
100	1.5	133	1.6	145	1.7	157	1.9	169	2.0	181
	6.6	265	7.2	267	7.8	268	8.4	269	9.1	269
	0.452	6211	0.452	5706	0.452	5271	0.452	4890	0.452	4553
50	0.7	67	0.8	73	0.8	79	0.9	85	1.0	91
	3.0	254	3.3	255	3.6	257	3.9	258	4.2	258
	0.413	6821	0.413	6271	0.413	5797	0.413	5383	0.413	5017

BD100_AEO_CLB280_IMP_LW_10 – 07/10/2003

Figure 04-03-02. Climb Performance—250/280 KIAS/0.80 M (Sheet 7 of 12)

CLIMB 250 / 280 KIAS / 0.80 M		
CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	FROM SEA LEVEL TIME (MIN) FUEL (LB) DIST (NAM) ATAS (KTS) MACH ROC (FPM)

FLIGHT LEVEL	INITIAL CLIMB WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430	25.4 181.2 0.800	1306 427 233	30.5 219.6 0.800	1507 432 118						
410	20.0 138.8 0.800	1133 416 547	22.2 154.6 0.800	1242 418 423	24.9 174.5 0.800	1372 420 308	28.5 201.6 0.800	1538 424 196	34.8 249.1 0.800	1799 430 82
390	17.1 116.2 0.800	1030 407 858	18.7 126.9 0.800	1116 408 728	20.4 139.1 0.800	1211 410 606	22.4 153.3 0.800	1318 411 490	24.7 170.2 0.800	1442 413 381
370	15.2 100.7 0.800	951 399 1166	16.4 109.1 0.800	1025 400 1037	17.7 118.3 0.800	1105 401 912	19.2 128.5 0.800	1192 402 790	20.8 140.0 0.800	1288 403 676
350	13.7 89.1 0.800	885 391 1473	14.7 96.1 0.800	952 392 1334	15.9 103.7 0.800	1023 392 1201	17.1 112.0 0.800	1099 393 1075	18.4 121.1 0.800	1182 394 954
330	12.2 77.3 0.789	815 381 1169	13.1 83.2 0.789	874 382 1070	14.1 89.5 0.789	937 382 978	15.1 96.3 0.789	1004 383 891	16.2 103.5 0.789	1076 384 808
310	10.6 65.5 0.757	738 369 1445	11.4 70.3 0.757	790 370 1331	12.2 75.4 0.757	846 370 1225	13.1 80.9 0.757	904 371 1126	14.0 86.7 0.757	967 372 1033
290	9.4 56.0 0.727	670 359 1694	10.0 60.0 0.727	717 359 1565	10.7 64.2 0.727	767 360 1448	11.5 68.7 0.727	819 360 1339	12.2 73.5 0.727	873 361 1236
250	7.3 41.3 0.672	553 340 2197	7.8 44.2 0.672	591 340 2043	8.3 47.2 0.672	631 340 1901	8.9 50.3 0.672	672 341 1769	9.4 53.7 0.672	715 341 1645
200	5.3 28.2 0.610	428 318 2875	5.7 30.1 0.610	457 319 2687	6.0 32.1 0.610	487 319 2514	6.4 34.2 0.610	517 319 2355	6.8 36.3 0.610	550 319 2206
150	3.7 18.4 0.555	315 297 3419	4.0 19.7 0.555	336 298 3204	4.2 21.0 0.555	358 298 3007	4.5 22.3 0.555	381 298 2826	4.8 23.7 0.555	404 299 2659
100	2.2 9.7 0.452	194 270 4250	2.3 10.4 0.452	207 270 3975	2.5 11.1 0.452	220 271 3726	2.6 11.8 0.452	234 271 3500	2.8 12.6 0.452	249 272 3293
50	1.0 4.5 0.413	98 259 4689	1.1 4.8 0.413	104 260 4394	1.2 5.1 0.413	111 260 4125	1.3 5.4 0.413	118 260 3881	1.3 5.8 0.413	125 261 3659

BD100_AEO_CLB280_IMP_HW_10 – 07/10/2003

Figure 04-03-02. Climb Performance—250/280 KIAS/0.80 M (Sheet 8 of 12)

CLIMB 250 / 280 KIAS / 0.80 M

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	FROM SEA LEVEL TIME (MIN) FUEL (LB) DIST (NAM) ATAS (KTS) MACH ROC (FPM)

FLIGHT LEVEL	INITIAL CLIMB WEIGHT - 1000 LB									
	24		26		28		30		32	
450	22.9	1046	27.1	1205	34.9	1463				
	166.5	437	199.0	440	259.5	446				
	0.800	299	0.800	182	0.800	71				
430	18.1	916	20.5	1022	23.2	1143	26.8	1292	32.5	1507
	129.2	427	146.2	429	166.7	431	194.1	434	237.9	439
	0.800	571	0.800	449	0.800	332	0.800	216	0.800	108
410	15.3	830	17.0	917	18.8	1010	20.9	1112	23.3	1227
	106.9	419	119.0	420	132.3	421	147.3	423	165.0	425
	0.800	860	0.800	731	0.800	609	0.800	492	0.800	378
390	13.4	763	14.8	840	16.2	920	17.8	1005	19.5	1095
	91.4	410	101.1	411	111.4	412	122.4	413	134.4	415
	0.800	1196	0.800	1051	0.800	920	0.800	797	0.800	679
370	11.9	708	13.1	777	14.4	850	15.7	925	17.0	1004
	79.9	403	88.1	403	96.7	404	105.7	405	115.3	406
	0.800	1561	0.800	1393	0.800	1246	0.800	1112	0.800	989
350	10.8	660	11.8	724	12.9	790	14.1	859	15.3	930
	70.9	395	78.1	396	85.6	397	93.3	397	101.5	398
	0.800	1878	0.800	1686	0.800	1518	0.800	1369	0.800	1234
330	9.6	605	10.5	663	11.5	723	12.4	784	13.5	847
	61.4	385	67.4	385	73.7	386	80.2	387	87.0	388
	0.789	1446	0.789	1296	0.789	1170	0.789	1057	0.789	957
310	8.3	546	9.1	598	9.9	650	10.8	704	11.6	759
	51.7	372	56.7	373	61.9	374	67.2	374	72.6	375
	0.757	1786	0.757	1613	0.757	1465	0.757	1335	0.757	1221
290	7.3	495	8.0	541	8.7	588	9.4	636	10.1	685
	44.0	362	48.3	362	52.5	363	56.9	363	61.5	364
	0.727	2148	0.727	1946	0.727	1771	0.727	1619	0.727	1485
250	5.7	407	6.2	444	6.7	482	7.3	520	7.8	560
	32.4	342	35.4	343	38.5	343	41.6	344	44.8	344
	0.672	2806	0.672	2557	0.672	2344	0.672	2159	0.672	1996
200	4.1	314	4.5	343	4.9	371	5.3	401	5.7	430
	22.1	320	24.2	321	26.2	321	28.3	322	30.5	322
	0.610	3722	0.610	3405	0.610	3134	0.610	2898	0.610	2690
150	2.9	231	3.1	251	3.4	272	3.7	294	3.9	315
	14.4	299	15.7	299	17.0	300	18.4	301	19.8	301
	0.555	4263	0.555	3905	0.555	3600	0.555	3335	0.555	3101
100	1.7	140	1.8	153	1.9	165	2.1	178	2.3	191
	7.4	269	8.1	270	8.8	271	9.5	272	10.2	273
	0.452	5513	0.452	5063	0.452	4673	0.452	4333	0.452	4030
50	0.8	70	0.8	76	0.9	83	1.0	89	1.1	96
	3.4	258	3.7	259	4.0	260	4.3	261	4.6	261
	0.413	6004	0.413	5516	0.413	5097	0.413	4730	0.413	4405

BD100_AEO_CLB280_IMP_LW_15 – 07/10/2003

Figure 04-03-02. Climb Performance—250/280 KIAS/0.80 M (Sheet 9 of 12)

CLIMB 250 / 280 KIAS / 0.80 M

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	FROM SEA LEVEL TIME (MIN) FUEL (LB) DIST (NAM) ATAS (KTS) MACH ROC (FPM)

FLIGHT LEVEL	INITIAL CLIMB WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430										
410	26.3 187.4 0.800	1364 427 267	30.5 218.7 0.800	1542 431 164	37.5 273.1 0.800	1821 436 70				
390	21.3 147.9 0.800	1194 416 566	23.5 163.5 0.800	1306 418 455	26.1 182.3 0.800	1434 420 350	29.3 206.1 0.800	1590 422 250	33.6 238.7 0.800	1791 426 158
370	18.5 125.7 0.800	1088 407 871	20.1 137.1 0.800	1179 408 760	22.0 149.9 0.800	1279 410 651	24.0 164.6 0.800	1391 411 545	26.4 181.9 0.800	1520 413 445
350	16.6 110.2 0.800	1005 399 1110	17.9 119.6 0.800	1086 400 994	19.4 129.9 0.800	1173 401 880	21.1 141.4 0.800	1268 402 772	23.0 154.4 0.800	1374 404 667
330	14.5 94.1 0.789	914 388 866	15.7 101.7 0.789	984 389 785	16.9 109.8 0.789	1059 390 708	18.2 118.8 0.789	1139 391 635	19.7 128.6 0.789	1227 392 566
310	12.5 78.4 0.757	817 376 1117	13.5 84.4 0.757	878 376 1021	14.5 90.8 0.757	942 377 933	15.5 97.7 0.757	1010 377 849	16.7 105.2 0.757	1084 378 770
290	10.9 66.2 0.727	736 364 1364	11.7 71.1 0.727	789 365 1255	12.5 76.3 0.727	845 365 1154	13.4 81.9 0.727	905 366 1060	14.4 87.9 0.727	968 366 972
250	8.4 48.2 0.672	600 344 1849	9.0 51.6 0.672	642 345 1715	9.6 55.2 0.672	686 345 1591	10.3 59.0 0.672	733 345 1475	10.9 63.0 0.672	781 346 1366
200	6.1 32.7 0.610	461 323 2505	6.5 35.0 0.610	493 323 2338	6.9 37.4 0.610	526 323 2184	7.4 39.8 0.610	560 324 2042	7.9 42.4 0.610	596 324 1908
150	4.2 21.2 0.555	338 302 2893	4.5 22.7 0.555	361 302 2707	4.8 24.2 0.555	384 302 2537	5.1 25.8 0.555	409 302 2380	5.4 27.4 0.555	435 303 2235
100	2.4 11.0 0.452	205 273 3758	2.6 11.8 0.452	219 274 3511	2.7 12.6 0.452	233 274 3287	2.9 13.4 0.452	248 274 3083	3.1 14.2 0.452	264 275 2897
50	1.1 5.0 0.413	102 262 4113	1.2 5.3 0.413	109 263 3849	1.3 5.7 0.413	116 263 3610	1.4 6.0 0.413	124 263 3392	1.5 6.4 0.413	131 264 3194

BD100_AEO_CLB280_IMP_HW_15 – 07/10/2003

Figure 04-03-02. Climb Performance—250/280 KIAS/0.80 M (Sheet 10 of 12)

CLIMB 250 / 280 KIAS / 0.80 M		
CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	FROM SEA LEVEL TIME (MIN) FUEL (LB) DIST (NAM) ATAS (KTS) MACH ROC (FPM)

FLIGHT LEVEL	INITIAL CLIMB WEIGHT – 1000 LB									
	24		26		28		30		32	
450										
430	26.1 191.6 0.800	1175 441 230	31.0 229.4 0.800	1361 444 140	39.8 298.6 0.800	1662 450 56				
410	20.2 145.0 0.800	1006 430 481	22.8 164.1 0.800	1124 432 384	25.8 186.6 0.800	1258 434 290	29.6 215.4 0.800	1420 436 198	35.2 258.1 0.800	1640 440 109
390	17.0 119.1 0.800	901 420 770	18.9 132.8 0.800	998 422 659	21.0 147.8 0.800	1101 423 557	23.2 164.4 0.800	1214 424 461	25.8 183.6 0.800	1339 426 367
370	14.8 101.7 0.800	822 412 1089	16.4 112.9 0.800	908 413 959	18.1 124.7 0.800	997 414 843	19.9 137.4 0.800	1091 415 738	21.8 151.2 0.800	1193 416 640
350	13.2 89.0 0.800	758 404 1335	14.6 98.5 0.800	835 405 1184	16.0 108.5 0.800	915 406 1053	17.6 119.0 0.800	999 407 937	19.2 130.3 0.800	1088 408 830
330	11.5 75.3 0.789	684 392 1049	12.7 83.0 0.789	752 393 930	13.9 91.1 0.789	822 394 830	15.1 99.5 0.789	894 394 741	16.5 108.4 0.789	970 395 662
310	9.9 62.3 0.757	609 379 1389	10.8 68.5 0.757	668 380 1247	11.8 74.9 0.757	728 380 1126	12.8 81.5 0.757	790 381 1019	13.9 88.4 0.757	855 381 925
290	8.6 52.5 0.727	548 367 1733	9.4 57.7 0.727	600 368 1563	10.2 62.9 0.727	652 368 1416	11.1 68.3 0.727	707 369 1288	12.0 73.9 0.727	763 369 1175
250	6.6 38.2 0.672	446 347 2356	7.2 41.8 0.672	487 348 2142	7.8 45.5 0.672	529 348 1959	8.5 49.3 0.672	572 348 1800	9.1 53.2 0.672	616 349 1660
200	4.8 25.9 0.610	342 325 3150	5.2 28.4 0.610	373 326 2877	5.7 30.8 0.610	405 326 2645	6.1 33.3 0.610	437 327 2441	6.6 35.9 0.610	470 327 2262
150	3.3 16.7 0.555	249 303 3601	3.6 18.3 0.555	271 304 3295	3.9 19.8 0.555	294 305 3034	4.2 21.4 0.555	317 305 2807	4.5 23.1 0.555	341 306 2606
100	1.8 8.4 0.452	149 273 4802	2.0 9.2 0.452	162 274 4406	2.2 10.0 0.452	175 275 4064	2.3 10.8 0.452	189 275 3764	2.5 11.6 0.452	203 276 3498
50	0.9 3.8 0.413	74 261 5472	0.9 4.1 0.413	81 262 5026	1.0 4.5 0.413	87 263 4641	1.1 4.8 0.413	94 264 4305	1.2 5.2 0.413	101 264 4006

BD100_AEO_CLB280_IMP_LW_20 – 07/10/2003

Figure 04-03-02. Climb Performance—250/280 KIAS/0.80 M (Sheet 11 of 12)

CLIMB 250 / 280 KIAS / 0.80 M

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	FROM SEA LEVEL TIME (MIN) FUEL (LB) DIST (NAM) ATAS (KTS) MACH ROC (FPM)

FLIGHT LEVEL	INITIAL CLIMB WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430										
410	47.3 353.4 0.800	2072 448 30								
390	29.0 206.8 0.800	1486 428 275	33.0 237.2 0.800	1667 431 185	38.9 282.9 0.800	1921 436 101	51.2 378.9 0.800	2403 444 29		
370	23.9 166.7 0.800	1305 418 545	26.4 184.5 0.800	1430 419 453	29.3 205.6 0.800	1574 421 364	32.8 232.0 0.800	1748 424 277	37.5 266.9 0.800	1968 427 194
350	20.9 142.7 0.800	1184 409 732	22.9 156.5 0.800	1289 410 637	25.1 172.2 0.800	1407 412 545	27.7 190.7 0.800	1541 414 457	30.7 213.1 0.800	1700 416 370
330	17.9 117.9 0.789	1051 398 589	19.4 128.2 0.789	1137 397 523	21.0 139.5 0.789	1231 398 461	22.9 152.3 0.789	1335 399 402	25.0 166.9 0.789	1451 401 345
310	15.0 95.7 0.757	922 382 839	16.2 103.5 0.757	994 383 760	17.5 111.9 0.757	1071 383 686	18.9 121.1 0.757	1154 384 615	20.5 131.2 0.757	1245 385 548
290	12.9 79.7 0.727	822 370 1073	13.9 85.9 0.727	883 370 980	15.0 92.5 0.727	949 371 895	16.1 99.7 0.727	1019 371 815	17.3 107.4 0.727	1095 372 739
250	9.8 57.2 0.672	662 349 1533	10.5 61.4 0.672	710 349 1417	11.3 65.8 0.672	760 350 1310	12.1 70.5 0.672	813 350 1208	12.9 75.6 0.672	869 351 1112
200	7.1 38.6 0.610	504 327 2102	7.6 41.3 0.610	540 328 1958	8.1 44.2 0.610	577 328 1825	8.6 47.2 0.610	615 328 1701	9.2 50.4 0.610	656 328 1584
150	4.9 24.7 0.555	366 306 2428	5.2 26.5 0.555	391 306 2268	5.5 28.3 0.555	418 306 2121	5.9 30.2 0.555	445 307 1985	6.3 32.2 0.555	474 307 1859
100	2.7 12.5 0.452	218 276 3257	2.9 13.3 0.452	233 277 3039	3.1 14.3 0.452	249 277 2839	3.3 15.2 0.452	265 277 2658	3.5 16.2 0.452	282 277 2493
50	1.3 5.6 0.413	108 265 3739	1.4 6.0 0.413	116 265 3496	1.4 6.4 0.413	123 266 3275	1.5 6.8 0.413	131 266 3075	1.6 7.2 0.413	139 266 2892

BD100_AEO_CLB280_IMP_HW_20 – 07/10/2003

Figure 04-03-02. Climb Performance—250/280 KIAS/0.80 M (Sheet 12 of 12)

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ACCELERATION DATA

All engine operating acceleration data are presented in tabular form as function of aircraft gross weight at 31, 35, 39, 41, 43 and 45 000 ft cruise altitude and temperature conditions up to ISA+20°C. The acceleration data assume an initial speed of 250 KIAS / 0.75MI (long-range climb speed schedule). Data are based on the use of CLB thrust with engine bleed on and anti-ice off.

Performance tables show the following data:

- TIME Time in minutes
- DIST Air distance in nautical miles
- FUEL Fuel consumed in pounds

The climb power setting is assumed to be maintained during acceleration. When accelerating from an initial Mach other than climb speed schedule, acceleration data can be obtained by taking the difference in acceleration time, distance and fuel from the target cruise speed and the initial cruise speed.

Example:

Associated conditions

- Target cruise speed = 0.80 MI (A)
- Top of climb weight = 38 000 lbs (B)
- Temperature conditions = ISA+5°C
- Flight Level = FL 310

Using Figure 04-04-01, Sheet 1, time, distance and fuel to accelerate from top of climb speed to 0.80 cruise Mach are (C):

- Time = 1.6 min.
- Air distance = 11.6 NAM
- Fuel = 82 lbs

ACCELERATION FROM 250 KIAS

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	UP TO ISA + 5 C 30% C.G.	FL 310 TIME (MIN) FUEL (LB) DISTANCE (NM)

MACH	TOP OF CLIMB WEIGHT – 1000 LB											
	24		26		30		34		38 (B)		42	
0.69			0.1 3	0.3	0.1 3	0.4	0.1 4	0.5	0.1 4	0.6	0.1 5	0.7
0.70	0.1 5	0.7	0.1 6	0.8	0.1 7	0.9	0.2 8	1.1	0.2 10	1.3	0.2 12	1.6
0.71	0.2 8	1.1	0.2 9	1.3	0.2 11	1.5	0.3 13	1.8	0.3 16	2.1	0.4 19	2.5
0.72	0.2 12	1.6	0.3 13	1.7	0.3 15	2.1	0.4 18	2.5	0.4 22	2.9	0.5 26	3.5
0.73	0.3 15	2.1	0.3 17	2.3	0.4 20	2.7	0.5 23	3.2	0.5 28	3.8	0.6 33	4.5
0.74	0.4 19	2.6	0.4 20	2.8	0.5 24	3.4	0.6 29	4.0	0.7 34	4.7	0.8 41	5.6
0.75	0.4 22	3.1	0.5 25	3.4	0.6 29	4.1	0.7 35	4.8	0.8 41	5.7	1.0 49	6.7
0.76	0.5 26	3.6	0.6 29	4.0	0.7 34	4.8	0.8 41	5.7	0.9 48	6.7	1.1 57	8.0
0.77	0.6 30	4.2	0.6 33	4.7	0.8 40	5.6	0.9 47	6.6	1.1 56	7.8	1.3 66	9.2
0.78	0.7 35	4.9	0.7 38	5.4	0.9 46	6.4	1.0 54	7.6	1.2 64	9.0	1.5 76	10.6
0.79	0.8 39	5.5	0.8 43	6.1	1.0 52	7.3	1.2 61	8.7	1.4 72	10.2	1.7 86	12.1
0.80 (A)	0.9 44	6.3	0.9 49	6.9	1.1 58	8.3	1.3 69	9.8	1.6 (C) 82	11.6	1.9 97	13.8
0.81	1.0 50	7.1	1.1 55	7.8	1.3 66	9.4	1.5 78	11.1	1.8 92	13.1	2.1 109	15.6
0.82	1.1 56	8.0	1.2 62	8.8	1.4 74	10.6	1.7 87	12.6	2.0 104	14.9	2.4 124	17.7
0.83	1.2 63	9.1	1.3 69	10.0	1.6 84	12.1	1.9 99	14.4	2.3 118	17.1	2.7 143	20.6

bd100_aeo_accel310_IMP_05 – 07/10/2003

Figure 04-04-01. Acceleration Data—FL310 (Sheet 1 of 4)

ACCELERATION FROM 250 KIAS

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	FL 310 TIME (MIN) FUEL (LB) DISTANCE (NM)

MACH	TOP OF CLIMB WEIGHT – 1000 LB											
	24		26		30		34		38		42	
0.69			0.1 3	0.4	0.1 3	0.4	0.1 4	0.5	0.1 5	0.6	0.1 5	0.8
0.70	0.1 6	0.8	0.1 6	0.9	0.1 7	1.0	0.2 9	1.2	0.2 11	1.5	0.3 13	1.7
0.71	0.2 9	1.2	0.2 10	1.4	0.2 12	1.6	0.3 14	1.9	0.3 17	2.3	0.4 20	2.8
0.72	0.2 12	1.7	0.3 14	1.9	0.3 16	2.3	0.4 19	2.7	0.5 23	3.2	0.5 28	3.8
0.73	0.3 16	2.2	0.3 18	2.5	0.4 21	3.0	0.5 25	3.5	0.6 30	4.2	0.7 36	5.0
0.74	0.4 20	2.8	0.4 22	3.1	0.5 26	3.7	0.6 31	4.4	0.7 37	5.2	0.9 44	6.2
0.75	0.5 24	3.4	0.5 26	3.7	0.6 31	4.4	0.7 37	5.3	0.9 44	6.3	1.0 53	7.5
0.76	0.6 28	4.0	0.6 31	4.4	0.7 37	5.3	0.9 44	6.2	1.0 52	7.4	1.2 62	8.8
0.77	0.6 32	4.6	0.7 36	5.1	0.8 43	6.1	1.0 51	7.3	1.2 60	8.7	1.4 72	10.3
0.78	0.7 37	5.4	0.8 41	5.9	1.0 49	7.1	1.2 59	8.4	1.4 70	10.0	1.6 83	12.0
0.79	0.8 43	6.2	0.9 47	6.8	1.1 56	8.2	1.3 67	9.7	1.6 80	11.5	1.9 95	13.8
0.80	0.9 48	7.0	1.0 53	7.8	1.3 64	9.4	1.5 76	11.1	1.8 91	13.2	2.1 109	15.8
0.81	1.1 55	8.0	1.2 60	8.9	1.4 73	10.7	1.7 87	12.7	2.0 103	15.2	2.4 124	18.2
0.82	1.2 62	9.2	1.3 69	10.1	1.6 83	12.2	1.9 99	14.6	2.3 118	17.4	2.8 142	21.1
0.83	1.4 71	10.5	1.5 78	11.7	1.8 95	14.2	2.2 114	17.0	2.7 138	20.6	3.3 170	25.4

bd100_aeo_accel310_IMP_10 – 07/10/2003

Figure 04-04-01. Acceleration Data—FL310 (Sheet 2 of 4)

ACCELERATION FROM 250 KIAS		
CLIMB THRUST **ENGINE BLEED ON** **ENGINE AND WING A/I OFF**	ISA + 15 C 30% C.G.	**FL 310** **TIME (MIN)** **DISTANCE (NM)** **FUEL (LB)**

MACH	TOP OF CLIMB WEIGHT – 1000 LB											
	24		26		30		34		38		42	
0.69	0.1 3	0.4	0.1 3	0.4	0.1 4	0.5	0.1 4	0.6	0.1 5	0.7	0.1 6	0.9
0.70	0.1 6	0.9	0.1 7	1.0	0.2 8	1.2	0.2 10	1.4	0.2 12	1.7	0.3 15	2.1
0.71	0.2 10	1.5	0.2 11	1.6	0.3 13	1.9	0.3 16	2.3	0.4 19	2.8	0.5 23	3.4
0.72	0.3 14	2.0	0.3 15	2.2	0.4 18	2.7	0.5 22	3.2	0.5 26	3.9	0.7 32	4.7
0.73	0.4 18	2.7	0.4 20	2.9	0.5 24	3.5	0.6 29	4.2	0.7 35	5.1	0.9 42	6.2
0.74	0.5 22	3.3	0.5 25	3.7	0.6 30	4.4	0.7 36	5.3	0.9 43	6.4	1.1 52	7.8
0.75	0.6 27	4.1	0.6 30	4.5	0.7 36	5.4	0.9 43	6.5	1.1 52	7.8	1.3 63	9.5
0.76	0.7 32	4.9	0.7 36	5.4	0.9 43	6.5	1.1 51	7.8	1.3 62	9.4	1.6 76	11.4
0.77	0.8 38	5.7	0.9 42	6.3	1.0 50	7.6	1.2 60	9.2	1.5 73	11.1	1.8 89	13.5
0.78	0.9 44	6.7	1.0 48	7.4	1.2 59	9.0	1.4 70	10.8	1.7 85	13.0	2.1 104	15.9
0.79	1.0 50	7.7	1.1 56	8.6	1.4 68	10.4	1.7 82	12.5	2.0 99	15.2	2.5 121	18.6
0.80	1.2 58	9.0	1.3 64	9.9	1.6 78	12.1	1.9 94	14.6	2.3 114	17.7	2.9 140	21.8
0.81	1.4 67	10.4	1.5 74	11.5	1.8 90	14.1	2.2 109	17.0	2.7 133	20.8	3.4 165	25.8
0.82	1.6 77	12.1	1.7 86	13.6	2.1 105	16.5	2.6 128	20.1	3.2 157	24.7	4.0 199	31.4
0.83	1.8 91	14.4	2.1 102	16.2	2.6 127	20.1	3.2 157	25.0	4.1 200	31.9	5.7 283	45.2

bd100_aeo_accel310_IMP_15 – 07/10/2003

Figure 04-04-01. Acceleration Data—FL310 (Sheet 3 of 4)

ACCELERATION FROM 250 KIAS

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	FL 310 TIME (MIN) DISTANCE (NM) FUEL (LB)

MACH	TOP OF CLIMB WEIGHT – 1000 LB											
	24		26		30		34		38		42	
0.69	0.1 3	0.5	0.1 3	0.5	0.1 4	0.6	0.1 5	0.8	0.1 6	0.9	0.2 8	1.2
0.70	0.2 7	1.1	0.2 8	1.2	0.2 10	1.5	0.3 12	1.8	0.3 14	2.2	0.4 18	2.7
0.71	0.2 11	1.8	0.3 13	1.9	0.3 15	2.4	0.4 19	2.9	0.5 23	3.5	0.6 28	4.4
0.72	0.3 16	2.5	0.4 18	2.7	0.5 21	3.3	0.6 26	4.0	0.7 32	5.0	0.9 40	6.2
0.73	0.5 21	3.3	0.5 23	3.6	0.6 28	4.4	0.7 34	5.3	0.9 42	6.6	1.1 52	8.2
0.74	0.6 26	4.1	0.6 29	4.6	0.8 35	5.5	0.9 43	6.7	1.1 52	8.3	1.4 65	10.3
0.75	0.7 32	5.0	0.8 35	5.6	0.9 43	6.8	1.1 52	8.3	1.4 64	10.2	1.7 80	12.7
0.76	0.8 38	6.1	0.9 42	6.7	1.1 52	8.2	1.4 63	10.0	1.7 77	12.3	2.1 97	15.5
0.77	1.0 45	7.2	1.1 50	8.0	1.3 61	9.8	1.6 75	12.0	2.0 92	14.8	2.5 116	18.6
0.78	1.1 53	8.6	1.3 59	9.5	1.6 72	11.7	1.9 88	14.3	2.4 109	17.7	3.0 139	22.4
0.79	1.3 62	10.1	1.5 69	11.3	1.8 85	13.9	2.2 105	17.1	2.8 130	21.2	3.6 166	27.2
0.80	1.6 73	11.9	1.7 81	13.3	2.2 101	16.5	2.7 125	20.5	3.3 156	25.7	4.3 203	33.5
0.81	1.8 86	14.2	2.1 97	16.0	2.6 121	20.0	3.2 151	25.0	4.1 193	32.0	5.6 261	43.5
0.82	2.2 104	17.4	2.5 118	19.7	3.2 150	25.1	4.1 191	32.1	5.4 257	43.1	9.2 432	73.3
0.83	2.9 135	22.8	3.4 158	26.8	4.7 222	37.7						

bd100_aeo_accel310_IMP_20 – 07/10/2003

Figure 04-04-01. Acceleration Data—FL310 (Sheet 4 of 4)

ACCELERATION FROM 250 KIAS		
CLIMB THRUST **ENGINE BLEED ON** **ENGINE AND WING A/I OFF**	UP TO ISA + 5 C 30% C.G.	**FL 350** **TIME (MIN)** **DISTANCE (NM)** **FUEL (LB)**

MACH	TOP OF CLIMB WEIGHT – 1000 LB											
	24		26		30		34		38		42	
0.75	0.1 3	0.5	0.1 3	0.5	0.1 4	0.7	0.1 5	0.8	0.1 6	1.0	0.2 7	1.2
0.76	0.1 7	1.1	0.2 7	1.2	0.2 9	1.4	0.2 11	1.7	0.3 13	2.1	0.4 16	2.6
0.77	0.2 11	1.7	0.3 12	1.9	0.3 14	2.3	0.4 17	2.7	0.5 21	3.3	0.6 26	4.1
0.78	0.3 15	2.4	0.4 16	2.6	0.4 20	3.1	0.5 24	3.8	0.6 29	4.6	0.8 36	5.7
0.79	0.4 19	3.0	0.5 21	3.4	0.5 25	4.1	0.7 30	4.9	0.8 37	6.0	1.0 46	7.4
0.80	0.5 23	3.8	0.6 26	4.2	0.7 31	5.1	0.8 38	6.1	1.0 46	7.5	1.2 57	9.3
0.81	0.6 28	4.6	0.7 31	5.1	0.8 38	6.2	1.0 46	7.4	1.2 56	9.1	1.5 70	11.4
0.82	0.7 33	5.5	0.8 37	6.1	1.0 45	7.4	1.2 54	8.9	1.5 67	11.0	1.9 86	14.2
0.83	0.8 39	6.5	0.9 44	7.2	1.1 53	8.8	1.4 65	10.7	1.8 82	13.5	2.4 110	18.2

bd100_aeo_accel350_IMP_05 – 07/10/2003

Figure 04-04-02. Acceleration Data—FL350 (Sheet 1 of 4)

ACCELERATION FROM 250 KIAS

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	FL 350 TIME (MIN) DISTANCE (NM) FUEL (LB)

MACH	TOP OF CLIMB WEIGHT – 1000 LB											
	24		26		30		34		38		42	
0.75	0.1 3	0.5	0.1 4	0.6	0.1 4	0.7	0.1 5	0.9	0.1 6	1.1	0.2 8	1.3
0.76	0.2 7	1.2	0.2 8	1.3	0.2 10	1.6	0.3 12	1.9	0.3 14	2.4	0.4 18	3.0
0.77	0.2 11	1.9	0.3 12	2.1	0.3 15	2.5	0.4 18	3.0	0.5 22	3.7	0.6 28	4.7
0.78	0.3 16	2.6	0.4 17	2.9	0.5 21	3.5	0.6 26	4.2	0.7 31	5.2	0.9 39	6.5
0.79	0.4 20	3.4	0.5 22	3.7	0.6 27	4.5	0.7 33	5.5	0.9 41	6.8	1.1 51	8.5
0.80	0.6 25	4.2	0.6 28	4.7	0.7 34	5.7	0.9 41	6.9	1.1 51	8.5	1.4 64	10.7
0.81	0.7 30	5.1	0.7 34	5.7	0.9 41	6.9	1.1 50	8.4	1.4 62	10.4	1.7 79	13.3
0.82	0.8 36	6.2	0.9 40	6.8	1.1 49	8.3	1.3 60	10.2	1.7 75	12.8	2.2 99	16.8
0.83	0.9 43	7.3	1.1 48	8.2	1.3 59	10.0	1.6 73	12.3	2.0 93	15.9	2.9 132	22.5

bd100_aeo_accel350_IMP_10 – 07/10/2003

Figure 04-04-02. Acceleration Data—FL350 (Sheet 2 of 4)

ACCELERATION FROM 250 KIAS

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	FL 350 TIME (MIN) DISTANCE (NM) FUEL (LB)

MACH	TOP OF CLIMB WEIGHT – 1000 LB											
	24		26		30		34		38		42	
0.75	0.1 4	0.6	0.1 4	0.7	0.1 5	0.9	0.1 6	1.0	0.2 8	1.3	0.2 10	1.7
0.76	0.2 8	1.4	0.2 9	1.6	0.3 11	1.9	0.3 14	2.3	0.4 17	2.9	0.5 22	3.8
0.77	0.3 13	2.2	0.3 14	2.5	0.4 17	3.0	0.5 21	3.7	0.6 27	4.6	0.8 34	6.0
0.78	0.4 18	3.1	0.5 20	3.5	0.6 24	4.3	0.7 30	5.3	0.9 38	6.6	1.1 49	8.5
0.79	0.5 23	4.1	0.6 26	4.6	0.7 32	5.6	0.9 39	6.9	1.1 49	8.7	1.5 64	11.3
0.80	0.7 29	5.2	0.8 33	5.8	0.9 40	7.1	1.1 50	8.8	1.4 63	11.1	1.9 82	14.5
0.81	0.8 36	6.4	0.9 40	7.1	1.1 49	8.8	1.4 61	10.9	1.8 78	13.9	2.4 105	18.7
0.82	1.0 44	7.8	1.1 49	8.7	1.4 60	10.8	1.7 76	13.5	2.3 99	17.7	3.3 144	25.8
0.83	1.2 53	9.6	1.4 60	10.7	1.7 74	13.4	2.2 95	17.2	3.1 134	24.2		

bd100_aeo_accel350_IMP_15 – 07/10/2003

Figure 04-04-02. Acceleration Data—FL350 (Sheet 3 of 4)

ACCELERATION FROM 250 KIAS

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	FL 350 TIME (MIN) DISTANCE (NM) FUEL (LB)

MACH	TOP OF CLIMB WEIGHT – 1000 LB											
	24		26		30		34		38		42	
0.75	0.1 4	0.8	0.1 5	0.9	0.1 6	1.1	0.2 8	1.4	0.2 10	1.8	0.3 14	2.5
0.76	0.2 10	1.8	0.3 11	2.0	0.3 14	2.5	0.4 17	3.2	0.5 23	4.1	0.8 31	5.7
0.77	0.4 16	2.9	0.4 17	3.2	0.5 22	4.0	0.7 28	5.1	0.9 36	6.6	1.2 50	9.2
0.78	0.5 22	4.1	0.6 25	4.6	0.8 31	5.8	1.0 39	7.3	1.3 52	9.6	1.8 73	13.4
0.79	0.7 29	5.5	0.8 33	6.1	1.0 41	7.7	1.3 52	9.8	1.7 69	12.9	2.4 98	18.3
0.80	0.9 37	7.0	1.0 42	7.9	1.3 53	9.9	1.6 68	12.7	2.2 90	16.9	3.2 131	24.6
0.81	1.1 47	8.8	1.3 53	9.9	1.6 67	12.5	2.1 86	16.2	2.8 118	22.3	4.5 187	35.3
0.82	1.4 58	11.1	1.6 66	12.5	2.0 84	16.0	2.7 111	21.1	4.0 166	31.7		
0.83	1.8 74	14.2	2.0 85	16.2	2.7 112	21.4	3.9 162	31.1				

bd100_aeo_accel350_IMP_20 – 07/10/2003

Figure 04-04-02. Acceleration Data—FL350 (Sheet 4 of 4)

ACCELERATION FROM 0.75 M

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	UP TO ISA + 5 C 30% C.G.	FL 390 TIME (MIN) DISTANCE (NM) FUEL (LB)

MACH	TOP OF CLIMB WEIGHT – 1000 LB											
	24		26		30		34		38		42	
0.76	0.1 4	0.8	0.1 4	0.8	0.1 6	1.1	0.2 7	1.4	0.3 10	1.9	0.4 15	2.8
0.77	0.2 8	1.6	0.2 9	1.7	0.3 11	2.2	0.4 15	2.9	0.5 20	3.9	0.8 30	5.8
0.78	0.3 12	2.4	0.4 14	2.7	0.5 18	3.4	0.6 23	4.4	0.8 31	5.9	1.2 46	8.9
0.79	0.4 17	3.3	0.5 19	3.7	0.6 24	4.7	0.8 31	6.1	1.1 42	8.2	1.7 63	12.3
0.80	0.6 22	4.3	0.6 25	4.8	0.8 31	6.1	1.0 40	7.9	1.4 55	10.7	2.1 82	16.0
0.81	0.7 27	5.3	0.8 31	6.0	1.0 39	7.6	1.3 51	9.9	1.8 70	13.7	2.9 111	21.7
0.82	0.9 33	6.5	1.0 37	7.3	1.2 47	9.3	1.6 64	12.5	2.4 93	18.3	5.0 193	38.2
0.83	1.0 40	7.8	1.1 45	8.8	1.5 58	11.5	2.1 82	16.1	3.8 147	29.3		

bd100_aeo_accel390_IMP_05 – 07/10/2003

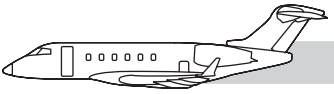
Figure 04-04-03. Acceleration Data—FL390 (Sheet 1 of 4)

ACCELERATION FROM 0.75 M		
CLIMB THRUST **ENGINE BLEED ON** **ENGINE AND WING A/I OFF**	ISA + 10 C 30% C.G.	**FL 390** **TIME (MIN)** **DISTANCE (NM)** **FUEL (LB)**

MACH	TOP OF CLIMB WEIGHT – 1000 LB											
	24		26		30		34		38		42	
0.76	0.1 4	0.9	0.1 5	1.0	0.2 6	1.2	0.2 8	1.6	0.3 11	2.3	0.5 18	3.6
0.77	0.2 9	1.8	0.3 10	2.0	0.3 13	2.6	0.5 17	3.4	0.6 23	4.7	1.0 38	7.5
0.78	0.4 14	2.7	0.4 15	3.1	0.5 20	4.0	0.7 26	5.2	1.0 36	7.3	1.6 58	11.7
0.79	0.5 19	3.8	0.6 21	4.3	0.7 27	5.5	1.0 36	7.3	1.4 50	10.2	2.2 81	16.4
0.80	0.7 24	5.0	0.7 28	5.6	0.9 35	7.2	1.2 47	9.5	1.8 66	13.4	2.9 108	21.8
0.81	0.8 30	6.2	0.9 34	7.0	1.2 44	9.0	1.6 59	12.1	2.3 86	17.6	4.2 156	31.9
0.82	1.0 37	7.6	1.1 42	8.6	1.5 55	11.2	2.0 76	15.6	3.3 123	25.3		
0.83	1.2 45	9.3	1.4 51	10.6	1.8 68	14.1	2.7 104	21.4				

bd100_aeo_accel390_IMP_10 – 07/10/2003

Figure 04-04-03. Acceleration Data—FL390 (Sheet 2 of 4)



ACCELERATION FROM 0.75 M

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	FL 390 TIME (MIN) DISTANCE (NM) FUEL (LB)

MACH	TOP OF CLIMB WEIGHT – 1000 LB											
	24		26		30		34		38		42	
0.76	0.1 5	1.0	0.2 6	1.2	0.2 7	1.6	0.3 10	2.1	0.4 15	3.2	0.8 30	6.2
0.77	0.3 10	2.2	0.3 12	2.5	0.4 16	3.3	0.6 21	4.5	0.9 33	6.9	1.8 65	13.7
0.78	0.5 16	3.5	0.5 19	3.9	0.7 24	5.2	0.9 34	7.1	1.4 51	10.9	2.9 104	22.2
0.79	0.6 23	4.9	0.7 26	5.6	1.0 34	7.4	1.3 48	10.2	2.1 74	15.8	4.4 158	33.7
0.80	0.8 30	6.4	1.0 34	7.3	1.3 45	9.7	1.8 64	13.7	2.8 101	21.8	6.5 234	50.2
0.81	1.1 38	8.2	1.2 44	9.4	1.6 58	12.6	2.4 84	18.2	4.2 150	32.4		
0.82	1.3 48	10.4	1.5 55	11.9	2.1 75	16.3	3.4 121	26.3				
0.83	1.7 60	13.2	1.9 70	15.3	2.8 103	22.5						

bd100_aeo_accel390_IMP_15 – 07/10/2003

Figure 04-04-03. Acceleration Data—FL390 (Sheet 3 of 4)

ACCELERATION FROM 0.75 M		
CLIMB THRUST **ENGINE BLEED ON** **ENGINE AND WING A/I OFF**	ISA + 20 C 30% C.G.	**FL 390** **TIME (MIN)** **DISTANCE (NM)** **FUEL (LB)**

MACH	TOP OF CLIMB WEIGHT – 1000 LB					
	24	26	30	34	38	42
0.76	0.2 1.4 6	0.2 1.6 7	0.3 2.3 10	0.4 3.4 15	0.8 6.3 28	5.3 39.8 179
0.77	0.4 3.1 14	0.5 3.5 16	0.6 4.9 22	1.0 7.4 33	1.9 14.3 64	23.4 177.6 793
0.78	0.6 4.8 22	0.7 5.6 25	1.0 7.8 35	1.6 12.0 53	3.1 24.1 107	
0.79	0.9 7.0 31	1.1 8.2 36	1.5 11.5 51	2.4 18.1 80	5.2 40.0 176	
0.80	1.2 9.5 42	1.4 11.0 49	2.0 15.8 69	3.3 26.0 114	9.7 75.8 331	
0.81	1.6 12.5 54	1.9 14.7 64	2.8 21.7 95	5.3 41.9 182		
0.82	2.1 16.6 72	2.5 19.7 86	4.1 32.2 139			
0.83	3.0 23.9 103	3.8 30.4 130				

bd100_aeo_accel390_IMP_20 – 07/10/2003

Figure 04-04-03. Acceleration Data—FL390 (Sheet 4 of 4)

ACCELERATION FROM 0.75 M		
CLIMB THRUST **ENGINE BLEED ON** **ENGINE AND WING A/I OFF**	UP TO ISA + 5 C 30% C.G.	**FL 410** **TIME (MIN)** **DISTANCE (NM)** **FUEL (LB)**

MACH	TOP OF CLIMB WEIGHT – 1000 LB											
	24		26		30		34		38		42	
0.76	0.1 4	0.9	0.1 5	1.0	0.2 6	1.4	0.3 9	1.9	0.4 14	3.0	0.9 32	6.8
0.77	0.3 9	1.9	0.3 10	2.1	0.4 13	2.8	0.5 19	4.0	0.9 29	6.3	2.0 68	14.4
0.78	0.4 14	2.9	0.5 16	3.3	0.6 21	4.4	0.8 29	6.2	1.3 46	9.8	3.1 108	23.1
0.79	0.5 19	4.0	0.6 21	4.6	0.8 28	6.1	1.1 39	8.5	1.8 62	13.4	4.3 150	32.3
0.80	0.7 24	5.2	0.8 27	5.9	1.0 36	7.9	1.5 51	11.1	2.3 81	17.6	5.8 203	43.9
0.81	0.9 30	6.5	1.0 34	7.4	1.3 46	10.0	1.9 66	14.3	3.2 112	24.3		
0.82	1.0 36	7.9	1.2 42	9.1	1.6 57	12.5	2.5 88	19.2				
0.83	1.3 44	9.7	1.5 51	11.2	2.1 74	16.1	4.1 144	31.7				

bd100_aeo_accel410_IMP_05 – 07/10/2003

Figure 04-04-04. Acceleration Data—FL410 (Sheet 1 of 4)

ACCELERATION FROM 0.75 M

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	FL 410 TIME (MIN) FUEL (LB) DISTANCE (NM)

MACH	TOP OF CLIMB WEIGHT – 1000 LB											
	24		26		30		34		38		42	
0.76	0.1 5	1.1	0.2 5	1.2	0.2 7	1.7	0.3 11	2.4	0.6 19	4.2	2.1 70	15.5
0.77	0.3 10	2.2	0.3 11	2.6	0.5 16	3.6	0.7 23	5.0	1.2 40	8.9	4.8 159	35.5
0.78	0.5 16	3.5	0.5 18	4.0	0.7 24	5.4	1.1 36	8.0	1.9 63	14.2	8.5 283	63.2
0.79	0.6 21	4.8	0.7 25	5.5	1.0 33	7.5	1.5 49	11.0	2.6 88	19.7	12.9 432	97.2
0.80	0.8 28	6.3	0.9 32	7.2	1.3 44	9.8	1.9 65	14.6	3.5 118	26.6	24.1 813	184.7
0.81	1.0 35	7.9	1.2 40	9.2	1.7 56	12.7	2.6 87	19.7	5.5 187	42.5		
0.82	1.3 43	9.8	1.5 50	11.4	2.1 72	16.5	3.8 130	29.8				
0.83	1.6 54	12.3	1.9 63	14.6	3.0 101	23.2						

bd100_aeo_accel410_IMP_10 – 07/10/2003

Figure 04-04-04. Acceleration Data—FL410 (Sheet 2 of 4)

ACCELERATION FROM 0.75 M

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	FL 410 TIME (MIN) DISTANCE (NM) FUEL (LB)

MACH	TOP OF CLIMB WEIGHT – 1000 LB											
	24		26		30		34		38		42	
0.76	0.2 6	1.4	0.2 7	1.6	0.3 10	2.3	0.5 16	3.8	1.3 40	9.5		
0.77	0.4 12	2.9	0.5 15	3.5	0.7 21	5.0	1.1 35	8.2	2.9 93	21.9		
0.78	0.6 20	4.7	0.7 23	5.5	1.1 34	8.0	1.8 57	13.5	5.2 165	39.2		
0.79	0.9 28	6.6	1.0 33	7.8	1.5 48	11.3	2.5 81	19.4	8.2 262	62.6		
0.80	1.1 37	8.8	1.4 43	10.4	2.0 64	15.4	3.6 115	27.7				
0.81	1.5 48	11.5	1.8 57	13.7	2.7 87	21.1	5.9 190	46.0				
0.82	1.9 61	14.7	2.3 73	17.8	4.0 130	31.6						
0.83	2.5 81	19.8	3.2 104	25.3								

bd100_aeo_accel410_IMP_15 - 07/10/2003

Figure 04-04-04. Acceleration Data—FL410 (Sheet 3 of 4)

ACCELERATION FROM 0.75 M		
CLIMB THRUST **ENGINE BLEED ON** **ENGINE AND WING A/I OFF**	ISA + 20 C 30% C.G.	**FL 410** **TIME (MIN)** / **DISTANCE (NM)** **FUEL (LB)**

MACH	TOP OF CLIMB WEIGHT – 1000 LB					
	24	26	30	34	38	42
0.76	0.3 2.0 8	0.3 2.4 10	0.5 3.7 15	1.1 8.2 33		
0.77	0.6 4.3 17	0.7 5.2 21	1.1 8.4 34	2.6 19.7 79		
0.78	0.9 7.1 28	1.1 8.6 34	1.9 14.4 58	5.0 37.9 151		
0.79	1.3 10.2 40	1.6 12.6 50	2.8 21.8 86	9.8 75.5 298		
0.80	1.8 14.2 56	2.3 17.7 70	4.3 33.4 131			
0.81	2.5 20.0 78	3.3 25.8 101	8.6 67.8 264			
0.82	3.7 29.1 113	5.3 42.1 163				
0.83						

bd100_aeo_accel410_IMP_20 – 07/10/2003

Figure 04-04-04. Acceleration Data—FL410 (Sheet 4 of 4)

ACCELERATION FROM 0.75 M

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	UP TO ISA + 5 C 30% C.G.	FL 430 TIME (MIN) DISTANCE (NM) FUEL (LB)

MACH	TOP OF CLIMB WEIGHT – 1000 LB					
	24	26	30	34	38	42
0.76	0.2 1.1 5	0.2 1.3 6	0.3 1.9 8	0.4 3.1 13	1.1 8.0 34	
0.77	0.3 2.3 10	0.4 2.7 12	0.5 3.9 16	0.9 6.4 27	2.4 17.3 73	
0.78	0.5 3.7 15	0.6 4.3 18	0.8 6.1 26	1.4 10.1 43	3.8 28.3 120	
0.79	0.7 5.0 21	0.8 5.9 25	1.1 8.4 35	1.9 13.9 58	5.4 40.4 169	
0.80	0.9 6.5 27	1.0 7.6 32	1.5 11.0 46	2.5 18.4 77	7.5 56.8 237	
0.81	1.1 8.2 34	1.3 9.7 40	1.9 14.3 60	3.4 25.8 107		
0.82	1.3 10.1 42	1.6 12.1 50	2.5 19.1 79			
0.83	1.6 12.5 52	2.0 15.3 63	3.9 30.5 125			

bd100 aeo accel430 IMP 05 - 07/10/2003

Figure 04-04-05. Acceleration Data—FL430 (Sheet 1 of 4)

ACCELERATION FROM 0.75 M

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	FL 430 TIME (MIN) FUEL (LB)	DISTANCE (NM)

MACH	TOP OF CLIMB WEIGHT – 1000 LB											
	24		26		30		34		38		42	
0.76	0.2 6	1.4	0.2 7	1.6	0.3 10	2.5	0.6 19	4.7	4.9 145	35.9		
0.77	0.4 12	2.9	0.5 14	3.5	0.7 21	5.2	1.4 41	10.1	15.2 455	112.9		
0.78	0.6 19	4.6	0.7 22	5.5	1.1 34	8.4	2.2 66	16.5				
0.79	0.8 26	6.4	1.0 30	7.6	1.6 47	11.8	3.1 93	23.4				
0.80	1.1 33	8.4	1.3 40	10.1	2.1 63	15.8	4.3 131	33.0				
0.81	1.4 43	10.9	1.7 52	13.2	2.8 86	21.8						
0.82	1.8 54	13.8	2.2 67	17.2	4.6 138	35.4						
0.83	2.3 71	18.3	3.1 95	24.5								

bd100_aeo_accel430_IMP_10 – 07/10/2003

Figure 04-04-05. Acceleration Data—FL430 (Sheet 2 of 4)

ACCELERATION FROM 0.75 M		
CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	FL 430 TIME (MIN) DISTANCE (NM) FUEL (LB)

MACH	TOP OF CLIMB WEIGHT – 1000 LB					
	24	26	30	34	38	42
0.76	0.3 1.9 7	0.3 2.4 9	0.6 4.1 16	1.8 13.8 53		
0.77	0.6 4.1 16	0.7 5.1 20	1.2 9.0 34	4.5 34.0 129		
0.78	0.9 6.7 26	1.1 8.4 32	2.0 15.2 58	9.0 68.3 259		
0.79	1.2 9.5 36	1.6 11.9 45	2.9 22.4 84	19.3 147.8 555		
0.80	1.7 12.9 48	2.1 16.3 61	4.3 33.0 124			
0.81	2.3 17.5 65	2.9 22.8 85				
0.82	3.1 24.0 89	4.5 35.4 131				
0.83						

bd100_aeo_accel430_IMP_15 – 07/10/2003

Figure 04-04-05. Acceleration Data—FL430 (Sheet 3 of 4)

ACCELERATION FROM 0.75 M		
CLIMB THRUST **ENGINE BLEED ON** **ENGINE AND WING A/I OFF**	ISA + 20 C 30% C.G.	**FL 430** **TIME (MIN)** **DISTANCE (NM)** **FUEL (LB)**

MACH	TOP OF CLIMB WEIGHT – 1000 LB					
	24	26	30	34	38	42
0.76	0.4 3.0 11	0.5 4.0 15	1.4 10.5 38			
0.77	0.9 6.8 25	1.2 9.2 33	3.6 27.4 98			
0.78	1.5 11.7 42	2.1 16.3 58	8.0 61.2 219			
0.79	2.3 17.7 63	3.3 25.7 91	67.9 528.1 1864			
0.80	3.4 26.8 95	5.5 43.0 151				
0.81	6.0 47.1 165					
0.82						
0.83						

bd100_aeo_accel430_IMP_20 – 07/10/2003

Figure 04-04-05. Acceleration Data—FL430 (Sheet 4 of 4)

ACCELERATION FROM 0.75 M		
CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	UP TO ISA + 5 C 30% C.G.	FL 450 TIME (MIN) DISTANCE (NM) FUEL (LB)

MACH	TOP OF CLIMB WEIGHT – 1000 LB					
	24	26	30	34	38	42
0.76	0.2 1.4 6	0.2 1.8 7	0.4 3.0 11	1.2 8.4 32		
0.77	0.4 3.0 12	0.5 3.7 14	0.8 6.2 24	2.5 18.4 70		
0.78	0.6 4.8 18	0.8 5.8 22	1.3 9.9 38	4.1 30.6 117		
0.79	0.9 6.6 25	1.1 8.0 30	1.8 13.7 52	5.9 44.1 167		
0.80	1.1 8.6 32	1.4 10.5 40	2.4 18.2 69	8.5 63.6 240		
0.81	1.4 11.0 41	1.8 13.7 51	3.4 25.6 96			
0.82	1.8 13.9 52	2.4 18.0 67				
0.83	2.4 18.3 68	3.5 26.9 100				

bd100_aeo_accel450_IMP_05 – 07/10/2003

Figure 04-04-06. Acceleration Data—FL450 (Sheet 1 of 4)

ACCELERATION FROM 0.75 M		
CLIMB THRUST **ENGINE BLEED ON** **ENGINE AND WING A/I OFF**	ISA + 10 C 30% C.G.	**FL 450** **TIME (MIN)** **DISTANCE (NM)** **FUEL (LB)**

MACH	TOP OF CLIMB WEIGHT – 1000 LB					
	24	26	30	34	38	42
0.76	0.3 1.9 7	0.3 2.5 9	0.7 5.0 18			
0.77	0.6 4.1 15	0.7 5.3 19	1.5 11.0 40			
0.78	0.9 6.7 24	1.2 8.6 31	2.5 18.5 66			
0.79	1.3 9.5 34	1.6 12.3 44	3.6 27.3 97			
0.80	1.7 12.7 45	2.2 16.8 60	5.4 41.4 147			
0.81	2.2 17.2 61	3.1 23.7 84				
0.82	3.1 23.9 84	5.2 40.6 142				
0.83						

bd100_aeo_accel450_IMP_10 – 07/10/2003

Figure 04-04-06. Acceleration Data—FL450 (Sheet 2 of 4)

ACCELERATION FROM 0.75 M		
CLIMB THRUST **ENGINE BLEED ON** **ENGINE AND WING A/I OFF**	ISA + 15 C 30% C.G.	**FL 450** **TIME (MIN)** **DISTANCE (NM)** **FUEL (LB)**

MACH	TOP OF CLIMB WEIGHT – 1000 LB					
	24	26	30	34	38	42
0.76	0.4 3.1 11	0.6 4.3 15	2.6 19.2 66			
0.77	0.9 6.8 23	1.3 9.6 33	7.0 52.9 181			
0.78	1.5 11.3 38	2.2 16.4 56	17.8 134.8 459			
0.79	2.1 16.4 55	3.2 24.7 84				
0.80	3.0 23.3 79	4.9 37.9 127				
0.81	4.7 36.3 121					
0.82						
0.83						

bd100_aeo_accel450_IMP_15 – 07/10/2003

Figure 04-04-06. Acceleration Data—FL450 (Sheet 3 of 4)

ACCELERATION FROM 0.75 M		
CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	FL 450 TIME (MIN) DISTANCE (NM) FUEL (LB)

MACH	TOP OF CLIMB WEIGHT – 1000 LB					
	24	26	30	34	38	42
0.76	0.8 6.3 20	1.6 12.4 40				
0.77	2.0 15.5 50	4.8 36.2 117				
0.78	4.0 30.7 99	13.8 105.5 339				
0.79	8.7 67.5 215					
0.80						
0.81						
0.82						
0.83						

bd100_aeo_accel450_IMP_20 – 07/10/2003

Figure 04-04-06. Acceleration Data—FL450 (Sheet 4 of 4)

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SPECIFIC AIR RANGE

The all engine operating Specific Air Range (SAR) values are presented in graphical form as function of Indicated Mach number (MI) at varying aircraft gross weight and flight levels from sea level to FL 450. The performance data are presented for the speed range from the minimum drag speed (VMD) up to the speed for Maximum Cruise thrust (MCR) or maximum operating speed limit (VMO/MMO), whichever is limiting.

The graphs are calculated for zero wind and ISA conditions with engine bleed on and anti-ice off. A correction factor is given on each graph for non-standard day temperatures. Lines indicating the Maximum Range Cruise (MRC) and Long Range Cruise (LRC) speeds are shown on each chart.

In wind conditions, the Specific Ground Range (SGR) can be computed from Specific Air Range (SAR), true airspeed and wind data using the following equation:

SGR "Wind" = [SAR "No wind" x (True airspeed +/- Wind*) / True airspeed]

* Wind convention "+" for Tailwind and "-" for Headwind

The effect of headwind / tailwind on Maximum Range Cruise (MRC) speed values is given on General Cruise Speeds chart (Figure 04-01-01).

Example:

Associated conditions

- Aircraft gross weight = 34 000 lbs (A)
- Flight Level = Sea Level
- Cruise speed = 0.32 MI (B)
- Static air temperature = ISA+5°C (C)

Using Figure 04-05-01, Sheet 1, the following data are obtained:

- Specific air range @ ISA = 0.1242 n.a.m./lb (D)
- True airspeed = 213 kts (E)

Specific Air Range at ISA+5°C is obtained by applying the SAR correction factor (0.9% SAR degradation per 10°C above ISA) shown on top of the chart:

- Specific air range @ ISA+5°C = 0.1242 - [(0.009 x 5/10) x 0.1242)]
= 0.1236 n.a.m./lb

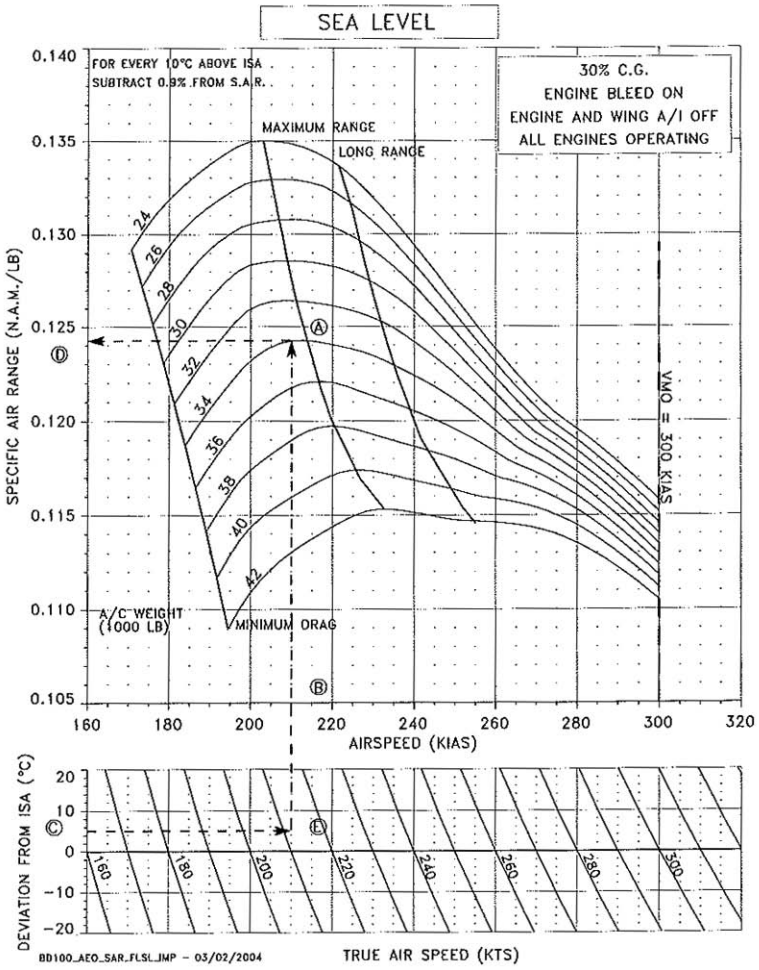

Figure 04-05-01. Specific Air Range (Sheet 1 of 15)

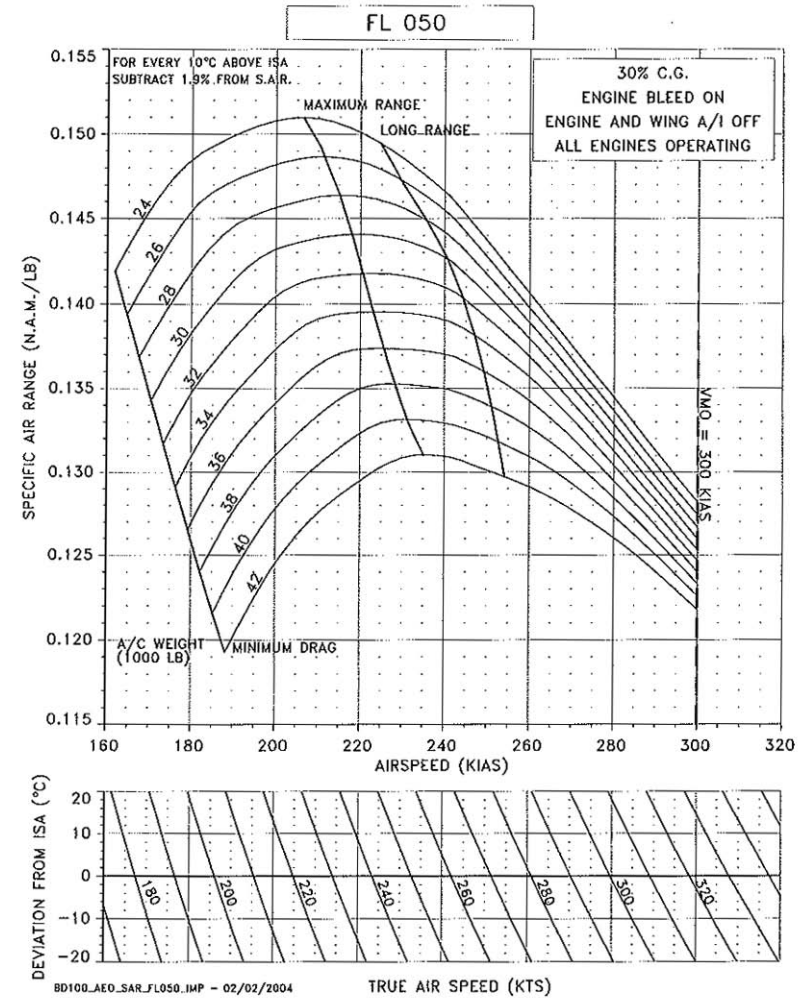

Figure 04-05-01. Specific Air Range (Sheet 2 of 15)

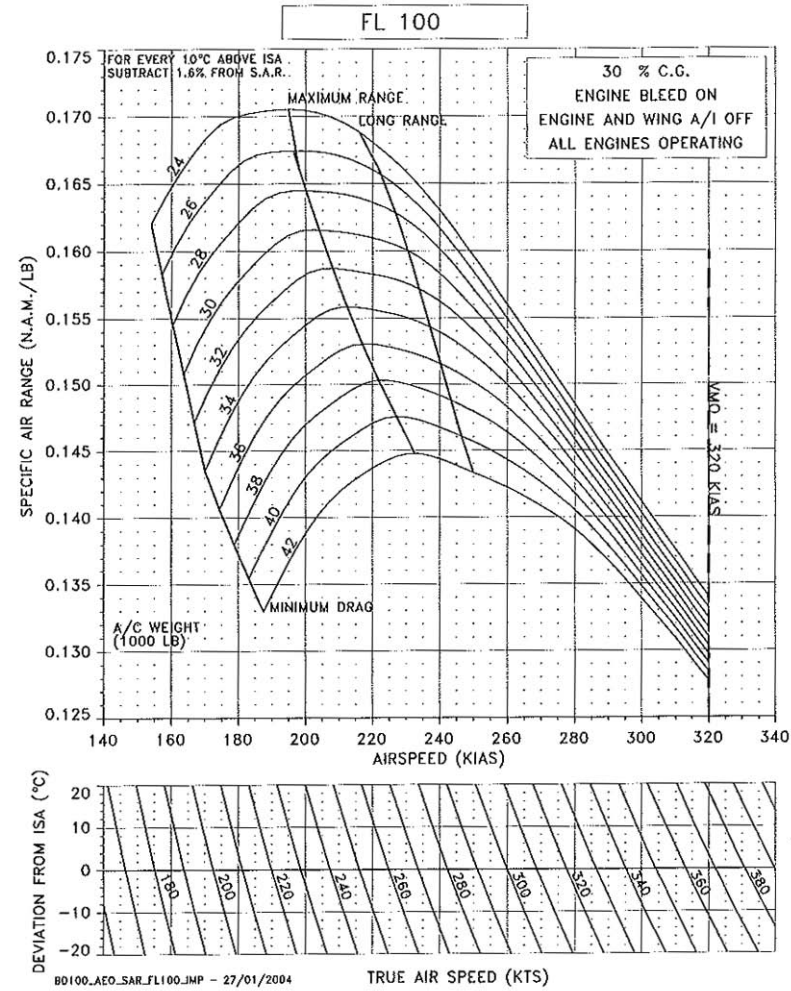

Figure 04-05-01. Specific Air Range (Sheet 3 of 15)

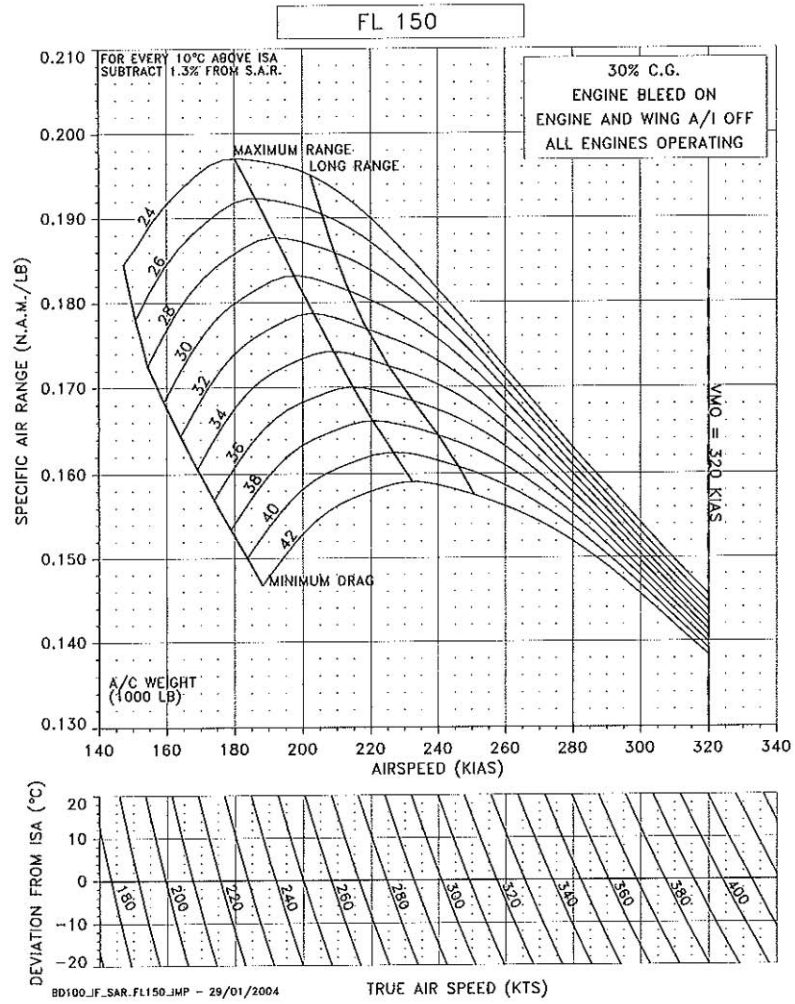

Figure 04-05-01. Specific Air Range (Sheet 4 of 15)

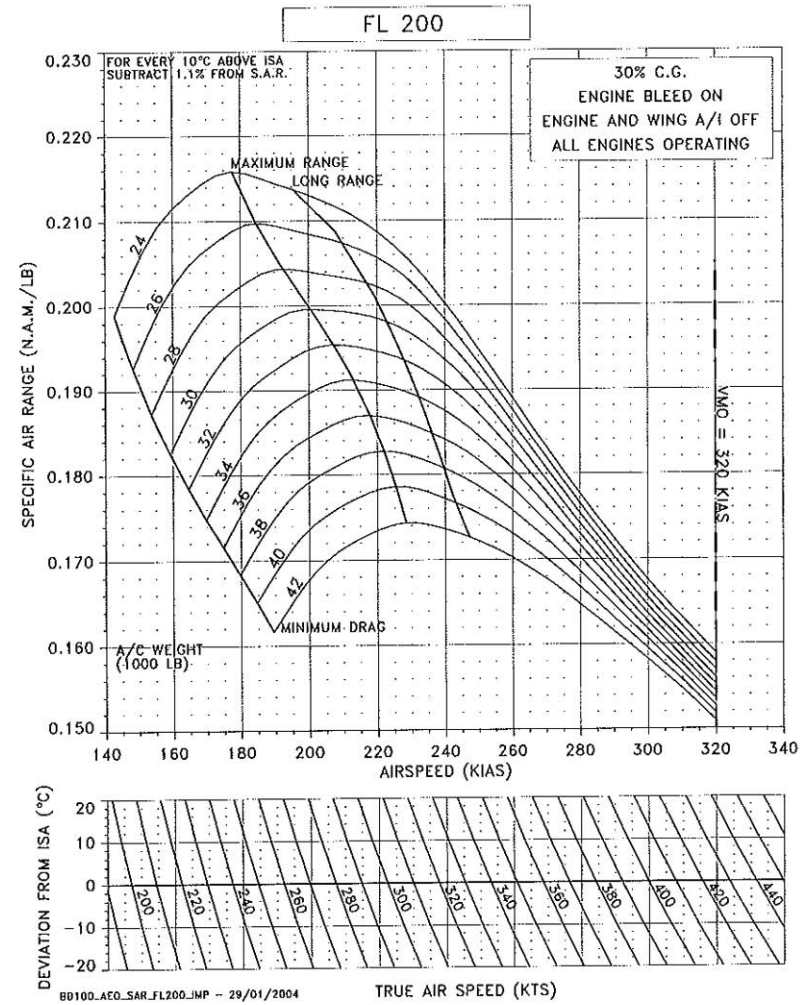

Figure 04-05-01. Specific Air Range (Sheet 5 of 15)

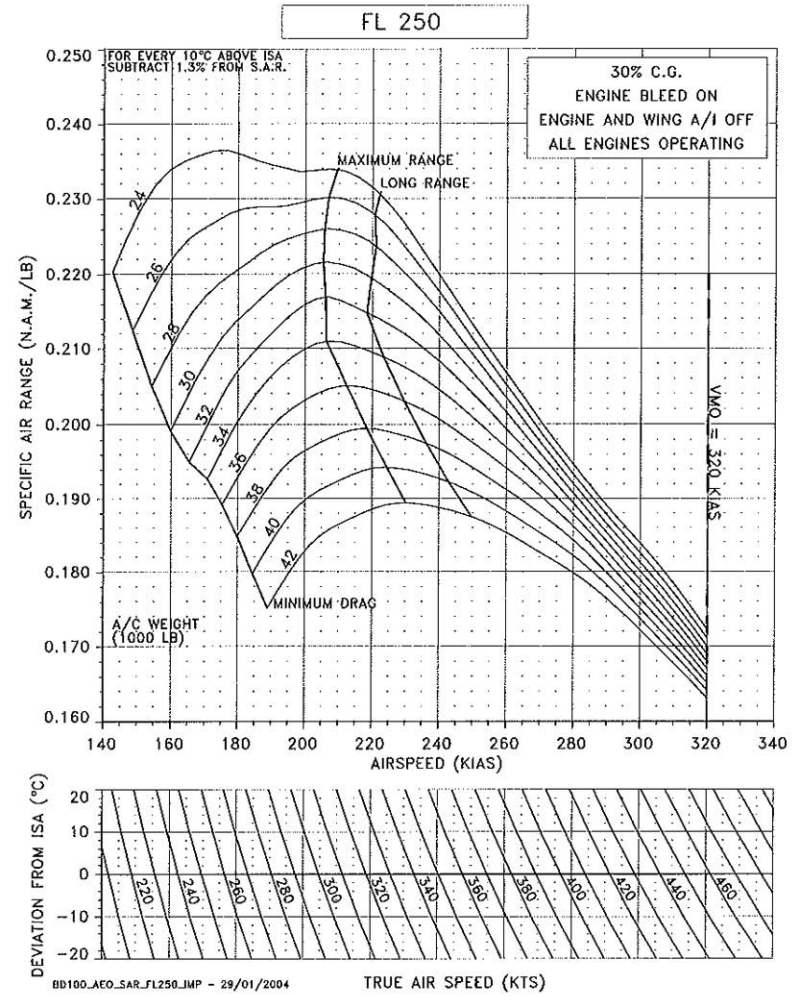

Figure 04-05-01. Specific Air Range (Sheet 6 of 15)

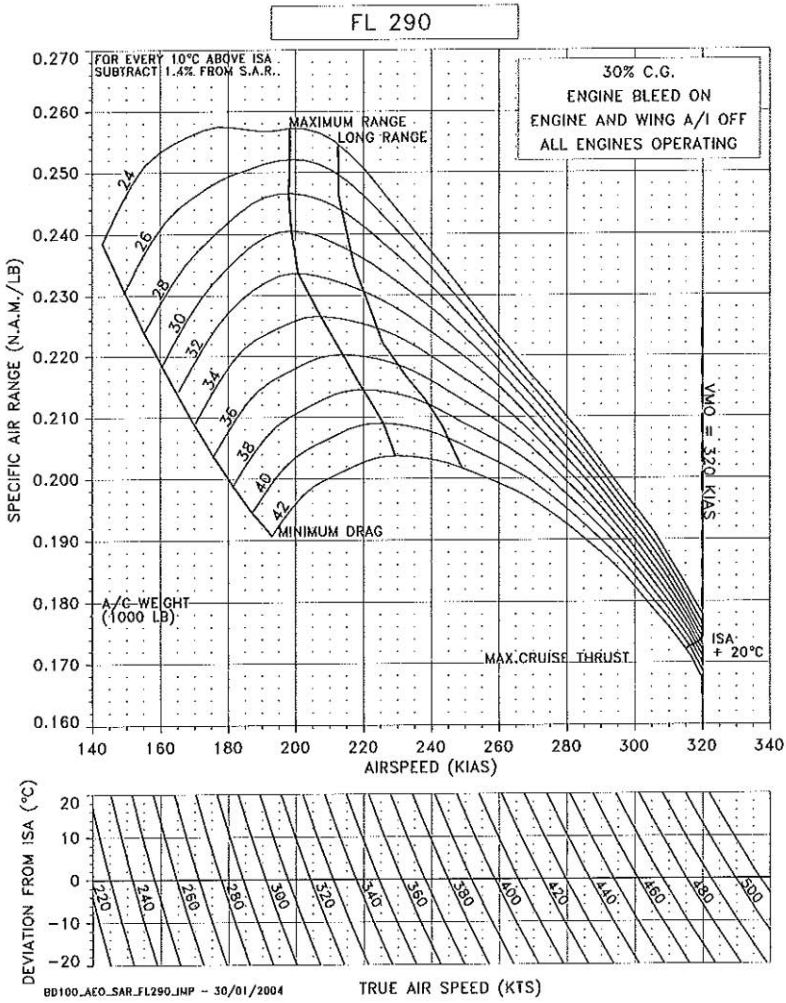

Figure 04-05-01. Specific Air Range (Sheet 7 of 15)

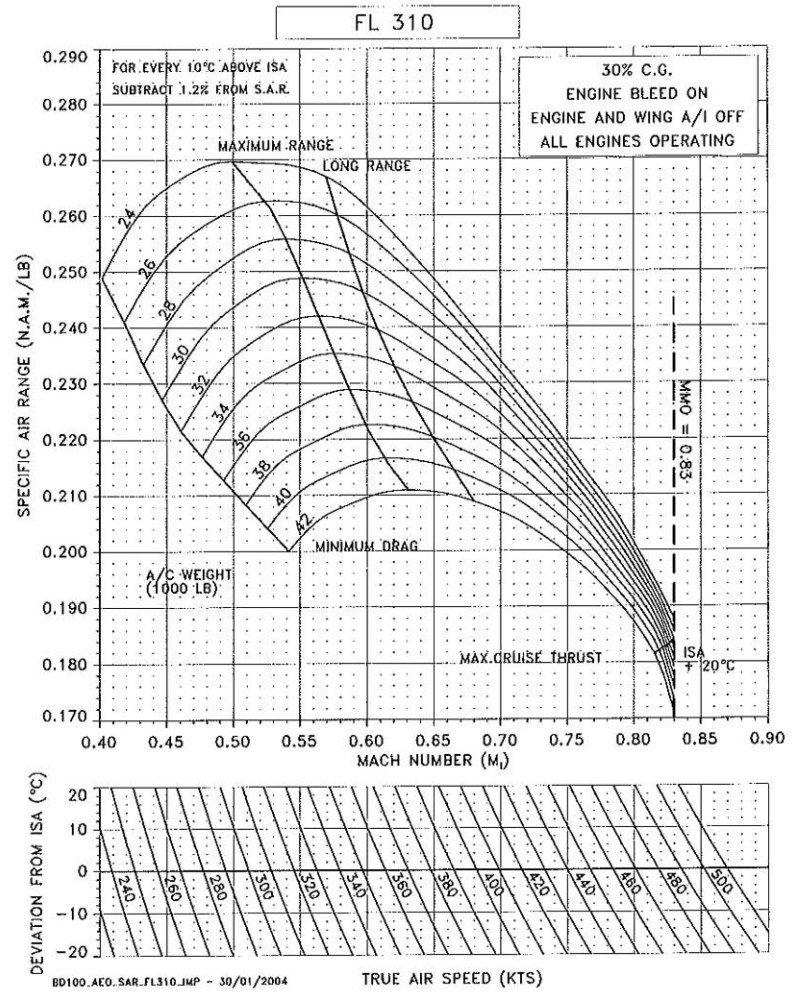

Figure 04-05-01. Specific Air Range (Sheet 8 of 15)

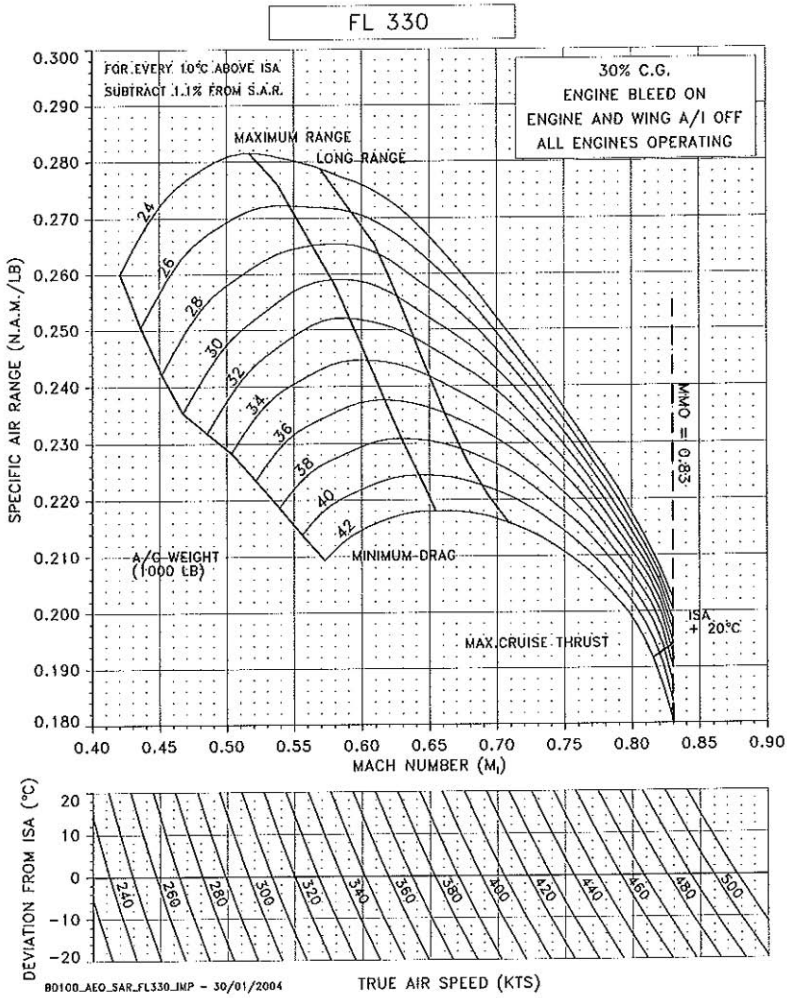

Figure 04-05-01. Specific Air Range (Sheet 9 of 15)

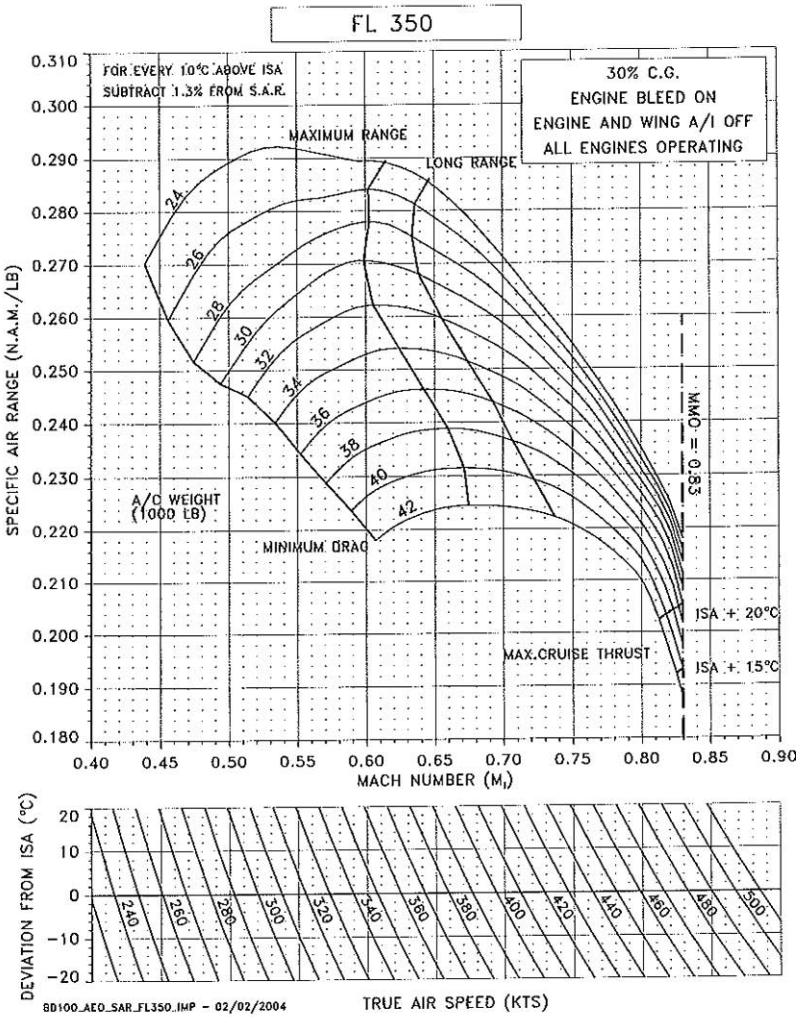

Figure 04-05-01. Specific Air Range (Sheet 10 of 15)

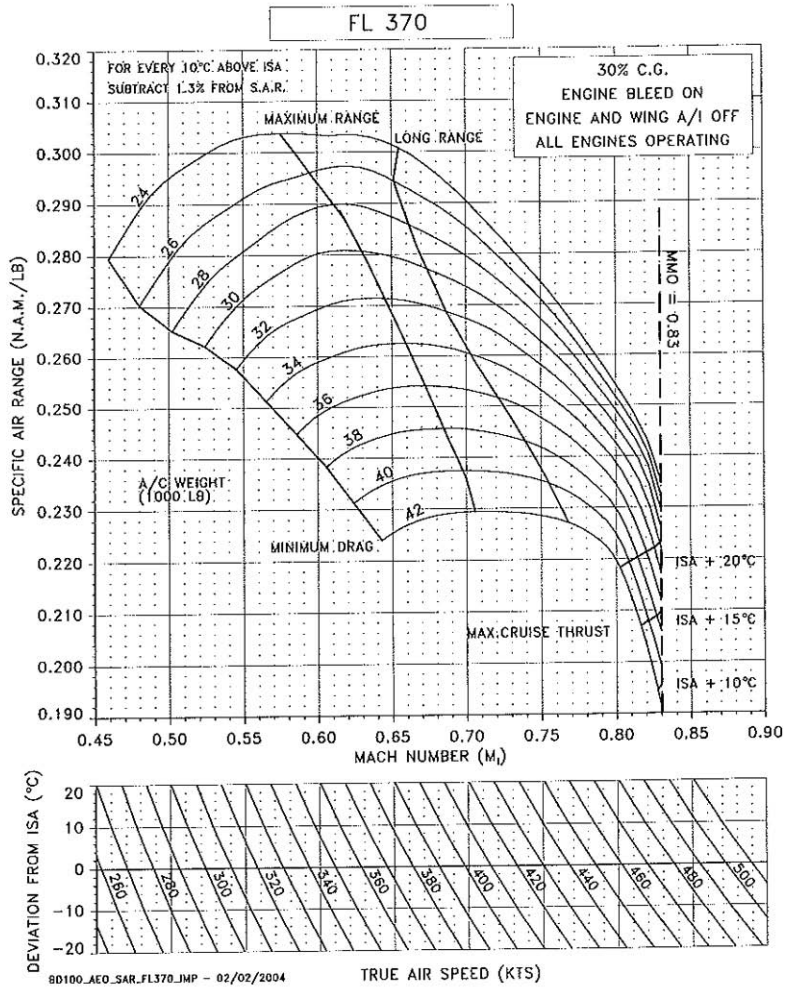

Figure 04-05-01. Specific Air Range (Sheet 11 of 15)

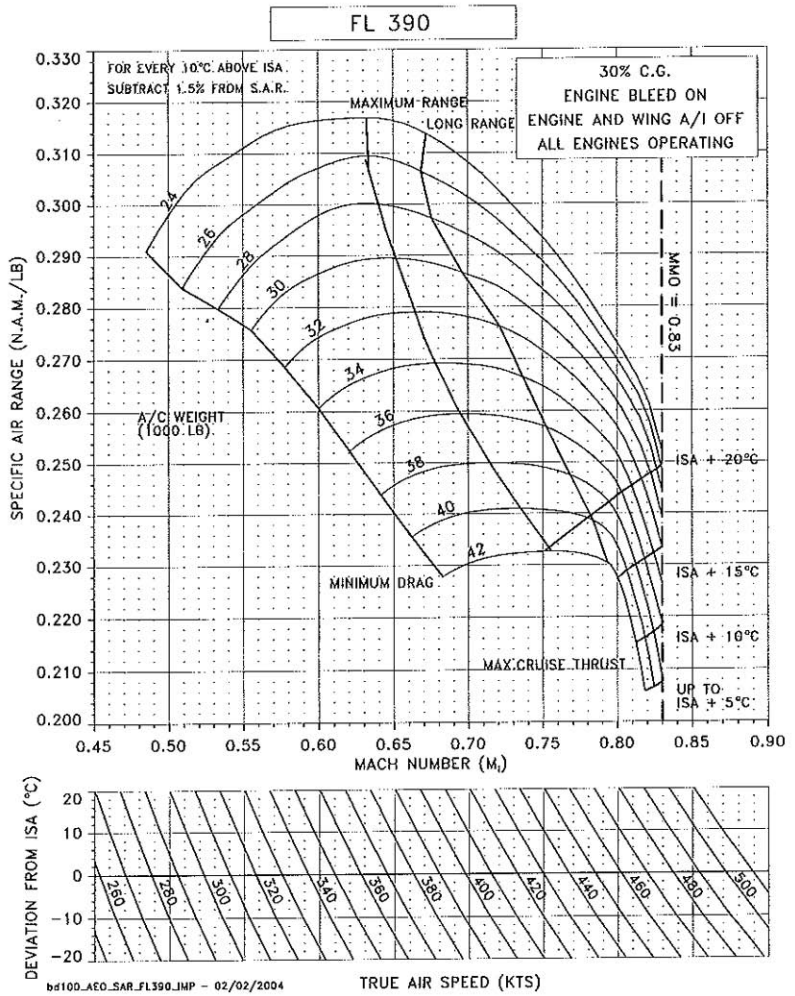

Figure 04-05-01. Specific Air Range (Sheet 12 of 15)

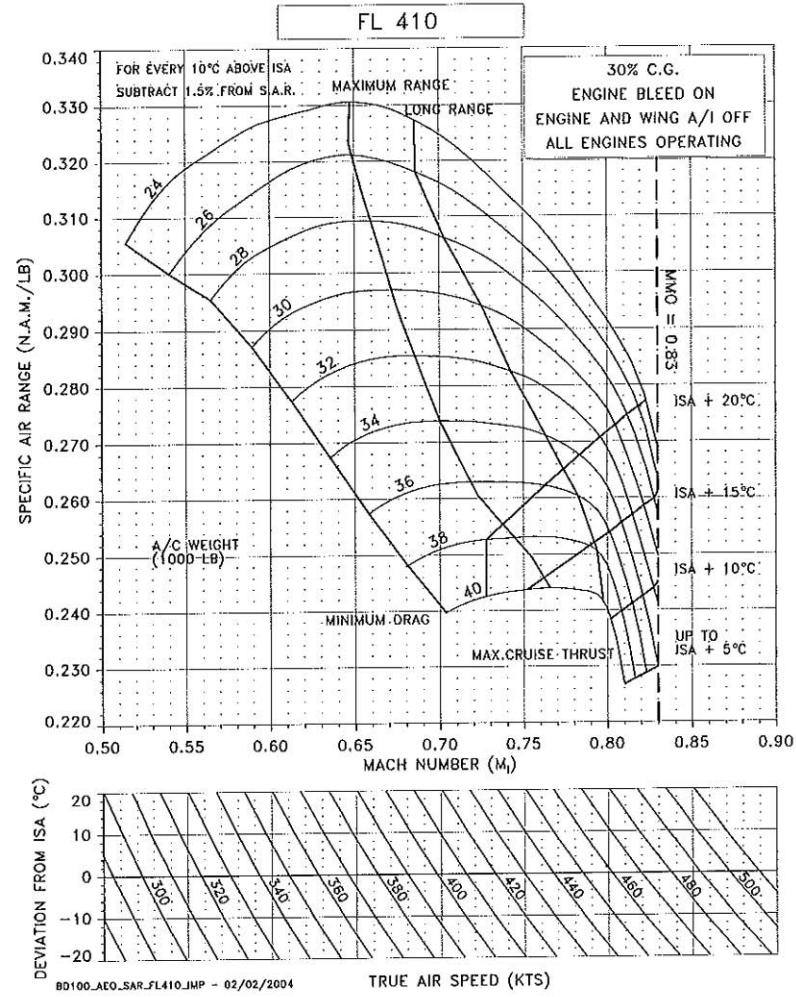

Figure 04-05-01. Specific Air Range (Sheet 13 of 15)

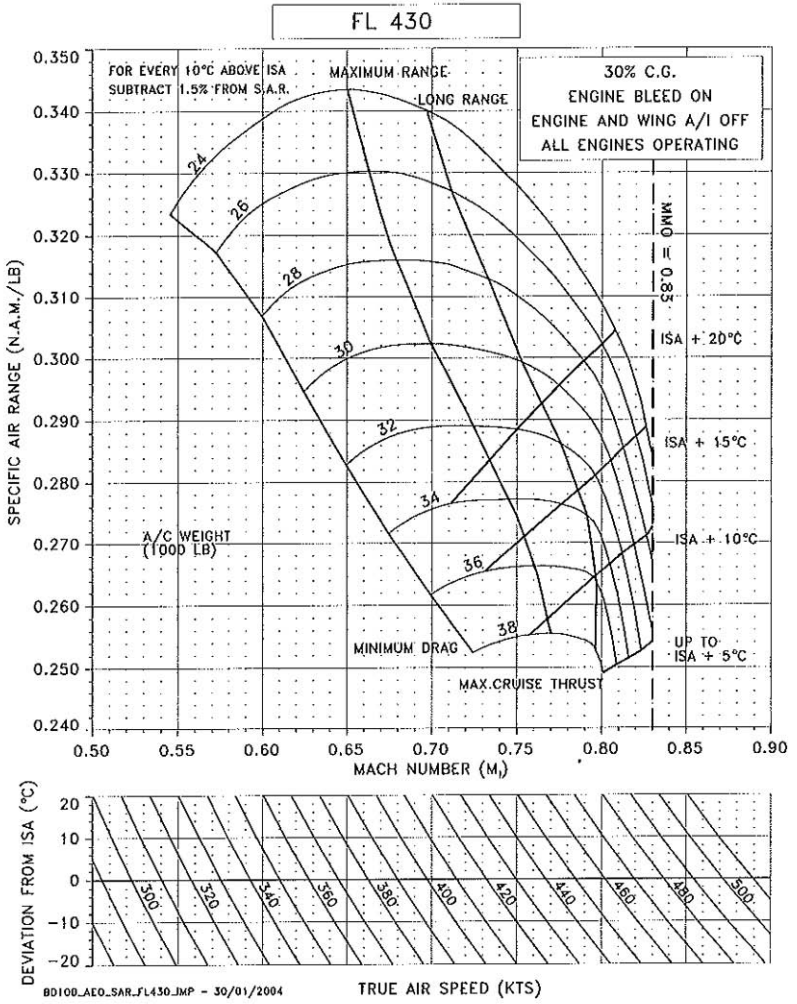

Figure 04-05-01. Specific Air Range (Sheet 14 of 15)

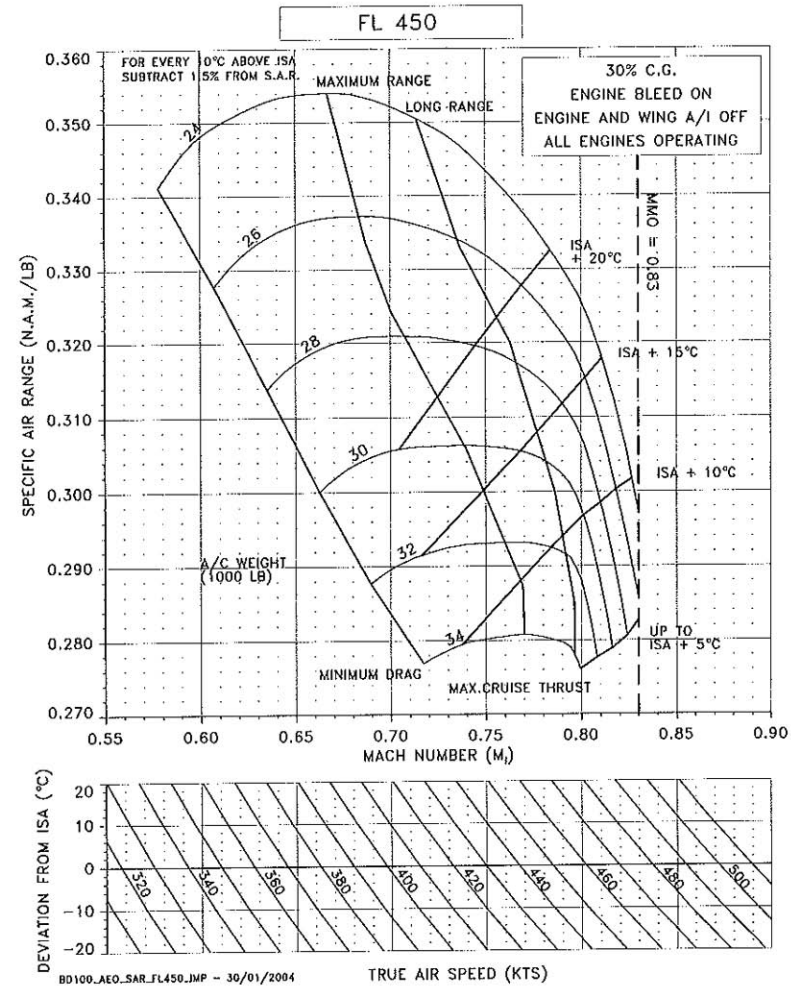

Figure 04-05-01. Specific Air Range (Sheet 15 of 15)

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CRUISE DATA

All engine operating cruise data are provided in tabular form for 250, 280, 300, 320 KIAS and 0.75, 0.78, 0.80, 0.82, 0.83 MI, Long Range Cruise (LRC) and Maximum Range Cruise (MRC) cruise speeds as function of flight level and aircraft gross weight for -10, 0, 5, 10, 15 and 20°C temperature deviation from ISA. The primary purpose of the cruise data is to establish a target thrust setting (N1%) for a selected set of cruise conditions.

All engine operating cruise data are terminated on the high speed end by either VMO/MMO speed limit or the maximum level flight speed as limited by MCR rating denoted "MAXIMUM CRUISE THRUST LIMITS" in title block of tables.

Cruise tables show the following data:

- %N1 Fan speed setting in percent
- LBS/HR Fuel flow in pounds per hour
- NAM/LB Specific air range in NAM per pound
- MACH Indicated Mach number
- KIAS Indicated airspeed in knots
- KTAS True airspeed in knots

N1 and fuel flow correction factors for C.G. variation relative to 30% MAC reference position are provided below:

N1 and FUEL FLOW CORRECTION FACTORS vs. C.G. POSITION.

C.G.	N1	Fuel Flow
20%	+ 1.00%	+ 2. 0%
25%	+ 0.50%	+ 1.00%
REF (30%)	-	-
35%	- 0.25%	- 0.50%
40%	- 0.50%	- 1.00%

Example:

Associated conditions

- Cruise speed = 250 KIAS
- Static air temperature = ISA-10°C
- Flight Level = FL 200 (A)
- Aircraft gross weight = 32 000 lbs (B)

Using Figure 04-06-01, Sheet 1, the following data are obtained (C):

- Fan speed RPM = 68.2%N1
- Fuel flow = 1744 lbs/hr.
- Specific air range = 0.1887 n.a.m./lb
- Indicated Mach number = 0.547 MI
- Indicated airspeed = 250 kts
- True airspeed = 329 kts

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CRUISE 250 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32 (B)	
350	76.3 1603 0.2603	0.741 250. 417.	76.5 1620 0.2576	0.741 250. 417.	76.9 1640 0.2545	0.741 250. 417.	77.2 1662 0.2511	0.741 250. 417.	77.6 1687 0.2473	0.741 250. 417.
330	75.1 1608 0.2512	0.711 250. 404.	75.3 1625 0.2486	0.711 250. 404.	75.6 1643 0.2458	0.711 250. 404.	75.9 1665 0.2427	0.711 250. 404.	76.3 1689 0.2392	0.711 250. 404.
310	73.9 1616 0.2420	0.682 250. 391.	74.1 1632 0.2397	0.682 250. 391.	74.4 1650 0.2371	0.682 250. 391.	74.7 1671 0.2341	0.682 250. 391.	75.1 1695 0.2307	0.682 250. 391.
290	72.8 1628 0.2327	0.655 250. 379.	73.0 1643 0.2306	0.655 250. 379.	73.3 1660 0.2282	0.655 250. 379.	73.6 1681 0.2254	0.655 250. 379.	73.9 1706 0.2221	0.655 250. 379.
280	72.2 1634 0.2282	0.641 250. 373.	72.5 1649 0.2262	0.641 250. 373.	72.7 1666 0.2238	0.641 250. 373.	73.0 1686 0.2211	0.641 250. 373.	73.4 1711 0.2179	0.641 250. 373.
260	71.1 1645 0.2195	0.616 250. 361.	71.3 1660 0.2176	0.616 250. 361.	71.5 1677 0.2154	0.616 250. 361.	71.8 1697 0.2129	0.616 250. 361.	72.2 1720 0.2100	0.616 250. 361.
240	69.8 1656 0.2114	0.592 250. 350.	70.1 1670 0.2096	0.592 250. 350.	70.3 1687 0.2076	0.592 250. 350.	70.6 1706 0.2052	0.592 250. 350.	70.9 1729 0.2025	0.592 250. 350.
220	68.6 1665 0.2038	0.569 250. 339.	68.8 1679 0.2021	0.569 250. 339.	69.0 1695 0.2002	0.569 250. 339.	69.3 1714 0.1980	0.569 250. 339.	69.6 1735 0.1955	0.569 250. 339.
200 (A)	67.2 1676 0.1963	0.547 250. 329.	67.4 1690 0.1947	0.547 250. 329.	67.7 1705 0.1930	0.547 250. 329.	67.9 1723 0.1910	0.547 250. 329.	68.2 1744 (C) 0.1887	0.547 250. 329.
180	65.9 1689 0.1889	0.526 250. 319.	66.1 1703 0.1874	0.526 250. 319.	66.3 1718 0.1858	0.526 250. 319.	66.6 1736 0.1839	0.526 250. 319.	66.9 1756 0.1817	0.526 250. 319.
160	64.5 1703 0.1818	0.506 250. 310.	64.7 1716 0.1804	0.506 250. 310.	65.0 1732 0.1788	0.506 250. 310.	65.3 1749 0.1770	0.506 250. 310.	65.6 1769 0.1750	0.506 250. 310.
140	63.2 1719 0.1748	0.487 250. 300.	63.4 1732 0.1734	0.487 250. 300.	63.7 1748 0.1719	0.487 250. 300.	63.9 1765 0.1702	0.487 250. 300.	64.2 1785 0.1683	0.487 250. 300.
120	61.9 1737 0.1679	0.469 250. 292.	62.1 1750 0.1666	0.469 250. 292.	62.3 1765 0.1652	0.469 250. 292.	62.6 1783 0.1636	0.469 250. 292.	62.9 1803 0.1618	0.469 250. 292.
100	60.5 1759 0.1610	0.452 250. 283.	60.7 1772 0.1598	0.452 250. 283.	61.0 1786 0.1586	0.452 250. 283.	61.3 1803 0.1571	0.452 250. 283.	61.6 1823 0.1554	0.452 250. 283.

bd100_aeo_cr250_IMP_lw_FL_m10 – 03/02/2004

Figure 04-06-01. Cruise Performance—250 KIAS (Sheet 1 of 12)

CRUISE 250 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF

ISA – 10 C

30% C.G.

%N1 MACH
LB/HR KIAS
NAM/LB KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350	78.0 1716 0.2432	0.741 250. 417.	78.5 1746 0.2390	0.741 250. 417.	79.0 1781 0.2343	0.741 250. 417.	79.5 1819 0.2294	0.741 250. 417.	80.1 1863 0.2240	0.741 250. 417.
330	76.7 1716 0.2354	0.711 250. 404.	77.2 1746 0.2313	0.711 250. 404.	77.7 1779 0.2271	0.711 250. 404.	78.2 1815 0.2226	0.711 250. 404.	78.8 1855 0.2177	0.711 250. 404.
310	75.5 1723 0.2270	0.682 250. 391.	75.9 1754 0.2231	0.682 250. 391.	76.4 1786 0.2191	0.682 250. 391.	76.9 1819 0.2150	0.682 250. 391.	77.4 1856 0.2108	0.682 250. 391.
290	74.3 1734 0.2185	0.655 250. 379.	74.7 1764 0.2148	0.655 250. 379.	75.2 1795 0.2111	0.655 250. 379.	75.6 1826 0.2074	0.655 250. 379.	76.1 1861 0.2036	0.655 250. 379.
280	73.8 1739 0.2144	0.641 250. 373.	74.2 1769 0.2108	0.641 250. 373.	74.6 1800 0.2072	0.641 250. 373.	75.0 1831 0.2037	0.641 250. 373.	75.5 1864 0.2000	0.641 250. 373.
260	72.5 1747 0.2067	0.616 250. 361.	72.9 1777 0.2033	0.616 250. 361.	73.4 1808 0.1999	0.616 250. 361.	73.8 1839 0.1964	0.616 250. 361.	74.2 1873 0.1929	0.616 250. 361.
240	71.3 1755 0.1995	0.592 250. 350.	71.7 1784 0.1963	0.592 250. 350.	72.1 1815 0.1929	0.592 250. 350.	72.6 1847 0.1895	0.592 250. 350.	73.0 1881 0.1861	0.592 250. 350.
220	70.0 1761 0.1927	0.569 250. 339.	70.4 1790 0.1896	0.569 250. 339.	70.8 1821 0.1864	0.569 250. 339.	71.3 1854 0.1831	0.569 250. 339.	71.7 1888 0.1797	0.569 250. 339.
200	68.6 1769 0.1860	0.547 250. 329.	69.0 1797 0.1831	0.547 250. 329.	69.4 1828 0.1800	0.547 250. 329.	69.9 1861 0.1769	0.547 250. 329.	70.4 1895 0.1736	0.547 250. 329.
180	67.3 1781 0.1792	0.526 250. 319.	67.7 1808 0.1765	0.526 250. 319.	68.1 1838 0.1737	0.526 250. 319.	68.6 1870 0.1707	0.526 250. 319.	69.0 1903 0.1677	0.526 250. 319.
160	65.9 1794 0.1726	0.506 250. 310.	66.3 1821 0.1700	0.506 250. 310.	66.8 1851 0.1673	0.506 250. 310.	67.2 1882 0.1645	0.506 250. 310.	67.7 1915 0.1617	0.506 250. 310.
140	64.6 1809 0.1661	0.487 250. 300.	65.0 1836 0.1636	0.487 250. 300.	65.4 1866 0.1610	0.487 250. 300.	65.9 1897 0.1584	0.487 250. 300.	66.3 1929 0.1558	0.487 250. 300.
120	63.3 1826 0.1597	0.469 250. 292.	63.7 1853 0.1574	0.469 250. 292.	64.1 1882 0.1550	0.469 250. 292.	64.5 1913 0.1525	0.469 250. 292.	64.9 1944 0.1500	0.469 250. 292.
100	61.9 1846 0.1534	0.452 250. 283.	62.4 1872 0.1513	0.452 250. 283.	62.8 1901 0.1490	0.452 250. 283.	63.2 1931 0.1466	0.452 250. 283.	63.6 1962 0.1443	0.452 250. 283.

bd100_aeo_cr250_IMP_hw_FL_m10 – 03/02/2004

Figure 04-06-01. Cruise Performance—250 KIAS (Sheet 2 of 12)

CRUISE 250 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF

ISA

30% C.G.

%NI
LB/HR
NAM/LB

MACH
KIAS
KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350	78.1 1657 0.2577	0.741 250. 427.	78.4 1675 0.2550	0.741 250. 427.	78.7 1695 0.2519	0.741 250. 427.	79.0 1718 0.2486	0.741 250. 427.	79.4 1744 0.2449	0.741 250. 427.
330	76.8 1662 0.2486	0.711 250. 413.	77.1 1680 0.2461	0.711 250. 413.	77.4 1699 0.2433	0.711 250. 413.	77.7 1720 0.2402	0.711 250. 413.	78.1 1745 0.2369	0.711 250. 413.
310	75.7 1672 0.2393	0.682 250. 400.	75.9 1688 0.2371	0.682 250. 400.	76.2 1706 0.2345	0.682 250. 400.	76.5 1727 0.2316	0.682 250. 400.	76.8 1752 0.2283	0.682 250. 400.
290	74.5 1683 0.2302	0.655 250. 387.	74.7 1698 0.2281	0.655 250. 387.	75.0 1716 0.2257	0.655 250. 387.	75.3 1737 0.2230	0.655 250. 387.	75.7 1763 0.2197	0.655 250. 387.
280	73.9 1688 0.2258	0.641 250. 381.	74.2 1703 0.2238	0.641 250. 381.	74.4 1721 0.2214	0.641 250. 381.	74.7 1742 0.2188	0.641 250. 381.	75.1 1767 0.2157	0.641 250. 381.
260	72.7 1699 0.2172	0.616 250. 369.	72.9 1714 0.2153	0.616 250. 369.	73.2 1732 0.2132	0.616 250. 369.	73.5 1752 0.2107	0.616 250. 369.	73.8 1777 0.2078	0.616 250. 369.
240	71.4 1708 0.2094	0.592 250. 358.	71.7 1723 0.2076	0.592 250. 358.	71.9 1740 0.2055	0.592 250. 358.	72.2 1760 0.2032	0.592 250. 358.	72.5 1784 0.2005	0.592 250. 358.
220	70.1 1715 0.2021	0.569 250. 347.	70.3 1730 0.2003	0.569 250. 347.	70.6 1746 0.1984	0.569 250. 347.	70.8 1766 0.1962	0.569 250. 347.	71.2 1788 0.1938	0.569 250. 347.
200	68.7 1724 0.1948	0.547 250. 336.	68.9 1738 0.1932	0.547 250. 336.	69.2 1754 0.1914	0.547 250. 336.	69.4 1773 0.1894	0.547 250. 336.	69.7 1795 0.1871	0.547 250. 336.
180	67.3 1737 0.1875	0.526 250. 326.	67.5 1751 0.1860	0.526 250. 326.	67.8 1767 0.1843	0.526 250. 326.	68.0 1785 0.1824	0.526 250. 326.	68.4 1806 0.1803	0.526 250. 326.
160	65.9 1751 0.1804	0.506 250. 316.	66.1 1765 0.1790	0.506 250. 316.	66.4 1780 0.1774	0.506 250. 316.	66.7 1798 0.1756	0.506 250. 316.	67.0 1819 0.1736	0.506 250. 316.
140	64.6 1767 0.1734	0.487 250. 306.	64.8 1781 0.1720	0.487 250. 306.	65.0 1797 0.1705	0.487 250. 306.	65.3 1815 0.1689	0.487 250. 306.	65.6 1835 0.1669	0.487 250. 306.
120	63.2 1786 0.1665	0.469 250. 297.	63.5 1800 0.1652	0.469 250. 297.	63.7 1815 0.1638	0.469 250. 297.	64.0 1833 0.1622	0.469 250. 297.	64.3 1853 0.1604	0.469 250. 297.
100	61.9 1809 0.1596	0.452 250. 289.	62.1 1822 0.1584	0.452 250. 289.	62.4 1837 0.1572	0.452 250. 289.	62.6 1853 0.1557	0.452 250. 289.	62.9 1873 0.1541	0.452 250. 289.

bd100_aeo_cr250_IMP_lw_FL_00 – 03/02/2004

Figure 04-06-01. Cruise Performance—250 KIAS (Sheet 3 of 12)

CRUISE 250 KIAS			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350	79.9 1773 0.2409	0.741 250. 427.	80.3 1805 0.2367	0.741 250. 427.	80.8 1840 0.2321	0.741 250. 427.	81.4 1880 0.2273	0.741 250. 427.	82.0 1925 0.2219	0.741 250. 427.
330	78.5 1774 0.2331	0.711 250. 413.	79.0 1805 0.2290	0.711 250. 413.	79.5 1838 0.2249	0.711 250. 413.	80.0 1875 0.2205	0.711 250. 413.	80.6 1917 0.2157	0.711 250. 413.
310	77.3 1781 0.2247	0.682 250. 400.	77.7 1812 0.2208	0.682 250. 400.	78.2 1845 0.2169	0.682 250. 400.	78.7 1880 0.2128	0.682 250. 400.	79.2 1917 0.2087	0.682 250. 400.
290	76.1 1792 0.2162	0.655 250. 387.	76.5 1823 0.2125	0.655 250. 387.	76.9 1854 0.2089	0.655 250. 387.	77.4 1887 0.2052	0.655 250. 387.	77.9 1923 0.2015	0.655 250. 387.
280	75.5 1796 0.2122	0.641 250. 381.	75.9 1827 0.2086	0.641 250. 381.	76.3 1859 0.2051	0.641 250. 381.	76.8 1891 0.2015	0.641 250. 381.	77.2 1926 0.1979	0.641 250. 381.
260	74.2 1804 0.2046	0.616 250. 369.	74.6 1835 0.2012	0.616 250. 369.	75.1 1866 0.1978	0.616 250. 369.	75.5 1899 0.1944	0.616 250. 369.	75.9 1933 0.1909	0.616 250. 369.
240	72.9 1811 0.1975	0.592 250. 358.	73.3 1840 0.1943	0.592 250. 358.	73.8 1873 0.1910	0.592 250. 358.	74.2 1906 0.1876	0.592 250. 358.	74.7 1941 0.1842	0.592 250. 358.
220	71.5 1815 0.1910	0.569 250. 347.	71.9 1844 0.1879	0.569 250. 347.	72.4 1877 0.1847	0.569 250. 347.	72.8 1911 0.1814	0.569 250. 347.	73.3 1947 0.1780	0.569 250. 347.
200	70.1 1820 0.1845	0.547 250. 336.	70.5 1850 0.1816	0.547 250. 336.	71.0 1881 0.1785	0.547 250. 336.	71.4 1916 0.1753	0.547 250. 336.	71.9 1951 0.1721	0.547 250. 336.
180	68.7 1832 0.1778	0.526 250. 326.	69.1 1860 0.1751	0.526 250. 326.	69.6 1891 0.1723	0.526 250. 326.	70.0 1924 0.1693	0.526 250. 326.	70.5 1958 0.1663	0.526 250. 326.
160	67.3 1844 0.1712	0.506 250. 316.	67.8 1872 0.1687	0.506 250. 316.	68.2 1903 0.1660	0.506 250. 316.	68.6 1935 0.1632	0.506 250. 316.	69.1 1969 0.1604	0.506 250. 316.
140	66.0 1860 0.1647	0.487 250. 306.	66.4 1888 0.1623	0.487 250. 306.	66.8 1918 0.1598	0.487 250. 306.	67.3 1949 0.1572	0.487 250. 306.	67.7 1982 0.1546	0.487 250. 306.
120	64.6 1877 0.1584	0.469 250. 297.	65.0 1905 0.1561	0.469 250. 297.	65.4 1934 0.1537	0.469 250. 297.	65.8 1966 0.1513	0.469 250. 297.	66.3 1998 0.1488	0.469 250. 297.
100	63.2 1896 0.1522	0.452 250. 289.	63.6 1923 0.1501	0.452 250. 289.	64.0 1951 0.1479	0.452 250. 289.	64.4 1982 0.1456	0.452 250. 289.	64.9 2014 0.1433	0.452 250. 289.

bd100_aeo_cr250_IMP_hw_FL_00 – 03/02/2004

Figure 04-06-01. Cruise Performance—250 KIAS (Sheet 4 of 12)

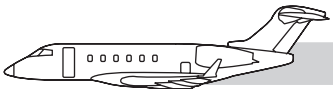
CRUISE 250 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C	%N1	MACH
	30% C.G.	LB/HR	KIAS
		NAM/LB	KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350	79.0	0.741	79.3	0.741	79.6	0.741	79.9	0.741	80.3	0.741
	1685	250.	1703	250.	1723	250.	1746	250.	1773	250.
	0.2564	432.	0.2537	432.	0.2507	432.	0.2474	432.	0.2437	432.
330	77.7	0.711	78.0	0.711	78.3	0.711	78.6	0.711	79.0	0.711
	1690	250.	1707	250.	1727	250.	1749	250.	1774	250.
	0.2473	418.	0.2448	418.	0.2421	418.	0.2390	418.	0.2357	418.
310	76.5	0.682	76.8	0.682	77.0	0.682	77.3	0.682	77.7	0.682
	1699	250.	1715	250.	1734	250.	1756	250.	1781	250.
	0.2381	405.	0.2358	405.	0.2333	405.	0.2304	405.	0.2271	405.
290	75.4	0.655	75.6	0.655	75.8	0.655	76.1	0.655	76.5	0.655
	1710	250.	1726	250.	1744	250.	1765	250.	1791	250.
	0.2289	392.	0.2269	392.	0.2245	392.	0.2218	392.	0.2186	392.
280	74.8	0.641	75.0	0.641	75.3	0.641	75.6	0.641	75.9	0.641
	1716	250.	1731	250.	1749	250.	1771	250.	1796	250.
	0.2245	385.	0.2225	385.	0.2202	385.	0.2176	385.	0.2145	385.
260	73.5	0.616	73.8	0.616	74.0	0.616	74.3	0.616	74.7	0.616
	1727	250.	1742	250.	1760	250.	1780	250.	1805	250.
	0.2160	373.	0.2141	373.	0.2120	373.	0.2095	373.	0.2067	373.
240	72.2	0.592	72.5	0.592	72.7	0.592	73.0	0.592	73.3	0.592
	1735	250.	1750	250.	1767	250.	1788	250.	1811	250.
	0.2082	361.	0.2064	361.	0.2044	361.	0.2021	361.	0.1994	361.
220	70.9	0.569	71.1	0.569	71.3	0.569	71.6	0.569	71.9	0.569
	1741	250.	1756	250.	1773	250.	1793	250.	1816	250.
	0.2010	350.	0.1993	350.	0.1974	350.	0.1952	350.	0.1928	350.
200	69.4	0.547	69.7	0.547	69.9	0.547	70.2	0.547	70.5	0.547
	1750	250.	1764	250.	1781	250.	1799	250.	1822	250.
	0.1939	339.	0.1923	339.	0.1905	339.	0.1885	339.	0.1862	339.
180	68.0	0.526	68.2	0.526	68.5	0.526	68.7	0.526	69.1	0.526
	1761	250.	1775	250.	1791	250.	1810	250.	1831	250.
	0.1868	329.	0.1852	329.	0.1836	329.	0.1817	329.	0.1796	329.
160	66.6	0.506	66.8	0.506	67.1	0.506	67.4	0.506	67.7	0.506
	1775	250.	1789	250.	1805	250.	1824	250.	1845	250.
	0.1796	319.	0.1782	319.	0.1766	319.	0.1749	319.	0.1728	319.
140	65.3	0.487	65.5	0.487	65.7	0.487	66.0	0.487	66.3	0.487
	1792	250.	1806	250.	1822	250.	1840	250.	1861	250.
	0.1726	309.	0.1713	309.	0.1698	309.	0.1681	309.	0.1662	309.
120	63.9	0.469	64.1	0.469	64.3	0.469	64.6	0.469	64.9	0.469
	1810	250.	1824	250.	1840	250.	1858	250.	1878	250.
	0.1658	300.	0.1645	300.	0.1631	300.	0.1616	300.	0.1598	300.
100	62.6	0.452	62.8	0.452	63.0	0.452	63.2	0.452	63.5	0.452
	1832	250.	1845	250.	1859	250.	1876	250.	1896	250.
	0.1590	291.	0.1579	291.	0.1567	291.	0.1553	291.	0.1537	291.

bd100_aeo_cr250_IMP_iw_FL_05 – 03/02/2004

Figure 04-06-01. Cruise Performance—250 KIAS (Sheet 5 of 12)



CRUISE 250 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT - 1000 LB									
	34		36		38		40		42	
350	80.8 1802 0.2397	0.741 250. 432.	81.3 1834 0.2355	0.741 250. 432.	81.8 1871 0.2309	0.741 250. 432.	82.3 1911 0.2261	0.741 250. 432.	82.9 1957 0.2207	0.741 250. 432.
330	79.4 1802 0.2319	0.711 250. 418.	79.9 1834 0.2279	0.711 250. 418.	80.4 1868 0.2237	0.711 250. 418.	80.9 1906 0.2193	0.711 250. 418.	81.5 1948 0.2146	0.711 250. 418.
310	78.1 1810 0.2234	0.682 250. 405.	78.6 1842 0.2196	0.682 250. 405.	79.0 1875 0.2157	0.682 250. 405.	79.5 1910 0.2118	0.682 250. 405.	80.1 1948 0.2077	0.682 250. 405.
290	76.9 1821 0.2150	0.655 250. 392.	77.3 1852 0.2114	0.655 250. 392.	77.8 1884 0.2078	0.655 250. 392.	78.2 1917 0.2042	0.655 250. 392.	78.7 1953 0.2004	0.655 250. 392.
280	76.3 1825 0.2110	0.641 250. 385.	76.7 1857 0.2075	0.641 250. 385.	77.2 1889 0.2040	0.641 250. 385.	77.6 1921 0.2005	0.641 250. 385.	78.1 1957 0.1969	0.641 250. 385.
260	75.0 1833 0.2035	0.616 250. 373.	75.5 1864 0.2001	0.616 250. 373.	75.9 1896 0.1967	0.616 250. 373.	76.3 1929 0.1934	0.616 250. 373.	76.8 1964 0.1899	0.616 250. 373.
240	73.7 1839 0.1965	0.592 250. 361.	74.1 1869 0.1933	0.592 250. 361.	74.6 1902 0.1900	0.592 250. 361.	75.0 1936 0.1866	0.592 250. 361.	75.5 1971 0.1833	0.592 250. 361.
220	72.3 1843 0.1900	0.569 250. 350.	72.7 1873 0.1869	0.569 250. 350.	73.2 1906 0.1837	0.569 250. 350.	73.6 1940 0.1804	0.569 250. 350.	74.1 1977 0.1771	0.569 250. 350.
200	70.8 1847 0.1836	0.547 250. 339.	71.3 1877 0.1807	0.547 250. 339.	71.7 1909 0.1777	0.547 250. 339.	72.2 1944 0.1745	0.547 250. 339.	72.7 1980 0.1713	0.547 250. 339.
180	69.4 1857 0.1771	0.526 250. 329.	69.9 1886 0.1744	0.526 250. 329.	70.3 1917 0.1715	0.526 250. 329.	70.8 1951 0.1686	0.526 250. 329.	71.2 1986 0.1656	0.526 250. 329.
160	68.0 1871 0.1705	0.506 250. 319.	68.5 1899 0.1679	0.506 250. 319.	68.9 1930 0.1652	0.506 250. 319.	69.3 1963 0.1625	0.506 250. 319.	69.8 1997 0.1597	0.506 250. 319.
140	66.6 1886 0.1640	0.487 250. 309.	67.0 1914 0.1616	0.487 250. 309.	67.5 1945 0.1590	0.487 250. 309.	67.9 1977 0.1565	0.487 250. 309.	68.4 2010 0.1539	0.487 250. 309.
120	65.2 1903 0.1578	0.469 250. 300.	65.6 1930 0.1555	0.469 250. 300.	66.0 1960 0.1531	0.469 250. 300.	66.5 1992 0.1507	0.469 250. 300.	66.9 2025 0.1483	0.469 250. 300.
100	63.8 1919 0.1518	0.452 250. 291.	64.2 1945 0.1497	0.452 250. 291.	64.6 1976 0.1475	0.452 250. 291.	65.0 2007 0.1451	0.452 250. 291.	65.5 2040 0.1428	0.452 250. 291.

bd100_aeo_cr250_IMP_hw_FL_05 - 03/02/2004

Figure 04-06-01. Cruise Performance—250 KIAS (Sheet 6 of 12)

CRUISE 250 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF

ISA + 10 C

30% C.G.

