DO NOT USE FOR FLIGHT

747

Quick Reference Handbook

Quick Action Index

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PREFLIGHT

Oxygen. . . . . Tested, 100%

Flight instruments . . . . Heading___, Altimeter___

Parking brake . . . . .Set

Fuel control switches. . . . . CUTOFF

BEFORE START

109 Flight deck door . . . . Closed and locked

Passenger signs . . . . ___

MCP . . . . .V2___, HDG___, ALT___

Takeoff speeds . . . . V1___, VR___, V2___

CDU preflight. . . . . Completed

Trim . . . . ___ Units, 0, 0

Taxi and takeoff briefing . . . . Completed

Beacon. . . . . BOTH

BEFORE TAXI

Anti-ice. . . . . ___

Recall . . . . Checked

Autobrake . . . . .RTO

Flight controls. . . . . Checked

Ground equipment . . . . Clear

BEFORE TAKEOFF

Flaps . . . . ___

AFTER TAKEOFF

Landing gear . . . . UP and OFF

Flaps . . . . UP

DESCENT

Recall . . . . Checked

Autobrake . . . . ___

Landing data . . . . .VREF___, Minimums___

Approach briefing. . . . . Completed

APPROACH

Altimeters . . . . ___

LANDING

Speedbrake . . . . .Armed

Landing gear . . . . .DOWN

Flaps . . . . ___

SHUTDOWN

Hydraulic panel. . . . . .Set

Fuel pumps . . . . .Off

Flaps . . . . UP

Parking brake . . . . ___

Fuel control switches. . . . . CUTOFF

Weather radar . . . . .Off

SECURE

IRSs . . . . OFF

Emergency exit lights. . . . . OFF

Packs . . . . OFF

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Ditching

Condition: Airplane ditching and evacuation are needed.

1 Jettison fuel as needed to reduce the VREF speed.

2 Do **not** arm the autobrakes.

3 Use flaps 30 and VREF 30.

4 **Checklist Complete Except Deferred Items**

Deferred Items

Descent Checklist

Recall . . . . Checked

Autobrake . . . . **OFF**

Landing data . . . .**VREF 30, SET____**

Approach briefing . . . . Completed

Approach Checklist

Altimeters . . . . ______

When below 5,000 feet:

109
GND PROX CONFIG GR OVRD switch . . . OVRD

405, 570
GND PROX GEAR OVRD switch. . . . . OVRD

405, 570
GND PROX TERR OVRD switch . . . . OVRD

▼ Continued on next page ▼

▼ **Ditching continued** ▼

PACK control selectors (all) . . . . OFF

OUTFLOW VALVES MAN
switches (both) . . . . .ON

OUTFLOW VALVES
manual control. . . . . Push to CLOSE
and hold until outflow
valve indications show fully closed

Passenger signs . . . . .ON

When on final approach:

Omit the landing checklist.

Landing gear lever . . . . UP

FLAP lever 30

Maintain airspeed at VREF 30.

Rotate to a touchdown attitude of 10 to 12 degrees.

After impact:

FUEL CONTROL switches (all). . . . . CUTOFF

Engine fire switches (all) . . . Pull, rotate to the
stop and hold for 1 second

Deploy the slide/rafts and evacuate the airplane.

■ ■ ■ ■

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AUTO UNLK

AUTOMATIC UNLOCK

109

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

■ ■ ■ ■

>CREW OXY LOW

Condition: Crew oxygen pressure is low.

■ ■ ■ ■

DOOR AFT CARGO

Condition: The aft cargo door is not closed and secure.

Objective: To reduce cabin differential pressure to decrease risk of door separation.

1 LDG ALT switch . . . . .MAN

2 LDG ALT selector . . . . Set landing altitude between 8,000 and 8,500 feet to command the cabin altitude to 8,000 feet

109

3 Choose one:

◆ Airplane altitude is **at or below** 8,000 feet:

Level off at the lowest safe altitude.

►► **Go to step 5**

◆ Airplane altitude is **above** 8,000 feet:

Descend to the lowest safe altitude or 8,000 feet, whichever is higher.

►► **Go to step 5**

▼ **Continued on next page** ▼

▼ **DOOR AFT CARGO continued** ▼

405, 570

4 Choose one:

◆ Airplane altitude is **at or below** 8,000 feet:

Level off at the lowest safe altitude.

►► **Go to step 6**

◆ Airplane altitude is **above** 8,000 feet:

Descend to the lowest safe altitude or 8,000 feet, whichever is higher.

►► **Go to step 6**

109

5 **After** level off, allow sufficient time for cabin altitude to stabilize. This minimizes passenger discomfort from affects of cabin depressurization.

405, 570

6 **After** level off, allow sufficient time for cabin altitude to stabilize. This minimizes supernumerary discomfort from affects of cabin depressurization.

7 Choose one:

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

►► **Go to step 8**

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

Don the oxygen masks.

Establish crew communications.

►► **Go to step 8**

▼ **Continued on next page** ▼

▼ DOOR AFT CARGO continued ▼

8 OUTFLOW VALVES MAN switches (both) . . . . . ON

9 OUTFLOW VALVES
manual control . . . . . . Move the outflow valves to fully OPEN to depressurize the airplane. Use momentary actuation of the outflow valve manual control

10 Once depressurized, the crew may change altitude as needed.

11 Do **not** accomplish the following checklists:

CABIN ALT AUTO

LANDING ALT

OUTFLOW VLV L, R

■ ■ ■ ■

DOOR BULK CARGO

Condition: The bulk cargo door is not closed and secure.

Objective: To reduce cabin differential pressure to decrease risk of door separation.

1 Choose one:

◆Pressurization is **normal**:

Continue normal flight.

■ ■ ■ ■

◆Pressurization is **not** normal:

▶▶**Go to step 2**

2 Descend to 10,000 feet or the lowest safe altitude.

405, 570

3 **If** the CABIN ALTITUDE message shows:

▶▶**Go to the CABIN ALTITUDE checklist on page 2.1**

109

4 **If** the CABIN ALTITUDE message shows:

▶▶**Go to the CABIN ALTITUDE checklist on page 2.2**

■ ■ ■ ■

DOOR ELEC MAIN, CTR

Condition: The electrical equipment door is not closed and secure.

1 Choose one:

◆Pressurization is **normal**:

Continue normal flight.

■ ■ ■ ■

◆Pressurization is **not** normal:

►►**Go to step 2**

2 Descend to 10,000 feet or the lowest safe altitude.

405, 570

3 **If** the CABIN ALTITUDE message shows:

►►**Go to the CABIN ALTITUDE checklist on page 2.1**

109

4 **If** the CABIN ALTITUDE message shows:

►►**Go to the CABIN ALTITUDE checklist on page 2.2**

■ ■ ■ ■

DOOR ENTRY L, R 1, 2, 3, 4, 5

109

Condition: A main deck entry door is not closed and secure.

1 Instruct the cabin attendant to check door handle.

2 Choose one:

◆ Door handle is **in closed position**:

▶▶**Go to step 3**

◆ Door handle is **not** in closed position:

Instruct the cabin attendant to move the handle to the closed position.

▶▶**Go to step 3**

3 Choose one:

◆ Pressurization is **normal**:

Continue normal flight.

■ ■ ■ ■

◆ Pressurization is **not** normal:

▶▶**Go to step 4**

4 Descend to 10,000 feet or the lowest safe altitude.

5 **If** the CABIN ALTITUDE message shows:

▶▶**Go to the CABIN ALTITUDE checklist on page 2.2**

■ ■ ■ ■

DOOR ENTRY L 1, 5

405, 570

Condition: A main deck entry door is not closed and secure.

1 Choose one:

◆Pressurization is **normal**:

Continue normal flight.

■ ■ ■ ■

◆Pressurization is **not** normal:

►►**Go to step 2**

2 Descend to 10,000 feet or the lowest safe altitude.

3 **If** the CABIN ALTITUDE message shows:

►►**Go to the CABIN ALTITUDE checklist on page 2.1**

■ ■ ■ ■

DOOR F/D OVHD

405, 570

Condition: The flight deck overhead door is not closed and secure.

1 Choose one:

◆Pressurization is **normal**:

Continue normal flight.

■ ■ ■ ■

◆Pressurization is **not** normal:

►►**Go to step 2**

2 Descend to 10,000 feet or the lowest safe altitude.

3 **If** the CABIN ALTITUDE message shows:

►►**Go to the CABIN ALTITUDE checklist on page 2.1**

■ ■ ■ ■

DOOR FWD CARGO

Condition: The forward cargo door is not closed and secure.

Objective: To reduce cabin differential pressure to decrease risk of door separation.

1 LDG ALT switch . . . . .MAN

2 LDG ALT selector . . . . Set landing altitude between 8,000 and 8,500 feet to command the cabin altitude to 8,000 feet

109

3 Choose one:

◆Airplane altitude is **at or below** 8,000 feet:

Level off at the lowest safe altitude.

►►**Go to step 5**

◆Airplane altitude is **above** 8,000 feet:

Descend to the lowest safe altitude or 8,000 feet, whichever is higher.

►►**Go to step 5**

▼ **Continued on next page** ▼

▼ DOOR FWD CARGO continued ▼

405, 570

4 Choose one:

◆ Airplane altitude is **at or below** 8,000 feet:

Level off at the lowest safe altitude.

►► **Go to step 6**

◆ Airplane altitude is **above** 8,000 feet:

Descend to the lowest safe altitude or 8,000 feet, whichever is higher.

►► **Go to step 6**

109

5 **After** level off, allow sufficient time for cabin altitude to stabilize. This minimizes passenger discomfort from affects of cabin depressurization.

405, 570

6 **After** level off, allow sufficient time for cabin altitude to stabilize. This minimizes supernumerary discomfort from affects of cabin depressurization.

7 Choose one:

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

►► **Go to step 8**

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

Don the oxygen masks.

Establish crew communications.

►► **Go to step 8**

▼ Continued on next page ▼

▼ **DOOR FWD CARGO continued** ▼

8 OUTFLOW VALVES MAN switches (both) . . . . . ON

9 OUTFLOW VALVES
manual control . . . . Move the outflow valves to fully OPEN to depressurize the airplane. Use momentary actuation of the outflow valve manual control

10 Once depressurized, the crew may change altitude as needed.

11 Do **not** accomplish the following checklists:

CABIN ALT AUTO

LANDING ALT

OUTFLOW VLV L, R

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DOOR L, R UPPER DK

109, 405

Condition: An upper deck door is not closed and secure.

109

1 Instruct the cabin attendant to check door handle.

405

2 Check the door handle.

109

3 Choose one:

◆Door handle is **in closed position**:

▶▶**Go to step 5**

◆Door handle is **not** in closed position:

Instruct the cabin attendant to move the handle to the closed position.

▶▶**Go to step 5**

405

4 Choose one:

◆Door handle is **in closed position**:

▶▶**Go to step 5**

◆Door handle is **not** in closed position:

Move the handle to the closed position.

▶▶**Go to step 5**

▼ **Continued on next page** ▼

▼ **DOOR L, R UPPER DK continued** ▼

5 Choose one:

◆Pressurization is **normal**:

Continue normal flight.

■ ■ ■ ■

◆Pressurization is **not** normal:

►►**Go to step 6**

6 Descend to 10,000 feet or the lowest safe altitude.

405

7 **If** the CABIN ALTITUDE message shows:

►►**Go to the CABIN ALTITUDE checklist on page 2.1**

109

8 **If** the CABIN ALTITUDE message shows:

►►**Go to the CABIN ALTITUDE checklist on page 2.2**

■ ■ ■ ■

DOOR R UPPER DK

570

Condition: The upper deck door is not closed and secure.

1 Check the door handle.

2 Choose one:

◆ Door handle is **in closed position**:

▶▶**Go to step 3**

◆ Door handle is **not** in closed position:

Move the handle to the closed position.

▶▶**Go to step 3**

3 Choose one:

◆ Pressurization is **normal**:

Continue normal flight.

■ ■ ■ ■

◆ Pressurization is **not** normal:

▶▶**Go to step 4**

4 Descend to 10,000 feet or the lowest safe altitude.

5 **If** the CABIN ALTITUDE message shows:

▶▶**Go to the CABIN ALTITUDE checklist on page 2.1**

■ ■ ■ ■

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DOOR NOSE CARGO

570

Condition: Nose cargo door is not closed and secure.

Objective: To reduce cabin differential pressure to decrease risk of door separation.

1 LDG ALT switch . . . . .MAN

2 LDG ALT selector . . . . Set landing altitude between 8,000 and 8,500 feet to command the cabin altitude to 8,000 feet

3 Choose one:

◆Airplane altitude is **at or below** 8,000 feet:

Level off at the lowest safe altitude.

►►**Go to step 4**

◆Airplane altitude is **above** 8,000 feet:

Descend to the lowest safe altitude or 8,000 feet, whichever is higher.

►►**Go to step 4**

4 **After** level off, allow sufficient time for cabin altitude to stabilize. This minimizes supernumerary discomfort from affects of cabin depressurization.

▼ **Continued on next page** ▼

▼ **DOOR NOSE CARGO continued** ▼

5 Choose one:

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

▶▶ **Go to step 6**

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

Don the oxygen masks.

Establish crew communications.

▶▶ **Go to step 6**

6 OUTFLOW VALVES MAN switches (both) . . . . . ON

7 OUTFLOW VALVES manual control. . . . . . . Move the outflow valves to fully OPEN to depressurize the airplane. Use momentary actuation of the outflow valve manual control

8 Once depressurized, the crew may change altitude as needed.

9 Do **not** accomplish the following checklists:

CABIN ALT AUTO

LANDING ALT

OUTFLOW VLV L, R

■ ■ ■ ■

DOOR SIDE CARGO

405, 570

Condition: The side cargo door is not closed and secure.

Objective: To reduce cabin differential pressure to decrease risk of door separation

1 LDG ALT switch . . . . MAN

2 LDG ALT selector . . . . Set landing altitude between 8,000 and 8,500 feet to command the cabin altitude to 8,000 feet

3 Choose one:

◆ Airplane altitude is **at or below** 8,000 feet:

Level off at the lowest safe altitude.

▶▶**Go to step 4**

◆ Airplane altitude is **above** 8,000 feet:

Descend to the lowest safe altitude or 8,000 feet, whichever is higher.

▶▶**Go to step 4**

4 **After** level off, allow sufficient time for cabin altitude to stabilize. This minimizes supernumerary discomfort from affects of cabin depressurization.

▼ **Continued on next page** ▼

▼ **DOOR SIDE CARGO continued** ▼

5 Choose one:

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

►► **Go to step 6**

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

Don the oxygen masks.

Establish crew communications.

►► **Go to step 6**

6 OUTFLOW VALVES MAN switches (both) . . . . . ON

7 OUTFLOW VALVES manual control . . . . Move the outflow valves to fully OPEN to depressurize the airplane. Use momentary actuation of the outflow valve manual control

8 Once depressurized, the crew may change altitude as needed.

9 Do **not** accomplish the following checklists:

CABIN ALT AUTO

LANDING ALT

OUTFLOW VLV L, R

■ ■ ■ ■

DOOR U/D FLT LK

109

Condition: The upper deck door automatic lock failed to lock after takeoff.

1 Station a flight attendant by the door any time differential pressure is less than 3 psi to ensure no one attempts to open the door.

■ ■ ■ ■

DOOR U/D FLT LK

405

Condition: The upper deck door automatic lock failed to lock after takeoff.

1 Check pressurization system for normal operation. If pressurization system indicates normal operation, continue normal flight.

■ ■ ■ ■

DOORS ELEC

Condition: Both electrical equipment doors are not closed and secure.

1 Choose one:

◆Pressurization is **normal**:

Continue normal flight.

■ ■ ■ ■

◆Pressurization is **not** normal:

►►**Go to step 2**

2 Descend to 10,000 feet or the lowest safe altitude.

405, 570

3 **If** the CABIN ALTITUDE message shows:

►►**Go to the CABIN ALTITUDE checklist on page 2.1**

109

4 **If** the CABIN ALTITUDE message shows:

►►**Go to the CABIN ALTITUDE checklist on page 2.2**

■ ■ ■ ■

DOORS ENTRY L, R

109

Condition: Two or more main deck entry doors on the same side are not closed and secure.

1 Instruct the cabin attendant to check door handles.

2 Choose one:

◆Door handles are **in closed position**:

▶▶**Go to step 3**

◆Door handles are **not** in closed position:

Instruct the cabin attendant to move the handles to the closed position.

▶▶**Go to step 3**

3 Choose one:

◆Pressurization is **normal**:

Continue normal flight.

■ ■ ■ ■

◆Pressurization is **not** normal:

▶▶**Go to step 4**

4 Descend to 10,000 feet or the lowest safe altitude.

5 **If** the CABIN ALTITUDE message shows:

▶▶**Go to the CABIN ALTITUDE checklist on page 2.2**

■ ■ ■ ■

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DOORS UPR DECK

109, 405

Condition: Both upper deck doors are not closed and secure.

109

1 Instruct the cabin attendant to check door handles.

405

2 Check the door handles.

109

3 Choose one:

◆ Door handles are **in closed position**:

▶▶**Go to step 5**

◆ Door handles are **not** in closed position:

Instruct the cabin attendant to move the handles to the closed position.

▶▶**Go to step 5**

405

4 Choose one:

◆ Door handles are **in closed position**:

▶▶**Go to step 5**

◆ Door handles are **not** in closed position:

Move the handles to the closed position.

▶▶**Go to step 5**

▼ **Continued on next page** ▼

▼ DOORS UPR DECK continued ▼

5 Choose one:

◆ Pressurization is **normal**:

Continue normal flight.

■ ■ ■ ■

◆ Pressurization is **not** normal:

▶▶**Go to step 6**

6 Descend to 10,000 feet or the lowest safe altitude.

405

7 **If** the CABIN ALTITUDE message shows:

▶▶**Go to the CABIN ALTITUDE checklist on page 2.1**

109

8 **If** the CABIN ALTITUDE message shows:

▶▶**Go to the CABIN ALTITUDE checklist on page 2.2**

■ ■ ■ ■

>ELT ON

405, 570

Condition: The emergency locator transmitter is on.

■ ■ ■ ■

>EMER LIGHTS

Condition: One of these occurs:
- The emergency lights switch is ARMED and emergency lights are on
- The emergency lights switch is not ARMED

LOCK FAIL

LOCK FAIL

109

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 if system is on.

1 **If** conditions allow:

FLIGHT DECK ACCESS SYSTEM switch . . . OFF

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

PASS OXYGEN ON

109

Condition: Passenger oxygen system is on.

1 **When** passenger oxygen is no longer needed:

PASS OXYGEN
switch . . . . RESET, release to NORM

■ ■ ■ ■

SUPRNMRY OXY ON

405, 570

Condition: Supernumerary oxygen system is on.

1 **When** supernumerary oxygen is no longer needed:

SUPRNMRY OXY
switch . . . . RESET, release to NORM

■ ■ ■ ■

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 pressure and descend if an inner pane is shattered or cracked.

