# 737
## Quick Reference Handbook

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**Z**

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## PREFLIGHT

Oxygen. . . . . Tested, 100%

Navigation transfer
and display switches . . . . . NORMAL, AUTO

Window heat . . . . . .ON

Pressurization mode
selector . . . . . AUTO

Flight instruments . . . . . Heading ___, Altimeter ___

Parking brake . . . . . .Set

Engine start levers . . . . . CUTOFF

## BEFORE START

Flight deck door . . . . . Closed and locked

Fuel . . . . . .___ LBS/KGS, Pumps ON

Passenger signs . . . . . ___

Windows . . . . . Locked

MCP . . . . . V2 ___, HEADING ___, ALTITUDE ___

Takeoff speeds . . . . . V1 ___, VR ___, V2 ___

CDU preflight. . . . . Completed

Rudder and aileron trim . . . . . Free and 0

Taxi and takeoff briefing . . . . . Completed

Anti collision light. . . . . .ON

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## BEFORE TAXI

Generators . . . . . On

Probe heat . . . . . ON

Anti-ice . . . . . ___

Isolation valve . . . . . AUTO

[Without automatic ignition]
Engine start switches . . . . . CONT

Recall . . . . . Checked

Autobrake . . . . . RTO

Engine start levers . . . . . IDLE detent

Flight controls . . . . . Checked

Ground equipment . . . . . Clear

## BEFORE TAKEOFF

Flaps . . . . . ___ , Green light

Stabilizer trim . . . . . ___ Units

## AFTER TAKEOFF

Engine bleeds . . . . . ON

Packs . . . . . AUTO

Landing gear . . . . . UP and OFF

Flaps . . . . . UP, No lights

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## DESCENT

Pressurization . . . . . LAND ALT ___

Recall . . . . . Checked

Autobrake . . . . . ___

Landing data . . . . . VREF ___, Minimums ___

Approach briefing . . . . . Completed

## APPROACH

Altimeters . . . . . ___

## LANDING

[Without automatic ignition]

Engine start switches . . . . . CONT

Speedbrake . . . . . ARMED

Landing gear . . . . . Down

Flaps . . . . . ___, Green light

## SHUTDOWN

Fuel pumps . . . . . OFF

Probe heat . . . . . OFF

Hydraulic panel . . . . . Set

Flaps . . . . . UP

Parking brake . . . . . ___

Engine start levers . . . . . CUTOFF

Weather radar . . . . . Off

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## SECURE

IRSs . . . . . OFF

Emergency exit lights . . . . . OFF

Window heat . . . . . OFF

Packs . . . . . OFF

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## Emergency Descent

Condition: One or more of these occur:
- Cabin altitude cannot be controlled when the airplane is above 14,000 feet
- A rapid descent is needed.

1 Announce the emergency descent. The captain will advise the cabin crew, on the PA system, of impending rapid descent. The first officer will advise ATC and obtain the area altimeter setting.

2 Passenger signs . . . . . ON

3 **Without delay**, descend to the lowest safe altitude or 10,000 feet, whichever is higher.

4 ENGINE START switches (both) . . . . . CONT

5 Thrust levers (both) . . . . . Reduce thrust to minimum or as needed for anti-ice

6 Speedbrake . . . . . FLIGHT DETENT

If structural integrity is in doubt, limit speed as much as possible and avoid high maneuvering loads.

7 ⚠ Set target speed to Mmo/Vmo.

▼ Continued on next page ▼

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▼ Emergency Descent continued ▼

[737-700 with Winglets]

**Caution! When gross weight is greater than 143,000 lbs / 64,864 kgs, speed brake will autostow to the 50% flight detent if airspeed exceeds 320 knots. Do not override autostow function unless airspeed is less than 320 knots.**

[737-900ER with Winglets]

**Caution! When gross weight is greater than 170,000 lbs / 77,112 kgs, speed brake will autostow to the 50% flight detent if airspeed exceeds 320 knots. Do not override autostow function unless airspeed is less than 320 knots.**

8 **When** approaching the level off altitude:

Smoothly lower the SPEED BRAKE lever to the DOWN detent and level off. Add thrust and stabilize on altitude and airspeed.

9 Crew oxygen regulators. . . . . Normal

Flight crew must use oxygen when cabin altitude is above 10,000 feet. To conserve oxygen, move the regulator to Normal.

10 ENGINE START switches (both) . . . . . .As needed

11 The new course of action is based on weather, oxygen, fuel remaining and available airports. Use of long range cruise may be needed.

■ ■ ■ ■

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## Ditching

Condition: Airplane ditching and evacuation are needed.

1 Send distress signals. Determine position, course, speed, altitude, situation, intention, time and position of intended touchdown and transmit mayday. Report type of aircraft and request intercept.

2 Alert the cabin crew to prepare for ditching and seat passengers as far forward as possible.

3 Burn off fuel to reduce touchdown speed and increase buoyancy.

4 Plan to touch down on the windward side and parallel to waves and swells.

5 Plan a flaps 40 landing unless another configuration is needed.

6 Set VREF 40.

7 Do **not** arm the autobrake.

8 Do **not** accomplish the normal landing checklist.

9 **Checklist Complete Except Deferred Items**

### Deferred Items

**Descent Checklist**

Pressurization . . . . . LAND ALT ___

Recall . . . . . Checked

Autobrake . . . . . **OFF**

Landing data . . . . . **VREF 40**

▼ Continued on next page ▼

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▼ Ditching continued ▼

Approach briefing . . . . . Completed

## Approach Checklist

Altimeters . . . . . ____

## Below 5000 feet

LANDING GEAR AURAL WARN
circuit breaker (P6-3:D18) . . . . . Pull

This prevents the warning horn with gear retracted and landing flaps selected.

Passenger signs . . . . . ON

Engine BLEED air switches (both) . . . . . OFF

This allows the airplane to be depressurized with the outflow valve closed.

Pressurization mode selector . . . . . MAN

Outflow VALVE switch . . . . . Hold in CLOSE until outflow valve indicates fully closed

This prevents water from entering the airplane.

**Note:** The outflow valve takes up to 20 seconds to close.

APU switch . . . . . OFF

[Option - Ground Proximity Gear Inhibit switch]
GROUND PROXIMITY GEAR
INHIBIT switch . . . . . GEAR INHIBIT

▼ Continued on next page ▼

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▼ Ditching continued ▼

[Option - Without Ground Proximity Gear Inhibit switch]
GND PROX WARN
circuit breaker (P18–1:B7) . . . . . Pull

GROUND PROXIMITY TERR
INHIBIT switch . . . . . TERR INHIBIT

Life vests, shoulder harnesses and seat belts . . . On

Confirm that passenger cabin preparations are complete.

**Caution! Do not open aft entry or service doors as they may be partially submerged.**

Transmit all pertinent information regarding final ditching position.

## After Impact Procedure Review

Set both engine start levers to CUTOFF. This closes fuel shutoff valves to prevent discharge of fuel from ruptured fuel lines.

Open flight deck windows. This ensures no cabin differential pressure prevents the opening of the doors or emergency exits.

Start the evacuation.

Proceed to assigned ditching stations, launch rafts and evacuate the airplane as soon as practicable.

The airplane may stay afloat indefinitely if fuel load is minimal and no serious damage was sustained during landing.

▼ Continued on next page ▼

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▼ Ditching continued ▼

## Ditching Final

LANDING GEAR lever. . . . . UP and OFF

Flaps . . . . . ____, Green light

At **500 feet**, advise the cabin crew that ditching is imminent.

At **50 feet**, advise the cabin crew to brace for impact.

Maintain airspeed at VREF. Flare the airplane to achieve the minimum rate of descent at touchdown. Maintain 200-300 fpm rate of descent until the start of the flare.

At flare, rotate smoothly to a touchdown attitude of 10-12°. Maintain airspeed and rate of descent with thrust.

At touchdown, reduce thrust to idle.

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AIR STAIR

## AIRSTAIR

[Option - Forward airstairs]

Condition: The airstair is not secure.

1 Choose one:

◆Pressurization is **normal**:

Continue normal operation.

■ ■ ■ ■

◆Pressurization is **not** normal:

▶▶**Go to step 2**

2 Don oxygen masks.

3 Establish crew communications.

4 Passenger signs . . . . . ON

5 Choose one:

◆Airplane has **not** reached the planned cruise altitude:

Do **not** continue the climb.

Reset the FLT ALT indicator to the actual airplane altitude.

▶▶**Go to step 6**

◆Airplane **has** reached the planned cruise altitude:

▶▶**Go to step 6**

6 LAND ALT indicator . . . . . 9,000 feet

▼ Continued on next page ▼

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▼ AIRSTAIR continued ▼

7 Choose one:

- Minimum safe altitude is **at or below 9000 feet**:

  ▶▶**Go to step 8**

- Minimum safe altitude is **between 9000 feet and 13,000 feet**:

  ▶▶**Go to step 10**

- Minimum safe altitude is **at or above 13,000 feet**:

  ▶▶**Go to step 12**

8 Descend to 9000 feet.

9 Maintain a cabin differential pressure of 0 psi by limiting flight altitude to 9000 feet.

▶▶**Go to step 15**

10 Descend to the minimum safe altitude.

11 LAND ALT indicator . . . . . Select a higher altitude (maximum 13,000 feet) to maintain a cabin differential pressure of 0 psi

**Note:** The intermittent cabin altitude/configuration warning horn will sound and the CABIN ALTITUDE lights (if installed and operative) will illuminate at a cabin altitude of approximately 10,000 feet.

▶▶**Go to step 15**

12 Descend to the minimum safe altitude.

▼ Continued on next page ▼

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▼ AIRSTAIR continued ▼

13 Pressurization mode selector . . . . . MAN

14 Outflow VALVE switch . . . . . Adjust to maintain a cabin differential pressure of 0 psi

**Note:** The intermittent cabin altitude/configuration warning horn will sound and the CABIN ALTITUDE lights (if installed and operative) will illuminate at a cabin altitude of approximately 10,000 feet.

15 Plan to land at the nearest suitable airport.

16 **When** the cabin altitude is at or below 10,000 feet:

Oxygen masks may be removed.

■ ■ ■ ■

AUTO UNLK

## AUTOMATIC UNLOCK

Condition: The correct emergency access code is entered.

Objective: To deny unauthorized access to the flight deck before the door automatically unlocks.

1 FLT DK DOOR lock selector . . . . . Rotate to DENY and hold for 1 second

■ ■ ■ ■

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## CARGO DOOR

FWD CARGO | AFT CARGO

Condition: One or more cargo doors are not closed and secure.

1 Choose one:

◆Pressurization is **normal**:

Continue normal operation.

■ ■ ■ ■

◆Pressurization is **not** normal:

▶▶**Go to step 2**

2 Don oxygen masks.

3 Establish crew communications.

4 Passenger signs . . . . . .ON

5 Choose one:

◆Airplane has **not** reached the planned cruise altitude:

Do **not** continue the climb.

Reset the FLT ALT indicator to the actual airplane altitude.

▶▶**Go to step 6**

◆Airplane **has** reached the planned cruise altitude:

▶▶**Go to step 6**

6 LAND ALT indicator . . . . . .9,000 feet

▼ Continued on next page ▼

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▼ CARGO DOOR continued ▼

7 Choose one:

- Minimum safe altitude is **at or below 9000 feet**:

  ▶▶**Go to step 8**

- Minimum safe altitude is **between 9000 feet and 13,000 feet**:

  ▶▶**Go to step 10**

- Minimum safe altitude is **at or above 13,000 feet**:

  ▶▶**Go to step 12**

8 Descend to 9000 feet.

9 Maintain a cabin differential pressure of 0 psi by limiting flight altitude to 9000 feet.

▶▶**Go to step 15**

10 Descend to the minimum safe altitude.

11 LAND ALT indicator . . . . . .Select a higher altitude (maximum 13,000 feet) to maintain a cabin differential pressure of 0 psi

**Note:** The intermittent cabin altitude/configuration warning horn will sound and the CABIN ALTITUDE lights (if installed and operative) will illuminate at a cabin altitude of approximately 10,000 feet.

▶▶**Go to step 15**

12 Descend to the minimum safe altitude.

▼ Continued on next page ▼

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▼ CARGO DOOR continued ▼

13 Pressurization mode selector . . . . . MAN

14 Outflow VALVE switch . . . . . Adjust to maintain a cabin differential pressure of 0 psi

**Note:** The intermittent cabin altitude/configuration warning horn will sound and the CABIN ALTITUDE lights (if installed and operative) will illuminate at a cabin altitude of approximately 10,000 feet.

15 Plan to land at the nearest suitable airport.

16 **When** the cabin altitude is at or below 10,000 feet:

Oxygen masks may be removed.

■ ■ ■ ■

ELT

## ELT

[Option - Gables G7116-01 and Artex 453-0161]

Condition: The emergency locator transmitter is on.

Objective: To reset the ELT.

1 **If** an uncommanded ELT activation occurs:

ELT switch . . . . . ON, then ARM

■ ■ ■ ■

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NOT ARMED

## EMERGENCY EXIT LIGHTS NOT ARMED

Condition: The emergency exit lights switch is not ARMED.

1 Choose one:

◆EMER EXIT LIGHTS switch is **ON**:

Individual emergency exit light batteries supply a minimum of 10 minutes of lighting.

■ ■ ■ ■

◆EMER EXIT LIGHTS switch is **OFF**:

Emergency lighting is not available.

■ ■ ■ ■

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# ENTRY DOOR

FWD ENTRY | AFT ENTRY

Condition: One or more entry doors are not closed and secure.

1 Instruct the cabin crew to verify that the door handle is in the closed position or to move the handle to the closed position if possible.

2 Choose one:

◆Handle is in the **closed** position:

▶▶**Go to step 3**

◆Handle is **not** in the closed position:

Plan to land at the nearest suitable airport.

■ ■ ■ ■

3 Choose one:

◆Pressurization is **normal**:

Continue normal operation.

■ ■ ■ ■

◆Pressurization is **not** normal:

Plan to land at the nearest suitable airport.

■ ■ ■ ■

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EQUIP

## EQUIPMENT DOOR

Condition: The equipment door is not closed and secure.

1 Choose one:

◆Pressurization is **normal**:

Continue normal operation.

■ ■ ■ ■

◆Pressurization is **not** normal:

▶▶**Go to step 2**

2 Don oxygen masks.

3 Establish crew communications.

4 Passenger signs . . . . . ON

5 Choose one:

◆Airplane has **not** reached the planned cruise altitude:

Do **not** continue the climb.

Reset the FLT ALT indicator to the actual airplane altitude.

▶▶**Go to step 6**

◆Airplane **has** reached the planned cruise altitude:

▶▶**Go to step 6**

6 LAND ALT indicator . . . . . 9,000 feet

▼ **Continued on next page** ▼

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▼ EQUIPMENT DOOR continued ▼

7 Choose one:

- Minimum safe altitude is **at or below 9000 feet**:

  ▶▶**Go to step 8**

- Minimum safe altitude is **between 9000 feet and 13,000 feet**:

  ▶▶**Go to step 10**

- Minimum safe altitude is **at or above 13,000 feet**:

  ▶▶**Go to step 12**

8 Descend to 9000 feet.

9 Maintain a cabin differential pressure of 0 psi by limiting flight altitude to 9000 feet.

▶▶**Go to step 15**

10 Descend to the minimum safe altitude.

11 LAND ALT indicator . . . . . Select a higher altitude (maximum 13,000 feet) to maintain a cabin differential pressure of 0 psi

**Note:** The intermittent cabin altitude/configuration warning horn will sound and the CABIN ALTITUDE lights (if installed and operative) will illuminate at a cabin altitude of approximately 10,000 feet.

▶▶**Go to step 15**

12 Descend to the minimum safe altitude.

▼ Continued on next page ▼

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▼ EQUIPMENT DOOR continued ▼

13 Pressurization mode selector . . . . . MAN

14 Outflow VALVE switch . . . . . Adjust to maintain a cabin differential pressure of 0 psi

**Note:** The intermittent cabin altitude/configuration warning horn will sound and the CABIN ALTITUDE lights (if installed and operative) will illuminate at a cabin altitude of approximately 10,000 feet.

15 Plan to land at the nearest suitable airport.

16 **When** the cabin altitude is at or below 10,000 feet:

Oxygen masks may be removed.

■ ■ ■ ■

LOCK FAIL

## LOCK FAIL

Condition: One or more of these occur:
- The FLIGHT DECK ACCESS SYSTEM switch is OFF
- The lock is failed.

Objective: To remove power from the lock to prevent a possible overheat.

1 **If** conditions allow:

FLIGHT DECK ACCESS SYSTEM switch . . . OFF

**Note:** The door can be locked with the dead bolt.

■ ■ ■ ■

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# MID EXIT DOOR

[Option - Mid-Exit doors]

LEFT MID EXIT | RIGHT MID EXIT

Condition: One or more mid exit doors are not closed and secure.

1 Choose one:

◆Pressurization is **normal**:

Continue normal operation.

■ ■ ■ ■

◆Pressurization is **not** normal:

Plan to land at the nearest suitable airport.

■ ■ ■ ■

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## OVERWING DOOR

[737 - 600/700]

| LEFT OVERWING | RIGHT OVERWING |
|---|---|

Condition: One or more overwing doors are not closed and secure.

1 Choose one:

◆Pressurization is **normal**:

Continue normal operation.

■ ■ ■ ■

◆Pressurization is **not** normal:

Plan to land at the nearest suitable airport.

■ ■ ■ ■

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## OVERWING DOOR

[737 - 800/900]

LEFT FWD OVERWING | LEFT AFT OVERWING | RIGHT FWD OVERWING | RIGHT AFT OVERWING

Condition: One or more overwing doors are not closed and secure.

1 Choose one:

◆Pressurization is **normal**:

Continue normal operation.

■ ■ ■ ■

◆Pressurization is **not** normal:

Plan to land at the nearest suitable airport.

■ ■ ■ ■

PASS OXY ON

## PASSENGER OXYGEN ON

Condition: The passenger oxygen system is on.

■ ■ ■ ■

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## SERVICE DOOR

FWD SERVICE | AFT SERVICE

Condition: One or more service doors are not closed and secure.

1 Instruct the cabin crew to verify that the door handle is in the closed position or to move the handle to the closed position if possible.

2 Choose one:

◆Handle is in the **closed** position:

▶▶**Go to step 3**

◆Handle is **not** in the closed position:

Plan to land at the nearest suitable airport.

■ ■ ■ ■

3 Choose one:

◆Pressurization is **normal**:

Continue normal operation.

■ ■ ■ ■

◆Pressurization is **not** normal:

Plan to land at the nearest suitable airport.

■ ■ ■ ■

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## Window Damage

Condition: A flight deck window has one or more of these:
- An electrical arc
- A delamination
- A crack
- Is shattered.

Objective: To remove electrical power, if needed, to prevent arcing. To reduce differential pressure and descend if a structural pane is shattered or cracked.

[Option - Windows 4 and 5 installed]

[Option - Window 3 not heated]

1 **If** the damage is on Window 3 not heated:

**▶▶Go to the Window Damage (Window 3 Not Heated) checklist on page 1.20**

■ ■ ■ ■

▼ Continued on next page ▼

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▼ Window Damage continued ▼

2 Choose one:

◆Window is **delaminated** only:

Continue normal operation.

■ ■ ■ ■

◆Window is **arcing**, **cracked** or **shattered**:

▶▶**Go to step 3**

3 Don seat belts and shoulder harnesses.

4 WINDOW HEAT switch
(affected window) . . . . . OFF

Limit airspeed to 250 knots maximum below 10,000 feet.

5 Pull both WINDSHIELD AIR controls. This vents conditioned air to the inside of the windshield for defogging.

6 **If** the **cracked or shattered** condition exists on:

Window 1 or 2 **outer** pane

[Option - Windows 4 and 5 installed]
Window 4 **inner** pane

Window 5 **outer** pane

▶▶**Go to step 8**

7 **If** the **cracked or shattered** condition exists on:

Window 1 or 2 **inner** pane

▼ Continued on next page ▼

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▼ Window Damage continued ▼

[Option - Windows 4 and 5 installed]

Window 4 **middle or outer** pane

Window 5 **inner** pane

▶▶**Go to step 10**

8 Continue normal operation.

9 Shoulder harnesses may be removed.

■ ■ ■ ■

10 Don oxygen masks.

11 Establish crew communications.

12 Passenger signs . . . . . .ON

13 Choose one:

◆Airplane has **not** reached the planned cruise altitude:

Do **not** continue the climb.

Reset the FLT ALT indicator to the actual airplane altitude.

▶▶**Go to step 14**

◆Airplane **has** reached the planned cruise altitude:

▶▶**Go to step 14**

14 LAND ALT indicator . . . . . .9,000 feet

15 Start a normal descent to below 14,000 feet or to the minimum safe altitude, whichever is higher.

▼ Continued on next page ▼

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**▼ Window Damage continued ▼**

16 Plan to land at the nearest suitable airport.

17 **When** cabin differential pressure is 2 psi or less:

Oxygen masks and shoulder harnesses may be removed.

18 Sustained flight below 10,000 feet is not recommended due to the greater risk of a bird strike.

■ ■ ■ ■

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# Window Damage (Window 3 Not Heated)

[Option - Window 3 not heated]

Condition: The window 3 not heated has one or more of these:
- A delamination
- A crack
- Is shattered.

Objective: To reduce differential pressure to 0 psi if both panes are shattered or cracked.

1 Choose one:

◆Window is **delaminated** only:

Continue normal operation.

■ ■ ■ ■

◆Window is **cracked** or **shattered**:

▶▶**Go to step 2**

2 Don seat belts and shoulder harnesses.

3 Choose one:

◆Cracked or shattered condition exists on the inner **or** outer pane:

▶▶**Go to step 4**

◆Cracked or shattered condition exists on the inner **and** outer panes:

▶▶**Go to step 6**

▼ **Continued on next page** ▼

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▼ Window Damage (Window 3 Not Heated) continued ▼

4 Continue normal operation.

5 Shoulder harnesses may be removed.

■ ■ ■ ■

6 Passenger signs . . . . . ON

7 Choose one:

◆Airplane has **not** reached the planned cruise altitude:

Do **not** continue the climb.

Reset the FLT ALT indicator to the actual airplane altitude.

▶▶**Go to step 8**

◆Airplane **has** reached the planned cruise altitude:

▶▶**Go to step 8**

8 LAND ALT indicator . . . . . 9,000 feet

▼ Continued on next page ▼

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▼ Window Damage (Window 3 Not Heated) continued ▼

9 Choose one:

- Minimum safe altitude is **at or below 9,000 feet**:

  ▶▶**Go to step 10**

- Minimum safe altitude is **between 9,000 feet and 13,000 feet**:

  ▶▶**Go to step 12**

- Minimum safe altitude is **at or above 13,000 feet**:

  ▶▶**Go to step 15**

10 Descend to 9000 feet.

11 Maintain a cabin differential pressure of 0 psi by limiting flight altitude to 9000 feet.

▶▶**Go to step 20**

12 Descend to the minimum safe altitude.

13 LAND ALT indicator . . . . . Select a higher altitude (maximum 13,000 feet) to maintain a cabin differential pressure of 0 psi

**Note:** The intermittent cabin altitude/configuration warning horn will sound and the CABIN ALTITUDE lights (if installed and operative) will illuminate at a cabin altitude of approximately 10,000 feet.

14 **If** the cabin altitude is above 10,000 feet:

Don oxygen masks.

▼ Continued on next page ▼

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Establish crew communications.

**▶▶Go to step 19**

15 Descend to the minimum safe altitude.

16 Pressurization mode selector . . . . . MAN

17 Outflow VALVE switch . . . . . Adjust to maintain a cabin differential pressure of 0 psi

**Note:** The intermittent cabin altitude/configuration warning horn will sound and the CABIN ALTITUDE lights (if installed and operative) will illuminate at a cabin altitude of approximately 10,000 feet.

18 **When** the cabin altitude is above 10,000 feet:

Don oxygen masks.

Establish crew communications.

19 **When** the cabin altitude is at or below 10,000 feet:

Oxygen masks may be removed.

20 Shoulder harnesses may be removed.

■ ■ ■ ■

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## Window Open

Condition: A side window opens during takeoff or in flight.

1 Maintain the maneuvering speed for the existing flap setting until the window is closed.

2 The force needed to close the window increases with airspeed. It may not be possible to close the window at speeds above 250 knots.

3 Close and lock the window.

4 Choose one:

◆Window **locks and** the pressurization is **normal**:

Continue normal operation.

■ ■ ■ ■

◆Window does **not** lock **or** the pressurization is **not** normal:

Level off at the lowest safe altitude.

The airplane can fly unpressurized and land safely with the window open.

■ ■ ■ ■

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# CABIN ALTITUDE WARNING or Rapid Depressurization

CABIN ALTITUDE **(If installed and operative)**

Condition: One or more of these occur:
- A cabin altitude exceedance
- In flight, the intermittent cabin altitude/configuration warning horn sounds and the CABIN ALTITUDE lights (if installed and operative) illuminate.

1 Don oxygen masks and set regulators to 100%.

2 Establish crew communications.

3 Pressurization mode selector . . . . . MAN

4 Outflow VALVE switch . . . . . Hold in CLOSE until outflow VALVE indicates fully closed

5 **If** cabin altitude is **not** controllable:

Passenger signs . . . . . ON

**If** the cabin altitude exceeds or is expected to exceed 14,000 feet:

PASS OXYGEN switch . . . . . ON

▶▶**Go to the Emergency Descent checklist on page 0.1**

■ ■ ■ ■

▼ **Continued on next page** ▼

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▼ CABIN ALTITUDE WARNING or Rapid Depressurization continued ▼

6 **If** cabin altitude is **controllable**:

Continue manual operation to maintain correct cabin altitude.

**When** the cabin altitude is at or below 10,000 feet:

Oxygen masks may be removed.

■ ■ ■ ■

## AUTO FAIL or Unscheduled Pressurization Change

AUTO FAIL **May or may not be illuminated**

Condition: One or more of these occur:
- Automatic pressurization mode has failed
- The cabin altitude is not controllable.

Objective: To maintain control of cabin altitude.

1 Increasing thrust may ensure sufficient air supply to control cabin altitude.

▼ Continued on next page ▼

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▼ AUTO FAIL or Unscheduled Pressurization Change continued ▼

One at a time.

2 ⚠ Engine BLEED air switches (both) . . . Verify ON

One at a time. Allow cabin rate to stabilize before placing second switch to AUTO.

3 ⚠ PACK switches (both) . . . . . Verify AUTO

4 Choose one:

◆AUTO FAIL light is **extinguished and** cabin altitude is **controllable**:

■ ■ ■ ■

◆AUTO FAIL light is **illuminated or** cabin altitude is **not** controllable:

Pressurization mode selector. . . . . ALTN

▶▶**Go to step 5**

5 Choose one:

◆AUTO FAIL light is **extinguished and** cabin altitude is **controllable**:

Continue normal operation.

■ ■ ■ ■

◆AUTO FAIL light is **illuminated or** cabin altitude is **not** controllable:

▶▶**Go to step 6**

6 Pressurization mode selector . . . . . MAN

▼ Continued on next page ▼

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▼ AUTO FAIL or Unscheduled Pressurization Change continued ▼

7 Outflow VALVE switch . . . . . Adjust as needed to maintain correct cabin altitude and cabin rate of change

8 Choose one:

◆Cabin altitude is **controllable**:

▶▶**Go to step 13**

◆Cabin altitude is **not** controllable:

▶▶**Go to step 9**

9 Don oxygen masks and set regulators to 100%.

10 Establish crew communications.

11 Passenger signs . . . . . ON

12 **If** the cabin altitude exceeds or is expected to exceed 14,000 feet:

PASS OXYGEN switch . . . . . ON

▶▶**Go to the Emergency Descent checklist on page 0.1**

■ ■ ■ ■

13 **Checklist Complete Except Deferred Items**

## Deferred Items

**Descent Checklist**

Pressurization . . . **Adjust outflow VALVE switch as needed to maintain correct cabin altitude and cabin rate of change**

▼ Continued on next page ▼

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**▼ AUTO FAIL or Unscheduled Pressurization Change continued ▼**

Recall . . . . . Checked

Autobrake . . . . . ___

Landing data . . . . . VREF ___, Minimums ___

Approach briefing . . . . . Completed

## Approach Checklist

Altimeters . . . . . ___

## At Pattern Altitude

Outflow VALVE switch . . . . . Hold in OPEN until outflow VALVE position indicates fully open

## Landing Checklist

[Without automatic ignition]

ENGINE START switches . . . . . CONT

Speedbrake . . . . . ARMED

Landing gear . . . . . Down

Flaps . . . . . ___, Green light

■ ■ ■ ■

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BLEED TRIP OFF

## BLEED TRIP OFF

Condition: One or more of these occur:
- An engine bleed air overheat
- An engine bleed air overpressure.

1 WING ANTI-ICE switch . . . . . OFF

2 TRIP RESET switch . . . . . Push

The BLEED TRIP OFF light extinguishes if the bleed air temperature has cooled below limits.

3 Choose one:

◆BLEED TRIP OFF light **stays illuminated**:

PACK switch (affected side). . . . . OFF

This causes the operating pack to regulate to high flow in flight with flaps up.

Avoid icing conditions.

■ ■ ■ ■

◆BLEED TRIP OFF light **extinguishes**:

▶▶**Go to step 4**

4 WING ANTI-ICE switch . . . . . .As needed

**Caution! Use of wing anti-ice above approximately FL350 may cause bleed trip off and possible loss of cabin pressure.**

■ ■ ■ ■

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DUAL BLEED

## DUAL BLEED

Condition: The APU bleed valve is open and one of these occurs:
- BLEED 1 air switch is on
- BLEED 2 air switch is on and the ISOLATION VALVE is open.

Objective: To prevent possible backpressure of the APU.

1 Limit engine thrust to idle while the light is illuminated.

2 **After** engine start:

APU BLEED air switch . . . . . OFF

■ ■ ■ ■

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DUCT OVERHEAT

## DUCT OVERHEAT

[737-600/700]

Condition: A duct overheat occurs.

1 Temperature selector (affected side) . . . . . Select cooler temperature

This prevents the air mix valves from returning to an overheat condition.

2 TRIP RESET switch . . . . . Push

The DUCT OVERHEAT light extinguishes if the duct temperature has cooled below limits.

3 Monitor duct temperature.

4 **If** the duct temperature increases rapidly or the air mix valve indicator moves toward full hot:

Temperature selector . . . . . MANUAL

Adjust the air mix valve position as needed.

■ ■ ■ ■

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## OFF — EQUIPMENT COOLING OFF

Condition: The equipment cooling supply or exhaust fan is failed.

1 EQUIP COOLING SUPPLY or EXHAUST switch (affected side) . . . . . ALTN

**Note:** Illumination of the EQUIP COOLING SUPPLY or EXHAUST OFF light may be an indication of a pressurization problem. Ensure the pressurization system is operating normally.

2 No further action is necessary in flight if the equipment cooling OFF light does not extinguish.

■ ■ ■ ■

## INOP — HIGH ALTITUDE LANDING INOPERATIVE

[Option]

Condition: The high altitude landing system is inoperative.

**Note:** The intermittent cabin altitude/configuration warning horn will sound and the CABIN ALTITUDE lights (if installed and operative) will illuminate at a cabin altitude of approximately 10,000 feet.

■ ■ ■ ■

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OFF SCHED DESCENT

## OFF SCHEDULE DESCENT

Condition: A descent is started before reaching the planned cruise altitude set in the FLT ALT indicator.

1 Choose one:

◆**Landing** at airport of departure:

Continue normal operation.

■ ■ ■ ■

◆**Not** landing at airport of departure:

FLT ALT indicator . . . . . Reset to actual airplane altitude

■ ■ ■ ■

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PACK

# PACK

[737-800/900]

Condition: One or more of these occur:
- The primary and standby pack controls are failed
- A pack overheat.

1 Temperature selectors (all) . . . . . Select warmer temperature

This reduces the workload on the affected air conditioning pack.

2 TRIP RESET switch . . . . . Push

If the PACK light illuminated as a result of the pack temperature exceeding limits, the light extinguishes if the pack temperature has cooled below limits.

Continued on next page

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▼ PACK continued ▼

3 Choose one:

◆**Both** PACK lights are **extinguished**:

Continue normal operation.

■ ■ ■ ■

◆**A single** PACK light **stays illuminated**:

ISOLATION VALVE switch . . . . . CLOSE

PACK switch (affected side) . . . . . OFF

■ ■ ■ ■

◆**Both** PACK lights **stay illuminated**:

**Note:** Both pack valves may have closed resulting in a gradual loss of cabin pressure and an eventual CABIN ALTITUDE warning.

▶▶**Go to step 4**

4 Descend to the lowest safe altitude, or 10,000 feet, whichever is higher. Monitor cabin altitude and rate.

5 **When** at level off:

Maintain 290 knots minimum. Flight deck and cabin temperatures may increase rapidly at speeds below 290 knots.

▼ Continued on next page ▼

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▼ PACK continued ▼

6 Choose one:

◆Airplane altitude is **at or below 10,000 feet**:

▶▶**Go to step 7**

◆Airplane altitude is **above 10,000 feet**:

Don oxygen masks.

Establish crew communications.

▶▶**Go to step 7**

7 Pressurization mode selector . . . . . MAN

8 Outflow VALVE switch . . . . . Hold in OPEN until outflow VALVE position indicates fully open

This increases airplane ventilation.

9 R RECIRC FAN switch . . . . . AUTO

10 L RECIRC FAN switch . . . . . OFF

11 **If** flight deck and cabin temperatures are excessively warm:

Open the flight deck door. This improves flight deck ventilation.

Use flight deck window shades, as needed.

Instruct the cabin crew to:

Dim cabin lighting.

Close cabin window shades.

CAB/UTIL switch . . . . . OFF

▼ Continued on next page ▼

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▼ PACK continued ▼

IFE/PASS SEAT switch. . . . . OFF

■ ■ ■ ■

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PACK TRIP OFF

## PACK TRIP OFF

[737-600/700]

Condition: A pack overheat occurs.

1 Temperature selectors (all) . . . . . Select warmer temperature

This reduces the workload on the affected air conditioning pack.

2 TRIP RESET switch . . . . . Push

The PACK TRIP OFF light extinguishes if the pack temperature has cooled below limits.

3 Choose one:

◆**Both** PACK TRIP OFF lights are **extinguished**:

Continue normal operation.

■ ■ ■ ■

◆**A single** PACK TRIP OFF light **stays illuminated**:

Continue normal operation.

■ ■ ■ ■

◆**Both** PACK TRIP OFF lights **stay illuminated**:

**Note:** Both pack valves may have closed resulting in a gradual loss of cabin pressure and an eventual CABIN ALTITUDE warning.

▶▶**Go to step 4**

▼ **Continued on next page** ▼

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▼ PACK TRIP OFF continued ▼

4 Descend to the lowest safe altitude, or 10,000 feet, whichever is higher. Monitor cabin altitude and rate.

5 **When** at level off:

Maintain 290 knots minimum. Flight deck and cabin temperatures may increase rapidly at speeds below 290 knots.

6 Choose one:

◆Airplane altitude is **at or below 10,000 feet**:

▶▶**Go to step 7**

◆Airplane altitude is **above 10,000 feet**:

Don oxygen masks.

Establish crew communications.

▶▶**Go to step 7**

7 Pressurization mode selector . . . . . MAN

8 Outflow VALVE switch . . . . . Hold in OPEN until outflow VALVE position indicates fully open

This increases airplane ventilation.

▼ Continued on next page ▼

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▼ PACK TRIP OFF continued ▼

9 **If** flight deck and cabin temperatures are excessively warm:

Open the flight deck door. This improves flight deck ventilation.

Use flight deck window shades, as needed.

Instruct the cabin crew to:

Dim cabin lighting.

Close cabin window shades.

CAB/UTIL switch . . . . . OFF

IFE/PASS SEAT switch. . . . . OFF

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WING-BODY OVERHEAT

## WING-BODY OVERHEAT

Condition: An overheat from a bleed duct leak occurs.

Objective: To isolate the bleed duct leak.

1 ISOLATION VALVE switch. . . . . CLOSE

2 Choose one:

◆**Right** WING-BODY OVERHEAT light illuminated:

▶▶**Go to step 3**

◆**Left** WING-BODY OVERHEAT light illuminated:

▶▶**Go to step 7**

3 R PACK switch . . . . . OFF

This causes the operating pack to regulate to high flow in flight with the flaps up.

4 BLEED 2 air switch . . . . . OFF

5 WING ANTI-ICE switch . . . . . OFF

This prevents possible asymmetrical ice buildup on the wings.

6 Avoid icing conditions where wing anti-ice is needed.

■ ■ ■ ■

7 L PACK switch . . . . . OFF

This causes the operating pack to regulate to high flow in flight with the flaps up.

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▼ WING-BODY OVERHEAT continued ▼

8 BLEED 1 air switch . . . . . OFF

9 WING ANTI-ICE switch . . . . . OFF

This prevents possible asymmetrical ice buildup on the wings.

10 Avoid icing conditions where wing anti-ice is needed.

11 Choose one:

◆WING-BODY OVERHEAT light **extinguishes**:

■ ■ ■ ■

◆WING-BODY OVERHEAT light **stays illuminated**:

▶▶**Go to step 12**

12 Choose one:

◆APU is **running**:

APU BLEED air switch (if needed) . . . OFF

This stops the flow of bleed air from the APU to the left side of the pneumatic ducting.

▶▶**Go to step 13**

◆APU is **not** running:

■ ■ ■ ■

▼ Continued on next page ▼

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▼ WING-BODY OVERHEAT continued ▼

13 Choose one:

◆WING-BODY OVERHEAT light **extinguishes**:

▶▶**Go to step 15**

◆WING-BODY OVERHEAT light **stays illuminated**:

APU switch . . . . . OFF

Do **not** start the APU for the rest of the flight.

▶▶**Go to step 14**

14 Choose one:

◆WING-BODY OVERHEAT light **extinguishes**:

▶▶**Go to step 15**

◆WING-BODY OVERHEAT light **stays illuminated**:

■ ■ ■ ■

15 ISOLATION VALVE switch. . . . . AUTO

16 BLEED 1 air switch . . . . . .ON

17 L PACK switch . . . . . AUTO

18 WING ANTI-ICE switch . . . . . .As needed

▼ Continued on next page ▼

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**▼ WING-BODY OVERHEAT continued ▼**

19 Choose one:

◆WING-BODY OVERHEAT light **stays extinguished**:

■ ■ ■ ■

◆WING-BODY OVERHEAT light **illuminates again**:

▶▶**Go to step 20**

20 ISOLATION VALVE switch . . . . . CLOSE

21 BLEED 1 air switch . . . . . OFF

22 L PACK switch . . . . . OFF

23 WING ANTI-ICE switch . . . . . OFF

24 Avoid icing conditions where wing anti-ice is needed.

25 The APU can be used during the rest of the flight, if needed.

■ ■ ■ ■

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ZONE TEMP

## ZONE TEMP

[737-800/900]

Condition: One or more of these occur:
- A zone duct overheat
- Flight deck temperature control is failed.

1 Temperature selector (affected cabin) . . . . . Select a cooler temperature

This prevents the trim air modulating valve from returning to an overheat condition.

2 TRIP RESET switch . . . . . Push

The ZONE TEMP light extinguishes if the duct temperature has cooled below limits.

3 **If** duct temperature increases rapidly:

TRIM AIR switch . . . . . OFF

■ ■ ■ ■

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COWL ANTI-ICE

## ENGINE COWL ANTI-ICE

| | |
|---|---|
| Condition: | An engine cowl anti-ice duct overpressure occurs. |
| Objective: | To reduce cowl duct pressure by reducing thrust. |

1 **If** flight conditions allow:

Autothrottle (if engaged). . . . . .Disengage

Thrust lever
(affected engine) . . . . . Retard until the COWL ANTI-ICE light extinguishes

■ ■ ■ ■

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COWL VALVE OPEN

## ENGINE COWL VALVE OPEN OR TAI INDICATION

Condition: An engine COWL VALVE OPEN light stays illuminated bright blue and an amber TAI indication is shown if the cowl anti-ice valve is not in the commanded position.

1 Choose one:

◆ENG ANTI-ICE switch is **ON**:

The cowl anti-ice valve is failed closed.

Avoid icing conditions.

■ ■ ■ ■

◆ENG ANTI-ICE switch is **OFF**:

The cowl anti-ice valve is failed open.

▶▶**Go to step 2**

2 **If** TAT is **above 10°C**:

Limit thrust on the affected engine to 80% N1 if possible.

■ ■ ■ ■

ICE DETECTOR

## ICE DETECTOR

[Option]

Condition: The ice detector system is failed.

1 Run engine anti–ice system as needed.

■ ■ ■ ■

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ICING P-CANCEL

## ICING

[Option]

Condition: Ice is detected.

1 ENG ANTI–ICE switches (both). . . . . ON

■ ■ ■ ■

## PROBE HEAT

| | | | |
|---|---|---|---|
| CAPT PITOT | L ELEV PITOT | L ALPHA VANE | TEMP PROBE |
| F/O PITOT | R ELEV PITOT | R ALPHA VANE | AUX PITOT |

Condition: One or more probe heats are failed.

1 Avoid icing conditions.

**Note:** Flight in icing conditions may result in erroneous flight instrument indications.

■ ■ ■ ■

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OFF

## WINDOW HEAT OFF

[Option]

Condition: One of the following occurs:
- An overheat due to high ambient temperature
- A system failure.

1 Choose one:

◆On the **ground**:

WINDOW HEAT switches (all) . . . . . .ON

WINDOW HEAT TEST switch . . . . . .PWR

▶▶**Go to step 2**

◆**In flight**:

WINDOW HEAT switch
(affected window) . . . . . OFF

Limit airspeed to 250 knots maximum below 10,000 feet.

Pull both WINDSHIELD AIR controls. This vents conditioned air to the inside of the windshield for defogging.

■ ■ ■ ■

▼ Continued on next page ▼

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**▼ WINDOW HEAT OFF continued ▼**

2 Choose one:

◆**All** WINDOW HEAT OFF lights are **extinguished**:

Continue normal operation. Power has been removed from the window for overheat protection.

■ ■ ■ ■

◆**Any** WINDOW HEAT OFF light **stays illuminated**:

The window heat system is inoperative.

■ ■ ■ ■

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OVERHEAT

## WINDOW OVERHEAT

Condition: A window overheat occurs.

1 WINDOW HEAT switch (affected window) . . . OFF

2 **Wait** 2 - 5 minutes.

3 WINDOW HEAT switch (affected window) . . . .ON

4 Choose one:

◆Window OVERHEAT light **stays extinguished**:

Continue normal operation.

■ ■ ■ ■

◆Window OVERHEAT light **illuminates again**:

▶▶**Go to step 5**

5 WINDOW HEAT switch (affected window) . . . OFF

Limit airspeed to 250 knots maximum below 10,000 feet.

6 Pull both WINDSHIELD AIR controls. This vents conditioned air to the inside of the windshield for defogging.

■ ■ ■ ■

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## WING ANTI-ICE VALVE OPEN

L VALVE OPEN | R VALVE OPEN

Condition: A wing anti-ice L VALVE OPEN or R VALVE OPEN light stays illuminated bright blue if the wing anti-ice valve is not in the commanded position.

1 Choose one:

◆WING ANTI-ICE switch is **ON**:

The wing anti-ice valve is failed closed.

WING ANTI-ICE switch . . . . . OFF

Avoid icing conditions where wing anti-ice is needed.

■ ■ ■ ■

◆WING ANTI-ICE switch is **OFF**:

The wing anti-ice valve is failed open.

▶▶**Go to step 2**

2 **If** TAT is **above 10°C or** there is **no** visible moisture:

ISOLATION VALVE switch . . . . . CLOSE

PACK switch (affected side) . . . . . OFF

This causes the operating pack to regulate to high flow in flight with the flaps up.

Engine BLEED air switch (affected side) . . OFF

▼ **Continued on next page** ▼

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**▼ WING ANTI-ICE VALVE OPEN continued ▼**

Wing anti-ice is not available on the affected side with the ISOLATION VALVE switch closed.

■ ■ ■ ■

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## AUTOPILOT DISENGAGE

A/P
P/RST

Condition: All autopilots are disengaged. The red light flashes and the aural tone sounds.

1 Fly the airplane manually or re–engage an autopilot.

■ ■ ■ ■

## AUTOTHROTTLE DISENGAGE

A/T
P/RST

Condition: The autothrottle is disengaged. The red light flashes.

1 Control thrust manually or re–engage the autothrottle.

■ ■ ■ ■

## NO AUTOLAND

Condition: Autoland is not available.

■ ■ ■ ■

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NO LAND 3

# NO LAND 3

Condition: The autoland system does not have the redundancy needed for LAND 3 operations.

■ ■ ■ ■

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## ACARS Electrical Power Loss

[Option - ACARS]

Condition: ACARS AC power is lost.

**Note:** The ACARS automatically reverts to VOX MODE. The DATA MODE is inoperative.

■ ■ ■ ■

## ACARS MU Fail or DU Fail

[Option - ACARS]

Condition: The ACARS system is failed.

1 Use normal voice procedures for reporting.

■ ■ ■ ■

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## Radio Transmit Continuous (Stuck Microphone Switch)

Condition: A radio transmits continuously without crew input.

1 MIC SELECTOR switches
(all audio selector panels) . . . . . .FLT INT

This deselects radios and stops radio transmissions.

**Note:** The microphone/interphone with the stuck switch continuously transmits on flight interphone.

2 The associated audio selector panel should stay on flight interphone. All other audio selector panels may be used normally.

■ ■ ■ ■

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BAT DISCHARGE

## BATTERY DISCHARGE

Condition: A battery discharge exceedance occurs.

[Option - Single battery]

**Note:** A fully charged battery supplies a minimum of 30 minutes of standby power.

[Option - Dual battery]

**Note:** Fully charged batteries supply a minimum of 60 minutes of standby power.

■ ■ ■ ■

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DRIVE

## DRIVE

Condition: A generator drive malfunction occurs.