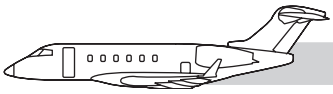
%N1 LB/HR NAM/LB

MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350	79.9	0.741	80.2	0.741	80.5	0.741	80.8	0.741	81.3	0.741
	1713	250.	1731	250.	1752	250.	1775	250.	1802	250.
	0.2550	437.	0.2523	437.	0.2493	437.	0.2460	437.	0.2424	437.
330	78.6	0.711	78.9	0.711	79.2	0.711	79.5	0.711	79.9	0.711
	1718	250.	1736	250.	1755	250.	1777	250.	1803	250.
	0.2459	423.	0.2434	423.	0.2407	423.	0.2377	423.	0.2344	423.
310	77.4	0.682	77.6	0.682	77.9	0.682	78.2	0.682	78.6	0.682
	1727	250.	1744	250.	1763	250.	1784	250.	1810	250.
	0.2367	409.	0.2344	409.	0.2319	409.	0.2291	409.	0.2258	409.
290	76.2	0.655	76.4	0.655	76.7	0.655	77.0	0.655	77.3	0.655
	1738	250.	1753	250.	1772	250.	1794	250.	1820	250.
	0.2276	396.	0.2256	396.	0.2233	396.	0.2206	396.	0.2174	396.
280	75.6	0.641	75.8	0.641	76.1	0.641	76.4	0.641	76.7	0.641
	1744	250.	1759	250.	1778	250.	1799	250.	1825	250.
	0.2232	389.	0.2213	389.	0.2190	389.	0.2164	389.	0.2133	389.
260	74.4	0.616	74.6	0.616	74.9	0.616	75.2	0.616	75.5	0.616
	1755	250.	1771	250.	1789	250.	1810	250.	1835	250.
	0.2147	377.	0.2128	377.	0.2107	377.	0.2082	377.	0.2054	377.
240	73.1	0.592	73.3	0.592	73.5	0.592	73.8	0.592	74.2	0.592
	1763	250.	1778	250.	1796	250.	1816	250.	1841	250.
	0.2070	365.	0.2052	365.	0.2032	365.	0.2009	365.	0.1983	365.
220	71.6	0.569	71.8	0.569	72.1	0.569	72.4	0.569	72.7	0.569
	1768	250.	1784	250.	1800	250.	1821	250.	1844	250.
	0.1999	354.	0.1982	354.	0.1964	354.	0.1942	354.	0.1918	354.
200	70.2	0.547	70.4	0.547	70.6	0.547	70.9	0.547	71.2	0.547
	1776	250.	1791	250.	1807	250.	1827	250.	1849	250.
	0.1929	343.	0.1913	343.	0.1895	343.	0.1875	343.	0.1853	343.
180	68.7	0.526	69.0	0.526	69.2	0.526	69.5	0.526	69.8	0.526
	1787	250.	1802	250.	1818	250.	1837	250.	1859	250.
	0.1858	332.	0.1843	332.	0.1826	332.	0.1808	332.	0.1786	332.
160	67.3	0.506	67.5	0.506	67.8	0.506	68.0	0.506	68.4	0.506
	1800	250.	1815	250.	1831	250.	1849	250.	1871	250.
	0.1788	322.	0.1774	322.	0.1758	322.	0.1741	322.	0.1721	322.
140	65.9	0.487	66.1	0.487	66.3	0.487	66.6	0.487	66.9	0.487
	1816	250.	1830	250.	1846	250.	1865	250.	1886	250.
	0.1719	312.	0.1706	312.	0.1691	312.	0.1675	312.	0.1656	312.
120	64.5	0.469	64.7	0.469	64.9	0.469	65.2	0.469	65.5	0.469
	1833	250.	1847	250.	1863	250.	1881	250.	1902	250.
	0.1652	303.	0.1640	303.	0.1626	303.	0.1611	303.	0.1593	303.
100	63.1	0.452	63.3	0.452	63.5	0.452	63.8	0.452	64.1	0.452
	1854	250.	1867	250.	1882	250.	1899	250.	1919	250.
	0.1586	294.	0.1575	294.	0.1562	294.	0.1548	294.	0.1532	294.

bd100_aeo_cr250_IMP_lw_FL_10 – 03/02/2004

Figure 04-06-01. Cruise Performance—250 KIAS (Sheet 7 of 12)



CRUISE 250 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350	81.7 1832 0.2384	0.741 250. 437.	82.1 1865 0.2342	0.741 250. 437.	82.6 1900 0.2298	0.741 250. 437.	83.2 1940 0.2251	0.741 250. 437.	83.8 1988 0.2198	0.741 250. 437.
330	80.3 1832 0.2307	0.711 250. 423.	80.7 1863 0.2268	0.711 250. 423.	81.2 1897 0.2227	0.711 250. 423.	81.8 1936 0.2182	0.711 250. 423.	82.4 1978 0.2136	0.711 250. 423.
310	79.0 1839 0.2223	0.682 250. 409.	79.4 1871 0.2185	0.682 250. 409.	79.9 1905 0.2146	0.682 250. 409.	80.4 1940 0.2107	0.682 250. 409.	80.9 1978 0.2066	0.682 250. 409.
290	77.7 1850 0.2139	0.655 250. 396.	78.2 1881 0.2103	0.655 250. 396.	78.6 1914 0.2067	0.655 250. 396.	79.1 1948 0.2031	0.655 250. 396.	79.6 1985 0.1994	0.655 250. 396.
280	77.1 1855 0.2099	0.641 250. 389.	77.6 1886 0.2064	0.641 250. 389.	78.0 1919 0.2029	0.641 250. 389.	78.4 1952 0.1994	0.641 250. 389.	78.9 1988 0.1958	0.641 250. 389.
260	75.9 1863 0.2022	0.616 250. 377.	76.3 1894 0.1989	0.616 250. 377.	76.7 1927 0.1956	0.616 250. 377.	77.2 1960 0.1923	0.616 250. 377.	77.6 1995 0.1889	0.616 250. 377.
240	74.6 1868 0.1953	0.592 250. 365.	75.0 1899 0.1922	0.592 250. 365.	75.4 1931 0.1890	0.592 250. 365.	75.8 1965 0.1857	0.592 250. 365.	76.3 2001 0.1824	0.592 250. 365.
220	73.1 1871 0.1889	0.569 250. 354.	73.5 1902 0.1859	0.569 250. 354.	74.0 1935 0.1827	0.569 250. 354.	74.4 1969 0.1795	0.569 250. 354.	74.9 2006 0.1762	0.569 250. 354.
200	71.6 1876 0.1826	0.547 250. 343.	72.0 1906 0.1798	0.547 250. 343.	72.5 1938 0.1767	0.547 250. 343.	73.0 1973 0.1736	0.547 250. 343.	73.4 2010 0.1704	0.547 250. 343.
180	70.2 1885 0.1762	0.526 250. 332.	70.6 1914 0.1735	0.526 250. 332.	71.0 1945 0.1707	0.526 250. 332.	71.5 1979 0.1678	0.526 250. 332.	72.0 2014 0.1649	0.526 250. 332.
160	68.7 1897 0.1697	0.506 250. 322.	69.1 1925 0.1672	0.506 250. 322.	69.6 1957 0.1645	0.506 250. 322.	70.0 1989 0.1619	0.506 250. 322.	70.5 2023 0.1592	0.506 250. 322.
140	67.3 1911 0.1634	0.487 250. 312.	67.7 1939 0.1610	0.487 250. 312.	68.1 1970 0.1585	0.487 250. 312.	68.6 2002 0.1560	0.487 250. 312.	69.1 2035 0.1534	0.487 250. 312.
120	65.9 1926 0.1572	0.469 250. 303.	66.3 1954 0.1550	0.469 250. 303.	66.7 1985 0.1526	0.469 250. 303.	67.1 2017 0.1502	0.469 250. 303.	67.6 2050 0.1478	0.469 250. 303.
100	64.4 1944 0.1512	0.452 250. 294.	64.8 1971 0.1491	0.452 250. 294.	65.3 2002 0.1469	0.452 250. 294.	65.7 2034 0.1445	0.452 250. 294.	66.2 2067 0.1422	0.452 250. 294.

bd100_aeo_cr250_IMP_hw_FL_10 – 03/02/2004

Figure 04-06-01. Cruise Performance—250 KIAS (Sheet 8 of 12)

CRUISE 250 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C	%N1	MACH
	30% C.G.	LB/HR	KIAS
		NAM/LB	KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350	80.8 1742 0.2535	0.741 250. 442.	81.1 1760 0.2508	0.741 250. 442.	81.4 1782 0.2478	0.741 250. 442.	81.8 1805 0.2446	0.741 250. 442.	82.2 1832 0.2410	0.741 250. 442.
330	79.5 1745 0.2447	0.711 250. 427.	79.7 1763 0.2422	0.711 250. 427.	80.0 1783 0.2395	0.711 250. 427.	80.4 1806 0.2365	0.711 250. 427.	80.8 1831 0.2332	0.711 250. 427.
310	78.2 1754 0.2355	0.682 250. 413.	78.4 1770 0.2334	0.682 250. 413.	78.7 1789 0.2309	0.682 250. 413.	79.0 1812 0.2280	0.682 250. 413.	79.4 1838 0.2248	0.682 250. 413.
290	77.0 1766 0.2264	0.655 250. 400.	77.2 1781 0.2244	0.655 250. 400.	77.5 1800 0.2221	0.655 250. 400.	77.8 1822 0.2194	0.655 250. 400.	78.2 1848 0.2163	0.655 250. 400.
280	76.4 1772 0.2219	0.641 250. 393.	76.6 1788 0.2200	0.641 250. 393.	76.9 1806 0.2177	0.641 250. 393.	77.2 1828 0.2152	0.641 250. 393.	77.6 1854 0.2121	0.641 250. 393.
260	75.2 1782 0.2136	0.616 250. 381.	75.4 1798 0.2117	0.616 250. 381.	75.7 1816 0.2096	0.616 250. 381.	76.0 1837 0.2072	0.616 250. 381.	76.3 1862 0.2044	0.616 250. 381.
240	73.8 1790 0.2060	0.592 250. 369.	74.0 1805 0.2042	0.592 250. 369.	74.3 1823 0.2022	0.592 250. 369.	74.6 1843 0.2000	0.592 250. 369.	74.9 1867 0.1974	0.592 250. 369.
220	72.3 1795 0.1989	0.569 250. 357.	72.6 1810 0.1972	0.569 250. 357.	72.8 1827 0.1954	0.569 250. 357.	73.1 1848 0.1932	0.569 250. 357.	73.4 1871 0.1908	0.569 250. 357.
200	70.9 1802 0.1919	0.547 250. 346.	71.1 1817 0.1903	0.547 250. 346.	71.4 1834 0.1886	0.547 250. 346.	71.7 1853 0.1866	0.547 250. 346.	72.0 1876 0.1843	0.547 250. 346.
180	69.4 1814 0.1848	0.526 250. 335.	69.7 1828 0.1833	0.526 250. 335.	69.9 1845 0.1817	0.526 250. 335.	70.2 1864 0.1798	0.526 250. 335.	70.5 1886 0.1778	0.526 250. 335.
160	68.0 1826 0.1779	0.506 250. 325.	68.2 1841 0.1765	0.506 250. 325.	68.5 1857 0.1750	0.506 250. 325.	68.7 1876 0.1732	0.506 250. 325.	69.1 1897 0.1713	0.506 250. 325.
140	66.5 1839 0.1713	0.487 250. 315.	66.7 1854 0.1700	0.487 250. 315.	67.0 1870 0.1685	0.487 250. 315.	67.3 1889 0.1668	0.487 250. 315.	67.6 1911 0.1649	0.487 250. 315.
120	65.1 1855 0.1648	0.469 250. 306.	65.3 1870 0.1635	0.469 250. 306.	65.5 1886 0.1621	0.469 250. 306.	65.8 1904 0.1605	0.469 250. 306.	66.1 1926 0.1587	0.469 250. 306.
100	63.7 1876 0.1581	0.452 250. 297.	63.9 1890 0.1570	0.452 250. 297.	64.1 1906 0.1556	0.452 250. 297.	64.4 1924 0.1542	0.452 250. 297.	64.8 1945 0.1525	0.452 250. 297.

bd100_aeo_cr250_IMP_lw_FL_15 – 03/02/2004

Figure 04-06-01. Cruise Performance—250 KIAS (Sheet 9 of 12)

CRUISE 250 KIAS			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350	82.6 1862 0.2371	0.741 250. 442.	83.1 1895 0.2330	0.741 250. 442.	83.6 1932 0.2286	0.741 250. 442.	84.2 1972 0.2239	0.741 250. 442.	84.8 2021 0.2185	0.741 250. 442.
330	81.2 1861 0.2295	0.711 250. 427.	81.6 1893 0.2256	0.711 250. 427.	82.1 1927 0.2216	0.711 250. 427.	82.7 1966 0.2172	0.711 250. 427.	83.2 2009 0.2126	0.711 250. 427.
310	79.8 1868 0.2212	0.682 250. 413.	80.3 1900 0.2174	0.682 250. 413.	80.8 1934 0.2136	0.682 250. 413.	81.3 1970 0.2097	0.682 250. 413.	81.8 2009 0.2057	0.682 250. 413.
290	78.6 1878 0.2128	0.655 250. 400.	79.0 1911 0.2092	0.655 250. 400.	79.5 1943 0.2057	0.655 250. 400.	79.9 1978 0.2021	0.655 250. 400.	80.4 2015 0.1984	0.655 250. 400.
280	78.0 1884 0.2088	0.641 250. 393.	78.4 1915 0.2053	0.641 250. 393.	78.8 1948 0.2019	0.641 250. 393.	79.3 1982 0.1985	0.641 250. 393.	79.8 2018 0.1949	0.641 250. 393.
260	76.7 1891 0.2013	0.616 250. 381.	77.1 1922 0.1981	0.616 250. 381.	77.5 1955 0.1947	0.616 250. 381.	77.9 1988 0.1914	0.616 250. 381.	78.4 2024 0.1880	0.616 250. 381.
240	75.3 1895 0.1945	0.592 250. 369.	75.7 1926 0.1914	0.592 250. 369.	76.1 1959 0.1881	0.592 250. 369.	76.6 1994 0.1848	0.592 250. 369.	77.1 2031 0.1815	0.592 250. 369.
220	73.8 1898 0.1880	0.569 250. 357.	74.3 1929 0.1850	0.569 250. 357.	74.7 1963 0.1819	0.569 250. 357.	75.2 1998 0.1787	0.569 250. 357.	75.6 2036 0.1754	0.569 250. 357.
200	72.4 1903 0.1818	0.547 250. 346.	72.8 1933 0.1789	0.547 250. 346.	73.3 1966 0.1759	0.547 250. 346.	73.7 2002 0.1728	0.547 250. 346.	74.2 2039 0.1697	0.547 250. 346.
180	70.9 1911 0.1754	0.526 250. 335.	71.3 1940 0.1728	0.526 250. 335.	71.8 1972 0.1700	0.526 250. 335.	72.2 2006 0.1671	0.526 250. 335.	72.7 2042 0.1642	0.526 250. 335.
160	69.4 1923 0.1690	0.506 250. 325.	69.9 1951 0.1665	0.506 250. 325.	70.3 1983 0.1639	0.506 250. 325.	70.8 2016 0.1612	0.506 250. 325.	71.2 2050 0.1585	0.506 250. 325.
140	68.0 1936 0.1628	0.487 250. 315.	68.4 1965 0.1604	0.487 250. 315.	68.8 1996 0.1579	0.487 250. 315.	69.3 2029 0.1553	0.487 250. 315.	69.7 2063 0.1528	0.487 250. 315.
120	66.5 1951 0.1566	0.469 250. 306.	66.9 1980 0.1544	0.469 250. 306.	67.4 2011 0.1520	0.469 250. 306.	67.8 2044 0.1495	0.469 250. 306.	68.3 2078 0.1471	0.469 250. 306.
100	65.1 1970 0.1505	0.452 250. 297.	65.5 1998 0.1484	0.452 250. 297.	66.0 2029 0.1462	0.452 250. 297.	66.4 2062 0.1439	0.452 250. 297.	66.8 2095 0.1416	0.452 250. 297.

bd100_aeo_cr250_IMP_hw_FL_15 ~ 03/02/2004

Figure 04-06-01. Cruise Performance—250 KIAS (Sheet 10 of 12)

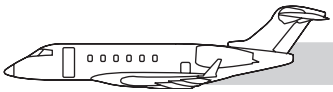
CRUISE 250 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350	81.7 1771 0.2520	0.741 250. 446.	82.0 1789 0.2494	0.741 250. 446.	82.3 1811 0.2464	0.741 250. 446.	82.7 1835 0.2432	0.741 250. 446.	83.1 1863 0.2396	0.741 250. 446.
330	80.3 1773 0.2434	0.711 250. 432.	80.6 1791 0.2409	0.711 250. 432.	80.9 1811 0.2383	0.711 250. 432.	81.2 1834 0.2353	0.711 250. 432.	81.6 1860 0.2320	0.711 250. 432.
310	79.0 1781 0.2343	0.682 250. 417.	79.3 1798 0.2322	0.682 250. 417.	79.6 1817 0.2297	0.682 250. 417.	79.9 1839 0.2269	0.682 250. 417.	80.3 1866 0.2237	0.682 250. 417.
290	77.8 1793 0.2252	0.655 250. 404.	78.1 1809 0.2232	0.655 250. 404.	78.3 1828 0.2209	0.655 250. 404.	78.6 1850 0.2183	0.655 250. 404.	79.0 1876 0.2152	0.655 250. 404.
280	77.2 1799 0.2207	0.641 250. 397.	77.4 1815 0.2188	0.641 250. 397.	77.7 1834 0.2166	0.641 250. 397.	78.0 1856 0.2141	0.641 250. 397.	78.4 1882 0.2111	0.641 250. 397.
260	75.9 1809 0.2125	0.616 250. 384.	76.2 1825 0.2106	0.616 250. 384.	76.4 1843 0.2086	0.616 250. 384.	76.7 1865 0.2062	0.616 250. 384.	77.1 1890 0.2034	0.616 250. 384.
240	74.6 1816 0.2050	0.592 250. 372.	74.8 1831 0.2032	0.592 250. 372.	75.0 1849 0.2013	0.592 250. 372.	75.3 1870 0.1990	0.592 250. 372.	75.7 1895 0.1964	0.592 250. 372.
220	73.1 1821 0.1979	0.569 250. 360.	73.3 1836 0.1962	0.569 250. 360.	73.6 1854 0.1944	0.569 250. 360.	73.9 1875 0.1922	0.569 250. 360.	74.2 1898 0.1899	0.569 250. 360.
200	71.6 1828 0.1909	0.547 250. 349.	71.9 1844 0.1894	0.547 250. 349.	72.1 1861 0.1876	0.547 250. 349.	72.4 1880 0.1857	0.547 250. 349.	72.7 1904 0.1834	0.547 250. 349.
180	70.2 1839 0.1839	0.526 250. 338.	70.4 1854 0.1825	0.526 250. 338.	70.6 1871 0.1809	0.526 250. 338.	70.9 1890 0.1790	0.526 250. 338.	71.2 1912 0.1769	0.526 250. 338.
160	68.7 1851 0.1772	0.506 250. 328.	68.9 1865 0.1758	0.506 250. 328.	69.2 1882 0.1743	0.506 250. 328.	69.4 1901 0.1725	0.506 250. 328.	69.8 1923 0.1705	0.506 250. 328.
140	67.2 1864 0.1706	0.487 250. 318.	67.4 1879 0.1692	0.487 250. 318.	67.7 1896 0.1677	0.487 250. 318.	68.0 1915 0.1660	0.487 250. 318.	68.3 1937 0.1641	0.487 250. 318.
120	65.8 1881 0.1640	0.469 250. 308.	66.0 1895 0.1627	0.469 250. 308.	66.2 1912 0.1613	0.469 250. 308.	66.5 1931 0.1597	0.469 250. 308.	66.8 1952 0.1579	0.469 250. 308.
100	64.3 1898 0.1576	0.452 250. 299.	64.5 1913 0.1564	0.452 250. 299.	64.8 1929 0.1551	0.452 250. 299.	65.0 1947 0.1537	0.452 250. 299.	65.3 1968 0.1520	0.452 250. 299.

bd100_aeo_cr250_IMP_lw_FL_20 – 03/02/2004

Figure 04-06-01. Cruise Performance—250 KIAS (Sheet 11 of 12)



CRUISE 250 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350	83.6 1893 0.2357	0.741 250. 446.	84.0 1927 0.2315	0.741 250. 446.	84.6 1964 0.2272	0.741 250. 446.	85.1 2006 0.2225	0.741 250. 446.	85.8 2054 0.2173	0.741 250. 446.
330	82.0 1889 0.2284	0.711 250. 432.	82.5 1922 0.2245	0.711 250. 432.	83.0 1957 0.2204	0.711 250. 432.	83.5 1997 0.2161	0.711 250. 432.	84.1 2040 0.2115	0.711 250. 432.
310	80.7 1896 0.2201	0.682 250. 417.	81.1 1929 0.2163	0.682 250. 417.	81.6 1964 0.2125	0.682 250. 417.	82.1 2001 0.2086	0.682 250. 417.	82.7 2040 0.2046	0.682 250. 417.
290	79.4 1907 0.2118	0.655 250. 404.	79.8 1940 0.2082	0.655 250. 404.	80.3 1973 0.2046	0.655 250. 404.	80.8 2008 0.2011	0.655 250. 404.	81.3 2045 0.1974	0.655 250. 404.
280	78.8 1912 0.2077	0.641 250. 397.	79.2 1945 0.2043	0.641 250. 397.	79.7 1978 0.2008	0.641 250. 397.	80.1 2012 0.1974	0.641 250. 397.	80.6 2048 0.1939	0.641 250. 397.
260	77.5 1920 0.2003	0.616 250. 384.	77.9 1951 0.1970	0.616 250. 384.	78.3 1985 0.1937	0.616 250. 384.	78.8 2019 0.1904	0.616 250. 384.	79.2 2055 0.1870	0.616 250. 384.
240	76.1 1924 0.1935	0.592 250. 372.	76.5 1955 0.1904	0.592 250. 372.	76.9 1989 0.1871	0.592 250. 372.	77.4 2025 0.1838	0.592 250. 372.	77.9 2062 0.1805	0.592 250. 372.
220	74.6 1926 0.1871	0.569 250. 360.	75.0 1958 0.1841	0.569 250. 360.	75.5 1992 0.1810	0.569 250. 360.	75.9 2028 0.1777	0.569 250. 360.	76.4 2066 0.1744	0.569 250. 360.
200	73.1 1931 0.1808	0.547 250. 349.	73.5 1961 0.1780	0.547 250. 349.	74.0 1995 0.1750	0.547 250. 349.	74.4 2031 0.1719	0.547 250. 349.	74.9 2068 0.1688	0.547 250. 349.
180	71.6 1938 0.1745	0.526 250. 338.	72.0 1968 0.1719	0.526 250. 338.	72.5 2000 0.1691	0.526 250. 338.	72.9 2035 0.1662	0.526 250. 338.	73.4 2071 0.1633	0.526 250. 338.
160	70.1 1950 0.1682	0.506 250. 328.	70.6 1979 0.1657	0.506 250. 328.	71.0 2011 0.1630	0.506 250. 328.	71.5 2045 0.1603	0.506 250. 328.	71.9 2081 0.1576	0.506 250. 328.
140	68.7 1963 0.1619	0.487 250. 318.	69.1 1993 0.1596	0.487 250. 318.	69.5 2025 0.1570	0.487 250. 318.	70.0 2058 0.1545	0.487 250. 318.	70.4 2093 0.1519	0.487 250. 318.
120	67.2 1978 0.1559	0.469 250. 308.	67.6 2007 0.1537	0.469 250. 308.	68.0 2038 0.1513	0.469 250. 308.	68.4 2071 0.1489	0.469 250. 308.	68.9 2106 0.1465	0.469 250. 308.
100	65.7 1993 0.1501	0.452 250. 299.	66.1 2021 0.1480	0.452 250. 299.	66.5 2052 0.1458	0.452 250. 299.	66.9 2085 0.1435	0.452 250. 299.	67.4 2119 0.1412	0.452 250. 299.

bd100_aeo_cr250_IMP_hw_FL_20 – 03/02/2004

Figure 04-06-01. Cruise Performance—250 KIAS (Sheet 12 of 12)

CRUISE 280 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF

ISA – 10 C

30% C.G.

%N1 MACH
LB/HR KIAS
NAM/LB KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350	81.1 2036 0.2272	0.821 280. 462.	81.3 2050 0.2255	0.821 280. 462.	81.5 2066 0.2238	0.821 280. 462.	81.7 2085 0.2217	0.821 280. 462.	82.0 2109 0.2193	0.821 280. 462.
330	79.3 1992 0.2250	0.789 280. 448.	79.5 2009 0.2231	0.789 280. 448.	79.7 2026 0.2212	0.789 280. 448.	80.0 2043 0.2193	0.789 280. 448.	80.2 2063 0.2172	0.789 280. 448.
310	77.9 1983 0.2190	0.757 280. 434.	78.1 1999 0.2173	0.757 280. 434.	78.3 2014 0.2157	0.757 280. 434.	78.5 2030 0.2139	0.757 280. 434.	78.7 2047 0.2122	0.757 280. 434.
290	76.6 1983 0.2123	0.727 280. 421.	76.8 1999 0.2106	0.727 280. 421.	77.0 2015 0.2090	0.727 280. 421.	77.2 2031 0.2073	0.727 280. 421.	77.5 2049 0.2055	0.727 280. 421.
280	76.1 1990 0.2083	0.713 280. 415.	76.3 2005 0.2068	0.713 280. 415.	76.4 2020 0.2052	0.713 280. 415.	76.6 2036 0.2036	0.713 280. 415.	76.9 2053 0.2019	0.713 280. 415.
260	75.0 2006 0.2004	0.685 280. 402.	75.1 2019 0.1991	0.685 280. 402.	75.3 2033 0.1977	0.685 280. 402.	75.5 2048 0.1963	0.685 280. 402.	75.7 2063 0.1948	0.685 280. 402.
240	73.9 2020 0.1930	0.659 280. 390.	74.1 2034 0.1917	0.659 280. 390.	74.2 2047 0.1904	0.659 280. 390.	74.4 2061 0.1891	0.659 280. 390.	74.6 2076 0.1878	0.659 280. 390.
220	72.8 2033 0.1860	0.634 280. 378.	72.9 2046 0.1848	0.634 280. 378.	73.1 2060 0.1836	0.634 280. 378.	73.3 2073 0.1824	0.634 280. 378.	73.4 2088 0.1811	0.634 280. 378.
200	71.6 2044 0.1795	0.610 280. 367.	71.8 2058 0.1783	0.610 280. 367.	71.9 2071 0.1772	0.610 280. 367.	72.1 2085 0.1760	0.610 280. 367.	72.3 2100 0.1747	0.610 280. 367.
180	70.4 2053 0.1734	0.587 280. 356.	70.5 2067 0.1723	0.587 280. 356.	70.7 2080 0.1712	0.587 280. 356.	70.9 2093 0.1701	0.587 280. 356.	71.1 2108 0.1689	0.587 280. 356.
160	69.1 2065 0.1674	0.565 280. 346.	69.2 2078 0.1663	0.565 280. 346.	69.4 2091 0.1653	0.565 280. 346.	69.6 2104 0.1642	0.565 280. 346.	69.8 2118 0.1632	0.565 280. 346.
140	67.8 2080 0.1613	0.544 280. 336.	68.0 2093 0.1603	0.544 280. 336.	68.1 2106 0.1594	0.544 280. 336.	68.3 2119 0.1584	0.544 280. 336.	68.5 2133 0.1573	0.544 280. 336.
120	66.5 2097 0.1554	0.525 280. 326.	66.7 2110 0.1544	0.525 280. 326.	66.8 2123 0.1535	0.525 280. 326.	67.0 2136 0.1526	0.525 280. 326.	67.2 2150 0.1516	0.525 280. 326.
100	65.2 2116 0.1496	0.506 280. 317.	65.4 2130 0.1487	0.506 280. 317.	65.5 2143 0.1478	0.506 280. 317.	65.7 2156 0.1469	0.506 280. 317.	65.9 2169 0.1460	0.506 280. 317.

bd100_aeo_cr280_IMP_lw_FL_m10 – 02/02/2004

Figure 04-06-02. Cruise Performance—280 KIAS (Sheet 1 of 12)

CRUISE 280 KIAS			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350	82.3 2140 0.2161	0.821 280. 462.	82.8 2178 0.2124	0.821 280. 462.	83.3 2224 0.2079	0.821 280. 462.	84.0 2281 0.2027	0.821 280. 462.	84.7 2342 0.1974	0.821 280. 462.
330	80.5 2083 0.2151	0.789 280. 448.	80.7 2105 0.2128	0.789 280. 448.	81.1 2130 0.2103	0.789 280. 448.	81.4 2159 0.2075	0.789 280. 448.	81.8 2191 0.2045	0.789 280. 448.
310	79.0 2066 0.2103	0.757 280. 434.	79.3 2087 0.2081	0.757 280. 434.	79.5 2111 0.2058	0.757 280. 434.	79.9 2138 0.2031	0.757 280. 434.	80.2 2168 0.2003	0.757 280. 434.
290	77.7 2068 0.2036	0.727 280. 421.	77.9 2089 0.2016	0.727 280. 421.	78.2 2111 0.1994	0.727 280. 421.	78.5 2136 0.1971	0.727 280. 421.	78.9 2164 0.1946	0.727 280. 421.
280	77.1 2071 0.2002	0.713 280. 415.	77.3 2091 0.1983	0.713 280. 415.	77.6 2113 0.1962	0.713 280. 415.	77.9 2138 0.1939	0.713 280. 415.	78.2 2165 0.1915	0.713 280. 415.
260	75.9 2080 0.1932	0.685 280. 402.	76.1 2099 0.1915	0.685 280. 402.	76.4 2121 0.1895	0.685 280. 402.	76.7 2146 0.1873	0.685 280. 402.	77.0 2173 0.1850	0.685 280. 402.
240	74.8 2093 0.1863	0.659 280. 390.	75.0 2112 0.1846	0.659 280. 390.	75.2 2133 0.1828	0.659 280. 390.	75.5 2158 0.1807	0.659 280. 390.	75.9 2186 0.1783	0.659 280. 390.
220	73.6 2104 0.1797	0.634 280. 378.	73.9 2123 0.1781	0.634 280. 378.	74.1 2144 0.1764	0.634 280. 378.	74.4 2169 0.1744	0.634 280. 378.	74.7 2196 0.1722	0.634 280. 378.
200	72.5 2116 0.1734	0.610 280. 367.	72.7 2134 0.1720	0.610 280. 367.	72.9 2154 0.1703	0.610 280. 367.	73.2 2178 0.1685	0.610 280. 367.	73.5 2205 0.1664	0.610 280. 367.
180	71.2 2123 0.1677	0.587 280. 356.	71.5 2141 0.1663	0.587 280. 356.	71.7 2161 0.1648	0.587 280. 356.	72.0 2184 0.1631	0.587 280. 356.	72.2 2210 0.1611	0.587 280. 356.
160	70.0 2134 0.1620	0.565 280. 346.	70.2 2150 0.1608	0.565 280. 346.	70.4 2170 0.1593	0.565 280. 346.	70.7 2192 0.1577	0.565 280. 346.	70.9 2216 0.1560	0.565 280. 346.
140	68.6 2148 0.1563	0.544 280. 336.	68.8 2164 0.1551	0.544 280. 336.	69.1 2183 0.1537	0.544 280. 336.	69.3 2204 0.1523	0.544 280. 336.	69.6 2228 0.1506	0.544 280. 336.
120	67.3 2165 0.1506	0.525 280. 326.	67.5 2181 0.1495	0.525 280. 326.	67.8 2199 0.1482	0.525 280. 326.	68.0 2220 0.1468	0.525 280. 326.	68.3 2243 0.1453	0.525 280. 326.
100	66.0 2184 0.1450	0.506 280. 317.	66.2 2200 0.1439	0.506 280. 317.	66.5 2218 0.1427	0.506 280. 317.	66.7 2239 0.1414	0.506 280. 317.	67.0 2262 0.1400	0.506 280. 317.

bd100_aeo_cr280_IMP_hw_FL_m10 – 02/02/2004

Figure 04-06-02. Cruise Performance—280 KIAS (Sheet 2 of 12)

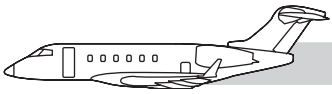
CRUISE 280 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA	%N1	MACH
	30% C.G.	LB/HR	KIAS
		NAM/LB	KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350	83.0	0.821	83.2	0.821	83.4	0.821	83.6	0.821	83.9	0.821
	2109	280.	2124	280.	2141	280.	2160	280.	2184	280.
	0.2245	473.	0.2228	473.	0.2211	473.	0.2192	473.	0.2168	473.
330	81.2	0.789	81.4	0.789	81.6	0.789	81.8	0.789	82.1	0.789
	2062	280.	2080	280.	2097	280.	2115	280.	2135	280.
	0.2223	459.	0.2205	459.	0.2187	459.	0.2168	459.	0.2148	459.
310	79.8	0.757	80.0	0.757	80.2	0.757	80.4	0.757	80.6	0.757
	2053	280.	2068	280.	2084	280.	2100	280.	2118	280.
	0.2164	444.	0.2148	444.	0.2132	444.	0.2115	444.	0.2098	444.
290	78.4	0.727	78.6	0.727	78.8	0.727	79.0	0.727	79.3	0.727
	2050	280.	2066	280.	2083	280.	2100	280.	2118	280.
	0.2100	430.	0.2084	430.	0.2067	430.	0.2050	430.	0.2032	430.
280	77.8	0.713	78.0	0.713	78.2	0.713	78.4	0.713	78.6	0.713
	2056	280.	2072	280.	2087	280.	2104	280.	2121	280.
	0.2061	424.	0.2046	424.	0.2030	424.	0.2014	424.	0.1998	424.
260	76.7	0.685	76.9	0.685	77.0	0.685	77.2	0.685	77.4	0.685
	2071	280.	2085	280.	2100	280.	2115	280.	2130	280.
	0.1983	411.	0.1970	411.	0.1956	411.	0.1942	411.	0.1928	411.
240	75.6	0.659	75.7	0.659	75.9	0.659	76.1	0.659	76.3	0.659
	2086	280.	2099	280.	2113	280.	2128	280.	2143	280.
	0.1909	398.	0.1897	398.	0.1884	398.	0.1872	398.	0.1858	398.
220	74.4	0.634	74.6	0.634	74.7	0.634	74.9	0.634	75.1	0.634
	2098	280.	2112	280.	2125	280.	2139	280.	2155	280.
	0.1841	386.	0.1829	386.	0.1817	386.	0.1805	386.	0.1792	386.
200	73.2	0.610	73.3	0.610	73.5	0.610	73.7	0.610	73.8	0.610
	2108	280.	2122	280.	2136	280.	2150	280.	2165	280.
	0.1776	375.	0.1765	375.	0.1754	375.	0.1742	375.	0.1730	375.
180	71.9	0.587	72.1	0.587	72.2	0.587	72.4	0.587	72.6	0.587
	2116	280.	2130	280.	2143	280.	2158	280.	2173	280.
	0.1717	363.	0.1706	363.	0.1695	363.	0.1684	363.	0.1672	363.
160	70.6	0.565	70.7	0.565	70.9	0.565	71.1	0.565	71.3	0.565
	2126	280.	2140	280.	2153	280.	2167	280.	2181	280.
	0.1658	353.	0.1648	353.	0.1637	353.	0.1627	353.	0.1616	353.
140	69.2	0.544	69.4	0.544	69.6	0.544	69.7	0.544	69.9	0.544
	2140	280.	2153	280.	2166	280.	2180	280.	2194	280.
	0.1600	342.	0.1590	342.	0.1580	342.	0.1570	342.	0.1560	342.
120	67.9	0.525	68.0	0.525	68.2	0.525	68.4	0.525	68.6	0.525
	2155	280.	2169	280.	2182	280.	2195	280.	2209	280.
	0.1542	332.	0.1532	332.	0.1523	332.	0.1514	332.	0.1504	332.
100	66.5	0.506	66.7	0.506	66.8	0.506	67.0	0.506	67.2	0.506
	2173	280.	2187	280.	2200	280.	2213	280.	2227	280.
	0.1485	323.	0.1476	323.	0.1467	323.	0.1458	323.	0.1449	323.

bd100_aeo_cr280_IMP_lw_FL_00 – 02/02/2004

Figure 04-06-02. Cruise Performance—280 KIAS (Sheet 3 of 12)



CRUISE 280 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350	84.3 2215 0.2137	0.821 280. 473.	84.7 2254 0.2100	0.821 280. 473.	85.3 2302 0.2056	0.821 280. 473.	86.0 2360 0.2006	0.821 280. 473.	86.6 2423 0.1954	0.821 280. 473.
330	82.4 2156 0.2127	0.789 280. 459.	82.6 2179 0.2105	0.789 280. 459.	82.9 2204 0.2080	0.789 280. 459.	83.3 2234 0.2053	0.789 280. 459.	83.7 2266 0.2023	0.789 280. 459.
310	80.9 2137 0.2079	0.757 280. 444.	81.1 2159 0.2058	0.757 280. 444.	81.4 2184 0.2034	0.757 280. 444.	81.8 2212 0.2008	0.757 280. 444.	82.1 2243 0.1981	0.757 280. 444.
290	79.5 2138 0.2014	0.727 280. 430.	79.8 2159 0.1994	0.727 280. 430.	80.1 2182 0.1973	0.727 280. 430.	80.4 2207 0.1950	0.727 280. 430.	80.7 2236 0.1926	0.727 280. 430.
280	78.9 2140 0.1980	0.713 280. 424.	79.1 2160 0.1962	0.713 280. 424.	79.4 2183 0.1941	0.713 280. 424.	79.7 2209 0.1919	0.713 280. 424.	80.0 2236 0.1895	0.713 280. 424.
260	77.6 2148 0.1912	0.685 280. 411.	77.9 2168 0.1895	0.685 280. 411.	78.1 2190 0.1876	0.685 280. 411.	78.4 2215 0.1854	0.685 280. 411.	78.7 2243 0.1831	0.685 280. 411.
240	76.5 2160 0.1844	0.659 280. 398.	76.7 2179 0.1827	0.659 280. 398.	76.9 2202 0.1809	0.659 280. 398.	77.2 2227 0.1788	0.659 280. 398.	77.6 2256 0.1765	0.659 280. 398.
220	75.3 2171 0.1778	0.634 280. 386.	75.5 2191 0.1763	0.634 280. 386.	75.7 2212 0.1746	0.634 280. 386.	76.0 2238 0.1726	0.634 280. 386.	76.4 2266 0.1704	0.634 280. 386.
200	74.0 2182 0.1716	0.610 280. 375.	74.3 2201 0.1702	0.610 280. 375.	74.5 2222 0.1686	0.610 280. 375.	74.8 2246 0.1667	0.610 280. 375.	75.1 2274 0.1647	0.610 280. 375.
180	72.8 2189 0.1660	0.587 280. 363.	73.0 2207 0.1647	0.587 280. 363.	73.2 2228 0.1631	0.587 280. 363.	73.5 2251 0.1614	0.587 280. 363.	73.8 2278 0.1595	0.587 280. 363.
160	71.5 2197 0.1605	0.565 280. 353.	71.7 2214 0.1592	0.565 280. 353.	71.9 2235 0.1578	0.565 280. 353.	72.2 2257 0.1562	0.565 280. 353.	72.5 2282 0.1545	0.565 280. 353.
140	70.1 2209 0.1549	0.544 280. 342.	70.3 2226 0.1537	0.544 280. 342.	70.5 2245 0.1524	0.544 280. 342.	70.8 2267 0.1510	0.544 280. 342.	71.1 2291 0.1494	0.544 280. 342.
120	68.7 2224 0.1494	0.525 280. 332.	68.9 2241 0.1483	0.525 280. 332.	69.2 2259 0.1471	0.525 280. 332.	69.4 2280 0.1457	0.525 280. 332.	69.7 2304 0.1442	0.525 280. 332.
100	67.4 2242 0.1439	0.506 280. 323.	67.6 2258 0.1429	0.506 280. 323.	67.8 2276 0.1418	0.506 280. 323.	68.1 2297 0.1405	0.506 280. 323.	68.3 2320 0.1391	0.506 280. 323.

bd100_aeo_cr280_IMP_hw_FL_00 – 02/02/2004

Figure 04-06-02. Cruise Performance—280 KIAS (Sheet 4 of 12)

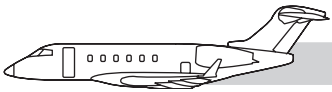
CRUISE 280 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C	%N1	MACH
	30% C.G.	LB/HR	KIAS
		NAM/LB	KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350	84.0	0.821	84.2	0.821	84.4	0.821	84.6	0.821	84.9	0.821
	2144	280.	2160	280.	2177	280.	2196	280.	2220	280.
	0.2233	479.	0.2216	479.	0.2200	479.	0.2180	479.	0.2156	479.
330	82.1	0.789	82.3	0.789	82.5	0.789	82.8	0.789	83.0	0.789
	2097	280.	2114	280.	2132	280.	2151	280.	2171	280.
	0.2211	464.	0.2193	464.	0.2175	464.	0.2156	464.	0.2136	464.
310	80.7	0.757	80.9	0.757	81.1	0.757	81.3	0.757	81.5	0.757
	2087	280.	2103	280.	2119	280.	2136	280.	2153	280.
	0.2152	449.	0.2136	449.	0.2120	449.	0.2103	449.	0.2086	449.
290	79.3	0.727	79.5	0.727	79.7	0.727	80.0	0.727	80.2	0.727
	2085	280.	2101	280.	2118	280.	2135	280.	2154	280.
	0.2087	435.	0.2071	435.	0.2054	435.	0.2038	435.	0.2020	435.
280	78.7	0.713	78.9	0.713	79.1	0.713	79.3	0.713	79.5	0.713
	2090	280.	2105	280.	2121	280.	2138	280.	2156	280.
	0.2050	428.	0.2034	428.	0.2019	428.	0.2003	428.	0.1987	428.
260	77.5	0.685	77.7	0.685	77.9	0.685	78.1	0.685	78.3	0.685
	2103	280.	2118	280.	2132	280.	2148	280.	2163	280.
	0.1973	415.	0.1960	415.	0.1947	415.	0.1933	415.	0.1919	415.
240	76.4	0.659	76.6	0.659	76.7	0.659	76.9	0.659	77.1	0.659
	2118	280.	2132	280.	2146	280.	2160	280.	2176	280.
	0.1900	402.	0.1887	402.	0.1875	402.	0.1862	402.	0.1849	402.
220	75.2	0.634	75.4	0.634	75.5	0.634	75.7	0.634	75.9	0.634
	2130	280.	2144	280.	2158	280.	2172	280.	2188	280.
	0.1831	390.	0.1819	390.	0.1808	390.	0.1796	390.	0.1783	390.
200	74.0	0.610	74.1	0.610	74.3	0.610	74.4	0.610	74.6	0.610
	2141	280.	2154	280.	2168	280.	2183	280.	2198	280.
	0.1767	378.	0.1756	378.	0.1745	378.	0.1733	378.	0.1721	378.
180	72.7	0.587	72.8	0.587	73.0	0.587	73.2	0.587	73.4	0.587
	2148	280.	2162	280.	2175	280.	2190	280.	2205	280.
	0.1708	367.	0.1697	367.	0.1687	367.	0.1676	367.	0.1664	367.
160	71.3	0.565	71.5	0.565	71.7	0.565	71.8	0.565	72.0	0.565
	2157	280.	2171	280.	2185	280.	2199	280.	2213	280.
	0.1650	356.	0.1640	356.	0.1629	356.	0.1619	356.	0.1608	356.
140	70.0	0.544	70.1	0.544	70.3	0.544	70.5	0.544	70.6	0.544
	2170	280.	2184	280.	2197	280.	2210	280.	2225	280.
	0.1592	346.	0.1582	346.	0.1573	346.	0.1563	346.	0.1553	346.
120	68.6	0.525	68.7	0.525	68.9	0.525	69.1	0.525	69.3	0.525
	2186	280.	2199	280.	2212	280.	2225	280.	2239	280.
	0.1535	336.	0.1525	336.	0.1516	336.	0.1507	336.	0.1498	336.
100	67.2	0.506	67.4	0.506	67.5	0.506	67.7	0.506	67.9	0.506
	2201	280.	2215	280.	2228	280.	2241	280.	2255	280.
	0.1480	326.	0.1471	326.	0.1462	326.	0.1453	326.	0.1444	326.

bd100_aeo_cr280_tMP_lw_FL_05 – 02/02/2004

Figure 04-06-02. Cruise Performance—280 KIAS (Sheet 5 of 12)



CRUISE 280 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C	%N1	MACH
	30% C.G.	LB/HR	KIAS
		NAM/LB	KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350	85.3	0.821	85.7	0.821	86.3	0.821	86.9	0.821	87.6	0.821
	2252	280.	2292	280.	2341	280.	2400	280.	2464	280.
	0.2126	479.	0.2089	479.	0.2045	479.	0.1995	479.	0.1943	479.
330	83.3	0.789	83.6	0.789	83.9	0.789	84.2	0.789	84.6	0.789
	2192	280.	2215	280.	2242	280.	2271	280.	2304	280.
	0.2115	464.	0.2093	464.	0.2068	464.	0.2041	464.	0.2012	464.
310	81.8	0.757	82.0	0.757	82.3	0.757	82.7	0.757	83.0	0.757
	2172	280.	2195	280.	2220	280.	2249	280.	2279	280.
	0.2067	449.	0.2046	449.	0.2023	449.	0.1997	449.	0.1970	449.
290	80.4	0.727	80.7	0.727	81.0	0.727	81.3	0.727	81.6	0.727
	2174	280.	2195	280.	2218	280.	2244	280.	2273	280.
	0.2002	435.	0.1982	435.	0.1962	435.	0.1939	435.	0.1914	435.
280	79.8	0.713	80.0	0.713	80.3	0.713	80.6	0.713	80.9	0.713
	2175	280.	2195	280.	2219	280.	2245	280.	2273	280.
	0.1969	428.	0.1951	428.	0.1930	428.	0.1908	428.	0.1885	428.
260	78.5	0.685	78.7	0.685	79.0	0.685	79.3	0.685	79.6	0.685
	2182	280.	2201	280.	2224	280.	2250	280.	2278	280.
	0.1903	415.	0.1886	415.	0.1866	415.	0.1845	415.	0.1822	415.
240	77.3	0.659	77.5	0.659	77.8	0.659	78.1	0.659	78.4	0.659
	2193	280.	2213	280.	2235	280.	2261	280.	2291	280.
	0.1834	402.	0.1818	402.	0.1800	402.	0.1779	402.	0.1756	402.
220	76.1	0.634	76.3	0.634	76.6	0.634	76.8	0.634	77.2	0.634
	2205	280.	2224	280.	2246	280.	2272	280.	2301	280.
	0.1769	390.	0.1754	390.	0.1737	390.	0.1717	390.	0.1696	390.
200	74.8	0.610	75.0	0.610	75.3	0.610	75.6	0.610	75.9	0.610
	2215	280.	2234	280.	2255	280.	2280	280.	2308	280.
	0.1708	378.	0.1693	378.	0.1677	378.	0.1659	378.	0.1639	378.
180	73.6	0.587	73.8	0.587	74.0	0.587	74.3	0.587	74.6	0.587
	2221	280.	2240	280.	2261	280.	2285	280.	2312	280.
	0.1652	367.	0.1638	367.	0.1623	367.	0.1606	367.	0.1587	367.
160	72.2	0.565	72.4	0.565	72.6	0.565	72.9	0.565	73.2	0.565
	2230	280.	2247	280.	2268	280.	2291	280.	2317	280.
	0.1597	356.	0.1584	356.	0.1570	356.	0.1554	356.	0.1537	356.
140	70.8	0.544	71.0	0.544	71.3	0.544	71.5	0.544	71.8	0.544
	2240	280.	2258	280.	2278	280.	2300	280.	2324	280.
	0.1542	346.	0.1530	346.	0.1517	346.	0.1502	346.	0.1486	346.
120	69.4	0.525	69.7	0.525	69.9	0.525	70.2	0.525	70.4	0.525
	2254	280.	2271	280.	2290	280.	2311	280.	2336	280.
	0.1488	336.	0.1477	336.	0.1465	336.	0.1451	336.	0.1436	336.
100	68.1	0.506	68.3	0.506	68.5	0.506	68.8	0.506	69.1	0.506
	2270	280.	2287	280.	2306	280.	2327	280.	2351	280.
	0.1435	326.	0.1424	326.	0.1413	326.	0.1400	326.	0.1385	326.

bd100_aeo_cr280_IMP_hw_FL_05 – 02/02/2004

Figure 04-06-02. Cruise Performance—280 KIAS (Sheet 6 of 12)

CRUISE 280 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350	86.2 2290 0.2114	0.821 280. 484.	86.7 2330 0.2078	0.821 280. 484.	87.2 2379 0.2034	0.821 280. 484.	87.9 2439 0.1985	0.821 280. 484.	88.6 2504 0.1933	0.821 280. 484.
330	84.2 2228 0.2103	0.789 280. 469.	84.5 2252 0.2081	0.789 280. 469.	84.8 2279 0.2057	0.789 280. 469.	85.1 2308 0.2031	0.789 280. 469.	85.5 2341 0.2002	0.789 280. 469.
310	82.7 2209 0.2055	0.757 280. 454.	82.9 2232 0.2034	0.757 280. 454.	83.2 2257 0.2012	0.757 280. 454.	83.6 2285 0.1987	0.757 280. 454.	83.9 2316 0.1960	0.757 280. 454.
290	81.3 2209 0.1990	0.727 280. 440.	81.6 2231 0.1971	0.727 280. 440.	81.9 2255 0.1950	0.727 280. 440.	82.2 2282 0.1927	0.727 280. 440.	82.5 2311 0.1903	0.727 280. 440.
280	80.6 2210 0.1958	0.713 280. 433.	80.9 2231 0.1940	0.713 280. 433.	81.2 2255 0.1919	0.713 280. 433.	81.5 2281 0.1897	0.713 280. 433.	81.8 2310 0.1874	0.713 280. 433.
260	79.3 2216 0.1892	0.685 280. 419.	79.6 2236 0.1876	0.685 280. 419.	79.8 2259 0.1856	0.685 280. 419.	80.1 2285 0.1835	0.685 280. 419.	80.5 2314 0.1812	0.685 280. 419.
240	78.1 2227 0.1825	0.659 280. 406.	78.3 2247 0.1809	0.659 280. 406.	78.6 2270 0.1791	0.659 280. 406.	78.9 2296 0.1770	0.659 280. 406.	79.2 2326 0.1747	0.659 280. 406.
220	76.9 2238 0.1761	0.634 280. 394.	77.1 2257 0.1745	0.634 280. 394.	77.4 2280 0.1728	0.634 280. 394.	77.7 2306 0.1708	0.634 280. 394.	78.0 2335 0.1687	0.634 280. 394.
200	75.6 2248 0.1699	0.610 280. 382.	75.9 2267 0.1685	0.610 280. 382.	76.1 2289 0.1669	0.610 280. 382.	76.4 2314 0.1651	0.610 280. 382.	76.8 2343 0.1631	0.610 280. 382.
180	74.3 2254 0.1644	0.587 280. 370.	74.5 2272 0.1631	0.587 280. 370.	74.7 2294 0.1615	0.587 280. 370.	75.0 2318 0.1598	0.587 280. 370.	75.3 2345 0.1580	0.587 280. 370.
160	72.9 2262 0.1589	0.565 280. 360.	73.1 2279 0.1577	0.565 280. 360.	73.3 2300 0.1562	0.565 280. 360.	73.6 2323 0.1547	0.565 280. 360.	73.9 2349 0.1530	0.565 280. 360.
140	71.5 2272 0.1535	0.544 280. 349.	71.7 2289 0.1523	0.544 280. 349.	72.0 2309 0.1510	0.544 280. 349.	72.2 2332 0.1496	0.544 280. 349.	72.5 2357 0.1480	0.544 280. 349.
120	70.1 2285 0.1481	0.525 280. 339.	70.3 2303 0.1470	0.525 280. 339.	70.6 2322 0.1458	0.525 280. 339.	70.8 2344 0.1444	0.525 280. 339.	71.1 2369 0.1429	0.525 280. 339.
100	68.7 2302 0.1428	0.506 280. 329.	68.9 2319 0.1417	0.506 280. 329.	69.2 2338 0.1406	0.506 280. 329.	69.4 2360 0.1393	0.506 280. 329.	69.7 2385 0.1378	0.506 280. 329.

bd100_aeo_cr280_IMP_hw_FL_10 – 02/02/2004

Figure 04-06-02. Cruise Performance—280 KIAS (Sheet 7 of 12)

CRUISE 280 KIAS			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350	86.2 2290 0.2114	0.821 280. 484.	86.7 2330 0.2078	0.821 280. 484.	87.2 2379 0.2034	0.821 280. 484.	87.9 2439 0.1985	0.821 280. 484.	88.6 2504 0.1933	0.821 280. 484.
330	84.2 2228 0.2103	0.789 280. 469.	84.5 2252 0.2081	0.789 280. 469.	84.8 2279 0.2057	0.789 280. 469.	85.1 2308 0.2031	0.789 280. 469.	85.5 2341 0.2002	0.789 280. 469.
310	82.7 2209 0.2055	0.757 280. 454.	82.9 2232 0.2034	0.757 280. 454.	83.2 2257 0.2012	0.757 280. 454.	83.6 2285 0.1987	0.757 280. 454.	83.9 2316 0.1960	0.757 280. 454.
290	81.3 2209 0.1990	0.727 280. 440.	81.6 2231 0.1971	0.727 280. 440.	81.9 2255 0.1950	0.727 280. 440.	82.2 2282 0.1927	0.727 280. 440.	82.5 2311 0.1903	0.727 280. 440.
280	80.6 2210 0.1958	0.713 280. 433.	80.9 2231 0.1940	0.713 280. 433.	81.2 2255 0.1919	0.713 280. 433.	81.5 2281 0.1897	0.713 280. 433.	81.8 2310 0.1874	0.713 280. 433.
260	79.3 2216 0.1892	0.685 280. 419.	79.6 2236 0.1876	0.685 280. 419.	79.8 2259 0.1856	0.685 280. 419.	80.1 2285 0.1835	0.685 280. 419.	80.5 2314 0.1812	0.685 280. 419.
240	78.1 2227 0.1825	0.659 280. 406.	78.3 2247 0.1809	0.659 280. 406.	78.6 2270 0.1791	0.659 280. 406.	78.9 2296 0.1770	0.659 280. 406.	79.2 2326 0.1747	0.659 280. 406.
220	76.9 2238 0.1761	0.634 280. 394.	77.1 2257 0.1745	0.634 280. 394.	77.4 2280 0.1728	0.634 280. 394.	77.7 2306 0.1708	0.634 280. 394.	78.0 2335 0.1687	0.634 280. 394.
200	75.6 2248 0.1699	0.610 280. 382.	75.9 2267 0.1685	0.610 280. 382.	76.1 2289 0.1669	0.610 280. 382.	76.4 2314 0.1651	0.610 280. 382.	76.8 2343 0.1631	0.610 280. 382.
180	74.3 2254 0.1644	0.587 280. 370.	74.5 2272 0.1631	0.587 280. 370.	74.7 2294 0.1615	0.587 280. 370.	75.0 2318 0.1598	0.587 280. 370.	75.3 2345 0.1580	0.587 280. 370.
160	72.9 2262 0.1589	0.565 280. 360.	73.1 2279 0.1577	0.565 280. 360.	73.3 2300 0.1562	0.565 280. 360.	73.6 2323 0.1547	0.565 280. 360.	73.9 2349 0.1530	0.565 280. 360.
140	71.5 2272 0.1535	0.544 280. 349.	71.7 2289 0.1523	0.544 280. 349.	72.0 2309 0.1510	0.544 280. 349.	72.2 2332 0.1496	0.544 280. 349.	72.5 2357 0.1480	0.544 280. 349.
120	70.1 2285 0.1481	0.525 280. 339.	70.3 2303 0.1470	0.525 280. 339.	70.6 2322 0.1458	0.525 280. 339.	70.8 2344 0.1444	0.525 280. 339.	71.1 2369 0.1429	0.525 280. 339.
100	68.7 2302 0.1428	0.506 280. 329.	68.9 2319 0.1417	0.506 280. 329.	69.2 2338 0.1405	0.506 280. 329.	69.4 2360 0.1393	0.506 280. 329.	69.7 2385 0.1378	0.506 280. 329.

bd100_aeo_cr280_IMP_hw_FL_10 – 02/02/2004

Figure 04-06-02. Cruise Performance—280 KIAS (Sheet 8 of 12)

CRUISE 280 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF

ISA + 15 C

30% C.G.

%N1 MACH
LB/HR KIAS
NAM/LB KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350	86.8	0.821	86.0	0.821	86.2	0.821	86.5	0.821	86.8	0.821
	2216	280.	2232	280.	2249	280.	2269	280.	2295	280.
	0.2208	489.	0.2192	489.	0.2176	489.	0.2156	489.	0.2132	489.
330	83.9	0.789	84.1	0.789	84.4	0.789	84.6	0.789	84.8	0.789
	2168	280.	2186	280.	2204	280.	2222	280.	2243	280.
	0.2185	474.	0.2167	474.	0.2150	474.	0.2132	474.	0.2112	474.
310	82.5	0.757	82.7	0.757	82.9	0.757	83.1	0.757	83.3	0.757
	2156	280.	2172	280.	2189	280.	2206	280.	2224	280.
	0.2127	459.	0.2111	459.	0.2096	459.	0.2080	459.	0.2062	459.
290	81.1	0.727	81.3	0.727	81.5	0.727	81.7	0.727	81.9	0.727
	2154	280.	2171	280.	2188	280.	2206	280.	2225	280.
	0.2062	444.	0.2046	444.	0.2030	444.	0.2014	444.	0.1996	444.
280	80.5	0.713	80.7	0.713	80.9	0.713	81.1	0.713	81.3	0.713
	2159	280.	2175	280.	2191	280.	2208	280.	2227	280.
	0.2026	437.	0.2010	437.	0.1995	437.	0.1980	437.	0.1964	437.
260	79.2	0.685	79.4	0.685	79.6	0.685	79.8	0.685	80.0	0.685
	2171	280.	2186	280.	2201	280.	2217	280.	2233	280.
	0.1951	424.	0.1938	424.	0.1925	424.	0.1911	424.	0.1897	424.
240	78.1	0.659	78.2	0.659	78.4	0.659	78.6	0.659	78.7	0.659
	2183	280.	2197	280.	2212	280.	2227	280.	2243	280.
	0.1880	410.	0.1868	410.	0.1856	410.	0.1843	410.	0.1830	410.
220	76.8	0.634	77.0	0.634	77.2	0.634	77.3	0.634	77.5	0.634
	2194	280.	2209	280.	2224	280.	2238	280.	2254	280.
	0.1813	398.	0.1801	398.	0.1789	398.	0.1777	398.	0.1765	398.
200	75.5	0.610	75.7	0.610	75.9	0.610	76.1	0.610	76.3	0.610
	2203	280.	2217	280.	2232	280.	2247	280.	2263	280.
	0.1751	386.	0.1739	386.	0.1728	386.	0.1716	386.	0.1704	386.
180	74.1	0.587	74.3	0.587	74.5	0.587	74.6	0.587	74.8	0.587
	2211	280.	2226	280.	2239	280.	2254	280.	2270	280.
	0.1691	374.	0.1680	374.	0.1670	374.	0.1659	374.	0.1647	374.
160	72.7	0.565	72.9	0.565	73.1	0.565	73.2	0.565	73.4	0.565
	2219	280.	2233	280.	2248	280.	2262	280.	2277	280.
	0.1635	363.	0.1624	363.	0.1614	363.	0.1604	363.	0.1593	363.
140	71.3	0.544	71.5	0.544	71.7	0.544	71.8	0.544	72.0	0.544
	2232	280.	2246	280.	2259	280.	2273	280.	2288	280.
	0.1577	352.	0.1567	352.	0.1558	352.	0.1548	352.	0.1538	352.
120	69.9	0.525	70.1	0.525	70.3	0.525	70.4	0.525	70.6	0.525
	2246	280.	2260	280.	2274	280.	2288	280.	2303	280.
	0.1521	342.	0.1511	342.	0.1502	342.	0.1493	342.	0.1484	342.
100	68.5	0.506	68.7	0.506	68.9	0.506	69.1	0.506	69.2	0.506
	2264	280.	2278	280.	2292	280.	2306	280.	2320	280.
	0.1465	332.	0.1456	332.	0.1447	332.	0.1438	332.	0.1429	332.

bd100_aeo_cr280_IMP_lw_FL_15 – 02/02/2004

Figure 04-06-02. Cruise Performance—280 KIAS (Sheet 9 of 12)

CRUISE 280 KIAS			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350	87.1 2328 0.2102	0.821 280. 489.	87.6 2368 0.2067	0.821 280. 489.	88.2 2417 0.2024	0.821 280. 489.	88.8 2477 0.1975	0.821 280. 489.	89.5 2544 0.1924	0.821 280. 489.
330	85.1 2265 0.2092	0.789 280. 474.	85.4 2289 0.2070	0.789 280. 474.	85.7 2315 0.2046	0.789 280. 474.	86.1 2345 0.2020	0.789 280. 474.	86.4 2379 0.1991	0.789 280. 474.
310	83.5 2245 0.2044	0.757 280. 459.	83.8 2268 0.2023	0.757 280. 459.	84.1 2293 0.2000	0.757 280. 459.	84.5 2322 0.1976	0.757 280. 459.	84.8 2353 0.1949	0.757 280. 459.
290	82.2 2245 0.1979	0.727 280. 444.	82.5 2267 0.1960	0.727 280. 444.	82.7 2291 0.1940	0.727 280. 444.	83.1 2318 0.1917	0.727 280. 444.	83.4 2348 0.1892	0.727 280. 444.
280	81.5 2246 0.1947	0.713 280. 437.	81.8 2267 0.1928	0.713 280. 437.	82.1 2291 0.1908	0.713 280. 437.	82.4 2318 0.1886	0.713 280. 437.	82.7 2347 0.1863	0.713 280. 437.
260	80.2 2252 0.1881	0.685 280. 424.	80.4 2272 0.1864	0.685 280. 424.	80.7 2296 0.1845	0.685 280. 424.	81.0 2322 0.1824	0.685 280. 424.	81.3 2351 0.1801	0.685 280. 424.
240	78.9 2261 0.1815	0.659 280. 410.	79.2 2281 0.1799	0.659 280. 410.	79.4 2304 0.1781	0.659 280. 410.	79.7 2331 0.1761	0.659 280. 410.	80.1 2361 0.1738	0.659 280. 410.
220	77.7 2272 0.1751	0.634 280. 398.	77.9 2291 0.1736	0.634 280. 398.	78.2 2314 0.1719	0.634 280. 398.	78.5 2340 0.1700	0.634 280. 398.	78.8 2369 0.1679	0.634 280. 398.
200	76.5 2281 0.1691	0.610 280. 386.	76.7 2300 0.1677	0.610 280. 386.	76.9 2322 0.1661	0.610 280. 386.	77.2 2348 0.1643	0.610 280. 386.	77.5 2376 0.1623	0.610 280. 386.
180	75.0 2287 0.1635	0.587 280. 374.	75.3 2306 0.1622	0.587 280. 374.	75.5 2327 0.1607	0.587 280. 374.	75.8 2352 0.1590	0.587 280. 374.	76.1 2380 0.1572	0.587 280. 374.
160	73.6 2293 0.1582	0.565 280. 363.	73.8 2312 0.1569	0.565 280. 363.	74.1 2333 0.1555	0.565 280. 363.	74.4 2357 0.1539	0.565 280. 363.	74.7 2384 0.1522	0.565 280. 363.
140	72.2 2304 0.1528	0.544 280. 352.	72.4 2322 0.1516	0.544 280. 352.	72.7 2343 0.1502	0.544 280. 352.	72.9 2366 0.1488	0.544 280. 352.	73.2 2391 0.1472	0.544 280. 352.
120	70.8 2318 0.1473	0.525 280. 342.	71.0 2336 0.1462	0.525 280. 342.	71.3 2355 0.1450	0.525 280. 342.	71.5 2378 0.1437	0.525 280. 342.	71.8 2402 0.1422	0.525 280. 342.
100	69.4 2336 0.1420	0.506 280. 332.	69.6 2353 0.1409	0.506 280. 332.	69.8 2372 0.1398	0.506 280. 332.	70.1 2394 0.1385	0.506 280. 332.	70.4 2419 0.1371	0.506 280. 332.

bd100_aeo_cr280_IMP_hw_FL_15 – 02/02/2004

Figure 04-06-02. Cruise Performance—280 KIAS (Sheet 10 of 12)

CRUISE 280 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF

ISA + 20 C

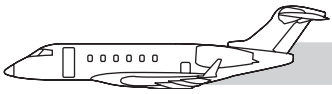
30% C.G.

%N1 MACH
LB/HR KIAS
NAM/LB KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350	86.8	0.821	87.0	0.821	87.2	0.821	87.4	0.821	87.7	0.821
	2253	280.	2269	280.	2286	280.	2307	280.	2332	280.
	0.2195	495.	0.2180	495.	0.2163	495.	0.2144	495.	0.2121	495.
330	84.8	0.789	85.0	0.789	85.3	0.789	85.5	0.789	85.8	0.789
	2202	280.	2221	280.	2239	280.	2258	280.	2279	280.
	0.2173	479.	0.2156	479.	0.2138	479.	0.2120	479.	0.2101	479.
310	83.3	0.757	83.5	0.757	83.7	0.757	84.0	0.757	84.2	0.757
	2191	280.	2207	280.	2224	280.	2241	280.	2260	280.
	0.2115	464.	0.2100	464.	0.2084	464.	0.2068	464.	0.2051	464.
290	81.9	0.727	82.1	0.727	82.3	0.727	82.6	0.727	82.8	0.727
	2188	280.	2205	280.	2223	280.	2241	280.	2260	280.
	0.2051	449.	0.2035	449.	0.2019	449.	0.2003	449.	0.1985	449.
280	81.3	0.713	81.5	0.713	81.7	0.713	81.9	0.713	82.1	0.713
	2193	280.	2209	280.	2226	280.	2244	280.	2262	280.
	0.2014	442.	0.1999	442.	0.1984	442.	0.1968	442.	0.1952	442.
260	80.1	0.685	80.2	0.685	80.4	0.685	80.6	0.685	80.8	0.685
	2205	280.	2220	280.	2235	280.	2251	280.	2267	280.
	0.1940	428.	0.1927	428.	0.1914	428.	0.1900	428.	0.1887	428.
240	78.9	0.659	79.0	0.659	79.2	0.659	79.4	0.659	79.6	0.659
	2217	280.	2232	280.	2246	280.	2261	280.	2277	280.
	0.1869	414.	0.1857	414.	0.1845	414.	0.1833	414.	0.1820	414.
220	77.6	0.634	77.8	0.634	78.0	0.634	78.1	0.634	78.3	0.634
	2227	280.	2242	280.	2256	280.	2271	280.	2288	280.
	0.1803	402.	0.1791	402.	0.1780	402.	0.1768	402.	0.1756	402.
200	76.3	0.610	76.5	0.610	76.7	0.610	76.8	0.610	77.0	0.610
	2236	280.	2251	280.	2265	280.	2281	280.	2297	280.
	0.1741	389.	0.1730	389.	0.1718	389.	0.1707	389.	0.1695	389.
180	75.0	0.587	75.1	0.587	75.3	0.587	75.5	0.587	75.7	0.587
	2241	280.	2256	280.	2270	280.	2286	280.	2302	280.
	0.1685	378.	0.1673	378.	0.1663	378.	0.1651	378.	0.1640	378.
160	73.5	0.565	73.7	0.565	73.9	0.565	74.0	0.565	74.2	0.565
	2250	280.	2265	280.	2279	280.	2294	280.	2309	280.
	0.1627	366.	0.1616	366.	0.1606	366.	0.1596	366.	0.1586	366.
140	72.1	0.544	72.2	0.544	72.4	0.544	72.6	0.544	72.8	0.544
	2264	280.	2278	280.	2291	280.	2305	280.	2320	280.
	0.1569	355.	0.1559	355.	0.1550	355.	0.1541	355.	0.1531	355.
120	70.6	0.525	70.8	0.525	70.9	0.525	71.1	0.525	71.3	0.525
	2278	280.	2292	280.	2306	280.	2320	280.	2334	280.
	0.1513	345.	0.1504	345.	0.1495	345.	0.1486	345.	0.1476	345.
100	69.1	0.506	69.3	0.506	69.5	0.506	69.6	0.506	69.8	0.506
	2291	280.	2306	280.	2320	280.	2334	280.	2348	280.
	0.1460	335.	0.1451	335.	0.1442	335.	0.1433	335.	0.1424	335.

bd100_aeo_cr280_IMP_lw_FL_20 - 02/02/2004

Figure 04-06-02. Cruise Performance—280 KIAS (Sheet 11 of 12)



CRUISE 280 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350	88.1 2365 0.2091	0.821 280. 495.	88.5 2406 0.2055	0.821 280. 495.	89.1 2456 0.2013	0.821 280. 495.				
330	86.0 2301 0.2081	0.789 280. 479.	86.3 2325 0.2059	0.789 280. 479.	86.6 2352 0.2035	0.789 280. 479.	87.0 2383 0.2009	0.789 280. 479.	87.3 2417 0.1981	0.789 280. 479.
310	84.4 2280 0.2032	0.757 280. 464.	84.7 2304 0.2012	0.757 280. 464.	85.0 2330 0.1989	0.757 280. 464.	85.4 2359 0.1965	0.757 280. 464.	85.7 2391 0.1939	0.757 280. 464.
290	83.0 2281 0.1967	0.727 280. 449.	83.3 2303 0.1948	0.727 280. 449.	83.6 2327 0.1928	0.727 280. 449.	83.9 2354 0.1906	0.727 280. 449.	84.3 2385 0.1882	0.727 280. 449.
280	82.4 2282 0.1935	0.713 280. 442.	82.6 2304 0.1917	0.713 280. 442.	82.9 2328 0.1897	0.713 280. 442.	83.2 2355 0.1875	0.713 280. 442.	83.6 2384 0.1852	0.713 280. 442.
260	81.0 2287 0.1871	0.685 280. 428.	81.3 2307 0.1854	0.685 280. 428.	81.5 2331 0.1835	0.685 280. 428.	81.8 2358 0.1814	0.685 280. 428.	82.2 2388 0.1791	0.685 280. 428.
240	79.8 2296 0.1805	0.659 280. 414.	80.0 2317 0.1789	0.659 280. 414.	80.3 2340 0.1771	0.659 280. 414.	80.6 2367 0.1751	0.659 280. 414.	80.9 2398 0.1729	0.659 280. 414.
220	78.5 2305 0.1742	0.634 280. 402.	78.7 2326 0.1727	0.634 280. 402.	79.0 2348 0.1710	0.634 280. 402.	79.3 2375 0.1691	0.634 280. 402.	79.6 2405 0.1670	0.634 280. 402.
200	77.2 2315 0.1682	0.610 280. 389.	77.5 2334 0.1668	0.610 280. 389.	77.7 2356 0.1652	0.610 280. 389.	78.0 2382 0.1634	0.610 280. 389.	78.3 2411 0.1614	0.610 280. 389.
180	75.8 2319 0.1628	0.587 280. 378.	76.1 2339 0.1614	0.587 280. 378.	76.3 2361 0.1599	0.587 280. 378.	76.6 2386 0.1582	0.587 280. 378.	76.9 2414 0.1563	0.587 280. 378.
160	74.4 2325 0.1574	0.565 280. 366.	74.6 2343 0.1562	0.565 280. 366.	74.9 2365 0.1548	0.565 280. 366.	75.1 2389 0.1532	0.565 280. 366.	75.4 2416 0.1515	0.565 280. 366.
140	73.0 2336 0.1520	0.544 280. 355.	73.2 2354 0.1509	0.544 280. 355.	73.4 2374 0.1496	0.544 280. 355.	73.7 2397 0.1482	0.544 280. 355.	74.0 2423 0.1466	0.544 280. 355.
120	71.5 2350 0.1466	0.525 280. 345.	71.7 2368 0.1455	0.525 280. 345.	72.0 2388 0.1443	0.525 280. 345.	72.2 2410 0.1430	0.525 280. 345.	72.5 2435 0.1415	0.525 280. 345.
100	70.0 2364 0.1415	0.506 280. 335.	70.2 2382 0.1404	0.506 280. 335.	70.5 2402 0.1393	0.506 280. 335.	70.7 2424 0.1380	0.506 280. 335.	71.0 2450 0.1365	0.506 280. 335.

bd100_aeo_cr280_IMP_hw_FL_20 – 02/02/2004

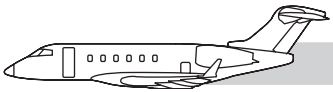
Figure 04-06-02. Cruise Performance—280 KIAS (Sheet 12 of 12)

CRUISE 300 KIAS			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350										
330										
310	80.9 2301 0.2010	0.806 300. 463.	81.1 2317 0.1996	0.806 300. 463.	81.3 2333 0.1983	0.806 300. 463.	81.4 2348 0.1970	0.806 300. 463.	81.6 2363 0.1958	0.806 300. 463.
290	79.3 2270 0.1976	0.775 300. 449.	79.5 2287 0.1962	0.775 300. 449.	79.7 2303 0.1949	0.775 300. 449.	79.8 2319 0.1935	0.775 300. 449.	80.0 2334 0.1922	0.775 300. 449.
280	78.7 2269 0.1947	0.760 300. 442.	78.8 2285 0.1934	0.760 300. 442.	79.0 2301 0.1921	0.760 300. 442.	79.2 2316 0.1908	0.760 300. 442.	79.4 2332 0.1895	0.760 300. 442.
260	77.3 2265 0.1892	0.731 300. 429.	77.5 2282 0.1879	0.731 300. 429.	77.7 2298 0.1865	0.731 300. 429.	77.9 2315 0.1852	0.731 300. 429.	78.1 2331 0.1839	0.731 300. 429.
240	76.3 2281 0.1824	0.703 300. 416.	76.4 2297 0.1811	0.703 300. 416.	76.6 2312 0.1799	0.703 300. 416.	76.8 2327 0.1788	0.703 300. 416.	76.9 2342 0.1777	0.703 300. 416.
220	75.2 2298 0.1757	0.677 300. 404.	75.4 2312 0.1746	0.677 300. 404.	75.5 2327 0.1735	0.677 300. 404.	75.7 2340 0.1725	0.677 300. 404.	75.8 2354 0.1715	0.677 300. 404.
200	74.2 2314 0.1694	0.651 300. 392.	74.4 2329 0.1683	0.651 300. 392.	74.5 2343 0.1673	0.651 300. 392.	74.6 2357 0.1663	0.651 300. 392.	74.8 2370 0.1653	0.651 300. 392.
180	73.0 2327 0.1635	0.627 300. 381.	73.2 2342 0.1625	0.627 300. 381.	73.4 2356 0.1615	0.627 300. 381.	73.5 2370 0.1605	0.627 300. 381.	73.7 2383 0.1596	0.627 300. 381.
160	71.9 2336 0.1581	0.604 300. 370.	72.1 2352 0.1571	0.604 300. 370.	72.2 2367 0.1561	0.604 300. 370.	72.4 2380 0.1552	0.604 300. 370.	72.5 2394 0.1544	0.604 300. 370.
140	70.6 2348 0.1529	0.582 300. 359.	70.8 2363 0.1519	0.582 300. 359.	71.0 2377 0.1510	0.582 300. 359.	71.1 2391 0.1501	0.582 300. 359.	71.2 2404 0.1493	0.582 300. 359.
120	69.3 2363 0.1476	0.561 300. 349.	69.5 2377 0.1467	0.561 300. 349.	69.7 2391 0.1458	0.561 300. 349.	69.8 2404 0.1450	0.561 300. 349.	70.0 2417 0.1442	0.561 300. 349.
100	68.0 2382 0.1423	0.541 300. 339.	68.2 2396 0.1414	0.541 300. 339.	68.4 2410 0.1406	0.541 300. 339.	68.5 2423 0.1398	0.541 300. 339.	68.7 2435 0.1391	0.541 300. 339.

bd100_aeo_cr300_IMP_lw_FL_m10 – 02/02/2004

Figure 04-06-03. Cruise Performance—300 KIAS (Sheet 1 of 12)



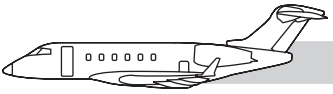
CRUISE 300 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C	%N1	MACH
	30% C.G.	LB/HR	KIAS
		NAM/LB	KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310	81.8 2380 0.1944	0.806 300. 463.	82.0 2398 0.1929	0.806 300. 463.	82.2 2419 0.1913	0.806 300. 463.	82.4 2442 0.1894	0.806 300. 463.	82.7 2470 0.1872	0.806 300. 463.
290	80.2 2351 0.1909	0.775 300. 449.	80.4 2368 0.1895	0.775 300. 449.	80.6 2388 0.1879	0.775 300. 449.	80.8 2409 0.1862	0.775 300. 449.	81.1 2432 0.1845	0.775 300. 449.
280	79.5 2347 0.1883	0.760 300. 442.	79.7 2364 0.1870	0.760 300. 442.	79.9 2382 0.1855	0.760 300. 442.	80.1 2402 0.1839	0.760 300. 442.	80.4 2424 0.1823	0.760 300. 442.
260	78.2 2347 0.1826	0.731 300. 429.	78.4 2365 0.1813	0.731 300. 429.	78.6 2384 0.1799	0.731 300. 429.	78.9 2403 0.1784	0.731 300. 429.	79.1 2425 0.1768	0.731 300. 429.
240	77.1 2356 0.1765	0.703 300. 416.	77.3 2372 0.1754	0.703 300. 416.	77.5 2390 0.1741	0.703 300. 416.	77.6 2408 0.1728	0.703 300. 416.	77.9 2428 0.1713	0.703 300. 416.
220	76.0 2368 0.1705	0.677 300. 404.	76.1 2383 0.1694	0.677 300. 404.	76.3 2399 0.1683	0.677 300. 404.	76.5 2417 0.1670	0.677 300. 404.	76.7 2437 0.1657	0.677 300. 404.
200	74.9 2384 0.1644	0.651 300. 392.	75.1 2398 0.1634	0.651 300. 392.	75.2 2414 0.1623	0.651 300. 392.	75.4 2432 0.1612	0.651 300. 392.	75.6 2451 0.1599	0.651 300. 392.
180	73.8 2398 0.1587	0.627 300. 381.	74.0 2412 0.1577	0.627 300. 381.	74.1 2428 0.1567	0.627 300. 381.	74.3 2445 0.1556	0.627 300. 381.	74.5 2465 0.1544	0.627 300. 381.
160	72.6 2408 0.1535	0.604 300. 370.	72.8 2423 0.1525	0.604 300. 370.	73.0 2439 0.1515	0.604 300. 370.	73.1 2455 0.1505	0.604 300. 370.	73.3 2475 0.1493	0.604 300. 370.
140	71.4 2418 0.1484	0.582 300. 359.	71.5 2432 0.1475	0.582 300. 359.	71.7 2448 0.1466	0.582 300. 359.	71.9 2465 0.1456	0.582 300. 359.	72.1 2483 0.1445	0.582 300. 359.
120	70.1 2431 0.1434	0.561 300. 349.	70.3 2445 0.1426	0.561 300. 349.	70.4 2460 0.1418	0.561 300. 349.	70.6 2476 0.1408	0.561 300. 349.	70.8 2494 0.1398	0.561 300. 349.
100	68.8 2448 0.1384	0.541 300. 339.	69.0 2462 0.1376	0.541 300. 339.	69.1 2476 0.1368	0.541 300. 339.	69.3 2491 0.1360	0.541 300. 339.	69.5 2508 0.1351	0.541 300. 339.

bd100_aeo_cr300_IMP_hw_FL_m10 – 02/02/2004

Figure 04-06-03. Cruise Performance—300 KIAS (Sheet 2 of 12)



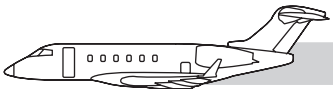
CRUISE 300 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350										
330										
310	82.9 2382 0.1986	0.806 300. 473.	83.0 2399 0.1973	0.806 300. 473.	83.2 2414 0.1960	0.806 300. 473.	83.4 2430 0.1947	0.806 300. 473.	83.6 2446 0.1935	0.806 300. 473.
290	81.2 2348 0.1953	0.775 300. 459.	81.4 2365 0.1939	0.775 300. 459.	81.6 2382 0.1926	0.775 300. 459.	81.7 2398 0.1913	0.775 300. 459.	81.9 2415 0.1900	0.775 300. 459.
280	80.5 2347 0.1925	0.760 300. 452.	80.7 2363 0.1912	0.760 300. 452.	80.9 2379 0.1899	0.760 300. 452.	81.0 2394 0.1887	0.760 300. 452.	81.2 2411 0.1874	0.760 300. 452.
260	79.1 2341 0.1871	0.731 300. 438.	79.3 2358 0.1858	0.731 300. 438.	79.5 2375 0.1844	0.731 300. 438.	79.7 2392 0.1832	0.731 300. 438.	79.9 2409 0.1819	0.731 300. 438.
240	78.0 2356 0.1803	0.703 300. 425.	78.2 2372 0.1791	0.703 300. 425.	78.3 2388 0.1779	0.703 300. 425.	78.5 2403 0.1768	0.703 300. 425.	78.7 2419 0.1757	0.703 300. 425.
220	76.9 2372 0.1738	0.677 300. 412.	77.1 2388 0.1727	0.677 300. 412.	77.2 2402 0.1716	0.677 300. 412.	77.4 2417 0.1706	0.677 300. 412.	77.5 2431 0.1696	0.677 300. 412.
200	75.8 2387 0.1676	0.651 300. 400.	76.0 2403 0.1665	0.651 300. 400.	76.1 2417 0.1655	0.651 300. 400.	76.3 2432 0.1645	0.651 300. 400.	76.4 2445 0.1636	0.651 300. 400.
180	74.6 2398 0.1619	0.627 300. 388.	74.8 2414 0.1608	0.627 300. 388.	74.9 2429 0.1599	0.627 300. 388.	75.1 2443 0.1589	0.627 300. 388.	75.2 2457 0.1580	0.627 300. 388.
160	73.4 2406 0.1567	0.604 300. 377.	73.6 2421 0.1557	0.604 300. 377.	73.7 2437 0.1547	0.604 300. 377.	73.9 2451 0.1538	0.604 300. 377.	74.0 2465 0.1529	0.604 300. 377.
140	72.1 2416 0.1515	0.582 300. 366.	72.3 2432 0.1505	0.582 300. 366.	72.4 2447 0.1496	0.582 300. 366.	72.6 2461 0.1487	0.582 300. 366.	72.7 2475 0.1479	0.582 300. 366.
120	70.8 2430 0.1463	0.561 300. 356.	71.0 2445 0.1454	0.561 300. 356.	71.1 2459 0.1445	0.561 300. 356.	71.3 2473 0.1437	0.661 300. 356.	71.4 2487 0.1429	0.561 300. 356.
100	69.5 2447 0.1411	0.541 300. 345.	69.6 2461 0.1403	0.541 300. 345.	69.8 2476 0.1395	0.541 300. 345.	69.9 2489 0.1387	0.541 300. 345.	70.1 2503 0.1380	0.541 300. 345.

bd100_aeo_cr300_IMP_lw_FL_00 – 02/02/2004

Figure 04-06-03. Cruise Performance—300 KIAS (Sheet 3 of 12)



CRUISE 300 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310	83.7 2462 0.1921	0.806 300. 473.	83.9 2481 0.1907	0.806 300. 473.	84.2 2503 0.1890	0.806 300. 473.	84.4 2527 0.1872	0.806 300. 473.	84.7 2556 0.1851	0.806 300. 473.
290	82.1 2432 0.1886	0.775 300. 459.	82.3 2450 0.1872	0.775 300. 459.	82.5 2470 0.1857	0.775 300. 459.	82.8 2492 0.1841	0.775 300. 459.	83.0 2516 0.1823	0.775 300. 459.
280	81.4 2427 0.1861	0.760 300. 452.	81.6 2444 0.1848	0.760 300. 452.	81.8 2463 0.1834	0.760 300. 452.	82.0 2484 0.1819	0.760 300. 452.	82.3 2507 0.1802	0.760 300. 452.
260	80.1 2426 0.1806	0.731 300. 438.	80.3 2444 0.1792	0.731 300. 438.	80.5 2463 0.1778	0.731 300. 438.	80.7 2484 0.1764	0.731 300. 438.	80.9 2506 0.1748	0.731 300. 438.
240	78.8 2434 0.1746	0.703 300. 425.	79.0 2451 0.1734	0.703 300. 425.	79.2 2468 0.1722	0.703 300. 425.	79.4 2487 0.1709	0.703 300. 425.	79.6 2508 0.1694	0.703 300. 425.
220	77.7 2445 0.1686	0.677 300. 412.	77.8 2461 0.1675	0.677 300. 412.	78.0 2477 0.1664	0.677 300. 412.	78.2 2496 0.1652	0.677 300. 412.	78.4 2516 0.1639	0.677 300. 412.
200	76.6 2459 0.1627	0.651 300. 400.	76.7 2474 0.1617	0.651 300. 400.	76.9 2491 0.1606	0.651 300. 400.	77.1 2508 0.1595	0.651 300. 400.	77.3 2528 0.1582	0.651 300. 400.
180	75.4 2471 0.1571	0.627 300. 388.	75.6 2486 0.1562	0.627 300. 388.	75.7 2502 0.1552	0.627 300. 388.	75.9 2520 0.1541	0.627 300. 388.	76.1 2540 0.1528	0.627 300. 388.
160	74.2 2479 0.1520	0.604 300. 377.	74.3 2495 0.1511	0.604 300. 377.	74.5 2511 0.1501	0.604 300. 377.	74.7 2528 0.1491	0.604 300. 377.	74.9 2548 0.1479	0.604 300. 377.
140	72.9 2489 0.1470	0.582 300. 366.	73.0 2504 0.1461	0.582 300. 366.	73.2 2520 0.1452	0.582 300. 366.	73.3 2537 0.1442	0.582 300. 366.	73.5 2556 0.1432	0.582 300. 366.
120	71.6 2501 0.1421	0.561 300. 356.	71.7 2515 0.1413	0.561 300. 356.	71.9 2531 0.1404	0.561 300. 356.	72.0 2548 0.1395	0.561 300. 356.	72.2 2566 0.1385	0.561 300. 356.
100	70.2 2516 0.1373	0.541 300. 345.	70.4 2530 0.1365	0.541 300. 345.	70.6 2545 0.1357	0.541 300. 345.	70.7 2561 0.1348	0.541 300. 345.	70.9 2579 0.1339	0.541 300. 345.

bd100_aeo_cr300_IMP_hw_FL_00 – 02/02/2004

Figure 04-06-03. Cruise Performance—300 KIAS (Sheet 4 of 12)

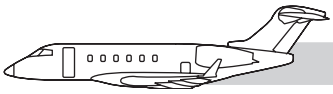
CRUISE 300 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT - 1000 LB									
	24		26		28		30		32	
350										
330										
310	83.8 2422 0.1975	0.806 300. 478.	84.0 2438 0.1962	0.806 300. 478.	84.1 2454 0.1949	0.806 300. 478.	84.3 2470 0.1937	0.806 300. 478.	84.5 2486 0.1924	0.806 300. 478.
290	82.1 2388 0.1942	0.775 300. 464.	82.3 2405 0.1928	0.775 300. 464.	82.5 2422 0.1915	0.775 300. 464.	82.7 2438 0.1902	0.775 300. 464.	82.9 2455 0.1889	0.775 300. 464.
280	81.4 2385 0.1914	0.760 300. 457.	81.6 2402 0.1901	0.760 300. 457.	81.8 2418 0.1888	0.760 300. 457.	82.0 2434 0.1876	0.760 300. 457.	82.1 2451 0.1863	0.760 300. 457.
260	80.0 2379 0.1861	0.731 300. 443.	80.2 2396 0.1847	0.731 300. 443.	80.4 2413 0.1834	0.731 300. 443.	80.6 2430 0.1821	0.731 300. 443.	80.7 2448 0.1809	0.731 300. 443.
240	78.9 2394 0.1794	0.703 300. 429.	79.0 2410 0.1782	0.703 300. 429.	79.2 2426 0.1770	0.703 300. 429.	79.4 2441 0.1759	0.703 300. 429.	79.5 2457 0.1747	0.703 300. 429.
220	77.8 2409 0.1728	0.677 300. 416.	77.9 2425 0.1717	0.677 300. 416.	78.1 2440 0.1707	0.677 300. 416.	78.2 2454 0.1697	0.677 300. 416.	78.4 2468 0.1687	0.677 300. 416.
200	76.6 2424 0.1667	0.651 300. 404.	76.8 2440 0.1656	0.651 300. 404.	76.9 2455 0.1646	0.651 300. 404.	77.1 2469 0.1636	0.651 300. 404.	77.2 2483 0.1627	0.651 300. 404.
180	75.4 2435 0.1610	0.627 300. 392.	75.6 2451 0.1600	0.627 300. 392.	75.8 2466 0.1590	0.627 300. 392.	75.9 2480 0.1581	0.627 300. 392.	76.1 2494 0.1572	0.627 300. 392.
160	74.1 2443 0.1557	0.604 300. 381.	74.3 2459 0.1547	0.604 300. 381.	74.5 2475 0.1538	0.604 300. 381.	74.6 2489 0.1529	0.604 300. 381.	74.8 2503 0.1520	0.604 300. 381.
140	72.8 2453 0.1506	0.582 300. 370.	73.0 2468 0.1497	0.582 300. 370.	73.1 2483 0.1488	0.582 300. 370.	73.3 2497 0.1480	0.582 300. 370.	73.4 2511 0.1471	0.582 300. 370.
120	71.5 2465 0.1456	0.561 300. 359.	71.6 2480 0.1447	0.561 300. 359.	71.8 2494 0.1439	0.561 300. 359.	71.9 2508 0.1431	0.561 300. 359.	72.1 2522 0.1423	0.561 300. 359.
100	70.2 2481 0.1405	0.541 300. 349.	70.3 2496 0.1396	0.541 300. 349.	70.5 2511 0.1388	0.541 300. 349.	70.6 2525 0.1381	0.541 300. 349.	70.8 2538 0.1373	0.541 300. 349.

bd100_aeo_cr300_IMP_lw_FL_05 - 02/02/2004

Figure 04-06-03. Cruise Performance—300 KIAS (Sheet 5 of 12)



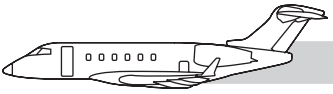
CRUISE 300 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310	84.7 2503 0.1911	0.806 300. 478.	84.9 2523 0.1896	0.806 300. 478.	85.1 2545 0.1880	0.806 300. 478.	85.3 2569 0.1862	0.806 300. 478.	85.6 2599 0.1841	0.806 300. 478.
290	83.0 2473 0.1875	0.775 300. 464.	83.2 2492 0.1861	0.775 300. 464.	83.5 2512 0.1846	0.775 300. 464.	83.7 2534 0.1830	0.775 300. 464.	83.9 2558 0.1813	0.775 300. 464.
280	82.3 2467 0.1851	0.760 300. 457.	82.5 2484 0.1838	0.760 300. 457.	82.7 2504 0.1823	0.760 300. 457.	82.9 2525 0.1808	0.760 300. 457.	83.2 2548 0.1792	0.760 300. 457.
260	80.9 2465 0.1796	0.731 300. 443.	81.1 2484 0.1783	0.731 300. 443.	81.3 2503 0.1769	0.731 300. 443.	81.6 2524 0.1754	0.731 300. 443.	81.8 2546 0.1739	0.731 300. 443.
240	79.7 2473 0.1736	0.703 300. 429.	79.9 2489 0.1725	0.703 300. 429.	80.1 2507 0.1712	0.703 300. 429.	80.3 2526 0.1699	0.703 300. 429.	80.5 2548 0.1685	0.703 300. 429.
220	78.5 2483 0.1677	0.677 300. 416.	78.7 2499 0.1667	0.677 300. 416.	78.8 2516 0.1655	0.677 300. 416.	79.0 2534 0.1643	0.677 300. 416.	79.2 2555 0.1630	0.677 300. 416.
200	77.4 2497 0.1618	0.651 300. 404.	77.5 2512 0.1608	0.651 300. 404.	77.7 2529 0.1598	0.651 300. 404.	77.9 2547 0.1586	0.651 300. 404.	78.1 2567 0.1574	0.651 300. 404.
180	76.2 2509 0.1563	0.627 300. 392.	76.4 2524 0.1554	0.627 300. 392.	76.5 2540 0.1544	0.627 300. 392.	76.7 2559 0.1532	0.627 300. 392.	77.0 2579 0.1520	0.627 300. 392.
160	74.9 2518 0.1512	0.604 300. 381.	75.1 2533 0.1502	0.604 300. 381.	75.3 2550 0.1493	0.604 300. 381.	75.4 2567 0.1483	0.604 300. 381.	75.7 2587 0.1471	0.604 300. 381.
140	73.6 2525 0.1463	0.582 300. 370.	73.7 2540 0.1454	0.582 300. 370.	73.9 2557 0.1445	0.582 300. 370.	74.1 2574 0.1436	0.582 300. 370.	74.3 2593 0.1425	0.582 300. 370.
120	72.2 2536 0.1415	0.561 300. 359.	72.4 2550 0.1407	0.561 300. 359.	72.5 2566 0.1398	0.561 300. 359.	72.7 2583 0.1389	0.561 300. 359.	72.9 2601 0.1379	0.561 300. 359.
100	70.9 2551 0.1366	0.541 300. 349.	71.1 2566 0.1358	0.541 300. 349.	71.2 2581 0.1350	0.541 300. 349.	71.4 2597 0.1342	0.541 300. 349.	71.6 2615 0.1333	0.541 300. 349.

bd100_aeo_cr300_IMP_hw_FL_05 – 02/02/2004

Figure 04-06-03. Cruise Performance—300 KIAS (Sheet 6 of 12)



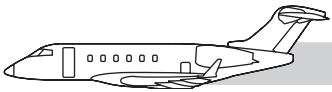
CRUISE 300 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350										
330										
310	84.7 2461 0.1964	0.806 300. 484.	84.9 2478 0.1951	0.806 300. 484.	85.0 2494 0.1938	0.806 300. 484.	85.2 2510 0.1926	0.806 300. 484.	85.4 2527 0.1913	0.806 300. 484.
290	83.0 2426 0.1931	0.775 300. 469.	83.2 2444 0.1917	0.775 300. 469.	83.4 2461 0.1904	0.775 300. 469.	83.6 2479 0.1891	0.775 300. 469.	83.8 2496 0.1877	0.775 300. 469.
280	82.3 2424 0.1903	0.760 300. 461.	82.5 2440 0.1890	0.760 300. 461.	82.7 2457 0.1878	0.760 300. 461.	82.8 2473 0.1865	0.760 300. 461.	83.0 2490 0.1853	0.760 300. 461.
260	80.9 2417 0.1850	0.731 300. 447.	81.1 2435 0.1837	0.731 300. 447.	81.2 2452 0.1824	0.731 300. 447.	81.4 2469 0.1811	0.731 300. 447.	81.6 2487 0.1799	0.731 300. 447.
240	79.7 2432 0.1783	0.703 300. 434.	79.9 2448 0.1772	0.703 300. 434.	80.0 2464 0.1760	0.703 300. 434.	80.2 2480 0.1749	0.703 300. 434.	80.4 2496 0.1738	0.703 300. 434.
220	78.6 2447 0.1719	0.677 300. 421.	78.7 2463 0.1708	0.677 300. 421.	78.9 2478 0.1698	0.677 300. 421.	79.0 2492 0.1688	0.677 300. 421.	79.2 2506 0.1678	0.677 300. 421.
200	77.4 2462 0.1657	0.651 300. 408.	77.6 2477 0.1647	0.651 300. 408.	77.8 2492 0.1637	0.651 300. 408.	77.9 2506 0.1628	0.651 300. 408.	78.0 2520 0.1619	0.651 300. 408.
180	76.2 2472 0.1601	0.627 300. 396.	76.4 2488 0.1591	0.627 300. 396.	76.6 2503 0.1581	0.627 300. 396.	76.7 2518 0.1572	0.627 300. 396.	76.8 2532 0.1564	0.627 300. 396.
160	74.9 2479 0.1550	0.604 300. 384.	75.1 2495 0.1540	0.604 300. 384.	75.3 2511 0.1530	0.604 300. 384.	75.4 2525 0.1522	0.604 300. 384.	75.6 2539 0.1513	0.604 300. 384.
140	73.6 2487 0.1500	0.582 300. 373.	73.7 2502 0.1490	0.582 300. 373.	73.9 2517 0.1482	0.582 300. 373.	74.1 2531 0.1474	0.582 300. 373.	74.2 2545 0.1465	0.582 300. 373.
120	72.2 2498 0.1450	0.561 300. 362.	72.3 2513 0.1441	0.561 300. 362.	72.5 2527 0.1433	0.561 300. 362.	72.6 2541 0.1425	0.561 300. 362.	72.8 2556 0.1417	0.561 300. 362.
100	70.8 2515 0.1399	0.541 300. 352.	71.0 2530 0.1390	0.541 300. 352.	71.1 2545 0.1382	0.541 300. 352.	71.3 2558 0.1375	0.541 300. 352.	71.4 2572 0.1368	0.541 300. 352.

bd100_aeo_cr300_IMP_lw_FL_10 – 02/02/2004

Figure 04-06-03. Cruise Performance—300 KIAS (Sheet 7 of 12)



CRUISE 300 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C	%N1	MACH
	30% C.G.	LB/HR	KIAS
		NAM/LB	KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310	85.6 2544 0.1900	0.806 300. 484.	85.8 2564 0.1885	0.806 300. 484.	86.0 2586 0.1870	0.806 300. 484.	86.3 2610 0.1852	0.806 300. 484.	86.6 2640 0.1831	0.806 300. 484.
290	84.0 2514 0.1864	0.775 300. 469.	84.2 2532 0.1851	0.775 300. 469.	84.4 2552 0.1836	0.775 300. 469.	84.6 2574 0.1820	0.775 300. 469.	84.9 2598 0.1803	0.775 300. 469.
280	83.2 2507 0.1840	0.760 300. 461.	83.4 2525 0.1827	0.760 300. 461.	83.6 2544 0.1813	0.760 300. 461.	83.9 2566 0.1798	0.760 300. 461.	84.1 2589 0.1782	0.760 300. 461.
260	81.8 2504 0.1786	0.731 300. 447.	82.0 2523 0.1773	0.731 300. 447.	82.2 2542 0.1759	0.731 300. 447.	82.5 2564 0.1745	0.731 300. 447.	82.7 2587 0.1729	0.731 300. 447.
240	80.5 2511 0.1727	0.703 300. 434.	80.7 2528 0.1715	0.703 300. 434.	80.9 2547 0.1703	0.703 300. 434.	81.1 2566 0.1690	0.703 300. 434.	81.3 2588 0.1676	0.703 300. 434.
220	79.3 2521 0.1668	0.677 300. 421.	79.5 2537 0.1658	0.677 300. 421.	79.7 2554 0.1647	0.677 300. 421.	79.9 2573 0.1635	0.677 300. 421.	80.1 2594 0.1622	0.677 300. 421.
200	78.2 2535 0.1610	0.651 300. 408.	78.3 2550 0.1600	0.651 300. 408.	78.5 2566 0.1590	0.651 300. 408.	78.7 2585 0.1579	0.651 300. 408.	78.9 2605 0.1566	0.651 300. 408.
180	77.0 2547 0.1555	0.627 300. 396.	77.1 2562 0.1545	0.627 300. 396.	77.3 2578 0.1536	0.627 300. 396.	77.5 2597 0.1525	0.627 300. 396.	77.7 2617 0.1513	0.627 300. 396.
160	75.7 2554 0.1504	0.604 300. 384.	75.9 2570 0.1495	0.604 300. 384.	76.1 2586 0.1485	0.604 300. 384.	76.2 2604 0.1475	0.604 300. 384.	76.4 2625 0.1464	0.604 300. 384.
140	74.4 2560 0.1457	0.582 300. 373.	74.5 2576 0.1448	0.582 300. 373.	74.7 2592 0.1439	0.582 300. 373.	74.9 2610 0.1429	0.582 300. 373.	75.1 2629 0.1418	0.582 300. 373.
120	73.0 2570 0.1409	0.561 300. 362.	73.1 2585 0.1401	0.561 300. 362.	73.3 2601 0.1392	0.561 300. 362.	73.5 2619 0.1383	0.561 300. 362.	73.7 2638 0.1373	0.561 300. 362.
100	71.6 2585 0.1360	0.541 300. 352.	71.7 2600 0.1353	0.541 300. 352.	71.9 2615 0.1345	0.541 300. 352.	72.1 2632 0.1336	0.541 300. 352.	72.3 2649 0.1327	0.541 300. 352.

bd100_aeo_cr300_IMP_hw_FL_10 – 02/02/2004

Figure 04-06-03. Cruise Performance—300 KIAS (Sheet 8 of 12)

CRUISE 300 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C	%N1	MACH
	30% C.G.	LB/HR	KIAS
		NAM/LB	KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350										
330										
310	85.6 2502 0.1952	0.806 300. 489.	85.8 2519 0.1939	0.806 300. 489.	86.0 2535 0.1927	0.806 300. 489.	86.1 2551 0.1915	0.806 300. 489.	86.3 2568 0.1902	0.806 300. 489.
290	83.9 2465 0.1920	0.775 300. 474.	84.1 2483 0.1907	0.775 300. 474.	84.3 2500 0.1893	0.775 300. 474.	84.5 2518 0.1880	0.775 300. 474.	84.7 2536 0.1867	0.775 300. 474.
280	83.2 2462 0.1893	0.760 300. 466.	83.4 2479 0.1880	0.760 300. 466.	83.6 2496 0.1867	0.760 300. 466.	83.7 2512 0.1855	0.760 300. 466.	83.9 2529 0.1843	0.760 300. 466.
260	81.7 2455 0.1840	0.731 300. 452.	81.9 2473 0.1827	0.731 300. 452.	82.1 2491 0.1814	0.731 300. 452.	82.3 2508 0.1801	0.731 300. 452.	82.5 2526 0.1789	0.731 300. 452.
240	80.5 2469 0.1774	0.703 300. 438.	80.7 2485 0.1762	0.703 300. 438.	80.9 2502 0.1751	0.703 300. 438.	81.1 2518 0.1739	0.703 300. 438.	81.2 2534 0.1728	0.703 300. 438.
220	79.4 2484 0.1710	0.677 300. 425.	79.6 2500 0.1699	0.677 300. 425.	79.7 2515 0.1689	0.677 300. 425.	79.9 2530 0.1679	0.677 300. 425.	80.0 2545 0.1669	0.677 300. 425.
200	78.2 2498 0.1649	0.651 300. 412.	78.4 2514 0.1638	0.651 300. 412.	78.5 2529 0.1629	0.651 300. 412.	78.7 2544 0.1619	0.651 300. 412.	78.8 2559 0.1610	0.651 300. 412.
180	77.0 2509 0.1593	0.627 300. 400.	77.2 2525 0.1583	0.627 300. 400.	77.3 2540 0.1573	0.627 300. 400.	77.5 2555 0.1564	0.627 300. 400.	77.6 2570 0.1555	0.627 300. 400.
160	75.7 2516 0.1541	0.604 300. 388.	75.9 2532 0.1531	0.604 300. 388.	76.0 2548 0.1522	0.604 300. 388.	76.2 2562 0.1513	0.604 300. 388.	76.4 2577 0.1505	0.604 300. 388.
140	74.3 2523 0.1492	0.582 300. 376.	74.5 2539 0.1483	0.582 300. 376.	74.7 2553 0.1474	0.582 300. 376.	74.8 2568 0.1466	0.582 300. 376.	75.0 2582 0.1458	0.582 300. 376.
120	72.9 2533 0.1443	0.561 300. 366.	73.1 2548 0.1434	0.561 300. 366.	73.3 2562 0.1426	0.561 300. 366.	73.4 2577 0.1418	0.561 300. 366.	73.6 2591 0.1411	0.561 300. 366.
100	71.5 2550 0.1392	0.541 300. 355.	71.7 2565 0.1384	0.541 300. 355.	71.9 2580 0.1375	0.541 300. 355.	72.0 2594 0.1368	0.541 300. 355.	72.2 2607 0.1361	0.541 300. 355.

bd100_aeo_cr300_IMP_lw_FL_15 – 02/02/2004

Figure 04-06-03. Cruise Performance—300 KIAS (Sheet 9 of 12)

CRUISE 300 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310	86.5 2586 0.1889	0.806 300. 489.	86.7 2606 0.1875	0.806 300. 489.	86.9 2628 0.1859	0.806 300. 489.	87.2 2653 0.1842	0.806 300. 489.	87.5 2683 0.1821	0.806 300. 489.
290	84.9 2554 0.1854	0.775 300. 474.	85.1 2573 0.1840	0.775 300. 474.	85.3 2593 0.1826	0.775 300. 474.	85.5 2616 0.1810	0.775 300. 474.	85.8 2640 0.1793	0.775 300. 474.
280	84.1 2547 0.1830	0.760 300. 466.	84.3 2564 0.1817	0.760 300. 466.	84.5 2584 0.1804	0.760 300. 466.	84.7 2606 0.1788	0.760 300. 466.	85.0 2630 0.1772	0.760 300. 466.
260	82.7 2544 0.1776	0.731 300. 452.	82.9 2563 0.1763	0.731 300. 452.	83.1 2583 0.1749	0.731 300. 452.	83.3 2604 0.1735	0.731 300. 452.	83.6 2627 0.1720	0.731 300. 452.
240	81.4 2550 0.1718	0.703 300. 438.	81.6 2567 0.1706	0.703 300. 438.	81.8 2586 0.1694	0.703 300. 438.	82.0 2605 0.1681	0.703 300. 438.	82.2 2627 0.1667	0.703 300. 438.
220	80.2 2560 0.1659	0.677 300. 425.	80.3 2576 0.1649	0.677 300. 425.	80.5 2593 0.1638	0.677 300. 425.	80.7 2612 0.1626	0.677 300. 425.	80.9 2633 0.1613	0.677 300. 425.
200	79.0 2573 0.1601	0.651 300. 412.	79.1 2588 0.1592	0.651 300. 412.	79.3 2605 0.1581	0.651 300. 412.	79.5 2624 0.1570	0.651 300. 412.	79.7 2645 0.1558	0.651 300. 412.
180	77.8 2585 0.1546	0.627 300. 400.	77.9 2600 0.1537	0.627 300. 400.	78.1 2617 0.1527	0.627 300. 400.	78.3 2636 0.1516	0.627 300. 400.	78.5 2656 0.1505	0.627 300. 400.
160	76.5 2592 0.1496	0.604 300. 388.	76.7 2608 0.1487	0.604 300. 388.	76.8 2625 0.1477	0.604 300. 388.	77.0 2643 0.1467	0.604 300. 388.	77.2 2664 0.1456	0.604 300. 388.
140	75.1 2597 0.1449	0.582 300. 376.	75.3 2612 0.1441	0.582 300. 376.	75.5 2629 0.1432	0.582 300. 376.	75.6 2647 0.1422	0.582 300. 376.	75.8 2667 0.1411	0.582 300. 376.
120	73.7 2605 0.1403	0.561 300. 366.	73.9 2619 0.1395	0.561 300. 366.	74.0 2635 0.1387	0.561 300. 366.	74.2 2653 0.1378	0.561 300. 366.	74.4 2672 0.1368	0.561 300. 366.
100	72.3 2621 0.1354	0.541 300. 355.	72.5 2635 0.1346	0.541 300. 355.	72.6 2651 0.1339	0.541 300. 355.	72.8 2667 0.1330	0.541 300. 355.	73.0 2685 0.1321	0.541 300. 355.

bd100_aeo_cr300_IMP_hw_FL_15 - 02/02/2004

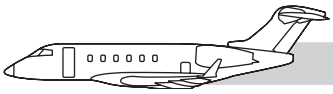
Figure 04-06-03. Cruise Performance—300 KIAS (Sheet 10 of 12)

CRUISE 300 KIAS			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350										
330										
310	86.5 2542 0.1942	0.806 300. 494.	86.7 2559 0.1928	0.806 300. 494.	86.8 2576 0.1916	0.806 300. 494.	87.0 2592 0.1904	0.806 300. 494.	87.2 2609 0.1892	0.806 300. 494.
290	84.8 2506 0.1908	0.775 300. 478.	85.0 2523 0.1895	0.775 300. 478.	85.2 2541 0.1882	0.775 300. 478.	85.4 2558 0.1869	0.775 300. 478.	85.6 2576 0.1856	0.775 300. 478.
280	84.1 2503 0.1881	0.760 300. 471.	84.3 2520 0.1868	0.760 300. 471.	84.5 2536 0.1856	0.760 300. 471.	84.6 2553 0.1844	0.760 300. 471.	84.8 2570 0.1832	0.760 300. 471.
260	82.6 2493 0.1830	0.731 300. 456.	82.8 2511 0.1817	0.731 300. 456.	83.0 2529 0.1804	0.731 300. 456.	83.2 2547 0.1792	0.731 300. 456.	83.4 2565 0.1779	0.731 300. 456.
240	81.4 2506 0.1765	0.703 300. 442.	81.6 2522 0.1753	0.703 300. 442.	81.7 2539 0.1742	0.703 300. 442.	81.9 2556 0.1731	0.703 300. 442.	82.1 2572 0.1720	0.703 300. 442.
220	80.2 2520 0.1701	0.677 300. 429.	80.4 2536 0.1691	0.677 300. 429.	80.5 2552 0.1680	0.677 300. 429.	80.7 2567 0.1670	0.677 300. 429.	80.8 2582 0.1661	0.677 300. 429.
200	79.0 2535 0.1640	0.651 300. 416.	79.2 2551 0.1630	0.651 300. 416.	79.3 2566 0.1620	0.651 300. 416.	79.5 2581 0.1611	0.651 300. 416.	79.6 2596 0.1602	0.651 300. 416.
180	77.8 2546 0.1584	0.627 300. 403.	78.0 2563 0.1574	0.627 300. 403.	78.1 2578 0.1565	0.627 300. 403.	78.3 2593 0.1556	0.627 300. 403.	78.4 2607 0.1547	0.627 300. 403.
160	76.5 2552 0.1533	0.604 300. 391.	76.6 2569 0.1523	0.604 300. 391.	76.8 2585 0.1514	0.604 300. 391.	77.0 2600 0.1505	0.604 300. 391.	77.1 2615 0.1497	0.604 300. 391.
140	75.1 2558 0.1485	0.582 300. 380.	75.2 2574 0.1475	0.582 300. 380.	75.4 2589 0.1467	0.582 300. 380.	75.5 2604 0.1458	0.582 300. 380.	75.7 2619 0.1450	0.582 300. 380.
120	73.6 2568 0.1435	0.561 300. 369.	73.8 2584 0.1427	0.561 300. 369.	74.0 2599 0.1419	0.561 300. 369.	74.1 2613 0.1411	0.561 300. 369.	74.3 2627 0.1403	0.561 300. 369.
100	72.2 2584 0.1385	0.541 300. 358.	72.4 2599 0.1377	0.541 300. 358.	72.5 2615 0.1369	0.541 300. 358.	72.7 2629 0.1362	0.541 300. 358.	72.9 2642 0.1355	0.541 300. 358.

bd100_aeo_cr300_IMP_lw_FL_20 – 02/02/2004

Figure 04-06-03. Cruise Performance—300 KIAS (Sheet 11 of 12)



CRUISE 300 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310	87.4 2627 0.1879	0.806 300. 494.	87.6 2647 0.1865	0.806 300. 494.	87.8 2669 0.1849	0.806 300. 494.	88.1 2694 0.1832	0.806 300. 494.	88.4 2725 0.1811	0.806 300. 494.
290	85.8 2594 0.1843	0.775 300. 478.	86.0 2613 0.1830	0.775 300. 478.	86.2 2634 0.1816	0.775 300. 478.	86.4 2657 0.1800	0.775 300. 478.	86.7 2681 0.1784	0.775 300. 478.
280	85.0 2587 0.1819	0.760 300. 471.	85.2 2605 0.1807	0.760 300. 471.	85.4 2625 0.1793	0.760 300. 471.	85.6 2647 0.1778	0.760 300. 471.	85.9 2671 0.1762	0.760 300. 471.
260	83.6 2583 0.1767	0.731 300. 456.	83.8 2602 0.1753	0.731 300. 456.	84.0 2622 0.1740	0.731 300. 456.	84.2 2644 0.1726	0.731 300. 456.	84.5 2667 0.1710	0.731 300. 466.
240	82.2 2588 0.1709	0.703 300. 442.	82.4 2606 0.1697	0.703 300. 442.	82.6 2625 0.1685	0.703 300. 442.	82.8 2645 0.1672	0.703 300. 442.	83.1 2667 0.1658	0.703 300. 442.
220	81.0 2597 0.1651	0.677 300. 429.	81.1 2614 0.1641	0.677 300. 429.	81.3 2631 0.1629	0.677 300. 429.	81.5 2651 0.1617	0.677 300. 429.	81.7 2673 0.1604	0.677 300. 429.
200	79.8 2610 0.1593	0.651 300. 416.	79.9 2626 0.1584	0.651 300. 416.	80.1 2643 0.1573	0.651 300. 416.	80.3 2662 0.1562	0.651 300. 416.	80.5 2683 0.1550	0.651 300. 416.
180	78.6 2623 0.1538	0.627 300. 403.	78.7 2638 0.1529	0.627 300. 403.	78.9 2655 0.1519	0.627 300. 403.	79.1 2675 0.1508	0.627 300. 403.	79.3 2695 0.1496	0.627 300. 403.
160	77.3 2630 0.1488	0.604 300. 391.	77.4 2647 0.1479	0.604 300. 391.	77.6 2663 0.1469	0.604 300. 391.	77.8 2682 0.1459	0.604 300. 391.	78.0 2703 0.1448	0.604 300. 391.
140	75.9 2634 0.1442	0.582 300. 380.	76.0 2650 0.1433	0.582 300. 380.	76.2 2667 0.1424	0.582 300. 380.	76.4 2685 0.1415	0.582 300. 380.	76.6 2705 0.1404	0.582 300. 380.
120	74.4 2642 0.1396	0.561 300. 369.	74.6 2656 0.1388	0.561 300. 369.	74.8 2673 0.1379	0.561 300. 369.	75.0 2690 0.1370	0.561 300. 369.	75.2 2710 0.1360	0.561 300. 369.
100	73.0 2656 0.1348	0.541 300. 358.	73.2 2671 0.1340	0.541 300. 358.	73.3 2687 0.1332	0.541 300. 358.	73.5 2703 0.1324	0.541 300. 358.	73.7 2721 0.1315	0.541 300. 358.

bd100_aeo_cr300_IMP_hw_FL_20 – 02/02/2004

Figure 04-06-03. Cruise Performance—300 KIAS (Sheet 12 of 12)

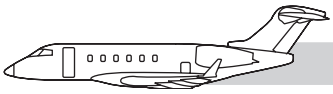
CRUISE 320 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350										
330										
310										
290	82.4 2642 0.1801	0.822 320. 476.	82.6 2664 0.1786	0.822 320. 476.	82.8 2684 0.1773	0.822 320. 476.	83.0 2700 0.1762	0.822 320. 476.	83.1 2716 0.1752	0.822 320. 476.
280	81.5 2610 0.1796	0.806 320. 469.	81.7 2629 0.1784	0.806 320. 469.	81.8 2646 0.1772	0.806 320. 469.	82.0 2661 0.1762	0.806 320. 469.	82.1 2677 0.1752	0.806 320. 469.
260	79.9 2575 0.1767	0.776 320. 455.	80.1 2593 0.1755	0.776 320. 455.	80.3 2610 0.1744	0.776 320. 455.	80.4 2627 0.1733	0.776 320. 455.	80.6 2643 0.1722	0.776 320. 455.
240	78.6 2568 0.1721	0.747 320. 442.	78.8 2586 0.1709	0.747 320. 442.	79.0 2603 0.1697	0.747 320. 442.	79.1 2620 0.1686	0.747 320. 442.	79.3 2636 0.1676	0.747 320. 442.
220	77.4 2574 0.1667	0.719 320. 429.	77.6 2592 0.1655	0.719 320. 429.	77.8 2610 0.1644	0.719 320. 429.	77.9 2626 0.1634	0.719 320. 429.	78.1 2642 0.1624	0.719 320. 429.
200	76.5 2596 0.1605	0.692 320. 417.	76.6 2612 0.1595	0.692 320. 417.	76.8 2628 0.1585	0.692 320. 417.	76.9 2643 0.1576	0.692 320. 417.	77.0 2658 0.1568	0.692 320. 417.
180	75.5 2617 0.1547	0.667 320. 405.	75.6 2633 0.1537	0.667 320. 405.	75.8 2649 0.1528	0.667 320. 405.	75.9 2664 0.1519	0.667 320. 405.	76.0 2678 0.1511	0.667 320. 405.
160	74.4 2631 0.1494	0.643 320. 393.	74.6 2648 0.1485	0.643 320. 393.	74.7 2665 0.1475	0.643 320. 393.	74.8 2680 0.1467	0.643 320. 393.	75.0 2694 0.1459	0.643 320. 393.
140	73.2 2644 0.1445	0.620 320. 382.	73.4 2662 0.1435	0.620 320. 382.	73.5 2678 0.1427	0.620 320. 382.	73.7 2694 0.1418	0.620 320. 382.	73.8 2709 0.1410	0.620 320. 382.
120	72.0 2655 0.1399	0.597 320. 371.	72.1 2672 0.1389	0.597 320. 371.	72.3 2689 0.1381	0.597 320. 371.	72.4 2704 0.1373	0.597 320. 371.	72.6 2720 0.1365	0.597 320. 371.
100	70.8 2666 0.1354	0.576 320. 361.	70.9 2683 0.1345	0.576 320. 361.	71.1 2700 0.1337	0.576 320. 361.	71.2 2715 0.1329	0.576 320. 361.	71.3 2729 0.1322	0.576 320. 361.

bd100_aeo_cr320_IMP_lw_FL_m10 – 02/02/2004

Figure 04-06-04. Cruise Performance—320 KIAS (Sheet 1 of 12)



CRUISE 320 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310										
290	83.3 2732 0.1742	0.822 320. 476.	83.4 2748 0.1732	0.822 320. 476.	83.6 2766 0.1721	0.822 320. 476.	83.8 2787 0.1708	0.822 320. 476.	84.0 2811 0.1693	0.822 320. 476.
280	82.3 2692 0.1742	0.806 320. 469.	82.4 2707 0.1732	0.806 320. 469.	82.6 2723 0.1722	0.806 320. 469.	82.8 2741 0.1710	0.806 320. 469.	82.9 2761 0.1698	0.806 320. 469.
260	80.7 2659 0.1712	0.776 320. 455.	80.9 2675 0.1701	0.776 320. 455.	81.1 2692 0.1691	0.776 320. 455.	81.2 2709 0.1680	0.776 320. 455.	81.4 2727 0.1669	0.776 320. 455.
240	79.4 2652 0.1666	0.747 320. 442.	79.6 2668 0.1656	0.747 320. 442.	79.8 2685 0.1646	0.747 320. 442.	79.9 2702 0.1636	0.747 320. 442.	80.1 2720 0.1625	0.747 320. 442.
220	78.2 2658 0.1614	0.719 320. 429.	78.4 2674 0.1605	0.719 320. 429.	78.6 2690 0.1595	0.719 320. 429.	78.7 2707 0.1585	0.719 320. 429.	78.9 2724 0.1575	0.719 320. 429.
200	77.2 2672 0.1559	0.692 320. 417.	77.3 2687 0.1551	0.692 320. 417.	77.4 2702 0.1542	0.692 320. 417.	77.6 2717 0.1534	0.692 320. 417.	77.7 2733 0.1524	0.692 320. 417.
180	76.2 2692 0.1504	0.667 320. 405.	76.3 2705 0.1496	0.667 320. 405.	76.4 2720 0.1488	0.667 320. 405.	76.5 2734 0.1480	0.667 320. 405.	76.7 2749 0.1472	0.667 320. 405.
160	75.1 2708 0.1452	0.643 320. 393.	75.2 2722 0.1445	0.643 320. 393.	75.4 2736 0.1437	0.643 320. 393.	75.5 2751 0.1429	0.643 320. 393.	75.6 2766 0.1422	0.643 320. 393.
140	74.0 2723 0.1403	0.620 320. 382.	74.1 2737 0.1396	0.620 320. 382.	74.2 2751 0.1389	0.620 320. 382.	74.3 2766 0.1381	0.620 320. 382.	74.5 2781 0.1374	0.620 320. 382.
120	72.7 2734 0.1358	0.597 320. 371.	72.8 2747 0.1352	0.597 320. 371.	72.9 2762 0.1344	0.597 320. 371.	73.1 2777 0.1337	0.597 320. 371.	73.2 2792 0.1330	0.597 320. 371.
100	71.5 2743 0.1316	0.576 320. 361.	71.6 2758 0.1309	0.576 320. 361.	71.7 2772 0.1302	0.576 320. 361.	71.8 2786 0.1296	0.576 320. 361.	72.0 2801 0.1289	0.576 320. 361.

bd100_aeo_cr320_IMP_hw_FL_m10 – 02/02/2004

Figure 04-06-04. Cruise Performance—320 KIAS (Sheet 2 of 12)

CRUISE 320 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF

ISA

30% C.G.