1 Don the seat belts and shoulder harnesses.

2 **If** the forward window has an arc, a crack, or is shattered:

WINDOW HEAT switch (affected side) . . . . . Off

WSHLD AIR switch (affected side) . . . . ON

3 Choose one:

◆ **Outer** glass pane is shattered or cracked and the inner glass pane is **not** shattered or cracked:

Continue normal flight.

Shoulder harnesses may be removed.

▶▶**Go to step 14**

◆ **Inner** glass pane is shattered or cracked:

▶▶**Go to step 4**

4 Don the oxygen masks.

▼ Continued on next page ▼

▼ Window Damage continued ▼

5 Establish crew communications.

6 Passenger signs . . . . ON

7 LDG ALT switch . . . . MAN

8 LDG ALT selector . . . . Set 9,000 feet

9 Do **not** accomplish the following checklist:

LANDING ALT

10 Descend normally to below 14,000 feet or minimum safe altitude, whichever is higher. Maintain a cabin differential pressure of 2 psi or less.

11 Plan to land at nearest suitable airport.

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

Oxygen masks and shoulder harnesses may be removed.

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

14 Do **not** accomplish the following checklist:

HEAT WINDOW

■ ■ ■ ■

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CABIN ALTITUDE or Rapid Depressurization

405, 570

Condition: A cabin altitude exceedance occurs.

1 Don the oxygen masks.

2 Establish crew communications.

3 Check the cabin altitude and rate. Verify packs are on and outflow valves are closed.

4 **If** the cabin altitude is uncontrollable:

SUPRNMRY OXY switch . . . . ON

Without delay, descend to the lowest safe altitude or 14,000 feet, whichever is higher.

To descend:

Move the thrust levers to idle.

Extend the speedbrakes.

If structural integrity is in doubt, limit airspeed and avoid high maneuvering loads.

Descend at VMO/MMO.

▼ Continued on next page ▼

▼ CABIN ALTITUDE or Rapid Depressurization continued ▼

5 **If** OUTFLOW VLV L, OUTFLOW VLV R, **and** CABIN ALT AUTO messages are shown:

Do **not** accomplish the following checklists:

CABIN ALT AUTO

OUTFLOW VLV L, R

■ ■ ■ ■

CABIN ALTITUDE or Rapid Depressurization

109

Condition: A cabin altitude exceedance occurs.

1 Don the oxygen masks.

2 Establish crew communications.

3 Check the cabin altitude and rate. Verify packs are on and outflow valves are closed.

4 **If** the cabin altitude is uncontrollable:

PASS OXYGEN switch . . . . .ON

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

To descend:

Move the thrust levers to idle.

Extend the speedbrakes.

▼ Continued on next page ▼

If structural integrity is in doubt, limit airspeed and avoid high maneuvering loads.

Descend at VMO/MMO.

---

5 **If** OUTFLOW VLV L, OUTFLOW VLV R, **and** CABIN ALT AUTO messages are shown:

Do **not** accomplish the following checklists:

CABIN ALT AUTO

OUTFLOW VLV L, R

■ ■ ■ ■

BLD DUCT LEAK L, C, R

Condition: A bleed air leak occurs in the left, center, or right duct.

Objective: To isolate the bleed duct leak.

1 Choose one:

◆ **BLD DUCT LEAK C** message is shown:

▶▶**Go to step 2**

◆ **BLD DUCT LEAK L** or **R** message is shown:

▶▶**Go to step 12**

2 ISLN valve switches (both) . . . . Off

3 PACK 2 control selector . . . . OFF

4 APU selector . . . . OFF

5 AFT CARGO HT switch . . . . .Off

6 TRIM AIR switch . . . . .Off

109
7 PASS TEMP selector . . . . Set

405, 570
8 FLT DECK TEMP selector . . . . Set

109, 570
9 Cargo smoke detection is no longer available.

10 Do not use ground pneumatic air.

11 Do **not** accomplish the following checklists:

109, 570
CARGO DET AIR

▼ Continued on next page ▼

▼ BLD DUCT LEAK L, C, R continued ▼

TEMP ZONE

TRIM AIR OFF

■ ■ ■ ■

12 ISLN valve switch (affected side) . . . . Off

13 ISLN valve switch (unaffected side) . . . . On

14 ENGINE BLEED air switches (affected side) . . OFF

This isolates the air source and maintains pressure on the unaffected side.

15 PACK control selector (affected side) . . . . . . OFF

16 Hydraulic DEMAND PUMP 1 or 4 selector (affected side) . . . . OFF

17 WING ANTI-ICE switch . . . . Off

Do not use wing anti-ice.

18 Choose one:

◆**At or above** 10,000 feet:

Sufficient bleed air may not be available for nacelle anti-ice if N1 is less than 70%.

▶▶**Go to step 19**

◆**Less than** 10,000 feet:

Sufficient bleed air may not be available for nacelle anti-ice if N1 is less than 55%.

▶▶**Go to step 19**

▼ Continued on next page ▼

▼ BLD DUCT LEAK L, C, R continued ▼

19 Do **not** accomplish the following checklists:

BLEED OFF

HYD PRESS DEM 1 or 4 (affected side)

20 **Checklist Complete Except Deferred Items**

Deferred Items

At top of descent:

PACK control selectors . . . . .Set a maximum of one pack on

This maintains bleed air extraction within limits.

Descent Checklist

Recall . . . . Checked

Autobrake . . . . ___

Landing data . . . . .VREF___, Minimums___

Approach briefing . . . . Completed

Flap Extension

LE flaps move in secondary mode. During approach, allow additional time for flap extension.

Do **not** accomplish the following checklist:

FLAPS PRIMARY

▼ Continued on next page ▼

BLD DUCT LEAK L, C, R continued

Note: A temporary LE flap asymmetry, accompanied by a mild rolling moment, results when the LE flaps are extended or retracted.

Approach Checklist

Altimeters . . . . ____

Caution! Do not deploy the thrust reversers until the nose gear contacts the runway.

Landing Checklist

Speedbrake . . . . Armed

Landing gear . . . . DOWN

Flaps . . . . ____

After landing

Note: If the BLD DUCT LEAK L message is shown, do not shut down engine 1 when towed into a gate. Shutting down engine 1 depressurizes hydraulic system 1, and body gear steering is inoperative. Tight turns may cause tire scrubbing.

■ ■ ■ ■

Continued on next page

▼ BLD DUCT LEAK L, C, R continued ▼

Additional Information

When the thrust reversers are deployed, the inboard and midspan LE flaps retract, resulting in a LE flap asymmetry. If the thrust reversers are deployed before the nose gear contacts the runway, immediate and significant control wheel input, approximately 25 to 65 degrees, may be needed to counter the LE flap asymmetry.

BLD 1, 2, 3, 4 OVHT/PRV

570

Condition: One or more of these occur:
- An engine bleed air overheat
- A PRV is failed closed

Objective: To turn the engine bleed switch OFF while at a high power setting.

1 ENGINE BLEED air switch (affected engine) . . OFF

2 **When** thrust is reduced in cruise:

ENGINE BLEED air switch (affected engine) . . . . .ON

▼ Continued on next page ▼

▼ **BLD 1, 2, 3, 4 OVHT/PRV continued** ▼

3 Choose one:

◆ BLD OVHT/PRV message **stays shown or shows again**:

Nacelle anti-ice is not available for the affected engine.

Reverse thrust is not available for the affected engine.

■ ■ ■ ■

◆ BLD OVHT/PRV message **stays blank**:

■ ■ ■ ■

BLD 1, 2, 3, 4 OVHT/PRV

109, 405

Condition: One or more of these occur:
- An engine bleed air overheat
- A PRV is failed closed

1 Nacelle anti-ice is not available for affected engine.

■ ■ ■ ■

SYS FAULT

BLEED 1, 2, 3, 4

Condition: One of these occurs:
- An engine bleed overpressure
- A high pressure bleed valve failed open
- A PRV failed open

Objective: To turn the engine bleed air switch OFF and then determine whether nacelle anti-ice is available.

1 ENGINE BLEED air
switch (affected engine) . . . . OFF

2 NACELLE ANTI-ICE
switch (affected engine) . . . . .ON

3 Choose one:

◆NAI VALVE message for the affected engine **is shown**:

Nacelle anti-ice for the affected engine is not available.

ANTI-ICE message may be shown.

NACELLE ANTI-ICE switch
(affected engine) . . . . .Off

▶▶**Go to step 6**

◆NAI VALVE message for the affected engine is **not** shown:

▶▶**Go to step 4**

4 Use the nacelle anti-ice normally.

▼ **Continued on next page** ▼

▼ **BLEED 1, 2, 3, 4 continued** ▼

5 Choose one:

◆ **At or above** 10,000 feet:

Sufficient bleed air may not be available for nacelle anti-ice if N1 is less than 70%.

▶▶ **Go to step 6**

◆ **Less than** 10,000 feet:

Sufficient bleed air may not be available for nacelle anti-ice if N1 is less than 55%.

▶▶ **Go to step 6**

6 Do **not** accomplish the following checklist:

BLEED OFF

■ ■ ■ ■

BLEED HP ENG 1, 2, 3, 4

Condition: The high pressure bleed valve is failed closed.

1 Choose one:

◆ **At or above** 10,000 feet:

Sufficient bleed air may not be available for nacelle anti-ice if N1 is less than 70%.

■ ■ ■ ■

◆ **Less than** 10,000 feet:

Sufficient bleed air may not be available for nacelle anti-ice if N1 is less than 55%.

■ ■ ■ ■

VALVE

BLEED ISLN L, R

Condition: The isolation valve is not in the commanded position.

1 **If** attempting duct isolation and the isolation valve will not close:

ISLN valve switch (unaffected side) . . . . . . .Off

PACK 2 control selector . . . . OFF

■ ■ ■ ■

VALVE

>BLEED ISLN APU

Condition: The APU bleed isolation valve is not in the commanded position.

■ ■ ■ ■

OFF

>BLEED 1, 2, 3, 4 OFF

Condition: All of these occur:
- Engine bleed air switch is OFF
- Engine is running
- Engine bleed air valve is closed

■ ■ ■ ■

Intentionally
Blank

CABIN ALT AUTO

Condition: One of these occurs:

- The automatic pressurization control is failed
- Both outflow valve manual switches are on

Objective: To manually control the cabin altitude.

1 OUTFLOW VALVES MAN switches (both) . . . . . ON

2 PACK control selector . . . . One pack OFF

This reduces the incoming volume of air to ease manual operation.

▼ Continued on next page ▼

▼ CABIN ALT AUTO continued ▼

3 Choose one:

◆Outflow valves **operate manually**:

OUTFLOW VALVES
manual control . . . . OPEN or CLOSE
as needed to maintain the
correct cabin altitude and rate

Note: The recommended cabin rate is approximately 500 FPM for climbs and descents.

Note: Recommended cabin altitude in cruise is:

FLIGHT LEVEL	CABIN ALTITUDE
Up to 230	Landing Field Elevation
Up to 260	2000
Up to 300	4000
Up to 350	6000
Above 350	8000

►►**Go to step 8**

◆Outflow valves **do not** operate manually:

►►**Go to step 4**

4 Pressurization control is lost. Check cabin altitude, cabin rate, and cabin differential pressure regularly.

5 Cabin altitude can only be maintained with packs and airplane altitude. Do not climb to higher altitudes.

6 Recalculate fuel requirements for destination.

▼ Continued on next page ▼

▼ CABIN ALT AUTO continued ▼

7 **If** cabin altitude increases to 10,000 feet or differential pressure exceeds 9 psi:

Don the oxygen masks.

Establish crew communications.

PASS OXYGEN switch . . . . .ON

Descend to maintain cabin altitude at or below 10,000 feet and cabin differential pressure at or below 9 psi.

8 **Checklist Complete Except Deferred Items**

Deferred Items

Descent Checklist

Recall . . . . Checked

Autobrake . . . . ___

Landing data . . . . .VREF___, Minimums___

Approach briefing . . . . Completed

Approach Checklist

Altimeters . . . . ___

▼ Continued on next page ▼

▼ CABIN ALT AUTO continued ▼

Choose one:

◆Outflow valves **operate manually**:

When at pattern altitude:

OUTFLOW VALVES manual control . . . . Move the outflow valves to full open

►►**Go to Landing Checklist**

◆Outflow valves **do not** operate manually:

►►**Go to Passing 15,000 feet**

Passing 15,000 feet

PACK control selectors . . . . Two packs off

Passing 10,000 feet

PACK control selectors . . . . All packs off

Landing Checklist

Speedbrake . . . . Armed

Landing gear . . . . DOWN

Flaps . . . . ____

■ ■ ■ ■

>E/E CLNG CARD

Condition: A fault occurs in the equipment cooling system. The system does not fully operate.

■ ■ ■ ■

EQUIP COOLING

Condition: The ground exhaust valve is not in the commanded position or:

With Equipment Cooling selector in NORM or STBY, one or more of these occur:
- Airflow is insufficient
- An overheat is sensed
- Smoke is sensed

With Equipment Cooling selector in OVRD, differential pressure for reverse flow cooling is not sufficient.

1 Avionics/electronic equipment and displays may become unreliable or fail.

2 Choose one:

◆On the **ground**:

EQUIP COOLING selector . . . . STBY

■ ■ ■ ■

◆In **flight**:

▶▶**Go to step 3**

3 EQUIP COOLING selector . . . . .OVRD

▼ **Continued on next page** ▼

▼ **EQUIP COOLING continued** ▼

4 Choose one:

◆EQUIP COOLING message **stays shown or shows again**:

Plan to land at the nearest suitable airport.

■ ■ ■ ■

◆EQUIP COOLING message **stays blank**:

■ ■ ■ ■

>HUMID FLT DK

109

Condition: A fault occurs in the flight deck humidifier.

■ ■ ■ ■

LANDING ALT

Condition: One of these occurs:
- The landing altitude disagrees between the cabin altitude controller and FMC
- The landing altitude switch is pushed

1 Choose one:

◆**Manual** landing altitude control is selected:

►►**Go to step 2**

◆**Automatic** landing altitude control is selected:

LDG ALT switch . . . . MAN

►►**Go to step 2**

2 LDG ALT selector . . . . Manually set the landing altitude

■ ■ ■ ■

OUTFLOW VLV L, R

Condition: One of these occurs:

- Automatic outflow valve control is inoperative
- The outflow valve manual switch is on

Objective: To control cabin altitude manually.

1 OUTFLOW VALVES MAN switch (affected valve) . . . . ON

2 PACK control selector . . . . One pack OFF

3 OUTFLOW VALVES manual control. . . . . .Push to CLOSE and hold until outflow valve indications show fully closed

■ ■ ■ ■

PACK 1, 2, 3

SYS FAULT **May or may not be illuminated**

Condition: One or more of these occur:
- A pack controller fault
- A pack operation fault
- A pack overheat
- A pack 2 shutdown and a cabin pressure relief valve is open

Objective: To attempt to switch to a functioning controller.

1 TRIM AIR switch . . . . .ON

2 PACK control selector (affected pack(s)) . . . . A

3 PACK RST switch . . . . Push

4 Choose one:

◆ PACK message(s) **blanks**:

■ ■ ■ ■

◆ PACK message(s) **stays shown or shows again**:

▶▶**Go to step 5**

5 PACK control selector (affected pack(s)) . . . . B

6 PACK RST switch . . . . Push

▼ **Continued on next page** ▼

▼ **PACK 1, 2, 3 continued** ▼

7 Choose one:

◆ PACK message(s) **blanks**:

■ ■ ■ ■

◆ PACK message(s) **stays shown or shows again**:

PACK control
selector (affected pack(s)) . . . . OFF

■ ■ ■ ■

PACK CONTROL

Condition: Automatic control of the outlet temperature of all packs is inoperative.

1 PACK RST switch . . . . Push

Note: If the PACK CONTROL message stays shown or shows again, the packs continue to work, but the air outlet temperature is not controlled.

2 Choose one:

◆PACK CONTROL message **blanks**:

■ ■ ■ ■

◆PACK CONTROL message **stays shown or shows again:**

►►**Go to step 3**

3 TRIM AIR switch . . . . .ON

4 Packs may overheat and shut down at lower altitudes during descent.

5 Choose one:

◆TEMP ZONE message is **shown**:

The cabin temperature cannot be controlled.

■ ■ ■ ■

◆TEMP ZONE message is **not** shown:

►►**Go to step 6**

▼ Continued on next page ▼

▼ PACK CONTROL continued ▼

6 Pack outlet temperature cannot be reduced to decrease cabin temperature.

Note: Passenger cabin temperatures may be controlled with passenger temperature selector and cabin temperature panel.

■ ■ ■ ■

PRESS RELIEF

Condition: One or more pressure relief valves opens with all packs on.

1 PACK 2 control selector . . . . OFF

■ ■ ■ ■

TEMP CARGO HEAT

Condition: An aft cargo compartment overheat occurs.

1 Choose one:

◆Aft cargo heat is **not** needed:

AFT CARGO HEAT switch. . . . . .Off

On extended flights, the aft cargo compartment temperature may decrease to below freezing.

■ ■ ■ ■

◆Aft cargo heat is **needed**:

Note: If aft cargo heat stays on, the system cycles at a higher temperature and alternately shows the TEMP CARGO HEAT message.

■ ■ ■ ■

SYS FAULT

TEMP ZONE

109

Condition: One or more of these occur:
- A zone duct overheat
- The master trim air valve fails closed
- A zone temperature controller fails

1 ZONE RST switch . . . . .Push

2 Choose one:

◆TEMP ZONE message **blanks**:

■ ■ ■ ■

◆TEMP ZONE message **stays shown or shows again within five minutes**:

►►**Go to step 3**

3 PASS TEMP selector . . . . .Set

If the zone temperature controller is failed:

All cabin zones are maintained at a moderate temperature.

4 Do **not** accomplish the following checklist:

TRIM AIR OFF

■ ■ ■ ■

SYS FAULT

TEMP ZONE

405, 570

Condition: One or more of these occur:
- A zone duct overheat
- The master trim air valve fails closed
- A zone temperature controller fails
- Forward or aft lower lobe cargo zone trim air valve fails closed
- Forward or aft lower lobe cargo compartment overheat

1 ZONE RST switch . . . . Push

2 Choose one:

◆TEMP ZONE message **blanks**:

■ ■ ■ ■

◆TEMP ZONE message **stays shown or shows again**:

►►**Go to step 3**

3 FLT DK TEMP selector . . . . Set

If the zone temperature controller is failed:

The flight deck zone is maintained at a moderate temperature.

4 Main deck and upper deck temperature is not controlled.

5 Lower lobe cargo temperature may be colder than selected.

▼ **Continued on next page** ▼

▼ TEMP ZONE continued ▼

6 Do **not** accomplish the following checklist:

TRIM AIR OFF

■ ■ ■ ■

>TRIM AIR OFF

109

Condition: The master trim air valve is closed. The backup mode controls flight deck and passenger cabin temperature.

570

Condition: The master trim air valve is closed. The backup mode controls flight deck, upper deck, crew rest, and main deck temperature.