Action is not reversible.

1 Generator drive DISCONNECT switch (affected side) . . . . . Confirm . . . . Hold in the DISCONNECT position momentarily

This prevents generator drive damage.

2 Choose one:

◆APU is **available** for start:

APU . . . . . START

**When** APU is running:

APU GEN switch (affected side) . . . . . ON

■ ■ ■ ■

◆APU is **not** available:

Plan to land at the nearest suitable airport.
Only one main AC power source remains.

■ ■ ■ ■

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ELEC

## ELEC

Condition: A standby power or DC system fault occurs.

**Note:** The ELEC light illuminates on the ground only.

■ ■ ■ ■

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# LOSS OF BOTH ENGINE DRIVEN GENERATORS

| GEN 1 & 2 | GEN 1 & 2 | GEN 1 & 2 |
|---|---|---|
| TRANSFER BUS OFF | SOURCE OFF | GEN OFF BUS |

Condition: Both engine driven generators are off.

**Note:** At high altitude, thrust deterioration or engine flameout may occur.

1 Engine GEN switches (both) . . . ON, one at a time

2 Choose one:

◆**A single** SOURCE OFF light **stays illuminated**:

▶▶**Go to step 3**

◆**Both** SOURCE OFF lights **stay illuminated**:

▶▶**Go to step 5**

◆**Both** SOURCE OFF lights **extinguish**:

YAW DAMPER switch . . . . . .ON

▶▶**Go to step 15**

## A single SOURCE OFF light stays illuminated

3 YAW DAMPER switch . . . . . .ON

▼ Continued on next page ▼

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▼ LOSS OF BOTH ENGINE DRIVEN GENERATORS continued ▼

4 Choose one:

◆APU is **available** for start:

**Note:** APU start attempts are not recommended above 25,000 feet.

APU . . . . . START

**When** APU is running:

APU GEN switch
(affected side) . . . . . ON

▶▶**Go to step 15**

◆APU is **not** available:

Plan to land at the nearest suitable airport.
Only one main AC power source remains.

▶▶**Go to step 15**

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## Both SOURCE OFF lights stay illuminated

5 Choose one:

◆APU is **available** for start:

BUS TRANSFER switch . . . . . OFF

ELEC HYD PUMP switches (both) . . . . OFF

**Note:** APU start attempts are not recommended above 25,000 feet. With both buses off, only one start attempt is recommended. Multiple start attempts reduce standby power capacity.

APU . . . . . START

▶▶**Go to step 6**

◆APU is **not** available:

▶▶**Go to step 12**

6 **When** APU is running:

APU GEN
switches (both) . . . . . ON, one at a time

[Option - Dual battery]

7 **If** REMOTE CONTROL circuit breaker (RCCB REMOTE) (STBY power control unit, P6-5:A4) is tripped:

Reset circuit breaker.

▼ Continued on next page ▼

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▼ LOSS OF BOTH ENGINE DRIVEN GENERATORS continued ▼

8 Choose one:

◆**A single or both** SOURCE OFF lights **extinguish**:

▶▶**Go to step 9**

◆**Both** SOURCE OFF lights **stay illuminated**:

▶▶**Go to step 12**

9 BUS TRANSFER switch . . . . . AUTO

This restores power to the remaining transfer bus if one BUS OFF light stays illuminated.

10 ELEC HYD PUMP switches (both) . . . . . ON, one at a time

11 YAW DAMPER switch . . . . . ON

▶▶**Go to step 15**

## Both SOURCE OFF lights stay illuminated

12 Avoid icing conditions.

**Note:** Flight in icing conditions may result in erroneous flight instrument indications.

13 Plan to land at the nearest suitable airport.

▼ Continued on next page ▼

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▼ LOSS OF BOTH ENGINE DRIVEN GENERATORS continued ▼

[Option - Single battery]

**Note:** A fully charged battery supplies a minimum of 30 minutes of standby power.

[Option - Dual battery]

**Note:** Fully charged batteries supply a minimum of 60 minutes of standby power.

14 The right IRS will operate on DC power for 5 minutes.

▼ Continued on next page ▼

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▼ LOSS OF BOTH ENGINE DRIVEN GENERATORS continued ▼

15 Choose one:

◆**Both** the captain's and first officer's primary attitude displays are **operative and** ATT flags are **not** shown:

■ ■ ■ ■

◆**Both** the captain's and first officer's primary attitude displays are **failed**:

▶▶**Go to step 16**

◆**Only** the **first officer's** primary attitude display is **failed**:

IRS TRANSFER switch . . . . . BOTH ON L

Do **not** use either autopilot.

**If** both SOURCE OFF lights **stay illuminated**:

The left IRS will operate as long as battery power remains.

Plan to land at the nearest suitable airport.

■ ■ ■ ■

▼ Continued on next page ▼

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▼ LOSS OF BOTH ENGINE DRIVEN GENERATORS continued ▼

Action is not reversible. Do this step only if **both** the captain's and first officer's primary attitude displays are **failed**.

16 ⚠ IRS MODE selectors (both). . . . . ATT

Maintain straight and level, constant airspeed flight until attitude displays recover (approximately 30 seconds).

**Note:** The primary attitude displays will stay failed and the SET IRS HDG prompt will not appear on the POS INIT page until the attitude mode alignment is complete.

17 Enter magnetic heading on the POS INIT page or on the overhead IRS display unit by selecting HDG/STS.

18 The MAP display is not available.

19 Enter updated heading periodically on the POS INIT page or on the overhead IRS display unit by selecting HDG/STS.

20 Do **not** use either autopilot.

■ ■ ■ ■

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SOURCE OFF

## SOURCE OFF

Condition: The transfer bus is not powered by the last selected source.

1 **If both** SOURCE OFF lights are illuminated:

▶▶**Go to the LOSS OF BOTH ENGINE DRIVEN GENERATORS checklist on page 6.4**

■ ■ ■ ■

2 Engine GEN switch (affected side) . . . . . ON

3 Choose one:

◆SOURCE OFF light **extinguishes**:

■ ■ ■ ■

◆SOURCE OFF light **stays illuminated**:

▶▶**Go to step 4**

▼ Continued on next page ▼

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▼ SOURCE OFF continued ▼

4 Choose one:

◆APU is **available** for start:

APU . . . . . START

**When** APU is running:

APU GEN switch
(affected side) . . . . . ON

▶▶**Go to step 5**

◆APU is **not** available:

Plan to land at the nearest suitable airport.
Only one main AC power source remains.

■ ■ ■ ■

5 Choose one:

◆SOURCE OFF light **extinguishes**:

■ ■ ■ ■

◆SOURCE OFF light **stays illuminated**:

Plan to land at the nearest suitable airport.
Only one main AC power source remains.

■ ■ ■ ■

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## STANDBY PWR OFF — STANDBY POWER OFF

Condition: One or more of these buses are not energized:
- AC standby bus
- DC standby bus
- Battery bus.

1 STANDBY POWER switch . . . . . BAT

■ ■ ■ ■

## TR UNIT — TR UNIT

Condition: One or more transformer rectifiers are failed.

[Airplanes with IAN]

1 Do not use the AFDS approach mode during an ILS approach.

[Airplanes without IAN]

2 Do not use the AFDS approach mode.

**Note:** Autoland is not available.

■ ■ ■ ■

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TRANSFER BUS OFF

## TRANSFER BUS OFF

Condition: The transfer bus is not energized.

1 Engine GEN switch (affected side) . . . . . ON

2 Choose one:

◆TRANSFER BUS OFF light **extinguishes**:

■ ■ ■ ■

◆TRANSFER BUS OFF light **stays illuminated**:

▶▶**Go to step 3**

3 Choose one:

◆APU is **available** for start:

APU . . . . . START

**When** APU is running:

APU GEN switch
(affected side) . . . . . ON

■ ■ ■ ■

◆APU is **not** available:

Plan to land at the nearest suitable airport.
Only one main AC power source remains.

■ ■ ■ ■

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## Aborted Engine Start

[Without Automatic Ignition]

Condition: During a ground start, an abort engine start condition occurs.

Objective: To shut down the engine and motor it.

1 Engine start lever (affected engine) . . . . CUTOFF

2 Choose one:

◆ENGINE START switch is in **GRD**:

Motor the engine for 60 seconds.

ENGINE START switch
(affected engine) . . . . . OFF

■ ■ ■ ■

◆ENGINE START switch is in **OFF**:

▶▶**Go to step 3**

3 **After** N2 decreases below 20%:

ENGINE START switch
(affected engine) . . . . . GRD

Motor the engine for 60 seconds.

ENGINE START switch
(affected engine) . . . . . OFF

■ ■ ■ ■

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## Aborted Engine Start

[With Automatic Ignition]

Condition: During a ground start, an abort engine start condition occurs.

Objective: To shut down the engine and motor it.

1 Engine start lever (affected engine) . . . . CUTOFF

2 Choose one:

◆ENGINE START switch is in **GRD**:

Motor the engine for 60 seconds.

ENGINE START switch
(affected engine) . . . . . AUTO

■ ■ ■ ■

◆ENGINE START switch is in **AUTO**:

▶▶**Go to step 3**

3 **After** N2 decreases below 20%:

ENGINE START switch
(affected engine) . . . . . .GRD

Motor the engine for 60 seconds.

ENGINE START switch
(affected engine) . . . . . AUTO

■ ■ ■ ■

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## Engine Limit or Surge or Stall

Condition: One or more of these occur:
- Engine indications are unusual
- Engine indications are rapidly approaching or exceeding limits
- Unusual engine noises are heard
- There is no response to thrust lever movement.

Objective: To attempt to recover normal engine operation or shut down the engine if recovery is not possible.

1 Autothrottle (if engaged). . . . . .Disengage

2 Thrust lever
(affected engine) . . . . Confirm. . . . .Retard until indications stay within limits or the thrust lever is closed

- - - - - - - - - - - - - - - - - - - - - - - -

3 Choose one:

◆Engine indications are **stabilized** and EGT **decreases**:

▶▶**Go to step 4**

◆Engine indications are **not** normal or EGT continues to **increase**:

▶▶**Go to step 5**

▼ Continued on next page ▼

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▼ Engine Limit or Surge or Stall continued ▼

4 Thrust lever
(affected engine) . . . . . Advance slowly while checking RPM and EGT follow thrust lever movement

Run the engine normally or at a reduced thrust setting which is surge and stall free.

■ ■ ■ ■

5 Engine start lever
(affected engine) . . . . Confirm. . . . . CUTOFF

6 PACK switch (affected side) . . . . . OFF

This causes the operating pack to regulate to high flow in flight with flaps up.

7 Choose one:

◆APU is **available** for start:

APU . . . . . START

**When** APU is running:

APU GEN switch
(affected side) . . . . . .ON

▶▶**Go to step 8**

◆APU is **not** available:

▶▶**Go to step 8**

8 Balance fuel as needed.

▼ Continued on next page ▼

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**▼ Engine Limit or Surge or Stall continued ▼**

9 Transponder mode selector . . . . . TA ONLY

This prevents climb commands which can exceed single engine performance capability.

10 **If** wing anti-ice is needed:

ISOLATION VALVE switch . . . . . AUTO

11 Plan to land at the nearest suitable airport.

12 A restart may be attempted if there is N1 rotation and no abnormal airframe vibration.

[Airplanes without Fail Operational Autoland Capability]

▶▶**Go to the One Engine Inoperative Landing checklist on page 7.26**

[Airplanes with Fail Operational Autoland Capability]

▶▶**Go to the One Engine Inoperative Landing checklist on page 7.29**

■ ■ ■ ■

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## Loss Of Thrust On Both Engines

Condition: Both of these occur:
- Both engines have a loss of thrust
- Both ENG FAIL alerts show.

Objective: To restart at least one engine.

1 ENGINE START switches (both) . . . . . FLT

2 Engine start levers (both) . . . . . CUTOFF

3 **When** EGT decreases:

Engine start levers (both) . . . . . IDLE detent

4 **If** EGT reaches 950°C or there is no increase in EGT within 30 seconds:

Engine start lever
(affected engine) . . . . Confirm . . . . . CUTOFF, then IDLE detent

**If** EGT again reaches 950°C or there is no increase in EGT within 30 seconds, repeat as needed.

**Note:** Engines may accelerate to idle very slowly, especially at high altitudes or in heavy precipitation. If N2 is steadily increasing and EGT stays within limits, do not interrupt the start.

5 At or above FL270, set airspeed to 275 knots. Below FL270, set airspeed to 300 knots.

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▼ Loss Of Thrust On Both Engines continued ▼

6 Choose one:

◆APU is **available** for start:

▶▶**Go to step 7**

◆APU is **not** available:

▶▶**Go to step 9**

Do **not** wait for successful engine start(s) before starting the APU.

7 ⚠ APU . . . . . START

8 **When** APU is running:

APU GEN switches
(both). . . . . ON, one at a time

9 Choose one:

◆**One or both** engines **start**:

▶▶**Go to step 13**

◆**Neither** engine starts:

▶▶**Go to step 10**

▼ Continued on next page ▼

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▼ Loss Of Thrust On Both Engines continued ▼

10 Choose one:

◆**N2** is **above 11%**:

Attempt a windmill start.

▶▶**Go to step 11**

◆**N2** is **at or below 11%**:

Attempt a starter assisted start.

▶▶**Go to step 14**

11 Thrust levers (both) . . . . . Close

12 Engine start lever (**either**) . . . . . Confirm. . . . . CUTOFF, then IDLE detent

**Note:** The engine may accelerate to idle very slowly. If N2 is steadily increasing and EGT stays within limits, do not interrupt the start.

13 **When** engine parameters have stabilized:

ENGINE START switch (operating engine) . . . . . .As needed

Thrust lever (operating engine) . . . . . Advance slowly

Engine GEN switch (operating engine side) . . . . . .ON

**Note:** The Engine In-Flight Start checklist will be used to start the other engine, if needed.

▶▶**Go to step 23**

14 Thrust levers (both) . . . . . Close

▼ Continued on next page ▼

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▼ Loss Of Thrust On Both Engines continued ▼

15 WING ANTI–ICE switch . . . . . OFF

16 PACK switches (both) . . . . . OFF

17 APU BLEED air switch . . . . . ON

18 Ignition select switch . . . . . BOTH

19 Engine start
lever (**either**) . . . . . Confirm. . . . . CUTOFF

20 ENGINE START switch . . . . . GRD

21 **When** N2 is at or above 11%:

Engine start lever. . . . . .IDLE detent

**Note:** The engine may accelerate to idle very slowly. If N2 is steadily increasing and EGT stays within limits, do not interrupt the start.

22 **When** engine parameters have stabilized:

APU BLEED air switch . . . . . OFF

ENGINE START switch
(operating engine) . . . . . .As needed

Thrust lever
(operating engine) . . . . . Advance slowly

Engine GEN switch
(operating engine side). . . . . ON

PACK switch
(operating engine side). . . . . AUTO

**Note:** The Engine In-Flight Start checklist will be used to start the other engine, if needed.

▼ Continued on next page ▼

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▼ Loss Of Thrust On Both Engines continued ▼

23 Choose one:

◆**Both** the captain's and first officer's primary attitude displays are **operative and** ATT flags are **not** shown:

▶▶**Go to step 29**

◆**Both** the captain's and first officer's primary attitude displays are **failed**:

▶▶**Go to step 24**

◆**Only** the **first officer's** primary attitude display is **failed**:

IRS TRANSFER switch. . . . . BOTH ON L

Do **not** use either autopilot.

▶▶**Go to step 29**

Action is not reversible. Do this step only if **both** the captain's and first officer's primary attitude displays are **failed**.

24 ⚠ IRS MODE selectors (both). . . . . ATT

Maintain straight and level, constant airspeed flight until attitude displays recover (approximately 30 seconds).

**Note:** The primary attitude displays will stay failed and the SET IRS HDG prompt will not appear on the POS INIT page until the attitude mode alignment is complete.

▼ Continued on next page ▼

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▼ Loss Of Thrust On Both Engines continued ▼

25 Enter magnetic heading on the POS INIT page or on the overhead IRS display unit by selecting HDG/STS.

26 The MAP display is not available.

27 Enter updated heading periodically on the POS INIT page or on the overhead IRS display unit by selecting HDG/STS.

28 Do **not** use either autopilot.

29 Choose one:

◆**Both** engines are **running**:

Run the APU as needed.

■ ■ ■ ■

◆**One** engine stays **failed**:

▶▶**Go to the Engine In-Flight Start checklist on page 7.18**

■ ■ ■ ■

## FAULT — APU FAULT

Condition: An APU malfunction occurs.

**Note:** The APU shuts down automatically.

1 APU switch . . . . . OFF

If the APU FAULT light extinguishes after 5 minutes, restarts may be attempted.

■ ■ ■ ■

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LOW OIL PRESSURE

## APU LOW OIL PRESSURE

Condition: The APU oil pressure is low.

**Note:** The APU shuts down automatically.

1 APU switch. . . . . OFF

The LOW OIL PRESSURE light extinguishes in 5 minutes.

■ ■ ■ ■

OVER SPEED

## APU OVERSPEED

Condition: One of these occurs:

- An APU RPM limit exceedance causes automatic shutdown
- During a normal APU shutdown the overspeed shutdown protection logic fails a self-test.

1 APU switch. . . . . OFF

The APU OVERSPEED light extinguishes in 5 minutes.

■ ■ ■ ■

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## ALTN EEC ALTERNATE MODE

Condition: An EEC operates in the alternate control mode.

1 Autothrottle (if engaged). . . . . .Disengage

2 Thrust levers (both) . . . . . Retard to mid position

This prevents exceeding thrust limits when switching to the EEC alternate mode.

3 EEC mode switches (one at a time) . . . . . ALTN

This ensures both engines operate in alternate mode.

4 Autothrottle (if needed) . . . . . .Engage

**Note:** Maximum thrust limiting is available with autothrottle engaged.

5 Do not exceed engine limits. Engine limit protection in alternate mode is not the same as in normal mode.

6 **If** the **DSPLY SOURCE** annunciation is shown and the DISPLAY SOURCE checklist has not been completed:

▶▶**Go to the DISPLAY SOURCE checklist on page 10.6**

■ ■ ■ ■

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ENGINE CONTROL

## ENGINE CONTROL

Condition: An engine control system fault occurs.

**Note:** An ENGINE CONTROL light illuminates on the ground only.

1 Do **not** takeoff.

■ ■ ■ ■

## Engine Failure or Shutdown

Condition: One of these occurs:
- An engine failure
- An ENG FAIL alert shows
- An engine flameout
- Another checklist directs an engine shutdown.

1 Do an engine shutdown only when flight conditions allow.

2 Autothrottle (if engaged) . . . . . .Disengage

3 Thrust lever
(affected engine) . . . . . Confirm . . . . . Close

4 **If** conditions allow:

Run the engine for three minutes at idle thrust.

5 Engine start lever
(affected engine) . . . . . Confirm . . . . . CUTOFF

6 PACK switch (affected side) . . . . . OFF

This causes the operating pack to regulate to high flow in flight with flaps up.

▼ Continued on next page ▼

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**▼ Engine Failure or Shutdown continued ▼**

7 Choose one:

◆APU is **available** for start:

APU . . . . . START

**When** APU is running:

APU GEN switch
(affected side) . . . . . ON

▶▶**Go to step 8**

◆APU is **not** available:

▶▶**Go to step 8**

8 Balance fuel as needed.

9 Transponder mode selector . . . . . TA ONLY

This prevents climb commands which can exceed single engine performance capability.

10 **If** wing anti–ice is needed:

ISOLATION VALVE switch . . . . . AUTO

11 Plan to land at the nearest suitable airport.

[Airplanes without Fail Operational Autoland Capability]

▶▶**Go to the One Engine Inoperative Landing checklist on page 7.26**

[Airplanes with Fail Operational Autoland Capability]

▶▶**Go to the One Engine Inoperative Landing checklist on page 7.29**

■ ■ ■ ■

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## Engine High Oil Temperature

Condition: The engine oil temperature is high.

1 Choose one:

◆Temperature is **at or above** the **redline**:

▶▶**Go to the Engine Failure or Shutdown checklist on page 7.14**

■ ■ ■ ■

◆Temperature is in the **amber band**:

▶▶**Go to step 2**

2 Autothrottle (if engaged) . . . . . .Disengage

3 Thrust lever
(affected engine) . . . . Confirm . . . Retard slowly until engine oil temperature is within normal operating range or thrust lever is closed

4 **If** temperature is in the **amber band** for more than **45 minutes**:

▶▶**Go to the Engine Failure or Shutdown checklist on page 7.14**

■ ■ ■ ■

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## Engine In-Flight Start

Condition: An engine start is needed after a shutdown and there is:
- N1 rotation
- No fire
- No abnormal airframe vibration.

**Note:** Oil quantity indication as low as zero is normal if windmilling N2 RPM is below approximately 8%.

1 Do this checklist **only** after completion of the Engine Failure or Shutdown checklist or as directed by the Loss of Thrust on Both Engines checklist.

2 Check the In-Flight Start Envelope. Starts are not assured outside of the in-flight start envelope.

**Note:** For engines shut down more than one hour, a crossbleed start is needed.

Continued on next page

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▼ Engine In-Flight Start continued ▼

3 Thrust lever
(affected engine) . . . . Confirm. . . . . Close

4 Engine start lever
(affected engine) . . . . Confirm. . . . . CUTOFF

**Note:** Engines may accelerate to idle very slowly, especially at high altitudes. Slow acceleration may be incorrectly interpreted as a hung start or an engine malfunction. If N2 is steadily increasing, and EGT stays within limits, the start is progressing normally.

5 Choose one:

◆**Windmill** start:

ENGINE START switch
(affected engine) . . . . . .FLT

▶▶**Go to step 6**

◆**Crossbleed** start:

PACK switch (affected side) . . . . . OFF

DUCT PRESSURE . . . . . Minimum 30 PSI

Advance the thrust lever to increase duct pressure if needed.

ENGINE START switch
(affected engine) . . . . . .GRD

▶▶**Go to step 6**

▼ Continued on next page ▼

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▼ Engine In-Flight Start continued ▼

6 **When** N2 is at or above 11%:

Engine start lever
(affected engine) . . . . . IDLE detent

Monitor EGT to ensure it does not rise rapidly or exceed the start limit of 725° C during the start attempt.

7 **If** EGT does not increase in 30 seconds or another abort start condition as listed in the Normal Procedures occurs:

Engine start lever
(affected engine) . . . . Confirm . . . . . CUTOFF

[Without automatic ignition]
ENGINE START switch
(affected engine) . . . . . OFF

[With automatic ignition]
ENGINE START switch
(affected engine) . . . . . AUTO

**Note:** If engine has been shutdown for more than 1 hour, multiple start attempts may be needed.

▼ Continued on next page ▼

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**▼ Engine In-Flight Start continued ▼**

8 Choose one:

◆Engine **starts** and runs normally:

▶▶**Go to step 9**

◆Engine **fails** to start:

[Airplanes without Fail Operational Autoland Capability]

▶▶**Go to the One Engine Inoperative Landing checklist on page 7.26**

■ ■ ■ ■

[Airplanes with Fail Operational Autoland Capability]

▶▶**Go to the One Engine Inoperative Landing checklist on page 7.29**

■ ■ ■ ■

9 Engine GEN switch (affected side) . . . . . ON

10 PACK switch (affected side) . . . . . AUTO

11 ENGINE START switch . . . . . As needed

12 APU . . . . . As needed

13 Transponder mode selector . . . . . TA/RA

■ ■ ■ ■

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## ENGINE LOW OIL PRESSURE

Condition: The engine oil pressure is low. The LOW OIL PRESSURE alert may or may not be illuminated.

1 Choose one:

◆Engine oil pressure is in the **amber band** with **takeoff thrust** set:

Do **not** takeoff.

■ ■ ■ ■

◆Engine oil pressure is **at or below** the **redline**:

▶▶**Go to the Engine Failure or Shutdown checklist on page 7.14**

■ ■ ■ ■

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## ENGINE OIL FILTER BYPASS

Condition: The OIL FILTER BYPASS alert indicates oil filter contamination can cause oil to bypass the oil filter.

1 Autothrottle (if engaged). . . . . .Disengage

2 Thrust lever
(affected engine) . . . Confirm . . . Retard until the OIL FILTER BYPASS alert extinguishes or the thrust lever is closed

3 Choose one:

◆OIL FILTER BYPASS alert **extinguishes**:

Run the engine at reduced thrust to keep the alert extinguished.

■ ■ ■ ■

◆OIL FILTER BYPASS alert **stays illuminated**:

▶▶**Go to the Engine Failure or Shutdown checklist on page 7.14**

■ ■ ■ ■

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## High Engine Vibration

Condition: Both of these occur:
- The vibration level is more than 4.0 units
- Airframe vibrations.

1 Choose one:

◆In **icing** conditions:

▶▶**Go to step 2**

◆**Not** in icing conditions:

▶▶**Go to step 4**

2 **If** in moderate to severe icing conditions during descent or holding, do the following on one engine at a time at approximately 15 minute intervals:

ENGINE START switch (affected engine) . . . . . FLT

Thrust (affected engine) . . . Adjust to 45% N1 for five seconds, then advance slowly to a minimum of 80% N1 for 1 second

3 Choose one:

◆Vibration **decreases**:

Continue normal operation.

■ ■ ■ ■

◆Vibration does **not** decrease:

▶▶**Go to step 4**

▼ Continued on next page ▼

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**▼ High Engine Vibration continued ▼**

4 Autothrottle (if engaged). . . . . .Disengage

5 Thrust lever
(affected engine) . . . . Confirm. . . . . Retard to maintain vibration levels below 4 units

**Note:** If the VIB indication does not decrease when the thrust lever is retarded, check other engine indications. If other engine indications are normal, no further action is needed.

■ ■ ■ ■

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## One Engine Inoperative Landing

Condition: Landing must be made with one engine inoperative.

### Airplanes without Fail Operational Autoland Capability

1 Plan a flaps 15 landing.

2 Set VREF 15 or VREF ICE.

**If** any of the following conditions apply, set VREF ICE = VREF 15 + 10 knots:

Engine anti–ice will be used during landing

Wing anti–ice has been used any time during the flight

Icing conditions were encountered during the flight and the landing temperature is below 10° C.

**Note:** When VREF ICE is needed, the wind additive should not exceed 10 knots.

3 Maintain VREF 15 + 5 knots or VREF ICE + 5 knots minimum on final approach to assure sufficient maneuver margin and speed for go-around.

4 Use engine anti-ice on the operating engine only.

5 **Checklist Complete Except Deferred Items**

### Deferred Items

**Descent Checklist**

Pressurization . . . . . LAND ALT ____

Recall . . . . . Checked

▼ Continued on next page ▼

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▼ One Engine Inoperative Landing continued ▼

Autobrake . . . . . ____

Landing data . . . . . **VREF 15 or VREF ICE, Minimums ____**

Approach briefing . . . . . Completed

## If additional go-around thrust is needed:

Configure the pressurization system for a no engine bleed landing when below 10,000 feet.

WING ANTI-ICE switch . . . . . OFF

ISOLATION VALVE switch . . . . . CLOSE

BLEED 1 air switch . . . . . OFF

Do not open the APU bleed air valve if the engine fire switch is illuminated.

APU BLEED air switch . . . . . ON

Left PACK switch . . . . . AUTO

BLEED 2 air switch . . . . . OFF

## Go-around Procedure Review

Do the normal go–around procedure except:

Use flaps 1.

Maintain VREF 15 + 5 knots or VREF ICE + 5 knots until reaching flap retraction altitude.

▼ Continued on next page ▼

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▼ One Engine Inoperative Landing continued ▼

Limit bank angle to 15° when airspeed is less than VREF 15 + 15 knots or VREF ICE + 5 knots or the minimum maneuver speed, whichever is lower.

Accelerate to flaps 1 maneuvering speed before flap retraction.

## Approach Checklist

Altimeters . . . . . ____

## Additional Deferred Item

GROUND PROXIMITY FLAP
INHIBIT switch . . . . . FLAP INHIBIT

## Landing Checklist

[Without automatic ignition]
**ENGINE START switch**
**(operating engine)** . . . . . CONT

Speedbrake . . . . . ARMED

Landing gear . . . . . Down

Flaps . . . . . **15, Green light**

■ ■ ■ ■

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## One Engine Inoperative Landing

Condition: Landing must be made with one engine inoperative.

**Airplanes with Fail Operational Autoland Capability**

1 Choose one:

◆Landing using **flaps 30** (if performance allows):

Use flaps 30 and VREF 30 for landing and flaps 15 for go-around.

▶▶**Go to step 4**

◆Landing using **flaps 15**:

▶▶**Go to step 2**

2 Use flaps 15 and VREF 15 or VREF ICE for landing and flaps 1 for go-around.

**If** any of the following conditions apply, set VREF ICE = VREF 15 + 10 knots:

Engine anti–ice will be used during landing

Wing anti–ice has been used any time during the flight

Icing conditions were encountered during the flight and the landing temperature is below 10° C.

**Note:** When VREF ICE is needed, the wind additive should not exceed 10 knots.

▼ Continued on next page ▼

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▼ One Engine Inoperative Landing continued ▼

3 Maintain VREF 15 + 5 knots or VREF ICE + 5 knots minimum on final approach to assure sufficient maneuver margin and speed for go-around.

**Note:** Autoland operations are not authorized when landing with flaps 15.

4 Use engine anti-ice on the operating engine only.

5 **Checklist Complete Except Deferred Items**

## Deferred Items

### Descent Checklist

Pressurization . . . . . LAND ALT ___

Recall . . . . . Checked

Autobrake . . . . . ___

Landing data **. . . . . .VREF ___ as directed by checklist, Minimums ___**

Approach briefing . . . . . Completed

**Note:** Check authorized autoland weather minima.

### If additional go-around thrust is needed:

Configure the pressurization system for a no engine bleed landing when below 10,000 feet.

WING ANTI-ICE switch . . . . . OFF

ISOLATION VALVE switch . . . . . CLOSE

BLEED 1 air switch . . . . . OFF

▼ Continued on next page ▼

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▼ One Engine Inoperative Landing continued ▼

Do not open the APU bleed air valve if the engine fire switch is illuminated.

APU BLEED air switch . . . . . ON

Left PACK switch . . . . . AUTO

BLEED 2 air switch . . . . . OFF

## Go-around Procedure Review

Do the normal go-around procedure except:

▼ Continued on next page ▼

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▼ One Engine Inoperative Landing continued ▼

Choose one:

◆Landing using **flaps 30**:

Use flaps 15.

Maintain VREF 30 + 5 knots and limit bank angle to 15° until initial maneuvering is complete and a safe altitude is reached.

▶▶**Go to Approach Checklist below**

◆Landing using **flaps 15**:

Use flaps 1.

Maintain VREF 15 + 5 knots or VREF ICE + 5 knots until reaching flap retraction altitude.

Limit bank angle to 15° when airspeed is less than VREF 15 + 15 knots or VREF ICE + 5 knots or the minimum maneuver speed, whichever is lower.

Accelerate to flaps 1 maneuvering speed before flap retraction.

▶▶**Go to Approach Checklist below**

## Approach Checklist

Altimeters . . . . . ____

▼ Continued on next page ▼

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▼ One Engine Inoperative Landing continued ▼

## Additional Deferred Item

Choose one:

◆Landing using **flaps 30**:

▶▶**Go to Landing Checklist below**

◆Landing using **flaps 15**:

GROUND PROXIMITY FLAP
INHIBIT switch . . . . . FLAP INHIBIT

▶▶**Go to Landing Checklist below**

## Landing Checklist

[Without automatic ignition]

**ENGINE START switch**
**(operating engine)**. . . . . CONT

Speedbrake . . . . . ARMED

Landing gear . . . . . Down

Flaps. . . . . ____, **Green light**

■ ■ ■ ■

REVERSER **REVERSER**

Condition: A fault occurs in the thrust reverser system.

**Note:** Additional system failures may cause in-flight deployment.

1 Expect normal reverser operation after landing.

■ ■ ■ ■

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## REVERSER UNLOCKED (IN FLIGHT)

Condition: The amber REV indication shows with uncommanded reverse thrust.

**Note:** Only multiple failures could allow the engine to go into reverse thrust.

Unstowed reverser sleeves produce buffet, yaw, roll and increased airplane drag.

1 Check movement of the forward thrust lever on the affected engine.

The EECs prevent power above idle if the related thrust reverser has moved from the stowed position.

**Warning! Do not actuate the reverse thrust lever.**

2 Choose one:

◆Engine **responds** to forward thrust lever movement **and no** buffet or yaw exists:

Continue normal operation.

■ ■ ■ ■

◆Engine does **not** respond to forward thrust lever movement **or** buffet or yaw **exists**:

▶▶**Go to the Engine Failure or Shutdown checklist on page 7.14**

■ ■ ■ ■

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## START VALVE OPEN

Condition: The START VALVE OPEN alert indicates the start valve fails to close.

[Without automatic ignition]

1 ENGINE START switch . . . . . OFF

[With automatic ignition]

2 ENGINE START switch . . . . . AUTO

3 Choose one:

◆START VALVE OPEN alert **extinguishes**:

■ ■ ■ ■

◆START VALVE OPEN alert **stays illuminated**:

▶▶**Go to step 4**

4 ISOLATION VALVE switch. . . . . CLOSE

5 PACK switch (affected side) . . . . . OFF

This causes the operating pack to regulate to high flow in flight with flaps up.

6 Engine BLEED air switch (affected side) . . . . . OFF

▼ Continued on next page ▼

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**START VALVE OPEN continued**

7 Choose one:

◆START VALVE OPEN alert stays illuminated for **engine 1**:

APU BLEED air switch . . . . . OFF

▶▶**Go to step 8**

◆START VALVE OPEN alert stays illuminated for **engine 2**:

▶▶**Go to step 8**

8 Choose one:

◆**In flight**:

■ ■ ■ ■

◆On the **ground**:

Ground air source
(if in use) . . . . . Disconnect

Engine start lever
(affected engine) . . . . . CUTOFF

■ ■ ■ ■

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## Volcanic Ash

| | |
|---|---|
| Condition: | Volcanic ash is suspected when one or more of these occur:<br>•A static discharge around the windshield<br>•A bright glow in the engine inlets<br>•Smoke or dust on the flight deck<br>•An acrid odor. |
| Objective: | To exit the ash cloud and restart engines if needed. |

**Caution! Exit volcanic ash as quickly as possible. Consider a 180° turn.**

1 Don oxygen masks and smoke goggles, as needed.

2 Establish crew communications, as needed.

3 Autothrottle (if engaged) . . . . . .Disengage

**If** conditions allow, run the engines at idle thrust.

4 Thrust levels (both) . . . . . Close

This reduces possible engine damage or flameout, or both, by decreasing EGT.

5 ENGINE START switches (both) . . . . . FLT

6 PACK switches . . . . . HIGH

7 WING ANTI–ICE switch . . . . . .ON

8 ENG ANTI–ICE switches (both) . . . . . .ON

▼ Continued on next page ▼

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▼ Volcanic Ash continued ▼

9 **If** the APU is available for start:

APU . . . . . START

This supplies backup electrical and pneumatic sources, if needed.

**Note:** Volcanic ash can cause non-normal system indications such as:

- Engine malfunctions, increasing EGT, engine stall or flameout.
- Decrease or loss of airspeed indications.
- Equipment cooling OFF light.

10 Engines may accelerate to idle very slowly, especially at high altitudes.

11 Slow acceleration may be incorrectly interpreted as a hung start or an engine malfunction. If N2 is steadily increasing, and EGT stays within limits, the start is progressing normally.

12 Plan to land at the nearest suitable airport.

13 Choose one:

◆Engines run **normally**:

■ ■ ■ ■

◆Engines do **not** run normally:

▶▶**Go to the Loss Of Thrust On Both Engines checklist on page 7.6**

■ ■ ■ ■

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## APU FIRE

Condition: Fire is detected in the APU.

1 APU fire switch . . . Confirm . . . .Pull, rotate to the stop, and hold for 1 second

2 APU switch . . . . . OFF

- - - - - - - - - - - - - - - - - - - - - - - -

3 Choose one:

◆APU fire switch **extinguishes**:

■ ■ ■ ■

◆APU fire switch **stays illuminated**:

▶▶**Go to step 4**

4 Plan to land at the nearest suitable airport.

■ ■ ■ ■

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## ENGINE FIRE
## or
## Engine Severe Damage or Separation

Condition: One or more of these occur:
- Engine fire warning
- Airframe vibrations with unusual engine indications
- Engine separation.

1 Autothrottle (if engaged) . . . . . Disengage

2 Thrust lever
(affected engine) . . . . . Confirm . . . . . Close

3 Engine start lever
(affected engine) . . . . . Confirm . . . CUTOFF

4 Engine fire switch
(affected engine) . . . . . Confirm . . . . . Pull

To manually unlock the engine fire switch, press the override and pull.

5 **If** the engine fire switch or ENG OVERHEAT light stays illuminated:

Engine fire switch . . . . . Rotate to the stop and hold for 1 second

**If** after 30 seconds the engine fire switch or ENG OVERHEAT light stays illuminated:

Engine fire switch. . . . . Rotate to the other stop and hold for 1 second

▼ Continued on next page ▼

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▼ ENGINE FIRE or Engine Severe Damage or Separation continued ▼

6 **If** high airframe vibration occurs and continues after the engine is shut down:

Without delay, reduce airspeed and descend to a safe altitude which results in an acceptable vibration level.

If high vibration returns and further airspeed reduction and descent are not practicable, increasing airspeed may reduce vibration.

7 ISOLATION VALVE switch . . . . . CLOSE

8 PACK switch (affected side) . . . . . OFF

This causes the operating pack to regulate to high flow in flight with the flaps up.

9 APU BLEED air switch . . . . . OFF

10 Choose one:

◆APU is **available** for start:

APU . . . . . START

**When** APU is running:

APU GEN switch
(affected side) . . . . . .ON

▶▶**Go to step 11**

◆APU is **not** available:

▶▶**Go to step 11**

11 Balance fuel as needed.

▼ Continued on next page ▼

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**▼ ENGINE FIRE or Engine Severe Damage or Separation continued ▼**

12 Transponder mode selector . . . . . TA ONLY

This prevents climb commands which can exceed single engine performance capability.

13 **If** wing anti–ice is needed:

ISOLATION VALVE switch
(after fire has been extinguished). . . . . AUTO

14 Plan to land at the nearest suitable airport.

[Airplanes without Fail Operational Autoland Capability]

▶▶**Go to the One Engine Inoperative Landing checklist on page 7.26**

[Airplanes with Fail Operational Autoland Capability]

▶▶**Go to the One Engine Inoperative Landing checklist on page 7.29**

■ ■ ■ ■

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## ENGINE OVERHEAT

| ENG 1 OVERHEAT | ENG 2 OVERHEAT |
|---|---|

Condition: An overheat is detected in the engine.

1 Autothrottle (if engaged). . . . . .Disengage

2 Thrust lever
(affected engine) . . . . . .Confirm . . . . . Close

3 **If** the ENG OVERHEAT light **stays illuminated**:

▶▶**Go to the ENGINE FIRE or Engine Severe Damage or Separation checklist on page 8.2**

■ ■ ■ ■

- - - - - - - - - - - - - - - - - - - - - - - -

4 **If** the ENG OVERHEAT light **extinguishes**:

Run the engine at reduced thrust to keep the light extinguished.

■ ■ ■ ■

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## Engine Tailpipe Fire

Condition: An engine tailpipe fire occurs on the ground with no engine fire warning.

1 Engine start lever (affected engine) . . . . . CUTOFF

2 Advise the cabin.

3 Choose one:

◆Bleed air is **not** available:

Advise the tower.

■ ■ ■ ■

◆Bleed air is **available**:

▶▶**Go to step 4**

4 PACK switches (both) . . . . . OFF

5 ISOLATION VALVE switch. . . . . AUTO

6 Engine BLEED air switches (both) . . . . . .ON

7 Choose one:

◆APU is **running**:

APU BLEED air switch . . . . . .ON

▶▶**Go to step 8**

◆APU is **not** running:

▶▶**Go to step 8**

▼ Continued on next page ▼

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**▼ Engine Tailpipe Fire continued ▼**

8 Choose one:

◆Affected ENGINE START switch is in **GRD**:

▶▶**Go to step 9**

◆Affected ENGINE START switch is **not** in GRD:

Allow the affected N2 to decrease below 20%.

ENGINE START switch
(affected engine) . . . . . GRD

▶▶**Go to step 9**

9 Advise the tower.

10 Continue to motor the engine until the tailpipe fire is extinguished.

[Without automatic ignition]

11 ENGINE START switch (affected engine) . . . . OFF

[With automatic ignition]

12 ENGINE START switch (affected engine) . . . AUTO

■ ■ ■ ■

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## Smoke, Fire or Fumes

Condition: Smoke, fire or fumes is identified.

1 Diversion may be needed.

2 Don oxygen masks and set regulators to 100%, as needed.

3 Don smoke goggles, as needed.

4 Establish crew and cabin communications.

5 BUS TRANSFER switch . . . . . OFF

6 CAB/UTIL switch. . . . . OFF

7 IFE/PASS SEAT switch . . . . . OFF

[737 - 600/700]

8 RECIRC FAN switch . . . . . OFF

[737 - 800/900]

9 RECIRC FAN switches (both) . . . . . OFF

10 Instruct the cabin crew to turn off the IFE and PC power switches (as installed).

11 APU BLEED air switch . . . . . OFF

12 **Anytime** the smoke or fumes becomes the greatest threat:

▶▶**Go to the Smoke or Fumes Removal checklist on page 8.18**

▼ Continued on next page ▼

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▼ Smoke, Fire or Fumes continued ▼

13 Choose one:

◆Source of the smoke, fire or fumes is **obvious and** can be **extinguished quickly**:

Isolate and extinguish the source.

If possible, remove power from the affected equipment by switch or circuit breaker in the flight deck or cabin.

**▶▶Go to step 14**

◆Source of the smoke, fire or fumes is **not** obvious **or cannot** be extinguished quickly:

**▶▶Go to step 15**

14 Choose one:

◆Source is **visually confirmed** to be extinguished **and** the smoke or fumes are **decreasing**:

Continue the flight at the captain's discretion.

Restore unpowered items at the captain's discretion.

**▶▶Go to the Smoke or Fumes Removal checklist on page 8.18, if needed**

■ ■ ■ ■

◆Source is **not** visually confirmed to be extinguished **or** smoke or fumes are **not** decreasing:

**▶▶Go to step 15**

▼ Continued on next page ▼

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▼ Smoke, Fire or Fumes continued ▼

15 EQUIP COOLING SUPPLY
and EXHAUST switches (both) . . . . . ALTN

16 Instruct the cabin crew to:

Turn on cabin reading lights.

Turn on galley attendants work lights.

Turn off cabin fluorescent light switches.

17 Divert to the nearest suitable airport while continuing the checklist.

18 Consider an immediate landing if the smoke, fire or fumes situation becomes uncontrollable.

19 Do **not** delay landing in an attempt to complete all of the following steps.

20 ISOLATION VALVE switch. . . . . CLOSE

21 R PACK switch . . . . . OFF

22 **Wait** 2 minutes unless the smoke or fumes are increasing. This allows time for the smoke or fumes to clear.

▼ Continued on next page ▼

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▼ Smoke, Fire or Fumes continued ▼

23 Choose one:

◆Smoke or fumes are **decreasing**:

▶▶**Go to the Smoke or Fumes Removal checklist on page 8.18, if needed**

■ ■ ■ ■

◆Smoke or fumes **continue or are increasing**:

R PACK switch . . . . . AUTO

L PACK switch . . . . . OFF

▶▶**Go to step 24**

24 **Wait** 2 minutes unless the smoke or fumes are increasing. This allows time for the smoke or fumes to clear.

25 Choose one:

◆Smoke or fumes are **decreasing**:

▶▶**Go to the Smoke or Fumes Removal checklist on page 8.18, if needed**

■ ■ ■ ■

◆Smoke or fumes **continue or are increasing**:

L PACK switch . . . . . AUTO

Consider an immediate landing.

▶▶**Go to the Smoke or Fumes Removal checklist on page 8.18, if needed**

■ ■ ■ ■

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APU DET INOP

## APU DETECTION INOPERATIVE

Condition: APU fire detection is inoperative.

1 APU switch. . . . . OFF

**Caution! Do not run the APU. An APU fire would not be detected and the APU would continue to run.**

■ ■ ■ ■

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# CARGO FIRE

FWD AFT

Condition: Fire is detected in the related cargo compartment.

1 CARGO FIRE ARM switch (affected compartment) . . . Confirm . . . . . Push, Verify ARMED

2 CARGO FIRE DISCH switch . . . . . Push and hold for 1 second

**Note:** DISCH light may need up to 30 seconds to illuminate.

[737 - 600/700]
3 RECIRC FAN switch . . . . . OFF

[737 - 800/900]
4 RECIRC FAN switches (both) . . . . . OFF

5 PACK switches (both) . . . . . HIGH

[Option - Airplanes equipped with #4 galley chiller]
6 CAB/UTIL switch. . . . . OFF

This prevents galley chiller exhaust from carrying smoke or fumes into the cabin.

7 Plan to land at the nearest suitable airport.

8 **Checklist Complete Except Deferred Items**

▼ Continued on next page ▼

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▼ CARGO FIRE continued ▼

## Deferred Items

### Descent Checklist

Pressurization . . . . . LAND ALT ___

Recall . . . . . Checked

Autobrake . . . . . ___

Landing data . . . . . VREF ___, Minimums ___

Approach briefing . . . . . Completed

### Approach Checklist

Altimeters . . . . . ___

**Warning! Inform ground personnel NOT to open any cargo door after landing until all passengers and crew have exited the airplane and fire fighting equipment is nearby.**

### Landing Checklist

[Without automatic ignition]

ENGINE START switches . . . . . CONT

Speedbrake . . . . . ARMED

Landing gear . . . . . Down

Flaps . . . . . ___, Green light

■ ■ ■ ■

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DETECTOR FAULT

## CARGO FIRE DETECTOR FAULT

Condition: Fire detection is inoperative in one or both cargo compartments.