%N1 / LB/HR / NAM/LB — MACH / KIAS / KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350										
330										
310										
290	84.4 2736 0.1779	0.822 320. 487.	84.6 2759 0.1764	0.822 320. 487.	84.8 2778 0.1751	0.822 320. 487.	85.0 2796 0.1740	0.822 320. 487.	85.1 2812 0.1731	0.822 320. 487.
280	83.4 2702 0.1774	0.806 320. 479.	83.6 2721 0.1762	0.806 320. 479.	83.8 2738 0.1750	0.806 320. 479.	83.9 2755 0.1740	0.806 320. 479.	84.1 2771 0.1730	0.806 320. 479.
260	81.7 2664 0.1746	0.776 320. 465.	81.9 2682 0.1734	0.776 320. 465.	82.1 2700 0.1723	0.776 320. 465.	82.3 2717 0.1712	0.776 320. 465.	82.4 2733 0.1702	0.776 320. 465.
240	80.4 2653 0.1701	0.747 320. 451.	80.6 2672 0.1689	0.747 320. 451.	80.7 2690 0.1678	0.747 320. 451.	80.9 2707 0.1667	0.747 320. 451.	81.1 2723 0.1657	0.747 320. 451.
220	79.1 2656 0.1650	0.719 320. 438.	79.3 2675 0.1638	0.719 320. 438.	79.5 2692 0.1627	0.719 320. 438.	79.6 2709 0.1617	0.719 320. 438.	79.8 2726 0.1607	0.719 320. 438.
200	78.1 2677 0.1589	0.692 320. 425.	78.3 2694 0.1579	0.692 320. 425.	78.4 2711 0.1569	0.692 320. 425.	78.6 2726 0.1560	0.692 320. 425.	78.7 2741 0.1552	0.692 320. 425.
180	77.1 2697 0.1531	0.667 320. 413.	77.2 2714 0.1521	0.667 320. 413.	77.4 2730 0.1513	0.667 320. 413.	77.5 2746 0.1504	0.667 320. 413.	77.7 2760 0.1496	0.667 320. 413.
160	76.0 2711 0.1479	0.643 320. 401.	76.1 2729 0.1470	0.643 320. 401.	76.3 2746 0.1460	0.643 320. 401.	76.4 2761 0.1452	0.643 320. 401.	76.6 2776 0.1445	0.643 320. 401.
140	74.7 2724 0.1430	0.620 320. 390.	74.9 2742 0.1421	0.620 320. 390.	75.1 2759 0.1412	0.620 320. 390.	75.2 2775 0.1404	0.620 320. 390.	75.4 2791 0.1396	0.620 320. 390.
120	73.4 2735 0.1384	0.597 320. 379.	73.6 2753 0.1375	0.597 320. 379.	73.8 2770 0.1367	0.597 320. 379.	73.9 2785 0.1359	0.597 320. 379.	74.1 2801 0.1352	0.597 320. 379.
100	72.1 2745 0.1340	0.576 320. 368.	72.3 2762 0.1332	0.576 320. 368.	72.5 2779 0.1324	0.576 320. 368.	72.6 2794 0.1317	0.576 320. 368.	72.7 2808 0.1310	0.576 320. 368.

bd100_aeo_cr320_IMP_lw_FL_00 – 02/02/2004

Figure 04-06-04. Cruise Performance—320 KIAS (Sheet 3 of 12)

CRUISE 320 KIAS			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310										
290	85.3 2828 0.1721	0.822 320. 487.	85.4 2845 0.1710	0.822 320. 487.	85.6 2864 0.1699	0.822 320. 487.	85.8 2885 0.1687	0.822 320. 487.	86.0 2910 0.1672	0.822 320. 487.
280	84.2 2786 0.1720	0.806 320. 479.	84.4 2802 0.1711	0.806 320. 479.	84.5 2819 0.1700	0.806 320. 479.	84.7 2838 0.1689	0.806 320. 479.	84.9 2858 0.1677	0.806 320. 479.
260	82.6 2750 0.1691	0.776 320. 465.	82.8 2767 0.1681	0.776 320. 465.	82.9 2784 0.1671	0.776 320. 465.	83.1 2802 0.1660	0.776 320. 465.	83.3 2821 0.1649	0.776 320. 465.
240	81.2 2740 0.1647	0.747 320. 451.	81.4 2756 0.1638	0.747 320. 451.	81.6 2773 0.1627	0.747 320. 451.	81.7 2791 0.1617	0.747 320. 451.	81.9 2809 0.1607	0.747 320. 451.
220	80.0 2742 0.1598	0.719 320. 438.	80.1 2759 0.1588	0.719 320. 438.	80.3 2775 0.1579	0.719 320. 438.	80.4 2793 0.1569	0.719 320. 438.	80.6 2811 0.1559	0.719 320. 438.
200	78.8 2756 0.1543	0.692 320. 425.	79.0 2771 0.1535	0.692 320. 425.	79.1 2786 0.1527	0.692 320. 425.	79.3 2802 0.1518	0.692 320. 425.	79.4 2819 0.1509	0.692 320. 425.
180	77.8 2774 0.1489	0.667 320. 413.	77.9 2788 0.1481	0.667 320. 413.	78.1 2803 0.1473	0.667 320. 413.	78.2 2817 0.1466	0.667 320. 413.	78.3 2833 0.1458	0.667 320. 413.
160	76.7 2790 0.1437	0.643 320. 401.	76.8 2804 0.1430	0.643 320. 401.	76.9 2819 0.1423	0.643 320. 401.	77.1 2834 0.1415	0.643 320. 401.	77.2 2849 0.1408	0.643 320. 401.
140	75.5 2805 0.1389	0.620 320. 390.	75.6 2819 0.1382	0.620 320. 390.	75.8 2833 0.1375	0.620 320. 390.	75.9 2849 0.1368	0.620 320. 390.	76.1 2865 0.1360	0.620 320. 390.
120	74.2 2815 0.1345	0.597 320. 379.	74.3 2829 0.1338	0.597 320. 379.	74.5 2843 0.1331	0.597 320. 379.	74.6 2858 0.1324	0.597 320. 379.	74.8 2874 0.1317	0.597 320. 379.
100	72.9 2822 0.1303	0.576 320. 368.	73.0 2836 0.1297	0.576 320. 368.	73.2 2851 0.1290	0.576 320. 368.	73.3 2865 0.1284	0.576 320. 368.	73.4 2880 0.1277	0.576 320. 368.

bd100_aeo_cr320_IMP_hw_FL_00 – 02/02/2004

Figure 04-06-04. Cruise Performance—320 KIAS (Sheet 4 of 12)

CRUISE 320 KIAS			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350										
330										
310										
290	85.3 2782 0.1768	0.822 320. 492.	85.5 2805 0.1753	0.822 320. 492.	85.7 2825 0.1741	0.822 320. 492.	85.9 2843 0.1730	0.822 320. 492.	86.1 2859 0.1720	0.822 320. 492.
280	84.3 2747 0.1763	0.806 320. 484.	84.5 2767 0.1751	0.806 320. 484.	84.7 2784 0.1740	0.806 320. 484.	84.9 2801 0.1729	0.806 320. 484.	85.0 2817 0.1719	0.806 320. 484.
260	82.7 2708 0.1736	0.776 320. 470.	82.8 2727 0.1724	0.776 320. 470.	83.0 2745 0.1712	0.776 320. 470.	83.2 2762 0.1702	0.776 320. 470.	83.4 2779 0.1691	0.776 320. 470.
240	81.3 2697 0.1691	0.747 320. 456.	81.4 2715 0.1679	0.747 320. 456.	81.6 2734 0.1668	0.747 320. 456.	81.8 2752 0.1657	0.747 320. 456.	81.9 2768 0.1648	0.747 320. 456.
220	80.0 2699 0.1640	0.719 320. 443.	80.2 2718 0.1628	0.719 320. 443.	80.3 2736 0.1618	0.719 320. 443.	80.5 2753 0.1607	0.719 320. 443.	80.7 2771 0.1597	0.719 320. 443.
200	78.9 2718 0.1581	0.692 320. 430.	79.1 2735 0.1571	0.692 320. 430.	79.2 2752 0.1561	0.692 320. 430.	79.4 2767 0.1552	0.692 320. 430.	79.5 2782 0.1544	0.692 320. 430.
180	77.9 2737 0.1524	0.667 320. 417.	78.0 2754 0.1514	0.667 320. 417.	78.2 2771 0.1505	0.667 320. 417.	78.3 2786 0.1497	0.667 320. 417.	78.4 2801 0.1489	0.667 320. 417.
160	76.8 2751 0.1472	0.643 320. 405.	76.9 2769 0.1462	0.643 320. 405.	77.1 2787 0.1453	0.643 320. 405.	77.2 2802 0.1445	0.643 320. 405.	77.3 2817 0.1438	0.643 320. 405.
140	75.6 2762 0.1424	0.620 320. 393.	75.7 2781 0.1414	0.620 320. 393.	75.9 2798 0.1406	0.620 320. 393.	76.0 2814 0.1398	0.620 320. 393.	76.2 2830 0.1390	0.620 320. 393.
120	74.3 2770 0.1379	0.597 320. 382.	74.4 2789 0.1370	0.597 320. 382.	74.6 2806 0.1361	0.597 320. 382.	74.7 2823 0.1354	0.597 320. 382.	74.9 2839 0.1346	0.597 320. 382.
100	72.9 2781 0.1335	0.576 320. 371.	73.1 2799 0.1326	0.576 320. 371.	73.3 2816 0.1318	0.576 320. 371.	73.4 2832 0.1311	0.576 320. 371.	73.6 2847 0.1304	0.576 320. 371.

bd100_aeo_cr320_IMP_lw_FL_05 – 02/02/2004

Figure 04-06-04. Cruise Performance—320 KIAS (Sheet 5 of 12)

CRUISE 320 KIAS			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310										
290	86.2 2876 0.1710	0.822 320. 492.	86.4 2893 0.1700	0.822 320. 492.	86.5 2912 0.1689	0.822 320. 492.	86.7 2934 0.1676	0.822 320. 492.	87.0 2960 0.1662	0.822 320. 492.
280	85.2 2833 0.1710	0.806 320. 484.	85.3 2850 0.1700	0.806 320. 484.	85.5 2867 0.1690	0.806 320. 484.	85.6 2885 0.1679	0.806 320. 484.	85.8 2906 0.1667	0.806 320. 484.
260	83.5 2796 0.1681	0.776 320. 470.	83.7 2813 0.1671	0.776 320. 470.	83.9 2831 0.1660	0.776 320. 470.	84.0 2849 0.1649	0.776 320. 470.	84.2 2868 0.1639	0.776 320. 470.
240	82.1 2785 0.1638	0.747 320. 456.	82.3 2802 0.1628	0.747 320. 456.	82.4 2819 0.1618	0.747 320. 456.	82.6 2837 0.1608	0.747 320. 456.	82.8 2856 0.1597	0.747 320. 456.
220	80.8 2787 0.1588	0.719 320. 443.	81.0 2804 0.1579	0.719 320. 443.	81.1 2821 0.1569	0.719 320. 443.	81.3 2838 0.1559	0.719 320. 443.	81.5 2857 0.1549	0.719 320. 443.
200	79.7 2798 0.1535	0.692 320. 430.	79.8 2813 0.1527	0.692 320. 430.	79.9 2828 0.1519	0.692 320. 430.	80.1 2845 0.1510	0.692 320. 430.	80.2 2862 0.1501	0.692 320. 430.
180	78.6 2815 0.1481	0.667 320. 417.	78.7 2830 0.1474	0.667 320. 417.	78.8 2845 0.1466	0.667 320. 417.	79.0 2860 0.1458	0.667 320. 417.	79.1 2876 0.1450	0.667 320. 417.
160	77.5 2831 0.1430	0.643 320. 405.	77.6 2845 0.1423	0.643 320. 405.	77.7 2860 0.1416	0.643 320. 405.	77.9 2875 0.1408	0.643 320. 405.	78.0 2891 0.1401	0.643 320. 405.
140	76.3 2844 0.1383	0.620 320. 393.	76.4 2859 0.1376	0.620 320. 393.	76.6 2873 0.1369	0.620 320. 393.	76.7 2889 0.1362	0.620 320. 393.	76.8 2905 0.1354	0.620 320. 393.
120	75.0 2853 0.1339	0.597 320. 382.	75.1 2868 0.1332	0.597 320. 382.	75.3 2883 0.1326	0.597 320. 382.	75.4 2898 0.1318	0.597 320. 382.	75.5 2915 0.1311	0.597 320. 382.
100	73.7 2862 0.1297	0.576 320. 371.	73.8 2876 0.1291	0.576 320. 371.	74.0 2891 0.1284	0.576 320. 371.	74.1 2906 0.1278	0.576 320. 371.	74.2 2921 0.1271	0.576 320. 371.

bd100_aeo_cr320_IMP_hw_FL_05 – 02/02/2004

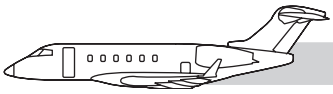
Figure 04-06-04. Cruise Performance—320 KIAS (Sheet 6 of 12)

CRUISE 320 KIAS			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350										
330										
310										
290	86.3 2829 0.1757	0.822 320. 497.	86.5 2852 0.1743	0.822 320. 497.	86.7 2873 0.1730	0.822 320. 497.	86.9 2891 0.1719	0.822 320. 497.	87.0 2907 0.1710	0.822 320. 497.
280	85.3 2793 0.1752	0.806 320. 490.	85.5 2813 0.1740	0.806 320. 490.	85.6 2831 0.1729	0.806 320. 490.	85.8 2848 0.1719	0.806 320. 490.	86.0 2864 0.1709	0.806 320. 490.
260	83.5 2752 0.1725	0.776 320. 475.	83.7 2771 0.1714	0.776 320. 475.	83.9 2790 0.1702	0.776 320. 475.	84.1 2807 0.1692	0.776 320. 475.	84.3 2824 0.1681	0.776 320. 475.
240	82.1 2740 0.1681	0.747 320. 461.	82.3 2759 0.1669	0.747 320. 461.	82.5 2778 0.1658	0.747 320. 461.	82.7 2796 0.1648	0.747 320. 461.	82.8 2813 0.1638	0.747 320. 461.
220	80.8 2742 0.1630	0.719 320. 447.	81.0 2761 0.1619	0.719 320. 447.	81.2 2779 0.1608	0.719 320. 447.	81.4 2797 0.1598	0.719 320. 447.	81.5 2814 0.1588	0.719 320. 447.
200	79.7 2760 0.1572	0.692 320. 434.	79.9 2777 0.1562	0.692 320. 434.	80.1 2794 0.1552	0.692 320. 434.	80.2 2811 0.1543	0.692 320. 434.	80.3 2826 0.1535	0.692 320. 434.
180	78.7 2778 0.1516	0.667 320. 421.	78.8 2796 0.1506	0.667 320. 421.	79.0 2813 0.1497	0.667 320. 421.	79.1 2828 0.1489	0.667 320. 421.	79.3 2843 0.1481	0.667 320. 421.
160	77.5 2791 0.1465	0.643 320. 409.	77.7 2810 0.1455	0.643 320. 409.	77.9 2828 0.1446	0.643 320. 409.	78.0 2843 0.1438	0.643 320. 409.	78.1 2858 0.1430	0.643 320. 409.
140	76.3 2802 0.1417	0.620 320. 397.	76.5 2821 0.1407	0.620 320. 397.	76.6 2838 0.1399	0.620 320. 397.	76.8 2855 0.1391	0.620 320. 397.	76.9 2870 0.1383	0.620 320. 397.
120	75.0 2811 0.1372	0.597 320. 386.	75.2 2829 0.1363	0.597 320. 386.	75.3 2846 0.1355	0.597 320. 386.	75.5 2862 0.1347	0.597 320. 386.	75.6 2878 0.1340	0.597 320. 386.
100	73.6 2818 0.1329	0.576 320. 375.	73.8 2836 0.1321	0.576 320. 375.	74.0 2852 0.1313	0.576 320. 375.	74.1 2868 0.1306	0.576 320. 375.	74.3 2882 0.1300	0.576 320. 375.

bd100_aeo_cr320_IMP_lw_FL_10 - 02/02/2004

Figure 04-06-04. Cruise Performance—320 KIAS (Sheet 7 of 12)



CRUISE 320 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310										
290	87.2 2924 0.1700	0.822 320. 497.	87.3 2942 0.1690	0.822 320. 497.	87.5 2961 0.1679	0.822 320. 497.	87.7 2983 0.1666	0.822 320. 497.	87.9 3009 0.1652	0.822 320. 497.
280	86.1 2880 0.1700	0.806 320. 490.	86.3 2896 0.1690	0.806 320. 490.	86.4 2914 0.1680	0.806 320. 490.	86.6 2933 0.1669	0.806 320. 490.	86.8 2954 0.1657	0.806 320. 490.
260	84.4 2842 0.1671	0.776 320. 475.	84.6 2859 0.1661	0.776 320. 475.	84.8 2877 0.1650	0.776 320. 475.	85.0 2896 0.1640	0.776 320. 475.	85.1 2915 0.1629	0.776 320. 475.
240	83.0 2830 0.1628	0.747 320. 461.	83.2 2847 0.1618	0.747 320. 461.	83.3 2864 0.1608	0.747 320. 461.	83.5 2882 0.1598	0.747 320. 461.	83.7 2901 0.1588	0.747 320. 461.
220	81.7 2830 0.1579	0.719 320. 447.	81.8 2848 0.1570	0.719 320. 447.	82.0 2865 0.1560	0.719 320. 447.	82.2 2883 0.1550	0.719 320. 447.	82.3 2901 0.1541	0.719 320. 447.
200	80.5 2842 0.1527	0.692 320. 434.	80.6 2857 0.1518	0.692 320. 434.	80.8 2872 0.1510	0.692 320. 434.	80.9 2888 0.1502	0.692 320. 434.	81.1 2906 0.1493	0.692 320. 434.
180	79.4 2858 0.1474	0.667 320. 421.	79.5 2872 0.1466	0.667 320. 421.	79.7 2887 0.1458	0.667 320. 421.	79.8 2902 0.1451	0.667 320. 421.	79.9 2918 0.1443	0.667 320. 421.
160	78.3 2872 0.1423	0.643 320. 409.	78.4 2887 0.1416	0.643 320. 409.	78.5 2901 0.1409	0.643 320. 409.	78.6 2917 0.1402	0.643 320. 409.	78.8 2933 0.1394	0.643 320. 409.
140	77.1 2885 0.1376	0.620 320. 397.	77.2 2900 0.1369	0.620 320. 397.	77.3 2914 0.1362	0.620 320. 397.	77.5 2930 0.1355	0.620 320. 397.	77.6 2946 0.1347	0.620 320. 397.
120	75.8 2893 0.1333	0.597 320. 386.	75.9 2908 0.1326	0.597 320. 386.	76.0 2923 0.1319	0.597 320. 386.	76.2 2939 0.1312	0.597 320. 386.	76.3 2955 0.1305	0.597 320. 386.
100	74.4 2897 0.1293	0.576 320. 375.	74.6 2912 0.1286	0.576 320. 375.	74.7 2927 0.1280	0.576 320. 375.	74.9 2942 0.1273	0.576 320. 375.	75.0 2958 0.1267	0.576 320. 375.

bd100_aeo_cr320_IMP_hw_FL_10 – 02/02/2004

Figure 04-06-04. Cruise Performance—320 KIAS (Sheet 8 of 12)

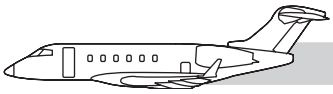
CRUISE 320 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350										
330										
310										
290	87.2 2875 0.1747	0.822 320. 502.	87.4 2898 0.1733	0.822 320. 502.	87.6 2919 0.1721	0.822 320. 502.	87.8 2937 0.1710	0.822 320. 502.	87.9 2954 0.1700	0.822 320. 502.
280	86.2 2838 0.1742	0.806 320. 495.	86.4 2858 0.1730	0.806 320. 495.	86.6 2876 0.1719	0.806 320. 495.	86.7 2893 0.1709	0.806 320. 495.	86.9 2909 0.1700	0.806 320. 495.
260	84.5 2796 0.1715	0.776 320. 480.	84.6 2815 0.1704	0.776 320. 480.	84.8 2834 0.1692	0.776 320. 480.	85.0 2852 0.1682	0.776 320. 480.	85.2 2869 0.1672	0.776 320. 480.
240	83.0 2783 0.1671	0.747 320. 465.	83.2 2803 0.1660	0.747 320. 465.	83.4 2822 0.1649	0.747 320. 465.	83.6 2840 0.1638	0.747 320. 465.	83.7 2857 0.1628	0.747 320. 465.
220	81.7 2785 0.1621	0.719 320. 451.	81.9 2804 0.1609	0.719 320. 451.	82.1 2823 0.1599	0.719 320. 451.	82.2 2841 0.1589	0.719 320. 451.	82.4 2858 0.1579	0.719 320. 451.
200	80.6 2802 0.1563	0.692 320. 438.	80.7 2820 0.1553	0.692 320. 438.	80.9 2837 0.1544	0.692 320. 438.	81.0 2854 0.1535	0.692 320. 438.	81.2 2869 0.1526	0.692 320. 438.
180	79.5 2820 0.1507	0.667 320. 425.	79.6 2838 0.1498	0.667 320. 425.	79.8 2855 0.1489	0.667 320. 425.	79.9 2871 0.1481	0.667 320. 425.	80.1 2886 0.1473	0.667 320. 425.
160	78.3 2832 0.1457	0.643 320. 413.	78.5 2851 0.1448	0.643 320. 413.	78.6 2869 0.1438	0.643 320. 413.	78.8 2884 0.1431	0.643 320. 413.	78.9 2900 0.1423	0.643 320. 413.
140	77.1 2842 0.1410	0.620 320. 401.	77.3 2861 0.1400	0.620 320. 401.	77.4 2879 0.1392	0.620 320. 401.	77.6 2896 0.1384	0.620 320. 401.	77.7 2912 0.1376	0.620 320. 401.
120	75.7 2849 0.1366	0.597 320. 389.	75.9 2868 0.1357	0.597 320. 389.	76.1 2886 0.1348	0.597 320. 389.	76.2 2902 0.1341	0.597 320. 389.	76.4 2918 0.1333	0.597 320. 389.
100	74.4 2857 0.1323	0.576 320. 378.	74.6 2875 0.1315	0.576 320. 378.	74.7 2892 0.1307	0.576 320. 378.	74.9 2908 0.1300	0.576 320. 378.	75.0 2922 0.1294	0.576 320. 378.

bd100_aeo_cr320_IMP_lw_FL_15 – 02/02/2004

Figure 04-06-04. Cruise Performance—320 KIAS (Sheet 9 of 12)



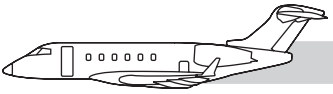
CRUISE 320 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310										
290	88.1 2971 0.1690	0.822 320. 502.	88.3 2988 0.1680	0.822 320. 502.	88.4 3008 0.1669	0.822 320. 502.	88.6 3031 0.1657	0.822 320. 502.	88.9 3057 0.1643	0.822 320. 502.
280	87.0 2926 0.1690	0.806 320. 495.	87.2 2942 0.1681	0.806 320. 495.	87.3 2960 0.1671	0.806 320. 495.	87.5 2979 0.1660	0.806 320. 495.	87.7 3000 0.1648	0.806 320. 495.
260	85.3 2887 0.1661	0.776 320. 480.	85.5 2905 0.1651	0.776 320. 480.	85.7 2922 0.1641	0.776 320. 480.	85.9 2942 0.1630	0.776 320. 480.	86.0 2961 0.1620	0.776 320. 480.
240	83.9 2874 0.1619	0.747 320. 465.	84.0 2892 0.1609	0.747 320. 465.	84.2 2909 0.1599	0.747 320. 465.	84.4 2927 0.1589	0.747 320. 465.	84.6 2947 0.1579	0.747 320. 465.
220	82.5 2875 0.1570	0.719 320. 451.	82.7 2892 0.1561	0.719 320. 451.	82.9 2910 0.1551	0.719 320. 451.	83.0 2928 0.1542	0.719 320. 451.	83.2 2947 0.1532	0.719 320. 451.
200	81.3 2885 0.1518	0.692 320. 438.	81.5 2901 0.1510	0.692 320. 438.	81.6 2917 0.1502	0.692 320. 438.	81.8 2933 0.1493	0.692 320. 438.	81.9 2951 0.1484	0.692 320. 438.
180	80.2 2901 0.1465	0.667 320. 425.	80.3 2916 0.1458	0.667 320. 425.	80.5 2931 0.1450	0.667 320. 425.	80.6 2946 0.1443	0.667 320. 425.	80.8 2963 0.1435	0.667 320. 425.
160	79.1 2914 0.1416	0.643 320. 413.	79.2 2929 0.1409	0.643 320. 413.	79.3 2943 0.1402	0.643 320. 413.	79.4 2959 0.1394	0.643 320. 413.	79.6 2975 0.1387	0.643 320. 413.
140	77.8 2927 0.1369	0.620 320. 401.	78.0 2941 0.1362	0.620 320. 401.	78.1 2956 0.1355	0.620 320. 401.	78.2 2972 0.1348	0.620 320. 401.	78.4 2988 0.1341	0.620 320. 401.
120	76.5 2933 0.1327	0.597 320. 389.	76.6 2948 0.1320	0.597 320. 389.	76.8 2963 0.1313	0.597 320. 389.	76.9 2980 0.1306	0.597 320. 389.	77.1 2996 0.1299	0.597 320. 389.
100	75.2 2936 0.1287	0.576 320. 378.	75.3 2951 0.1281	0.576 320. 378.	75.4 2966 0.1274	0.576 320. 378.	75.6 2981 0.1268	0.576 320. 378.	75.8 2998 0.1261	0.576 320. 378.

bd100_aeo_cr320_IMP_hw_FL_15 – 02/02/2004

Figure 04-06-04. Cruise Performance—320 KIAS (Sheet 10 of 12)



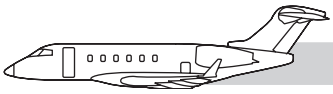
CRUISE 320 KIAS

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350										
330										
310										
290	88.1 2918 0.1739	0.822 320. 507.	88.3 2942 0.1724	0.822 320. 507.	88.5 2963 0.1712	0.822 320. 507.				
280	87.1 2881 0.1734	0.806 320. 500.	87.3 2901 0.1722	0.806 320. 500.	87.5 2919 0.1711	0.806 320. 500.	87.6 2936 0.1701	0.806 320. 500.	87.8 2953 0.1691	0.806 320. 500.
260	85.3 2839 0.1706	0.776 320. 484.	85.5 2859 0.1694	0.776 320. 484.	85.7 2877 0.1683	0.776 320. 484.	85.9 2895 0.1673	0.776 320. 484.	86.1 2913 0.1663	0.776 320. 484.
240	83.9 2826 0.1662	0.747 320. 470.	84.1 2845 0.1651	0.747 320. 470.	84.2 2864 0.1640	0.747 320. 470.	84.4 2883 0.1630	0.747 320. 470.	84.6 2900 0.1620	0.747 320. 470.
220	82.5 2827 0.1612	0.719 320. 456.	82.7 2847 0.1601	0.719 320. 456.	82.9 2866 0.1590	0.719 320. 456.	83.1 2884 0.1580	0.719 320. 456.	83.2 2902 0.1570	0.719 320. 456.
200	81.4 2845 0.1554	0.692 320. 442.	81.6 2863 0.1544	0.692 320. 442.	81.7 2880 0.1535	0.692 320. 442.	81.9 2897 0.1526	0.692 320. 442.	82.0 2913 0.1518	0.692 320. 442.
180	80.3 2862 0.1499	0.667 320. 429.	80.5 2880 0.1490	0.667 320. 429.	80.6 2897 0.1481	0.667 320. 429.	80.8 2913 0.1473	0.667 320. 429.	80.9 2929 0.1465	0.667 320. 429.
160	79.1 2874 0.1449	0.643 320. 416.	79.3 2893 0.1440	0.643 320. 416.	79.4 2911 0.1431	0.643 320. 416.	79.6 2927 0.1423	0.643 320. 416.	79.7 2942 0.1415	0.643 320. 416.
140	77.8 2882 0.1403	0.620 320. 404.	78.0 2902 0.1393	0.620 320. 404.	78.2 2920 0.1385	0.620 320. 404.	78.3 2937 0.1377	0.620 320. 404.	78.5 2953 0.1369	0.620 320. 404.
120	76.5 2889 0.1359	0.597 320. 393.	76.6 2908 0.1350	0.597 320. 393.	76.8 2926 0.1342	0.597 320. 393.	77.0 2943 0.1334	0.597 320. 393.	77.1 2959 0.1327	0.597 320. 393.
100	75.1 2896 0.1317	0.576 320. 381.	75.3 2914 0.1308	0.576 320. 381.	75.4 2932 0.1301	0.576 320. 381.	75.6 2948 0.1293	0.576 320. 381.	75.7 2963 0.1287	0.576 320. 381.

bd100_aeo_cr320_IMP_lw_FL_20 – 02/02/2004

Figure 04-06-04. Cruise Performance—320 KIAS (Sheet 11 of 12)



CRUISE 320 KIAS			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310										
290										
280	87.9 2969 0.1682	0.806 320. 500.	88.1 2986 0.1673	0.806 320. 500.	88.2 3004 0.1663	0.806 320. 500.	88.4 3024 0.1652	0.806 320. 500.	88.6 3045 0.1640	0.806 320. 500.
260	86.2 2931 0.1653	0.776 320. 484.	86.4 2949 0.1643	0.776 320. 484.	86.6 2967 0.1633	0.776 320. 484.	86.7 2986 0.1622	0.776 320. 484.	86.9 3006 0.1611	0.776 320. 484.
240	84.7 2918 0.1610	0.747 320. 470.	84.9 2935 0.1601	0.747 320. 470.	85.1 2953 0.1591	0.747 320. 470.	85.3 2972 0.1581	0.747 320. 470.	85.4 2991 0.1570	0.747 320. 470.
220	83.4 2918 0.1561	0.719 320. 456.	83.6 2936 0.1552	0.719 320. 456.	83.7 2953 0.1543	0.719 320. 456.	83.9 2972 0.1533	0.719 320. 456.	84.1 2990 0.1524	0.719 320. 456.
200	82.2 2929 0.1510	0.692 320. 442.	82.3 2944 0.1502	0.692 320. 442.	82.4 2960 0.1494	0.692 320. 442.	82.6 2977 0.1485	0.692 320. 442.	82.8 2995 0.1476	0.692 320. 442.
180	81.0 2944 0.1457	0.667 320. 429.	81.2 2959 0.1450	0.667 320. 429.	81.3 2974 0.1443	0.667 320. 429.	81.4 2990 0.1435	0.667 320. 429.	81.6 3006 0.1427	0.667 320. 429.
160	79.8 2957 0.1408	0.643 320. 416.	80.0 2972 0.1401	0.643 320. 416.	80.1 2987 0.1394	0.643 320. 416.	80.2 3003 0.1387	0.643 320. 416.	80.4 3019 0.1379	0.643 320. 416.
140	78.6 2968 0.1362	0.620 320. 404.	78.7 2983 0.1355	0.620 320. 404.	78.9 2998 0.1349	0.620 320. 404.	79.0 3014 0.1341	0.620 320. 404.	79.1 3030 0.1334	0.620 320. 404.
120	77.2 2974 0.1320	0.597 320. 393.	77.4 2989 0.1313	0.597 320. 393.	77.5 3005 0.1307	0.597 320. 393.	77.7 3021 0.1300	0.597 320. 393.	77.8 3038 0.1292	0.597 320. 393.
100	75.9 2978 0.1281	0.576 320. 381.	76.0 2992 0.1274	0.576 320. 381.	76.1 3007 0.1268	0.576 320. 381.	76.3 3022 0.1262	0.576 320. 381.	76.4 3039 0.1255	0.576 320. 381.

bd100_aoo_cr320_IMP_hw_FL_20 – 02/02/2004

Figure 04-06-04. Cruise Performance—320 KIAS (Sheet 12 of 12)

CRUISE 0.75 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF

ISA – 10 C

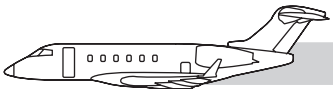
30% C.G.

%N1 MACH
LB/HR KIAS
NAM/LB KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	79.8 1206 0.3483	0.750 200. 420.	80.6 1247 0.3367	0.750 200. 420.	81.6 1298 0.3237	0.750 200. 420.	82.7 1354 0.3101	0.750 200. 420.	83.9 1415 0.2969	0.750 200. 420.
430	78.8 1263 0.3324	0.750 210. 420.	79.4 1296 0.3240	0.750 210. 420.	80.2 1336 0.3144	0.750 210. 420.	81.1 1383 0.3037	0.750 210. 420.	82.0 1436 0.2924	0.750 210. 420.
410	77.9 1331 0.3155	0.750 220. 420.	78.4 1359 0.3091	0.750 220. 420.	79.1 1390 0.3021	0.750 220. 420.	79.7 1426 0.2945	0.750 220. 420.	80.5 1470 0.2857	0.750 220. 420.
390	77.2 1414 0.2970	0.750 231. 420.	77.6 1437 0.2923	0.750 231. 420.	78.1 1464 0.2868	0.750 231. 420.	78.6 1494 0.2811	0.750 231. 420.	79.2 1528 0.2749	0.750 231. 420.
370	76.7 1515 0.2772	0.750 242. 420.	77.0 1534 0.2738	0.750 242. 420.	77.4 1557 0.2698	0.750 242. 420.	77.8 1583 0.2654	0.750 242. 420.	78.3 1612 0.2606	0.750 242. 420.
350	76.7 1640 0.2574	0.750 253. 422.	77.0 1657 0.2547	0.750 253. 422.	77.3 1676 0.2519	0.750 253. 422.	77.6 1698 0.2487	0.750 253. 422.	78.0 1722 0.2452	0.750 253. 422.
330	77.1 1786 0.2386	0.750 265. 426.	77.4 1802 0.2365	0.750 265. 426.	77.6 1819 0.2343	0.750 265. 426.	77.9 1837 0.2320	0.750 265. 426.	78.2 1857 0.2295	0.750 265. 426.
310	77.5 1942 0.2216	0.750 277. 430.	77.7 1957 0.2198	0.750 277. 430.	77.9 1973 0.2180	0.750 277. 430.	78.1 1990 0.2162	0.750 277. 430.	78.4 2008 0.2143	0.750 277. 430.
290	77.9 2113 0.2054	0.750 289. 434.	78.1 2129 0.2039	0.750 289. 434.	78.2 2144 0.2025	0.750 289. 434.	78.4 2159 0.2010	0.750 289. 434.	78.6 2176 0.1995	0.750 289. 434.
280	78.1 2203 0.1979	0.750 296. 436.	78.3 2219 0.1965	0.750 296. 436.	78.4 2235 0.1951	0.750 296. 436.	78.6 2251 0.1937	0.750 296. 436.	78.8 2267 0.1924	0.750 296. 436.
270	78.2 2295 0.1908	0.750 302. 438.	78.4 2312 0.1895	0.750 302. 438.	78.6 2328 0.1882	0.750 302. 438.	78.8 2343 0.1869	0.750 302. 438.	78.9 2359 0.1857	0.750 302. 438.
260	78.4 2391 0.1840	0.750 308. 440.	78.6 2408 0.1827	0.750 308. 440.	78.8 2425 0.1814	0.750 308. 440.	78.9 2440 0.1803	0.750 308. 440.	79.1 2456 0.1791	0.750 308. 440.
250	78.5 2488 0.1776	0.750 315. 442.	78.7 2506 0.1763	0.750 315. 442.	78.9 2522 0.1752	0.750 315. 442.	79.1 2538 0.1741	0.750 315. 442.	79.2 2554 0.1730	0.750 315. 442.
240										

bd100_aeo_cr75_IMP_lw_hFL_m10 – 02/02/2004

Figure 04-06-05. Cruise Performance—0.75 M (Sheet 1 of 12)



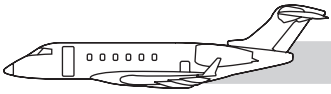
CRUISE 0.75 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450	85.2 1480 0.2837	0.750 200. 420.	87.1 1569 0.2677	0.750 200. 420.						
430	83.1 1496 0.2808	0.750 210. 420.	84.2 1559 0.2695	0.750 210. 420.	85.4 1628 0.2580	0.750 210. 420.	87.3 1722 0.2439	0.750 210. 420.		
410	81.3 1521 0.2762	0.750 220. 420.	82.2 1576 0.2665	0.750 220. 420.	83.2 1638 0.2565	0.750 220. 420.	84.2 1702 0.2468	0.750 220. 420.	85.3 1773 0.2369	0.750 220. 420.
390	79.8 1568 0.2679	0.750 231. 420.	80.6 1614 0.2603	0.750 231. 420.	81.4 1666 0.2522	0.750 231. 420.	82.2 1723 0.2438	0.750 231. 420.	83.1 1785 0.2353	0.750 231. 420.
370	78.8 1644 0.2556	0.750 242. 420.	79.3 1680 0.2501	0.750 242. 420.	79.9 1720 0.2442	0.750 242. 420.	80.6 1768 0.2376	0.750 242. 420.	81.4 1821 0.2307	0.750 242. 420.
350	78.4 1750 0.2413	0.750 253. 422.	78.8 1780 0.2371	0.750 253. 422.	79.3 1814 0.2328	0.750 253. 422.	79.8 1851 0.2281	0.750 253. 422.	80.4 1893 0.2230	0.750 253. 422.
330	78.5 1881 0.2266	0.750 265. 426.	78.8 1908 0.2234	0.750 265. 426.	79.2 1937 0.2201	0.750 265. 426.	79.7 1968 0.2166	0.750 265. 426.	80.1 2003 0.2128	0.750 265. 426.
310	78.6 2027 0.2122	0.750 277. 430.	78.9 2049 0.2099	0.750 277. 430.	79.2 2074 0.2074	0.750 277. 430.	79.6 2101 0.2047	0.750 277. 430.	79.9 2132 0.2018	0.750 277. 430.
290	78.8 2193 0.1979	0.750 289. 434.	79.1 2212 0.1962	0.750 289. 434.	79.3 2233 0.1944	0.750 289. 434.	79.6 2256 0.1924	0.750 289. 434.	79.9 2281 0.1903	0.750 289. 434.
280	79.0 2283 0.1910	0.750 296. 436.	79.2 2301 0.1895	0.750 296. 436.	79.4 2321 0.1879	0.750 296. 436.	79.7 2341 0.1862	0.750 296. 436.	79.9 2365 0.1844	0.750 296. 436.
270	79.1 2375 0.1844	0.750 302. 438.	79.3 2392 0.1831	0.750 302. 438.	79.5 2410 0.1817	0.750 302. 438.	79.7 2430 0.1803	0.750 302. 438.	80.0 2450 0.1787	0.750 302. 438.
260	79.3 2471 0.1780	0.750 308. 440.	79.4 2488 0.1768	0.750 308. 440.	79.6 2505 0.1756	0.750 308. 440.	79.8 2523 0.1743	0.750 308. 440.	80.0 2543 0.1730	0.750 308. 440.
250	79.4 2569 0.1720	0.750 315. 442.	79.6 2585 0.1709	0.750 315. 442.	79.7 2602 0.1698	0.750 315. 442.	79.9 2620 0.1687	0.750 315. 442.	80.1 2638 0.1675	0.750 315. 442.
240										

bd100_aeo_cr75_IMP_hw_hFL_m10 – 02/02/2004

Figure 04-06-05. Cruise Performance—0.75 M (Sheet 2 of 12)



CRUISE 0.75 M_1

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT - 1000 LB									
	24		26		28		30		32	
450	81.9 1253 0.3433	0.750 200. 430.	82.7 1296 0.3319	0.750 200. 430.	83.7 1348 0.3191	0.750 200. 430.	84.8 1405 0.3060	0.750 200. 430.	86.0 1468 0.2931	0.750 200. 430.
430	80.8 1311 0.3279	0.750 210. 430.	81.5 1346 0.3195	0.750 210. 430.	82.3 1387 0.3101	0.750 210. 430.	83.1 1435 0.2996	0.750 210. 430.	84.1 1490 0.2886	0.750 210. 430.
410	79.9 1382 0.3111	0.750 220. 430.	80.5 1411 0.3048	0.750 220. 430.	81.1 1444 0.2978	0.750 220. 430.	81.8 1482 0.2902	0.750 220. 430.	82.5 1527 0.2817	0.750 220. 430.
390	79.2 1465 0.2935	0.750 231. 430.	79.6 1490 0.2887	0.750 231. 430.	80.1 1518 0.2833	0.750 231. 430.	80.6 1549 0.2777	0.750 231. 430.	81.2 1584 0.2715	0.750 231. 430.
370	78.6 1567 0.2744	0.750 242. 430.	78.9 1587 0.2710	0.750 242. 430.	79.3 1610 0.2671	0.750 242. 430.	79.7 1637 0.2627	0.750 242. 430.	80.2 1667 0.2580	0.750 242. 430.
350	78.6 1696 0.2548	0.750 253. 432.	78.8 1714 0.2522	0.750 253. 432.	79.1 1733 0.2493	0.750 253. 432.	79.5 1755 0.2462	0.750 253. 432.	79.8 1780 0.2428	0.750 253. 432.
330	79.0 1848 0.2360	0.750 265. 436.	79.2 1864 0.2339	0.750 265. 436.	79.4 1881 0.2318	0.750 265. 436.	79.7 1900 0.2296	0.750 265. 436.	80.0 1921 0.2270	0.750 265. 436.
310	79.4 2010 0.2189	0.750 277. 440.	79.6 2026 0.2171	0.750 277. 440.	79.8 2043 0.2154	0.750 277. 440.	80.0 2060 0.2136	0.750 277. 440.	80.2 2078 0.2117	0.750 277. 440.
290	79.7 2185 0.2031	0.750 289. 444.	79.9 2201 0.2017	0.750 289. 444.	80.1 2217 0.2002	0.750 289. 444.	80.3 2233 0.1988	0.750 289. 444.	80.5 2249 0.1973	0.750 289. 444.
280	79.9 2278 0.1957	0.750 296. 446.	80.1 2294 0.1943	0.750 296. 446.	80.3 2310 0.1929	0.750 296. 446.	80.5 2326 0.1916	0.750 296. 446.	80.6 2343 0.1902	0.750 296. 446.
270	80.0 2372 0.1887	0.750 302. 448.	80.2 2389 0.1874	0.750 302. 448.	80.4 2406 0.1861	0.750 302. 448.	80.6 2422 0.1848	0.750 302. 448.	80.8 2438 0.1836	0.750 302. 448.
260	80.2 2472 0.1818	0.750 308. 450.	80.4 2490 0.1805	0.750 308. 450.	80.6 2507 0.1793	0.750 308. 450.	80.8 2523 0.1782	0.750 308. 450.	80.9 2539 0.1771	0.750 308. 450.
250	80.4 2573 0.1754	0.750 315. 452.	80.6 2591 0.1742	0.750 315. 452.	80.7 2608 0.1731	0.750 315. 452.	80.9 2625 0.1720	0.750 315. 452.	81.1 2640 0.1710	0.750 315. 452.
240										

bd100_aeo_cr75_tMP_lw_hFL_00 - 02/02/2004

Figure 04-06-05. Cruise Performance—0.75 M (Sheet 3 of 12)

CRUISE 0.75 M_I			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450	87.3 1535 0.2801	0.750 200. 430.								
430	85.1 1551 0.2772	0.750 210. 430.	86.3 1616 0.2662	0.750 210. 430.	87.5 1687 0.2549	0.750 210. 430.	89.5 1786 0.2408	0.750 210. 430.		
410	83.4 1579 0.2724	0.750 220. 430.	84.3 1637 0.2628	0.750 220. 430.	85.3 1699 0.2531	0.750 220. 430.	86.3 1765 0.2436	0.750 220. 430.	87.4 1839 0.2339	0.750 220. 430.
390	81.9 1624 0.2648	0.750 231. 430.	82.6 1672 0.2572	0.750 231. 430.	83.4 1727 0.2491	0.750 231. 430.	84.3 1786 0.2408	0.750 231. 430.	85.2 1849 0.2326	0.750 231. 430.
370	80.7 1699 0.2531	0.750 242. 430.	81.2 1737 0.2476	0.750 242. 430.	81.9 1778 0.2418	0.750 242. 430.	82.5 1827 0.2354	0.750 242. 430.	83.3 1882 0.2285	0.750 242. 430.
350	80.3 1809 0.2389	0.750 253. 432.	80.7 1841 0.2348	0.750 253. 432.	81.2 1875 0.2305	0.750 253. 432.	81.7 1913 0.2259	0.750 253. 432.	82.3 1957 0.2209	0.750 253. 432.
330	80.3 1945 0.2242	0.750 265. 436.	80.7 1972 0.2211	0.750 265. 436.	81.1 2002 0.2178	0.750 265. 436.	81.5 2034 0.2144	0.750 265. 436.	82.0 2070 0.2107	0.750 265. 436.
310	80.5 2098 0.2097	0.750 277. 440.	80.8 2120 0.2075	0.750 277. 440.	81.1 2145 0.2051	0.750 277. 440.	81.4 2174 0.2023	0.750 277. 440.	81.8 2206 0.1995	0.750 277. 440.
290	80.7 2268 0.1957	0.750 289. 444.	80.9 2287 0.1940	0.750 289. 444.	81.2 2308 0.1923	0.750 289. 444.	81.5 2332 0.1903	0.750 289. 444.	81.8 2358 0.1882	0.750 289. 444.
280	80.8 2360 0.1888	0.750 296. 446.	81.1 2379 0.1874	0.750 296. 446.	81.3 2399 0.1858	0.750 296. 446.	81.5 2420 0.1842	0.750 296. 446.	81.8 2444 0.1824	0.750 296. 446.
270	81.0 2455 0.1823	0.750 302. 448.	81.1 2472 0.1810	0.750 302. 448.	81.3 2491 0.1797	0.750 302. 448.	81.6 2511 0.1783	0.750 302. 448.	81.8 2532 0.1768	0.750 302. 448.
260	81.1 2555 0.1760	0.750 308. 450.	81.3 2572 0.1748	0.750 308. 450.	81.5 2590 0.1736	0.750 308. 450.	81.7 2609 0.1723	0.750 308. 450.	81.9 2629 0.1710	0.750 308. 450.
250	81.2 2656 0.1699	0.750 315. 452.	81.4 2673 0.1689	0.750 315. 452.	81.6 2690 0.1678	0.750 315. 452.	81.8 2709 0.1667	0.750 315. 452.	81.9 2727 0.1655	0.750 315. 452.
240										

bd100_aeo_cr75_IMP_hw_hFL_00 – 02/02/2004

Figure 04-06-05. Cruise Performance—0.75 M (Sheet 4 of 12)

CRUISE 0.75 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF

ISA + 5 C

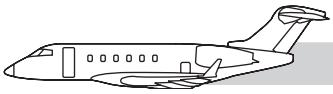
30% C.G.

%N1 MACH
LB/HR KIAS
NAM/LB KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	82.9 1276 0.3409	0.750 200. 435.	83.7 1320 0.3296	0.750 200. 435.	84.7 1372 0.3170	0.750 200. 435.	85.8 1430 0.3041	0.750 200. 435.	87.0 1494 0.2913	0.750 200. 435.
430	81.8 1336 0.3257	0.750 210. 435.	82.5 1371 0.3173	0.750 210. 435.	83.3 1412 0.3080	0.750 210. 435.	84.1 1461 0.2977	0.750 210. 435.	85.1 1517 0.2867	0.750 210. 435.
410	80.9 1408 0.3090	0.750 220. 435.	81.5 1437 0.3026	0.750 220. 435.	82.1 1471 0.2957	0.750 220. 435.	82.8 1510 0.2881	0.750 220. 435.	83.5 1556 0.2796	0.750 220. 435.
390	80.1 1494 0.2913	0.750 231. 435.	80.6 1518 0.2866	0.750 231. 435.	81.1 1546 0.2813	0.750 231. 435.	81.6 1578 0.2757	0.750 231. 435.	82.2 1614 0.2695	0.750 231. 435.
370	79.5 1594 0.2729	0.750 242. 435.	79.8 1614 0.2695	0.750 242. 435.	80.2 1638 0.2656	0.750 242. 435.	80.6 1665 0.2613	0.750 242. 435.	81.1 1695 0.2566	0.750 242. 435.
350	79.5 1725 0.2534	0.750 253. 437.	79.7 1743 0.2508	0.750 253. 437.	80.0 1763 0.2480	0.750 253. 437.	80.4 1785 0.2449	0.750 253. 437.	80.8 1811 0.2414	0.750 253. 437.
330	79.9 1879 0.2347	0.750 265. 441.	80.1 1896 0.2326	0.750 265. 441.	80.3 1913 0.2305	0.750 265. 441.	80.6 1932 0.2283	0.750 266. 441.	80.9 1954 0.2257	0.750 265. 441.
310	80.2 2044 0.2177	0.750 277. 445.	80.5 2060 0.2160	0.750 277. 445.	80.7 2076 0.2142	0.750 277. 445.	80.9 2094 0.2124	0.750 277. 445.	81.1 2112 0.2106	0.750 277. 445.
290	80.6 2221 0.2020	0.750 289. 449.	80.8 2237 0.2006	0.750 289. 449.	81.0 2253 0.1991	0.750 289. 449.	81.2 2269 0.1977	0.750 289. 449.	81.4 2286 0.1962	0.750 289. 449.
280	80.8 2315 0.1946	0.750 296. 451.	81.0 2332 0.1932	0.750 296. 451.	81.2 2348 0.1918	0.750 296. 451.	81.4 2365 0.1905	0.750 296. 451.	81.6 2381 0.1892	0.750 296. 451.
270	80.9 2411 0.1876	0.750 302. 452.	81.1 2429 0.1862	0.750 302. 452.	81.3 2446 0.1850	0.750 302. 452.	81.5 2462 0.1838	0.750 302. 452.	81.7 2478 0.1825	0.750 302. 452.
260	81.1 2512 0.1808	0.750 308. 454.	81.3 2530 0.1795	0.750 308. 454.	81.5 2548 0.1783	0.750 308. 454.	81.7 2564 0.1772	0.750 308. 454.	81.8 2580 0.1761	0.750 308. 454.
250	81.2 2615 0.1744	0.750 315. 456.	81.4 2633 0.1732	0.750 315. 456.	81.6 2650 0.1721	0.750 315. 456.	81.8 2667 0.1710	0.750 315. 456.	82.0 2684 0.1700	0.750 315. 456.
240										

bd100_aeo_cr75_IMP_lw_hFL_05 – 02/02/2004

Figure 04-06-05. Cruise Performance—0.75 M (Sheet 5 of 12)



CRUISE 0.75 M_i

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450	88.3 1562 0.2784	0.750 200. 435.								
430	86.2 1580 0.2753	0.750 210. 435.	87.3 1645 0.2645	0.750 210. 435.	88.5 1717 0.2533	0.750 210. 435.	90.6 1818 0.2393	0.750 210. 435.		
410	84.4 1609 0.2704	0.750 220. 435.	85.3 1667 0.2609	0.750 220. 435.	86.3 1731 0.2514	0.750 220. 435.	87.3 1797 0.2421	0.750 220. 435.	88.5 1872 0.2324	0.750 220. 435.
390	82.9 1655 0.2628	0.750 231. 435.	83.6 1704 0.2553	0.750 231. 435.	84.4 1758 0.2474	0.750 231. 435.	85.3 1818 0.2393	0.750 231. 435.	86.2 1882 0.2312	0.750 231. 435.
370	81.6 1729 0.2516	0.750 242. 435.	82.2 1767 0.2462	0.750 242. 435.	82.8 1809 0.2405	0.750 242. 435.	83.5 1859 0.2340	0.750 242. 435.	84.3 1914 0.2273	0.750 242. 435.
350	81.2 1840 0.2376	0.750 253. 437.	81.6 1872 0.2335	0.750 253. 437.	82.1 1906 0.2293	0.750 253. 437.	82.6 1945 0.2248	0.750 253. 437.	83.2 1989 0.2198	0.750 253. 437.
330	81.2 1978 0.2229	0.750 265. 441.	81.6 2006 0.2199	0.750 265. 441.	82.0 2036 0.2166	0.750 265. 441.	82.4 2069 0.2132	0.750 265. 441.	82.9 2105 0.2095	0.750 265. 441.
310	81.4 2133 0.2085	0.750 277. 445.	81.7 2155 0.2064	0.750 277. 445.	82.0 2181 0.2040	0.750 277. 445.	82.3 2210 0.2012	0.750 277. 445.	82.7 2242 0.1984	0.750 277. 445.
290	81.6 2305 0.1946	0.750 289. 449.	81.9 2325 0.1930	0.750 289. 449.	82.1 2346 0.1912	0.750 289. 449.	82.4 2370 0.1893	0.750 289. 449.	82.7 2397 0.1872	0.750 289. 449.
280	81.8 2399 0.1878	0.750 296. 451.	82.0 2418 0.1863	0.750 296. 451.	82.2 2438 0.1848	0.750 296. 451.	82.4 2460 0.1832	0.750 296. 451.	82.7 2484 0.1813	0.750 296. 451.
270	81.9 2495 0.1813	0.750 302. 452.	82.1 2513 0.1800	0.750 302. 452.	82.3 2532 0.1787	0.750 302. 452.	82.5 2552 0.1772	0.750 302. 452.	82.7 2574 0.1757	0.750 302. 452.
260	82.0 2596 0.1750	0.750 308. 454.	82.2 2614 0.1738	0.750 308. 454.	82.4 2632 0.1726	0.750 308. 454.	82.6 2651 0.1713	0.750 308. 454.	82.8 2673 0.1700	0.750 308. 454.
250	82.1 2700 0.1689	0.750 315. 456.	82.3 2717 0.1679	0.750 315. 456.	82.5 2735 0.1668	0.750 315. 456.	82.6 2753 0.1657	0.750 315. 456.	82.8 2772 0.1645	0.750 315. 456.
240										

bd100_aeo_cr75_IMP_hw_hFL_05 – 02/02/2004

Figure 04-06-05. Cruise Performance—0.75 M (Sheet 6 of 12)

CRUISE 0.75 M_I			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	83.9 1299 0.3387	0.750 200. 440.	84.8 1344 0.3273	0.750 200. 440.	85.8 1397 0.3150	0.750 200. 440.	86.9 1457 0.3019	0.750 200. 440.	88.0 1521 0.2893	0.750 200. 440.
430	82.8 1360 0.3235	0.750 210. 440.	83.5 1396 0.3152	0.750 210. 440.	84.3 1438 0.3059	0.750 210. 440.	85.1 1487 0.2957	0.750 210. 440.	86.1 1545 0.2848	0.750 210. 440.
410	81.9 1434 0.3067	0.750 220. 440.	82.5 1464 0.3004	0.750 220. 440.	83.1 1499 0.2935	0.750 220. 440.	83.8 1537 0.2861	0.750 220. 440.	84.5 1583 0.2778	0.750 220. 440.
390	81.1 1521 0.2891	0.750 231. 440.	81.6 1546 0.2845	0.750 231. 440.	82.1 1575 0.2793	0.750 231. 440.	82.6 1608 0.2736	0.750 231. 440.	83.2 1644 0.2676	0.750 231. 440.
370	80.5 1623 0.2711	0.750 242. 440.	80.8 1643 0.2677	0.750 242. 440.	81.2 1666 0.2640	0.750 242. 440.	81.6 1693 0.2598	0.750 242. 440.	82.1 1725 0.2551	0.750 242. 440.
350	80.4 1754 0.2519	0.750 253. 442.	80.6 1772 0.2494	0.750 253. 442.	80.9 1792 0.2467	0.750 253. 442.	81.3 1814 0.2437	0.750 253. 442.	81.6 1840 0.2402	0.750 253. 442.
330	80.8 1909 0.2335	0.750 265. 446.	81.0 1926 0.2315	0.750 265. 446.	81.2 1944 0.2293	0.750 265. 446.	81.5 1963 0.2271	0.750 265. 446.	81.8 1985 0.2246	0.750 265. 446.
310	81.1 2078 0.2163	0.750 277. 450.	81.3 2094 0.2147	0.750 277. 450.	81.6 2111 0.2130	0.750 277. 450.	81.8 2128 0.2113	0.750 277. 450.	82.0 2146 0.2095	0.750 277. 450.
290	81.5 2257 0.2009	0.750 289. 453.	81.7 2273 0.1994	0.750 289. 453.	81.9 2290 0.1980	0.750 289. 453.	82.1 2307 0.1965	0.750 289. 453.	82.3 2324 0.1950	0.750 289. 453.
280	81.7 2352 0.1935	0.750 296. 455.	81.9 2369 0.1921	0.750 296. 455.	82.1 2386 0.1908	0.750 296. 455.	82.2 2402 0.1895	0.750 296. 455.	82.4 2419 0.1882	0.750 296. 455.
270	81.8 2450 0.1865	0.750 302. 457.	82.0 2468 0.1852	0.750 302. 457.	82.2 2485 0.1840	0.750 302. 457.	82.4 2501 0.1828	0.750 302. 457.	82.6 2517 0.1816	0.750 302. 457.
260	82.0 2553 0.1798	0.750 308. 459.	82.2 2571 0.1785	0.750 308. 459.	82.4 2589 0.1773	0.750 308. 459.	82.5 2605 0.1761	0.750 308. 459.	82.7 2622 0.1750	0.750 308. 459.
250	82.1 2658 0.1734	0.750 315. 461.	82.3 2676 0.1722	0.750 315. 461.	82.5 2694 0.1710	0.750 315. 461.	82.7 2711 0.1699	0.750 315. 461.	82.8 2728 0.1689	0.750 315. 461.
240										

bd100_aeo_cr75_IMP_lw_hFL_10 – 02/02/2004

Figure 04-06-05. Cruise Performance—0.75 M (Sheet 7 of 12)

CRUISE 0.75 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF

ISA + 10 C

30% C.G.

%N1 LB/HR NAM/LB

MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430	87.2 1607 0.2737	0.750 210. 440.	88.3 1673 0.2629	0.750 210. 440.	89.5 1748 0.2517	0.750 210. 440.				
410	85.4 1637 0.2687	0.750 220. 440.	86.3 1697 0.2593	0.750 220. 440.	87.3 1761 0.2498	0.750 220. 440.	88.3 1829 0.2405	0.750 220. 440.	89.5 1905 0.2309	0.750 220. 440.
390	83.9 1686 0.2608	0.750 231. 440.	84.6 1736 0.2534	0.750 231. 440.	85.4 1791 0.2457	0.750 231. 440.	86.3 1852 0.2376	0.750 231. 440.	87.2 1918 0.2294	0.750 231. 440.
370	82.6 1759 0.2501	0.750 242. 440.	83.2 1797 0.2448	0.750 242. 440.	83.8 1841 0.2390	0.750 242. 440.	84.5 1891 0.2326	0.750 242. 440.	85.3 1947 0.2259	0.750 242. 440.
350	82.1 1870 0.2364	0.750 253. 442.	82.5 1902 0.2324	0.750 253. 442.	83.0 1937 0.2282	0.750 253. 442.	83.5 1977 0.2236	0.750 253. 442.	84.1 2021 0.2187	0.750 253. 442.
330	82.1 2009 0.2219	0.750 265. 446.	82.5 2036 0.2189	0.750 265. 446.	82.9 2068 0.2156	0.750 265. 446.	83.3 2101 0.2121	0.750 265. 446.	83.8 2138 0.2085	0.750 265. 446.
310	82.3 2168 0.2074	0.750 277. 450.	82.6 2191 0.2052	0.750 277. 450.	82.9 2218 0.2027	0.750 277. 450.	83.3 2247 0.2001	0.750 277. 450.	83.6 2278 0.1974	0.750 277. 450.
290	82.5 2343 0.1935	0.750 289. 453.	82.8 2363 0.1919	0.750 289. 453.	83.0 2384 0.1901	0.750 289. 453.	83.3 2409 0.1882	0.750 289. 453.	83.6 2436 0.1861	0.750 289. 453.
280	82.6 2437 0.1868	0.750 296. 455.	82.8 2456 0.1853	0.750 296. 455.	83.1 2477 0.1838	0.750 296. 455.	83.3 2499 0.1821	0.750 296. 455.	83.6 2524 0.1804	0.750 296. 455.
270	82.8 2535 0.1803	0.750 302. 457.	83.0 2553 0.1790	0.750 302. 457.	83.2 2572 0.1777	0.750 302. 457.	83.4 2593 0.1763	0.750 302. 457.	83.6 2616 0.1747	0.750 302. 457.
260	82.9 2639 0.1739	0.750 308. 459.	83.1 2657 0.1728	0.750 308. 459.	83.3 2675 0.1716	0.750 308. 459.	83.5 2694 0.1703	0.750 308. 459.	83.7 2715 0.1690	0.750 308. 459.
250	83.0 2745 0.1679	0.750 315. 461.	83.2 2762 0.1668	0.750 315. 461.	83.4 2779 0.1658	0.750 315. 461.	83.5 2798 0.1647	0.750 315. 461.	83.7 2817 0.1636	0.750 315. 461.
240										

bd100_aeo_cr75_IMP_hw_hFL_10 – 02/02/2004

Figure 04-06-05. Cruise Performance—0.75 M (Sheet 8 of 12)

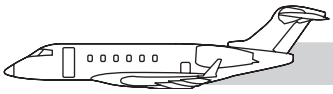
CRUISE 0.75 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	84.9 1322 0.3363	0.750 200. 445.	85.8 1368 0.3251	0.750 200. 445.	86.8 1422 0.3127	0.750 200. 445.	87.9 1482 0.3000	0.750 200. 445.		
430	83.8 1385 0.3211	0.750 210. 445.	84.5 1420 0.3131	0.750 210. 445.	85.3 1464 0.3037	0.750 210. 445.	86.2 1514 0.2937	0.750 210. 445.	87.2 1573 0.2828	0.750 210. 445.
410	82.9 1460 0.3046	0.750 220. 445.	83.5 1491 0.2983	0.750 220. 445.	84.1 1525 0.2916	0.750 220. 445.	84.8 1565 0.2841	0.750 220. 445.	85.5 1612 0.2758	0.750 220. 445.
390	82.1 1549 0.2870	0.750 231. 445.	82.5 1574 0.2825	0.750 231. 445.	83.1 1604 0.2773	0.750 231. 445.	83.6 1637 0.2717	0.750 231. 445.	84.2 1674 0.2657	0.750 231. 445.
370	81.4 1651 0.2694	0.750 242. 445.	81.7 1671 0.2661	0.750 242. 445.	82.1 1695 0.2623	0.750 242. 445.	82.6 1723 0.2581	0.750 242. 445.	83.1 1754 0.2535	0.750 242. 445.
350	81.3 1783 0.2506	0.750 253. 447.	81.6 1801 0.2480	0.750 253. 447.	81.9 1821 0.2453	0.750 253. 447.	82.2 1844 0.2423	0.750 253. 447.	82.6 1870 0.2389	0.750 253. 447.
330	81.6 1940 0.2322	0.750 265. 451.	81.9 1957 0.2302	0.750 265. 451.	82.1 1975 0.2281	0.750 265. 451.	82.4 1995 0.2259	0.750 265. 451.	82.7 2017 0.2234	0.750 265. 451.
310	82.0 2111 0.2152	0.750 277. 454.	82.2 2128 0.2135	0.750 277. 454.	82.4 2145 0.2118	0.750 277. 454.	82.7 2163 0.2101	0.750 277. 454.	82.9 2181 0.2083	0.750 277. 454.
290	82.4 2294 0.1997	0.750 289. 458.	82.6 2310 0.1982	0.760 289. 458.	82.8 2327 0.1968	0.750 289. 458.	83.0 2344 0.1954	0.750 289. 458.	83.2 2362 0.1939	0.750 289. 458.
280	82.6 2390 0.1924	0.750 296. 460.	82.8 2408 0.1910	0.750 296. 460.	82.9 2425 0.1897	0.750 296. 460.	83.1 2441 0.1884	0.750 296. 460.	83.3 2459 0.1870	0.750 296. 460.
270	82.7 2490 0.1854	0.750 302. 462.	82.9 2508 0.1841	0.750 302. 462.	83.1 2525 0.1829	0.750 302. 462.	83.3 2541 0.1817	0.750 302. 462.	83.5 2558 0.1805	0.750 302. 462.
260	82.9 2593 0.1787	0.750 308. 464.	83.1 2612 0.1775	0.750 308. 464.	83.3 2630 0.1763	0.750 308. 464.	83.4 2647 0.1752	0.750 308. 464.	83.6 2664 0.1740	0.750 308. 464.
250	83.0 2700 0.1724	0.750 315. 465.	83.2 2719 0.1712	0.750 315. 465.	83.4 2737 0.1701	0.750 315. 465.	83.6 2754 0.1690	0.750 315. 465.	83.7 2771 0.1679	0.750 315. 465.
240										

bd100_aeo_cr75_IMP_lw_hFL_15 - 02/02/2004

Figure 04-06-05. Cruise Performance—0.75 M (Sheet 9 of 12)



CRUISE 0.75 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C	%N1	MACH
	30% C.G.	LB/HR	KIAS
		NAM/LB	KTAS

FLIGHT LEVEL	GROSS WEIGHT - 1000 LB									
	34		36		38		40		42	
450										
430	88.2 1636 0.2718	0.750 210. 445.								
410	86.4 1667 0.2668	0.750 220. 445.	87.3 1727 0.2575	0.750 220. 445.	88.3 1792 0.2481	0.750 220. 445.	89.3 1860 0.2391	0.750 220. 445.		
390	84.9 1717 0.2590	0.750 231. 445.	85.6 1767 0.2517	0.750 231. 445.	86.4 1823 0.2440	0.750 231. 445.	87.3 1885 0.2360	0.750 231. 445.	88.2 1952 0.2278	0.750 231. 445.
370	83.6 1769 0.2486	0.750 242. 445.	84.2 1827 0.2434	0.750 242. 445.	84.8 1872 0.2375	0.750 242. 445.	85.5 1923 0.2312	0.750 242. 445.	86.3 1981 0.2245	0.750 242. 445.
350	83.0 1900 0.2351	0.750 253. 447.	83.5 1933 0.2312	0.750 253. 447.	83.9 1968 0.2270	0.750 253. 447.	84.5 2008 0.2225	0.750 253. 447.	85.1 2054 0.2176	0.750 253. 447.
330	83.0 2041 0.2207	0.750 265. 451.	83.4 2069 0.2178	0.750 265. 451.	83.8 2101 0.2145	0.750 265. 451.	84.2 2135 0.2111	0.750 265. 451.	84.7 2172 0.2075	0.750 265. 451.
310	83.2 2202 0.2063	0.750 277. 454.	83.4 2226 0.2041	0.750 277. 454.	83.8 2253 0.2016	0.750 277. 454.	84.1 2283 0.1990	0.750 277. 454.	84.5 2315 0.1963	0.750 277. 454.
290	83.4 2381 0.1924	0.750 289. 458.	83.6 2401 0.1907	0.750 289. 458.	83.9 2423 0.1890	0.750 289. 458.	84.2 2448 0.1871	0.750 289. 458.	84.5 2475 0.1850	0.750 289. 458.
280	83.5 2477 0.1857	0.750 296. 460.	83.7 2496 0.1843	0.750 296. 460.	84.0 2517 0.1827	0.750 296. 460.	84.2 2540 0.1811	0.750 296. 460.	84.5 2565 0.1793	0.750 296. 460.
270	83.6 2575 0.1793	0.750 302. 462.	83.8 2594 0.1780	0.750 302. 462.	84.1 2613 0.1767	0.750 302. 462.	84.3 2635 0.1753	0.750 302. 462.	84.5 2657 0.1737	0.750 302. 462.
260	83.8 2680 0.1729	0.750 308. 464.	84.0 2699 0.1718	0.750 308. 464.	84.2 2717 0.1706	0.750 308. 464.	84.4 2737 0.1694	0.750 308. 464.	84.6 2759 0.1680	0.750 308. 464.
250	83.9 2788 0.1669	0.750 315. 465.	84.1 2805 0.1659	0.750 315. 465.	84.2 2823 0.1648	0.750 315. 465.	84.4 2842 0.1638	0.750 315. 465.	84.6 2861 0.1626	0.750 315. 465.
240										

bd100_aeo_cr75_tMP_hw_hFL_15 - 02/02/2004

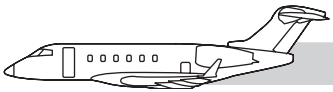
Figure 04-06-05. Cruise Performance—0.75 M (Sheet 10 of 12)

CRUISE 0.75 M_I			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	85.9 1346 0.3338	0.750 200. 450.	86.8 1392 0.3230	0.750 200. 450.						
430	84.8 1410 0.3188	0.750 210. 450.	85.5 1447 0.3107	0.750 210. 450.	86.3 1491 0.3015	0.750 210. 450.	87.2 1542 0.2916	0.750 210. 450.	88.1 1600 0.2809	0.750 210. 450.
410	83.8 1485 0.3026	0.750 220. 450.	84.4 1517 0.2964	0.750 220. 450.	85.1 1552 0.2896	0.750 220. 450.	85.8 1593 0.2822	0.750 220. 450.	86.5 1641 0.2739	0.750 220. 450.
390	83.1 1577 0.2850	0.750 231. 450.	83.5 1602 0.2805	0.750 231. 450.	84.0 1633 0.2753	0.750 231. 450.	84.6 1666 0.2698	0.750 231. 450.	85.2 1704 0.2638	0.750 231. 450.
370	82.4 1680 0.2676	0.750 242. 450.	82.7 1701 0.2643	0.750 242. 450.	83.1 1725 0.2605	0.750 242. 450.	83.6 1754 0.2563	0.750 242. 450.	84.0 1786 0.2517	0.750 242. 450.
350	82.2 1812 0.2492	0.750 253. 452.	82.5 1831 0.2466	0.750 253. 452.	82.8 1851 0.2439	0.750 253. 452.	83.1 1874 0.2409	0.750 253. 452.	83.5 1901 0.2375	0.750 253. 452.
330	82.5 1972 0.2309	0.750 265. 455.	82.8 1989 0.2289	0.750 265. 455.	83.0 2007 0.2269	0.750 265. 455.	83.3 2027 0.2246	0.750 265. 455.	83.6 2049 0.2222	0.750 265. 455.
310	82.9 2145 0.2140	0.750 277. 459.	83.1 2162 0.2123	0.750 277. 459.	83.3 2179 0.2106	0.750 277. 459.	83.5 2197 0.2089	0.750 277. 459.	83.8 2217 0.2071	0.750 277. 459.
290	83.3 2332 0.1984	0.750 289. 463.	83.5 2348 0.1970	0.750 289. 463.	83.7 2365 0.1956	0.750 289. 463.	83.9 2382 0.1942	0.750 289. 463.	84.1 2400 0.1928	0.750 289. 463.
280	83.4 2429 0.1912	0.750 296. 465.	83.6 2447 0.1898	0.750 296. 465.	83.8 2464 0.1885	0.750 296. 465.	84.0 2481 0.1872	0.750 296. 465.	84.2 2498 0.1859	0.750 296. 465.
270	83.6 2529 0.1844	0.750 302. 466.	83.8 2547 0.1831	0.750 302. 466.	84.0 2564 0.1819	0.750 302. 466.	84.2 2581 0.1807	0.750 302. 466.	84.3 2598 0.1795	0.750 302. 466.
260	83.8 2634 0.1777	0.750 308. 468.	84.0 2652 0.1765	0.750 308. 468.	84.1 2670 0.1753	0.750 308. 468.	84.3 2687 0.1742	0.750 308. 468.	84.5 2704 0.1731	0.750 308. 468.
250	83.9 2741 0.1714	0.750 315. 470.	84.1 2761 0.1702	0.750 315. 470.	84.3 2779 0.1691	0.750 315. 470.	84.4 2796 0.1681	0.750 315. 470.	84.6 2813 0.1671	0.750 315. 470.
240										

bd100_aeo_cr75_IMP_lw_hFL_20 - 02/02/2004

Figure 04-06-05. Cruise Performance—0.75 M (Sheet 11 of 12)



CRUISE 0.75 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430										
410	87.4 1696 0.2651	0.750 220. 450.	88.3 1756 0.2559	0.750 220. 450.						
390	85.9 1748 0.2572	0.750 231. 450.	86.6 1798 0.2500	0.750 231. 450.	87.4 1856 0.2422	0.750 231. 450.	88.3 1918 0.2343	0.750 231. 450.	89.2 1986 0.2263	0.750 231. 450.
370	84.6 1820 0.2469	0.750 242. 450.	85.1 1860 0.2417	0.750 242. 450.	85.8 1906 0.2359	0.750 242. 450.	86.5 1958 0.2296	0.750 242. 450.	87.3 2016 0.2230	0.750 242. 450.
350	83.9 1932 0.2337	0.750 253. 452.	84.4 1965 0.2298	0.750 253. 452.	84.9 2001 0.2257	0.750 253. 452.	85.4 2042 0.2211	0.750 253. 452.	86.1 2087 0.2163	0.750 253. 452.
330	83.9 2074 0.2195	0.750 265. 455.	84.3 2102 0.2166	0.750 265. 455.	84.7 2134 0.2134	0.750 265. 455.	85.1 2168 0.2100	0.750 265. 455.	85.6 2206 0.2064	0.750 265. 455.
310	84.0 2238 0.2051	0.750 277. 459.	84.3 2262 0.2029	0.750 277. 459.	84.7 2289 0.2005	0.750 277. 459.	85.0 2319 0.1979	0.750 277. 459.	85.4 2351 0.1952	0.750 277. 459.
290	84.3 2420 0.1912	0.750 289. 463.	84.5 2440 0.1896	0.750 289. 463.	84.8 2462 0.1879	0.750 289. 463.	85.1 2487 0.1860	0.750 289. 463.	85.4 2514 0.1840	0.750 289. 463.
280	84.4 2517 0.1846	0.750 296. 465.	84.6 2536 0.1832	0.750 296. 465.	84.9 2557 0.1816	0.750 296. 465.	85.1 2580 0.1801	0.750 296. 465.	85.4 2605 0.1783	0.750 296. 465.
270	84.5 2616 0.1783	0.750 302. 466.	84.7 2634 0.1770	0.750 302. 466.	84.9 2654 0.1757	0.750 302. 466.	85.2 2675 0.1743	0.750 302. 466.	85.4 2698 0.1729	0.750 302. 466.
260	84.7 2721 0.1720	0.750 308. 468.	84.8 2740 0.1709	0.750 308. 468.	85.0 2758 0.1697	0.750 308. 468.	85.2 2778 0.1685	0.750 308. 468.	85.5 2800 0.1672	0.750 308. 468.
250	84.8 2830 0.1661	0.750 315. 470.	84.9 2847 0.1651	0.750 315. 470.	85.1 2865 0.1640	0.750 315. 470.	85.3 2884 0.1629	0.750 315. 470.	85.5 2904 0.1618	0.750 315. 470.
240										

bd100_aeo_cr75_IMP_hw_hFL_20 – 02/02/2004

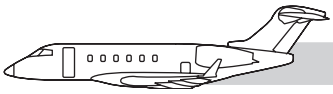
Figure 04-06-05. Cruise Performance—0.75 M (Sheet 12 of 12)

CRUISE 0.78 M_1			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	81.0 1290 0.3386	0.780 210. 437.	81.7 1328 0.3290	0.780 210. 437.	82.5 1370 0.3188	0.780 210. 437.	83.4 1417 0.3082	0.780 210. 437.	84.5 1473 0.2965	0.780 210. 437.
430	80.1 1356 0.3221	0.780 220. 437.	80.7 1387 0.3149	0.780 220. 437.	81.3 1423 0.3069	0.780 220. 437.	82.1 1464 0.2983	0.780 220. 437.	82.8 1509 0.2894	0.780 220. 437.
410	79.4 1434 0.3045	0.780 230. 437.	79.8 1459 0.2993	0.780 230. 437.	80.3 1489 0.2935	0.780 230. 437.	80.9 1522 0.2870	0.780 230. 437.	81.5 1561 0.2799	0.780 230. 437.
390	78.7 1532 0.2852	0.780 241. 437.	79.1 1552 0.2814	0.780 241. 437.	79.5 1576 0.2771	0.780 241. 437.	79.9 1603 0.2724	0.780 241. 437.	80.4 1635 0.2671	0.780 241. 437.
370	78.3 1646 0.2654	0.780 252. 437.	78.6 1664 0.2626	0.780 252. 437.	78.9 1684 0.2594	0.780 252. 437.	79.2 1706 0.2560	0.780 252. 437.	79.6 1732 0.2522	0.780 252. 437.
350	78.4 1784 0.2461	0.780 264. 439.	78.6 1801 0.2438	0.780 264. 439.	78.9 1819 0.2414	0.780 264. 439.	79.1 1839 0.2388	0.780 264. 439.	79.4 1860 0.2361	0.780 264. 439.
330	78.8 1943 0.2282	0.780 277. 443.	79.0 1959 0.2263	0.780 277. 443.	79.2 1975 0.2244	0.780 277. 443.	79.5 1993 0.2224	0.780 277. 443.	79.7 2012 0.2203	0.780 277. 443.
310	79.2 2116 0.2114	0.780 289. 448.	79.4 2132 0.2098	0.780 289. 448.	79.6 2149 0.2082	0.780 289. 448.	79.8 2166 0.2066	0.780 289. 448.	80.0 2184 0.2049	0.780 289. 448.
290	79.6 2301 0.1962	0.780 302. 452.	79.8 2318 0.1948	0.780 302. 452.	79.9 2334 0.1934	0.780 302. 452.	80.1 2350 0.1921	0.780 302. 452.	80.3 2367 0.1907	0.780 302. 452.
280	79.7 2399 0.1891	0.780 309. 454.	79.9 2416 0.1877	0.780 309. 454.	80.1 2433 0.1864	0.780 309. 454.	80.3 2450 0.1851	0.780 309. 454.	80.5 2466 0.1839	0.780 309. 454.
270	79.9 2497 0.1824	0.780 315. 456.	80.1 2516 0.1811	0.780 315. 456.	80.3 2533 0.1798	0.780 315. 456.	80.5 2550 0.1786	0.780 315. 456.	80.6 2566 0.1775	0.780 315. 456.
260										
250										
240										

bd100_aeo_cr78_IMP_lw_hFL_m10 – 02/02/2004

Figure 04-06-06. Cruise Performance—0.78 M (Sheet 1 of 12)



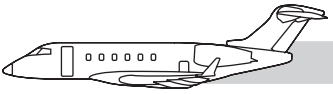
CRUISE 0.78 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450	85.7 1538 0.2841	0.780 210. 437.								
430	83.7 1561 0.2798	0.780 220. 437.	84.8 1621 0.2694	0.780 220. 437.	85.9 1689 0.2586	0.780 220. 437.				
410	82.2 1604 0.2723	0.780 230. 437.	83.0 1653 0.2643	0.780 230. 437.	83.8 1708 0.2558	0.780 230. 437.	84.8 1770 0.2469	0.780 230. 437.	85.9 1839 0.2375	0.780 230. 437.
390	81.0 1672 0.2612	0.780 241. 437.	81.6 1713 0.2551	0.780 241. 437.	82.2 1757 0.2486	0.780 241. 437.	82.9 1806 0.2418	0.780 241. 437.	83.7 1862 0.2346	0.780 241. 437.
370	80.1 1761 0.2480	0.780 252. 437.	80.5 1795 0.2433	0.780 252. 437.	81.1 1833 0.2383	0.780 252. 437.	81.6 1875 0.2330	0.780 252. 437.	82.2 1919 0.2276	0.780 252. 437.
350	79.8 1885 0.2330	0.780 264. 439.	80.2 1912 0.2297	0.780 264. 439.	80.6 1943 0.2260	0.780 264. 439.	81.0 1977 0.2221	0.780 264. 439.	81.5 2015 0.2179	0.780 264. 439.
330	80.0 2033 0.2160	0.780 277. 443.	80.3 2056 0.2156	0.780 277. 443.	80.6 2082 0.2129	0.780 277. 443.	81.0 2111 0.2100	0.780 277. 443.	81.4 2143 0.2068	0.780 277. 443.
310	80.2 2202 0.2032	0.780 289. 448.	80.5 2222 0.2014	0.780 289. 448.	80.7 2243 0.1994	0.780 289. 448.	81.0 2267 0.1973	0.780 289. 448.	81.3 2294 0.1950	0.780 289. 448.
290	80.5 2384 0.1894	0.780 302. 452.	80.7 2403 0.1879	0.780 302. 452.	80.9 2421 0.1864	0.780 302. 452.	81.1 2443 0.1848	0.780 302. 452.	81.4 2465 0.1831	0.780 302. 452.
280	80.7 2483 0.1826	0.780 309. 454.	80.8 2501 0.1813	0.780 309. 454.	81.0 2519 0.1800	0.780 309. 454.	81.2 2538 0.1787	0.780 309. 454.	81.4 2560 0.1772	0.780 309. 454.
270	80.8 2583 0.1764	0.780 315. 456.	81.0 2600 0.1752	0.780 315. 456.	81.2 2618 0.1740	0.780 315. 456.	81.3 2635 0.1728	0.780 315. 456.	81.5 2655 0.1716	0.780 315. 456.
260										
250										
240										

bd100_aeo_cr78_IMP_hw_hFL_m10 – 02/02/2004

Figure 04-06-06. Cruise Performance—0.78 M (Sheet 2 of 12)



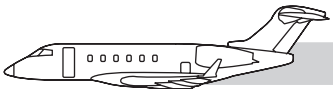
CRUISE 0.78 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	83.1 1339 0.3340	0.780 210. 447.	83.8 1378 0.3246	0.780 210. 447.	84.6 1421 0.3147	0.780 210. 447.	85.5 1470 0.3042	0.780 210. 447.	86.6 1528 0.2928	0.780 210. 447.
430	82.2 1409 0.3175	0.780 220. 447.	82.7 1441 0.3103	0.780 220. 447.	83.4 1479 0.3025	0.780 220. 447.	84.1 1520 0.2942	0.780 220. 447.	84.9 1567 0.2855	0.780 220. 447.
410	81.4 1490 0.3001	0.780 230. 447.	81.8 1516 0.2949	0.780 230. 447.	82.4 1547 0.2892	0.780 230. 447.	82.9 1582 0.2827	0.780 230. 447.	83.6 1622 0.2757	0.780 230. 447.
390	80.7 1587 0.2818	0.780 241. 447.	81.1 1609 0.2780	0.780 241. 447.	81.5 1633 0.2738	0.780 241. 447.	81.9 1661 0.2692	0.780 241. 447.	82.4 1695 0.2639	0.780 241. 447.
370	80.2 1703 0.2627	0.780 252. 447.	80.5 1721 0.2599	0.780 252. 447.	80.8 1742 0.2568	0.780 252. 447.	81.2 1765 0.2534	0.780 252. 447.	81.5 1792 0.2497	0.780 252. 447.
350	80.3 1846 0.2435	0.780 264. 450.	80.5 1864 0.2412	0.780 264. 450.	80.8 1882 0.2388	0.780 264. 450.	81.0 1902 0.2363	0.780 264. 450.	81.3 1924 0.2336	0.780 264. 450.
330	80.7 2012 0.2255	0.780 277. 454.	80.9 2028 0.2236	0.780 277. 454.	81.1 2045 0.2218	0.780 277. 454.	81.4 2064 0.2198	0.780 277. 454.	81.6 2083 0.2178	0.780 277. 454.
310	81.1 2189 0.2091	0.780 289. 458.	81.3 2206 0.2075	0.780 289. 458.	81.5 2223 0.2059	0.780 289. 458.	81.7 2240 0.2042	0.780 289. 458.	81.9 2259 0.2026	0.780 289. 458.
290	81.4 2380 0.1939	0.780 302. 462.	81.6 2398 0.1925	0.780 302. 462.	81.8 2414 0.1912	0.780 302. 462.	82.0 2431 0.1899	0.780 302. 462.	82.2 2449 0.1885	0.780 302. 462.
280	81.6 2482 0.1868	0.780 309. 464.	81.8 2500 0.1854	0.780 309. 464.	82.0 2518 0.1841	0.780 309. 464.	82.2 2534 0.1829	0.780 309. 464.	82.4 2551 0.1817	0.780 309. 464.
270	81.8 2584 0.1802	0.780 316. 466.	82.0 2603 0.1789	0.780 315. 466.	82.2 2621 0.1776	0.780 315. 466.	82.3 2638 0.1765	0.780 315. 466.	82.5 2655 0.1754	0.780 315. 466.
260										
250										
240										

bd100_aao_cr78_IMP_lw_hFL_00 – 02/02/2004

Figure 04-06-06. Cruise Performance—0.78 M (Sheet 3 of 12)



CRUISE 0.78 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450	87.8 1595 0.2805	0.780 210. 447.								
430	85.8 1620 0.2760	0.780 220. 447.	86.9 1682 0.2659	0.780 220. 447.	88.1 1753 0.2552	0.780 220. 447.				
410	84.3 1666 0.2684	0.780 230. 447.	85.0 1716 0.2607	0.780 230. 447.	85.9 1772 0.2524	0.780 230. 447.	86.9 1836 0.2437	0.780 230. 447.	88.0 1908 0.2345	0.780 230. 447.
390	83.0 1733 0.2581	0.780 241. 447.	83.6 1775 0.2520	0.780 241. 447.	84.3 1820 0.2458	0.780 241. 447.	85.0 1871 0.2391	0.780 241. 447.	85.8 1929 0.2319	0.780 241. 447.
370	82.0 1822 0.2455	0.780 252. 447.	82.5 1857 0.2409	0.780 252. 447.	83.0 1896 0.2359	0.780 252. 447.	83.6 1938 0.2308	0.780 252. 447.	84.2 1984 0.2254	0.780 252. 447.
350	81.7 1950 0.2306	0.780 264. 450.	82.0 1978 0.2272	0.780 264. 450.	82.5 2011 0.2236	0.780 264. 450.	82.9 2046 0.2197	0.780 264. 450.	83.4 2085 0.2156	0.780 264. 450.
330	81.9 2105 0.2155	0.780 277. 454.	82.2 2128 0.2131	0.780 277. 454.	82.5 2155 0.2105	0.780 277. 454.	82.8 2184 0.2077	0.780 277. 454.	83.2 2217 0.2046	0.780 277. 454.
310	82.1 2277 0.2009	0.780 289. 458.	82.4 2298 0.1991	0.780 289. 458.	82.7 2321 0.1972	0.780 289. 458.	82.9 2345 0.1951	0.780 289. 458.	83.2 2373 0.1928	0.780 289. 458.
290	82.4 2467 0.1871	0.780 302. 462.	82.6 2486 0.1857	0.780 302. 462.	82.8 2505 0.1843	0.780 302. 462.	83.0 2527 0.1826	0.780 302. 462.	83.3 2550 0.1810	0.780 302. 462.
280	82.6 2569 0.1804	0.780 309. 464.	82.7 2587 0.1792	0.780 309. 464.	82.9 2606 0.1779	0.780 309. 464.	83.1 2626 0.1766	0.780 309. 464.	83.4 2648 0.1751	0.780 309. 464.
270	82.7 2672 0.1742	0.780 315. 466.	82.9 2689 0.1731	0.780 315. 466.	83.0 2708 0.1719	0.780 315. 466.	83.2 2726 0.1708	0.780 315. 466.	83.4 2746 0.1695	0.780 315. 466.
260										
250										
240										

bd100_aeo_cr78_IMP_hw_hFL_00 – 02/02/2004

Figure 04-06-06. Cruise Performance—0.78 M (Sheet 4 of 12)

CRUISE 0.78 M_I			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	84.1 1365 0.3315	0.780 210. 452.	84.8 1404 0.3223	0.780 210. 452.	85.7 1448 0.3124	0.780 210. 452.	86.6 1498 0.3021	0.780 210. 452.	87.6 1556 0.2907	0.780 210. 452.
430	83.2 1435 0.3152	0.780 220. 452.	83.8 1468 0.3081	0.780 220. 452.	84.4 1506 0.3004	0.780 220. 452.	85.1 1548 0.2922	0.780 220. 452.	85.9 1595 0.2836	0.780 220. 452.
410	82.4 1519 0.2978	0.780 230. 452.	82.9 1546 0.2927	0.780 230. 452.	83.4 1576 0.2870	0.780 230. 452.	84.0 1612 0.2807	0.780 230. 452.	84.6 1653 0.2737	0.780 230. 452.
390	81.7 1617 0.2798	0.780 241. 452.	82.1 1639 0.2761	0.780 241. 452.	82.5 1663 0.2720	0.780 241. 452.	82.9 1692 0.2674	0.780 241. 452.	83.4 1726 0.2621	0.780 241. 452.
370	81.2 1733 0.2611	0.780 252. 452.	81.5 1751 0.2584	0.780 252. 452.	81.8 1772 0.2553	0.780 252. 452.	82.1 1796 0.2519	0.780 252. 452.	82.5 1823 0.2482	0.780 252. 452.
350	81.2 1878 0.2421	0.780 264. 455.	81.4 1895 0.2399	0.780 264. 455.	81.7 1914 0.2376	0.780 264. 455.	81.9 1934 0.2350	0.780 264. 455.	82.3 1956 0.2324	0.780 264. 455.
330	81.6 2045 0.2242	0.780 277. 459.	81.8 2062 0.2224	0.780 277. 459.	82.0 2079 0.2206	0.780 277. 459.	82.3 2098 0.2186	0.780 277. 459.	82.5 2118 0.2166	0.780 277. 459.
310	82.0 2226 0.2078	0.780 289. 463.	82.2 2243 0.2062	0.780 289. 463.	82.4 2260 0.2047	0.780 289. 463.	82.6 2278 0.2031	0.780 289. 463.	82.8 2296 0.2014	0.780 289. 463.
290	82.4 2420 0.1928	0.780 302. 467.	82.6 2438 0.1914	0.780 302. 467.	82.8 2455 0.1901	0.780 302. 467.	82.9 2472 0.1888	0.780 302. 467.	83.1 2490 0.1874	0.780 302. 467.
280	82.5 2523 0.1857	0.780 309. 469.	82.7 2542 0.1843	0.780 309. 469.	82.9 2560 0.1830	0.780 309. 469.	83.1 2577 0.1818	0.780 309. 469.	83.3 2594 0.1806	0.780 309. 469.
270	82.7 2627 0.1791	0.780 315. 470.	82.9 2646 0.1778	0.780 315. 470.	83.1 2664 0.1766	0.780 315. 470.	83.3 2682 0.1754	0.780 315. 470.	83.4 2699 0.1743	0.780 315. 470.
260										
250										
240										

bd100_aeo_cr78_IMP_lw_hFt_05 – 02/02/2004

Figure 04-06-06. Cruise Performance—0.78 M (Sheet 5 of 12)

CRUISE 0.78 M_1

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF

ISA + 5 C

30% C.G.

%N1 MACH
LB/HR KIAS
NAM/LB KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450	88.9 1624 0.2786	0.780 210. 452.								
430	86.9 1650 0.2742	0.780 220. 452.	87.9 1712 0.2642	0.780 220. 452.	89.1 1784 0.2536	0.780 220. 452.				
410	85.3 1697 0.2665	0.780 230. 452.	86.1 1747 0.2590	0.780 230. 452.	86.9 1805 0.2507	0.780 230. 452.	87.9 1869 0.2421	0.780 230. 452.	89.0 1943 0.2329	0.780 230. 452.
390	84.0 1765 0.2564	0.780 241. 452.	84.6 1807 0.2504	0.780 241. 452.	85.3 1853 0.2442	0.780 241. 452.	86.0 1904 0.2376	0.780 241. 452.	86.8 1963 0.2304	0.780 241. 452.
370	83.0 1854 0.2441	0.780 252. 452.	83.4 1889 0.2395	0.780 252. 452.	84.0 1928 0.2346	0.780 252. 452.	84.5 1971 0.2295	0.780 252. 452.	85.2 2018 0.2242	0.780 252. 452.
350	82.6 1982 0.2294	0.780 264. 455.	83.0 2011 0.2261	0.780 264. 455.	83.4 2043 0.2225	0.780 264. 455.	83.9 2079 0.2187	0.780 264. 455.	84.4 2119 0.2146	0.780 264. 455.
330	82.8 2140 0.2143	0.780 277. 459.	83.1 2164 0.2120	0.780 277. 459.	83.4 2191 0.2093	0.780 277. 459.	83.8 2220 0.2066	0.780 277. 459.	84.2 2255 0.2034	0.780 277. 459.
310	83.1 2315 0.1998	0.780 289. 463.	83.3 2336 0.1980	0.780 289. 463.	83.6 2359 0.1961	0.780 289. 463.	83.8 2384 0.1940	0.780 289. 463.	84.2 2412 0.1918	0.780 289. 463.
290	83.3 2508 0.1860	0.780 302. 467.	83.5 2528 0.1846	0.780 302. 467.	83.7 2547 0.1832	0.780 302. 467.	84.0 2570 0.1816	0.780 302. 467.	84.2 2593 0.1800	0.780 302. 467.
280	83.5 2612 0.1794	0.780 309. 469.	83.7 2630 0.1781	0.780 309. 469.	83.9 2649 0.1768	0.780 309. 469.	84.1 2669 0.1755	0.780 309. 469.	84.3 2692 0.1740	0.780 309. 469.
270	83.6 2716 0.1732	0.780 315. 470.	83.8 2734 0.1721	0.780 315. 470.	84.0 2753 0.1709	0.780 315. 470.	84.2 2772 0.1698	0.780 315. 470.	84.4 2792 0.1685	0.780 315. 470.
260										
250										
240										

bd100_aeo_cr78_IMP_hw_hFL_05 – 02/02/2004

Figure 04-06-06. Cruise Performance—0.78 M (Sheet 6 of 12)

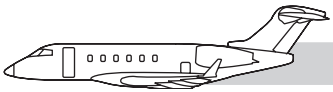
CRUISE 0.78 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT - 1000 LB									
	24		26		28		30		32	
450	85.1 1390 0.3292	0.780 210. 458.	85.9 1430 0.3200	0.780 210. 458.	86.7 1474 0.3103	0.780 210. 458.	87.6 1525 0.3000	0.780 210. 458.	88.7 1584 0.2888	0.780 210. 458.
430	84.2 1461 0.3131	0.780 220. 458.	84.8 1494 0.3061	0.780 220. 458.	85.4 1533 0.2984	0.780 220. 458.	86.2 1576 0.2902	0.780 220. 458.	87.0 1624 0.2817	0.780 220. 458.
410	83.4 1547 0.2957	0.780 230. 458.	83.9 1574 0.2907	0.780 230. 458.	84.4 1605 0.2850	0.780 230. 458.	85.0 1642 0.2787	0.780 230. 458.	85.6 1683 0.2718	0.780 230. 458.
390	82.7 1647 0.2777	0.780 241. 458.	83.1 1669 0.2741	0.780 241. 458.	83.5 1695 0.2700	0.780 241. 458.	83.9 1724 0.2654	0.780 241. 458.	84.5 1758 0.2603	0.780 241. 458.
370	82.1 1763 0.2595	0.780 252. 458.	82.4 1781 0.2569	0.780 252. 458.	82.7 1802 0.2538	0.780 252. 458.	83.1 1826 0.2506	0.780 252. 458.	83.5 1853 0.2468	0.780 252. 458.
350	82.1 1909 0.2408	0.780 264. 460.	82.3 1926 0.2386	0.780 264. 460.	82.6 1945 0.2364	0.780 264. 460.	82.9 1965 0.2339	0.780 264. 460.	83.2 1988 0.2312	0.780 264. 460.
330	82.5 2079 0.2230	0.780 277. 464.	82.7 2097 0.2211	0.780 277. 464.	82.9 2114 0.2193	0.780 277. 464.	83.2 2133 0.2173	0.780 277. 464.	83.4 2153 0.2153	0.780 277. 464.
310	82.9 2263 0.2066	0.780 289. 468.	83.1 2280 0.2051	0.780 289. 468.	83.3 2297 0.2036	0.780 289. 468.	83.5 2315 0.2020	0.780 289. 468.	83.7 2334 0.2003	0.780 289. 468.
290	83.3 2459 0.1917	0.780 302. 472.	83.5 2478 0.1903	0.780 302. 472.	83.7 2495 0.1889	0.780 302. 472.	83.9 2513 0.1876	0.780 302. 472.	84.1 2531 0.1863	0.780 302. 472.
280	83.5 2565 0.1846	0.780 309. 474.	83.7 2583 0.1833	0.780 309. 474.	83.9 2601 0.1820	0.780 309. 474.	84.0 2619 0.1808	0.780 309. 474.	84.2 2636 0.1796	0.780 309. 474.
270	83.6 2670 0.1780	0.780 315. 475.	83.8 2690 0.1767	0.780 315. 475.	84.0 2708 0.1755	0.780 315. 475.	84.2 2726 0.1744	0.780 315. 475.	84.3 2743 0.1733	0.780 315. 475.
260										
250										
240										

bd100_aeo_cr78_IMP_lw_hFL_10 - 02/02/2004

Figure 04-06-06. Cruise Performance—0.78 M (Sheet 7 of 12)



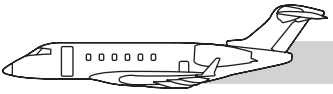
CRUISE 0.78 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430	87.9 1680 0.2724	0.780 220. 458.	88.9 1742 0.2626	0.780 220. 458.						
410	86.3 1728 0.2647	0.780 230. 458.	87.1 1779 0.2572	0.780 230. 458.	88.0 1837 0.2490	0.780 230. 458.	88.9 1902 0.2405	0.780 230. 458.	90.1 1977 0.2314	0.780 230. 458.
390	85.0 1797 0.2546	0.780 241. 458.	85.6 1839 0.2487	0.780 241. 458.	86.3 1886 0.2425	0.780 241. 458.	87.0 1939 0.2359	0.780 241. 458.	87.8 2000 0.2288	0.780 241. 458.
370	83.9 1885 0.2427	0.780 252. 458.	84.4 1920 0.2383	0.780 252. 458.	85.0 1961 0.2333	0.780 252. 458.	85.5 2005 0.2282	0.780 252. 458.	86.1 2052 0.2229	0.780 252. 458.
350	83.5 2014 0.2282	0.780 264. 460.	83.9 2043 0.2250	0.780 264. 460.	84.3 2076 0.2214	0.780 264. 460.	84.8 2113 0.2175	0.780 264. 460.	85.3 2154 0.2134	0.780 264. 460.
330	83.7 2175 0.2132	0.780 277. 464.	84.0 2199 0.2108	0.780 277. 464.	84.3 2227 0.2082	0.780 277. 464.	84.7 2257 0.2054	0.780 277. 464.	85.1 2291 0.2024	0.780 277. 464.
310	83.9 2353 0.1987	0.780 289. 468.	84.2 2375 0.1969	0.780 289. 468.	84.5 2398 0.1950	0.780 289. 468.	84.7 2423 0.1930	0.780 289. 468.	85.1 2451 0.1908	0.780 289. 468.
290	84.3 2549 0.1850	0.780 302. 472.	84.5 2568 0.1836	0.780 302. 472.	84.7 2588 0.1822	0.780 302. 472.	84.9 2611 0.1806	0.780 302. 472.	85.2 2634 0.1790	0.780 302. 472.
280	84.4 2655 0.1783	0.780 309. 474.	84.6 2673 0.1771	0.780 309. 474.	84.8 2692 0.1758	0.780 309. 474.	85.0 2713 0.1745	0.780 309. 474.	85.2 2736 0.1731	0.780 309. 474.
270	84.5 2761 0.1722	0.780 315. 475.	84.7 2779 0.1710	0.780 315. 475.	84.9 2799 0.1699	0.780 315. 475.	85.1 2818 0.1687	0.780 315. 475.	85.3 2839 0.1674	0.780 315. 475.
260										
250										
240										

bd100_aeo_cr78_tMP_hw_hFL_10 – 02/02/2004

Figure 04-06-06. Cruise Performance—0.78 M (Sheet 8 of 12)



CRUISE 0.78 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF

ISA + 15 C

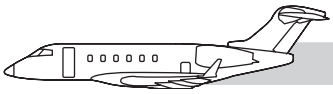
30% C.G.