405

Condition: The master trim air valve is closed. The backup mode controls flight deck, upper deck, and main deck temperature.

■ ■ ■ ■

Intentionally
Blank

Non-Normal Checklists — Chapter NNC

Anti-Ice, Rain — Section 3

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Intentionally
Blank

>ANTI-ICE

405

Condition: Any nacelle or wing anti-ice system is on, and TAT is greater than 12°C.

■ ■ ■ ■

>ANTI-ICE

109, 570

Condition: Any nacelle or wing anti-ice system is on, and:
- TAT greater than 12°C
- The ice detector does not detect ice.

■ ■ ■ ■

HEAT L, R AOA

Condition: An AOA probe heat is failed.

1 Flight in icing conditions may result in erroneous flight instrument indications.

■ ■ ■ ■

HEAT L, R TAT

Condition: One of these occurs:
- TAT probe heat is failed off
- Air/ground logic failure, TAT probe is heated on the ground

1 Flight in icing conditions may result in unreliable performance calculations.

■ ■ ■ ■

HEAT P/S CAPT, F/O

570

Condition: A pitot static probe heat is failed.

1 Flight in icing conditions may result in erroneous flight instrument indications.

■ ■ ■ ■

HEAT P/S CAPT, F/O

109, 405

Condition: A pitot static probe heat is failed.

Objective: To isolate the failed probe to prevent erroneous flight instrument indications.

1 Disengage the autopilot.

2 Choose one:

◆HEAT P/S **CAPT** message is shown:

AIR DATA SOURCE selector (Captain). . . R

AIR DATA SOURCE selector (First Officer) C

Engage the R autopilot, if needed.

L and C autopilots are unreliable.

■ ■ ■ ■

◆HEAT P/S **F/O** message is shown:

▶▶**Go to step 3**

3 AIR DATA SOURCE selector (Captain) C

4 AIR DATA SOURCE selector (First Officer). L

5 Engage the L or C autopilot, if needed.

6 R autopilot is unreliable.

■ ■ ■ ■

HEAT P/S L, R AUX

570

Condition: A pitot static probe is failed.

1 Flight in icing conditions may result in erroneous flight instrument indications.

■ ■ ■ ■

HEAT P/S L, R AUX

109, 405

Condition: A pitot static probe heat is failed.

Objective: To isolate the failed probe to prevent erroneous flight instrument indications.

1 Disengage the autopilot.

2 Choose one:

◆ HEAT P/S **R** AUX message is shown:

AIR DATA SOURCE selector (Captain) . . . R

AIR DATA SOURCE selector (First Officer) C

Engage the R autopilot, if needed.

L and C autopilots are unreliable.

■ ■ ■ ■

◆ HEAT P/S **L** AUX message is shown:

►►**Go to step 3**

▼ Continued on next page ▼

▼ **HEAT P/S L, R AUX continued** ▼

3 AIR DATA SOURCE selector (Captain) C

4 AIR DATA SOURCE selector (First Officer) L

5 Engage the L or C autopilot, if needed.

6 R autopilot is unreliable.

■ ■ ■ ■

INOP

HEAT WINDOW L, R

Condition: Window heat is off.

Objective: To attempt to reset the window heat.

1 WINDOW HEAT switch
(affected window). . . . . . .Off 10 seconds, then ON

109, 570
2 Choose one:

◆ HEAT WINDOW message **stays shown**:

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

WSHLD AIR switch (affected side) . . . .ON

■ ■ ■ ■

◆ HEAT WINDOW message **blanks**:

Continue normal operation.

■ ■ ■ ■

405
3 Choose one:

◆ HEAT WINDOW message **stays shown**:

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

WSHLD AIR switch (affected side) . . . .ON

►►**Go to step 4**

◆ HEAT WINDOW message **blanks**:

►►**Go to step 4**

▼ **Continued on next page** ▼

▼ HEAT WINDOW L, R continued ▼

405

4 Choose one:

◆ Window **fogs**:

FLT DECK FAN switch . . . . On

■ ■ ■ ■

◆ Window stays **clear**:

Continue normal operation.

■ ■ ■ ■

>ICING

109, 570

Condition: Ice detector detects ice.

1 Message can be cancelled but cannot be recalled.

■ ■ ■ ■

VALVE

NAI VALVE 1, 2, 3, 4

Condition: The nacelle anti-ice valve is not in the commanded position.

1 Choose one:

◆ Nacelle anti-ice switch is **ON**:

Nacelle anti-ice is not available for the affected engine.

Valve is failed closed.

■ ■ ■ ■

◆ Nacelle anti-ice switch is **Off**:

If TAT above 10° C:

If conditions allow, avoid high thrust settings.

Valve is failed open.

■ ■ ■ ■

>NO ICING

109, 570

Condition: Ice no longer detected.

1 Message can be cancelled but cannot be recalled. If ice detected, message no longer shown.

■ ■ ■ ■

Intentionally
Blank

VALVE

WAI VALVE LEFT, RIGHT

Condition: The wing anti-ice valve is not in the commanded position.

1 Choose one:

◆ WING ANTI-ICE switch is **ON**:

WING ANTI-ICE switch . . . . Off

Do not use wing anti-ice.

Valve is failed closed.

■ ■ ■ ■

◆ WING ANTI-ICE switch is **Off**:

WING ANTI-ICE switch . . . . ON

Valve is failed open.

▶▶**Go to step 2**

2 **Checklist Complete Except Deferred Items**

▼ **Continued on next page** ▼

▼ **WAI VALVE LEFT, RIGHT continued** ▼

Deferred Items

Descent Checklist

Recall . . . . Checked

Autobrake . . . . ____

Landing data . . . . VREF____, Minimums____

Approach briefing . . . . Completed

Approach Checklist

Altimeters . . . . ____

Landing Checklist

Speedbrake . . . . Armed

Landing gear . . . . DOWN

Flaps . . . . ____

After Landing

ENGINE BLEED air switches
(affected side) . . . . OFF

ISLN valve switch (affected side) . . . . Off

Note: **If** the WAI VALVE LEFT message is shown, do not shut down engine 1 when towed into a gate. Shutting down engine 1 depressurizes hydraulic system 1, and body gear steering is inoperative. Tight turns may cause tire scrubbing.

■ ■ ■ ■

Intentionally
Blank

Non-Normal Checklists — Chapter NNC

Automatic Flight — Section 4

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Intentionally
Blank

>AUTOPILOT

Condition: One or more of these occur:
- The autopilot operates in a degraded mode
- The engaged roll mode fails
- The engaged pitch mode fails

■ ■ ■ ■

>AUTOPILOT DISC

Condition: All autopilots are disengaged.

■ ■ ■ ■

>AUTOTHROT DISC

Condition: The autothrottle is disconnected.

■ ■ ■ ■

>NO AUTOLAND

Condition: The autoland system is not available.

■ ■ ■ ■

>NO LAND 3

Condition: The autoland system does not have redundancy for a triple channel autoland.

■ ■ ■ ■

Intentionally
Blank

Non-Normal Checklists — Chapter NNC
Communications — Section 5

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Intentionally
Blank

>DATALINK AVAIL

Condition: The ACARS datalink is available after a temporary loss.

■ ■ ■ ■

>DATALINK LOST

Condition: The ACARS datalink is temporarily lost.

■ ■ ■ ■

>DATALINK SYS

Condition: The ACARS datalink is failed and not available.

■ ■ ■ ■

>HF DATA

570

Condition: Selected HF radio failed and not available for ACARS data communication.

■ ■ ■ ■

RADIO TRANSMIT

570

Condition:	A radio transmits continuously without crew input.
Objective:	To identify and isolate the stuck microphone.

1 Transmitter select switches (all audio select panels) . . . . FLT interphone

This deselects radios and stops radio transmissions.

2 The microphone or interphone with the stuck switch continuously transmits on flight interphone.

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

■ ■ ■ ■

Radio Transmit Continuous (Stuck Microphone Switch)

109, 405

Condition: A radio transmits continuously without crew input.

Objective: To identify and isolate the stuck microphone.

1 Transmitter select switches (all audio select panels) . . . . Flight Interphone

This deselects the radios and stops radio transmissions.

2 The microphone or interphone with the stuck switch continuously transmits on flight interphone.

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

■ ■ ■ ■

>SATCOM

Condition: The SATCOM system is failed.

■ ■ ■ ■

>SATCOM DATA

Condition: ACARS data communication through SATCOM system not available.

■ ■ ■ ■

>SATCOM VOICE

Condition: SATCOM voice communication is not available. ACARS data communication through SATCOM is available.

■ ■ ■ ■

>SATVOICE AVAIL

Condition: SATCOM voice communication is available after a temporary loss.

■ ■ ■ ■

>SATVOICE LOST

Condition: SATCOM voice communication is temporarily lost.

■ ■ ■ ■

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Intentionally
Blank

>BAT DISCH APU

Condition: An APU battery is discharging.

■ ■ ■ ■

>BAT DISCH MAIN

Condition: A main battery is discharging.

■ ■ ■ ■

OFF

>BATTERY OFF

Condition: The battery switch is off.

■ ■ ■ ■

>DRIVE DISC 1, 2, 3, 4

Condition: The generator drive is disconnected.

■ ■ ■ ■

ISLN

ELEC AC BUS 1, 2, 3, 4

570

OFF

Condition: The AC bus is not powered.

Objective: To attempt to reset the generator and then the bus tie. Also, to reset the EECs if the bus is recovered.

109, 405

OFF

Condition: The AC bus is not powered.

Objective: To attempt to reset the generator and then the bus tie. Also, to reset the EEC if the bus is recovered.

Attempt only one reset of the generator control switch.

1 GEN CONT switch
(affected generator). . . . . OFF, then ON

2 Choose one:

◆ELEC AC BUS message **stays shown**:

Do not attempt to close the bus tie.

▶▶**Go to step 3**

◆ELEC AC BUS message **blanks**:

▶▶**Go to step 6**

▼ **Continued on next page** ▼

▼ ELEC AC BUS 1, 2, 3, 4 continued ▼

3 Choose one:

◆ELEC AC BUS **2 or 3** message stays shown:

■ ■ ■ ■

◆ELEC AC BUS **1 or 4** message stays shown:

►►**Go to step 4**

4 Choose one:

◆ELEC AC BUS **1** message is shown:

Avoid icing conditions.

Flight in icing conditions may result in unreliable Captain's and Standby flight instrument indications.

►►**Go to Inoperative Items**

◆ELEC AC BUS **4** message is shown:

Avoid icing conditions.

Flight in icing conditions may result in unreliable First Officer's flight instrument indications.

►►**Go to Inoperative Items**

▼ **Continued on next page** ▼

▼ ELEC AC BUS 1, 2, 3, 4 continued ▼

Inoperative Items

Both pitot probe heaters on one side of the airplane inop
Avoid icing conditions.

Autothrottle inop
Use manual throttle.

LNAV/VNAV modes inop
Use HDG SEL or HDG HOLD

570

Reference N1 inop
Use manual throttle.

109, 405

Reference EPR is blank
Use manual throttle.

5 Do **not** accomplish the following checklists:

HEAT P/S CAPT, F/O

HEAT P/S L, R AUX

■ ■ ■ ■

6 Choose one:

◆ ELEC BUS ISLN message is **not** shown:

■ ■ ■ ■

◆ ELEC BUS ISLN message is **shown**:

►►**Go to step 7**

▼ Continued on next page ▼

ELEC AC BUS 1, 2, 3, 4 continued

Attempt only one reset

7 BUS TIE switch
(affected generator). . . . . Off, then AUTO

570

8 Choose one:

◆ELEC BUS ISLN message **stays shown**:

■ ■ ■ ■

◆ELEC BUS ISLN message **blanks** and the ENG EEC MODE message is **not** shown:

■ ■ ■ ■

◆ELEC BUS ISLN message **blanks** and the ENG EEC MODE message is **shown**:

►►**Go to step 10**

109, 405

9 Choose one:

◆ELEC BUS ISLN message **stays shown**:

■ ■ ■ ■

◆ELEC BUS ISLN message **blanks**:

►►**Go to step 11**

Continued on next page

▼ ELEC AC BUS 1, 2, 3, 4 continued ▼

570

10 Do these steps for all operating engines, one engine at a time:

Thrust lever. . . . . Retard to mid position

ELEC ENG CONTROL switch . . . . ALTN, then NORM

109, 405

11 Do these steps for the affected engine:

Thrust lever. . . . . Retard to mid position

ELEC ENG CONTROL switch . . . . ALTN, then NORM

■ ■ ■ ■

ISLN

ELEC BUS ISLN 1, 2, 3, 4

Condition: The bus tie is open.

Objective: To attempt to reset the bus tie.

Attempt only one reset of the bus tie switch.

1 ⚠ BUS TIE switch . . . . Off, then AUTO

■ ■ ■ ■

DRIVE

ELEC DRIVE 1, 2, 3, 4

570
(SB changes 109 ; installs improved generator control units for added IDG protection)

Condition: One of these occurs:
- IDG oil pressure low
- IDG oil temperature high
- Generator control open due to uncorrectable generator frequency fault

Objective: To prevent damage to the IDG.

405
(SB changes 109 ; before SB, improved generator control units for added IDG protection not installed)

Condition: One of these occurs:
- IDG oil pressure low
- IDG oil temperature high

Objective: To prevent damage to the IDG.

Action is irreversible

1 ⚠ Generator DRIVE DISC switch (affected generator). . Confirm . . . Push

2 Do **not** accomplish the following checklists:

DRIVE DISC

ELEC GEN OFF

■ ■ ■ ■

OFF

ELEC GEN OFF 1, 2, 3, 4

Condition: The generator control is open.

Objective: To attempt to reset the generator.

Attempt only one reset of the generator control switch.

1 GEN CONT switch . . . . OFF, then ON

■ ■ ■ ■

>ELEC SSB OPEN

Condition: The split system breaker is failed open.

■ ■ ■ ■

OFF

ELEC UTIL BUS L, R

109

Condition: One or more of these occur:
- A galley bus is not powered
- A utility bus is not powered
- The galley emergency power switch is off

Objective: To attempt to reset power.

405, 570

Condition: A utility bus is not powered.

Objective: To attempt to reset power.

Attempt only one reset

1 UTILITY power switch . . . . Off, then ON

Leave the UTILITY power switch ON.

■ ■ ■ ■

>STBY BUS APU

109, 570

Condition: The APU standby bus is not powered.

■ ■ ■ ■

>STBY BUS MAIN

109, 570

Condition: The main standby bus is not powered.

■ ■ ■ ■

>STBY POWER OFF

405

Condition: The standby bus is not powered.

■ ■ ■ ■

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Aborted Engine Start

109, 405

Condition:	During a ground start, an abort start condition occurs.
Objective:	To shut down the engine and motor it.

1 FUEL CONTROL switch . . . . CUTOFF

2 Choose one:

◆ Engine START light is **illuminated**:

Motor the engine for 30 seconds.

Engine START switch . . . . .Push

■ ■ ■ ■

◆ Engine START light is **extinguished**:

►► **Go to step 3**

3 **When** N2 decreases below 15%:

109
AUTOSTART switch . . . . Off

This allows engine motoring.

Engine START switch . . . . Pull

Motor the engine for 30 seconds.

Engine START switch . . . . .Push

■ ■ ■ ■

Aborted Engine Start

570

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

Objective: To shut down the engine and motor it.

1 FUEL CONTROL switch . . . . CUTOFF

2 Choose one:

◆ Engine START light is **illuminated**:

Motor the engine for 30 seconds.

Engine START switch . . . . Push

■ ■ ■ ■

◆ Engine START light is **extinguished**:

▶▶ **Go to step 3**

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

AUTOSTART switch . . . . Off

This allows engine motoring.

Engine START switch . . . . Pull

Motor the engine for 30 seconds.

Engine START switch . . . . Push

■ ■ ■ ■

ENG 1, 2, 3, 4 AUTOSTART

109

Condition: During a ground start, any of the following conditions occur:
- Autostart did not start the engine
- The fuel control switch is in RUN at low engine RPM with the autostart switch off

Objective: To shut down the engine and motor it.

1 FUEL CONTROL switch . . . . CUTOFF

---

2 Choose one:

◆ Engine START light is **illuminated**:

Motor the engine for 30 seconds.

Engine START switch . . . . .Push

■ ■ ■ ■

◆ Engine START light is **extinguished**:

►► **Go to step 3**

3 **When** N2 decreases below 15%:

AUTOSTART switch . . . . Off

This allows engine motoring.

Engine START switch. . . . . Pull

Motor the engine for 30 seconds.

Engine START switch . . . . .Push

■ ■ ■ ■

ENG 1, 2, 3, 4 AUTOSTART

570

Condition: During a ground start, one of the following conditions occurs:
- Autostart did not start the engine.
- The fuel control switch is in RUN at low engine RPM with the autostart switch off.

Objective: To shut down the engine and motor it.

1 FUEL CONTROL switch. . . . . CUTOFF

2 Choose one:

◆ Engine START light is **illuminated**:

Motor the engine for 30 seconds.

Engine START switch . . . . Push

■ ■ ■ ■

◆ Engine START light is **extinguished**:

►►**Go to step 3**

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

AUTOSTART switch .Off

This allows engine motoring.

Engine START switch . . . . Pull

Motor the engine for 30 seconds.

Engine START switch. . . . . Push

■ ■ ■ ■

Intentionally
Blank

ENG 1, 2, 3, 4 FAIL or Multiple Engine Flameout or Stall

570

Condition: One of these occurs on two or more engines:
- engine flameout
- engine indications are unusual
- engine indications are more than limits
- unusual engine noises are heard
- there is no response to thrust lever movement

Objective: To attempt a rapid relight.

1 FUEL CONTROL switches (affected engines) . . . . . Confirm . . . . . CUTOFF, then RUN

2 **If** EGT rises rapidly approaching the EGT takeoff limit:

Repeat the above step as needed.

---

3 The multi-engine in-flight start limit is the takeoff limit. EGT turns red at the ground/single engine in-flight start limit. Autostart protects the maximum takeoff limit.

▼ Continued on next page ▼

▼ ENG 1, 2, 3, 4 FAIL or Multiple Engine Flameout or Stall continued ▼

4 Choose one:

◆ Airspeed is **less than** 220 KIAS:

PACK control selectors . . . Set a maximum of one pack on

Engine START switch (affected engines) . . . . Pull

▶▶Go to step 5

◆ Airspeed is **equal to or more than** 220 KIAS:

▶▶Go to step 5

5 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.

6 If N2 is steadily increasing, and EGT stays within limits, the start is progressing normally.

7 Choose one:

◆ AUTOSTART switch is **Off**:

Monitor EGT during engine start.

■ ■ ■ ■

◆ AUTOSTART switch is **ON**:

■ ■ ■ ■

ENG 1, 2, 3, 4 FAIL
or
Multiple Engine Flameout or Stall

109, 405

Condition: One of these occurs on two or more engines:
- engine flameout
- engine indications are unusual
- engine indications are more than limits
- unusual engine noises are heard
- there is no response to thrust lever movement

Objective: To attempt a rapid relight.