1 The fire detection system in one or both cargo compartments is inoperative.

■ ■ ■ ■

FAULT

## ENGINE FIRE/OVERHEAT DETECTOR FAULT

Condition: Engine fire and overheat detection is inoperative.

1 The fire detection system in one or both engines is inoperative.

■ ■ ■ ■

SMOKE

## LAVATORY SMOKE

[Option]

Condition: Smoke is detected in one or more lavatories.

1 Verify that the lavatory fire is contained.

■ ■ ■ ■

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## Smoke or Fumes Removal

Condition: Smoke or fumes removal is needed.

1 Do this checklist **only** when directed by the Smoke, Fire or Fumes checklist.

2 Do **not** delay landing in an attempt to complete the following steps.

3 Close the flight deck door.

4 Choose one:

◆**Both** PACKS are **OFF**:

▶▶**Go to step 5**

◆**A single or both** PACKS are in **AUTO**:

▶▶**Go to step 6**

▼ Continued on next page ▼

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▼ Smoke or Fumes Removal continued ▼

5 Choose one:

◆Smoke or fumes source is confirmed to be **outside** the flight deck:

■ ■ ■ ■

◆Smoke or fumes source is confirmed to be **on** the flight deck:

**Caution! Window should not be opened unless the source is confirmed to be on the flight deck.**

Establish normal holding speed. High airspeed may prevent opening the window.

Open the first officer's sliding window.

▶▶**Go to the Smoke, Fire or Fumes checklist on page 8.8 and do the remaining steps**

■ ■ ■ ■

Do **not** turn on any PACK switch that was turned off by the Smoke, Fire or Fumes checklist.

6 ⚠ Operating PACK switch(es) . . . . . HIGH

7 LAND ALT indicator . . . . . 10,000 feet

**Note:** The intermittent cabin altitude/configuration warning horn will sound and the CABIN ALTITUDE lights (if installed and operative) will illuminate at a cabin altitude of approximately 10,000 feet.

▼ Continued on next page ▼

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▼ Smoke or Fumes Removal continued ▼

8 Engine BLEED air switches (both) . . . . . Verify ON

9 Set thrust to maximum practical N1 (minimum 45%).

10 Open flight deck air conditioning and gasper outlets.

**Caution! Do not open any flight deck window. Keep the flight deck door closed.**

11 Choose one:

◆Smoke or fumes are **controllable**:

▶▶**Go to the Smoke, Fire or Fumes checklist on page 8.8 and do the remaining steps**

■ ■ ■ ■

◆Smoke or fumes are **not** controllable:

▶▶**Go to step 12**

12 Descend to the lowest safe altitude or 10,000 feet, whichever is higher.

▼ Continued on next page ▼

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▼ Smoke or Fumes Removal continued ▼

13 **When** at 14,000 feet or below:

Pressurization mode selector . . . . . MAN

Outflow VALVE switch . . . . . Hold in OPEN until the outflow VALVE position indicates fully OPEN

This causes the cabin airflow to carry smoke or fumes aft.

**Note:** The outflow valve can take up to 20 seconds to open.

▶▶**Go to the Smoke, Fire or Fumes checklist on page 8.8 and do the remaining steps**

■ ■ ■ ■

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WHEEL WELL

## WHEEL WELL FIRE

Condition: Fire is detected in the main wheel well.

Do **not** exceed the gear EXTEND limit speed (270K/.82M)

1 ⚠ LANDING GEAR lever . . . . . .DN

**Note:** Do **not** use FMC fuel predictions with landing gear extended.

2 Choose one:

◆Gear **must be retracted** for airplane performance:

▶▶**Go to step 3**

◆Gear **does not** need to be retracted for airplane performance:

Plan to land at the nearest suitable airport.

■ ■ ■ ■

3 **When** the WHEEL WELL light extinguishes:

**Wait** 20 minutes.

235K maximum

4 ⚠ LANDING GEAR lever . . . . . UP

5 **When** the landing gear indicator lights extinguish:

LANDING GEAR lever . . . . . OFF

6 Plan to land at the nearest suitable airport.

■ ■ ■ ■

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## Elevator Tab Limit Cycle Oscillation

Condition: An elevator tab limit cycle oscillation (LCO) is encountered in flight. One or more of the following may be evidence of an elevator tab LCO:

- High frequency resonant vibration that originates, and is strongest, in the aft part of the airplane but can be felt throughout the entire structure
- The vibration may or may not be felt in the control wheel.

1 Airspeed . . . . . Reduce to 270 KIAS or until the vibration ceases, whichever is lower

2 Do not use speedbrakes or change aircraft configuration to reduce airspeed.

- - - - - - - - - - - - - - - - - - - - - - - -

3 Remain at or below the indicated airspeed at which the vibration ceased, but do not exceed 270 knots.

4 Do not use speedbrakes for the remainder of the flight.

**Note:** Ground spoilers may be used for landing.

5 Consider landing at the nearest suitable airport.

■ ■ ■ ■

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## Runaway Stabilizer

Condition: Uncommanded stabilizer trim movement occurs continuously.

1 Control column. . . . . Hold firmly

2 Autopilot (if engaged) . . . . . .Disengage

Do **not** re-engage the autopilot.

Control airplane pitch attitude manually with control column and main electric trim as needed.

3 **If** the runaway **stops**:

■ ■ ■ ■

4 **If** the runaway **continues**:

STAB TRIM CUTOUT
switches (both) . . . . . CUTOUT

**If** the runaway **continues**:

Stabilizer
trim wheel. . . . . Grasp and hold

- - - - - - - - - - - - - - - - - - - - - - - -

5 Stabilizer. . . . . Trim manually

6 Anticipate trim requirements.

7 **Checklist Complete Except Deferred Items**

### Deferred Items

**Descent Checklist**

Pressurization. . . . . LAND ALT ____

▼ Continued on next page ▼

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▼ Runaway Stabilizer continued ▼

Recall . . . . . Checked

Autobrake . . . . . ___

Landing data . . . . . VREF ___, Minimums ___

Approach briefing . . . . . Completed

## Approach Checklist

Altimeters . . . . . ___

## Airspeed and Trim

Establish correct airspeed and in-trim condition early on final approach.

## Landing Checklist

[Without automatic ignition]

ENGINE START switches . . . . . CONT

Speedbrake . . . . . ARMED

Landing gear . . . . . Down

Flaps . . . . . ___, Green light

■ ■ ■ ■

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## All Flaps Up Landing

| | |
|---|---|
| Condition: | The leading edge devices fail to extend and trailing edge flaps are less than 1. |
| Objective: | To configure for a landing with leading edge devices retracted and trailing edge flaps less than 1. |

1 Do this checklist **only** when directed by the Trailing Edge Flaps Up Landing checklist.

2 Burn off fuel to reduce touchdown speed.

3 Set VREF 40 + 55 knots.

4 Check the Non–Normal Configuration Landing Distance table in the Advisory Information section of the Performance Inflight chapter.

5 Maintain flaps up maneuvering speed until established on final approach.

6 Limit bank angle to 15° when airspeed is less than the flaps up maneuvering speed.

7 **Checklist Complete Except Deferred Items**

### Deferred Items

**Descent Checklist**

Pressurization . . . . . LAND ALT ____

Recall . . . . . Checked

Autobrake . . . . . ____

Landing data **. . . . . VREF 40 + 55 knots, Minimums ____**

▼ Continued on next page ▼

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▼ All Flaps Up Landing continued ▼

Approach briefing . . . . . Completed

## Go-around Procedure Review

Do the normal go-around procedure except:

Limit bank angle to 15° when the airspeed is less than the flaps up maneuvering speed.

Accelerate to flaps up maneuvering speed.

## Approach Checklist

Altimeters . . . . . ____

## Additional Deferred Items

FASTEN BELTS switch . . . . . ON

[With automatic ignition]
ENGINE START switches . . . . . CONT

GROUND PROXIMITY FLAP
INHIBIT switch . . . . . FLAP INHIBIT

## Landing Checklist

[Without automatic ignition]
ENGINE START switches . . . . . CONT

Speedbrake . . . . . ARMED

Landing gear . . . . . Down

Flaps. . . . . ____, **No lights**

■ ■ ■ ■

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AUTO SLAT FAIL

## AUTO SLAT FAIL

Condition: The auto slat system is failed.

1 Continue normal operation.

■ ■ ■ ■

FEEL DIFF PRESS

## FEEL DIFFERENTIAL PRESSURE

Condition: High differential pressure is measured by the elevator feel computer.

1 Continue normal operation.

■ ■ ■ ■

FLAP LOAD RELIEF

## FLAP LOAD RELIEF

[Option]

Condition: Flap load relief occurs.

1 Check flap position and maintain the appropriate airspeed.

■ ■ ■ ■

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LOW PRESSURE

## FLIGHT CONTROL LOW PRESSURE

Condition: Hydraulic system pressure to the ailerons, elevators and rudder is low.

Objective: To activate the standby hydraulic system and standby rudder PCU.

1 FLT CONTROL switch (affected side) . . . . . Confirm. . . . . .STBY RUD

■ ■ ■ ■

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## Jammed or Restricted Flight Controls

Condition: A flight control is jammed or restricted in roll, pitch, or yaw.

1 Autopilot (if engaged) . . . . . .Disengage

2 Autothrottle (if engaged) . . . . . .Disengage

3 Verify that the thrust is symmetrical.

4 Overpower the jammed or restricted system. Use maximum force, including a combined effort of both pilots, if needed. A maximum two-pilot effort on the controls will not cause a cable or system failure.

5 Do **not** turn off any flight control switches.

6 **If** the failure could be due to freezing water and conditions allow:

Consider descent to a warmer temperature and attempt to overpower the jammed or restricted system again.

7 Choose one:

◆Controls are **normal**:

■ ■ ■ ■

◆Controls are **not** normal:

▶▶**Go to step 8**

8 Use stabilizer or rudder trim to offload control forces.

▼ Continued on next page ▼

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▼ Jammed or Restricted Flight Controls continued ▼

9 **If** electric stabilizer trim is needed:

Move the Stabilizer Trim Override switch to OVERRIDE.

10 Do not make abrupt thrust changes. Extend or retract speedbrake slowly and smoothly.

11 Limit bank angle to 15°.

12 Plan to land at the nearest suitable airport.

13 Plan a flaps 15 landing.

14 Set VREF 15 or VREF ICE.

**If** any of the following conditions apply, set VREF ICE = VREF 15 + 10 knots:

Engine anti–ice will be used during landing

Wing anti–ice has been used any time during the flight

Icing conditions were encountered during the flight and the landing temperature is below 10° C.

**Note:** When VREF ICE is needed, the wind additive should not exceed 10 knots.

15 Check the Non–Normal Configuration Landing Distance table in the Advisory Information section of the Performance Inflight chapter.

16 **Checklist Complete Except Deferred Items**

▼ Continued on next page ▼

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▼ Jammed or Restricted Flight Controls continued ▼

## Deferred Items

### Descent Checklist

Pressurization . . . . . LAND ALT ____

Recall . . . . . Checked

Autobrake . . . . . ____

Landing data . . . . . **VREF 15 or VREF ICE, Minimums ____**

Approach briefing . . . . . Completed

### Go-around Procedure Review

Do the normal go-around procedure.

Advance thrust to go-around smoothly and slowly to avoid excessive pitch-up.

### Approach Checklist

Altimeters . . . . . ____

### Additional Deferred Item

GROUND PROXIMITY FLAP INHIBIT switch . . . . . FLAP INHIBIT

### Landing Checklist

[Without automatic ignition]
ENGINE START switches. . . . . CONT

Speedbrake . . . . . ARMED

▼ Continued on next page ▼

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**▼ Jammed or Restricted Flight Controls continued ▼**

Landing gear . . . . . Down

Flaps. . . . . **15, Green light**

■ ■ ■ ■

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LE FLAPS TRANSIT

## LEADING EDGE FLAPS TRANSIT

Condition: One or more of these occur:
- The leading edge devices are not in the commanded position
- A leading edge device asymmetry is detected
- A leading edge device skew is detected.

**Note:** Do not use FMC fuel predictions with any flaps or slats extended.

1 Choose one:

◆ **Trailing** edge flaps are **extended** and the trailing edge flap position indication **disagrees** with the flap handle position:

▶▶**Go to the Trailing Edge Flap Disagree checklist on page 9.33**

■ ■ ■ ■

◆ **Trailing** edge flaps are **extended** and the trailing edge flap position indication **agrees** with the flap handle position:

▶▶**Go to step 6**

◆ **Trailing** edge flaps are **up**:

Limit airspeed to 230 knots maximum.

▶▶**Go to step 2**

▼ Continued on next page ▼

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▼ LEADING EDGE FLAPS TRANSIT continued ▼

2 Choose one:

◆Roll is **encountered**:

▶▶**Go to step 6**

◆Roll is **not** encountered:

**Note:** Roll may be difficult to identify with the autopilot engaged.

Flaps . . . . . Extend to flaps 1, then retract to flaps up

▶▶**Go to step 3**

3 Choose one:

◆LE FLAPS TRANSIT light **extinguishes** after the flaps are up:

Continue normal operation.

■ ■ ■ ■

◆LE FLAPS TRANSIT light **stays illuminated** after the flaps are up:

▶▶**Go to step 4**

4 Check LE DEVICES annunciator panel.

▼ Continued on next page ▼

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▼ LEADING EDGE FLAPS TRANSIT continued ▼

5 Choose one:

- Light(s) for **only one** leading edge device is illuminated:

  Limit airspeed to 300 knots (280 knots for turbulent air penetration) or .65 Mach, whichever is lower.

  ▶▶**Go to step 6**

- Light(s) for **more than one** leading edge device is illuminated:

  Limit airspeed to 230 knots maximum.

  ▶▶**Go to step 6**

6 Plan a flaps 15 landing.

7 Set VREF 15 + 15 knots.

8 Limit bank angle to 15° when airspeed is less than the flaps up maneuvering speed.

9 Check the Non–Normal Configuration Landing Distance table in the Advisory Information section of the Performance Inflight chapter.

10 **Checklist Complete Except Deferred Items**

## Deferred Items

### Descent Checklist

Pressurization . . . . . LAND ALT ____

Recall . . . . . Checked

Autobrake . . . . . ____

▼ Continued on next page ▼

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▼ LEADING EDGE FLAPS TRANSIT continued ▼

Landing data . . . . . **VREF 15 + 15 knots, Minimums ____**

Approach briefing . . . . . Completed

## Approach Checklist

Altimeters . . . . . ____

## Additional Deferred Item

GROUND PROXIMITY FLAP
INHIBIT switch . . . . . FLAP INHIBIT

**Note:** The amber LE FLAPS TRANSIT light may be illuminated. Operation within the lower amber airspeed band for landing is normal for this condition.

**Note:** V/S and VNAV PTH modes may revert to LVL CHG mode.

## Landing Checklist

[Without automatic ignition]
ENGINE START switches . . . . . CONT

Speedbrake . . . . . ARMED

Landing gear . . . . . Down

Flaps. . . . . **15, Green or amber light**

**Note:** The light may be green or amber depending on the cause of the failure.

■ ■ ■ ■

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MACH TRIM FAIL

## MACH TRIM FAIL

Condition: The mach trim system is failed.

1 Limit airspeed to 280 knots/.82 Mach.

■ ■ ■ ■

SPEED BRAKE DO NOT ARM

## SPEED BRAKE DO NOT ARM

[Without Load Alleviation System]

Condition: An automatic speedbrake fault occurs.

**Note:** Speedbrakes may be used in flight.

1 Do **not** arm the speedbrake for landing. Manually deploy the speedbrakes immediately upon landing.

2 **Checklist Complete Except Deferred Items**

### Deferred Items

**Descent Checklist**

Pressurization . . . . . LAND ALT ____

Recall . . . . . Checked

Autobrake . . . . . ____

Landing data . . . . . VREF ____, Minimums ____

Approach briefing . . . . . Completed

**Approach Checklist**

Altimeters . . . . . ____

▼ Continued on next page ▼

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▼ SPEED BRAKE DO NOT ARM continued ▼

## Landing Checklist

[Without automatic ignition]

ENGINE START switches . . . . . CONT

Speedbrake . . . . . **DOWN detent**

Landing gear . . . . . Down

Flaps . . . . . ____, Green light

■ ■ ■ ■

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SPEED BRAKE DO NOT ARM

## SPEED BRAKE DO NOT ARM

[Load Alleviation System]

Condition: An automatic speedbrake fault occurs.

**Note:** Speedbrakes may be used in flight.

1 Choose one:

◆SPEED BRAKE DO NOT ARM light is illuminated with the flaps **up**:

Limit airspeed to 320 knots maximum.

■ ■ ■ ■

◆SPEED BRAKE DO NOT ARM light illuminates or stays illuminated with the flaps **not** up:

▶▶**Go to step 2**

2 Do **not** arm the speedbrake for landing. Manually deploy the speedbrakes immediately upon landing. Increased force may be needed to move the SPEED BRAKE lever to the UP position.

3 **Checklist Complete Except Deferred Items**

### Deferred Items

**Descent Checklist**

Pressurization . . . . . LAND ALT ___

Recall . . . . . Checked

Autobrake . . . . . ___

Landing data . . . . . VREF ___, Minimums ___

Approach briefing . . . . . Completed

▼ Continued on next page ▼

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▼ SPEED BRAKE DO NOT ARM continued ▼

## Approach Checklist

Altimeters . . . . . ____

## Landing Checklist

[Without automatic ignition]

ENGINE START switches . . . . . CONT

Speedbrake . . . . . **DOWN detent**

Landing gear . . . . . Down

Flaps . . . . . ____, Green light

■ ■ ■ ■

SPEED TRIM FAIL

## SPEED TRIM FAIL

Condition: The speed trim system is failed.

1 Continue normal operation.

■ ■ ■ ■

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SPEEDBRAKES EXTENDED

## SPEEDBRAKES EXTENDED

Condition: In flight, the speedbrakes are extended beyond the ARMED position and one or more of these occur:

- The radio altitude is below 800 feet
- The flap lever setting is more than flaps 10.

On the ground, the SPEED BRAKE lever is down and the speedbrakes are extended.

1 SPEED BRAKE lever . . . . ARMED or DOWN detent

2 **If** the light is illuminated on the ground:

Do not takeoff.

■ ■ ■ ■

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## STABILIZER OUT OF TRIM

| STAB OUT OF TRIM | Condition: The autopilot does not set the stabilizer trim correctly. |
|---|---|

**Note:** Momentary illumination of the STAB OUT OF TRIM light during large changes in trim requirements is normal.

1 Choose one:

◆ Stabilizer is **trimming**:

Continue normal operation.

■ ■ ■ ■

◆ Stabilizer is **not** trimming:

▶▶ **Go to step 2**

2 Control column. . . . . Hold firmly

3 Autopilot . . . . . .Disengage

4 Stabilizer trim . . . . . .As needed

5 Choose one:

◆ Stabilizer **responds** to electric trim inputs:

■ ■ ■ ■

◆ Stabilizer does **not** respond to electric trim inputs:

▶▶ **Go to the Stabilizer Trim Inoperative checklist on page 9.22**

■ ■ ■ ■

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## Stabilizer Trim Inoperative

Condition: The main electric and autopilot stabilizer trim are inoperative.

1 STAB TRIM CUTOUT switches (both) . . . . CUTOUT

The autopilot is not available.

2 Apply steady pressure on the manual trim handles until the needed trim is attained.

3 **If** needed:

Use force to cause the disconnect clutch to disengage. Approximately 1/2 turn of the stabilizer trim wheel may be needed.

**Note:** A maximum two-pilot effort on the trim wheels will not cause a cable or system failure.

The handle(s) should be folded inside the stabilizer trim wheel when manual trim is no longer needed.

If the failure could be due to ice accumulation, descend to a warmer temperature and attempt again.

4 Choose one:

◆ Stabilizer **can** be trimmed manually:

▶▶ **Go to step 5**

◆ Stabilizer can **not** be trimmed manually:

▶▶ **Go to step 9**

▼ Continued on next page ▼

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▼ Stabilizer Trim Inoperative continued ▼

5 Maintain in-trim airspeed until the start of the approach.

6 Use an airspeed which results in an in-trim condition. This will reduce the force that is needed to move the stabilizer.

7 Continue to trim manually for the rest of the flight.

8 Establish the landing configuration early.

▶▶**Go to step 11**

9 Anticipate higher than normal elevator forces during approach and landing.

10 The thrust reduction at flare will cause a nose down pitch.

**Note:** Elevator control is sufficient to safely land the airplane regardless of stabilizer position.

11 Plan a flaps 15 landing.

12 Set VREF 15 or VREF ICE.

**If** any of the following conditions apply, set VREF ICE = VREF 15 + 10 knots:

Engine anti–ice will be used during landing

Wing anti–ice has been used any time during the flight

Icing conditions were encountered during the flight and the landing temperature is below 10° C.

▼ Continued on next page ▼

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▼ Stabilizer Trim Inoperative continued ▼

**Note:** When VREF ICE is needed, the wind additive should not exceed 10 knots.

13 Check the Non–Normal Configuration Landing Distance table in the Advisory Information section of the Performance Inflight chapter.

14 **Checklist Complete Except Deferred Items**

## Deferred Items

### Descent Checklist

Pressurization . . . . . LAND ALT ___

Recall . . . . . Checked

Autobrake . . . . . ___

Landing data . . . . . **VREF 15 or VREF ICE, Minimums ___**

Approach briefing . . . . . Completed

### Go-around Procedure Review

Do the normal go-around procedure.

Advance thrust to go-around smoothly and slowly to avoid excessive pitch-up.

### Approach Checklist

Altimeters . . . . . ___

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▼ Stabilizer Trim Inoperative continued ▼

## Additional Deferred Item

GROUND PROXIMITY FLAP
INHIBIT switch . . . . . FLAP INHIBIT

## Landing Checklist

[Without automatic ignition]
ENGINE START switches . . . . . CONT

Speedbrake . . . . . ARMED

Landing gear . . . . . Down

Flaps. . . . . **15, Green light**

■ ■ ■ ■

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## STBY RUD ON — STANDBY RUDDER ON

[737 Modified rudder installed]

Condition: The standby rudder hydraulic system is commanded on.

1 Choose one:

- STBY RUD ON light is illuminated with **no other flight deck indications**:

  Avoid large or abrupt rudder pedal inputs.

  ■ ■ ■ ■

- STBY RUD ON light is illuminated due to the **pilot moving** the FLT CONTROL A or B switch to STBY RUD:

  ■ ■ ■ ■

- STBY RUD ON light is illuminated in response to a hydraulic system **non-normal** situation:

  ■ ■ ■ ■

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Intentionally
Blank

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## Trailing Edge Flap Asymmetry

| | |
|---|---|
| Condition: | One or more of these occur:<br>• An uncommanded roll occurs when the flaps change position<br>• The left and right flap indications disagree. |
| Objective: | To configure the airplane for landing. |

1 Set the flap lever to the nearest detent that is equal to or less than the smallest indicated flap position.

**Caution! Do not attempt to move the trailing edge flaps with the ALTERNATE FLAPS switch because there is no asymmetry protection.**

▼ Continued on next page ▼

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▼ Trailing Edge Flap Asymmetry continued ▼

**Note:** Do not use FMC fuel predictions with any flaps or slats extended.

2 Choose one:

◆ Flap **lever** is set to **30 or greater**:

Set VREF 30.

**Note:** VREF + wind additive must not exceed the flap placard speed for the next larger flap setting.

▶▶**Go to step 4**

◆ Flap **lever** is set to **15 or 25**:

Set VREF 15 or VREF ICE.

▶▶**Go to step 3**

◆ Flap **lever** is set to **1 or greater** and **less than 15**:

Set VREF 40 + 30 knots.

▶▶**Go to step 4**

◆ Flap **lever** is set to **UP**:

▶▶**Go to the Trailing Edge Flaps Up Landing checklist on page 9.40**

■ ■ ■ ■

▼ Continued on next page ▼

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▼ Trailing Edge Flap Asymmetry continued ▼

3 **If** any of the following conditions apply, set VREF ICE = VREF 15 + 10 knots:

Engine anti–ice will be used during landing

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▼ Trailing Edge Flap Asymmetry continued ▼

Wing anti–ice has been used any time during the flight

Icing conditions were encountered during the flight and the landing temperature is below 10° C.

**Note:** When VREF ICE is needed, the wind additive should not exceed 10 knots.

VREF + wind additive, or VREF ICE + wind additive if needed, must not exceed the flap placard speed for the next larger flap setting.

4 Check the Non–Normal Configuration Landing Distance table in the Advisory Information section of the Performance Inflight chapter.

5 **Checklist Complete Except Deferred Items**

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▼ Trailing Edge Flap Asymmetry continued ▼

## Deferred Items

### Descent Checklist

Pressurization . . . . . LAND ALT ___

Recall . . . . . Checked

Autobrake . . . . . ___

Landing data **. . . . . .VREF ___ as directed by checklist, Minimums ___**

Approach briefing . . . . . Completed

### Approach Checklist

Altimeters . . . . . ___

### Additional Deferred Item

GROUND PROXIMITY FLAP
INHIBIT switch . . . . . FLAP INHIBIT

### Landing Checklist

[Without automatic ignition]
ENGINE START switches. . . . . CONT

Speedbrake . . . . . ARMED

Landing gear . . . . . Down

Flaps **. . . . . ___, Green or amber light**

**Note:** The light may be green or amber depending on the cause of the failure.

■ ■ ■ ■

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## Trailing Edge Flap Disagree

Condition: Both of these occur:
- The trailing edge flaps are not in the commanded position
- There is no trailing edge flap asymmetry.

Objective: To configure the airplane for landing.

1 **If** a trailing edge flap asymmetry exists:

▶▶**Go to the Trailing Edge Flap Asymmetry checklist on page 9.28**

■ ■ ■ ■

2 Choose one:

◆ Indicated flap position is **30 or greater and less than 40**:

Land using existing flaps.

▶▶**Go to step 3**

◆ Indicated flap position is **15 or greater and less than 30**:

Land using existing flaps.

▶▶**Go to step 5**

◆ Indicated flap position is **less than 15**:

▶▶**Go to step 4**

3 Set VREF 30 for landing.

**Note:** VREF 30 + wind additive must not exceed the flap placard speed for flaps 40.

▼ Continued on next page ▼

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▼ Trailing Edge Flap Disagree continued ▼

**▶▶Go to step 6**

4 Plan to extend flaps to 15 using alternate flap extension.

**Note:** Alternate flap extension time to flaps 15 is approximately 2 minutes.

The drag penalty with the leading edge devices extended may make it impossible to reach an alternate field.

5 Set VREF 15 or VREF ICE for landing.

**If** any of the following conditions apply, set VREF ICE = VREF 15 + 10 knots:

Engine anti–ice will be used during landing

Wing anti–ice has been used any time during the flight

Icing conditions were encountered during the flight and the landing temperature is below 10° C.

**Note:** When VREF ICE is needed, the wind additive should not exceed 10 knots.

VREF 15 + wind additive, or VREF ICE + wind additive if needed, must not exceed the flap placard speed for the next larger flap setting.

6 Check the Non–Normal Configuration Landing Distance table in the Advisory Information section of the Performance Inflight chapter.

7 **Checklist Complete Except Deferred Items**

▼ Continued on next page ▼

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▼ Trailing Edge Flap Disagree continued ▼

## Deferred Items

### Descent Checklist

Pressurization . . . . . LAND ALT ___

Recall . . . . . Checked

Autobrake . . . . . ___

Landing data **. . . . . VREF ___ as directed by checklist, Minimums ___**

Approach briefing . . . . . Completed

### Approach Checklist

Altimeters . . . . . ___

▼ Continued on next page ▼

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▼ Trailing Edge Flap Disagree continued ▼

## Additional Deferred Item

Choose one:

- Indicated flap position is **30 or greater**:

  ▶▶**Go to Landing Checklist below**

- Indicated flap position is **15 or greater and less than 30**:

  GROUND PROXIMITY FLAP
  INHIBIT switch . . . . . FLAP INHIBIT

  ▶▶**Go to Landing Checklist below**

- Indicated flap position is **less than 15**:

  GROUND PROXIMITY FLAP
  INHIBIT switch . . . . . FLAP INHIBIT

  ▶▶**Go to Alternate Flap Extension below**

## Alternate Flap Extension

During flap extension, set the flap lever to the desired flap position.

▼ Continued on next page ▼

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▼ Trailing Edge Flap Disagree continued ▼

230K maximum during alternate flap extension.

ALTERNATE FLAPS master switch . . . . . ARM

**Note:** The landing gear configuration warning may sound if the flaps are between 10 and 15 and the landing gear are retracted.

**Note:** The amber LE FLAPS TRANSIT light will stay illuminated until the flaps approach the flaps 10 position.

**Note:** Operation within the lower amber airspeed band may be needed until the LE FLAPS TRANSIT light extinguishes.

If flap asymmetry occurs, release the switch immediately. There is no asymmetry protection.

ALTERNATE FLAPS
position switch . . . . . Hold DOWN
to extend flaps
to 15 on schedule

As flaps are extending, slow to respective maneuvering speed.

▼ Continued on next page ▼

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▼ Trailing Edge Flap Disagree continued ▼

Choose one:

◆Trailing edge flaps asymmetry occurs:

▶▶**Go to the Trailing Edge Flap Asymmetry checklist on page 9.28**

■ ■ ■ ■

◆Trailing edge flaps extend to **15**:

▶▶**Go to Landing Checklist below**

◆Indicated flap position is **less than 1** after attempting alternate flap extension:

▶▶**Go to the Trailing Edge Flaps Up Landing checklist on page 9.40**

■ ■ ■ ■

◆Indicated flap position is **1 or greater and less than 15** after attempting alternate flap extension:

Land using existing flaps.

Set VREF 40 + 30 knots for landing.

Check the Non–Normal Configuration Landing Distance table in the Advisory Information section of the Performance Inflight chapter.

▶▶**Go to Landing Checklist below**

▼ Continued on next page ▼

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▼ Trailing Edge Flap Disagree continued ▼

## Landing Checklist

[Without automatic ignition]

ENGINE START switches . . . . . CONT

Speedbrake . . . . . ARMED

Landing gear . . . . . Down

Flaps. . . . . ____, **Green or amber light**

**Note:** The light may be green or amber depending on the failure.

■ ■ ■ ■

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## Trailing Edge Flaps Up Landing

| | |
|---|---|
| Condition: | The trailing edge flaps are less than 1. |
| Objective: | To configure for a landing with trailing edge flaps less than 1. |

1 Choose one:

◆Trailing edge flap asymmetry does **not exist**:

Do this checklist **only** when directed by the Trailing Edge Flap Disagree checklist.

▶▶**Go to step 4**

◆Trailing edge flap asymmetry **exists**:

▶▶**Go to step 2**

230K maximum.

2 ⚠ALTERNATE FLAPS master switch . . . . . ARM

**Note:** This procedure extends the leading edge devices only.

3 ALTERNATE FLAPS
position switch . . . . . Momentary DOWN

Verify that the LE DEVICES annunciator indicates FULL EXT for all leading edge slats and flaps.

▼ Continued on next page ▼

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▼ Trailing Edge Flaps Up Landing continued ▼

**Note:** The LE FLAPS TRANSIT light may stay illuminated after the LE devices are fully extended.

4 Choose one:

◆ LE DEVICES annunciator does **not** show FULL EXT:

▶▶ **Go to the All Flaps Up Landing checklist on page 9.4**

■ ■ ■ ■

◆ LE DEVICES annunciator **shows** FULL EXT:

▶▶ **Go to step 5**

5 Burn off fuel to reduce touchdown speed.

6 Set VREF 40 + 40 knots.

7 Check the Non–Normal Configuration Landing Distance table in the Advisory Information section of the Performance Inflight chapter.

8 Maintain flaps up maneuvering speed until on final.

9 Limit bank angle to 15° when airspeed is less than the flaps up maneuvering speed.

10 **Checklist Complete Except Deferred Items**

## Deferred Items

### Descent Checklist

Pressurization . . . . . LAND ALT ___

Recall . . . . . Checked

Autobrake . . . . . ___

▼ Continued on next page ▼

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▼ Trailing Edge Flaps Up Landing continued ▼

Landing data . . . . . **VREF 40 + 40 knots, Minimums ____**

Approach briefing . . . . . Completed

## Go-around Procedure Review

Do the normal go-around procedure except:

Limit bank angle to 15° when the airspeed is less than the flaps up maneuvering speed.

Accelerate to flaps up maneuvering speed.

Do not exceed 230 knots with leading edge devices extended.

## Approach Checklist

Altimeters . . . . . ____

## Additional Deferred Items

FASTEN BELTS switch . . . . . .ON

[With automatic ignition]
ENGINE START switches. . . . . CONT

GROUND PROXIMITY FLAP
INHIBIT switch . . . . . FLAP INHIBIT

▼ Continued on next page ▼

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▼ Trailing Edge Flaps Up Landing continued ▼

**Note:** A nuisance stick shaker may occur when slowing to VREF 40 + 40 knots at high gross weights and/or bank angles greater than 15°.

Operation within the lower amber airspeed band for landing is normal for this condition.

**Note:** V/S and VNAV PTH modes may revert to LVL CHG mode.

## Landing Checklist

[Without automatic ignition]

ENGINE START switches . . . . . CONT

Speedbrake . . . . . ARMED

Landing gear . . . . . Down

Flaps. . . . . ____, **Green or amber light**

**Note:** The light may be green or amber depending on the cause of the failure.

■ ■ ■ ■

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YAW DAMPER

## YAW DAMPER

Condition: The yaw damper is disengaged.

1 YAW DAMPER switch . . . . . OFF then ON

2 Choose one:

◆YAW DAMPER light **extinguishes**:

■ ■ ■ ■

◆YAW DAMPER light **stays illuminated**:

YAW DAMPER switch . . . . . OFF

▶▶**Go to step 3**

3 Avoid areas of predicted moderate or severe turbulence. If turbulence is encountered and passenger comfort becomes affected, reduce airspeed and/or descend to a lower altitude.

4 Do not exceed flaps 30 if the crosswind exceeds 30 knots.

■ ■ ■ ■

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## Airspeed Unreliable

Condition: The pitch attitude is not consistent with the phase of flight, altitude, thrust and weight, or noise or low frequency buffeting is experienced.

Objective: To establish the normal pitch attitude and thrust setting for the phase of flight.

1 Adjust the airplane attitude and thrust. Maintain airplane control.

2 PROBE HEAT switches . . . . . Check ON

3 Cross check the MACH/AIRSPEED indicators.

- - - - - - - - - - - - - - - - - - - - - - - -

4 Cross check the IRS and FMC ground speed and winds to determine airspeed accuracy if indicated airspeed is questionable.

**Note:** Erroneous or unreliable airspeed indications may be caused by blocked or frozen pitot-static system(s), or a severely damaged or missing radome.

5 Attitude and thrust information is located in the Performance Inflight section.

■ ■ ■ ■

## Additional Information

The flight path vector is based on inertial sources and may be used as a reference in maintaining proper path control.

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## ALT DISAGREE

Condition: The ALT DISAGREE alert indicates the captain's and first officer's altitude indications disagree by more than 200 feet.

1 Check all altimeters are set to correct barometric setting for phase of flight.

2 Choose one:

◆ALT DISAGREE alert **extinguishes**:

Continue normal operation.

■ ■ ■ ■

◆ALT DISAGREE alert **stays illuminated**:

▶▶**Go to step 3**

3 Flight is not allowed in RVSM airspace.

4 Standby altimeter is available.

5 Transponder altitude received by ATC may be unreliable.

6 Maintain visual conditions if possible.

7 Establish landing configuration early.

8 Radio altitude reference is available below 2,500 feet.

9 Use electronic and visual glide slope indicators, where available, for approach and landing.

■ ■ ■ ■

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## AOA DISAGREE

Condition: The AOA DISAGREE alert indicates the left and right angle of attack vanes disagree.

1 Airspeed errors and the IAS DISAGREE alert may occur.

2 Altimeter errors and the ALT DISAGREE alert may occur.

■ ■ ■ ■

## CDS FAULT

Condition: The CDS FAULT annunciation indicates a CDS fault occurs.

**Note:** CDS FAULT annunciates on the ground only, before the second engine start.

1 Do not takeoff.

■ ■ ■ ■

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## Display Failure

Condition: A display in the common display system is failed.

1 Choose one:

◆A single display is not usable and **automatic switching** has occurred:

Continue normal operation.

■ ■ ■ ■

◆A single display is not usable and automatic switching has **not** occurred:

▶▶**Go to step 2**

2 MAIN PANEL DUs selector . . . . . .As needed

3 LOWER DU selector. . . . . .As needed

■ ■ ■ ■

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## DISPLAYS CONTROL PANEL

Condition: The DISPLAYS CONTROL PANEL annunciation indicates the EFIS control panel is failed.

**Note:** The altimeter blanks and an ALT flag illuminates on the side corresponding to the failed control panel.

1 CONTROL PANEL select switch . . . . . .BOTH ON 1 or BOTH ON 2

Select the operating control panel.

2 Verify that the DISPLAYS CONTROL PANEL annunciation and ALT flag extinguish.

■ ■ ■ ■

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## DISPLAY SOURCE

Condition: The DSPLY SOURCE annunciation indicates only one DEU is supplying display information. Indications may include:

- No hydraulic pressure indication on the failed side
- Speed limit flag shown on the failed side
- Minimum maneuver speed and stick shaker band removed on the failed side
- Both EEC ALTN lights illuminated.

**Note:** Flight director indications may be removed and autoflight mode reversions may occur.

Dual autopilot approach is not available.

1 **If** the DEU fails on the same side as the engaged autopilot:

Select the opposite autopilot.

Verify that the correct flight director indications and flight mode annunciations are shown on the same side as the operating autopilot.

2 **If** the EEC ALTN lights are illuminated and the EEC ALTERNATE MODE checklist has not been completed:

▶▶**Go to the EEC ALTERNATE MODE checklist on page 7.13**

■ ■ ■ ■

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OFF

## FLIGHT RECORDER OFF

Condition: The flight recorder is off.

1 Continue normal operation.

■ ■ ■ ■

## IAS DISAGREE

Condition: The IAS DISAGREE alert indicates the captain's and first officer's airspeed indications disagree.

▶▶**Go to the Airspeed Unreliable checklist on page 10.1**

■ ■ ■ ■

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MSG

## FMC DISAGREE

FMC P/RST

Condition: Data needed for dual FMC operation disagree.

1 Choose one:

◆Flying an approach with an **RNP alerting requirement**:

Go-around unless suitable visual references can be established and maintained.

■ ■ ■ ■

◆Flying an approach **without** an RNP alerting requirement

Verify position.

■ ■ ■ ■

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MSG

## FMC DISAGREE

FMC P/RST

Condition: Data needed for dual FMC operation disagree.

1 Choose one:

◆Flying an approach with an **RNP alerting requirement**:

Go-around unless suitable visual references can be established and maintained.

■ ■ ■ ■

◆Flying an approach **without** an RNP alerting requirement

Verify position.

■ ■ ■ ■

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FMC P/RST

## FMC FAIL

[Option - Single FMC]

Condition: One or more of these occur:
- Loss of FMC data on a CDU
- Loss of FMC data on a navigation display map mode
- Illumination of the FMC alert light.

1 Resume conventional navigation. Without an operating FMC, LNAV and VNAV are not available.

2 Verify position relative to terrain using conventional navigation.

**Note:** EGPWS may use inaccurate GPS position data or an inappropriate value of RNP. This could result in a VSD terrain display that is incorrectly positioned relative to the airplane track.

3 **When** preparing for approach:

Use the SPD REF selector to set the reference airspeed bugs.

Use the N1 SET selector to set the N1 bugs.

■ ■ ■ ■

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FMC
P/RST

# FMC FAIL

[Option - Dual FMC]

Condition: Dual FMC failure:
- Loss of FMC data on both CDUs
- Loss of FMC data on the captain's and first officer's navigation display MAP modes.

Left FMC failure:
- Loss of FMC data on both CDUs
- Loss of FMC data on the captain's navigation display MAP mode.

Right FMC failure:
- Illumination of the FMC message light
- Loss of FMC data on the first officer's navigation display MAP mode
- SINGLE FMC OPERATION scratchpad message.

Objective: To restore dual FMC operation, configure for single FMC operation or resume conventional navigation.

1 Choose one:

◆Only the **left or right** FMC has failed:

▶▶**Go to step 2**

◆**Dual** FMC failure has occurred:

▶▶**Go to step 4**

▼ **Continued on next page** ▼

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▼ FMC FAIL continued ▼

2 FMC source
select switch . . . . . .BOTH ON L or BOTH ON R

Select the operating FMC.

3 Choose one:

◆DUAL FMC OP RESTORED message **appears**:

FMC source select switch . . . . . NORMAL

■ ■ ■ ■

◆DUAL FMC OP RESTORED message does **not** appear:

■ ■ ■ ■

4 Resume conventional navigation. Without an operating FMC, LNAV and VNAV are not available.

5 Verify position relative to terrain using conventional navigation.

**Note:** EGPWS may use inaccurate GPS position data or an inappropriate value of RNP. This could result in a VSD terrain display that is incorrectly positioned relative to the airplane track.

6 **When** preparing for the approach:

Use the SPD REF selector to set the reference airspeed bugs.

Use the N1 SET selector to set the N1 bugs.

■ ■ ■ ■

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MSG

## FMC/CDU ALERTING MESSAGE

FMC P/RST

Condition: An alert message is in the FMC scratchpad.

1 Take action as needed by the message.

■ ■ ■ ■

GLS

## GLS

[With GLS capability]

Condition: A GLS failure occurs.

1 Do not fly a GLS approach.

2 ILS and non-ILS approaches may be flown.

■ ■ ■ ■

GPS

## GPS

Condition: One or both GPS receivers are failed.

**Note:** The FMC uses only IRS or radio inputs.

Look-ahead terrain alerting and display are unavailable due to position uncertainty.

1 Continue normal operation if ANP meets the requirements for the phase of flight.

■ ■ ■ ■

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## ILS — ILS

[With GLS capability]

Condition: An ILS failure occurs.

1 Do not fly an ILS approach.

2 GLS and non-ILS approaches may be flown.

■ ■ ■ ■

## DC FAIL — IRS DC FAIL

Condition: IRS backup DC power is failed.

1 **If** all other IRS lights are extinguished:

Continue normal operation.

**Note:** With both IRS DC FAIL lights illuminated, the switched hot battery bus is not powered or the battery is nearly discharged.

■ ■ ■ ■

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FAULT

## IRS FAULT

[Without SB 737-22-1140 incorporated]

Condition: One or more of these occur:
- An IRS fault occurs
- On the ground, if the ALIGN light is also illuminated, the present position entry is possibly incorrect.

1 Choose one:

◆On the **ground**:

▶▶**Go to step 2**

◆**In flight**:

▶▶**Go to step 6**

---

**On the ground**

2 Choose one:

◆ALIGN light is **extinguished**:

Notify maintenance.

■ ■ ■ ■

◆ALIGN light is also **illuminated**:

IRS mode selector . . . . . OFF

The FAULT light extinguishes immediately and the ALIGN light extinguishes after approximately 30 seconds.

▶▶**Go to step 3**

▼ Continued on next page ▼

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▼ IRS FAULT continued ▼

3 **After** the ALIGN light extinguishes:

IRS mode selector . . . . . NAV

Enter present position.

4 Choose one:

◆ALIGN light **is** flashing:

Re-enter present position.

▶▶**Go to step 5**

◆ALIGN light is **not** flashing:

▶▶**Go to step 5**

5 Choose one:

◆FAULT light **illuminates** again:

Notify maintenance.

■ ■ ■ ■

◆FAULT light does **not** illuminate again:

■ ■ ■ ■

## In flight

6 The IRS ATT and/or NAV mode(s) may be inoperative.

7 Partial capability may be restored by selecting attitude mode on the failed IRS. Straight and level, constant airspeed flight must be maintained for at least 30 seconds.

▼ Continued on next page ▼

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▼ IRS FAULT continued ▼

8 Choose one:

◆Selecting attitude mode on the failed IRS **is** desired:

▶▶**Go to step 9**

◆Selecting attitude mode on the failed IRS is **not** desired:

▶▶**Go to step 12**

Action is not reversible. Do this step only if the captain's or first officer's **primary attitude display** is **failed**.

9 ⚠ IRS mode selector (**failed side**) . . . . . ATT

Maintain straight and level, constant airspeed flight until the attitude display recovers (approximately 30 seconds).

▼ Continued on next page ▼

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▼ IRS FAULT continued ▼

**Note:** The primary attitude display will stay failed and the SET IRS HDG prompt will not appear on the POS INIT page until the attitude mode alignment is complete.

[Option - Heading Up]

10 Choose one:

◆FAULT light **extinguishes**:

Enter magnetic heading on the POS INIT page or on the overhead IRS display unit by selecting HDG/STS.

The MAP display on the failed side is not available.

Enter updated heading periodically on the POS INIT page or on the overhead IRS display unit by selecting HDG/STS.

Do **not** use either autopilot.

■ ■ ■ ■

◆FAULT light **stays illuminated**:

▶▶**Go to step 12**

▼ Continued on next page ▼

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▼ IRS FAULT continued ▼

[Option - Track Up]

11 Choose one:

◆FAULT light **extinguishes**:

Enter magnetic heading on the POS INIT page or on the overhead IRS display unit by selecting HDG/STS.

Enter updated heading periodically on the POS INIT page or on the overhead IRS display unit by selecting HDG/STS.

Do **not** use either autopilot.

■ ■ ■ ■

◆FAULT light **stays illuminated**:

▶▶**Go to step 12**

12 IRS transfer switch . . . .BOTH ON L or BOTH ON R

**Note:** Autopilot(s) cannot be engaged.

■ ■ ■ ■

ON DC

## IRS ON DC

Condition: IRS AC power is failed.

1 Power to the right IRS is removed after 5 minutes.

■ ■ ■ ■


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## UNABLE REQD NAV PERF - RNP

[Option - U10.7 and later.]