%N1 MACH
LB/HR KIAS
NAM/LB KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	86.2 1415 0.3268	0.780 210. 463.	86.9 1455 0.3178	0.780 210. 463.	87.7 1502 0.3080	0.780 210. 463.				
430	85.2 1488 0.3109	0.780 220. 463.	85.8 1521 0.3040	0.780 220. 463.	86.5 1560 0.2964	0.780 220. 463.	87.2 1604 0.2883	0.780 220. 463.	88.0 1652 0.2799	0.780 220. 463.
410	84.4 1576 0.2935	0.780 230. 463.	84.9 1602 0.2886	0.780 230. 463.	85.4 1634 0.2830	0.780 230. 463.	86.0 1672 0.2766	0.780 230. 463.	86.6 1714 0.2699	0.780 230. 463.
390	83.7 1678 0.2757	0.780 241. 463.	84.1 1700 0.2721	0.780 241. 463.	84.5 1726 0.2680	0.780 241. 463.	84.9 1755 0.2635	0.780 241. 463.	85.5 1790 0.2583	0.780 241. 463.
370	83.1 1793 0.2580	0.780 252. 463.	83.4 1812 0.2553	0.780 252. 463.	83.7 1833 0.2523	0.780 252. 463.	84.1 1857 0.2490	0.780 252. 463.	84.5 1885 0.2453	0.780 252. 463.
350	83.0 1940 0.2395	0.780 264. 465.	83.3 1958 0.2373	0.780 264. 465.	83.5 1977 0.2351	0.780 264. 465.	83.8 1998 0.2326	0.780 264. 465.	84.1 2021 0.2300	0.780 264. 465.
330	83.4 2114 0.2217	0.780 277. 469.	83.6 2131 0.2199	0.780 277. 469.	83.8 2149 0.2180	0.780 277. 469.	84.1 2168 0.2161	0.780 277. 469.	84.3 2188 0.2141	0.780 277. 469.
310	83.8 2301 0.2054	0.780 289. 473.	84.0 2318 0.2038	0.780 289. 473.	84.2 2335 0.2023	0.780 289. 473.	84.4 2353 0.2008	0.780 289. 473.	84.6 2372 0.1992	0.780 289. 473.
290	84.2 2498 0.1907	0.780 302. 476.	84.4 2517 0.1892	0.780 302. 476.	84.6 2535 0.1879	0.780 302. 476.	84.8 2553 0.1866	0.780 302. 476.	85.0 2571 0.1853	0.780 302. 476.
280	84.4 2605 0.1836	0.780 309. 478.	84.6 2624 0.1823	0.780 309. 478.	84.8 2643 0.1810	0.780 309. 478.	84.9 2660 0.1798	0.780 309. 478.	85.1 2678 0.1786	0.780 309. 478.
270	84.5 2713 0.1770	0.780 315. 480.	84.7 2733 0.1757	0.780 315. 480.	84.9 2751 0.1745	0.780 315. 480.	85.1 2769 0.1734	0.780 315. 480.	85.3 2787 0.1723	0.780 315. 480.
260										
250										
240										

bd100_aeo_cr78_IMP_lw_hFL_15 – 02/02/2004

Figure 04-06-06. Cruise Performance—0.78 M (Sheet 9 of 12)



CRUISE 0.78 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430										
410	87.3 1760 0.2628	0.780 230. 463.	88.1 1811 0.2554	0.780 230. 463.	89.0 1870 0.2473	0.780 230. 463.				
390	86.0 1830 0.2527	0.780 241. 463.	86.7 1874 0.2468	0.780 241. 463.	87.3 1921 0.2408	0.780 241. 463.	88.0 1974 0.2343	0.780 241. 463.	88.8 2035 0.2273	0.780 241. 463.
370	84.9 1917 0.2412	0.780 252. 463.	85.4 1953 0.2368	0.780 252. 463.	86.0 1994 0.2319	0.780 252. 463.	86.5 2039 0.2268	0.780 252. 463.	87.2 2087 0.2216	0.780 252. 463.
350	84.5 2047 0.2270	0.780 264. 465.	84.9 2076 0.2238	0.780 264. 465.	85.3 2110 0.2203	0.780 264. 465.	85.7 2147 0.2164	0.780 264. 465.	86.2 2189 0.2123	0.780 264. 465.
330	84.6 2211 0.2120	0.780 277. 469.	84.9 2235 0.2097	0.780 277. 469.	85.2 2263 0.2071	0.780 277. 469.	85.6 2293 0.2043	0.780 277. 469.	86.0 2328 0.2013	0.780 277. 469.
310	84.9 2392 0.1975	0.780 289. 473.	85.1 2414 0.1958	0.780 289. 473.	85.4 2437 0.1939	0.780 289. 473.	85.7 2463 0.1919	0.780 289. 473.	86.0 2491 0.1897	0.780 289. 473.
290	85.2 2590 0.1839	0.780 302. 476.	85.4 2609 0.1826	0.780 302. 476.	85.6 2629 0.1812	0.780 302. 476.	85.8 2652 0.1796	0.780 302. 476.	86.1 2676 0.1780	0.780 302. 476.
280	85.3 2697 0.1774	0.780 309. 478.	85.5 2716 0.1761	0.780 309. 478.	85.7 2735 0.1749	0.780 309. 478.	85.9 2756 0.1736	0.780 309. 478.	86.1 2779 0.1721	0.780 309. 478.
270	85.4 2805 0.1712	0.780 315. 480.	85.6 2823 0.1701	0.780 315. 480.	85.8 2843 0.1689	0.780 315. 480.	86.0 2862 0.1678	0.780 315. 480.	86.2 2883 0.1665	0.780 315. 480.
260										
250										
240										

bd100_aeo_cr78_IMP_hw_hFL_15 – 02/02/2004

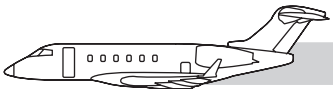
Figure 04-06-06. Cruise Performance—0.78 M (Sheet 10 of 12)

CRUISE 0.78 M_1			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	87.2 1441 0.3245	0.780 210. 468.								
430	86.2 1514 0.3087	0.780 220. 468.	86.8 1549 0.3018	0.780 220. 468.	87.5 1589 0.2942	0.780 220. 468.				
410	85.4 1604 0.2914	0.780 230. 468.	85.9 1632 0.2865	0.780 230. 468.	86.4 1664 0.2809	0.780 230. 468.	87.0 1702 0.2747	0.780 230. 468.	87.6 1744 0.2681	0.780 230. 468.
390	84.7 1708 0.2737	0.780 241. 468.	85.1 1731 0.2700	0.780 241. 468.	85.5 1758 0.2660	0.780 241. 468.	85.9 1788 0.2615	0.780 241. 468.	86.5 1823 0.2564	0.780 241. 468.
370	84.1 1825 0.2562	0.780 252. 468.	84.3 1844 0.2535	0.780 252. 468.	84.7 1866 0.2505	0.780 252. 468.	85.0 1891 0.2473	0.780 252. 468.	85.4 1919 0.2436	0.780 252. 468.
350	84.0 1973 0.2381	0.780 264. 470.	84.2 1991 0.2359	0.780 264. 470.	84.5 2010 0.2337	0.780 264. 470.	84.8 2031 0.2313	0.780 264. 470.	85.1 2054 0.2286	0.780 264. 470.
330	84.3 2147 0.2205	0.780 277. 474.	84.5 2165 0.2187	0.780 277. 474.	84.7 2183 0.2169	0.780 277. 474.	85.0 2203 0.2150	0.780 277. 474.	85.2 2223 0.2130	0.780 277. 474.
310	84.7 2338 0.2042	0.780 289. 477.	84.9 2355 0.2027	0.780 289. 477.	85.1 2373 0.2012	0.780 289. 477.	85.3 2391 0.1997	0.780 289. 477.	85.5 2410 0.1981	0.780 289. 477.
290	85.1 2539 0.1895	0.780 302. 481.	85.3 2558 0.1881	0.780 302. 481.	85.5 2576 0.1868	0.780 302. 481.	85.7 2593 0.1855	0.780 302. 481.	85.9 2612 0.1842	0.780 302. 481.
280	85.2 2645 0.1826	0.780 309. 483.	85.4 2664 0.1813	0.780 309. 483.	85.6 2683 0.1801	0.780 309. 483.	85.8 2701 0.1789	0.780 309. 483.	86.0 2718 0.1777	0.780 309. 483.
270	85.4 2755 0.1760	0.780 315. 485.	85.6 2775 0.1748	0.780 315. 485.	85.8 2794 0.1736	0.780 315. 485.	86.0 2812 0.1725	0.780 315. 485.	86.2 2830 0.1714	0.780 315. 485.
260										
250										
240										

bd100_aeo_cr78_IMP_lw_hFL_20 - 02/02/2004

Figure 04-06-06. Cruise Performance—0.78 M (Sheet 11 of 12)



CRUISE 0.78 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430										
410	88.3 1791 0.2611	0.780 230. 468.								
390	87.0 1864 0.2509	0.780 241. 468.	87.6 1908 0.2450	0.780 241. 468.	88.3 1956 0.2390	0.780 241. 468.	89.0 2009 0.2327	0.780 241. 468.		
370	85.9 1951 0.2396	0.780 252. 468.	86.4 1988 0.2351	0.780 252. 468.	86.9 2030 0.2303	0.780 252. 468.	87.5 2075 0.2253	0.780 252. 468.	88.1 2124 0.2201	0.780 252. 468.
350	85.4 2081 0.2257	0.780 264. 470.	85.8 2110 0.2225	0.780 264. 470.	86.2 2145 0.2190	0.780 264. 470.	86.7 2182 0.2152	0.780 264. 470.	87.2 2225 0.2111	0.780 264. 470.
330	85.5 2246 0.2108	0.780 277. 474.	85.8 2271 0.2085	0.780 277. 474.	86.2 2299 0.2060	0.780 277. 474.	86.5 2329 0.2033	0.780 277. 474.	86.9 2365 0.2002	0.780 277. 474.
310	85.8 2430 0.1965	0.780 289. 477.	86.0 2452 0.1947	0.780 289. 477.	86.3 2475 0.1929	0.780 289. 477.	86.5 2501 0.1908	0.780 289. 477.	86.8 2530 0.1887	0.780 289. 477.
290	86.0 2630 0.1829	0.780 302. 481.	86.2 2650 0.1816	0.780 302. 481.	86.5 2671 0.1802	0.780 302. 481.	86.7 2694 0.1786	0.780 302. 481.	86.9 2718 0.1770	0.780 302. 481.
280	86.2 2737 0.1765	0.780 309. 483.	86.4 2757 0.1752	0.780 309. 483.	86.6 2776 0.1740	0.780 309. 483.	86.8 2797 0.1727	0.780 309. 483.	87.0 2820 0.1713	0.780 309. 483.
270	86.3 2848 0.1703	0.780 315. 485.	86.5 2866 0.1692	0.780 315. 485.	86.7 2886 0.1680	0.780 315. 485.	86.9 2905 0.1669	0.780 315. 485.	87.1 2927 0.1657	0.780 315. 485.
260										
250										
240										

bd100_aeo_cr78_IMP_hw_hFL_20 – 02/02/2004

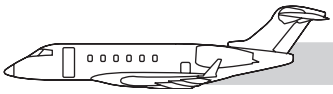
Figure 04-06-06. Cruise Performance—0.78 M (Sheet 12 of 12)

CRUISE 0.80 M_I			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	82.0 1358 0.3300	0.800 216. 448.	82.7 1395 0.3211	0.800 216. 448.	83.5 1438 0.3116	0.800 216. 448.	84.3 1484 0.3019	0.800 216. 448.	85.3 1535 0.2919	0.800 216. 448.
430	81.1 1429 0.3135	0.800 226. 448.	81.7 1460 0.3069	0.800 226. 448.	82.3 1496 0.2995	0.800 226. 448.	83.0 1538 0.2913	0.800 226. 448.	83.8 1584 0.2829	0.800 226. 448.
410	80.4 1514 0.2958	0.800 237. 448.	80.8 1538 0.2913	0.800 237. 448.	81.3 1567 0.2859	0.800 237. 448.	81.9 1601 0.2798	0.800 237. 448.	82.5 1642 0.2729	0.800 237. 448.
390	79.9 1621 0.2763	0.800 248. 448.	80.2 1641 0.2731	0.800 248. 448.	80.5 1663 0.2694	0.800 248. 448.	80.9 1691 0.2650	0.800 248. 448.	81.4 1722 0.2601	0.800 248. 448.
370	79.5 1746 0.2567	0.800 260. 448.	79.7 1762 0.2543	0.800 260. 448.	80.0 1781 0.2516	0.800 260. 448.	80.3 1802 0.2486	0.800 260. 448.	80.7 1827 0.2452	0.800 260. 448.
350	79.6 1896 0.2376	0.800 272. 450.	79.8 1911 0.2357	0.800 272. 450.	80.0 1928 0.2337	0.800 272. 450.	80.3 1946 0.2315	0.800 272. 450.	80.5 1966 0.2291	0.800 272. 450.
330	80.1 2067 0.2199	0.800 284. 455.	80.3 2083 0.2183	0.800 284. 455.	80.4 2098 0.2167	0.800 284. 455.	80.7 2115 0.2150	0.800 284. 455.	80.9 2132 0.2132	0.800 284. 455.
310	80.5 2252 0.2037	0.800 297. 459.	80.7 2269 0.2023	0.800 297. 459.	80.8 2284 0.2009	0.800 297. 459.	81.0 2300 0.1995	0.800 297. 459.	81.2 2316 0.1981	0.800 297. 459.
290	80.8 2451 0.1889	0.800 310. 463.	81.0 2468 0.1876	0.800 310. 463.	81.2 2485 0.1863	0.800 310. 463.	81.4 2500 0.1852	0.800 310. 463.	81.5 2516 0.1840	0.800 310. 463.
280	81.0 2555 0.1820	0.800 317. 465.	81.2 2573 0.1808	0.800 317. 465.	81.4 2590 0.1796	0.800 317. 465.	81.6 2606 0.1785	0.800 317. 465.	81.7 2622 0.1774	0.800 317. 465.
270										
260										
250										
240										

bd100_aeo_cr80_IMP_lw_hFL_m10 - 02/02/2004

Figure 04-06-07. Cruise Performance—0.80 M (Sheet 1 of 12)



CRUISE 0.80 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%NI LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450	86.5 1603 0.2794	0.800 216. 448.								
430	84.6 1632 0.2746	0.800 226. 448.	85.5 1686 0.2657	0.800 226. 448.	86.8 1763 0.2541	0.800 226. 448.				
410	83.2 1686 0.2658	0.800 237. 448.	83.9 1733 0.2586	0.800 237. 448.	84.6 1783 0.2513	0.800 237. 448.	85.5 1841 0.2434	0.800 237. 448.	86.8 1919 0.2335	0.800 237. 448.
390	81.9 1759 0.2546	0.800 248. 448.	82.5 1801 0.2487	0.800 248. 448.	83.2 1847 0.2426	0.800 248. 448.	83.8 1895 0.2364	0.800 248. 448.	84.5 1946 0.2303	0.800 248. 448.
370	81.1 1857 0.2413	0.800 260. 448.	81.5 1890 0.2370	0.800 260. 448.	82.0 1929 0.2322	0.800 260. 448.	82.6 1972 0.2272	0.800 260. 448.	83.2 2017 0.2221	0.800 260. 448.
350	80.8 1989 0.2265	0.800 272. 450.	81.2 2015 0.2235	0.800 272. 450.	81.6 2047 0.2201	0.800 272. 450.	82.0 2082 0.2163	0.800 272. 450.	82.5 2122 0.2123	0.800 272. 450.
330	81.1 2152 0.2113	0.800 284. 455.	81.4 2174 0.2091	0.800 284. 455.	81.7 2199 0.2067	0.800 284. 455.	82.0 2228 0.2040	0.800 284. 455.	82.4 2260 0.2012	0.800 284. 455.
310	81.4 2333 0.1966	0.800 297. 459.	81.6 2352 0.1951	0.800 297. 459.	81.8 2372 0.1934	0.800 297. 459.	82.1 2395 0.1916	0.800 297. 459.	82.3 2420 0.1896	0.800 297. 459.
290	81.7 2532 0.1829	0.800 310. 463.	81.9 2548 0.1817	0.800 310. 463.	82.1 2566 0.1804	0.800 310. 463.	82.2 2586 0.1791	0.800 310. 463.	82.5 2607 0.1776	0.800 310. 463.
280	81.9 2637 0.1764	0.800 317. 465.	82.0 2653 0.1753	0.800 317. 465.	82.2 2670 0.1742	0.800 317. 465.	82.4 2688 0.1730	0.800 317. 465.	82.6 2708 0.1718	0.800 317. 465.
270										
260										
250										
240										

bd100_aeo_cr80_IMP_hw_hFL_m10 - 02/02/2004

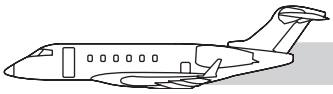
Figure 04-06-07. Cruise Performance—0.80 M (Sheet 2 of 12)

CRUISE 0.80 M_1			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	84.1 1409 0.3257	0.800 216. 459.	84.8 1448 0.3168	0.800 216. 459.	85.6 1492 0.3075	0.800 216. 459.	86.5 1540 0.2979	0.800 216. 459.	87.4 1592 0.2882	0.800 216. 459.
430	83.2 1486 0.3088	0.800 226. 459.	83.7 1517 0.3023	0.800 226. 459.	84.4 1555 0.2951	0.800 226. 459.	85.1 1597 0.2872	0.800 226. 459.	85.9 1644 0.2791	0.800 226. 459.
410	82.5 1574 0.2915	0.800 237. 459.	82.9 1598 0.2870	0.800 237. 459.	83.4 1629 0.2817	0.800 237. 459.	83.9 1664 0.2757	0.800 237. 459.	84.6 1705 0.2690	0.800 237. 459.
390	81.9 1680 0.2730	0.800 248. 459.	82.2 1700 0.2698	0.800 248. 459.	82.5 1724 0.2661	0.800 248. 459.	83.0 1752 0.2618	0.800 248. 459.	83.4 1785 0.2570	0.800 248. 459.
370	81.4 1806 0.2540	0.800 260. 459.	81.7 1823 0.2516	0.800 260. 459.	81.9 1843 0.2490	0.800 260. 459.	82.2 1865 0.2460	0.800 260. 459.	82.6 1891 0.2426	0.800 260. 459.
350	81.5 1962 0.2350	0.800 272. 461.	81.7 1978 0.2331	0.800 272. 461.	81.9 1995 0.2311	0.800 272. 461.	82.2 2014 0.2289	0.800 272. 461.	82.5 2035 0.2266	0.800 272. 461.
330	81.9 2140 0.2174	0.800 284. 465.	82.1 2156 0.2158	0.800 284. 465.	82.3 2171 0.2142	0.800 284. 465.	82.5 2188 0.2126	0.800 284. 465.	82.8 2206 0.2109	0.800 284. 465.
310	82.4 2331 0.2013	0.800 297. 469.	82.6 2348 0.1999	0.800 297. 469.	82.8 2364 0.1985	0.800 297. 469.	83.0 2380 0.1972	0.800 297. 469.	83.1 2397 0.1958	0.800 297. 469.
290	82.8 2536 0.1867	0.800 310. 474.	82.9 2554 0.1854	0.800 310. 474.	83.1 2571 0.1841	0.800 310. 474.	83.3 2587 0.1830	0.800 310. 474.	83.5 2603 0.1819	0.800 310. 474.
280	83.0 2644 0.1798	0.800 317. 476.	83.1 2663 0.1785	0.800 317. 476.	83.3 2680 0.1774	0.800 317. 476.	83.5 2697 0.1763	0.800 317. 476.	83.6 2713 0.1752	0.800 317. 476.
270										
260										
250										
240										

bd100_aeo_cr80_IMP_lw_hFL_00 - 02/02/2004

Figure 04-06-07. Cruise Performance—0.80 M (Sheet 3 of 12)



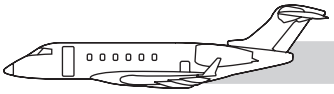
CRUISE 0.80 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450	88.7 1663 0.2758	0.800 216. 459.								
430	86.7 1693 0.2710	0.800 226. 459.	87.6 1751 0.2620	0.800 226. 459.	89.0 1831 0.2505	0.800 226. 459.				
410	85.2 1750 0.2621	0.800 237. 459.	86.0 1799 0.2550	0.800 237. 459.	86.8 1850 0.2480	0.800 237. 459.	87.6 1910 0.2402	0.800 237. 459.	88.9 1993 0.2302	0.800 237. 459.
390	84.0 1823 0.2517	0.800 248. 459.	84.6 1866 0.2459	0.800 248. 459.	85.2 1913 0.2399	0.800 248. 459.	85.9 1962 0.2338	0.800 248. 459.	86.6 2014 0.2278	0.800 248. 459.
370	83.0 1922 0.2387	0.800 260. 459.	83.5 1956 0.2345	0.800 260. 459.	84.0 1996 0.2298	0.800 260. 459.	84.6 2040 0.2249	0.800 260. 459.	85.1 2087 0.2198	0.800 260. 459.
350	82.8 2059 0.2239	0.800 272. 461.	83.1 2086 0.2210	0.800 272. 461.	83.5 2118 0.2176	0.800 272. 461.	83.9 2154 0.2140	0.800 272. 461.	84.4 2195 0.2100	0.800 272. 461.
330	83.0 2226 0.2089	0.800 284. 465.	83.3 2249 0.2069	0.800 284. 465.	83.6 2275 0.2045	0.800 284. 465.	83.9 2304 0.2019	0.800 284. 465.	84.3 2337 0.1991	0.800 284. 465.
310	83.3 2415 0.1944	0.800 297. 469.	83.6 2434 0.1928	0.800 297. 469.	83.8 2455 0.1912	0.800 297. 469.	84.0 2478 0.1894	0.800 297. 469.	84.3 2505 0.1874	0.800 297. 469.
290	83.6 2619 0.1808	0.800 310. 474.	83.8 2637 0.1795	0.800 310. 474.	84.0 2655 0.1783	0.800 310. 474.	84.2 2675 0.1770	0.800 310. 474.	84.4 2697 0.1755	0.800 310. 474.
280	83.8 2729 0.1742	0.800 317. 476.	84.0 2746 0.1731	0.800 317. 476.	84.1 2764 0.1720	0.800 317. 476.	84.3 2782 0.1709	0.800 317. 476.	84.5 2803 0.1697	0.800 317. 476.
270										
260										
250										
240										

bd100_aeo_cr80_IMP_hw_hFL_00 – 02/02/2004

Figure 04-06-07. Cruise Performance—0.80 M (Sheet 4 of 12)



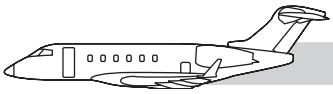
CRUISE 0.80 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C	%N1	MACH
	30% C.G.	LB/HR	KIAS
		NAM/LB	KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	85.1 1435 0.3233	0.800 216. 464.	85.8 1475 0.3147	0.800 216. 464.	86.6 1520 0.3053	0.800 216. 464.	87.5 1567 0.2960	0.800 216. 464.	88.4 1621 0.2863	0.800 216. 464.
430	84.2 1513 0.3067	0.800 226. 464.	84.8 1545 0.3003	0.800 226. 464.	85.4 1583 0.2932	0.800 226. 464.	86.1 1626 0.2854	0.800 226. 464.	86.9 1674 0.2772	0.800 226. 464.
410	83.5 1604 0.2892	0.800 237. 464.	83.9 1629 0.2848	0.800 237. 464.	84.4 1660 0.2795	0.800 237. 464.	85.0 1696 0.2736	0.800 237. 464.	85.6 1737 0.2671	0.800 237. 464.
390	82.9 1710 0.2713	0.800 248. 464.	83.2 1731 0.2681	0.800 248. 464.	83.5 1755 0.2644	0.800 248. 464.	84.0 1784 0.2601	0.800 248. 464.	84.5 1817 0.2553	0.800 248. 464.
370	82.4 1837 0.2526	0.800 260. 464.	82.6 1854 0.2502	0.800 260. 464.	82.9 1874 0.2476	0.800 260. 464.	83.2 1897 0.2447	0.800 260. 464.	83.5 1923 0.2413	0.800 260. 464.
350	82.4 1995 0.2337	0.800 272. 466.	82.6 2012 0.2318	0.800 272. 466.	82.9 2029 0.2298	0.800 272. 466.	83.1 2048 0.2277	0.800 272. 466.	83.4 2069 0.2254	0.800 272. 466.
330	82.9 2176 0.2162	0.800 284. 470.	83.1 2192 0.2146	0.800 284. 470.	83.3 2208 0.2130	0.800 284. 470.	83.5 2226 0.2113	0.800 284. 470.	83.7 2244 0.2096	0.800 284. 470.
310	83.3 2370 0.2002	0.800 297. 475.	83.5 2387 0.1988	0.800 297. 475.	83.7 2403 0.1974	0.800 297. 475.	83.9 2420 0.1961	0.800 297. 475.	84.1 2437 0.1947	0.800 297. 475.
290	83.7 2579 0.1855	0.800 310. 479.	83.9 2597 0.1843	0.800 310. 479.	84.1 2614 0.1830	0.800 310. 479.	84.2 2631 0.1819	0.800 310. 479.	84.4 2647 0.1808	0.800 310. 479.
280	83.9 2689 0.1787	0.800 317. 481.	84.1 2708 0.1775	0.800 317. 481.	84.2 2725 0.1763	0.800 317. 481.	84.4 2742 0.1752	0.800 317. 481.	84.6 2759 0.1742	0.800 317. 481.
270										
260										
250										
240										

bd100_aeo_cr80_IMP_lw_hFL_05 – 02/02/2004

Figure 04-06-07. Cruise Performance—0.80 M (Sheet 5 of 12)



CRUISE 0.80 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430	87.7 1724 0.2692	0.800 226. 464.	88.7 1782 0.2604	0.800 226. 464.	90.1 1864 0.2489	0.800 226. 464.				
410	86.3 1783 0.2602	0.800 237. 464.	87.0 1833 0.2532	0.800 237. 464.	87.8 1883 0.2464	0.800 237. 464.	88.7 1945 0.2385	0.800 237. 464.	90.0 2030 0.2286	0.800 237. 464.
390	85.0 1856 0.2500	0.800 248. 464.	85.6 1899 0.2443	0.800 248. 464.	86.3 1947 0.2384	0.800 248. 464.	86.9 1997 0.2324	0.800 248. 464.	87.7 2050 0.2264	0.800 248. 464.
370	84.0 1954 0.2375	0.800 260. 464.	84.4 1989 0.2333	0.800 260. 464.	85.0 2030 0.2286	0.800 260. 464.	85.6 2075 0.2237	0.800 260. 464.	86.1 2122 0.2187	0.800 260. 464.
350	83.7 2093 0.2228	0.800 272. 466.	84.1 2121 0.2199	0.800 272. 466.	84.4 2154 0.2165	0.800 272. 466.	84.9 2190 0.2129	0.800 272. 466.	85.4 2232 0.2089	0.800 272. 466.
330	83.9 2265 0.2077	0.800 284. 470.	84.2 2287 0.2057	0.800 284. 470.	84.5 2313 0.2034	0.800 284. 470.	84.8 2343 0.2008	0.800 284. 470.	85.2 2376 0.1980	0.800 284. 470.
310	84.3 2454 0.1933	0.800 297. 475.	84.5 2474 0.1918	0.800 297. 475.	84.7 2495 0.1902	0.800 297. 475.	85.0 2519 0.1884	0.800 297. 475.	85.2 2546 0.1864	0.800 297. 475.
290	84.6 2663 0.1797	0.800 310. 479.	84.8 2681 0.1785	0.800 310. 479.	84.9 2700 0.1772	0.800 310. 479.	85.1 2720 0.1759	0.800 310. 479.	85.4 2743 0.1745	0.800 310. 479.
280	84.7 2775 0.1732	0.800 317. 481.	84.9 2792 0.1721	0.800 317. 481.	85.1 2810 0.1710	0.800 317. 481.	85.3 2829 0.1699	0.800 317. 481.	85.4 2850 0.1686	0.800 317. 481.
270										
260										
250										
240										

bd100_aeo_cr80_IMP_hw_hFL_05 – 02/02/2004

Figure 04-06-07. Cruise Performance—0.80 M (Sheet 6 of 12)

CRUISE 0.80 M_1			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	86.2 1462 0.3209	0.800 216. 469.	86.9 1502 0.3123	0.800 216. 469.	87.6 1547 0.3033	0.800 216. 469.	88.5 1596 0.2940	0.800 216. 469.		
430	85.2 1541 0.3045	0.800 226. 469.	85.8 1573 0.2982	0.800 226. 469.	86.4 1612 0.2911	0.800 226. 469.	87.2 1656 0.2833	0.800 226. 469.	87.9 1704 0.2753	0.800 226. 469.
410	84.5 1634 0.2871	0.800 237. 469.	84.9 1659 0.2827	0.800 237. 469.	85.4 1690 0.2776	0.800 237. 469.	86.0 1727 0.2718	0.800 237. 469.	86.6 1769 0.2653	0.800 237. 469.
390	83.9 1742 0.2693	0.800 248. 469.	84.2 1763 0.2662	0.800 248. 469.	84.6 1787 0.2626	0.800 248. 469.	85.0 1816 0.2583	0.800 248. 469.	85.5 1851 0.2536	0.800 248. 469.
370	83.3 1869 0.2511	0.800 260. 469.	83.6 1887 0.2487	0.800 260. 469.	83.9 1906 0.2461	0.800 260. 469.	84.2 1929 0.2433	0.800 260. 469.	84.6 1956 0.2399	0.800 260. 469.
350	83.4 2028 0.2325	0.800 272. 472.	83.6 2044 0.2307	0.800 272. 472.	83.8 2061 0.2287	0.800 272. 472.	84.0 2080 0.2266	0.800 272. 472.	84.3 2102 0.2243	0.800 272. 472.
330	83.8 2212 0.2150	0.800 284. 476.	84.0 2229 0.2134	0.800 284. 476.	84.2 2245 0.2118	0.800 284. 476.	84.4 2263 0.2102	0.800 284. 476.	84.6 2281 0.2085	0.800 284. 476.
310	84.2 2410 0.1990	0.800 297. 480.	84.4 2427 0.1976	0.800 297. 480.	84.6 2443 0.1963	0.800 297. 480.	84.8 2460 0.1950	0.800 297. 480.	85.0 2477 0.1936	0.800 297. 480.
290	84.6 2621 0.1845	0.800 310. 484.	84.8 2640 0.1832	0.800 310. 484.	85.0 2658 0.1820	0.800 310. 484.	85.2 2674 0.1808	0.800 310. 484.	85.3 2691 0.1797	0.800 310. 484.
280	84.8 2734 0.1776	0.800 317. 486.	85.0 2753 0.1764	0.800 317. 486.	85.2 2771 0.1752	0.800 317. 486.	85.4 2788 0.1741	0.800 317. 486.	85.5 2805 0.1731	0.800 317. 486.
270										
260										
250										
240										

bd100_aeo_cr80_IMP_lw_hFL_10 – 02/02/2004

Figure 04-06-07. Cruise Performance—0.80 M (Sheet 7 of 12)

CRUISE 0.80 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF

ISA + 10 C

30% C.G.

%N1 LB/HR NAM/LB

MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430	88.7 1754 0.2675	0.800 226. 469.								
410	87.3 1816 0.2584	0.800 237. 469.	88.0 1865 0.2515	0.800 237. 469.	88.8 1918 0.2447	0.800 237. 469.	89.7 1980 0.2370	0.800 237. 469.		
390	86.0 1890 0.2483	0.800 248. 469.	86.6 1935 0.2426	0.800 248. 469.	87.3 1983 0.2367	0.800 248. 469.	87.9 2034 0.2308	0.800 248. 469.	88.7 2087 0.2249	0.800 248. 469.
370	85.0 1988 0.2361	0.800 260. 469.	85.4 2024 0.2318	0.800 260. 469.	86.0 2065 0.2272	0.800 260. 469.	86.5 2109 0.2224	0.800 260. 469.	87.1 2158 0.2175	0.800 260. 469.
350	84.6 2127 0.2216	0.800 272. 472.	85.0 2156 0.2186	0.800 272. 472.	85.4 2190 0.2153	0.800 272. 472.	85.8 2227 0.2117	0.800 272. 472.	86.3 2269 0.2078	0.800 272. 472.
330	84.9 2302 0.2066	0.800 284. 476.	85.1 2324 0.2046	0.800 284. 476.	85.4 2351 0.2023	0.800 284. 476.	85.8 2381 0.1997	0.800 284. 476.	86.1 2415 0.1969	0.800 284. 476.
310	85.2 2495 0.1922	0.800 297. 480.	85.4 2515 0.1907	0.800 297. 480.	85.6 2537 0.1890	0.800 297. 480.	85.9 2561 0.1873	0.800 297. 480.	86.2 2588 0.1853	0.800 297. 480.
290	85.5 2708 0.1786	0.800 310. 484.	85.7 2726 0.1774	0.800 310. 484.	85.9 2745 0.1762	0.800 310. 484.	86.1 2766 0.1749	0.800 310. 484.	86.3 2788 0.1735	0.800 310. 484.
280	85.7 2822 0.1721	0.800 317. 486.	85.8 2839 0.1711	0.800 317. 486.	86.0 2857 0.1700	0.800 317. 486.	86.2 2875 0.1689	0.800 317. 486.	86.4 2896 0.1676	0.800 317. 486.
270										
260										
250										
240										

bd100_aeo_cr80_IMP_hw_hFL_10 – 02/02/2004

Figure 04-06-07. Cruise Performance—0.80 M (Sheet 8 of 12)

CRUISE 0.80 M_I			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT - 1000 LB									
	24		26		28		30		32	
450	87.2 1489 0.3186	0.800 216. 474.	87.9 1529 0.3102	0.800 216. 474.						
430	86.3 1569 0.3024	0.800 226. 474.	86.8 1602 0.2961	0.800 226. 474.	87.4 1641 0.2891	0.800 226. 474.	88.2 1685 0.2815	0.800 226. 474.		
410	85.5 1664 0.2850	0.800 237. 474.	85.9 1690 0.2806	0.800 237. 474.	86.4 1722 0.2754	0.800 237. 474.	87.0 1759 0.2697	0.800 237. 474.	87.6 1801 0.2633	0.800 237. 474.
390	84.9 1775 0.2673	0.800 248. 474.	85.2 1796 0.2641	0.800 248. 474.	85.6 1821 0.2605	0.800 248. 474.	86.0 1850 0.2564	0.800 248. 474.	86.5 1885 0.2517	0.800 248. 474.
370	84.3 1901 0.2496	0.800 260. 474.	84.6 1919 0.2472	0.800 260. 474.	84.9 1939 0.2446	0.800 260. 474.	85.2 1962 0.2418	0.800 260. 474.	85.5 1989 0.2385	0.800 260. 474.
350	84.3 2061 0.2312	0.800 272. 477.	84.5 2078 0.2294	0.800 272. 477.	84.7 2095 0.2275	0.800 272. 477.	85.0 2114 0.2254	0.800 272. 477.	85.2 2137 0.2231	0.800 272. 477.
330	84.7 2249 0.2137	0.800 284. 481.	84.9 2265 0.2122	0.800 284. 481.	85.1 2282 0.2106	0.800 284. 481.	85.3 2300 0.2090	0.800 284. 481.	85.5 2318 0.2073	0.800 284. 481.
310	85.1 2449 0.1979	0.800 297. 485.	85.3 2467 0.1965	0.800 297. 485.	85.5 2483 0.1952	0.800 297. 485.	85.7 2500 0.1939	0.800 297. 485.	85.9 2517 0.1925	0.800 297. 485.
290	85.6 2663 0.1835	0.800 310. 489.	85.8 2682 0.1822	0.800 310. 489.	85.9 2700 0.1809	0.800 310. 489.	86.1 2717 0.1798	0.800 310. 489.	86.3 2735 0.1787	0.800 310. 489.
280	85.7 2778 0.1766	0.800 317. 491.	85.9 2797 0.1754	0.800 317. 491.	86.1 2815 0.1743	0.800 317. 491.	86.3 2832 0.1732	0.800 317. 491.	86.4 2849 0.1722	0.800 317. 491.
270										
260										
250										
240										

bd100_aeo_cr80_IMP_lw_hFL_15 - 02/02/2004

Figure 04-06-07. Cruise Performance—0.80 M (Sheet 9 of 12)

CRUISE 0.80 M_I			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430										
410	88.3 1848 0.2567	0.800 237. 474.	89.0 1899 0.2498	0.800 237. 474.						
390	87.0 1925 0.2465	0.800 248. 474.	87.6 1970 0.2409	0.800 248. 474.	88.3 2018 0.2350	0.800 248. 474.	88.9 2069 0.2293	0.800 248. 474.	89.7 2123 0.2234	0.800 248. 474.
370	86.0 2021 0.2347	0.800 260. 474.	86.4 2057 0.2306	0.800 260. 474.	87.0 2100 0.2259	0.800 260. 474.	87.5 2145 0.2211	0.800 260. 474.	88.1 2194 0.2162	0.800 260. 474.
350	85.6 2162 0.2204	0.800 272. 477.	85.9 2192 0.2175	0.800 272. 477.	86.3 2225 0.2142	0.800 272. 477.	86.8 2263 0.2106	0.800 272. 477.	87.3 2305 0.2067	0.800 272. 477.
330	85.8 2339 0.2055	0.800 284. 481.	86.1 2362 0.2035	0.800 284. 481.	86.4 2388 0.2012	0.800 284. 481.	86.7 2419 0.1987	0.800 284. 481.	87.1 2454 0.1959	0.800 284. 481.
310	86.1 2535 0.1911	0.800 297. 485.	86.3 2556 0.1896	0.800 297. 485.	86.5 2578 0.1880	0.800 297. 485.	86.8 2602 0.1862	0.800 297. 485.	87.1 2630 0.1843	0.800 297. 485.
290	86.4 2752 0.1775	0.800 310. 489.	86.6 2770 0.1764	0.800 310. 489.	86.8 2789 0.1752	0.800 310. 489.	87.0 2810 0.1739	0.800 310. 489.	87.2 2832 0.1725	0.800 310. 489.
280	86.6 2866 0.1712	0.800 317. 491.	86.8 2883 0.1701	0.800 317. 491.	86.9 2902 0.1691	0.800 317. 491.	87.1 2921 0.1679	0.800 317. 491.	87.3 2942 0.1667	0.800 317. 491.
270										
260										
250										
240										

bd100_aeo_cr80_IMP_hw_hFL_15 – 02/02/2004

Figure 04-06-07. Cruise Performance—0.80 M (Sheet 10 of 12)

CRUISE 0.80 M_I

MAXIMUM CRUISE THRUST LIMITS
ENGINE BLEED ON
ENGINE AND WING A/I OFF

ISA + 20 C

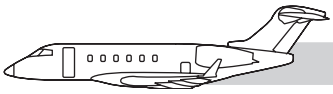
30% C.G.

%N1 MACH
LB/HR KIAS
NAM/LB KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450										
430	87.2 1597 0.3002	0.800 226. 480.	87.8 1630 0.2941	0.800 226. 480.						
410	86.5 1695 0.2828	0.800 237. 480.	86.9 1722 0.2785	0.800 237. 480.	87.4 1753 0.2735	0.800 237. 480.	88.0 1790 0.2678	0.800 237. 480.		
390	85.9 1808 0.2652	0.800 248. 480.	86.2 1829 0.2621	0.800 248. 480.	86.6 1854 0.2586	0.800 248. 480.	87.0 1884 0.2545	0.800 248. 480.	87.5 1920 0.2498	0.800 248. 480.
370	85.3 1934 0.2479	0.800 260. 480.	85.5 1952 0.2456	0.800 260. 480.	85.8 1972 0.2431	0.800 260. 480.	86.2 1996 0.2402	0.800 260. 480.	86.5 2024 0.2369	0.800 260. 480.
350	85.2 2096 0.2298	0.800 272. 482.	85.4 2113 0.2280	0.800 272. 482.	85.7 2130 0.2261	0.800 272. 482.	85.9 2150 0.2240	0.800 272. 482.	86.2 2172 0.2218	0.800 272. 482.
330	85.6 2284 0.2126	0.800 284. 486.	85.8 2301 0.2110	0.800 284. 486.	86.0 2318 0.2095	0.800 284. 486.	86.2 2336 0.2079	0.800 284. 486.	86.4 2355 0.2062	0.800 284. 486.
310	86.0 2488 0.1968	0.800 297. 490.	86.2 2506 0.1954	0.800 297. 490.	86.4 2523 0.1941	0.800 297. 490.	86.6 2540 0.1928	0.800 297. 490.	86.8 2557 0.1914	0.800 297. 490.
290	86.4 2705 0.1825	0.800 310. 494.	86.6 2723 0.1812	0.800 310. 494.	86.8 2741 0.1800	0.800 310. 494.	87.0 2758 0.1789	0.800 310. 494.	87.1 2775 0.1779	0.800 310. 494.
280	86.6 2820 0.1757	0.800 317. 496.	86.8 2839 0.1745	0.800 317. 496.	87.0 2857 0.1734	0.800 317. 496.	87.2 2875 0.1723	0.800 317. 496.	87.3 2892 0.1713	0.800 317. 496.
270										
260										
250										
240										

bd100_aeo_cr80_IMP_lw_hFL_20 - 02/02/2004

Figure 04-06-07. Cruise Performance—0.80 M (Sheet 11 of 12)



CRUISE 0.80 M_I

MAXIMUM CRUISE THRUST LIMITS
ENGINE BLEED ON
ENGINE AND WING A/I OFF

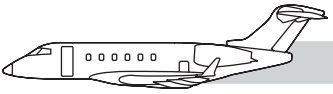
ISA + 20 C
30% C.G.

%N1 MACH
LB/HR KIAS
NAM/LB KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430										
410										
390	88.0 1960 0.2447	0.800 248. 480.	88.6 2004 0.2392	0.800 248. 480.						
370	86.9 2056 0.2332	0.800 260. 480.	87.4 2093 0.2291	0.800 260. 480.	87.9 2136 0.2245	0.800 260. 480.	88.5 2182 0.2198	0.800 260. 480.	89.1 2232 0.2149	0.800 260. 480.
350	86.5 2197 0.2192	0.800 272. 482.	86.9 2227 0.2163	0.800 272. 482.	87.3 2261 0.2130	0.800 272. 482.	87.7 2300 0.2094	0.800 272. 482.	88.2 2343 0.2055	0.800 272. 482.
330	86.7 2376 0.2044	0.800 284. 486.	87.0 2400 0.2024	0.800 284. 486.	87.3 2427 0.2001	0.800 284. 486.	87.6 2458 0.1976	0.800 284. 486.	88.0 2493 0.1948	0.800 284. 486.
310	87.0 2576 0.1901	0.800 297. 490.	87.2 2597 0.1886	0.800 297. 490.	87.4 2619 0.1870	0.800 297. 490.	87.7 2643 0.1852	0.800 297. 490.	88.0 2671 0.1833	0.800 297. 490.
290	87.3 2792 0.1767	0.800 310. 494.	87.5 2811 0.1756	0.800 310. 494.	87.7 2830 0.1744	0.800 310. 494.	87.9 2851 0.1731	0.800 310. 494.	88.1 2874 0.1717	0.800 310. 494.
280	87.5 2909 0.1703	0.800 317. 496.	87.6 2926 0.1693	0.800 317. 496.	87.8 2945 0.1683	0.800 317. 496.	88.0 2964 0.1672	0.800 317. 496.	88.2 2986 0.1659	0.800 317. 496.
270										
260										
250										
240										

bd100_aeo_cr80_IMP_hw_hFL_20 – 02/02/2004

Figure 04-06-07. Cruise Performance—0.80 M (Sheet 12 of 12)



CRUISE 0.82 M_j

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	83.6 1463 0.3138	0.820 222. 459.	84.6 1519 0.3023	0.820 222. 459.	85.7 1580 0.2907	0.820 222. 459.				
430	82.5 1527 0.3007	0.820 232. 459.	83.2 1572 0.2921	0.820 232. 459.	84.2 1628 0.2822	0.820 232. 459.	85.1 1687 0.2723	0.820 232. 459.	86.2 1753 0.2619	0.820 232. 459.
410	81.7 1614 0.2846	0.820 243. 459.	82.2 1644 0.2794	0.820 243. 459.	82.8 1684 0.2727	0.820 243. 459.	83.6 1738 0.2643	0.820 243. 459.	84.5 1797 0.2556	0.820 243. 459.
390	81.1 1728 0.2657	0.820 255. 459.	81.4 1749 0.2626	0.820 255. 459.	81.9 1777 0.2584	0.820 255. 459.	82.4 1814 0.2531	0.820 255. 459.	83.1 1863 0.2465	0.820 255. 459.
370	80.8 1863 0.2466	0.820 267. 459.	81.0 1879 0.2445	0.820 267. 459.	81.3 1898 0.2420	0.820 267. 459.	81.6 1923 0.2388	0.820 267. 459.	82.1 1957 0.2347	0.820 267. 459.
350	81.0 2024 0.2281	0.820 280. 462.	81.1 2038 0.2265	0.820 280. 462.	81.3 2053 0.2248	0.820 280. 462.	81.6 2072 0.2228	0.820 280. 462.	81.8 2095 0.2204	0.820 280. 462.
330	81.5 2214 0.2104	0.820 292. 466.	81.6 2229 0.2091	0.820 292. 466.	81.8 2243 0.2078	0.820 292. 466.	82.0 2258 0.2064	0.820 292. 466.	82.2 2275 0.2049	0.820 292. 466.
310	81.9 2413 0.1949	0.820 306. 470.	82.1 2430 0.1936	0.820 306. 470.	82.2 2445 0.1923	0.820 306. 470.	82.4 2459 0.1913	0.820 306. 470.	82.5 2474 0.1901	0.820 306. 470.
290	82.2 2622 0.1810	0.820 319. 475.	82.5 2642 0.1797	0.820 319. 475.	82.6 2660 0.1784	0.820 319. 475.	82.8 2675 0.1774	0.820 319. 475.	82.9 2689 0.1765	0.820 319. 475.
280										
270										
260										
250										
240										

bd100_aeo_cr82_IMP_lw_hFL_m10 – 02/02/2004

Figure 04-06-08. Cruise Performance—0.82 M (Sheet 1 of 12)

CRUISE 0.82 M_I			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430										
410	85.4 1858 0.2472	0.820 243. 459.	86.5 1933 0.2376	0.820 243. 459.						
390	83.8 1920 0.2392	0.820 255. 459.	84.7 1980 0.2319	0.820 255. 459.	85.5 2043 0.2248	0.820 255. 459.	86.6 2121 0.2165	0.820 255. 459.		
370	82.6 1999 0.2297	0.820 267. 459.	83.3 2052 0.2238	0.820 267. 459.	84.0 2112 0.2175	0.820 267. 459.	84.8 2172 0.2114	0.820 267. 459.	85.6 2235 0.2055	0.820 267. 459.
350	82.2 2125 0.2173	0.820 280. 462.	82.6 2162 0.2135	0.820 280. 462.	83.2 2209 0.2090	0.820 280. 462.	83.8 2264 0.2039	0.820 280. 462.	84.5 2324 0.1986	0.820 280. 462.
330	82.4 2295 0.2031	0.820 292. 466.	82.7 2321 0.2008	0.820 292. 466.	83.0 2354 0.1980	0.820 292. 466.	83.5 2394 0.1947	0.820 292. 466.	84.0 2443 0.1908	0.820 292. 466.
310	82.7 2490 0.1889	0.820 306. 470.	82.9 2509 0.1874	0.820 306. 470.	83.1 2531 0.1858	0.820 306. 470.	83.4 2559 0.1838	0.820 306. 470.	83.7 2593 0.1814	0.820 306. 470.
290	83.1 2704 0.1755	0.820 319. 475.	83.2 2719 0.1745	0.820 319. 475.	83.4 2737 0.1734	0.820 319. 475.	83.6 2756 0.1722	0.820 319. 475.	83.8 2779 0.1708	0.820 319. 475.
280										
270										
260										
250										
240										

bd100_aeo_cr82_IMP_hw_hFL_m10 - 02/02/2004

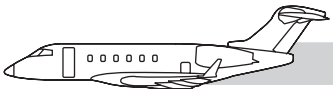
Figure 04-06-08. Cruise Performance—0.82 M (Sheet 2 of 12)

CRUISE 0.82 M_i			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA	%N1	MACH
		LB/HR	KIAS
	30% C.G.	NAM/LB	KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	85.7 1519 0.3096	0.820 222. 470.	86.8 1576 0.2983	0.820 222. 470.	87.9 1639 0.2869	0.820 222. 470.				
430	84.6 1587 0.2963	0.820 232. 470.	85.3 1633 0.2880	0.820 232. 470.	86.3 1689 0.2783	0.820 232. 470.	87.3 1751 0.2686	0.820 232. 470.	88.3 1820 0.2584	0.820 232. 470.
410	83.8 1676 0.2806	0.820 243. 470.	84.3 1708 0.2753	0.820 243. 470.	84.9 1750 0.2686	0.820 243. 470.	85.7 1805 0.2606	0.820 243. 470.	86.6 1866 0.2521	0.820 243. 470.
390	83.2 1791 0.2626	0.820 255. 470.	83.5 1812 0.2595	0.820 255. 470.	83.9 1841 0.2554	0.820 255. 470.	84.5 1880 0.2501	0.820 255. 470.	85.1 1930 0.2437	0.820 255. 470.
370	82.7 1928 0.2439	0.820 267. 470.	83.0 1944 0.2419	0.820 267. 470.	83.2 1964 0.2395	0.820 267. 470.	83.6 1990 0.2363	0.820 267. 470.	84.0 2024 0.2323	0.820 267. 470.
350	82.9 2097 0.2254	0.820 280. 473.	83.1 2111 0.2238	0.820 280. 473.	83.3 2127 0.2222	0.820 280. 473.	83.5 2146 0.2202	0.820 280. 473.	83.8 2169 0.2178	0.820 280. 473.
330	83.4 2290 0.2082	0.820 292. 477.	83.6 2305 0.2068	0.820 292. 477.	83.7 2320 0.2056	0.820 292. 477.	83.9 2335 0.2042	0.820 292. 477.	84.1 2353 0.2027	0.820 292. 477.
310	83.9 2498 0.1926	0.820 306. 481.	84.0 2516 0.1912	0.820 306. 481.	84.2 2531 0.1900	0.820 306. 481.	84.3 2546 0.1890	0.820 306. 481.	84.5 2561 0.1878	0.820 306. 481.
290	84.2 2714 0.1788	0.820 319. 485.	84.4 2735 0.1774	0.820 319. 485.	84.6 2754 0.1762	0.820 319. 485.	84.7 2770 0.1752	0.820 319. 485.	84.9 2784 0.1743	0.820 319. 485.
280										
270										
260										
250										
240										

bd100_aeo_cr82_IMP_lw_hFL_00 – 02/02/2004

Figure 04-06-08. Cruise Performance—0.82 M (Sheet 3 of 12)



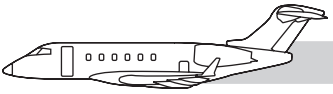
CRUISE 0.82 M_t

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430										
410	87.6 1929 0.2438	0.820 243. 470.	88.6 2006 0.2344	0.820 243. 470.						
390	85.9 1989 0.2365	0.820 255. 470.	86.8 2051 0.2293	0.820 255. 470.	87.6 2116 0.2222	0.820 255. 470.	88.7 2197 0.2140	0.820 255. 470.		
370	84.6 2068 0.2274	0.820 267. 470.	85.3 2122 0.2216	0.820 267. 470.	86.0 2183 0.2154	0.820 267. 470.	86.8 2247 0.2093	0.820 267. 470.	87.6 2311 0.2035	0.820 267. 470.
350	84.1 2200 0.2148	0.820 280. 473.	84.6 2238 0.2111	0.820 280. 473.	85.1 2286 0.2068	0.820 280. 473.	85.8 2342 0.2018	0.820 280. 473.	86.5 2404 0.1966	0.820 280. 473.
330	84.3 2374 0.2009	0.820 292. 477.	84.6 2400 0.1987	0.820 292. 477.	85.0 2434 0.1959	0.820 292. 477.	85.4 2474 0.1927	0.820 292. 477.	86.0 2525 0.1889	0.820 292. 477.
310	84.7 2578 0.1866	0.820 306. 481.	84.9 2597 0.1852	0.820 306. 481.	85.1 2620 0.1836	0.820 306. 481.	85.4 2649 0.1816	0.820 306. 481.	85.7 2684 0.1792	0.820 306. 481.
290	85.0 2799 0.1733	0.820 319. 485.	85.2 2815 0.1724	0.820 319. 485.	85.3 2833 0.1713	0.820 319. 485.	85.5 2853 0.1701	0.820 319. 485.	85.7 2877 0.1687	0.820 319. 485.
280										
270										
260										
250										
240										

bd100_aeo_cr82_IMP_hw_hFL_00 – 02/02/2004

Figure 04-06-08. Cruise Performance—0.82 M (Sheet 4 of 12)



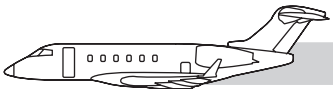
CRUISE 0.82 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	86.8 1546 0.3076	0.820 222. 476.	87.8 1604 0.2965	0.820 222. 476.	88.9 1669 0.2849	0.820 222. 476.				
430	85.6 1616 0.2942	0.820 232. 476.	86.4 1663 0.2861	0.820 232. 476.	87.3 1721 0.2764	0.820 232. 476.	88.3 1783 0.2668	0.820 232. 476.	89.4 1854 0.2565	0.820 232. 476.
410	84.8 1707 0.2785	0.820 243. 476.	85.3 1739 0.2735	0.820 243. 476.	85.9 1782 0.2669	0.820 243. 476.	86.8 1838 0.2587	0.820 243. 476.	87.7 1900 0.2503	0.820 243. 476.
390	84.2 1822 0.2610	0.820 255. 476.	84.5 1844 0.2580	0.820 255. 476.	84.9 1873 0.2539	0.820 255. 476.	85.5 1912 0.2488	0.820 255. 476.	86.1 1963 0.2423	0.820 255. 476.
370	83.7 1961 0.2426	0.820 267. 476.	83.9 1977 0.2405	0.820 267. 476.	84.2 1998 0.2381	0.820 267. 476.	84.5 2024 0.2350	0.820 267. 476.	85.0 2059 0.2310	0.820 267. 476.
350	83.8 2132 0.2242	0.820 280. 478.	84.0 2147 0.2226	0.820 280. 478.	84.2 2163 0.2210	0.820 280. 478.	84.4 2182 0.2190	0.820 280. 478.	84.7 2206 0.2167	0.820 280. 478.
330	84.3 2329 0.2070	0.820 292. 482.	84.5 2344 0.2057	0.820 292. 482.	84.7 2359 0.2044	0.820 292. 482.	84.8 2374 0.2031	0.820 292. 482.	85.0 2392 0.2016	0.820 292. 482.
310	84.8 2540 0.1915	0.820 306. 486.	85.0 2558 0.1901	0.820 306. 486.	85.1 2574 0.1890	0.820 306. 486.	85.3 2589 0.1879	0.820 306. 486.	85.5 2604 0.1868	0.820 306. 486.
290	85.1 2760 0.1777	0.820 319. 491.	85.4 2781 0.1764	0.820 319. 491.	85.5 2800 0.1752	0.820 319. 491.	85.7 2816 0.1742	0.820 319. 491.	85.8 2831 0.1733	0.820 319. 491.
280										
270										
260										
250										
240										

bd100_aeo_cr82_IMP_lw_hFL_05 - 02/02/2004

Figure 04-06-08. Cruise Performance—0.82 M (Sheet 5 of 12)



CRUISE 0.82 M_1

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430										
410	88.6 1964 0.2421	0.820 243. 476.	89.7 2044 0.2327	0.820 243. 476.						
390	86.9 2023 0.2351	0.820 255. 476.	87.8 2087 0.2279	0.820 255. 476.	88.7 2153 0.2209	0.820 255. 476.	89.7 2236 0.2127	0.820 255. 476.		
370	85.6 2103 0.2261	0.820 267. 476.	86.2 2158 0.2204	0.820 267. 476.	87.0 2220 0.2142	0.820 267. 476.	87.8 2284 0.2083	0.820 267. 476.	88.6 2351 0.2023	0.820 267. 476.
350	85.1 2237 0.2137	0.820 280. 478.	85.6 2276 0.2100	0.820 280. 478.	86.1 2324 0.2056	0.820 280. 478.	86.8 2382 0.2007	0.820 280. 478.	87.4 2444 0.1955	0.820 280. 478.
330	85.3 2413 0.1998	0.820 292. 482.	85.6 2441 0.1976	0.820 292. 482.	85.9 2475 0.1948	0.820 292. 482.	86.4 2516 0.1916	0.820 292. 482.	86.9 2567 0.1878	0.820 292. 482.
310	85.6 2621 0.1856	0.820 306. 486.	85.8 2641 0.1842	0.820 306. 486.	86.1 2663 0.1826	0.820 306. 486.	86.4 2693 0.1806	0.820 306. 486.	86.7 2729 0.1782	0.820 306. 486.
290	86.0 2846 0.1723	0.820 319. 491.	86.1 2863 0.1713	0.820 319. 491.	86.3 2881 0.1703	0.820 319. 491.	86.5 2902 0.1690	0.820 319. 491.	86.7 2926 0.1676	0.820 319. 491.
280										
270										
260										
250										
240										

bd100_aao_cr82_IMP_hw_hFL_05 – 02/02/2004

Figure 04-06-08. Cruise Performance—0.82 M (Sheet 6 of 12)

CRUISE 0.82 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF

ISA + 10 C

30% C.G.

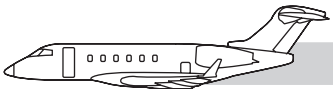
%N1 LB/HR NAM/LB

MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	87.8 1574 0.3055	0.820 222. 481.								
430	86.7 1647 0.2920	0.820 232. 481.	87.4 1693 0.2841	0.820 232. 481.	88.3 1752 0.2745	0.820 232. 481.				
410	85.8 1740 0.2764	0.820 243. 481.	86.3 1773 0.2713	0.820 243. 481.	87.0 1816 0.2649	0.820 243. 481.	87.8 1873 0.2568	0.820 243. 481.	88.7 1934 0.2486	0.820 243. 481.
390	85.2 1857 0.2591	0.820 255. 481.	85.5 1878 0.2560	0.820 255. 481.	85.9 1909 0.2520	0.820 255. 481.	86.5 1948 0.2469	0.820 255. 481.	87.2 2000 0.2405	0.820 255. 481.
370	84.7 1995 0.2411	0.820 267. 481.	84.9 2012 0.2391	0.820 267. 481.	85.2 2032 0.2367	0.820 267. 481.	85.6 2060 0.2335	0.820 267. 481.	86.0 2095 0.2296	0.820 267. 481.
350	84.8 2168 0.2229	0.820 280. 483.	84.9 2183 0.2214	0.820 280. 483.	85.1 2199 0.2198	0.820 280. 483.	85.4 2218 0.2179	0.820 280. 483.	85.7 2242 0.2155	0.820 280. 483.
330	85.3 2368 0.2058	0.820 292. 488.	85.4 2384 0.2045	0.820 292. 488.	85.6 2399 0.2032	0.820 292. 488.	85.8 2415 0.2019	0.820 292. 488.	86.0 2433 0.2003	0.820 292. 488.
310	85.7 2580 0.1906	0.820 306. 492.	85.9 2598 0.1892	0.820 306. 492.	86.1 2614 0.1881	0.820 306. 492.	86.2 2628 0.1870	0.820 306. 492.	86.4 2644 0.1859	0.820 306. 492.
290	86.1 2807 0.1766	0.820 319. 496.	86.3 2828 0.1753	0.820 319. 496.	86.5 2847 0.1741	0.820 319. 496.	86.7 2864 0.1731	0.820 319. 496.	86.8 2878 0.1722	0.820 319. 496.
280										
270										
260										
250										
240										

bd100_aeo_cr82_IMP_lw_hFL_10 - 02/02/2004

Figure 04-06-08. Cruise Performance—0.82 M (Sheet 7 of 12)



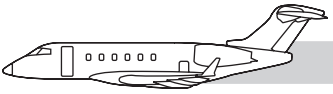
CRUISE 0.82 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430										
410	89.6 2000 0.2405	0.820 243. 481.								
390	87.9 2060 0.2335	0.820 255. 481.	88.8 2124 0.2265	0.820 255. 481.	89.7 2191 0.2195	0.820 255. 481.				
370	86.6 2140 0.2247	0.820 267. 481.	87.3 2196 0.2191	0.820 267. 481.	88.0 2258 0.2130	0.820 267. 481.	88.8 2323 0.2071	0.820 267. 481.	89.6 2390 0.2012	0.820 267. 481.
350	86.0 2274 0.2125	0.820 280. 483.	86.5 2314 0.2089	0.820 280. 483.	87.1 2363 0.2045	0.820 280. 483.	87.7 2421 0.1996	0.820 280. 483.	88.4 2484 0.1945	0.820 280. 483.
330	86.2 2454 0.1986	0.820 292. 488.	86.5 2482 0.1964	0.820 292. 488.	86.9 2516 0.1937	0.820 292. 488.	87.3 2558 0.1906	0.820 292. 488.	87.8 2609 0.1868	0.820 292. 488.
310	86.5 2661 0.1847	0.820 306. 492.	86.7 2682 0.1833	0.820 306. 492.	87.0 2705 0.1817	0.820 306. 492.	87.3 2735 0.1797	0.820 306. 492.	87.6 2772 0.1774	0.820 306. 492.
290	86.9 2894 0.1713	0.820 319. 496.	87.1 2911 0.1703	0.820 319. 496.	87.3 2929 0.1692	0.820 319. 496.	87.4 2951 0.1680	0.820 319. 496.	87.7 2975 0.1666	0.820 319. 496.
280										
270										
260										
250										
240										

bd100_aeo_cr82_IMP_hw_hFL_10 – 02/02/2004

Figure 04-06-08. Cruise Performance—0.82 M (Sheet 8 of 12)



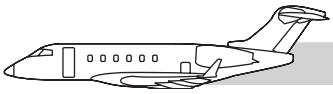
CRUISE 0.82 M_i

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C	%N1	MACH
	30% C.G.	LB/HR	KIAS
		NAM/LB	KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450										
430	87.7 1676 0.2900	0.820 232. 486.	88.4 1723 0.2822	0.820 232. 486.						
410	86.9 1773 0.2743	0.820 243. 486.	87.3 1805 0.2693	0.820 243. 486.	88.0 1849 0.2629	0.820 243. 486.	88.8 1906 0.2551	0.820 243. 486.		
390	86.2 1890 0.2572	0.820 255. 486.	86.5 1912 0.2543	0.820 255. 486.	86.9 1943 0.2502	0.820 255. 486.	87.5 1983 0.2452	0.820 255. 486.	88.2 2035 0.2389	0.820 255. 486.
370	85.7 2029 0.2397	0.820 267. 486.	85.9 2046 0.2376	0.820 267. 486.	86.2 2067 0.2352	0.820 267. 486.	86.5 2095 0.2321	0.820 267. 486.	87.0 2131 0.2282	0.820 267. 486.
350	85.7 2204 0.2217	0.820 280. 489.	85.9 2219 0.2202	0.820 280. 489.	86.1 2235 0.2186	0.820 280. 489.	86.3 2254 0.2167	0.820 280. 489.	86.6 2279 0.2143	0.820 280. 489.
330	86.2 2407 0.2047	0.820 292. 493.	86.4 2423 0.2034	0.820 292. 493.	86.5 2438 0.2021	0.820 292. 493.	86.7 2454 0.2008	0.820 292. 493.	86.9 2472 0.1993	0.820 292. 493.
310	86.6 2622 0.1894	0.820 306. 497.	86.8 2641 0.1881	0.820 306. 497.	87.0 2657 0.1870	0.820 306. 497.	87.1 2672 0.1859	0.820 306. 497.	87.3 2688 0.1848	0.820 306. 497.
290	87.0 2853 0.1755	0.820 319. 501.	87.2 2874 0.1742	0.820 319. 501.	87.4 2893 0.1731	0.820 319. 501.	87.6 2909 0.1721	0.820 319. 501.	87.7 2924 0.1712	0.820 319. 501.
280										
270										
260										
250										
240										

bd100_aeo_cr82_IMP_lw_hFL_15 – 02/02/2004

Figure 04-06-08. Cruise Performance—0.82 M (Sheet 9 of 12)



CRUISE 0.82 M_1

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430										
410										
390	88.9 2097 0.2319	0.820 255. 486.								
370	87.6 2176 0.2234	0.820 267. 486.	88.2 2232 0.2179	0.820 267. 486.	89.0 2296 0.2117	0.820 267. 486.	89.8 2361 0.2059	0.820 267. 486.		
350	87.0 2312 0.2113	0.820 280. 489.	87.4 2351 0.2077	0.820 280. 489.	88.0 2400 0.2035	0.820 280. 489.	88.6 2459 0.1987	0.820 280. 489.	89.3 2524 0.1936	0.820 280. 489.
330	87.1 2495 0.1975	0.820 292. 493.	87.4 2523 0.1953	0.820 292. 493.	87.8 2557 0.1926	0.820 292. 493.	88.2 2599 0.1895	0.820 292. 493.	88.8 2651 0.1859	0.820 292. 493.
310	87.5 2705 0.1836	0.820 306. 497.	87.7 2725 0.1823	0.820 306. 497.	87.9 2749 0.1807	0.820 306. 497.	88.2 2780 0.1787	0.820 306. 497.	88.5 2817 0.1763	0.820 306. 497.
290	87.9 2941 0.1703	0.820 319. 501.	88.0 2957 0.1694	0.820 319. 501.	88.2 2976 0.1683	0.820 319. 501.	88.4 2997 0.1671	0.820 319. 501.	88.6 3022 0.1657	0.820 319. 501.
280										
270										
260										
250										
240										

bd100_aeo_cr82_IMP_hw_hFL_15 – 02/02/2004

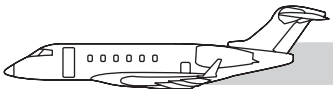
Figure 04-06-08. Cruise Performance—0.82 M (Sheet 10 of 12)

CRUISE 0.82 M_I			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450										
430										
410	87.8 1805 0.2723	0.820 243. 492.								
390	87.2 1924 0.2554	0.820 255. 492.	87.5 1947 0.2524	0.820 255. 492.	87.9 1979 0.2484	0.820 255. 492.	88.5 2019 0.2434	0.820 255. 492.		
370	86.7 2063 0.2383	0.820 267. 492.	86.9 2080 0.2363	0.820 267. 492.	87.1 2101 0.2339	0.820 267. 492.	87.5 2129 0.2308	0.820 267. 492.	88.0 2165 0.2270	0.820 267. 492.
350	86.6 2240 0.2204	0.820 280. 494.	86.8 2255 0.2189	0.820 280. 494.	87.0 2272 0.2173	0.820 280. 494.	87.3 2292 0.2154	0.820 280. 494.	87.5 2316 0.2131	0.820 280. 494.
330	87.1 2445 0.2036	0.820 292. 498.	87.3 2461 0.2023	0.820 292. 498.	87.4 2476 0.2010	0.820 292. 498.	87.6 2493 0.1997	0.820 292. 498.	87.8 2512 0.1982	0.820 292. 498.
310	87.5 2664 0.1884	0.820 306. 502.	87.7 2682 0.1871	0.820 306. 502.	87.9 2698 0.1860	0.820 306. 502.	88.0 2713 0.1850	0.820 306. 502.	88.2 2730 0.1838	0.820 306. 502.
290	87.9 2895 0.1747	0.820 319. 506.	88.1 2917 0.1734	0.820 319. 506.	88.3 2936 0.1723	0.820 319. 506.	88.5 2953 0.1713	0.820 319. 506.	88.6 2968 0.1704	0.820 319. 506.
280										
270										
260										
250										
240										

bd100_aeo_cr82_IMP_lw_hFL_20 – 02/02/2004

Figure 04-06-08. Cruise Performance—0.82 M (Sheet 11 of 12)



CRUISE 0.82 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430										
410										
390										
370	88.5 2212 0.2222	0.820 267. 492.	89.2 2270 0.2165	0.820 267. 492.						
350	87.9 2349 0.2102	0.820 280. 494.	88.4 2390 0.2066	0.820 280. 494.	88.9 2439 0.2024	0.820 280. 494.				
330	88.0 2534 0.1964	0.820 292. 498.	88.3 2562 0.1943	0.820 292. 498.	88.7 2597 0.1917	0.820 292. 498.	89.1 2640 0.1885	0.820 292. 498.		
310	88.4 2747 0.1827	0.820 306. 502.	88.6 2768 0.1813	0.820 306. 502.	88.8 2792 0.1798	0.820 306. 502.				
290										
280										
270										
260										
250										
240										

bd100_aeo_cr82_IMP_hw_hFL_20 – 02/02/2004

Figure 04-06-08. Cruise Performance—0.82 M (Sheet 12 of 12)

CRUISE 0.83 M_I

MAXIMUM CRUISE THRUST LIMITS
ENGINE BLEED ON
ENGINE AND WING A/I OFF

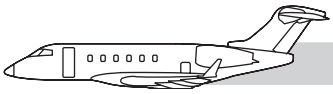
ISA – 10 C
30% C.G.

%N1 MACH
LB/HR KIAS
NAM/LB KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	84.9 1543 0.3012	0.830 225. 465.	86.0 1605 0.2895	0.830 225. 465.						
430	83.8 1614 0.2879	0.830 235. 465.	84.5 1660 0.2800	0.830 235. 465.	85.5 1718 0.2705	0.830 235. 465.	86.7 1795 0.2590	0.830 235. 465.		
410	83.0 1705 0.2726	0.830 247. 465.	83.5 1740 0.2672	0.830 247. 465.	84.1 1783 0.2607	0.830 247. 465.	84.9 1837 0.2531	0.830 247. 465.	85.9 1903 0.2442	0.830 247. 465.
390	82.3 1822 0.2552	0.830 258. 465.	82.7 1848 0.2515	0.830 258. 465.	83.2 1881 0.2471	0.830 258. 465.	83.7 1922 0.2418	0.830 258. 465.	84.4 1972 0.2357	0.830 258. 465.
370	81.9 1956 0.2377	0.830 271. 465.	82.2 1980 0.2348	0.830 271. 465.	82.5 2006 0.2317	0.830 271. 465.	82.9 2037 0.2282	0.830 271. 465.	83.4 2074 0.2242	0.830 271. 465.
350	82.0 2119 0.2205	0.830 283. 467.	82.2 2141 0.2182	0.830 283. 467.	82.5 2165 0.2158	0.830 283. 467.	82.8 2190 0.2134	0.830 283. 467.	83.1 2219 0.2106	0.830 283. 467.
330	82.4 2307 0.2045	0.830 296. 472.	82.6 2331 0.2024	0.830 296. 472.	82.9 2353 0.2004	0.830 296. 472.	83.1 2377 0.1985	0.830 296. 472.	83.4 2402 0.1964	0.830 296. 472.
310	82.7 2506 0.1900	0.830 310. 476.	82.9 2532 0.1880	0.830 310. 476.	83.2 2556 0.1862	0.830 310. 476.	83.4 2579 0.1846	0.830 310. 476.	83.7 2602 0.1830	0.830 310. 476.
290										
280										
270										
260										
250										
240										

bd100_aeo_cr83_IMP_lw_hFL_m10 - 02/02/2004

Figure 04-06-09. Cruise Performance—0.83 M (Sheet 1 of 12)



CRUISE 0.83 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430										
410	87.2 1994 0.2332	0.830 247. 465.								
390	85.2 2031 0.2288	0.830 258. 465.	86.1 2103 0.2211	0.830 258. 465.	87.5 2201 0.2112	0.830 258. 465.				
370	84.0 2120 0.2193	0.830 271. 465.	84.6 2173 0.2139	0.830 271. 465.	85.4 2236 0.2079	0.830 271. 465.	86.3 2310 0.2013	0.830 271. 465.	87.6 2409 0.1930	0.830 271. 465.
350	83.5 2253 0.2074	0.830 283. 467.	84.0 2293 0.2038	0.830 283. 467.	84.5 2342 0.1995	0.830 283. 467.	85.1 2398 0.1949	0.830 283. 467.	85.9 2462 0.1898	0.830 283. 467.
330	83.7 2429 0.1942	0.830 296. 472.	84.0 2460 0.1918	0.830 296. 472.	84.4 2496 0.1890	0.830 296. 472.	84.8 2540 0.1857	0.830 296. 472.	85.3 2591 0.1821	0.830 296. 472.
310	83.9 2626 0.1813	0.830 310. 476.	84.1 2652 0.1795	0.830 310. 476.	84.4 2680 0.1776	0.830 310. 476.	84.7 2713 0.1755	0.830 310. 476.	85.1 2751 0.1731	0.830 310. 476.
290										
280										
270										
260										
250										
240										

bd100_aeo_cr83_IMP_lw_hFL_m10 - 02/02/2004

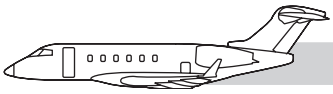
Figure 04-06-09. Cruise Performance—0.83 M (Sheet 2 of 12)

CRUISE 0.83 M_1			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	87.0 1602 0.2972	0.830 225. 476.	88.1 1666 0.2857	0.830 225. 476.						
430	85.9 1677 0.2837	0.830 235. 476.	86.7 1724 0.2760	0.830 235. 476.	87.6 1784 0.2668	0.830 235. 476.	88.8 1863 0.2555	0.830 235. 476.		
410	85.1 1771 0.2688	0.830 247. 476.	85.6 1807 0.2635	0.830 247. 476.	86.2 1852 0.2570	0.830 247. 476.	87.1 1907 0.2496	0.830 247. 476.	88.0 1975 0.2409	0.830 247. 476.
390	84.4 1888 0.2521	0.830 258. 476.	84.8 1916 0.2484	0.830 258. 476.	85.2 1949 0.2442	0.830 258. 476.	85.8 1990 0.2391	0.830 258. 476.	86.5 2042 0.2331	0.830 258. 476.
370	83.9 2025 0.2351	0.830 271. 476.	84.2 2049 0.2323	0.830 271. 476.	84.5 2076 0.2293	0.830 271. 476.	84.9 2107 0.2259	0.830 271. 476.	85.4 2145 0.2219	0.830 271. 476.
350	83.9 2194 0.2180	0.830 283. 478.	84.2 2216 0.2158	0.830 283. 478.	84.4 2240 0.2135	0.830 283. 478.	84.7 2266 0.2111	0.830 283. 478.	85.1 2296 0.2084	0.830 283. 478.
330	84.3 2385 0.2023	0.830 296. 483.	84.6 2410 0.2002	0.830 296. 483.	84.8 2433 0.1983	0.830 296. 483.	85.1 2457 0.1964	0.830 296. 483.	85.3 2483 0.1944	0.830 296. 483.
310	84.6 2593 0.1878	0.830 310. 487.	84.9 2620 0.1859	0.830 310. 487.	85.2 2645 0.1841	0.830 310. 487.	85.4 2669 0.1824	0.830 310. 487.	85.6 2693 0.1808	0.830 310. 487.
290										
280										
270										
260										
250										
240										

bd100_aeo_cr83_IMP_lw_hFL_00 - 02/02/2004

Figure 04-06-09. Cruise Performance—0.83 M (Sheet 3 of 12)



CRUISE 0.83 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430										
410	89.4 2072 0.2297	0.830 247. 476.								
390	87.3 2103 0.2263	0.830 258. 476.	88.2 2177 0.2186	0.830 258. 476.	89.7 2282 0.2086	0.830 258. 476.				
370	85.9 2192 0.2171	0.830 271. 476.	86.6 2248 0.2118	0.830 271. 476.	87.4 2312 0.2059	0.830 271. 476.	88.3 2389 0.1993	0.830 271. 476.	89.7 2494 0.1909	0.830 271. 476.
350	85.5 2331 0.2052	0.830 283. 478.	86.0 2372 0.2016	0.830 283. 478.	86.5 2422 0.1975	0.830 283. 478.	87.1 2480 0.1929	0.830 283. 478.	87.9 2546 0.1878	0.830 283. 478.
330	85.6 2511 0.1922	0.830 296. 483.	86.0 2543 0.1898	0.830 296. 483.	86.3 2581 0.1870	0.830 296. 483.	86.8 2625 0.1839	0.830 296. 483.	87.3 2678 0.1803	0.830 296. 483.
310	85.9 2718 0.1791	0.830 310. 487.	86.1 2745 0.1774	0.830 310. 487.	86.4 2774 0.1755	0.830 310. 487.	86.7 2808 0.1734	0.830 310. 487.	87.1 2848 0.1710	0.830 310. 487.
290										
280										
270										
260										
250										
240										

bd100_aeo_cr83_IMP_hw_hFL_00 – 02/02/2004

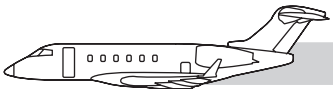
Figure 04-06-09. Cruise Performance—0.83 M (Sheet 4 of 12)

CRUISE 0.83 M_I			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT - 1000 LB									
	24		26		28		30		32	
450	88.1 1631 0.2951	0.830 225. 482.	89.2 1697 0.2837	0.830 225. 482.						
430	86.9 1709 0.2818	0.830 235. 482.	87.7 1756 0.2741	0.830 235. 482.	88.7 1817 0.2649	0.830 235. 482.	89.9 1898 0.2536	0.830 235. 482.		
410	86.1 1804 0.2669	0.830 247. 482.	86.6 1839 0.2617	0.830 247. 482.	87.3 1886 0.2553	0.830 247. 482.	88.1 1942 0.2479	0.830 247. 482.	89.1 2012 0.2393	0.830 247. 482.
390	85.4 1920 0.2507	0.830 258. 482.	85.8 1948 0.2471	0.830 258. 482.	86.2 1982 0.2429	0.830 258. 482.	86.8 2025 0.2378	0.830 258. 482.	87.5 2078 0.2317	0.830 258. 482.
370	84.8 2059 0.2338	0.830 271. 482.	85.1 2083 0.2311	0.830 271. 482.	85.5 2111 0.2281	0.830 271. 482.	85.9 2143 0.2247	0.830 271. 482.	86.3 2181 0.2207	0.830 271. 482.
350	84.9 2232 0.2168	0.830 283. 484.	85.1 2255 0.2146	0.830 283. 484.	85.4 2279 0.2123	0.830 283. 484.	85.7 2305 0.2099	0.830 283. 484.	86.1 2335 0.2072	0.830 283. 484.
330	85.2 2426 0.2011	0.830 296. 488.	85.5 2451 0.1991	0.830 296. 488.	85.8 2475 0.1972	0.830 296. 488.	86.0 2499 0.1953	0.830 296. 488.	86.3 2525 0.1933	0.830 296. 488.
310	85.6 2637 0.1866	0.830 310. 492.	85.9 2665 0.1847	0.830 310. 492.	86.2 2690 0.1830	0.830 310. 492.	86.4 2715 0.1813	0.830 310. 492.	86.6 2739 0.1797	0.830 310. 492.
290										
280										
270										
260										
250										
240										

bd100_aeo_cr83_IMP_lw_hFL_05 - 02/02/2004

Figure 04-06-09. Cruise Performance—0.83 M (Sheet 5 of 12)



CRUISE 0.83 M_1

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430										
410										
390	88.3 2139 0.2250	0.830 258. 482.	89.3 2216 0.2172	0.830 258. 482.	90.8 2323 0.2072	0.830 258. 482.				
370	86.9 2229 0.2160	0.830 271. 482.	87.6 2285 0.2107	0.830 271. 482.	88.4 2350 0.2049	0.830 271. 482.	89.3 2429 0.1982	0.830 271. 482.	90.6 2536 0.1899	0.830 271. 482.
350	86.5 2370 0.2041	0.830 283. 484.	86.9 2413 0.2005	0.830 283. 484.	87.5 2464 0.1964	0.830 283. 484.	88.1 2521 0.1919	0.830 283. 484.	88.9 2589 0.1869	0.830 283. 484.
330	86.6 2553 0.1912	0.830 296. 488.	86.9 2586 0.1888	0.830 296. 488.	87.3 2625 0.1860	0.830 296. 488.	87.7 2669 0.1828	0.830 296. 488.	88.3 2723 0.1793	0.830 296. 488.
310	86.9 2765 0.1781	0.830 310. 492.	87.1 2791 0.1764	0.830 310. 492.	87.4 2821 0.1745	0.830 310. 492.	87.7 2856 0.1724	0.830 310. 492.	88.1 2898 0.1700	0.830 310. 492.
290										
280										
270										
260										
250										
240										

bd100_aeo_cr83_IMP_hw_hFL_05 – 02/02/2004

Figure 04-06-09. Cruise Performance—0.83 M (Sheet 6 of 12)

CRUISE 0.83 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C	%N1	MACH
	30% C.G.	LB/HR	KIAS
		NAM/LB	KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450										
430	88.0 1740 0.2798	0.830 235. 487.	88.7 1788 0.2723	0.830 235. 487.						
410	87.1 1837 0.2650	0.830 247. 487.	87.6 1874 0.2597	0.830 247. 487.	88.3 1921 0.2535	0.830 247. 487.	89.1 1977 0.2462	0.830 247. 487.		
390	86.4 1956 0.2489	0.830 258. 487.	86.8 1985 0.2453	0.830 258. 487.	87.3 2019 0.2411	0.830 258. 487.	87.8 2062 0.2361	0.830 258. 487.	88.5 2115 0.2302	0.830 258. 487.
370	85.8 2094 0.2324	0.830 271. 487.	86.1 2119 0.2297	0.830 271. 487.	86.5 2147 0.2268	0.830 271. 487.	86.9 2179 0.2234	0.830 271. 487.	87.4 2219 0.2194	0.830 271. 487.
350	85.8 2269 0.2156	0.830 283. 489.	86.1 2292 0.2134	0.830 283. 489.	86.4 2317 0.2111	0.830 283. 489.	86.7 2343 0.2088	0.830 283. 489.	87.0 2373 0.2061	0.830 283. 489.
330	86.2 2468 0.1999	0.830 296. 494.	86.4 2493 0.1979	0.830 296. 494.	86.7 2517 0.1961	0.830 296. 494.	86.9 2541 0.1942	0.830 296. 494.	87.2 2567 0.1922	0.830 296. 494.
310	86.5 2679 0.1857	0.830 310. 498.	86.8 2708 0.1838	0.830 310. 498.	87.1 2734 0.1820	0.830 310. 498.	87.3 2758 0.1804	0.830 310. 498.	87.5 2782 0.1789	0.830 310. 498.
290										
280										
270										
260										
250										
240										

bd100_aeo_cr83_IMP_lw_hFL_10 – 02/02/2004

Figure 04-06-09. Cruise Performance—0.83 M (Sheet 7 of 12)

CRUISE 0.83 M_I			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430										
410										
390	89.3 2177 0.2236	0.830 258. 487.	90.3 2254 0.2160	0.830 258. 487.						
370	87.9 2267 0.2148	0.830 271. 487.	88.6 2324 0.2095	0.830 271. 487.	89.4 2391 0.2036	0.830 271. 487.	90.3 2471 0.1970	0.830 271. 487.		
350	87.4 2409 0.2030	0.830 283. 489.	87.9 2452 0.1995	0.830 283. 489.	88.4 2504 0.1953	0.830 283. 489.	89.1 2563 0.1908	0.830 283. 489.	89.8 2631 0.1859	0.830 283. 489.
330	87.5 2596 0.1901	0.830 296. 494.	87.9 2629 0.1877	0.830 296. 494.	88.2 2668 0.1849	0.830 296. 494.	88.7 2713 0.1819	0.830 296. 494.	89.2 2768 0.1783	0.830 296. 494.
310	87.8 2807 0.1772	0.830 310. 498.	88.0 2835 0.1755	0.830 310. 498.	88.3 2865 0.1736	0.830 310. 498.	88.6 2901 0.1715	0.830 310. 498.	89.0 2941 0.1692	0.830 310. 498.
290										
280										
270										
260										
250										
240										

bd100_aeo_cr83_IMP_hw_hFL_10 - 02/02/2004

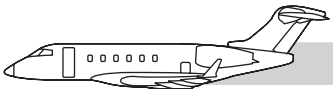
Figure 04-06-09. Cruise Performance—0.83 M (Sheet 8 of 12)

CRUISE 0.83 M_i			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT - 1000 LB									
	24		26		28		30		32	
450										
430										
410	88.1 1871 0.2630	0.830 247. 492.	88.7 1908 0.2579	0.830 247. 492.						
390	87.4 1991 0.2472	0.830 258. 492.	87.8 2020 0.2437	0.830 258. 492.	88.3 2055 0.2395	0.830 258. 492.	88.8 2099 0.2345	0.830 258. 492.		
370	86.8 2130 0.2310	0.830 271. 492.	87.1 2156 0.2283	0.830 271. 492.	87.5 2184 0.2253	0.830 271. 492.	87.9 2217 0.2220	0.830 271. 492.	88.3 2256 0.2182	0.830 271. 492.
350	86.8 2306 0.2144	0.830 283. 495.	87.0 2330 0.2122	0.830 283. 495.	87.3 2354 0.2100	0.830 283. 495.	87.6 2381 0.2077	0.830 283. 495.	87.9 2412 0.2050	0.830 283. 495.
330	87.1 2508 0.1988	0.830 296. 499.	87.4 2534 0.1967	0.830 296. 499.	87.6 2558 0.1949	0.830 296. 499.	87.9 2583 0.1931	0.830 296. 499.	88.1 2609 0.1911	0.830 296. 499.
310	87.4 2722 0.1847	0.830 310. 503.	87.7 2750 0.1828	0.830 310. 503.	88.0 2776 0.1811	0.830 310. 503.	88.2 2801 0.1795	0.830 310. 503.	88.4 2825 0.1779	0.830 310. 503.
290										
280										
270										
260										
250										
240										

bd100_aeo_cr83_IMP_lw_hFL_15 - 02/02/2004

Figure 04-06-09. Cruise Performance—0.83 M (Sheet 9 of 12)



CRUISE 0.83 M_I

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430										
410										
390										
370	88.9 2304 0.2136	0.830 271. 492.	89.6 2363 0.2083	0.830 271. 492.						
350	88.4 2449 0.2019	0.830 283. 495.	88.8 2492 0.1984	0.830 283. 495.	89.4 2545 0.1943	0.830 283. 495.				
330	88.4 2638 0.1890	0.830 296. 499.	88.8 2671 0.1867	0.830 296. 499.	89.2 2710 0.1840	0.830 296. 499.	89.6 2756 0.1809	0.830 296. 499.		
310	88.7 2852 0.1763	0.830 310. 503.	88.9 2880 0.1746	0.830 310. 503.	89.2 2911 0.1727	0.830 310. 503.	89.6 2945 0.1707	0.830 310. 503.		
290										
280										
270										
260										
250										
240										

bd100_aeo_cr83_IMP_hw_hFL_15 - 02/02/2004

Figure 04-06-09. Cruise Performance—0.83 M (Sheet 10 of 12)

CRUISE 0.83 M_I			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT - 1000 LB									
	24		26		28		30		32	
450										
430										
410										
390	88.4 2028 0.2453	0.830 258. 498.								
370	87.8 2166 0.2296	0.830 271. 498.	88.1 2192 0.2270	0.830 271. 498.	88.4 2220 0.2241	0.830 271. 498.	88.8 2253 0.2208	0.830 271. 498.		
350	87.7 2344 0.2132	0.830 283. 500.	87.9 2368 0.2111	0.830 283. 500.	88.2 2393 0.2088	0.830 283. 500.	88.5 2420 0.2065	0.830 283. 500.	88.9 2451 0.2039	0.830 283. 500.
330	88.0 2548 0.1978	0.830 296. 504.	88.3 2574 0.1957	0.830 296. 504.	88.5 2599 0.1939	0.830 296. 504.	88.8 2624 0.1920	0.830 296. 504.	89.1 2650 0.1901	0.830 296. 504.
310	88.4 2765 0.1837	0.830 310. 508.	88.6 2793 0.1818	0.830 310. 508.						
290										
280										
270										
260										
250										
240										

bd100_aeo_cr83_tMP_lw_hFL_20 - 02/02/2004

Figure 04-06-09. Cruise Performance—0.83 M (Sheet 11 of 12)

CRUISE 0.83 M_1			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB				
	34	36	38	40	42
450					
430					
410					
390					
370					
350					
330					
310					
290					
280					
270					
260					
250					
240					

bd100_aeo_cr83_IMP_hw_hFL_20 - 02/02/2004

Figure 04-06-09. Cruise Performance—0.83 M (Sheet 12 of 12)

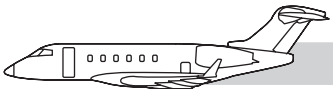
LONG RANGE CRUISE

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	78.7	0.719	80.4	0.741	82.0	0.764	83.6	0.785	85.0	0.796
	1135	191.	1227	198.	1329	205.	1432	211.	1515	214.
	0.3546	402.	0.3381	415.	0.3219	428.	0.3073	440.	0.2941	446.
430	76.9	0.700	78.2	0.713	79.7	0.733	81.2	0.755	82.7	0.777
	1141	195.	1206	199.	1296	205.	1395	212.	1501	219.
	0.3437	392.	0.3310	399.	0.3170	411.	0.3031	423.	0.2900	435.
410	75.5	0.692	76.2	0.690	77.5	0.706	79.0	0.728	80.3	0.745
	1172	202.	1203	201.	1276	206.	1369	213.	1459	219.
	0.3306	388.	0.3215	387.	0.3098	396.	0.2978	408.	0.2862	418.
390	74.0	0.678	74.5	0.673	75.4	0.679	76.7	0.697	78.2	0.720
	1197	206.	1217	205.	1265	207.	1344	213.	1441	221.
	0.3169	380.	0.3097	377.	0.3007	380.	0.2902	390.	0.2797	403.
370	72.4	0.656	72.9	0.653	73.5	0.654	74.6	0.666	75.9	0.685
	1208	209.	1231	208.	1262	208.	1327	212.	1411	219.
	0.3038	367.	0.2973	366.	0.2901	366.	0.2812	373.	0.2718	384.
350	68.9	0.586	71.8	0.639	72.3	0.636	73.1	0.639	74.2	0.655
	1128	194.	1267	213.	1289	212.	1330	213.	1407	219.
	0.2924	330.	0.2837	360.	0.2777	358.	0.2706	360.	0.2622	369.
330	67.9	0.568	70.6	0.610	71.6	0.619	72.2	0.622	73.1	0.629
	1147	197.	1274	212.	1327	216.	1366	217.	1417	219.
	0.2814	323.	0.2720	347.	0.2652	352.	0.2589	354.	0.2521	357.
310	67.6	0.564	69.0	0.579	70.1	0.588	71.1	0.599	72.1	0.608
	1201	204.	1265	210.	1321	214.	1381	218.	1443	221.
	0.2696	324.	0.2622	332.	0.2554	337.	0.2485	343.	0.2419	349.
290	67.2	0.556	68.1	0.563	68.7	0.564	69.5	0.566	70.6	0.577
	1251	210.	1295	213.	1326	213.	1366	214.	1432	219.
	0.2574	322.	0.2515	326.	0.2460	326.	0.2400	328.	0.2333	334.
280	66.5	0.546	67.8	0.557	68.4	0.558	69.0	0.559	69.9	0.565
	1263	211.	1319	216.	1349	216.	1382	216.	1434	219.
	0.2515	318.	0.2455	324.	0.2405	325.	0.2350	325.	0.2290	328.
270	65.9	0.536	67.4	0.551	68.0	0.553	68.5	0.552	69.2	0.553
	1271	211.	1342	218.	1372	218.	1399	218.	1436	218.
	0.2460	313.	0.2399	322.	0.2352	323.	0.2302	322.	0.2248	323.
260	62.7	0.487	67.0	0.545	67.6	0.546	68.0	0.544	68.6	0.544
	1187	196.	1363	220.	1392	220.	1416	220.	1446	219.
	0.2408	286.	0.2345	320.	0.2301	320.	0.2254	319.	0.2204	319.
250	61.3	0.468	66.6	0.538	67.1	0.540	67.6	0.538	68.0	0.535
	1170	192.	1383	222.	1413	222.	1434	221.	1459	220.
	0.2358	276.	0.2292	317.	0.2251	318.	0.2207	317.	0.2161	315.
240	60.9	0.462	66.0	0.529	66.6	0.531	67.1	0.531	67.6	0.530
	1181	193.	1395	222.	1427	223.	1455	223.	1481	223.
	0.2311	273.	0.2243	313.	0.2202	314.	0.2160	314.	0.2116	314.

bd100_aeo_crlrc_IMP_lw_hFL_m10 – 02/02/2004

Figure 04-06-10. Cruise Performance—Long Range Cruise (Sheet 1 of 12)



LONG RANGE CRUISE

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450	86.2 1585 0.2816	0.797 215. 446.								
430	84.1 1595 0.2780	0.792 223. 444.	85.3 1672 0.2670	0.797 225. 447.	86.5 1740 0.2563	0.797 225. 446.				
410	81.8 1563 0.2747	0.767 226. 430.	83.1 1661 0.2639	0.783 231. 438.	84.3 1751 0.2540	0.794 235. 445.	85.3 1825 0.2447	0.797 236. 447.	87.8 1985 0.2270	0.805 238. 451.
390	79.4 1527 0.2698	0.736 226. 412.	80.6 1617 0.2602	0.751 231. 421.	81.9 1719 0.2504	0.768 237. 430.	83.0 1814 0.2415	0.782 242. 438.	84.1 1905 0.2330	0.793 245. 444.
370	77.2 1504 0.2626	0.705 226. 395.	78.4 1588 0.2541	0.720 231. 404.	79.5 1678 0.2457	0.736 237. 412.	80.7 1773 0.2374	0.752 242. 421.	81.8 1870 0.2294	0.766 248. 429.
350	75.5 1491 0.2540	0.673 225. 379.	76.7 1585 0.2461	0.693 232. 390.	77.8 1669 0.2386	0.708 238. 398.	79.0 1763 0.2312	0.724 244. 408.	80.1 1858 0.2241	0.740 250. 416.
330	74.2 1499 0.2446	0.645 225. 367.	75.4 1584 0.2374	0.662 231. 376.	76.6 1675 0.2305	0.680 238. 386.	77.7 1763 0.2240	0.695 244. 395.	78.8 1859 0.2177	0.712 250. 405.
310	73.1 1515 0.2352	0.621 226. 356.	74.2 1594 0.2287	0.636 232. 365.	75.2 1676 0.2225	0.650 238. 373.	76.3 1766 0.2165	0.666 244. 382.	77.4 1860 0.2107	0.683 250. 392.
290	71.9 1523 0.2264	0.596 226. 345.	73.1 1609 0.2201	0.612 233. 354.	74.1 1691 0.2143	0.626 238. 362.	75.1 1774 0.2088	0.640 244. 370.	76.1 1862 0.2036	0.655 250. 379.
280	71.3 1524 0.2223	0.583 226. 339.	72.4 1611 0.2161	0.599 232. 348.	73.5 1697 0.2103	0.614 239. 357.	74.5 1779 0.2050	0.627 244. 365.	75.5 1867 0.1999	0.642 250. 373.
270	70.5 1522 0.2183	0.569 225. 332.	71.8 1613 0.2122	0.586 232. 342.	72.9 1701 0.2065	0.601 239. 351.	73.9 1787 0.2013	0.616 245. 360.	74.9 1872 0.1964	0.630 250. 368.
260	69.8 1523 0.2143	0.557 225. 327.	71.0 1613 0.2084	0.573 232. 336.	72.2 1702 0.2028	0.588 238. 345.	73.3 1789 0.1976	0.603 244. 354.	74.3 1880 0.1928	0.618 251. 362.
250	69.1 1526 0.2105	0.545 225. 321.	70.3 1610 0.2047	0.560 231. 330.	71.5 1700 0.1992	0.575 238. 339.	72.6 1789 0.1941	0.590 244. 347.	73.7 1882 0.1893	0.605 251. 356.
240	68.6 1542 0.2063	0.538 226. 318.	69.7 1619 0.2009	0.550 232. 325.	70.9 1704 0.1957	0.564 238. 334.	72.0 1792 0.1908	0.578 244. 342.	73.0 1882 0.1861	0.592 250. 350.

bd100_aeo_crirc_tMP_hw_hFL_m10 - 02/02/2004

Figure 04-06-10. Cruise Performance—Long Range Cruise (Sheet 2 of 12)

LONG RANGE CRUISE

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	80.6 1167 0.3505	0.714 190. 409.	82.3 1265 0.3339	0.737 197. 422.	84.1 1377 0.3177	0.763 204. 438.	85.7 1487 0.3031	0.786 211. 451.	87.1 1573 0.2903	0.796 214. 457.
430	78.8 1175 0.3401	0.697 194. 400.	80.1 1248 0.3270	0.712 198. 408.	81.7 1344 0.3129	0.733 205. 420.	83.2 1443 0.2993	0.753 211. 432.	84.8 1554 0.2862	0.776 218. 445.
410	77.3 1201 0.3273	0.685 200. 393.	78.0 1237 0.3180	0.686 200. 394.	79.4 1316 0.3062	0.703 205. 403.	80.9 1414 0.2941	0.725 212. 416.	82.3 1507 0.2825	0.742 218. 426.
390	75.7 1228 0.3137	0.672 205. 386.	76.3 1251 0.3064	0.668 204. 383.	77.2 1303 0.2972	0.675 206. 387.	78.7 1393 0.2866	0.696 213. 399.	80.2 1497 0.2762	0.721 221. 414.
370	74.2 1249 0.3007	0.655 209. 376.	74.7 1269 0.2944	0.651 207. 374.	75.3 1304 0.2870	0.653 208. 374.	76.5 1374 0.2780	0.666 213. 382.	77.8 1465 0.2687	0.687 220. 394.
350	71.8 1216 0.2894	0.611 203. 352.	73.5 1303 0.2813	0.636 212. 367.	74.0 1328 0.2752	0.634 211. 365.	74.8 1373 0.2680	0.639 213. 368.	76.1 1455 0.2596	0.655 219. 378.
330	69.7 1187 0.2787	0.569 197. 331.	72.2 1314 0.2695	0.609 212. 354.	73.2 1368 0.2628	0.618 215. 360.	74.0 1411 0.2564	0.622 217. 362.	74.8 1467 0.2496	0.630 220. 366.
310	69.5 1251 0.2670	0.569 206. 334.	70.7 1305 0.2601	0.578 210. 339.	71.7 1358 0.2533	0.586 213. 344.	72.7 1421 0.2463	0.597 217. 350.	73.7 1486 0.2396	0.607 221. 356.
290	69.0 1300 0.2549	0.560 212. 331.	69.7 1332 0.2496	0.562 213. 332.	70.3 1362 0.2441	0.562 213. 332.	71.0 1398 0.2381	0.563 213. 333.	72.1 1467 0.2313	0.574 217. 339.
280	68.3 1309 0.2494	0.549 212. 326.	69.2 1352 0.2439	0.555 215. 330.	69.8 1381 0.2389	0.555 215. 330.	70.4 1413 0.2334	0.555 215. 330.	71.3 1464 0.2273	0.560 216. 333.
270	67.7 1318 0.2440	0.539 213. 322.	68.9 1373 0.2385	0.549 217. 328.	69.4 1401 0.2338	0.549 217. 328.	69.9 1426 0.2289	0.547 216. 326.	70.5 1463 0.2233	0.547 216. 327.
260	66.7 1318 0.2389	0.526 212. 315.	68.4 1394 0.2331	0.542 219. 325.	69.0 1423 0.2287	0.543 219. 326.	69.4 1445 0.2241	0.540 218. 324.	69.9 1473 0.2190	0.538 217. 323.
250	63.0 1212 0.2341	0.472 193. 284.	68.0 1415 0.2279	0.536 221. 323.	68.5 1444 0.2237	0.537 221. 323.	68.9 1463 0.2194	0.533 220. 321.	69.3 1486 0.2148	0.530 218. 319.
240	62.5 1225 0.2295	0.465 195. 281.	67.3 1427 0.2230	0.527 221. 318.	68.0 1459 0.2189	0.529 222. 320.	68.5 1486 0.2146	0.528 222. 319.	68.9 1512 0.2102	0.526 221. 318.

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Figure 04-06-10. Cruise Performance—Long Range Cruise (Sheet 3 of 12)

LONG RANGE CRUISE			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450	88.4 1643 0.2780	0.796 214. 457.								
430	86.2 1653 0.2744	0.791 223. 454.	87.4 1733 0.2636	0.797 225. 457.	88.6 1805 0.2529	0.796 225. 457.				
410	83.7 1615 0.2711	0.763 225. 438.	85.1 1723 0.2604	0.782 231. 449.	86.3 1817 0.2506	0.794 235. 455.	87.5 1893 0.2415	0.797 236. 457.	89.8 2048 0.2251	0.804 238. 461.
390	81.4 1585 0.2665	0.737 226. 423.	82.7 1680 0.2569	0.753 232. 432.	83.9 1781 0.2475	0.769 237. 441.	85.1 1883 0.2386	0.784 242. 450.	86.2 1976 0.2303	0.793 246. 455.
370	79.2 1560 0.2599	0.707 227. 406.	80.3 1646 0.2516	0.722 232. 414.	81.5 1739 0.2432	0.738 238. 423.	82.6 1837 0.2350	0.753 243. 432.	83.8 1940 0.2271	0.768 248. 441.
350	77.3 1545 0.2515	0.674 226. 389.	78.6 1637 0.2438	0.693 232. 399.	79.7 1722 0.2365	0.707 237. 407.	80.8 1816 0.2293	0.722 243. 416.	81.9 1911 0.2223	0.737 248. 425.
330	76.0 1551 0.2422	0.646 226. 376.	77.2 1636 0.2352	0.662 231. 385.	78.3 1726 0.2285	0.678 238. 394.	79.4 1816 0.2221	0.694 244. 404.	80.5 1910 0.2158	0.709 249. 412.
310	74.8 1562 0.2330	0.621 226. 364.	75.9 1643 0.2266	0.634 231. 372.	77.0 1727 0.2204	0.649 237. 381.	78.1 1819 0.2145	0.665 243. 390.	79.1 1911 0.2088	0.680 249. 399.
290	73.6 1569 0.2243	0.595 226. 352.	74.7 1660 0.2180	0.612 233. 362.	75.8 1741 0.2123	0.625 238. 370.	76.7 1824 0.2069	0.638 243. 378.	77.8 1914 0.2017	0.652 249. 386.
280	72.8 1564 0.2203	0.580 225. 345.	74.1 1661 0.2141	0.598 232. 356.	75.2 1747 0.2084	0.613 238. 364.	76.2 1830 0.2031	0.626 244. 372.	77.2 1919 0.1981	0.640 249. 380.
270	72.0 1557 0.2166	0.565 224. 337.	73.3 1659 0.2103	0.584 232. 349.	74.5 1751 0.2046	0.600 238. 358.	75.5 1838 0.1994	0.614 244. 367.	76.5 1924 0.1946	0.627 250. 374.
260	71.2 1558 0.2127	0.553 223. 331.	72.6 1654 0.2066	0.570 230. 342.	73.8 1749 0.2009	0.586 237. 352.	74.9 1839 0.1958	0.601 244. 360.	75.9 1932 0.1909	0.616 250. 369.
250	70.5 1562 0.2089	0.542 223. 326.	71.8 1651 0.2030	0.557 230. 335.	73.0 1744 0.1975	0.572 236. 344.	74.2 1837 0.1923	0.587 243. 353.	75.3 1935 0.1875	0.603 250. 363.
240	69.9 1577 0.2048	0.534 225. 323.	71.1 1658 0.1993	0.547 230. 330.	72.3 1745 0.1941	0.561 236. 339.	73.5 1838 0.1891	0.575 243. 348.	74.6 1934 0.1843	0.590 249. 357.

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Figure 04-06-10. Cruise Performance—Long Range Cruise (Sheet 4 of 12)

LONG RANGE CRUISE

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C	%N1	MACH
	30% C.G.	LB/HR	KIAS
		NAM/LB	KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	81.6	0.711	83.3	0.737	85.0	0.761	86.7	0.785	88.2	0.796
	1184	189.	1289	197.	1398	204.	1512	211.	1601	214.
	0.3484	413.	0.3316	428.	0.3158	442.	0.3012	456.	0.2884	462.
430	79.5	0.691	81.1	0.710	82.7	0.732	84.2	0.753	85.8	0.775
	1185	192.	1268	198.	1366	205.	1470	211.	1580	218.
	0.3384	401.	0.3248	412.	0.3109	425.	0.2972	437.	0.2845	450.
410	78.1	0.683	78.9	0.684	80.3	0.702	81.9	0.723	83.3	0.741
	1216	199.	1255	199.	1338	205.	1434	211.	1532	217.
	0.3258	396.	0.3163	397.	0.3043	407.	0.2923	419.	0.2806	430.
390	76.6	0.669	77.1	0.667	78.1	0.674	79.6	0.694	81.1	0.717
	1243	204.	1269	203.	1323	205.	1413	212.	1515	220.
	0.3122	388.	0.3048	387.	0.2956	391.	0.2849	403.	0.2745	416.
370	75.0	0.653	75.5	0.650	76.2	0.652	77.4	0.666	78.7	0.686
	1265	208.	1288	207.	1326	208.	1398	212.	1489	219.
	0.2992	379.	0.2928	377.	0.2853	378.	0.2765	386.	0.2673	398.
350	72.8	0.614	74.4	0.636	74.9	0.634	75.7	0.639	76.9	0.655
	1244	204.	1323	212.	1349	211.	1397	213.	1478	219.
	0.2878	358.	0.2799	371.	0.2738	370.	0.2666	372.	0.2583	382.
330	70.5	0.569	73.1	0.609	74.1	0.618	74.8	0.622	75.7	0.630
	1207	197.	1336	212.	1389	215.	1433	216.	1491	220.
	0.2772	335.	0.2681	358.	0.2615	363.	0.2552	366.	0.2485	370.
310	70.2	0.567	71.4	0.577	72.5	0.585	73.6	0.597	74.6	0.608
	1266	206.	1322	209.	1378	212.	1444	217.	1513	221.
	0.2658	336.	0.2587	342.	0.2520	347.	0.2451	354.	0.2384	361.
290	69.8	0.560	70.5	0.562	71.1	0.562	71.8	0.563	73.0	0.574
	1319	212.	1352	213.	1383	213.	1421	213.	1493	218.
	0.2537	335.	0.2484	336.	0.2429	336.	0.2369	337.	0.2301	344.
280	69.1	0.549	70.0	0.555	70.6	0.555	71.2	0.555	72.1	0.560
	1329	212.	1373	214.	1402	215.	1435	215.	1489	217.
	0.2482	330.	0.2428	333.	0.2377	333.	0.2323	333.	0.2261	337.
270	68.4	0.539	69.6	0.548	70.1	0.549	70.6	0.547	71.3	0.547
	1337	212.	1392	216.	1422	217.	1447	216.	1485	216.
	0.2429	325.	0.2374	331.	0.2327	331.	0.2278	330.	0.2223	330.
260	67.5	0.526	69.1	0.541	69.7	0.542	70.1	0.539	70.6	0.537
	1338	212.	1411	218.	1440	218.	1462	217.	1491	216.
	0.2380	318.	0.2322	328.	0.2278	328.	0.2232	326.	0.2181	325.
250	63.7	0.472	68.7	0.535	69.2	0.535	69.6	0.532	70.0	0.529
	1229	193.	1431	220.	1460	220.	1478	219.	1501	218.
	0.2333	287.	0.2271	325.	0.2230	326.	0.2187	323.	0.2141	322.
240	63.3	0.466	68.0	0.525	68.6	0.527	69.1	0.526	69.6	0.524
	1243	195.	1443	221.	1475	222.	1502	221.	1529	220.
	0.2288	284.	0.2223	321.	0.2182	322.	0.2139	321.	0.2094	320.

bd100_aeo_crlrc_IMP_lw_hFL_05 - 02/02/2004

Figure 04-06-10. Cruise Performance—Long Range Cruise (Sheet 5 of 12)

LONG RANGE CRUISE

MAXIMUM CRUISE THRUST LIMITS
ENGINE BLEED ON
ENGINE AND WING A/I OFF

ISA + 5 C
30% C.G.

%N1 MACH
LB/HR KIAS
NAM/LB KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450	89.4 1673 0.2762	0.796 214. 462.								
430	87.2 1683 0.2726	0.791 223. 459.	88.4 1764 0.2620	0.797 225. 462.	89.6 1836 0.2514	0.796 225. 462.				
410	84.7 1641 0.2693	0.762 224. 442.	86.1 1752 0.2587	0.782 231. 453.	87.4 1849 0.2490	0.794 235. 460.	88.5 1927 0.2400	0.797 236. 462.	90.7 2078 0.2242	0.803 238. 466.
390	82.4 1608 0.2648	0.734 225. 426.	83.6 1709 0.2551	0.752 231. 436.	85.0 1818 0.2457	0.770 238. 447.	86.2 1922 0.2369	0.785 243. 455.	87.2 2011 0.2289	0.794 246. 460.
370	80.1 1586 0.2584	0.706 226. 410.	81.3 1676 0.2501	0.723 232. 419.	82.5 1771 0.2418	0.738 238. 428.	83.6 1869 0.2337	0.753 243. 437.	84.7 1971 0.2259	0.768 248. 445.
350	78.2 1569 0.2503	0.674 225. 393.	79.5 1667 0.2426	0.694 233. 404.	80.6 1751 0.2354	0.707 238. 412.	81.7 1846 0.2282	0.723 243. 421.	82.8 1941 0.2212	0.737 248. 429.
330	76.9 1575 0.2412	0.646 225. 380.	78.0 1660 0.2342	0.661 231. 389.	79.2 1752 0.2275	0.678 238. 399.	80.3 1840 0.2211	0.692 243. 407.	81.4 1937 0.2148	0.708 249. 416.
310	75.7 1591 0.2318	0.622 226. 369.	76.7 1669 0.2255	0.635 232. 377.	77.7 1749 0.2195	0.647 236. 384.	78.9 1841 0.2136	0.663 242. 393.	80.0 1939 0.2079	0.679 249. 403.
290	74.4 1594 0.2232	0.595 226. 356.	75.5 1683 0.2170	0.611 232. 365.	76.6 1766 0.2114	0.624 238. 373.	77.6 1849 0.2060	0.637 243. 381.	78.6 1940 0.2008	0.651 249. 390.
280	73.6 1587 0.2193	0.580 225. 348.	74.9 1683 0.2131	0.597 232. 359.	75.9 1771 0.2074	0.612 238. 367.	77.0 1856 0.2022	0.625 243. 375.	78.0 1947 0.1971	0.639 249. 384.
270	72.7 1579 0.2156	0.564 223. 340.	74.1 1680 0.2093	0.583 231. 352.	75.3 1773 0.2037	0.599 238. 361.	76.3 1863 0.1984	0.613 244. 370.	77.3 1953 0.1936	0.627 249. 378.
260	71.9 1577 0.2118	0.551 223. 334.	73.3 1675 0.2056	0.569 230. 345.	74.6 1772 0.2000	0.585 237. 354.	75.7 1864 0.1948	0.600 243. 363.	76.7 1959 0.1900	0.615 250. 372.
250	71.2 1578 0.2081	0.540 222. 328.	72.5 1670 0.2021	0.555 229. 338.	73.8 1767 0.1966	0.571 236. 347.	75.0 1863 0.1914	0.586 242. 357.	76.1 1961 0.1866	0.602 249. 366.
240	70.6 1594 0.2041	0.533 224. 325.	71.8 1678 0.1985	0.546 230. 333.	73.1 1767 0.1932	0.559 236. 342.	74.2 1862 0.1882	0.574 242. 350.	75.4 1960 0.1835	0.589 249. 360.

bd100_aeo_crirc_IMP_hw_hFL_05 – 02/02/2004

Figure 04-06-10. Cruise Performance—Long Range Cruise (Sheet 6 of 12)

LONG RANGE CRUISE

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C	%N1	MACH
	30% C.G.	LB/HR	KIAS
		NAM/LB	KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	82.6	0.713	84.3	0.735	86.1	0.762	87.7	0.785		
	1209	190.	1308	196.	1425	204.	1538	211.		
	0.3459	418.	0.3296	431.	0.3136	447.	0.2992	460.		
430	80.6	0.693	82.0	0.708	83.6	0.730	85.3	0.754	86.8	0.775
	1210	193.	1286	197.	1386	204.	1498	211.	1609	218.
	0.3360	407.	0.3229	415.	0.3088	428.	0.2952	442.	0.2825	455.
410	78.9	0.680	79.9	0.685	81.3	0.702	82.8	0.722	84.2	0.740
	1230	198.	1279	199.	1362	205.	1459	211.	1555	217.
	0.3240	399.	0.3142	402.	0.3023	412.	0.2903	424.	0.2789	434.
390	77.3	0.665	78.0	0.665	79.1	0.673	80.5	0.694	82.0	0.715
	1255	202.	1288	202.	1344	205.	1439	212.	1537	219.
	0.3107	390.	0.3030	390.	0.2937	395.	0.2831	407.	0.2728	419.
370	75.9	0.652	76.4	0.649	77.1	0.652	78.3	0.666	79.7	0.686
	1284	208.	1307	206.	1347	208.	1420	212.	1514	219.
	0.2975	382.	0.2912	381.	0.2838	382.	0.2749	390.	0.2657	402.
350	73.8	0.617	75.2	0.635	75.8	0.634	76.6	0.640	77.8	0.656
	1271	205.	1344	212.	1372	211.	1423	213.	1504	219.
	0.2861	364.	0.2784	374.	0.2723	374.	0.2651	377.	0.2569	386.
330	71.4	0.571	74.0	0.610	74.9	0.617	75.6	0.621	76.5	0.630
	1232	198.	1359	212.	1409	215.	1453	216.	1514	219.
	0.2757	340.	0.2668	363.	0.2604	367.	0.2540	369.	0.2472	374.
310	71.0	0.567	72.2	0.577	73.3	0.586	74.4	0.597	75.4	0.607
	1285	205.	1343	209.	1402	213.	1467	217.	1535	221.
	0.2642	340.	0.2573	346.	0.2506	352.	0.2438	358.	0.2373	364.
290	70.3	0.556	71.0	0.559	71.7	0.559	72.5	0.562	73.9	0.578
	1331	210.	1366	211.	1399	212.	1442	213.	1527	219.
	0.2525	336.	0.2472	338.	0.2416	338.	0.2356	340.	0.2287	349.
280	69.8	0.548	70.6	0.552	71.2	0.553	71.8	0.552	73.0	0.562
	1347	212.	1386	214.	1416	214.	1449	214.	1517	218.
	0.2469	333.	0.2418	335.	0.2368	335.	0.2313	335.	0.2249	341.
270	69.3	0.541	70.1	0.546	70.7	0.546	71.1	0.542	72.0	0.547
	1364	214.	1406	216.	1432	215.	1455	214.	1505	216.
	0.2416	330.	0.2367	333.	0.2321	333.	0.2271	330.	0.2213	333.
260	68.7	0.532	69.7	0.538	70.2	0.538	70.6	0.534	71.3	0.536
	1375	214.	1421	217.	1447	217.	1466	215.	1510	216.
	0.2366	326.	0.2318	329.	0.2274	329.	0.2227	327.	0.2172	328.
250	68.0	0.522	69.2	0.531	69.7	0.531	70.0	0.527	70.7	0.528
	1383	215.	1438	219.	1464	218.	1483	217.	1523	217.
	0.2318	321.	0.2269	326.	0.2227	326.	0.2182	324.	0.2131	324.
240	67.0	0.509	68.6	0.523	69.2	0.524	69.7	0.523	70.3	0.524
	1381	214.	1456	220.	1485	220.	1512	220.	1549	220.
	0.2272	314.	0.2218	323.	0.2177	323.	0.2133	322.	0.2085	323.

bd100_aeo_crlrc_IMP_lw_hFL_10 – 02/02/2004

Figure 04-06-10. Cruise Performance—Long Range Cruise (Sheet 7 of 12)

LONG RANGE CRUISE

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430	88.2 1713 0.2709	0.791 223. 464.								
410	85.7 1670 0.2675	0.762 224. 447.	87.1 1782 0.2570	0.781 230. 458.	88.4 1883 0.2473	0.794 235. 466.	89.5 1961 0.2384	0.797 236. 468.		
390	83.4 1637 0.2630	0.734 225. 431.	84.6 1737 0.2534	0.750 231. 440.	86.0 1851 0.2440	0.770 238. 452.	87.2 1954 0.2353	0.784 242. 460.	88.3 2051 0.2272	0.794 246. 466.
370	81.1 1614 0.2569	0.707 227. 415.	82.3 1706 0.2485	0.723 232. 424.	83.5 1801 0.2403	0.738 238. 433.	84.6 1897 0.2324	0.752 242. 441.	85.8 2009 0.2245	0.769 248. 451.
350	79.1 1595 0.2489	0.674 225. 397.	80.4 1691 0.2413	0.692 232. 408.	81.6 1788 0.2340	0.710 239. 418.	82.6 1878 0.2270	0.723 243. 426.	83.8 1979 0.2200	0.739 249. 435.
330	77.7 1598 0.2400	0.645 225. 384.	78.9 1689 0.2330	0.662 232. 394.	80.1 1781 0.2264	0.678 238. 403.	81.2 1874 0.2200	0.694 244. 412.	82.2 1964 0.2139	0.707 248. 420.
310	76.5 1613 0.2307	0.621 226. 372.	77.6 1695 0.2244	0.634 231. 380.	78.6 1780 0.2183	0.648 237. 389.	79.7 1871 0.2125	0.663 243. 398.	80.8 1968 0.2069	0.679 249. 407.
290	75.2 1623 0.2220	0.596 226. 360.	76.3 1707 0.2160	0.610 232. 369.	77.3 1789 0.2104	0.623 237. 376.	78.4 1877 0.2050	0.637 243. 385.	79.4 1969 0.1997	0.651 248. 393.
280	74.4 1615 0.2181	0.580 225. 352.	75.6 1706 0.2120	0.596 231. 362.	76.7 1795 0.2064	0.610 237. 370.	77.8 1885 0.2011	0.625 243. 379.	78.8 1977 0.1961	0.639 249. 388.
270	73.5 1605 0.2144	0.565 223. 344.	74.8 1702 0.2083	0.582 230. 354.	76.1 1798 0.2026	0.598 237. 364.	77.1 1892 0.1974	0.613 243. 374.	78.2 1984 0.1925	0.627 249. 382.
260	72.7 1602 0.2107	0.552 223. 338.	74.0 1696 0.2046	0.567 229. 347.	75.3 1793 0.1990	0.583 236. 357.	76.5 1891 0.1938	0.599 243. 366.	77.6 1991 0.1890	0.615 250. 376.
250	72.0 1602 0.2070	0.540 222. 332.	73.2 1691 0.2012	0.554 228. 340.	74.5 1786 0.1956	0.569 235. 349.	75.8 1887 0.1904	0.585 242. 359.	76.9 1994 0.1856	0.603 250. 370.
240	71.4 1615 0.2031	0.532 224. 328.	72.6 1698 0.1976	0.544 229. 336.	73.8 1787 0.1923	0.557 235. 344.	75.0 1885 0.1873	0.572 241. 353.	76.2 1992 0.1825	0.589 249. 364.

bd100_aeo_crlrc_IMP_hw_hFL_10 – 02/02/2004

Figure 04-06-10. Cruise Performance—Long Range Cruise (Sheet 8 of 12)

LONG RANGE CRUISE			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	83.6 1229 0.3438	0.713 190. 423.	85.3 1330 0.3274	0.735 196. 436.	87.1 1446 0.3117	0.760 204. 451.				
430	81.4 1223 0.3341	0.689 192. 409.	83.0 1310 0.3206	0.708 197. 420.	84.7 1410 0.3068	0.730 204. 433.	86.2 1520 0.2934	0.752 211. 446.	87.8 1639 0.2806	0.776 218. 460.
410	79.9 1254 0.3217	0.680 198. 404.	80.9 1303 0.3118	0.686 200. 407.	82.4 1390 0.3002	0.704 205. 418.	83.8 1486 0.2884	0.723 212. 429.	85.3 1587 0.2769	0.741 217. 440.
390	78.1 1270 0.3091	0.662 201. 393.	78.8 1304 0.3013	0.663 202. 393.	80.0 1370 0.2917	0.674 205. 400.	81.5 1461 0.2814	0.693 212. 411.	82.9 1559 0.2712	0.713 218. 423.
370	76.5 1296 0.2963	0.648 206. 384.	77.0 1317 0.2901	0.644 205. 382.	77.8 1355 0.2826	0.646 206. 383.	79.1 1440 0.2733	0.663 212. 394.	80.6 1540 0.2640	0.686 219. 407.
350	75.1 1311 0.2843	0.626 208. 373.	75.9 1350 0.2777	0.629 209. 375.	76.4 1377 0.2715	0.627 209. 374.	77.4 1441 0.2636	0.638 212. 380.	78.7 1530 0.2552	0.656 219. 391.
330	72.2 1254 0.2739	0.572 198. 344.	75.0 1388 0.2652	0.613 213. 368.	75.6 1424 0.2592	0.615 214. 369.	76.4 1470 0.2529	0.619 215. 372.	77.4 1541 0.2458	0.630 220. 379.
310	71.2 1285 0.2630	0.558 202. 338.	73.1 1371 0.2555	0.579 210. 350.	74.5 1440 0.2488	0.591 215. 358.	75.3 1495 0.2424	0.599 218. 363.	76.2 1559 0.2361	0.607 221. 368.
290	70.6 1333 0.2515	0.549 208. 335.	71.6 1383 0.2458	0.557 211. 340.	72.6 1429 0.2400	0.562 213. 343.	73.7 1487 0.2339	0.570 216. 348.	74.8 1560 0.2274	0.581 220. 355.
280	70.0 1349 0.2460	0.541 209. 332.	71.1 1398 0.2405	0.549 212. 336.	71.9 1441 0.2351	0.553 214. 339.	73.0 1494 0.2294	0.559 216. 343.	74.1 1563 0.2231	0.569 220. 349.
270	69.5 1367 0.2406	0.534 211. 329.	70.5 1417 0.2354	0.542 214. 334.	71.4 1456 0.2303	0.545 215. 336.	72.3 1502 0.2249	0.549 217. 338.	73.4 1566 0.2190	0.557 220. 343.
260	69.0 1378 0.2357	0.525 212. 325.	70.1 1433 0.2305	0.534 215. 330.	70.8 1471 0.2256	0.537 216. 332.	71.6 1513 0.2205	0.540 218. 334.	72.7 1572 0.2149	0.547 221. 338.
250	68.4 1390 0.2308	0.517 213. 321.	69.6 1449 0.2256	0.527 217. 327.	70.4 1490 0.2208	0.530 218. 329.	71.1 1529 0.2161	0.532 219. 330.	72.0 1582 0.2109	0.538 221. 334.
240	67.7 1397 0.2263	0.508 213. 316.	69.1 1464 0.2210	0.519 218. 324.	69.8 1501 0.2165	0.522 219. 325.	70.4 1536 0.2120	0.523 220. 326.	71.2 1582 0.2072	0.526 221. 328.

bd100_aeo_crlrc_IMP_lw_hFL_15 – 02/02/2004

Figure 04-06-10. Cruise Performance—Long Range Cruise (Sheet 9 of 12)

LONG RANGE CRUISE			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430										
410	86.7 1695 0.2659	0.760 224. 451.	88.1 1812 0.2553	0.780 230. 463.						
390	84.3 1661 0.2613	0.732 225. 434.	85.6 1766 0.2517	0.750 231. 445.	86.9 1879 0.2424	0.768 237. 456.	88.1 1987 0.2338	0.783 242. 465.	89.3 2090 0.2256	0.795 246. 472.
370	82.0 1641 0.2552	0.706 226. 419.	83.3 1738 0.2469	0.724 233. 429.	84.5 1837 0.2388	0.740 238. 439.	85.6 1937 0.2308	0.754 243. 447.	86.8 2047 0.2230	0.770 249. 457.
350	80.1 1626 0.2473	0.675 226. 402.	81.3 1721 0.2399	0.693 232. 413.	82.5 1814 0.2327	0.708 238. 422.	83.6 1912 0.2256	0.724 244. 432.	84.7 2010 0.2188	0.738 249. 440.
330	78.6 1625 0.2386	0.645 225. 388.	79.8 1715 0.2318	0.662 231. 398.	80.9 1809 0.2252	0.678 238. 408.	82.1 1906 0.2189	0.695 244. 417.	83.2 2000 0.2128	0.708 249. 426.
310	77.3 1636 0.2296	0.620 226. 376.	78.4 1723 0.2233	0.635 232. 385.	79.5 1812 0.2172	0.650 237. 394.	80.6 1903 0.2114	0.664 243. 402.	81.7 1997 0.2059	0.679 249. 411.
290	76.0 1645 0.2210	0.595 226. 364.	77.1 1732 0.2149	0.609 232. 372.	78.2 1821 0.2092	0.624 238. 381.	79.3 1909 0.2039	0.637 243. 389.	80.3 1997 0.1988	0.650 248. 397.
280	75.2 1643 0.2169	0.581 225. 357.	76.4 1729 0.2110	0.595 231. 365.	77.6 1824 0.2053	0.611 237. 374.	78.6 1916 0.2001	0.625 243. 383.	79.6 2005 0.1952	0.638 249. 391.
270	74.5 1640 0.2131	0.568 225. 350.	75.6 1723 0.2072	0.580 230. 357.	76.9 1823 0.2016	0.597 237. 368.	78.0 1923 0.1964	0.613 244. 378.	79.0 2013 0.1916	0.627 249. 386.
260	73.7 1643 0.2093	0.556 225. 344.	74.8 1722 0.2036	0.567 229. 351.	76.1 1821 0.1981	0.584 236. 361.	77.3 1924 0.1929	0.600 243. 371.	78.4 2018 0.1882	0.614 249. 380.
250	73.0 1647 0.2055	0.546 225. 339.	74.1 1719 0.2001	0.555 229. 344.	75.3 1818 0.1947	0.570 236. 354.	76.6 1925 0.1895	0.588 243. 365.	77.7 2022 0.1848	0.602 249. 374.
240	72.2 1647 0.2020	0.534 225. 333.	73.3 1721 0.1967	0.544 229. 339.	74.5 1812 0.1915	0.557 235. 347.	75.8 1918 0.1864	0.574 242. 358.	76.9 2018 0.1817	0.589 249. 367.

bd100_aeo_crlrc_IMP_hw_hFL_15 – 02/02/2004

Figure 04-06-10. Cruise Performance—Long Range Cruise (Sheet 10 of 12)

LONG RANGE CRUISE

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	84.5 1248 0.3415	0.711 189. 426.	86.3 1355 0.3250	0.735 196. 441.						
430	82.5 1250 0.3319	0.692 192. 415.	83.9 1324 0.3189	0.705 196. 422.	85.6 1431 0.3049	0.728 203. 436.	87.2 1545 0.2915	0.751 210. 450.		
410	80.7 1267 0.3200	0.677 197. 406.	81.7 1318 0.3102	0.682 199. 409.	83.3 1411 0.2983	0.702 205. 421.	84.8 1511 0.2865	0.722 211. 433.	86.3 1618 0.2750	0.742 218. 445.
390	79.0 1291 0.3074	0.662 201. 397.	79.8 1329 0.2993	0.664 202. 398.	81.0 1394 0.2898	0.674 205. 404.	82.4 1487 0.2795	0.694 212. 416.	83.9 1585 0.2695	0.713 218. 427.
370	77.2 1309 0.2948	0.644 205. 386.	77.9 1337 0.2882	0.643 204. 385.	78.9 1391 0.2801	0.650 207. 390.	80.1 1467 0.2713	0.664 212. 398.	81.6 1568 0.2622	0.686 219. 411.
350	75.8 1326 0.2825	0.622 207. 375.	76.6 1367 0.2759	0.627 208. 377.	77.4 1412 0.2691	0.631 210. 380.	78.4 1475 0.2616	0.641 214. 386.	79.6 1553 0.2538	0.655 218. 394.
330	73.7 1302 0.2724	0.584 203. 355.	75.6 1396 0.2645	0.608 212. 369.	76.2 1430 0.2585	0.609 212. 370.	77.1 1488 0.2516	0.617 215. 374.	78.2 1563 0.2444	0.629 219. 382.
310	71.8 1301 0.2615	0.556 201. 340.	74.5 1418 0.2537	0.588 213. 360.	75.2 1461 0.2477	0.591 215. 362.	76.0 1511 0.2415	0.597 217. 365.	77.0 1578 0.2350	0.606 220. 371.
290	70.6 1328 0.2506	0.540 204. 333.	72.6 1417 0.2441	0.561 212. 346.	73.8 1473 0.2380	0.568 215. 351.	74.6 1516 0.2323	0.571 216. 352.	75.6 1581 0.2261	0.580 220. 358.
280	70.1 1344 0.2451	0.532 205. 330.	72.1 1437 0.2367	0.554 214. 343.	73.3 1491 0.2330	0.561 217. 348.	74.0 1529 0.2277	0.562 218. 348.	74.9 1586 0.2219	0.568 220. 352.
270	69.4 1356 0.2398	0.523 206. 325.	71.7 1460 0.2334	0.548 216. 341.	72.8 1510 0.2281	0.554 219. 344.	73.4 1545 0.2232	0.555 219. 345.	74.2 1594 0.2178	0.558 221. 347.
260	68.8 1361 0.2349	0.512 206. 320.	71.1 1470 0.2286	0.538 217. 336.	72.2 1524 0.2234	0.546 220. 341.	72.8 1560 0.2188	0.547 221. 341.	73.5 1604 0.2138	0.549 222. 343.
250	68.1 1370 0.2301	0.503 207. 315.	70.5 1485 0.2238	0.531 218. 332.	71.6 1540 0.2189	0.538 222. 337.	72.2 1574 0.2145	0.539 222. 338.	72.9 1614 0.2099	0.541 223. 339.
240	67.9 1394 0.2258	0.501 210. 315.	69.7 1482 0.2201	0.519 218. 326.	70.6 1528 0.2154	0.523 220. 329.	71.3 1566 0.2110	0.525 221. 330.	72.0 1610 0.2062	0.528 222. 332.

bd100_aeo_crlrc_IMP_lw_hFL_20 – 02/02/2004

Figure 04-06-10. Cruise Performance—Long Range Cruise (Sheet 11 of 12)

LONG RANGE CRUISE			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430										
410	87.7 1731 0.2640	0.762 224. 457.								
390	85.2 1686 0.2597	0.730 224. 438.	86.6 1796 0.2500	0.749 231. 449.	87.9 1908 0.2409	0.767 236. 460.				
370	82.9 1665 0.2536	0.704 226. 422.	84.2 1765 0.2453	0.722 232. 433.	85.5 1870 0.2371	0.740 238. 444.	86.6 1969 0.2293	0.753 243. 452.	87.8 2085 0.2214	0.770 249. 462.
350	80.9 1650 0.2459	0.674 226. 406.	82.2 1748 0.2384	0.692 232. 417.	83.5 1848 0.2312	0.710 238. 428.	84.6 1942 0.2243	0.724 244. 436.	85.7 2042 0.2175	0.738 249. 444.
330	79.5 1652 0.2372	0.645 225. 392.	80.7 1745 0.2304	0.662 232. 402.	81.9 1843 0.2239	0.680 238. 413.	83.0 1936 0.2177	0.694 244. 422.	84.1 2035 0.2116	0.709 249. 431.
310	78.1 1662 0.2284	0.620 226. 380.	79.3 1749 0.2222	0.635 232. 389.	80.4 1839 0.2162	0.650 237. 398.	81.4 1930 0.2104	0.664 243. 406.	82.5 2028 0.2049	0.679 249. 416.
290	76.7 1665 0.2198	0.593 225. 366.	78.0 1765 0.2137	0.611 232. 377.	79.1 1853 0.2081	0.625 238. 386.	80.0 1935 0.2030	0.637 243. 393.	81.1 2025 0.1979	0.650 248. 401.
280	76.0 1662 0.2159	0.579 224. 359.	77.3 1763 0.2098	0.597 232. 370.	78.4 1856 0.2042	0.612 238. 379.	79.4 1941 0.1992	0.624 243. 387.	80.4 2031 0.1943	0.637 248. 395.
270	75.2 1657 0.2121	0.565 224. 352.	76.5 1758 0.2061	0.583 231. 362.	77.7 1858 0.2005	0.599 238. 372.	78.8 1949 0.1955	0.613 243. 381.	79.8 2040 0.1907	0.626 249. 389.
260	74.4 1658 0.2084	0.554 224. 346.	75.6 1749 0.2026	0.568 230. 354.	76.9 1851 0.1970	0.584 236. 365.	78.0 1947 0.1920	0.599 243. 374.	79.1 2044 0.1872	0.613 249. 383.
250	73.6 1660 0.2048	0.543 224. 340.	74.7 1740 0.1993	0.553 228. 347.	76.0 1842 0.1938	0.570 235. 357.	77.3 1943 0.1886	0.585 242. 366.	78.4 2043 0.1839	0.600 248. 376.
240	72.8 1663 0.2013	0.532 224. 335.	74.0 1741 0.1959	0.542 228. 341.	75.3 1840 0.1905	0.557 235. 351.	76.5 1941 0.1855	0.573 242. 360.	77.7 2040 0.1808	0.587 248. 369.

bd100_aeo_crlrc_IMP_hw_hFL_20 – 02/02/2004

Figure 04-06-10. Cruise Performance—Long Range Cruise (Sheet 12 of 12)

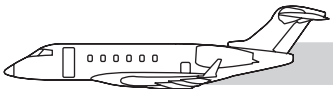
MAXIMUM RANGE CRUISE

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	77.4 1052 0.3582	0.673 178. 377.	79.1 1130 0.3416	0.689 183. 386.	80.6 1210 0.3252	0.703 187. 394.	82.2 1307 0.3104	0.724 193. 406.	84.1 1436 0.2971	0.762 204. 427.
430	75.2 1058 0.3472	0.656 182. 368.	76.8 1120 0.3343	0.669 185. 375.	78.2 1181 0.3202	0.675 187. 378.	79.6 1255 0.3062	0.686 190. 384.	81.1 1348 0.2929	0.705 196. 395.
410	73.9 1091 0.3339	0.651 188. 364.	74.8 1118 0.3247	0.649 188. 363.	76.2 1178 0.3130	0.658 191. 369.	77.6 1257 0.3008	0.675 196. 378.	79.0 1337 0.2891	0.690 201. 386.
390	71.8 1093 0.3201	0.625 189. 350.	73.2 1141 0.3128	0.637 193. 357.	74.1 1172 0.3038	0.636 193. 356.	75.3 1232 0.2931	0.645 196. 361.	76.8 1329 0.2826	0.671 204. 376.
370	68.7 1037 0.3069	0.568 179. 318.	71.5 1158 0.3003	0.621 197. 348.	72.3 1185 0.2930	0.620 197. 347.	73.0 1213 0.2840	0.615 195. 345.	74.4 1293 0.2745	0.634 201. 355.
350	66.7 1020 0.2954	0.535 176. 302.	70.4 1186 0.2866	0.604 200. 340.	71.2 1215 0.2805	0.606 201. 341.	71.8 1234 0.2734	0.599 199. 338.	72.7 1287 0.2648	0.605 201. 341.
330	65.4 1032 0.2843	0.517 178. 294.	67.3 1111 0.2748	0.537 186. 305.	70.1 1240 0.2679	0.585 203. 332.	70.8 1272 0.2615	0.585 203. 333.	71.6 1304 0.2547	0.684 203. 332.
310	64.2 1050 0.2724	0.499 180. 286.	66.3 1139 0.2649	0.526 190. 302.	68.1 1210 0.2580	0.544 197. 312.	69.4 1273 0.2510	0.557 202. 320.	70.4 1323 0.2443	0.564 204. 323.
290	62.3 1048 0.2600	0.471 177. 273.	66.0 1196 0.2540	0.525 198. 304.	66.8 1222 0.2485	0.525 198. 304.	67.7 1258 0.2424	0.527 199. 305.	68.7 1306 0.2356	0.532 201. 308.
280	61.5 1054 0.2541	0.461 177. 268.	65.7 1224 0.2480	0.522 201. 304.	66.2 1236 0.2429	0.517 199. 300.	67.1 1272 0.2374	0.519 200. 302.	68.2 1321 0.2313	0.526 203. 306.
270	60.6 1054 0.2485	0.448 176. 262.	65.5 1254 0.2423	0.520 205. 304.	65.9 1264 0.2376	0.515 203. 300.	66.6 1288 0.2326	0.513 202. 300.	67.7 1335 0.2271	0.519 205. 303.
260	59.7 1052 0.2432	0.436 175. 256.	65.0 1272 0.2368	0.514 207. 301.	65.5 1288 0.2324	0.510 205. 300.	66.1 1305 0.2277	0.507 204. 297.	66.9 1341 0.2227	0.509 205. 299.
250	58.9 1054 0.2382	0.426 174. 251.	64.7 1295 0.2315	0.509 209. 300.	65.0 1306 0.2273	0.504 207. 297.	65.6 1324 0.2230	0.501 206. 295.	66.5 1358 0.2183	0.503 207. 297.
240	58.4 1069 0.2335	0.422 176. 250.	64.0 1304 0.2266	0.500 210. 296.	64.8 1330 0.2225	0.500 210. 296.	65.4 1356 0.2181	0.500 210. 296.	66.0 1382 0.2137	0.499 209. 295.

bd100_aeo_crmrc_IMP_lw_hFL_m10 – 02/02/2004

Figure 04-06-11. Cruise Performance—Maximum Range Cruise (Sheet 1 of 12)



MAXIMUM RANGE CRUISE

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KTAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450	85.5 1515 0.2844	0.769 206. 431.	87.2 1583 0.2683	0.758 203. 425.						
430	83.0 1492 0.2808	0.748 210. 419.	84.5 1599 0.2697	0.770 216. 431.	85.7 1665 0.2589	0.770 216. 431.	87.6 1764 0.2452	0.772 217. 432.		
410	80.2 1413 0.2775	0.700 204. 392.	82.1 1558 0.2665	0.741 217. 415.	83.4 1659 0.2565	0.760 224. 426.	84.5 1735 0.2472	0.766 225. 429.	NaN **** NaN	0.689 200. 386.
390	78.0 1396 0.2725	0.679 207. 381.	79.2 1477 0.2628	0.693 212. 388.	80.7 1588 0.2530	0.717 220. 402.	82.0 1698 0.2439	0.739 227. 414.	83.2 1797 0.2354	0.755 232. 423.
370	75.8 1382 0.2653	0.655 209. 367.	77.1 1469 0.2567	0.673 215. 377.	78.2 1546 0.2481	0.685 219. 384.	79.4 1634 0.2398	0.700 224. 392.	80.3 1692 0.2318	0.700 224. 392.
350	74.0 1370 0.2566	0.624 208. 352.	75.3 1454 0.2486	0.642 214. 362.	76.5 1541 0.2410	0.660 220. 372.	77.6 1626 0.2336	0.675 226. 380.	78.7 1707 0.2264	0.686 230. 386.
330	72.7 1376 0.2470	0.598 208. 340.	73.9 1451 0.2398	0.612 213. 348.	75.1 1536 0.2329	0.629 219. 358.	76.2 1621 0.2263	0.646 225. 367.	77.4 1711 0.2198	0.662 231. 376.
310	71.5 1387 0.2376	0.574 208. 330.	72.5 1452 0.2310	0.585 212. 336.	73.7 1533 0.2247	0.601 218. 345.	74.8 1615 0.2186	0.616 224. 353.	75.9 1701 0.2128	0.631 230. 362.
290	70.1 1389 0.2287	0.549 208. 318.	71.4 1471 0.2223	0.565 214. 327.	72.5 1550 0.2165	0.580 220. 336.	73.6 1633 0.2109	0.595 226. 345.	74.5 1700 0.2056	0.604 230. 350.
280	69.4 1390 0.2245	0.537 207. 312.	70.7 1471 0.2183	0.552 214. 321.	71.9 1552 0.2125	0.567 220. 330.	73.0 1633 0.2071	0.582 226. 338.	74.0 1715 0.2019	0.596 231. 346.
270	68.6 1390 0.2205	0.525 207. 307.	70.0 1473 0.2143	0.541 213. 316.	71.2 1553 0.2086	0.555 219. 324.	72.3 1635 0.2033	0.569 225. 332.	73.3 1717 0.1984	0.583 231. 341.
260	67.9 1392 0.2165	0.514 207. 302.	69.3 1476 0.2105	0.530 213. 311.	70.4 1555 0.2048	0.543 219. 319.	71.6 1636 0.1996	0.557 225. 326.	72.7 1719 0.1947	0.571 231. 335.
250	67.4 1407 0.2126	0.508 209. 299.	68.6 1483 0.2068	0.521 214. 307.	69.7 1554 0.2013	0.531 219. 313.	70.8 1635 0.1961	0.544 224. 321.	71.9 1718 0.1912	0.558 230. 329.
240	66.7 1419 0.2084	0.500 210. 296.	67.9 1490 0.2030	0.511 215. 302.	69.1 1569 0.1977	0.524 220. 310.	70.2 1640 0.1927	0.534 225. 316.	71.2 1718 0.1880	0.546 230. 323.