1 CONT IGNITION switch . . . . .ON

2 FUEL CONTROL switches (affected engines) . . . . . Confirm . . . . . CUTOFF, then RUN

3 **If** EGT rises rapidly approaching the EGT takeoff limit:

Repeat the above step as needed.

Continued on next page

▼ ENG 1, 2, 3, 4 FAIL or Multiple Engine Flameout or Stall continued ▼

4 Choose one:

◆Airspeed is **less than** 200 KIAS:

PACKS control selectors . . Set a maximum of one pack on

Engine START switch
(affected engines) . . . . Pull

▶▶**Go to step 5**

◆Airspeed is **equal or more than** 200 KIAS:

▶▶**Go to step 5**

5 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.

6 If N2 is steadily increasing, and EGT stays within limits, the start is progressing normally.

109

7 Choose one:

◆AUTOSTART switch for the affected engine is **Off**:

Monitor EGT during engine start.

■ ■ ■ ■

◆AUTOSTART switch for the affected engine is **ON**:

■ ■ ■ ■

405

8 AUTO IGNITION selector . . . . BOTH

■ ■ ■ ■

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 Thrust lever
(affected engine) . . . . Confirm. . . . . Retard until indications stay within normal limits, or return to normal, or the thrust lever is at idle

- -

109, 405

2 CONT IGNITION switch . . . . ON

This may prevent flameout.

570

3 **If** EGT continues to increase toward the limit or abnormal condition continues:

ENGINE BLEED air switch
(affected engine) . . . . OFF

▼ Continued on next page ▼

▼ Engine Limit or Surge or Stall continued ▼

4 Choose one:

◆ **EGT is stabilized or decreasing** and the other engine indications are **normal**:

►► **Go to step 5**

◆ **EGT continues to increase** toward the limit or the abnormal **condition continues**:

FUEL CONTROL switch
(affected engine) . . . Confirm . . . CUTOFF

109, 405
Transponder mode selector . . . . TA

570
Transponder mode selector . . . . . TA ONLY

Do **not** accomplish the following checklist:

ENG SHUTDOWN

■ ■ ■ ■

5 Thrust lever
(affected engine) . . . . Advance slowly, and check that RPM and EGT follow thrust lever movement and all indications stay within limits

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

■ ■ ■ ■

APU

Condition: One of these occurs:
- An APU automatic shutdown
- APU N1 RPM is more than 95% with the APU selector off

Objective: To shut down or attempt to restart the APU.

1 Choose one:

◆APU selector is **OFF**:

APU fire switch . . . . Confirm . . . Override and pull

■ ■ ■ ■

◆APU selector is **ON**:

APU selector . . . . OFF

▶▶**Go to step 2**

2 Choose one:

◆APU message **blanks**:

A restart may be attempted.

■ ■ ■ ■

◆APU message **stays shown:**

Do **not** attempt a restart.

■ ■ ■ ■

Intentionally
Blank

APU DOOR

Condition: The APU door is not in the commanded position.

Objective: To ensure accurate fuel burn calculations in flight, or attempt an APU restart on the ground.

1 Choose one:

◆In **flight**:

If the APU selector is **OFF**:

Apply the APU door open fuel burn penalty of 2%.

■ ■ ■ ■

◆On the **ground**:

▶▶**Go to step 2**

2 Choose one:

◆APU selector is **OFF**:

■ ■ ■ ■

◆APU selector is **ON**:

▶▶**Go to step 3**

3 APU selector .OFF, then ON

▼ Continued on next page ▼

▼ APU DOOR continued ▼

4 Choose one:

◆ APU DOOR message **blanks**:

A restart may be attempted.

■ ■ ■ ■

◆ APU DOOR message **stays shown**:

Do **not** attempt a restart.

■ ■ ■ ■

APU FUEL

Condition: One of the following occurs:
- Low pump pressure is detected when the pump is activated
- APU fuel valve is not in the commanded position

1 APU selector . . . . OFF

2 Do **not** start the APU.

■ ■ ■ ■

>AUTOSTART OFF

109, 570

Condition: The engine autostart switch is off.

■ ■ ■ ■

>EEC 1, 2, 3, 4 TEST PWR

405

Condition: EEC maintenance power switch in TEST.

■ ■ ■ ■

>ENG 1, 2, 3, 4 CONTROL

Condition: An EEC system fault occurs.

■ ■ ■ ■

ALTN

ENG 1, 2, 3, 4 EEC MODE

Condition: An EEC operates in the alternate control mode.

Objective: To place all the EECs in alternate.

1 Do these steps on all operating engines, one engine at a time:

Thrust lever. . . . . Retard to mid position

ELEC ENG CONTROL switch . . . . ALTN

2 Maximum thrust limiting is not available.

570

3 Autothrottle is available.

109, 405

4 Autothrottle is not available.

■ ■ ■ ■

ENG 1, 2, 3, 4 FAIL

570

Condition: One of these occurs:
- An engine failure
- An engine flameout

1 **If** more than one ENG FAIL message is shown:

▶▶**Go to the ENG 1, 2, 3, 4 FAIL or Multiple Engine Flameout or Stall checklist on page 7.6**

2 Thrust lever . . . . Confirm . . . . Idle

3 FUEL CONTROL switch . . . . Confirm . . . CUTOFF

4 Transponder mode selector . . . . TA ONLY

5 Do **not** accomplish the following checklist:

ENG SHUTDOWN

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

7 Choose one:

◆Restart **is not** needed:

■ ■ ■ ■

◆Restart **is** needed:

▶▶**Go to step 8**

8 Monitor EGT during start.

▼ Continued on next page ▼

▼ **ENG 1, 2, 3, 4 FAIL continued** ▼

9 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.

10 If N2 is steadily increasing, and EGT stays within limits, the start is progressing normally.

11 Choose one:

◆X-BLD is **not** shown:

FUEL CONTROL switch . . . . RUN

▶▶**Go to step 13**

◆X-BLD is **shown**:

Engine START switch . . . . Pull

▶▶**Go to step 12**

12 Choose one:

◆AUTOSTART switch is **ON**:

FUEL CONTROL switch . . . . RUN

▶▶**Go to step 13**

◆AUTOSTART switch is **Off**:

When N2 exceeds the fuel-on indicator:

FUEL CONTROL switch . . . . RUN

▶▶**Go to step 13**

▼ **Continued on next page** ▼

▼ ENG 1, 2, 3, 4 FAIL continued ▼

13 Choose one:

◆ An abort start condition as listed in normal procedures **occurs**:

FUEL CONTROL switch . . . . Confirm . . . . CUTOFF

Engine START switch . . . . .Push or verify pushed

■ ■ ■ ■

◆ Start is **normal**:

Transponder mode selector . . . . .TA/RA

■ ■ ■ ■

ENG 1, 2, 3, 4 FAIL

109

Condition: One of these occurs:
- An engine failure
- An engine flameout

1 **If** more than one ENG FAIL message is shown:

  ►► **Go to the ENG 1, 2, 3, 4 FAIL or Multiple Engine Flameout or Stall checklist on page 7.8**

2 Thrust lever . . . . Confirm . . . . Idle

3 FUEL CONTROL switch. . . . . Confirm . . . CUTOFF

4 Transponder mode selector . . . . TA

5 Do **not** accomplish the following checklist:

  ENG SHUTDOWN

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

7 Choose one:

◆ Restart **is not** needed:

■ ■ ■ ■

◆ Restart **is** needed:

  ►► **Go to step 8**

8 Monitor EGT during start.

▼ **Continued on next page** ▼

▼ ENG 1, 2, 3, 4 FAIL continued ▼

9 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.

10 If N2 is steadily increasing, and EGT stays within limits, the start is progressing normally.

11 Choose one:

◆AUTOSTART switch is **ON**:

▶▶**Go to step 12**

◆AUTOSTART switch is **Off**:

AUTO IGNITION selector . . . . BOTH

▶▶**Go to step 13**

12 Choose one:

◆X-BLD is **not** shown:

FUEL CONTROL switch . . . . RUN

▶▶**Go to step 14**

◆X-BLD is **shown**:

Engine START switch . . . . Pull

FUEL CONTROL switch . . . . RUN

▶▶**Go to step 15**

▼ Continued on next page ▼

▼ ENG 1, 2, 3, 4 FAIL continued ▼

13 Choose one:

◆X-BLD is **not** shown:

CONT IGNITION switch . . . . .ON

FUEL CONTROL switch . . . . .RUN

►►Go to step 14

◆X-BLD is **shown**:

Engine START switch . . . . Pull

When N2 exceeds the fuel-on indicator:

FUEL CONTROL switch . . . . .RUN

►►Go to step 15

14 Choose one:

◆EGT **does not** increase within 30 seconds **or** an abort start condition as listed in normal procedures **occurs**:

FUEL CONTROL switch . . . . Confirm . . . . . CUTOFF

■ ■ ■ ■

◆Start is **normal**:

Transponder mode selector . . . . TA/RA

▼ Continued on next page ▼

▼ ENG 1, 2, 3, 4 FAIL continued ▼

15 Choose one:

◆ EGT **does not** increase within 30 seconds **or** an abort start condition as listed in normal procedures **occurs**:

FUEL CONTROL switch . . . . Confirm . . . . . CUTOFF

Engine START switch . . . . .Push

■ ■ ■ ■

◆ Start is **normal**:

Transponder mode selector . . . . .TA/RA

■ ■ ■ ■

ENG 1, 2, 3, 4 FAIL

405

Condition: One of these occurs:
- An engine failure
- An engine flameout

1 **If** more than one ENG FAIL message is shown:

  ▶▶**Go to the ENG 1, 2, 3, 4 FAIL or Multiple Engine Flameout or Stall checklist on page 7.8**

2 Thrust lever . . . . Confirm . . . . Idle

3 FUEL CONTROL switch. . . . . Confirm . . . CUTOFF

4 Transponder mode selector . . . . TA

5 Do **not** accomplish the following checklist:

  ENG SHUTDOWN

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

7 Choose one:

◆Restart **is not** needed:

■ ■ ■ ■

◆Restart **is** needed:

  ▶▶**Go to step 8**

8 Monitor EGT during start.

▼ **Continued on next page** ▼

▼ ENG 1, 2, 3, 4 FAIL continued ▼

9 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.

10 If N2 is steadily increasing, and EGT stays within limits, the start is progressing normally.

11 AUTO IGNITION selector . . . . BOTH

12 Choose one:

◆ X-BLD is **not** shown:

CONT IGNITION switch. . . . . ON

FUEL CONTROL switch . . . . RUN

►► **Go to step 13**

◆ X-BLD is **shown**:

Engine START switch . . . . Pull

FUEL CONTROL switch . . . . RUN

►► **Go to step 14**

▼ Continued on next page ▼

▼ **ENG 1, 2, 3, 4 FAIL continued** ▼

13 Choose one:

◆EGT **does not** increase within 30 seconds **or** an abort start condition as listed in normal procedures **occurs**:

FUEL CONTROL switch . . . . Confirm . . . . . CUTOFF

■ ■ ■ ■

◆Start is **normal**:

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

14 Choose one:

◆EGT **does not** increase within 30 seconds **or** an abort start condition as listed in normal procedures **occurs**:

FUEL CONTROL switch . . . . Confirm . . . . . CUTOFF

Engine START switch . . . . Push

■ ■ ■ ■

◆Start is **normal**:

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

■ ■ ■ ■

ENG 1, 2, 3, 4 FUEL FILT

Condition: Fuel contamination can cause fuel to bypass the fuel filter.

1 Erratic engine operation and flameout may occur due to fuel contamination.

■ ■ ■ ■

ENG 1, 2, 3, 4 FUEL VLV

Condition: One or more of these occur:
- The engine fuel valve is not in the commanded position
- The fuel spar valve is not in the commanded position

1 Choose one:

◆In **flight**:

■ ■ ■ ■

◆On the **ground**

Do not attempt an engine start.

■ ■ ■ ■

>ENG 1, 2, 3, 4 LIM PROT

570

Condition: The EEC operates in the alternate mode and command N1 is more than the limit.

109, 405

Condition: The EEC operates in the alternate control mode and thrust is approaching maximum rating.

■ ■ ■ ■

ENG 1, 2, 3, 4 LOW IDLE

Condition: Engine idle not in approach setting when commanded.

1 Thrust lever
(affected engine) . . . . Advance until the ENG LOW IDLE message blanks

■ ■ ■ ■

ENG 1, 2, 3, 4 OIL FILT

570

Condition: Oil filter contamination can cause oil to bypass the oil filter.

1 Thrust lever (affected engine) . . . . Confirm. . . Retard slowly until the ENG OIL FILT message blanks

2 Choose one:

◆ ENG OIL FILT message **stays shown** with thrust lever at idle:

FUEL CONTROL switch (affected engine) . . . Confirm . . . CUTOFF

Transponder mode selector . . . . . TA ONLY

Do **not** accomplish the following checklist:

ENG SHUTDOWN

■ ■ ■ ■

◆ ENG OIL FILT message **blanks**:

Run the engine at a thrust level to keep the ENG OIL FILT message from showing.

■ ■ ■ ■

ENG 1, 2, 3, 4 OIL FILT

109, 405

Condition: Oil filter contamination can cause oil to bypass the primary oil filter.

1 Primary engine oil filter approaching bypass condition. Oil flow to the engine will be filtered through the secondary filter element.

■ ■ ■ ■

ENG 1, 2, 3, 4 OIL PRESS

Condition: The oil pressure is low.

1 Choose one:

◆Oil pressure is **above** the red line limit:

■ ■ ■ ■

◆Oil pressure **is at or below** the red line limit:

▶▶**Go to step 2**

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

3 FUEL CONTROL switch
(affected engine) . . . . Confirm . . . . . CUTOFF

109, 405
4 Transponder mode selector . . . . TA

570
5 Transponder mode selector . . . . TA ONLY

▼ **Continued on next page** ▼

▼ ENG 1, 2, 3, 4 OIL PRESS continued ▼

6 Do **not** accomplish the following checklist:

ENG SHUTDOWN

■ ■ ■ ■

ENG 1, 2, 3, 4 OIL TEMP

Condition: The oil temperature is high.

1 Thrust lever
(affected engine) . . . . Confirm. . . Retard slowly until the temperature decreases

570

2 Choose one:

◆ENG OIL TEMP message **blanks:**

Run the engine at a thrust level to keep the ENG OIL TEMP message from showing.

■ ■ ■ ■

◆Oil temperature does **not decrease** below the red line limit or **stays in the amber band** for longer than 15 minutes:

▶▶**Go to step 4**

109, 405

3 Choose one:

◆ENG OIL TEMP message **blanks:**

Run the engine at a thrust level to keep the ENG OIL TEMP message from showing.

■ ■ ■ ■

◆Oil temperature does **not decrease** below the red line limit or **stays in the amber band** for longer than 20 minutes:

▶▶**Go to step 4**

▼ Continued on next page ▼

▼ **ENG 1, 2, 3, 4 OIL TEMP continued** ▼

4 Thrust lever
(affected engine) . . . . Confirm . . . . Idle

5 FUEL CONTROL switch
(affected engine) . . . . Confirm . . . CUTOFF

109, 405

6 Transponder mode selector . . . . TA

570

7 Transponder mode selector . . . . TA ONLY

8 Do **not** accomplish the following checklist:

ENG SHUTDOWN

■ ■ ■ ■

>ENG 1, 2, 3, 4 REVERSER

405, 570
(SB changes 109 ; installs engine thrust reverser locks)

Condition: A fault occurs in the thrust reverser system.

■ ■ ■ ■

ENG 1, 2, 3, 4 REVERSER

(SB changes 109 ; before SB, engine thrust reverser locks not installed)

Condition: A fault occurs in the thrust reverser system.

1 Further system faults may cause in-flight deployment.

2 Expect normal reverser operation after landing.

■ ■ ■ ■

>ENG 1, 2, 3, 4 RPM LIM

570

Condition: The N2 red line limit restricts the engine's thrust.

109, 405

Condition: The N1 or N2 red line limit restricts the engine's thrust.

■ ■ ■ ■

>ENG 1, 2, 3, 4 SHUTDOWN

Condition: The engine was shut down by the fuel control switch or the engine fire switch.

■ ■ ■ ■

ENG 1, 2, 3, 4 START VLV

Condition: The start valve is not in the commanded position.

1 In-flight or ground start using bleed air source may be unsuccessful.

2 **If** in flight:

Increase airspeed until X-BLD is no longer shown.

■ ■ ■ ■

>ENG CONTROLS

Condition: Three or four EEC systems operate in a degraded mode. The systems do not have full redundancy.

■ ■ ■ ■

ENG IGNITION

Condition: The continuous ignition system is failed.

1 STBY IGNITION selector . . . . .1 or 2

■ ■ ■ ■

Engine In-flight Start

570

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

1 Monitor EGT during start.

2 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.

3 If N2 is steadily increasing, and EGT stays within limits, the start is progressing normally.

4 Choose one:

◆X-BLD is **not** shown:

FUEL CONTROL switch . . . . RUN

▶▶**Go to step 6**

◆X-BLD is **shown**:

Engine START switch . . . . Pull

▶▶**Go to step 5**

▼ **Continued on next page** ▼

▼ **Engine In-flight Start continued** ▼

5 Choose one:

◆AUTOSTART switch is **ON**:

FUEL CONTROL switch . . . . RUN

►►**Go to step 6**

◆AUTOSTART switch is **Off**:

When N2 exceeds the fuel-on indicator:

FUEL CONTROL switch . . . . RUN

►►**Go to step 6**

6 Choose one:

◆An abort start condition as listed in normal procedures **occurs**:

FUEL CONTROL switch . . . . Confirm . . . . CUTOFF

Engine START switch . . . . .Push or verify pushed

■ ■ ■ ■

◆Start is **normal**:

Transponder mode selector . . . . .TA/RA

■ ■ ■ ■

Engine In-flight Start

109

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

1 Monitor EGT during start.

2 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.

3 If N2 is steadily increasing, and EGT stays within limits, the start is progressing normally.

4 Choose one:

◆AUTOSTART switch is **ON**:

▶▶**Go to step 5**

◆AUTOSTART switch is **Off**:

AUTO IGNITION selector . . . . BOTH

▶▶**Go to step 6**

▼ **Continued on next page** ▼

▼ **Engine In-flight Start continued** ▼

5 Choose one:

◆X-BLD is **not** shown:

FUEL CONTROL switch . . . . RUN

►►**Go to step 7**

◆X-BLD is **shown**:

Engine START switch . . . . Pull

FUEL CONTROL switch . . . . RUN

►►**Go to step 8**

6 Choose one:

◆X-BLD is **not** shown:

CONT IGNITION switch. . . . . ON

FUEL CONTROL switch . . . . RUN

►►**Go to step 7**

◆X-BLD is **shown**:

Engine START switch . . . . Pull

When N2 exceeds the fuel-on indicator:

FUEL CONTROL switch . . . . RUN

►►**Go to step 8**

▼ **Continued on next page** ▼

▼ **Engine In-flight Start continued** ▼

7 Choose one:

◆EGT **does not** increase within 30 seconds **or** an abort start condition as listed in normal procedures **occurs**:

FUEL CONTROL switch . . . . Confirm . . . . . CUTOFF

■ ■ ■ ■

◆Start is **normal**:

Transponder mode selector . . . . TA/RA

■ ■ ■ ■

8 Choose one:

◆EGT **does not** increase within 30 seconds **or** an abort start condition as listed in normal procedures **occurs**:

FUEL CONTROL switch . . . . Confirm . . . . . CUTOFF

Engine START switch . . . . Push

■ ■ ■ ■

◆Start is **normal**:

Transponder mode selector . . . . TA/RA

■ ■ ■ ■

Intentionally
Blank

Engine In-flight Start

405

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

1 Monitor EGT during start.

2 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.