Condition: UNABLE REQD NAV PERF-RNP is shown. The actual navigation performance is not sufficient.

1 Choose one:

◆On a procedure or airway with an **RNP alerting requirement**:

Select an alternate procedure or airway. During an approach, go-around unless suitable visual references can be established and maintained.

■ ■ ■ ■

◆On a procedure or airway **without** an RNP alerting requirement:

Verify position.

■ ■ ■ ■

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## CONFIG

[Option - Center tank auto shutoff]

Condition: All of these occur:
- Both center tank fuel pump switches are off
- There is more than 726 kgs / 1600 lbs of fuel in the center tank
- An engine is running.

1 Do not accomplish this procedure until established in a level flight attitude.

2 CTR FUEL PUMP switches (both). . . . . ON

Verify that the LOW PRESSURE lights extinguish.

3 **When** both LOW PRESSURE lights illuminate:

CTR FUEL PUMP switches (both). . . . . OFF

■ ■ ■ ■

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## CONFIG

[Option - Without center tank auto shutoff]

Condition: All of these occur:
- Both center tank fuel pump pressures are low
- There is more than 726 kgs / 1600 lbs of fuel in the center tank
- An engine is running.

1 Do not accomplish this procedure until established in a level flight attitude.

2 CTR FUEL PUMP switches (both) . . . . . ON

Verify that the LOW PRESSURE lights extinguish.

3 **When** both LOW PRESSURE lights illuminate:

CTR FUEL PUMP switches (both) . . . . . OFF

■ ■ ■ ■

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VALVE OPEN

## CROSSFEED SELECTOR INOPERATIVE

Condition: The crossfeed VALVE OPEN light stays illuminated bright blue if the fuel crossfeed valve is not in the commanded position.

1 Choose one:

◆CROSSFEED selector is **closed**:

Crossfeed **valve** is failed open.

Maintain fuel balance with selective use of fuel pumps.

■ ■ ■ ■

◆CROSSFEED selector is **open**:

Crossfeed **valve** is failed closed.

▶▶**Go to step 2**

2 **If** flight conditions allow:

Vary thrust to maintain fuel balance.

**If** unable to maintain acceptable balance:

Land at the nearest suitable airport.

■ ■ ■ ■

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## Engine Fuel Leak

| | |
|---|---|
| Condition: | An inflight engine fuel leak is suspected or confirmed. (Items which may indicate an engine fuel leak are listed in the Additional Information section at the end of the checklist.) |
| Objective: | To verify that there is an engine fuel leak and to take corrective action, if needed. |

1 CTR FUEL PUMP switches (both) . . . . . OFF

The fuel CONFIG alert may show with fuel in the center tank.

2 CROSSFEED selector . . . . . Close

3 Identify an engine fuel leak by observing one main fuel tank quantity decreasing faster than the other.

4 An increase in fuel imbalance of approximately 230 kgs / 500 lbs or more in 30 minutes should be considered an engine fuel leak.

5 **If** conditions allow:

Visually check for an engine fuel leak.

▼ Continued on next page ▼

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▼ Engine Fuel Leak continued ▼

6 Choose one:

◆Both main tank quantities decrease at the **same** rate:

▶▶**Go to step 7**

◆Both main tank quantities decrease at **different** rates as described above **or an engine fuel leak is confirmed**:

▶▶**Go to step 15**

7 Resume normal fuel management procedures.

8 **If** the FMC message USING RSV FUEL, INSUFFICIENT FUEL, or CHECK FMC FUEL QUANTITY is shown on the CDU scratch pad:

Select PROGRESS page 1.

Check destination fuel estimate. Compare FMC fuel quantity with fuel gauges and flight plan fuel.

9 Choose one:

◆Fuel quantity indicator is **inoperative**:

Enter and periodically update the manually calculated FUEL weight on the FMC PERF INIT page, if needed.

▶▶**Go to step 10**

◆Fuel quantity indicator is **operative**:

▶▶**Go to step 10**

▼ Continued on next page ▼

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▼ Engine Fuel Leak continued ▼

10 Choose one:

◆Fuel LOW alert is **shown**:

▶▶**Go to step 11**

◆Fuel LOW alert is **not** shown:

■ ■ ■ ■

11 Main tank FUEL PUMP switches (all) . . . . . .ON

12 CROSSFEED selector. . . . . Open

13 Apply thrust changes slowly and smoothly.

14 **If** a climb is needed:

Maintain the minimum pitch attitude needed for safe flight. This minimizes the possibility of uncovering the fuel pumps.

■ ■ ■ ■

## Engine fuel leak is confirmed

15 Autothrottle . . . . . .Disengage

16 Thrust lever
(affected engine) . . . . . Confirm . . . . . Close

17 Engine start lever
(affected engine) . . . . . Confirm . . . . . CUTOFF

18 PACK switch (affected side) . . . . . OFF

This causes the operating pack to regulate to high flow in flight with the flaps up.

▼ Continued on next page ▼

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▼ Engine Fuel Leak continued ▼

19 Choose one:

◆APU is **available** for start:

APU . . . . . START

**When** APU is running:

APU GEN switch
(affected side) . . . . . ON

▶▶**Go to step 20**

◆APU is **not** available:

▶▶**Go to step 20**

20 Transponder mode selector . . . . . TA ONLY

This prevents climb commands which can exceed single engine performance capability.

21 After engine shutdown, all remaining fuel can be used for the operating engine. Balance fuel as needed.

22 Plan to land at the nearest suitable airport.

[Airplanes without Fail Operational Autoland Capability]

▶▶**Go to the One Engine Inoperative Landing checklist on page 7.26**

[Airplanes with Fail Operational Autoland Capability]

▶▶**Go to the One Engine Inoperative Landing checklist on page 7.29**

■ ■ ■ ■

▼ Continued on next page ▼

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▼ Engine Fuel Leak continued ▼

## Additional Information

One or more of the following may be an indication of a fuel leak:

- Visual observation of fuel spray from strut or engine
- Excessive fuel flow
- Total fuel quantity decreasing at an abnormal rate
- Fuel IMBAL alert
- USING RSV FUEL message
- INSUFFICIENT FUEL message
- CHECK FMC FUEL QUANTITY message.

FILTER BYPASS

## FUEL FILTER BYPASS

Condition: Fuel contamination can cause fuel to bypass the fuel filter.

**Note:** Erratic engine operation and flameout may occur due to fuel contamination.

■ ■ ■ ■

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LOW PRESSURE

## FUEL PUMP LOW PRESSURE

Condition: The fuel pump pressure is low.

**Note:** Fuel pump LOW PRESSURE lights may flicker when tank quantity is low and the airplane is in turbulent air or during climb or descent.

1 Choose one:

◆**One main** tank fuel pump LOW PRESSURE light is illuminated:

Main tank FUEL PUMP switch (affected pump). . . . . OFF

Sufficient fuel pressure is available for normal operation.

■ ■ ■ ■

◆**Both main** tank fuel pump LOW PRESSURE lights are illuminated:

**Note:** At high altitude, thrust deterioration or engine flameout may occur.

■ ■ ■ ■

◆**One CTR** tank fuel pump LOW PRESSURE light is illuminated:

▶▶**Go to step 2**

◆**Both CTR** tank fuel pump LOW PRESSURE lights are illuminated:

▶▶**Go to step 5**

▼ **Continued on next page** ▼

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▼ FUEL PUMP LOW PRESSURE continued ▼

2 CROSSFEED selector. . . . . Open

This prevents fuel imbalance.

3 CTR FUEL PUMP switch (affected side) . . . . . OFF

4 **When** the other CTR tank fuel pump LOW PRESSURE light illuminates:

CROSSFEED selector . . . . . Close

Remaining CTR FUEL PUMP switch . . . . . OFF

■ ■ ■ ■

**Both CTR tank fuel pump LOW PRESSURE lights are illuminated**

5 CTR FUEL PUMP switches (both). . . . . OFF

6 Fuel CONFIG alert may show with fuel in the center tank.

7 Center tank fuel is unusable. Main tank fuel may not be sufficient for the planned flight.

■ ■ ■ ■

## Fuel Quantity Indication Inoperative

Condition: The fuel quantity indication is blank.

1 Enter and periodically update the manually calculated FUEL weight on the FMC PERF INIT page.

■ ■ ■ ■

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## Fuel Temperature Low

Condition: Fuel temperature is near the minimum.

1 **When** fuel temperature is approaching the fuel temperature limit (3° C /5° F above the fuel freeze point or - 43° C /- 45° F whichever is higher):

Increase speed, change altitude and/or deviate to a warmer air mass to achieve a TAT equal to or higher than the fuel temperature limit.

TAT will increase approximately 0.5 to 0.7° C for each .01 Mach increase in speed. In extreme conditions, it may be necessary to descend as low as FL250.

■ ■ ■ ■

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## IMBAL

Condition: There is a fuel imbalance between the main fuel tanks of more than 453 kgs / 1000 lbs.

Objective: To balance fuel if there are no indications of an engine fuel leak.

1 The fuel imbalance may be caused by an engine fuel leak. For indications of an engine fuel leak, check:

Total fuel remaining compared to planned fuel remaining.

Fuel flow indications for an engine with excessive fuel flow.

Individual tank quantities.

2 Choose one:

◆There **is** an indication of an engine fuel leak:

▶▶**Go to the Engine Fuel Leak checklist on page 12.4**

■ ■ ■ ■

◆There is **no** indication of an engine fuel leak:

Balance fuel.

■ ■ ■ ■

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## LOW

[Option - LOW Alert below 2000 lbs/907 kgs]

| | |
|---|---|
| Condition: | The fuel quantity in a main tank is less than 907 kgs / 2000 lbs. |
| Objective: | To check for indications of an engine fuel leak and ensure all remaining fuel is available to both engines. |

[Option - LOW Alert below 1000 lbs/453 kgs]

| | |
|---|---|
| Condition: | The fuel quantity in a main tank is less than 453 kgs / 1000 lbs. |
| Objective: | To check for indications of an engine fuel leak and ensure all remaining fuel is available to both engines. |

1 The fuel LOW indication may be caused by an engine fuel leak. For indications of an engine fuel leak, check:

Total fuel remaining compared to planned fuel remaining.

Fuel flow indications for an engine with excessive fuel flow.

Individual tank quantities.

▼ Continued on next page ▼

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▼ LOW continued ▼

2 Choose one:

◆There **is** an indication of an engine fuel leak:

▶▶**Go to the Engine Fuel Leak checklist on page 12.4**

■ ■ ■ ■

◆There is **no** indication of an engine fuel leak:

▶▶**Go to step 3**

3 Main tank FUEL PUMP switches (all) . . . . . ON

4 CROSSFEED selector. . . . . Open

5 Apply thrust changes slowly and smoothly.

6 **If** a climb is needed:

Maintain the minimum pitch attitude needed for safe flight. This minimizes the possibility of uncovering the fuel pumps.

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LOW PRESSURE

## HYDRAULIC PUMP LOW PRESSURE

Condition: The hydraulic pump pressure is low.

1 HYD PUMP switch (affected side) . . . . . OFF

**Note:** Loss of an engine-driven hydraulic pump and a high demand on the system may result in an intermittent illumination of the LOW PRESSURE light for the remaining electric motor-driven hydraulic pump.

■ ■ ■ ■

OVERHEAT

## HYDRAULIC PUMP OVERHEAT

Condition: The hydraulic pump temperature is high.

1 ELEC HYD PUMP switch (affected side) . . . . . OFF

**Note:** One pump supplies sufficient pressure for normal system operation.

■ ■ ■ ■

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# LOSS OF SYSTEM A

| FLT CONTROL | A HYD PUMPS | |
|---|---|---|
| A | ENG 1 | ELEC 2 |
| LOW PRESSURE | LOW PRESSURE | LOW PRESSURE |

Condition: Hydraulic system A pressure is low.

1 System A
FLT CONTROL switch . . . . Confirm . . . . STBY RUD

2 System A
HYD PUMP switches (both). . . . . OFF

## Inoperative Items

**Autopilot A inop**
Autopilot B is available.

**Flight spoilers (two on each wing) inop**
Roll rate and speedbrake effectiveness may be reduced in flight.

**Main landing gear normal hydraulic system inop**
Manual gear extension is needed.

**Ground spoilers inop**
Landing distance will be increased.

**Alternate brakes inop**
Normal brakes are available.

**Engine 1 thrust reverser normal hydraulic pressure inop**
Thrust reverser will deploy and retract at a slower rate and some thrust asymmetry can be anticipated during thrust reverser deployment.

**Normal nose wheel steering inop**
Alternate nose wheel steering is available.

▼ Continued on next page ▼

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▼ LOSS OF SYSTEM A continued ▼

3 Check the Non–Normal Configuration Landing Distance table in the Advisory Information section of the Performance Inflight chapter.

4 NOSE WHEEL STEERING switch . . . . . ALT

5 Plan for manual gear extension.

**Note:** When the gear has been lowered manually, it cannot be retracted. The drag penalty with gear extended may make it impossible to reach an alternate field.

6 **Checklist Complete Except Deferred Items**

## Deferred Items

### Descent Checklist

Pressurization. . . . . LAND ALT ___

Recall . . . . . Checked

Autobrake . . . . . ___

Landing data . . . . . VREF ___, Minimums ___

Approach briefing . . . . . Completed

### Approach Checklist

Altimeters . . . . . ___

▼ Continued on next page ▼

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▼ LOSS OF SYSTEM A continued ▼

## Manual Gear Extension

LANDING GEAR lever . . . . . OFF

Manual gear extension handles . . . . . Pull

The uplock is released when the handle is pulled to its limit.

The related red landing gear indicator light illuminates, indicating uplock release.

**Wait** 15 seconds after the last manual gear extension handle is pulled:

LANDING GEAR lever . . . . . DN

## Landing Checklist

[Without automatic ignition]

ENGINE START switches . . . . . CONT

Speedbrake . . . . . ARMED

Landing gear . . . . . Down

Flaps . . . . . ___, Green light

■ ■ ■ ■

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# LOSS OF SYSTEM B

| FLT CONTROL | B HYD PUMPS | |
|---|---|---|
| B | ELEC 1 | ENG 2 |
| LOW PRESSURE | LOW PRESSURE | LOW PRESSURE |

Condition: Hydraulic system B pressure is low.

1 System B
FLT CONTROL switch . . . . Confirm . . . . STBY RUD

2 System B
HYD PUMP switches (both). . . . . OFF

Continued on next page

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▼ LOSS OF SYSTEM B continued ▼

## Inoperative Items

**Autopilot B inop**
Autopilot A is available.

**Flight spoilers (two on each wing) inop**
Roll rate and speedbrake effectiveness may be reduced in flight.

**Yaw damper inop**

**Trailing edge flaps normal hydraulic system inop**
The trailing edge flaps can be operated with the alternate electrical system. Alternate flap extension time to flaps 15 is approximately 2 minutes.

**Leading edge flaps and slats normal hydraulic system inop**
The leading edge flaps and slats can be extended with standby pressure. Once extended, they can not be retracted.

**Autobrake inop**
Use manual braking.

**Normal brakes inop**
Alternate brakes are available.

**Engine 2 thrust reverser normal hydraulic pressure inop**
Thrust reverser will deploy and retract at a slower rate and some thrust asymmetry can be anticipated during thrust reverser deployment.

**Alternate nose wheel steering inop**
Normal nose wheel steering is available.

3 Plan for flaps 15 landing.

▼ Continued on next page ▼

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▼ LOSS OF SYSTEM B continued ▼

4 Set VREF 15 or VREF ICE.

**If** any of the following conditions apply, set VREF ICE = VREF 15 + 10 knots:

Engine anti–ice will be used during landing

Wing anti–ice has been used any time during the flight

Icing conditions were encountered during the flight and the landing temperature is below 10° C.

**Note:** When VREF ICE is needed, the wind additive should not exceed 10 knots.

5 Plan to extend flaps to 15 using alternate flap extension.

**Note:** The drag penalty with the leading edge devices extended may make it impossible to reach an alternate field.

6 Check the Non–Normal Configuration Landing Distance table in the Advisory Information section of the Performance Inflight chapter.

7 Do **not** arm the autobrake for landing. Use manual braking.

8 **Checklist Complete Except Deferred Items**

## Deferred Items

### Descent Checklist

Pressurization . . . . . LAND ALT ____

Recall . . . . . Checked

▼ Continued on next page ▼

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▼ LOSS OF SYSTEM B continued ▼

Autobrake . . . . . **OFF**

Landing data . . . . . **VREF 15 or VREF ICE, Minimums ____**

Approach briefing . . . . . Completed

## Approach Checklist

Altimeters . . . . . ____

## Alternate Flap Extension

During flap extension, set the flap lever to the desired flap position.

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▼ LOSS OF SYSTEM B continued ▼

230K maximum during alternate flap extension.

ALTERNATE FLAPS master switch . . . . . ARM

**Note:** The landing gear configuration warning may sound if the flaps are between 10 and 15 and the landing gear are retracted.

**Note:** The amber LE FLAPS TRANSIT light will stay illuminated until the flaps approach the flaps 10 position.

**Note:** Operation within the lower amber airspeed band may be needed until the LE FLAPS TRANSIT light extinguishes.

If flap asymmetry occurs, release the switch immediately. There is no asymmetry protection.

ALTERNATE FLAPS
position switch . . . . . Hold DOWN
to extend flaps
to 15 on schedule

As flaps are extending, slow to respective maneuvering speed.

## Additional Deferred Item

GROUND PROXIMITY FLAP
INHIBIT switch . . . . . FLAP INHIBIT

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▼ LOSS OF SYSTEM B continued ▼

## Landing Checklist

[Without automatic ignition]

ENGINE START switches . . . . . CONT

Speedbrake . . . . . ARMED

Landing gear . . . . . Down

Flaps. . . . . **15, Green light**

■ ■ ■ ■

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# MANUAL REVERSION or LOSS OF SYSTEM A AND SYSTEM B

| FLT CONTROL | | HYD PUMPS | |
|---|---|---|---|
| A | B | ENG 1 ELEC 2 | ELEC 1 ENG 2 |
| LOW PRESSURE | LOW PRESSURE | LOW PRESSURE | LOW PRESSURE |

Condition: Hydraulic system A and B pressures are low.

1 System A and B FLT CONTROL switches (both) . . . . . Confirm. . . . . .STBY RUD

2 YAW DAMPER switch . . . . . .ON

3 System A and B HYD PUMPS switches (all) . . . . . OFF

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▼ MANUAL REVERSION or LOSS OF SYSTEM A AND SYSTEM B continued ▼

## Inoperative Items

**Autopilots A and B inop**

**All flight spoilers inop**
Roll rate will be reduced and speedbrakes will not be available in flight.

**Trailing edge flaps normal hydraulic system inop**
The trailing edge flaps can be operated with the alternate electrical system. Alternate flap extension time to flaps 15 is approximately 2 minutes.

**Leading edge flaps and slats normal hydraulic system inop**
The leading edge flaps and slats can be extended with standby hydraulic pressure. Once extended, they can not be retracted.

**Main landing gear normal hydraulic system inop**
Manual gear extension is needed.

**Autobrake inop**

**Ground spoilers inop**
Landing distance will be increased.

**Normal and alternate brakes inop**
Inboard and outboard brakes have accumulator pressure only. On landing, apply steady brake pressure without modulating the brakes.

**Both thrust reversers normal pressure inop**
Thrust reversers will deploy and retract at a slower rate.

**Nose wheel steering inop**
Do not attempt to taxi the airplane after stopping.

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**▼ MANUAL REVERSION or LOSS OF SYSTEM A AND SYSTEM B continued ▼**

4 Plan to land at the nearest suitable airport.

5 Plan for flaps 15 landing.

6 Set VREF 15 or VREF ICE.

**If** any of the following conditions apply, set VREF ICE = VREF 15 + 10 knots:

Engine anti–ice will be used during landing

Wing anti–ice has been used any time during the flight

Icing conditions were encountered during the flight and the landing temperature is below 10° C.

**Note:** When VREF ICE is needed, the wind additive should not exceed 10 knots.

7 Plan to extend flaps to 15 using alternate flap extension.

**Note:** The drag penalty with the leading edge devices extended may make it impossible to reach an alternate field.

8 Plan for manual gear extension.

**Note:** When the gear has been lowered manually, it cannot be retracted. The drag penalty with gear extended may make it impossible to reach an alternate field.

9 Check the Non–Normal Configuration Landing Distance table in the Advisory Information section of the Performance Inflight chapter.

**▼ Continued on next page ▼**

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▼ MANUAL REVERSION or LOSS OF SYSTEM A AND SYSTEM B continued ▼

**Note:** The crosswind capability of the airplane is greatly reduced.

10 Do **not** arm the autobrake for landing.

11 Do **not** arm the speedbrakes for landing.

12 On touchdown, apply steady brake pressure without modulating the brakes.

13 Do not attempt to taxi the airplane after stopping.

14 **Checklist Complete Except Deferred Items**

## Deferred Items

### Descent Checklist

Pressurization . . . . . LAND ALT ___

Recall . . . . . Checked

Autobrake . . . . . **OFF**

Landing data . . . . . **VREF 15 or VREF ICE, Minimums ___**

Approach briefing . . . . . Completed

▼ Continued on next page ▼

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▼ MANUAL REVERSION or LOSS OF SYSTEM A AND SYSTEM B continued ▼

## Go-Around Procedure Review

Do the normal go-around procedure except:

Advance thrust to go-around smoothly and slowly to avoid excessive pitch-up.

Be prepared to trim.

Limit bank angle to 15° when airspeed is less than the minimum maneuver speed.

## Approach Checklist

Altimeters . . . . . ____

## Alternate Flap Extension

During flap extension, set the flap lever to the desired flap position.

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**▼ MANUAL REVERSION or LOSS OF SYSTEM A AND SYSTEM B continued ▼**

230K maximum during alternate flap extension.

ALTERNATE FLAPS master switch . . . . . ARM

**Note:** The landing gear configuration warning may sound if the flaps are between 10 and 15 and the landing gear are retracted.

**Note:** The amber LE FLAPS TRANSIT light will stay illuminated until the flaps approach the flaps 10 position.

**Note:** Operation within the lower amber airspeed band may be needed until the LE FLAPS TRANSIT light extinguishes.

If flap asymmetry occurs, release the switch immediately. There is no asymmetry protection.

ALTERNATE FLAPS position switch . . . . . Hold DOWN to extend flaps to 15 on schedule

As flaps are extending, slow to respective maneuvering speed.

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▼ MANUAL REVERSION or LOSS OF SYSTEM A AND SYSTEM B continued ▼

## Manual Gear Extension

LANDING GEAR lever . . . . . OFF

Manual gear extension handles . . . . . Pull

The uplock is released when the handle is pulled to its limit.

The related red landing gear indicator light illuminates, indicating uplock release.

**Wait** 15 seconds after the last manual gear extension handle is pulled:

LANDING GEAR lever . . . . . DN

## Additional Deferred Item

GROUND PROXIMITY FLAP INHIBIT switch . . . . . FLAP INHIBIT

## Landing Checklist

[Without automatic ignition]
ENGINE START switches. . . . . CONT

Speedbrake . . . . . **DOWN detent**

Landing gear . . . . . Down

Flaps . . . . . **15, Green light**

■ ■ ■ ■

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LOW PRESSURE

## STANDBY HYDRAULIC LOW PRESSURE

Condition: The standby hydraulic pump pressure is low.

**Note:** With a loss of hydraulic system A and B, the rudder is inoperative.

■ ■ ■ ■

LOW QUANTITY

## STANDBY HYDRAULIC LOW QUANTITY

Condition: The standby hydraulic quantity is low.

1 Continue normal operation.

■ ■ ■ ■

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ANTISKID INOP

## ANTISKID INOPERATIVE

Condition: An antiskid system fault occurs.

**Note:** Locked wheel protection is not available.

1 AUTO BRAKE select switch. . . . . OFF

2 Do **not** arm the speedbrakes for landing. Manually deploy the speedbrakes immediately upon landing.

Automatic speedbrake extension may be inoperative.

3 Do **not** apply brakes until after main gear touchdown. Use minimum braking consistent with runway conditions to reduce the possibility of a tire blowout.

4 Check the Non–Normal Configuration Landing Distance table in the Advisory Information section of the Performance Inflight chapter.

5 **Checklist Complete Except Deferred Items**

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▼ ANTISKID INOPERATIVE continued ▼

## Deferred Items

### Descent Checklist

Pressurization . . . . . LAND ALT ___

Recall . . . . . Checked

Autobrake **. . . . . .OFF**

Landing data . . . . . .VREF ___, Minimums ___

Approach briefing . . . . . Completed

### Approach Checklist

Altimeters . . . . . ___

### Landing Checklist

[Without automatic ignition]

ENGINE START switches. . . . . CONT

Speedbrake **. . . . . .DOWN detent**

Landing gear . . . . . Down

Flaps . . . . . ___, Green light

■ ■ ■ ■

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AUTO BRAKE DISARM

## AUTO BRAKE DISARM

Condition: The autobrake system disarms after being set.

1 Choose one:

◆On the **ground**:

AUTO BRAKE select switch . . . . . OFF

▶▶**Go to step 2**

◆**In flight**:

▶▶**Go to step 3**

2 Choose one:

◆AUTO BRAKE DISARM light **extinguishes**:

■ ■ ■ ■

◆AUTO BRAKE DISARM light **stays illuminated**:

Do not takeoff.

■ ■ ■ ■

3 AUTO BRAKE select switch. . . . OFF, then reselect

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▼ AUTO BRAKE DISARM continued ▼

4 Choose one:

◆AUTO BRAKE DISARM light **stays extinguished**:

■ ■ ■ ■

◆AUTO BRAKE DISARM light **illuminates again**:

AUTO BRAKE select switch . . . . . OFF

Use manual brakes for landing.

▶▶**Go to step 5**

5 **Checklist Complete Except Deferred Items**

## Deferred Items

### Descent Checklist

Pressurization . . . . . LAND ALT ___

Recall . . . . . Checked

Autobrake **. . . . . .OFF**

Landing data . . . . . .VREF ___, Minimums ___

Approach briefing . . . . . Completed

### Approach Checklist

Altimeters . . . . . ___

### Landing Checklist

[Without automatic ignition]

ENGINE START switches. . . . . CONT

Speedbrake . . . . . .ARMED

▼ Continued on next page ▼

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▼ AUTO BRAKE DISARM continued ▼

Landing gear . . . . . Down

Flaps . . . . . ____, Green light

■ ■ ■ ■

## Brake Pressure Indicator Zero PSI

Condition: The brake accumulator has no nitrogen precharge.

1 Accumulator braking is not available.

**Note:** If hydraulic systems indications are normal, brake operation is unaffected.

■ ■ ■ ■

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BRAKE TEMP

## BRAKE TEMPERATURE

[Option - Brake Temperature Indicator]

Condition: One or more brake temperatures are high.

1 Choose one:

◆On the **ground**:

Check the Recommended Brake Cooling Schedule in the Advisory Information section of the Performance Inflight chapter for needed cooling time.

■ ■ ■ ■

◆**In flight**:

▶▶**Go to step 2**

270K/.82M maximum.

2 ⚠ LANDING GEAR lever . . . . . DN

This allows cooling air to flow around the brakes.

3 **When** the BRAKE TEMP light is **extinguished**:

**Wait** 7 minutes. This ensures sufficient cooling time.

235K maximum.

4 ⚠ LANDING GEAR lever . . . . . UP

5 **When** the landing gear indicator lights extinguish:

LANDING GEAR lever . . . . . OFF

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## Landing Gear Lever Jammed in the Up Position

Condition: The LANDING GEAR lever will not move from the UP position.

**Note:** Start this checklist **only** when ready to extend the gear for landing.

Once the gear is extended, do **not** retract.

270K/.82M maximum.

1 ⚠ LANDING GEAR override trigger . . . . . Pull

2 LANDING GEAR lever . . . . . DN

3 Choose one:

◆LANDING GEAR **lever** moves to the **DN** position:

▶▶**Go to step 4**

◆LANDING GEAR **lever** does **not** move to the DN position:

▶▶**Go to step 6**

4 Check landing gear indicator lights.

▼ Continued on next page ▼


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▼ Landing Gear Lever Jammed in the Up Position continued ▼

**Note:** If a green landing gear indicator light is illuminated on either the center main panel or the overhead panel, the related landing gear is down and locked.

5 Choose one:

◆**All** landing gear indicate down and locked:

Plan to land at the nearest suitable airport.

■ ■ ■ ■

◆**Only one or two** landing gear indicate down and locked:

▶▶**Go to the Manual Gear Extension checklist on page 14.16**

■ ■ ■ ■

6 NOSE WHEEL STEERING switch . . . . . Verify NORM

Nose wheel steering is not available.

**Warning! Do not use alternate nose wheel steering because the landing gear may retract on the ground.**

▼ Continued on next page ▼

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▼ Landing Gear Lever Jammed in the Up Position continued ▼

270K/.82M maximum.

7 ⚠ Manual gear extension handles (all). . . . . Pull

Do not wait for an indication that a landing gear is down and locked before pulling the next handle.

**Note:** The uplock is released when the handle is pulled to its limit. The related red landing gear indicator light illuminates, indicating uplock released.

With the LANDING GEAR lever in the UP or OFF position, the red landing gear indicator lights will stay illuminated.

8 Choose one:

◆**All** landing gear indicate down and locked:

▶▶**Go to step 9**

◆**Only one or two** landing gear indicate down and locked:

▶▶**Go to the Partial or All Gear Up Landing checklist on page 14.18**

■ ■ ■ ■

9 **Checklist Complete Except Deferred Items**

## Deferred Items

**Descent Checklist**

Pressurization . . . . . LAND ALT ____

Recall . . . . . Checked

▼ Continued on next page ▼

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▼ Landing Gear Lever Jammed in the Up Position continued ▼

Autobrake . . . . . ___

Landing data . . . . . VREF ___, Minimums ___

Approach briefing . . . . . Completed

## Approach Checklist

Altimeters . . . . . ___

## Additional Deferred Item

[Option - Ground Proximity Gear Inhibit switch]
GROUND PROXIMITY GEAR
INHIBIT switch . . . . . GEAR INHIBIT

[Option - Without Ground Proximity Gear Inhibit switch]
GND PROX WARN
circuit breaker (P18–1:B7). . . . . Pull

## Landing Checklist

[Without automatic ignition]
ENGINE START switches . . . . . CONT

Speedbrake . . . . . ARMED

Landing gear . . . . . **Down, Three green**

Flaps . . . . . ___, Green light

**Note:** Nose wheel steering is not available.

**Warning! Do not use alternate nose wheel steering because the landing gear may retract on the ground.**

■ ■ ■ ■

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## Landing Gear Lever Will Not Move Up After Takeoff

Condition: The LANDING GEAR lever cannot be moved to the UP position due to one of the following:

- Failure of the landing gear lever lock solenoid
- Failure of the air/ground system
- Failure of the ground spoiler bypass valve to close.

**Note:** Do not use FMC fuel predictions.

1 LANDING GEAR lever . . . . . DN

2 Retract the flaps on schedule.

▼ Continued on next page ▼


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▼ Landing Gear Lever Will Not Move Up After Takeoff continued ▼

3 Choose one:

◆Intermittent cabin altitude/configuration warning horn **stays silent** and the TAKEOFF CONFIG lights (if installed and operative) do **not illuminate** after the flaps are fully retracted and the thrust levers are beyond the normal takeoff position:

**Note:** This indicates a failure of the landing gear lever lock solenoid.

▶▶**Go to step 4**

◆Intermittent cabin altitude/configuration warning horn **sounds** and the TAKEOFF CONFIG lights (if installed and operative) **illuminate** when the flaps are fully retracted:

**Note:** This indicates either a failure of the air/ground system or a failure of the ground spoiler bypass to close.

Do **not** retract the gear.

▶▶**Go to step 8**

235K maximum.

4 ⚠ LANDING GEAR override trigger . . . . . Pull

5 LANDING GEAR lever . . . . . UP

6 **When** the landing gear indicator lights extinguish:

LANDING GEAR lever . . . . . OFF

▼ Continued on next page ▼

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▼ Landing Gear Lever Will Not Move Up After Takeoff continued ▼

7 Continue normal operation.

■ ■ ■ ■

8 LANDING GEAR
TAKEOFF WARNING CUTOFF
circuit breaker (P6–3:C18) . . . . . Pull

**Note:** The intermittent cabin altitude/configuration warning horn may still sound and the TAKEOFF CONFIG lights (if installed and operative) may still illuminate depending on thrust lever and flap position.

**Caution! Do not use the speedbrakes in flight.**

9 Plan to land at the nearest suitable airport.

10 Do **not** arm the autobrake for landing. Use manual braking.

11 Do **not** arm the speedbrakes for landing. Manually deploy the speedbrakes immediately upon landing.

12 **Checklist Complete Except Deferred Items**

## Deferred Items

### Descent Checklist

Pressurization . . . . . LAND ALT ___

Recall . . . . . Checked

Autobrake . . . . . **OFF**

Landing data . . . . . VREF ___, Minimums ___

Approach briefing . . . . . Completed

▼ Continued on next page ▼

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▼ Landing Gear Lever Will Not Move Up After Takeoff continued ▼

## Approach Checklist

Altimeters . . . . . ___

## Gear Down Verification

LANDING GEAR lever. . . . . Verify DN

## Landing Checklist

[Without automatic ignition]

ENGINE START switches . . . . . CONT

Speedbrake . . . . . **DOWN detent**

Landing gear . . . . . **Down (previously verified)**

Flaps . . . . . ___, Green light

**Note:** Manually deploy the speedbrakes immediately upon touchdown. Use manual braking.

■ ■ ■ ■

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## Manual Gear Extension

Condition: One of these occurs:
- Any landing gear is not down and locked when the LANDING GEAR lever is down
- The LANDING GEAR lever is jammed in the OFF position.

**Note:** If a green landing gear indicator light is illuminated on either the center main panel or the overhead panel, the related landing gear is down and locked.

1 LANDING GEAR lever . . . . . OFF (if possible)

270K/.82M maximum.

2 Manual gear extension handles (affected gear) . . . . . Pull

The uplock is released when the handle is pulled to its limit. The related red landing gear indicator light illuminates, indicating uplock released.

3 **Wait** 15 seconds after the last manual gear extension handle is pulled:

LANDING GEAR lever . . . . . DN (if possible)

4 Check landing gear indicator lights.

▼ Continued on next page ▼

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▼ Manual Gear Extension continued ▼

**Note:** If the LANDING GEAR lever is in the OFF position, the red landing gear indicator lights will also be illuminated.

5 Choose one:

◆ **All** landing gear indicate down and locked:

▶▶**Go to step 6**

◆ **Only one or two** landing gear indicate down and locked:

▶▶**Go to the Partial or All Gear Up Landing checklist on page 14.18**

■ ■ ■ ■

6 Choose one:

◆ LANDING GEAR **lever** is in the **DN** position:

Land normally.

■ ■ ■ ■

◆ LANDING GEAR **lever** is in the **OFF** position:

GROUND PROXIMITY GEAR
INHIBIT switch . . . . . .GEAR INHIBIT

GND PROX WARN
circuit breaker (P18–1:B7) . . . . . Pull

Land normally.

**Note:** Nose wheel steering is not available.

■ ■ ■ ■

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## Partial or All Gear Up Landing

Condition: All landing gear are not down and locked after attempting manual gear extension.

1 Choose one:

◆Manual gear extension **has** been attempted:

▶▶**Go to step 2**

◆Manual gear extension has **not** been attempted:

▶▶**Go to the Manual Gear Extension checklist on page 14.16**

■ ■ ■ ■

2 Brief the crew and passengers on emergency landing and evacuation procedures.

3 Burn off fuel to reduce touchdown speed.

4 Plan a flaps 40 landing.

5 Set VREF 40.

6 LANDING GEAR
AURAL WARN circuit breaker (P6-3:D18). . . . Pull

This prevents the landing gear warning horn with gear retracted and landing flaps selected.

7 FLIGHT CONTROL
AUTO SPEED BRAKE
circuit breaker (P6-2:B9). . . . . Pull

This prevents inadvertent deployment of ground spoilers after landing.

▼ Continued on next page ▼

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▼ Partial or All Gear Up Landing continued ▼

8 Do **not** arm the autobrake for landing. Use manual braking.

9 Do **not** arm the speedbrakes for landing.

10 **Checklist Complete Except Deferred Items**

## Deferred Items

### Descent Checklist

Pressurization . . . . . LAND ALT ___

Recall . . . . . Checked

Autobrake **. . . . . .OFF**

Landing data **. . . . . VREF 40, Minimums ___**

Approach briefing . . . . . Completed

### Approach Checklist

Altimeters . . . . . ___

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▼ Partial or All Gear Up Landing continued ▼

## Landing Procedure Review

Do not extend the speedbrakes unless stopping distance is critical. When stopping distance is critical, extend the speedbrakes after all landing gear, the nose or the engine nacelle have contacted the runway.

Do not use the thrust reversers unless stopping distance is critical.

Turn all fuel pump switches OFF just before the flare.

After stopping, do the Evacuation checklist, if needed.

## Additional Deferred Items

APU switch . . . . . OFF

[Option - Ground Proximity Gear Inhibit switch]
GROUND PROXIMITY GEAR
INHIBIT switch . . . . . GEAR INHIBIT

[Option - Without Ground Proximity Gear Inhibit switch]
GND PROX WARN
circuit breaker (P18–1:B7) . . . . . Pull

**When** on approach:

Engine BLEED air switches. . . . . OFF

This ensures the airplane is depressurized at touchdown.

▼ Continued on next page ▼

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▼ Partial or All Gear Up Landing continued ▼

## Landing Checklist

[Without automatic ignition]

ENGINE START switches . . . . . CONT

Speedbrake . . . . . **DOWN detent**

Landing gear . . . . . ____ **Down**

Flaps. . . . . **40, Green light**

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## Overspeed

Condition: Airspeed is more than Vmo/Mmo.

1 Reduce thrust and, if needed, adjust attitude to reduce airspeed to less than Vmo/Mmo.

## TAKEOFF CONFIGURATION

TAKEOFF CONFIG **(If installed and operative)**

Condition: On the ground, the intermittent cabin altitude/configuration warning horn sounds and the TAKEOFF CONFIG lights (if installed and operative) illuminate when advancing the thrust levers to takeoff thrust.

1 Assure correct airplane takeoff configuration.

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# WARNING HORN - CABIN ALTITUDE OR CONFIGURATION

**(If installed and operative)**

| **Left Forward Panel** | | **Right Forward Panel** | |
|---|---|---|---|
| TAKEOFF CONFIG | CABIN ALTITUDE | CABIN ALTITUDE | TAKEOFF CONFIG |

Condition: One of these occurs:

- In flight, an intermittent horn sounds and the CABIN ALTITUDE lights (if installed and operative) illuminate, when the cabin altitude is at or above 10,000 feet
- On the ground, an intermittent horn sounds and the TAKEOFF CONFIG lights (if installed and operative) illuminate, when the takeoff configuration is not correct during takeoff
- In flight, a steady horn sounds when the landing configuration is not correct.

1 **If** the intermittent warning horn sounds and the CABIN ALTITUDE lights (if installed and operative) illuminate **in flight**:

Don the oxygen masks and set the regulators to 100%.

Establish crew communications.

▶▶**Go to the CABIN ALTITUDE WARNING or Rapid Depressurization checklist on page 2.1**

■ ■ ■ ■

▼ **Continued on next page** ▼

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**▼ WARNING HORN - CABIN ALTITUDE OR CONFIGURATION continued ▼**

2 **If** the intermittent warning horn sounds and the TAKEOFF CONFIG lights (if installed and operative) illuminate **on the ground**:

Assure correct airplane takeoff configuration.

■ ■ ■ ■

3 **If** the steady warning horn sounds **in flight**:

Assure correct airplane landing configuration.

■ ■ ■ ■

## ALTITUDE ALERT

Condition: The ALT ALERT indication shows that one of these occurs:
- The airplane is about to reach the MCP altitude
- A deviation from the MCP altitude.

1 Reset the selected altitude (if needed).

2 Maintain the correct altitude.

■ ■ ■ ■

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## INOP — GROUND PROXIMITY INOPERATIVE

Condition: A ground proximity warning system fault occurs.

**Note:** Some or all GPWS alerts are not available. GPWS alerts which occur are valid.

■ ■ ■ ■

## PSEU — PSEU

Condition: A proximity switch electronics unit fault occurs.

**Note:** The PSEU light illuminates on the ground only.

1 Choose one:

- PSEU light **stays** illuminated when either system annunciator panel is pushed and released:

  ▶▶**Go to step 2**

- PSEU light **extinguishes** when either system annunciator panel is pushed and released:

■ ■ ■ ■

▼ Continued on next page ▼

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▼ PSEU continued ▼

2 Choose one:

◆PSEU light **stays** illuminated when the parking brake is set or when both engines are shut down:

Do not takeoff.

■ ■ ■ ■

◆PSEU light **extinguishes** when the parking brake is set or when both engines are shut down:

■ ■ ■ ■

3 **If** the PSEU light stays illuminated when the parking brake is set or when both engines are shut down:

Do not takeoff.

■ ■ ■ ■

SPSEU

## SPSEU

Condition: A supplemental proximity switch electronics unit fault occurs.

**Note:** The SPSEU light illuminates on the ground only.

1 Do not takeoff.

■ ■ ■ ■

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## Tailstrike On Takeoff

Condition: The tail hits the runway on takeoff.