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Figure 04-06-11. Cruise Performance—Maximum Range Cruise (Sheet 2 of 12)

MAXIMUM RANGE CRUISE

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA	%N1	MACH
	30% C.G.	LB/HR	KIAS
		NAM/LB	KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	79.2	0.667	81.0	0.687	82.6	0.700	84.6	0.740	86.4	0.769
	1080	176.	1168	182.	1251	186.	1386	198.	1505	206.
	0.3540	382.	0.3373	394.	0.3209	402.	0.3062	424.	0.2932	441.
430	77.0	0.650	78.8	0.668	80.2	0.675	81.9	0.699	83.4	0.720
	1085	180.	1160	185.	1225	187.	1326	194.	1427	201.
	0.3435	373.	0.3303	383.	0.3160	387.	0.3023	401.	0.2891	413.
410	75.7	0.648	76.7	0.647	78.0	0.654	79.6	0.675	80.7	0.678
	1123	188.	1154	187.	1213	190.	1302	196.	1362	197.
	0.3306	372.	0.3212	371.	0.3093	375.	0.2971	387.	0.2854	389.
390	74.0	0.632	74.9	0.634	75.8	0.632	77.2	0.645	78.8	0.671
	1144	192.	1174	192.	1206	191.	1277	196.	1378	204.
	0.3169	363.	0.3095	364.	0.3002	362.	0.2895	370.	0.2790	385.
370	70.7	0.575	73.3	0.619	74.2	0.620	74.9	0.615	76.3	0.634
	1085	182.	1194	196.	1226	197.	1256	195.	1340	202.
	0.3038	330.	0.2973	355.	0.2899	356.	0.2808	353.	0.2714	364.
350	68.4	0.535	72.1	0.602	72.8	0.603	73.5	0.599	74.5	0.605
	1056	176.	1221	200.	1250	200.	1274	198.	1330	201.
	0.2923	309.	0.2841	347.	0.2780	348.	0.2707	345.	0.2622	349.
330	67.1	0.516	69.0	0.538	71.6	0.579	72.5	0.584	73.2	0.583
	1066	178.	1149	186.	1268	201.	1312	203.	1345	202.
	0.2816	300.	0.2723	313.	0.2655	337.	0.2590	340.	0.2522	339.
310	65.7	0.499	68.1	0.528	69.5	0.539	70.8	0.551	72.1	0.563
	1085	180.	1179	191.	1236	195.	1299	199.	1365	204.
	0.2697	293.	0.2627	310.	0.2558	316.	0.2488	323.	0.2421	330.
290	63.8	0.471	67.6	0.526	68.4	0.525	69.3	0.527	70.3	0.532
	1083	177.	1233	198.	1259	198.	1295	199.	1347	201.
	0.2575	279.	0.2521	311.	0.2466	310.	0.2405	312.	0.2336	315.
280	63.2	0.465	67.4	0.524	67.7	0.516	68.6	0.518	69.8	0.526
	1097	178.	1263	202.	1271	199.	1306	200.	1360	203.
	0.2519	276.	0.2464	311.	0.2413	307.	0.2358	308.	0.2295	312.
270	62.1	0.451	66.9	0.517	67.2	0.511	67.9	0.509	69.0	0.515
	1091	177.	1281	204.	1292	201.	1315	201.	1361	203.
	0.2465	269.	0.2409	309.	0.2362	305.	0.2312	304.	0.2256	307.
260	61.3	0.441	66.4	0.511	66.9	0.507	67.3	0.502	68.4	0.509
	1094	176.	1300	205.	1316	204.	1330	202.	1378	205.
	0.2413	264.	0.2354	306.	0.2310	304.	0.2263	301.	0.2212	305.
250	60.2	0.426	65.8	0.504	66.3	0.501	67.0	0.500	67.9	0.502
	1085	174.	1318	207.	1334	206.	1358	205.	1392	206.
	0.2365	257.	0.2301	304.	0.2260	302.	0.2217	301.	0.2169	302.
240	59.8	0.422	65.4	0.498	66.2	0.500	66.9	0.500	67.4	0.497
	1099	176.	1336	209.	1365	210.	1392	210.	1415	208.
	0.2319	255.	0.2252	301.	0.2211	302.	0.2168	302.	0.2123	300.

bd100_aeo_crmrc_IMP_lw_hFL_00 – 02/02/2004

Figure 04-06-11. Cruise Performance—Maximum Range Cruise (Sheet 3 of 12)

MAXIMUM RANGE CRUISE

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA	%N1	MACH
	30% C.G.	LB/HR	KIAS
		NAM/LB	KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450	87.6 1573 0.2808	0.770 207. 442.	89.3 1622 0.2639	0.747 200. 428.						
430	85.1 1551 0.2772	0.750 210. 430.	86.5 1641 0.2663	0.762 214. 437.	87.8 1728 0.2555	0.770 216. 442.	89.6 1809 0.2415	0.762 214. 437.		
410	82.3 1466 0.2738	0.700 204. 402.	83.7 1576 0.2630	0.723 211. 414.	85.4 1710 0.2531	0.755 222. 433.	86.6 1800 0.2439	0.766 225. 439.	89.6 2035 0.2263	0.803 238. 461.
390	79.9 1439 0.2692	0.676 206. 388.	81.2 1529 0.2595	0.692 211. 397.	82.7 1647 0.2500	0.718 220. 412.	83.9 1740 0.2410	0.731 224. 419.	85.3 1863 0.2327	0.756 233. 433.
370	77.8 1437 0.2625	0.658 210. 377.	79.0 1518 0.2541	0.673 215. 386.	80.2 1607 0.2457	0.689 220. 395.	81.4 1690 0.2374	0.700 224. 401.	82.4 1765 0.2294	0.706 226. 405.
350	75.8 1416 0.2540	0.624 208. 360.	77.1 1503 0.2462	0.642 214. 370.	78.3 1592 0.2389	0.660 220. 380.	79.4 1671 0.2316	0.672 225. 387.	80.3 1732 0.2245	0.675 226. 389.
330	74.5 1421 0.2446	0.598 208. 348.	75.7 1504 0.2376	0.615 214. 358.	76.8 1585 0.2308	0.629 219. 366.	78.0 1673 0.2244	0.645 225. 375.	79.0 1746 0.2180	0.655 229. 381.
310	73.2 1431 0.2354	0.574 208. 337.	74.2 1499 0.2289	0.585 212. 343.	75.4 1584 0.2227	0.601 219. 353.	76.5 1667 0.2167	0.616 224. 361.	77.6 1755 0.2109	0.631 230. 370.
290	71.8 1433 0.2266	0.549 208. 325.	73.1 1518 0.2202	0.565 214. 334.	74.2 1600 0.2145	0.580 220. 343.	75.3 1684 0.2090	0.595 226. 352.	76.2 1753 0.2037	0.604 229. 357.
280	70.9 1428 0.2226	0.535 206. 318.	72.3 1518 0.2162	0.552 214. 328.	73.5 1601 0.2105	0.567 220. 337.	74.6 1685 0.2052	0.582 225. 346.	75.7 1769 0.2001	0.596 231. 354.
270	70.2 1431 0.2188	0.525 207. 313.	71.5 1516 0.2124	0.539 213. 322.	72.8 1601 0.2067	0.555 219. 331.	73.9 1686 0.2014	0.569 225. 340.	75.0 1770 0.1965	0.583 231. 348.
260	69.5 1433 0.2148	0.514 207. 308.	70.8 1518 0.2086	0.528 213. 317.	72.1 1603 0.2030	0.543 219. 325.	73.2 1686 0.1977	0.556 225. 334.	74.3 1773 0.1929	0.571 231. 342.
250	68.9 1446 0.2110	0.507 208. 305.	70.0 1517 0.2050	0.517 212. 311.	71.3 1603 0.1994	0.531 219. 320.	72.4 1686 0.1942	0.544 224. 328.	73.6 1772 0.1894	0.558 230. 336.
240	68.3 1460 0.2069	0.500 210. 302.	69.4 1531 0.2014	0.510 214. 308.	70.5 1602 0.1960	0.520 218. 314.	71.7 1688 0.1910	0.533 224. 322.	72.8 1771 0.1862	0.546 230. 330.

bd100_aeo_crmrc_IMP_hw_hFL_00 – 02/02/2004

Figure 04-06-11. Cruise Performance—Maximum Range Cruise (Sheet 4 of 12)

MAXIMUM RANGE CRUISE

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	80.2 1098 0.3519	0.666 176. 386.	82.0 1189 0.3350	0.687 182. 398.	83.6 1273 0.3190	0.700 186. 406.	85.3 1380 0.3042	0.724 193. 420.	87.2 1516 0.2913	0.761 204. 442.
430	78.0 1101 0.3418	0.649 179. 377.	79.6 1169 0.3281	0.661 183. 384.	81.2 1248 0.3140	0.676 187. 392.	82.6 1325 0.3002	0.686 190. 398.	84.4 1453 0.2873	0.720 201. 418.
410	76.6 1140 0.3291	0.647 187. 375.	77.5 1169 0.3195	0.644 186. 374.	79.0 1234 0.3074	0.654 190. 380.	80.4 1318 0.2952	0.671 195. 389.	81.7 1388 0.2835	0.678 197. 394.
390	74.9 1162 0.3154	0.632 192. 367.	75.8 1189 0.3079	0.631 191. 366.	76.7 1222 0.2986	0.629 190. 365.	78.1 1299 0.2878	0.645 196. 374.	79.7 1394 0.2773	0.667 203. 387.
370	72.1 1127 0.3022	0.587 186. 341.	74.1 1211 0.2957	0.617 196. 358.	75.0 1243 0.2882	0.618 196. 358.	75.8 1278 0.2793	0.615 195. 357.	77.2 1361 0.2700	0.634 201. 368.
350	69.2 1073 0.2907	0.535 176. 312.	72.9 1241 0.2828	0.602 200. 351.	73.6 1266 0.2766	0.601 199. 350.	74.2 1287 0.2693	0.595 197. 347.	75.3 1352 0.2609	0.605 201. 353.
330	67.8 1084 0.2800	0.516 178. 304.	69.8 1168 0.2708	0.538 186. 316.	72.5 1290 0.2642	0.580 201. 341.	73.4 1333 0.2578	0.584 203. 344.	74.1 1369 0.2510	0.584 203. 344.
310	66.5 1102 0.2684	0.499 180. 296.	68.9 1199 0.2613	0.529 191. 314.	70.3 1257 0.2545	0.540 195. 320.	71.7 1320 0.2475	0.551 199. 327.	72.9 1387 0.2408	0.563 204. 334.
290	64.5 1100 0.2562	0.471 177. 282.	68.4 1251 0.2509	0.525 198. 314.	69.1 1277 0.2454	0.524 198. 314.	70.1 1316 0.2393	0.527 199. 315.	71.1 1368 0.2324	0.532 201. 318.
280	63.7 1105 0.2507	0.461 177. 277.	68.0 1278 0.2452	0.522 201. 314.	68.4 1289 0.2401	0.515 199. 310.	69.3 1324 0.2346	0.517 199. 311.	70.5 1382 0.2284	0.525 203. 316.
270	62.8 1107 0.2454	0.450 177. 272.	67.6 1301 0.2398	0.517 204. 312.	68.1 1314 0.2351	0.512 202. 309.	68.8 1338 0.2301	0.510 201. 308.	69.8 1385 0.2245	0.515 203. 311.
260	62.0 1109 0.2404	0.440 176. 267.	67.0 1314 0.2346	0.509 205. 308.	67.5 1331 0.2301	0.506 204. 306.	68.1 1352 0.2255	0.503 202. 305.	69.2 1397 0.2203	0.508 204. 308.
250	60.9 1100 0.2357	0.426 174. 259.	66.5 1333 0.2294	0.503 207. 306.	67.0 1350 0.2253	0.500 206. 304.	67.8 1376 0.2209	0.500 205. 304.	68.6 1409 0.2162	0.501 206. 305.
240	60.4 1114 0.2311	0.422 176. 258.	66.1 1351 0.2246	0.497 208. 304.	66.9 1384 0.2204	0.500 210. 305.	67.6 1409 0.2161	0.499 209. 304.	68.0 1429 0.2116	0.495 208. 302.

bd100_aeo_crnirc_IMP_lw_hFL_05 - 02/02/2004

Figure 04-06-11. Cruise Performance—Maximum Range Cruise (Sheet 5 of 12)

MAXIMUM RANGE CRUISE			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT - 1000 LB									
	34		36		38		40		42	
450	88.6 1601 0.2790	0.770 206. 447.								
430	86.0 1560 0.2754	0.741 207. 430.	87.5 1670 0.2647	0.762 214. 442.	88.8 1759 0.2540	0.770 216. 447.	90.6 1831 0.2398	0.757 212. 439.		
410	83.2 1492 0.2721	0.700 204. 406.	84.7 1603 0.2613	0.722 211. 419.	86.5 1753 0.2515	0.760 224. 441.	87.6 1832 0.2424	0.765 225. 444.	NaN **** NaN	0.672 195. 390.
390	80.8 1465 0.2674	0.675 206. 392.	82.0 1543 0.2577	0.686 209. 398.	83.4 1646 0.2481	0.704 215. 409.	85.0 1780 0.2393	0.734 226. 426.	86.3 1895 0.2312	0.755 233. 438.
370	78.6 1455 0.2610	0.655 209. 380.	80.0 1546 0.2526	0.673 215. 391.	81.1 1627 0.2443	0.685 219. 398.	82.3 1719 0.2361	0.700 224. 406.	83.3 1794 0.2282	0.706 226. 410.
350	76.7 1439 0.2528	0.624 208. 364.	78.0 1527 0.2451	0.642 214. 374.	79.2 1618 0.2377	0.660 220. 385.	80.4 1706 0.2305	0.675 226. 393.	81.5 1790 0.2234	0.686 230. 400.
330	75.3 1446 0.2436	0.599 208. 352.	76.5 1523 0.2366	0.613 213. 360.	77.7 1610 0.2298	0.629 219. 370.	78.9 1699 0.2234	0.645 225. 380.	79.9 1774 0.2170	0.655 229. 385.
310	74.0 1454 0.2341	0.574 208. 341.	75.2 1539 0.2278	0.591 215. 351.	76.2 1608 0.2217	0.601 218. 357.	77.3 1692 0.2157	0.615 224. 365.	78.5 1782 0.2100	0.631 230. 374.
290	72.6 1456 0.2254	0.549 207. 328.	73.9 1541 0.2192	0.565 214. 338.	75.0 1624 0.2135	0.580 220. 347.	76.1 1710 0.2081	0.595 226. 356.	77.0 1780 0.2028	0.604 229. 361.
280	71.8 1455 0.2215	0.537 207. 322.	73.1 1541 0.2152	0.552 214. 332.	74.3 1626 0.2095	0.567 220. 341.	75.4 1710 0.2042	0.581 225. 349.	76.3 1780 0.1991	0.590 229. 354.
270	70.9 1450 0.2178	0.524 206. 316.	72.3 1539 0.2114	0.539 213. 325.	73.6 1626 0.2057	0.554 219. 334.	74.7 1712 0.2004	0.569 225. 343.	75.8 1798 0.1955	0.583 231. 352.
260	70.2 1454 0.2139	0.514 207. 311.	71.5 1538 0.2077	0.527 212. 320.	72.8 1624 0.2020	0.542 218. 328.	74.0 1712 0.1968	0.556 225. 337.	75.1 1800 0.1919	0.570 231. 346.
250	69.4 1452 0.2102	0.502 206. 305.	70.8 1539 0.2042	0.517 212. 314.	72.0 1624 0.1986	0.530 218. 322.	73.2 1712 0.1934	0.544 224. 331.	74.4 1799 0.1885	0.558 230. 339.
240	68.9 1475 0.2061	0.498 209. 304.	70.2 1554 0.2005	0.510 214. 312.	71.3 1625 0.1952	0.520 218. 317.	72.5 1710 0.1901	0.532 224. 325.	73.6 1798 0.1853	0.546 230. 333.

bd100_aeo_crmrc_IMP_hw_hFL_05 - 02/02/2004

Figure 04-06-11. Cruise Performance—Maximum Range Cruise (Sheet 6 of 12)

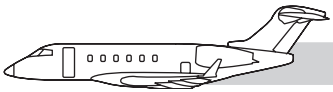
MAXIMUM RANGE CRUISE

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	81.2 1119 0.3494	0.666 176. 391.	83.0 1206 0.3329	0.685 181. 402.	84.6 1296 0.3168	0.700 186. 411.	86.3 1403 0.3023	0.723 193. 424.	88.8 1594 0.2885	0.784 211. 460.
430	78.9 1121 0.3394	0.649 179. 381.	80.4 1177 0.3262	0.655 181. 384.	82.2 1269 0.3120	0.675 187. 396.	83.6 1352 0.2982	0.688 191. 403.	85.5 1480 0.2854	0.720 201. 422.
410	77.5 1153 0.3273	0.643 186. 377.	78.3 1181 0.3173	0.639 185. 375.	79.9 1256 0.3053	0.654 190. 384.	81.5 1349 0.2933	0.675 196. 396.	82.9 1435 0.2817	0.689 201. 404.
390	75.8 1177 0.3139	0.630 191. 370.	76.6 1204 0.3060	0.628 190. 368.	77.5 1238 0.2967	0.626 190. 367.	79.1 1323 0.2860	0.645 196. 378.	80.6 1419 0.2756	0.667 203. 391.
370	73.0 1148 0.3005	0.588 186. 345.	74.9 1226 0.2942	0.615 195. 361.	75.8 1254 0.2866	0.613 194. 360.	76.7 1299 0.2777	0.615 195. 361.	78.1 1385 0.2684	0.634 201. 372.
350	70.0 1092 0.2890	0.535 176. 316.	73.7 1261 0.2812	0.602 200. 355.	74.5 1287 0.2750	0.601 199. 354.	75.1 1308 0.2678	0.595 197. 350.	76.2 1376 0.2595	0.606 201. 357.
330	68.6 1102 0.2785	0.516 178. 307.	70.6 1186 0.2695	0.538 186. 320.	73.2 1307 0.2630	0.578 200. 344.	74.2 1352 0.2566	0.584 202. 347.	75.0 1389 0.2497	0.584 202. 347.
310	67.2 1119 0.2669	0.498 179. 299.	69.6 1213 0.2599	0.526 190. 315.	71.0 1274 0.2531	0.538 194. 323.	72.5 1343 0.2463	0.552 200. 331.	73.7 1408 0.2397	0.563 204. 338.
290	65.2 1116 0.2550	0.471 177. 285.	69.0 1263 0.2497	0.522 197. 315.	69.8 1291 0.2441	0.521 197. 315.	70.8 1333 0.2380	0.525 198. 317.	71.9 1393 0.2310	0.532 201. 322.
280	64.4 1122 0.2494	0.461 177. 280.	68.4 1280 0.2443	0.515 198. 313.	69.2 1306 0.2392	0.515 198. 313.	70.0 1338 0.2336	0.515 198. 313.	71.1 1391 0.2272	0.520 201. 316.
270	63.5 1126 0.2440	0.451 177. 275.	68.0 1303 0.2391	0.511 201. 312.	68.4 1312 0.2345	0.505 199. 308.	69.4 1348 0.2294	0.507 200. 309.	70.3 1388 0.2235	0.509 200. 310.
260	62.6 1127 0.2390	0.440 176. 270.	67.6 1322 0.2341	0.506 204. 310.	68.0 1333 0.2297	0.500 201. 306.	68.8 1361 0.2249	0.500 201. 306.	69.6 1395 0.2194	0.500 201. 306.
250	61.7 1130 0.2341	0.431 176. 265.	67.1 1343 0.2292	0.501 206. 308.	67.8 1367 0.2249	0.500 206. 308.	68.6 1394 0.2204	0.500 205. 307.	69.3 1427 0.2152	0.500 205. 307.
240	61.0 1134 0.2295	0.422 176. 260.	66.9 1371 0.2240	0.498 209. 307.	67.7 1402 0.2198	0.500 210. 308.	68.2 1420 0.2154	0.496 208. 306.	68.6 1441 0.2106	0.492 206. 304.

bd100_aeo_crmrc_IMP_lw_hFL_10 – 02/02/2004

Figure 04-06-11. Cruise Performance—Maximum Range Cruise (Sheet 7 of 12)



MAXIMUM RANGE CRUISE

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450	89.2 1567 0.2760	0.738 197. 433.								
430	87.2 1604 0.2737	0.749 210. 439.	88.5 1694 0.2631	0.760 213. 446.	89.7 1763 0.2521	0.758 212. 444.				
410	84.2 1518 0.2702	0.700 204. 410.	85.7 1631 0.2596	0.722 211. 424.	87.4 1771 0.2498	0.754 222. 442.	88.6 1866 0.2408	0.766 225. 449.	90.1 1983 0.2313	0.782 231. 459.
390	81.8 1491 0.2657	0.675 206. 396.	83.2 1585 0.2560	0.692 211. 406.	84.4 1675 0.2465	0.704 215. 413.	85.9 1807 0.2377	0.733 225. 430.	87.3 1931 0.2295	0.756 233. 443.
370	79.6 1480 0.2595	0.655 209. 384.	80.9 1575 0.2510	0.674 215. 395.	82.1 1656 0.2428	0.685 219. 402.	83.3 1747 0.2348	0.699 224. 410.	84.3 1826 0.2268	0.706 226. 414.
350	77.6 1463 0.2515	0.624 208. 368.	78.9 1553 0.2437	0.642 214. 379.	80.0 1634 0.2364	0.655 219. 386.	81.3 1735 0.2293	0.675 226. 398.	82.4 1821 0.2222	0.687 230. 405.
330	76.2 1469 0.2424	0.599 208. 356.	77.3 1548 0.2354	0.613 213. 364.	78.5 1635 0.2286	0.629 219. 374.	79.7 1725 0.2223	0.645 225. 384.	80.9 1820 0.2161	0.662 231. 393.
310	74.9 1478 0.2330	0.575 208. 344.	75.9 1548 0.2266	0.585 212. 351.	77.1 1632 0.2205	0.601 218. 360.	78.2 1721 0.2147	0.616 224. 370.	79.3 1809 0.2090	0.631 230. 378.
290	73.3 1478 0.2243	0.548 207. 332.	74.8 1576 0.2182	0.569 216. 344.	75.8 1649 0.2125	0.580 220. 351.	76.8 1719 0.2070	0.589 223. 356.	77.9 1808 0.2018	0.604 229. 365.
280	72.5 1478 0.2204	0.537 207. 326.	73.9 1564 0.2142	0.552 213. 335.	75.1 1652 0.2085	0.567 220. 344.	76.2 1733 0.2031	0.580 225. 352.	77.2 1809 0.1980	0.590 229. 358.
270	71.7 1476 0.2166	0.525 207. 320.	73.1 1562 0.2104	0.539 213. 329.	74.4 1650 0.2046	0.554 219. 338.	75.5 1737 0.1994	0.568 225. 346.	76.6 1825 0.1945	0.582 231. 355.
260	71.0 1477 0.2128	0.514 207. 314.	72.3 1560 0.2067	0.527 212. 323.	73.5 1645 0.2010	0.540 218. 331.	74.7 1732 0.1958	0.554 224. 339.	75.9 1826 0.1909	0.570 230. 349.
250	70.2 1477 0.2091	0.503 207. 309.	71.5 1562 0.2032	0.517 212. 318.	72.6 1633 0.1976	0.525 216. 323.	73.9 1723 0.1924	0.540 222. 332.	75.1 1815 0.1875	0.554 228. 340.
240	69.6 1494 0.2052	0.497 208. 306.	70.9 1576 0.1996	0.510 214. 315.	72.0 1649 0.1943	0.520 218. 320.	73.1 1721 0.1892	0.528 222. 326.	74.4 1820 0.1844	0.544 229. 336.

bd100_aeo_crmrc_IMP_hw_hFL_10 – 02/02/2004

Figure 04-06-11. Cruise Performance—Maximum Range Cruise (Sheet 8 of 12)

MAXIMUM RANGE CRUISE

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	81.9 1119 0.3472	0.655 173. 389.	83.7 1210 0.3307	0.675 178. 400.	85.6 1319 0.3148	0.700 186. 415.	87.3 1427 0.3004	0.723 193. 429.	88.5 1484 0.2862	0.716 191. 425.
430	79.9 1141 0.3374	0.649 180. 385.	81.6 1210 0.3239	0.661 183. 392.	83.1 1292 0.3099	0.675 187. 400.	84.7 1380 0.2964	0.690 192. 409.	86.5 1505 0.2834	0.720 201. 427.
410	78.2 1167 0.3250	0.640 185. 379.	79.4 1212 0.3150	0.644 186. 382.	80.7 1266 0.3032	0.648 188. 384.	82.5 1371 0.2913	0.674 196. 400.	83.9 1462 0.2797	0.690 201. 409.
390	76.5 1186 0.3122	0.624 189. 370.	77.5 1223 0.3043	0.628 190. 372.	78.5 1262 0.2947	0.627 190. 372.	80.0 1345 0.2842	0.645 196. 382.	81.5 1442 0.2739	0.666 203. 395.
370	75.0 1216 0.2993	0.614 195. 364.	75.7 1237 0.2930	0.611 194. 363.	76.5 1262 0.2855	0.608 192. 360.	77.6 1320 0.2760	0.615 195. 364.	79.0 1408 0.2666	0.633 201. 376.
350	70.8 1111 0.2871	0.535 176. 319.	74.5 1274 0.2805	0.600 199. 358.	75.3 1303 0.2742	0.600 199. 357.	75.9 1327 0.2663	0.593 197. 353.	77.1 1400 0.2578	0.606 201. 361.
330	69.4 1120 0.2767	0.516 178. 310.	73.1 1288 0.2679	0.574 199. 345.	74.0 1326 0.2618	0.578 200. 347.	74.8 1361 0.2554	0.579 200. 348.	75.8 1413 0.2483	0.584 202. 351.
310	67.7 1124 0.2657	0.493 178. 299.	70.3 1232 0.2581	0.525 190. 318.	72.0 1306 0.2513	0.542 196. 328.	73.6 1380 0.2449	0.558 202. 338.	74.6 1431 0.2384	0.563 204. 341.
290	65.9 1132 0.2540	0.471 177. 288.	68.9 1246 0.2483	0.507 191. 310.	70.1 1296 0.2425	0.515 194. 314.	71.3 1348 0.2362	0.521 197. 318.	72.9 1431 0.2297	0.538 203. 329.
280	65.3 1148 0.2485	0.465 179. 285.	68.3 1264 0.2430	0.501 193. 307.	69.6 1314 0.2375	0.509 196. 312.	70.7 1362 0.2317	0.515 198. 316.	72.1 1432 0.2254	0.526 203. 323.
270	64.4 1153 0.2430	0.455 178. 280.	68.1 1295 0.2378	0.500 197. 308.	68.9 1324 0.2327	0.500 197. 308.	70.0 1370 0.2272	0.506 199. 311.	71.4 1439 0.2212	0.517 204. 318.
260	63.3 1144 0.2380	0.441 176. 272.	68.0 1326 0.2328	0.500 201. 309.	68.7 1355 0.2279	0.500 201. 309.	69.5 1387 0.2228	0.500 201. 309.	70.7 1447 0.2171	0.508 204. 314.
250	62.4 1147 0.2332	0.431 176. 268.	67.5 1348 0.2278	0.495 203. 307.	68.6 1390 0.2231	0.500 205. 310.	69.0 1407 0.2183	0.495 203. 307.	70.0 1459 0.2130	0.501 206. 311.
240	61.8 1155 0.2286	0.424 177. 264.	66.8 1353 0.2232	0.485 203. 302.	67.9 1397 0.2187	0.491 206. 306.	68.4 1419 0.2142	0.488 204. 304.	69.3 1462 0.2093	0.491 206. 306.

bd100_aeo_crmrc_IMP_lw_hFL_15 – 02/02/2004

Figure 04-06-11. Cruise Performance—Maximum Range Cruise (Sheet 9 of 12)

MAXIMUM RANGE CRUISE			
MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450										
430	88.0 1615 0.2718	0.740 207. 439.	89.0 1665 0.2604	0.731 204. 434.						
410	85.2 1546 0.2686	0.700 204. 415.	86.6 1644 0.2579	0.715 209. 424.	88.2 1783 0.2482	0.746 219. 443.	89.4 1865 0.2391	0.752 221. 446.		
390	82.8 1517 0.2640	0.675 206. 401.	84.0 1598 0.2543	0.686 209. 406.	85.4 1702 0.2449	0.703 215. 417.	86.8 1816 0.2362	0.723 222. 429.	88.4 1978 0.2279	0.760 234. 451.
370	80.5 1506 0.2578	0.655 208. 388.	81.9 1601 0.2494	0.673 215. 399.	83.1 1686 0.2412	0.686 219. 407.	84.4 1792 0.2332	0.705 226. 418.	85.3 1858 0.2253	0.706 226. 419.
350	78.5 1488 0.2498	0.624 208. 372.	79.8 1579 0.2423	0.642 214. 383.	81.1 1673 0.2350	0.660 220. 393.	82.3 1762 0.2279	0.674 226. 402.	83.4 1849 0.2210	0.686 230. 409.
330	77.0 1495 0.2410	0.600 208. 360.	78.2 1578 0.2342	0.615 214. 370.	79.4 1661 0.2275	0.629 219. 378.	80.6 1753 0.2211	0.645 225. 388.	81.8 1850 0.2149	0.662 231. 398.
310	75.7 1501 0.2319	0.576 208. 348.	76.7 1571 0.2255	0.585 212. 354.	77.9 1659 0.2194	0.601 218. 364.	79.1 1748 0.2136	0.616 224. 373.	80.2 1839 0.2080	0.632 230. 383.
290	74.2 1502 0.2232	0.549 208. 335.	75.4 1589 0.2171	0.565 214. 345.	76.6 1676 0.2113	0.580 220. 354.	77.6 1748 0.2060	0.589 224. 360.	78.7 1835 0.2009	0.604 229. 369.
280	73.5 1511 0.2191	0.540 208. 331.	74.7 1589 0.2131	0.552 213. 339.	75.9 1677 0.2074	0.567 220. 348.	77.1 1763 0.2021	0.581 225. 356.	78.2 1852 0.1971	0.596 231. 365.
270	72.7 1515 0.2152	0.530 209. 326.	73.9 1588 0.2093	0.540 213. 332.	75.1 1668 0.2036	0.552 218. 340.	76.4 1764 0.1984	0.569 225. 350.	77.4 1854 0.1936	0.583 231. 359.
260	71.9 1516 0.2114	0.519 209. 321.	73.2 1592 0.2057	0.530 214. 328.	74.2 1659 0.2001	0.537 217. 332.	75.6 1763 0.1948	0.556 224. 344.	76.7 1855 0.1901	0.570 231. 353.
250	71.2 1522 0.2076	0.509 209. 316.	72.3 1586 0.2022	0.517 212. 321.	73.4 1659 0.1966	0.526 216. 326.	74.8 1763 0.1914	0.544 224. 338.	76.0 1853 0.1867	0.558 230. 346.
240	70.4 1520 0.2041	0.498 209. 310.	71.7 1599 0.1987	0.510 214. 318.	72.8 1673 0.1934	0.520 218. 324.	74.0 1755 0.1882	0.531 223. 330.	75.2 1852 0.1835	0.546 230. 340.

bd100_aeo_crmrc_IMP_hw_hFL_15 – 02/02/2004

Figure 04-06-11. Cruise Performance—Maximum Range Cruise (Sheet 10 of 12)

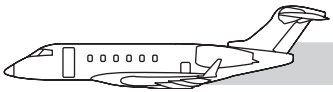
MAXIMUM RANGE CRUISE

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%NI LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	82.9 1138 0.3450	0.655 173. 393.	84.8 1232 0.3283	0.675 179. 405.	86.6 1341 0.3126	0.699 186. 419.	87.9 1417 0.2978	0.704 187. 422.		
430	80.8 1160 0.3352	0.649 179. 389.	82.4 1218 0.3221	0.655 181. 393.	83.9 1295 0.3079	0.665 184. 399.	85.6 1394 0.2944	0.685 190. 411.	87.5 1532 0.2816	0.720 201. 431.
410	79.3 1190 0.3232	0.642 186. 385.	80.2 1221 0.3133	0.639 185. 383.	81.8 1300 0.3013	0.654 190. 392.	83.4 1391 0.2894	0.672 195. 403.	84.9 1487 0.2777	0.689 201. 413.
390	77.4 1205 0.3105	0.625 189. 374.	78.3 1237 0.3024	0.624 189. 374.	79.5 1291 0.2928	0.631 191. 378.	80.9 1369 0.2823	0.645 196. 387.	82.5 1467 0.2722	0.666 203. 399.
370	75.5 1220 0.2978	0.606 192. 363.	76.4 1246 0.2911	0.605 192. 363.	77.4 1291 0.2829	0.609 193. 365.	78.5 1346 0.2741	0.615 195. 369.	79.9 1433 0.2648	0.633 201. 380.
350	71.4 1119 0.2853	0.530 175. 319.	75.2 1286 0.2787	0.595 197. 358.	75.8 1308 0.2718	0.590 196. 356.	76.7 1352 0.2643	0.593 197. 357.	78.0 1421 0.2564	0.605 201. 364.
330	69.8 1124 0.2752	0.510 176. 310.	74.1 1311 0.2671	0.577 200. 350.	74.8 1336 0.2611	0.575 199. 349.	75.7 1378 0.2542	0.577 200. 350.	76.6 1434 0.2469	0.583 202. 354.
310	68.4 1143 0.2642	0.493 178. 302.	71.0 1255 0.2563	0.526 190. 322.	73.3 1349 0.2502	0.552 200. 338.	74.4 1399 0.2440	0.558 202. 341.	75.4 1453 0.2374	0.564 204. 345.
290	66.7 1148 0.2531	0.471 177. 291.	69.2 1250 0.2466	0.500 188. 308.	71.3 1346 0.2404	0.525 198. 324.	72.5 1397 0.2347	0.532 201. 328.	73.8 1455 0.2284	0.539 204. 332.
280	66.1 1163 0.2476	0.465 178. 288.	68.7 1271 0.2411	0.495 190. 307.	70.6 1356 0.2353	0.515 199. 319.	72.0 1416 0.2300	0.526 203. 326.	73.1 1466 0.2241	0.531 205. 329.
270	65.2 1168 0.2422	0.455 178. 283.	68.2 1292 0.2358	0.490 193. 305.	70.3 1387 0.2304	0.514 202. 320.	71.2 1421 0.2254	0.515 203. 320.	72.3 1469 0.2200	0.520 205. 323.
260	64.1 1159 0.2373	0.441 176. 275.	67.2 1284 0.2309	0.475 191. 297.	69.1 1367 0.2257	0.494 199. 308.	70.5 1432 0.2210	0.507 204. 316.	71.4 1472 0.2159	0.509 205. 318.
250	63.2 1163 0.2324	0.431 176. 270.	66.3 1287 0.2261	0.465 190. 291.	69.3 1417 0.2211	0.500 205. 313.	69.7 1436 0.2167	0.497 204. 311.	70.8 1486 0.2120	0.503 206. 315.
240	62.6 1171 0.2281	0.425 177. 267.	66.2 1317 0.2223	0.465 195. 293.	68.5 1416 0.2176	0.490 205. 308.	69.1 1438 0.2131	0.487 204. 307.	70.1 1486 0.2083	0.492 206. 310.

bd100_aeo_crmrc_iMP_lw_hFL_20 – 02/02/2004

Figure 04-06-11. Cruise Performance—Maximum Range Cruise (Sheet 11 of 12)



MAXIMUM RANGE CRUISE

MAXIMUM CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT - 1000 LB									
	34		36		38		40		42	
450										
430	88.4 1582 0.2694	0.711 198. 426.								
410	86.3 1574 0.2666	0.700 204. 420.	87.7 1688 0.2563	0.722 211. 433.	88.8 1771 0.2463	0.728 213. 436.				
390	83.7 1542 0.2623	0.675 206. 405.	85.0 1626 0.2526	0.685 209. 411.	86.3 1729 0.2433	0.702 215. 421.	87.9 1864 0.2346	0.730 224. 437.	89.2 1989 0.2263	0.751 231. 450.
370	81.4 1532 0.2562	0.655 209. 393.	82.7 1621 0.2477	0.670 214. 402.	84.0 1714 0.2395	0.685 219. 411.	85.2 1802 0.2316	0.696 223. 417.	86.3 1890 0.2237	0.706 226. 423.
350	79.3 1512 0.2484	0.624 208. 376.	80.7 1604 0.2409	0.642 214. 386.	82.0 1701 0.2336	0.660 220. 397.	83.2 1793 0.2266	0.675 226. 406.	84.3 1881 0.2197	0.686 230. 413.
330	77.9 1517 0.2396	0.599 208. 364.	79.0 1598 0.2327	0.613 213. 372.	80.3 1688 0.2262	0.629 219. 382.	81.5 1780 0.2199	0.645 225. 392.	82.7 1878 0.2138	0.661 231. 401.
310	76.5 1524 0.2307	0.575 208. 352.	77.5 1597 0.2244	0.586 212. 358.	78.7 1684 0.2184	0.601 218. 368.	79.9 1774 0.2126	0.616 224. 377.	81.0 1866 0.2070	0.631 230. 386.
290	74.9 1523 0.2220	0.548 207. 338.	76.3 1613 0.2158	0.564 214. 348.	77.4 1701 0.2102	0.580 220. 358.	78.6 1791 0.2050	0.595 226. 367.	79.5 1862 0.1999	0.603 229. 372.
280	74.1 1523 0.2181	0.536 207. 332.	75.5 1613 0.2119	0.552 213. 342.	76.7 1703 0.2063	0.567 220. 351.	77.9 1792 0.2012	0.582 226. 360.	78.8 1863 0.1962	0.590 229. 366.
270	73.5 1538 0.2142	0.530 209. 330.	74.6 1608 0.2081	0.538 212. 335.	76.0 1703 0.2025	0.555 219. 345.	77.1 1791 0.1974	0.569 225. 354.	78.2 1881 0.1927	0.583 231. 362.
260	72.7 1537 0.2105	0.518 209. 324.	73.8 1608 0.2047	0.527 212. 329.	75.2 1700 0.1990	0.542 219. 338.	76.4 1791 0.1939	0.556 225. 347.	77.4 1877 0.1891	0.569 230. 355.
250	72.0 1543 0.2069	0.510 210. 319.	73.0 1608 0.2013	0.517 212. 324.	74.3 1695 0.1957	0.530 218. 332.	75.5 1780 0.1905	0.541 223. 339.	76.6 1872 0.1858	0.555 229. 348.
240	71.3 1553 0.2033	0.502 211. 316.	72.4 1619 0.1979	0.510 214. 320.	73.5 1698 0.1924	0.520 218. 327.	74.7 1780 0.1874	0.530 223. 334.	75.9 1874 0.1827	0.544 229. 342.

bd100_aeo_crmrc_IMP_hw_hFL_20 ~ 02/02/2004

Figure 04-06-11. Cruise Performance—Maximum Range Cruise (Sheet 12 of 12)

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DESCENT DATA

All engine operating descent performance data are presented in tabular form as a function of aircraft weight during a descent from altitude to sea level for -10, 0, 10, and 20°C temperature deviations from ISA.

Descent performance data are presented for the following speed schedules:

- 0.75 MI / 250 KIAS - Long Range (typical) descent schedule
- 0.82 MI / 310 /250 KIAS

Data are based on idle power with engine bleed on and anti-ice off, or if required, a power slightly higher in order to respect a maximum airplane descent rate has been limited to 3000 ft/min. following NBAA operational rules. All climb speed schedules incorporate a speed limit of 250 KIAS below 10 000 ft.

Descent performance tables show the following data:

• TIME	Time in minutes
• DIST	Air distance in nautical miles
• FUEL	Fuel consumed in pounds
• ROD	Rate of descent in fpm (altitude pressure)
• ATAS	Average true airspeed in knots
• MACH	Indicated Mach number

At a selected descent speed schedule, the table is entered at an initial descent weight with average temperature conditions at given initial and final descent altitudes. Descent time, distance and fuel consumed are the difference between the values read at the initial and final altitudes. Airplane rate of descent and indicated Mach number at altitude are also given.

The descent distance represents the air distance (zero wind) covered and ATAS represents the average true airspeed from top of descent altitude to the point final descent altitude is reached. In wind conditions, the ground distance can be derived using the following equation:

Ground distance = [Air distance x (ATAS +/- Wind*) / ATAS]

* Wind convention "+" for Tailwind and "-" for Headwind

Time, distance and fuel corrections factors for C.G. variations relative to the 30% MAC reference position are provided below:

TIME, DISTANCE AND FUEL CORRECTION FACTORS vs. C.G. POSITION.

C.G.	Time, Distance and Fuel
20%	- 2.0%
25%	- 1.0%
REF (30%)	-
35%	+ 2.0%
40%	+ 3.0%

Example:

Associated conditions

- Initial descent altitude = FL 390 (A)
- Initial descent weight at altitude = 30 000 lbs (B)
- Descent speed schedule = 0.75 MI / 250 KIAS
- Average descent temperature = ISA-10°C
- Average descent wind = -30 kt (headwind)
- Final altitude = Sea Level

Using Figure 04-07-01, Sheet 1, the following data are obtained (C):

- Time = 19.0 min.
- Air distance = 103.9 n.a.m.
- Descent rate at FL 390 = 2240 ft/min.
- Fuel consumed = 251 lbs
- Avg true airspeed = 328 kts
- Indicated Mach = 0.75 MI

Ground distance = [Air distance x (ATAS +/- Wind*) / ATAS]

* Wind convention "+" for Tailwind and "-" for Headwind

Ground distance is estimated using equation given above:

- Ground distance = 94.4 n.m. [103.9 x (328-30)/328]

DESCENT 0.75 M /250 KIAS

IDLE THRUST OR 3000 FPM ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C	MAXIMUM TRUE RATE OF DESCENT 3000 FPM
		SEA LEVEL FINAL ALTITUDE
	30 % C.G.	TIME(MIN) FUEL(LB) DIST(NAM) ATAS(KTS) ROD(FPM) MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	22		24		26		28		30 (B)	
450	17.8 102.2 1654	235 343 0.750	19.1 109.0 1627	251 343 0.750	20.2 115.4 1623	266 342 0.750	21.2 121.0 1646	280 342 0.750	22.2 126.5 1670	293 341 0.750
430	16.7 94.1 1844	220 338 0.750	17.9 100.8 1786	236 338 0.750	19.0 107.0 1749	251 338 0.750	20.0 112.7 1740	264 337 0.750	21.1 118.2 1732	278 337 0.750
410	15.7 87.2 2232	208 333 0.750	16.9 93.6 2127	223 333 0.750	18.0 99.6 2051	237 333 0.750	19.0 105.2 2002	250 333 0.750	20.0 110.6 1956	264 332 0.750
390 (A)	14.9 81.5 2685	197 328 0.750	16.0 87.6 2528	212 328 0.750	17.1 93.4 2408	226 328 0.750	18.0 98.7 2322	239 328 0.750	19.0 103.9 (C) 2240	251 328 0.750
370	14.2 76.7 3068	189 324 0.750	15.3 82.4 2870	202 324 0.750	16.3 87.9 2712	216 324 0.750	17.2 93.0 2593	228 324 0.750	18.2 98.0 2479	241 324 0.750
350	13.5 72.0 2671	180 319 0.741	14.6 77.5 2493	193 319 0.741	15.6 82.8 2346	207 319 0.741	16.5 87.6 2233	219 319 0.741	17.4 92.4 2122	231 319 0.741
330	12.8 66.9 2677	170 314 0.711	13.8 72.0 2496	183 314 0.711	14.7 76.9 2348	196 314 0.711	15.6 81.5 2233	208 314 0.711	16.4 85.9 2120	219 314 0.711
310	12.0 61.9 2664	161 309 0.682	13.0 66.7 2481	174 309 0.682	13.8 71.3 2330	185 309 0.682	14.7 75.5 2214	196 309 0.682	15.5 79.6 2102	207 309 0.682
290	11.3 57.1 2652	152 304 0.655	12.1 61.5 2467	164 304 0.655	13.0 65.7 2316	175 304 0.655	13.8 69.7 2201	185 304 0.655	14.5 73.5 2089	195 304 0.655
250	9.8 47.8 2623	133 294 0.604	10.5 51.5 2440	143 294 0.604	11.2 55.1 2288	153 294 0.604	11.9 58.4 2170	162 294 0.604	12.6 61.7 2055	172 294 0.604
200	7.9 37.1 2690	109 283 0.547	8.5 40.0 2498	118 283 0.547	9.1 42.8 2339	126 283 0.547	9.6 45.4 2214	134 283 0.547	10.2 48.0 2093	141 283 0.547
150	6.0 27.2 2613	85 272 0.497	6.5 29.3 2425	91 272 0.497	6.9 31.3 2269	98 272 0.497	7.3 33.3 2147	104 273 0.497	7.7 35.2 2027	110 273 0.497
100	4.1 17.7 2556	60 262 0.452	4.4 19.1 2371	64 263 0.452	4.7 20.5 2218	69 263 0.452	5.0 21.7 2096	73 263 0.452	5.2 23.0 1978	77 263 0.452
50	2.1 8.8 2510	33 253 0.413	2.3 9.5 2327	35 253 0.413	2.4 10.2 2175	38 254 0.413	2.6 10.8 2055	40 254 0.413	2.7 11.5 1937	42 254 0.413

BD100_AEO_DES250_IMP_M10_LW – 08/10/2003

Figure 04-07-01. Descent Data—0.75 M/250 KIAS (Sheet 1 of 8)

DESCENT 0.75 M /250 KIAS

IDLE THRUST
OR 3000 FPM
ENGINE BLEED ON
ENGINE AND WING A/I OFF

ISA – 10 C

30 % C.G.

MAXIMUM TRUE RATE OF DESCENT 3000 FPM

SEA LEVEL FINAL ALTITUDE

TIME(MIN) FUEL(LB)
DIST(NAM) ATAS(KTS)
ROD(FPM) MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	32		34		36		38		40	
450	23.1	304	23.8	314	24.4	322	24.9	329	25.3	334
	131.0	341	134.8	340	138.0	339	140.6	339	142.7	338
	1714	0.750	1771	0.750	1844	0.750	1939	0.750	2055	0.750
430	21.9	289	22.7	299	23.3	308	23.9	315	24.3	321
	122.9	336	126.9	336	130.4	336	133.3	335	135.6	335
	1750	0.750	1779	0.750	1817	0.750	1868	0.750	1938	0.750
410	20.8	275	21.6	285	22.2	294	22.8	301	23.3	308
	115.3	332	119.4	332	122.9	331	125.9	331	128.5	331
	1936	0.750	1933	0.750	1942	0.750	1961	0.750	1991	0.750
390	19.9	263	20.6	273	21.3	281	21.8	289	22.3	296
	108.5	328	112.5	328	116.0	327	119.1	327	121.7	327
	2184	0.750	2144	0.750	2122	0.750	2113	0.750	2116	0.750
370	19.0	252	19.7	261	20.3	270	20.9	277	21.4	284
	102.4	324	106.2	323	109.6	323	112.6	323	115.2	323
	2397	0.750	2330	0.750	2279	0.750	2243	0.750	2222	0.750
350	18.1	241	18.8	251	19.5	259	20.0	266	20.5	273
	96.5	319	100.2	319	103.4	319	106.3	319	108.8	319
	2041	0.741	1974	0.741	1918	0.741	1874	0.741	1841	0.741
330	17.2	229	17.8	238	18.4	246	18.9	253	19.4	259
	89.8	314	93.3	314	96.3	314	99.0	314	101.4	314
	2037	0.711	1970	0.711	1915	0.711	1869	0.711	1835	0.711
310	16.2	217	16.8	225	17.4	233	17.9	239	18.3	245
	83.3	309	86.5	309	89.4	309	91.9	309	94.1	309
	2021	0.682	1955	0.682	1901	0.682	1857	0.682	1820	0.682
290	15.2	205	15.8	213	16.3	220	16.8	226	17.2	232
	76.9	304	79.9	304	82.6	304	85.0	304	87.0	304
	2008	0.655	1944	0.655	1891	0.655	1844	0.655	1805	0.655
250	13.2	180	13.7	187	14.2	193	14.6	199	15.0	204
	64.6	294	67.2	294	69.5	294	71.5	294	73.3	294
	1970	0.604	1903	0.604	1848	0.604	1802	0.604	1763	0.604
200	10.7	148	11.1	154	11.5	159	11.8	164	12.1	168
	50.3	283	52.3	283	54.2	283	55.8	283	57.2	283
	2001	0.547	1926	0.547	1865	0.547	1814	0.547	1773	0.547
150	8.1	115	8.4	120	8.7	124	9.0	128	9.2	131
	36.9	273	38.4	273	39.8	273	41.0	273	42.0	273
	1937	0.497	1863	0.497	1802	0.497	1752	0.497	1710	0.497
100	5.5	81	5.7	84	5.9	87	6.1	90	6.3	92
	24.1	263	25.1	263	26.0	263	26.8	263	27.6	263
	1888	0.452	1813	0.452	1752	0.452	1702	0.452	1659	0.452
50	2.8	45	3.0	46	3.1	48	3.2	50	3.3	51
	12.0	254	12.5	254	13.0	254	13.4	254	13.8	254
	1846	0.413	1771	0.413	1709	0.413	1658	0.413	1614	0.413

BD100_AEO_DES250_IMP_M10_HW – 08/10/2003

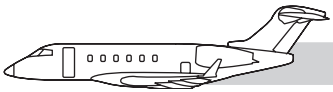
Figure 04-07-01. Descent Data—0.75 M/250 KIAS (Sheet 2 of 8)

DESCENT 0.75 M /250 KIAS		
IDLE THRUST OR 3000 FPM ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30 % C.G.	MAXIMUM TRUE RATE OF DESCENT 3000 FPM SEA LEVEL FINAL ALTITUDE TIME(MIN) FUEL(LB) DIST(NAM) ATAS(KTS) ROD(FPM) MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	22		24		26		28		30	
450	18.0	243	19.3	260	20.4	275	21.5	289	22.5	303
	105.3	351	112.4	350	119.0	349	124.8	349	130.5	348
	1677	0.750	1645	0.750	1637	0.750	1656	0.750	1676	0.750
430	16.9	228	18.1	244	19.2	260	20.3	274	21.3	287
	97.2	345	104.0	345	110.5	345	116.4	344	122.1	344
	1863	0.750	1801	0.750	1761	0.750	1748	0.750	1737	0.750
410	15.9	215	17.1	231	18.2	246	19.2	259	20.2	273
	90.2	340	96.7	340	103.0	340	108.7	339	114.4	339
	2251	0.750	2142	0.750	2064	0.750	2011	0.750	1962	0.750
390	15.1	205	16.2	220	17.3	234	18.3	248	19.3	261
	84.4	335	90.6	335	96.6	335	102.1	335	107.5	335
	2687	0.750	2528	0.750	2406	0.750	2319	0.750	2234	0.750
370	14.4	196	15.5	210	16.5	224	17.5	237	18.4	250
	79.4	331	85.3	331	90.9	330	96.2	330	101.4	330
	2984	0.750	2853	0.750	2694	0.750	2576	0.750	2460	0.750
350	13.7	186	14.8	201	15.8	214	16.7	227	17.6	240
	74.4	326	80.2	326	85.6	326	90.6	326	95.6	326
	2645	0.741	2467	0.741	2322	0.741	2209	0.741	2099	0.741
330	13.0	177	14.0	190	14.9	204	15.8	216	16.7	227
	69.2	320	74.5	320	79.6	320	84.3	320	88.9	320
	2651	0.711	2471	0.711	2323	0.711	2209	0.711	2097	0.711
310	12.2	167	13.1	180	14.0	193	14.9	204	15.7	215
	64.0	315	69.0	315	73.7	315	78.1	315	82.4	315
	2636	0.682	2454	0.682	2304	0.682	2189	0.682	2077	0.682
290	11.4	158	12.3	170	13.2	182	14.0	192	14.7	203
	59.1	310	63.6	310	68.0	310	72.1	310	76.1	310
	2621	0.655	2438	0.655	2288	0.655	2174	0.655	2063	0.655
250	9.9	138	10.7	149	11.4	159	12.1	169	12.8	178
	49.5	300	53.3	300	57.0	300	60.5	300	63.9	300
	2595	0.604	2413	0.604	2262	0.604	2145	0.604	2031	0.604
200	8.0	114	8.6	123	9.2	131	9.8	139	10.3	147
	38.4	288	41.4	288	44.3	288	47.0	288	49.7	288
	2654	0.547	2464	0.547	2307	0.547	2184	0.547	2063	0.547
150	6.1	88	6.6	95	7.0	102	7.4	108	7.9	114
	28.1	277	30.3	278	32.4	278	34.4	278	36.4	278
	2580	0.497	2395	0.497	2241	0.497	2119	0.497	2001	0.497
100	4.1	62	4.4	67	4.8	72	5.0	76	5.3	80
	18.4	267	19.8	267	21.2	268	22.5	268	23.8	268
	2524	0.452	2341	0.452	2189	0.452	2069	0.452	1953	0.452
50	2.1	34	2.3	37	2.4	39	2.6	42	2.7	44
	9.1	258	9.8	258	10.5	258	11.2	258	11.8	258
	2479	0.413	2299	0.413	2148	0.413	2029	0.413	1913	0.413

BD100_AEO_DES250_IMP_00_LW – 08/10/2003

Figure 04-07-01. Descent Data—0.75 M/250 KIAS (Sheet 3 of 8)



DESCENT 0.75 M /250 KIAS

IDLE THRUST OR 3000 FPM ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA	MAXIMUM TRUE RATE OF DESCENT 3000 FPM
		SEA LEVEL FINAL ALTITUDE
	30 % C.G.	TIME(MIN) FUEL(LB) DIST(NAM) ATAS(KTS) ROD(FPM) MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	32		34		36		38		40	
450	23.3	315	24.1	325	24.7	333	25.2	341	25.7	346
	135.3	348	139.3	347	142.7	346	145.5	346	147.7	345
	1716	0.750	1769	0.750	1839	0.750	1929	0.750	2041	0.750
430	22.2	299	23.0	310	23.6	319	24.2	327	24.7	333
	127.0	343	131.2	343	134.8	342	137.9	342	140.4	342
	1751	0.750	1777	0.750	1812	0.750	1860	0.750	1927	0.750
410	21.1	285	21.9	296	22.6	305	23.1	313	23.6	320
	119.2	339	123.5	339	127.2	338	130.4	338	133.1	338
	1939	0.750	1934	0.750	1940	0.750	1957	0.750	1984	0.750
390	20.1	273	20.9	283	21.6	292	22.1	300	22.7	307
	112.2	335	116.4	334	120.1	334	123.3	334	126.0	334
	2177	0.750	2136	0.750	2112	0.750	2101	0.750	2102	0.750
370	19.3	261	20.0	271	20.6	280	21.2	288	21.7	295
	105.9	330	110.0	330	113.5	330	116.6	330	119.4	330
	2378	0.750	2311	0.750	2259	0.750	2222	0.750	2200	0.750
350	18.4	251	19.1	260	19.7	269	20.3	277	20.8	283
	99.9	326	103.7	325	107.1	325	110.1	325	112.7	325
	2017	0.741	1950	0.741	1895	0.741	1850	0.741	1817	0.741
330	17.4	238	18.1	247	18.7	255	19.2	263	19.7	269
	93.0	320	96.5	320	99.7	320	102.5	320	105.0	320
	2014	0.711	1947	0.711	1891	0.711	1846	0.711	1811	0.711
310	16.4	225	17.1	234	17.6	242	18.1	249	18.6	255
	86.2	315	89.6	315	92.5	315	95.2	315	97.5	315
	1996	0.682	1931	0.682	1877	0.682	1832	0.682	1795	0.682
290	15.4	213	16.0	221	16.6	228	17.0	235	17.5	241
	79.6	310	82.7	310	85.5	310	88.0	310	90.1	310
	1983	0.655	1919	0.655	1865	0.655	1819	0.655	1780	0.655
250	13.4	187	13.9	194	14.4	201	14.8	207	15.2	212
	66.9	300	69.6	300	72.0	300	74.1	300	75.9	300
	1947	0.604	1880	0.604	1825	0.604	1779	0.604	1740	0.604
200	10.8	154	11.3	160	11.7	166	12.0	171	12.3	175
	52.0	289	54.2	289	56.1	289	57.7	289	59.2	289
	1973	0.547	1898	0.547	1838	0.547	1788	0.547	1747	0.547
150	8.2	120	8.6	125	8.9	129	9.2	133	9.4	136
	38.2	278	39.8	278	41.2	278	42.4	278	43.5	278
	1911	0.497	1838	0.497	1778	0.497	1728	0.497	1687	0.497
100	5.6	84	5.8	88	6.0	91	6.2	94	6.4	96
	25.0	268	26.0	268	27.0	268	27.8	268	28.6	268
	1863	0.452	1789	0.452	1729	0.452	1679	0.452	1636	0.452
50	2.9	46	3.0	48	3.1	50	3.2	51	3.3	53
	12.4	258	12.9	258	13.4	258	13.8	258	14.2	258
	1823	0.413	1749	0.413	1687	0.413	1636	0.413	1593	0.413

BD100_AEO_DES250_IMP_00_HW – 08/10/2003

Figure 04-07-01. Descent Data—0.75 M/250 KIAS (Sheet 4 of 8)

DESCENT 0.75 M /250 KIAS

IDLE THRUST OR 3000 FPM ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30 % C.G.	MAXIMUM TRUE RATE OF DESCENT 3000 FPM SEA LEVEL FINAL ALTITUDE TIME(MIN) FUEL(LB) DIST(NAM) ATAS(KTS) ROD(FPM) MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	22		24		26		28		30	
450	18.2	251	19.4	267	20.6	283	21.7	298	22.7	312
	108.4	358	115.6	357	122.4	356	128.5	356	134.4	355
	1695	0.750	1659	0.750	1647	0.750	1662	0.750	1680	0.750
430	17.1	236	18.3	252	19.4	267	20.5	282	21.5	296
	100.2	352	107.2	352	113.8	351	119.9	351	125.8	351
	1883	0.750	1818	0.750	1774	0.750	1758	0.750	1744	0.750
410	16.1	223	17.3	238	18.4	253	19.4	267	20.5	282
	93.1	347	99.8	347	106.2	346	112.1	346	117.9	346
	2267	0.750	2155	0.750	2074	0.750	2019	0.750	1967	0.750
390	15.3	212	16.4	227	17.5	242	18.5	255	19.5	269
	87.2	342	93.5	342	99.6	342	105.3	341	110.9	341
	2692	0.750	2531	0.750	2407	0.750	2319	0.750	2232	0.750
370	14.6	203	15.7	217	16.7	231	17.7	245	18.6	258
	82.0	337	88.0	337	93.9	337	99.3	337	104.6	337
	2867	0.750	2842	0.750	2682	0.750	2563	0.750	2447	0.750
350	13.9	192	14.9	207	16.0	221	16.9	234	17.8	247
	76.8	332	82.7	332	88.3	332	93.5	332	98.6	332
	2619	0.741	2442	0.741	2298	0.741	2185	0.741	2076	0.741
330	13.1	182	14.1	197	15.1	210	16.0	222	16.9	235
	71.3	327	76.8	327	82.1	327	86.9	327	91.7	327
	2626	0.711	2447	0.711	2300	0.711	2186	0.711	2075	0.711
310	12.3	173	13.3	186	14.2	199	15.1	211	15.9	222
	66.0	321	71.2	321	76.0	321	80.6	321	85.0	321
	2609	0.682	2429	0.682	2280	0.682	2166	0.682	2055	0.682
290	11.6	163	12.5	175	13.3	187	14.1	199	14.9	210
	60.9	316	65.6	316	70.2	316	74.3	316	78.5	316
	2593	0.655	2412	0.655	2263	0.655	2150	0.655	2039	0.655
250	10.0	143	10.8	154	11.5	164	12.2	174	12.9	184
	51.0	305	55.0	306	58.8	306	62.4	306	65.9	306
	2567	0.604	2386	0.604	2237	0.604	2121	0.604	2008	0.604
200	8.1	117	8.7	126	9.3	135	9.9	144	10.5	152
	39.6	293	42.7	294	45.7	294	48.4	294	51.2	294
	2625	0.547	2437	0.547	2281	0.547	2159	0.547	2039	0.547
150	6.2	91	6.6	98	7.1	105	7.5	111	8.0	118
	29.0	282	31.2	283	33.4	283	35.5	283	37.5	283
	2546	0.497	2363	0.497	2210	0.497	2091	0.497	1974	0.497
100	4.2	64	4.5	69	4.8	74	5.1	78	5.4	83
	18.9	272	20.4	272	21.8	272	23.2	272	24.5	272
	2493	0.452	2313	0.452	2163	0.452	2044	0.452	1928	0.452
50	2.1	35	2.3	38	2.5	40	2.6	43	2.8	45
	9.4	262	10.1	263	10.8	263	11.5	263	12.2	263
	2455	0.413	2276	0.413	2127	0.413	2009	0.413	1893	0.413

BD100_AEO_DES250_IMP_10_LW – 08/10/2003

Figure 04-07-01. Descent Data—0.75 M/250 KIAS (Sheet 5 of 8)

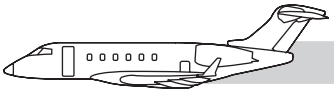
DESCENT 0.75 M /250 KIAS

IDLE THRUST OR 3000 FPM ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C	MAXIMUM TRUE RATE OF DESCENT 3000 FPM
		SEA LEVEL FINAL ALTITUDE
	30 % C.G.	TIME(MIN) FUEL(LB) DIST(NAM) ATAS(KTS) ROD(FPM) MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	32		34		36		38		40	
450	23.6	324	24.3	335	25.0	344	25.5	351	26.0	357
	139.4	355	143.6	354	147.2	353	150.1	353	152.4	352
	1716	0.750	1765	0.750	1831	0.750	1918	0.750	2026	0.750
430	22.4	309	23.2	319	23.9	329	24.5	337	25.0	344
	130.9	350	135.3	350	139.1	349	142.3	349	145.0	348
	1755	0.750	1778	0.750	1810	0.750	1855	0.750	1918	0.750
410	21.3	294	22.1	305	22.8	314	23.4	323	23.9	330
	123.0	346	127.4	345	131.2	345	134.6	345	137.4	345
	1942	0.750	1933	0.750	1937	0.750	1951	0.750	1976	0.750
390	20.4	281	21.1	292	21.8	301	22.4	310	22.9	317
	115.8	341	120.2	341	124.0	341	127.3	341	130.2	340
	2173	0.750	2130	0.750	2104	0.750	2092	0.750	2091	0.750
370	19.5	270	20.2	280	20.9	289	21.5	298	22.0	305
	109.4	337	113.5	337	117.2	336	120.5	336	123.3	336
	2364	0.750	2296	0.750	2244	0.750	2205	0.750	2182	0.750
350	18.6	259	19.4	269	20.0	278	20.6	286	21.1	293
	103.1	332	107.1	332	110.6	332	113.7	332	116.5	332
	1994	0.741	1928	0.741	1872	0.741	1827	0.741	1794	0.741
330	17.6	246	18.3	255	18.9	264	19.5	271	20.0	278
	95.9	327	99.7	326	103.0	326	105.9	326	108.5	326
	1992	0.711	1925	0.711	1870	0.711	1824	0.711	1789	0.711
310	16.6	233	17.3	242	17.9	250	18.4	257	18.8	264
	89.0	321	92.4	321	95.5	321	98.3	321	100.7	321
	1974	0.682	1909	0.682	1855	0.682	1810	0.682	1773	0.682
290	15.6	219	16.2	228	16.8	236	17.3	243	17.7	249
	82.2	316	85.4	316	88.3	316	90.8	316	93.1	316
	1959	0.655	1896	0.655	1842	0.655	1796	0.655	1757	0.655
250	13.5	193	14.1	201	14.6	208	15.0	214	15.4	219
	69.0	306	71.8	306	74.3	306	76.5	306	78.4	306
	1924	0.604	1857	0.604	1802	0.604	1756	0.604	1718	0.604
200	11.0	159	11.4	166	11.8	171	12.2	176	12.5	181
	53.7	294	55.9	294	57.8	294	59.6	294	61.1	294
	1949	0.547	1876	0.547	1815	0.547	1765	0.547	1725	0.547
150	8.3	123	8.7	129	9.0	133	9.3	137	9.5	141
	39.3	283	41.0	283	42.4	283	43.7	283	44.9	283
	1885	0.497	1813	0.497	1753	0.497	1704	0.497	1662	0.497
100	5.7	87	5.9	90	6.1	94	6.3	96	6.5	99
	25.7	273	26.8	273	27.8	273	28.7	273	29.4	273
	1840	0.452	1767	0.452	1707	0.452	1657	0.452	1615	0.452
50	2.9	48	3.0	50	3.1	51	3.2	53	3.3	54
	12.8	263	13.3	263	13.8	263	14.2	263	14.6	263
	1804	0.413	1730	0.413	1669	0.413	1618	0.413	1575	0.413

BD100_AEO_DES250_IMP_10_HW – 08/10/2003

Figure 04-07-01. Descent Data—0.75 M/250 KIAS (Sheet 6 of 8)



DESCENT 0.75 M /250 KIAS

IDLE THRUST
OR 3000 FPM
ENGINE BLEED ON
ENGINE AND WING A/I OFF

ISA + 20 C

30 % C.G.

MAXIMUM TRUE RATE OF DESCENT 3000 FPM

SEA LEVEL FINAL ALTITUDE

TIME(MIN) FUEL(LB)
DIST(NAM) ATAS(KTS)
ROD(FPM) MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	22		24		26		28		30	
450	18.3	260	19.6	277	20.8	293	21.8	308	22.9	323
	111.5	365	118.8	364	125.7	363	131.9	363	138.1	362
	1710	0.750	1671	0.750	1656	0.750	1668	0.750	1682	0.750
430	17.2	245	18.4	261	19.6	277	20.7	292	21.7	307
	103.2	359	110.2	359	117.0	358	123.2	358	129.3	357
	1903	0.750	1834	0.750	1787	0.750	1768	0.750	1751	0.750
410	16.3	232	17.4	247	18.6	263	19.6	277	20.6	292
	96.0	354	102.7	353	109.2	353	115.3	353	121.3	353
	2277	0.750	2163	0.750	2079	0.750	2022	0.750	1968	0.750
390	15.5	221	16.6	236	17.7	251	18.7	265	19.7	279
	89.9	349	96.3	349	102.5	348	108.4	348	114.1	348
	2698	0.750	2536	0.750	2410	0.750	2319	0.750	2231	0.750
370	14.7	211	15.8	226	16.9	240	17.9	254	18.8	268
	84.5	344	90.7	344	96.6	344	102.2	343	107.7	343
	2746	0.750	2740	0.750	2676	0.750	2556	0.750	2439	0.750
350	14.0	200	15.1	215	16.1	230	17.1	243	18.0	257
	79.0	339	85.0	339	90.9	339	96.2	339	101.5	339
	2600	0.741	2425	0.741	2280	0.741	2168	0.741	2059	0.741
330	13.2	189	14.2	204	15.2	218	16.1	231	17.0	244
	73.3	333	79.0	333	84.4	333	89.4	333	94.4	333
	2599	0.711	2421	0.711	2275	0.711	2162	0.711	2051	0.711
310	12.5	179	13.4	193	14.3	206	15.2	219	16.0	231
	67.9	327	73.2	327	78.2	327	82.9	327	87.5	327
	2586	0.682	2406	0.682	2258	0.682	2145	0.682	2034	0.682
290	11.7	169	12.6	182	13.4	195	14.3	206	15.1	218
	62.6	322	67.5	322	72.1	322	76.5	322	80.7	322
	2570	0.655	2390	0.655	2242	0.655	2129	0.655	2019	0.655
250	10.1	148	10.9	160	11.6	171	12.4	181	13.1	192
	52.4	311	56.5	311	60.4	311	64.1	311	67.7	311
	2537	0.604	2358	0.604	2210	0.604	2095	0.604	1983	0.604
200	8.2	122	8.8	132	9.4	141	10.0	150	10.5	158
	40.6	299	43.8	299	46.9	299	49.7	299	52.6	299
	2597	0.547	2411	0.547	2256	0.547	2135	0.547	2017	0.547
150	6.2	95	6.7	103	7.2	110	7.6	116	8.0	123
	29.7	287	32.0	287	34.3	288	36.4	288	38.5	288
	2519	0.497	2337	0.497	2186	0.497	2067	0.497	1951	0.497
100	4.2	67	4.5	72	4.9	77	5.2	82	5.4	86
	19.4	277	20.9	277	22.4	277	23.8	277	25.2	277
	2509	0.452	2327	0.452	2175	0.452	2055	0.452	1938	0.452
50	2.2	36	2.3	39	2.5	42	2.7	44	2.8	47
	9.6	267	10.4	267	11.1	267	11.8	267	12.5	267
	2438	0.413	2260	0.413	2112	0.413	1994	0.413	1879	0.413

BD100_AEO_DES250_IMP_20_LW – 08/10/2003

Figure 04-07-01. Descent Data—0.75 M/250 KIAS (Sheet 7 of 8)

DESCENT 0.75 M /250 KIAS		
IDLE THRUST OR 3000 FPM ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30 % C.G.	MAXIMUM TRUE RATE OF DESCENT 3000 FPM SEA LEVEL FINAL ALTITUDE TIME(MIN) FUEL(LB) DIST(NAM) ATAS(KTS) ROD(FPM) MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	32		34		36		38		40	
450	23.8	335	24.6	346	25.2	356	25.8	364	26.2	371
	143.2	361	147.7	361	151.4	360	154.5	360	157.0	359
	1715	0.750	1761	0.750	1824	0.750	1907	0.750	2011	0.750
430	22.6	320	23.4	331	24.1	341	24.7	349	25.2	357
	134.6	357	139.2	357	143.1	356	146.5	356	149.3	355
	1759	0.750	1779	0.750	1808	0.750	1850	0.750	1910	0.750
410	21.5	305	22.3	316	23.0	326	23.7	335	24.2	342
	126.5	352	131.1	352	135.1	352	138.6	352	141.5	351
	1940	0.750	1930	0.750	1931	0.750	1943	0.750	1966	0.750
390	20.6	292	21.3	303	22.0	313	22.7	322	23.2	329
	119.2	348	123.7	348	127.6	347	131.1	347	134.1	347
	2170	0.750	2126	0.750	2098	0.750	2084	0.750	2081	0.750
370	19.7	280	20.4	291	21.1	301	21.7	309	22.2	317
	112.6	343	116.9	343	120.7	343	124.1	343	127.1	343
	2355	0.750	2286	0.750	2233	0.750	2193	0.750	2169	0.750
350	18.8	269	19.6	279	20.2	289	20.8	297	21.3	304
	106.1	338	110.3	338	113.9	338	117.1	338	120.0	338
	1977	0.741	1910	0.741	1855	0.741	1809	0.741	1775	0.741
330	17.8	255	18.5	265	19.1	274	19.7	282	20.2	289
	98.7	333	102.6	333	106.0	333	109.0	332	111.7	332
	1969	0.711	1902	0.711	1847	0.711	1801	0.711	1766	0.711
310	16.8	242	17.5	251	18.0	260	18.6	268	19.0	274
	91.5	327	95.1	327	98.3	327	101.2	327	103.7	327
	1954	0.682	1889	0.682	1834	0.682	1789	0.682	1752	0.682
290	15.8	228	16.4	237	16.9	246	17.4	253	17.9	259
	84.5	322	87.9	322	90.9	322	93.5	322	95.9	322
	1940	0.655	1876	0.655	1822	0.655	1776	0.655	1737	0.655
250	13.7	201	14.2	209	14.7	216	15.2	223	15.6	228
	70.9	311	73.8	311	76.4	311	78.7	311	80.7	311
	1900	0.604	1833	0.604	1779	0.604	1733	0.604	1695	0.604
200	11.1	166	11.5	173	11.9	179	12.3	184	12.6	189
	55.1	299	57.4	299	59.4	299	61.2	299	62.8	299
	1927	0.547	1854	0.547	1794	0.547	1744	0.647	1704	0.547
150	8.4	129	8.8	134	9.1	139	9.4	144	9.6	147
	40.4	288	42.1	288	43.6	288	44.9	288	46.1	288
	1863	0.497	1792	0.497	1732	0.497	1683	0.497	1642	0.497
100	5.7	91	6.0	94	6.2	98	6.4	101	6.5	104
	26.4	277	27.5	277	28.5	277	29.4	277	30.2	277
	1848	0.452	1774	0.452	1713	0.452	1662	0.452	1619	0.452
50	2.9	49	3.1	51	3.2	53	3.3	55	3.4	56
	13.1	267	13.7	267	14.2	267	14.6	267	15.0	267
	1790	0.413	1717	0.413	1656	0.413	1605	0.413	1562	0.413

BD100_AEO_OES250_IMP_20_HW – 08/10/2003

Figure 04-07-01. Descent Data—0.75 M/250 KIAS (Sheet 8 of 8)

DESCENT 0.82 M /310/250 KIAS

IDLE THRUST OR 3000 FPM ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30 % C.G.	MAXIMUM TRUE RATE OF DESCENT 3000 FPM SEA LEVEL FINAL ALTITUDE TIME(MIN) FUEL(LB) DIST(NAM) ATAS(KTS) ROD(FPM) MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	22		24		26		28		30	
450	15.8	308	16.2	303	16.6	298	16.9	293	17.3	287
	100.9	383	102.9	381	104.7	379	106.3	377	107.9	375
	2534	0.820	2478	0.820	2469	0.820	2488	0.820	2512	0.820
430	15.1	298	15.4	293	15.8	288	16.2	282	16.5	277
	95.3	379	97.0	377	98.8	375	100.4	373	102.0	371
	2889	0.820	2756	0.820	2682	0.820	2661	0.820	2643	0.820
410	14.4	290	14.8	284	15.1	279	15.5	273	15.8	268
	90.3	376	91.9	373	93.5	371	95.0	369	96.5	367
	3145	0.820	3145	0.820	3137	0.820	3050	0.820	2970	0.820
390	13.8	280	14.1	275	14.5	270	14.8	265	15.1	259
	85.5	372	87.1	369	88.6	367	90.1	365	91.6	363
	3145	0.820	3145	0.820	3145	0.820	3145	0.820	3145	0.820
370	13.1	269	13.5	265	13.9	261	14.2	256	14.5	250
	80.6	368	82.2	365	83.8	363	85.3	361	86.7	359
	3145	0.820	3145	0.820	3145	0.820	3145	0.820	3145	0.820
350	12.5	256	12.9	253	13.2	249	13.5	244	13.9	240
	75.7	363	77.4	361	78.9	358	80.4	356	81.8	354
	3144	0.820	3144	0.820	3144	0.820	3144	0.820	3144	0.820
330	11.9	242	12.2	238	12.6	235	12.9	231	13.2	227
	70.8	358	72.4	355	74.0	353	75.5	351	76.9	349
	3141	0.820	3141	0.820	3141	0.820	3141	0.820	3141	0.820
310	11.2	225	11.6	222	11.9	219	12.3	216	12.6	212
	65.9	352	67.5	349	69.0	347	70.5	345	72.0	343
	3138	0.820	3138	0.820	3138	0.820	3138	0.820	3138	0.820
290	10.6	209	11.0	206	11.3	204	11.6	201	12.0	198
	60.9	345	62.5	342	64.1	340	65.5	338	67.0	336
	3136	0.799	3136	0.799	3136	0.799	3136	0.799	3136	0.799
250	9.3	179	9.7	178	10.0	177	10.4	176	10.7	174
	51.4	331	53.0	328	54.6	326	56.0	325	57.5	323
	3131	0.739	3131	0.739	3131	0.739	3131	0.739	3131	0.739
200	7.7	141	8.1	143	8.4	144	8.8	144	9.1	145
	40.2	312	41.8	310	43.4	309	44.9	307	46.3	306
	3126	0.672	3126	0.672	3126	0.672	3126	0.672	3126	0.672
150	6.1	104	6.5	107	6.8	110	7.2	113	7.5	115
	29.8	292	31.5	291	33.0	290	34.5	289	35.9	288
	3121	0.612	3121	0.612	3121	0.612	3121	0.612	3121	0.612
100	4.0	59	4.4	64	4.7	69	5.0	73	5.2	77
	17.7	262	19.1	263	20.5	263	21.7	263	23.0	263
	2563	0.452	2375	0.452	2220	0.452	2097	0.452	1978	0.452
50	2.1	33	2.3	35	2.4	38	2.6	40	2.7	42
	8.8	253	9.5	253	10.2	254	10.8	254	11.5	254
	2516	0.413	2331	0.413	2177	0.413	2055	0.413	1937	0.413

BD100_AEO_DES310_IMP_M10_LW – 08/10/2003

Figure 04-07-02. Descent Data—0.82 M/310/250 KIAS (Sheet 1 of 8)

DESCENT 0.82 M /310/250 KIAS

IDLE THRUST OR 3000 FPM ENGINE BLEED ON ENGINE AND WING A/I OFF

ISA – 10 C

30 % C.G.

MAXIMUM TRUE RATE OF DESCENT 3000 FPM

SEA LEVEL FINAL ALTITUDE

TIME(MIN) FUEL(LB)
DIST(NAM) ATAS(KTS)
ROD(FPM) MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	32		34		36		38		40	
450	17.6	281	17.8	274	18.0	266	18.3	261	18.6	262
	109.3	373	110.4	371	111.3	370	112.3	369	114.0	368
	2583	0.820	2680	0.820	2790	0.820	2917	0.820	3069	0.820
430	16.8	271	17.1	264	17.3	256	17.6	251	17.9	253
	103.4	369	104.6	368	105.7	366	107.0	365	108.9	364
	2651	0.820	2689	0.820	2756	0.820	2841	0.820	2939	0.820
410	16.1	261	16.4	255	16.6	247	16.9	242	17.3	244
	97.9	365	99.2	364	100.3	362	101.7	361	103.8	361
	2936	0.820	2918	0.820	2919	0.820	2948	0.820	3004	0.820
390	15.4	253	15.7	246	15.9	239	16.2	234	16.6	236
	92.9	361	94.1	360	95.2	358	96.6	357	98.7	357
	3140	0.820	3097	0.820	3065	0.820	3045	0.820	3048	0.820
370	14.8	244	15.1	238	15.3	231	15.6	226	16.0	228
	88.0	357	89.2	355	90.3	354	91.7	353	93.8	353
	3145	0.820	3145	0.820	3145	0.820	3145	0.820	3145	0.820
350	14.2	234	14.4	228	14.7	221	14.9	216	15.3	218
	83.2	352	84.4	351	85.5	350	86.8	349	88.9	348
	3144	0.820	3144	0.820	3144	0.820	3144	0.820	3144	0.820
330	13.5	221	13.8	216	14.0	209	14.3	205	14.7	207
	78.2	347	79.4	346	80.5	344	81.9	343	84.0	343
	3141	0.820	3141	0.820	3141	0.820	3141	0.820	3141	0.820
310	12.9	207	13.2	202	13.4	195	13.7	192	14.1	194
	73.3	341	74.5	340	75.6	339	76.9	338	79.0	337
	3138	0.820	3138	0.820	3138	0.820	3138	0.820	3138	0.820
290	12.3	194	12.5	190	12.8	184	13.0	181	13.4	184
	68.3	335	69.5	333	70.6	332	71.9	331	74.0	331
	3136	0.799	3136	0.799	3136	0.799	3133	0.799	3107	0.799
250	11.0	172	11.2	169	11.5	165	11.8	164	12.1	168
	58.8	321	60.0	320	61.1	319	62.4	319	64.4	319
	3131	0.739	3131	0.739	3131	0.739	3126	0.739	3084	0.739
200	9.4	145	9.6	144	9.9	143	10.1	143	10.5	147
	47.6	305	48.8	304	49.9	303	51.2	303	52.9	303
	3126	0.672	3126	0.672	3126	0.672	3115	0.672	3029	0.672
150	7.8	117	8.0	119	8.3	119	8.5	121	8.8	125
	37.3	288	38.5	287	39.6	287	40.8	287	42.1	287
	3121	0.612	3121	0.612	3119	0.612	3088	0.612	2959	0.612
100	5.5	81	5.7	84	5.9	87	6.1	90	6.3	92
	24.1	263	25.1	263	26.1	263	26.9	263	27.6	263
	1887	0.452	1812	0.452	1751	0.452	1700	0.452	1658	0.452
50	2.8	45	3.0	46	3.1	48	3.2	50	3.3	51
	12.0	254	12.6	254	13.0	254	13.4	254	13.8	254
	1845	0.413	1770	0.413	1708	0.413	1656	0.413	1613	0.413

BD100_AEO_DES310_IMP_M10_HW – 08/10/2003

Figure 04-07-02. Descent Data—0.82 M/310/250 KIAS (Sheet 2 of 8)

DESCENT 0.82 M /310/250 KIAS		
IDLE THRUST OR 3000 FPM ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30 % C.G.	MAXIMUM TRUE RATE OF DESCENT 3000 FPM SEA LEVEL FINAL ALTITUDE TIME(MIN) FUEL(LB) DIST(NAM) ATAS(KTS) ROD(FPM) MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	22		24		26		28		30	
450	16.3	333	16.7	327	17.1	322	17.5	316	17.8	310
	106.7	392	108.7	390	110.6	388	112.2	385	113.8	383
	2544	0.820	2484	0.820	2470	0.820	2485	0.820	2504	0.820
430	15.6	323	16.0	317	16.3	311	16.7	305	17.0	299
	101.0	388	102.7	386	104.5	384	106.1	381	107.7	379
	2902	0.820	2766	0.820	2687	0.820	2663	0.820	2641	0.820
410	14.9	313	15.3	308	15.6	302	16.0	296	16.3	290
	95.7	385	97.4	382	99.0	380	100.6	378	102.1	376
	3000	0.820	3000	0.820	2998	0.820	2980	0.820	2960	0.820
390	14.3	303	14.6	297	15.0	292	15.3	287	15.6	281
	90.5	381	92.2	378	93.8	376	95.3	374	96.9	372
	3000	0.820	3000	0.820	3000	0.820	3000	0.820	3000	0.820
370	13.6	290	14.0	286	14.3	281	14.6	276	15.0	271
	85.3	377	87.0	374	88.6	371	90.1	369	91.6	367
	3000	0.820	3000	0.820	3000	0.820	3000	0.820	3000	0.820
350	12.9	276	13.3	272	13.6	268	14.0	264	14.3	259
	80.1	372	81.8	369	83.4	367	84.9	364	86.4	362
	3000	0.820	3000	0.820	3000	0.820	3000	0.820	3000	0.820
330	12.3	260	12.6	257	13.0	253	13.3	249	13.6	245
	74.8	366	76.5	364	78.1	361	79.6	359	81.1	357
	3000	0.820	3000	0.820	3000	0.820	3000	0.820	3000	0.820
310	11.6	242	12.0	239	12.3	236	12.6	232	13.0	228
	69.5	360	71.2	357	72.8	355	74.3	353	75.8	351
	3000	0.820	3000	0.820	3000	0.820	3000	0.820	3000	0.820
290	10.9	224	11.3	222	11.6	219	12.0	216	12.3	213
	64.2	353	65.9	350	67.5	348	69.0	346	70.5	344
	3000	0.799	3000	0.799	3000	0.799	3000	0.799	3000	0.799
250	9.6	191	10.0	191	10.3	190	10.6	188	11.0	187
	54.0	338	55.7	336	57.3	333	58.8	332	60.4	330
	3000	0.739	3000	0.739	3000	0.739	3000	0.739	3000	0.739
200	7.9	151	8.3	152	8.6	153	9.0	154	9.3	154
	42.1	319	43.8	317	45.4	315	47.0	314	48.5	312
	3000	0.672	3000	0.672	3000	0.672	3000	0.672	3000	0.672
150	6.3	110	6.6	113	7.0	116	7.3	119	7.6	122
	31.1	298	32.8	297	34.4	296	35.9	295	37.5	294
	3000	0.612	3000	0.612	3000	0.612	3000	0.612	3000	0.612
100	4.1	62	4.4	67	4.7	71	5.0	76	5.3	80
	18.3	267	19.8	267	21.2	268	22.5	268	23.8	268
	2532	0.452	2347	0.452	2192	0.452	2071	0.452	1953	0.452
50	2.1	34	2.3	37	2.4	39	2.6	42	2.7	44
	9.1	258	9.8	258	10.5	258	11.2	258	11.8	258
	2488	0.413	2304	0.413	2151	0.413	2031	0.413	1913	0.413

BD100_AEO_OES310_IMP_00_LW – 08/10/2003

Figure 04-07-02. Descent Data—0.82 M/310/250 KIAS (Sheet 3 of 8)

DESCENT 0.82 M /310/250 KIAS		
IDLE THRUST OR 3000 FPM ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30 % C.G.	MAXIMUM TRUE RATE OF DESCENT 3000 FPM SEA LEVEL FINAL ALTITUDE TIME(MIN) FUEL(LB) DIST(NAM) ATAS(KTS) ROD(FPM) MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	32		34		36		38		40	
450	18.1	303	18.4	296	18.6	288	18.8	280	19.0	278
	115.1	382	116.2	380	117.1	378	117.9	377	119.2	376
	2570	0.820	2662	0.820	2767	0.820	2882	0.820	2967	0.820
430	17.3	293	17.6	286	17.8	278	18.1	271	18.4	268
	109.1	378	110.4	376	111.4	375	112.5	374	113.9	372
	2645	0.820	2678	0.820	2741	0.820	2822	0.820	2914	0.820
410	16.6	283	16.9	276	17.1	269	17.4	261	17.7	260
	103.5	374	104.7	372	105.9	371	107.0	370	108.6	369
	2924	0.820	2902	0.820	2900	0.820	2926	0.820	2979	0.820
390	15.9	274	16.2	268	16.5	260	16.7	253	17.0	251
	98.2	370	99.5	368	100.6	367	101.7	366	103.3	365
	3000	0.820	3000	0.820	3000	0.820	3000	0.820	3000	0.820
370	15.3	265	15.5	258	15.8	251	16.0	244	16.3	242
	93.0	365	94.2	364	95.4	362	96.5	361	98.1	360
	3000	0.820	3000	0.820	3000	0.820	3000	0.820	3000	0.820
350	14.6	253	14.9	247	15.1	240	15.4	233	15.7	231
	87.8	361	89.0	359	90.1	358	91.3	357	92.9	356
	3000	0.820	3000	0.820	3000	0.820	3000	0.820	3000	0.820
330	13.9	239	14.2	234	14.5	227	14.7	220	15.0	219
	82.5	355	83.8	354	84.9	352	86.0	351	87.6	351
	3000	0.820	3000	0.820	3000	0.820	3000	0.820	3000	0.820
310	13.3	224	13.5	218	13.8	212	14.0	206	14.3	205
	77.2	349	78.4	348	79.6	346	80.7	345	82.3	345
	3000	0.820	3000	0.820	3000	0.820	3000	0.820	3000	0.820
290	12.6	209	12.9	205	13.1	199	13.4	194	13.7	193
	71.9	342	73.1	341	74.3	340	75.4	339	77.0	338
	3000	0.799	3000	0.799	3000	0.799	3000	0.799	3000	0.799
250	11.3	185	11.5	182	11.8	178	12.0	174	12.3	176
	61.7	329	63.0	327	64.1	326	65.2	325	66.8	325
	3000	0.739	3000	0.739	3000	0.739	3000	0.739	3000	0.739
200	9.6	154	9.9	154	10.1	153	10.4	151	10.7	154
	49.8	311	51.1	310	52.2	310	53.3	309	54.9	309
	3000	0.672	3000	0.672	3000	0.672	2996	0.672	2962	0.672
150	7.9	124	8.2	126	8.5	127	8.7	127	9.0	131
	38.8	293	40.1	293	41.2	292	42.3	292	43.6	292
	3000	0.612	3000	0.612	3000	0.612	2990	0.612	2899	0.612
100	5.6	84	5.8	88	6.0	91	6.2	94	6.4	96
	25.0	268	26.0	268	27.0	268	27.8	268	28.6	268
	1862	0.452	1788	0.452	1728	0.452	1677	0.452	1635	0.452
50	2.9	46	3.0	48	3.1	50	3.2	51	3.3	53
	12.4	258	12.9	258	13.4	258	13.8	258	14.2	258
	1823	0.413	1748	0.413	1686	0.413	1635	0.413	1592	0.413

BD100_AEO_DES310_IMP_00_HW – 08/10/2003

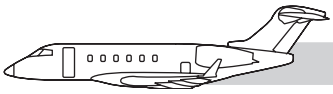
Figure 04-07-02. Descent Data—0.82 M/310/250 KIAS (Sheet 4 of 8)

DESCENT 0.82 M /310/250 KIAS		
IDLE THRUST OR 3000 FPM ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30 % C.G.	MAXIMUM TRUE RATE OF DESCENT 3000 FPM SEA LEVEL FINAL ALTITUDE TIME(MIN) FUEL(LB) DIST(NAM) ATAS(KTS) ROD(FPM) MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	22		24		26		28		30	
450	16.8	358	17.2	351	17.6	345	18.0	339	18.3	332
	112.6	401	114.6	399	116.4	396	118.1	394	119.7	392
	2549	0.820	2486	0.820	2468	0.820	2479	0.820	2494	0.820
430	16.1	347	16.5	341	16.8	334	17.2	328	17.5	321
	106.7	398	108.5	395	110.2	393	111.8	390	113.4	388
	2862	0.820	2776	0.820	2694	0.820	2666	0.820	2640	0.820
410	15.4	337	15.8	331	16.1	325	16.5	318	16.8	312
	101.2	394	102.9	391	104.6	389	106.1	386	107.7	384
	2868	0.820	2868	0.820	2868	0.820	2868	0.820	2868	0.820
390	14.7	325	15.1	320	15.4	314	15.8	308	16.1	302
	95.6	390	97.3	387	99.0	385	100.6	382	102.1	380
	2868	0.820	2868	0.820	2868	0.820	2868	0.820	2868	0.820
370	14.0	312	14.4	307	14.7	302	15.1	296	15.4	291
	90.0	385	91.7	383	93.4	380	95.0	378	96.5	376
	2868	0.820	2868	0.820	2868	0.820	2868	0.820	2868	0.820
350	13.3	296	13.7	292	14.0	287	14.4	282	14.7	277
	84.4	380	86.1	378	87.8	375	89.4	373	90.9	371
	2869	0.820	2869	0.820	2869	0.820	2869	0.820	2869	0.820
330	12.6	279	13.0	275	13.4	271	13.7	266	14.0	262
	78.8	374	80.5	372	82.2	369	83.8	367	85.3	365
	2871	0.820	2871	0.820	2871	0.820	2871	0.820	2871	0.820
310	11.9	259	12.3	256	12.7	252	13.0	248	13.3	244
	73.1	368	74.8	365	76.5	363	78.1	361	79.6	359
	2873	0.820	2873	0.820	2873	0.820	2873	0.820	2873	0.820
290	11.2	239	11.6	237	12.0	234	12.3	231	12.6	227
	67.4	360	69.2	358	70.8	355	72.4	353	74.0	351
	2875	0.799	2875	0.799	2875	0.799	2875	0.799	2875	0.799
250	9.8	204	10.2	203	10.6	201	10.9	200	11.2	198
	56.6	345	58.3	343	60.0	341	61.6	339	63.1	337
	2879	0.739	2879	0.739	2879	0.739	2879	0.739	2879	0.739
200	8.1	159	8.5	161	8.8	162	9.2	162	9.5	163
	44.0	326	45.7	324	47.4	322	49.0	320	50.5	319
	2884	0.672	2884	0.672	2884	0.672	2884	0.672	2884	0.672
150	6.4	115	6.7	118	7.1	122	7.4	124	7.8	127
	32.3	304	34.0	303	35.7	302	37.3	301	38.8	300
	2888	0.612	2888	0.612	2888	0.612	2888	0.612	2888	0.612
100	4.2	64	4.5	69	4.8	73	5.1	78	5.4	83
	18.8	272	20.3	272	21.8	272	23.2	272	24.5	272
	2503	0.452	2320	0.452	2166	0.452	2047	0.452	1929	0.452
50	2.1	35	2.3	38	2.5	40	2.6	43	2.8	45
	9.3	262	10.1	263	10.8	263	11.5	263	12.2	263
	2465	0.413	2282	0.413	2130	0.413	2011	0.413	1894	0.413

BD100_AEO_DES310_IMP_10_LW – 08/10/2003

Figure 04-07-02. Descent Data—0.82 M/310/250 KIAS (Sheet 5 of 8)



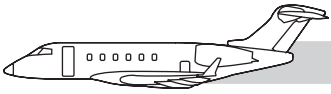
DESCENT 0.82 M /310/250 KIAS

IDLE THRUST OR 3000 FPM ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C	MAXIMUM TRUE RATE OF DESCENT 3000 FPM
		SEA LEVEL FINAL ALTITUDE
	30 % C.G.	TIME(MIN) FUEL(LB) DIST(NAM) ATAS(KTS) ROD(FPM) MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	32		34		36		38		40	
450	18.6	325	18.9	318	19.1	310	19.3	302	19.5	298
	121.1	390	122.2	389	123.1	387	123.9	386	125.1	385
	2555	0.820	2643	0.820	2743	0.820	2848	0.820	2862	0.820
430	17.8	315	18.1	307	18.4	300	18.6	292	18.8	287
	114.9	386	116.2	385	117.3	383	118.3	382	119.5	381
	2640	0.820	2669	0.820	2728	0.820	2800	0.820	2848	0.820
410	17.1	305	17.4	298	17.6	290	17.9	283	18.1	278
	109.1	382	110.4	381	111.5	379	112.6	378	113.9	377
	2868	0.820	2868	0.820	2868	0.820	2868	0.820	2868	0.820
390	16.4	295	16.7	288	16.9	281	17.2	273	17.4	268
	103.5	378	104.8	377	106.0	375	107.0	374	108.4	373
	2868	0.820	2868	0.820	2868	0.820	2868	0.820	2868	0.820
370	15.7	284	16.0	278	16.2	270	16.5	263	16.7	258
	97.9	374	99.2	372	100.4	371	101.5	370	102.8	369
	2868	0.820	2868	0.820	2868	0.820	2868	0.820	2868	0.820
350	15.0	272	15.3	265	15.5	258	15.8	251	16.0	246
	92.4	369	93.6	367	94.8	366	95.9	365	97.2	364
	2869	0.820	2869	0.820	2869	0.820	2869	0.820	2869	0.820
330	14.3	256	14.6	250	14.8	244	15.1	237	15.3	232
	86.7	363	88.0	362	89.2	360	90.2	359	91.6	358
	2871	0.820	2871	0.820	2871	0.820	2871	0.820	2871	0.820
310	13.6	239	13.9	234	14.2	228	14.4	221	14.6	217
	81.1	357	82.3	355	83.5	354	84.6	353	85.9	352
	2873	0.820	2873	0.820	2873	0.820	2873	0.820	2873	0.820
290	12.9	223	13.2	219	13.5	213	13.7	208	13.9	204
	75.4	350	76.7	348	77.8	347	78.9	346	80.2	345
	2875	0.799	2875	0.799	2875	0.799	2875	0.799	2875	0.799
250	11.5	196	11.8	193	12.1	190	12.3	186	12.6	184
	64.6	336	65.8	334	67.0	333	68.1	332	69.4	332
	2879	0.739	2879	0.739	2879	0.739	2879	0.739	2879	0.739
200	9.8	163	10.1	162	10.3	161	10.6	159	10.8	160
	51.9	318	53.2	317	54.4	316	55.5	315	56.8	315
	2884	0.672	2884	0.672	2884	0.672	2884	0.672	2884	0.672
150	8.1	129	8.4	131	8.6	132	8.8	133	9.1	135
	40.3	299	41.5	299	42.7	298	43.8	298	45.0	298
	2888	0.612	2888	0.612	2888	0.612	2884	0.612	2839	0.612
100	5.7	87	5.9	90	6.1	94	6.3	97	6.5	99
	25.7	273	26.8	273	27.8	273	28.7	273	29.5	273
	1840	0.452	1766	0.452	1706	0.452	1656	0.452	1614	0.452
50	2.9	48	3.0	50	3.2	51	3.3	53	3.3	54
	12.8	263	13.3	263	13.8	263	14.2	263	14.6	263
	1804	0.413	1730	0.413	1668	0.413	1617	0.413	1574	0.413

BD100 AEO_DES310_IMP_10_HW – 08/10/2003

Figure 04-07-02. Descent Data—0.82 M/310/250 KIAS (Sheet 6 of 8)



DESCENT 0.82 M /310/250 KIAS

IDLE THRUST OR 3000 FPM ENGINE BLEED ON ENGINE AND WING A/I OFF

ISA + 20 C

30 % C.G.

MAXIMUM TRUE RATE OF DESCENT 3000 FPM

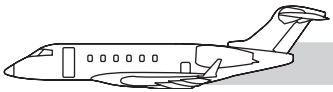
SEA LEVEL FINAL ALTITUDE

TIME(MIN) FUEL(LB)
DIST(NAM) ATAS(KTS)
ROD(FPM) MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	22		24		26		28		30	
450	17.3	386	17.7	379	18.1	372	18.5	366	18.8	359
	118.6	410	120.5	408	122.4	405	124.0	403	125.7	401
	2558	0.820	2491	0.820	2469	0.820	2476	0.820	2487	0.820
430	16.6	375	17.0	368	17.3	362	17.7	355	18.0	348
	112.5	407	114.3	404	116.0	401	117.6	399	119.3	397
	2746	0.820	2743	0.820	2695	0.820	2664	0.820	2634	0.820
410	15.9	364	16.2	357	16.6	351	16.9	344	17.3	338
	106.6	403	108.3	400	110.1	398	111.7	395	113.3	393
	2746	0.820	2746	0.820	2746	0.820	2746	0.820	2746	0.820
390	15.1	351	15.5	345	15.9	339	16.2	333	16.6	326
	100.6	399	102.4	396	104.1	393	105.7	391	107.3	389
	2746	0.820	2746	0.820	2746	0.820	2746	0.820	2746	0.820
370	14.4	336	14.8	331	15.2	326	15.5	320	15.8	314
	94.7	394	96.4	391	98.1	389	99.8	386	101.4	384
	2746	0.820	2746	0.820	2746	0.820	2746	0.820	2746	0.820
350	13.7	319	14.1	315	14.4	310	14.8	305	15.1	300
	88.7	389	90.5	386	92.2	383	93.8	381	95.4	379
	2749	0.820	2749	0.820	2749	0.820	2749	0.820	2749	0.820
330	13.0	300	13.3	296	13.7	292	14.0	287	14.4	282
	82.7	383	84.5	380	86.2	378	87.8	375	89.4	373
	2753	0.820	2753	0.820	2753	0.820	2753	0.820	2753	0.820
310	12.2	278	12.6	275	13.0	271	13.3	267	13.6	263
	76.7	376	78.4	373	80.1	371	81.8	369	83.4	366
	2757	0.820	2757	0.820	2757	0.820	2757	0.820	2757	0.820
290	11.5	257	11.9	254	12.2	252	12.6	248	12.9	245
	70.6	368	72.4	366	74.1	363	75.7	361	77.3	359
	2761	0.799	2761	0.799	2761	0.799	2761	0.799	2761	0.799
250	10.1	218	10.4	217	10.8	216	11.1	214	11.5	213
	59.1	353	60.9	350	62.6	348	64.2	346	65.8	344
	2768	0.739	2768	0.739	2768	0.739	2768	0.739	2768	0.739
200	8.3	170	8.6	171	9.0	172	9.3	173	9.7	174
	45.8	332	47.5	330	49.2	328	50.9	327	52.5	325
	2777	0.672	2777	0.672	2777	0.672	2777	0.672	2777	0.672
150	6.5	122	6.8	126	7.2	129	7.5	132	7.9	135
	33.4	310	35.2	309	36.9	308	38.5	306	40.1	306
	2785	0.612	2785	0.612	2785	0.612	2785	0.612	2785	0.612
100	4.2	66	4.5	72	4.8	77	5.1	81	5.4	86
	19.3	277	20.8	277	22.3	277	23.7	277	25.1	277
	2521	0.452	2335	0.452	2179	0.452	2058	0.452	1939	0.452
50	2.2	36	2.3	39	2.5	42	2.7	44	2.8	47
	9.6	267	10.4	267	11.1	267	11.8	267	12.5	267
	2450	0.413	2268	0.413	2116	0.413	1997	0.413	1881	0.413

BD100_AEO_DES310_IMP_20_LW – 08/10/2003

Figure 04-07-02. Descent Data—0.82 M/310/250 KIAS (Sheet 7 of 8)



DESCENT 0.82 M /310/250 KIAS

IDLE THRUST OR 3000 FPM ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C	MAXIMUM TRUE RATE OF DESCENT 3000 FPM
		SEA LEVEL FINAL ALTITUDE
	30 % C.G.	TIME(MIN) FUEL(LB) DIST(NAM) ATAS(KTS) ROD(FPM) MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	32		34		36		38		40	
450	19.1	352	19.4	344	19.6	336	19.8	329	20.0	323
	127.1	399	128.3	397	129.2	396	130.2	395	131.3	393
	2544	0.820	2628	0.820	2717	0.820	2746	0.820	2746	0.820
430	18.3	341	18.6	333	18.9	326	19.1	318	19.3	312
	120.7	395	122.0	394	123.2	392	124.3	391	125.4	390
	2631	0.820	2657	0.820	2709	0.820	2746	0.820	2746	0.820
410	17.6	330	17.9	323	18.1	315	18.3	308	18.6	301
	114.7	391	116.0	390	117.2	388	118.3	387	119.4	386
	2746	0.820	2746	0.820	2746	0.820	2746	0.820	2746	0.820
390	16.9	319	17.1	312	17.4	305	17.6	297	17.8	290
	108.8	387	110.1	385	111.3	384	112.4	383	113.5	382
	2746	0.820	2746	0.820	2746	0.820	2746	0.820	2746	0.820
370	16.1	307	16.4	300	16.7	293	16.9	286	17.1	279
	102.8	382	104.1	381	105.3	379	106.4	378	107.5	377
	2746	0.820	2746	0.820	2746	0.820	2746	0.820	2746	0.820
350	15.4	293	15.7	287	15.9	280	16.2	273	16.4	266
	96.8	377	98.2	375	99.4	374	100.4	373	101.6	372
	2749	0.820	2749	0.820	2749	0.820	2749	0.820	2749	0.820
330	14.7	277	15.0	271	15.2	264	15.4	257	15.7	250
	90.9	371	92.2	370	93.4	368	94.5	367	95.6	366
	2753	0.820	2753	0.820	2753	0.820	2753	0.820	2753	0.820
310	14.0	258	14.2	252	14.5	246	14.7	240	14.9	233
	84.8	365	86.1	363	87.3	362	88.4	361	89.5	360
	2757	0.820	2757	0.820	2757	0.820	2757	0.820	2757	0.820
290	13.2	241	13.5	236	13.8	230	14.0	225	14.2	219
	78.8	357	80.1	356	81.3	355	82.4	353	83.5	353
	2761	0.799	2761	0.799	2761	0.799	2761	0.799	2761	0.799
250	11.8	210	12.1	207	12.3	204	12.5	200	12.8	197
	67.3	343	68.6	341	69.8	340	70.9	339	72.0	338
	2768	0.739	2768	0.739	2768	0.739	2768	0.739	2768	0.739
200	10.0	174	10.3	173	10.5	172	10.7	171	11.0	170
	53.9	324	55.2	323	56.4	322	57.5	321	58.6	321
	2777	0.672	2777	0.672	2777	0.672	2777	0.672	2777	0.672
150	8.2	137	8.5	139	8.7	141	8.9	142	9.2	143
	41.6	305	42.9	304	44.1	304	45.2	303	46.3	303
	2785	0.612	2785	0.612	2785	0.612	2784	0.612	2783	0.612
100	5.7	91	6.0	94	6.2	96	6.4	101	6.5	104
	26.4	277	27.5	277	28.5	277	29.4	277	30.2	277
	1848	0.452	1773	0.452	1712	0.452	1661	0.452	1618	0.452
50	2.9	49	3.1	51	3.2	53	3.3	55	3.4	56
	13.1	267	13.7	267	14.2	267	14.6	267	15.0	267
	1791	0.413	1717	0.413	1655	0.413	1604	0.413	1561	0.413

BD100_AEO_DES310_IMP_20_HW – 08/10/2003

Figure 04-07-02. Descent Data—0.82 M/310/250 KIAS (Sheet 8 of 8)

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HOLDING DATA

All engine operating holding data are provided for typical holding altitudes for Minimum Drag speed (VMD) and 200 KIAS. The holding data are presented in tabular form from sea level to Flight Level 310 and -10, 0, 5, 10, 15 and 20°C deviations from ISA. Holding data are based on power for level flight without exceeding Maximum Cruise Thrust (MCR) with engine bleed on and anti-ice off.

The following data are presented for each holding speed.

- %N1: Fan speed setting in percent
- Fuel Flow: Fuel flow in pounds per hour
- IAS: Indicated airspeed in knots

Holding fuel flow data are based on linear holding (zero bank). For non-linear holding pattern correction factors to be applied to zero bank N1 and fuel flow data are given, at the end of this section, for bank angles up to 30 degrees.

N1 and fuel flow correction factors for C.G. variation relative to 30% MAC reference position are provided below:

N1 and FUEL FLOW CORRECTION FACTORS vs. C.G. POSITION.

C.G.	N1	Fuel Flow
20%	+ 2.00%	+ 4.00%
25%	+ 1.00%	+ 2.00%
REF (30%)	-	-
35%	- 0.50%	- 1.00%
40%	- 1.00%	- 2.00%

Example:

Associated conditions

- Flight Level = FL 250 (A)
- Aircraft gross weight = 30 000 lbs (B)
- Holding speed = V_{MD}
- Static air temperature = ISA-10°C
- Bank angle = 20 degrees (D)

From Figure 04-08-01, Sheet 1, the following data are obtained (C):

- N_1 setting = 61.5%
- Fuel flow = 1154 lbs/hr.
- Indicated airspeed = 160 kts

From Figure 04-08-03, enter the chart with the required bank angle and holding speed and read N_1 and fuel flow correction factors in percentage.