3 If N2 is steadily increasing, and EGT stays within limits, the start is progressing normally.

4 AUTO IGNITION selector . . . . BOTH

5 Choose one:

◆X-BLD is **not** shown:

CONT IGNITION switch. . . . . .ON

FUEL CONTROL switch . . . . RUN

►►**Go to step 6**

◆X-BLD is **shown**:

Engine START switch . . . . Pull

FUEL CONTROL switch . . . . RUN

►►**Go to step 7**

▼ **Continued on next page** ▼

▼ **Engine In-flight Start continued** ▼

6 Choose one:

◆ EGT **does not** increase within 30 seconds **or** an abort start condition as listed in normal procedures **occurs**:

FUEL CONTROL switch . . . . Confirm . . . . . CUTOFF

■ ■ ■ ■

◆ Start is **normal**:

Transponder mode selector . . . . .TA/RA

■ ■ ■ ■

7 Choose one:

◆ EGT **does not** increase within 30 seconds **or** an abort start condition as listed in normal procedures **occurs**:

FUEL CONTROL switch . . . . Confirm . . . . . CUTOFF

Engine START switch . . . . .Push

■ ■ ■ ■

◆ Start is **normal**:

Transponder mode selector . . . . .TA/RA

■ ■ ■ ■

>IDLE DISAGREE

Condition: One or more engines are at approach idle and one or more engines are at minimum idle.

■ ■ ■ ■

Reverser Unlocked

Condition: The reverse annunciation shows with intentional reverse thrust not selected.

1 Choose one:

◆With **no** yaw, loss of airspeed, or buffet:

Run the engine normally.

■ ■ ■ ■

◆**With** yaw, loss of airspeed, or buffet:

▶▶**Go to step 2**

2 FUEL CONTROL switch
(affected engine) . . . . Confirm . . . . . CUTOFF

3 Do **not** accomplish the following checklist:

ENG SHUTDOWN

109, 405

4 Transponder mode selector . . . . TA

570

5 Transponder mode selector . . . . TA ONLY

6 Buffet may be reduced by decreasing airspeed.

▼ Continued on next page ▼

▼ Reverser Unlocked continued ▼

7 Plan to use flaps 25 and VREF 30+20 for landing.

8 **Checklist Complete Except Deferred Items**

Deferred Items

Descent Checklist

Recall . . . . Checked

Autobrake . . . . ___

Landing data . . . . . **VREF 30+20, Minimums___**

Approach briefing . . . . COMPLETED

Approach Checklist

Altimeters . . . . ___

Landing Checklist

Speedbrake . . . . Armed

Landing gear . . . . DOWN

Flaps **25**

■ ■ ■ ■

STARTER CUTOUT 1, 2, 3, 4

Condition: Start valve does not close.

1 Engine START switch (affected engine) . . . . Push

2 Choose one:

◆STARTER CUTOUT message **blanks**:

■ ■ ■ ■

◆STARTER CUTOUT message **stays shown**:

▶▶**Go to step 3**

3 ENGINE BLEED air switch
(affected engine) . . . . OFF

4 Nacelle anti-ice for the affected engine is not available.

570

5 Reverse thrust for the affected engine is not available.

■ ■ ■ ■

Intentionally
Blank

Two Engines Inoperative

Condition: A two engine landing is needed.

1 The autothrottle is inoperative.

2 **Checklist Complete Except Deferred Items**

Deferred Items

Landing commit point is gear extension.

Warning! Go-Around after passing the landing commit point is not recommended. Performance is not assured.

Use Flaps 25 and VREF 25 for landing.

PACK control selectors . . . . Two packs OFF

Descent Checklist

Recall . . . . Checked

Autobrake . . . . ____

Landing data . . . . **VREF 25, Minimums**____

Approach briefing . . . . COMPLETED

Approach Checklist

Altimeters . . . . ____

▼ Continued on next page ▼

▼ Two Engines Inoperative continued ▼

Go-around procedure review

If a go-around is absolutely required:

Do not use TO/GA

Set flaps 20, at the same time increase thrust as airspeed increases while maintaining directional control

Retract the landing gear without delay

Retract flaps to flaps 1 on schedule. Descent may be required

Climb at VREF 30+60.

Extend the landing gear and select flaps 20 at glideslope intercept, or at final descent point.

Approaching 1,000’ AGL select flaps 25 and center rudder trim.

Landing Checklist

Speedbrake . . . . Armed

Landing gear . . . . DOWN

Flaps **25**

■ ■ ■ ■

Volcanic Ash

Condition: Volcanic ash is suspected when one or more of these occur:
- A static discharge around the windshield
- A bright glow in the engine inlets
- Smoke or dust on the flight deck
- 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 degree turn.

109, 405

1 Don the oxygen masks, if needed.

570

2 Don oxygen masks and smoke goggles, if needed.

3 Establish crew communications, if needed.

4 Autothrottle disconnect switch . . . . Push

This allows the thrust levers to stay where manually positioned.

If conditions allow, run the engines at idle

5 Thrust levers. . . . . Idle

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

6 CONT IGNITION switch . . . . .ON

7 PACK control selectors (all) . . . . .NORM

Continued on next page

Volcanic Ash continued

8 HI FLOW switch . . . . ON

9 NACELLE ANTI–ICE switches . . . . ON

This increases bleed air extraction to improve engine stall margins.

10 WING ANTI–ICE switch . . . . ON

This increases bleed air extraction to improve engine stall margins.

Continued on next page

▼ Volcanic Ash continued ▼

11 **If** any engine is flamed out or stalled, or EGT is rapidly approaching or exceeding limit:

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.

FUEL CONTROL switch (affected engines) . . . . . Confirm . . . CUTOFF, then RUN

109, 405

If airspeed less than 200 KIAS:

PACK control selectors . . . . SET

Set a maximum of one pack on.

ENGINE START SWITCH (Affected engines) . . . . PULL

570

If airspeed is less than 220 KIAS:

PACK control selectors . . . . Set a maximum of one pack on

Engine START switch (affected engines) . . . . Pull

109, 405

12 AUTO IGNITION selector . . . . BOTH

▼ Continued on next page ▼

▼ **Volcanic Ash continued** ▼

13 Volcanic ash can cause abnormal system operation such as:

Engine malfunctions, increasing EGT, unusually high EGT, compressor stall, or flameout

Decreased or complete loss of airspeed indications

Equipment cooling system malfunctions

Cargo fire indications.

14 Plan to land at nearest suitable airport.

■ ■ ■ ■

Intentionally
Blank

Table of Contents

Table of Contents

APU

FIRE APU

Condition: Fire is detected in the APU.

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

2 Choose one:

◆ FIRE APU message **stays shown**:

Plan to land at the nearest suitable airport.

▶▶**Go to step 3**

◆ FIRE APU message **blanks**:

▶▶**Go to step 3**

3 Do **not** accomplish the following checklist:

APU

■ ■ ■ ■

FIRE ENG 1, 2, 3, 4 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 Thrust lever
(affected engine) . . . . Confirm. . . . . Idle

2 FUEL CONTROL switch
(affected engine) . . . . Confirm. . . . . CUTOFF

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

4 **If** the FIRE ENG message is shown:

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

If after 30 seconds the FIRE ENG message stays shown:

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

Continued on next page

▼ FIRE ENG 1, 2, 3, 4 or Engine Severe Damage or Separation continued ▼

5 **If** high vibration occurs and continues after engine shutdown:

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 practical, increasing airspeed may reduce the vibration.

109, 405

►►Go to step 6

570

►►Go to step 7

109, 405

6 Transponder mode selector . . . . TA

570

7 Transponder mode selector . . . . TA ONLY

8 For severe engine damage, separation, or an engine fire that does not extinguish:

Plan to land at the nearest suitable airport.

9 Do **not** accomplish the following checklist:

ENG SHUTDOWN

■ ■ ■ ■

Fire Engine Tailpipe

570

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

1 FUEL CONTROL switch
(affected engine) . . . . CUTOFF

2 Advise the cabin.

3 Choose one:

◆Bleed air is **available**:

PACK control selectors (all) . . . . OFF

This allows maximum bleed air for engine motoring.

AUTOSTART switch . . . . .Off

Engine START switch
(affected engine) . . . . Pull

This allows the EEC to engage the starter below the maximum starter engagement speed.

►►**Go to step 4**

◆Bleed air is **not** available:

►►**Go to step 4**

4 Advise the tower.

▼ **Continued on next page** ▼

▼ Fire Engine Tailpipe continued ▼

5 Choose one:

◆Engine **is being motored**:

Continue to motor until the tailpipe fire is extinguished.

Engine START switch
(affected engine) . . . . .Push

■ ■ ■ ■

◆Engine is **not** being motored:

■ ■ ■ ■

Fire Engine Tailpipe

109, 405

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

1 FUEL CONTROL switch
(affected engine) . . . . CUTOFF

2 Advise the cabin.

109

3 Choose one:

◆ Bleed air is **available**:

PACK control selectors (all) . . . . OFF

This allows maximum bleed air for engine motoring.

If the affected engine start light is extinguished:

Allow the affected N2 to decrease below 20%.

AUTOSTART switch
(affected engine). . . . . .Off

Engine START switch
(affected engine). . . . . Pull

▶▶**Go to step 5**

◆ Bleed air is **not** available:

▶▶**Go to step 5**

▼ Continued on next page ▼

▼ Fire Engine Tailpipe continued ▼

405

4 Choose one:

◆ Bleed air is **available**:

PACK control selectors (all) . . . . OFF

This allows maximum bleed air for engine motoring.

If the affected engine start light is extinguished:

Allow the affected N2 to decrease below 20%.

Engine START switch (affected engine). . . . . Pull

▶▶**Go to step 5**

◆ Bleed air is **not** available:

▶▶**Go to step 5**

5 Advise the tower.

▼ Continued on next page ▼

▼ Fire Engine Tailpipe continued ▼

6 Choose one:

◆ Engine **is being motored**:

Continue to motor until the tailpipe fire is extinguished.

Engine START switch
(affected engine) . . . . Push

■ ■ ■ ■

◆ Engine is **not** being motored:

■ ■ ■ ■

Smoke, Fire or Fumes

109

Condition: Smoke, fire or fumes occurs.

1 Diversion may be needed.

2 Don the oxygen masks, if needed.

3 Establish crew and cabin communications.

4 Advise the cabin crew to turn off the main IFE and PC power switches (as installed).

5 Instruct the cabin crew to turn on the cabin night lighting.

6 UTILITY power switches (both) . . . . Off

7 APU selector . . . . OFF

8 Passenger signs . . . . ON

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

►►Go to the Smoke or Fumes Removal checklist on page 8.42

▼ Continued on next page ▼

▼ **Smoke, Fire or Fumes continued** ▼

10 Choose one:

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

  Isolate and extinguish the source of the smoke, fire or fumes.

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

  ►►**Go to step 11**

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

  ►►**Go to step 12**

11 Choose one:

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

  Continue the flight at the Captain's discretion.

  Restore unpowered items at the Captain's discretion.

  ►►**Go to step 23**

- ◆Source is **not** visually confirmed to be extinguished **or** smoke or fumes **continue**:

  ►►**Go to step 12**

▼ **Continued on next page** ▼

▼ Smoke, Fire or Fumes continued ▼

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

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

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

15 ISLN valve switches (both) . . . . Off

This isolates the left and right sides of the bleed air system.

16 PACK 2 control selector . . . . OFF

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

18 Choose one:

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

PACK 3 control selector . . . . OFF

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

▶▶**Go to step 19**

◆ Smoke or fumes are **decreasing**:

▶▶**Go to step 23**

▼ Continued on next page ▼

19 Choose one:

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

PACK 3 control selector . . . . NORM

PACK 1 control selector . . . . OFF

R ISLN valve switch . . . . .ON

►►**Go to step 20**

◆Smoke or fumes are **decreasing**:

L ISLN valve switch . . . . .ON

►►**Go to step 20**

20 PACK 2 control selector . . . . .NORM

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

22 Choose one:

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

ISLN switches (both) . . . . On

PACK 1 control selector . . . . NORM

Consider an immediate landing.

►►**Go to step 23**

◆Smoke or fumes are **decreasing**:

►►**Go to step 23**

▼ Continued on next page ▼

▼ **Smoke, Fire or Fumes continued** ▼

23 Do **not** accomplish the following checklists:

CARGO DET AIR

ELEC UTIL BUS L, R

FUEL OVRD 2, 3 FWD

FUEL PRESS CTR L

FUEL PUMP 2, 3 FWD

HUMID FLT DK

TEMP ZONE

TRIM AIR OFF

► ►**Go to the Smoke or Fumes Removal checklist on page 8.42, if needed**

■ ■ ■ ■

Smoke, Fire or Fumes

405, 570

Condition: Smoke, fire or fumes occurs.

1 Diversion may be needed.

2 Don the oxygen masks, if needed.

570

3 Don the smoke goggles, if needed.

4 Establish crew communications.

5 Instruct the supernumeraries to turn on the upper deck reading lights.

6 UTILITY power switches (both). . . . . Off

7 FLT DECK FAN switch . . . . Off

8 APU selector . . . . OFF

9 Supernumerary signs . . . . ON

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

▶▶**Go to the Smoke or Fumes Removal checklist on page 8.46**

▼ **Continued on next page** ▼

▼ Smoke, Fire or Fumes continued ▼

11 Choose one:

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

Isolate and extinguish the source of the smoke, fire or fumes.

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

►► **Go to step 12**

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

►► **Go to step 13**

12 Choose one:

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

Continue the flight at the Captain's discretion.

Restore unpowered items at the Captain's discretion.

►► **Go to step 24**

◆ Source **is not** visually confirmed extinguished **or** smoke or fumes **continue**:

►► **Go to step 13**

▼ Continued on next page ▼

▼ **Smoke, Fire or Fumes continued** ▼

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

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

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

16 ISLN valve switches (both) . . . . Off

This isolates the left and right sides of the bleed air system.

17 PACK 2 control selector . . . . OFF

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

19 Choose one:

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

PACK 3 control selector . . . . OFF

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

►► **Go to step 20**

◆ Smoke or fumes are **decreasing**:

►► **Go to step 24**

▼ **Continued on next page** ▼

▼ Smoke, Fire or Fumes continued ▼

20 Choose one:

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

PACK 3 control selector . . . . .NORM

PACK 1 control selector . . . . OFF

R ISLN valve switch . . . . .ON

►►**Go to step 21**

◆Smoke or fumes are **decreasing**:

L ISLN valve switch . . . . .ON

►►**Go to step 21**

21 PACK 2 control selector . . . . .NORM

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

23 Choose one:

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

ISLN valve switches (both) . . . . On

PACK 1 control selector . . . . .NORM

Consider an immediate landing.

►►**Go to step 24**

◆Smoke or fumes are **decreasing**:

►►**Go to step 24**

▼ Continued on next page ▼

▼ **Smoke, Fire or Fumes continued** ▼

24 Do **not** accomplish the following checklists:

570
CARGO DET AIR

ELEC UTIL BUS L, R

FUEL OVRD 2, 3 FWD

FUEL PRESS CTR L

FUEL PUMP 2, 3 FWD

TEMP ZONE

TRIM AIR OFF

►►**Go to the Smoke or Fumes Removal checklist on page 8.46, if needed**

■ ■ ■ ■

>BOTTLE LOW APU

Condition: The APU fire bottle pressure is low.

■ ■ ■ ■

>BTL LO L ENG A, B

Condition: The left wing fire bottle A or B pressure is low.

■ ■ ■ ■

>BTL LO R ENG A, B

Condition: The right wing fire bottle A or B pressure is low.

■ ■ ■ ■

>CARGO DET AIR

109, 570

Condition: Cargo smoke detection airflow is not sufficient.

■ ■ ■ ■

>CGO BTL DISCH

Condition: One of these occurs:
- On the ground, a cargo fire bottle pressure is low
- In flight, both cargo fire bottles A and B are discharged

■ ■ ■ ■

>DET FIRE APU

Condition: APU fire detection is inoperative.

■ ■ ■ ■

>DET FIRE/OHT 1, 2, 3, 4

Condition: Engine fire and overheat detection is inoperative.

■ ■ ■ ■

AFT

FIRE CARGO AFT

109

Condition: Smoke is detected in the lower aft cargo compartment.

1 AFT CARGO FIRE ARM switch . . . . Confirm. . . . . ARMED

SATCOM will shut down to prevent overheating.

Pack 3 shuts down.

2 PACK 3 control selector . . . . OFF

3 PACK 1 or 2 control selector . . . . OFF, set a maximum of one pack on

4 CARGO FIRE DISCH switch . . . . Push and hold for one second

195 minutes of fire suppression are available.

5 Choose one:

◆ Airplane is **at or below** 8,000 feet:

▶▶**Go to step 9**

◆ Airplane is **above** 8,000 feet:

▶▶**Go to step 6**

6 LDG ALT switch . . . . MAN

7 LDG ALT selector . . . . Set the landing altitude between 8,000 and 8,500 to command cabin altitude to 8,000 feet

▼ **Continued on next page** ▼

▼ **FIRE CARGO AFT continued** ▼

8 Direct personnel to remove power from all galley chillers. An operating galley chiller may allow smoke to enter the cabin.

9 Plan to land at the nearest suitable airport

10 Do **not** accomplish the following checklist:

LANDING ALT

11 **Checklist Complete Except Deferred Items**

Deferred Items

Before descent

LDG ALT switch . . . . AUTO

Descent Checklist

Recall . . . . Checked

Autobrake . . . . ____

Landing data . . . . .VREF____, Minimums____

Approach briefing . . . . Completed

Approach Checklist

Altimeters . . . . ____

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

▼ **Continued on next page** ▼

▼ FIRE CARGO AFT continued ▼

Landing Checklist

Speedbrake . . . . Armed

Landing gear . . . . DOWN

Flaps . . . . ___

■ ■ ■ ■

AFT

FIRE CARGO AFT

405, 570

Condition: Smoke is detected in the lower aft cargo compartment.

1 AFT CARGO FIRE
ARM switch . . . . Confirm. . . . . ARMED

SATCOM will shut down to prevent overheating.

System shuts down two packs and respective PACK EICAS messages are shown.