**Caution! Do not pressurize the airplane due to possible structural damage.**

1 Pressurization mode selector . . . . . .MAN

2 Outflow VALVE switch . . . . Hold in OPEN until the outflow VALVE position indicates fully open

3 Plan to land at the nearest suitable airport.

■ ■ ■ ■

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## Introduction

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## Flight With Unreliable Airspeed/ Turbulent Air Penetration

**Altitude and/or vertical speed indications may also be unreliable.**

### Climb (280/.76)

**Flaps Up, Set Max Climb Thrust**

| PRESSURE ALTITUDE (FT) | | WEIGHT (1000 KG) | | | | |
|---|---|---|---|---|---|---|
| | | 40 | 50 | 60 | 70 | 80 |
| 40000 | **PITCH ATT** | **4.0** | **4.0** | | | |
| | V/S (FT/MIN) | 1700 | 1000 | | | |
| 30000 | **PITCH ATT** | **4.0** | **3.5** | **3.5** | **3.5** | **4.0** |
| | V/S (FT/MIN) | 2500 | 1900 | 1400 | 1100 | 800 |
| 20000 | **PITCH ATT** | **7.0** | **6.5** | **6.0** | **6.0** | **6.0** |
| | V/S (FT/MIN) | 4200 | 3200 | 2600 | 2100 | 1700 |
| 10000 | **PITCH ATT** | **10.5** | **9.0** | **8.5** | **8.0** | **7.5** |
| | V/S (FT/MIN) | 5600 | 4400 | 3600 | 3000 | 2500 |
| SEA LEVEL | **PITCH ATT** | **14.0** | **12.0** | **11.0** | **10.0** | **9.5** |
| | V/S (FT/MIN) | 6700 | 5300 | 4300 | 3600 | 3100 |

### Cruise (.76/280)

**Flaps Up, %N1 for Level Flight**

| PRESSURE ALTITUDE (FT) | | WEIGHT (1000 KG) | | | | |
|---|---|---|---|---|---|---|
| | | 40 | 50 | 60 | 70 | 80 |
| 40000 | **PITCH ATT** | **2.0** | **2.5** | **3.5** | | |
| | %N1 | 84 | 87 | 92 | | |
| 35000 | **PITCH ATT** | **1.0** | **2.0** | **2.5** | **3.0** | **3.5** |
| | %N1 | 82 | 83 | 86 | 89 | 94 |
| 30000 | **PITCH ATT** | **1.0** | **1.5** | **2.0** | **2.5** | **3.0** |
| | %N1 | 81 | 82 | 83 | 85 | 87 |
| 25000 | **PITCH ATT** | **1.0** | **1.5** | **2.0** | **2.5** | **3.0** |
| | %N1 | 77 | 78 | 80 | 81 | 83 |
| 20000 | **PITCH ATT** | **1.0** | **1.5** | **2.0** | **2.5** | **3.5** |
| | %N1 | 74 | 74 | 76 | 77 | 79 |
| 15000 | **PITCH ATT** | **1.0** | **1.5** | **2.0** | **2.5** | **3.5** |
| | %N1 | 70 | 71 | 72 | 73 | 75 |

### Descent (.76/280)

**Flaps Up, Set Idle Thrust**

| PRESSURE ALTITUDE (FT) | | WEIGHT (1000 KG) | | | | |
|---|---|---|---|---|---|---|
| | | 40 | 50 | 60 | 70 | 80 |
| 40000 | **PITCH ATT** | **-2.0** | **-1.0** | **-0.5** | **0.0** | **0.0** |
| | V/S (FT/MIN) | -2900 | -2600 | -2600 | -2900 | -3400 |
| 30000 | **PITCH ATT** | **-2.0** | **-1.0** | **0.0** | **1.0** | **1.5** |
| | V/S (FT/MIN) | -2400 | -2100 | -1900 | -1800 | -1900 |
| 20000 | **PITCH ATT** | **-2.0** | **-1.0** | **0.0** | **1.0** | **2.0** |
| | V/S (FT/MIN) | -2200 | -1900 | -1700 | -1700 | -1700 |
| 10000 | **PITCH ATT** | **-2.5** | **-1.0** | **0.0** | **1.0** | **2.0** |
| | V/S (FT/MIN | -2000 | -1700 | -1500 | -1500 | -1500 |
| SEA LEVEL | **PITCH ATT** | **-2.5** | **-1.0** | **0.0** | **1.0** | **2.0** |
| | V/S (FT/MIN) | -1800 | -1500 | -1400 | -1300 | -1300 |

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## Flight With Unreliable Airspeed/ Turbulent Air Penetration

**Altitude and/or vertical speed indications may also be unreliable.**

**Holding (VREF40 + 70)**

**Flaps Up, %N1 for Level Flight**

| PRESSURE ALTITUDE (FT) | | WEIGHT (1000 KG) | | | | |
|---|---|---|---|---|---|---|
| | | 40 | 50 | 60 | 70 | 80 |
| 10000 | **PITCH ATT** | **5.0** | **5.0** | **5.0** | **5.0** | **5.0** |
| | %N1 | 53 | 58 | 63 | 67 | 70 |
| 5000 | **PITCH ATT** | **5.0** | **5.0** | **5.0** | **5.0** | **5.0** |
| | %N1 | 49 | 54 | 59 | 63 | 67 |

**Terminal Area (5000 FT)**

**%N1 for Level Flight**

| FLAP POSITION (VREF + INCREMENT) | | WEIGHT (1000 KG) | | | | |
|---|---|---|---|---|---|---|
| | | 40 | 50 | 60 | 70 | 80 |
| FLAPS 1 (GEAR UP) | **PITCH ATT** | **4.5** | **5.0** | **5.5** | **5.5** | **6.0** |
| (VREF40 + 50) | %N1 | 52 | 57 | 61 | 65 | 69 |
| FLAPS 5 (GEAR UP) | **PITCH ATT** | **5.5** | **5.5** | **6.0** | **6.0** | **6.5** |
| (VREF40 + 30) | %N1 | 52 | 58 | 63 | 67 | 70 |
| FLAPS 15 (GEAR DOWN) | **PITCH ATT** | **5.5** | **5.5** | **6.0** | **6.0** | **6.5** |
| (VREF40 + 20) | %N1 | 60 | 66 | 71 | 75 | 79 |

**Final Approach (1500 FT)**

**Gear Down, %N1 for 3° Glideslope**

| FLAP POSITION (VREF + INCREMENT) | | WEIGHT (1000 KG) | | | | |
|---|---|---|---|---|---|---|
| | | 40 | 50 | 60 | 70 | 80 |
| FLAPS 15 | **PITCH ATT** | **2.0** | **2.0** | **2.0** | **2.5** | **2.5** |
| (VREF15 + 10) | %N1 | 44 | 49 | 53 | 56 | 59 |
| FLAPS 30 | **PITCH ATT** | **0.5** | **0.5** | **1.0** | **1.0** | **1.0** |
| (VREF30 + 10) | %N1 | 48 | 53 | 58 | 61 | 65 |
| FLAPS 40 | **PITCH ATT** | **-0.5** | **-0.5** | **-0.5** | **-0.5** | **0.0** |
| (VREF40 + 10) | %N1 | 53 | 59 | 64 | 68 | 71 |

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## Max Climb %N1

### Based on engine bleed for packs on or off and anti-ice off

| TAT (°C) | PRESSURE ALTITUDE (FT)/SPEED (KIAS/MACH) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 5000 | 10000 | 15000 | 20000 | 25000 | 30000 | 35000 | 37000 | 41000 |
| | 280 | 280 | 280 | 280 | 280 | 280 | 280 | .78 | .78 | .78 |
| 60 | 90.2 | 90.5 | 90.4 | 90.6 | 90.4 | 92.1 | 93.8 | 95.1 | 95.2 | 93.5 |
| 55 | 91.0 | 91.2 | 91.3 | 91.4 | 90.8 | 91.5 | 93.1 | 94.4 | 94.5 | 92.8 |
| 50 | 91.7 | 92.0 | 92.1 | 92.2 | 91.7 | 91.5 | 92.4 | 93.7 | 93.8 | 92.1 |
| 45 | 92.4 | 92.6 | 92.8 | 93.0 | 92.6 | 92.4 | 92.4 | 93.0 | 93.1 | 91.4 |
| 40 | 93.1 | 93.3 | 93.6 | 93.8 | 93.4 | 93.2 | 93.2 | 92.3 | 92.4 | 90.7 |
| 35 | 93.6 | 94.0 | 94.3 | 94.5 | 94.3 | 94.0 | 94.0 | 93.0 | 92.4 | 90.8 |
| 30 | 92.9 | 94.8 | 95.0 | 95.2 | 95.1 | 94.8 | 94.7 | 93.9 | 93.3 | 91.8 |
| 25 | 92.2 | 94.8 | 95.7 | 95.9 | 95.9 | 95.5 | 95.4 | 94.7 | 94.1 | 92.8 |
| 20 | 91.4 | 94.0 | 96.5 | 96.7 | 96.6 | 96.2 | 96.1 | 95.4 | 94.9 | 93.7 |
| 15 | 90.6 | 93.2 | 95.9 | 97.5 | 97.4 | 96.9 | 96.7 | 96.2 | 95.7 | 94.6 |
| 10 | 89.9 | 92.5 | 95.1 | 97.8 | 98.3 | 97.7 | 97.4 | 96.9 | 96.5 | 95.6 |
| 5 | 89.1 | 91.7 | 94.3 | 97.0 | 99.2 | 98.6 | 98.1 | 97.7 | 97.3 | 96.5 |
| 0 | 88.3 | 90.9 | 93.5 | 96.2 | 98.6 | 99.6 | 99.1 | 98.5 | 98.2 | 97.5 |
| -5 | 87.6 | 90.1 | 92.7 | 95.4 | 97.8 | 99.6 | 100.0 | 99.2 | 99.0 | 98.4 |
| -10 | 86.8 | 89.3 | 91.9 | 94.6 | 97.1 | 98.8 | 100.3 | 100.2 | 99.8 | 99.4 |
| -15 | 86.0 | 88.5 | 91.0 | 93.8 | 96.3 | 98.0 | 99.6 | 101.1 | 100.8 | 100.4 |
| -20 | 85.2 | 87.6 | 90.2 | 93.0 | 95.5 | 97.2 | 98.7 | 100.8 | 101.3 | 101.0 |
| -25 | 84.3 | 86.8 | 89.4 | 92.2 | 94.7 | 96.4 | 97.9 | 100.0 | 100.5 | 100.1 |
| -30 | 83.5 | 86.0 | 88.5 | 91.3 | 93.9 | 95.6 | 97.1 | 99.1 | 99.6 | 99.3 |
| -35 | 82.7 | 85.1 | 87.7 | 90.5 | 93.1 | 94.8 | 96.3 | 98.3 | 98.8 | 98.4 |
| -40 | 81.8 | 84.3 | 86.8 | 89.6 | 92.3 | 93.9 | 95.4 | 97.4 | 97.9 | 97.6 |

### %N1 Adjustments for Engine Bleeds

| BLEED CONFIGURATION | PRESSURE ALTITUDE (1000 FT) | | | | | |
|---|---|---|---|---|---|---|
| | 0 | 10 | 20 | 30 | 35 | 41 |
| ENGINE ANTI-ICE | -0.6 | -0.8 | -0.9 | -0.9 | -0.8 | -0.8 |
| ENGINE & WING ANTI-ICE* | -1.8 | -2.1 | -2.5 | -2.7 | -3.0 | -3.0 |

***Dual bleed sources**

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## Go-around %N1

### Based on engine bleed for packs on, engine and wing anti-ice on or off

| AIRPORT OAT | | TAT (°C) | AIRPORT PRESSURE ALTITUDE (FT) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| °C | °F | | -2000 | 0 | 1000 | 2000 | 3000 | 4000 | 5000 | 6000 | 7000 | 8000 | 9000 | 10000 |
| 57 | 134 | 60 | 95.0 | 96.2 | 96.8 | | | | | | | | | |
| 52 | 125 | 55 | 95.9 | 96.7 | 96.6 | 96.8 | 97.5 | | | | | | | |
| 47 | 116 | 50 | 96.6 | 97.6 | 97.8 | 97.8 | 97.7 | 97.5 | 98.2 | 98.8 | | | | |
| 42 | 108 | 45 | 97.4 | 98.4 | 98.5 | 98.6 | 98.7 | 98.8 | 98.7 | 98.5 | 98.5 | 99.0 | | |
| 37 | 99 | 40 | 98.0 | 99.1 | 99.2 | 99.3 | 99.4 | 99.5 | 99.6 | 99.5 | 99.1 | 98.9 | 98.8 | 99.1 |
| 32 | 90 | 35 | 98.1 | 99.9 | 100.0 | 100.1 | 100.1 | 100.3 | 100.3 | 100.2 | 99.9 | 99.6 | 99.6 | 99.5 |
| 27 | 81 | 30 | 97.3 | 99.8 | 100.4 | 100.7 | 100.7 | 100.7 | 100.7 | 100.7 | 100.6 | 100.4 | 100.4 | 100.3 |
| 22 | 72 | 25 | 96.6 | 99.1 | 99.7 | 100.2 | 100.6 | 100.9 | 100.9 | 100.9 | 100.9 | 100.9 | 100.9 | 100.8 |
| 17 | 63 | 20 | 95.8 | 98.3 | 98.9 | 99.5 | 99.8 | 100.2 | 100.5 | 100.9 | 101.0 | 101.1 | 101.0 | 101.0 |
| 12 | 54 | 15 | 95.0 | 97.5 | 98.1 | 98.7 | 99.1 | 99.4 | 99.8 | 100.1 | 100.5 | 100.9 | 101.3 | 101.2 |
| 7 | 45 | 10 | 94.2 | 96.8 | 97.4 | 98.0 | 98.3 | 98.7 | 99.0 | 99.4 | 99.8 | 100.2 | 100.5 | 100.9 |
| 2 | 36 | 5 | 93.4 | 96.0 | 96.6 | 97.2 | 97.6 | 97.9 | 98.3 | 98.7 | 99.0 | 99.4 | 99.8 | 100.2 |
| -3 | 27 | 0 | 92.6 | 95.2 | 95.8 | 96.4 | 96.8 | 97.2 | 97.5 | 97.9 | 98.3 | 98.7 | 99.0 | 99.4 |
| -8 | 18 | -5 | 91.8 | 94.4 | 95.0 | 95.6 | 96.0 | 96.4 | 96.8 | 97.2 | 97.5 | 97.9 | 98.3 | 98.6 |
| -13 | 9 | -10 | 91.0 | 93.6 | 94.2 | 94.8 | 95.2 | 95.6 | 96.0 | 96.4 | 96.8 | 97.1 | 97.5 | 97.9 |
| -17 | 1 | -15 | 90.2 | 92.8 | 93.4 | 94.0 | 94.4 | 94.8 | 95.2 | 95.6 | 96.0 | 96.4 | 96.7 | 97.1 |
| -22 | -8 | -20 | 89.3 | 92.0 | 92.6 | 93.2 | 93.6 | 94.0 | 94.4 | 94.8 | 95.2 | 95.6 | 95.9 | 96.3 |
| -27 | -17 | -25 | 88.5 | 91.1 | 91.8 | 92.4 | 92.8 | 93.2 | 93.6 | 94.0 | 94.4 | 94.8 | 95.1 | 95.5 |
| -32 | -26 | -30 | 87.6 | 90.3 | 90.9 | 91.6 | 92.0 | 92.4 | 92.8 | 93.3 | 93.6 | 94.0 | 94.3 | 94.7 |
| -37 | -35 | -35 | 86.8 | 89.4 | 90.1 | 90.7 | 91.1 | 91.6 | 92.0 | 92.4 | 92.8 | 93.2 | 93.5 | 93.9 |
| -42 | -44 | -40 | 85.9 | 88.6 | 89.2 | 89.9 | 90.3 | 90.7 | 91.2 | 91.6 | 92.0 | 92.4 | 92.7 | 93.0 |
| -47 | -53 | -45 | 85.0 | 87.7 | 88.4 | 89.0 | 89.4 | 89.9 | 90.3 | 90.8 | 91.2 | 91.5 | 91.9 | 92.2 |
| -52 | -62 | -50 | 84.1 | 86.8 | 87.5 | 88.2 | 88.6 | 89.0 | 89.5 | 90.0 | 90.3 | 90.7 | 91.0 | 91.4 |

### %N1 Adjustments for Engine Bleeds

| BLEED CONFIGURATION | PRESSURE ALTITUDE (FT) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | -2000 | 0 | 1000 | 2000 | 3000 | 4000 | 5000 | 6000 | 7000 | 8000 | 9000 | 10000 |
| PACKS OFF | 0.7 | 0.8 | 0.8 | 0.8 | 0.8 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 |
| A/C HIGH | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 |

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## VREF

| WEIGHT (1000 KG) | FLAPS | | |
|---|---|---|---|
| | 40 | 30 | 15 |
| 85 | 160 | 168 | 177 |
| 80 | 155 | 163 | 172 |
| 75 | 151 | 158 | 167 |
| 70 | 146 | 153 | 161 |
| 65 | 141 | 148 | 156 |
| 60 | 135 | 142 | 149 |
| 55 | 128 | 136 | 143 |
| 50 | 122 | 129 | 136 |
| 45 | 115 | 122 | 128 |
| 40 | 108 | 115 | 121 |

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# ADVISORY INFORMATION

## Normal Configuration Landing Distances

### Flaps 15

### Dry Runway

| | LANDING DISTANCE AND ADJUSTMENT (M) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | REF DIST | WT ADJ | ALT ADJ | WIND ADJ PER 10 KTS | | SLOPE ADJ PER 1% | | TEMP ADJ PER 10°C | | VREF ADJ | REVERSE THRUST ADJ | |
| BRAKING CONFIGURATION | 60000 KG LANDING WEIGHT | PER 5000 KG ABOVE/ BELOW 60000 KG | PER 1000 FT STD/ HIGH* | HEAD WIND | TAIL WIND | DOWN HILL | UP HILL | ABV ISA | BLW ISA | PER 10 KTS ABOVE VREF15 | ONE REV | NO REV |
| MAX MANUAL | 945 | 70/-55 | 20/25 | -35 | 115 | 10 | -10 | 20 | -20 | 65 | 20 | 40 |
| MAX AUTO | 1225 | 70/-70 | 25/35 | -45 | 145 | 5 | -5 | 30 | -30 | 105 | 0 | 0 |
| AUTOBRAKE 3 | 1745 | 120/-115 | 45/60 | -75 | 250 | 5 | -5 | 45 | -45 | 175 | 0 | 0 |
| AUTOBRAKE 2 | 2240 | 170/-170 | 65/85 | -100 | 340 | 35 | -40 | 65 | -65 | 185 | 75 | 75 |
| AUTOBRAKE 1 | 2465 | 200/-195 | 80/105 | -115 | 400 | 65 | -70 | 70 | -70 | 175 | 240 | 325 |

### Good Reported Braking Action

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAX MANUAL | 1310 | 85/-80 | 35/45 | -55 | 200 | 30 | -25 | 30 | -30 | 90 | 70 | 165 |
| MAX AUTO | 1445 | 90/-85 | 35/45 | -60 | 205 | 30 | -25 | 35 | -35 | 100 | 75 | 175 |
| AUTOBRAKE 3 | 1750 | 120/-115 | 45/60 | -75 | 250 | 10 | -10 | 45 | -45 | 175 | 5 | 15 |
| AUTOBRAKE 2 | 2240 | 170/-170 | 65/85 | -100 | 340 | 35 | -40 | 65 | -65 | 185 | 75 | 75 |

### Medium Reported Braking Action

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAX MANUAL | 1800 | 135/-130 | 55/70 | -90 | 330 | 75 | -60 | 45 | -45 | 120 | 200 | 490 |
| MAX AUTO | 1885 | 135/-130 | 55/75 | -90 | 330 | 80 | -60 | 45 | -50 | 125 | 205 | 500 |
| AUTOBRAKE 3 | 1935 | 140/-135 | 55/75 | -95 | 340 | 60 | -40 | 50 | -50 | 175 | 135 | 425 |
| AUTOBRAKE 2 | 2290 | 175/-170 | 70/90 | -110 | 385 | 60 | -55 | 65 | -65 | 185 | 115 | 245 |

### Poor Reported Braking Action

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAX MANUAL | 2360 | 220/-180 | 75/105 | -135 | 520 | 190 | -125 | 65 | -65 | 150 | 430 | 1185 |
| MAX AUTO | 2450 | 190/-180 | 75/105 | -135 | 520 | 190 | -125 | 65 | -65 | 150 | 430 | 1185 |
| AUTOBRAKE 3 | 2450 | 190/-180 | 75/105 | -135 | 520 | 185 | -120 | 65 | -65 | 160 | 430 | 1185 |
| AUTOBRAKE 2 | 2545 | 200/-195 | 80/110 | -145 | 540 | 170 | -110 | 70 | -70 | 185 | 350 | 1040 |

**Reference distance is for sea level, standard day, no wind or slope, VREF15 approach speed and two engine detent reverse thrust.**
**Max manual braking data valid for auto speedbrakes. Autobrake data valid for both auto and manual speedbrakes.**
**For max manual braking and manual speedbrakes, increase reference landing distance by 55 m.**
**Actual (unfactored) distances are shown.**
**Includes distance from 50 ft above threshold (305 m of air distance).**
***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

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# ADVISORY INFORMATION

## Normal Configuration Landing Distances

### Flaps 30

### Dry Runway

| | LANDING DISTANCE AND ADJUSTMENT (M) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | REF DIST | WT ADJ | ALT ADJ | WIND ADJ PER 10 KTS | | SLOPE ADJ PER 1% | | TEMP ADJ PER 10°C | | VREF ADJ | REVERSE THRUST ADJ | |
| BRAKING CONFIGURATION | 60000 KG LANDING WEIGHT | PER 5000 KG ABOVE/ BELOW 60000 KG | PER 1000 FT STD/ HIGH* | HEAD WIND | TAIL WIND | DOWN HILL | UP HILL | ABV ISA | BLW ISA | PER 10 KTS ABOVE VREF30 | ONE REV | NO REV |
| MAX MANUAL | 900 | 60/-50 | 20/25 | -35 | 110 | 10 | -10 | 20 | -20 | 65 | 15 | 35 |
| MAX AUTO | 1145 | 65/-60 | 25/30 | -40 | 140 | 5 | -5 | 25 | -25 | 100 | 0 | 0 |
| AUTOBRAKE 3 | 1610 | 105/-105 | 40/55 | -70 | 235 | 5 | -5 | 45 | -45 | 165 | 0 | 0 |
| AUTOBRAKE 2 | 2065 | 150/-150 | 60/80 | -95 | 325 | 30 | -35 | 55 | -55 | 170 | 65 | 65 |
| AUTOBRAKE 1 | 2270 | 175/-175 | 70/95 | -110 | 385 | 60 | -65 | 65 | -65 | 160 | 200 | 280 |

### Good Reported Braking Action

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAX MANUAL | 1250 | 80/-75 | 30/40 | -55 | 195 | 30 | -25 | 30 | -30 | 95 | 65 | 145 |
| MAX AUTO | 1370 | 80/-80 | 35/45 | -55 | 200 | 30 | -25 | 30 | -30 | 100 | 70 | 160 |
| AUTOBRAKE 3 | 1615 | 105/-105 | 40/55 | -70 | 240 | 10 | -10 | 45 | -45 | 165 | 5 | 15 |
| AUTOBRAKE 2 | 2065 | 150/-150 | 60/80 | -95 | 325 | 30 | -35 | 55 | -55 | 170 | 65 | 65 |

### Medium Reported Braking Action

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAX MANUAL | 1695 | 120/-120 | 50/65 | -90 | 320 | 75 | -60 | 45 | -45 | 120 | 175 | 425 |
| MAX AUTO | 1770 | 125/-120 | 50/65 | -90 | 320 | 75 | -60 | 45 | -45 | 120 | 180 | 435 |
| AUTOBRAKE 3 | 1810 | 125/-120 | 50/70 | -90 | 330 | 60 | -40 | 45 | -50 | 165 | 130 | 385 |
| AUTOBRAKE 2 | 2115 | 155/-155 | 60/80 | -105 | 370 | 55 | -55 | 55 | -60 | 170 | 100 | 215 |

### Poor Reported Braking Action

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAX MANUAL | 2195 | 175/-165 | 70/95 | -130 | 505 | 180 | -115 | 60 | -60 | 140 | 370 | 995 |
| MAX AUTO | 2280 | 175/-165 | 70/95 | -130 | 505 | 180 | -115 | 60 | -60 | 140 | 370 | 1000 |
| AUTOBRAKE 3 | 2280 | 175/-165 | 70/95 | -130 | 505 | 180 | -115 | 60 | -60 | 150 | 375 | 1000 |
| AUTOBRAKE 2 | 2360 | 185/-175 | 75/100 | -135 | 520 | 160 | -105 | 65 | -65 | 170 | 305 | 880 |

**Reference distance is for sea level, standard day, no wind or slope, VREF30 approach speed and two engine detent reverse thrust.**
**Max manual braking data valid for auto speedbrakes. Autobrake data valid for both auto and manual speedbrakes.**
**For max manual braking and manual speedbrakes, increase reference landing distance by 55 m.**
**Actual (unfactored) distances are shown.**
**Includes distance from 50 ft above threshold (305 m of air distance).**
***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

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# ADVISORY INFORMATION

## Normal Configuration Landing Distances

### Flaps 40

### Dry Runway

| | LANDING DISTANCE AND ADJUSTMENT (M) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | REF DIST | WT ADJ | ALT ADJ | WIND ADJ PER 10 KTS | | SLOPE ADJ PER 1% | | TEMP ADJ PER 10°C | | VREF ADJ | REVERSE THRUST ADJ | |
| BRAKING CONFIGURATION | 60000 KG LANDING WEIGHT | PER 5000 KG ABOVE/ BELOW 60000 KG | PER 1000 FT STD/ HIGH* | HEAD WIND | TAIL WIND | DOWN HILL | UP HILL | ABV ISA | BLW ISA | PER 10 KTS ABOVE VREF40 | ONE REV | NO REV |
| MAX MANUAL | 860 | 55/-45 | 15/25 | -30 | 110 | 10 | -10 | 15 | -15 | 65 | 15 | 30 |
| MAX AUTO | 1070 | 60/-55 | 20/30 | -40 | 135 | 5 | -5 | 25 | -25 | 95 | 0 | 0 |
| AUTOBRAKE 3 | 1485 | 100/-95 | 35/50 | -65 | 225 | 5 | -5 | 40 | -40 | 160 | 0 | 0 |
| AUTOBRAKE 2 | 1910 | 140/-135 | 55/70 | -90 | 315 | 25 | -30 | 50 | -50 | 175 | 35 | 35 |
| AUTOBRAKE 1 | 2115 | 165/-160 | 65/85 | -105 | 370 | 50 | -60 | 60 | -60 | 160 | 155 | 205 |

### Good Reported Braking Action

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAX MANUAL | 1195 | 75/-75 | 30/40 | -55 | 190 | 30 | -25 | 30 | -30 | 95 | 60 | 135 |
| MAX AUTO | 1300 | 80/-75 | 30/40 | -55 | 195 | 30 | -25 | 30 | -30 | 100 | 65 | 140 |
| AUTOBRAKE 3 | 1490 | 100/-95 | 35/50 | -65 | 230 | 10 | -10 | 40 | -40 | 160 | 5 | 15 |
| AUTOBRAKE 2 | 1910 | 140/-135 | 55/70 | -90 | 315 | 25 | -30 | 50 | -50 | 175 | 35 | 35 |

### Medium Reported Braking Action

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAX MANUAL | 1610 | 115/-110 | 45/60 | -85 | 315 | 75 | -55 | 40 | -40 | 120 | 160 | 385 |
| MAX AUTO | 1675 | 115/-115 | 45/65 | -85 | 315 | 75 | -55 | 40 | -40 | 120 | 160 | 385 |
| AUTOBRAKE 3 | 1700 | 120/-115 | 45/65 | -90 | 320 | 60 | -40 | 45 | -45 | 160 | 135 | 365 |
| AUTOBRAKE 2 | 1960 | 145/-140 | 55/75 | -100 | 355 | 50 | -45 | 50 | -55 | 175 | 75 | 185 |

### Poor Reported Braking Action

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAX MANUAL | 2080 | 165/-155 | 65/90 | -130 | 495 | 175 | -115 | 55 | -55 | 140 | 335 | 885 |
| MAX AUTO | 2165 | 165/-155 | 65/90 | -130 | 495 | 175 | -115 | 55 | -55 | 140 | 335 | 885 |
| AUTOBRAKE 3 | 2165 | 165/-155 | 65/90 | -130 | 495 | 175 | -115 | 55 | -55 | 145 | 335 | 890 |
| AUTOBRAKE 2 | 2215 | 170/-165 | 65/90 | -135 | 510 | 155 | -100 | 60 | -60 | 170 | 270 | 795 |

**Reference distance is for sea level, standard day, no wind or slope, VREF40 approach speed and two engine detent reverse thrust.**
**Max manual braking data valid for auto speedbrakes. Autobrake data valid for both auto and manual speedbrakes.**
**For max manual braking and manual speedbrakes, increase reference landing distance by 55 m.**
**Actual (unfactored) distances are shown.**
**Includes distance from 50 ft above threshold (305 m of air distance).**
***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

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# ADVISORY INFORMATION

## Non-Normal Configuration Landing Distance
### Dry Runway

| LANDING CONFIGURATION | VREF | LANDING DISTANCE AND ADJUSTMENT (M) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | REFERENCE DISTANCE FOR 60000 KG LANDING WEIGHT | WT ADJ PER 5000 KG ABOVE/ BELOW 60000 KG | ALT ADJ PER 1000 FT STD/HIGH* | WIND ADJ PER 10 KTS | | SLOPE ADJ PER 1% | | APPROACH SPEED |
| | | | | | HEAD WIND | TAIL WIND | DOWN HILL | UP HILL | PER 10 KTS ABOVE VREF |
| ALL FLAPS UP | VREF40+55 | 1225 | 170/-70 | 45/45 | -45 | 205 | 20 | -20 | 105 |
| ANTI SKID INOPERATIVE (FLAPS 40) | VREF40 | 1515 | 90/-95 | 40/55 | -75 | 270 | 45 | -40 | 115 |
| HYDRAULICS - LOSS OF SYSTEM A (FLAPS 15) | VREF15 | 1025 | 70/-55 | 25/30 | -35 | 125 | 15 | -15 | 85 |
| HYDRAULICS - LOSS OF SYSTEM A (FLAPS 30) | VREF30 | 990 | 65/-55 | 20/30 | -35 | 125 | 15 | -10 | 90 |
| HYDRAULICS - LOSS OF SYSTEM A (FLAPS 40) | VREF40 | 950 | 60/-50 | 20/25 | -35 | 120 | 15 | -10 | 90 |
| HYDRAULICS - LOSS OF SYSTEM B (FLAPS 15) | VREF15 | 1065 | 55/-60 | 25/30 | -40 | 140 | 15 | -15 | 75 |
| HYDRAULICS - MANUAL REVERSION (LOSS OF BOTH SYSTEM A & B) | VREF15 | 1425 | 80/-85 | 35/45 | -55 | 185 | 35 | -30 | 145 |
| LEADING EDGE FLAPS TRANSIT | VREF15+15 | 1060 | 75/-60 | 25/30 | -35 | 125 | 10 | -10 | 70 |
| ONE ENGINE INOPERATIVE (FLAPS 15) | VREF15 | 955 | 70/-55 | 20/25 | -35 | 120 | 10 | -10 | 65 |
| ONE ENGINE INOPERATIVE (FLAPS 30)** | VREF30 | 910 | 60/-50 | 20/25 | -35 | 115 | 10 | -10 | 65 |

**Reference distance assumes sea level, standard day, with no wind or slope.**
**Actual (unfactored) distances are shown.**
**Includes distance from 50 ft above runway threshold (305 m of air distance).**
**Assumes maximum manual braking and maximum reverse thrust when available on operating engine(s).**
**Altitude adjustment for STD altitudes valid up to 8000 ft pressure altitude.**
**Altitude adjustment for HIGH altitudes valid for altitudes above 8000 ft up to 14000 ft.**

***For landing distance above 8000 ft pressure altitude, first apply the STD altitude adjustment to derive new reference landing distance for 8000 ft, then apply applicable HIGH altitude adjustment between 8000 ft and 14000 ft to this new reference distance.**

****ONE ENGINE INOPERATIVE (FLAPS 30) data are only applicable to Fail Operational airplanes.**

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# ADVISORY INFORMATION

## Non-Normal Configuration Landing Distance

### Dry Runway

| | | LANDING DISTANCE AND ADJUSTMENT (M) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | WIND ADJ PER 10 KTS | | SLOPE ADJ PER 1% | | APPROACH SPEED |
| LANDING CONFIGURATION | VREF | REFERENCE DISTANCE FOR 60000 KG LANDING WEIGHT | WT ADJ PER 5000 KG ABOVE/ BELOW 60000 KG | ALT ADJ PER 1000 FT STD/HIGH* | HEAD WIND | TAIL WIND | DOWN HILL | UP HILL | PER 10 KTS ABOVE VREF |
| STABILIZER TRIM INOPERATIVE | VREF15 | 945 | 70/-55 | 20/25 | -35 | 120 | 10 | -10 | 65 |
| JAMMED OR RESTRICTED FLIGHT CONTROLS | VREF15 | 945 | 70/-55 | 20/25 | -35 | 120 | 10 | -10 | 65 |
| TRAILING EDGE FLAP ASYMMETRY (30 FLAPS < 40) | VREF30 | 900 | 60/-50 | 20/25 | -35 | 110 | 10 | -10 | 65 |
| TRAILING EDGE FLAP ASYMMETRY (15 FLAPS < 30) | VREF15 | 945 | 70/-55 | 20/25 | -35 | 120 | 10 | -10 | 65 |
| TRAILING EDGE FLAP ASYMMETRY (1 FLAPS < 15) | VREF40+30 | 1050 | 85/-60 | 25/30 | -35 | 130 | 10 | -10 | 70 |
| TRAILING EDGE FLAP DISAGREE (30 FLAPS < 40) | VREF30 | 900 | 60/-50 | 20/25 | -35 | 110 | 10 | -10 | 65 |
| TRAILING EDGE FLAP DISAGREE (15 FLAPS < 30) | VREF15 | 945 | 70/-55 | 20/25 | -35 | 120 | 10 | -10 | 65 |
| TRAILING EDGE FLAP DISAGREE (1 FLAPS < 15) | VREF40+30 | 1050 | 85/-60 | 25/30 | -35 | 130 | 10 | -10 | 70 |
| TRAILING EDGE FLAPS UP | VREF40+40 | 1110 | 110/-65 | 30/30 | -40 | 165 | 15 | -10 | 70 |

**Reference distance assumes sea level, standard day, with no wind or slope.**
**Actual (unfactored) distances are shown.**
**Includes distance from 50 ft above runway threshold (305 m of air distance).**
**Assumes maximum manual braking and maximum reverse thrust when available on operating engine(s).**
**Altitude adjustment for STD altitudes valid up to 8000 ft pressure altitude.**
**Altitude adjustment for HIGH altitudes valid for altitudes above 8000 ft up to 14000 ft.**

***For landing distance above 8000 ft pressure altitude, first apply the STD altitude adjustment to derive new reference landing distance for 8000 ft, then apply applicable HIGH altitude adjustment between 8000 ft and 14000 ft to this new reference distance.**

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# ADVISORY INFORMATION

## Non-Normal Configuration Landing Distance
### Good Reported Braking Action

| | | LANDING DISTANCE AND ADJUSTMENT (M) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | REFERENCE DISTANCE FOR 60000 KG LANDING WEIGHT | WT ADJ PER 5000 KG ABOVE/ BELOW 60000 KG | ALT ADJ PER 1000 FT STD/HIGH* | WIND ADJ PER 10 KTS | | SLOPE ADJ PER 1% | | APPROACH SPEED |
| LANDING CONFIGURATION | VREF | | | | HEAD WIND | TAIL WIND | DOWN HILL | UP HILL | PER 10 KTS ABOVE VREF |
| ALL FLAPS UP | VREF40+55 | 1660 | 90/-95 | 45/60 | -65 | 225 | 35 | -30 | 85 |
| ANTI SKID INOPERATIVE (FLAPS 40) | VREF40 | 1685 | 110/-110 | 45/60 | -85 | 330 | 65 | -55 | 125 |
| HYDRAULICS - LOSS OF SYSTEM A (FLAPS 15) | VREF15 | 1485 | 95/-100 | 40/55 | -60 | 225 | 40 | -35 | 130 |
| HYDRAULICS - LOSS OF SYSTEM A (FLAPS 30) | VREF30 | 1410 | 90/-90 | 40/50 | -60 | 220 | 40 | -35 | 130 |
| HYDRAULICS - LOSS OF SYSTEM A (FLAPS 40) | VREF40 | 1340 | 85/-85 | 35/50 | -60 | 215 | 40 | -35 | 130 |
| HYDRAULICS - LOSS OF SYSTEM B (FLAPS 15) | VREF15 | 1350 | 85/-85 | 35/45 | -60 | 205 | 30 | -25 | 100 |
| HYDRAULICS - MANUAL REVERSION (LOSS OF BOTH SYSTEM A & B) | VREF15 | 1760 | 105/-110 | 45/60 | -75 | 250 | 55 | -50 | 170 |
| LEADING EDGE FLAPS TRANSIT | VREF15+15 | 1475 | 90/-90 | 40/55 | -60 | 215 | 35 | -30 | 95 |
| ONE ENGINE INOPERATIVE (FLAPS 15) | VREF15 | 1350 | 80/-85 | 35/45 | -60 | 210 | 35 | -30 | 100 |
| ONE ENGINE INOPERATIVE (FLAPS 30)** | VREF30 | 1285 | 75/-80 | 30/45 | -55 | 205 | 30 | -30 | 100 |

**Reference distance assumes sea level, standard day, with no wind or slope.**
**Actual (unfactored) distances are shown.**
**Includes distance from 50 ft above runway threshold (305 m of air distance).**
**Assumes maximum manual braking and maximum reverse thrust when available on operating engine(s).**
**Altitude adjustment for STD altitudes valid up to 8000 ft pressure altitude.**
**Altitude adjustment for HIGH altitudes valid for altitudes above 8000 ft up to 14000 ft.**

***For landing distance above 8000 ft pressure altitude, first apply the STD altitude adjustment to derive new reference landing distance for 8000 ft, then apply applicable HIGH altitude adjustment between 8000 ft and 14000 ft to this new reference distance.**

****ONE ENGINE INOPERATIVE (FLAPS 30) data are only applicable to Fail Operational airplanes.**

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# ADVISORY INFORMATION

## Non-Normal Configuration Landing Distance
### Good Reported Braking Action

| | | LANDING DISTANCE AND ADJUSTMENT (M) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | WIND ADJ PER 10 KTS | | SLOPE ADJ PER 1% | | APPROACH SPEED |
| LANDING CONFIGURATION | VREF | REFERENCE DISTANCE FOR 60000 KG LANDING WEIGHT | WT ADJ PER 5000 KG ABOVE/ BELOW 60000 KG | ALT ADJ PER 1000 FT STD/HIGH* | HEAD WIND | TAIL WIND | DOWN HILL | UP HILL | PER 10 KTS ABOVE VREF |
| STABILIZER TRIM INOPERATIVE | VREF15 | 1295 | 80/-80 | 35/45 | -55 | 200 | 30 | -25 | 90 |
| JAMMED OR RESTRICTED FLIGHT CONTROLS | VREF15 | 1295 | 80/-80 | 35/45 | -55 | 200 | 30 | -25 | 90 |
| TRAILING EDGE FLAP ASYMMETRY (30 FLAPS < 40) | VREF30 | 1250 | 80/-75 | 30/40 | -55 | 195 | 30 | -25 | 95 |
| TRAILING EDGE FLAP ASYMMETRY (15 FLAPS < 30) | VREF15 | 1295 | 80/-80 | 35/45 | -55 | 200 | 30 | -25 | 90 |
| TRAILING EDGE FLAP ASYMMETRY (1 FLAPS < 15) | VREF40+30 | 1435 | 80/-85 | 40/50 | -60 | 210 | 30 | -25 | 90 |
| TRAILING EDGE FLAP DISAGREE (30 FLAPS < 40) | VREF30 | 1250 | 80/-75 | 30/40 | -55 | 195 | 30 | -25 | 95 |
| TRAILING EDGE FLAP DISAGREE (15 FLAPS < 30) | VREF15 | 1295 | 80/-80 | 35/45 | -55 | 200 | 30 | -25 | 90 |
| TRAILING EDGE FLAP DISAGREE (1 FLAPS < 15) | VREF40+30 | 1435 | 80/-85 | 40/50 | -60 | 210 | 30 | -25 | 90 |
| TRAILING EDGE FLAPS UP | VREF40+40 | 1510 | 80/-85 | 40/55 | -60 | 215 | 30 | -30 | 85 |

**Reference distance assumes sea level, standard day, with no wind or slope.**
**Actual (unfactored) distances are shown.**
**Includes distance from 50 ft above runway threshold (305 m of air distance).**
**Assumes maximum manual braking and maximum reverse thrust when available on operating engine(s).**
**Altitude adjustment for STD altitudes valid up to 8000 ft pressure altitude.**
**Altitude adjustment for HIGH altitudes valid for altitudes above 8000 ft up to 14000 ft.**

***For landing distance above 8000 ft pressure altitude, first apply the STD altitude adjustment to derive new reference landing distance for 8000 ft, then apply applicable HIGH altitude adjustment between 8000 ft and 14000 ft to this new reference distance.**

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# ADVISORY INFORMATION

## Non-Normal Configuration Landing Distance
### Medium Reported Braking Action

| | | LANDING DISTANCE AND ADJUSTMENT (M) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | REFERENCE DISTANCE FOR 60000 KG LANDING WEIGHT | WT ADJ PER 5000 KG ABOVE/ BELOW 60000 KG | ALT ADJ PER 1000 FT STD/HIGH* | WIND ADJ PER 10 KTS | | SLOPE ADJ PER 1% | | APPROACH SPEED |
| LANDING CONFIGURATION | VREF | | | | HEAD WIND | TAIL WIND | DOWN HILL | UP HILL | PER 10 KTS ABOVE VREF |
| ALL FLAPS UP | VREF40+55 | 2340 | 150/-155 | 75/100 | -100 | 375 | 85 | -75 | 120 |
| ANTI SKID INOPERATIVE (FLAPS 40) | VREF40 | 2130 | 155/-155 | 65/90 | -130 | 515 | 150 | -105 | 145 |
| HYDRAULICS - LOSS OF SYSTEM A (FLAPS 15) | VREF15 | 2030 | 155/-150 | 65/90 | -100 | 365 | 95 | -80 | 165 |
| HYDRAULICS - LOSS OF SYSTEM A (FLAPS 30) | VREF30 | 1905 | 140/-140 | 60/80 | -95 | 355 | 90 | -75 | 160 |
| HYDRAULICS - LOSS OF SYSTEM A (FLAPS 40) | VREF40 | 1795 | 130/-130 | 55/75 | -95 | 345 | 85 | -70 | 160 |
| HYDRAULICS - LOSS OF SYSTEM B (FLAPS 15) | VREF15 | 1845 | 135/-130 | 55/75 | -90 | 340 | 80 | -65 | 130 |
| HYDRAULICS - MANUAL REVERSION (LOSS OF BOTH SYSTEM A & B) | VREF15 | 2425 | 170/-170 | 70/100 | -115 | 395 | 120 | -105 | 210 |
| LEADING EDGE FLAPS TRANSIT | VREF15+15 | 2020 | 140/-140 | 60/85 | -95 | 355 | 80 | -70 | 125 |
| ONE ENGINE INOPERATIVE (FLAPS 15) | VREF15 | 1930 | 135/-140 | 55/75 | -100 | 360 | 90 | -75 | 135 |
| ONE ENGINE INOPERATIVE (FLAPS 30)** | VREF30 | 1805 | 125/-130 | 50/70 | -95 | 350 | 85 | -70 | 135 |

**Reference distance assumes sea level, standard day, with no wind or slope.**
**Actual (unfactored) distances are shown.**
**Includes distance from 50 ft above runway threshold (305 m of air distance).**
**Assumes maximum manual braking and maximum reverse thrust when available on operating engine(s).**
**Altitude adjustment for STD altitudes valid up to 8000 ft pressure altitude.**
**Altitude adjustment for HIGH altitudes valid for altitudes above 8000 ft up to 14000 ft.**

***For landing distance above 8000 ft pressure altitude, first apply the STD altitude adjustment to derive new reference landing distance for 8000 ft, then apply applicable HIGH altitude adjustment between 8000 ft and 14000 ft to this new reference distance.**

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# ADVISORY INFORMATION

## Non-Normal Configuration Landing Distance

### Medium Reported Braking Action

| | | LANDING DISTANCE AND ADJUSTMENT (M) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | WIND ADJ PER 10 KTS | | SLOPE ADJ PER 1% | | APPROACH SPEED |
| LANDING CONFIGURATION | VREF | REFERENCE DISTANCE FOR 60000 KG LANDING WEIGHT | WT ADJ PER 5000 KG ABOVE/ BELOW 60000 KG | ALT ADJ PER 1000 FT STD/HIGH* | HEAD WIND | TAIL WIND | DOWN HILL | UP HILL | PER 10 KTS ABOVE VREF |
| STABILIZER TRIM INOPERATIVE | VREF15 | 1770 | 125/-125 | 50/75 | -90 | 330 | 70 | -60 | 120 |
| JAMMED OR RESTRICTED FLIGHT CONTROLS | VREF15 | 1770 | 125/-125 | 50/75 | -90 | 330 | 70 | -60 | 120 |
| TRAILING EDGE FLAP ASYMMETRY (30 FLAPS < 40) | VREF30 | 1695 | 120/-120 | 50/65 | -90 | 320 | 75 | -60 | 120 |
| TRAILING EDGE FLAP ASYMMETRY (15 FLAPS < 30) | VREF15 | 1770 | 125/-125 | 50/75 | -90 | 330 | 70 | -60 | 120 |
| TRAILING EDGE FLAP ASYMMETRY (1 FLAPS < 15) | VREF40+30 | 1985 | 130/-135 | 60/80 | -95 | 350 | 80 | -65 | 120 |
| TRAILING EDGE FLAP DISAGREE (30 FLAPS < 40) | VREF30 | 1695 | 120/-120 | 50/65 | -90 | 320 | 75 | -60 | 120 |
| TRAILING EDGE FLAP DISAGREE (15 FLAPS < 30) | VREF15 | 1770 | 125/-125 | 50/75 | -90 | 330 | 70 | -60 | 120 |
| TRAILING EDGE FLAP DISAGREE (1 FLAPS < 15) | VREF40+30 | 1985 | 130/-135 | 60/80 | -95 | 350 | 80 | -65 | 120 |
| TRAILING EDGE FLAPS UP | VREF40+40 | 2110 | 135/-140 | 65/85 | -100 | 360 | 80 | -70 | 115 |

**Reference distance assumes sea level, standard day, with no wind or slope.**
**Actual (unfactored) distances are shown.**
**Includes distance from 50 ft above runway threshold (305 m of air distance).**
**Assumes maximum manual braking and maximum reverse thrust when available on operating engine(s).**
**Altitude adjustment for STD altitudes valid up to 8000 ft pressure altitude.**
**Altitude adjustment for HIGH altitudes valid for altitudes above 8000 ft up to 14000 ft.**

***For landing distance above 8000 ft pressure altitude, first apply the STD altitude adjustment to derive new reference landing distance for 8000 ft, then apply applicable HIGH altitude adjustment between 8000 ft and 14000 ft to this new reference distance.**

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# ADVISORY INFORMATION

## Non-Normal Configuration Landing Distance
### Poor Reported Braking Action

| LANDING CONFIGURATION | VREF | LANDING DISTANCE AND ADJUSTMENT (M) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | REFERENCE DISTANCE FOR 60000 KG LANDING WEIGHT | WT ADJ PER 5000 KG ABOVE/ BELOW 60000 KG | ALT ADJ PER 1000 FT STD/HIGH* | WIND ADJ PER 10 KTS | | SLOPE ADJ PER 1% | | APPROACH SPEED |
| | | | | | HEAD WIND | TAIL WIND | DOWN HILL | UP HILL | PER 10 KTS ABOVE VREF |
| ALL FLAPS UP | VREF40+55 | 3090 | 220/-225 | 110/150 | -155 | 590 | 200 | -150 | 150 |
| ANTI SKID INOPERATIVE (FLAPS 40) | VREF40 | 2815 | 225/-215 | 85/130 | -210 | 955 | 515 | -245 | 160 |
| HYDRAULICS - LOSS OF SYSTEM A (FLAPS 15) | VREF15 | 2620 | 220/-210 | 90/130 | -145 | 570 | 205 | -150 | 190 |
| HYDRAULICS - LOSS OF SYSTEM A (FLAPS 30) | VREF30 | 2435 | 195/-190 | 80/115 | -140 | 555 | 190 | -140 | 180 |
| HYDRAULICS - LOSS OF SYSTEM A (FLAPS 40) | VREF40 | 2285 | 180/-175 | 75/105 | -135 | 540 | 185 | -135 | 175 |
| HYDRAULICS - LOSS OF SYSTEM B (FLAPS 15) | VREF15 | 2390 | 190/-185 | 80/115 | -135 | 540 | 170 | -130 | 155 |
| HYDRAULICS - MANUAL REVERSION (LOSS OF BOTH SYSTEM A & B) | VREF15 | 3115 | 240/-235 | 105/145 | -165 | 605 | 240 | -185 | 235 |
| LEADING EDGE FLAPS TRANSIT | VREF15+15 | 2615 | 200/-200 | 90/125 | -140 | 555 | 180 | -135 | 150 |
| ONE ENGINE INOPERATIVE (FLAPS 15) | VREF15 | 2635 | 205/-205 | 85/115 | -155 | 595 | 225 | -160 | 170 |
| ONE ENGINE INOPERATIVE (FLAPS 30)** | VREF30 | 2430 | 185/-185 | 75/105 | -145 | 575 | 210 | -150 | 160 |

**Reference distance assumes sea level, standard day, with no wind or slope.**
**Actual (unfactored) distances are shown.**
**Includes distance from 50 ft above runway threshold (305 m of air distance).**
**Assumes maximum manual braking and maximum reverse thrust when available on operating engine(s).**
**Altitude adjustment for STD altitudes valid up to 8000 ft pressure altitude.**
**Altitude adjustment for HIGH altitudes valid for altitudes above 8000 ft up to 14000 ft.**