- ΔN_1 = 2.4% (E)
- Δ Fuel flow = 6.6% (F)

The corrected N1 and fuel flow values for a 20 degree bank angle are:

- N1 = 62.9% [61.5 x 1.024]
- Fuel flow = 1230 lbs [1154 x 1.066]

HOLDING VMD

MAX CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%N1 IAS (KTS)	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	22		24		26		28		30 (B)	
310	59.3	848	61.2	918	63.1	988	64.8	1054	66.6	1120
	137		143		150		155		160	
290	57.7	850	59.7	922	61.4	996	63.2	1064	64.9	1128
	137		143		149		155		160	
270	56.1	854	58.2	926	59.8	1002	61.5	1076	63.1	1142
	137		143		149		155		161	
250 (A)	54.6	860	56.6	932	58.2	1008	59.8	1082	61.5	(C) 1154
	136		143		149		154		160	
230	53.1	866	55.1	940	56.7	1012	58.3	1088	60.0	1160
	137		142		148		154		160	
210	51.6	876	53.6	946	55.3	1016	56.9	1086	58.6	1156
	137		143		148		154		159	
190	50.0	896	52.0	956	53.8	1020	55.5	1088	57.1	1154
	139		143		148		154		159	
170	47.8	904	50.7	972	52.4	1028	54.1	1090	55.7	1154
	141		145		149		154		159	
150	46.1	914	48.6	968	51.1	1038	52.6	1096	54.2	1158
	144		147		151		154		159	
130	46.2	956	48.1	1002	49.8	1058	51.3	1114	52.7	1174
	146		150		153		157		160	
100	45.1	1018	46.4	1064	47.8	1112	49.1	1164	50.5	1218
	151		154		157		160		164	
70	43.2	1126	44.7	1174	46.1	1220	47.3	1266	48.6	1312
	155		158		162		165		168	
50	42.6	1152	43.9	1196	45.1	1240	46.3	1286	47.6	1334
	159		162		165		168		170	
15	41.3	1220	42.4	1258	43.6	1300	44.7	1344	45.8	1388
	165		168		171		173		176	

bd100_aeo_holVMD_IMP_lw_m10 – 08/10/2003

Figure 04-08-01. Holding Data—Linear Holding—V_{MD} (Sheet 1 of 12)

HOLDING VMD		
MAX CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%N1 FUEL FLOW (LB/HR) IAS (KTS)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	32		34		36		38		40	
310	68.2	1184	69.7	1250	71.1	1318	72.3	1390	73.4	1466
	165		171		177		184		190	
290	66.5	1184	68.2	1248	69.5	1318	70.8	1392	72.0	1466
	165		170		175		181		187	
270	64.8	1200	66.4	1254	68.0	1320	69.2	1390	70.5	1466
	166		170		175		180		185	
250	63.1	1220	64.7	1272	66.3	1330	67.7	1392	68.9	1466
	166		171		175		180		184	
230	61.6	1226	63.1	1284	64.6	1340	66.1	1400	67.3	1468
	165		170		176		180		185	
210	60.1	1224	61.6	1286	63.1	1346	64.5	1408	65.7	1474
	165		170		175		180		185	
190	58.7	1220	60.2	1284	61.6	1350	62.9	1416	64.2	1482
	164		170		175		179		184	
170	57.2	1218	58.7	1284	60.1	1352	61.4	1420	62.6	1490
	164		169		174		179		184	
150	55.7	1222	57.2	1286	58.6	1354	59.9	1424	61.1	1494
	164		169		174		179		184	
130	54.2	1236	55.6	1300	57.0	1366	58.4	1434	59.6	1502
	164		169		174		179		183	
100	51.9	1272	53.3	1330	54.7	1392	56.0	1456	57.4	1522
	167		170		174		179		183	
70	50.0	1362	51.3	1416	52.6	1470	53.8	1524	55.1	1582
	171		174		177		180		184	
50	48.8	1382	50.1	1434	51.3	1488	52.5	1542	53.7	1600
	173		176		179		182		185	
15	47.0	1436	48.1	1486	49.3	1536	50.4	1590	51.5	1648
	179		181		184		187		190	

bd100_aeo_holVMD_IMP_hw_m10 – 08/10/2003

Figure 04-08-01. Holding Data—Linear Holding—V_{MD} (Sheet 2 of 12)

HOLDING VMD

MAX CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1 IAS (KTS)	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	22		24		26		28		30	
310	60.7	874	62.7	946	64.6	1018	66.4	1086	68.2	1154
	137		143		150		155		160	
290	59.0	876	61.1	950	62.8	1026	64.6	1098	66.4	1162
	137		143		149		155		160	
270	57.4	880	59.5	954	61.1	1032	62.9	1108	64.6	1176
	137		143		149		155		161	
250	55.8	884	57.9	958	59.6	1036	61.2	1112	62.9	1186
	136		143		149		154		160	
230	54.3	890	56.3	964	58.0	1040	59.7	1118	61.3	1190
	137		142		148		154		160	
210	52.8	900	54.7	972	56.5	1044	58.2	1116	59.9	1188
	137		143		148		154		159	
190	51.1	920	53.1	982	55.0	1048	56.7	1116	58.4	1184
	139		143		148		154		159	
170	48.9	926	51.8	996	53.5	1054	55.2	1118	56.8	1184
	141		145		149		154		159	
150	47.3	938	49.8	994	52.1	1064	53.7	1122	55.3	1186
	144		147		151		154		159	
130	47.2	978	49.1	1026	50.8	1084	52.3	1142	53.8	1202
	146		150		153		157		160	
100	45.9	1056	47.3	1102	48.7	1152	50.1	1204	51.6	1258
	151		154		157		160		164	
70	44.1	1154	45.6	1202	47.0	1250	48.3	1296	49.6	1346
	155		158		162		165		168	
50	43.4	1180	44.7	1226	46.0	1270	47.2	1316	48.5	1366
	159		162		165		168		170	
15	42.1	1248	43.2	1288	44.4	1332	45.5	1376	46.7	1422
	165		168		171		173		176	

bd100_aeo_holVMD_IMP_lw_00 - 08/10/2003

Figure 04-08-01. Holding Data—Linear Holding—V_{MD} (Sheet 3 of 12)

HOLDING VMD			
MAX CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1 IAS (KTS)	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	32		34		36		38		40	
310	69.8	1220	71.4	1288	72.7	1360	73.9	1434	75.1	1510
	165		171		177		184		190	
290	68.1	1218	69.8	1284	71.1	1358	72.4	1436	73.6	1512
	165		170		175		181		187	
270	66.3	1234	68.0	1290	69.5	1358	70.8	1432	72.1	1510
	166		170		175		180		185	
250	64.6	1252	66.2	1306	67.9	1366	69.2	1432	70.5	1508
	166		171		175		180		184	
230	63.0	1258	64.6	1318	66.1	1374	67.5	1438	68.8	1508
	165		170		176		180		185	
210	61.5	1256	63.0	1320	64.5	1380	65.9	1444	67.1	1514
	165		170		175		180		185	
190	60.0	1252	61.5	1318	62.9	1384	64.2	1452	65.5	1520
	164		170		175		179		184	
170	58.4	1250	59.9	1318	61.4	1388	62.7	1456	63.9	1528
	164		169		174		179		184	
150	56.9	1252	58.4	1320	59.8	1388	61.1	1460	62.4	1534
	164		169		174		179		184	
130	55.3	1266	56.8	1332	58.2	1400	59.6	1470	60.8	1540
	164		169		174		179		183	
100	53.0	1314	54.4	1374	55.8	1436	57.2	1500	58.5	1566
	167		170		174		179		183	
70	51.0	1398	52.3	1452	53.6	1506	54.9	1564	56.2	1622
	171		174		177		180		184	
50	49.8	1416	51.1	1468	52.3	1524	53.6	1580	54.8	1638
	173		176		179		182		185	
15	47.9	1470	49.0	1520	50.2	1574	51.4	1630	52.5	1688
	179		181		184		187		190	

bd100_aeo_holVMD_IMP_hw_00 – 08/10/2003

Figure 04-08-01. Holding Data—Linear Holding—V_{MD} (Sheet 4 of 12)

HOLDING VMD

MAX CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	%N1 IAS (KTS)	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	22		24		26		28		30	
310	61.4	886	63.4	960	65.3	1034	67.1	1104	68.9	1170
	137		143		150		155		160	
290	59.7	890	61.8	964	63.6	1042	65.4	1114	67.1	1180
	137		143		149		155		160	
270	58.0	892	60.2	968	61.8	1046	63.6	1124	65.3	1194
	137		143		149		155		161	
250	56.5	896	58.5	970	60.2	1048	61.9	1126	63.6	1200
	136		143		149		154		160	
230	54.9	902	56.9	978	58.6	1054	60.3	1132	62.0	1206
	137		142		148		154		160	
210	53.3	912	55.3	984	57.1	1058	58.8	1130	60.5	1202
	137		143		148		154		159	
190	51.6	932	53.7	994	55.6	1062	57.3	1130	59.0	1200
	139		143		148		154		159	
170	49.4	936	52.3	1008	54.1	1066	55.8	1132	57.4	1200
	141		145		149		154		159	
150	47.5	940	51.3	1018	52.7	1076	54.3	1136	55.9	1200
	144		147		151		154		159	
130	47.7	986	49.8	1040	51.3	1096	52.9	1154	54.4	1216
	146		150		153		157		160	
100	46.3	1076	47.7	1124	49.1	1176	50.6	1230	52.1	1284
	151		154		157		160		164	
70	44.6	1164	46.1	1210	47.4	1258	48.8	1304	50.1	1354
	155		158		162		165		168	
50	43.8	1192	45.1	1238	46.4	1282	47.7	1330	49.0	1378
	159		162		165		168		170	
15	42.5	1262	43.6	1304	44.8	1346	46.0	1392	47.1	1438
	165		168		171		173		176	

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Figure 04-08-01. Holding Data—Linear Holding—V_{MD} (Sheet 5 of 12)

HOLDING VMD			
MAX CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	%N1 IAS (KTS)	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	32		34		36		38		40	
310	70.6	1238	72.2	1308	73.6	1380	74.8	1458	75.9	1534
	165		171		177		184		190	
290	68.9	1238	70.5	1304	71.9	1380	73.2	1458	74.4	1536
	165		170		175		181		187	
270	67.1	1252	68.7	1310	70.3	1378	71.6	1454	72.9	1534
	166		170		175		180		185	
250	65.3	1268	66.9	1324	68.6	1384	69.9	1452	71.2	1530
	166		171		175		180		184	
230	63.7	1274	65.2	1334	66.8	1392	68.3	1458	69.5	1530
	165		170		176		180		185	
210	62.1	1272	63.6	1336	65.1	1398	66.6	1464	67.8	1534
	165		170		175		180		185	
190	60.6	1268	62.1	1336	63.5	1402	64.9	1470	66.2	1540
	164		170		175		179		184	
170	59.0	1266	60.6	1336	62.0	1406	63.3	1476	64.6	1548
	164		169		174		179		184	
150	57.5	1266	59.0	1336	60.4	1406	61.7	1478	63.0	1550
	164		169		174		179		184	
130	55.9	1280	57.4	1348	58.8	1418	60.2	1488	61.4	1560
	164		169		174		179		183	
100	53.6	1342	55.0	1402	56.4	1464	57.7	1528	59.0	1592
	167		170		174		179		183	
70	51.5	1406	52.8	1460	54.2	1516	55.5	1574	56.7	1634
	171		174		177		180		184	
50	50.3	1430	51.6	1482	52.8	1538	54.1	1594	55.3	1654
	173		176		179		182		185	
15	48.3	1488	49.5	1538	50.7	1592	51.9	1648	53.0	1708
	179		181		184		187		190	

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Figure 04-08-01. Holding Data—Linear Holding—V_{MD} (Sheet 6 of 12)

HOLDING VMD		
MAX CRUISE THRUST LIMITS **ENGINE BLEED ON** **ENGINE AND WING A/I OFF**	ISA + 10 C 30% C.G.	%N1 FUEL FLOW (LB/HR) IAS (KTS)

FLIGHT LEVEL	GROSS WEIGHT - 1000 LB									
	22		24		26		28		30	
310	62.0	898	64.1	976	66.0	1050	67.9	1122	69.7	1188
	137		143		150		155		160	
290	60.3	902	62.4	978	64.3	1058	66.1	1130	67.9	1196
	137		143		149		155		160	
270	58.7	904	60.9	982	62.4	1062	64.2	1140	66.0	1210
	137		143		149		155		161	
250	57.1	908	59.2	986	60.8	1066	62.4	1146	64.2	1222
	136		143		149		154		160	
230	55.5	914	57.6	992	59.2	1070	60.9	1150	62.6	1226
	137		142		148		154		160	
210	53.9	924	55.9	998	57.7	1072	59.4	1148	61.1	1222
	137		143		148		154		159	
190	52.2	942	54.3	1006	56.2	1076	57.9	1148	59.6	1220
	139		143		148		154		159	
170	50.3	948	52.9	1016	54.6	1080	56.3	1150	58.0	1220
	141		145		149		154		159	
150	47.9	936	51.5	1030	53.2	1088	54.8	1148	56.5	1214
	144		147		151		154		159	
130	48.2	994	50.3	1052	51.8	1108	53.4	1166	55.0	1230
	146		150		153		157		160	
100	46.7	1098	48.1	1150	49.6	1202	51.1	1258	52.6	1314
	151		154		157		160		164	
70	45.1	1172	46.5	1218	47.9	1264	49.3	1312	50.6	1362
	155		158		162		165		168	
50	44.3	1202	45.6	1246	46.9	1290	48.2	1336	49.5	1386
	159		162		165		168		170	
15	42.9	1276	44.0	1316	45.2	1360	46.4	1406	47.6	1454
	165		168		171		173		176	

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Figure 04-08-01. Holding Data—Linear Holding—V_{MD} (Sheet 7 of 12)

HOLDING VMD			
MAX CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1 IAS (KTS)	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	32		34		36		38		40	
310	71.4	1256	72.9	1328	74.3	1402	75.6	1480	76.8	1558
	165		171		177		184		190	
290	69.6	1256	71.3	1324	72.7	1400	74.0	1480	75.3	1560
	165		170		175		181		187	
270	67.8	1270	69.5	1328	71.0	1398	72.4	1478	73.7	1558
	166		170		175		180		185	
250	66.0	1290	67.7	1342	69.4	1402	70.7	1474	72.0	1554
	166		171		175		180		184	
230	64.4	1296	65.9	1352	67.5	1410	69.0	1476	70.2	1552
	165		170		176		180		185	
210	62.7	1292	64.3	1354	65.8	1416	67.2	1482	68.6	1554
	165		170		175		180		185	
190	61.2	1290	62.7	1356	64.2	1422	65.6	1490	66.9	1560
	164		170		175		179		184	
170	59.6	1288	61.1	1356	62.6	1426	64.0	1496	65.3	1566
	164		169		174		179		184	
150	58.1	1280	59.6	1350	61.0	1422	62.4	1496	63.7	1570
	164		169		174		179		184	
130	56.5	1296	58.0	1364	59.4	1434	60.7	1506	62.0	1578
	164		169		174		179		183	
100	54.1	1372	55.5	1430	56.9	1490	58.3	1554	59.6	1616
	167		170		174		179		183	
70	52.0	1414	53.4	1468	54.8	1524	56.0	1584	57.3	1644
	171		174		177		180		184	
50	50.8	1438	52.1	1490	53.4	1546	54.7	1604	55.9	1666
	173		176		179		182		185	
15	48.8	1502	50.0	1554	51.2	1610	52.3	1668	53.5	1730
	179		181		184		187		190	

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Figure 04-08-01. Holding Data—Linear Holding—V_{MD} (Sheet 8 of 12)

HOLDING VMD

MAX CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1 IAS (KTS)	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	22		24		26		28		30	
310	62.7	912	64.8	990	66.8	1066	68.6	1138	70.5	1208
	137		143		150		155		160	
290	61.0	914	63.1	994	65.0	1072	66.8	1148	68.7	1214
	137		143		149		155		160	
270	59.3	916	61.4	998	63.0	1080	64.9	1158	66.8	1228
	137		143		149		155		161	
250	57.7	920	59.9	1000	61.3	1082	63.0	1164	64.9	1238
	136		143		149		154		160	
230	56.1	926	58.1	1004	59.7	1084	61.5	1166	63.3	1240
	137		142		148		154		160	
210	54.5	936	56.5	1010	58.2	1088	59.9	1166	61.7	1240
	137		143		148		154		159	
190	52.8	952	54.9	1016	56.7	1092	58.4	1168	60.1	1242
	139		143		148		154		159	
170	50.9	956	53.4	1026	55.1	1096	56.9	1168	58.5	1240
	141		145		149		154		159	
150	47.9	928	52.0	1040	53.7	1100	55.4	1162	57.1	1228
	144		147		151		154		159	
130	48.8	1000	50.8	1064	52.4	1122	54.0	1184	55.5	1250
	146		150		153		157		160	
100	47.0	1120	48.5	1170	50.0	1222	51.5	1278	53.1	1334
	151		154		157		160		164	
70	45.5	1178	47.0	1226	48.4	1270	49.8	1316	51.2	1366
	155		158		162		165		168	
50	44.7	1208	46.0	1250	47.3	1296	48.6	1342	50.0	1392
	159		162		165		168		170	
15	43.3	1282	44.4	1322	45.6	1366	46.8	1412	48.0	1460
	165		168		171		173		176	

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Figure 04-08-01. Holding Data—Linear Holding—V_{MD} (Sheet 9 of 12)

HOLDING VMD			
MAX CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1 IAS (KTS)	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	32		34		36		38		40	
310	72.1	1278	73.7	1348	75.2	1424	76.4	1502	77.6	1582
	165		171		177		184		190	
290	70.4	1276	72.0	1346	73.5	1422	74.8	1502	76.1	1582
	165		170		175		181		187	
270	68.6	1284	70.3	1346	71.7	1420	73.1	1498	74.4	1580
	166		170		175		180		185	
250	66.8	1300	68.5	1356	70.0	1420	71.3	1496	72.7	1576
	166		171		175		180		184	
230	65.0	1304	66.7	1360	68.3	1424	69.7	1496	71.0	1574
	165		170		176		180		185	
210	63.3	1308	65.0	1370	66.5	1432	67.9	1500	69.3	1576
	165		170		175		180		185	
190	61.7	1310	63.3	1376	64.9	1440	66.3	1506	67.6	1578
	164		170		175		179		184	
170	60.1	1308	61.7	1376	63.2	1444	64.6	1512	66.0	1584
	164		169		174		179		184	
150	58.7	1298	60.2	1368	61.6	1440	63.0	1514	64.3	1588
	164		169		174		179		184	
130	57.1	1318	58.5	1386	59.9	1456	61.3	1526	62.6	1598
	164		169		174		179		183	
100	54.6	1390	56.0	1446	57.5	1508	58.8	1568	60.2	1632
	167		170		174		179		183	
70	52.6	1420	54.0	1474	55.3	1534	56.6	1594	57.9	1660
	171		174		177		180		184	
50	51.3	1444	52.6	1500	54.0	1558	55.2	1622	56.4	1688
	173		176		179		182		185	
15	49.2	1512	50.4	1566	51.6	1624	52.8	1690	53.9	1760
	179		181		184		187		190	

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Figure 04-08-01. Holding Data—Linear Holding—V_{MD} (Sheet 10 of 12)

HOLDING VMD			
MAX CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1 IAS (KTS)	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	22		24		26		28		30	
310	63.4	928	65.5	1006	67.5	1082	69.4	1156	71.2	1228
	137		143		150		155		160	
290	61.6	928	63.7	1008	65.6	1088	67.5	1162	69.4	1230
	137		143		149		155		160	
270	59.9	928	62.0	1012	63.7	1094	65.6	1172	67.6	1242
	137		143		149		155		161	
250	58.3	932	60.4	1014	61.9	1098	63.8	1180	65.7	1254
	136		143		149		154		160	
230	56.6	938	58.7	1018	60.4	1098	62.2	1178	64.0	1252
	137		142		148		154		160	
210	55.0	948	57.0	1024	58.8	1102	60.6	1180	62.3	1254
	137		143		148		154		159	
190	53.3	962	55.5	1030	57.2	1108	59.0	1184	60.6	1256
	139		143		148		154		159	
170	52.2	974	53.9	1040	55.6	1114	57.4	1188	59.0	1260
	141		145		149		154		159	
150	50.2	954	52.5	1054	54.3	1118	56.0	1182	57.6	1250
	144		147		151		154		159	
130	49.7	1014	51.3	1080	52.9	1142	54.5	1208	56.0	1274
	146		150		153		157		160	
100	47.2	1140	48.8	1188	50.4	1236	52.0	1290	53.6	1342
	151		154		157		160		164	
70	46.0	1182	47.5	1226	48.9	1270	50.3	1318	51.7	1370
	155		158		162		165		168	
50	45.0	1208	46.4	1252	47.7	1296	49.1	1344	50.4	1396
	159		162		165		168		170	
15	43.7	1288	44.8	1330	46.1	1374	47.3	1422	48.5	1470
	165		168		171		173		176	

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Figure 04-08-01. Holding Data—Linear Holding—V_{MD} (Sheet 11 of 12)

HOLDING VMD

MAX CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1 IAS (KTS)	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	32		34		36		38		40	
310	72.9	1296	74.5	1366	76.0	1444	77.2	1524	78.4	1606
	165		171		177		184		190	
290	71.1	1298	72.7	1368	74.3	1444	75.6	1524	76.9	1606
	165		170		175		181		187	
270	69.4	1302	70.9	1370	72.4	1442	73.9	1522	75.2	1604
	166		170		175		180		185	
250	67.5	1314	69.2	1376	70.6	1444	72.1	1520	73.5	1600
	166		171		175		180		184	
230	65.7	1316	67.4	1378	69.0	1448	70.4	1520	71.8	1596
	165		170		176		180		185	
210	64.0	1320	65.7	1384	67.2	1450	68.7	1522	70.0	1598
	165		170		175		180		185	
190	62.3	1324	64.0	1390	65.5	1456	67.0	1524	68.3	1600
	164		170		175		179		184	
170	60.6	1328	62.3	1394	63.9	1460	65.3	1530	66.6	1604
	164		169		174		179		184	
150	59.2	1320	60.7	1390	62.2	1460	63.6	1534	64.9	1610
	164		169		174		179		184	
130	57.5	1342	59.0	1412	60.5	1480	61.9	1548	63.3	1620
	164		169		174		179		183	
100	55.1	1396	56.7	1454	58.1	1512	59.4	1576	60.8	1642
	167		170		174		179		183	
70	53.2	1424	54.6	1482	55.9	1546	57.2	1612	58.4	1680
	171		174		177		180		184	
50	51.8	1452	53.3	1514	54.4	1584	55.6	1656	56.7	1728
	173		176		179		182		185	
15	49.7	1524	51.0	1580	52.1	1642	53.3	1710	54.4	1782
	179		181		184		187		190	

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Figure 04-08-01. Holding Data—Linear Holding—V_{MD} (Sheet 12 of 12)

HOLDING 200 KIAS			
MAX CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%N1	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	22		24		26		28		30	
310	66.2	1146	66.9	1172	67.7	1200	68.5	1230	69.2	1264
290	64.9	1162	65.5	1184	66.3	1208	67.1	1234	67.9	1266
270	63.4	1162	64.1	1204	64.8	1226	65.5	1250	66.3	1276
250	61.9	1198	62.6	1222	63.2	1244	64.0	1268	64.8	1292
230	60.6	1206	61.2	1230	61.9	1256	62.6	1282	63.4	1308
210	59.3	1210	59.9	1236	60.6	1262	61.3	1290	62.0	1318
190	58.1	1210	58.7	1236	59.3	1262	60.0	1292	60.6	1320
170	56.8	1210	57.4	1236	58.0	1264	58.6	1292	59.2	1322
150	55.3	1220	55.9	1246	56.5	1272	57.2	1300	57.8	1330
130	53.9	1238	54.5	1262	55.1	1290	55.7	1318	56.3	1346
100	51.5	1288	52.1	1310	52.7	1334	53.3	1358	54.0	1384
70	49.6	1358	50.2	1380	50.8	1404	51.4	1428	52.0	1452
50	48.4	1368	48.9	1390	49.5	1416	50.1	1440	50.7	1464
15	46.2	1406	46.7	1428	47.3	1452	47.9	1478	48.5	1504

bd100_aeo_hol200_IMP_lw_m10 – 08/10/2003

Figure 04-08-02. Holding Data—Linear Holding—200 KIAS (Sheet 1 of 12)

HOLDING 200 KIAS			
MAX CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%N1	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	32		34		36		38		40	
310	70.0	1300	70.9	1342	71.8	1388	72.6	1438	73.5	1488
290	68.6	1302	69.5	1346	70.4	1394	71.3	1442	72.1	1494
270	67.2	1308	68.0	1350	68.9	1398	69.8	1446	70.7	1498
250	65.6	1322	66.6	1358	67.5	1404	68.3	1450	69.2	1500
230	64.2	1340	65.1	1374	66.0	1414	66.8	1458	67.7	1506
210	62.8	1350	63.6	1386	64.5	1426	65.3	1468	66.2	1514
190	61.3	1354	62.2	1392	63.0	1432	63.8	1476	64.7	1522
170	59.9	1356	60.7	1398	61.5	1440	62.3	1484	63.2	1532
150	58.5	1364	59.3	1404	60.1	1448	60.9	1492	61.7	1540
130	57.0	1378	57.8	1418	58.6	1460	59.4	1502	60.2	1550
100	54.7	1414	55.5	1450	56.4	1488	57.3	1528	58.1	1572
70	52.7	1482	53.4	1516	54.2	1550	55.0	1586	55.8	1626
50	51.4	1494	52.1	1528	52.9	1564	53.7	1602	54.5	1642
15	49.1	1532	49.9	1568	50.6	1606	51.4	1644	52.2	1686

bd100_aeo_hol200_IMP_hw_m10 - 08/10/2003

Figure 04-08-02. Holding Data—Linear Holding—200 KIAS (Sheet 2 of 12)

HOLDING 200 KIAS			
MAX CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	22		24		26		28		30	
310	67.9	1182	68.6	1208	69.3	1236	70.1	1270	70.9	1304
290	66.4	1198	67.1	1220	67.9	1244	68.7	1272	69.5	1304
270	64.9	1214	65.6	1238	66.3	1260	67.1	1284	67.9	1312
250	63.4	1232	64.0	1256	64.7	1278	65.5	1302	66.3	1328
230	62.0	1238	62.6	1264	63.3	1290	64.0	1316	64.8	1344
210	60.7	1244	61.3	1270	61.9	1296	62.6	1324	63.4	1354
190	59.4	1242	60.0	1268	60.6	1298	61.3	1326	62.0	1356
170	58.0	1244	58.6	1270	59.3	1298	59.9	1328	60.5	1358
150	56.5	1252	57.1	1278	57.8	1306	58.4	1336	59.1	1366
130	55.1	1270	55.7	1294	56.3	1322	57.0	1350	57.6	1380
100	52.6	1336	53.2	1358	53.9	1384	54.5	1408	55.2	1434
70	50.7	1392	51.2	1414	51.9	1438	52.5	1464	53.1	1490
50	49.4	1404	49.9	1426	50.5	1450	51.1	1476	51.7	1502
15	47.1	1440	47.6	1462	48.2	1488	48.8	1514	49.4	1540

bd100_aeo_hol200_IMP_lw_00 – 08/10/2003

Figure 04-08-02. Holding Data—Linear Holding—200 KIAS (Sheet 3 of 12)

HOLDING 200 KIAS			
MAX CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	32		34		36		38		40	
310	71.7	1342	72.6	1384	73.4	1434	74.3	1484	75.2	1536
290	70.2	1342	71.1	1388	72.0	1438	72.9	1490	73.8	1542
270	68.8	1346	69.6	1390	70.5	1440	71.4	1492	72.4	1544
250	67.2	1358	68.2	1398	69.0	1444	69.9	1494	70.8	1546
230	65.7	1376	66.6	1412	67.5	1454	68.3	1498	69.2	1548
210	64.2	1386	65.0	1424	65.9	1464	66.8	1506	67.6	1554
190	62.7	1390	63.5	1430	64.3	1470	65.2	1514	66.1	1562
170	61.2	1392	62.0	1434	62.8	1478	63.7	1522	64.5	1572
150	59.8	1400	60.6	1442	61.4	1486	62.2	1530	63.0	1580
130	58.3	1414	59.1	1454	59.9	1498	60.7	1542	61.5	1590
100	55.9	1464	56.8	1498	57.6	1536	58.4	1576	59.2	1620
70	53.8	1518	54.5	1552	55.4	1590	56.1	1626	57.0	1668
50	52.4	1530	53.2	1566	54.0	1602	54.8	1640	55.6	1682
15	50.0	1570	50.8	1606	51.6	1644	52.4	1684	53.2	1728

bd100_aeo_hol200_IMP_hw_00 - 08/10/2003

Figure 04-08-02. Holding Data—Linear Holding—200 KIAS (Sheet 4 of 12)

HOLDING 200 KIAS			
MAX CRUISE THRUST LIMITS **ENGINE BLEED ON** **ENGINE AND WING A/I OFF**	ISA + 5 C 30% C.G.	%N1	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	22		24		26		28		30	
310	68.7	1202	69.4	1228	70.2	1258	71.0	1290	71.7	1324
290	67.2	1216	67.9	1238	68.7	1264	69.5	1292	70.3	1324
270	65.6	1234	66.3	1256	67.1	1278	67.8	1304	68.6	1332
250	64.1	1248	64.7	1272	65.4	1296	66.2	1320	67.0	1346
230	62.7	1254	63.3	1280	64.0	1306	64.7	1332	65.5	1362
210	61.3	1260	61.9	1286	62.6	1314	63.3	1342	64.1	1372
190	60.0	1260	60.6	1286	61.3	1314	61.9	1344	62.6	1374
170	58.6	1260	59.2	1286	59.9	1316	60.5	1344	61.1	1376
150	57.2	1268	57.8	1294	58.4	1322	59.0	1352	59.7	1382
130	55.7	1288	56.3	1314	56.9	1342	57.6	1370	58.2	1400
100	53.2	1364	53.8	1386	54.5	1412	55.1	1436	55.7	1462
70	51.2	1402	51.8	1424	52.4	1448	53.1	1474	53.7	1500
50	49.9	1418	50.5	1440	51.1	1466	51.7	1492	52.3	1516
15	47.5	1458	48.1	1480	48.7	1506	49.3	1532	49.9	1558

bd100_aeo_hol200_IMP_lw_05 – 08/10/2003

Figure 04-08-02. Holding Data—Linear Holding—200 KIAS (Sheet 5 of 12)

HOLDING 200 KIAS			
MAX CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	%N1	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	32		34		36		38		40	
310	72.5	1364	73.4	1408	74.3	1456	75.1	1506	76.0	1560
290	71.0	1364	71.9	1410	72.8	1462	73.7	1512	74.6	1564
270	69.5	1366	70.4	1412	71.3	1462	72.2	1514	73.1	1568
250	67.9	1378	68.9	1418	69.8	1464	70.6	1514	71.5	1568
230	66.4	1394	67.3	1430	68.2	1474	69.1	1520	69.9	1570
210	64.9	1404	65.7	1442	66.6	1482	67.5	1526	68.3	1576
190	63.3	1408	64.2	1448	65.0	1490	65.9	1534	66.8	1584
170	61.9	1412	62.7	1454	63.5	1498	64.3	1542	65.2	1592
150	60.4	1418	61.2	1460	62.0	1504	62.8	1548	63.7	1598
130	58.9	1434	59.7	1474	60.5	1518	61.3	1562	62.1	1610
100	56.4	1492	57.2	1526	58.0	1562	58.8	1600	59.7	1642
70	54.3	1528	55.1	1564	55.9	1602	56.7	1640	57.5	1680
50	53.0	1546	53.7	1582	54.6	1620	55.3	1658	56.1	1700
15	50.5	1588	51.3	1624	52.1	1664	52.8	1704	53.7	1750

bd100_aeo_hol200_IMP_hw_05 – 08/10/2003

Figure 04-08-02. Holding Data—Linear Holding—200 KIAS (Sheet 6 of 12)

HOLDING 200 KIAS			
MAX CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	22		24		26		28		30	
310	69.5	1222	70.2	1248	71.0	1278	71.7	1310	72.5	1346
290	68.0	1234	68.7	1258	69.5	1284	70.3	1314	71.0	1346
270	66.4	1252	67.1	1272	67.8	1296	68.6	1320	69.4	1350
250	64.8	1266	65.4	1288	66.2	1310	67.0	1336	67.8	1364
230	63.3	1274	63.9	1298	64.7	1324	65.5	1352	66.3	1380
210	61.9	1280	62.5	1304	63.2	1332	64.0	1362	64.8	1390
190	60.6	1280	61.2	1306	61.9	1336	62.6	1364	63.2	1394
170	59.2	1282	59.8	1310	60.5	1338	61.1	1368	61.8	1398
150	57.8	1282	58.4	1310	59.0	1338	59.7	1368	60.3	1398
130	56.3	1312	56.9	1336	57.5	1364	58.1	1394	58.8	1422
100	53.8	1380	54.4	1402	55.1	1428	55.7	1454	56.3	1480
70	51.8	1408	52.4	1432	53.0	1456	53.7	1482	54.3	1508
50	50.5	1426	51.0	1450	51.7	1476	52.3	1502	52.9	1528
15	48.0	1472	48.5	1496	49.1	1522	49.8	1548	50.4	1576

bd100_aeo_hol200_IMP_lw_10 – 08/10/2003

Figure 04-08-02. Holding Data—Linear Holding—200 KIAS (Sheet 7 of 12)

HOLDING 200 KIAS			
MAX CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	32		34		36		38		40	
310	73.3	1384	74.2	1428	75.1	1478	76.0	1530	76.9	1584
290	71.8	1386	72.7	1434	73.6	1484	74.5	1536	75.4	1588
270	70.3	1386	71.2	1434	72.1	1486	73.0	1538	73.9	1592
250	68.7	1396	69.6	1440	70.5	1486	71.4	1538	72.3	1592
230	67.1	1412	68.0	1450	68.9	1494	69.8	1540	70.7	1592
210	65.5	1422	66.4	1460	67.3	1502	68.2	1548	69.1	1598
190	64.0	1428	64.8	1468	65.7	1510	66.6	1554	67.5	1604
170	62.5	1434	63.3	1474	64.2	1518	65.0	1562	65.9	1612
150	61.0	1436	61.8	1478	62.6	1522	63.5	1568	64.3	1618
130	59.5	1456	60.3	1496	61.1	1538	61.9	1582	62.7	1630
100	57.1	1508	57.9	1544	58.7	1582	59.5	1620	60.4	1664
70	55.0	1538	55.8	1574	56.5	1614	57.3	1652	58.1	1694
50	53.6	1560	54.4	1596	55.1	1636	55.9	1674	56.7	1716
15	51.0	1606	51.8	1644	52.6	1684	53.3	1726	54.1	1772

bd100_aeo_hol200_IMP_hw_10 – 08/10/2003

Figure 04-08-02. Holding Data—Linear Holding—200 KIAS (Sheet 8 of 12)

HOLDING 200 KIAS			
MAX CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	22		24		26		28		30	
310	70.3	1244	71.0	1272	71.7	1302	72.5	1334	73.3	1368
290	68.8	1254	69.5	1278	70.2	1306	70.9	1336	71.7	1370
270	67.2	1266	67.9	1290	68.6	1316	69.4	1346	70.1	1376
250	65.5	1276	66.3	1300	67.0	1328	67.8	1356	68.6	1386
230	64.0	1286	64.7	1310	65.5	1338	66.3	1366	67.0	1394
210	62.5	1294	63.2	1320	64.0	1348	64.7	1376	65.4	1404
190	61.1	1300	61.8	1326	62.5	1356	63.2	1384	63.9	1412
170	59.8	1304	60.4	1330	61.1	1360	61.7	1388	62.4	1416
150	58.4	1298	59.0	1324	59.7	1354	60.3	1384	60.9	1416
130	56.8	1336	57.4	1362	58.0	1390	58.7	1418	59.3	1446
100	54.4	1392	55.0	1414	55.7	1440	56.3	1464	57.0	1490
70	52.5	1416	53.1	1440	53.7	1468	54.4	1494	55.0	1522
50	51.1	1438	51.7	1462	52.4	1490	53.0	1520	53.6	1548
15	48.5	1482	49.0	1506	49.6	1532	50.2	1560	50.9	1588

bd100_aeo_hol200_IMP_lw_15 – 08/10/2003

Figure 04-08-02. Holding Data—Linear Holding—200 KIAS (Sheet 9 of 12)

HOLDING 200 KIAS			
MAX CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	32		34		36		38		40	
310	74.2	1406	75.1	1452	75.9	1502	76.8	1554	77.7	1608
290	72.5	1410	73.5	1456	74.5	1506	75.3	1558	76.2	1612
270	71.0	1416	71.9	1460	72.8	1508	73.8	1560	74.7	1616
250	69.4	1422	70.3	1464	71.2	1510	72.1	1560	73.1	1616
230	67.9	1428	68.7	1468	69.6	1512	70.5	1562	71.4	1614
210	66.3	1438	67.1	1478	68.0	1520	68.9	1568	69.8	1620
190	64.7	1446	65.6	1486	66.4	1528	67.3	1574	68.2	1624
170	63.1	1452	64.0	1492	64.8	1534	65.7	1580	66.5	1630
150	61.6	1452	62.4	1496	63.3	1540	64.1	1588	65.0	1638
130	60.0	1478	60.8	1518	61.6	1558	62.5	1602	63.3	1650
100	57.7	1522	58.5	1558	59.3	1596	60.1	1636	61.0	1680
70	55.6	1552	56.4	1590	57.2	1630	57.9	1672	58.7	1716
50	54.2	1580	54.9	1620	55.6	1662	56.4	1704	57.2	1750
15	51.5	1620	52.2	1660	52.9	1704	53.7	1752	54.5	1802

bd100_aeo_hol200_IMP_hw_15 – 08/10/2003

Figure 04-08-02. Holding Data—Linear Holding—200 KIAS (Sheet 10 of 12)

HOLDING 200 KIAS			
MAX CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT - 1000 LB									
	22		24		26		28		30	
310	70.9	1268	71.6	1294	72.5	1322	73.3	1352	74.2	1388
290	69.5	1276	70.1	1300	70.8	1330	71.6	1360	72.4	1392
270	67.9	1286	68.5	1312	69.3	1342	70.0	1372	70.8	1402
250	66.3	1294	67.1	1322	67.8	1352	68.5	1382	69.2	1410
230	64.7	1298	65.5	1324	66.2	1352	67.0	1380	67.7	1410
210	63.2	1306	63.9	1332	64.7	1360	65.4	1388	66.1	1418
190	61.7	1316	62.5	1344	63.2	1370	63.9	1398	64.6	1428
170	60.3	1328	61.0	1354	61.7	1380	62.3	1406	63.0	1436
150	59.0	1324	59.6	1352	60.2	1380	60.8	1410	61.5	1440
130	57.2	1362	57.9	1386	58.5	1412	59.1	1438	59.7	1466
100	55.1	1396	55.7	1420	56.4	1444	57.0	1470	57.6	1498
70	53.2	1428	53.8	1454	54.4	1482	55.0	1510	55.5	1540
50	51.6	1448	52.3	1474	52.9	1502	53.4	1532	53.9	1560
15	49.0	1496	49.6	1520	50.2	1546	50.8	1574	51.4	1604

bd100_aeo_hol200_IMP_lw_20 - 08/10/2003

Figure 04-08-02. Holding Data—Linear Holding—200 KIAS (Sheet 11 of 12)

HOLDING 200 KIAS			
MAX CRUISE THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	32		34		36		38		40	
310	75.0	1426	75.8	1472	76.7	1526	77.6	1578	78.5	1634
290	73.4	1432	74.3	1478	75.2	1530	76.1	1582	77.0	1636
270	71.7	1438	72.6	1482	73.6	1530	74.5	1584	75.5	1642
250	70.0	1446	70.9	1486	71.9	1532	72.9	1584	73.8	1640
230	68.6	1446	69.4	1490	70.3	1536	71.3	1584	72.2	1640
210	67.0	1454	67.9	1496	68.7	1542	69.6	1590	70.5	1642
190	65.4	1462	66.3	1504	67.1	1546	67.9	1594	68.8	1646
170	63.8	1470	64.6	1510	65.5	1552	66.3	1600	67.1	1652
150	62.2	1474	63.0	1516	63.9	1560	64.7	1606	65.6	1660
130	60.5	1498	61.3	1536	62.2	1578	63.1	1620	64.0	1672
100	58.3	1528	59.1	1566	59.9	1606	60.8	1648	61.7	1694
70	56.1	1572	56.9	1612	57.6	1654	58.4	1696	59.2	1740
50	54.4	1596	55.2	1640	55.9	1688	56.7	1732	57.5	1780
15	51.9	1636	52.7	1678	53.5	1726	54.2	1774	55.0	1824

bd100_aeo_hol200_IMP_hw_20 – 08/10/2003

Figure 04-08-02. Holding Data—Linear Holding—200 KIAS (Sheet 12 of 12)

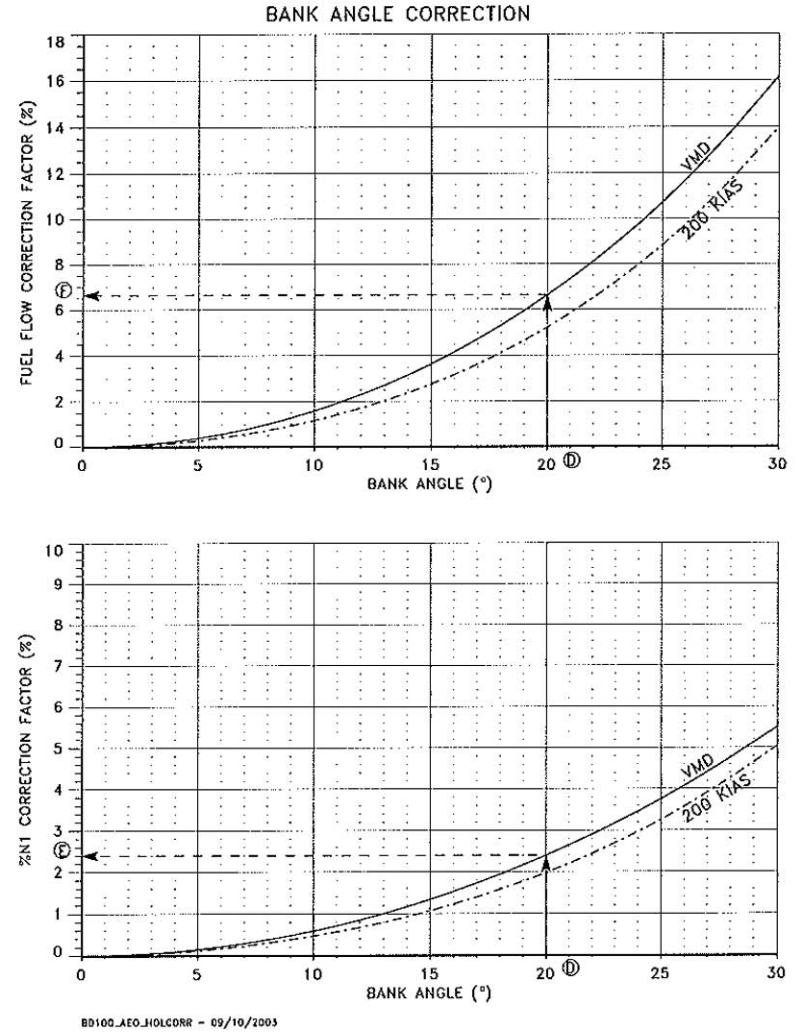

Figure 04-08-03. Holding Data—Bank Angle Correction

SINGLE ENGINE PERFORMANCE DATA

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CHAPTER 5
SINGLE ENGINE PERFORMANCE DATA

INTRODUCTION

This chapter provides performance data to be used in the event of an engine failure during flight.

In the event of an engine failure during flight a descent to a lower altitude must be expected. In order to maintain the highest possible altitude level, a driftdown procedure should be selected. This requires Climb Thrust (CLB rating) on the remaining engine and a driftdown speed close to best lift over drag ratio.

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DRIFTDOWN

The driftdown tabulated data are provided to determine time, distance and fuel consumed from point of engine failure to level-off altitude. The data are based on zero percent gross (actual) performance with single engine operation at Climb Thrust (CLB rating) with engine bleed on and anti-ice off.

The data is presented in tabular form, in Figure 05-02-02, as a function of aircraft weight and flight level for -10, 0, 5, 10, 15 and 20°C deviation from ISA. Driftdown speeds are based on AFM enroute climb speed (final segment) and are close to best lift over drag ratio. Level-off altitudes have been rounded off to the nearest 100 ft on the lower side.

For more conservatism and compatibility with AFM enroute climb gradient data, driftdown data are based on "minimum thrust" engine performance and the most forward C.G. position.

Driftdown tables show the following data:

- TIME: Time to level-off altitude in minutes
- DIST: Air distance in nautical air miles
- KIAS: Initial driftdown speed in knots
- LEVEL OFF: Level-off altitude in feet (gross ceiling)

In order to attain the driftdown performance data contained in this chapter the following driftdown procedure is recommended:

(1) At engine failure point, Climb power should be set on the operative engine and maintained during deceleration to driftdown speed.

(2) Deceleration to driftdown speed (Figure 05-02-01) should be performed at initial cruise altitude before start of driftdown. Driftdown data assume an initial cruise speed of 0.75 MI.

(3) Initiate driftdown to level-off altitude. Level off altitudes are based on 0% aircraft climb capability. Driftdown speed should be adjusted as function of altitude for optimum performance.

Airworthiness regulations require that terrain clearance flight planning be based on the net performance, which is the gross gradient performance degraded by 1.1% (two engine airplane). The certified enroute net ceiling data is presented in the AFM.

Example:

Associated conditions

- Cruise altitude at engine failure = FL 430 (A)
- Aircraft weight at engine failure = 32 000 lbs (B)
- Temperature deviation = ISA-10°C
- Average wind = -30 kt (headwind)

Using Figure 05-02-01, driftdown speed at start of driftdown is:

- Driftdown speed = 188 KIAS (C)

Using Figure 05-02-02, Sheet 1, the following data are obtained (D):

- Time to level-off altitude = 58.7 min.
- Air distance = 309 n.a.m.
- Fuel consumed = 1048 lbs
- Level-off altitude = 33 500 ft
- Initial driftdown speed = 188 KIAS

In wind conditions, the ground distance can be derived using the following equation:

Ground distance = [Air distance x (ATAS +/- Wind) / ATAS]

where: Wind convention "+" for tailwind and "-" for headwind

Average true airspeed (ATAS) = air distance / time

For the associated conditions above:

- Avg true airspeed during driftdown = 315.8 kts [(309 / 58.7) x 60]
- Ground distance = 279.6 n.m.[309 x (315.8-30)/315.8]

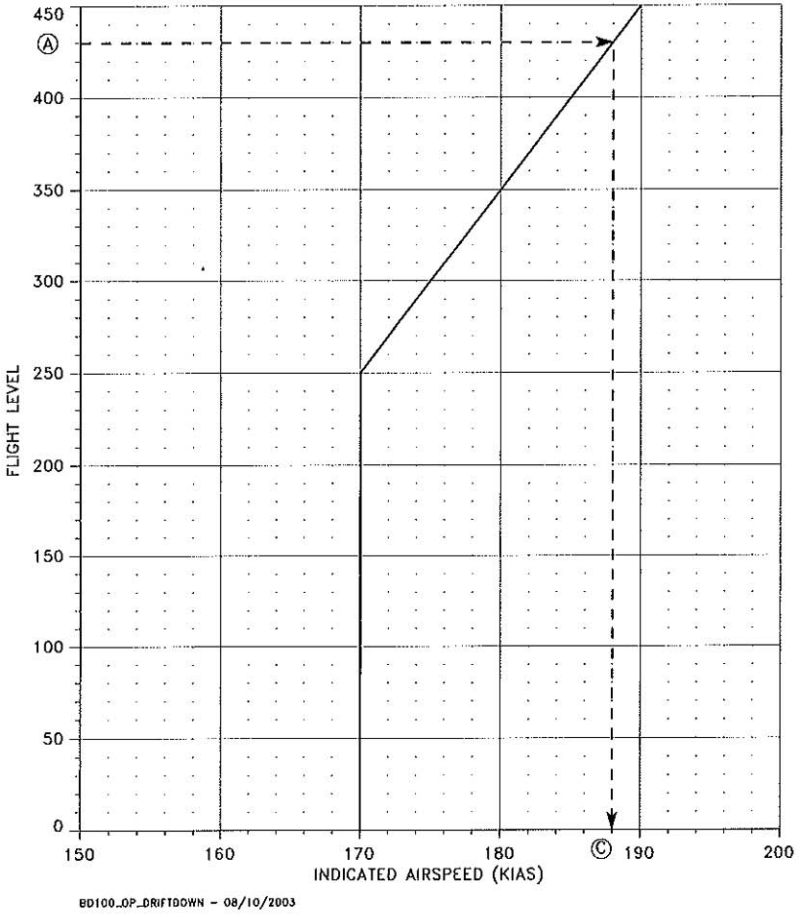

Figure 05-02-01. Driftdown Airspeed

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DRIFTDOWN – GROSS FLIGHT PATH

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C FORWARD C.G.	DRIFTDOWN SPEED DIST (NAM) TIME (MIN) KIAS LEVEL OFF (FT) FUEL (LB)

FLIGHT LEVEL	INITIAL GROSS WEIGHT – 1000 LB									
	24		26		28		30		32 (B)	
450	287. 190. 38000	49.6 781.	301. 190. 37000	53.2 861.	309. 190. 35800	55.8 926.	315. 190. 34700	58.3 998.	319. 190. 33500	60.2 1068.
430 (A)	273. 188. 38000	47.5 755.	289. 188. 37000	51.3 837.	298. 188. 35800	54.2 906.	303. 188. 34700	56.4 973.	309. 188. 33500	58.7 (D) 1048.
410	247. 186. 38000	43.2 697.	267. 186. 36900	47.9 791.	277. 186. 35800	50.9 862.	287. 186. 34700	53.8 940.	292. 186. 33500	55.8 1009.
390	219. 184. 37900	38.6 634.	244. 184. 36900	44.0 736.	260. 184. 35800	47.8 821.	272. 184. 34600	51.2 907.	279. 184. 33400	53.7 981.
370			171. 182. 36800	30.5 531.	219. 182. 35700	40.4 711.	242. 182. 34600	45.7 826.	255. 182. 33400	49.4 920.
350							197. 180. 34500	36.9 691.	229. 180. 33400	44.3 847.
330										
310										
290										
270										
250										
230										

BD100_OEI_DRFD_DATAM10_IMP_LW – 22/10/2003

Figure 05-02-02. Driftdown Data (Sheet 1 of 12)

DRIFTDOWN – GROSS FLIGHT PATH

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C	DRIFTDOWN SPEED
	FORWARD C.G.	DIST (NAM) TIME (MIN) KIAS FUEL (LB) LEVEL OFF (FT)

FLIGHT LEVEL	INITIAL GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450	324. 190. 32300	62.5 1150.	325. 190. 31000	64.2 1226.	328. 190. 29800	66.1 1315.	331. 190. 28500	68.2 1414.	335. 190. 27100	70.9 1532.
430	316. 188. 32300	61.3 1136.	317. 188. 31000	62.8 1208.	321. 188. 29700	65.2 1305.	323. 188. 28500	67.1 1401.	328. 188. 27100	69.7 1516.
410	300. 186. 32200	58.8 1102.	303. 186. 31000	60.6 1180.	307. 186. 29700	62.9 1273.	311. 186. 28400	65.2 1376.	315. 186. 27100	67.6 1488.
390	288. 184. 32200	56.6 1073.	294. 184. 31000	59.1 1163.	297. 184. 29700	61.1 1249.	303. 184. 28400	63.7 1357.	308. 184. 27100	66.5 1476.
370	268. 182. 32200	53.1 1023.	277. 182. 31000	56.1 1121.	283. 182. 29700	58.7 1219.	288. 182. 28400	61.0 1318.	295. 182. 27000	64.1 1441.
350	248. 180. 32200	49.0 965.	260. 180. 30900	52.7 1074.	268. 180. 29700	55.6 1173.	277. 180. 28400	58.8 1291.	285. 180. 27000	62.0 1415.
330	221. 178. 32100	43.2 881.	238. 178. 30900	48.1 1004.	252. 178. 29600	52.2 1127.	263. 178. 28400	55.8 1248.	274. 178. 27000	59.8 1387.
310			223. 176. 30900	43.5 955.	232. 176. 29600	47.6 1058.	246. 176. 28300	52.0 1190.	260. 176. 26900	56.6 1339.
290							244. 174. 28300	50.6 1197.	249. 174. 26900	53.7 1301.
270										
250										
230										

BD100_OEI_DRFD_DATAM10_IMP_HW – 22/10/2003

Figure 05-02-02. Driftdown Data (Sheet 2 of 12)

DRIFTDOWN – GROSS FLIGHT PATH

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA FORWARD C.G.	DRIFTDOWN SPEED DIST (NAM) TIME (MIN) KIAS FUEL (LB) LEVEL OFF (FT)

FLIGHT LEVEL	INITIAL GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	289. 190. 38100	48.6 791.	303. 190. 37000	52.2 871.	313. 190. 35900	55.3 947.	313. 190. 34800	56.3 993.	316. 190. 33600	58.2 1062.
430	278. 188. 38100	47.0 772.	293. 188. 37000	50.8 855.	302. 188. 35900	53.6 926.	303. 188. 34800	54.9 976.	309. 188. 33600	57.1 1050.
410	248. 186. 38100	42.3 705.	269. 186. 37000	46.9 801.	282. 186. 35900	50.4 881.	284. 186. 34800	51.8 933.	291. 186. 33600	54.3 1010.
390	222. 184. 38000	37.9 644.	247. 184. 37000	43.3 751.	262. 184. 35800	47.1 834.	269. 184. 34700	49.4 901.	278. 184. 33600	52.1 983.
370			166. 182. 36800	28.8 520.	220. 182. 35800	39.6 720.	239. 182. 34700	44.0 821.	255. 182. 33600	48.0 921.
350							196. 180. 34600	35.6 691.	228. 180. 33500	42.8 846.
330										
310										
290										
270										
250										
230										

BD100_OEI_DRFD_DATA00_IMP_LW – 22/10/2003

Figure 05-02-02. Driftdown Data (Sheet 3 of 12)

DRIFTDOWN – GROSS FLIGHT PATH

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA FORWARD C.G.	DRIFTDOWN SPEED: DIST (NAM) / KIAS / LEVEL OFF (FT) — TIME (MIN) / FUEL (LB)

FLIGHT LEVEL	INITIAL GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450	322. 190. 32400	60.5 1145.	325. 190. 31200	62.5 1228.	330. 190. 29900	64.8 1326.	331. 190. 28600	66.5 1416.	342. 190. 27200	70.5 1571.
430	313. 188. 32400	59.3 1130.	316. 188. 31200	61.1 1211.	323. 188. 29900	63.8 1315.	323. 188. 28600	65.4 1403.	334. 188. 27200	69.3 1555.
410	300. 186. 32400	57.2 1105.	303. 186. 31200	59.0 1181.	309. 186. 29900	61.5 1282.	311. 186. 28600	63.5 1377.	324. 186. 27200	67.8 1537.
390	288. 184. 32400	55.1 1076.	294. 184. 31200	57.5 1164.	301. 184. 29900	60.3 1269.	302. 184. 28600	62.0 1358.	314. 184. 27200	66.1 1512.
370	268. 182. 32400	51.7 1026.	277. 182. 31100	54.5 1122.	285. 182. 29900	57.4 1227.	290. 182. 28600	59.9 1330.	303. 182. 27200	64.2 1489.
350	248. 180. 32300	47.8 971.	260. 180. 31100	51.3 1076.	272. 180. 29800	54.9 1193.	277. 180. 28500	57.2 1292.	293. 180. 27100	62.2 1462.
330	221. 178. 32300	41.8 881.	241. 178. 31100	47.2 1016.	255. 178. 29800	51.4 1141.	263. 178. 28500	54.4 1251.	280. 178. 27100	59.6 1423.
310					238. 176. 29800	47.4 1086.	248. 176. 28500	51.0 1202.	267. 176. 27100	56.6 1379.
290							251. 174. 28500	50.5 1233.	259. 174. 27000	54.3 1354.
270										
250										
230										

BD100_OEI_DRFD_DATA00_IMP_HW – 22/10/2003

Figure 05-02-02. Driftdown Data (Sheet 4 of 12)

DRIFTDOWN – GROSS FLIGHT PATH

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C FORWARD C.G.	DRIFTDOWN SPEED DIST (NAM) TIME (MIN) KIAS FUEL (LB) LEVEL OFF (FT)

FLIGHT LEVEL	INITIAL GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	286. 190. 38200	47.6 785.	303. 190. 37100	51.6 874.	313. 190. 35900	54.6 948.	310. 190. 34800	55.2 987.	317. 190. 33700	57.6 1067.
430	273. 188. 38100	45.8 762.	292. 188. 37100	50.0 854.	301. 188. 35900	52.8 925.	302. 188. 34800	54.1 977.	306. 188. 33700	56.0 1044.
410	248. 186. 38100	41.9 708.	270. 186. 37000	46.5 806.	283. 186. 35900	50.0 887.	285. 186. 34800	51.5 942.	291. 186. 33600	53.6 1012.
390	222. 184. 38100	37.5 647.	249. 184. 37000	43.1 759.	264. 184. 35900	46.8 841.	269. 184. 34800	48.7 901.	278. 184. 33600	51.5 985.
370			164. 182. 36900	28.0 515.	223. 182. 35800	39.5 730.	242. 182. 34700	43.9 831.	255. 182. 33600	47.4 925.
350							197. 180. 34700	35.4 697.	230. 180. 33500	42.5 852.
330										
310										
290										
270										
250										
230										

BD100_OEI_DRFD_DATA05_IMP_LW – 22/10/2003

Figure 05-02-02. Driftdown Data (Sheet 5 of 12)

DRIFTDOWN – GROSS FLIGHT PATH

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C FORWARD C.G.	DRIFTDOWN SPEED DIST (NAM) TIME (MIN) KIAS FUEL (LB) LEVEL OFF (FT)

FLIGHT LEVEL	INITIAL GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450	321. 190. 32500	59.6 1143.	324. 190. 31300	61.5 1225.	329. 190. 30000	63.8 1322.	332. 190. 28700	65.9 1423.	343. 190. 27300	69.9 1578.
430	312. 188. 32500	58.3 1126.	317. 188. 31300	60.6 1217.	321. 188. 30000	62.7 1310.	324. 188. 28700	64.8 1409.	335. 188. 27300	68.6 1560.
410	298. 186. 32500	56.2 1100.	303. 186. 31300	58.4 1186.	309. 186. 30000	60.9 1287.	312. 186. 28700	62.8 1382.	324. 186. 27300	67.1 1542.
390	286. 184. 32500	54.1 1072.	292. 184. 31200	56.5 1159.	301. 184. 30000	59.7 1275.	303. 184. 28700	61.4 1363.	317. 184. 27300	65.9 1529.
370	267. 182. 32400	50.7 1022.	275. 182. 31200	53.5 1116.	286. 182. 29900	56.8 1232.	291. 182. 28600	59.3 1335.	304. 182. 27200	63.6 1493.
350	247. 180. 32400	47.0 968.	261. 180. 31200	50.9 1082.	273. 180. 29900	54.4 1199.	278. 180. 28600	56.7 1297.	294. 180. 27200	61.6 1466.
330	221. 178. 32300	41.3 884.	240. 178. 31100	46.5 1016.	256. 178. 29900	50.9 1148.	264. 178. 28600	53.9 1257.	283. 178. 27200	59.4 1440.
310					240. 176. 29800	47.1 1096.	251. 176. 28600	50.8 1213.	271. 176. 27200	56.6 1398.
290							259. 174. 28600	51.4 1272.	262. 174. 27100	54.2 1371.
270										
250										
230										

BD100_OEI_DRFD_DATA05_IMP_HW – 22/10/2003

Figure 05-02-02. Driftdown Data (Sheet 6 of 12)

DRIFTDOWN – GROSS FLIGHT PATH		
CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C FORWARD C.G.	DRIFTDOWN SPEED DIST (NAM) TIME (MIN) KIAS FUEL (LB) LEVEL OFF (FT)

FLIGHT LEVEL	INITIAL GROSS WEIGHT – 1000 LB				
	24	26	28	30	32
450	257. 42.6 190. 700. 37900	275. 46.6 190. 789. 37000	294. 50.8 190. 889. 35900	302. 53.3 190. 962. 34800	315. 56.9 190. 1066. 33700
430	247. 41.3 188. 685. 37900	265. 45.1 188. 771. 37000	286. 49.7 188. 877. 35900	293. 52.0 188. 947. 34800	306. 55.5 188. 1048. 33700
410	224. 37.6 186. 635. 37900	248. 42.5 186. 739. 37000	268. 47.0 186. 840. 35900	277. 49.5 186. 915. 34800	292. 53.4 186. 1021. 33700
390	206. 34.8 184. 599. 37900	231. 39.7 184. 702. 36900	253. 44.4 184. 806. 35900	263. 47.2 184. 883. 34800	280. 51.5 184. 997. 33600
370		160. 27.2 182. 500. 36800	216. 38.1 182. 710. 35800	237. 42.7 182. 818. 34800	259. 47.7 182. 942. 33600
350				189. 33.6 180. 667. 34700	231. 42.4 180. 859. 33500
330					
310					
290					
270					
250					
230					

BD100_OEI_DRFD_DATA10_IMP_LW – 22/10/2003

Figure 05-02-02. Driftdown Data (Sheet 7 of 12)

DRIFTDOWN – GROSS FLIGHT PATH

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C FORWARD C.G.	DRIFTDOWN SPEED DIST (NAM) TIME (MIN) KIAS FUEL (LB) LEVEL OFF (FT)

FLIGHT LEVEL	INITIAL GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450	321. 190. 32400	59.2 1148.	336. 190. 31100	63.5 1281.	346. 190. 29700	67.2 1409.	357. 190. 28100	71.2 1554.	367. 190. 26400	75.2 1710.
430	314. 188. 32400	58.2 1138.	328. 188. 31100	62.4 1269.	339. 188. 29600	66.0 1394.	349. 188. 28100	70.0 1536.	358. 188. 26400	73.9 1689.
410	300. 186. 32400	55.9 1108.	316. 186. 31100	60.5 1245.	328. 186. 29600	64.5 1378.	339. 186. 28100	68.4 1518.	348. 186. 26400	72.3 1669.
390	289. 184. 32400	54.1 1084.	306. 184. 31100	58.9 1224.	320. 184. 29600	63.1 1362.	332. 184. 28100	67.3 1508.	342. 184. 26400	71.5 1666.
370	271. 182. 32400	51.1 1042.	291. 182. 31000	56.4 1190.	306. 182. 29600	60.7 1329.	319. 182. 28000	65.1 1478.	329. 182. 26400	69.1 1629.
350	250. 180. 32300	47.2 982.	274. 180. 31000	53.0 1139.	292. 180. 29600	58.1 1290.	305. 180. 28000	62.5 1436.	318. 180. 26300	67.0 1599.
330	215. 178. 32200	40.2 861.	252. 178. 30900	48.6 1067.	272. 178. 29500	54.1 1221.	291. 178. 28000	59.8 1395.	306. 178. 26300	64.6 1563.
310			209. 176. 30800	39.4 895.	245. 176. 29400	48.6 1123.	272. 176. 27900	55.7 1325.	291. 176. 26300	61.5 1511.
290							252. 174. 27800	51.1 1244.	273. 174. 26200	57.5 1437.
270									256. 172. 26100	53.1 1362.
250										
230										

BD100_OEI_DRFD_DATA10_IMP_HW – 22/10/2003

Figure 05-02-02. Driftdown Data (Sheet 8 of 12)

DRIFTDOWN – GROSS FLIGHT PATH

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C FORWARD C.G.	DRIFTDOWN SPEED DIST (NAM) TIME (MIN) KIAS FUEL (LB) LEVEL OFF (FT)

FLIGHT LEVEL	INITIAL GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	247. 190. 37200	41.2 670.	262. 190. 36400	44.5 748.	295. 190. 35300	51.3 894.	315. 190. 34100	55.9 1010.	328. 190. 32800	59.5 1112.
430	238. 188. 37200	39.9 657.	256. 188. 36400	43.7 741.	286. 188. 35300	49.9 877.	305. 188. 34100	54.5 991.	320. 188. 32800	58.5 1101.
410	223. 186. 37200	37.6 629.	240. 186. 36400	41.2 710.	272. 186. 35300	47.7 851.	293. 186. 34100	52.7 972.	308. 186. 32800	56.6 1079.
390	206. 184. 37200	34.8 594.	225. 184. 36400	38.8 680.	259. 184. 35300	45.6 826.	281. 184. 34100	50.6 945.	296. 184. 32800	54.7 1054.
370			184. 182. 36300	31.6 572.	231. 182. 35300	40.8 756.	259. 182. 34000	47.0 893.	279. 182. 32800	51.7 1014.
350							219. 180. 34000	39.6 772.	252. 180. 32700	46.7 934.
330									197. 178. 32600	36.3 747.
310										
290										
270										
250										
230										

BD100_OEI_DRFD_DATA15_IMP_LW – 22/10/2003

Figure 05-02-02. Driftdown Data (Sheet 9 0f 12)

DRIFTDOWN – GROSS FLIGHT PATH

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C FORWARD C.G.	DRIFTDOWN SPEED DIST (NAM) KIAS LEVEL OFF (FT) / TIME (MIN) FUEL (LB)

FLIGHT LEVEL	INITIAL GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450	340. 190. 31500	63.2 1225.	349. 190. 30000	66.5 1337.	363. 190. 28500	71.2 1490.	379. 190. 26700	76.8 1675.	394. 190. 24800	82.5 1876.
430	332. 188. 31500	62.1 1211.	341. 188. 30000	65.3 1321.	355. 188. 28500	69.9 1472.	373. 188. 26700	76.0 1666.	388. 188. 24800	81.6 1865.
410	319. 186. 31400	60.1 1186.	330. 186. 30000	63.8 1305.	344. 186. 28400	68.3 1453.	362. 186. 26700	74.3 1645.	379. 186. 24700	80.3 1855.
390	311. 184. 31400	58.9 1175.	321. 184. 30000	62.3 1288.	337. 184. 28400	67.2 1442.	354. 184. 26700	73.0 1630.	370. 184. 24700	78.9 1835.
370	294. 182. 31400	55.9 1133.	307. 182. 30000	60.0 1257.	324. 182. 28400	65.1 1414.	343. 182. 26600	71.1 1607.	359. 182. 24700	76.9 1806.
350	274. 180. 31400	52.3 1078.	291. 180. 29900	56.9 1211.	310. 180. 28400	62.5 1376.	330. 180. 26600	68.6 1567.	348. 180. 24700	75.0 1781.
330	241. 178. 31300	45.9 965.	267. 178. 29900	52.5 1135.	291. 178. 28300	58.8 1313.	314. 178. 26600	65.7 1520.	336. 178. 24600	72.6 1743.
310			232. 176. 29800	45.4 1005.	266. 176. 28200	53.8 1224.	296. 176. 26500	62.0 1457.	320. 176. 24600	69.5 1690.
290					236. 174. 28100	47.3 1102.	275. 174. 26400	57.5 1375.	303. 174. 24500	65.9 1626.
270							240. 172. 26200	49.7 1216.	278. 172. 24400	60.3 1515.
250									240. 170. 24200	51.1 1315.
230										

BD100_OEI_DRFD_DATA15_IMP_HW – 22/10/2003

Figure 05-02-02. Driftdown Data (Sheet 10 0f 12)

DRIFTDOWN – GROSS FLIGHT PATH

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C FORWARD C.G.	DRIFTDOWN SPEED DIST (NAM) TIME (MIN) KIAS FUEL (LB) LEVEL OFF (FT)

FLIGHT LEVEL	INITIAL GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
450	245. 190. 36300	41.2 665.	286. 190. 35400	49.2 826.	310. 190. 34200	54.5 946.	333. 190. 32800	59.9 1077.	344. 190. 31400	63.5 1182.
430	238. 188. 36300	40.3 656.	279. 188. 35400	48.2 815.	302. 188. 34100	53.4 934.	325. 188. 32800	58.8 1064.	336. 188. 31400	62.3 1168.
410	220. 186. 36300	37.5 622.	263. 186. 35300	45.9 787.	289. 186. 34100	51.5 912.	311. 186. 32800	56.8 1041.	325. 186. 31400	60.8 1152.
390	208. 184. 36300	35.5 597.	253. 184. 35300	44.3 771.	280. 184. 34100	50.1 898.	301. 184. 32800	55.1 1021.	316. 184. 31400	59.4 1137.
370	171. 182. 36300	29.2 506.	224. 182. 35300	39.2 698.	256. 182. 34100	46.0 840.	282. 182. 32800	51.9 977.	300. 182. 31400	56.7 1101.
350					212. 180. 34000	38.0 710.	252. 180. 32700	46.6 893.	276. 180. 31300	52.4 1033.
330							188. 178. 32500	34.4 677.	241. 178. 31200	45.8 921.
310									139. 176. 30900	25.4 531.
290										
270										
250										
230										

BD100_OEI_DRFD_DATA20_IMP_LW – 22/10/2003

Figure 05-02-02. Driftdown Data (Sheet 11 0f 12)

DRIFTDOWN – GROSS FLIGHT PATH

CLIMB THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C FORWARD C.G.	DRIFTDOWN SPEED DIST (NAM) TIME (MIN) KIAS FUEL (LB) LEVEL OFF (FT)

FLIGHT LEVEL	INITIAL GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
450	356. 190. 30000	67.5 1302.	380. 190. 28300	74.2 1492.	389. 190. 26400	78.5 1638.	400. 190. 24500	83.2 1809.	398. 190. 22600	84.9 1916.
430	350. 188. 29900	66.7 1296.	374. 188. 28200	73.4 1485.	383. 188. 26400	77.6 1629.	394. 188. 24500	82.3 1798.	391. 188. 22600	83.9 1904.
410	339. 186. 29900	65.0 1277.	363. 186. 28200	71.7 1465.	374. 186. 26400	76.3 1619.	382. 186. 24500	80.5 1775.	382. 186. 22600	82.6 1891.
390	332. 184. 29900	63.9 1268.	355. 184. 28200	70.5 1452.	366. 184. 26400	74.9 1602.	376. 184. 24500	79.5 1766.	375. 184. 22600	81.5 1879.
370	317. 182. 29900	61.4 1233.	341. 182. 28200	68.2 1422.	354. 182. 26400	73.0 1577.	366. 182. 24500	77.9 1749.	365. 182. 22600	79.8 1857.
350	299. 180. 29900	58.1 1185.	326. 180. 28100	65.5 1381.	339. 180. 26300	70.4 1537.	353. 180. 24400	75.5 1711.	353. 180. 22500	77.6 1824.
330	275. 178. 29800	53.8 1114.	305. 178. 28100	61.5 1316.	323. 178. 26300	67.3 1488.	339. 178. 24400	72.9 1672.	341. 178. 22500	75.2 1787.
310	236. 176. 29700	46.0 974.	279. 176. 28000	56.5 1229.	303. 176. 26200	63.3 1420.	322. 176. 24300	69.6 1617.	326. 176. 22500	72.4 1739.
290			244. 174. 27900	49.2 1091.	280. 174. 26100	58.5 1334.	303. 174. 24200	65.7 1546.	311. 174. 22400	69.3 1686.
270					241. 172. 26000	50.3 1173.	277. 172. 24100	60.2 1440.	292. 172. 22300	65.1 1606.
250							236. 170. 23900	50.6 1240.	263. 170. 22200	58.4 1471.
230									241. 170. 22100	52.8 1360.

BD100_OEI_DRFD_DATA20_IMP_HW – 22/10/2003

Figure 05-02-02. Driftdown Data (Sheet 12 0f 12)

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ALTITUDE SELECTION

The gross ceiling is presented at Long Range Cruise speed (LRC), as a function of aircraft gross weight for various temperature deviation from ISA. The data is based on single engine operation with Climb Thrust (CLB rating) with engine bleed on and anti-ice off.

Single engine LRC speeds are given on Specific Air Range charts (Section 05-04) and in Cruise Performance tables (Section 05-05).

Altitude selection correction factors for C.G. variation relative to 30% MAC reference position are provided below.

CRUISE CEILING CORRECTION FACTORS vs. C.G. POSITION.

C.G.	LRC
20%	-500 ft
25%	-250 ft
REF (30%)	-
35%	+100 ft
40%	+200 ft

Example:
Associated conditions

- Aircraft weight = 34 000 lbs (A)
- Cruise speed = LRC
- Temperature deviation = ISA+10°C

Using example shown on Figure 05-03-01, the gross ceiling for the above associated conditions is FL 288 (B).

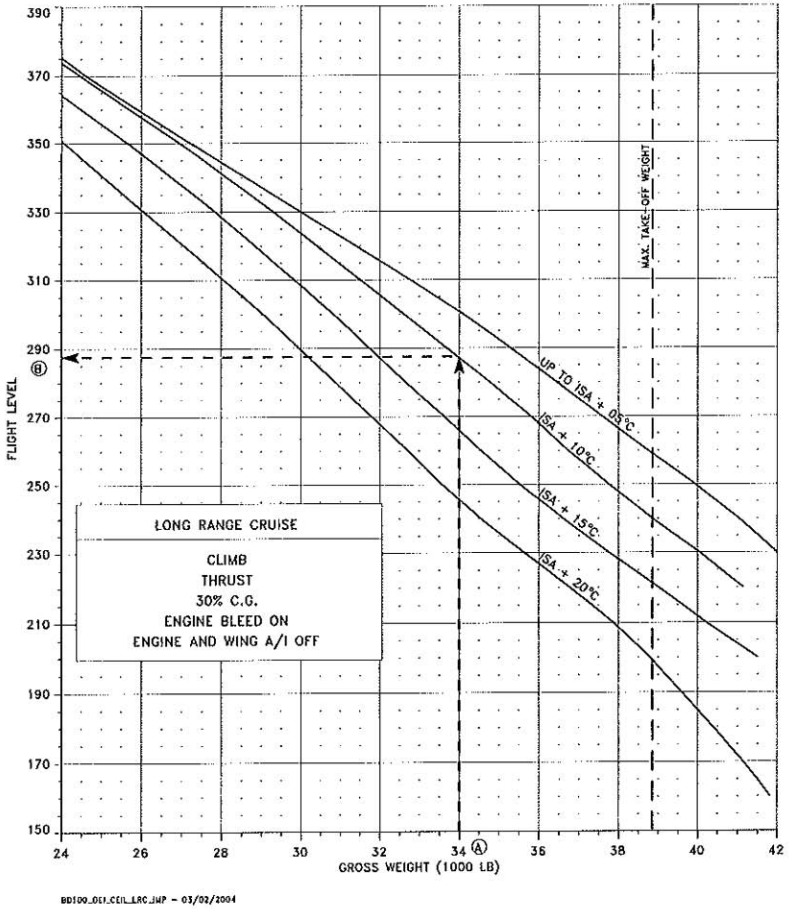

Figure 05-03-01. Altitude Selection—Gross Ceiling

SPECIFIC AIR RANGE

Single engine operation Specific Air Range (SAR) values are presented in graphical form as function of Indicated Mach number (MI) at varying aircraft gross weight and pressure altitude from sea level to Flight Level 350. The performance data is presented for the speed range from the minimum drag speed (VMD) up to the speed for Climb Thrust (CLB rating) or maximum operating speed limit (VMO/MMO), whichever is limiting.

The graphs are calculated for zero wind and ISA conditions with engine bleed on and anti-ice off. A correction factor is given on each graph for non-standard day temperatures. Lines indicating the Maximum Range Cruise (MRC) and Long Range Cruise (LRC) speeds are shown on each chart.

In wind conditions, the Specific Ground Range (SGR) can be computed from Specific Air Range (SAR), true airspeed and wind data using the following equation:

SGR "Wind" = [SAR "No wind" x (True airspeed +/- Wind*) / True airspeed]

* Wind convention "+" for Tailwind and "-" for Headwind

Example:

Associated conditions

- Aircraft gross weight = 42 000 lbs (A)
- Flight Level = Sea Level
- Static air temperature = ISA+10°C (B)
- Cruise speed = 0.42 MI (C)

Using Figure 05-04-01, Sheet 1, the following data are obtained:

- Specific air range @ ISA = 0.1264 n.a.m./lb (D)
- True airspeed = 282 kts (E)

Specific Air Range at ISA+10°C is obtained by applying the SAR correction factor (1.0% SAR degradation per 10°C above ISA) shown on top of the chart:

- Specific Air Range @ ISA+10°C = 0.1264 - (0.01 x 0.1242)
= 0.1251 n.a.m./lb

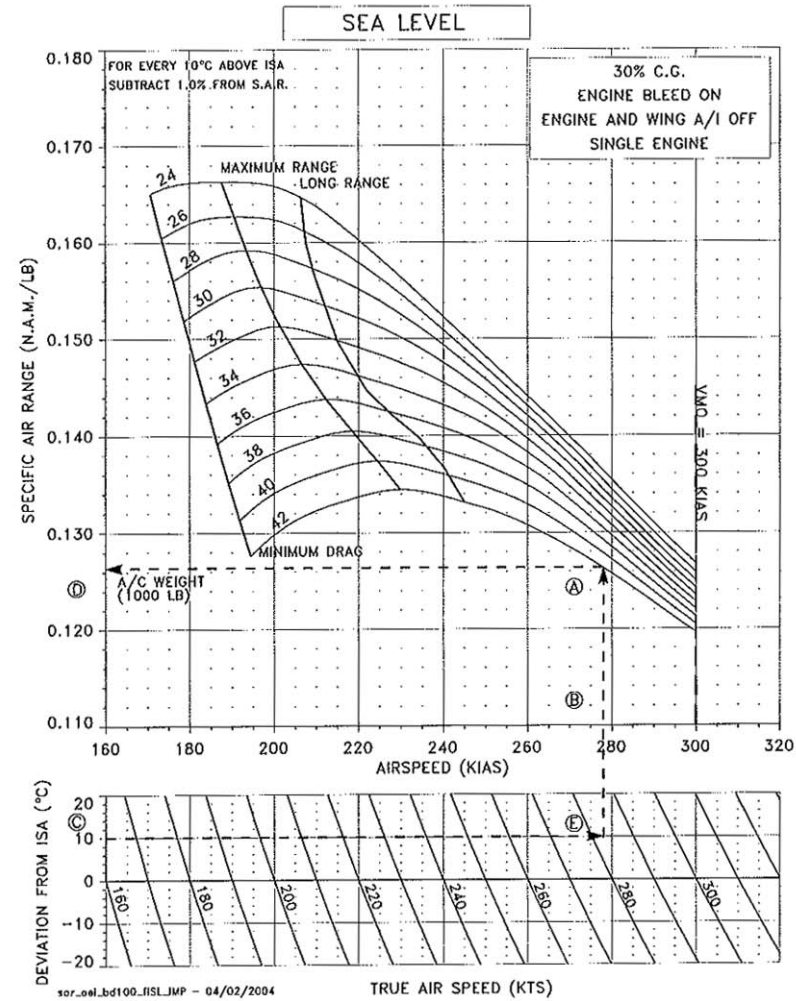

Figure 05-04-01. Specific Air Range (Sheet 1 of 14)

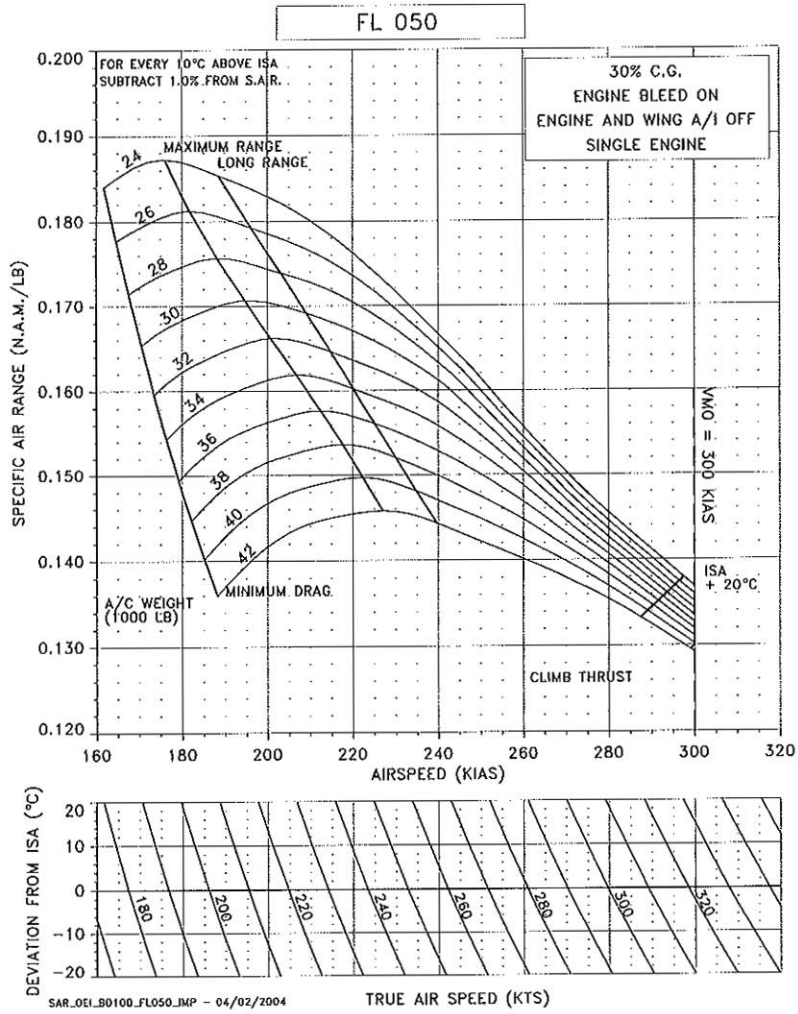

Figure 05-04-01. Specific Air Range (Sheet 2 of 14)

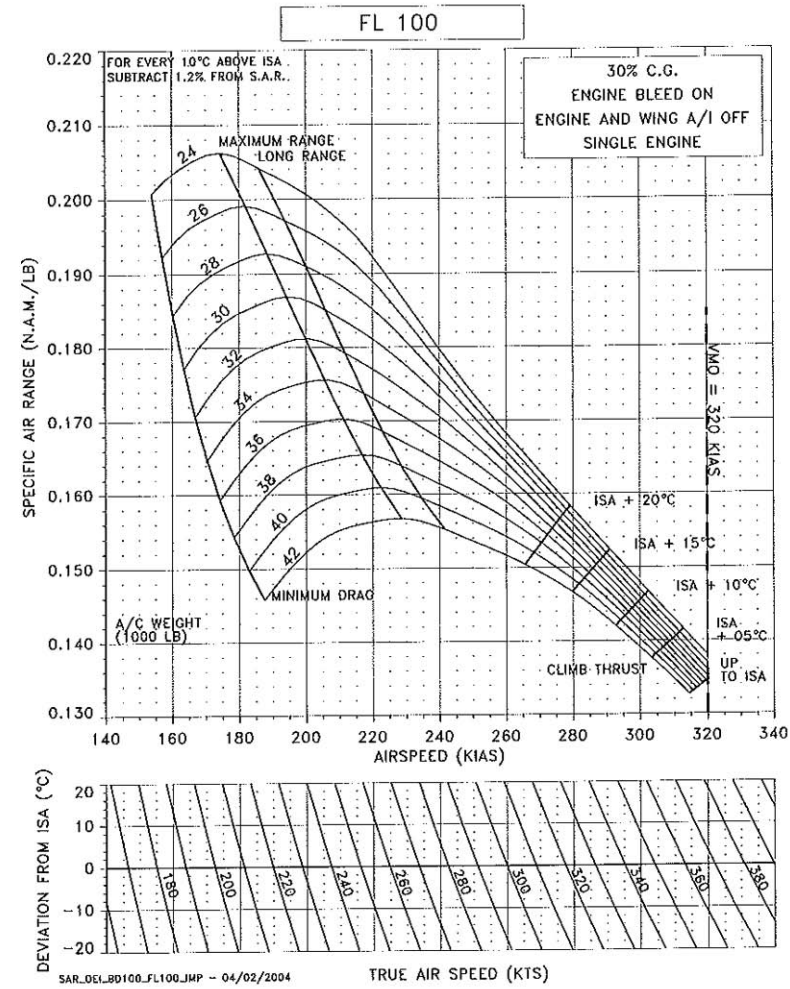

Figure 05-04-01. Specific Air Range (Sheet 3 of 14)

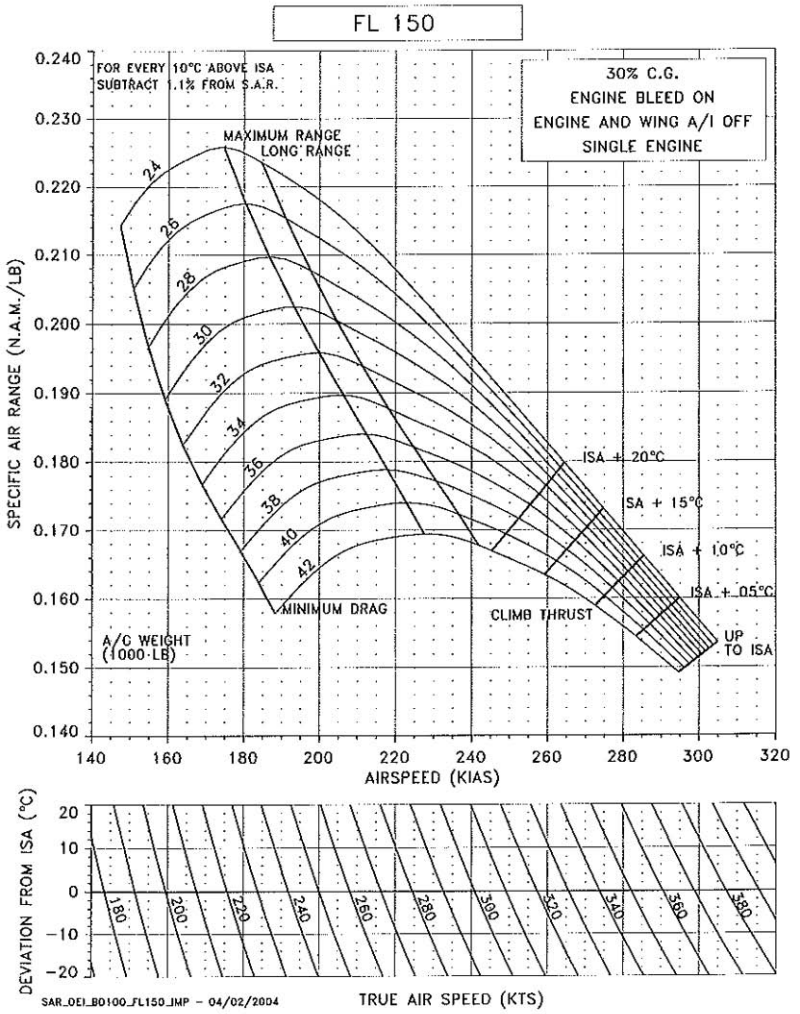

Figure 05-04-01. Specific Air Range (Sheet 4 of 14)

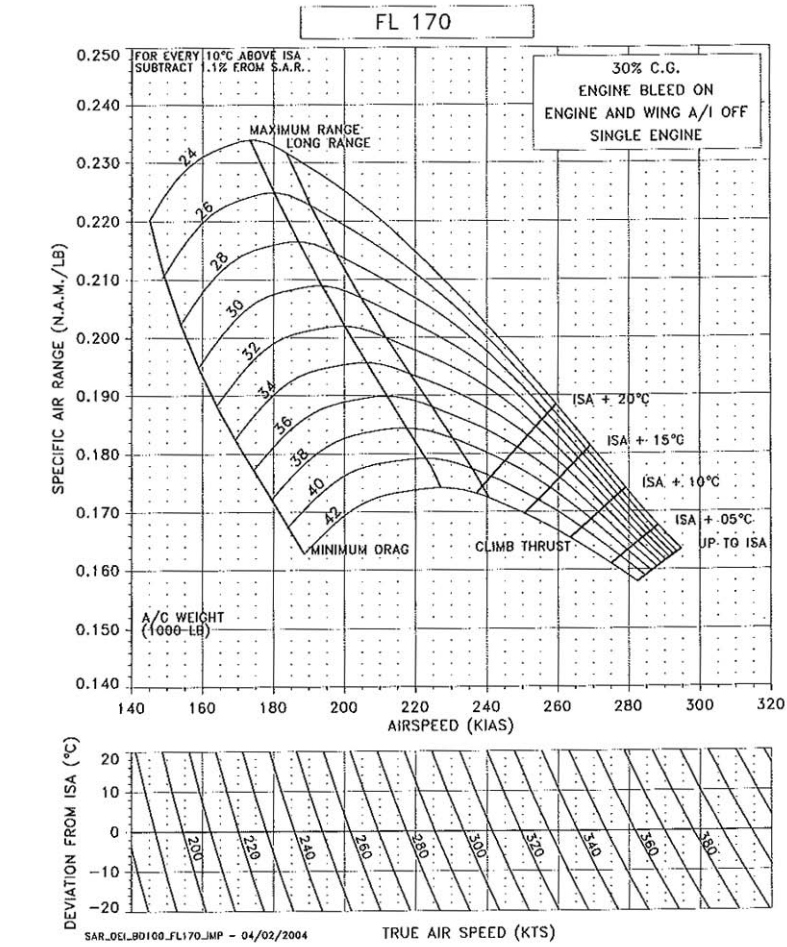

Figure 05-04-01. Specific Air Range (Sheet 5 of 14)

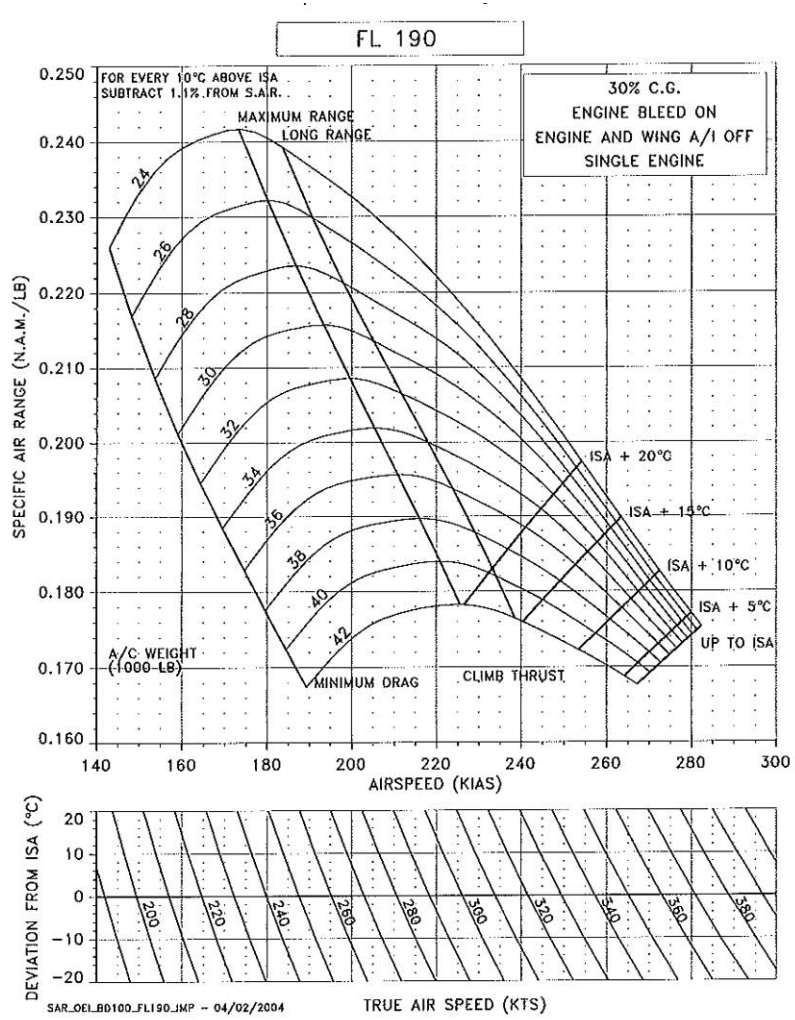

Figure 05-04-01. Specific Air Range (Sheet 6 of 14)

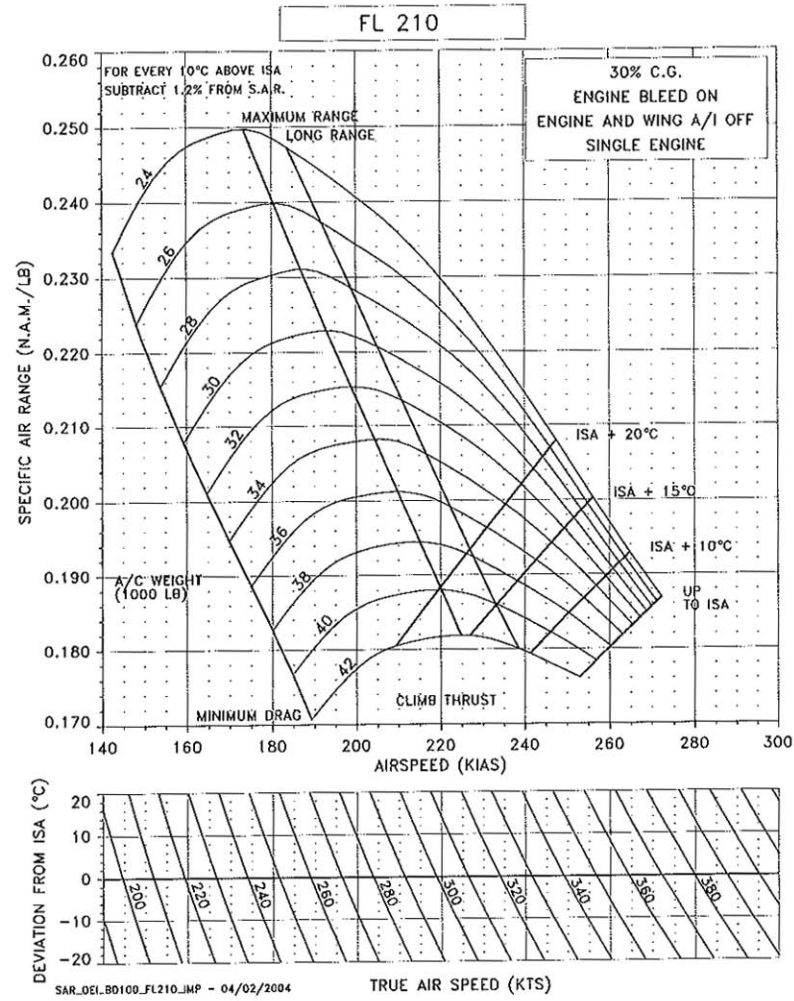

Figure 05-04-01. Specific Air Range (Sheet 7 of 14)

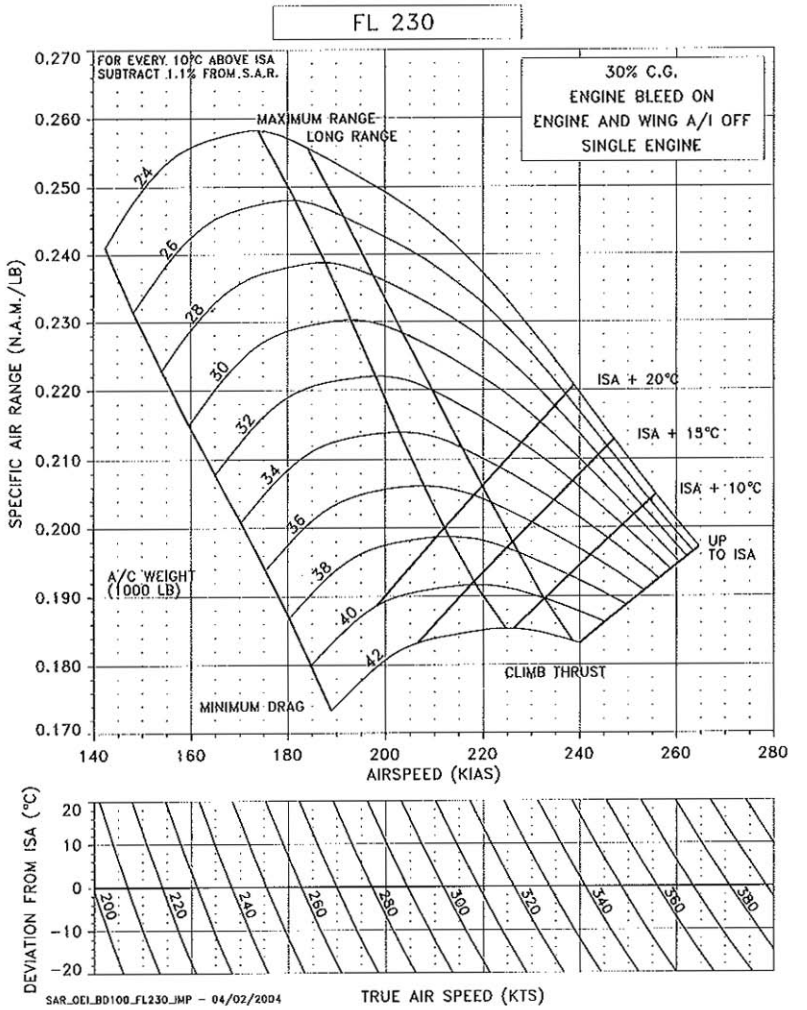

Figure 05-04-01. Specific Air Range (Sheet 8 of 14)

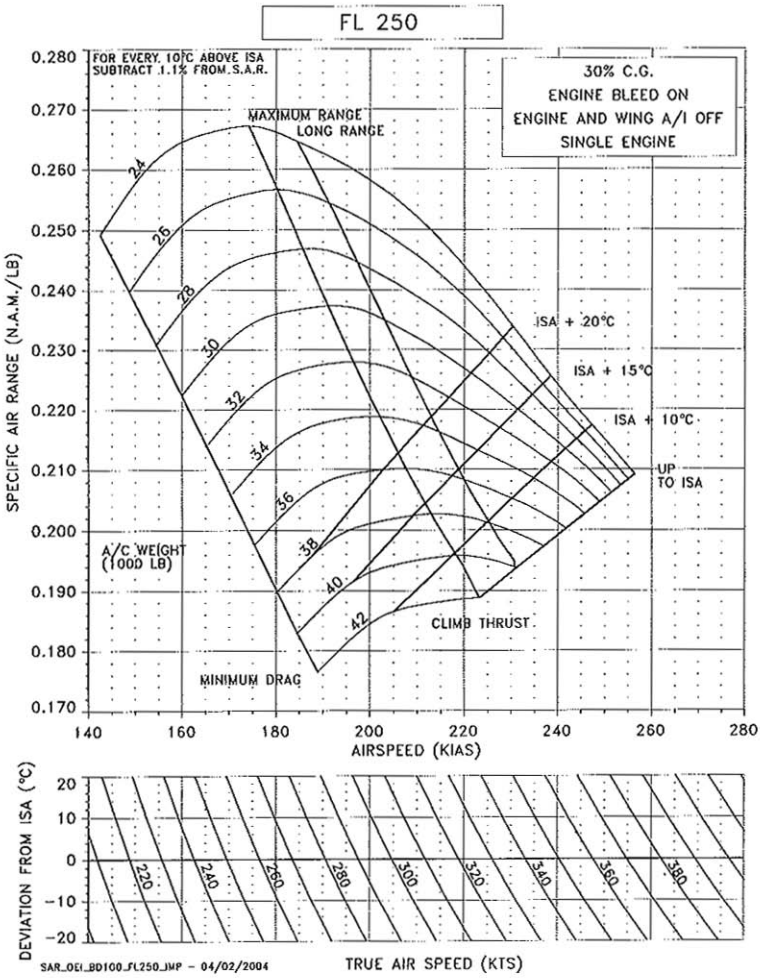

Figure 05-04-01. Specific Air Range (Sheet 9 of 14)

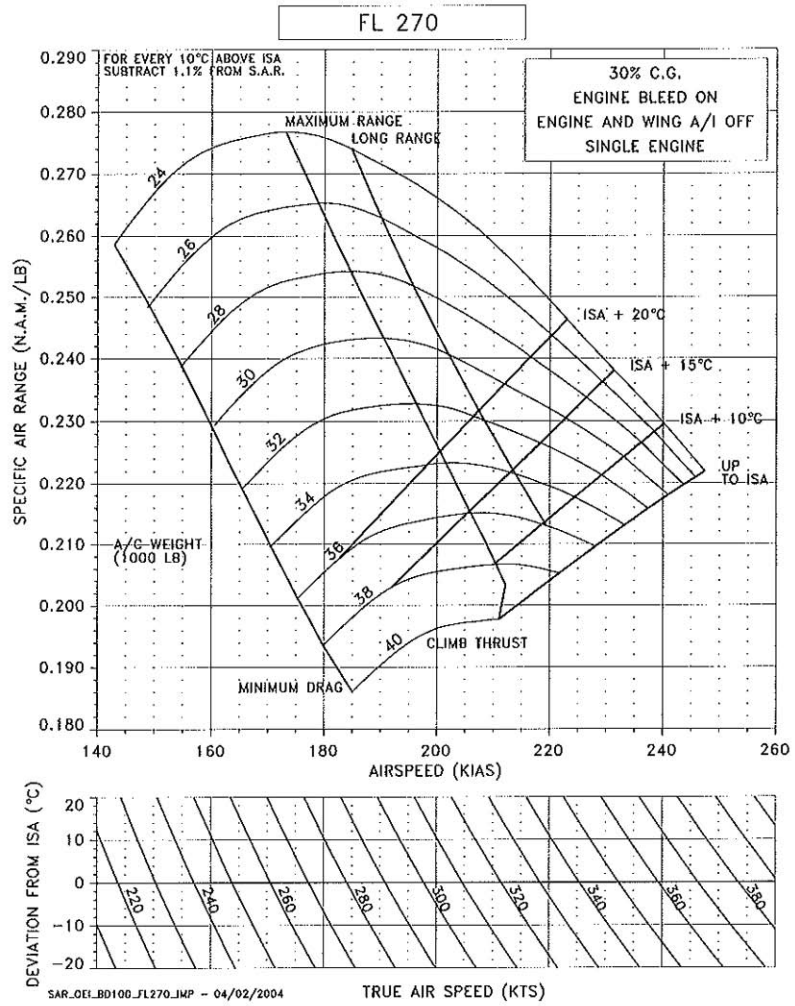

Figure 05-04-01. Specific Air Range (Sheet 10 of 14)

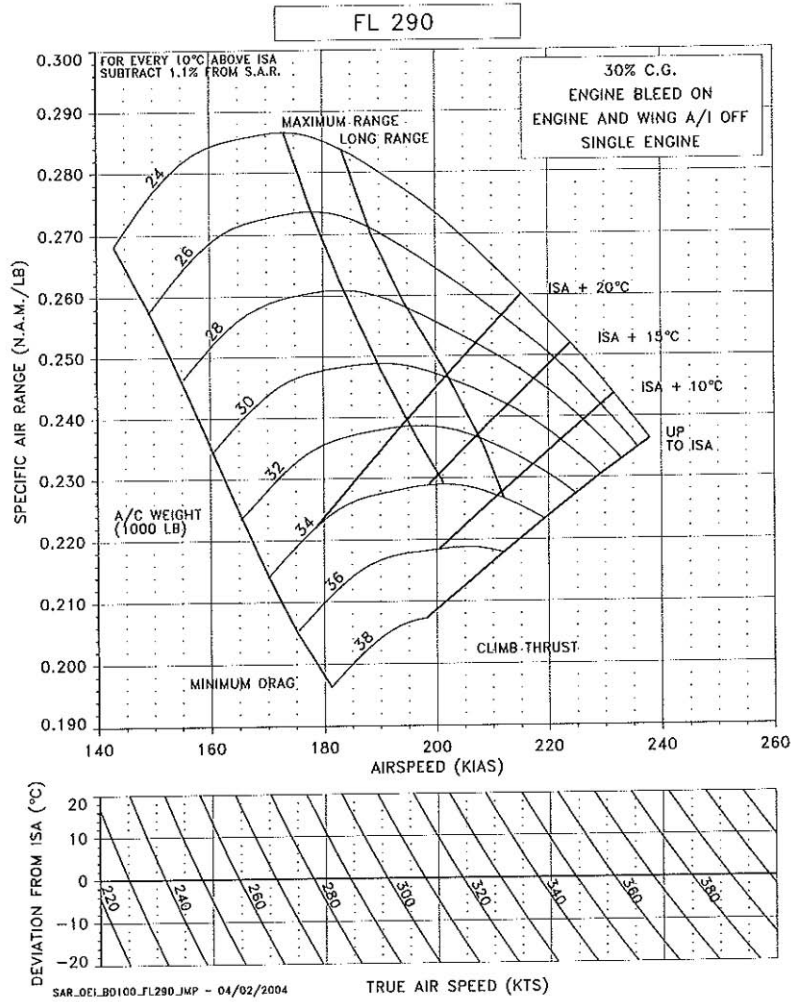

Figure 05-04-01. Specific Air Range (Sheet 11 of 14)

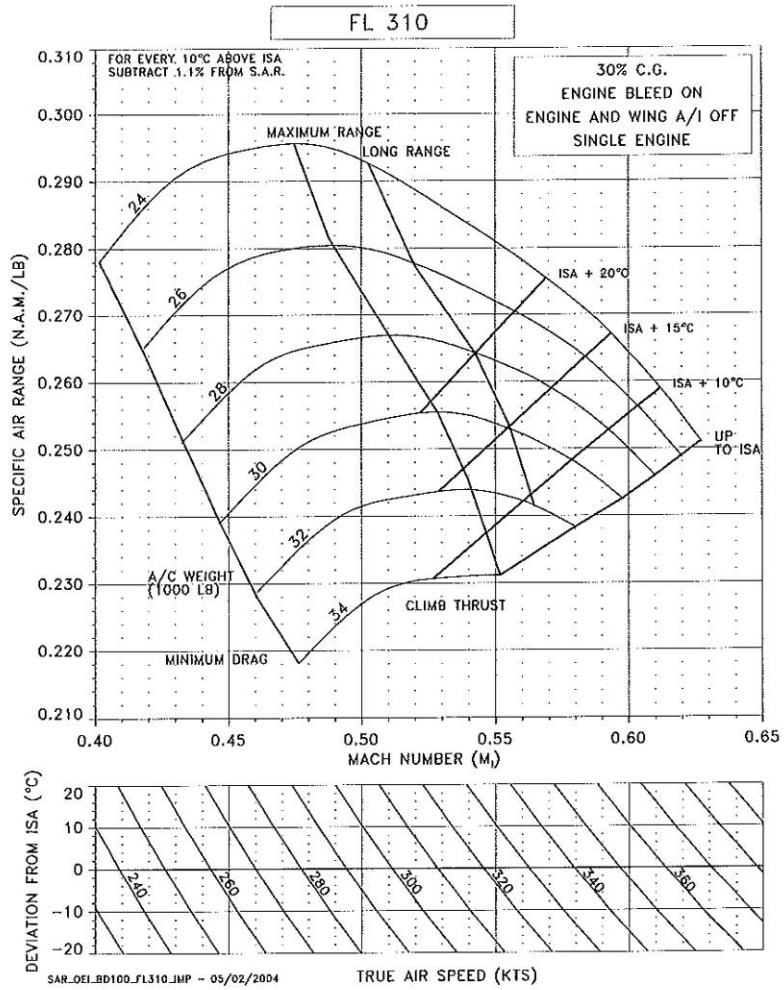

Figure 05-04-01. Specific Air Range (Sheet 12 of 14)

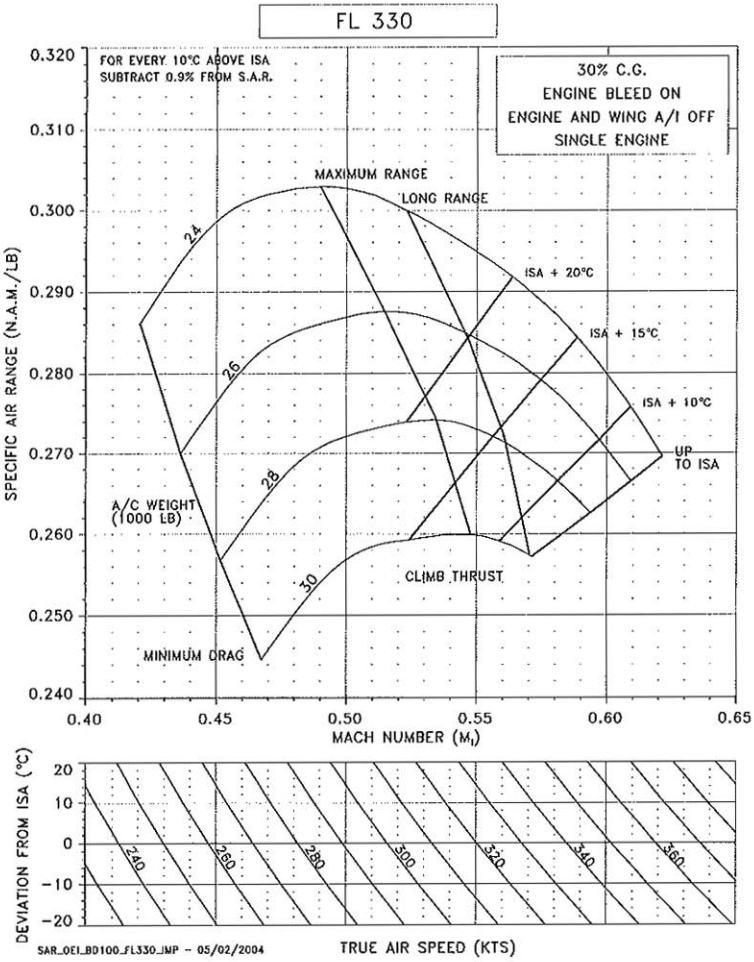

Figure 05-04-01. Specific Air Range (Sheet 13 of 14)

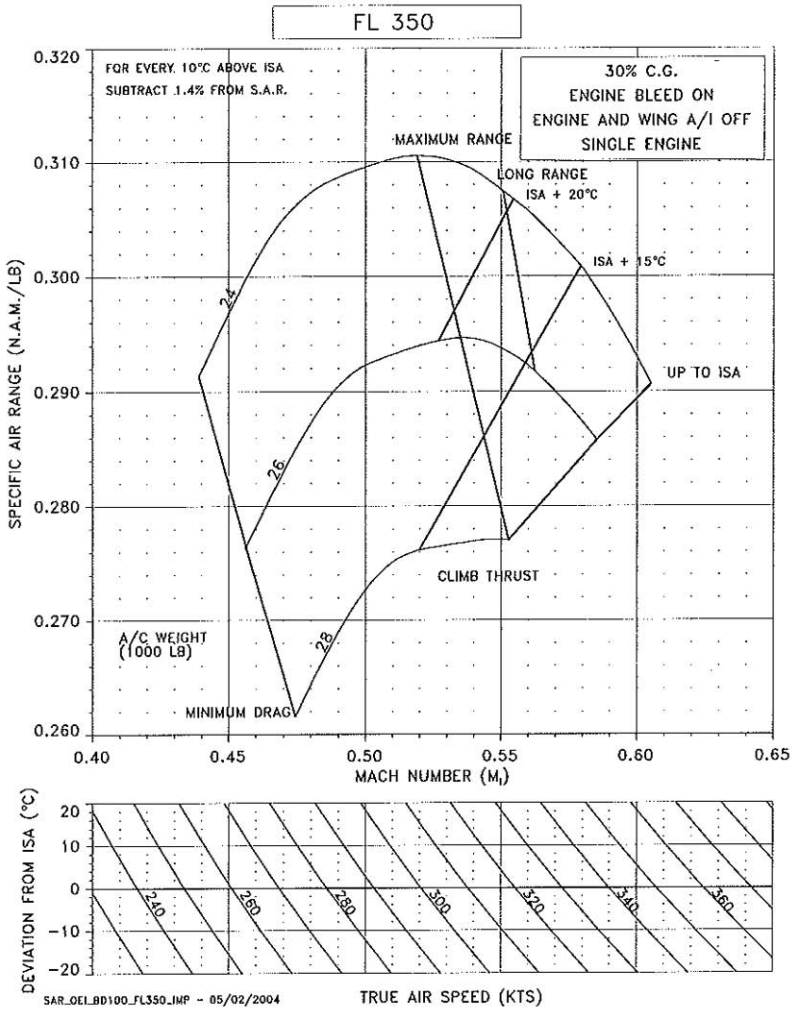

Figure 05-04-01. Specific Air Range (Sheet 14 of 14)

CRUISE DATA

Single engine operation cruise tabulated data are provided for long range cruise, maximum range cruise and maximum cruise speeds as function of flight level and aircraft gross weight for -10, 0, 5, 10, 15 and 20°C temperature deviation from ISA. The primary purpose of the cruise data is to establish a target thrust setting (N1%) for a selected set of cruise conditions.

Single engine cruise data are presented in tabular form and are based on the use of power for level flight, not exceeding Climb Thrust (CLB rating), with engine bleed on and anti-ice off.

Cruise performance tables show the following data:

- %N1: Fan speed setting in percent
- LB/HR: Fuel flow in pounds per hour
- NAM/LB: Specific air range in n.a.m. per lb
- MACH: Indicated Mach number
- KIAS: Indicated airspeed in knots
- KTAS: True airspeed in knots

N1 and fuel flow correction factors for C.G. variation relative to 30% MAC reference position are provided below.

N1 and FUEL FLOW CORRECTION FACTORS vs. C.G. POSITION.

C.G.	N1	Fuel Flow
20%	+ 1.00%	+ 2.00%
25%	+ 0.50%	+ 1.00%
REF (30%)	-	-
35%	- 0.25%	- 0.50%
40%	- 0.50%	- 1.00%

Example:

Associated conditions

- Cruise speed = LRC
- Static air temperature = ISA-10°C
- Flight Level = FL 290 (A)
- Aircraft gross weight = 32 000 lbs (B)

Using Figure 05-05-01, Sheet 1, the following data are obtained (C):

- Fan speed RPM = 86.7%N1
- Fuel flow = 1339 lbs/hr.
- Specific air range = 0.2384 nam/lb
- Indicated Mach number = 0.551 M1
- Indicated airspeed = 209 kts
- True airspeed = 319 kts

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LONG RANGE CRUISE

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32 (B)	
350	84.4 1000 0.3109	0.552 182. 311.	86.9 1072 0.2951	0.562 186. 317.						
330	82.3 986 0.3028	0.525 181. 299.	84.6 1081 0.2876	0.547 189. 311.	86.8 1159 0.2742	0.559 194. 318.	89.7 1246 0.2599	0.570 197. 324.		
310	80.7 977 0.2955	0.503 181. 289.	82.6 1065 0.2804	0.521 188. 299.	84.7 1165 0.2670	0.542 196. 311.	86.8 1248 0.2553	0.556 201. 319.	89.1 1329 0.2437	0.565 204. 324.
290 (A)	79.5 984 0.2865	0.487 183. 282.	81.2 1061 0.2735	0.501 189. 290.	82.9 1146 0.2607	0.516 195. 299.	84.7 1244 0.2488	0.535 202. 310.	86.7 1339 (C) 0.2384	0.551 209. 319.
270	78.1 994 0.2769	0.472 185. 275.	79.9 1070 0.2654	0.486 191. 284.	81.5 1144 0.2544	0.499 196. 291.	83.0 1225 0.2435	0.511 201. 298.	84.6 1322 0.2329	0.527 208. 308.
250	76.5 994 0.2674	0.451 185. 266.	78.5 1075 0.2568	0.469 192. 276.	80.1 1149 0.2470	0.482 198. 284.	81.7 1228 0.2375	0.495 203. 292.	83.1 1310 0.2280	0.507 208. 299.
230	74.9 992 0.2584	0.432 184. 256.	76.8 1072 0.2482	0.448 191. 266.	78.7 1159 0.2388	0.466 199. 277.	80.3 1236 0.2302	0.479 205. 285.	81.8 1316 0.2220	0.492 210. 292.
210	73.3 991 0.2498	0.413 184. 248.	75.3 1074 0.2399	0.430 191. 258.	77.1 1158 0.2309	0.446 199. 268.	78.8 1241 0.2228	0.462 206. 277.	80.4 1325 0.2153	0.476 212. 285.
190	71.8 992 0.2417	0.397 184. 240.	73.7 1074 0.2321	0.413 191. 249.	75.5 1157 0.2235	0.428 198. 259.	77.3 1241 0.2156	0.443 205. 268.	78.9 1326 0.2085	0.458 212. 277.
170	70.3 997 0.2336	0.382 184. 233.	72.2 1075 0.2247	0.397 191. 242.	74.0 1156 0.2164	0.411 198. 250.	75.7 1239 0.2089	0.425 205. 259.	77.3 1324 0.2020	0.439 212. 268.
150	69.1 1010 0.2254	0.371 186. 228.	70.7 1080 0.2174	0.382 191. 235.	72.5 1159 0.2096	0.396 198. 243.	74.1 1238 0.2024	0.408 205. 251.	75.7 1322 0.1958	0.422 212. 259.
100	65.5 1035 0.2057	0.340 187. 213.	67.3 1108 0.1989	0.352 194. 220.	69.0 1160 0.1925	0.363 200. 227.	70.6 1255 0.1865	0.374 206. 234.	72.1 1331 0.1807	0.384 212. 241.
50	62.1 1070 0.1866	0.313 189. 200.	63.9 1143 0.1808	0.324 196. 207.	65.8 1223 0.1753	0.336 203. 214.	67.5 1301 0.1703	0.347 210. 222.	68.8 1367 0.1659	0.355 215. 227.
0	61.3 1218 0.1661	0.312 206. 202.	62.2 1254 0.1624	0.314 208. 204.	62.8 1282 0.1589	0.314 207. 204.	63.7 1327 0.1551	0.317 210. 206.	65.3 1404 0.1509	0.326 216. 212.

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Figure 05-05-01. Cruise Data—Long Range Cruise (Sheet 1 of 12)

LONG RANGE CRUISE			
CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310										
290	88.6 1419 0.2287	0.561 212. 325.								
270	86.5 1428 0.2234	0.547 216. 319.	88.2 1511 0.2153	0.557 220. 325.						
250	84.5 1400 0.2189	0.520 214. 306.	86.2 1507 0.2103	0.536 222. 317.	87.8 1603 0.2029	0.552 228. 325.	89.3 1684 0.1961	0.561 231. 330.		
230	83.2 1398 0.2140	0.503 216. 299.	84.5 1485 0.2063	0.516 221. 306.	85.9 1579 0.1989	0.528 227. 314.	87.4 1677 0.1919	0.542 233. 322.	89.0 1778 0.1856	0.555 239. 330.
210	81.8 1403 0.2082	0.487 218. 292.	83.1 1484 0.2013	0.499 223. 299.	84.4 1570 0.1947	0.510 228. 306.	85.7 1660 0.1882	0.522 233. 313.	86.9 1755 0.1821	0.533 239. 320.
190	80.4 1410 0.2019	0.471 219. 286.	81.8 1492 0.1957	0.483 225. 292.	83.1 1572 0.1899	0.494 230. 299.	84.2 1651 0.1841	0.503 234. 304.	85.3 1735 0.1785	0.512 238. 310.
170	78.9 1410 0.1957	0.453 219. 276.	80.4 1499 0.1899	0.467 226. 285.	81.6 1577 0.1845	0.478 231. 291.	82.8 1654 0.1793	0.487 236. 297.	84.0 1736 0.1743	0.497 240. 303.
150	77.3 1408 0.1897	0.435 218. 267.	78.7 1492 0.1840	0.447 225. 275.	80.1 1578 0.1789	0.460 231. 282.	81.4 1661 0.1740	0.471 237. 289.	82.6 1743 0.1695	0.481 242. 295.
100	73.4 1407 0.1753	0.394 217. 247.	74.8 1486 0.1702	0.404 223. 253.	76.2 1571 0.1653	0.415 229. 260.	77.6 1663 0.1607	0.427 236. 267.	78.9 1752 0.1566	0.438 242. 274.
50	70.2 1439 0.1615	0.364 220. 232.	71.5 1514 0.1574	0.373 226. 238.	72.8 1583 0.1534	0.381 230. 243.	73.8 1655 0.1495	0.388 235. 248.	75.0 1737 0.1456	0.397 240. 253.
0	66.8 1487 0.1471	0.337 223. 219.	68.3 1569 0.1435	0.347 229. 225.	69.7 1649 0.1403	0.356 235. 231.	71.0 1726 0.1372	0.364 241. 237.	72.1 1793 0.1343	0.371 245. 241.