2 PACKS control selectors
(affected packs) . . . . OFF, set a maximum of one pack on

3 CARGO FIRE DEPRESS/
DISCH switch . . . . Push and hold for one second

405
334 minutes of fire suppression are available.

570
210 minutes of fire suppression are available.

4 Choose one:

◆Airplane is **at or below** 8,000 feet:

►►**Go to step 7**

◆Airplane is **above** 8,000 feet:

►►**Go to step 5**

5 LDG ALT switch . . . . MAN

▼ **Continued on next page** ▼

▼ FIRE CARGO AFT continued ▼

6 LDG ALT selector . . . . Set the landing altitude between 8,000 and 8,500 to command cabin altitude to 8,000 feet

7 Plan to land at the nearest suitable airport

8 Do **not** accomplish the following checklist:

LANDING ALT

9 **Checklist Complete Except Deferred Items**

▼ Continued on next page ▼

▼ FIRE CARGO AFT continued ▼

Deferred Items

Before descent

LDG ALT switch . . . . AUTO

Descent Checklist

Recall . . . . Checked

Autobrake . . . . ____

Landing data . . . . .VREF____, Minimums____

Approach briefing . . . . Completed

Approach Checklist

Altimeters . . . . ____

Warning! Inform ground personnel not to open the cargo door until all supernumeraries and crew have exited the airplane and fire fighting equipment is nearby.

Landing Checklist

Speedbrake . . . . Armed

Landing gear . . . . DOWN

Flaps . . . . ____

■ ■ ■ ■

FWD

FIRE CARGO FWD

109

Condition: Smoke is detected in the lower forward cargo compartment.

1 FWD CARGO FIRE ARM switch . . . . Confirm. . . . . ARMED

SATCOM will shut down to prevent overheating.

Pack 3 shuts down.

2 PACK 3 control selector . . . . OFF

3 PACK 1 or 2 control selector . . . . OFF, set a maximum of one pack on

4 CARGO FIRE DISCH switch . . . . Push and hold for one second

195 minutes of fire suppression are available.

5 Choose one:

◆Airplane is **at or below** 8,000 feet:

▶▶**Go to step 9**

◆Airplane is **above** 8,000 feet:

▶▶**Go to step 6**

6 LDG ALT switch . . . . MAN

7 LDG ALT selector . . . . Set the landing altitude between 8,000 and 8,500 to command cabin altitude to 8,000 feet

▼ Continued on next page ▼

8 Direct personnel to remove power from all galley chillers. An operating galley chiller may allow smoke to enter the cabin.

9 Plan to land at the nearest suitable airport

10 Do **not** accomplish the following checklist:

LANDING ALT

11 **Checklist Complete Except Deferred Items**

Deferred Items

Before descent

LDG ALT switch . . . . AUTO

Descent Checklist

Recall . . . . Checked

Autobrake . . . . ____

Landing data . . . . .VREF____, Minimums____

Approach briefing . . . . Completed

Approach Checklist

Altimeters . . . . ____

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

▼ Continued on next page ▼

▼ FIRE CARGO FWD continued ▼

Landing Checklist

Speedbrake . . . . Armed

Landing gear . . . . DOWN

Flaps . . . . ___

■ ■ ■ ■

FWD

FIRE CARGO FWD

405, 570

Condition: Smoke is detected in the lower forward cargo compartment.

1 FWD CARGO FIRE ARM switch . . . . Confirm. . . . . ARMED

SATCOM will shut down to prevent overheating.

System shuts down two packs and respective PACK EICAS messages are shown.

2 PACKS control selectors (affected packs) . . . . OFF, set a maximum of one pack on

3 CARGO FIRE DEPRESS/ DISCH switch . . . . Push and hold for one second

405
334 minutes of fire suppression are available.

570
210 minutes of fire suppression are available.

4 Choose one:

◆Airplane is **at or below** 8,000 feet:

▶▶**Go to step 7**

◆Airplane is **above** 8,000 feet:

▶▶**Go to step 5**

5 LDG ALT switch . . . . .MAN

▼ Continued on next page ▼

▼ FIRE CARGO FWD continued ▼

6 LDG ALT selector . . . . Set the landing altitude between 8,000 and 8,500 to command cabin altitude to 8,000 feet

7 Plan to land at the nearest suitable airport

8 Do **not** accomplish the following checklist:

LANDING ALT

9 **Checklist Complete Except Deferred Items**

▼ Continued on next page ▼

▼ **FIRE CARGO FWD continued** ▼

Deferred Items

Before descent

LDG ALT switch . . . . AUTO

Descent Checklist

Recall . . . . Checked

Autobrake . . . . ____

Landing data . . . . .VREF____, Minimums____

Approach briefing . . . . Completed

Approach Checklist

Altimeters . . . . ____

Warning! Inform ground personnel not to open the cargo door until all supernumeraries and crew have exited the airplane and fire fighting equipment is nearby.

Landing Checklist

Speedbrake . . . . Armed

Landing gear . . . . DOWN

Flaps . . . . ____

■ ■ ■ ■

MAIN DECK

FIRE MAIN DECK
FIRE MN DK AFT, FWD, MID

405, 570

Condition: Smoke is detected in the main deck cargo area(s).

1 Don the oxygen masks.

2 Establish crew communications.

3 SUPRNMRY OXY switch . . . . ON

4 MAIN Deck CARGO FIRE
ARM switch . . . . Confirm . . . . ARMED

SATCOM will shut down to prevent overheating.

System shuts down two packs and respective PACK EICAS messages are shown.

5 PACK control selectors
(affected packs) . . . . OFF, set a maximum of one pack on

6 CARGO FIRE
DEPRES/DISCH switch . . . . Push and hold for one second

7 Climb or descend to 25,000 feet when conditions and terrain allow.

8 Plan to land at the nearest suitable airport.

▼ Continued on next page ▼

▼ FIRE MAIN DECK continued ▼

9 Do **not** accomplish the following checklists:

CABIN ALTITUDE or Rapid Depressurization

TEMP ZONE

TRIM AIR OFF

10 **Checklist Complete Except Deferred Items**

Deferred Items

Before descent

LDG ALT switch . . . . AUTO

Descent Checklist

Recall . . . . Checked

Autobrake . . . . ____

Landing data . . . . .VREF____, Minimums____

Approach briefing . . . . Completed

---

Approach Checklist

Altimeters . . . . ____

Warning! Inform ground personnel not to open the cargo door until all supernumeraries and crew have exited the airplane and fire fighting equipment is nearby.

▼ Continued on next page ▼

Landing Checklist

Speedbrake . . . . Armed

Landing gear . . . . DOWN

Flaps . . . . ___

■ ■ ■ ■

FIRE WHEEL WELL

Condition: Fire is detected in a main wheel well.

1 **When** extending or retracting the landing gear, do not exceed the gear EXTEND limit speed (270K/.82M).

2 Landing gear lever . . . . DN

This attempts to remove and extinguish the fire source.

3 Do not use FMC fuel predictions with gear extended.

4 Choose one:

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

▶▶ **Go to step 5**

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

▶▶ **Go to step 6**

5 **When** the FIRE WHEEL WELL message blanks:

Wait 20 minutes. This attempts to ensure the wheel well fire is extinguished.

Landing gear lever . . . . UP, then OFF

6 Plan to land at the nearest suitable airport.

■ ■ ■ ■

Intentionally
Blank

OVHT ENG 1, 2, 3, 4 NAC

Condition: An overheat is detected in the engine.

1 ENGINE BLEED air
switch (affected engine) . . . . OFF

2 Thrust lever
(affected engine) . . .Confirm . . . . Retard slowly
until the OVHT ENG
NAC message blanks

109, 405
3 Choose one:

◆OVHT ENG NAC message **stays shown**:

Thrust lever
(affected engine) . . .Confirm . . . . Idle

FUEL CONTROL switch
(affected engine) . . .Confirm . . . CUTOFF

►►**Go to step 4**

◆OVHT ENG NAC message **blanks**:

Run the engine at reduced thrust to keep the OVHT ENG NAC message from showing.

►►**Go to step 4**

109, 405
4 Transponder mode selector . . . . TA

▼ **Continued on next page** ▼

▼ OVHT ENG 1, 2, 3, 4 NAC continued ▼

570

5 Choose one:

◆OVHT ENG NAC message **stays shown**:

Thrust lever
(affected engine) . . . Confirm . . . . Idle

FUEL CONTROL switch
(affected engine) . . . Confirm . . . CUTOFF

▶▶**Go to step 6**

◆OVHT ENG NAC message **blanks**:

Run the engine at reduced thrust to keep the OVHT ENG NAC message from showing.

▶▶**Go to step 6**

570

6 Transponder mode selector . . . . TA ONLY

7 Do **not** accomplish the following checklists:

BLEED OFF

ENG SHUTDOWN

■ ■ ■ ■

>SMOKE CREW REST

570

Condition:	Smoke detected in upper deck crew rest area.

■ ■ ■ ■

SMOKE DR 5 REST

109

Condition: Smoke detected in door 5 crew rest area.

1 Establish communications with the cabin crew.

2 Choose one:

◆Smoke is **persistent**:

Plan to land at the nearest suitable airport.

■ ■ ■ ■

◆Smoke is **cleared** and the fire is visually confirmed to be **extinguished**:

▶▶**Go to step 3**

3 Instruct a cabin crew member to push the Crew Reset switch on the bottom of the Crew Rest Temperature Selector panel. This returns the packs to normal flow by resetting the recirculation fans.

4 **After** the Crew Reset switch is pushed:

PACK RST switch . . . . Push

This may be needed to complete the reset.

■ ■ ■ ■

>SMOKE LAVATORY

109

Condition: Smoke is detected in a lavatory.

■ ■ ■ ■

Intentionally
Blank

Smoke or Fumes Removal

109

Condition: Smoke or fumes removal is needed.

Objective: To remove smoke or fumes through the smoke override valve, or the smoke evacuation port, or a cabin door.

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. This prevents smoke or fumes from penetrating onto the flight deck.

4 EQUIP COOLING selector. . . . . .OVRD

▼ Continued on next page ▼

▼ **Smoke or Fumes Removal continued** ▼

5 Choose one:

◆ Smoke or fumes does **not** persist and is **not** severe:

►► **Go to the Smoke, Fire or Fumes checklist on page 8.9 and do the remaining steps**

■ ■ ■ ■

◆ Smoke or fumes **persists or** is **severe** and the smoke or fumes source is determined to be on the **flight deck**:

Pull the smoke evacuation handle. Pulling the smoke evacuation handle when smoke or fumes source is not on the flight deck may bring the smoke or fumes into the flight deck.

►► **Go to the Smoke, Fire or Fumes checklist on page 8.9 and do the remaining steps**

■ ■ ■ ■

◆ Smoke or fumes **persists or** is **severe** and the smoke or fumes source is determined to be in the **cabin**:

►► **Go to step 6**

6 LDG ALT switch . . . . MAN

▼ **Continued on next page** ▼

▼ Smoke or Fumes Removal continued ▼

7 LDG ALT selector . . . . Set the landing altitude between 8000 and 8500 to command the cabin altitude to 8,000 feet

8 EQUIP COOLING selector. . . . . .NORM

9 Start a descent. Level off at the lowest safe altitude or 8,500 feet, whichever is higher.

10 OUTFLOW VALVES MAN switches (both) . . . . . .ON

11 OUTFLOW VALVES manual control . . . . OPEN

12 Do **not** accomplish the following checklists:

CABIN ALT AUTO

LANDING ALT

OUTFLOW VLV L, R

13 Set airspeed at 200 KIAS or less.

14 Determine the cabin doors to be opened.

If the smoke or fumes concentration is determined to be in the forward section of the cabin, a door 1 or door 2 and a door 4 or door 5 must be opened.

If the smoke or fumes concentration is determined to be in the aft section of the cabin, open a door 2 only.

▼ Continued on next page ▼

▼ **Smoke or Fumes Removal continued** ▼

15 Advise the cabin crew to open the door(s).

Move the door mode select lever to MANUAL and rotate and secure the handle in the 12 o'clock position.

16 **When** the smoke or fumes has cleared:

Advise the cabin crew to close the door(s).

Move the door mode select lever to AUTOMATIC. The forward door must be closed before closing the aft door.

►►**Go to the Smoke, Fire or Fumes checklist on page 8.9 and do the remaining steps**

■ ■ ■ ■

Smoke or Fumes Removal

405, 570

Condition: Smoke or fumes removal is needed.

Objective: To remove smoke or fumes through the smoke override valve, or the smoke evacuation port.

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 EQUIP COOLING selector. . . . . .OVRD

This attempts to discharge the smoke or fumes overboard by using the equipment cooling override mode.

▼ Continued on next page ▼

▼ **Smoke or Fumes Removal continued** ▼

4 Choose one:

◆ Smoke or fumes does **not** persist and is **not** severe:

►► **Go to the Smoke, Fire or Fumes checklist on page 8.14 and do the remaining steps**

■ ■ ■ ■

◆ Smoke or fumes **persists or** is **severe** and the smoke or fumes source is determined to be on the **flight deck**:

Pull the smoke evacuation handle. Pulling the smoke evacuation handle when smoke or fumes source is not on the flight deck may bring the smoke or fumes into the flight deck.

►► **Go to the Smoke, Fire or Fumes checklist on page 8.14 and do the remaining steps**

■ ■ ■ ■

◆ Smoke or fumes **persists or** is **severe** and the smoke or fumes source is determined to be in the **cabin**:

►► **Go to step 5**

5 LDG ALT switch . . . . MAN

▼ **Continued on next page** ▼

▼ **Smoke or Fumes Removal continued** ▼

6 LDG ALT selector . . . . Set the landing altitude between 8000 and 8500 to command the cabin altitude to 8,000 feet.

7 EQUIP COOLING selector. . . . . .NORM

8 Start a descent. Level off at the lowest safe altitude or 8,500 feet, whichever is higher.

9 OUTFLOW VALVES MAN switches (both) . . . . . .ON

10 OUTFLOW VALVES manual control . . . . OPEN

11 Do **not** accomplish the following checklists:

CABIN ALT AUTO

LANDING ALT

OUTFLOW VLV L, R

▶▶**Go to the Smoke, Fire or Fumes checklist on page 8.14 and do the remaining steps**

■ ■ ■ ■

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AILERON LOCKOUT

Condition: An aileron lockout actuator is not in the commanded position.

1 At high airspeed, avoid large or abrupt control wheel inputs.

2 Crosswind limit for landing is 20 knots.

■ ■ ■ ■

>FLAP RELIEF

Condition: Flap load relief occurs.

■ ■ ■ ■

Flap Indication Disagree

Condition: The flap position indication does not reach the selected setting and none of these messages show:
- FLAPS CONTROL
- FLAPS DRIVE
- FLAPS PRIMARY

Objective: To move the flaps normally.

1 Flaps are operating normally.

2 Use the speeds for the selected flap setting.

3 Choose one:

◆ During flap **extension**:

Continue normal flap extension.

■ ■ ■ ■

◆ During flap **retraction**:

►► **Go to step 4**

4 Continue normal flap retraction.

5 The flap position indication may not reach the selected flap position.

6 The pitch limit indication and maximum speed may indicate previous flap setting.

▼ **Continued on next page** ▼

▼ Flap Indication Disagree continued ▼

7 Choose one:

◆ Maximum speed **stays** at 280 knots after normal retraction time with the flaps selected UP:

Plan to land at the nearest suitable airport.

Warning system functions and indications that use flap position data are unreliable.

■ ■ ■ ■

◆ Maximum speed does **not** stay at 280 knots after normal retraction time with the flaps selected UP:

■ ■ ■ ■

FLAPS CONTROL

570

Condition: All flap control units are failed.

Objective: To use alternate flaps.

1 Choose one:

◆During flap **retraction**:

Limit airspeed to the flaps 5 placard speed while the flaps are between UP and 5.

▶▶**Go to step 2**

◆During flap **extension**:

▶▶**Go to step 2**

2 Use flaps 25 and VREF 25 for landing.

3 Plan additional time for flap operation.

4 ALTN FLAPS ARM switch . . . . ALTN

5 ALTN FLAPS selector . . . . .Move the alternate flap selector to EXT or RET to extend or retract the flaps on schedule

6 **Checklist Complete Except Deferred Items**

Deferred Items

Descent Checklist

Recall . . . . Checked

Autobrake . . . . ____

Landing data . . . . **VREF 25, Minimums**____

▼ **Continued on next page** ▼

▼ **FLAPS CONTROL continued** ▼

Approach briefing . . . . COMPLETED

Approach Checklist

Altimeters . . . . ____

Landing Checklist

Speedbrake . . . . Armed

Landing gear . . . . DOWN

Flaps **25**

■ ■ ■ ■

FLAPS CONTROL

109, 405

Condition:	All flap control units are failed.
Objective:	To use alternate flaps. Flaps still extend or retract normally with an inoperative flap position indication.

1 Choose one:

◆ During flap **retraction**:

Limit airspeed to the flaps 5 placard speed while the flaps are between 5 and UP.

▶▶**Go to step 2**

◆ During flap **extension**:

▶▶**Go to step 2**

2 Use flaps 25 and VREF 25 for landing.

3 Plan additional time for flap operation.

4 ALTN FLAPS ARM switch . . . . ALTN

5 ALTN FLAPS selector . . . . Move to EXT or RET to extend or retract the flaps on schedule

▼ Continued on next page ▼

▼ **FLAPS CONTROL continued** ▼

6 Choose one:

◆Expanded flap position indication is **operative**:

▶▶**Go to step 14**

◆Expanded flap position indication is **inoperative**:

▶▶**Go to step 7**

7 Autopilots are inoperative.

8 Outboard ailerons are unlocked.

9 At high airspeed, avoid large or abrupt control wheel inputs.

▼ **Continued on next page** ▼

▼ **FLAPS CONTROL continued** ▼

10 Choose one:

◆During flap **extension**:

Maintain flaps UP maneuvering speed.

Slow to flaps 5 maneuvering speed after 3 minutes and 45 seconds with the alternate flap selector in EXT.

Slow to flaps 25 approach speed after 5 minutes total.

Do not fly in stick shaker.

Extend the gear after the flaps are extended.

GND PROX FLAP OVRD switch . . . . . OVRD

►►**Go to step 14**

◆During flap **retraction**:

►►**Go to step 11**

11 Do not exceed 20,000 feet until flaps are UP.

12 At gross weights above 308,443 kilograms, limit the angle of bank to 15 degrees until flaps are UP.

13 **If** flap retraction is required:

Accelerate to flaps 5 maneuvering speed.

After 90 seconds, accelerate to flaps 5 placard.

After 5 minutes total with alternate flap selector in RET, accelerate to climb speed.

▼ **Continued on next page** ▼

▼ **FLAPS CONTROL continued** ▼

Do not fly in stick shaker.