***For landing distance above 8000 ft pressure altitude, first apply the STD altitude adjustment to derive new reference landing distance for 8000 ft, then apply applicable HIGH altitude adjustment between 8000 ft and 14000 ft to this new reference distance.**

****ONE ENGINE INOPERATIVE (FLAPS 30) data are only applicable to Fail Operational airplanes.**

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# ADVISORY INFORMATION

## Non-Normal Configuration Landing Distance

### Poor Reported Braking Action

| | | LANDING DISTANCE AND ADJUSTMENT (M) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | WIND ADJ PER 10 KTS | | SLOPE ADJ PER 1% | | APPROACH SPEED |
| LANDING CONFIGURATION | VREF | REFERENCE DISTANCE FOR 60000 KG LANDING WEIGHT | WT ADJ PER 5000 KG ABOVE/ BELOW 60000 KG | ALT ADJ PER 1000 FT STD/HIGH* | HEAD WIND | TAIL WIND | DOWN HILL | UP HILL | PER 10 KTS ABOVE VREF |
| STABILIZER TRIM INOPERATIVE | VREF15 | 2295 | 180/-175 | 75/105 | -135 | 525 | 160 | -120 | 140 |
| JAMMED OR RESTRICTED FLIGHT CONTROLS | VREF15 | 2295 | 180/-175 | 75/105 | -135 | 525 | 160 | -120 | 140 |
| TRAILING EDGE FLAP ASYMMETRY (30 FLAPS < 40) | VREF30 | 2195 | 175/-165 | 70/95 | -130 | 505 | 180 | -115 | 140 |
| TRAILING EDGE FLAP ASYMMETRY (15 FLAPS < 30) | VREF15 | 2295 | 180/-175 | 75/105 | -135 | 525 | 160 | -120 | 140 |
| TRAILING EDGE FLAP ASYMMETRY (1 FLAPS < 15) | VREF40+30 | 2595 | 190/-190 | 85/120 | -140 | 555 | 175 | -130 | 145 |
| TRAILING EDGE FLAP DISAGREE (30 FLAPS < 40) | VREF30 | 2195 | 175/-165 | 70/95 | -130 | 505 | 180 | -115 | 140 |
| TRAILING EDGE FLAP DISAGREE (15 FLAPS < 30) | VREF15 | 2295 | 180/-175 | 75/105 | -135 | 525 | 160 | -120 | 140 |
| TRAILING EDGE FLAP DISAGREE (1 FLAPS < 15) | VREF40+30 | 2595 | 190/-190 | 85/120 | -140 | 555 | 175 | -130 | 145 |
| TRAILING EDGE FLAPS UP | VREF40+40 | 2780 | 200/-200 | 95/130 | -145 | 565 | 185 | -140 | 145 |

**Reference distance assumes sea level, standard day, with no wind or slope.**
**Actual (unfactored) distances are shown.**
**Includes distance from 50 ft above runway threshold (305 m of air distance).**
**Assumes maximum manual braking and maximum reverse thrust when available on operating engine(s).**
**Altitude adjustment for STD altitudes valid up to 8000 ft pressure altitude.**
**Altitude adjustment for HIGH altitudes valid for altitudes above 8000 ft up to 14000 ft.**

***For landing distance above 8000 ft pressure altitude, first apply the STD altitude adjustment to derive new reference landing distance for 8000 ft, then apply applicable HIGH altitude adjustment between 8000 ft and 14000 ft to this new reference distance.**

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# ADVISORY INFORMATION

## Recommended Brake Cooling Schedule

### Reference Brake Energy Per Brake (Millions of Foot Pounds)

| | | WIND CORRECTED BRAKES ON SPEED (KIAS) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 80 | | | 100 | | | 120 | | | 140 | | | 160 | | | 180 | | |
| WEIGHT (1000 KG) | OAT (°C) | PRESSURE ALTITUDE (1000 FT) | | | | | | | | | | | | | | | | | |
| | | 0 | 5 | 10 | 0 | 5 | 10 | 0 | 5 | 10 | 0 | 5 | 10 | 0 | 5 | 10 | 0 | 5 | 10 |
| 80 | 0 | 15.1 | 16.9 | 19.1 | 22.3 | 25.3 | 29.0 | 30.7 | 35.1 | 40.4 | 40.1 | 46.0 | 53.1 | 50.4 | 57.8 | 66.7 | 60.5 | 69.2 | 79.9 |
| | 10 | 15.6 | 17.4 | 19.7 | 23.1 | 26.2 | 30.0 | 31.8 | 36.3 | 41.8 | 41.5 | 47.5 | 54.9 | 52.1 | 59.7 | 68.9 | 62.5 | 71.5 | 82.5 |
| | 15 | 15.8 | 17.7 | 20.0 | 23.4 | 26.6 | 30.4 | 32.3 | 36.9 | 42.5 | 42.2 | 48.3 | 55.8 | 53.0 | 60.7 | 70.1 | 63.5 | 72.7 | 83.8 |
| | 20 | 16.0 | 17.9 | 20.2 | 23.8 | 27.0 | 30.9 | 32.8 | 37.4 | 43.1 | 42.9 | 49.1 | 56.7 | 53.8 | 61.7 | 71.1 | 64.5 | 73.8 | 85.0 |
| | 30 | 16.3 | 18.3 | 20.7 | 24.3 | 27.6 | 31.7 | 33.6 | 38.4 | 44.3 | 44.0 | 50.4 | 58.2 | 55.2 | 63.3 | 73.1 | 66.2 | 75.8 | 87.4 |
| | 40 | 16.5 | 18.5 | 21.0 | 24.7 | 28.1 | 32.2 | 34.2 | 39.1 | 45.1 | 44.8 | 51.4 | 59.4 | 56.3 | 64.6 | 74.6 | 67.6 | 77.5 | 89.3 |
| | 50 | 16.6 | 18.7 | 21.2 | 24.9 | 28.3 | 32.5 | 34.5 | 39.5 | 45.6 | 45.3 | 52.0 | 60.2 | 57.1 | 65.6 | 75.9 | 68.7 | 78.8 | 91.0 |
| 70 | 0 | 13.7 | 15.3 | 17.2 | 20.1 | 22.7 | 26.0 | 27.5 | 31.4 | 36.1 | 35.8 | 41.0 | 47.3 | 44.9 | 51.4 | 59.4 | 54.3 | 62.2 | 71.8 |
| | 10 | 14.1 | 15.7 | 17.7 | 20.8 | 23.5 | 26.8 | 28.4 | 32.4 | 37.3 | 37.0 | 42.3 | 48.9 | 46.4 | 53.1 | 61.3 | 56.1 | 64.2 | 74.1 |
| | 15 | 14.3 | 16.0 | 17.9 | 21.1 | 23.9 | 27.3 | 28.9 | 32.9 | 37.9 | 37.6 | 43.1 | 49.7 | 47.1 | 54.0 | 62.4 | 57.0 | 65.3 | 75.3 |
| | 20 | 14.5 | 16.2 | 18.2 | 21.4 | 24.2 | 27.7 | 29.3 | 33.5 | 38.5 | 38.2 | 43.7 | 50.5 | 47.9 | 54.9 | 63.3 | 57.9 | 66.3 | 76.5 |
| | 30 | 14.8 | 16.5 | 18.6 | 21.9 | 24.8 | 28.3 | 30.0 | 34.3 | 39.5 | 39.2 | 44.9 | 51.8 | 49.1 | 56.3 | 65.0 | 59.5 | 68.1 | 78.6 |
| | 40 | 15.0 | 16.7 | 18.8 | 22.2 | 25.2 | 28.8 | 30.6 | 34.9 | 40.2 | 39.9 | 45.7 | 52.8 | 50.1 | 57.4 | 66.4 | 60.7 | 69.6 | 80.3 |
| | 50 | 15.1 | 16.8 | 19.0 | 22.4 | 25.4 | 29.1 | 30.8 | 35.3 | 40.6 | 40.3 | 46.3 | 53.5 | 50.7 | 58.2 | 67.4 | 61.5 | 70.6 | 81.7 |
| 60 | 0 | 12.4 | 13.7 | 15.3 | 17.9 | 20.2 | 22.9 | 24.3 | 27.6 | 31.7 | 31.4 | 35.9 | 41.4 | 39.2 | 44.9 | 51.8 | 47.6 | 54.6 | 63.1 |
| | 10 | 12.7 | 14.1 | 15.7 | 18.5 | 20.8 | 23.7 | 25.1 | 28.5 | 32.7 | 32.5 | 37.1 | 42.8 | 40.5 | 46.4 | 53.6 | 49.2 | 56.4 | 65.2 |
| | 15 | 12.9 | 14.3 | 16.0 | 18.8 | 21.1 | 24.1 | 25.5 | 29.0 | 33.3 | 33.0 | 37.7 | 43.5 | 41.2 | 47.2 | 54.5 | 50.1 | 57.4 | 66.2 |
| | 20 | 13.0 | 14.4 | 16.2 | 19.0 | 21.4 | 24.4 | 25.9 | 29.4 | 33.8 | 33.5 | 38.3 | 44.2 | 41.9 | 47.9 | 55.3 | 50.9 | 58.3 | 67.3 |
| | 30 | 13.3 | 14.7 | 16.5 | 19.4 | 21.9 | 25.0 | 26.5 | 30.2 | 34.6 | 34.4 | 39.3 | 45.3 | 42.9 | 49.2 | 56.8 | 52.2 | 59.8 | 69.1 |
| | 40 | 13.4 | 14.9 | 16.7 | 19.7 | 22.3 | 25.4 | 26.9 | 30.7 | 35.3 | 35.0 | 40.0 | 46.2 | 43.7 | 50.1 | 57.9 | 53.2 | 61.0 | 70.5 |
| | 50 | 13.5 | 15.0 | 16.8 | 19.9 | 22.4 | 25.6 | 27.2 | 31.0 | 35.6 | 35.3 | 40.5 | 46.7 | 44.3 | 50.8 | 58.8 | 53.9 | 61.9 | 71.7 |
| 50 | 0 | 11.0 | 12.1 | 13.4 | 15.7 | 17.6 | 19.9 | 21.1 | 23.9 | 27.3 | 27.0 | 30.8 | 35.4 | 33.5 | 38.3 | 44.2 | 40.6 | 46.5 | 53.7 |
| | 10 | 11.3 | 12.4 | 13.8 | 16.2 | 18.2 | 20.5 | 21.8 | 24.6 | 28.2 | 27.9 | 31.8 | 36.6 | 34.6 | 39.6 | 45.7 | 41.9 | 48.0 | 55.4 |
| | 15 | 11.5 | 12.6 | 14.0 | 16.4 | 18.4 | 20.9 | 22.1 | 25.0 | 28.6 | 28.4 | 32.3 | 37.2 | 35.2 | 40.3 | 46.4 | 42.6 | 48.8 | 56.4 |
| | 20 | 11.6 | 12.7 | 14.1 | 16.6 | 18.7 | 21.1 | 22.4 | 25.4 | 29.1 | 28.8 | 32.8 | 37.8 | 35.8 | 40.9 | 47.2 | 43.3 | 49.6 | 57.3 |
| | 30 | 11.8 | 13.0 | 14.4 | 17.0 | 19.1 | 21.6 | 22.9 | 26.0 | 29.8 | 29.5 | 33.7 | 38.7 | 36.7 | 42.0 | 48.4 | 44.4 | 50.9 | 58.8 |
| | 40 | 11.9 | 13.1 | 14.6 | 17.2 | 19.4 | 21.9 | 23.3 | 26.4 | 30.3 | 30.0 | 34.3 | 39.4 | 37.3 | 42.7 | 49.3 | 45.3 | 51.9 | 60.0 |
| | 50 | 12.0 | 13.2 | 14.7 | 17.3 | 19.5 | 22.1 | 23.5 | 26.7 | 30.6 | 30.3 | 34.6 | 39.9 | 37.7 | 43.2 | 50.0 | 45.8 | 52.6 | 60.8 |
| 40 | 0 | 9.7 | 10.5 | 11.6 | 13.5 | 15.0 | 16.9 | 17.8 | 20.1 | 22.8 | 22.6 | 25.6 | 29.4 | 27.7 | 31.6 | 36.3 | 33.1 | 37.8 | 43.6 |
| | 10 | 10.0 | 10.8 | 11.9 | 13.9 | 15.5 | 17.4 | 18.4 | 20.7 | 23.6 | 23.3 | 26.5 | 30.3 | 28.6 | 32.7 | 37.6 | 34.2 | 39.1 | 45.0 |
| | 15 | 10.1 | 11.0 | 12.0 | 14.1 | 15.7 | 17.7 | 18.7 | 21.0 | 23.9 | 23.7 | 26.9 | 30.8 | 29.1 | 33.2 | 38.2 | 34.7 | 39.7 | 45.8 |
| | 20 | 10.2 | 11.1 | 12.2 | 14.3 | 15.9 | 17.9 | 18.9 | 21.3 | 24.3 | 24.1 | 27.3 | 31.3 | 29.6 | 33.7 | 38.8 | 35.3 | 40.3 | 46.5 |
| | 30 | 10.3 | 11.2 | 12.4 | 14.6 | 16.2 | 18.3 | 19.3 | 21.8 | 24.9 | 24.6 | 28.0 | 32.1 | 30.3 | 34.6 | 39.8 | 36.2 | 41.4 | 47.7 |
| | 40 | 10.4 | 11.4 | 12.5 | 14.7 | 16.4 | 18.5 | 19.6 | 22.2 | 25.3 | 25.0 | 28.4 | 32.6 | 30.8 | 35.2 | 40.5 | 36.8 | 42.1 | 48.6 |
| | 50 | 10.5 | 11.4 | 12.6 | 14.8 | 16.6 | 18.7 | 19.8 | 22.3 | 25.5 | 25.2 | 28.7 | 33.0 | 31.1 | 35.5 | 41.0 | 37.2 | 42.6 | 49.3 |

**To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind. If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 15°C.**

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# ADVISORY INFORMATION

## Recommended Brake Cooling Schedule

### Adjusted Brake Energy Per Brake (Millions of Foot Pounds)

### No Reverse Thrust

| | | REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| EVENT | | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 |
| RTO MAX MAN | | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 |
| LANDING | MAX MAN | 5.5 | 15.6 | 25.4 | 35.0 | 44.6 | 54.6 | 64.9 | 75.7 | 86.9 |
| | MAX AUTO | 5.0 | 14.7 | 24.1 | 33.3 | 42.7 | 52.5 | 62.9 | 73.7 | 85.1 |
| | AUTOBRAKE 3 | 4.3 | 13.4 | 21.8 | 29.7 | 37.7 | 46.6 | 56.4 | 67.1 | 78.7 |
| | AUTOBRAKE 2 | 3.7 | 12.1 | 19.7 | 26.4 | 33.2 | 41.0 | 49.8 | 59.6 | 70.4 |
| | AUTOBRAKE 1 | 3.1 | 10.9 | 17.8 | 23.6 | 29.2 | 35.8 | 43.1 | 51.2 | 60.2 |

### Two Engine Reverse Thrust

| | | REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| EVENT | | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 |
| LANDING | MAX MAN | 5.1 | 14.5 | 23.6 | 32.5 | 41.3 | 50.5 | 60.0 | 69.9 | 80.0 |
| | MAX AUTO | 3.7 | 11.9 | 20.0 | 28.1 | 36.4 | 45.5 | 55.3 | 65.8 | 77.0 |
| | AUTOBRAKE 3 | 1.4 | 7.3 | 12.9 | 18.4 | 24.3 | 31.2 | 39.1 | 47.9 | 57.7 |
| | AUTOBRAKE 2 | | 4.0 | 7.8 | 11.3 | 15.1 | 19.9 | 25.7 | 32.5 | 40.3 |
| | AUTOBRAKE 1 | | 2.1 | 4.6 | 6.6 | 8.7 | 11.6 | 15.3 | 19.7 | 25.0 |

### Cooling Time (Minutes)

| | EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 16 & BELOW | 17 | 20 | 23 | 25 | 28 | 32 | 33 TO 48 | 49 & ABOVE |
| | BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON CDS | | | | | | | | |
| | UP TO 2.4 | 2.6 | 3.1 | 3.5 | 3.9 | 4.4 | 4.9 | 5.0 TO 7.5 | 7.5 & ABOVE |
| INFLIGHT GEAR DOWN | NO SPECIAL PROCEDURE REQUIRED | 1 | 2 | 3 | 4 | 5 | 6 | CAUTION | FUSE PLUG MELT ZONE |
| GROUND | | 10 | 20 | 30 | 40 | 50 | 60 | | |

**Observe maximum quick turnaround limit.**
**Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.**
**Add 1.0 million foot pounds per brake for each taxi mile.**

**When in caution zone, wheel fuse plugs may melt. Delay takeoff and inspect after one hour. If overheat occurs after takeoff, extend gear soon for at least 7 minutes.**

**When in fuse plug melt zone, clear runway immediately. Unless required, do not set parking brake. Do not approach gear or attempt to taxi for one hour. Tire, wheel and brake replacement may be required. If overheat occurs after takeoff, extend gear soon for at least 12 minutes.**

**Brake temperature monitor system (BTMS) indication on CDS systems page may be used 10 to 15 minutes after airplane has come to a complete stop or inflight with gear retracted to determine recommended cooling schedule.**

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# ENGINE INOP

## Initial Max Continuous %N1
**Based on .79M, A/C high and anti-ice off**

| TAT (°C) | PRESSURE ALTITUDE (1000 FT) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 25 | 27 | 29 | 31 | 33 | 35 | 37 | 39 | 41 |
| 20 | 96.8 | 96.6 | 96.3 | 96.1 | 95.9 | 95.4 | 95.0 | 94.7 | 93.9 |
| 15 | 97.4 | 97.2 | 96.9 | 96.8 | 96.6 | 96.2 | 95.7 | 95.5 | 94.8 |
| 10 | 98.0 | 97.8 | 97.5 | 97.4 | 97.4 | 96.9 | 96.5 | 96.3 | 95.7 |
| 5 | 98.3 | 98.6 | 98.3 | 98.1 | 98.1 | 97.7 | 97.3 | 97.1 | 96.6 |
| 0 | 97.5 | 98.7 | 99.2 | 99.0 | 98.9 | 98.5 | 98.2 | 98.0 | 97.5 |
| -5 | 96.7 | 98.0 | 99.1 | 99.8 | 99.7 | 99.3 | 98.9 | 98.7 | 98.4 |
| -10 | 96.0 | 97.2 | 98.4 | 99.6 | 100.5 | 100.2 | 99.8 | 99.6 | 99.4 |
| -15 | 95.2 | 96.4 | 97.6 | 98.8 | 100.1 | 101.0 | 100.8 | 100.6 | 100.3 |
| -20 | 94.4 | 95.6 | 96.8 | 98.0 | 99.3 | 100.5 | 101.1 | 100.8 | 100.6 |
| -25 | 93.6 | 94.9 | 96.0 | 97.2 | 98.5 | 99.7 | 100.2 | 100.0 | 99.8 |
| -30 | 92.8 | 94.1 | 95.2 | 96.4 | 97.7 | 98.8 | 99.4 | 99.2 | 99.0 |
| -35 | 92.0 | 93.2 | 94.4 | 95.6 | 96.8 | 98.0 | 98.5 | 98.3 | 98.1 |
| -40 | 91.2 | 92.4 | 93.5 | 94.7 | 96.0 | 97.1 | 97.6 | 97.4 | 97.2 |

## %N1 Adjustments for Engine Bleeds

| BLEED CONFIGURATION | PRESSURE ALTITUDE (1000 FT) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 25 | 27 | 29 | 31 | 33 | 35 | 37 | 39 | 41 |
| ENGINE ANTI-ICE | -1.2 | -1.1 | -1.0 | -0.9 | -0.8 | -0.8 | -0.8 | -0.8 | -0.8 |
| ENGINE & WING ANTI-ICE | -4.2 | -4.4 | -4.5 | -4.7 | -5.0 | -4.8 | -4.8 | -4.8 | -4.8 |

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# ENGINE INOP

## Max Continuous %N1
### 37000 FT to 29000 FT Pressure Altitudes

| 37000 FT PRESS ALT | | TAT (°C) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KIAS | M | -55 | -50 | -45 | -40 | -35 | -30 | -25 | -20 | -15 | -10 | -5 | 0 |
| 160 | .51 | 96.6 | 97.6 | 98.5 | 99.4 | 100.2 | 99.6 | 98.8 | 97.6 | 96.3 | 94.7 | 93.2 | 91.8 |
| 200 | .63 | 96.0 | 96.9 | 97.8 | 98.7 | 99.6 | 100.4 | 100.1 | 99.3 | 98.4 | 97.5 | 96.3 | 95.2 |
| 240 | .74 | 95.1 | 96.0 | 96.8 | 97.7 | 98.6 | 99.4 | 100.3 | 100.7 | 100.0 | 99.2 | 98.4 | 97.5 |
| 280 | .86 | 94.3 | 95.2 | 96.1 | 97.0 | 97.8 | 98.7 | 99.5 | 100.4 | 101.2 | 100.9 | 100.0 | 99.1 |
| 35000 FT PRESS ALT | | TAT (°C) | | | | | | | | | | | |
| KIAS | M | -55 | -50 | -45 | -40 | -35 | -30 | -25 | -20 | -15 | -10 | -5 | 0 |
| 160 | .49 | 96.5 | 97.4 | 98.3 | 99.2 | 100.1 | 99.8 | 99.0 | 98.0 | 96.8 | 95.4 | 94.0 | 92.7 |
| 200 | .60 | 96.1 | 97.0 | 97.9 | 98.8 | 99.7 | 100.6 | 100.5 | 99.6 | 98.6 | 97.6 | 96.5 | 95.4 |
| 240 | .71 | 95.0 | 95.9 | 96.8 | 97.7 | 98.6 | 99.4 | 100.3 | 100.8 | 100.2 | 99.5 | 98.6 | 97.7 |
| 280 | .82 | 93.8 | 94.6 | 95.5 | 96.4 | 97.3 | 98.1 | 98.9 | 99.8 | 100.6 | 100.3 | 99.5 | 98.8 |
| 33000 FT PRESS ALT | | TAT (°C) | | | | | | | | | | | |
| KIAS | M | -50 | -45 | -40 | -35 | -30 | -25 | -20 | -15 | -10 | -5 | 0 | 5 |
| 160 | .47 | 97.4 | 98.3 | 99.2 | 100.0 | 100.8 | 100.0 | 99.1 | 97.9 | 96.7 | 95.3 | 93.9 | 92.6 |
| 200 | .58 | 97.0 | 97.9 | 98.8 | 99.7 | 100.6 | 101.4 | 100.6 | 99.6 | 98.6 | 97.5 | 96.3 | 95.1 |
| 240 | .68 | 95.9 | 96.8 | 97.7 | 98.5 | 99.4 | 100.2 | 101.1 | 100.9 | 100.2 | 99.4 | 98.4 | 97.4 |
| 280 | .79 | 94.3 | 95.1 | 96.0 | 96.8 | 97.7 | 98.5 | 99.3 | 100.2 | 100.5 | 99.7 | 98.9 | 98.1 |
| 320 | .89 | 93.6 | 94.5 | 95.4 | 96.2 | 97.1 | 97.9 | 98.7 | 99.5 | 100.3 | 101.1 | 100.7 | 99.8 |
| 31000 FT PRESS ALT | | TAT (°C) | | | | | | | | | | | |
| KIAS | M | -50 | -45 | -40 | -35 | -30 | -25 | -20 | -15 | -10 | -5 | 0 | 5 |
| 160 | .45 | 97.3 | 98.2 | 99.1 | 100.0 | 100.9 | 101.1 | 100.2 | 99.2 | 98.0 | 96.6 | 95.2 | 93.9 |
| 200 | .55 | 97.1 | 98.0 | 98.9 | 99.7 | 100.6 | 101.5 | 101.6 | 100.7 | 99.7 | 98.6 | 97.4 | 96.2 |
| 240 | .66 | 95.6 | 96.5 | 97.4 | 98.3 | 99.1 | 100.0 | 100.8 | 101.3 | 100.5 | 99.8 | 98.8 | 97.8 |
| 280 | .76 | 93.8 | 94.7 | 95.5 | 96.4 | 97.2 | 98.0 | 98.8 | 99.7 | 100.5 | 99.8 | 98.9 | 98.0 |
| 320 | .85 | 92.4 | 93.2 | 94.1 | 94.9 | 95.7 | 96.5 | 97.4 | 98.2 | 98.9 | 99.7 | 99.9 | 99.1 |
| 29000 FT PRESS ALT | | TAT (°C) | | | | | | | | | | | |
| KIAS | M | -45 | -40 | -35 | -30 | -25 | -20 | -15 | -10 | -5 | 0 | 5 | 10 |
| 160 | .43 | 98.1 | 99.0 | 99.9 | 100.8 | 101.6 | 101.2 | 100.2 | 99.1 | 97.9 | 96.4 | 95.1 | 93.8 |
| 200 | .53 | 97.5 | 98.4 | 99.3 | 100.2 | 101.0 | 101.9 | 101.3 | 100.4 | 99.3 | 98.2 | 96.9 | 95.8 |
| 240 | .63 | 96.3 | 97.1 | 98.0 | 98.9 | 99.7 | 100.5 | 101.4 | 101.1 | 100.2 | 99.2 | 98.3 | 97.2 |
| 280 | .73 | 94.2 | 95.0 | 95.9 | 96.7 | 97.5 | 98.3 | 99.1 | 99.9 | 100.1 | 99.1 | 98.2 | 97.5 |
| 320 | .82 | 92.1 | 92.9 | 93.7 | 94.5 | 95.3 | 96.1 | 96.9 | 97.7 | 98.5 | 99.2 | 98.5 | 97.6 |
| 360 | .91 | 92.1 | 92.9 | 93.7 | 94.5 | 95.3 | 96.1 | 96.9 | 97.7 | 98.5 | 99.2 | 100.0 | 100.1 |

## %N1 Adjustments for Engine Bleeds

| BLEED CONFIGURATION | PRESSURE ALTITUDE (1000 FT) | | | | |
|---|---|---|---|---|---|
| | 29 | 31 | 33 | 35 | 37 |
| ENGINE ANTI-ICE ON | -0.9 | -0.9 | -0.8 | -0.8 | -0.8 |
| ENGINE & WING ANTI-ICE ON | -4.1 | -4.3 | -4.5 | -4.7 | -4.7 |

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# ENGINE INOP

## Max Continuous %N1
### 27000 FT to 20000 FT Pressure Altitudes

| 27000 FT PRESS ALT | | TAT (°C) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KIAS | M | -45 | -40 | -35 | -30 | -25 | -20 | -15 | -10 | -5 | 0 | 5 | 10 |
| 160 | .41 | 98.0 | 98.8 | 99.7 | 100.6 | 101.4 | 102.2 | 101.2 | 100.2 | 99.0 | 97.8 | 96.4 | 95.1 |
| 200 | .51 | 96.9 | 97.8 | 98.7 | 99.6 | 100.4 | 101.2 | 101.8 | 100.8 | 99.9 | 98.8 | 97.6 | 96.4 |
| 240 | .60 | 95.6 | 96.5 | 97.4 | 98.2 | 99.1 | 99.9 | 100.7 | 101.3 | 100.4 | 99.4 | 98.5 | 97.5 |
| 280 | .70 | 93.6 | 94.4 | 95.3 | 96.1 | 96.9 | 97.7 | 98.5 | 99.3 | 100.1 | 99.4 | 98.4 | 97.6 |
| 320 | .79 | 91.6 | 92.4 | 93.2 | 94.0 | 94.8 | 95.6 | 96.4 | 97.2 | 98.0 | 98.7 | 98.6 | 97.8 |
| 360 | .88 | 91.0 | 91.8 | 92.6 | 93.4 | 94.2 | 95.0 | 95.8 | 96.6 | 97.3 | 98.1 | 98.8 | 99.4 |

| 25000 FT PRESS ALT | | TAT (°C) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KIAS | M | -40 | -35 | -30 | -25 | -20 | -15 | -10 | -5 | 0 | 5 | 10 | 15 |
| 160 | .39 | 98.8 | 99.7 | 100.5 | 101.4 | 102.2 | 102.4 | 101.4 | 100.3 | 99.1 | 97.7 | 96.5 | 95.2 |
| 200 | .49 | 97.5 | 98.3 | 99.2 | 100.0 | 100.9 | 101.7 | 101.5 | 100.6 | 99.5 | 98.4 | 97.3 | 96.2 |
| 240 | .58 | 95.7 | 96.5 | 97.4 | 98.2 | 99.0 | 99.9 | 100.7 | 100.5 | 99.5 | 98.6 | 97.6 | 96.7 |
| 280 | .67 | 93.9 | 94.7 | 95.5 | 96.3 | 97.1 | 97.9 | 98.7 | 99.5 | 99.5 | 98.6 | 97.6 | 96.9 |
| 320 | .76 | 91.7 | 92.6 | 93.4 | 94.2 | 95.0 | 95.8 | 96.5 | 97.3 | 98.0 | 98.6 | 97.8 | 97.2 |
| 360 | .85 | 90.4 | 91.2 | 92.1 | 92.9 | 93.7 | 94.5 | 95.3 | 96.1 | 96.9 | 97.6 | 98.4 | 98.2 |

| 24000 FT PRESS ALT | | TAT (°C) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KIAS | M | -40 | -35 | -30 | -25 | -20 | -15 | -10 | -5 | 0 | 5 | 10 | 15 |
| 160 | .38 | 98.6 | 99.5 | 100.4 | 101.2 | 102.1 | 102.9 | 101.9 | 100.8 | 99.6 | 98.4 | 97.1 | 95.8 |
| 200 | .48 | 97.5 | 98.4 | 99.2 | 100.1 | 100.9 | 101.8 | 102.2 | 101.1 | 100.1 | 99.0 | 97.8 | 96.7 |
| 240 | .57 | 95.9 | 96.8 | 97.6 | 98.5 | 99.3 | 100.1 | 100.9 | 101.2 | 100.2 | 99.2 | 98.2 | 97.3 |
| 280 | .66 | 94.2 | 95.1 | 95.9 | 96.7 | 97.5 | 98.3 | 99.1 | 99.9 | 100.4 | 99.4 | 98.3 | 97.5 |
| 320 | .75 | 92.1 | 93.0 | 93.8 | 94.6 | 95.4 | 96.2 | 96.9 | 97.7 | 98.5 | 99.2 | 98.6 | 97.8 |
| 360 | .83 | 90.6 | 91.4 | 92.2 | 93.1 | 93.9 | 94.7 | 95.5 | 96.2 | 97.0 | 97.8 | 98.5 | 98.6 |

| 22000 FT PRESS ALT | | TAT (°C) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KIAS | M | -35 | -30 | -25 | -20 | -15 | -10 | -5 | 0 | 5 | 10 | 15 | 20 |
| 160 | .37 | 99.1 | 100.0 | 100.9 | 101.7 | 102.5 | 102.8 | 101.8 | 100.7 | 99.5 | 98.2 | 97.0 | 95.8 |
| 200 | .46 | 98.4 | 99.3 | 100.1 | 101.0 | 101.8 | 102.6 | 102.3 | 101.2 | 100.0 | 98.9 | 97.8 | 96.8 |
| 240 | .55 | 97.2 | 98.1 | 98.9 | 99.7 | 100.5 | 101.3 | 102.1 | 101.6 | 100.5 | 99.4 | 98.5 | 97.5 |
| 280 | .63 | 95.7 | 96.5 | 97.4 | 98.2 | 99.0 | 99.8 | 100.6 | 101.3 | 101.0 | 99.8 | 98.9 | 98.1 |
| 320 | .72 | 93.9 | 94.7 | 95.5 | 96.3 | 97.1 | 97.9 | 98.6 | 99.4 | 100.1 | 100.2 | 99.3 | 98.6 |
| 360 | .80 | 92.2 | 93.0 | 93.8 | 94.6 | 95.4 | 96.1 | 96.9 | 97.7 | 98.4 | 99.2 | 99.7 | 99.1 |

| 20000 FT PRESS ALT | | TAT (°C) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KIAS | M | -35 | -30 | -25 | -20 | -15 | -10 | -5 | 0 | 5 | 10 | 15 | 20 |
| 160 | .35 | 98.7 | 99.5 | 100.4 | 101.2 | 102.0 | 102.8 | 102.5 | 101.5 | 100.4 | 99.2 | 98.0 | 96.8 |
| 200 | .44 | 98.3 | 99.2 | 100.0 | 100.9 | 101.7 | 102.5 | 103.3 | 102.3 | 101.1 | 100.0 | 98.9 | 97.8 |
| 240 | .53 | 97.5 | 98.4 | 99.2 | 100.0 | 100.8 | 101.7 | 102.5 | 103.1 | 101.8 | 100.5 | 99.5 | 98.6 |
| 280 | .61 | 96.2 | 97.0 | 97.8 | 98.7 | 99.5 | 100.3 | 101.1 | 101.8 | 102.5 | 101.3 | 100.1 | 99.3 |
| 320 | .69 | 94.7 | 95.5 | 96.3 | 97.1 | 97.9 | 98.7 | 99.5 | 100.2 | 101.0 | 101.7 | 100.9 | 99.9 |
| 360 | .77 | 93.0 | 93.8 | 94.6 | 95.4 | 96.2 | 97.0 | 97.7 | 98.5 | 99.2 | 100.0 | 100.7 | 100.4 |

## %N1 Adjustments for Engine Bleeds

| BLEED CONFIGURATION | PRESSURE ALTITUDE (1000 FT) | | | | |
|---|---|---|---|---|---|
| | 20 | 22 | 24 | 25 | 27 |
| ENGINE ANTI-ICE ON | -0.9 | -0.9 | -1.0 | -1.0 | -1.0 |
| ENGINE & WING ANTI-ICE ON | -3.6 | -3.8 | -3.8 | -3.9 | -4.0 |

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# ENGINE INOP

## Max Continuous %N1
### 18000 FT to 12000 FT Pressure Altitudes

| 18000 FT PRESS ALT | | TAT (°C) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KIAS | M | -30 | -25 | -20 | -15 | -10 | -5 | 0 | 5 | 10 | 15 | 20 | 25 |
| 160 | .34 | 98.5 | 99.3 | 100.2 | 101.0 | 101.8 | 102.6 | 101.6 | 100.3 | 99.2 | 98.1 | 97.0 | 95.9 |
| 200 | .42 | 98.7 | 99.6 | 100.4 | 101.2 | 102.0 | 102.8 | 103.1 | 101.7 | 100.4 | 99.3 | 98.3 | 97.3 |
| 240 | .51 | 97.8 | 98.7 | 99.5 | 100.3 | 101.1 | 101.9 | 102.7 | 102.5 | 101.1 | 99.9 | 99.0 | 98.1 |
| 280 | .59 | 96.3 | 97.1 | 97.9 | 98.7 | 99.5 | 100.3 | 101.0 | 101.8 | 101.6 | 100.5 | 99.6 | 98.8 |
| 320 | .67 | 94.8 | 95.6 | 96.4 | 97.2 | 97.9 | 98.7 | 99.5 | 100.2 | 101.0 | 100.9 | 100.0 | 99.2 |
| 360 | .75 | 93.0 | 93.8 | 94.6 | 95.3 | 96.1 | 96.9 | 97.6 | 98.4 | 99.1 | 99.9 | 100.2 | 99.6 |

| 16000 FT PRESS ALT | | TAT (°C) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KIAS | M | -30 | -25 | -20 | -15 | -10 | -5 | 0 | 5 | 10 | 15 | 20 | 25 |
| 160 | .33 | 97.1 | 98.0 | 98.8 | 99.6 | 100.4 | 101.2 | 101.6 | 100.3 | 99.1 | 98.1 | 97.1 | 96.1 |
| 200 | .41 | 98.0 | 98.8 | 99.6 | 100.4 | 101.2 | 102.0 | 102.8 | 102.5 | 101.3 | 100.2 | 99.3 | 98.3 |
| 240 | .49 | 97.1 | 97.9 | 98.7 | 99.5 | 100.3 | 101.1 | 101.9 | 102.7 | 101.8 | 100.5 | 99.6 | 98.7 |
| 280 | .57 | 95.6 | 96.4 | 97.2 | 98.0 | 98.8 | 99.6 | 100.3 | 101.1 | 101.8 | 100.9 | 99.8 | 99.0 |
| 320 | .64 | 94.0 | 94.8 | 95.6 | 96.4 | 97.2 | 97.9 | 98.7 | 99.4 | 100.2 | 100.9 | 100.2 | 99.4 |
| 360 | .72 | 92.1 | 92.9 | 93.7 | 94.5 | 95.3 | 96.1 | 96.9 | 97.7 | 98.4 | 99.2 | 99.9 | 99.6 |

| 14000 FT PRESS ALT | | TAT (°C) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KIAS | M | -25 | -20 | -15 | -10 | -5 | 0 | 5 | 10 | 15 | 20 | 25 | 30 |
| 160 | .31 | 96.6 | 97.4 | 98.2 | 99.0 | 99.8 | 100.6 | 100.4 | 99.1 | 98.0 | 97.1 | 96.2 | 95.3 |
| 200 | .39 | 97.1 | 97.9 | 98.7 | 99.5 | 100.3 | 101.1 | 101.8 | 101.5 | 101.0 | 100.1 | 99.3 | 98.4 |
| 240 | .47 | 96.6 | 97.4 | 98.2 | 99.0 | 99.8 | 100.6 | 101.3 | 101.8 | 101.1 | 100.3 | 99.5 | 98.7 |
| 280 | .54 | 95.5 | 96.3 | 97.1 | 97.8 | 98.6 | 99.4 | 100.1 | 100.9 | 101.0 | 100.1 | 99.2 | 98.5 |
| 320 | .62 | 94.1 | 94.9 | 95.7 | 96.5 | 97.2 | 98.0 | 98.7 | 99.5 | 100.2 | 100.3 | 99.5 | 98.8 |
| 360 | .69 | 92.2 | 93.1 | 93.9 | 94.7 | 95.5 | 96.3 | 97.0 | 97.8 | 98.6 | 99.3 | 99.6 | 99.0 |

| 12000 FT PRESS ALT | | TAT (°C) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KIAS | M | -20 | -15 | -10 | -5 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 |
| 160 | .30 | 96.3 | 97.0 | 97.8 | 98.6 | 99.4 | 100.1 | 99.3 | 98.1 | 97.1 | 96.3 | 95.4 | 94.5 |
| 200 | .38 | 97.1 | 97.9 | 98.7 | 99.5 | 100.3 | 101.0 | 101.5 | 100.8 | 99.8 | 99.0 | 98.2 | 97.3 |
| 240 | .45 | 96.5 | 97.3 | 98.0 | 98.8 | 99.6 | 100.3 | 101.1 | 101.0 | 100.1 | 99.4 | 98.6 | 97.9 |
| 280 | .52 | 95.5 | 96.3 | 97.0 | 97.8 | 98.6 | 99.3 | 100.0 | 100.8 | 100.3 | 99.4 | 98.6 | 98.0 |
| 320 | .60 | 94.0 | 94.8 | 95.6 | 96.4 | 97.2 | 97.9 | 98.7 | 99.4 | 100.2 | 99.7 | 98.9 | 98.2 |
| 360 | .67 | 92.3 | 93.2 | 94.0 | 94.8 | 95.6 | 96.4 | 97.1 | 97.9 | 98.7 | 99.4 | 99.1 | 98.5 |

## %N1 Adjustments for Engine Bleeds

| BLEED CONFIGURATION | PRESSURE ALTITUDE (1000 FT) | | | |
|---|---|---|---|---|
| | 12 | 14 | 16 | 18 |
| ENGINE ANTI-ICE ON | -0.9 | -0.9 | -0.9 | -0.9 |
| ENGINE & WING ANTI-ICE ON | -3.2 | -3.4 | -3.4 | -3.5 |

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# ENGINE INOP

## Max Continuous %N1
### 10000 FT to 1000 FT Pressure Altitudes

| 10000 FT PRESS ALT | | | | | | | | TAT (°C) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KIAS | M | -20 | -15 | -10 | -5 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 |
| 160 | .29 | 95.2 | 96.0 | 96.8 | 97.6 | 98.3 | 99.1 | 99.8 | 98.6 | 97.4 | 96.6 | 95.8 | 94.9 |
| 200 | .36 | 96.0 | 96.7 | 97.5 | 98.3 | 99.0 | 99.8 | 100.5 | 100.5 | 99.4 | 98.5 | 97.8 | 97.0 |
| 240 | .43 | 95.6 | 96.4 | 97.2 | 97.9 | 98.7 | 99.4 | 100.2 | 100.9 | 100.1 | 99.2 | 98.4 | 97.7 |
| 280 | .51 | 94.5 | 95.3 | 96.1 | 96.9 | 97.6 | 98.4 | 99.1 | 99.9 | 100.4 | 99.5 | 98.7 | 98.0 |
| 320 | .58 | 93.0 | 93.9 | 94.7 | 95.5 | 96.2 | 97.0 | 97.8 | 98.6 | 99.3 | 99.7 | 99.0 | 98.2 |
| 360 | .65 | 91.6 | 92.4 | 93.2 | 94.0 | 94.8 | 95.6 | 96.4 | 97.2 | 98.0 | 98.7 | 99.1 | 98.5 |
| 5000 FT PRESS ALT | | | | | | | | TAT (°C) | | | | | |
| KIAS | M | -10 | -5 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 |
| 160 | .26 | 94.9 | 95.7 | 96.4 | 97.2 | 98.0 | 98.8 | 99.2 | 98.3 | 97.4 | 96.6 | 95.9 | 95.1 |
| 200 | .33 | 94.7 | 95.5 | 96.3 | 97.1 | 97.8 | 98.6 | 99.4 | 98.9 | 98.0 | 97.3 | 96.6 | 95.8 |
| 240 | .40 | 94.0 | 94.8 | 95.6 | 96.4 | 97.2 | 97.9 | 98.7 | 99.5 | 98.7 | 97.9 | 97.2 | 96.5 |
| 280 | .46 | 93.3 | 94.1 | 94.9 | 95.7 | 96.5 | 97.3 | 98.1 | 98.8 | 98.9 | 98.2 | 97.5 | 96.8 |
| 320 | .53 | 92.5 | 93.3 | 94.1 | 94.9 | 95.7 | 96.5 | 97.2 | 98.0 | 98.7 | 98.4 | 97.7 | 97.1 |
| 360 | .59 | 91.5 | 92.3 | 93.1 | 93.9 | 94.7 | 95.5 | 96.2 | 97.0 | 97.8 | 98.5 | 98.0 | 97.3 |
| 3000 FT PRESS ALT | | | | | | | | TAT (°C) | | | | | |
| KIAS | M | -5 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 |
| 160 | .26 | 94.8 | 95.6 | 96.4 | 97.2 | 98.0 | 98.7 | 98.8 | 97.9 | 97.1 | 96.4 | 95.6 | 94.8 |
| 200 | .32 | 94.5 | 95.3 | 96.1 | 96.9 | 97.6 | 98.4 | 99.2 | 98.3 | 97.5 | 96.8 | 96.1 | 95.3 |
| 240 | .38 | 94.1 | 94.9 | 95.6 | 96.4 | 97.2 | 98.0 | 98.7 | 98.8 | 98.0 | 97.2 | 96.6 | 95.9 |
| 280 | .45 | 93.2 | 94.0 | 94.8 | 95.6 | 96.4 | 97.2 | 97.9 | 98.7 | 98.3 | 97.5 | 96.9 | 96.2 |
| 320 | .51 | 92.5 | 93.3 | 94.1 | 94.9 | 95.7 | 96.4 | 97.2 | 98.0 | 98.5 | 97.8 | 97.1 | 96.5 |
| 360 | .57 | 91.6 | 92.4 | 93.2 | 94.0 | 94.7 | 95.5 | 96.3 | 97.1 | 97.8 | 98.1 | 97.4 | 96.8 |
| 1000 FT PRESS ALT | | | | | | | | TAT (°C) | | | | | |
| KIAS | M | -5 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 |
| 160 | .25 | 93.9 | 94.7 | 95.4 | 96.2 | 97.0 | 97.8 | 98.5 | 98.2 | 97.4 | 96.7 | 96.0 | 95.2 |
| 200 | .31 | 93.5 | 94.3 | 95.1 | 95.9 | 96.7 | 97.4 | 98.2 | 98.5 | 97.8 | 97.0 | 96.3 | 95.6 |
| 240 | .37 | 93.0 | 93.8 | 94.6 | 95.4 | 96.1 | 96.9 | 97.7 | 98.4 | 98.1 | 97.3 | 96.6 | 95.9 |
| 280 | .43 | 92.3 | 93.2 | 93.9 | 94.7 | 95.5 | 96.3 | 97.1 | 97.8 | 98.3 | 97.6 | 96.9 | 96.2 |
| 320 | .49 | 91.6 | 92.4 | 93.2 | 94.0 | 94.8 | 95.6 | 96.3 | 97.1 | 97.9 | 97.9 | 97.2 | 96.5 |
| 360 | .55 | 90.7 | 91.5 | 92.3 | 93.1 | 93.9 | 94.7 | 95.4 | 96.2 | 96.9 | 97.7 | 97.3 | 96.6 |

## %N1 Adjustments for Engine Bleeds

| BLEED CONFIGURATION | PRESSURE ALTITUDE (1000 FT) | | | |
|---|---|---|---|---|
| | 1 | 3 | 5 | 10 |
| ENGINE ANTI-ICE ON | -0.6 | -0.8 | -0.8 | -0.8 |
| ENGINE & WING ANTI-ICE ON | -2.9 | -3.0 | -3.1 | -3.2 |