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Figure 05-05-01. Cruise Data—Long Range Cruise (Sheet 2 of 12)

LONG RANGE CRUISE

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT - 1000 LB									
	24		26		28		30		32	
350	86.4 1032 0.3075	0.551 182. 317.	89.0 1111 0.2917	0.562 186. 324.						
330	84.1 1014 0.2999	0.523 180. 304.	86.5 1117 0.2847	0.547 189. 318.	88.9 1200 0.2714	0.560 194. 326.	91.8 1289 0.2573	0.570 198. 332.		
310	82.5 1007 0.2927	0.503 181. 295.	84.4 1098 0.2777	0.520 188. 305.	86.6 1204 0.2643	0.542 196. 318.	88.7 1287 0.2530	0.555 201. 326.	91.1 1372 0.2415	0.565 204. 331.
290	81.2 1017 0.2837	0.488 183. 288.	83.0 1094 0.2709	0.501 189. 296.	84.7 1180 0.2583	0.515 194. 305.	86.6 1285 0.2464	0.535 202. 317.	88.6 1361 0.2362	0.551 208. 326.
270	79.9 1025 0.2740	0.471 185. 281.	81.7 1101 0.2627	0.485 190. 289.	83.3 1182 0.2517	0.498 196. 298.	84.9 1268 0.2409	0.512 202. 305.	86.5 1364 0.2304	0.527 208. 314.
250	78.2 1025 0.2646	0.451 184. 271.	80.2 1110 0.2542	0.469 192. 282.	81.9 1187 0.2444	0.482 198. 290.	83.5 1266 0.2350	0.495 203. 298.	84.9 1350 0.2257	0.506 208. 305.
230	76.5 1024 0.2557	0.432 184. 262.	78.6 1108 0.2456	0.449 192. 272.	80.4 1194 0.2364	0.465 199. 282.	82.0 1272 0.2280	0.478 204. 290.	83.5 1354 0.2198	0.490 210. 298.
210	74.9 1023 0.2472	0.414 184. 253.	76.9 1108 0.2375	0.430 191. 263.	78.8 1192 0.2287	0.446 198. 273.	80.5 1277 0.2207	0.461 205. 282.	82.1 1363 0.2132	0.475 212. 291.
190	73.3 1023 0.2393	0.397 184. 245.	75.3 1105 0.2299	0.412 191. 254.	77.1 1190 0.2214	0.427 198. 264.	78.9 1277 0.2136	0.442 205. 273.	80.6 1364 0.2065	0.457 212. 282.
170	71.8 1024 0.2316	0.382 184. 237.	73.7 1104 0.2227	0.396 191. 246.	75.5 1189 0.2144	0.410 198. 255.	77.3 1275 0.2069	0.424 205. 264.	78.9 1362 0.2000	0.438 212. 272.
150	70.3 1033 0.2237	0.369 185. 231.	72.1 1108 0.2154	0.381 191. 239.	74.0 1191 0.2076	0.395 198. 248.	75.6 1275 0.2005	0.408 204. 256.	77.3 1361 0.1939	0.421 211. 264.
100	66.6 1055 0.2042	0.337 186. 215.	68.7 1139 0.1971	0.352 194. 225.	70.6 1218 0.1909	0.364 201. 232.	72.1 1288 0.1851	0.373 206. 238.	73.4 1359 0.1794	0.382 211. 244.
50	63.3 1093 0.1854	0.312 188. 203.	65.1 1168 0.1795	0.322 195. 210.	67.0 1253 0.1739	0.335 203. 218.	68.8 1337 0.1690	0.348 210. 226.	70.2 1403 0.1645	0.355 215. 231.
0	62.6 1253 0.1647	0.312 206. 206.	63.4 1289 0.1611	0.314 208. 208.	64.0 1317 0.1576	0.314 208. 208.	65.0 1362 0.1538	0.317 210. 210.	66.4 1437 0.1498	0.325 215. 215.

bd100_oei_crctl_lrc_IMP_lw_00 - 19/11/2003

Figure 05-05-01. Cruise Data—Long Range Cruise (Sheet 3 of 12)

LONG RANGE CRUISE

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310										
290	90.5 1462 0.2267	0.560 212. 331.								
270	88.4 1471 0.2211	0.545 215. 326.	90.1 1554 0.2130	0.555 219. 331.						
250	86.4 1442 0.2166	0.519 214. 312.	88.0 1552 0.2080	0.536 221. 323.	89.8 1654 0.2006	0.551 227. 332.	91.3 1736 0.1939	0.559 231. 337.		
230	85.0 1439 0.2118	0.502 215. 305.	86.4 1529 0.2041	0.514 221. 312.	87.7 1626 0.1967	0.527 226. 320.	89.3 1729 0.1897	0.541 232. 328.	90.9 1835 0.1834	0.555 239. 337.
210	83.5 1443 0.2061	0.486 217. 298.	84.9 1527 0.1992	0.497 222. 304.	86.2 1616 0.1925	0.509 227. 311.	87.5 1710 0.1861	0.520 233. 318.	88.8 1811 0.1800	0.533 238. 326.
190	82.1 1450 0.1999	0.470 218. 290.	83.5 1534 0.1937	0.482 224. 297.	84.8 1618 0.1878	0.493 229. 304.	86.0 1700 0.1821	0.502 234. 310.	87.2 1791 0.1765	0.513 239. 316.
170	80.5 1450 0.1937	0.452 218. 281.	82.0 1539 0.1880	0.466 225. 289.	83.4 1624 0.1826	0.477 231. 297.	84.6 1707 0.1774	0.487 236. 303.	85.8 1792 0.1724	0.497 241. 309.
150	78.9 1447 0.1878	0.434 218. 272.	80.4 1536 0.1822	0.447 224. 280.	81.9 1628 0.1771	0.460 231. 288.	83.1 1712 0.1723	0.471 237. 295.	84.3 1796 0.1677	0.481 242. 301.
100	74.9 1442 0.1739	0.393 217. 251.	76.3 1529 0.1686	0.404 223. 258.	77.7 1618 0.1637	0.415 229. 265.	79.1 1707 0.1593	0.426 235. 272.	80.5 1799 0.1552	0.437 242. 279.
50	71.4 1473 0.1603	0.363 220. 236.	72.8 1549 0.1561	0.372 225. 242.	74.1 1622 0.1521	0.380 230. 247.	75.2 1698 0.1482	0.387 234. 252.	76.4 1783 0.1443	0.396 240. 257.
0	68.0 1520 0.1459	0.336 222. 222.	69.5 1603 0.1424	0.345 228. 228.	70.9 1684 0.1391	0.354 234. 234.	72.2 1766 0.1360	0.363 240. 240.	73.4 1840 0.1331	0.370 245. 245.

bd100_oei_crctl_lrc_IMP_hw_00 – 19/11/2003

Figure 05-05-01. Cruise Data—Long Range Cruise (Sheet 4 of 12)

LONG RANGE CRUISE

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350	87.4 1048 0.3057	0.550 182. 321.	90.0 1128 0.2900	0.561 185. 327.						
330	85.1 1031 0.2983	0.523 180. 308.	87.5 1135 0.2832	0.547 189. 322.	89.8 1218 0.2700	0.559 194. 329.	92.8 1310 0.2559	0.570 198. 335.		
310	83.4 1021 0.2912	0.502 181. 298.	85.4 1116 0.2763	0.520 188. 308.	87.5 1223 0.2630	0.542 196. 322.	89.6 1310 0.2516	0.566 201. 330.	92.1 1394 0.2403	0.565 205. 335.
290	82.1 1032 0.2823	0.487 183. 292.	83.9 1111 0.2696	0.501 189. 300.	85.6 1200 0.2570	0.516 194. 309.	87.5 1303 0.2453	0.534 202. 320.	89.5 1405 0.2350	0.552 209. 330.
270	80.7 1042 0.2726	0.471 185. 284.	82.5 1119 0.2614	0.485 191. 293.	84.2 1199 0.2506	0.498 196. 300.	85.8 1285 0.2398	0.511 201. 308.	87.4 1384 0.2294	0.526 208. 318.
250	79.1 1041 0.2632	0.451 184. 274.	81.1 1127 0.2528	0.468 192. 286.	82.8 1205 0.2432	0.482 198. 293.	84.4 1287 0.2337	0.495 203. 301.	85.8 1370 0.2245	0.506 208. 308.
230	77.4 1040 0.2544	0.432 184. 265.	79.4 1124 0.2444	0.448 191. 275.	81.3 1213 0.2352	0.466 199. 285.	82.9 1292 0.2268	0.478 204. 293.	84.4 1373 0.2187	0.490 210. 300.
210	75.7 1038 0.2461	0.413 184. 255.	77.8 1126 0.2363	0.431 192. 266.	79.6 1210 0.2276	0.446 198. 276.	81.3 1295 0.2196	0.460 205. 284.	83.0 1382 0.2121	0.474 212. 293.
190	74.1 1037 0.2382	0.397 184. 247.	76.0 1123 0.2288	0.412 191. 257.	77.9 1206 0.2203	0.427 198. 266.	79.7 1294 0.2126	0.442 205. 275.	81.4 1383 0.2055	0.456 212. 284.
170	72.5 1039 0.2305	0.382 184. 240.	74.4 1121 0.2216	0.396 191. 248.	76.2 1204 0.2134	0.410 197. 257.	78.0 1292 0.2059	0.424 204. 266.	79.7 1382 0.1990	0.438 211. 275.
150	71.0 1048 0.2225	0.369 185. 233.	72.9 1124 0.2144	0.381 191. 241.	74.6 1206 0.2067	0.394 198. 249.	76.4 1291 0.1994	0.407 204. 258.	78.2 1383 0.1928	0.422 212. 267.
100	67.3 1069 0.2032	0.337 186. 217.	69.4 1154 0.1962	0.352 194. 227.	71.2 1232 0.1900	0.363 200. 234.	72.6 1299 0.1842	0.372 205. 240.	74.0 1378 0.1785	0.382 211. 246.
50	63.8 1106 0.1847	0.312 188. 204.	65.7 1180 0.1788	0.322 195. 211.	67.6 1265 0.1733	0.334 202. 219.	69.3 1345 0.1684	0.345 209. 227.	70.8 1423 0.1638	0.355 215. 233.
0	63.2 1270 0.1640	0.312 207. 208.	64.0 1305 0.1605	0.314 208. 210.	64.6 1333 0.1570	0.314 208. 209.	65.5 1379 0.1532	0.317 210. 211.	67.0 1454 0.1492	0.325 215. 217.

bd100_ooi_crctl_lrc_IMP_lw_05 – 19/11/2003

Figure 05-05-01. Cruise Data—Long Range Cruise (Sheet 5 of 12)

LONG RANGE CRUISE

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310										
290	91.5 1485 0.2257	0.560 212. 335.								
270	89.3 1492 0.2201	0.544 215. 328.	91.0 1577 0.2120	0.554 219. 334.						
250	87.3 1464 0.2154	0.519 213. 315.	89.0 1576 0.2069	0.536 221. 326.	90.7 1679 0.1996	0.551 227. 335.	92.2 1760 0.1929	0.558 230. 340.		
230	85.8 1459 0.2107	0.501 215. 308.	87.3 1553 0.2029	0.514 220. 315.	88.7 1650 0.1956	0.526 226. 323.	90.2 1756 0.1887	0.540 232. 331.	91.9 1864 0.1824	0.555 239. 340.
210	84.4 1463 0.2050	0.485 217. 300.	85.8 1549 0.1982	0.497 222. 307.	87.1 1640 0.1915	0.508 227. 314.	88.4 1735 0.1851	0.520 232. 321.	89.8 1839 0.1790	0.533 238. 329.
190	82.9 1470 0.1989	0.469 218. 292.	84.3 1555 0.1927	0.481 224. 300.	85.7 1642 0.1868	0.493 229. 307.	86.8 1724 0.1811	0.501 233. 312.	88.0 1817 0.1755	0.512 238. 319.
170	81.3 1470 0.1928	0.452 218. 284.	82.8 1560 0.1870	0.465 225. 292.	84.2 1648 0.1816	0.477 231. 299.	85.4 1732 0.1764	0.487 236. 306.	86.6 1817 0.1715	0.497 240. 312.
150	79.7 1470 0.1868	0.434 218. 275.	81.2 1555 0.1813	0.446 224. 282.	82.7 1649 0.1762	0.460 231. 291.	84.0 1740 0.1714	0.472 237. 298.	85.2 1820 0.1669	0.481 242. 304.
100	75.6 1464 0.1729	0.393 217. 253.	77.1 1552 0.1677	0.404 223. 260.	78.6 1644 0.1628	0.416 230. 268.	80.0 1737 0.1585	0.427 236. 275.	81.2 1820 0.1545	0.437 241. 281.
50	72.3 1499 0.1595	0.365 221. 239.	73.6 1570 0.1555	0.372 225. 244.	74.7 1637 0.1516	0.379 229. 248.	75.9 1721 0.1476	0.387 234. 254.	77.1 1803 0.1437	0.395 239. 259.
0	68.6 1537 0.1453	0.335 222. 224.	70.1 1621 0.1418	0.345 228. 230.	71.5 1704 0.1385	0.354 234. 236.	72.9 1788 0.1354	0.363 240. 242.	74.1 1864 0.1325	0.370 245. 247.

bd100_oei_crcll_lrc_IMP_hw_05 – 19/11/2003

Figure 05-05-01. Cruise Data—Long Range Cruise (Sheet 6 of 12)

LONG RANGE CRUISE

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350	88.4 1065 0.3039	0.550 181. 324.	91.1 1147 0.2882	0.561 185. 331.						
330	86.0 1047 0.2967	0.523 180. 311.	88.4 1152 0.2816	0.546 189. 325.	90.8 1240 0.2684	0.560 194. 333.				
310	84.3 1038 0.2898	0.502 181. 301.	86.3 1133 0.2749	0.520 188. 312.	88.4 1244 0.2615	0.543 196. 325.	90.6 1331 0.2504	0.556 201. 333.		
290	82.9 1047 0.2809	0.487 183. 294.	84.7 1127 0.2683	0.500 188. 302.	86.5 1220 0.2557	0.516 194. 312.	88.4 1327 0.2439	0.536 202. 324.	90.4 1424 0.2340	0.551 208. 333.
270	81.6 1057 0.2713	0.471 185. 287.	83.4 1135 0.2602	0.485 190. 296.	85.0 1215 0.2494	0.497 196. 303.	86.6 1303 0.2387	0.510 201. 311.	88.4 1406 0.2283	0.527 208. 321.
250	80.0 1058 0.2618	0.451 185. 277.	82.0 1144 0.2515	0.469 192. 286.	83.7 1223 0.2419	0.482 198. 296.	85.3 1306 0.2325	0.494 203. 304.	86.8 1392 0.2232	0.506 208. 311.
230	78.3 1059 0.2529	0.432 184. 268.	80.2 1141 0.2431	0.448 191. 278.	82.2 1231 0.2340	0.465 199. 288.	83.8 1312 0.2256	0.478 204. 296.	85.3 1395 0.2175	0.490 210. 303.
210	76.5 1055 0.2448	0.414 184. 258.	78.5 1141 0.2352	0.430 191. 268.	80.4 1227 0.2265	0.445 198. 278.	82.2 1315 0.2185	0.460 205. 287.	83.8 1400 0.2110	0.474 211. 296.
190	74.9 1054 0.2370	0.397 184. 250.	76.8 1139 0.2277	0.412 191. 259.	78.7 1224 0.2192	0.427 198. 268.	80.5 1314 0.2115	0.442 205. 278.	82.1 1400 0.2045	0.455 211. 286.
170	73.3 1056 0.2293	0.382 184. 242.	75.2 1138 0.2205	0.396 191. 251.	77.0 1221 0.2123	0.409 197. 259.	78.9 1313 0.2048	0.424 205. 269.	80.5 1399 0.1981	0.437 211. 277.
150	71.9 1067 0.2214	0.370 185. 236.	73.6 1140 0.2134	0.381 191. 243.	75.4 1221 0.2058	0.394 197. 251.	77.2 1308 0.1985	0.407 204. 260.	78.9 1400 0.1919	0.421 211. 269.
100	68.0 1084 0.2024	0.338 186. 219.	70.1 1169 0.1954	0.351 194. 228.	71.7 1241 0.1892	0.361 199. 235.	73.3 1319 0.1832	0.372 205. 242.	74.9 1400 0.1775	0.382 211. 249.
50	64.4 1115 0.1843	0.311 188. 206.	66.1 1187 0.1784	0.320 194. 212.	67.9 1268 0.1728	0.331 200. 219.	69.8 1358 0.1675	0.344 208. 228.	71.6 1446 0.1629	0.356 216. 236.
0	63.8 1286 0.1634	0.312 207. 210.	64.5 1321 0.1598	0.314 208. 211.	65.1 1348 0.1564	0.313 207. 211.	66.1 1396 0.1526	0.317 210. 213.	67.6 1473 0.1485	0.325 215. 219.

bd100_oei_crctl_lrc_IMP_lw_10 – 19/11/2003

Figure 05-05-01. Cruise Data—Long Range Cruise (Sheet 7 of 12)

LONG RANGE CRUISE

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310										
290										
270	90.2 1515 0.2190	0.545 215. 332.								
250	88.2 1487 0.2142	0.519 213. 319.	89.9 1601 0.2057	0.536 221. 329.						
230	86.7 1481 0.2096	0.501 215. 310.	88.1 1575 0.2019	0.514 220. 318.	89.6 1673 0.1946	0.526 226. 326.	91.2 1783 0.1877	0.540 232. 335.		
210	85.3 1486 0.2039	0.486 217. 303.	86.6 1571 0.1972	0.496 222. 310.	87.9 1662 0.1905	0.507 227. 317.	89.3 1761 0.1841	0.520 232. 324.	90.7 1867 0.1780	0.533 238. 332.
190	83.8 1491 0.1979	0.469 218. 295.	85.2 1578 0.1917	0.481 224. 303.	86.5 1664 0.1858	0.492 229. 309.	87.7 1749 0.1801	0.501 233. 315.	88.9 1845 0.1745	0.512 238. 322.
170	82.1 1490 0.1918	0.451 218. 286.	83.7 1582 0.1861	0.465 224. 294.	85.0 1671 0.1806	0.476 230. 302.	86.3 1755 0.1755	0.486 235. 308.	87.5 1845 0.1705	0.497 240. 315.
150	80.5 1489 0.1859	0.434 218. 277.	82.0 1578 0.1804	0.446 224. 285.	83.4 1671 0.1753	0.459 230. 293.	84.8 1764 0.1705	0.471 237. 301.	86.1 1851 0.1660	0.481 242. 307.
100	76.4 1484 0.1721	0.393 217. 256.	77.8 1573 0.1669	0.404 223. 263.	79.3 1665 0.1621	0.415 229. 270.	80.8 1765 0.1576	0.428 236. 278.	82.0 1849 0.1537	0.437 242. 284.
50	73.1 1526 0.1587	0.366 221. 242.	74.3 1593 0.1547	0.373 226. 246.	75.5 1665 0.1509	0.380 230. 251.	76.5 1736 0.1471	0.386 234. 255.	77.8 1826 0.1431	0.395 239. 261.
0	69.2 1556 0.1447	0.335 221. 225.	70.7 1640 0.1412	0.344 228. 232.	72.1 1725 0.1379	0.354 234. 238.	73.5 1809 0.1348	0.363 240. 244.	74.7 1886 0.1320	0.370 245. 249.

bd100_oei_crcl_lrc_IMP_hw_10 – 19/11/2003

Figure 05-05-01. Cruise Data—Long Range Cruise (Sheet 8 of 12)

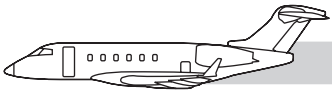
LONG RANGE CRUISE

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350	89.5 1086 0.3018	0.551 182. 328.								
330	87.0 1064 0.2949	0.522 180. 314.	89.5 1173 0.2798	0.547 189. 328.						
310	85.2 1053 0.2884	0.502 181. 304.	87.1 1147 0.2736	0.518 187. 314.	89.3 1262 0.2601	0.542 196. 328.				
290	83.8 1063 0.2796	0.486 183. 297.	85.6 1144 0.2669	0.500 188. 305.	87.4 1237 0.2544	0.516 194. 315.	89.3 1348 0.2426	0.536 202. 327.		
270	82.4 1072 0.2700	0.470 184. 290.	84.2 1152 0.2589	0.485 190. 298.	85.9 1233 0.2482	0.497 196. 306.	87.5 1324 0.2375	0.511 201. 314.	89.2 1425 0.2272	0.526 207. 324.
250	80.8 1075 0.2604	0.451 185. 280.	82.8 1162 0.2502	0.469 192. 291.	84.5 1242 0.2406	0.482 198. 299.	86.1 1326 0.2314	0.494 203. 307.	87.6 1411 0.2222	0.505 208. 314.
230	79.0 1072 0.2517	0.432 184. 270.	81.1 1159 0.2418	0.448 191. 280.	83.0 1248 0.2328	0.465 199 291.	84.7 1334 0.2244	0.479 205. 299.	86.2 1417 0.2163	0.490 210. 307.
210	77.3 1069 0.2436	0.413 184. 261.	79.4 1158 0.2339	0.430 191. 271.	81.2 1245 0.2253	0.445 198. 281.	83.0 1335 0.2173	0.461 205. 290.	84.6 1422 0.2099	0.474 211. 299.
190	75.6 1068 0.2358	0.397 184. 252.	77.6 1155 0.2265	0.412 191. 262.	79.6 1245 0.2181	0.428 198. 272.	81.3 1331 0.2105	0.441 205. 280.	83.0 1420 0.2035	0.455 211. 289.
170	74.0 1069 0.2282	0.382 184. 244.	76.0 1154 0.2194	0.396 191. 253.	77.8 1241 0.2113	0.410 198. 262.	79.6 1328 0.2039	0.424 204. 271.	81.3 1420 0.1971	0.438 211. 280.
150	72.6 1081 0.2205	0.370 185. 239.	74.3 1155 0.2126	0.381 191. 246.	76.1 1237 0.2049	0.393 197. 254.	77.9 1323 0.1977	0.406 204. 262.	79.7 1421 0.1910	0.421 211. 271.
100	68.6 1097 0.2016	0.337 186. 221.	70.5 1178 0.1947	0.350 193. 229.	72.4 1260 0.1884	0.362 200. 238.	74.1 1339 0.1825	0.373 205. 244.	75.5 1414 0.1769	0.381 210. 250.
50	65.2 1136 0.1834	0.312 189. 208.	66.5 1192 0.1779	0.318 192. 212.	68.6 1285 0.1719	0.331 200. 221.	70.5 1377 0.1668	0.344 208. 230.	72.3 1467 0.1621	0.356 216. 238.
0	64.3 1301 0.1627	0.312 206. 212.	64.9 1330 0.1593	0.312 206. 212.	65.5 1355 0.1559	0.311 206. 211.	66.7 1415 0.1519	0.317 210. 215.	68.3 1494 0.1479	0.326 215. 221.

bd100_oei_crcll_lrc_IMP_lw_15 – 19/11/2003

Figure 05-05-01. Cruise Data—Long Range Cruise (Sheet 9 of 12)



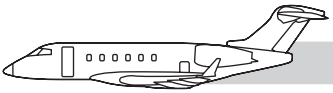
LONG RANGE CRUISE

CLIMB THRUST LIMITS **ENGINE BLEED ON** **ENGINE AND WING A/I OFF**	ISA + 15 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310										
290										
270										
250	89.1 1509 0.2132	0.519 213. 322.								
230	87.6 1503 0.2085	0.501 215. 314.	89.0 1596 0.2009	0.513 220. 321.						
210	86.1 1507 0.2029	0.485 216. 306.	87.5 1592 0.1962	0.496 221. 312.	88.8 1686 0.1895	0.507 227. 320.	90.2 1786 0.1831	0.519 232. 327.		
190	84.6 1512 0.1969	0.469 218. 298.	86.0 1599 0.1908	0.481 223. 305.	87.3 1687 0.1849	0.492 228. 312.	88.6 1775 0.1792	0.501 233. 318.	89.9 1876 0.1736	0.513 239. 326.
170	82.9 1509 0.1909	0.451 218. 288.	84.5 1604 0.1851	0.464 224. 297.	85.9 1694 0.1797	0.476 230. 305.	87.1 1781 0.1746	0.486 235. 311.	88.4 1871 0.1697	0.496 240. 318.
150	81.2 1508 0.1851	0.433 218. 279.	82.7 1599 0.1795	0.446 224. 287.	84.3 1695 0.1744	0.459 230. 296.	85.6 1788 0.1696	0.471 237. 303.	86.9 1876 0.1652	0.481 242. 310.
100	77.0 1502 0.1713	0.392 216. 257.	78.6 1592 0.1661	0.403 222. 264.	80.1 1690 0.1613	0.416 230. 273.	81.5 1786 0.1569	0.428 236. 280.	82.8 1876 0.1530	0.438 242. 287.
50	73.8 1547 0.1580	0.366 222. 244.	75.0 1613 0.1541	0.373 226. 249.	76.2 1687 0.1502	0.380 230. 254.	77.3 1761 0.1464	0.386 234. 258.	78.4 1845 0.1425	0.394 239. 263.
0	69.8 1575 0.1441	0.335 221. 227.	71.2 1657 0.1406	0.343 227. 233.	72.8 1748 0.1372	0.354 234. 240.	74.2 1833 0.1342	0.363 240. 246.	75.5 1914 0.1313	0.371 245. 252.

bd100_oei_crctl_lrc_IMP_hw_15 – 19/11/2003

Figure 05-05-01. Cruise Data—Long Range Cruise (Sheet 10 of 12)



LONG RANGE CRUISE

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350	90.5 1107 0.2997	0.551 182. 332.								
330	87.9 1082 0.2930	0.523 180. 317.	90.5 1193 0.2782	0.547 189. 332.						
310	86.1 1068 0.2869	0.501 180. 306.	88.0 1166 0.2720	0.518 187. 317.	90.2 1282 0.2586	0.542 196. 332.				
290	84.6 1077 0.2782	0.486 183. 300.	86.4 1161 0.2656	0.500 188. 308.	88.2 1252 0.2532	0.514 194. 317.	90.2 1365 0.2414	0.534 202. 330.		
270	83.2 1087 0.2686	0.470 184. 292.	85.0 1169 0.2576	0.484 190. 301.	86.8 1253 0.2469	0.498 196. 310.	88.4 1344 0.2363	0.511 201. 318.		
250	81.6 1090 0.2590	0.451 184. 282.	83.6 1180 0.2489	0.469 192. 294.	85.4 1262 0.2394	0.482 198. 302.	87.0 1346 0.2302	0.495 203. 310.	88.4 1430 0.2212	0.505 207. 316.
230	79.9 1089 0.2503	0.432 184. 273.	81.9 1176 0.2405	0.448 191. 283.	83.8 1268 0.2315	0.465 199. 294.	85.5 1353 0.2232	0.478 205. 302.	87.0 1436 0.2152	0.490 210. 309.
210	78.1 1086 0.2422	0.414 184. 263.	80.2 1175 0.2327	0.430 191. 274.	82.1 1263 0.2241	0.445 198. 283.	83.9 1355 0.2162	0.461 205. 293.	85.5 1445 0.2088	0.474 211. 302.
190	76.4 1084 0.2346	0.397 184. 254.	78.4 1170 0.2254	0.412 191. 264.	80.3 1262 0.2170	0.427 198. 274.	82.1 1352 0.2094	0.442 205. 283.	83.8 1441 0.2025	0.455 211. 292.
170	74.7 1084 0.2272	0.382 184. 246.	76.6 1168 0.2184	0.395 190. 255.	78.6 1259 0.2102	0.410 198. 265.	80.4 1348 0.2029	0.424 204. 274.	82.0 1437 0.1962	0.437 211. 282.
150	73.1 1093 0.2194	0.369 185. 240.	75.0 1172 0.2114	0.381 191. 248.	76.9 1256 0.2038	0.394 197. 256.	78.6 1341 0.1967	0.406 203. 264.	80.4 1439 0.1900	0.421 211. 274.
100	69.2 1108 0.2008	0.336 185. 223.	71.2 1194 0.1938	0.350 193. 231.	73.1 1278 0.1875	0.362 200. 240.	74.8 1357 0.1817	0.373 206. 247.	76.2 1430 0.1762	0.381 210. 252.
50	65.6 1147 0.1825	0.311 188. 209.	67.3 1219 0.1767	0.320 194. 215.	69.2 1306 0.1711	0.332 201. 224.	71.1 1394 0.1661	0.344 208. 232.	72.9 1483 0.1615	0.356 215. 240.
0	64.2 1282 0.1632	0.306 202. 209.	64.8 1312 0.1596	0.306 202. 209.	65.9 1362 0.1555	0.310 205. 212.	67.3 1427 0.1514	0.316 209. 216.	68.7 1502 0.1474	0.324 214. 222.

bd100_oei_crctl_lrc_IMP_lw_20 - 19/11/2003

Figure 05-05-01. Cruise Data—Long Range Cruise (Sheet 11 of 12)

LONG RANGE CRUISE

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310										
290										
270										
250										
230	88.5 1528 0.2074	0.502 215. 317.								
210	87.0 1529 0.2019	0.485 216. 309.	88.3 1615 0.1952	0.496 221. 315.	89.7 1706 0.1886	0.506 226. 322.				
190	85.4 1533 0.1960	0.469 218. 300.	86.8 1621 0.1899	0.480 223. 308.	88.2 1711 0.1840	0.491 228. 315.				
170	83.7 1531 0.1899	0.450 218. 291.	85.3 1627 0.1842	0.464 224. 300.	86.7 1718 0.1789	0.476 230. 307.	88.0 1805 0.1738	0.486 235. 314.		
150	82.0 1531 0.1841	0.433 218. 282.	83.5 1620 0.1786	0.445 224. 290.	85.1 1719 0.1735	0.459 230. 298.	86.5 1813 0.1688	0.471 237. 306.	87.8 1907 0.1644	0.482 242. 314.
100	77.7 1518 0.1706	0.391 216. 259.	79.3 1613 0.1653	0.403 222. 267.	80.8 1712 0.1605	0.415 229. 275.	82.3 1812 0.1561	0.428 236. 283.	83.6 1905 0.1522	0.438 242. 290.
50	74.4 1560 0.1574	0.365 221. 246.	75.8 1636 0.1534	0.373 226. 251.	76.8 1705 0.1496	0.379 229. 255.	78.0 1788 0.1456	0.387 234. 260.	79.2 1872 0.1419	0.395 239. 266.
0	70.3 1591 0.1435	0.334 221. 228.	71.9 1677 0.1399	0.343 227. 235.	73.5 1773 0.1366	0.354 234. 242.	74.9 1862 0.1336	0.364 240. 249.	76.1 1938 0.1308	0.371 245. 254.

bd100_oei_crctl_lrc_IMP_hw_20 - 19/11/2003

Figure 05-05-01. Cruise Data—Long Range Cruise (Sheet 12 of 12)

MAXIMUM RANGE CRUISE

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350	82.7 930 0.3140	0.519 171. 292.	85.1 1011 0.2981	0.535 176. 301.	88.7 1113 0.2804	0.554 183. 312.				
330	80.8 911 0.3059	0.490 168. 279.	83.0 1007 0.2905	0.515 178. 293.	85.2 1090 0.2770	0.532 183. 302.	88.1 1185 0.2624	0.547 189. 311.		
310	79.3 911 0.2984	0.474 170. 272.	81.4 1002 0.2833	0.495 178. 284.	83.3 1088 0.2697	0.512 184. 294.	85.2 1176 0.2579	0.529 191. 303.	87.4 1257 0.2462	0.540 195. 310.
290	78.0 923 0.2894	0.461 173. 267.	79.7 989 0.2763	0.472 178. 274.	81.5 1068 0.2633	0.486 183. 281.	83.4 1163 0.2513	0.505 190. 292.	85.0 1252 0.2408	0.521 197. 302.
270	76.4 922 0.2797	0.442 173. 258.	78.4 999 0.2681	0.459 180. 268.	80.1 1070 0.2570	0.471 185. 275.	81.5 1139 0.2460	0.480 188. 280.	83.3 1232 0.2352	0.496 195. 290.
250	74.9 930 0.2701	0.427 174. 251.	76.8 1002 0.2594	0.441 181. 260.	78.6 1075 0.2495	0.455 186. 268.	80.2 1146 0.2398	0.467 191. 275.	81.7 1219 0.2303	0.477 196. 281.
230	73.3 930 0.2610	0.408 174. 243.	75.3 1007 0.2507	0.425 181. 252.	77.2 1083 0.2412	0.440 188. 261.	78.8 1154 0.2326	0.452 193. 269.	80.4 1236 0.2242	0.466 199. 277.
210	71.7 928 0.2523	0.391 173. 234.	73.8 1007 0.2423	0.407 181. 244.	75.6 1085 0.2333	0.422 188. 253.	77.3 1162 0.2251	0.437 194. 262.	78.8 1232 0.2175	0.447 199. 268.
190	70.2 928 0.2441	0.375 173. 227.	72.2 1006 0.2345	0.390 180. 236.	73.9 1081 0.2257	0.404 187. 244.	75.7 1161 0.2178	0.419 194. 253.	77.4 1242 0.2106	0.433 201. 262.
170	68.6 929 0.2360	0.360 173. 219.	70.6 1005 0.2270	0.374 180. 228.	72.4 1083 0.2186	0.389 187. 237.	74.1 1161 0.2110	0.402 194. 245.	75.8 1240 0.2040	0.415 200. 253.
150	67.3 942 0.2277	0.349 175. 215.	69.1 1007 0.2196	0.360 180. 221.	70.9 1083 0.2117	0.374 187. 229.	72.6 1160 0.2045	0.386 194. 237.	74.2 1240 0.1978	0.400 200. 245.
100	63.4 955 0.2077	0.317 174. 198.	65.4 1028 0.2009	0.330 182. 207.	67.2 1101 0.1945	0.342 188. 214.	68.8 1171 0.1883	0.352 194. 221.	70.3 1240 0.1826	0.362 199. 226.
50	60.0 986 0.1885	0.291 176. 186.	61.6 1049 0.1826	0.300 181. 192.	63.6 1126 0.1770	0.313 189. 200.	65.2 1195 0.1720	0.322 195. 206.	66.8 1267 0.1676	0.333 201. 212.
0	58.5 1112 0.1678	0.287 190. 187.	59.4 1143 0.1641	0.289 191. 188.	60.3 1175 0.1605	0.290 192. 189.	61.7 1231 0.1566	0.297 196. 193.	63.1 1292 0.1525	0.303 201. 197.

bd100_oei_crctl_mrc_IMP_lw_m10 – 19/11/2003

Figure 05-05-02. Cruise Data—Maximum Range Cruise (Sheet 1 of 12)

MAXIMUM RANGE CRUISE			
CLIMB THRUST LIMITS **ENGINE BLEED ON** **ENGINE AND WING A/I OFF**	ISA – 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310	90.3 1354 0.2334	0.551 199. 316.								
290	87.0 1336 0.2311	0.534 202. 309.	90.4 1476 0.2197	0.560 212. 324.	90.5 1451 0.2088	0.523 198. 303.				
270	84.9 1330 0.2257	0.514 202. 300.	86.5 1419 0.2175	0.529 208. 309.	88.4 1502 0.2091	0.538 212. 314.	90.2 1573 0.2002	0.539 213. 315.		
250	83.1 1300 0.2211	0.488 200. 288.	84.7 1402 0.2124	0.506 208. 298.	86.4 1509 0.2050	0.525 216. 310.	87.8 1586 0.1981	0.533 220. 314.	89.7 1682 0.1910	0.545 225. 321.
230	81.7 1303 0.2161	0.474 203. 282.	83.1 1383 0.2083	0.485 208. 288.	84.5 1470 0.2009	0.497 213. 295.	85.9 1569 0.1939	0.512 220. 304.	87.4 1667 0.1875	0.526 226. 313.
210	80.4 1318 0.2103	0.463 206. 277.	81.6 1384 0.2034	0.470 209. 282.	83.0 1469 0.1966	0.482 215. 289.	84.4 1558 0.1901	0.494 221. 296.	85.7 1650 0.1840	0.507 226. 304.
190	78.7 1310 0.2040	0.442 205. 267.	80.2 1390 0.1977	0.455 211. 275.	81.6 1472 0.1918	0.467 217. 282.	82.8 1542 0.1860	0.475 220. 287.	84.0 1628 0.1803	0.486 226. 294.
170	77.3 1320 0.1976	0.428 206. 261.	78.8 1398 0.1918	0.440 212. 268.	80.0 1465 0.1863	0.448 216. 273.	81.6 1564 0.1811	0.465 225. 283.	82.6 1625 0.1761	0.470 227. 286.
150	75.8 1319 0.1916	0.412 206. 253.	77.2 1399 0.1859	0.424 212. 260.	78.6 1479 0.1807	0.435 218. 267.	79.7 1544 0.1758	0.442 222. 272.	81.0 1623 0.1712	0.452 227. 278.
100	71.9 1318 0.1771	0.373 206. 234.	73.3 1396 0.1719	0.383 211. 240.	74.7 1477 0.1670	0.394 217. 247.	75.9 1552 0.1624	0.402 222. 252.	77.3 1641 0.1582	0.414 229. 260.
50	68.3 1339 0.1632	0.343 207. 219.	69.7 1413 0.1590	0.352 213. 225.	71.2 1490 0.1550	0.362 219. 231.	72.3 1552 0.1511	0.367 222. 234.	73.6 1634 0.1471	0.377 228. 240.
0	64.6 1368 0.1486	0.313 207. 203.	66.1 1442 0.1450	0.322 213. 209.	67.4 1517 0.1417	0.331 219. 215.	68.8 1590 0.1386	0.339 224. 220.	70.1 1665 0.1357	0.348 230. 226.

bd100_oei_crctl_mrc_IMP_hw_m10 - 19/11/2003

Figure 05-05-02. Cruise Data—Maximum Range Cruise (Sheet 2 of 12)

MAXIMUM RANGE CRUISE

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350	84.7 963 0.3106*	0.519 171. 299.	87.2 1046 0.2947	0.535 176. 308.	90.8 1150 0.2770	0.553 182. 319.				
330	82.6 940 0.3030	0.490 168. 286.	84.9 1041 0.2876	0.515 177. 300.	87.2 1133 0.2741	0.534 184. 311.	90.1 1225 0.2599	0.548 189. 318.	91.3 1235 0.2428	0.516 178. 300.
310	81.1 942 0.2956	0.475 170. 278.	83.0 1020 0.2805	0.488 175. 286.	85.2 1126 0.2670	0.512 185. 301.	87.0 1213 0.2555	0.529 191. 310.	89.3 1298 0.2439	0.540 195. 317.
290	79.8 952 0.2866	0.461 173. 273.	81.5 1022 0.2737	0.473 178. 280.	83.3 1103 0.2609	0.486 183. 288.	85.2 1201 0.2489	0.505 190. 299.	86.9 1292 0.2386	0.521 196. 308.
270	78.2 952 0.2768	0.442 173. 264.	80.2 1031 0.2653	0.459 180. 274.	81.9 1105 0.2542	0.471 185. 281.	83.5 1184 0.2433	0.483 190. 288.	85.2 1272 0.2328	0.496 195. 296.
250	76.7 960 0.2673	0.426 174. 257.	78.5 1032 0.2567	0.440 180. 265.	80.4 1110 0.2469	0.455 186. 274.	82.1 1191 0.2374	0.470 192. 283.	83.5 1259 0.2280	0.477 196. 287.
230	75.0 959 0.2583	0.408 174. 248.	77.0 1039 0.2481	0.425 181. 258.	78.9 1118 0.2388	0.440 188. 267.	80.5 1190 0.2303	0.452 193. 274.	82.2 1273 0.2220	0.466 199. 283.
210	73.3 957 0.2497	0.391 173. 239.	75.4 1039 0.2399	0.407 181. 249.	77.1 1111 0.2310	0.420 186. 257.	78.8 1189 0.2229	0.433 193. 265.	80.5 1269 0.2153	0.447 199. 273.
190	71.7 956 0.2417	0.375 173. 231.	73.7 1036 0.2322	0.390 180. 241.	75.5 1111 0.2236	0.403 186. 249.	77.3 1194 0.2157	0.418 193. 258.	79.0 1278 0.2086	0.432 200. 267.
170	70.1 958 0.2339	0.361 173. 224.	72.1 1035 0.2249	0.376 180. 233.	73.9 1114 0.2165	0.388 187. 241.	75.7 1194 0.2090	0.401 193. 250.	77.4 1278 0.2020	0.415 200. 258.
150	68.7 968 0.2259	0.349 175. 219.	70.4 1035 0.2176	0.360 180. 225.	72.4 1115 0.2097	0.373 187. 234.	74.1 1194 0.2025	0.386 193. 242.	75.7 1275 0.1959	0.399 200. 250.
100	64.7 979 0.2062	0.316 174. 202.	66.8 1057 0.1991	0.330 182. 211.	68.6 1131 0.1928	0.342 188. 218.	70.4 1206 0.1869	0.353 195. 226.	71.9 1274 0.1812	0.362 200. 231.
50	61.1 1010 0.1872	0.291 176. 189.	62.8 1075 0.1813	0.300 181. 195.	64.7 1150 0.1757	0.311 188. 202.	66.5 1225 0.1707	0.322 195. 209.	68.1 1300 0.1662	0.332 201. 216.
0	59.2 1127 0.1664	0.283 188. 188.	60.6 1175 0.1627	0.289 191. 191.	61.8 1219 0.1592	0.293 194. 194.	62.9 1265 0.1554	0.297 197. 197.	64.2 1324 0.1513	0.303 200. 200.

bd100_oei_crctl_mrc_IMP_lw_00 - 19/11/2003

Figure 05-05-02. Cruise Data—Maximum Range Cruise (Sheet 3 of 12)

MAXIMUM RANGE CRUISE

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310	92.3 1400 0.2312	0.552 200. 324.								
290	88.8 1377 0.2290	0.533 201. 315.	92.2 1521 0.2178	0.560 212. 331.	92.5 1499 0.2073	0.525 198. 311.				
270	86.9 1373 0.2234	0.514 202. 307.	88.5 1467 0.2152	0.529 209. 316.	90.4 1552 0.2068	0.538 212. 321.	92.1 1614 0.1978	0.535 211. 319.		
250	85.0 1341 0.2188	0.487 200. 293.	86.6 1449 0.2101	0.506 208. 304.	88.1 1545 0.2027	0.520 214. 313.	89.8 1639 0.1959	0.533 220. 321.	91.5 1727 0.1888	0.542 223. 326.
230	83.5 1343 0.2139	0.474 202. 287.	84.9 1427 0.2061	0.485 208. 294.	86.4 1516 0.1987	0.496 213. 301.	87.8 1618 0.1916	0.511 219. 310.	89.3 1715 0.1853	0.524 225. 316.
210	82.1 1355 0.2082	0.461 205. 282.	83.4 1426 0.2012	0.469 209. 287.	84.9 1516 0.1945	0.482 215. 295.	86.2 1607 0.1880	0.494 220. 302.	87.4 1693 0.1818	0.503 225. 308.
190	80.4 1349 0.2020	0.442 205. 272.	81.9 1432 0.1957	0.455 211. 280.	83.4 1518 0.1897	0.467 217. 288.	84.5 1589 0.1839	0.474 220. 292.	85.8 1679 0.1782	0.485 226. 299.
170	79.0 1361 0.1957	0.429 207. 266.	80.5 1440 0.1899	0.440 212. 274.	81.7 1510 0.1844	0.448 216. 279.	83.3 1612 0.1792	0.465 224. 289.	84.3 1677 0.1741	0.470 227. 292.
150	77.4 1357 0.1897	0.411 206. 258.	78.9 1441 0.1841	0.424 212. 265.	80.3 1523 0.1789	0.435 218. 272.	81.4 1593 0.1740	0.443 222. 277.	82.7 1674 0.1694	0.453 228. 284.
100	73.4 1355 0.1756	0.373 206. 238.	74.7 1432 0.1703	0.382 211. 244.	76.3 1521 0.1654	0.394 218. 252.	77.5 1595 0.1609	0.402 222. 257.	78.9 1686 0.1567	0.414 229. 264.
50	69.7 1376 0.1619	0.343 207. 223.	71.0 1446 0.1577	0.351 212. 228.	72.3 1516 0.1537	0.359 217. 233.	73.7 1595 0.1497	0.368 222. 239.	74.9 1672 0.1458	0.375 227. 244.
0	65.8 1403 0.1474	0.313 207. 207.	67.3 1478 0.1438	0.321 213. 213.	68.7 1556 0.1405	0.331 219. 219.	70.0 1631 0.1374	0.339 224. 224.	71.4 1709 0.1345	0.347 230. 230.

bd100_oei_crcll_mrc_IMP_hw_00 – 19/11/2003

Figure 05-05-02. Cruise Data—Maximum Range Cruise (Sheet 4 of 12)

MAXIMUM RANGE CRUISE

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350	85.7 979 0.3088	0.519 171. 302.	88.3 1064 0.2929	0.535 176. 312.	91.8 1167 0.2754	0.551 182. 322.				
330	83.5 955 0.3013	0.490 168. 288.	85.9 1058 0.2860	0.515 177. 303.	88.2 1150 0.2727	0.533 184. 314.	90.5 1222 0.2585	0.537 186. 316.	92.3 1256 0.2415	0.516 178. 303.
310	82.0 956 0.2942	0.474 170. 281.	83.9 1036 0.2791	0.487 175. 289.	86.1 1142 0.2656	0.512 184. 304.	88.0 1232 0.2542	0.528 191. 313.	90.3 1320 0.2427	0.540 195. 320.
290	80.6 967 0.2851	0.461 173. 276.	82.3 1036 0.2724	0.472 177. 282.	84.2 1120 0.2596	0.486 183. 291.	86.1 1219 0.2477	0.505 190. 302.	87.8 1312 0.2374	0.521 196. 312.
270	79.0 966 0.2754	0.441 173. 266.	81.0 1048 0.2641	0.459 180. 277.	82.7 1122 0.2531	0.471 185. 284.	84.2 1192 0.2422	0.479 188. 289.	85.9 1284 0.2317	0.493 194. 298.
250	77.5 975 0.2659	0.426 174. 259.	79.4 1050 0.2554	0.441 180. 268.	81.3 1128 0.2457	0.456 186. 277.	83.0 1207 0.2361	0.468 192. 285.	84.6 1292 0.2268	0.482 198. 293.
230	75.8 973 0.2570	0.408 174. 250.	77.9 1055 0.2468	0.425 181. 261.	79.7 1134 0.2376	0.440 188. 270.	81.3 1208 0.2291	0.452 193. 277.	82.9 1286 0.2209	0.464 198. 284.
210	74.0 969 0.2485	0.390 173. 241.	76.2 1053 0.2387	0.407 181. 252.	78.1 1136 0.2299	0.423 188. 261.	79.6 1206 0.2219	0.433 193. 268.	81.3 1289 0.2143	0.447 199. 276.
190	72.5 971 0.2406	0.375 173. 234.	74.5 1052 0.2311	0.390 180. 243.	76.3 1129 0.2226	0.404 187. 251.	78.1 1210 0.2147	0.417 193. 260.	79.7 1288 0.2076	0.429 199. 267.
170	70.8 972 0.2328	0.361 173. 226.	72.8 1051 0.2238	0.375 180. 235.	74.5 1124 0.2156	0.386 186. 242.	76.5 1211 0.2080	0.401 193. 252.	78.2 1296 0.2010	0.415 200. 261.
150	69.4 982 0.2248	0.349 175. 221.	71.2 1051 0.2166	0.360 180. 228.	73.1 1130 0.2087	0.373 187. 236.	74.7 1206 0.2014	0.384 192. 243.	76.6 1295 0.1947	0.399 200. 252.
100	65.4 993 0.2053	0.317 174. 204.	67.4 1071 0.1982	0.330 182. 212.	69.3 1148 0.1920	0.342 188. 220.	70.9 1215 0.1861	0.351 194. 226.	72.5 1292 0.1803	0.362 199. 233.
50	61.6 1018 0.1866	0.290 175. 190.	63.5 1089 0.1806	0.300 181. 197.	65.4 1166 0.1751	0.311 188. 204.	67.1 1241 0.1701	0.322 195. 211.	68.8 1318 0.1655	0.333 201. 218.
0	60.1 1155 0.1657	0.287 190. 191.	61.2 1191 0.1621	0.290 192. 193.	62.0 1222 0.1586	0.290 192. 194.	63.5 1280 0.1548	0.297 196. 198.	64.9 1343 0.1507	0.304 201. 202.

bd100_oel_crctl_mrc_IMP_lw_05 – 19/11/2003

Figure 05-05-02. Cruise Data—Maximum Range Cruise (Sheet 5 of 12)

MAXIMUM RANGE CRUISE

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310	93.3 1421 0.2303	0.552 200. 327.								
290	89.7 1398 0.2279	0.533 201. 319.	93.2 1545 0.2169	0.560 212. 335.	93.5 1524 0.2065	0.526 198. 315.				
270	87.8 1395 0.2223	0.514 202. 310.	89.4 1490 0.2141	0.529 209. 319.	91.4 1576 0.2058	0.538 212. 324.	93.0 1637 0.1969	0.535 211. 322.		
250	85.9 1364 0.2176	0.488 200. 297.	87.4 1458 0.2089	0.501 206. 305.	89.1 1569 0.2016	0.520 214. 316.	90.7 1664 0.1948	0.533 219. 324.	92.4 1750 0.1877	0.540 222. 328.
230	84.4 1362 0.2128	0.473 202. 290.	85.8 1449 0.2050	0.485 207. 297.	87.2 1538 0.1976	0.496 212. 304.	88.7 1643 0.1906	0.511 219. 313.	90.2 1741 0.1842	0.523 224. 321.
210	83.0 1374 0.2071	0.461 205. 285.	84.3 1448 0.2002	0.469 209. 290.	85.7 1539 0.1934	0.482 215. 298.	86.9 1614 0.1869	0.488 218. 302.	88.4 1720 0.1808	0.503 225. 311.
190	81.3 1370 0.2009	0.442 205. 275.	82.8 1455 0.1947	0.455 211. 283.	84.2 1541 0.1887	0.467 217. 291.	85.3 1609 0.1830	0.473 220. 294.	86.7 1706 0.1772	0.486 226. 302.
170	79.8 1381 0.1947	0.428 207. 269.	81.3 1460 0.1889	0.440 212. 276.	82.6 1534 0.1834	0.448 216. 281.	83.9 1617 0.1782	0.459 222. 288.	85.2 1702 0.1732	0.470 227. 295.
150	78.2 1379 0.1887	0.412 206. 260.	79.5 1448 0.1832	0.420 210. 265.	81.1 1546 0.1779	0.435 218. 275.	82.3 1615 0.1731	0.442 222. 280.	83.5 1698 0.1686	0.453 227. 286.
100	73.9 1370 0.1746	0.371 205. 239.	75.5 1453 0.1694	0.382 211. 246.	77.0 1542 0.1645	0.394 217. 254.	78.4 1626 0.1601	0.404 223. 260.	79.7 1709 0.1561	0.414 229. 267.
50	70.3 1394 0.1611	0.342 207. 225.	71.8 1472 0.1570	0.353 213. 231.	73.0 1533 0.1531	0.358 217. 235.	74.4 1615 0.1491	0.367 222. 241.	75.5 1691 0.1452	0.374 226. 246.
0	66.4 1420 0.1468	0.313 207. 208.	67.9 1499 0.1432	0.322 213. 215.	69.3 1576 0.1399	0.330 219. 220.	70.7 1655 0.1368	0.339 224. 226.	72.0 1731 0.1339	0.347 230. 232.

bd100_oei_crctl_mrc_IMP_hw_05 – 19/11/2003

Figure 05-05-02. Cruise Data—Maximum Range Cruise (Sheet 6 of 12)

MAXIMUM RANGE CRUISE

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350	86.7 996 0.3070	0.519 171. 306.	89.3 1083 0.2911	0.535 176. 315.	92.7 1178 0.2736	0.547 180. 322.				
330	84.5 972 0.2997	0.490 168. 291.	86.8 1076 0.2844	0.515 178. 306.	89.2 1170 0.2711	0.534 184. 317.	92.8 1296 0.2563	0.559 193. 332.		
310	82.8 968 0.2927	0.473 170. 284.	84.7 1052 0.2777	0.487 175. 292.	86.9 1158 0.2642	0.511 184. 306.	88.9 1253 0.2529	0.529 191. 317.	91.2 1340 0.2416	0.540 195. 324.
290	81.5 981 0.2837	0.461 173. 278.	83.3 1055 0.2710	0.473 178. 286.	85.1 1137 0.2582	0.486 183. 294.	86.8 1227 0.2463	0.500 188. 302.	88.8 1335 0.2363	0.522 197. 316.
270	79.8 981 0.2740	0.441 173. 269.	81.9 1063 0.2629	0.459 180. 280.	83.6 1139 0.2519	0.471 185. 287.	85.3 1223 0.2411	0.484 190. 295.	86.8 1304 0.2306	0.493 194. 301.
250	78.3 991 0.2644	0.426 174. 262.	80.3 1066 0.2540	0.441 180. 271.	82.1 1145 0.2443	0.455 186. 280.	83.8 1221 0.2348	0.467 191. 287.	85.3 1299 0.2255	0.477 196. 293.
230	76.6 990 0.2555	0.409 174. 253.	78.7 1072 0.2456	0.425 181. 263.	80.5 1148 0.2364	0.438 187. 271.	82.2 1227 0.2279	0.452 193. 280.	83.8 1307 0.2197	0.464 198. 287.
210	74.9 987 0.2473	0.391 174. 244.	76.9 1068 0.2376	0.407 181. 254.	78.7 1145 0.2288	0.420 186. 262.	80.7 1236 0.2207	0.437 194. 273.	82.2 1308 0.2132	0.447 199. 279.
190	73.2 985 0.2394	0.375 173. 236.	75.3 1068 0.2300	0.391 181. 246.	77.1 1144 0.2214	0.403 186. 254.	78.9 1226 0.2136	0.417 193. 262.	80.5 1305 0.2066	0.429 199. 270.
170	71.5 985 0.2316	0.360 173. 228.	73.5 1065 0.2227	0.375 180. 237.	75.5 1148 0.2145	0.389 187. 246.	77.3 1230 0.2069	0.402 194. 255.	78.8 1304 0.2001	0.412 198. 261.
150	70.0 997 0.2236	0.349 175. 223.	71.9 1066 0.2156	0.360 180. 230.	73.8 1146 0.2078	0.373 187. 238.	75.4 1217 0.2005	0.383 192. 244.	77.4 1314 0.1939	0.399 200. 255.
100	66.0 1007 0.2044	0.317 174. 206.	68.1 1085 0.1974	0.330 182. 214.	70.0 1163 0.1911	0.342 188. 222.	71.5 1231 0.1851	0.351 193. 228.	73.2 1312 0.1793	0.362 200. 235.
50	62.0 1023 0.1861	0.288 174. 190.	64.0 1100 0.1802	0.300 181. 198.	66.0 1178 0.1745	0.311 188. 206.	67.8 1258 0.1692	0.322 195. 213.	69.5 1337 0.1645	0.333 201. 220.
0	60.7 1169 0.1650	0.287 190. 193.	61.7 1204 0.1615	0.289 191. 194.	62.6 1237 0.1580	0.290 192. 195.	64.1 1296 0.1541	0.297 196. 200.	65.4 1360 0.1500	0.303 201. 204.

bd100_oei_crctl_mrc_tMP_lw_10 – 19/11/2003

Figure 05-05-02. Cruise Data—Maximum Range Cruise (Sheet 7 of 12)

MAXIMUM RANGE CRUISE

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310	92.8 1380 0.2287	0.527 190. 316.								
290	90.6 1419 0.2268	0.533 201. 322.	92.4 1482 0.2166	0.531 200. 321.						
270	88.7 1416 0.2213	0.514 203. 314.	90.4 1513 0.2132	0.529 209. 323.	92.0 1584 0.2050	0.533 210. 325.	92.6 1530 0.1744	0.438 172. 267.		
250	86.8 1385 0.2164	0.488 200. 300.	88.5 1493 0.2078	0.505 208. 310.	90.0 1593 0.2005	0.520 214. 320.	91.4 1675 0.1938	0.528 217. 324.	91.6 1662 0.1846	0.499 205. 307.
230	85.2 1380 0.2117	0.472 202. 292.	86.7 1471 0.2039	0.484 207. 300.	88.0 1553 0.1965	0.493 211. 305.	89.7 1669 0.1896	0.511 219. 316.	91.4 1781 0.1833	0.527 226. 326.
210	83.7 1389 0.2060	0.459 204. 286.	85.2 1471 0.1992	0.469 209. 293.	86.6 1563 0.1924	0.482 215. 301.	87.8 1637 0.1859	0.488 218. 304.	89.2 1742 0.1798	0.502 224. 313.
190	82.1 1389 0.1999	0.442 205. 278.	83.6 1476 0.1937	0.455 211. 286.	85.0 1560 0.1877	0.466 216. 293.	86.2 1634 0.1819	0.473 220. 297.	87.6 1732 0.1763	0.486 226. 305.
170	80.4 1390 0.1937	0.425 205. 269.	82.0 1478 0.1879	0.438 212. 278.	83.4 1556 0.1825	0.448 216. 284.	84.8 1643 0.1773	0.460 222. 291.	86.1 1729 0.1723	0.470 227. 298.
150	78.9 1398 0.1878	0.411 206. 263.	80.3 1470 0.1822	0.420 210. 268.	81.9 1567 0.1771	0.435 218. 278.	83.1 1637 0.1722	0.442 222. 282.	84.4 1726 0.1677	0.453 228. 289.
100	74.8 1394 0.1738	0.373 206. 242.	76.2 1473 0.1686	0.382 211. 248.	77.8 1564 0.1637	0.394 217. 256.	79.1 1646 0.1592	0.403 223. 262.	80.4 1735 0.1553	0.414 229. 270.
50	71.0 1416 0.1603	0.343 208. 227.	72.5 1492 0.1563	0.353 213. 233.	74.0 1573 0.1524	0.362 219. 240.	75.1 1636 0.1485	0.368 222. 243.	76.2 1707 0.1446	0.373 226. 247.
0	67.1 1440 0.1462	0.313 207. 211.	68.5 1518 0.1426	0.322 213. 216.	69.9 1596 0.1393	0.330 218. 222.	71.3 1676 0.1362	0.339 224. 228.	72.6 1752 0.1333	0.347 230. 234.

bd100_oei_crctl_mrc_IMP_hw_10 – 19/11/2003

Figure 05-05-02. Cruise Data—Maximum Range Cruise (Sheet 8 of 12)

MAXIMUM RANGE CRUISE

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350	87.6 1013 0.3048	0.519 171. 309.	90.3 1102 0.2893	0.535 176. 319.	92.2 1142 0.2711	0.520 171. 310.				
330	85.5 988 0.2978	0.490 168. 294.	87.8 1095 0.2827	0.515 178. 310.	90.1 1188 0.2695	0.533 184. 320.	91.9 1235 0.2549	0.524 181. 315.		
310	83.7 983 0.2913	0.473 170. 287.	85.6 1067 0.2764	0.487 175. 295.	87.9 1178 0.2628	0.511 184. 310.	89.8 1273 0.2516	0.529 191. 320.	91.6 1334 0.2400	0.529 191. 320.
290	82.2 991 0.2824	0.458 172. 280.	84.1 1068 0.2696	0.472 177. 288.	85.8 1147 0.2569	0.483 182. 295.	87.7 1245 0.2451	0.500 188. 305.	89.6 1354 0.2351	0.521 197. 318.
270	80.6 996 0.2727	0.441 173. 272.	82.7 1079 0.2615	0.459 180. 282.	84.4 1156 0.2507	0.471 185. 290.	86.1 1238 0.2399	0.483 190. 297.	87.8 1331 0.2295	0.496 195. 306.
250	79.2 1006 0.2630	0.426 174. 265.	81.1 1081 0.2527	0.440 180. 273.	83.0 1162 0.2430	0.455 186. 282.	84.6 1240 0.2337	0.467 191. 290.	86.1 1316 0.2245	0.476 195. 296.
230	77.4 1003 0.2543	0.408 174. 255.	79.5 1088 0.2443	0.425 181. 266.	81.3 1165 0.2352	0.438 187. 274.	83.1 1245 0.2267	0.452 193. 282.	84.6 1323 0.2185	0.462 198. 289.
210	75.7 1001 0.2460	0.391 174. 246.	77.8 1086 0.2363	0.407 181. 257.	79.7 1170 0.2276	0.423 188. 266.	81.3 1242 0.2195	0.433 192. 273.	83.0 1328 0.2121	0.447 199. 282.
190	73.9 1000 0.2382	0.375 173. 238.	75.8 1074 0.2288	0.387 179. 246.	77.9 1164 0.2203	0.404 187. 256.	79.7 1248 0.2126	0.418 194. 265.	81.3 1324 0.2055	0.429 199. 272.
170	72.3 1000 0.2305	0.361 173. 231.	74.3 1081 0.2216	0.375 180. 240.	76.3 1164 0.2134	0.388 187. 248.	78.0 1243 0.2060	0.400 193. 256.	79.6 1323 0.1991	0.412 198. 263.
150	70.8 1010 0.2228	0.349 175. 225.	72.7 1080 0.2148	0.360 180. 232.	74.5 1162 0.2070	0.373 187. 241.	76.1 1235 0.1997	0.383 192. 247.	78.1 1332 0.1929	0.399 200. 257.
100	66.7 1020 0.2037	0.317 174. 208.	68.7 1098 0.1967	0.329 182. 216.	70.6 1178 0.1903	0.342 188. 224.	72.3 1252 0.1843	0.352 194. 231.	74.0 1328 0.1786	0.362 200. 237.
50	62.9 1048 0.1853	0.291 176. 194.	64.7 1114 0.1796	0.300 181. 200.	66.4 1187 0.1737	0.309 187. 206.	68.4 1275 0.1684	0.322 195. 215.	70.1 1355 0.1638	0.333 201. 222.
0	61.9 1207 0.1644	0.293 194. 198.	62.4 1223 0.1609	0.290 192. 197.	63.2 1251 0.1574	0.290 192. 197.	64.6 1312 0.1534	0.297 196. 201.	66.0 1378 0.1494	0.303 201. 206.

bd100_oei_crctl_mrc_IMP_lw_15 – 19/11/2003

Figure 05-05-02. Cruise Data—Maximum Range Cruise (Sheet 9 of 12)

MAXIMUM RANGE CRUISE

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310										
290	91.2 1424 0.2256	0.526 199. 321.	91.8 1389 0.1951	0.444 166. 271.						
270	89.6 1438 0.2202	0.514 203. 317.	90.8 1513 0.2121	0.521 205. 321.	91.1 1499 0.2004	0.488 192. 300.				
250	87.7 1406 0.2154	0.488 200. 303.	89.2 1504 0.2068	0.501 205. 311.	90.5 1584 0.1993	0.509 209. 316.	90.7 1575 0.1888	0.479 196. 297.		
230	86.2 1407 0.2106	0.474 203. 296.	87.6 1494 0.2029	0.485 208. 303.	88.9 1577 0.1955	0.493 211. 308.	90.4 1682 0.1886	0.507 218. 317.	90.5 1672 0.1805	0.483 207. 302.
210	84.6 1408 0.2050	0.458 204. 289.	86.0 1491 0.1982	0.469 209. 296.	87.5 1586 0.1914	0.482 215. 304.	88.6 1660 0.1849	0.487 217. 307.	90.4 1790 0.1788	0.508 227. 320.
190	82.9 1410 0.1989	0.442 205. 280.	84.5 1498 0.1927	0.455 211. 289.	85.9 1585 0.1868	0.466 216. 296.	87.1 1660 0.1810	0.473 220. 301.	88.5 1756 0.1754	0.485 225. 308.
170	81.2 1410 0.1928	0.425 205. 272.	82.8 1495 0.1870	0.437 211. 280.	84.2 1577 0.1816	0.448 216. 286.	85.6 1667 0.1764	0.460 222. 294.	86.9 1752 0.1714	0.470 227. 300.
150	79.7 1417 0.1869	0.411 206. 265.	81.0 1489 0.1814	0.419 210. 270.	82.7 1586 0.1762	0.434 218. 280.	83.9 1662 0.1714	0.442 222. 285.	85.2 1749 0.1668	0.453 228. 292.
100	75.4 1406 0.1730	0.371 205. 244.	76.8 1483 0.1678	0.380 209. 249.	78.3 1571 0.1629	0.390 215. 256.	79.9 1670 0.1585	0.404 223. 265.	81.2 1757 0.1545	0.414 229. 272.
50	71.7 1433 0.1596	0.343 207. 229.	73.2 1510 0.1556	0.352 213. 235.	74.5 1579 0.1517	0.359 217. 240.	75.8 1661 0.1479	0.368 223. 246.	76.9 1728 0.1440	0.373 226. 249.
0	67.6 1457 0.1455	0.313 207. 212.	69.1 1538 0.1420	0.322 213. 218.	70.6 1617 0.1386	0.331 219. 224.	72.0 1695 0.1355	0.339 224. 230.	73.3 1778 0.1327	0.348 230. 236.

bd100_ooi_crctl_mrc_fMP_hw_15 – 19/11/2003

Figure 05-05-02. Cruise Data—Maximum Range Cruise (Sheet 10 of 12)

MAXIMUM RANGE CRUISE

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350	88.6 1031 0.3027	0.519 171. 312.	90.9 1105 0.2870	0.527 174. 317.						
330	86.4 1004 0.2960	0.490 168. 297.	88.8 1113 0.2810	0.515 178. 313.	90.6 1185 0.2678	0.523 180. 318.				
310	84.6 1001 0.2897	0.474 170. 290.	86.6 1084 0.2748	0.487 175. 298.	88.7 1189 0.2612	0.508 183. 311.	90.4 1278 0.2500	0.522 188. 320.	90.9 1247 0.2192	0.447 160. 274.
290	83.0 1005 0.2810	0.458 172. 282.	84.9 1083 0.2683	0.471 177. 291.	86.7 1165 0.2558	0.483 182. 298.	88.7 1277 0.2438	0.505 190. 311.	90.3 1357 0.2336	0.514 194. 317.
270	81.4 1010 0.2713	0.441 173. 274.	83.5 1095 0.2602	0.458 180. 285.	85.3 1174 0.2494	0.471 185. 293.	87.0 1258 0.2387	0.483 190. 300.	88.5 1343 0.2283	0.493 194. 307.
250	79.9 1020 0.2616	0.426 174. 267.	81.8 1094 0.2514	0.439 180. 275.	83.8 1179 0.2418	0.455 186. 285.	85.4 1259 0.2326	0.467 192. 293.	87.0 1336 0.2235	0.477 195. 299.
230	78.2 1018 0.2529	0.408 174. 258.	80.3 1104 0.2429	0.425 181. 268.	82.2 1187 0.2338	0.440 188. 278.	83.9 1265 0.2255	0.452 193. 285.	85.4 1341 0.2174	0.462 197. 292.
210	76.4 1017 0.2447	0.391 174. 249.	78.6 1101 0.2351	0.407 181. 259.	80.5 1186 0.2264	0.422 188. 269.	82.1 1261 0.2184	0.433 192. 275.	83.8 1346 0.2109	0.446 199. 284.
190	74.7 1014 0.2370	0.375 173. 240.	76.8 1099 0.2277	0.391 181. 250.	78.6 1177 0.2192	0.403 186. 258.	80.5 1266 0.2115	0.418 194. 268.	82.3 1353 0.2045	0.432 200. 277.
170	73.0 1013 0.2294	0.360 173. 232.	75.0 1096 0.2206	0.375 180. 242.	76.8 1170 0.2123	0.385 185. 248.	78.9 1268 0.2050	0.403 194. 260.	80.3 1341 0.1981	0.412 198. 266.
150	71.4 1021 0.2217	0.348 174. 226.	73.3 1096 0.2136	0.360 180. 234.	75.3 1179 0.2059	0.373 187. 243.	76.9 1255 0.1987	0.384 192. 250.	78.8 1346 0.1919	0.397 199. 258.
100	67.2 1032 0.2028	0.316 174. 209.	69.3 1113 0.1957	0.329 181. 218.	71.3 1195 0.1894	0.342 189. 226.	72.9 1265 0.1835	0.351 194. 232.	74.6 1344 0.1779	0.362 199. 239.
50	63.6 1069 0.1843	0.293 177. 197.	65.2 1129 0.1785	0.300 181. 202.	67.2 1210 0.1729	0.311 188. 209.	69.0 1290 0.1678	0.322 195. 217.	70.7 1370 0.1632	0.332 201. 224.
0	61.5 1177 0.1649	0.284 188. 194.	62.2 1201 0.1612	0.283 187. 194.	63.6 1255 0.1571	0.288 191. 197.	65.2 1327 0.1530	0.297 196. 203.	66.7 1394 0.1489	0.304 201. 208.

bd100_oei_crctl_mrc_IMP_lw_20 – 19/11/2003

Figure 05-05-02. Cruise Data—Maximum Range Cruise (Sheet 11 of 12)

MAXIMUM RANGE CRUISE

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310										
290	90.5 1343 0.2182	0.475 179. 293.								
270	90.0 1431 0.2189	0.504 198. 313.	90.2 1419 0.2040	0.466 183. 290.						
250	88.5 1425 0.2144	0.488 200. 306.	89.8 1504 0.2058	0.494 203. 310.	90.0 1495 0.1920	0.458 188. 287.				
230	87.0 1427 0.2095	0.474 202. 299.	88.5 1517 0.2019	0.485 208. 306.	89.7 1595 0.1945	0.491 210. 310.	89.8 1585 0.1848	0.464 198. 293.		
210	85.5 1438 0.2039	0.461 205. 293.	86.8 1512 0.1972	0.469 209. 298.	88.1 1592 0.1905	0.477 213. 303.	89.7 1700 0.1840	0.492 219. 313.	89.8 1689 0.1769	0.470 209. 299.
190	83.7 1429 0.1980	0.441 205. 283.	85.3 1519 0.1918	0.455 211. 292.	86.7 1601 0.1858	0.464 216. 298.	87.9 1682 0.1801	0.473 220. 303.	89.4 1786 0.1748	0.487 226. 312.
170	82.0 1428 0.1918	0.424 205. 274.	83.6 1515 0.1861	0.437 211. 282.	85.0 1600 0.1807	0.448 216. 289.	86.4 1687 0.1755	0.459 222. 296.	87.7 1776 0.1706	0.469 227. 303.
150	80.4 1436 0.1860	0.411 206. 267.	81.8 1512 0.1804	0.420 210. 273.	83.4 1603 0.1753	0.432 217. 281.	84.7 1685 0.1705	0.442 222. 287.	86.0 1772 0.1661	0.453 227. 294.
100	76.0 1417 0.1723	0.369 204. 244.	77.5 1504 0.1670	0.380 209. 251.	79.0 1592 0.1621	0.390 215. 258.	80.6 1690 0.1577	0.403 222. 267.	82.0 1782 0.1538	0.414 229. 274.
50	72.3 1451 0.1590	0.343 207. 231.	73.8 1529 0.1549	0.352 213. 237.	75.1 1599 0.1511	0.359 217. 242.	76.5 1680 0.1471	0.367 222. 247.	77.7 1764 0.1433	0.376 227. 253.
0	68.2 1472 0.1449	0.312 206. 214.	69.7 1555 0.1413	0.321 212. 220.	71.2 1637 0.1380	0.330 218. 226.	72.7 1721 0.1349	0.340 225. 232.	74.0 1799 0.1321	0.348 230. 238.

bd100_oei_crctl_mrc_IMP_hw_20 – 19/11/2003

Figure 05-05-02. Cruise Data—Maximum Range Cruise (Sheet 12 of 12)

MAXIMUM CRUISE SPEED

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%NI LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350	89.2 1158 0.2941	0.605 201. 341.	89.0 1140 0.2891	0.586 194. 330.	88.7 1113 0.2804	0.554 183. 312.				
330	90.0 1295 0.2724	0.621 216. 353.	90.0 1284 0.2694	0.609 212. 346.	89.9 1268 0.2655	0.593 206. 337.	89.7 1246 0.2598	0.570 197. 324.		
310	90.3 1422 0.2533	0.628 229. 360.	90.4 1417 0.2511	0.621 226. 356.	90.5 1412 0.2481	0.611 222. 350.	90.6 1404 0.2445	0.598 217. 343.	90.5 1384 0.2404	0.580 210. 333.
290	89.8 1522 0.2383	0.627 239. 363.	89.9 1518 0.2369	0.621 236. 360.	90.0 1513 0.2350	0.614 234. 356.	90.0 1507 0.2324	0.605 230. 350.	90.1 1499 0.2293	0.594 225. 344.
270	89.4 1629 0.2240	0.625 248. 365.	89.4 1626 0.2230	0.621 247. 363.	89.5 1623 0.2218	0.616 245. 360.	89.5 1618 0.2201	0.610 242. 356.	89.6 1611 0.2179	0.601 239. 351.
250	89.0 1732 0.2110	0.620 257. 366.	89.0 1730 0.2101	0.617 256. 364.	89.0 1728 0.2092	0.614 254. 362.	89.1 1725 0.2081	0.609 252. 359.	89.1 1722 0.2066	0.604 250. 356.
230	88.7 1836 0.1988	0.614 266. 365.	88.7 1834 0.1982	0.612 264. 364.	88.7 1832 0.1974	0.609 263. 362.	88.7 1830 0.1966	0.606 262. 360.	88.7 1828 0.1955	0.601 260. 357.
210	88.4 1931 0.1884	0.607 273. 364.	88.4 1929 0.1878	0.605 272. 362.	88.4 1927 0.1872	0.602 271. 361.	88.4 1926 0.1865	0.599 270. 359.	88.5 1924 0.1857	0.596 268. 357.
190	88.6 2067 0.1769	0.605 283. 366.	88.6 2065 0.1763	0.603 282. 364.	88.6 2064 0.1758	0.600 281. 363.	88.6 2062 0.1752	0.598 280. 362.	88.6 2061 0.1746	0.596 279. 360.
170	89.2 2254 0.1643	0.608 296. 370.	89.2 2252 0.1638	0.606 295. 369.	89.2 2251 0.1633	0.603 294. 368.	89.2 2249 0.1629	0.601 293. 366.	89.2 2248 0.1624	0.599 292. 365.
150	89.8 2456 0.1527	0.611 309. 375.	89.8 2454 0.1523	0.609 308. 374.	89.8 2453 0.1518	0.606 307. 372.	89.8 2451 0.1514	0.604 306. 371.	89.8 2450 0.1510	0.603 305. 370.
100	87.8 2587 0.1395	0.576 320. 361.	88.0 2607 0.1384	0.576 320. 361.	88.2 2626 0.1374	0.576 320. 361.	88.3 2644 0.1365	0.576 320. 361.	88.5 2660 0.1357	0.576 320. 361.
50	81.3 2281 0.1384	0.495 300. 316.	81.5 2297 0.1375	0.495 300. 316.	81.7 2312 0.1366	0.495 300. 316.	81.8 2326 0.1358	0.495 300. 316.	82.0 2340 0.1349	0.495 300. 316.
0	78.0 2303 0.1280	0.454 300. 295.	78.2 2320 0.1270	0.454 300. 295.	78.4 2335 0.1262	0.454 300. 295.	78.6 2350 0.1254	0.454 300. 295.	78.7 2364 0.1247	0.454 300. 295.

bd100_oei_crctl_mrcz_IMP_lw_m10 – 19/11/2003

Figure 05-05-03. Cruise Data—Maximum Cruise Speed (Sheet 1 of 12)

MAXIMUM CRUISE SPEED

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310	90.3 1354 0.2334	0.551 199. 316.								
290	90.2 1489 0.2252	0.579 220. 335.	90.3 1476 0.2197	0.560 212. 324.	90.5 1451 0.2088	0.523 198. 303.				
270	89.7 1605 0.2152	0.591 234. 345.	89.8 1597 0.2117	0.579 229. 338.	90.0 1588 0.2074	0.564 223. 329.	90.2 1573 0.2002	0.539 213. 315.		
250	89.2 1717 0.2046	0.597 247. 352.	89.3 1711 0.2023	0.588 243. 346.	89.3 1704 0.1994	0.577 238. 340.	89.5 1694 0.1958	0.563 232. 332.	89.6 1682 0.1910	0.545 225. 321.
230	88.8 1824 0.1942	0.596 257. 354.	88.8 1820 0.1925	0.590 254. 350.	88.9 1814 0.1905	0.582 251. 346.	88.9 1808 0.1880	0.572 246. 340.	89.0 1800 0.1851	0.561 241. 333.
210	88.5 1922 0.1847	0.592 266. 355.	88.5 1919 0.1834	0.588 264. 352.	88.5 1916 0.1819	0.582 261. 349.	88.6 1912 0.1800	0.574 258. 344.	88.6 1908 0.1777	0.566 254. 339.
190	88.6 2060 0.1739	0.593 277. 358.	88.7 2058 0.1731	0.589 276. 356.	88.7 2055 0.1721	0.585 274. 354.	88.7 2053 0.1708	0.580 271. 351.	88.7 2049 0.1692	0.574 268. 347.
170	89.2 2247 0.1619	0.597 291. 364.	89.3 2245 0.1613	0.595 290. 362.	89.3 2244 0.1607	0.592 288. 361.	89.3 2242 0.1599	0.588 286. 359.	89.3 2239 0.1590	0.584 284. 356.
150	89.9 2449 0.1506	0.601 304. 369.	89.9 2447 0.1502	0.598 303. 368.	89.9 2446 0.1497	0.596 302. 366.	89.9 2444 0.1492	0.594 300. 365.	89.9 2442 0.1486	0.591 299. 363.
100	88.6 2676 0.1349	0.576 320. 361.	88.8 2692 0.1341	0.576 320. 361.	88.9 2709 0.1332	0.576 320. 361.	89.1 2725 0.1324	0.576 320. 361.	89.3 2742 0.1316	0.576 320. 361.
50	82.2 2354 0.1341	0.495 300. 316.	82.3 2368 0.1334	0.495 300. 316.	82.5 2383 0.1325	0.495 300. 316.	82.7 2399 0.1316	0.495 300. 316.	82.9 2417 0.1306	0.495 300. 316.
0	78.9 2378 0.1239	0.454 300. 295.	79.0 2392 0.1232	0.454 300. 295.	79.2 2407 0.1224	0.454 300. 295.	79.4 2424 0.1216	0.454 300. 295.	79.6 2441 0.1207	0.454 300. 295.

bd100_oei_crctl_mrcz_IMP_hw_m10 – 19/11/2003

Figure 05-05-03. Cruise Data—Maximum Cruise Speed (Sheet 2 of 12)

MAXIMUM CRUISE SPEED

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350	91.3 1200 0.2907	0.605 201. 349.	91.1 1180 0.2858	0.585 194. 337.	90.8 1150 0.2770	0.553 182. 319.				
330	92.0 1340 0.2696	0.621 216. 361.	92.0 1329 0.2665	0.609 212. 354.	92.0 1315 0.2626	0.594 206. 345.	91.8 1291 0.2572	0.571 198. 332.	91.2 1235 0.2428	0.516 178. 300.
310	92.3 1467 0.2509	0.628 229. 368.	92.4 1462 0.2487	0.620 226. 364.	92.5 1456 0.2459	0.610 222. 358.	92.6 1447 0.2424	0.598 217. 351.	92.4 1429 0.2382	0.580 210. 341.
290	91.7 1565 0.2363	0.625 238. 370.	91.8 1561 0.2349	0.620 236. 367.	91.9 1556 0.2329	0.613 233. 363.	91.9 1549 0.2305	0.603 229. 357.	92.0 1542 0.2273	0.592 225. 350.
270	91.3 1674 0.2220	0.622 248. 372.	91.3 1670 0.2210	0.619 246. 369.	91.3 1666 0.2197	0.614 244. 366.	91.4 1661 0.2180	0.607 241. 362.	91.5 1655 0.2158	0.599 237. 357.
250	90.8 1779 0.2091	0.618 256. 372.	90.9 1777 0.2083	0.615 255. 370.	90.9 1775 0.2073	0.612 253. 368.	90.9 1772 0.2061	0.607 252. 365.	91.0 1768 0.2046	0.601 249. 362.
230	90.5 1886 0.1971	0.613 265. 372.	90.5 1884 0.1965	0.610 264. 370.	90.5 1882 0.1957	0.607 262. 368.	90.5 1880 0.1949	0.604 261. 366.	90.6 1877 0.1938	0.600 259. 364.
210	90.2 1982 0.1868	0.605 272. 370.	90.2 1980 0.1862	0.603 271. 369.	90.2 1978 0.1856	0.600 270. 367.	90.2 1977 0.1849	0.598 269. 366.	90.3 1975 0.1841	0.594 267. 364.
190	90.3 2121 0.1754	0.603 282. 372.	90.4 2119 0.1748	0.601 281. 371.	90.4 2118 0.1743	0.599 280. 369.	90.4 2117 0.1737	0.596 279. 368.	90.4 2115 0.1731	0.594 278. 366.
170	90.8 2300 0.1634	0.605 295. 376.	90.8 2298 0.1629	0.603 294. 375.	90.9 2297 0.1625	0.600 292. 373.	90.9 2296 0.1620	0.598 291. 372.	90.9 2294 0.1615	0.596 290. 371.
150	91.0 2457 0.1536	0.603 305. 378.	91.0 2456 0.1531	0.600 304. 376.	91.0 2454 0.1527	0.598 303. 375.	91.1 2453 0.1522	0.596 302. 374.	91.1 2452 0.1518	0.594 301. 372.
100	89.6 2665 0.1380	0.576 320. 368.	89.8 2686 0.1370	0.576 320. 368.	90.0 2705 0.1360	0.576 320. 368.	90.1 2723 0.1351	0.576 320. 368.	90.2 2731 0.1345	0.576 320. 367.
50	82.9 2348 0.1369	0.495 300. 322.	83.1 2364 0.1360	0.495 300. 322.	83.3 2379 0.1351	0.495 300. 322.	83.4 2394 0.1343	0.495 300. 322.	83.6 2408 0.1335	0.495 300. 322.
0	79.5 2366 0.1268	0.454 300. 300.	79.7 2383 0.1259	0.454 300. 300.	79.9 2399 0.1250	0.454 300. 300.	80.0 2414 0.1243	0.454 300. 300.	80.2 2429 0.1235	0.454 300. 300.

bd100_oei_crctl_mrcz_IMP_lw_00 - 19/11/2003

Figure 05-05-03. Cruise Data—Maximum Cruise Speed (Sheet 3 of 12)

MAXIMUM CRUISE SPEED

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310	92.2 1400 0.2312	0.552 200. 324.								
290	92.1 1533 0.2233	0.578 219. 342.	92.3 1521 0.2178	0.560 212. 331.	92.5 1499 0.2073	0.525 198. 311.				
270	91.6 1648 0.2131	0.589 233. 351.	91.7 1641 0.2096	0.576 228. 344.	91.9 1630 0.2053	0.561 222. 335.	92.1 1614 0.1978	0.535 211. 319.		
250	91.0 1764 0.2027	0.594 246. 358.	91.1 1757 0.2003	0.585 242. 352.	91.2 1750 0.1974	0.574 237. 345.	91.3 1740 0.1938	0.560 231. 337.	91.5 1727 0.1888	0.542 223. 326.
230	90.6 1873 0.1925	0.594 256. 361.	90.7 1869 0.1908	0.588 253. 357.	90.7 1863 0.1887	0.579 250. 352.	90.8 1856 0.1862	0.569 245. 346.	90.9 1848 0.1832	0.558 240. 339.
210	90.3 1973 0.1831	0.591 265. 361.	90.3 1970 0.1819	0.586 263. 358.	90.3 1967 0.1803	0.580 260. 355.	90.4 1963 0.1784	0.572 257. 350.	90.4 1958 0.1762	0.564 253. 345.
190	90.4 2114 0.1724	0.591 276. 364.	90.4 2112 0.1716	0.588 275. 362.	90.5 2110 0.1705	0.583 273. 360.	90.5 2107 0.1692	0.578 270. 357.	90.5 2103 0.1677	0.572 267. 353.
170	90.9 2293 0.1610	0.594 289. 369.	90.9 2291 0.1604	0.591 288. 368.	90.9 2290 0.1597	0.589 286. 366.	91.0 2288 0.1589	0.585 285. 364.	91.0 2285 0.1580	0.581 282. 361.
150	91.1 2452 0.1514	0.593 300. 371.	91.1 2451 0.1509	0.590 299. 370.	91.1 2449 0.1504	0.588 298. 368.	91.1 2448 0.1499	0.586 296. 367.	91.1 2446 0.1492	0.583 295. 365.
100	90.2 2730 0.1341	0.574 319. 366.	90.2 2729 0.1338	0.572 318. 365.	90.2 2728 0.1335	0.570 317. 364.	90.3 2727 0.1331	0.569 316. 363.	90.3 2726 0.1327	0.567 315. 362.
50	83.8 2423 0.1327	0.495 300. 322.	83.9 2437 0.1320	0.495 300. 322.	84.1 2452 0.1311	0.495 300. 322.	84.3 2469 0.1302	0.495 300. 322.	84.5 2487 0.1293	0.495 300. 322.
0	80.4 2443 0.1228	0.454 300. 300.	80.5 2458 0.1221	0.454 300. 300.	80.7 2473 0.1213	0.454 300. 300.	80.9 2490 0.1205	0.454 300. 300.	81.1 2508 0.1196	0.454 300. 300.

bd100_oei_crcll_mrcz_IMP_hw_00 – 19/11/2003

Figure 05-05-03. Cruise Data—Maximum Cruise Speed (Sheet 4 of 12)

MAXIMUM CRUISE SPEED

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350	92.3 1218 0.2891	0.604 200. 352.	92.1 1198 0.2842	0.584 194. 341.	91.8 1167 0.2754	0.551 182. 322.				
330	93.0 1362 0.2681	0.621 216. 365.	93.1 1352 0.2649	0.609 212. 358.	93.0 1337 0.2611	0.594 206. 349.	92.8 1313 0.2557	0.571 198. 336.	92.3 1256 0.2415	0.516 178. 303.
310	93.2 1488 0.2499	0.627 229. 372.	93.3 1484 0.2477	0.620 226. 368.	93.4 1477 0.2448	0.610 222. 362.	93.5 1468 0.2414	0.598 217. 355.	93.4 1450 0.2372	0.580 210. 344.
290	92.7 1588 0.2353	0.624 238. 374.	92.7 1583 0.2339	0.619 236. 370.	92.8 1578 0.2320	0.612 233. 366.	92.9 1572 0.2295	0.603 229. 361.	93.0 1565 0.2263	0.592 225. 354.
270	92.2 1696 0.2210	0.621 247. 375.	92.2 1692 0.2200	0.617 245. 372.	92.3 1688 0.2188	0.612 243. 370.	92.3 1683 0.2171	0.606 240. 366.	92.4 1677 0.2149	0.597 237. 360.
250	91.7 1803 0.2082	0.617 256. 376.	91.8 1801 0.2073	0.614 255. 374.	91.8 1799 0.2064	0.610 253. 371.	91.8 1795 0.2052	0.606 251. 368.	91.9 1792 0.2037	0.600 248. 365.
230	91.4 1910 0.1963	0.612 264. 375.	91.4 1908 0.1956	0.609 263. 373.	91.4 1906 0.1949	0.606 262. 372.	91.4 1904 0.1940	0.603 260. 370.	91.5 1901 0.1930	0.598 258. 367.
210	91.1 2006 0.1861	0.604 272. 374.	91.1 2005 0.1855	0.602 271. 372.	91.1 2003 0.1849	0.599 270. 370.	91.1 2001 0.1842	0.597 268. 369.	91.1 2000 0.1834	0.594 267. 367.
190	90.9 2115 0.1761	0.598 280. 372.	90.9 2114 0.1756	0.596 279. 371.	90.9 2113 0.1750	0.594 278. 370.	90.9 2112 0.1744	0.591 277. 368.	91.0 2110 0.1737	0.589 275. 367.
170	90.7 2232 0.1665	0.592 288. 372.	90.8 2230 0.1660	0.590 287. 370.	90.8 2229 0.1655	0.588 286. 369.	90.8 2229 0.1650	0.586 285. 368.	90.8 2228 0.1644	0.584 284. 366.
150	90.3 2318 0.1591	0.583 295. 369.	90.3 2317 0.1586	0.581 294. 368.	90.3 2316 0.1581	0.579 293. 366.	90.3 2316 0.1576	0.577 292. 365.	90.4 2315 0.1571	0.575 291. 364.
100	89.3 2578 0.1408	0.564 313. 363.	89.3 2577 0.1403	0.562 312. 362.	89.3 2577 0.1399	0.560 310. 361.	89.4 2576 0.1395	0.558 310. 360.	89.4 2576 0.1391	0.556 309. 358.
50	83.7 2381 0.1363	0.495 300. 324.	83.9 2397 0.1353	0.495 300. 324.	84.1 2413 0.1345	0.495 300. 324.	84.2 2427 0.1337	0.495 300. 324.	84.4 2442 0.1329	0.495 300. 324.
0	80.2 2399 0.1261	0.454 300. 303.	80.4 2416 0.1252	0.454 300. 303.	80.6 2431 0.1244	0.454 300. 303.	80.8 2447 0.1237	0.454 300. 303.	80.9 2461 0.1229	0.454 300. 303.

bd100_oei_crcll_mrcz_IMP_lw_05 – 19/11/2003

Figure 05-05-03. Cruise Data—Maximum Cruise Speed (Sheet 5 of 12)

MAXIMUM CRUISE SPEED

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT - 1000 LB									
	34		36		38		40		42	
350										
330										
310	93.2 1421 0.2303	0.552 200. 327.								
290	93.1 1556 0.2223	0.578 219. 346.	93.2 1545 0.2169	0.560 212. 335.	93.5 1524 0.2065	0.526 198. 315.				
270	92.5 1670 0.2121	0.587 233. 354.	92.6 1662 0.2087	0.575 228. 347.	92.8 1653 0.2044	0.560 221. 338.	93.0 1637 0.1969	0.535 211. 322.		
250	91.9 1787 0.2017	0.593 245. 360.	92.0 1780 0.1993	0.583 241. 355.	92.1 1773 0.1964	0.572 236. 348.	92.2 1763 0.1928	0.559 231. 340.	92.4 1750 0.1877	0.540 222. 328.
230	91.5 1898 0.1916	0.593 256. 364.	91.6 1893 0.1899	0.586 253. 360.	91.6 1887 0.1878	0.578 249. 354.	91.7 1880 0.1853	0.568 245. 348.	91.8 1872 0.1822	0.556 239. 341.
210	91.2 1997 0.1824	0.590 265. 364.	91.2 1995 0.1811	0.585 263. 361.	91.2 1991 0.1796	0.579 260. 358.	91.3 1987 0.1776	0.571 256. 353.	91.3 1982 0.1753	0.563 252. 348.
190	91.0 2109 0.1730	0.586 274. 365.	91.0 2107 0.1721	0.582 272. 363.	91.0 2104 0.1710	0.578 270. 360.	91.1 2102 0.1696	0.572 267. 356.	91.1 2098 0.1679	0.566 264. 352.
170	90.8 2226 0.1638	0.581 283. 365.	90.8 2225 0.1631	0.578 281. 363.	90.9 2224 0.1623	0.575 280. 361.	90.9 2222 0.1613	0.571 278. 358.	90.9 2219 0.1601	0.566 275. 355.
150	90.4 2314 0.1566	0.573 290. 362.	90.4 2314 0.1560	0.571 288. 361.	90.4 2313 0.1554	0.568 287. 359.	90.4 2311 0.1546	0.565 285. 357.	90.5 2310 0.1536	0.561 283. 355.
100	89.4 2575 0.1387	0.555 308. 357.	89.4 2575 0.1383	0.553 307. 356.	89.4 2574 0.1379	0.551 306. 355.	89.5 2574 0.1375	0.549 305. 354.	89.5 2573 0.1370	0.547 303. 352.
50	84.6 2457 0.1321	0.495 300. 324.	84.7 2471 0.1313	0.495 300. 324.	84.9 2486 0.1305	0.495 300. 324.	85.1 2503 0.1296	0.495 300. 324.	85.3 2521 0.1287	0.495 300. 324.
0	81.1 2476 0.1222	0.454 300. 303.	81.3 2491 0.1215	0.454 300. 303.	81.4 2506 0.1207	0.454 300. 303.	81.6 2523 0.1199	0.454 300. 303.	81.8 2542 0.1190	0.454 300. 303.

bd100_oei_crctl_mrcz_IMP_hw_05 - 19/11/2003

Figure 05-05-03. Cruise Data—Maximum Cruise Speed (Sheet 6 of 12)

MAXIMUM CRUISE SPEED			
CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350	93.0 1225 0.2887	0.600 199. 354.	92.9 1208 0.2832	0.581 192. 342.	92.6 1178 0.2736	0.547 180. 322.				
330	92.5 1327 0.2728	0.609 212. 362.	92.6 1320 0.2688	0.597 207. 355.	92.7 1310 0.2637	0.581 201. 345.	92.8 1296 0.2563	0.559 193. 332.		
310	92.1 1429 0.2566	0.612 223. 367.	92.1 1424 0.2540	0.603 219. 362.	92.2 1418 0.2505	0.593 215. 355.	92.4 1410 0.2460	0.579 210. 347.	92.5 1399 0.2401	0.560 203. 336.
290	91.6 1526 0.2413	0.609 232. 368.	91.7 1523 0.2395	0.603 229. 365.	91.8 1519 0.2371	0.596 226. 360.	91.9 1513 0.2340	0.586 222. 354.	92.0 1506 0.2301	0.573 217. 346.
270	91.2 1625 0.2269	0.605 240. 369.	91.3 1623 0.2256	0.601 238. 366.	91.3 1620 0.2240	0.596 236. 363.	91.4 1616 0.2218	0.588 233. 358.	91.5 1610 0.2191	0.579 229. 353.
250	90.9 1709 0.2147	0.597 247. 367.	90.9 1708 0.2137	0.594 246. 365.	90.9 1705 0.2125	0.590 244. 362.	91.0 1703 0.2109	0.584 242. 359.	91.0 1699 0.2087	0.577 239. 355.
230	90.8 1814 0.2024	0.593 256. 367.	90.8 1813 0.2015	0.590 254. 365.	90.8 1811 0.2006	0.587 253. 363.	90.8 1809 0.1995	0.583 251. 361.	90.9 1807 0.1980	0.578 249. 358.
210	90.8 1929 0.1907	0.589 265. 368.	90.8 1927 0.1900	0.587 264. 366.	90.8 1925 0.1893	0.584 262. 364.	90.8 1923 0.1885	0.581 261. 362.	90.8 1921 0.1875	0.577 259. 360.
190	90.5 2029 0.1806	0.583 272. 367.	90.5 2028 0.1800	0.580 271. 365.	90.6 2026 0.1794	0.578 270. 364.	90.6 2025 0.1787	0.575 269. 362.	90.6 2023 0.1780	0.572 268. 360.
170	90.1 2113 0.1721	0.574 279. 364.	90.1 2112 0.1716	0.572 278. 362.	90.1 2111 0.1710	0.570 277. 361.	90.1 2110 0.1704	0.567 276. 360.	90.2 2109 0.1697	0.565 274. 358.
150	89.6 2194 0.1644	0.565 286. 361.	89.6 2194 0.1639	0.563 284. 360.	89.7 2194 0.1633	0.561 284. 358.	89.7 2193 0.1628	0.559 282. 357.	89.7 2193 0.1622	0.557 281. 356.
100	88.5 2438 0.1454	0.545 302. 354.	88.5 2438 0.1449	0.543 301. 353.	88.6 2438 0.1444	0.542 300. 352.	88.6 2438 0.1440	0.540 299. 351.	88.6 2438 0.1435	0.538 298. 350.
50	84.5 2413 0.1356	0.495 300. 327.	84.7 2429 0.1347	0.495 300. 327.	84.8 2445 0.1338	0.495 300. 327.	85.0 2460 0.1330	0.495 300. 327.	85.2 2475 0.1323	0.495 300. 327.
0	81.0 2431 0.1255	0.454 300. 305.	81.2 2448 0.1246	0.454 300. 305.	81.3 2464 0.1238	0.454 300. 305.	81.5 2479 0.1231	0.454 300. 305.	81.7 2494 0.1223	0.454 300. 305.

bd100_oei_crctl_mrcz_IMP_lw_10 – 19/11/2003

Figure 05-05-03. Cruise Data—Maximum Cruise Speed (Sheet 7 of 12)

MAXIMUM CRUISE SPEED			
CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310	92.8 1380 0.2287	0.527 190. 316.								
290	92.1 1496 0.2250	0.557 211. 337.	92.4 1482 0.2166	0.531 200. 321.						
270	91.6 1603 0.2156	0.567 224. 346.	91.7 1595 0.2113	0.553 219. 337.	91.9 1584 0.2050	0.533 210. 325.	92.6 1530 0.1744	0.438 172. 267.		
250	91.1 1695 0.2061	0.569 235. 349.	91.2 1689 0.2029	0.558 230. 343.	91.3 1683 0.1991	0.545 225. 335.	91.4 1675 0.1938	0.528 217. 324.	91.6 1662 0.1846	0.499 205. 307.
230	90.9 1803 0.1961	0.571 246. 354.	90.9 1799 0.1937	0.563 242. 349.	91.0 1794 0.1908	0.553 238. 342.	91.0 1789 0.1875	0.542 233. 336.	91.1 1781 0.1833	0.527 226. 326.
210	90.8 1918 0.1862	0.572 257. 357.	90.8 1914 0.1846	0.566 254. 353.	90.9 1909 0.1825	0.558 250. 349.	90.9 1903 0.1801	0.549 246. 343.	90.9 1896 0.1773	0.539 241. 336.
190	90.6 2020 0.1771	0.569 266. 358.	90.6 2018 0.1759	0.565 264. 355.	90.6 2014 0.1745	0.559 261. 352.	90.7 2009 0.1727	0.552 258. 347.	90.7 2004 0.1705	0.543 253. 342.
170	90.2 2108 0.1690	0.562 273. 356.	90.2 2107 0.1680	0.559 271. 354.	90.2 2105 0.1669	0.555 269. 352.	90.3 2103 0.1655	0.549 267. 348.	90.3 2101 0.1638	0.543 264. 344.
150	89.7 2193 0.1615	0.555 280. 354.	89.8 2192 0.1608	0.552 279. 353.	89.8 2192 0.1599	0.549 277. 350.	89.8 2192 0.1588	0.545 276. 348.	89.9 2191 0.1574	0.540 273. 345.
100	88.6 2438 0.1431	0.537 298. 349.	88.7 2438 0.1426	0.535 297. 348.	88.7 2438 0.1421	0.533 295. 346.	88.7 2438 0.1415	0.531 294. 345.	88.8 2438 0.1408	0.528 293. 343.
50	85.3 2489 0.1315	0.495 300. 327.	85.5 2504 0.1307	0.495 300. 327.	85.7 2519 0.1299	0.495 300. 327.	85.9 2536 0.1290	0.495 300. 327.	86.1 2555 0.1281	0.495 300. 327.
0	81.8 2509 0.1216	0.454 300. 305.	82.0 2524 0.1209	0.454 300. 305.	82.2 2539 0.1201	0.454 300. 305.	82.3 2556 0.1194	0.454 300. 305.	82.5 2575 0.1185	0.454 300. 305.

bd100_oel_crcll_mrcz_IMP_hw_10 – 19/11/2003

Figure 05-05-03. Cruise Data—Maximum Cruise Speed (Sheet 8 of 12)

MAXIMUM CRUISE SPEED

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350	91.7 1170 0.2949	0.579 192. 345.	91.9 1160 0.2869	0.559 185. 333.	92.2 1142 0.2711	0.520 171. 310.				
330	91.3 1266 0.2792	0.589 204. 354.	91.4 1259 0.2741	0.575 199. 345.	91.6 1250 0.2672	0.556 192. 334.	91.9 1235 0.2549	0.524 181. 315.		
310	91.0 1368 0.2629	0.594 216. 360.	91.0 1362 0.2595	0.584 212. 354.	91.2 1356 0.2551	0.571 207. 346.	91.3 1348 0.2493	0.555 201. 336.	91.5 1334 0.2400	0.529 191. 320.
290	90.7 1452 0.2483	0.590 224. 360.	90.8 1448 0.2458	0.583 221. 356.	90.8 1444 0.2426	0.574 217. 350.	90.9 1439 0.2384	0.562 213. 343.	91.0 1433 0.2333	0.548 207. 334.
270	90.4 1535 0.2342	0.584 231. 360.	90.5 1533 0.2325	0.579 229. 356.	90.5 1531 0.2301	0.572 226. 352.	90.6 1528 0.2270	0.564 223. 347.	90.6 1524 0.2232	0.553 218. 340.
250	90.2 1617 0.2215	0.577 238. 358.	90.2 1615 0.2202	0.573 237. 356.	90.2 1613 0.2185	0.568 234. 352.	90.2 1609 0.2162	0.561 231. 348.	90.3 1605 0.2133	0.552 228. 342.
230	90.1 1718 0.2089	0.574 247. 359.	90.1 1716 0.2079	0.571 246. 357.	90.1 1714 0.2067	0.567 244. 354.	90.2 1711 0.2052	0.561 242. 351.	90.2 1707 0.2031	0.555 239. 347.
210	90.1 1828 0.1968	0.571 256. 360.	90.1 1826 0.1960	0.568 255. 358.	90.1 1824 0.1951	0.565 253. 356.	90.2 1822 0.1940	0.561 252. 354.	90.2 1819 0.1927	0.556 249. 350.
190	89.8 1917 0.1868	0.564 264. 358.	89.8 1916 0.1861	0.562 262. 357.	89.8 1915 0.1854	0.559 261. 355.	89.9 1913 0.1845	0.556 260. 353.	89.9 1911 0.1835	0.552 258. 351.
170	89.2 1986 0.1785	0.554 269. 355.	89.3 1986 0.1779	0.552 268. 353.	89.3 1985 0.1772	0.550 267. 352.	89.3 1985 0.1764	0.548 266. 350.	89.3 1984 0.1756	0.545 264. 348.
150	88.6 2058 0.1704	0.545 275. 351.	88.7 2058 0.1698	0.543 274. 350.	88.7 2058 0.1692	0.541 273. 348.	88.7 2058 0.1686	0.539 272. 347.	88.8 2058 0.1678	0.536 270. 346.
100	87.5 2292 0.1502	0.525 291. 344.	87.5 2292 0.1497	0.523 290. 343.	87.5 2292 0.1492	0.522 289. 342.	87.6 2292 0.1487	0.520 288. 341.	87.6 2292 0.1482	0.518 287. 340.
50	85.3 2444 0.1350	0.495 300. 330.	85.4 2461 0.1341	0.495 300. 330.	85.6 2477 0.1333	0.495 300. 330.	85.8 2492 0.1325	0.495 300. 330.	86.0 2507 0.1317	0.495 300. 330.
0	81.7 2463 0.1249	0.454 300. 308.	81.9 2480 0.1241	0.454 300. 308.	82.1 2496 0.1232	0.454 300. 308.	82.2 2512 0.1225	0.454 300. 308.	82.4 2527 0.1218	0.454 300. 308.

bd100_oei_crctl_mrcz_IMP_lw_15 – 19/11/2003

Figure 05-05-03. Cruise Data—Maximum Cruise Speed (Sheet 9 of 12)

MAXIMUM CRUISE SPEED			
CLIMB THRUST LIMITS **ENGINE BLEED ON** **ENGINE AND WING A/I OFF**	ISA + 15 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310										
290	91.2 1424 0.2256	0.526 199. 321.	91.7 1389 0.1951	0.444 166. 271.						
270	90.7 1519 0.2186	0.540 213. 332.	90.8 1513 0.2121	0.521 205. 321.	91.0 1499 0.2004	0.488 192. 300.				
250	90.3 1600 0.2097	0.541 223. 336.	90.4 1594 0.2056	0.528 217. 328.	90.5 1584 0.1993	0.509 209. 316.	90.7 1575 0.1888	0.479 196. 297.		
230	90.2 1703 0.2005	0.546 235. 342.	90.3 1697 0.1974	0.536 230. 335.	90.3 1691 0.1938	0.524 225. 328.	90.4 1682 0.1886	0.507 218. 317.	90.5 1672 0.1805	0.483 207. 302.
210	90.2 1815 0.1909	0.550 246. 346.	90.2 1811 0.1886	0.542 243. 342.	90.3 1805 0.1859	0.532 238. 336.	90.3 1798 0.1828	0.522 233. 329.	90.3 1790 0.1788	0.508 227. 320.
190	89.9 1909 0.1822	0.548 256. 348.	89.9 1906 0.1805	0.542 253. 344.	90.0 1902 0.1784	0.535 249. 340.	90.0 1897 0.1760	0.526 245. 334.	90.1 1892 0.1733	0.517 240. 328.
170	89.4 1983 0.1745	0.541 263. 346.	89.4 1983 0.1732	0.537 260. 344.	89.5 1982 0.1715	0.532 258. 340.	89.5 1980 0.1695	0.525 254. 336.	89.6 1979 0.1671	0.517 250. 331.
150	88.8 2058 0.1670	0.533 269. 344.	88.8 2058 0.1659	0.530 267. 342.	88.9 2058 0.1646	0.526 265. 339.	89.0 2058 0.1630	0.521 262. 336.	89.1 2058 0.1611	0.515 259. 332.
100	87.6 2292 0.1477	0.516 286. 339.	87.6 2292 0.1471	0.514 285. 337.	87.7 2292 0.1464	0.512 283. 336.	87.7 2291 0.1456	0.509 282. 334.	87.8 2291 0.1446	0.505 280. 331.
50	86.1 2522 0.1309	0.495 300. 330.	86.3 2537 0.1301	0.495 300. 330.	86.5 2552 0.1293	0.495 300. 330.	86.7 2569 0.1285	0.495 300. 330.	86.7 2573 0.1279	0.493 299. 329.
0	82.6 2542 0.1210	0.454 300. 308.	82.7 2556 0.1203	0.454 300. 308.	82.9 2573 0.1196	0.454 300. 308.	83.1 2590 0.1188	0.454 300. 308.	83.3 2608 0.1180	0.454 300. 308.

bd100_osi_crctl_mrcz_IMP_hw_15 – 19/11/2003

Figure 05-05-03. Cruise Data—Maximum Cruise Speed (Sheet 10 of 12)

MAXIMUM CRUISE SPEED

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	24		26		28		30		32	
350	90.6 1116 0.2991	0.554 183. 334.	90.8 1105 0.2870	0.527 174. 317.						
330	90.3 1201 0.2849	0.564 195. 342.	90.4 1194 0.2781	0.547 189. 332.	90.6 1185 0.2678	0.523 180. 318.				
310	90.1 1293 0.2693	0.569 206. 348.	90.2 1289 0.2645	0.557 202. 341.	90.3 1284 0.2585	0.543 196. 332.	90.4 1278 0.2500	0.522 188. 320.	90.8 1247 0.2192	0.447 160. 274.
290	89.9 1376 0.2547	0.568 215. 351.	90.0 1374 0.2512	0.559 212. 345.	90.1 1370 0.2467	0.548 207. 338.	90.1 1365 0.2414	0.534 202. 330.	90.3 1357 0.2336	0.514 194. 317.
270	89.7 1453 0.2414	0.564 223. 351.	89.8 1451 0.2389	0.557 220. 347.	89.8 1447 0.2355	0.548 217. 341.	89.9 1444 0.2313	0.537 212. 334.	89.9 1439 0.2264	0.524 206. 326.
250	89.5 1531 0.2285	0.558 230. 350.	89.5 1529 0.2268	0.553 228. 347.	89.6 1526 0.2244	0.547 225. 343.	89.6 1522 0.2213	0.538 221. 337.	89.6 1517 0.2175	0.527 217. 330.
230	89.5 1627 0.2154	0.555 239. 351.	89.5 1625 0.2142	0.551 237. 348.	89.5 1623 0.2126	0.547 235. 345.	89.5 1619 0.2105	0.540 232. 341.	89.6 1615 0.2076	0.531 228. 335.
210	89.4 1730 0.2030	0.552 248. 351.	89.4 1728 0.2021	0.549 246. 349.	89.5 1727 0.2009	0.545 244. 347.	89.5 1724 0.1995	0.541 242. 344.	89.5 1721 0.1975	0.534 239. 340.
190	89.0 1809 0.1931	0.545 254. 349.	89.1 1808 0.1922	0.543 253. 348.	89.1 1807 0.1913	0.540 252. 346.	89.1 1806 0.1902	0.536 250. 344.	89.1 1804 0.1887	0.531 248. 340.
170	88.3 1871 0.1846	0.535 259. 345.	88.4 1870 0.1838	0.533 258. 344.	88.4 1870 0.1830	0.530 257. 342.	88.4 1870 0.1820	0.527 256. 340.	88.5 1869 0.1808	0.524 254. 338.
150	87.6 1935 0.1763	0.525 264. 341.	87.7 1935 0.1756	0.523 264. 340.	87.7 1935 0.1749	0.521 262. 338.	87.7 1935 0.1740	0.518 261. 337.	87.8 1935 0.1731	0.515 260. 335.
100	86.4 2148 0.1553	0.504 279. 334.	86.4 2148 0.1547	0.502 278. 332.	86.4 2147 0.1542	0.500 277. 331.	86.4 2147 0.1537	0.499 276. 330.	86.5 2147 0.1531	0.497 275. 329.
50	85.6 2435 0.1356	0.491 298. 330.	85.6 2435 0.1351	0.489 296. 329.	85.7 2435 0.1347	0.487 296. 328.	85.7 2435 0.1343	0.486 295. 327.	85.7 2435 0.1339	0.484 294. 326.
0	82.4 2494 0.1244	0.454 300. 310.	82.6 2511 0.1235	0.454 300. 310.	82.8 2528 0.1227	0.454 300. 310.	83.0 2543 0.1220	0.454 300. 310.	83.1 2559 0.1212	0.454 300. 310.

bd100_oei_crcti_mrcz_IMP_tw_20 – 19/11/2003

Figure 05-05-03. Cruise Data—Maximum Cruise Speed (Sheet 11 of 12)

MAXIMUM CRUISE SPEED

CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1 LB/HR NAM/LB	MACH KIAS KTAS

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	34		36		38		40		42	
350										
330										
310										
290	90.4 1343 0.2182	0.475 179. 293.								
270	90.0 1431 0.2189	0.504 198. 313.	90.2 1419 0.2040	0.466 183. 290.						
250	89.7 1511 0.2130	0.514 211. 322.	89.8 1504 0.2058	0.494 203. 310.	89.9 1495 0.1920	0.458 188. 287.				
230	89.6 1609 0.2043	0.521 223. 329.	89.7 1603 0.2004	0.509 218. 321.	89.7 1595 0.1945	0.491 210. 310.	89.8 1585 0.1848	0.464 198. 293.		
210	89.6 1717 0.1950	0.526 235. 335.	89.6 1712 0.1920	0.517 231. 329.	89.7 1706 0.1886	0.506 226. 322.	89.7 1700 0.1840	0.492 219. 313.	89.8 1689 0.1769	0.470 209. 299.
190	89.2 1801 0.1868	0.525 245. 337.	89.2 1798 0.1845	0.518 241. 332.	89.3 1795 0.1817	0.509 237. 326.	89.4 1791 0.1788	0.500 232. 320.	89.4 1786 0.1748	0.487 226. 312.
170	88.5 1868 0.1793	0.519 252. 335.	88.6 1868 0.1773	0.513 249. 331.	88.7 1866 0.1750	0.506 245. 327.	88.8 1865 0.1724	0.498 241. 322.	88.8 1864 0.1696	0.490 237. 316.
150	87.8 1935 0.1719	0.512 258. 333.	87.9 1935 0.1704	0.507 255. 330.	88.0 1935 0.1685	0.501 252. 326.	88.1 1934 0.1663	0.495 249. 322.	88.2 1934 0.1639	0.488 245. 317.
100	86.5 2147 0.1524	0.495 274. 327.	86.5 2147 0.1516	0.492 272. 326.	86.6 2148 0.1506	0.489 270. 324.	86.6 2148 0.1493	0.485 268. 321.	86.7 2148 0.1479	0.480 266. 318.
50	85.7 2435 0.1334	0.483 293. 325.	85.7 2435 0.1329	0.481 292. 324.	85.7 2434 0.1324	0.479 290. 322.	85.8 2434 0.1318	0.477 289. 321.	85.8 2434 0.1311	0.474 288. 319.
0	83.3 2574 0.1205	0.454 300. 310.	83.4 2589 0.1198	0.454 300. 310.	83.6 2605 0.1191	0.454 300. 310.	83.8 2622 0.1183	0.454 300. 310.	84.0 2641 0.1175	0.454 300. 310.

bd100_oei_crctl_mrcz_IMP_hw_20 – 19/11/2003

Figure 05-05-03. Cruise Data—Maximum Cruise Speed (Sheet 12 of 12)

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DESCENT DATA

Single engine operation descent performance data is presented in tabular form as a function of aircraft weight during a descent from altitude to sea level for -10, 0, 10 and 20°C temperature deviations from ISA.

Descent performance data is presented for the following descent speed schedule:

- 0.80 MI / 280 / 250 KIAS

Data is based on a descent with the remaining engine set at idle power with engine bleed on and anti-ice off. The normal descent speed schedule incorporates a speed limit of 250 KIAS below 10 000 ft.

Descent performance tables show the following data:

- TIME: Time in minutes
- DIST: Air distance in nautical miles
- FUEL: Fuel consumed in pounds
- ROD: Rate of descent in fpm
- ATAS: Average true airspeed in knots
- MACH: Indicated Mach number

At a selected descent speed schedule, the table is entered at an initial descent weight with average temperature conditions at given initial and final descent altitudes. Descent time, distance and fuel consumed are the difference between the values read at the initial and final altitudes. Airplane rate of descent and indicated Mach number at altitude are also given.

The descent distance represents the air distance (zero wind) covered and ATAS represents the average true airspeed from top of descent altitude to the point final descent altitude is reached. In wind conditions, the ground distance can be derived using the following equation:

- Ground distance = [Air distance x (ATAS +/- Wind*) / ATAS]

* Wind convention "+" for Tailwind and "-" for Headwind

Time, distance and fuel correction factors for C.G. variation relative to 30% MAC reference position are provided below:

TIME, DISTANCE and FUEL CORRECTION FACTORS vs. C.G. POSITION.

C.G.	Time, Distance and Fuel
20%	- 2.0 %
25%	- 1.0 %
REF (30%)	-
35%	+ 2.0 %
40%	+ 3.0 %

Example:

Associated conditions

- Initial descent altitude = FL 390 (A)
- Initial descent weight at altitude = 30 000 lbs (B)
- Descent speed schedule = 0.80 MI / 280/250 KIAS
- Average descent temperature = ISA-10°C
- Average descent wind = -30 kt (headwind)
- Final altitude = Sea Level

Using Figure 05-06-01, Sheet 1, the following data are obtained (C):

- Time = 12.8 min.
- Air distance = 72.8 n.a.m.
- Descent rate at FL390 = 3888 ft/min.
- Fuel consumed = 87 lbs
- Avg true airspeed = 341 kts
- Indicated Mach = 0.80

Ground distance is estimated using equation given above:

- Ground distance = 66.4 n.m. [72.8 x (341-30)/341]

DESCENT 0.80 M /280 KIAS /250 KIAS

IDLE THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	SEA LEVEL FINAL ALTITUDE TIME(MIN) FUEL(LB) DIST(NAM) ATAS(KTS) ROD(FPM) MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	22		24		26		28		30 (B)	
450	11.2	76	12.1	82	12.9	87	13.8	93	14.6	98
	65.9	353	71.2	354	76.3	354	81.1	354	85.8	354
	3675	0.800	3471	0.800	3321	0.800	3215	0.800	3117	0.800
430	10.7	72	11.5	78	12.4	83	13.2	89	13.9	94
	62.1	349	67.1	349	71.9	349	76.6	349	81.2	349
	4013	0.800	3760	0.800	3566	0.800	3424	0.800	3292	0.800
410	10.2	69	11.0	75	11.8	80	12.6	85	13.4	90
	58.6	344	63.3	345	67.9	345	72.4	345	76.8	345
	4509	0.800	4199	0.800	3953	0.800	3764	0.800	3587	0.800
390 (A)	9.8	66	10.6	72	11.3	77	12.1	82	12.8	87
	55.4	340	59.9	340	64.3	341	68.6	341	72.8 (C)	341
	4990	0.800	4631	0.800	4339	0.800	4108	0.800	3888	0.800
370	9.4	64	10.2	69	10.9	74	11.6	79	12.3	84
	52.6	336	56.9	336	61.1	336	65.1	337	69.2	337
	5478	0.800	5073	0.800	4739	0.800	4468	0.800	4210	0.800
350	9.1	62	9.8	67	10.5	72	11.2	76	11.9	81
	50.1	332	54.2	332	58.2	332	62.1	333	65.9	333
	6676	0.800	6175	0.800	5759	0.800	5416	0.800	5088	0.800
330	8.7	60	9.4	65	10.1	69	10.8	74	11.5	78
	47.7	327	51.6	328	55.4	328	59.1	328	62.7	328
	4962	0.789	4593	0.789	4284	0.789	4027	0.789	3781	0.789
310	8.3	57	9.0	62	9.7	66	10.3	71	10.9	75
	44.7	322	48.3	322	51.9	322	55.4	323	58.8	323
	4881	0.757	4516	0.757	4210	0.757	3956	0.757	3713	0.757
290	7.9	55	8.6	59	9.2	63	9.8	68	10.4	72
	41.8	316	45.2	317	48.5	317	51.7	317	54.9	318
	4792	0.727	4437	0.727	4139	0.727	3893	0.727	3656	0.727
250	7.1	49	7.6	53	8.2	57	8.7	61	9.3	65
	36.0	306	39.0	306	41.9	306	44.6	307	47.4	307
	4683	0.672	4331	0.672	4036	0.672	3791	0.672	3555	0.672
200	6.0	43	6.5	46	6.9	49	7.4	52	7.8	56
	29.2	293	31.6	293	33.9	293	36.2	293	38.4	294
	4562	0.610	4218	0.610	3930	0.610	3689	0.610	3458	0.610
150	4.9	35	5.3	38	5.6	41	6.0	43	6.4	46
	22.7	279	24.5	279	26.3	280	28.0	280	29.7	280
	4359	0.555	4030	0.555	3754	0.555	3524	0.555	3303	0.555
100	3.5	26	3.7	28	4.0	30	4.3	32	4.5	34
	15.1	262	16.4	262	17.5	262	18.7	263	19.8	263
	3051	0.452	2826	0.452	2639	0.452	2487	0.452	2343	0.452
50	1.8	14	1.9	15	2.1	16	2.2	18	2.3	19
	7.5	253	8.1	253	8.7	253	9.3	253	9.8	254
	2902	0.413	2688	0.413	2510	0.413	2365	0.413	2226	0.413

BD100_OEI_DES280_IMP_M10_LW.PS_HP - 08/10/2003

Figure 05-06-01. Descent Data (Sheet 1 of 8)

DESCENT 0.80 M /280 KIAS /250 KIAS

IDLE THRUST
ENGINE BLEED ON
ENGINE AND WING A/I OFF

ISA – 10 C

30% C.G.