14 **Checklist Complete Except Deferred Items**

Deferred Items

Descent Checklist

Recall . . . . Checked

Autobrake . . . . ____

Landing data . . . . **VREF 25, Minimums____**

Approach briefing . . . . COMPLETED

Approach Checklist

Altimeters . . . . ____

Landing Checklist

Speedbrake . . . . Armed

Landing gear . . . . DOWN

Flaps **25**

■ ■ ■ ■

FLAPS DRIVE

Condition: One or more of these occur:
- A flap group failed to move in secondary mode
- An asymmetry is detected

1 Do not use alternate flaps. Asymmetry and uncommanded motion protection is not provided in alternate mode.

2 Do **not** use FMC fuel predictions with flaps extended.

3 Use flaps 25 and VREF 30+25 for landing (using flaps primary or secondary).

4 **Checklist Complete Except Deferred Items**

Deferred Items

If the amber minimum maneuvering speed band is above the flap maneuvering speed:

Disconnect the autothrottle.

Use the shown flap maneuvering speeds.

Do **not** accomplish the following checklist:

AIRSPEED LOW

Descent Checklist

Recall . . . . Checked

Autobrake . . . . ____

Landing data . . . . . . **VREF 30+25, Minimums**____

▼ Continued on next page ▼

▼ FLAPS DRIVE continued ▼

Approach briefing . . . . COMPLETED

Approach preparation

GND PROX FLAP OVRD switch . . . . OVRD

Caution! The "CONFIG GEAR" message, master warning lights, and siren may not function when the landing gear is not down and locked, any thrust lever is at idle, radio altitude (RA) is less than 800 feet with any inboard trailing edge flap at 20 or less.

If the inboard trailing edge flaps are affected:

109
Approach idle minimum thrust setting is inoperative.

109
Maintain a minimum thrust setting of 50% N1 at or above 10,000 feet and 45% N1 below 10,000.

CON IGNITION switch . . . . On

405, 570
This provides automatic approach idle. Automatic continuous ignition may be inoperative.

109
Automatic continuous ignition may be inoperative.

▼ Continued on next page ▼

▼ FLAPS DRIVE continued ▼

Approach Checklist

Altimeters . . . . ____

Landing Checklist

Speedbrake . . . . Armed

Landing gear . . . . .DN

Flaps **25**

■ ■ ■ ■

FLAPS PRIMARY

Condition: One or more flap groups primary mode is failed.

1 Plan additional time for flap operation.

■ ■ ■ ■

VALVE CLOSED

>FLT CONT VLVS

Condition: One or more flight control shutoff valves are closed.

■ ■ ■ ■

Jammed Or Restricted Flight Controls

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

1 Overpower the jammed or restricted flight control. Use maximum force, including a combined effort of both pilots, if needed.

2 Do not turn off any flight control hydraulic power switch.

3 Choose one:

◆ Freezing water is **not** the suspected cause:

▶▶**Go to step 4**

◆ Freezing water **is** the suspected cause:

If conditions allow, consider descent to warmer air and attempt to override the jammed or restricted control again.

▶▶**Go to step 4**

4 Choose one:

◆ Faulty system **can not** be overpowered:

Use operative flight controls, trim (including alternate trim), and thrust as needed for airplane control.

■ ■ ■ ■

◆ Faulty system **can** be overpowered:

■ ■ ■ ■

Jammed Stabilizer Landing

Condition: The stabilizer is jammed.

1 Use flaps 25 and VREF 30+20 for landing

2 **Checklist Complete Except Deferred Items**

Deferred Items

Descent Checklist

Recall . . . . Checked

Autobrake . . . . ___

Landing data . . . . . **VREF 30+20, Minimums**___

Approach briefing . . . . COMPLETED

Approach Checklist

Altimeters . . . . ___

Landing Checklist

Speedbrake . . . . Armed

Landing gear . . . . DN

Flaps **25**

■ ■ ■ ■

RUD RATIO DUAL

Condition: Both rudder ratio changers are failed.

1 At high airspeed, avoid large or abrupt rudder inputs.

2 At low airspeed, less than normal rudder may be available.

3 Manual landing crosswind limit is 10 knots.

4 Automatic landing crosswind limits are:

With all engines operating, 10 knots

With an engine inoperative, 5 knots

■ ■ ■ ■

RUD RATIO SNGL

Condition: One rudder ratio changer is failed.

1 At high airspeed, avoid large or abrupt rudder inputs.

2 At low airspeed, less than normal rudder may be available.

3 Landing crosswind limit is 20 knots.

■ ■ ■ ■

SPEEDBRAKE AUTO

Condition: An automatic ground spoiler system fault occurs.

1 Do not arm the speedbrakes. This prevents inadvertent in flight extension.

Deferred Items

Descent Checklist

Recall . . . . Checked

Autobrake . . . . ___

Landing data . . . . .VREF___, Minimums___

Approach briefing . . . . Completed

Approach Checklist

Altimeters . . . . ___

Additional deferred item

Extend the ground spoilers manually after landing.

Landing Checklist

Speedbrake . . . . **DN**

Landing gear . . . . DOWN

Flaps . . . . ___

■ ■ ■ ■

>SPEEDBRAKES EXT

Condition: The speedbrakes are extended and one or more of these occur:
- The radio altitude is between 15 and 800 feet
- The flap lever is in a landing setting
- Two or more thrust levers are not at idle

■ ■ ■ ■

>STAB GREENBAND

Condition: The nose gear pressure switch disagrees with the stabilizer green band calculated by the FMC.

■ ■ ■ ■

>STAB TRIM 2, 3

Condition: One of these occurs:
- Automatic cutout of stabilizer trim
- A stabilizer trim cut out switch is in CUTOUT
- Trim commanded and the respective actuator failed to function

■ ■ ■ ■

STAB TRIM UNSCHD

Condition: One of these occurs:
- Stabilizer movement without a signal to trim and automatic cutout does not occur
- The alternate stabilizer trim switches are used with an autopilot engaged

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

2 Do **not** accomplish the following checklists:

STAB TRIM 2

STAB TRIM 3

3 Higher than normal control column force may be required to prevent unwanted pitch change.

4 Autopilot disengage switch . . . . Push

5 STAB TRIM CUTOUT 2 switch . . . . AUTO

6 Check for correct stabilizer movement. Trim is available after a brief delay.

7 Choose one:

◆ Stabilizer movement is normal:

Continue normal operation.

Autopilot available for use.

■ ■ ■ ■

◆ **Unscheduled stabilizer** movement occurs:

▶▶**Go to step 8**

8 STAB TRIM CUTOUT 2 switch . . . . CUTOUT

9 STAB TRIM CUTOUT 3 switch . . . . AUTO

▼ Continued on next page ▼

▼ **STAB TRIM UNSCHD continued** ▼

10 Check for correct stabilizer movement. Trim is available after a brief delay.

11 Choose one:

◆Stabilizer movement is normal:

Continue normal operation.

Autopilot available for use.

■ ■ ■ ■

◆**Unscheduled stabilizer** movement occurs:

►►**Go to step 12**

12 STAB TRIM CUTOUT 3 switch . . . . CUTOUT

13 Do **not** accomplish the following checklist:

Jammed Stabilizer Landing

14 Use flaps 25 and VREF 30+20 for landing.

15 **Checklist Complete Except Deferred Items**

▼ **Continued on next page** ▼

▼ STAB TRIM UNSCHD continued ▼

Deferred Items

Descent Checklist

Recall . . . . Checked

Autobrake . . . . ____

Landing data . . . . . **VREF 30+20, Minimums**____

Approach briefing . . . . COMPLETED

Approach Checklist

Altimeters . . . . ____

Landing Checklist

Speedbrake . . . . Armed

Landing gear . . . . .DN

Flaps **25**

■ ■ ■ ■

INOP **>YAW DAMPER LWR, UPR**

Condition: A yaw damper is inoperative because one of these occurs:
- A yaw damper system is failed
- An IRU is not aligned

■ ■ ■ ■

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IAS DISAGREE or Airspeed Unreliable

Condition: One or more of these occur:
- The captain's and first officer's airspeed indications disagree by 5 knots or more
- The airspeed or Mach indications are suspected to be unreliable (Items which may indicate Airspeed or Mach Unreliable are listed in the Additional Information section)

Objective: To maintain control using manual pitch and thrust

1 Check pitch attitude and thrust.

2 **If** pitch attitude or thrust are not normal for the phase of flight:

Autopilot disengage switch . . . . .Push

Autothrottle disconnect switch . . . . .Push

F/D switches (both) . . . . OFF

Establish normal pitch attitude and thrust setting for the phase of flight.

Note: Normal pitch attitude and thrust setting are available in the FLIGHT WITH UNRELIABLE AIRSPEED table.

▼ Continued on next page ▼

▼ **IAS DISAGREE or Airspeed Unreliable continued** ▼

109, 405

3 Altitude, vertical speed, and reference EPR indicator may be unreliable.

570

4 Altitude, vertical speed, reference N1 indicator, and maximum N1 may be unreliable.

5 Cross check PFD airspeed displays and standby airspeed indicator. An airspeed display differing by more than 10 knots from the standby indicator should be considered unreliable.

6 Choose one:

◆ Reliable airspeed data source **can be determined**:

AIR DATA SOURCE selectors (both) . . . . . . Select reliable ADC

Invalid overspeed warning and invalid input to AFDS and autothrottle may occur or continue.

Do **not** accomplish the following checklist:

SOURCE SEL ADC

■ ■ ■ ■

◆ Reliable airspeed data source **can not** be determined:

▶▶**Go to step 7**

▼ **Continued on next page** ▼

▼ IAS DISAGREE or Airspeed Unreliable continued ▼

7 Maintain normal pitch attitude and thrust setting for the phase of flight. Refer to the FLIGHT WITH UNRELIABLE AIRSPEED table.

8 **Checklist Complete Except Deferred Items**

▼ Continued on next page ▼

▼ IAS DISAGREE or Airspeed Unreliable continued ▼

Deferred Items

Maintain visual conditions if possible.

Establish landing configuration early.

Use electronic and visual glide slope indicators, where available, for approach and landing.

Refer to IRS ground speed on the CDU POS REF page, and reported wind for approach.

Descent Checklist

Recall . . . . Checked

Autobrake . . . . ___

Landing data . . . . .VREF___, Minimums___

Approach briefing . . . . Completed

Approach Checklist

Altimeters . . . . ___

Landing Checklist

Speedbrake . . . . Armed

Landing gear . . . . DOWN

Flaps . . . . ___

■ ■ ■ ■

▼ Continued on next page ▼

Additional Information

One or more of the following may indicate unreliable airspeed or Mach:

- Speed or altitude information not consistent with pitch attitude and thrust setting.
- Airspeed or Mach failure flags.
- PFD current airspeed box amber.
- Blank or fluctuating airspeed displays.
- Variation between captain's and first officer's airspeed displays.
- Amber line through one or more PFD flight mode annunciations.
- Invalid minimum maneuvering speed.
- Overspeed indications.
- Simultaneous overspeed and stall warnings.
- Radome damage or loss.
- One or more of the following EICAS messages show:

Continued on next page

▼ **IAS DISAGREE or Airspeed Unreliable continued** ▼

109, 405

>OVERSPEED	RUD RATIO DUAL
>AIRSPEED LOW	RUD RATIO SNGL
AILERON LOCKOUT	

570

>OVERSPEED	HEAT P/S CAPT
>AIRSPEED LOW	HEAT P/S F/O
AILERON LOCKOUT	HEAT P/S L, R AUX
RUD RATIO DUAL	RUD RATIO SNGL

ALT DISAGREE

570

Condition: Captain and first officer uncorrected altitude indications disagree by more than 200 feet.

1 Airplane does not meet RVSM airspace requirements.

2 Transponder altitude received by ATC may be unreliable.

3 LANDING PREPARATION:

Maintain visual conditions if possible.

Establish landing configuration early.

Radio altitude reference available below 2, 500 feet.

Use electronic and visual glide slope indicators, where available, for approach and landing.

■ ■ ■ ■

ALT DISAGREE

109, 405

Condition: The captain's and the first officer's altitude indications disagree by more than 200 feet.

Objective: To attempt to select ADCs that do not disagree by more than 200 feet.

1 Transponder altitude received by ATC may be unreliable.

2 Autopilot disengage switch . . . . Push

3 AIR DATA SOURCE selector (Captain) C

4 Choose one:

◆ ALT DISAGREE message **blanks**:

■ ■ ■ ■

◆ ALT DISAGREE message **stays shown**:

►► **Go to step 5**

5 AIR DATA SOURCE selector (First Officer) L

6 Choose one:

◆ ALT DISAGREE message **blanks**:

Engage the L or C autopilot, if needed.

R autopilot is unreliable.

■ ■ ■ ■

◆ ALT DISAGREE message **stays shown**:

►► **Go to step 7**

▼ Continued on next page ▼

▼ ALT DISAGREE continued ▼

7 AIR DATA SOURCE selector (Captain) . . . . R

8 AIR DATA SOURCE selector (First Officer) C

9 Choose one:

◆ ALT DISAGREE message **blanks**:

Engage the R autopilot, if needed.

L and C autopilots are unreliable.

■ ■ ■ ■

◆ ALT DISAGREE message **stays shown**:

►► **Go to step 10**

10 AIR DATA SOURCE selector (Captain) L

11 Choose one:

◆ ALT DISAGREE message **blanks**:

Engage the autopilot, if needed.

■ ■ ■ ■

◆ ALT DISAGREE message **stays shown**:

►► **Go to step 12**

12 Airplane does not meet RVSM airspace requirements.

▼ Continued on next page ▼

▼ ALT DISAGREE continued ▼

13 Maintain visual conditions if possible.

14 Establish landing configuration early.

15 Radio altitude reference available below 2,500 feet.

16 Use electronic and visual glide slope indicators, where available, for approach and landing.

■ ■ ■ ■

>AOA RIGHT

109, 405

Condition: The right angle of attack sensor is failed. AOA system redundancy is lost.

■ ■ ■ ■

>ATTITUDE

Condition: The captain's and the first officer's attitude indications disagree.

■ ■ ■ ■

>BARO DISAGREE

Condition: The captain’s and first officer’s barometric reference settings disagree.

■ ■ ■ ■

>EFIS CONTROL L, R

Condition: (CDU-152) The EFIS control panel is failed.

Condition: (CDU-161) One of these occurs:
- The EFIS control panel is failed
- CDU control of the EFIS is used

■ ■ ■ ■

>EFIS/EICAS C/P

Condition: (CDU-152) Both EFIS control panels and the EICAS display select panel are failed.

Condition: (CDU-161) One of these occurs:
- Both EFIS control panels and the EICAS display select panel are failed
- CDU control of the EFIS and EICAS is used

■ ■ ■ ■

>EIU LEFT

Condition: The left EFIS/EICAS interface unit is failed.

■ ■ ■ ■

>HEADING

Condition: Captain and First Officer selected IRS heading output disagree by 4 degrees or more.

■ ■ ■ ■

>SNGL SOURCE RA

Condition: Both primary flight displays use the same radio altimeter source.

■ ■ ■ ■

>SOURCE SEL ADC

Condition: Both primary flight displays use the same air data source.

■ ■ ■ ■

>SOURCE SEL EIU

Condition: Both pilots' displays use the same EFIS/EICAS interface unit source.

■ ■ ■ ■

>SOURCE SEL F/D

Condition: Both primary flight displays use the same flight director source.

■ ■ ■ ■

>SOURCE SEL IRS

Condition: Both pilots' displays use the same IRS source.

■ ■ ■ ■

>SOURCE SEL NAV

Condition: Both pilots' displays use the same FMC source.

■ ■ ■ ■

>TRACK

Condition: Captain and First Officer selected track output disagree by 6 degrees or more.

■ ■ ■ ■

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FMC LEFT, RIGHT

Condition: An FMC is failed.

1 Choose one:

◆**A single** FMC is failed:

FMC selector . . . . .Select operable FMC

Reengage the autothrottle.

NAV SOURCE selector . . . . .Select operable FMC

■ ■ ■ ■

◆**Both** FMCs are failed:

►►**Go to step 2**

2 NAV SOURCE selector (Captain). . . . . .CDU L or CDU C

3 NAV SOURCE selector (First Officer) . . . . CDU R or CDU C

▼ **Continued on next page** ▼

▼ FMC LEFT, RIGHT continued ▼

4 Choose one:

◆Airplane position **is** north of 82°N latitude (or north of 70°N between 80°W and 130°W) **or** south of 82°S latitude (or south of 60°S between 120°E and 160°E):

HDG reference switch. . . . . TRUE

▶▶**Go to step 5**

◆Airplane position is **not** in the above regions:

▶▶**Go to step 5**

5 Engage heading select or heading hold mode as needed.

6 Route modifications must be entered into all three CDUs. Enter any new waypoints by latitude and longitude.

7 Manually tune navigation radios through CDUs.

8 LDG ALT switch . . . . .MAN

9 LDG ALT selector . . . . Set the landing altitude

10 The autothrottle is inoperative.

11 Do **not** accomplish the following checklist:

LANDING ALT

■ ■ ■ ■

>FMC MESSAGE

Condition: An alert message is in the FMC scratchpad.

■ ■ ■ ■

>FMC RUNWAY DIS

405

Condition: Airplane position or heading not lined up within specified limits of active FMC departure runway and takeoff thrust applied.

■ ■ ■ ■

>GPS

Condition: Both GPS receivers are failed.

■ ■ ■ ■

>GPS LEFT, RIGHT

Condition: One GPS receiver is failed.

■ ■ ■ ■

ILS ANTENNA

Condition: An ILS receiver does not use the correct antenna.

1 Threshold clearance may be reduced.

■ ■ ■ ■

IRS CENTER, LEFT, RIGHT

Condition: An IRU fault occurs.

1 IRS SOURCE selector . . . . Select operable IRU

Action is not reversible

2 IRS mode selector (affected IRU) . . . . Confirm. . . . . . ATT

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

3 Choose one:

◆ IRS message **blanks**:

Enter the current heading on the SET IRS HEADING line of the CDU position initialization page. Maintain straight and level flight while entering the heading.

The IRS heading may have to be updated periodically.

■ ■ ■ ■

◆ IRS message **stays shown**:

▶▶**Go to step 4**

Action is not reversible

4 IRS mode selector (affected IRU) . . . . Confirm. . . . . OFF

■ ■ ■ ■

>IRS AC CENTER, LEFT, RIGHT

Condition: IRU AC power is failed.

■ ■ ■ ■

>IRS DC CENTER, LEFT, RIGHT

Condition: IRU backup DC power is failed.

■ ■ ■ ■

IRS MOTION

Condition: Airplane motion is detected while the IRS aligns.

1 Stop airplane motion until IRS alignment is complete.

2 Verify that the position is correct and reenter if needed.

■ ■ ■ ■

>SNGL SOURCE ILS

Condition: Both pilots' displays use the same ILS source.

■ ■ ■ ■

>TRANSPONDER L, R

Condition: A transponder fault occurs.

■ ■ ■ ■

UNABLE RNP

Condition: The actual navigational performance is not sufficient.

1 Choose one:

◆ On the **ground**:

The message may show with GPS inhibited.

■ ■ ■ ■

◆ On procedure or airway that **has 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 procedure or airway **without** an RNP alerting requirement:

Verify position.