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# ENGINE INOP

## MAX CONTINUOUS THRUST

### Driftdown Speed/Level Off Altitude
**100 ft/min residual rate of climb**

| WEIGHT (1000 KG) | | OPTIMUM DRIFTDOWN SPEED (KIAS) | LEVEL OFF ALTITUDE (FT) | | |
|---|---|---|---|---|---|
| START DRIFTDOWN | LEVEL OFF | | ISA + 10°C & BELOW | ISA + 15°C | ISA + 20°C |
| 85 | 81 | 270 | 17500 | 16200 | 15000 |
| 80 | 77 | 262 | 19200 | 18000 | 16700 |
| 75 | 72 | 255 | 20800 | 19800 | 18500 |
| 70 | 67 | 246 | 22300 | 21300 | 20300 |
| 65 | 62 | 238 | 23900 | 23000 | 22000 |
| 60 | 57 | 228 | 25800 | 24800 | 23900 |
| 55 | 53 | 219 | 28100 | 27100 | 26000 |
| 50 | 48 | 209 | 30300 | 29500 | 28500 |
| 45 | 43 | 198 | 32500 | 31800 | 30900 |
| 40 | 38 | 187 | 34900 | 34100 | 33300 |

**Includes APU fuel burn.**

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# ENGINE INOP

## MAX CONTINUOUS THRUST

## Driftdown/LRC Cruise Range Capability

### Ground to Air Miles Conversion

| AIR DISTANCE (NM) HEADWIND COMPONENT (KTS) | | | | | GROUND DISTANCE (NM) | AIR DISTANCE (NM) TAILWIND COMPONENT (KTS) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 80 | 60 | 40 | 20 | | 20 | 40 | 60 | 80 | 100 |
| 139 | 129 | 120 | 113 | 106 | 100 | 95 | 90 | 86 | 82 | 78 |
| 277 | 257 | 240 | 225 | 212 | 200 | 189 | 180 | 171 | 164 | 156 |
| 416 | 386 | 360 | 338 | 318 | 300 | 284 | 270 | 257 | 245 | 235 |
| 554 | 515 | 480 | 450 | 424 | 400 | 379 | 360 | 343 | 327 | 313 |
| 693 | 643 | 600 | 563 | 529 | 500 | 474 | 450 | 428 | 409 | 391 |
| 831 | 772 | 720 | 675 | 635 | 600 | 568 | 540 | 514 | 491 | 469 |
| 969 | 900 | 840 | 788 | 741 | 700 | 663 | 630 | 600 | 573 | 548 |
| 1108 | 1029 | 960 | 900 | 847 | 800 | 758 | 720 | 686 | 655 | 626 |
| 1246 | 1157 | 1080 | 1012 | 953 | 900 | 853 | 810 | 771 | 736 | 704 |
| 1385 | 1286 | 1200 | 1125 | 1059 | 1000 | 947 | 900 | 857 | 818 | 783 |
| 1523 | 1414 | 1320 | 1237 | 1165 | 1100 | 1042 | 990 | 943 | 900 | 861 |
| 1662 | 1543 | 1440 | 1350 | 1271 | 1200 | 1137 | 1080 | 1029 | 982 | 939 |
| 1800 | 1672 | 1560 | 1463 | 1376 | 1300 | 1232 | 1170 | 1114 | 1064 | 1017 |
| 1939 | 1800 | 1680 | 1575 | 1482 | 1400 | 1326 | 1260 | 1200 | 1145 | 1095 |
| 2078 | 1929 | 1800 | 1688 | 1588 | 1500 | 1421 | 1350 | 1285 | 1227 | 1174 |
| 2217 | 2058 | 1921 | 1800 | 1694 | 1600 | 1516 | 1440 | 1371 | 1309 | 1252 |
| 2356 | 2187 | 2041 | 1913 | 1800 | 1700 | 1610 | 1530 | 1457 | 1390 | 1330 |
| 2496 | 2317 | 2161 | 2026 | 1906 | 1800 | 1705 | 1619 | 1542 | 1472 | 1408 |

### Driftdown/Cruise Fuel and Time

| AIR DIST (NM) | FUEL REQUIRED (1000 KG) WEIGHT AT START OF DRIFTDOWN (1000 KG) | | | | | | | | | | TIME (HR:MIN) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | |
| 100 | 0.4 | 0.4 | 0.4 | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 | 0.6 | 0.6 | 0:17 |
| 200 | 0.8 | 0.8 | 0.9 | 1.0 | 1.0 | 1.1 | 1.1 | 1.2 | 1.3 | 1.3 | 0:34 |
| 300 | 1.3 | 1.3 | 1.4 | 1.6 | 1.7 | 1.7 | 1.9 | 2.0 | 2.1 | 2.2 | 0:50 |
| 400 | 1.7 | 1.8 | 2.0 | 2.2 | 2.3 | 2.4 | 2.6 | 2.8 | 2.9 | 3.1 | 1:07 |
| 500 | 2.1 | 2.3 | 2.5 | 2.7 | 2.9 | 3.1 | 3.3 | 3.5 | 3.7 | 3.9 | 1:24 |
| 600 | 2.5 | 2.8 | 3.0 | 3.3 | 3.5 | 3.7 | 4.0 | 4.2 | 4.5 | 4.7 | 1:40 |
| 700 | 2.9 | 3.2 | 3.5 | 3.8 | 4.1 | 4.3 | 4.6 | 4.9 | 5.2 | 5.5 | 1:57 |
| 800 | 3.4 | 3.7 | 4.0 | 4.3 | 4.7 | 5.0 | 5.3 | 5.6 | 6.0 | 6.3 | 2:14 |
| 900 | 3.8 | 4.1 | 4.5 | 4.9 | 5.3 | 5.6 | 6.0 | 6.4 | 6.7 | 7.1 | 2:30 |
| 1000 | 4.2 | 4.6 | 5.0 | 5.4 | 5.8 | 6.2 | 6.6 | 7.0 | 7.5 | 7.9 | 2:47 |
| 1100 | 4.6 | 5.0 | 5.5 | 5.9 | 6.4 | 6.8 | 7.3 | 7.7 | 8.2 | 8.7 | 3:04 |
| 1200 | 5.0 | 5.4 | 5.9 | 6.5 | 6.9 | 7.4 | 7.9 | 8.4 | 8.9 | 9.4 | 3:21 |
| 1300 | 5.3 | 5.9 | 6.4 | 7.0 | 7.5 | 8.0 | 8.6 | 9.1 | 9.7 | 10.2 | 3:37 |
| 1400 | 5.7 | 6.3 | 6.9 | 7.5 | 8.1 | 8.6 | 9.2 | 9.8 | 10.4 | 11.0 | 3:54 |
| 1500 | 6.1 | 6.7 | 7.3 | 8.0 | 8.6 | 9.2 | 9.8 | 10.4 | 11.1 | 11.7 | 4:11 |
| 1600 | 6.5 | 7.2 | 7.8 | 8.5 | 9.1 | 9.8 | 10.4 | 11.1 | 11.8 | 12.5 | 4:28 |
| 1700 | 6.9 | 7.6 | 8.3 | 9.0 | 9.7 | 10.3 | 11.1 | 11.8 | 12.5 | 13.2 | 4:45 |
| 1800 | 7.2 | 8.0 | 8.7 | 9.5 | 10.2 | 10.9 | 11.7 | 12.4 | 13.2 | 13.9 | 5:02 |

**Includes APU fuel burn.**
**Driftdown at optimum driftdown speed and cruise at Long Range Cruise speed.**

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# ENGINE INOP

## MAX CONTINUOUS THRUST

### Long Range Cruise Altitude Capability
**100 ft/min residual rate of climb**

| WEIGHT (1000 KG) | PRESSURE ALTITUDE (FT) | | |
|---|---|---|---|
| | ISA + 10°C & BELOW | ISA + 15°C | ISA + 20°C |
| 85 | 13800 | 11300 | 8900 |
| 80 | 16100 | 13700 | 11400 |
| 75 | 18100 | 16300 | 14000 |
| 70 | 20200 | 18500 | 16300 |
| 65 | 21800 | 20600 | 18600 |
| 60 | 23400 | 22300 | 20700 |
| 55 | 25300 | 24100 | 22700 |
| 50 | 28100 | 26700 | 24800 |
| 45 | 30700 | 29700 | 28100 |
| 40 | 33200 | 32300 | 31100 |

**With engine anti-ice on, decrease altitude capability by 2100 ft.**
**With engine and wing anti-ice on, decrease altitude capability by 5700 ft (optional system).**

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# ENGINE INOP

## MAX CONTINUOUS THRUST

### Long Range Cruise Control

| WEIGHT (1000 KG) | | PRESSURE ALTITUDE (1000 FT) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 10 | 14 | 18 | 22 | 25 | 27 | 29 | 31 |
| 85 | %N1 | 92.5 | 95.7 | | | | | | |
| | MACH | .561 | .593 | | | | | | |
| | KIAS | 311 | 306 | | | | | | |
| | FF/ENG | 3152 | 3144 | | | | | | |
| 80 | %N1 | 90.8 | 94.2 | 98.5 | | | | | |
| | MACH | .545 | .585 | .612 | | | | | |
| | KIAS | 302 | 302 | 292 | | | | | |
| | FF/ENG | 2951 | 2983 | 2973 | | | | | |
| 75 | %N1 | 89.0 | 92.4 | 96.2 | | | | | |
| | MACH | .528 | .569 | .599 | | | | | |
| | KIAS | 293 | 293 | 286 | | | | | |
| | FF/ENG | 2751 | 2781 | 2756 | | | | | |
| 70 | %N1 | 87.1 | 90.6 | 94.1 | | | | | |
| | MACH | .510 | .551 | .589 | | | | | |
| | KIAS | 282 | 284 | 281 | | | | | |
| | FF/ENG | 2552 | 2581 | 2578 | | | | | |
| 65 | %N1 | 85.1 | 88.5 | 92.0 | 96.3 | | | | |
| | MACH | .491 | .532 | .574 | .604 | | | | |
| | KIAS | 271 | 273 | 274 | 266 | | | | |
| | FF/ENG | 2356 | 2381 | 2394 | 2388 | | | | |
| 60 | %N1 | 82.9 | 86.3 | 89.9 | 93.8 | | | | |
| | MACH | .471 | .511 | .553 | .590 | | | | |
| | KIAS | 261 | 262 | 263 | 260 | | | | |
| | FF/ENG | 2168 | 2183 | 2196 | 2192 | | | | |
| 55 | %N1 | 80.7 | 83.9 | 87.5 | 91.2 | 94.5 | 97.7 | | |
| | MACH | .453 | .488 | .530 | .574 | .597 | .614 | | |
| | KIAS | 250 | 250 | 252 | 252 | 247 | 244 | | |
| | FF/ENG | 1991 | 1987 | 1998 | 2009 | 2010 | 2060 | | |
| 50 | %N1 | 78.3 | 81.4 | 84.9 | 88.5 | 91.7 | 94.0 | 97.1 | |
| | MACH | .434 | .466 | .505 | .549 | .583 | .596 | .613 | |
| | KIAS | 240 | 239 | 240 | 241 | 241 | 236 | 233 | |
| | FF/ENG | 1822 | 1803 | 1801 | 1811 | 1831 | 1829 | 1873 | |
| 45 | %N1 | 75.9 | 78.8 | 82.0 | 85.7 | 88.4 | 90.6 | 93.2 | 96.2 |
| | MACH | .415 | .444 | .478 | .522 | .556 | .578 | .593 | .610 |
| | KIAS | 229 | 227 | 227 | 229 | 229 | 229 | 225 | 222 |
| | FF/ENG | 1661 | 1629 | 1608 | 1615 | 1627 | 1647 | 1649 | 1683 |
| 40 | %N1 | 73.4 | 76.0 | 79.1 | 82.5 | 85.2 | 87.1 | 89.2 | 91.8 |
| | MACH | .395 | .422 | .453 | .491 | .525 | .548 | .571 | .589 |
| | KIAS | 218 | 216 | 215 | 215 | 216 | 216 | 216 | 214 |
| | FF/ENG | 1506 | 1466 | 1434 | 1422 | 1432 | 1445 | 1461 | 1470 |

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# ENGINE INOP

## MAX CONTINUOUS THRUST

## Long Range Cruise Diversion Fuel and Time

### Ground to Air Miles Conversion

| AIR DISTANCE (NM) HEADWIND COMPONENT (KTS) | | | | | GROUND DISTANCE (NM) | AIR DISTANCE (NM) TAILWIND COMPONENT (KTS) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 80 | 60 | 40 | 20 | | 20 | 40 | 60 | 80 | 100 |
| 309 | 279 | 253 | 233 | 215 | 200 | 190 | 180 | 172 | 164 | 157 |
| 625 | 564 | 511 | 467 | 432 | 400 | 379 | 360 | 342 | 326 | 312 |
| 943 | 850 | 769 | 703 | 648 | 600 | 568 | 540 | 513 | 489 | 468 |
| 1263 | 1137 | 1028 | 939 | 865 | 800 | 758 | 719 | 683 | 652 | 623 |
| 1586 | 1426 | 1287 | 1175 | 1082 | 1000 | 947 | 898 | 853 | 813 | 778 |
| 1912 | 1717 | 1548 | 1412 | 1299 | 1200 | 1136 | 1076 | 1023 | 975 | 932 |
| 2240 | 2009 | 1810 | 1649 | 1517 | 1400 | 1324 | 1255 | 1192 | 1136 | 1086 |
| 2570 | 2304 | 2074 | 1888 | 1735 | 1600 | 1513 | 1434 | 1362 | 1297 | 1240 |
| 2903 | 2600 | 2337 | 2127 | 1953 | 1800 | 1702 | 1613 | 1531 | 1458 | 1393 |

### Reference Fuel and Time Required at Check Point

| AIR DIST (NM) | PRESSURE ALTITUDE (1000 FT) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | | 14 | | 18 | | 22 | | 26 | |
| | FUEL (1000 KG) | TIME (HR:MIN) | FUEL (1000 KG) | TIME (HR:MIN) | FUEL (1000 KG) | TIME (HR:MIN) | FUEL (1000 KG) | TIME (HR:MIN) | FUEL (1000 KG) | TIME (HR:MIN) |
| 200 | 1.3 | 0:46 | 1.1 | 0:43 | 1.0 | 0:41 | 0.9 | 0:39 | 0.8 | 0:38 |
| 400 | 2.7 | 1:30 | 2.4 | 1:25 | 2.2 | 1:20 | 2.0 | 1:15 | 1.9 | 1:12 |
| 600 | 4.0 | 2:14 | 3.7 | 2:07 | 3.4 | 2:00 | 3.1 | 1:52 | 2.9 | 1:46 |
| 800 | 5.3 | 3:00 | 4.9 | 2:50 | 4.5 | 2:40 | 4.2 | 2:29 | 4.0 | 2:21 |
| 1000 | 6.7 | 3:45 | 6.1 | 3:33 | 5.7 | 3:20 | 5.3 | 3:07 | 5.0 | 2:56 |
| 1200 | 8.0 | 4:32 | 7.3 | 4:17 | 6.8 | 4:01 | 6.3 | 3:45 | 6.0 | 3:31 |
| 1400 | 9.3 | 5:18 | 8.6 | 5:01 | 7.9 | 4:42 | 7.4 | 4:23 | 7.0 | 4:07 |
| 1600 | 10.5 | 6:06 | 9.7 | 5:45 | 9.0 | 5:24 | 8.4 | 5:02 | 7.9 | 4:43 |
| 1800 | 11.8 | 6:54 | 10.9 | 6:31 | 10.1 | 6:07 | 9.4 | 5:42 | 8.9 | 5:20 |

### Fuel Required Adjustments (1000 KG)

| REFERENCE FUEL REQUIRED (1000 KG) | WEIGHT AT CHECK POINT (1000 KG) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 |
| 1 | -0.1 | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 |
| 2 | -0.1 | -0.1 | 0.0 | 0.1 | 0.3 | 0.5 | 0.7 | 0.9 | 1.2 |
| 3 | -0.2 | -0.1 | 0.0 | 0.2 | 0.4 | 0.7 | 1.0 | 1.4 | 1.8 |
| 4 | -0.3 | -0.2 | 0.0 | 0.3 | 0.6 | 1.0 | 1.4 | 1.9 | 2.4 |
| 5 | -0.4 | -0.2 | 0.0 | 0.3 | 0.7 | 1.2 | 1.8 | 2.4 | 3.0 |
| 6 | -0.5 | -0.2 | 0.0 | 0.4 | 0.9 | 1.4 | 2.1 | 2.8 | 3.6 |
| 7 | -0.6 | -0.3 | 0.0 | 0.4 | 1.0 | 1.6 | 2.4 | 3.2 | 4.2 |
| 8 | -0.6 | -0.3 | 0.0 | 0.5 | 1.1 | 1.9 | 2.7 | 3.6 | 4.7 |
| 9 | -0.7 | -0.4 | 0.0 | 0.6 | 1.2 | 2.0 | 3.0 | 4.0 | 5.2 |
| 10 | -0.8 | -0.4 | 0.0 | 0.6 | 1.4 | 2.2 | 3.2 | 4.4 | 5.6 |
| 11 | -0.9 | -0.4 | 0.0 | 0.7 | 1.5 | 2.4 | 3.5 | 4.7 | 6.1 |
| 12 | -1.0 | -0.5 | 0.0 | 0.7 | 1.6 | 2.6 | 3.7 | 5.0 | 6.5 |
| 13 | -1.0 | -0.5 | 0.0 | 0.8 | 1.7 | 2.7 | 3.9 | 5.3 | 6.9 |
| 14 | -1.1 | -0.6 | 0.0 | 0.8 | 1.8 | 2.8 | 4.1 | 5.6 | 7.2 |

**Includes APU fuel burn.**

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# ENGINE INOP

## MAX CONTINUOUS THRUST

### Holding
**Flaps Up**

| WEIGHT (1000 KG) | | PRESSURE ALTITUDE (FT) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1500 | 5000 | 10000 | 15000 | 20000 | 25000 | 30000 | 35000 |
| 85 | %N1 | 82.0 | 84.9 | 89.2 | 94.1 | | | | |
| | KIAS | 252 | 253 | 254 | 255 | | | | |
| | FF/ENG | 2820 | 2830 | 2850 | 2920 | | | | |
| 80 | %N1 | 80.3 | 83.2 | 87.5 | 92.0 | | | | |
| | KIAS | 244 | 245 | 246 | 247 | | | | |
| | FF/ENG | 2650 | 2650 | 2660 | 2710 | | | | |
| 75 | %N1 | 78.6 | 81.4 | 85.6 | 90.1 | 96.9 | | | |
| | KIAS | 236 | 238 | 238 | 239 | 241 | | | |
| | FF/ENG | 2490 | 2480 | 2480 | 2520 | 2620 | | | |
| 70 | %N1 | 76.7 | 79.4 | 83.7 | 88.1 | 93.6 | | | |
| | KIAS | 229 | 229 | 230 | 231 | 233 | | | |
| | FF/ENG | 2330 | 2310 | 2310 | 2330 | 2380 | | | |
| 65 | %N1 | 74.7 | 77.5 | 81.6 | 85.9 | 90.7 | | | |
| | KIAS | 221 | 221 | 222 | 223 | 224 | | | |
| | FF/ENG | 2160 | 2150 | 2130 | 2150 | 2170 | | | |
| 60 | %N1 | 72.5 | 75.4 | 79.4 | 83.7 | 88.3 | 95.6 | | |
| | KIAS | 211 | 212 | 213 | 214 | 215 | 216 | | |
| | FF/ENG | 2000 | 1980 | 1970 | 1970 | 1980 | 2080 | | |
| 55 | %N1 | 70.1 | 73.0 | 77.0 | 81.3 | 85.8 | 91.4 | | |
| | KIAS | 202 | 203 | 203 | 204 | 205 | 207 | | |
| | FF/ENG | 1850 | 1820 | 1800 | 1790 | 1790 | 1840 | | |
| 50 | %N1 | 67.7 | 70.4 | 74.5 | 78.7 | 83.2 | 87.9 | 96.7 | |
| | KIAS | 192 | 193 | 194 | 195 | 195 | 197 | 198 | |
| | FF/ENG | 1690 | 1660 | 1640 | 1630 | 1620 | 1630 | 1780 | |
| 45 | %N1 | 64.9 | 67.6 | 71.7 | 75.8 | 80.3 | 84.9 | 91.2 | |
| | KIAS | 185 | 185 | 185 | 185 | 185 | 186 | 187 | |
| | FF/ENG | 1540 | 1510 | 1480 | 1470 | 1450 | 1450 | 1510 | |
| 40 | %N1 | 61.8 | 64.6 | 68.5 | 72.8 | 77.0 | 81.6 | 86.5 | 96.3 |
| | KIAS | 178 | 178 | 178 | 178 | 178 | 178 | 178 | 178 |
| | FF/ENG | 1380 | 1360 | 1330 | 1310 | 1280 | 1280 | 1310 | 1440 |

**This table includes 5% additional fuel for holding in a racetrack pattern.**

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# GEAR DOWN

## Long Range Cruise Altitude Capability

### Max Cruise Thrust, 100 ft/min residual rate of climb

| WEIGHT (1000 KG) | PRESSURE ALTITUDE (FT) | | |
|---|---|---|---|
| | ISA + 10°C & BELOW | ISA + 15°C | ISA + 20°C |
| 85 | 14600 | 11500 | 8500 |
| 80 | 17400 | 14600 | 11700 |
| 75 | 20300 | 17600 | 14900 |
| 70 | 22800 | 20500 | 17800 |
| 65 | 25400 | 23500 | 20900 |
| 60 | 27800 | 26300 | 24400 |
| 55 | 30200 | 29000 | 27300 |
| 50 | 32300 | 31300 | 30100 |
| 45 | 34500 | 33500 | 32400 |
| 40 | 36900 | 36000 | 34900 |

## Long Range Cruise Control

| WEIGHT (1000 KG) | | PRESSURE ALTITUDE (1000 FT) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 10 | 21 | 23 | 25 | 27 | 29 | 31 | 33 | 35 | 37 |
| 80 | %N1 | 84.8 | | | | | | | | | |
| | MACH | .468 | | | | | | | | | |
| | KIAS | 259 | | | | | | | | | |
| | FF/ENG | 2313 | | | | | | | | | |
| 70 | %N1 | 81.1 | 90.4 | 92.6 | | | | | | | |
| | MACH | .440 | .541 | .557 | | | | | | | |
| | KIAS | 243 | 242 | 240 | | | | | | | |
| | FF/ENG | 2010 | 2004 | 2002 | | | | | | | |
| 60 | %N1 | 76.9 | 86.2 | 88.0 | 89.8 | 92.3 | 95.7 | | | | |
| | MACH | .409 | .504 | .525 | .544 | .562 | .580 | | | | |
| | KIAS | 226 | 225 | 225 | 224 | 222 | 220 | | | | |
| | FF/ENG | 1722 | 1694 | 1696 | 1697 | 1709 | 1756 | | | | |
| 50 | %N1 | 72.3 | 81.2 | 83.0 | 84.8 | 86.6 | 88.5 | 91.1 | 94.7 | | |
| | MACH | .376 | .463 | .482 | .502 | .523 | .544 | .561 | .580 | | |
| | KIAS | 207 | 206 | 206 | 206 | 206 | 205 | 203 | 201 | | |
| | FF/ENG | 1443 | 1395 | 1392 | 1394 | 1403 | 1409 | 1418 | 1461 | | |
| 40 | %N1 | 66.6 | 75.3 | 77.0 | 78.8 | 80.5 | 82.3 | 84.2 | 86.1 | 88.6 | 92.5 |
| | MACH | .340 | .417 | .434 | .452 | .471 | .491 | .513 | .535 | .554 | .573 |
| | KIAS | 187 | 185 | 185 | 185 | 185 | 185 | 185 | 185 | 183 | 181 |
| | FF/ENG | 1184 | 1114 | 1102 | 1102 | 1108 | 1112 | 1115 | 1119 | 1125 | 1160 |

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# GEAR DOWN

## Long Range Cruise Enroute Fuel and Time
### Ground to Air Miles Conversion

| AIR DISTANCE (NM) HEADWIND COMPONENT (KTS) | | | | | GROUND DISTANCE (NM) | AIR DISTANCE (NM) TAILWIND COMPONENT (KTS) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 80 | 60 | 40 | 20 | | 20 | 40 | 60 | 80 | 100 |
| 327 | 291 | 260 | 236 | 217 | 200 | 188 | 177 | 167 | 159 | 152 |
| 657 | 585 | 524 | 475 | 435 | 400 | 377 | 356 | 337 | 320 | 305 |
| 992 | 882 | 788 | 714 | 653 | 600 | 565 | 534 | 505 | 480 | 458 |
| 1331 | 1182 | 1055 | 954 | 872 | 800 | 754 | 712 | 674 | 640 | 610 |
| 1676 | 1486 | 1323 | 1195 | 1091 | 1000 | 942 | 889 | 842 | 799 | 762 |
| 2026 | 1792 | 1593 | 1436 | 1310 | 1200 | 1130 | 1066 | 1009 | 958 | 913 |
| 2382 | 2103 | 1865 | 1680 | 1530 | 1400 | 1318 | 1244 | 1176 | 1116 | 1064 |
| 2744 | 2418 | 2140 | 1924 | 1751 | 1600 | 1506 | 1420 | 1342 | 1274 | 1214 |
| 3112 | 2737 | 2418 | 2171 | 1972 | 1800 | 1694 | 1597 | 1510 | 1432 | 1364 |

### Reference Fuel and Time Required at Check Point

| AIR DIST (NM) | PRESSURE ALTITUDE (1000 FT) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | | 14 | | 20 | | 24 | | 28 | |
| | FUEL (1000 KG) | TIME (HR:MIN) | FUEL (1000 KG) | TIME (HR:MIN) | FUEL (1000 KG) | TIME (HR:MIN) | FUEL (1000 KG) | TIME (HR:MIN) | FUEL (1000 KG) | TIME (HR:MIN) |
| 200 | 2.4 | 0:49 | 2.2 | 0:47 | 1.9 | 0:44 | 1.8 | 0:42 | 1.6 | 0:41 |
| 400 | 5.0 | 1:36 | 4.6 | 1:31 | 4.1 | 1:24 | 3.8 | 1:20 | 3.6 | 1:17 |
| 600 | 7.5 | 2:25 | 7.0 | 2:17 | 6.2 | 2:06 | 5.8 | 1:59 | 5.5 | 1:54 |
| 800 | 9.9 | 3:14 | 9.2 | 3:03 | 8.3 | 2:48 | 7.7 | 2:38 | 7.4 | 2:31 |
| 1000 | 12.3 | 4:05 | 11.5 | 3:51 | 10.3 | 3:31 | 9.7 | 3:18 | 9.2 | 3:08 |
| 1200 | 14.6 | 4:56 | 13.7 | 4:39 | 12.3 | 4:14 | 11.5 | 3:59 | 11.0 | 3:46 |
| 1400 | 16.9 | 5:49 | 15.8 | 5:28 | 14.2 | 4:59 | 13.3 | 4:40 | 12.7 | 4:24 |
| 1600 | 19.1 | 6:43 | 17.9 | 6:19 | 16.1 | 5:44 | 15.1 | 5:22 | 14.4 | 5:04 |
| 1800 | 21.3 | 7:39 | 19.9 | 7:11 | 18.0 | 6:30 | 16.9 | 6:05 | 16.1 | 5:43 |

### Fuel Required Adjustments (1000 KG)

| REFERENCE FUEL REQUIRED (1000 KG) | WEIGHT AT CHECK POINT (1000 KG) | | | | |
|---|---|---|---|---|---|
| | 40 | 50 | 60 | 70 | 80 |
| 2 | -0.3 | -0.2 | 0.0 | 0.3 | 0.7 |
| 4 | -0.7 | -0.3 | 0.0 | 0.7 | 1.5 |
| 6 | -1.0 | -0.5 | 0.0 | 1.0 | 2.2 |
| 8 | -1.4 | -0.7 | 0.0 | 1.2 | 2.8 |
| 10 | -1.7 | -0.9 | 0.0 | 1.5 | 3.4 |
| 12 | -2.0 | -1.0 | 0.0 | 1.8 | 4.0 |
| 14 | -2.4 | -1.2 | 0.0 | 2.0 | 4.5 |
| 16 | -2.7 | -1.4 | 0.0 | 2.2 | 4.9 |
| 18 | -3.1 | -1.5 | 0.0 | 2.4 | 5.3 |
| 20 | -3.4 | -1.7 | 0.0 | 2.5 | 5.7 |
| 22 | -3.8 | -1.9 | 0.0 | 2.6 | 6.0 |

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# GEAR DOWN

## Descent
### VREF40 + 70 KIAS

| PRESSURE ALTITUDE (FT) | TIME (MIN) | FUEL (KG) | DISTANCE (NM) |
|---|---|---|---|
| 41000 | 20 | 270 | 88 |
| 39000 | 20 | 270 | 84 |
| 37000 | 19 | 260 | 79 |
| 35000 | 18 | 260 | 75 |
| 33000 | 18 | 250 | 71 |
| 31000 | 17 | 250 | 67 |
| 29000 | 16 | 240 | 63 |
| 27000 | 15 | 240 | 59 |
| 25000 | 15 | 230 | 55 |
| 23000 | 14 | 220 | 51 |
| 21000 | 13 | 220 | 47 |
| 19000 | 12 | 210 | 43 |
| 17000 | 11 | 200 | 39 |
| 15000 | 11 | 190 | 35 |
| 10000 | 8 | 170 | 25 |
| 5000 | 6 | 130 | 16 |
| 1500 | 4 | 110 | 9 |

**Allowances for a straight-in approach are included.**

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# GEAR DOWN

## Holding
### Flaps Up

| WEIGHT (1000 KG) | | PRESSURE ALTITUDE (FT) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1500 | 5000 | 10000 | 15000 | 20000 | 25000 | 30000 | 35000 |
| 80 | %N1 | 74.8 | 77.5 | 81.8 | 86.1 | 90.8 | | | |
| | KIAS | 225 | 225 | 225 | 225 | 225 | | | |
| | FF/ENG | 2160 | 2150 | 2140 | 2160 | 2170 | | | |
| 75 | %N1 | 73.1 | 76.0 | 80.0 | 84.4 | 89.0 | | | |
| | KIAS | 220 | 220 | 220 | 220 | 220 | | | |
| | FF/ENG | 2040 | 2030 | 2010 | 2020 | 2030 | | | |
| 70 | %N1 | 71.3 | 74.3 | 78.2 | 82.5 | 87.1 | 93.1 | | |
| | KIAS | 216 | 216 | 216 | 216 | 216 | 216 | | |
| | FF/ENG | 1920 | 1900 | 1890 | 1890 | 1890 | 1940 | | |
| 65 | %N1 | 69.5 | 72.4 | 76.4 | 80.7 | 85.1 | 90.2 | | |
| | KIAS | 211 | 211 | 211 | 211 | 211 | 211 | | |
| | FF/ENG | 1800 | 1780 | 1770 | 1760 | 1750 | 1780 | | |
| 60 | %N1 | 67.5 | 70.3 | 74.5 | 78.6 | 83.1 | 87.7 | 95.7 | |
| | KIAS | 204 | 204 | 204 | 204 | 204 | 204 | 204 | |
| | FF/ENG | 1680 | 1660 | 1640 | 1630 | 1620 | 1630 | 1740 | |
| 55 | %N1 | 65.5 | 68.2 | 72.4 | 76.4 | 80.9 | 85.5 | 91.6 | |
| | KIAS | 198 | 198 | 198 | 198 | 198 | 198 | 198 | |
| | FF/ENG | 1570 | 1540 | 1520 | 1500 | 1490 | 1490 | 1550 | |
| 50 | %N1 | 63.3 | 66.0 | 70.0 | 74.2 | 78.5 | 83.0 | 87.9 | |
| | KIAS | 192 | 192 | 192 | 192 | 192 | 192 | 192 | |
| | FF/ENG | 1450 | 1430 | 1400 | 1380 | 1360 | 1360 | 1390 | |
| 45 | %N1 | 60.8 | 63.7 | 67.6 | 71.8 | 76.0 | 80.5 | 85.1 | 92.6 |
| | KIAS | 185 | 185 | 185 | 185 | 185 | 185 | 185 | 185 |
| | FF/ENG | 1330 | 1310 | 1290 | 1270 | 1240 | 1230 | 1250 | 1320 |
| 40 | %N1 | 58.2 | 61.0 | 65.0 | 69.1 | 73.4 | 77.7 | 82.2 | 87.7 |
| | KIAS | 178 | 178 | 178 | 178 | 178 | 178 | 178 | 178 |
| | FF/ENG | 1220 | 1200 | 1170 | 1150 | 1130 | 1110 | 1120 | 1140 |

**This table includes 5% additional fuel for holding in a racetrack pattern.**

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# GEAR DOWN
# ENGINE INOP

## MAX CONTINUOUS THRUST

### Driftdown Speed/Level Off Altitude
**100 ft/min residual rate of climb**

| WEIGHT (1000 KG) | | OPTIMUM DRIFTDOWN SPEED (KIAS) | LEVEL OFF ALTITUDE (FT) | | |
|---|---|---|---|---|---|
| START DRIFTDOWN | LEVEL OFF | | ISA + 10°C & BELOW | ISA + 15°C | ISA + 20°C |
| 80 | 76 | 224 | 3000 | 1300 | |
| 75 | 71 | 219 | 5400 | 4000 | 2000 |
| 70 | 67 | 215 | 7800 | 6400 | 4600 |
| 65 | 62 | 210 | 10200 | 9000 | 7300 |
| 60 | 57 | 204 | 12500 | 11600 | 10200 |
| 55 | 53 | 198 | 15000 | 14100 | 13200 |
| 50 | 48 | 192 | 17500 | 16700 | 15900 |
| 45 | 43 | 185 | 20100 | 19300 | 18400 |
| 40 | 38 | 178 | 22600 | 21800 | 21000 |

**Includes APU fuel burn.**

### Long Range Cruise Altitude Capability
**100 ft/min residual rate of climb**

| WEIGHT (1000 KG) | PRESSURE ALTITUDE (FT) | | |
|---|---|---|---|
| | ISA + 10°C & BELOW | ISA + 15°C | ISA + 20°C |
| 75 | 700 | | |
| 70 | 3800 | 1600 | |
| 65 | 6800 | 5200 | 2600 |
| 60 | 10000 | 8400 | 6200 |
| 55 | 12700 | 11600 | 9800 |
| 50 | 15600 | 14800 | 13700 |
| 45 | 18700 | 17800 | 17000 |
| 40 | 21800 | 20900 | 20000 |

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# GEAR DOWN
# ENGINE INOP

## MAX CONTINUOUS THRUST

### Long Range Cruise Control

| WEIGHT (1000 KG) | | PRESSURE ALTITUDE (1000 FT) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 5 | 7 | 9 | 11 | 13 | 15 | 17 | 19 | 21 |
| 70 | %N1 | 95.5 | | | | | | | | |
| | MACH | .389 | | | | | | | | |
| | KIAS | 235 | | | | | | | | |
| | FF/ENG | 3850 | | | | | | | | |
| 65 | %N1 | 93.1 | 95.0 | | | | | | | |
| | MACH | .376 | .389 | | | | | | | |
| | KIAS | 228 | 227 | | | | | | | |
| | FF/ENG | 3544 | 3556 | | | | | | | |
| 60 | %N1 | 90.7 | 92.4 | 94.3 | 97.3 | | | | | |
| | MACH | .364 | .375 | .388 | .402 | | | | | |
| | KIAS | 220 | 219 | 218 | 218 | | | | | |
| | FF/ENG | 3250 | 3252 | 3263 | 3326 | | | | | |
| 55 | %N1 | 88.2 | 89.8 | 91.6 | 93.5 | 96.4 | | | | |
| | MACH | .351 | .362 | .374 | .387 | .400 | | | | |
| | KIAS | 212 | 211 | 210 | 209 | 209 | | | | |
| | FF/ENG | 2973 | 2961 | 2961 | 2971 | 3027 | | | | |
| 50 | %N1 | 85.7 | 87.2 | 88.7 | 90.5 | 92.3 | 95.1 | 99.5 | | |
| | MACH | .338 | .348 | .359 | .371 | .384 | .398 | .412 | | |
| | KIAS | 204 | 203 | 202 | 201 | 200 | 199 | 198 | | |
| | FF/ENG | 2714 | 2691 | 2676 | 2674 | 2684 | 2722 | 2824 | | |
| 45 | %N1 | 83.1 | 84.4 | 85.9 | 87.4 | 89.1 | 90.9 | 93.5 | 97.7 | |
| | MACH | .325 | .334 | .344 | .355 | .367 | .380 | .393 | .408 | |
| | KIAS | 196 | 195 | 193 | 192 | 191 | 190 | 189 | 189 | |
| | FF/ENG | 2468 | 2437 | 2412 | 2396 | 2393 | 2396 | 2411 | 2489 | |
| 40 | %N1 | 80.2 | 81.5 | 82.9 | 84.3 | 85.8 | 87.5 | 89.3 | 91.5 | 95.1 |
| | MACH | .311 | .320 | .329 | .339 | .349 | .361 | .374 | .387 | .402 |
| | KIAS | 188 | 186 | 184 | 183 | 182 | 181 | 180 | 179 | 179 |
| | FF/ENG | 2234 | 2196 | 2164 | 2139 | 2122 | 2113 | 2106 | 2107 | 2160 |

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# GEAR DOWN
# ENGINE INOP
## MAX CONTINUOUS THRUST

## Long Range Cruise Diversion Fuel and Time
### Ground to Air Miles Conversion

| AIR DISTANCE (NM) HEADWIND COMPONENT (KTS) | | | | | GROUND DISTANCE (NM) | AIR DISTANCE (NM) TAILWIND COMPONENT (KTS) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 80 | 60 | 40 | 20 | | 20 | 40 | 60 | 80 | 100 |
| 167 | 148 | 132 | 119 | 109 | 100 | 94 | 88 | 82 | 78 | 74 |
| 341 | 300 | 266 | 239 | 218 | 200 | 187 | 174 | 164 | 155 | 147 |
| 516 | 454 | 402 | 361 | 328 | 300 | 280 | 261 | 245 | 231 | 219 |
| 692 | 608 | 537 | 482 | 438 | 400 | 373 | 348 | 326 | 307 | 291 |
| 869 | 763 | 673 | 603 | 548 | 500 | 465 | 434 | 407 | 383 | 363 |
| 1048 | 919 | 809 | 725 | 658 | 600 | 558 | 521 | 488 | 459 | 434 |
| 1228 | 1076 | 947 | 847 | 768 | 700 | 651 | 607 | 568 | 535 | 506 |
| 1410 | 1234 | 1084 | 970 | 879 | 800 | 744 | 693 | 648 | 610 | 577 |
| 1593 | 1392 | 1222 | 1092 | 989 | 900 | 836 | 779 | 729 | 685 | 648 |
| 1778 | 1552 | 1361 | 1215 | 1100 | 1000 | 929 | 865 | 809 | 760 | 719 |

### Reference Fuel and Time Required at Check Point

| AIR DIST (NM) | PRESSURE ALTITUDE (1000 FT) 6 | | 10 | | 14 | |
|---|---|---|---|---|---|---|
| | FUEL (1000 KG) | TIME (HR:MIN) | FUEL (1000 KG) | TIME (HR:MIN) | FUEL (1000 KG) | TIME (HR:MIN) |
| 100 | 1.3 | 0:27 | 1.1 | 0:26 | 1.1 | 0:26 |
| 200 | 2.6 | 0:53 | 2.4 | 0:50 | 2.4 | 0:48 |
| 300 | 4.0 | 1:18 | 3.7 | 1:15 | 3.7 | 1:11 |
| 400 | 5.3 | 1:44 | 5.0 | 1:39 | 4.9 | 1:35 |
| 500 | 6.6 | 2:10 | 6.2 | 2:04 | 6.1 | 1:58 |
| 600 | 7.9 | 2:37 | 7.5 | 2:29 | 7.3 | 2:22 |
| 700 | 9.2 | 3:04 | 8.7 | 2:55 | 8.5 | 2:46 |
| 800 | 10.5 | 3:31 | 9.9 | 3:20 | 9.7 | 3:10 |
| 900 | 11.7 | 3:58 | 11.1 | 3:46 | 10.8 | 3:35 |
| 1000 | 13.0 | 4:25 | 12.2 | 4:12 | 11.9 | 4:00 |

### Fuel Required Adjustments (1000 KG)

| REFERENCE FUEL REQUIRED (1000 KG) | WEIGHT AT CHECK POINT (1000 KG) | | | | |
|---|---|---|---|---|---|
| | 40 | 50 | 60 | 70 | 80 |
| 1 | -0.2 | -0.1 | 0.0 | 0.1 | 0.3 |
| 2 | -0.4 | -0.2 | 0.0 | 0.3 | 0.6 |
| 3 | -0.5 | -0.3 | 0.0 | 0.5 | 1.0 |
| 4 | -0.7 | -0.4 | 0.0 | 0.7 | 1.3 |
| 5 | -0.9 | -0.5 | 0.0 | 0.9 | 1.7 |
| 6 | -1.1 | -0.6 | 0.0 | 1.1 | 2.0 |
| 7 | -1.3 | -0.7 | 0.0 | 1.2 | 2.4 |
| 8 | -1.4 | -0.7 | 0.0 | 1.4 | 2.7 |
| 9 | -1.6 | -0.8 | 0.0 | 1.6 | 3.1 |
| 10 | -1.8 | -0.9 | 0.0 | 1.8 | 3.4 |
| 11 | -2.0 | -1.0 | 0.0 | 1.9 | 3.8 |
| 12 | -2.2 | -1.1 | 0.0 | 2.1 | 4.1 |
| 13 | -2.3 | -1.2 | 0.0 | 2.2 | 4.5 |

**Includes APU fuel burn.**

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# GEAR DOWN
# ENGINE INOP
## MAX CONTINUOUS THRUST

### Holding
### Flaps Up

| WEIGHT (1000 KG) | | PRESSURE ALTITUDE (FT) | | | |
|---|---|---|---|---|---|
| | | 1500 | 5000 | 10000 | 15000 |
| 80 | %N1 | 94.1 | | | |
| | KIAS | 225 | | | |
| | FF/ENG | 4240 | | | |
| 75 | %N1 | 92.1 | 95.5 | | |
| | KIAS | 220 | 220 | | |
| | FF/ENG | 3960 | 4010 | | |
| 70 | %N1 | 90.0 | 93.3 | | |
| | KIAS | 216 | 216 | | |
| | FF/ENG | 3680 | 3730 | | |
| 65 | %N1 | 88.0 | 91.1 | 97.0 | |
| | KIAS | 211 | 211 | 211 | |
| | FF/ENG | 3430 | 3450 | 3560 | |
| 60 | %N1 | 85.8 | 88.8 | 93.6 | |
| | KIAS | 204 | 204 | 204 | |
| | FF/ENG | 3170 | 3180 | 3230 | |
| 55 | %N1 | 83.5 | 86.4 | 91.0 | 98.4 |
| | KIAS | 198 | 198 | 198 | 198 |
| | FF/ENG | 2920 | 2920 | 2940 | 3110 |
| 50 | %N1 | 80.9 | 83.9 | 88.3 | 93.6 |
| | KIAS | 192 | 192 | 192 | 192 |
| | FF/ENG | 2670 | 2660 | 2670 | 2730 |
| 45 | %N1 | 78.3 | 81.2 | 85.5 | 90.2 |
| | KIAS | 185 | 185 | 185 | 185 |
| | FF/ENG | 2440 | 2420 | 2420 | 2450 |
| 40 | %N1 | 75.6 | 78.3 | 82.6 | 87.1 |
| | KIAS | 178 | 178 | 178 | 178 |
| | FF/ENG | 2210 | 2190 | 2170 | 2180 |

**This table includes 5% additional fuel for holding in a racetrack pattern.**

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## Introduction

This chapter contains information to supplement performance data from the Flight Management Computer (FMC). In addition, sufficient inflight data is provided to complete a flight with the FMC inoperative. In the event of conflict between data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

## General

### Flight with Unreliable Airspeed / Turbulent Air Penetration

Pitch attitude and average %N1 information is provided for use in all phases of flight in the event of unreliable airspeed/Mach indications resulting from blocking or freezing of the pitot system. Loss of radome or turbulent air may also cause unreliable airspeed/Mach indications. The cruise table in this section may also be used for turbulent air penetration.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed indications may also be unreliable.

### Max Climb %N1

This table shows Max Climb %N1 for a 280/.78 climb speed schedule, normal engine bleed for packs on or off and anti-ice off. Enter the table with airport pressure altitude and TAT and read %N1. %N1 adjustments are shown for anti-ice operation.

### Go-around %N1

To find Max Go-around %N1 based on normal engine bleed for packs on (AUTO) and anti-ice on or off, enter the Go-around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. For packs OFF or HIGH operation, apply the %N1 adjustment shown below the table.

### VREF

This table contains flaps 40, 30 and 15 reference speeds for a given weight.

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With autothrottles disengaged an approach speed wind correction (max 20 knots) of 1/2 steady headwind component + gust increment above steady wind is recommended. Do not apply a wind correction for tailwinds. The maximum command speed should not exceed landing flap placard speed minus 5 knots.

## Advisory Information

## Normal Configuration Landing Distance

The normal configuration distance tables are provided as advisory information to help determine the actual landing distance performance of the airplane for different runway surface conditions and brake configurations.

Flaps 15, 30, and 40 landing distances and adjustments are provided for dry runways as well as runways with good, medium, and poor reported braking action, which are commonly referred to as slippery runway conditions.

If the surface is affected by water, snow or ice, and the braking action is reported as "good", conditions should not be expected to be as good as on clean, dry runways. The value "good" is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when landing. The performance level used to calculate the "good" data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate "poor" data reflects runways covered with wet ice.

Dry runway landing performance is shown for max manual braking configuration and autobrake settings max, 3, 2, and 1. Use of autobrake setting 1 is not recommended for landings on slippery runways, and is therefore not provided for these conditions. The autobrake performance may be used to assist in the selection of the most desirable autobrake setting for a given field length. Selection of an autobrake setting results in a constant rate of deceleration. Maximum effort manual braking should achieve shorter landing distance than the max autobrake setting. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and normal approach speed for the selected landing flap at sea level, zero wind, zero slope, and two engine detent reverse thrust. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, temperature, speed, and reverse thrust. Each adjustment is independently added to the reference landing distance.