SEA LEVEL FINAL ALTITUDE

TIME(MIN)	FUEL(LB)
DIST(NAM)	ATAS(KTS)
ROD(FPM)	MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	32		34		36		38		40	
450	15.3	103	16.0	108	16.7	112	17.2	116	17.8	120
	90.2	354	94.4	354	98.2	354	101.6	353	104.7	353
	3057	0.800	3034	0.800	3048	0.800	3096	0.800	3176	0.800
430	14.7	99	15.4	104	16.0	108	16.6	112	17.1	116
	85.5	350	89.5	350	93.3	350	96.8	350	99.9	350
	3200	0.800	3129	0.800	3084	0.800	3073	0.800	3092	0.800
410	14.1	95	14.7	100	15.4	104	16.0	108	16.5	112
	81.0	345	84.9	346	88.6	346	92.0	346	95.2	346
	3461	0.800	3359	0.800	3277	0.800	3215	0.800	3177	0.800
390	13.5	92	14.2	96	14.8	100	15.4	104	15.9	108
	76.8	341	80.6	341	84.2	342	87.5	342	90.6	342
	3723	0.800	3589	0.800	3481	0.800	3393	0.800	3319	0.800
370	13.0	88	13.6	93	14.2	97	14.8	100	15.3	104
	73.0	337	76.6	337	80.0	338	83.2	338	86.2	338
	4009	0.800	3842	0.800	3702	0.800	3588	0.800	3493	0.800
350	12.5	86	13.2	90	13.7	94	14.3	97	14.8	101
	69.6	333	73.1	333	76.3	334	79.4	334	82.2	334
	4825	0.800	4601	0.800	4410	0.800	4249	0.800	4113	0.800
330	12.1	83	12.7	87	13.2	90	13.7	94	14.2	97
	66.2	329	69.5	329	72.6	329	75.5	329	78.2	330
	3582	0.789	3408	0.789	3257	0.789	3127	0.789	3015	0.789
310	11.5	79	12.1	83	12.6	87	13.1	90	13.6	93
	62.0	323	65.1	323	68.0	324	70.7	324	73.3	324
	3515	0.757	3344	0.757	3195	0.757	3067	0.757	2957	0.757
290	10.9	76	11.5	79	12.0	83	12.4	86	12.9	89
	58.0	318	60.8	318	63.5	318	66.1	319	68.4	319
	3464	0.727	3296	0.727	3150	0.727	3024	0.727	2914	0.727
250	9.8	68	10.2	72	10.7	75	11.1	77	11.5	80
	50.0	307	52.5	307	54.8	308	56.9	308	59.0	308
	3364	0.672	3198	0.672	3055	0.672	2933	0.672	2828	0.672
200	8.3	59	8.7	61	9.0	64	9.4	66	9.7	69
	40.5	294	42.4	294	44.3	294	46.0	294	47.6	295
	3271	0.610	3108	0.610	2966	0.610	2844	0.610	2739	0.610
150	6.7	48	7.0	51	7.3	53	7.6	55	7.8	56
	31.3	280	32.8	280	34.1	281	35.4	281	36.6	281
	3123	0.555	2966	0.555	2829	0.555	2711	0.555	2609	0.555
100	4.7	36	5.0	37	5.1	39	5.3	40	5.5	41
	20.8	263	21.7	263	22.5	263	23.3	263	24.0	263
	2230	0.452	2136	0.452	2058	0.452	1992	0.452	1934	0.452
50	2.4	20	2.6	20	2.7	21	2.7	22	2.8	23
	10.3	254	10.8	254	11.2	254	11.6	254	12.0	254
	2118	0.413	2028	0.413	1952	0.413	1888	0.413	1833	0.413

BD100_OEI_DES280_IMP_M10_HW.PS_HP – 08/10/2003

Figure 05-06-01. Descent Data (Sheet 2 of 8)

DESCENT 0.80 M /280 KIAS /250 KIAS

IDLE THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	SEA LEVEL FINAL ALTITUDE TIME(MIN) FUEL(LB) DIST(NAM) ATAS(KTS) ROD(FPM) MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	22		24		26		28		30	
450	11.3	78	12.2	84	13.1	90	13.9	96	14.8	102
	68.3	361	73.7	361	79.0	361	84.0	361	88.9	361
	3640	0.800	3437	0.800	3287	0.800	3180	0.800	3081	0.800
430	10.8	75	11.7	81	12.5	86	13.3	92	14.1	98
	64.2	356	69.4	357	74.5	357	79.3	357	84.1	357
	3977	0.800	3724	0.800	3531	0.800	3389	0.800	3257	0.800
410	10.3	72	11.2	77	12.0	83	12.8	88	13.5	94
	60.6	352	65.6	352	70.4	352	75.0	352	79.6	353
	4462	0.800	4154	0.800	3910	0.800	3722	0.800	3546	0.800
390	9.9	69	10.7	74	11.5	80	12.3	85	13.0	90
	57.4	347	62.1	347	66.6	348	71.1	348	75.4	348
	4923	0.800	4569	0.800	4280	0.800	4051	0.800	3833	0.800
370	9.5	66	10.3	72	11.0	77	11.8	82	12.5	87
	54.4	343	58.9	343	63.2	343	67.4	344	71.6	344
	5400	0.800	5000	0.800	4671	0.800	4403	0.800	4148	0.800
350	9.2	64	9.9	69	10.7	74	11.4	79	12.1	84
	51.9	339	56.1	339	60.3	339	64.3	339	68.3	340
	6555	0.800	6063	0.800	5653	0.800	5317	0.800	4994	0.800
330	8.9	62	9.6	67	10.3	72	10.9	77	11.6	81
	49.3	334	53.3	334	57.3	335	61.1	335	64.9	335
	4880	0.789	4517	0.789	4212	0.789	3960	0.789	3717	0.789
310	8.4	59	9.1	64	9.8	69	10.4	73	11.1	78
	46.2	328	50.0	329	53.7	329	57.3	329	60.8	330
	4797	0.757	4438	0.757	4137	0.757	3887	0.757	3648	0.757
290	8.0	57	8.7	61	9.3	66	9.9	70	10.5	74
	43.2	323	46.7	323	50.1	323	53.5	324	56.8	324
	4708	0.727	4359	0.727	4066	0.727	3824	0.727	3591	0.727
250	7.2	51	7.7	55	8.3	59	8.8	63	9.4	67
	37.2	312	40.3	312	43.2	312	46.1	313	49.0	313
	4607	0.672	4260	0.672	3970	0.672	3729	0.672	3497	0.672
200	6.1	44	6.6	48	7.0	51	7.5	54	7.9	58
	30.1	298	32.6	299	35.0	299	37.3	299	39.6	299
	4493	0.610	4155	0.610	3870	0.610	3633	0.610	3405	0.610
150	4.9	36	5.3	39	5.7	42	6.1	45	6.4	48
	23.3	284	25.2	285	27.1	285	28.9	285	30.6	285
	4293	0.555	3969	0.555	3697	0.555	3470	0.555	3252	0.555
100	3.5	27	3.8	29	4.1	31	4.3	33	4.6	35
	15.6	267	16.8	267	18.0	267	19.2	267	20.3	267
	3009	0.452	2787	0.452	2602	0.452	2453	0.452	2310	0.452
50	1.8	15	2.0	16	2.1	17	2.2	18	2.4	19
	7.8	257	8.4	258	9.0	258	9.6	258	10.1	258
	2880	0.413	2666	0.413	2489	0.413	2345	0.413	2208	0.413

BD100_OEI_DES280_IMP_00_LW.PS_HP – 08/10/2003

Figure 05-06-01. Descent Data (Sheet 3 of 8)

DESCENT 0.80 M /280 KIAS /250 KIAS		
IDLE THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	SEA LEVEL FINAL ALTITUDE TIME(MIN) FUEL(LB) DIST(NAM) ATAS(KTS) ROD(FPM) MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	22		24		26		28		30	
450	11.5	81	12.4	87	13.3	93	14.1	99	15.0	105
	70.6	368	76.2	369	81.7	369	86.9	369	92.0	369
	3607	0.800	3404	0.800	3254	0.800	3147	0.800	3047	0.800
430	11.0	77	11.8	83	12.7	89	13.5	95	14.3	101
	66.5	364	71.8	364	77.0	364	82.1	364	87.0	364
	3942	0.800	3691	0.800	3498	0.800	3357	0.800	3224	0.800
410	10.5	74	11.3	80	12.2	85	13.0	91	13.7	97
	62.7	359	67.8	359	72.8	359	77.6	360	82.4	360
	4416	0.800	4111	0.800	3868	0.800	3682	0.800	3506	0.800
390	10.1	71	10.9	77	11.7	82	12.4	88	13.2	93
	59.4	354	64.2	354	68.9	355	73.5	355	78.1	355
	4868	0.800	4517	0.800	4231	0.800	4004	0.800	3788	0.800
370	9.7	68	10.4	74	11.2	79	11.9	85	12.7	90
	56.3	350	60.9	350	65.4	350	69.8	350	74.1	351
	5328	0.800	4933	0.800	4608	0.800	4344	0.800	4091	0.800
350	9.3	66	10.1	71	10.8	77	11.5	82	12.2	87
	53.7	345	58.0	346	62.3	346	66.5	346	70.6	346
	6442	0.800	5958	0.800	5555	0.800	5224	0.800	4906	0.800
330	9.0	64	9.7	69	10.4	74	11.1	79	11.8	84
	51.0	341	55.2	341	59.2	341	63.2	342	67.1	342
	4804	0.789	4445	0.789	4146	0.789	3897	0.789	3658	0.789
310	8.6	61	9.3	66	9.9	71	10.6	76	11.2	80
	47.8	335	51.7	335	55.5	335	59.2	336	62.9	336
	4724	0.757	4370	0.757	4073	0.757	3827	0.757	3591	0.757
290	8.1	58	8.8	63	9.4	68	10.1	72	10.7	77
	44.6	329	48.3	329	51.8	330	55.3	330	58.7	330
	4636	0.727	4292	0.727	4004	0.727	3765	0.727	3535	0.727
250	7.3	53	7.8	57	8.4	61	9.0	65	9.5	69
	38.5	318	41.6	318	44.7	318	47.6	319	50.6	319
	4534	0.672	4193	0.672	3907	0.672	3669	0.672	3441	0.672
200	6.1	45	6.6	49	7.1	52	7.6	56	8.1	59
	31.1	304	33.7	304	36.1	304	38.5	305	40.9	305
	4425	0.610	4091	0.610	3811	0.610	3577	0.610	3353	0.610
150	5.0	37	5.4	40	5.8	43	6.2	46	6.5	49
	24.1	290	26.0	290	27.9	290	29.8	290	31.6	290
	4233	0.555	3914	0.555	3645	0.555	3421	0.555	3206	0.555
100	3.5	27	3.8	30	4.1	32	4.4	34	4.6	36
	16.1	272	17.3	272	18.6	272	19.8	272	21.0	272
	2969	0.452	2750	0.452	2567	0.452	2420	0.452	2279	0.452
50	1.8	15	2.0	16	2.1	18	2.3	19	2.4	20
	8.0	262	8.6	262	9.3	262	9.8	262	10.4	263
	2864	0.413	2651	0.413	2475	0.413	2331	0.413	2194	0.413

BD100_OEI_DES280_IMP_10_LW.PS_HP – 08/10/2003

Figure 05-06-01. Descent Data (Sheet 4 of 8)

DESCENT 0.80 M /280 KIAS /250 KIAS		
IDLE THRUST **ENGINE BLEED ON** **ENGINE AND WING A/I OFF**	ISA + 10 C 30% C.G.	SEA LEVEL FINAL ALTITUDE TIME(MIN) FUEL(LB) DIST(NAM) ATAS(KTS) ROD(FPM) MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	22		24		26		28		30	
450	11.5	81	12.4	87	13.3	93	14.1	99	15.0	105
	70.6	368	76.2	369	81.7	369	86.9	369	92.0	369
	3607	0.800	3404	0.800	3254	0.800	3147	0.800	3047	0.800
430	11.0	77	11.8	83	12.7	89	13.5	95	14.3	101
	66.5	364	71.8	364	77.0	364	82.1	364	87.0	364
	3942	0.800	3691	0.800	3498	0.800	3357	0.800	3224	0.800
410	10.5	74	11.3	80	12.2	85	13.0	91	13.7	97
	62.7	359	67.8	359	72.8	359	77.6	360	82.4	360
	4416	0.800	4111	0.800	3868	0.800	3682	0.800	3506	0.800
390	10.1	71	10.9	77	11.7	82	12.4	88	13.2	93
	59.4	354	64.2	354	68.9	355	73.5	355	78.1	355
	4868	0.800	4517	0.800	4231	0.800	4004	0.800	3788	0.800
370	9.7	68	10.4	74	11.2	79	11.9	85	12.7	90
	56.3	350	60.9	350	65.4	350	69.8	350	74.1	351
	5328	0.800	4933	0.800	4608	0.800	4344	0.800	4091	0.800
350	9.3	66	10.1	71	10.8	77	11.5	82	12.2	87
	53.7	345	58.0	346	62.3	346	66.5	346	70.6	346
	6442	0.800	5958	0.800	5555	0.800	5224	0.800	4906	0.800
330	9.0	64	9.7	69	10.4	74	11.1	79	11.8	84
	51.0	341	55.2	341	59.2	341	63.2	342	67.1	342
	4804	0.789	4445	0.789	4146	0.789	3897	0.789	3658	0.789
310	8.6	61	9.3	66	9.9	71	10.6	76	11.2	80
	47.8	335	51.7	335	55.5	335	59.2	336	62.9	336
	4724	0.757	4370	0.757	4073	0.757	3827	0.757	3591	0.757
290	8.1	58	8.8	63	9.4	68	10.1	72	10.7	77
	44.6	329	48.3	329	51.8	330	55.3	330	58.7	330
	4636	0.727	4292	0.727	4004	0.727	3765	0.727	3535	0.727
250	7.3	53	7.8	57	8.4	61	9.0	65	9.5	69
	38.5	318	41.6	318	44.7	318	47.6	319	50.6	319
	4534	0.672	4193	0.672	3907	0.672	3669	0.672	3441	0.672
200	6.1	45	6.6	49	7.1	52	7.6	56	8.1	59
	31.1	304	33.7	304	36.1	304	38.5	305	40.9	305
	4425	0.610	4091	0.610	3811	0.610	3577	0.610	3353	0.610
150	5.0	37	5.4	40	5.8	43	6.2	46	6.5	49
	24.1	290	26.0	290	27.9	290	29.8	290	31.6	290
	4233	0.555	3914	0.555	3645	0.555	3421	0.555	3206	0.555
100	3.5	27	3.8	30	4.1	32	4.4	34	4.6	36
	16.1	272	17.3	272	18.6	272	19.8	272	21.0	272
	2969	0.452	2750	0.452	2567	0.452	2420	0.452	2279	0.452
50	1.8	15	2.0	16	2.1	18	2.3	19	2.4	20
	8.0	262	8.6	262	9.3	262	9.8	262	10.4	263
	2864	0.413	2651	0.413	2475	0.413	2331	0.413	2194	0.413

BD100_OEI_DES280_IMP_10_LW.PS_HP – 08/10/2003

Figure 05-06-01. Descent Data (Sheet 5 of 8)

DESCENT 0.80 M /280 KIAS /250 KIAS

IDLE THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	SEA LEVEL FINAL ALTITUDE TIME(MIN) FUEL(LB) DIST(NAM) ATAS(KTS) ROD(FPM) MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	32		34		36		38		40	
450	15.7	110	16.5	116	17.1	120	17.8	125	18.3	128
	96.7	369	101.2	369	105.3	369	109.0	368	112.4	368
	2986	0.800	2960	0.800	2969	0.800	3012	0.800	3086	0.800
430	15.1	106	15.8	111	16.5	116	17.1	120	17.7	124
	91.6	364	96.0	364	100.1	364	103.8	365	107.2	365
	3131	0.800	3059	0.800	3012	0.800	2998	0.800	3013	0.800
410	14.5	102	15.2	107	15.8	111	16.4	115	17.0	119
	86.8	360	91.1	360	95.0	360	98.7	360	102.1	361
	3381	0.800	3279	0.800	3197	0.800	3134	0.800	3095	0.800
390	13.9	98	14.6	103	15.2	107	15.8	111	16.4	115
	82.4	355	86.4	356	90.3	356	93.8	356	97.2	356
	3626	0.800	3494	0.800	3387	0.800	3299	0.800	3226	0.800
370	13.4	95	14.0	99	14.6	104	15.2	108	15.8	111
	78.2	351	82.1	351	85.8	352	89.2	352	92.4	352
	3895	0.800	3731	0.800	3594	0.800	3482	0.800	3389	0.800
350	12.9	91	13.5	96	14.1	100	14.7	104	15.2	108
	74.5	347	78.3	347	81.8	347	85.1	348	88.2	348
	4652	0.800	4435	0.800	4249	0.800	4093	0.800	3961	0.800
330	12.4	88	13.0	93	13.6	97	14.1	101	14.6	104
	70.8	342	74.4	342	77.7	343	80.9	343	83.8	343
	3464	0.789	3296	0.789	3149	0.789	3022	0.789	2913	0.789
310	11.8	85	12.4	89	13.0	93	13.5	96	14.0	100
	66.4	336	69.7	337	72.8	337	75.7	337	78.5	337
	3399	0.757	3233	0.757	3089	0.757	2964	0.757	2857	0.757
290	11.3	81	11.8	85	12.3	88	12.8	92	13.2	95
	62.0	330	65.1	331	68.0	331	70.7	331	73.2	332
	3349	0.727	3186	0.727	3045	0.727	2922	0.727	2815	0.727
250	10.0	73	10.5	76	11.0	80	11.4	83	11.8	86
	53.4	319	56.0	319	58.5	320	60.8	320	63.0	320
	3255	0.672	3094	0.672	2955	0.672	2836	0.672	2734	0.672
200	8.5	62	8.9	65	9.3	68	9.6	71	10.0	73
	43.1	305	45.2	305	47.2	306	49.0	306	50.8	306
	3171	0.610	3012	0.610	2874	0.610	2756	0.610	2654	0.610
150	6.9	51	7.2	54	7.5	56	7.8	58	8.0	60
	33.3	291	34.9	291	36.3	291	37.7	291	39.0	291
	3032	0.555	2879	0.555	2746	0.555	2631	0.555	2531	0.555
100	4.9	38	5.1	39	5.3	41	5.5	42	5.6	43
	22.1	272	23.0	272	23.9	272	24.8	272	25.5	272
	2169	0.452	2077	0.452	2000	0.452	1935	0.452	1879	0.452
50	2.5	21	2.6	22	2.7	23	2.8	23	2.9	24
	11.0	263	11.5	263	11.9	263	12.3	263	12.7	263
	2087	0.413	1997	0.413	1922	0.413	1858	0.413	1803	0.413

BD100_OEI_DES280_IMP_10_HW.PS_HP – 08/10/2003

Figure 05-06-01. Descent Data (Sheet 6 of 8)

DESCENT 0.80 M /280 KIAS /250 KIAS

IDLE THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	SEA LEVEL FINAL ALTITUDE TIME(MIN) FUEL(LB) DIST(NAM) ATAS(KTS) ROD(FPM) MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	22		24		26		28		30	
450	11.6	83	12.6	89	13.5	95	14.3	102	15.2	107
	72.8	376	78.7	376	84.3	376	89.7	376	94.9	376
	3577	0.800	3375	0.800	3225	0.800	3117	0.800	3017	0.800
430	11.1	79	12.0	85	12.9	91	13.7	97	14.5	103
	68.6	371	74.1	371	79.5	371	84.7	371	89.8	371
	3906	0.800	3656	0.800	3464	0.800	3323	0.800	3190	0.800
410	10.6	76	11.5	82	12.3	87	13.1	93	13.9	99
	64.7	366	70.0	366	75.1	366	80.1	367	85.0	367
	4372	0.800	4069	0.800	3827	0.800	3642	0.800	3468	0.800
390	10.2	73	11.0	78	11.8	84	12.6	90	13.3	95
	61.2	361	66.3	361	71.1	362	75.9	362	80.6	362
	4817	0.800	4468	0.800	4185	0.800	3959	0.800	3745	0.800
370	9.8	70	10.6	76	11.3	81	12.1	86	12.8	92
	58.1	356	62.8	357	67.5	357	72.0	357	76.5	358
	5262	0.800	4872	0.800	4550	0.800	4288	0.800	4039	0.800
350	9.4	68	10.2	73	10.9	78	11.7	84	12.4	89
	55.3	352	59.9	352	64.3	353	68.6	353	72.9	353
	6332	0.800	5856	0.800	5460	0.800	5134	0.800	4821	0.800
330	9.1	65	9.8	71	10.5	76	11.2	81	11.9	86
	52.6	347	56.9	347	61.1	348	65.2	348	69.2	348
	4729	0.789	4376	0.789	4081	0.789	3836	0.789	3600	0.789
310	8.7	62	9.4	67	10.0	72	10.7	77	11.4	82
	49.2	341	53.3	342	57.2	342	61.1	342	64.8	342
	4653	0.757	4304	0.757	4011	0.757	3769	0.757	3536	0.757
290	8.2	60	8.9	64	9.5	69	10.2	74	10.8	78
	46.0	335	49.7	336	53.4	336	57.0	336	60.5	336
	4570	0.727	4231	0.727	3946	0.727	3710	0.727	3484	0.727
250	7.3	54	7.9	58	8.5	62	9.1	66	9.6	70
	39.6	324	42.8	324	46.0	324	49.1	324	52.1	325
	4475	0.672	4138	0.672	3856	0.672	3621	0.672	3395	0.672
200	6.2	46	6.7	50	7.2	53	7.7	57	8.1	60
	32.0	309	34.6	310	37.2	310	39.6	310	42.1	310
	4365	0.610	4035	0.610	3759	0.610	3528	0.610	3307	0.610
150	5.0	38	5.4	41	5.8	44	6.2	47	6.6	49
	24.7	295	26.8	295	28.7	295	30.6	295	32.5	296
	4175	0.555	3859	0.555	3594	0.555	3373	0.555	3161	0.555
100	3.6	28	3.9	30	4.1	32	4.4	34	4.7	36
	16.5	276	17.8	276	19.1	277	20.3	277	21.5	277
	2930	0.462	2713	0.452	2533	0.452	2387	0.452	2248	0.452
50	1.9	16	2.0	17	2.1	18	2.3	19	2.4	20
	8.2	266	8.9	267	9.5	267	10.1	267	10.7	267
	2824	0.413	2615	0.413	2441	0.413	2299	0.413	2164	0.413

BD100_OEI_DES280_IMP_20_LW.PS_HP – 08/10/2003

Figure 05-06-01. Descent Data (Sheet 7 of 8)

DESCENT 0.80 M /280 KIAS /250 KIAS

IDLE THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	SEA LEVEL FINAL ALTITUDE TIME(MIN) FUEL(LB) DIST(NAM) ATAS(KTS) ROD(FPM) MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	32		34		36		38		40	
450	15.9	113	16.7	118	17.4	123	18.0	128	18.5	132
	99.9	376	104.5	376	108.7	376	112.6	376	116.1	376
	2955	0.800	2927	0.800	2935	0.800	2975	0.800	3046	0.800
430	15.3	108	16.0	114	16.7	118	17.3	123	17.9	127
	94.6	372	99.1	372	103.3	372	107.2	372	110.8	372
	3097	0.800	3024	0.800	2977	0.800	2962	0.800	2975	0.800
410	14.7	104	15.4	109	16.0	114	16.6	118	17.2	122
	89.6	367	94.0	367	98.1	367	101.9	368	105.5	368
	3342	0.800	3241	0.800	3159	0.800	3095	0.800	3056	0.800
390	14.1	100	14.8	105	15.4	110	16.0	114	16.6	118
	85.0	362	89.2	363	93.2	363	96.9	363	100.3	363
	3584	0.800	3453	0.800	3347	0.800	3259	0.800	3186	0.800
370	13.5	97	14.2	101	14.8	106	15.4	110	16.0	114
	80.7	358	84.8	358	88.6	358	92.1	359	95.5	359
	3844	0.800	3682	0.800	3547	0.800	3435	0.800	3343	0.800
350	13.1	94	13.7	98	14.3	102	14.9	106	15.4	110
	76.9	353	80.8	354	84.4	354	87.8	354	91.0	355
	4571	0.800	4357	0.800	4175	0.800	4021	0.800	3891	0.800
330	12.6	90	13.2	95	13.8	99	14.3	103	14.8	106
	73.1	349	76.7	349	80.2	349	83.5	349	86.5	350
	3409	0.789	3243	0.789	3099	0.789	2974	0.789	2866	0.789
310	12.0	86	12.6	91	13.1	95	13.6	98	14.1	102
	68.4	343	71.9	343	75.1	343	78.1	343	80.9	344
	3347	0.757	3183	0.757	3041	0.757	2918	0.757	2812	0.757
290	11.4	82	11.9	86	12.5	90	13.0	94	13.4	97
	63.9	337	67.1	337	70.1	337	72.9	338	75.5	338
	3300	0.727	3139	0.727	2999	0.727	2878	0.727	2773	0.727
250	10.2	74	10.6	78	11.1	81	11.5	84	11.9	87
	55.0	325	57.7	325	60.3	326	62.7	326	64.9	326
	3211	0.672	3053	0.672	2915	0.672	2798	0.672	2697	0.672
200	8.6	64	9.0	67	9.4	69	9.7	72	10.1	75
	44.4	311	46.6	311	48.6	311	50.5	311	52.3	311
	3127	0.610	2970	0.610	2834	0.610	2717	0.610	2616	0.610
150	6.9	52	7.3	55	7.6	57	7.8	59	8.1	61
	34.2	296	35.8	296	37.4	296	38.8	296	40.1	296
	2989	0.555	2838	0.555	2707	0.555	2593	0.555	2495	0.555
100	4.9	38	5.1	39	5.3	41	5.5	42	5.7	44
	22.6	277	23.6	277	24.6	277	25.4	277	26.2	277
	2139	0.452	2048	0.452	1973	0.452	1908	0.452	1853	0.452
50	2.5	21	2.7	22	2.8	23	2.9	24	2.9	25
	11.3	267	11.8	267	12.3	267	12.7	267	13.1	267
	2058	0.413	1969	0.413	1895	0.413	1832	0.413	1777	0.413

BD100_OEI_DES280_IMP_20_HW.PS_HP – 08/10/2003

Figure 05-06-01. Descent Data (Sheet 8 of 8)

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Single engine operation holding data are provided for typical holding altitudes for Minimum Drag speed (VMD) and 200 KIAS. The holding data are presented in tabular form from sea level to Flight Level 310 and -10, 0, 5, 10, 15 and 20°C deviations from ISA. Holding data are based on power for level flight without exceeding Climb Thrust (CLB rating) with engine bleed on and anti-ice off.

The following data are presented for each holding speed.

- %N1: Fan speed setting in percent
- FUEL FLOW: Fuel flow in pounds per hour
- IAS: Indicated airspeed in knots

Holding fuel flow data are based on linear holding (zero bank). For non-linear holding pattern correction factors to be applied to zero bank N1 and fuel flow data are given at the end of this section for bank angles up to 30 degrees.

N1 and fuel flow correction factors for C.G. variation relative to 30% MAC reference position are provided below:

N1 and FUEL FLOW CORRECTION FACTORS vs. C.G. POSITION.

C.G.	N1	Fuel Flow
20%	+ 2.00%	+ 4.00%
25%	+ 1.00%	+ 2.00%
REF (30%)	-	-
35%	- 0.50%	- 1.00%
40%	- 1.00%	- 2.00%

Example:

Associated conditions

- Flight Level = FL 250 (A)
- Aircraft gross weight = 30 000 lbs (B)
- Holding speed = VMD
- Static air temperature = ISA-10°C
- Bank angle = 20 degrees (D)

From Figure 05-07-01, Sheet 1, the following data are obtained (C):

- Fan speed N1 setting = 78.1%
- Fuel flow = 1029 lbs/hr.
- Indicated airspeed = 160 kts

From Figure 05-07-03, enter the chart with the required bank angle and holding speed and read N1 and fuel flow correction factors in percentage.

- Δ N1 = 2.4% (E)
- Δ Fuel flow = 7.8% (F)

The corrected N1 and fuel flow values for a 20 degree bank angle are:

- N1 = 79.9% [78.1 x 1.024)
- Fuel flow = 1109 lbs [1029 x 1.078)

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HOLDING VMD

MAXIMUM CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%N1 IAS (KTS)	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	22		24		26		28		30 (B)	
310	75.1	751	77.3	821	79.4	898	81.4	980	83.3	1063
	137		143		150		155		160	
290	73.4	751	75.6	820	77.7	891	79.7	968	81.6	1049
	137		143		149		155		160	
270	71.7	752	73.9	820	76.0	889	78.0	961	79.9	1037
	137		143		149		155		161	
250 (A)	70.0	752	72.2	820	74.3	889	76.2	958	78.1 (C)	1029
	136		143		149		154		160	
230	68.4	753	70.6	820	72.6	888	74.5	958	76.3	1028
	137		142		148		154		160	
210	66.7	756	68.9	820	70.9	888	72.8	957	74.6	1027
	137		143		148		154		159	
190	65.2	763	67.3	823	69.3	888	71.2	957	73.0	1026
	139		143		148		154		159	
170	63.7	772	65.8	831	67.7	891	69.6	957	71.4	1025
	141		145		149		154		159	
150	62.4	781	64.4	841	66.2	898	68.0	959	69.8	1025
	144		147		151		154		159	
130	61.0	792	62.9	849	64.8	908	66.5	967	68.2	1029
	146		150		153		157		160	
100	59.1	813	60.9	867	62.6	924	64.3	982	65.9	1042
	151		154		157		160		164	
70	57.4	852	59.1	899	60.8	950	62.4	1006	63.9	1064
	155		158		162		165		168	
50	56.4	877	58.0	923	59.6	972	61.1	1026	62.6	1082
	159		162		165		168		170	
15	54.8	928	56.3	974	57.6	1022	59.0	1071	60.4	1122
	165		168		171		173		176	

BD100_OEI_HOLVMD_IMP_LW_M10 - 20/10/2003

Figure 05-07-01. Holding Data—V_{MD} (Sheet 1 of 12)

HOLDING VMD

MAXIMUM CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C	%N1	FUEL FLOW (LB/HR)
	30% C.G.	IAS (KTS)	

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	32		34		36		38		40	
310	85.4	1146	88.3	1243						
	165		171							
290	83.3	1133	85.1	1216	87.3	1306	90.3	1411		
	165		170		175		181			
270	81.6	1117	83.2	1202	84.8	1286	86.5	1371	88.8	1465
	166		170		175		180		185	
250	79.8	1104	81.5	1183	83.0	1267	84.5	1353	85.9	1437
	166		171		175		180		184	
230	78.1	1098	79.7	1172	81.3	1251	82.8	1332	84.2	1416
	165		170		176		180		185	
210	76.3	1097	78.0	1168	79.5	1241	81.0	1318	82.4	1398
	165		170		175		180		185	
190	74.7	1096	76.3	1167	77.8	1238	79.3	1310	80.7	1385
	164		170		175		179		184	
170	73.0	1095	74.6	1165	76.1	1237	77.6	1308	79.0	1380
	164		169		174		179		184	
150	71.4	1094	73.0	1164	74.5	1235	75.9	1306	77.3	1378
	164		169		174		179		184	
130	69.8	1096	71.4	1165	72.9	1235	74.3	1306	75.7	1378
	164		169		174		179		183	
100	67.5	1104	69.1	1169	70.5	1237	72.0	1307	73.3	1378
	167		170		174		179		183	
70	65.4	1124	66.9	1185	68.3	1245	69.7	1308	71.0	1375
	171		174		177		180		184	
50	64.0	1140	65.4	1198	66.8	1258	68.2	1320	69.5	1383
	173		176		179		182		185	
15	61.8	1175	63.2	1232	64.5	1291	65.7	1351	67.0	1412
	179		181		184		187		190	

BD100_OEI_HOLVMD_IMP_HW_M10 – 20/10/2003

Figure 05-07-01. Holding Data—V_{MD} (Sheet 2 of 12)

HOLDING VMD

MAXIMUM CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA	%N1	FUEL FLOW (LB/HR)
	30% C.G.	IAS (KTS)	

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	22		24		26		28		30	
310	76.8	774	79.1	847	81.2	926	83.2	1010	85.1	1096
	137		143		150		155		160	
290	75.0	775	77.3	845	79.4	918	81.4	997	83.3	1082
	137		143		149		155		160	
270	73.3	776	75.6	846	77.7	917	79.7	990	81.6	1069
	137		143		149		155		161	
250	71.6	776	73.8	846	75.9	917	77.9	988	79.9	1062
	136		143		149		154		160	
230	69.9	775	72.1	845	74.2	916	76.2	988	78.0	1060
	137		142		148		154		160	
210	68.2	777	70.4	845	72.5	915	74.4	987	76.3	1059
	137		143		148		154		159	
190	66.6	784	68.8	847	70.8	915	72.8	986	74.6	1057
	139		143		148		154		159	
170	65.1	793	67.2	853	69.2	916	71.1	985	72.9	1056
	141		145		149		154		159	
150	63.7	802	65.7	862	67.6	923	69.4	986	71.2	1055
	144		147		151		154		159	
130	62.3	812	64.2	871	66.1	931	67.9	993	69.6	1059
	146		150		153		157		160	
100	60.3	835	62.1	890	63.9	948	65.6	1008	67.3	1071
	151		154		157		160		164	
70	58.5	875	60.3	922	62.0	975	63.6	1032	65.2	1092
	155		158		162		165		168	
50	57.5	899	59.1	946	60.8	997	62.3	1052	63.8	1109
	159		162		165		168		170	
15	55.8	952	57.3	1000	58.7	1049	60.1	1099	61.6	1151
	165		168		171		173		176	

BD100_OEI_HOLVMD_IMP_LW_00 – 20/10/2003

Figure 05-07-01. Holding Data—V_{MD} (Sheet 3 of 12)

HOLDING VMD

MAXIMUM CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1 IAS (KTS)	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	32		34		36		38		40	
310	87.2	1182	90.2	1282						
	165		171							
290	85.1	1168	86.9	1254	89.2	1346	92.2	1453		
	165		170		175		181			
270	83.4	1152	85.1	1240	86.7	1327	88.5	1414	90.8	1512
	166		170		175		180		185	
250	81.6	1140	83.3	1221	84.9	1307	86.4	1396	87.9	1484
	166		171		175		180		184	
230	79.8	1133	81.5	1209	83.1	1290	84.6	1374	86.0	1461
	165		170		176		180		185	
210	78.0	1130	79.7	1204	81.3	1279	82.8	1359	84.2	1441
	165		170		175		180		185	
190	76.3	1129	77.9	1202	79.5	1275	81.0	1349	82.4	1427
	164		170		175		179		184	
170	74.6	1127	76.2	1199	77.7	1273	79.2	1346	80.6	1420
	164		169		174		179		184	
150	72.9	1126	74.5	1197	76.0	1270	77.5	1343	78.9	1418
	164		169		174		179		184	
130	71.3	1127	72.9	1198	74.4	1270	75.8	1344	77.2	1417
	164		169		174		179		183	
100	68.9	1134	70.5	1199	72.0	1268	73.4	1341	74.8	1416
	167		170		174		179		183	
70	66.8	1154	68.2	1215	69.6	1278	71.0	1344	72.3	1414
	171		174		177		180		184	
50	65.3	1169	66.7	1229	68.1	1290	69.5	1354	70.8	1420
	173		176		179		182		185	
15	63.0	1206	64.4	1264	65.7	1324	67.0	1386	68.3	1448
	179		181		184		187		190	

BD100_OEI_HOLVMD_IMP_HW_00 – 20/10/2003

Figure 05-07-01. Holding Data—V_{MD} (Sheet 4 of 12)

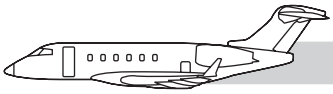
HOLDING VMD

MAXIMUM CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	%N1 IAS (KTS)	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	22		24		26		28		30	
310	77.6	786	79.9	860	82.1	940	84.1	1026	86.0	1113
	137		143		150		155		160	
290	75.9	787	78.1	858	80.3	932	82.3	1012	84.2	1098
	137		143		149		155		160	
270	74.1	788	76.4	859	78.5	930	80.6	1005	82.5	1084
	137		143		149		155		161	
250	72.4	788	74.6	859	76.7	931	78.8	1003	80.7	1077
	136		143		149		154		160	
230	70.6	787	72.9	857	75.0	929	77.0	1002	78.9	1076
	137		142		148		154		160	
210	68.9	788	71.2	857	73.3	928	75.2	1001	77.1	1074
	137		143		148		154		159	
190	67.3	795	69.5	858	71.6	927	73.5	1000	75.3	1072
	139		143		148		154		159	
170	65.8	803	67.9	864	69.9	928	71.8	999	73.6	1070
	141		145		149		154		159	
150	64.3	812	66.3	873	68.3	936	70.1	1001	71.9	1070
	144		147		151		154		159	
130	62.9	822	64.9	882	66.7	944	68.5	1008	70.3	1073
	146		150		153		157		160	
100	60.9	846	62.8	901	64.6	961	66.3	1023	68.0	1086
	151		154		157		160		164	
70	59.1	884	60.9	933	62.6	987	64.2	1045	65.8	1105
	155		158		162		165		168	
50	58.0	907	59.7	955	61.4	1009	62.9	1064	64.4	1122
	159		162		165		168		170	
15	56.4	964	57.9	1013	59.3	1062	60.7	1113	62.1	1165
	165		168		171		173		176	

BD100_OEI_HOLVMD_IMP_LW_05 - 20/10/2003

Figure 05-07-01. Holding Data—V_{MD} (Sheet 5 of 12)



HOLDING VMD

MAXIMUM CLIMB THRUST LIMITS
ENGINE BLEED ON
ENGINE AND WING A/I OFF

ISA + 5 C
30% C.G.

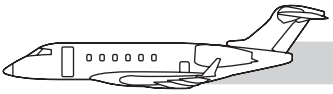
%N1
IAS (KTS)

FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	32		34		36		38		40	
310	88.1	1200	91.1	1301						
	165		171							
290	86.0	1186	87.8	1273	90.1	1366	93.1	1475		
	165		170		175		181			
270	84.2	1169	85.9	1258	87.6	1347	89.4	1435	91.6	1534
	166		170		175		180		185	
250	82.5	1157	84.2	1240	85.8	1328	87.3	1418	88.8	1507
	166		171		175		180		184	
230	80.6	1150	82.4	1227	84.0	1310	85.5	1395	86.9	1483
	165		170		176		180		185	
210	78.8	1147	80.5	1222	82.1	1298	83.7	1379	85.1	1463
	165		170		175		180		185	
190	77.0	1145	78.7	1219	80.3	1293	81.8	1369	83.3	1448
	164		170		175		179		184	
170	75.3	1143	77.0	1216	78.5	1291	80.0	1365	81.5	1441
	164		169		174		179		184	
150	73.6	1142	75.2	1215	76.8	1288	78.3	1362	79.7	1438
	164		169		174		179		184	
130	72.0	1142	73.6	1213	75.1	1287	76.6	1362	78.0	1437
	164		169		174		179		183	
100	69.6	1148	71.2	1214	72.6	1286	74.1	1360	75.5	1435
	167		170		174		179		183	
70	67.3	1167	68.8	1230	70.3	1295	71.7	1363	73.0	1434
	171		174		177		180		184	
50	65.9	1183	67.3	1244	68.8	1307	70.2	1372	71.5	1438
	173		176		179		182		185	
15	63.6	1220	65.0	1280	66.3	1341	67.6	1404	68.9	1467
	179		181		184		187		190	

BD100_OEI_HOLVMD_IMP_HW_05 – 20/10/2003

Figure 05-07-01. Holding Data—V_{MD} (Sheet 6 of 12)



HOLDING VMD

MAXIMUM CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1 IAS (KTS)	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	22		24		26		28		30	
310	78.5	799	80.8	873	82.9	955	85.0	1042	86.9	1130
	137		143		150		155		160	
290	76.7	799	78.9	871	81.1	946	83.1	1027	85.1	1114
	137		143		149		155		160	
270	74.9	800	77.2	872	79.3	944	81.4	1020	83.3	1101
	137		143		149		155		161	
250	73.2	800	75.4	872	77.5	945	79.6	1018	81.5	1093
	136		143		149		154		160	
230	71.4	799	73.7	871	75.8	943	77.8	1017	79.7	1092
	137		142		148		154		160	
210	69.6	800	71.9	869	74.0	942	76.0	1016	77.9	1090
	137		143		148		154		159	
190	68.0	806	70.2	870	72.3	941	74.3	1014	76.1	1087
	139		143		148		154		159	
170	66.5	813	68.6	876	70.6	943	72.5	1013	74.3	1086
	141		145		149		154		159	
150	65.0	821	67.0	884	68.9	949	70.8	1015	72.7	1085
	144		147		151		154		159	
130	63.5	833	65.5	894	67.4	957	69.2	1022	71.0	1087
	146		150		153		157		160	
100	61.5	857	63.4	914	65.2	974	67.0	1037	68.7	1100
	151		154		157		160		164	
70	59.7	892	61.5	944	63.2	999	64.8	1057	66.4	1118
	155		158		162		165		168	
50	58.6	915	60.4	965	61.9	1019	63.5	1076	65.0	1135
	159		162		165		168		170	
15	56.9	978	58.3	1027	59.8	1077	61.2	1127	62.7	1179
	165		168		171		173		176	

BD100_OEI_HOLVMD_IMP_LW_10 – 20/10/2003

Figure 05-07-01. Holding Data—V_{MD} (Sheet 7 of 12)

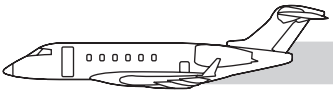
HOLDING VMD

MAXIMUM CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1 IAS (KTS)	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	32		34		36		38		40	
310	89.1	1218	92.0	1320						
	165		171							
290	86.9	1204	88.7	1292	91.0	1386				
	165		170		175					
270	85.1	1186	86.8	1277	88.4	1367	90.2	1456		
	166		170		175		180			
250	83.3	1173	85.0	1258	86.7	1348	88.2	1440	89.7	1529
	166		171		175		180		184	
230	81.5	1167	83.2	1246	84.8	1329	86.3	1416	87.8	1505
	165		170		176		180		185	
210	79.7	1164	81.3	1240	83.0	1318	84.5	1399	86.0	1485
	165		170		175		180		185	
190	77.8	1162	79.5	1237	81.1	1312	82.7	1390	84.1	1469
	164		170		175		179		184	
170	76.1	1160	77.7	1234	79.3	1309	80.8	1385	82.3	1461
	164		169		174		179		184	
150	74.3	1157	76.0	1232	77.6	1306	79.1	1382	80.5	1457
	164		169		174		179		184	
130	72.7	1157	74.3	1230	75.9	1305	77.3	1380	78.8	1456
	164		169		174		179		183	
100	70.3	1164	71.8	1232	73.3	1305	74.8	1379	76.2	1455
	167		170		174		179		183	
70	68.0	1181	69.5	1246	70.9	1313	72.3	1381	73.8	1451
	171		174		177		180		184	
50	66.5	1197	68.0	1261	69.5	1326	70.8	1391	72.1	1457
	173		176		179		182		185	
15	64.2	1236	65.5	1296	66.9	1358	68.2	1421	69.5	1485
	179		181		184		187		190	

BD100_OEI_HOLVMD_IMP_HW_10 – 20/10/2003

Figure 05-07-01. Holding Data—V_{MD} (Sheet 8 of 12)



HOLDING VMD

MAXIMUM CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1 IAS (KTS)	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	22		24		26		28		30	
310	79.3	811	81.7	887	83.9	970	85.9	1058	87.9	1148
	137		143		150		155		160	
290	77.4	811	79.8	884	82.0	960	84.0	1043	85.9	1130
	137		143		149		155		160	
270	75.7	812	78.0	885	80.1	959	82.2	1034	84.1	1116
	137		143		149		155		161	
250	73.9	812	76.2	885	78.3	959	80.4	1033	82.3	1109
	136		143		149		154		160	
230	72.1	810	74.4	884	76.5	957	78.6	1032	80.5	1107
	137		142		148		154		160	
210	70.4	811	72.7	882	74.8	955	76.7	1030	78.7	1105
	137		143		148		154		159	
190	68.7	816	70.9	882	73.0	954	75.0	1028	76.9	1103
	139		143		148		154		159	
170	67.1	823	69.2	889	71.3	956	73.3	1027	75.1	1101
	141		145		149		154		159	
150	65.6	832	67.6	897	69.6	962	71.5	1028	73.4	1099
	144		147		151		154		159	
130	64.2	843	66.2	906	68.1	971	69.9	1035	71.7	1102
	146		150		153		157		160	
100	62.2	869	64.0	926	65.8	986	67.6	1049	69.3	1114
	151		154		157		160		164	
70	60.4	902	62.1	955	63.7	1011	65.4	1070	67.0	1133
	155		158		162		165		168	
50	59.2	928	60.8	979	62.4	1032	64.0	1088	65.6	1150
	159		162		165		168		170	
15	57.2	998	58.7	1046	60.2	1094	61.8	1143	63.3	1196
	165		168		171		173		176	

BD100_OEI_HOLVMD_IMP_LW_15 - 20/10/2003

Figure 05-07-01. Holding Data—V_{MD} (Sheet 9 of 12)

HOLDING VMD			
MAXIMUM CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1 IAS (KTS)	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	32		34		36		38		40	
310	90.0	1236								
	165									
290	87.8	1222	89.6	1311						
	165		170							
270	85.9	1203	87.7	1295	89.3	1387	91.1	1476		
	166		170		175		180			
250	84.2	1190	85.9	1276	87.5	1367	89.1	1460	90.5	1551
	166		171		175		180		184	
230	82.3	1184	84.1	1265	85.7	1349	87.2	1437	88.7	1528
	165		170		176		180		185	
210	80.5	1181	82.2	1258	83.8	1337	85.4	1420	86.8	1507
	165		170		175		180		185	
190	78.6	1179	80.3	1254	81.9	1331	83.5	1409	85.0	1490
	164		170		175		179		184	
170	76.9	1176	78.5	1251	80.1	1328	81.6	1405	83.1	1482
	164		169		174		179		184	
150	75.1	1173	76.8	1249	78.3	1324	79.8	1401	81.3	1478
	164		169		174		179		184	
130	73.3	1173	75.0	1248	76.6	1323	78.1	1400	79.5	1476
	164		169		174		179		183	
100	70.9	1180	72.5	1249	74.1	1321	75.5	1396	76.9	1473
	167		170		174		179		183	
70	68.6	1198	70.1	1263	71.6	1330	73.0	1397	74.4	1469
	171		174		177		180		184	
50	67.2	1213	68.7	1278	70.1	1343	71.4	1408	72.8	1475
	173		176		179		182		185	
15	64.7	1252	66.1	1312	67.4	1374	68.8	1438	70.1	1503
	179		181		184		187		190	

BD100_OEI_HOLVMD_IMP_HW_15 - 20/10/2003

Figure 05-07-01. Holding Data—V_{MD} (Sheet 10 of 12)

HOLDING VMD

MAXIMUM CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1 IAS (KTS)	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	22		24		26		28		30	
310	80.2	824	82.6	900	84.8	985	86.8	1075	88.8	1166
	137		143		150		155		160	
290	78.3	823	80.6	897	82.8	974	84.9	1058	86.8	1147
	137		143		149		155		160	
270	76.4	824	78.8	898	80.9	973	83.0	1050	84.9	1132
	137		143		149		155		161	
250	74.7	825	77.0	899	79.1	973	81.2	1048	83.1	1125
	136		143		149		154		160	
230	72.9	822	75.2	896	77.3	971	79.3	1047	81.3	1123
	137		142		148		154		160	
210	71.1	823	73.4	895	75.5	969	77.5	1045	79.5	1121
	137		143		148		154		159	
190	69.4	828	71.6	895	73.7	967	75.7	1042	77.6	1118
	139		143		148		154		159	
170	67.8	835	69.9	901	72.0	968	73.9	1041	75.8	1116
	141		145		149		154		159	
150	66.2	844	68.3	910	70.3	974	72.2	1042	74.0	1115
	144		147		151		154		159	
130	64.8	855	66.8	918	68.7	983	70.6	1049	72.3	1117
	146		150		153		157		160	
100	62.8	880	64.6	937	66.4	998	68.2	1063	69.9	1129
	151		154		157		160		164	
70	60.8	914	62.6	967	64.3	1023	66.0	1085	67.7	1148
	155		158		162		165		168	
50	59.5	948	61.3	997	63.0	1048	64.7	1105	66.2	1165
	159		162		165		168		170	
15	57.6	1008	59.3	1055	60.9	1104	62.5	1154	63.9	1208
	165		168		171		173		176	

BD100_OEI_HOLVMD_IMP_LW_20 – 20/10/2003

Figure 05-07-01. Holding Data—V_{MD} (Sheet 11 of 12)

HOLDING VMD

MAXIMUM CLIMB
THRUST LIMITS
ENGINE BLEED ON
ENGINE AND WING A/I OFF

ISA + 20 C
30% C.G.

%N1
IAS (KTS)
FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT - 1000 LB									
	32		34		36		38		40	
310										
290	88.6 165	1240	90.4 170	1330						
270	86.8 166	1220	88.5 170	1314	90.2 175	1406				
250	85.0 166	1207	86.7 171	1294	88.3 175	1386	89.9 180	1481		
230	83.1 165	1201	84.9 170	1283	86.5 176	1369	88.1 180	1458	89.6 185	1550
210	81.2 165	1198	83.0 170	1276	84.7 175	1357	86.2 180	1440	87.7 185	1528
190	79.4 164	1196	81.1 170	1273	82.7 175	1350	84.3 179	1429	85.8 184	1512
170	77.6 164	1192	79.3 169	1269	80.9 174	1347	82.4 179	1424	83.9 184	1503
150	75.8 164	1189	77.5 169	1266	79.1 174	1343	80.6 179	1420	82.0 184	1499
130	74.1 164	1190	75.8 169	1264	77.3 174	1341	78.8 179	1418	80.3 183	1496
100	71.6 167	1196	73.2 170	1264	74.7 174	1337	76.2 179	1414	77.6 183	1493
70	69.3 171	1213	70.7 174	1279	72.2 177	1345	73.7 180	1414	75.1 184	1487
50	67.7 173	1228	69.2 176	1293	70.6 179	1359	72.1 182	1426	73.4 185	1493
15	65.3 179	1266	66.7 181	1327	68.0 184	1391	69.4 187	1456	70.7 190	1523

BD100_OEI_HOLVMD_IMP_HW_20 - 20/10/2003

Figure 05-07-01. Holding Data—V_{MD} (Sheet 12 of 12)

HOLDING 200 KIAS			
MAXIMUM CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%N1	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	22		24		26		28		30	
310	82.8	1087	83.5	1120	84.3	1157	85.4	1196	86.6	1240
290	81.2	1077	82.0	1111	82.8	1148	83.6	1188	84.4	1229
270	79.7	1072	80.4	1103	81.2	1138	82.0	1175	82.8	1216
250	78.2	1072	78.9	1101	79.6	1132	80.4	1167	81.2	1203
230	76.7	1076	77.4	1104	78.1	1134	78.8	1166	79.6	1200
210	75.2	1080	75.9	1108	76.6	1138	77.3	1168	78.1	1201
190	73.7	1082	74.4	1110	75.1	1140	75.8	1170	76.5	1202
170	72.2	1084	72.9	1111	73.6	1141	74.3	1172	75.0	1203
150	70.7	1085	71.4	1113	72.1	1142	72.8	1172	73.4	1204
130	69.2	1089	69.9	1116	70.6	1145	71.2	1175	71.9	1206
100	67.0	1097	67.6	1122	68.3	1151	69.0	1180	69.6	1210
70	64.8	1111	65.4	1136	66.1	1163	66.8	1191	67.4	1220
50	63.3	1119	63.9	1145	64.6	1172	65.3	1201	65.9	1229
15	60.7	1139	61.3	1163	62.0	1190	62.7	1219	63.4	1248

BD100_OEI_HOL200_IMP_LW_M10 – 20/10/2003

Figure 05-07-02. Holding Data—200 KIAS (Sheet 1 of 12)

HOLDING 200 KIAS			
MAXIMUM CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA – 10 C 30% C.G.	%N1	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	32		34		36		38		40	
310	88.2	1293								
290	85.4	1275	86.8	1328	88.6	1392				
270	83.7	1263	84.7	1316	85.8	1370	87.0	1429	88.8	1496
250	82.1	1248	83.1	1299	84.1	1356	85.1	1413	86.2	1473
230	80.5	1240	81.4	1287	82.4	1338	83.4	1394	84.5	1454
210	78.9	1238	79.8	1283	80.8	1330	81.8	1381	82.8	1437
190	77.3	1239	78.3	1281	79.2	1326	80.1	1373	81.1	1426
170	75.8	1239	76.7	1282	77.6	1326	78.5	1371	79.5	1421
150	74.2	1240	75.1	1282	76.0	1326	76.9	1371	77.9	1421
130	72.7	1242	73.6	1284	74.4	1328	75.3	1373	76.3	1422
100	70.4	1245	71.3	1286	72.2	1330	73.0	1375	73.9	1424
70	68.2	1251	69.1	1290	70.0	1332	70.8	1375	71.7	1422
50	66.7	1260	67.5	1298	68.4	1339	69.3	1381	70.1	1426
15	64.1	1281	65.0	1320	65.9	1361	66.7	1403	67.6	1447

BD100_OEI_HOL200_IMP_HW_M10 – 20/10/2003

Figure 05-07-02. Holding Data—200 KIAS (Sheet 2 of 12)

HOLDING 200 KIAS			
MAXIMUM CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	22		24		26		28		30	
310	84.6	1123	85.4	1157	86.2	1195	87.3	1235	88.5	1280
290	83.0	1113	83.8	1147	84.6	1186	85.5	1227	86.3	1269
270	81.5	1108	82.3	1140	83.1	1175	83.9	1214	84.7	1256
250	79.9	1107	80.7	1136	81.5	1169	82.2	1205	83.1	1243
230	78.4	1111	79.1	1139	79.8	1170	80.6	1203	81.4	1238
210	76.9	1114	77.6	1143	78.3	1173	79.0	1205	79.8	1238
190	75.3	1116	76.0	1144	76.7	1175	77.4	1206	78.2	1239
170	73.8	1117	74.4	1146	75.1	1176	75.8	1207	76.6	1240
150	72.2	1118	72.9	1146	73.6	1177	74.3	1208	75.0	1240
130	70.7	1121	71.3	1149	72.0	1179	72.7	1210	73.4	1241
100	68.4	1128	69.0	1154	69.7	1183	70.4	1212	71.1	1242
70	66.1	1141	66.8	1167	67.5	1195	68.2	1224	68.8	1253
50	64.6	1149	65.2	1175	65.9	1204	66.6	1233	67.2	1261
15	61.9	1170	62.5	1194	63.2	1222	63.9	1251	64.6	1280

BD100_OEI_HOL200_IMP_LW_00 – 20/10/2003

Figure 05-07-02. Holding Data—200 KIAS (Sheet 3 of 12)

HOLDING 200 KIAS			
MAXIMUM CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA 30% C.G.	%N1	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	32		34		36		38		40	
310	90.1	1334								
290	87.3	1315	88.7	1370	90.5	1436				
270	85.6	1304	86.7	1359	87.7	1415	89.0	1476	90.9	1545
250	84.0	1288	85.0	1341	86.0	1399	87.0	1459	88.1	1520
230	82.3	1279	83.2	1328	84.3	1381	85.3	1438	86.4	1500
210	80.6	1277	81.6	1322	82.6	1371	83.6	1424	84.6	1482
190	79.0	1277	79.9	1320	80.9	1366	81.9	1415	82.9	1469
170	77.4	1277	78.3	1320	79.2	1366	80.2	1412	81.2	1464
150	75.8	1276	76.7	1320	77.6	1365	78.5	1412	79.5	1463
130	74.2	1278	75.1	1322	76.0	1367	76.9	1414	77.9	1464
100	71.9	1278	72.8	1321	73.6	1366	74.5	1414	75.5	1465
70	69.6	1286	70.4	1326	71.3	1369	72.1	1414	73.1	1463
50	68.0	1294	68.8	1333	69.7	1375	70.6	1418	71.5	1465
15	65.4	1314	66.2	1354	67.1	1396	68.0	1439	68.8	1484

BD100_OEI_HOL200_IMP_HW_00 – 20/10/2003

Figure 05-07-02. Holding Data—200 KIAS (Sheet 4 of 12)

HOLDING 200 KIAS			
MAXIMUM CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	%N1	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	22		24		26		28		30	
310	85.6	1142	86.3	1176	87.2	1214	88.2	1255	89.4	1301
290	83.9	1130	84.7	1165	85.5	1205	86.4	1246	87.2	1289
270	82.4	1125	83.1	1157	84.0	1194	84.8	1233	85.6	1276
250	80.8	1124	81.5	1154	82.4	1188	83.1	1224	84.0	1262
230	79.2	1128	79.9	1157	80.7	1188	81.5	1221	82.3	1257
210	77.7	1131	78.4	1160	79.1	1191	79.9	1223	80.6	1257
190	76.1	1133	76.8	1162	77.5	1193	78.2	1224	79.0	1257
170	74.5	1134	75.2	1163	75.9	1194	76.6	1225	77.4	1258
150	73.0	1135	73.6	1163	74.3	1194	75.0	1226	75.7	1259
130	71.4	1137	72.1	1164	72.8	1195	73.5	1227	74.2	1259
100	69.1	1144	69.7	1170	70.4	1199	71.2	1229	71.8	1260
70	66.8	1156	67.4	1182	68.1	1211	68.8	1240	69.4	1269
50	65.2	1164	65.8	1191	66.5	1220	67.2	1249	67.9	1278
15	62.5	1185	63.1	1209	63.8	1237	64.5	1267	65.2	1297

BD100_OEI_HOL200_IMP_LW_05 – 20/10/2003

Figure 05-07-02. Holding Data—200 KIAS (Sheet 4 of 12)

HOLDING 200 KIAS			
MAXIMUM CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 5 C 30% C.G.	%N1	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	32		34		36		38		40	
310	91.1	1355								
290	88.2	1336	89.6	1391	91.4	1458				
270	86.5	1325	87.6	1379	88.6	1437	89.9	1498	91.8	1568
250	84.9	1308	85.9	1362	86.9	1422	87.9	1482	89.1	1544
230	83.1	1299	84.1	1349	85.1	1402	86.2	1460	87.3	1523
210	81.5	1296	82.4	1342	83.4	1392	84.4	1446	85.5	1505
190	79.8	1296	80.8	1340	81.7	1387	82.7	1436	83.7	1492
170	78.2	1296	79.1	1340	80.1	1386	81.0	1433	82.0	1486
150	76.6	1296	77.5	1340	78.4	1385	79.3	1432	80.3	1484
130	75.0	1296	75.9	1341	76.8	1386	77.7	1433	78.7	1484
100	72.6	1297	73.4	1340	74.3	1387	75.3	1434	76.2	1486
70	70.2	1303	71.1	1344	71.9	1388	72.8	1434	73.8	1483
50	68.6	1311	69.5	1351	70.4	1394	71.3	1437	72.2	1484
15	66.0	1331	66.8	1371	67.7	1415	68.6	1458	69.5	1504

BD100_OEI_HOL200_IMP_HW_05 – 20/10/2003

Figure 05-07-02. Holding Data—200 KIAS (Sheet 5 of 12)

HOLDING 200 KIAS			
MAXIMUM CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	22		24		26		28		30	
310	86.5	1160	87.3	1196	88.1	1234	89.1	1275	90.4	1321
290	84.8	1148	85.6	1184	86.4	1224	87.3	1266	88.1	1309
270	83.3	1142	84.0	1175	84.8	1212	85.7	1252	86.5	1296
250	81.7	1142	82.4	1173	83.2	1207	84.0	1243	84.9	1282
230	80.1	1145	80.8	1174	81.6	1207	82.3	1240	83.1	1276
210	78.5	1148	79.2	1177	80.0	1209	80.7	1242	81.5	1276
190	76.9	1150	77.6	1179	78.3	1210	79.1	1243	79.8	1276
170	75.3	1151	76.0	1180	76.7	1212	77.4	1244	78.2	1276
150	73.7	1151	74.4	1180	75.1	1211	75.8	1244	76.6	1277
130	72.2	1152	72.9	1181	73.5	1212	74.2	1244	74.9	1277
100	69.8	1160	70.4	1187	71.1	1217	71.8	1248	72.5	1279
70	67.4	1171	68.0	1198	68.7	1227	69.4	1257	70.1	1287
50	65.9	1179	66.5	1206	67.2	1236	67.9	1266	68.6	1296
15	63.1	1200	63.7	1225	64.4	1253	65.1	1284	65.8	1314

BD100_OEI_HOL200_IMP_LW_10 – 20/10/2003

Figure 05-07-02. Holding Data—200 KIAS (Sheet 7 of 12)

HOLDING 200 KIAS			
MAXIMUM CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 10 C 30% C.G.	%N1	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	32		34		36		38		40	
310	92.0	1376								
290	89.1	1357	90.5	1412	92.4	1479				
270	87.4	1345	88.4	1400	89.5	1458	90.8	1520		
250	85.8	1330	86.8	1384	87.8	1444	88.9	1506	90.0	1568
230	84.0	1319	85.0	1369	86.0	1424	87.1	1482	88.2	1546
210	82.3	1316	83.3	1363	84.3	1413	85.3	1467	86.4	1527
190	80.6	1314	81.6	1360	82.5	1407	83.5	1458	84.6	1514
170	79.0	1314	79.9	1359	80.9	1406	81.8	1454	82.8	1507
150	77.4	1314	78.3	1359	79.2	1405	80.1	1452	81.1	1505
130	75.7	1315	76.6	1360	77.5	1406	78.5	1454	79.4	1505
100	73.2	1315	74.1	1359	75.1	1406	76.0	1454	77.0	1506
70	70.9	1321	71.7	1362	72.7	1407	73.6	1452	74.5	1502
50	69.3	1330	70.2	1371	71.1	1414	72.0	1457	72.9	1504
15	66.6	1349	67.4	1389	68.3	1433	69.2	1477	70.1	1523

BD100_OEI_HOL200_IMP_HW_10 – 20/10/2003

Figure 05-07-02. Holding Data—200 KIAS (Sheet 8 of 12)

HOLDING 200 KIAS			
MAXIMUM CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	22		24		26		28		30	
310	87.4	1180	88.2	1216	89.0	1254	90.1	1295	91.3	1342
290	85.7	1167	86.5	1203	87.3	1243	88.2	1286	89.1	1330
270	84.1	1160	84.9	1193	85.7	1231	86.5	1271	87.4	1315
250	82.5	1160	83.3	1191	84.1	1226	84.9	1262	85.7	1301
230	80.9	1163	81.6	1193	82.4	1225	83.2	1259	84.0	1296
210	79.3	1165	80.0	1195	80.8	1227	81.5	1260	82.3	1295
190	77.7	1167	78.4	1196	79.1	1228	79.9	1261	80.6	1295
170	76.1	1167	76.8	1197	77.5	1229	78.2	1261	78.9	1295
150	74.4	1167	75.1	1196	75.9	1228	76.6	1261	77.3	1294
130	72.8	1169	73.5	1198	74.2	1230	74.9	1262	75.6	1295
100	70.4	1176	71.1	1203	71.8	1233	72.5	1264	73.2	1295
70	68.1	1187	68.7	1214	69.4	1244	70.1	1274	70.8	1305
50	66.5	1195	67.1	1222	67.8	1252	68.5	1283	69.2	1313
15	63.6	1215	64.3	1241	65.0	1270	65.7	1301	66.4	1331

BD100_OEI_HOL200_IMP_LW_15 – 20/10/2003

Figure 05-07-02. Holding Data—200 KIAS (Sheet 9 of 12)

HOLDING 200 KIAS			
MAXIMUM CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 15 C 30% C.G.	%N1	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	32		34		36		38		40	
310										
290	90.0	1378								
270	88.3	1365	89.3	1421	90.4	1479				
250	86.6	1349	87.6	1404	88.7	1465	89.7	1528		
230	84.9	1339	85.9	1390	86.9	1445	88.0	1505	89.0	1570
210	83.2	1336	84.1	1383	85.1	1434	86.2	1489	87.2	1550
190	81.4	1334	82.4	1379	83.4	1427	84.4	1478	85.4	1535
170	79.8	1334	80.7	1379	81.7	1426	82.6	1474	83.6	1528
150	78.1	1333	79.0	1378	79.9	1424	80.9	1473	81.9	1526
130	76.4	1333	77.4	1379	78.3	1426	79.2	1474	80.2	1526
100	74.0	1332	74.9	1377	75.8	1424	76.7	1473	77.7	1526
70	71.5	1339	72.4	1381	73.4	1425	74.3	1470	75.2	1522
50	69.9	1348	70.8	1389	71.7	1432	72.6	1475	73.6	1523
15	67.1	1366	68.0	1407	68.9	1451	69.8	1495	70.7	1542

BD100_OEI_HOL200_IMP_HW_15 - 20/10/2003

Figure 05-07-02. Holding Data—200 KIAS (Sheet 10 of 12)

HOLDING 200 KIAS			
MAXIMUM CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	22		24		26		28		30	
310	88.3	1199	89.1	1236	89.9	1275				
290	86.6	1185	87.4	1222	88.2	1263	89.0	1306	90.0	1351
270	85.0	1178	85.7	1211	86.5	1249	87.4	1290	88.2	1334
250	83.4	1178	84.1	1209	84.9	1244	85.7	1281	86.5	1320
230	81.7	1181	82.5	1211	83.2	1244	84.0	1279	84.8	1315
210	80.1	1183	80.8	1213	81.6	1246	82.4	1279	83.1	1314
190	78.5	1183	79.2	1213	79.9	1246	80.7	1279	81.4	1313
170	76.8	1184	77.5	1214	78.3	1246	79.0	1279	79.7	1312
150	75.2	1184	75.9	1213	76.6	1246	77.3	1279	78.0	1313
130	73.5	1185	74.2	1214	75.0	1246	75.7	1279	76.4	1313
100	71.1	1192	71.7	1219	72.4	1249	73.2	1281	73.9	1312
70	68.7	1203	69.3	1230	70.0	1260	70.7	1291	71.4	1321
50	67.1	1211	67.7	1238	68.4	1269	69.1	1299	69.8	1330
15	64.3	1228	64.9	1255	65.6	1285	66.3	1316	67.0	1347

BD100_OEI_HOL200_IMP_LW_20 – 20/10/2003

Figure 05-07-02. Holding Data—200 KIAS (Sheet 11 of 12)

HOLDING 200 KIAS			
MAXIMUM CLIMB THRUST LIMITS ENGINE BLEED ON ENGINE AND WING A/I OFF	ISA + 20 C 30% C.G.	%N1	FUEL FLOW (LB/HR)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB									
	32		34		36		38		40	
310										
290										
270	89.2	1386								
250	87.5	1369	88.5	1425	89.5	1486				
230	85.7	1359	86.8	1411	87.8	1467	88.8	1527		
210	84.0	1355	85.0	1403	86.0	1455	87.0	1510	88.1	1573
190	82.2	1353	83.2	1399	84.2	1448	85.2	1499	86.3	1557
170	80.5	1362	81.5	1398	82.4	1446	83.4	1495	84.5	1550
150	78.9	1352	79.8	1398	80.7	1444	81.7	1493	82.7	1547
130	77.2	1352	78.1	1398	79.0	1445	80.0	1494	80.9	1547
100	74.7	1349	75.6	1395	76.5	1443	77.4	1493	78.4	1547
70	72.2	1356	73.1	1398	74.1	1443	75.0	1489	75.9	1541
50	70.5	1364	71.4	1406	72.4	1449	73.3	1494	74.2	1542
15	67.7	1382	68.6	1424	69.5	1469	70.5	1514	71.4	1562

BD100_OEI_HOL200_IMP_HW_20 – 20/10/2003

Figure 05-07-02. Holding Data—200 KIAS (Sheet 12 of 12)

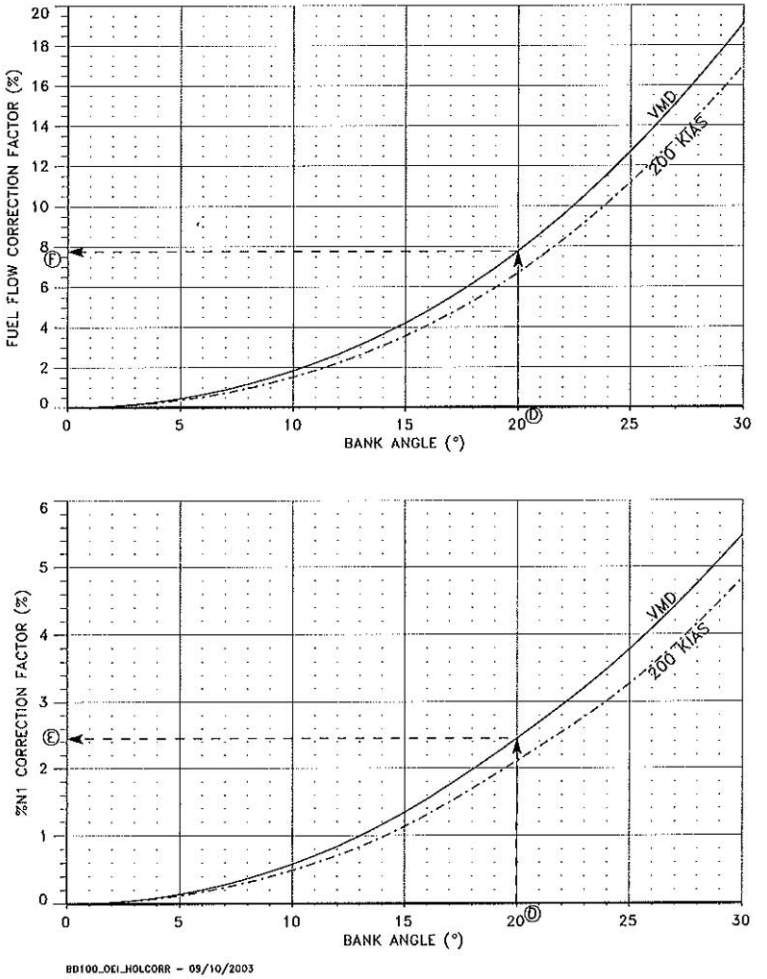


Figure 05-07-03. Bank Angle Correction

SPECIAL OPERATIONAL DATA

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CHAPTER 6
SPECIAL OPERATIONAL DATA

INTRODUCTION

This chapter discusses some non-standard performance items.

The following data are presented:

- Emergency descent data (two engines/single engine)
- Gliding performance
- Gear down performance

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EMERGENCY DESCENT

Single engine operation descent performance data are presented in tabular form as a function of aircraft weight during a descent from altitude to sea level for ISA temperature deviation. Descent profile is based on VMO/MMO speed with idle thrust (two engines or single engine) with flight spoilers extended (EMER) and with engine bleed and anti-ice off.

Emergency descent tables show the following data:

- TIME Time in minutes
- DIST Air distance in nautical miles
- FUEL Fuel consumed in pounds
- ROD Rate of descent in fpm (altitude pressure)
- ATAS Average true airspeed in knots
- MACH Indicated Mach number

At a selected descent speed schedule, the table is entered at an initial descent weight with average temperature conditions at given initial and final descent altitudes. Descent time, distance and fuel consumed are the difference between the values read at the initial and final altitudes. Airplane rate of descent and indicated Mach number at altitude are also given.

The descent distance represents the air distance (zero wind) covered and ATAS represents the average true airspeed from top of descent altitude to the point final descent altitude is reached. In wind conditions, the ground distance can be derived using the following equation:

- Ground distance = [Air distance x (ATAS +/- Wind*) / ATAS]

* Wind convention "+" for Tailwind and "-" for Headwind

Time, distance and fuel correction factors for C.G. variation relative to 30% MAC reference position are provided below:

TIME, DISTANCE and FUEL CORRECTION FACTORS vs. C.G. POSITION.

C.G.	Time, Distance and Fuel
20%	- 2.0%
25%	- 1.0%
REF (30%)	-
35%	+ 2.0%
40%	+ 3.0%

Example:

Associated conditions

- Initial descent altitude = FL 390 (A)
- Initial descent weight at altitude = 30 000 lbs (B)
- Descent speed schedule = VMO/MMO
- Average descent temperature = ISA+10°C*
- Average descent wind = -30 kt (headwind)
- Final altitude = FL 100 (D)

(*) Note: Only data at ISA conditions available.

Using Figure 06-02-01, Sheet 1, the following data are obtained at FL 390 initial descent altitude (C):

- Time = 4.6 min.
- Air distance = 29.8 n.a.m.
- Descent rate = 8076 ft/min.
- Fuel consumed = 63 lbs
- Avg. true airspeed = 393 kts
- Indicated Mach = 0.83 MI

Ground distance is estimated using equation given below:

- Ground distance = 27.5 n.m. [29.8 x (393-30)/393]

Using Figure 06-02-01, Sheet 1, the following data are obtained at FL 100 final descent altitude (E):

- Time = 1.5 min.
- Air distance = 7.9 n.a.m.
- Descent rate = 8053 ft/min.
- Fuel consumed = 23 lbs
- Avg true airspeed = 318 kts
- Indicated Mach = 0.576 MI

Ground distance is estimated using equation given below:

- Ground distance = 7.2 n.m. [7.9 x (318-30)/318]

Descent time, distance and fuel consumed from FL 390 and FL 100 are obtained as follows:

- Time	= 3.1 min	[4.6-1.5]
- Air distance	= 21.9 n.a.m.	[29.8-7.9]
- Ground distance	= 20.3 n.m.	[27.5-7.2]
- Fuel	= 40 lb	[63-23]

DESCENT MMO/VMO – ALL ENGINES OPERATING

IDLE THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF SPOILERS EMER	ISA 30% C.G.	FROM FL TO SL TIME(MIN) FUEL(LB) DIST(NAM) ATAS(KTS) ROD(FPM) MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	22		24		26		28		30 (B)	
450	4.1	56	4.4	61	4.8	65	5.1	70	5.4	74
	27.2	399	29.6	402	32.0	403	34.3	404	36.5	405
	7508	0.830	7039	0.830	6687	0.830	6441	0.830	6251	0.830
430	3.8	53	4.2	57	4.5	61	4.8	66	5.1	70
	25.2	395	27.5	397	29.7	399	31.9	400	34.1	401
	8385	0.830	7801	0.830	7339	0.830	6995	0.830	6715	0.830
410	3.6	50	3.9	54	4.2	58	4.5	62	4.8	66
	23.4	390	25.6	393	27.7	395	29.8	396	31.8	397
	9523	0.830	8818	0.830	8241	0.830	7788	0.830	7406	0.830
390 (A)	3.4	47	3.7	51	4.0	55	4.3	59	4.6	63
	21.9	386	23.9	388	25.9	390	27.9	392	29.8 (C)	393
	10570	0.830	9765	0.830	9093	0.830	8548	0.830	8076	0.830
370	3.2	45	3.5	49	3.8	52	4.0	56	4.3	60
	20.5	382	22.4	384	24.3	386	26.1	388	28.0	389
	11727	0.830	10822	0.830	10059	0.830	9428	0.830	8871	0.830
350	3.1	43	3.3	46	3.6	50	3.9	54	4.1	57
	19.3	378	21.1	380	22.9	382	24.6	384	26.4	385
	14432	0.830	13318	0.830	12369	0.830	11574	0.830	10866	0.830
330	2.9	41	3.2	45	3.4	48	3.7	52	3.9	55
	18.3	374	20.0	377	21.7	379	23.4	380	25.0	381
	16115	0.830	14873	0.830	13813	0.830	12918	0.830	12115	0.830
310	2.8	40	3.1	43	3.3	46	3.5	50	3.8	53
	17.4	371	19.0	373	20.6	375	22.2	377	23.8	378
	17952	0.830	16577	0.830	15398	0.830	14400	0.830	13501	0.830
290	2.7	38	2.9	41	3.2	45	3.4	48	3.6	51
	16.6	367	18.1	369	19.6	371	21.1	373	22.6	374
	13314	0.822	12276	0.822	11387	0.822	10631	0.822	9951	0.822
250	2.4	34	2.6	37	2.8	40	3.0	43	3.2	46
	14.2	356	15.5	358	16.8	360	18.1	361	19.4	362
	12744	0.761	11732	0.761	10873	0.761	10150	0.761	9500	0.761
200	2.0	29	2.2	31	2.3	34	2.5	36	2.7	39
	11.3	342	12.4	344	13.4	346	14.5	347	15.5	348
	12037	0.692	11085	0.692	10276	0.692	9594	0.692	8982	0.692
150	1.6	23	1.7	25	1.8	27	2.0	29	2.1	31
	8.5	328	9.3	330	10.1	331	10.9	333	11.6	334
	11342	0.631	10449	0.631	9688	0.631	9046	0.631	8469	0.631
100 (D)	1.1	17	1.2	19	1.3	20	1.4	22	1.5	23
	5.8	312	6.3	314	6.8	316	7.4	317	7.9 (E)	318
	10787	0.576	9935	0.576	9211	0.576	8601	0.576	8053	0.576
50	0.6	10	0.6	11	0.7	11	0.7	12	0.8	13
	2.9	299	3.2	301	3.4	302	3.7	303	4.0	304
	8901	0.495	8198	0.495	7600	0.495	7096	0.495	6644	0.495

BD100_SPO_EMDES_AEO_IMP_LW – 09/10/2003

Figure 06-02-01. Emergency Descent M_{MO}/V_{MO}— All Engines Operating (Sheet 1 of 2)

DESCENT MMO/VMO – ALL ENGINES OPERATING		
IDLE THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF SPOILERS EMER	ISA 30% C.G.	FROM FL TO SL TIME(MIN) FUEL(LB) DIST(NAM) ATAS(KTS) ROD(FPM) MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	32		34		36		38		40	
450	5.7 38.7 6122	78 406 0.830	6.0 40.8 6048	83 406 0.830	6.3 42.8 6011	87 407 0.830	6.6 44.7 6006	90 407 0.830	6.9 46.5 6018	94 407 0.830
430	5.4 36.2 6501	74 402 0.830	5.7 38.2 6351	78 403 0.830	6.0 40.2 6249	82 403 0.830	6.3 42.1 6189	86 403 0.830	6.5 43.9 6152	90 403 0.830
410	5.1 33.9 7101	70 398 0.830	5.4 35.8 6866	74 399 0.830	5.7 37.8 6686	78 399 0.830	5.9 39.6 6557	82 400 0.830	6.2 41.4 6458	86 400 0.830
390	4.8 31.7 7685	67 394 0.830	5.1 33.6 7374	71 395 0.830	5.4 35.5 7121	74 395 0.830	5.6 37.3 6925	78 396 0.830	5.9 39.0 6763	82 396 0.830
370	4.6 29.8 8397	64 390 0.830	4.8 31.6 8005	67 391 0.830	5.1 33.3 7678	71 391 0.830	5.4 35.1 7414	74 392 0.830	5.6 36.8 7187	78 392 0.830
350	4.4 28.1 10252	61 386 0.830	4.6 29.8 9732	64 387 0.830	4.9 31.5 9285	68 388 0.830	5.1 33.2 8911	71 388 0.830	5.4 34.8 8583	75 389 0.830
330	4.2 26.7 11413	58 382 0.830	4.4 28.3 10808	62 383 0.830	4.7 29.9 10279	65 384 0.830	4.9 31.5 9827	69 385 0.830	5.1 33.0 9420	72 385 0.830
310	4.0 25.4 12709	56 379 0.830	4.3 26.9 12021	60 380 0.830	4.5 28.4 11414	63 380 0.830	4.7 29.9 10886	66 381 0.830	4.9 31.4 10405	69 381 0.830
290	3.9 24.1 9350	54 375 0.822	4.1 25.5 8827	57 376 0.822	4.3 27.0 8363	61 376 0.822	4.5 28.4 7958	64 377 0.822	4.7 29.8 7586	67 377 0.822
250	3.4 20.7 8929	49 363 0.761	3.6 21.9 8432	52 364 0.761	3.8 23.2 7991	54 365 0.761	4.0 24.4 7603	57 365 0.761	4.2 25.6 7246	60 366 0.761
200	2.8 16.5 8443	41 349 0.692	3.0 17.5 7974	44 350 0.692	3.2 18.5 7557	46 351 0.692	3.3 19.5 7190	48 351 0.692	3.5 20.5 6853	51 352 0.692
150	2.2 12.4 7961	33 335 0.631	2.4 13.2 7517	35 335 0.631	2.5 13.9 7123	37 336 0.631	2.6 14.7 6777	39 336 0.631	2.7 15.4 6457	41 337 0.631
100	1.6 8.4 7569	25 319 0.576	1.7 8.9 7148	26 319 0.576	1.8 9.4 6774	28 320 0.576	1.9 9.9 6444	29 320 0.576	1.9 10.4 6140	30 321 0.576
50	0.8 4.2 6247	14 305 0.495	0.9 4.5 5901	15 305 0.495	0.9 4.7 5594	15 306 0.495	1.0 5.0 5324	16 306 0.495	1.0 5.2 5078	17 307 0.495

BD100_SPO_EMDES_AEO_IMP_HW – 09/10/2003

Figure 06-02-01. Emergency Descent M_{MO}/V_{MO}— All Engines Operating (Sheet 2 of 2)

DESCENT MMO/VMO – SINGLE ENGINE

IDLE THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF SPOILERS EMER	ISA 30% C.G.	FROM FL TO SL TIME(MIN) FUEL(LB) DIST(NAM) ATAS(KTS) ROD(FPM) MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	22		24		26		28		30	
450	3.8 24.7 9011	26 395 0.830	4.1 27.0 8414	28 398 0.830	4.4 29.2 7955	30 400 0.830	4.7 31.3 7618	32 401 0.830	5.0 33.4 7345	35 402 0.830
430	3.5 23.0 9880	25 391 0.830	3.8 25.2 9169	27 394 0.830	4.1 27.3 8601	29 396 0.830	4.4 29.3 8167	31 397 0.830	4.7 31.4 7804	33 399 0.830
410	3.3 21.6 10926	23 387 0.830	3.6 23.6 10102	25 389 0.830	3.9 25.5 9426	27 392 0.830	4.2 27.5 8869	29 393 0.830	4.5 29.4 8429	31 395 0.830
390	3.2 20.2 11991	22 382 0.830	3.4 22.1 11067	24 385 0.830	3.7 24.0 10295	26 388 0.830	4.0 25.8 9666	28 389 0.830	4.2 27.6 9115	30 391 0.830
370	3.0 19.0 13160	21 378 0.830	3.3 20.8 12136	23 381 0.830	3.5 22.5 11272	25 383 0.830	3.8 24.3 10556	26 385 0.830	4.0 26.0 9920	28 387 0.830
350	2.9 17.9 15997	20 375 0.830	3.1 19.6 14753	22 378 0.830	3.4 21.3 13695	24 380 0.830	3.6 22.9 12808	25 382 0.830	3.8 24.6 12015	27 383 0.830
330	2.8 17.0 17689	19 371 0.830	3.0 18.6 16318	21 374 0.830	3.2 20.2 15148	23 376 0.830	3.5 21.8 14161	24 378 0.830	3.7 23.4 13272	26 380 0.830
310	2.6 16.2 19522	19 368 0.830	2.9 17.8 18019	20 371 0.830	3.1 19.3 16731	22 373 0.830	3.3 20.8 15642	24 375 0.830	3.5 22.2 14658	25 376 0.830
290	2.5 15.4 14387	18 365 0.822	2.8 16.9 13261	20 367 0.822	3.0 18.3 12296	21 369 0.822	3.2 19.7 11479	23 371 0.822	3.4 21.1 10740	24 372 0.822
250	2.3 13.3 13680	16 354 0.761	2.4 14.5 12590	18 356 0.761	2.6 15.7 11666	19 358 0.761	2.8 17.0 10888	20 360 0.761	3.0 18.2 10187	22 361 0.761
200	1.9 10.6 12877	14 340 0.692	2.0 11.6 11856	15 342 0.692	2.2 12.6 10988	16 344 0.692	2.4 13.6 10256	17 346 0.692	2.5 14.5 9598	18 347 0.692
150	1.5 8.0 12088	11 326 0.631	1.6 8.8 11133	12 328 0.631	1.7 9.5 10320	13 330 0.631	1.9 10.2 9634	14 332 0.631	2.0 11.0 9017	15 333 0.631
100	1.0 5.4 11459	8 311 0.576	1.1 5.9 10551	9 313 0.576	1.2 6.4 9780	10 315 0.576	1.3 6.9 9131	10 316 0.576	1.4 7.4 8546	11 317 0.576
50	0.6 2.7 9346	5 297 0.495	0.6 3.0 8606	5 299 0.495	0.6 3.2 7977	5 301 0.495	0.7 3.5 7447	6 302 0.495	0.7 3.7 6970	6 303 0.495

BD100_SPO_EMDES_OEI_IMP_LW – 09/10/2003

Figure 06-02-02. Emergency Descent M_{MO}/V_{MO}— Single Engine (Sheet 1 of 2)

DESCENT MMO/VMO – SINGLE ENGINE

IDLE THRUST ENGINE BLEED ON ENGINE AND WING A/I OFF SPOILERS EMER	ISA 30% C.G.	FROM FL TO SL TIME(MIN) FUEL(LB) DIST(NAM) ATAS(KTS) ROD(FPM) MACH

FLIGHT LEVEL	INITIAL DESCENT WEIGHT – 1000 LB									
	32		34		36		38		40	
450	5.3	37	5.6	39	5.8	41	6.1	42	6.4	44
	35.5	403	37.4	404	39.4	404	41.2	405	43.0	405
	7146	0.830	7010	0.830	6919	0.830	6866	0.830	6834	0.830
430	5.0	35	5.3	37	5.6	39	5.8	40	6.1	42
	33.3	400	35.3	400	37.1	401	38.9	401	40.7	402
	7521	0.830	7310	0.830	7153	0.830	7046	0.830	6964	0.830
410	4.7	33	5.0	35	5.3	37	5.5	39	5.8	40
	31.3	396	33.2	397	35.0	397	36.7	398	38.5	398
	8060	0.830	7768	0.830	7536	0.830	7362	0.830	7222	0.830
390	4.5	31	4.8	33	5.0	35	5.3	37	5.5	39
	29.4	392	31.2	393	33.0	394	34.7	394	36.3	395
	8659	0.830	8289	0.830	7984	0.830	7743	0.830	7538	0.830
370	4.3	30	4.5	32	4.8	34	5.0	35	5.3	37
	27.7	388	29.4	389	31.1	390	32.7	390	34.3	391
	9381	0.830	8930	0.830	8550	0.830	8240	0.830	7970	0.830
350	4.1	29	4.3	30	4.6	32	4.8	34	5.0	35
	26.2	384	27.8	385	29.4	386	31.0	387	32.5	387
	11329	0.830	10745	0.830	10240	0.830	9817	0.830	9441	0.830
330	3.9	28	4.2	29	4.4	31	4.6	33	4.8	34
	24.9	381	26.4	382	27.9	383	29.4	383	30.9	384
	12498	0.830	11830	0.830	11243	0.830	10741	0.830	10286	0.830
310	3.8	27	4.0	28	4.2	30	4.4	31	4.6	33
	23.7	377	25.2	378	26.6	379	28.0	380	29.5	380
	13795	0.830	13043	0.830	12379	0.830	11801	0.830	11272	0.830
290	3.6	26	3.8	27	4.0	29	4.3	30	4.5	32
	22.5	373	23.9	374	25.3	375	26.6	376	28.0	376
	10090	0.822	9524	0.822	9021	0.822	8582	0.822	8178	0.822
250	3.2	23	3.4	25	3.6	26	3.8	27	4.0	29
	19.4	362	20.6	363	21.8	364	22.9	364	24.1	365
	9574	0.761	9039	0.761	8564	0.761	8147	0.761	7761	0.761
200	2.7	20	2.8	21	3.0	22	3.1	23	3.3	24
	15.5	348	16.5	349	17.4	350	18.3	350	19.3	351
	9021	0.692	8518	0.692	8071	0.692	7678	0.692	7315	0.692
150	2.1	16	2.2	17	2.3	18	2.5	19	2.6	20
	11.7	334	12.4	335	13.1	335	13.8	336	14.5	336
	8474	0.631	8001	0.631	7580	0.631	7210	0.631	6868	0.631
100	1.5	12	1.6	12	1.7	13	1.8	14	1.8	14
	7.9	318	8.4	319	8.9	319	9.3	320	9.8	320
	8032	0.576	7583	0.576	7185	0.576	6834	0.576	6510	0.576
50	0.8	7	0.8	7	0.9	7	0.9	8	1.0	8
	4.0	304	4.2	305	4.5	305	4.7	306	4.9	306
	6553	0.495	6189	0.495	5866	0.495	5583	0.495	5323	0.495

BD100_SPO_EMDES_OEI_IMP_HW – 09/10/2003

Figure 06-02-02. Emergency Descent M_{MO}/V_{MO}— Single Engine (Sheet 2 of 2)

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GLIDING PERFORMANCE

Gliding performance data (two engines out) are presented as a function of aircraft gross weight during a descent from altitude to sea level. Descent profile assumes two engines wind milling and a gliding speed close to minimum drag speed based on AFM data.

Gliding data are valid for all temperature conditions. For more conservative gliding performance, calculations have been made based on worst case temperature and most forward C.G. position (minimum time and distance).

The following data are presented in tabular form as function of initial descent weight at altitude.

- •TIME Time in minutes
- •DIST Air distance in nautical miles
- •KIAS Gliding speed in knots

To determine gliding time and distance, the tables are entered at an initial descent weight at initial altitude. Gliding time and distance are the differences between the values read at the initial and final altitudes. Distance represents the air distance covered with zero wind.

Gliding speed should be adjusted as required during descent to attain performance data presented in this section.

Example:

Associated conditions

- Flight Level = FL 390 (A)
- Aircraft weight at altitude = 38 000 lbs (B)
- Average temperature = ISA+10°C*
- Final altitude = Sea Level

* Gliding data valid for all temperatures.

Using Figure 06-03-01, the following data are obtained (C):

- Gliding speed = 185 KIAS
- Gliding time = 25.7 min.
- Gliding air distance = 110 n.a.m.

GLIDING

FLAPS 0 LANDING GEAR RETRACTED TWO ENGINES INOPERATIVE	ALL TEMPERATURE FWD C.G.	FROM FL TO SL TIME (MIN) DIST (NM)	KIAS (KTS)

FLIGHT LEVEL	GROSS WEIGHT – 1000 LB											
	22		26		30		34		38 (B)		42	
450	30.5 119	160	31.9 125	160	31.5 127	165	30.0 128	175	28.8 130	185	27.6 131	195
430	29.5 113	160	30.9 118	160	30.5 121	165	29.0 122	175	27.8 123	185	26.6 124	195
410	28.5 107	160	29.8 112	160	29.4 114	165	28.0 115	175	26.7 116	185	25.6 118	195
390 (A)	27.4 101	160	28.6 106	160	28.2 108	165	26.9 109	175	25.7 (C) 110	185	24.6 111	195
370	26.2 96	160	27.5 100	160	27.1 102	165	25.8 103	175	24.6 104	185	23.6 104	195
350	25.1 90	160	26.3 94	160	25.9 96	165	24.7 97	175	23.5 97	185	22.5 98	195
330	24.0 84	160	25.1 88	160	24.7 90	165	23.5 91	175	22.5 91	185	21.5 92	195
310	22.8 79	160	23.9 83	160	23.5 84	165	22.4 85	175	21.3 85	185	20.4 86	195
290	21.6 73	160	22.6 77	160	22.3 78	165	21.2 79	175	20.2 80	185	19.3 80	195
250	19.0 63	160	20.0 66	160	19.7 67	165	18.7 67	175	17.8 68	185	17.0 68	195
200	15.7 50	160	16.5 52	160	16.2 53	165	15.4 53	175	14.7 54	185	14.0 54	195
150	12.2 37	160	12.8 39	160	12.6 39	165	11.9 40	175	11.4 40	185	10.8 40	195
100	8.4 24	160	8.8 26	160	8.6 26	165	8.2 26	175	7.8 26	185	7.4 26	195
50	4.3 12	160	4.5 12	160	4.5 13	165	4.2 13	175	4.0 13	185	3.8 13	195

BD100_EMDES_AEI_DIVE_IMP ~ 09/10/2003

Figure 06-03-01. Gliding Performance

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GEAR DOWN PERFORMANCE

For gear down operation, mission fuel burn required to fly a specific route distance should be increased by a factor of 80%.

WEIGHT AND BALANCE

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CHAPTER 2
WEIGHT AND BALANCE

INTRODUCTION

This chapter will introduce the various charts, tables and methods used to compute aircraft weight and balance. A set of conditions (aircraft load, ambient conditions, etc.) is presented and used throughout each section in examples which demonstrate the use of charts and tables.

GENERAL

The aircraft weight and load arrangement must be within limits of the applicable center-of-gravity (CG) at all times. Prior to each flight, the pilot must make certain that the aircraft is loaded within the defined limits to insure acceptable stability, control, performance and structural loads.

Weight and balance data are supplied by the manufacturer when the aircraft is delivered. Any subsequent change to the aircraft which might affect weight and balance such as interior installation by a completion center must be entered in the airplane record.

Weight and CG information for each aircraft is recorded in the *Weight and Balance Manual* assigned to the airplane. An Aircraft Weighing Record is maintained for each aircraft. The basic empty weight, CG, and the moment are recorded on the weighing record. The charts and tables required for computing weight and balance are provided in the *Weight and Balance Manual*.

The following pages show various forms for weight and balance data.

	WEIGHT	F.S.	MOM/1000	% MAC
OPERATING EMPTY WEIGHT	23600.0	601.9	14211.0	40.3
BAGGAGE		650.0		
PASSENGER 1		415.0		
PASSENGER 2		415.0		
PASSENGER 3		478.0		
PASSENGER 4		478.0		
PASSENGER 5		512.0		
PASSENGER 6		512.0		
PASSENGER 7		571.0		
PASSENGER 8		571.0		
PASSENGER 9		613.0		
ZERO FUEL WEIGHT				
TRIP FUEL				
TAKEOFF GROSS WEIGHT				
ZERO FUEL WEIGHT				
LANDING FUEL				
LANDING WEIGHT				

1. APU FUEL BURNOFF IS APPROXIMATELY 2.7 LB/MIN FROM THE RIGHT TANK
2. FUEL BURNOFF IS APPROXIMATELY 7.5 LB/MIN/ENGINE

% MAC FORMULA

$$\frac{FS - 556.67}{112.22} \times 100$$

FUEL BURN	
1ST HOUR	2600
2ND HOUR	2000
3RD HOUR	1800

Figure 7-1. Challenger 300 Loading Form Worksheet

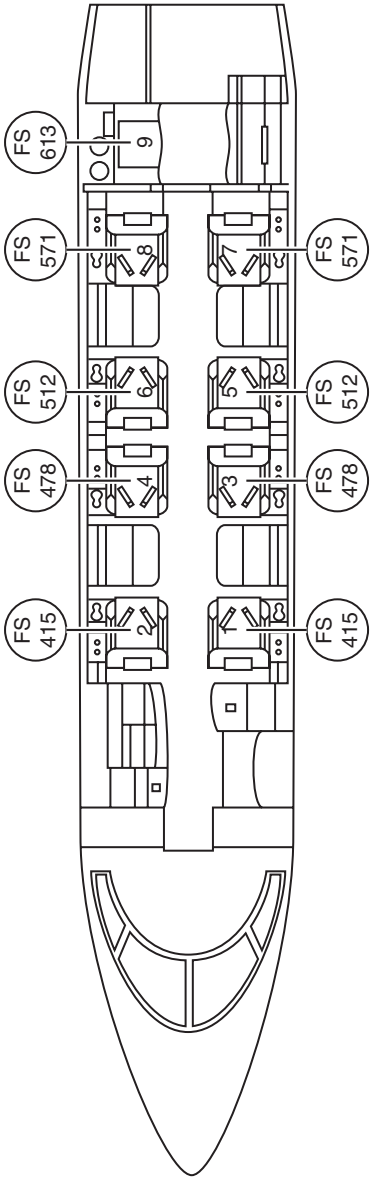

Figure 7-2. Floorplan

Table 7-1. CL-300 FUEL MOMENTS

LBS	F.S.	MOM
100	543.3	54328
200	543.4	108687
300	543.6	163080
400	543.8	217507
500	543.9	271970
600	544.1	235471
700	544.3	381011
800	544.5	435591
900	544.7	490212
1000	544.9	544875
1100	545.1	599581
1200	545.3	654331
1300	545.5	709126
1400	545.7	763966
1500	545.9	818852
1600	546.1	873785
1700	546.3	928765
1800	546.6	983793
1900	546.8	1038869
2000	547.0	1093993
2100	547.2	1149165
2200	547.4	1204386
2300	547.7	1259656
2400	547.9	1314975
2500	548.1	1370343
2600	548.4	1425760
2700	548.6	1481225
2800	548.8	1536739
2900	549.1	1592302
3000	549.3	1647913
3100	549.5	1703572
3200	549.8	1759279
3300	550.0	1815033
3400	550.2	1870834
3500	550.5	1926682
3600	550.7	1982576
3700	551.0	2038516
3800	551.2	2094501
3900	551.4	2150531
4000	551.7	2206605
4100	551.9	2262723
4200	552.1	2318884
4300	552.3	2375087
4400	552.6	2431332
4500	552.8	2487618
4600	553.0	2543945
4700	553.3	2600311
4800	553.5	2656716
4900	553.7	2713160
5000	553.9	2769642

LBS	F.S.	MOM
5100	554.1	2826161
5200	554.4	2882716
5300	554.6	2939307
5400	554.8	2995993
5500	550.0	3052593
5600	555.2	3109287
5700	555.4	3166014
5800	555.7	3222774
5900	555.9	3279565
6000	556.0	3336387
6100	556.3	3393240
6200	556.5	3450123
6300	556.7	3507035
6400	556.9	3563976
6500	557.1	3620945
6600	557.3	3677942
6700	557.5	3734966
6800	557.6	3792017
6900	557.8	3849095
7000	558.0	3906199
7100	558.2	3963328
7200	558.4	4020483
7300	558.6	4077663
7400	558.8	4134868
7500	558.9	4192098
7600	559.1	4249352
7700	559.3	4306631
7800	559.5	4363934
7900	559.7	4421262
8000	559.8	4478615
8100	560.0	4535992
8200	560.2	4593394
8300	560.3	4650821
8400	560.5	4708274
8500	560.7	4765753
8600	560.8	4823258
8700	561.0	4880790
8800	561.2	4938349
8900	561.3	4995936
9000	561.5	5053551
9100	561.7	5111196
9200	561.8	5168871
9300	562.0	5226577
9400	562.2	5284316
9500	562.3	5342088
9600	562.5	5399894
9700	562.7	5457736
9800	562.8	5515615
9900	563.0	5573533
10000	563.1	5631491

LBS	F.S.	MOM
10100	563.3	5689491
10200	563.5	5747534
10300	563.7	5805623
10400	563.8	5863759
10500	564.0	5921944
10600	564.2	5980181
10700	564.3	6038471
10800	564.5	6096817
10900	564.7	6155222
11000	564.9	6213688
11100	565.1	6272217
11200	565.3	6330813
11300	565.4	6389478
11400	565.6	6448216
11500	565.8	6507029
11600	566.0	6565921
11700	566.2	6624895
11800	566.4	6683955
11900	566.6	6743104
12000	566.9	6802347
12100	567.1	6861687
12200	567.3	6921128
12300	567.5	6980674
12400	567.8	7040330
12500	568.0	7100100
12600	568.3	7159989
12700	568.5	7220002
12800	568.8	7280143
12900	569.0	7340418
13000	569.3	7400831
13100	569.6	7461388
13200	569.9	7522095
13300	570.1	7582957
13400	570.4	7643980
13500	570.8	7705170
13600	571.1	7766533
13700	571.4	7828076
13800	571.7	7889805
13900	572.1	7951726
14000	572.4	8013846
14100	572.8	8076173
14200	573.1	8138713
14300	573.5	8201474

Table 7-2. XARM TO %MAC CONVERSION (IMPERIAL UNITS)

XARM (IN.)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
580	20.8	20.9	21.0	21.1	21.1	21.2	21.3	21.4	21.5	21.6
581	21.7	21.8	21.9	21.9	22.0	22.1	22.2	22.3	22.4	22.5
582	22.6	22.7	22.8	22.8	22.9	23.0	23.1	23.2	23.3	23.4
583	23.5	23.6	23.6	23.7	23.8	23.9	24.0	24.0	24.2	24.3
584	24.4	24.4	24.5	24.6	24.7	24.8	24.9	25.0	25.1	25.2
585	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9	26.0	26.0
586	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.8	26.9
587	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.7	27.8
588	27.9	28.0	28.0	28.1	28.3	28.4	28.5	28.5	28.6	28.7
589	28.8	28.9	29.0	29.1	29.2	29.3	29.3	29.4	29.5	29.6
590	29.7	29.8	29.9	30.0	30.1	30.1	30.2	30.3	30.4	30.5
591	30.6	30.7	30.8	30.9	30.9	31.0	31.1	31.2	31.3	31.4
592	31.5	31.6	31.7	31.8	31.8	31.9	32.0	32.1	32.2	32.3
593	32.4	32.5	32.6	32.6	32.7	32.8	32.9	33.0	33.1	33.2
594	33.3	33.4	33.4	33.5	33.6	33.7	33.8	33.9	34.0	34.1
595	34.2	34.2	34.3	34.4	34.5	34.6	34.7	34.8	34.9	35.0
596	35.0	35.1	35.2	35.3	35.4	35.5	35.6	35.7	35.8	35.8
597	35.9	36.0	36.1	36.2	36.2	36.4	36.5	36.6	36.7	36.7
598	36.8	36.9	37.0	37.0	37.2	37.3	37.4	37.5	37.5	37.6
599	37.7	37.8	37.9	38.0	38.1	38.2	38.8	38.3	38.4	38.5
600	38.6	38.7	38.8	38.9	39.0	39.1	39.1	39.2	39.3	39.4
601	39.5	39.6	39.7	39.8	39.9	39.9	40.0	40.1	40.2	40.3
602	40.4	40.5	40.6	40.7	40.8	40.8	40.9	41.0	41.12	41.2
603	41.3	41.4	41.5	41.6	41.6	41.7	41.8	41.9	42.0	42.1
604	42.2	42.3	42.4	42.4	42.5	42.6	42.7	42.8	42.9	43.0
605	43.0	43.2	43.2	43.3	43.4	43.5	43.6	43.7	43.8	43.9

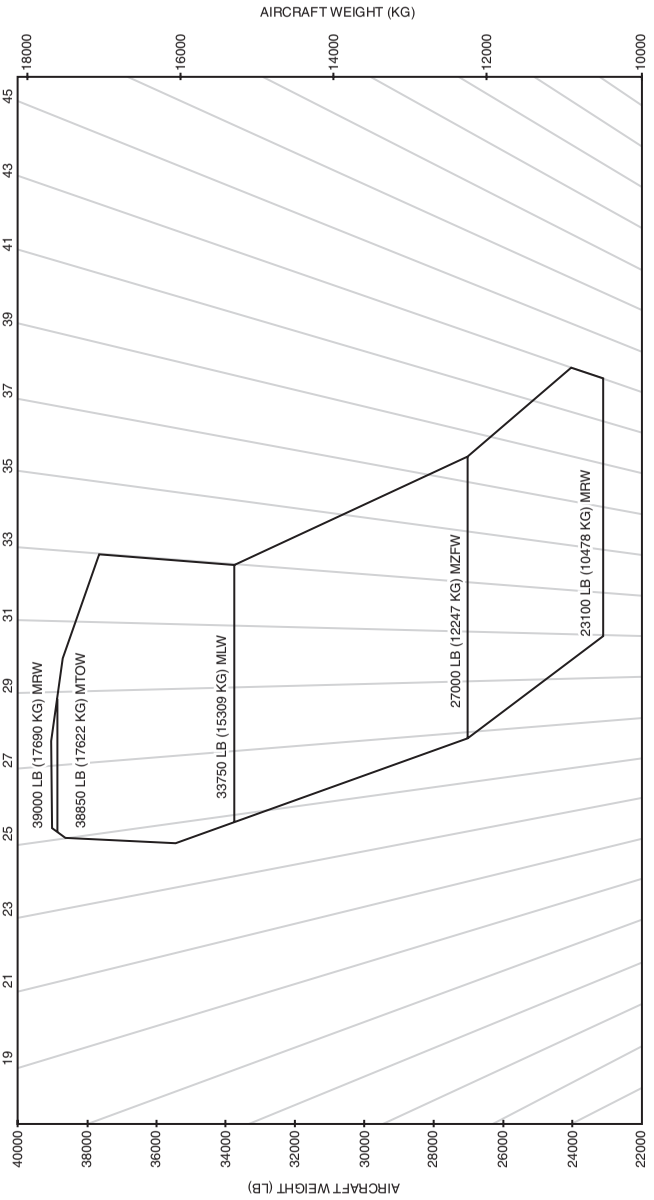

Figure 7-3. Center of Gravity Envelope

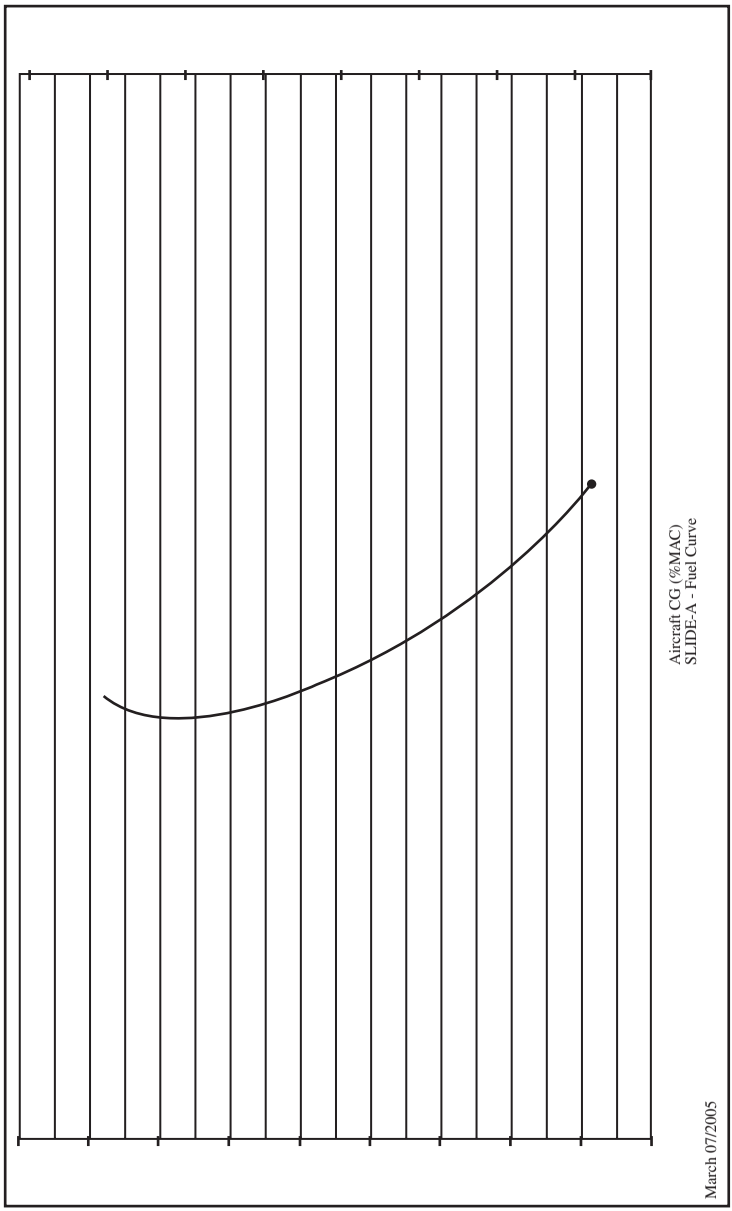

Figure 7-4. Fuel Curve

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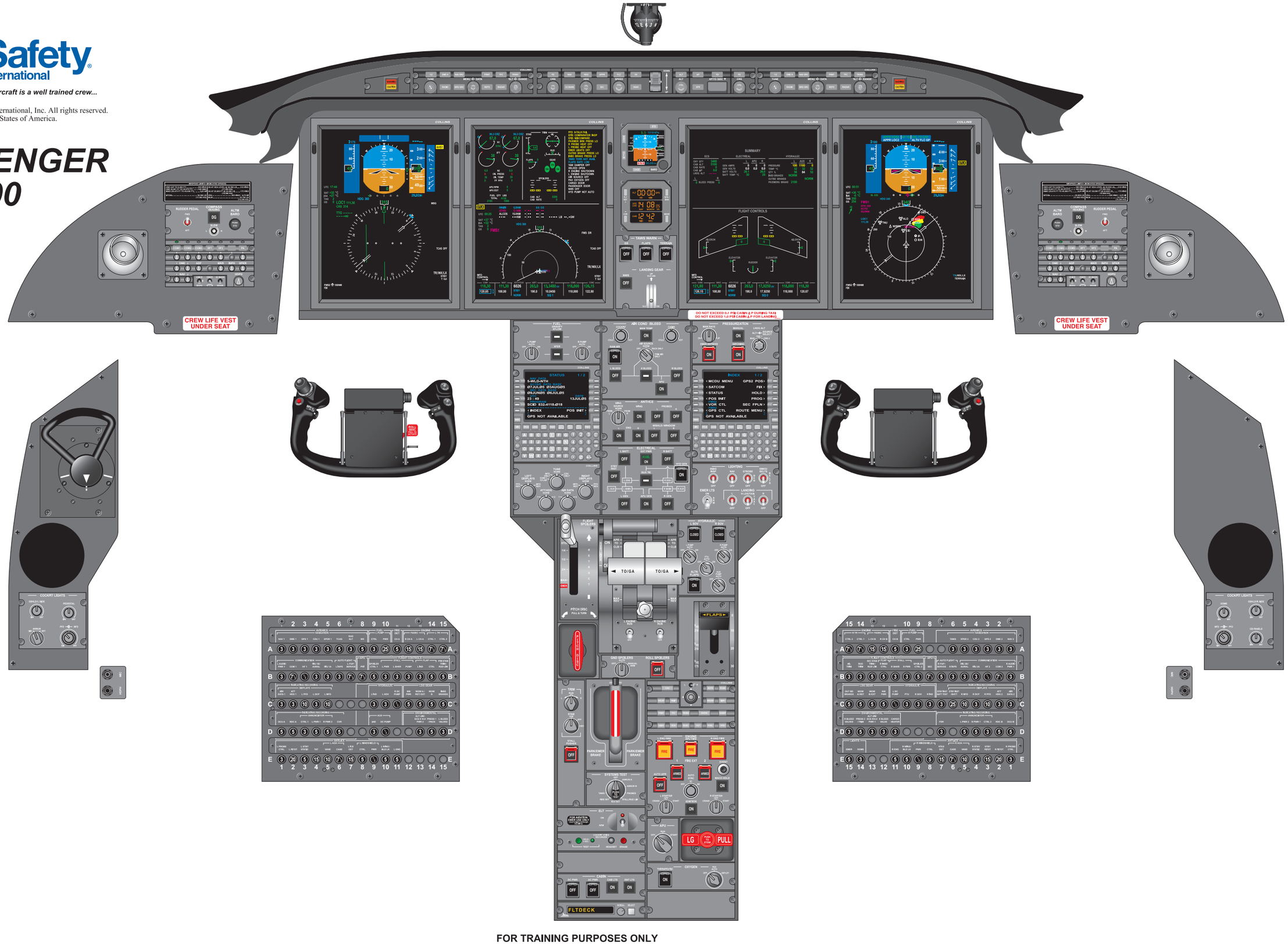
CHALLENGER 300



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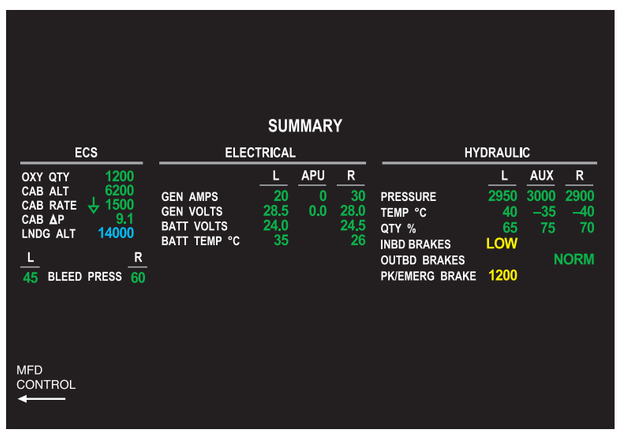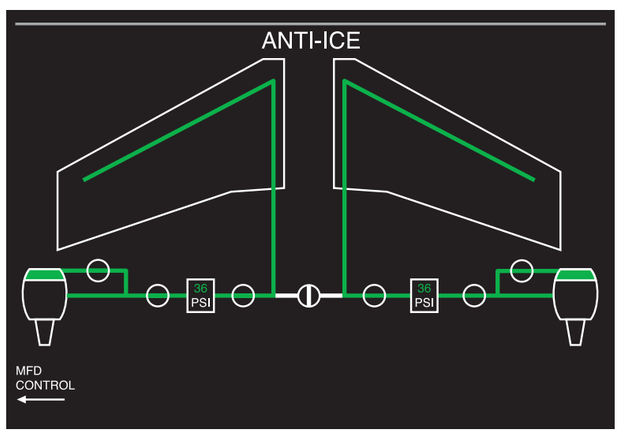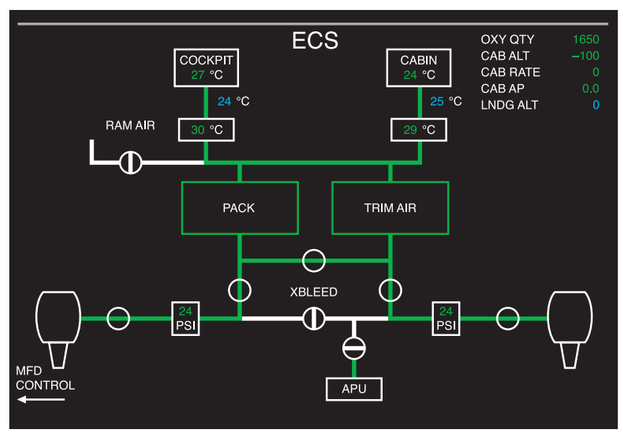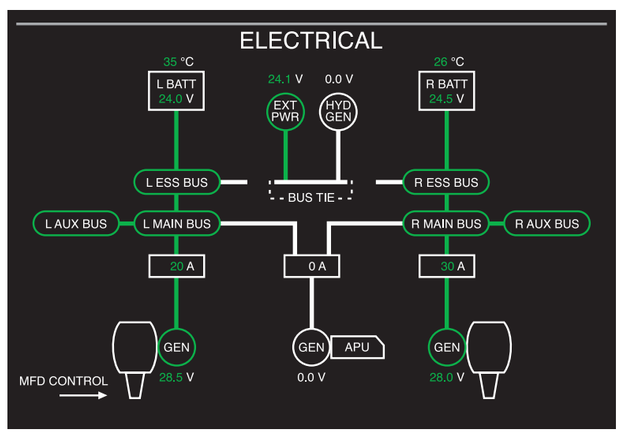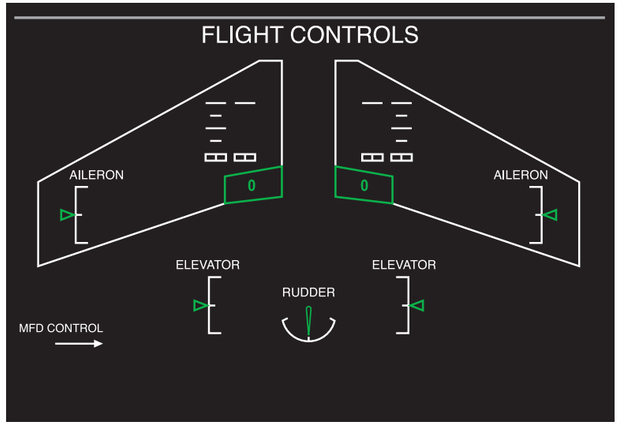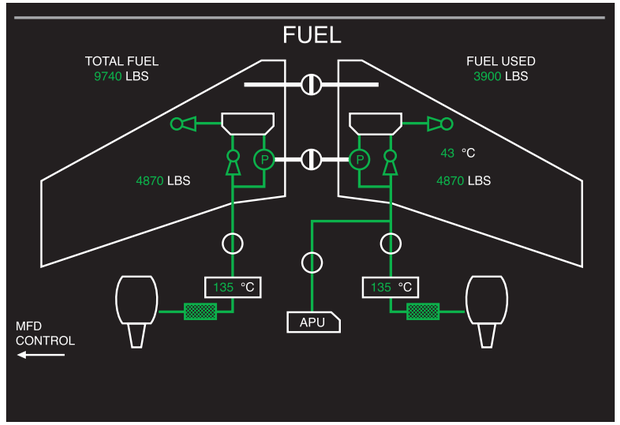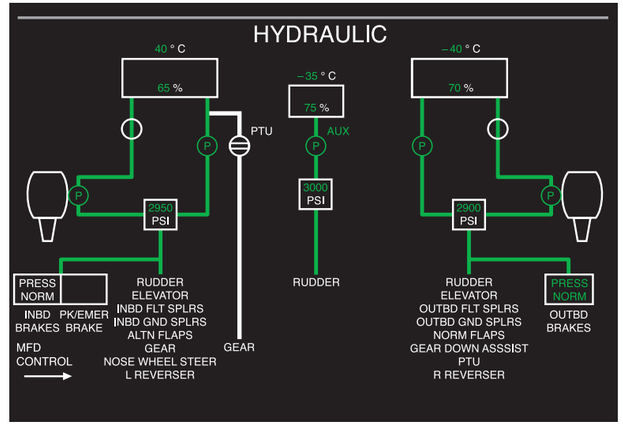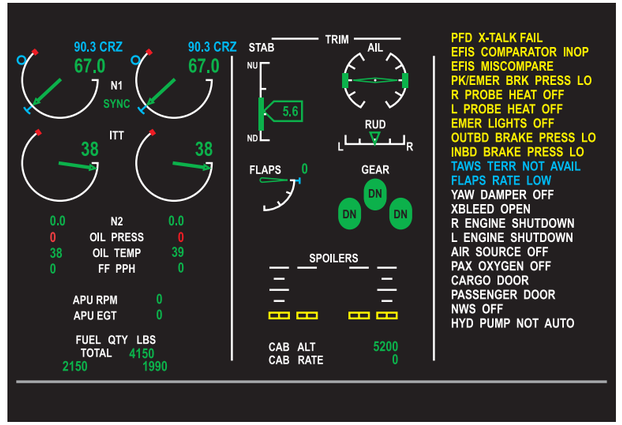
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