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## Non-normal Configuration Landing Distance

Advisory information is provided to support non-normal configurations that affect the landing performance of the airplane. Landing distances and adjustments are provided for dry runways and runways with good, medium, and poor reported braking action.

Enter the table with the applicable non-normal configuration and read the normal approach speed. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and speed at sea level, zero wind, and zero slope. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, and speed conditions. Each adjustment is independently added to the reference landing distance. Landing distance includes the effect of max manual braking and reverse thrust.

## Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding the problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landings at short time intervals or a rejected takeoff.

Enter the Recommended Brake Cooling Schedule table with the airplane weight and brakes on speed, adjusted for wind at the appropriate temperature and altitude condition. Instructions for applying wind adjustments are included below the table. Linear interpolation may be used to obtain intermediate values. The resulting number is the reference brake energy per brake in millions of foot-pounds, and represents the amount of energy absorbed by each brake during a rejected takeoff. Notes providing adjustments for wind are included below the table.

To determine the energy per brake absorbed during landing, enter the appropriate Adjusted Brake Energy Per Brake table (No Reverse Thrust or 2 Engine Reverse) with the reference brake energy per brake and the type of braking used during landing (Max Manual, Max Auto, or Autobrake). The resulting number is the adjusted brake energy per brake and represents the energy absorbed in each brake during the landing.

The recommended cooling time is found in the final table by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

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Brake Temperature Monitor System (BTMS) indications are also shown. If brake cooling is determined from the BTMS, use the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted to determine recommended cooling schedule.

## Engine Inoperative

### Initial Max Continuous %N1

The Initial Max Continuous %N1 setting for use following an engine failure is shown. The table is based on the typical all engine cruise speed of .79M to provide a target %N1 setting at the start of driftdown. Once driftdown is established, the Max Continuous %N1 table should be used to determine %N1 for the given conditions.

### Max Continuous %N1

Power setting is based on one engine operating with one A/C pack operating and all anti-ice bleeds off. Enter the table with pressure altitude, TAT, and IAS or Mach to read %N1.

It is desirable to maintain engine thrust level within the limits of the Max Cruise thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous thrust rating. The Max Continuous thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

### Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

### Driftdown/LRC Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to Long Range Cruise speed. Cruise is continued at level off altitude and Long Range Cruise speed.

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To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and adjust for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude is used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Enroute Fuel and Time table.

## Long Range Cruise Altitude Capability

The table shows the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on Long Range Cruise speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

## Long Range Cruise Control

The table provides target %N1, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

## Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .78/280/250 descent. Enter with Air Distance as determined from the Ground to Air Miles Conversion table and read Fuel and Time required at the cruise pressure altitude. Adjust the fuel obtained for deviation from the reference weight at checkpoint as required by entering the off reference fuel adjustments table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel required and time for the actual weight.

## Holding

Target %N1, indicated airspeed and fuel flow per engine information is tabulated for holding with flaps up based on the FMC optimum holding speed schedule. This is the higher of the maximum endurance speed and the maneuvering speed. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read %N1, IAS and fuel flow per engine.

# Gear Down

This section contains performance for airplane operation with the landing gear extended. The data is based on engine bleeds for normal air conditioning.

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Note: The Flight Management Computer System (FMCS) does not contain special provisions for operation with landing gear extended. As a result, the FMCS may generate inappropriate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. An accurate estimated time of arrival (ETA) is available if current speed or Mach is entered into the VNAV cruise page.

Tables for gear down performance in this section are identical in format and used in the same manner as tables for the gear up configuration previously described.

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General . . . . . MAN.05.1
Non-Normal Maneuvers . . . . . MAN.05.1
Flight Patterns . . . . . MAN.05.1

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Approach to Stall Recovery . . . . . MAN.1.1
Rejected Takeoff . . . . . MAN.1.1
Terrain Avoidance . . . . . MAN.1.4
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ILS Approach Using HUD . . . . . MAN.2.11
Instrument Approach Using VNAV and HUD . . . . . MAN.2.12
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## General

Non-Normal Maneuvers and Flight Patterns are included for training and review purposes.

## Non-Normal Maneuvers

Flight crews are expected to do non-normal maneuvers from memory.

## Flight Patterns

Flight patterns show procedures for some all-engine and engine-inoperative situations.

Flight patterns do not include all procedural items but show required/recommended:

- configuration changes
- thrust changes
- Mode Control Panel (MCP) changes
- pitch mode and roll mode changes
- checklist calls.

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## Approach to Stall Recovery

The following is immediately accomplished at the first indication of stall buffet or stick shaker.

| Pilot Flying | Pilot Monitoring |
|---|---|
| • Advance thrust levers to maximum thrust*.<br>• Smoothly adjust pitch attitude** to avoid ground contact or obstacles.<br>• Level the wings (do not change flaps or landing gear configuration).<br>• Retract the speedbrakes. | • Verify maximum thrust.<br>• Monitor altitude and airspeed.<br>• Call out any trend toward terrain contact.<br>• Verify all required actions have been completed and call out any omissions. |
| When ground contact is no longer a factor:<br>• Adjust pitch attitude to accelerate while minimizing altitude loss.<br>• Return to speed appropriate for the configuration. | |

**Note:** *If an approach to stall is encountered with the autopilot engaged, apply maximum thrust and allow the airplane to return to the normal airspeed.

**Note:** **At high altitude, it may be necessary to descend to accelerate.

**Note:** If autopilot response is not acceptable, it should be disengaged.

## Rejected Takeoff

The captain has the sole responsibility for the decision to reject the takeoff. The decision must be made in time to start the rejected takeoff maneuver by V1. If the decision is to reject the takeoff, the captain must clearly announce “REJECT,” immediately start the rejected takeoff maneuver and assume control of the airplane. If the first officer is making the takeoff, the first officer must maintain control of the airplane until the captain makes a positive input to the controls.

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Prior to 80 knots, the takeoff should be rejected for any of the following:

- activation of the master caution system
- system failure(s)
- unusual noise or vibration
- tire failure
- abnormally slow acceleration
- takeoff configuration warning
- fire or fire warning
- engine failure
- predictive windshear warning
- if a side window opens
- if the airplane is unsafe or unable to fly.

Above 80 knots and prior to V1, the takeoff should be rejected for any of the following:

- fire or fire warning
- engine failure
- predictive windshear warning
- if the airplane is unsafe or unable to fly.

During the takeoff, the crewmember observing the non-normal situation will immediately call it out as clearly as possible.

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| Captain | First Officer |
|---|---|
| Without delay:<br>Simultaneously close the thrust levers, disengage the autothrottles and apply maximum manual wheel brakes or verify operation of RTO autobrake.<br>If RTO autobrake is selected, monitor system performance and apply manual wheel brakes if the AUTO BRAKE DISARM light illuminates or deceleration is not adequate.<br>Raise SPEED BRAKE lever.<br>Apply the maximum amount of reverse thrust consistent with conditions.<br>Apply maximum reverse thrust consistent with conditions.<br>Continue maximum braking until certain the airplane will stop on the runway. | Verify actions as follows:<br>Thrust levers closed.<br>Autothrottles disengaged.<br>Maximum brakes applied.<br>Verify SPEED BRAKE lever UP and call "SPEEDBRAKES UP." If SPEED BRAKE lever is not UP, call "SPEEDBRAKES NOT UP."<br>Reverse thrust applied.<br>Call out omitted action items. |
| Field length permitting:<br>Initiate movement of the reverse thrust levers to reach the reverse idle detent by taxi speed. | Call out 60 knots.<br>Communicate the reject decision to the control tower and cabin as soon as practical. |
| When the airplane is stopped, perform procedures as required.<br>Review Brake Cooling Schedule for brake cooling time and precautions (refer to Performance Inflight Chapter.)<br>Consider the following:<br>The possibility of wheel fuse plugs melting<br>The need to clear the runway<br>The requirement for remote parking<br>Wind direction in case of fire<br>Alerting fire equipment<br>Not setting the parking brake unless passenger evacuation is necessary<br>Advising the ground crew of the hot brake hazard<br>Advising passengers of the need to remain seated or evacuate<br>Completion of Non-Normal checklist (if appropriate) for conditions which caused the RTO. | |

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## Terrain Avoidance

### Ground Proximity Caution

Accomplish the following maneuver for any of these aural alerts:

- SINK RATE
- TERRAIN
- DON'T SINK
- TOO LOW FLAPS
- TOO LOW GEAR
- TOO LOW TERRAIN
- GLIDESLOPE
- BANK ANGLE
- CAUTION TERRAIN

| Pilot Flying | Pilot Monitoring |
|---|---|
| Correct the flight path or the airplane configuration. | |

The below glideslope deviation alert may be cancelled or inhibited for:

- localizer or backcourse approach
- circling approach from an ILS
- when conditions require a deliberate approach below glideslope
- unreliable glideslope signal.

**Note:** If a terrain caution occurs when flying under daylight VMC, and positive visual verification is made that no obstacle or terrain hazard exists, the alert may be regarded as cautionary and the approach may be continued.

**Note:** Some aural alerts repeat.

### Ground Proximity Warning

Accomplish the following maneuver for any of these conditions:

- Activation of "PULL UP" or "TERRAIN TERRAIN PULL UP" warning.
- Other situations resulting in unacceptable flight toward terrain.

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| Pilot Flying | Pilot Monitoring |
|---|---|
| Disconnect autopilot.<br>Disconnect autothrottle.<br>Aggressively apply maximum* thrust.<br>Simultaneously roll wings level and rotate to an initial pitch attitude of 20°.<br>Retract speedbrakes.<br>If terrain remains a threat, continue rotation up to the pitch limit indicator (if available) or stick shaker or initial buffet. | Assure maximum* thrust.<br>Verify all required actions have been completed and call out any omissions. |
| Do not change gear or flap configuration until terrain separation is assured.<br>Monitor radio altimeter for sustained or increasing terrain separation.<br>When clear of terrain, slowly decrease pitch attitude and accelerate. | Monitor vertical speed and altitude (radio altitude for terrain clearance and barometric altitude for a minimum safe altitude.)<br>Call out any trend toward terrain contact. |

**Note:** Aft control column force increases as the airspeed decreases. In all cases, the pitch attitude that results in intermittent stick shaker or initial buffet is the upper pitch attitude limit. Flight at intermittent stick shaker may be required to obtain a positive terrain separation. Smooth, steady control will avoid a pitch attitude overshoot and stall.

**Note:** Do not use flight director commands.

**Note:** *Maximum thrust can be obtained by advancing the thrust levers full forward if the EEC's are in the normal mode. If terrain contact is imminent, advance thrust levers full forward.

**Note:** If positive visual verification is made that no obstacle or terrain hazard exists when flying under daylight VMC conditions prior to a terrain or obstacle warning, the alert may be regarded as cautionary and the approach may be continued.

## Traffic Avoidance

Immediately accomplish the following by recall whenever a TCAS traffic advisory (TA) or resolution advisory (RA) occurs.

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**WARNING: Comply with the RA if there is a conflict between the RA and air traffic control.**

**WARNING: Once an RA has been issued, safe separation could be compromised if current vertical speed is changed, except as necessary to comply with the RA. This is because TCAS II-to-TCAS II coordination may be in progress with the intruder aircraft, and any change in vertical speed that does not comply with the RA may negate the effectiveness of the others aircraft's compliance with the RA.**

**Note:** If stick shaker or initial buffet occurs during the maneuver, immediately accomplish the APPROACH TO STALL RECOVERY procedure.

**Note:** If high speed buffet occurs during the maneuver, relax pitch force as necessary to reduce buffet, but continue the maneuver.

**Note:** Do not use flight director commands until clear of conflict.

**Note:** Do not use flight director pitch commands until clear of conflict.

## For TA:

| Pilot Flying | Pilot Monitoring |
|---|---|
| Look for traffic using traffic display as a guide. Call out any conflicting traffic. | |
| If traffic is sighted, maneuver if needed. | |

**Note:** Maneuvers based solely on a TA may result in reduced separation and are not recommended.

## For RA, except a climb in landing configuration:

**WARNING: A DESCEND (fly down) RA issued below 1000 feet AGL should not be followed.**

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| Pilot Flying | Pilot Monitoring |
|---|---|
| If maneuvering is required, disengage the autopilot and autothrottle. Smoothly adjust pitch and thrust to satisfy the RA command. Follow the planned lateral flight path unless visual contact with the conflicting traffic requires other action. | |
| Attempt to establish visual contact. Call out any conflicting traffic. | |

### For a climb RA in landing configuration:

| Pilot Flying | Pilot Monitoring |
|---|---|
| Disengage the autopilot and autothrottle. Advance thrust levers forward to ensure maximum thrust is attained and call for FLAPS 15. Smoothly adjust pitch to satisfy the RA command. Follow the planned lateral flight path unless visual contact with the conflicting traffic requires other action. | Verify maximum thrust set. Position flap lever to 15 detent. |
| Verify a positive rate of climb on the altimeter and call “GEAR UP.” | Verify a positive rate of climb on the altimeter and call “POSITIVE RATE.”<br>Set the landing gear lever to UP. |
| Attempt to establish visual contact. Call out any conflicting traffic. | |

## Upset Recovery

An upset can generally be defined as unintentionally exceeding the following conditions:

- Pitch attitude greater than 25 degrees nose up, or
- Pitch attitude greater than 10 degrees nose down, or
- Bank angle greater than 45 degrees, or
- Within above parameters but flying at airspeeds inappropriate for the conditions.

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The following techniques represent a logical progression for recovering the airplane. The sequence of actions is for guidance only and represents a series of options to be considered and used depending on the situation. Not all actions may be necessary once recovery is under way. If needed, use pitch trim sparingly. Careful use of rudder to aid roll control should be considered only if roll control is ineffective and the airplane is not stalled.

These techniques assume that the airplane is not stalled. A stalled condition can exist at any attitude and may be recognized by continuous stick shaker activation accompanied by one or more of the following:

- Buffeting which could be heavy at times
- Lack of pitch authority and/or roll control
- Inability to arrest descent rate.

If the airplane is stalled, recovery from the stall must be accomplished first by applying and maintaining nose down elevator until stall recovery is complete and stick shaker activation ceases.

## Nose High Recovery

| Pilot Flying | Pilot Monitoring |
|---|---|
| • Recognize and confirm the situation | |
| • Disconnect autopilot and autothrottle<br>• Apply as much as full nose-down elevator<br>• * Apply appropriate nose down stabilizer trim<br>• Reduce thrust<br>• * Roll (adjust bank angle) to obtain a nose down pitch rate<br>• Complete the recovery:<br>- When approaching the horizon, roll to wings level<br>- Check airspeed and adjust thrust<br>- Establish pitch attitude. | • Call out attitude, airspeed and altitude throughout the recovery<br>• Verify all required actions have been completed and call out any omissions. |

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## Nose Low Recovery

| Pilot Flying | Pilot Monitoring |
|---|---|
| • Recognize and confirm the situation | |
| • Disconnect autopilot and autothrottle<br>• Recover from stall, if required<br>• * Roll in shortest direction to wings level (unload and roll if bank angle is more than 90 degrees)<br>• Recover to level flight:<br>- Apply nose up elevator<br>- *Apply nose up trim, if required<br>- Adjust thrust and drag as required. | • Call out attitude, airspeed and altitude throughout the recovery<br>• Verify all required actions have been completed and call out any omissions. |

**WARNING: * Excessive use of pitch trim or rudder may aggravate an upset situation or may result in loss of control and/or high structural loads.**

## Windshear

### Windshear Caution

For predictive windshear caution alert: (“MONITOR RADAR DISPLAY” aural).

| Pilot Flying | Pilot Monitoring |
|---|---|
| Maneuver as required to avoid the windshear. | |

### Windshear Warning

Predictive windshear warning during takeoff roll: (“WINDSHEAR AHEAD, WINDSHEAR AHEAD” aural)

- prior to V1, reject takeoff
- after V1, perform the Windshear Escape Maneuver.

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Windshear encountered during takeoff roll:

- If windshear is encountered prior to V1, there may not be sufficient runway remaining to stop if an RTO is initiated at V1. At VR, rotate at a normal rate toward a 15 degree pitch attitude. Once airborne, perform the Windshear Escape Maneuver.
- If windshear is encountered near the normal rotation speed and airspeed suddenly decreases, there may not be sufficient runway left to accelerate back to normal takeoff speed. If there is insufficient runway left to stop, initiate a normal rotation at least 2,000 feet before the end of the runway, even if airspeed is low. Higher than normal attitudes may be required to lift off in the remaining runway. Ensure maximum thrust is set.

Predictive windshear warning during approach: ("GO–AROUND, WINDSHEAR AHEAD" aural)

- perform the Windshear Escape Maneuver, or, at pilot's discretion, perform a normal go–around.

Windshear encountered in flight:

- perform the Windshear Escape Maneuver.

**Note:** The following are indications the airplane is in windshear:

- windshear warning (two–tone siren followed by "WINDSHEAR, WINDSHEAR, WINDSHEAR") or
- unacceptable flight path deviations.

**Note:** Unacceptable flight path deviations are recognized as uncontrolled changes from normal steady state flight conditions below 1000 feet AGL, in excess of any of the following:

- 15 knots indicated airspeed
- 500 fpm vertical speed
- 5° pitch attitude
- 1 dot displacement from the glideslope
- unusual thrust lever position for a significant period of time.

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## Windshear Escape Maneuver

| Pilot Flying | Pilot Monitoring |
|---|---|
| MANUAL FLIGHT<br>• Disconnect autopilot.<br>• Press either TO/GA switch.<br>• Aggressively apply maximum* thrust.<br>• Disconnect autothrottle.<br>• Simultaneously roll wings level and rotate toward an initial pitch attitude of 15 °.<br>• Retract speedbrakes.<br>• Follow flight director TO/GA guidance (if available).<br>AUTOMATIC FLIGHT<br>• Press either TO/GA switch**.<br>• Verify TO/GA mode annunciation.<br>• Verify thrust advances to GA power.<br>• Retract speedbrakes.<br>• Monitor system performance***. | • Assure maximum* thrust.<br>• Verify all required actions have been completed and call out any omissions. |
| • Do not change flap or gear configuration until windshear is no longer a factor.<br>• Monitor vertical speed and altitude.<br>• Do not attempt to regain lost airspeed until windshear is no longer a factor. | • Monitor vertical speed and altitude.<br>• Call out any trend toward terrain contact, descending flight path, or significant airspeed changes. |

**Note:** Aft control column force increases as the airspeed decreases. In all cases, the pitch attitude that results in intermittent stick shaker or initial buffet is the upper pitch attitude limit. Flight at intermittent stick shaker may be required to obtain a positive terrain separation. Smooth, steady control will avoid a pitch attitude overshoot and stall.

**Note:** *Maximum thrust can be obtained by advancing the thrust levers full forward if the EEC's are in the normal mode. If terrain contact is imminent, advance thrust levers full forward.

**Note:** ** If TO/GA is not available, disconnect autopilot and autothrottle and fly manually.

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**WARNING:** ***** Severe windshear may exceed the performance of the AFDS. The pilot flying must be prepared to disconnect the autopilot and autothrottle and fly manually.**

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## Takeoff

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# Takeoff

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# ILS Approach - Fail Passive

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# ILS Approach - Fail Operational

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# Instrument Approach Using VNAV

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# Instrument Approach Using IAN (As installed)

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# Instrument Approach Using V/S

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# Circling Approach

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# Visual Traffic Pattern

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# Go–Around and Missed Approach

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# ILS Approach Using HUD

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# Instrument Approach Using VNAV and HUD

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# Circling Approach Using HUD

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# Visual Traffic Pattern Using HUD

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# Checklist Instructions — Chapter CI
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## General

The airplanes listed in the table below are covered in the Quick Reference Handbook. The numbers are used to distinguish data peculiar to one or more, but not all of the airplanes. Where data applies to all airplanes listed, no reference is made to individual airplane numbers.

The table permits flight crew correlation of configuration differences by Registry Number in alpha/numeric order within an operator's fleet for airplanes covered in this manual. Configuration data reflects the airplane as delivered configuration and is updated for service bulletin incorporations in conformance with the policy stated in the introduction section of this chapter.

Registry number is supplied by the national regulatory agency. Serial and tabulation numbers are supplied by Boeing.

| Airplane Number | Registry Number | Serial Number | Tabulation Number |
|---|---|---|---|
| YX600 | YX600 | YX600 | YX600 |
| YX700 | YX700 | YX700 | YX700 |
| YX800 | YX800 | YX800 | YX800 |
| YX900 | YX900 | YX900 | YX900 |
| YX910 | YX910 | YX910 | YX910 |

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## Revision Transmittal Letter

To: All holders of The Boeing Company 737 Flight Crew Operations Manual, Boeing Document Number D6-27370-TBC.

Subject: Flight Crew Operations Manual Revision.

This revision reflects the most current information available to The Boeing Company 45 days before the subject revision date. The following revision highlights explain changes in this revision. General information below explains the use of revision bars to identify new or revised information.

## Revision Record

| No. | Revision Date | Date Filed | No. | Revision Date | Date Filed |
|---|---|---|---|---|---|
| 1 | March 5, 1998 | | 2 | July 31, 1998 | |
| 3 | January 29, 1999 | | 4 | July 30, 1999 | |
| 5 | January 28, 2000 | | 6 | August 30, 2000 | |
| 7 | June 6, 2001 | | 8 | October 15, 2001 | |
| 9 | March 15, 2002 | | 10 | September 30, 2002 | |
| 11 | March 31, 2003 | | 12 | September 26, 2003 | |
| 13 | March 29, 2004 | | 14 | September 27, 2004 | |
| 15 | March 28, 2005 | | 16 | September 29, 2005 | |
| 17 | March 31, 2006 | | 18 | September 28, 2006 | |
| 19 | March 15, 2007 | | 20 | September 24, 2007 | |
| 21 | January 25, 2008 | | 22 | May 15, 2008 | |
| 23 | September 18, 2008 | | 24 | March 27, 2009 | |

## General

The Boeing Company issues flight crew operations manual revisions to provide new or revised procedures and information. Formal revisions also incorporate appropriate information from previously issued flight crew operations manual bulletins.

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The revision date is the approximate date the manual is mailed to the customer.

Formal revisions include a Transmittal Letter, a new Revision Record, Revision Highlights, and a current List of Effective Pages. Use the information on the new Revision Record and List of Effective Pages to verify the manual content.

Pages containing revised technical material have revision bars associated with the changed text or illustration. Editorial revisions (for example, spelling corrections) may have revision bars with no associated highlight.

The record above should be completed by the person incorporating the revision into the manual.

## Filing Instructions

Consult the List of Effective Pages (CI.LEP). Pages identified with an asterisk (*) are either replacement pages or new (original) issue pages. Remove corresponding old pages and replace or add new pages. Remove pages that are marked DELETED; there are no replacement pages for deleted pages.

## Revision Highlights

This section (CI.RR) replaces the existing section CI.RR in your manual.

Be careful when inserting changes not to throw away pages from the manual that are not replaced. Using the List of Effective Pages (CI.LEP) can help determine the correct content of the manual.

Throughout the manual, airplane effectivity may be updated to reflect coverage as listed on the Preface - Model Identification page, or to show service bulletin airplane effectivity. Highlights are not supplied.

This manual is published from a database; the text and illustrations are marked with configuration information. Occasionally, because the editors rearrange the database markers, or mark items with configuration information due to the addition of new database content, some customers may receive revision bars on content that appears to be unchanged. Pages may also be republished without revision bars due to slight changes in the flow of the document.

**Chapter NNC - Non-Normal Checklists**

**Section 1 - Airplane General, Emer. Equip., Doors, Windows**

AIRSTAIR

1.1 - Removed step to turn on passenger oxygen. Between 10,000 and 15,000 feet, passenger oxygen may not be needed depending on regulations. Above that, the cabin altitude checklist provides direction.

1.3 - Revised step to be consistent with regulations regarding the required use of oxygen by the flight crew.

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CARGO DOOR

1.4 - Removed step to turn on passenger oxygen. Between 10,000 and 15,000 feet, passenger oxygen may not be needed depending on regulations. Above that, the cabin altitude checklist provides direction.

1.6 - Revised step to be consistent with regulations regarding the required use of oxygen by the flight crew.

EQUIPMENT DOOR

1.9 - Removed step to turn on passenger oxygen. Between 10,000 and 15,000 feet, passenger oxygen may not be needed depending on regulations. Above that, the cabin altitude checklist provides direction.

1.11 - Revised step to be consistent with regulations regarding the required use of oxygen by the flight crew.

Window Damage

1.17 - Revised step for Boeing cross-model standardization.

1.18 - Removed the reference to maintaining a cabin differential pressure of 2 psi or less after descending to 14,000 feet or minimum safe altitude, whichever is higher. It is not necessary to raise the cabin altitude to maintain 2 psi or less if the current minimum safe altitude is greater than 14,000 feet. The airplane can continue with greater than 2 psi differential pressure until a lower safe altitude is reached.

Window Damage (Window 3 Not Heated)

1.20 - Removed step to turn on passenger oxygen. Between 10,000 and 15,000 feet, passenger oxygen may not be needed depending on regulations. Above that, the cabin altitude checklist provides direction.

1.20 - Revised step for Boeing cross-model standardization.

1.22-23 - Revised step to be consistent with regulations regarding the required use of oxygen by the flight crew.

**Section 2 - Air Systems**

CABIN ALTITUDE WARNING or Rapid Depressurization

2.1 - Revised the condition statement for clarification.

2.2 - Revised step to be consistent with regulations regarding the required use of oxygen by the flight crew.

PACK

2.12 - Removed step to turn on passenger oxygen. Between 10,000 and 15,000 feet, passenger oxygen may not be needed depending on regulations. Above that, the cabin altitude checklist provides direction.

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2.14 - Revised step to be consistent with regulations regarding the required use of oxygen by the flight crew.

PACK TRIP OFF

2.16 - Removed step to turn on passenger oxygen. Between 10,000 and 15,000 feet, passenger oxygen may not be needed depending on regulations. Above that, the cabin altitude checklist provides direction.

2.17 - Revised step to be consistent with regulations regarding the required use of oxygen by the flight crew.

WING-BODY OVERHEAT

2.20 - Revised checklist to remove unnecessary steps. Provided additional guidance to help determine the cause of the overheat condition. Provided steps in the event the WING-BODY OVERHEAT light illuminates again after re-configuring the engine bleed air system

**Section 3 - Anti-Ice, Rain**

ENGINE COWL ANTI-ICE

3.1 - Revised the descriptor to "affected engine" for cross-model consistency.

**Section 6 - Electrical**

LOSS OF BOTH ENGINE DRIVEN GENERATORS

6.6 - Format change.

TRANSFER BUS OFF

6.15 - Added "Plan to land....." step for QRH consistency.

**Section 7 - Engines, APU**

Engine Limit or Surge or Stall

7.5 - Added a "restart may be attempted" step if there is N1 rotation and no abnormal vibration.

Engine In-Flight Start

7.18 - Revised Condition Statement to include N1 rotation, fire and airframe vibration to help define "apparent damage."

7.19-20 - Revised the descriptor to "affected engine" for cross-model consistency.

7.20 - Changed for standardization.

START VALVE OPEN

7.36 - Revised to "affected side" for 737 model consistency.

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**Section 8 - Fire Protection**

Engine Tailpipe Fire

8.7 - Revised the descriptor to "affected engine" for cross-model consistency.

**Section 9 - Flight Controls**

Trailing Edge Flap Disagree

9.39 - Added "or amber" to the response. The light may be green or amber depending on the failure. Added Note for clarification.

**Section 10 - Flight Instruments, Displays**

DISPLAY SOURCE

10.6 - Added step to reference the EEC ALTN lights. Corrective action is only taken in response to a red or amber light, alert or other indication of failure.

**Section 11 - Flight Management, Navigation**

IRS FAULT

11.8 - Added "also" to clarify that both the IRS FAULT and ALIGN lights are illuminated.

11.9 - Replaced "IF" statement with a decision table.

11.9 - Changed to a "step" to ensure the information is read.

11.9 - Moved step earlier in checklist to help crew decision making.

11.10 - Added decision table. The crew should not attempt to put the failed IRS into ATT mode during high a high workload phase.

UNABLE REQD NAV PERF - RNP

11.13 - Corrected the Conditon Statement. The alert indicates the actual navigation performance is not sufficient.

**Section 15 - Warning Systems**

TAKEOFF CONFIGURATION

15.1 - Revised the condition statement for clarification.

PSEU

15.4 - Developed a combined NNC for -4 and -5 PSEU's. Clarified the meaning of Master Caution reset. This change is NA for the 737-900ER.

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## Chapter PI-QRH - Performance Inflight - QRH

### Section 13 - Gear Down

Gear Down

PI-QRH.13.1 - Added Gear down Section to Performance Inflight - QRH.

### Section 14 - Gear Down, Engine Inop

Gear Down, Engine Inoperative

PI-QRH.14.1 - Added Gear down, Engine Inop Section to Performance Inflight - QRH.

### Section 23 - Gear Down

Gear Down

PI-QRH.23.1 - Added Gear down Section to Performance Inflight - QRH.

### Section 24 - Gear Down, Engine Inop

Gear Down, Engine Inoperative

PI-QRH.24.1 - Added Gear down, Engine Inop Section to Performance Inflight - QRH.

### Section 31 - Advisory Information

Non-Normal Configuration Landing Distance

PI-QRH.31.5 - Corrected typo.

### Section 33 - Gear Down

Gear Down

PI-QRH.33.1 - Added Gear down Section to Performance Inflight - QRH.

### Section 34 - Gear Down, Engine Inop

Gear Down, Engine Inoperative

PI-QRH.34.1 - Added Gear down, Engine Inop Section to Performance Inflight - QRH.

### Section 43 - Gear Down

Gear Down

PI-QRH.43.1 - Added Gear down Section to Performance Inflight - QRH.

### Section 44 - Gear Down, Engine Inop

Gear Down, Engine Inoperative

PI-QRH.44.1 - Added Gear down, Engine Inop Section to Performance Inflight - QRH.

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**Section 53 - Gear Down**

Gear Down

PI-QRH.53.1 - Added Gear down Section to Performance Inflight - QRH.

**Section 54 - Gear Down, Engine Inop**

Gear Down, Engine Inoperative

PI-QRH.54.1 - Added Gear down, Engine Inop Section to Performance Inflight - QRH.

**Chapter Man - Maneuvers**

**Section 2 - Flight Patterns**

Takeoff

MAN.2.2 - Created a new Takeoff Profile to include VNAV armed on the ground to be consistent with the Takeoff Procedure.

**Chapter CI - Checklist Instructions**

**Section 1 - Normal Checklists**

Checklist Content

CI.1.2 - Standardized autobrake nomenclature and capitalization to match panels and for cross-model standardization.

**Section 2 - Non-Normal Checklists**

Non–Normal Checklist Use

CI.2.5 - Changed to more clearly define the areas of responsibility on the ground, in flight and during an evacuation.

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## Introduction

This introduction gives guidelines for use of the Normal Checklist (NC).

The NC is organized by phase of flight.

The NC is used to verify that critical items have been done.

## Normal Checklist Operation

Normal checklists are used after doing all respective procedural items.

The following table shows which pilot calls for the checklist and which pilot reads the checklist. Both pilots visually verify that each item is in the needed configuration or that the step is done. The far right column shows which pilot gives the response. This is different than the normal procedures where the far right column can show which pilot does the step.

| Checklist | Call | Read | Verify | Respond |
|---|---|---|---|---|
| PREFLIGHT | Captain | First officer | Both | Area of responsibility |
| BEFORE START | Captain | First officer | Both | Area of responsibility |
| BEFORE TAXI | Captain | First officer | Both | Area of responsibility |
| BEFORE TAKEOFF | Pilot flying | Pilot monitoring | Both | Pilot flying |
| AFTER TAKEOFF | Pilot flying | Pilot monitoring | Both | Pilot monitoring |
| DESCENT | Pilot flying | Pilot monitoring | Both | Area of responsibility |
| APPROACH | Pilot flying | Pilot monitoring | Both | Area of responsibility |
| LANDING | Pilot flying | Pilot monitoring | Both | Pilot flying |
| SHUTDOWN | Captain | First officer | Both | Area of responsibility |
| SECURE | Captain | First officer | Both | Area of responsibility |

If the airplane configuration does not agree with the needed configuration:

- stop the checklist
- complete the respective procedure steps
- continue the checklist

If it becomes apparent that an entire procedure was not done:

- stop the checklist
- complete the entire procedure
- do the checklist from the start

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Try to do checklists before or after high work load times. The crew may need to stop a checklist for a short time to do other tasks. If the interruption is short, continue the checklist with the next step. If a pilot is not sure where the checklist was stopped, do the checklist from the start. If the checklist is stopped for a long time, also do the checklist from the start.

After completion of each checklist, the pilot reading the checklist calls, "___ CHECKLIST COMPLETE."

## Checklist Content

The checklist has the minimum items needed to operate the airplane safely.

Normal checklists have items that meet any of the following criteria:

- items essential to safety of flight that are not monitored by an alerting system, or
- items essential to safety of flight that are monitored by an alerting system but if not done, would likely result in a catastrophic event if the alerting system fails, or
- items needed to meet regulatory requirements, or
- items needed to maintain fleet commonality between the 737, 747-400, 757, 767, 777, and 787, or
- items that enhance safety of flight and are not monitored by an alerting system (for example the autobrakes), or
- during shutdown and secure, items that could result in injury to personnel or damage to equipment if not done.

## Checklist Construction

When a checklist challenge does not end with “switch or lever”, then the challenge refers to system status. For example, “Landing Gear...Down”, refers to the status of the landing gear, not just the position of the lever.

When a checklist challenge ends with “switch or lever”, then the challenge refers to the position of the switch or lever. For example, “Engine start levers...CUTOFF” refers to the position of the levers.

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## Introduction

The non-normal checklists chapter contains checklists used by the flight crew to manage non–normal situations. The checklists are grouped in sections which match the system description chapters in Volume 2.

Most checklists correspond to a light, alert or other indication. In most cases, the MASTER CAUTION and system annunciator lights also illuminate to indicate the non-normal condition. These lights, alerts and other indications are the cues to select and do the associated checklist.

Checklists without a light, alert or other indication (such as Ditching) are called unannunciated checklists. Most unannunciated checklists are in the associated system section. For example, Engine Fuel Leak is in section 12, Fuel. Unannunciated checklists with no associated system are in section 0, Miscellaneous.

All checklists have condition statements. The condition statement briefly describes the situation that caused the light, alert or other indication. Unannunciated checklists also have condition statements to help in understanding the reason for the checklist.

Some checklists have objective statements. The objective statement briefly describes the expected result of doing the checklist or briefly describes the reason for steps in the checklist.

Checklists can have both memory and reference items. Memory items are critical steps that must be done before reading the checklist. The last memory item is followed by a dashed horizontal line. Reference items are actions to be done while reading the checklist.

- - - - - - - - - - - - - - - - - - - -

Some checklists have additional information at the end of the checklist. The additional information provides data the crew may wish to consider. The additional information does not need to be read.

Checklists that need a quick response are listed in the Quick Action Index. In each system section, Quick Action Index checklists are listed first, followed by checklists that are not in the Quick Action Index. The titles of Quick Action Index checklists are printed in **bold** type. Checklist titles in upper case (such as AUTO BRAKE DISARM) are annunciated by a light, alert, or other indication. Checklist titles in upper and lower case (such as Window Damage) are not annunciated.

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## Non–Normal Checklist Operation

Non–normal checklists start with steps to correct the situation. If needed, information for planning the rest of the flight is included. When special items are needed to configure the airplane for landing, the items are included in the Deferred Items section of the checklist. Flight patterns for some non–normal situations are located in the Maneuvers chapter and show the sequence of configuration changes.

While every attempt is made to supply needed non–normal checklists, it is not possible to develop checklists for all conceivable situations. In some smoke, fire or fumes situations, the flight crew may need to move between the Smoke, Fire or Fumes checklist and the Smoke or Fumes Removal checklist. In some multiple failure situations, the flight crew may need to combine the elements of more than one checklist. In all situations, the captain must assess the situation and use good judgment to determine the safest course of action.

There are some situations where the flight crew must land at the nearest suitable airport. These situations include, but are not limited to, conditions where:

- the non–normal checklist includes the item “Plan to land at the nearest suitable airport.”
- fire or smoke continues
- only one AC power source remains (engine or APU generator)
- only one hydraulic system remains (the standby system is considered a hydraulic system)
- any other situation determined by the flight crew to have a significant adverse effect on safety if the flight is continued.

It must be stressed that for smoke that continues or a fire that cannot be positively confirmed to be completely extinguished, the earliest possible descent, landing, and evacuation must be done.

If a smoke, fire or fumes situation becomes uncontrollable, the flight crew should consider an immediate landing. Immediate landing implies immediate diversion to a runway. However, in a severe situation, the flight crew should consider an overweight landing, a tailwind landing, an off-airport landing, or a ditching.

Checklists directing an engine shutdown must be evaluated by the captain to determine whether an actual shutdown or operation at reduced thrust is the safest course of action. Consideration must be given to the probable effects of running the engine at reduced thrust.

There are no non–normal checklists for the loss of an engine indication or automatic display of the secondary engine indications. Continue normal engine operation unless a limit is exceeded.

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Non–normal checklists also assume:

- During engine start and before takeoff, the associated non–normal checklist is done if a non-normal situation is identified. After completion of the checklist, the Dispatch Deviations Guide or operator equivalent is consulted to determine if Minimum Equipment List dispatch relief is available.
- System controls are in the normal configuration for the phase of flight before the start of the non–normal checklist.
- If the MASTER CAUTION and system annunciator lights illuminate, all related amber lights are reviewed to assist in recognizing the cause(s) of the alert.
- Aural alerts are silenced and the master caution system is reset by the flight crew as soon as the cause of the alert is recognized.
- The EMERGENCY position of the oxygen regulator is used when needed to supply positive pressure in the masks and goggles to remove contaminants. The 100% position of the oxygen regulator is used when positive pressure is not needed but contamination of the flight deck air exists. The Normal position of the oxygen regulator is used if prolonged use is needed and the situation allows. Normal boom microphone operation is restored when oxygen is no longer in use.
- Indicator lights are tested to verify suspected faults.

**[Option - Single battery]**

- In flight, reset of a tripped circuit breaker is not recommended. However, a tripped circuit breaker may be reset once, after a short cooling period (approximately 2 minutes), if in the judgment of the captain, the situation resulting from the circuit breaker trip has a significant adverse effect on safety. On the ground, flight crew reset of a tripped circuit breaker should only be done after maintenance has determined that it is safe to reset the circuit breaker.

**[Option - Dual battery]**

- In flight, reset of a tripped circuit breaker is not recommended unless directed by a non-normal checklist. However, a tripped circuit breaker may be reset once, after a short cooling period (approximately 2 minutes), if in the judgment of the captain, the situation resulting from the circuit breaker trip has a significant adverse effect on safety. On the ground, flight crew reset of a tripped circuit breaker should only be done after maintenance has determined that it is safe to reset the circuit breaker.
- Flight crew cycling (pulling and resetting) of a circuit breaker to clear a non-normal condition is not recommended, unless directed by a non-normal checklist.

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After engine start and before takeoff, illumination of a red warning light, an amber caution light, an alert or other indication requires completion of the associated checklist. In certain cases, amber system monitor lights illuminate during MASTER CAUTION recall to inform the flight crew of the failure of one element in a system with redundant elements. If system operation is maintained by a second element, the amber system monitor light will extinguish when MASTER CAUTION is reset. In these situations, the amber light alerts the flight crew that normal system operation will be affected if another element fails. If an amber light illuminates during MASTER CAUTION recall, but extinguishes after MASTER CAUTION reset, completion of the associated checklist is not required.

## Non–Normal Checklist Use

If a checklist or a step in a checklist is not applicable to all airplanes, airplane effectivity information is included in the checklist. Airplane effectivity can be listed by airplane number, registry number, serial number or tabulation number. If a checklist is applicable to some but not all airplanes, airplane effectivity is centered below the checklist title. If a step in a checklist is applicable to some but not all airplanes, airplane effectivity is included above the step. If a checklist or a step in a checklist is applicable to all airplanes, airplane effectivity information is not included.

Non–normal checklist use starts when the airplane flight path and configuration are correctly established. Only a few situations need an immediate response (such as CABIN ALTITUDE WARNING or Rapid Depressurization). Usually, time is available to assess the situation before corrective action is started. All actions must then be coordinated under the captain's supervision and done in a deliberate, systematic manner. Flight path control must never be compromised.

When a non–normal situation occurs, at the direction of the pilot flying, both crewmembers do all memory items in their areas of responsibility without delay.

The pilot flying calls for the checklist when:

- the flight path is under control
- the airplane is not in a critical phase of flight (such as takeoff or landing)
- all memory items are complete.

The pilot monitoring reads aloud:

- the checklist title
- as much of the condition statement as needed to verify that the correct checklist has been selected
- as much of the objective statement (if applicable) as needed to understand the expected result of doing the checklist.

The pilot flying does not need to repeat this information but must acknowledge that the information was heard and understood.

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For checklists with memory items, the pilot monitoring first verifies that each memory item has been done. The checklist is normally read aloud during this verification. The pilot flying does not need to respond except for items that are not in agreement with the checklist. The item numbers do not need to be read.

Non-memory items are called reference items. The pilot monitoring reads aloud the reference items, including:

- the precaution (if any)
- the response or action
- any amplifying information.

The pilot flying does not need to repeat this information but must acknowledge that the information was heard and understood. The item numbers do not need to be read.

The word "Confirm" is added to checklist items when both crewmembers must verbally agree before action is taken. During an inflight non-normal situation, verbal confirmation is required for:

- an engine thrust lever
- an engine start lever
- an engine, APU or cargo fire switch
- a generator drive disconnect switch
- a flight control switch

This does not apply to the Loss of Thrust on Both Engines checklist.

With the airplane stationary on the ground:

- the captain and the first officer take action based on preflight and postflight areas of responsibility
- during an evacuation, the first officer sets the flap lever to 40.

With the airplane in flight or in motion on the ground:

- the pilot flying and the pilot monitoring take action based on each crewmember's Areas of Responsibility.

After moving the control, the crewmember taking the action also states the checklist response.

The pilot flying may also direct reference checklists to be done by memory if no hazard is created by such action, or if the situation does not allow reference to the checklist.

Checklists include an Inoperative Items table only when the condition of the items is needed for planning the rest of the flight. The inoperative items, including the consequences (if any), are read aloud by the pilot monitoring. The pilot flying does not need to repeat this information but must acknowledge that the information was heard and understood.

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After completion of the non–normal checklist, normal procedures are used to configure the airplane for each phase of flight.

When there are no deferred items, the DESCENT, APPROACH and LANDING normal checklists are used to verify that the configuration is correct for each phase of flight.

When there are deferred items, the non-normal checklist will include the item "**Checklist Complete Except Deferred Items.**" The pilot flying is to be made aware when there are deferred items. These items are included in the Deferred Items section of the checklist and may be delayed until the usual point during descent, approach or landing.

The deferred items are read aloud by the pilot monitoring. The pilot flying or the pilot monitoring takes action based on each crewmember's area of responsibility. After moving the control, the crewmember taking the action also states the response.

When there are deferred items, the Deferred Items section of the non-normal checklist will include the Descent, Approach and Landing normal checklists. These checklists should be used instead of the usual DESCENT, APPROACH and LANDING normal checklists. If a normal checklist item is changed as a result of the non-normal situation, the changed response is printed in **bold** type. The pilot flying or the pilot monitoring responds to the deferred normal checklist items based on each crewmember's area of responsibility. However, during the deferred Landing normal checklist, the pilot flying responds to all deferred normal checklist items.

Each checklist has a checklist complete symbol at the end. The following symbol indicates that the checklist is complete:

■ ■ ■ ■

The checklist complete symbol can also be in the body of the checklist. This only occurs when a checklist divides into two or more paths. Each path can have a checklist complete symbol at the end. The flight crew does not need to continue reading the checklist after the checklist complete symbol.

After completion of each non–normal checklist, the pilot monitoring states "___ CHECKLIST COMPLETE."

Additional information at the end of the checklist is not required to be read.

The flight crew must be aware that checklists cannot be created for all conceivable situations and are not intended to replace good judgment. In some situations, at the captain's discretion, deviation from a checklist may be needed.

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# Non–Normal Checklist Legend

## Redirection Symbol

▶▶

The redirection symbol is used in two ways:

- In the Table of Contents of a system section, to direct the flight crew to a different system section.
- In a non-normal checklist, with the word “Go to”, to direct the flight crew to a different checklist or to a different step in the current checklist.

## Separator Symbol

The separator symbol is used in two ways:

- In the Table of Contents of a system section, to separate the Quick Action Index checklists from the checklists that are not in the Quick Action Index.
- In a non-normal checklist, to separate the memory items from the reference items.

## Task Divider Symbol

The task divider symbol is used to indicate the end of one task and the beginning of another task.

## Decision Symbol

Choose one:

The decision symbol is used to identify possible choices.

## Precaution Symbol

The precaution symbol is used to identify information the flight crew must consider before taking the action.

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**Evacuation Checklist is on the reverse side of this page.**

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## Evacuation

Condition: Evacuation is needed.

1 PARKING BRAKE. . . . . Set

2 Speedbrake lever . . . . . DOWN

3 FLAP lever . . . . . 40

4 Pressurization mode selector . . . . . .MAN

5 Outflow VALVE switch . . . . Hold in OPEN until the outflow VALVE position indicates fully open

6 **If** time allows:

Verify that the flaps are 40 before the engine start levers are moved to CUTOFF.

7 Engine start levers (both) . . . . . CUTOFF

8 Advise the cabin to evacuate.

9 Advise the tower.

10 Engine and APU fire switches (all) . . . . . .Override and pull

11 **If** an engine or APU fire warning occurs:

Illuminated fire switch. . . . . Rotate to the stop and hold for 1 second

■ ■ ■ ■

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