■ ■ ■ ■

Table of Contents

Table of Contents

FUEL IMBAL 1-4

570

Condition: There is a fuel imbalance of 3,000 pounds between main tanks 1 and 4.

Objective: To check for indications of an engine fuel leak before balancing fuel.

109, 405

Condition: There is a fuel imbalance of 1,360 kgs between main tanks 1 and 4.

Objective: To check for indications of an engine fuel leak before balancing fuel.

1 The FUEL IMBAL message may be caused by an engine fuel leak.

2 For indications of an engine fuel leak, check:

Total fuel remaining on EICAS compared to planned fuel remaining

Fuel flow indications, for an engine with excessive fuel flow

Individual tank quantities

Totalizer compared to calculated quantities (PROGRESS page 2). The TOTALIZER value is the sum of the individual tank quantities. The CALCULATED value is the totalizer value at engine start minus fuel used (calculated using fuel flow rates and time)

▼ Continued on next page ▼

▼ FUEL IMBAL 1-4 continued ▼

3 Choose one:

◆ There is an **indication** of an engine fuel leak:

▶▶ **Go to the Fuel Leak Engine checklist on page 12.10**

■ ■ ■ ■

◆ There is **no** indication of an engine fuel leak:

▶▶ **Go to step 4**

4 Configure the fuel pumps and crossfeed valves as needed to balance fuel.

5 **When** fuel balancing is complete:

Resume normal fuel management.

■ ■ ■ ■

Intentionally
Blank

FUEL IMBAL 2-3

570

Condition:	There is a fuel imbalance of 6,000 pounds between main tanks 2 and 3.
Objective:	To check for indications of an engine fuel leak before balancing fuel.

109, 405

Condition:	There is a fuel imbalance of 2,720 kgs between main tanks 2 and 3.
Objective:	To check for indications of an engine fuel leak before balancing fuel.

1 The FUEL IMBAL message may be caused by an engine fuel leak.

2 For indications of an engine fuel leak, check:

Total fuel remaining on EICAS compared to planned fuel remaining

Fuel flow indications, for an engine with excessive fuel flow

Individual tank quantities

Totalizer compared to calculated quantities (PROGRESS page 2). The TOTALIZER value is the sum of the individual tank quantities. The CALCULATED value is the totalizer value at engine start minus fuel used (calculated using fuel flow rates and time)

▼ Continued on next page ▼

▼ **FUEL IMBAL 2-3 continued** ▼

3 Choose one:

◆There is an **indication** of an engine fuel leak:

▶▶**Go to the Fuel Leak Engine checklist on page 12.10**

■ ■ ■ ■

◆There is **no** indication of an engine fuel leak:

▶▶**Go to step 4**

4 Configure the fuel pumps and crossfeed valves as needed to balance fuel.

5 **When** fuel balancing is complete:

Resume normal fuel management.

■ ■ ■ ■

FUEL IMBALANCE

570

Condition: There is a fuel imbalance of 6,000 pounds between the inboard and outboard main tanks after the FUEL TANK/ENG message shows.

Objective: To check for indications of an engine fuel leak before balancing fuel.

109, 405

Condition: There is a fuel imbalance of 2,720 kgs between the inboard and outboard main tanks after the FUEL TANK/ENG message shows.

Objective: To check for indications of an engine fuel leak before balancing fuel.

1 The FUEL IMBALANCE message may be caused by an engine fuel leak.

2 For indications of an engine fuel leak, check:

Total fuel remaining on EICAS compared to planned fuel remaining

Fuel flow indications, for an engine with excessive fuel flow

Individual tank quantities

▼ Continued on next page ▼

▼ **FUEL IMBALANCE continued** ▼

Totalizer compared to calculated quantities (PROGRESS page 2). The TOTALIZER value is the sum of the individual tank quantities. The CALCULATED value is the totalizer value at engine start minus fuel used (calculated using fuel flow rates and time)

3 Choose one:

◆ There is an **indication** of an engine fuel leak:

▶▶ **Go to the Fuel Leak Engine checklist on page 12.10**

■ ■ ■ ■

◆ There is **no** indication of an engine fuel leak:

▶▶ **Go to step 4**

4 Configure the fuel pumps and crossfeed valves as needed to balance fuel.

5 **When** fuel balancing is complete:

Resume normal fuel management.

■ ■ ■ ■

>FUEL JETT A, B

Condition: A fuel jettison system is failed.

■ ■ ■ ■

FUEL JETT SYS

Condition: One of these occurs:
- The total fuel quantity is less than the FUEL TO REMAIN and a jettison nozzle valve is open
- Both fuel jettison systems are failed

1 FUEL JETTISON NOZZLE valve switches (both) .Off

2 FUEL JETTISON selector . . . . OFF

■ ■ ■ ■

Fuel Jettison

Condition: Fuel jettison is needed.

1 FUEL JETTISON selector . . . . A or B

2 FUEL TO REMAIN . . . . Set

3 FUEL JETTISON NOZZLE valve switches (both) .ON

4 Fuel pump switches (all tanks that have fuel) . . . . .ON

109
This turns on center wing tank and horizontal stabilizer tank pump switches which may be off. This ensures override pumps 2 and 3 are on.

405, 570
This turns on center wing tank pump switches which may be off. This ensures override pumps 2 and 3 are on.

▼ Continued on next page ▼

▼ Fuel Jettison continued ▼

5 Do not extend or retract flaps between flaps 1 and 5 during fuel jettison.

6 Do **not** accomplish the following checklist during jettison:

FUEL OVRD 2, 3

This precludes turning the FUEL OVRD 2, 3 pumps off if low back pressure and high flow rates trigger a low pressure indication.

109

7 **When** the FUEL PRES STB message shows:

STAB pump switches (both). . . . . Off

8 **When** the FUEL PRESS CTR message shows:

CTR pump switches (both) . . . . Off

9 **When** jettison is complete:

FUEL JETTISON NOZZLE
valve switches (both) . . . . Off

FUEL JETTISON selector . . . . OFF

■ ■ ■ ■

Fuel Leak Engine

Condition: An in-flight engine fuel leak is suspected or confirmed. (Items which may indicate an engine fuel leak are listed in the Additional Information section.)

Objective: To verify that there is an engine fuel leak. To identify the leaking engine, and shut down the engine.

109

1 STAB pump switches (both) . . . . Off

2 CTR pump switches (both). . . . . Off

3 FUEL X FEED valve switches (all) . . . . Off

4 OVRD 2 pump switches (both) . . . . Off

5 OVRD 3 pump switches (both) . . . . Off

6 Identify an engine fuel leak by observing one main tank fuel quantity decreasing faster than other main tank fuel quantities.

570

7 An increase in fuel imbalance of approximately 1,000 pounds or more in 30 minutes should be considered an engine fuel leak.

109, 405

8 An increase in fuel imbalance of approximately 500 kg or more in 30 minutes should be considered an engine fuel leak.

9 **If** conditions allow:

Visually check for an engine fuel leak.

Continued on next page

▼ Fuel Leak Engine continued ▼

10 Do **not** accomplish the following checklists:

FUEL IMBAL 1-4

FUEL IMBAL 2-3

FUEL IMBALANCE

X FEED CONFIG

11 Choose one:

◆ All main tank quantities decrease at **same rate** (an engine fuel leak is **not** confirmed):

Resume normal fuel management.

If the FUEL DISAGREE - PROG 2 message is shown on the CDU scratchpad:

Select PROGRESS PAGE 2.

TOTALIZER or CALCULATED . . . Select USE for the most accurate indication

►►**Go to step 20**

◆ Any main tank quantity decreases at a different rate (an engine fuel leak is **confirmed**):

►►**Go to step 12**

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

▼ Continued on next page ▼

▼ **Fuel Leak Engine continued** ▼

13 **If** conditions allow:

Run at idle for two minutes to allow the engine to cool and stabilize.

14 FUEL CONTROL switch
(affected engine) . . . . Confirm . . . . . CUTOFF

109, 405

15 Transponder mode selector . . . . TA

570

16 Transponder mode selector . . . . TA ONLY

17 Do **not** accomplish the following checklist:

ENGINE SHUTDOWN

18 Choose one:

◆ FUEL DISAGREE - PROG 2 message is **shown** on the CDU scratchpad:

Select PROGRESS PAGE 2.

TOTALIZER . . . . Select USE

Use TOTALIZER to determine fuel remaining.

►► **Go to step 19**

◆ FUEL DISAGREE - PROG 2 message is **not** shown on the CDU scratchpad:

►► **Go to step 19**

▼ **Continued on next page** ▼

19 After engine shutdown, all remaining fuel can be used for the operating engines. Resume normal fuel management.

20 Choose one:

◆ FUEL QTY LOW message is **not** shown:

■ ■ ■ ■

◆ FUEL QTY LOW message is **shown**:

►► **Go to step 21**

21 FUEL X FEED valve switches (all) . . . . On

22 Fuel pump switches (all tanks that have fuel) . . . . ON

23 Plan to land at nearest suitable airport.

24 Avoid high nose up attitude and excessive acceleration and deceleration.

25 Do **not** accomplish the following checklist:

FUEL QTY LOW

■ ■ ■ ■

▼ Continued on next page ▼

▼ Fuel Leak Engine 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 engine fuel flow
- Total fuel quantity decreasing at an abnormal rate
- FUEL DISAGREE message on CDU scratchpad
- INSUFFICIENT FUEL message on CDU scratchpad
- FUEL QTY LOW EICAS message
- FUEL IMBAL 1-4 EICAS message
- FUEL IMBAL 2-3 EICAS message
- FUEL IMBALANCE EICAS message

>FUEL LOW CTR L, R

570

Condition: One of these occurs:

- Before start, the center wing tank quantity is less than 17,000 pounds with the pump switches ON
- In climb, the center wing tank quantity is approximately 7,000 pounds with the pump switches ON
- In cruise, the center wing tank quantity is approximately 3,000 pounds with the pump switches ON

109, 405

Condition: One of these occurs:

- Before start, the center wing tank quantity is less than 7,700 kgs with the pump switches ON
- In climb, the center wing tank quantity is approximately 3,200 kgs with the pump switches ON
- In cruise, the center wing tank quantity is approximately 1,300 kgs with the pump switches ON

■ ■ ■ ■

>FUEL OVD CTR L, R

570

Condition: One of these occurs:
- On the ground, the center wing tank quantity is 17,000 pounds or more with the pump switch off
- In cruise, the center wing tank quantity is 4,000 pounds or more with the pump switch off

109, 405

Condition: One of these occurs:
- On the ground, the center wing tank quantity is 7,700 kgs or more with the pump switch off
- In cruise, the center wing tank quantity is 1,800 kgs or more with the pump switch off

■ ■ ■ ■

PRESS

FUEL OVRD 2, 3 AFT, FWD

Condition: The pump pressure is low.

1 OVRD pump switch (affected pump(s)) . . . . Off

2 Choose one:

◆**A single** OVRD pump in tank 2 or 3 is inoperative:

■ ■ ■ ■

◆**Both** OVRD pumps in tank 2 **or both** OVRD pumps in tank 3 are inoperative:

▶▶**Go to step 3**

3 OVRD 2 pump switches (both) . . . . Off

4 OVRD 3 pump switches (both) . . . . Off

5 MAIN 1 pump switches (both) . . . . Off

6 MAIN 4 pump switches (both) . . . . Off

7 **When** the FUEL TANK/ENG message shows:

MAIN 1 pump switches (both) . . . . ON

MAIN 4 pump switches (both) . . . . ON

FUEL X FEED 1 and 4 valve switches. . . . . . . Off

■ ■ ■ ■

>FUEL PMP STB L

109

Condition: One of these occurs:
- On the ground, the pump switch is ON
- In cruise, the stabilizer tank quantity is 500 kgs or more with the pump switch off

■ ■ ■ ■

>FUEL PMP STB R

109

Condition: One of these occurs:
- On the ground, the pump switch is ON
- In cruise, the stabilizer tank quantity is 500 kgs or more with the pump switch off

■ ■ ■ ■

PRESS

FUEL PRES STB L, R

109

Condition: The pump pressure is low.

1 Choose one:

◆ Stabilizer tank fuel quantity is **less than or equal to** 900 kgs:

■ ■ ■ ■

◆ Stabilizer tank fuel quantity is **greater than** 900 kgs:

STAB pump switch
(affected pump) . . . . Off

▶▶**Go to step 2**

2 Choose one:

◆ **Both** pumps are inoperative:

The remaining stab fuel is unusable.

■ ■ ■ ■

◆ **A single** pump is inoperative:

Continue normal operations.

■ ■ ■ ■

FUEL PRESS CTR L, R

Condition: One of these occurs:
- The FUEL LOW CTR L, R message is shown for 60 seconds
- The pump pressure is low

1 CTR pump switch
(affected pump) . . . . Off

Override pumps 2 and 3, commanded on by center wing tank pump failure, return to armed after approximately five minutes.

570

2 Choose one:

◆**Both** center wing tank override pumps are inoperative:

■ ■ ■ ■

◆**A single** center wing tank override pump is inoperative:

▶▶**Go to step 3**

▼ **Continued on next page** ▼

▼ FUEL PRESS CTR L, R continued ▼

570

3 Choose one:

◆ Center wing tank quantity **less than or equal to** 7,000 pounds in climb **and** 3000 pounds in cruise:

Resume normal fuel management.

■ ■ ■ ■

◆ Center wing tank quantity **greater than** 7,000 pounds in climb **or** 3000 pounds in cruise:

►► **Go to step 6**

109, 405

4 Choose one:

◆ **Both** center wing tank override pumps are inoperative:

■ ■ ■ ■

◆ **A single** center wing tank override pump is inoperative:

►► **Go to step 5**

▼ Continued on next page ▼

▼ **FUEL PRESS CTR L, R continued** ▼

109, 405

5 Choose one:

◆ Center wing tank quantity **less than or equal to** 3,200 kgs in climb **and** 1,300 kgs in cruise:

Resume normal fuel management.

■ ■ ■ ■

◆ Center wing tank quantity **greater than** 3,200 kgs in climb **or** 1,300 kgs in cruise:

▶▶**Go to step 6**

6 MAIN 1 pump switches (both) . . . . Off

7 MAIN 4 pump switches (both) . . . . Off

8 **When** the FUEL LOW CTR message shows for the operable pump:

MAIN 1 pump switches (both) . . . . .ON

MAIN 4 pump switches (both) . . . . .ON

CTR pump switch
(operable pump) . . . . .Off

9 **If** the FUEL OVD CTR message shows in cruise:

CTR pump switch
(operable pump) . . . . .ON

MAIN 1 pump switches (both) . . . . Off

MAIN 4 pump switches (both) . . . . Off

When the FUEL LOW CTR message shows:

MAIN 1 pump switches (both) . . . . . . .ON

▼ **Continued on next page** ▼

▼ FUEL PRESS CTR L, R continued ▼

MAIN 4 pump switches (both) . . . . . . ON

CTR pump switch
(operable pump) . . . . Off

10 Resume normal fuel management.

■ ■ ■ ■

FUEL PRESS ENG 1, 2, 3, 4

Condition: An engine is on suction feed.

Objective: To open the crossfeed valves to ensure fuel flow. To reconfigure if both pumps are failed in tank 1 or 4.

1 FUEL X FEED valve switches (all) . . . . On

2 MAIN pump switches (related tank) . . . . ON

570

3 Choose one:

◆**Both** main pumps in tank 2 are inoperative:

OVRD 2 pump switches (both). . . . . . . .ON

The last 7,000 pounds of fuel in the affected tank is available only by suction feed.

■ ■ ■ ■

◆**Both** main pumps in tank 3 are inoperative:

OVRD 3 pump switches (both). . . . . . . .ON

The last 7,000 pounds of fuel in the affected tank is available only by suction feed.

■ ■ ■ ■

◆**Both** main pumps in tank 1 **or both** main pumps in tank 4 are inoperative:

▶▶**Go to step 5**

▼ Continued on next page ▼

▼ FUEL PRESS ENG 1, 2, 3, 4 continued ▼

109, 405

4 Choose one:

◆**Both** main pumps in tank 2 are inoperative:

OVRD 2 pump switches (both) . . . . ON

The last 3,200 kgs of fuel in the affected tank are available only by suction feed.

■ ■ ■ ■

◆**Both** main pumps in tank 3 are inoperative:

OVRD 3 pump switches (both) . . . . ON

The last 3,200 kgs of fuel in the affected tank are available only by suction feed.

■ ■ ■ ■

◆**Both** main pumps in tank 1 **or both** main pumps in tank 4 are inoperative:

►►**Go to step 5**

5 OVRD 2 pump switches (both) . . . . ON

6 OVRD 3 pump switches (both) . . . . ON

570

7 The last 7,000 pounds of fuel in the affected tank are available only by suction feed.

109, 405

8 The last 3,200 kgs of fuel in the affected tank are available only by suction feed.

▼ Continued on next page ▼

▼ **FUEL PRESS ENG 1, 2, 3, 4 continued** ▼

9 **When** the FUEL TANK/ENG message shows:

Do **not** accomplish the fuel tank to engine procedure.

FUEL XFER MAIN 1 & 4 switch . . . . .ON

This allows gravity transfer of fuel to main tanks 2 and 3.

10 **When** the FUEL OVRD 2 and 3, AFT and FWD messages show:

OVRD 2 pump switches (both) . . . . .Off

OVRD 3 pump switches (both) . . . . .Off

FUEL X FEED 1 and 4 valve switches. . . . . . .Off

Fuel in the affected tank (1 or 4) is available only by suction feed. The unaffected tanks operate normally.

11 Do **not** accomplish the following checklist:

FUEL XFER 1+4

12 Do **not reaccomplish** the following checklist:

FUEL PRESS ENG

■ ■ ■ ■

Intentionally
Blank

PRESS FUEL PUMP 1, 4 AFT, FWD

Condition: The pump pressure is low.

1 MAIN pump switch (affected pump(s)) . . . . Off

2 Choose one:

◆ **At least one** main pump in tank 1 **and at least one** main pump in tank 4 are **operative**:

■ ■ ■ ■

◆ **Both** main pumps in tank 1 **or both** main pumps in tank 4 are **inoperative**:

109, 405

▶▶ **Go to step 3**

570

▶▶ **Go to step 4**

109, 405

3 The last 3,200 kgs of fuel in the affected tank are available only by suction feed.

570

4 The last 7,000 pounds of fuel in the affected tank available only by suction feed.

5 **When** the FUEL TANK/ENG message shows:

Do **not** accomplish the fuel tank to engine procedure.

FUEL XFER MAIN 1 & 4 switch . . . . ON

This allows gravity transfer of fuel to main tanks 2 and 3.

▼ Continued on next page ▼

▼ **FUEL PUMP 1, 4 AFT, FWD continued** ▼

6 **When** the FUEL OVRD 2 and 3, AFT and FWD messages show:

OVRD 2 pump switches (both) . . . . Off

OVRD 3 pump switches (both) . . . . Off

FUEL X FEED 1 and 4 valve switches. . . . . . . Off

Fuel in the affected tank (1 or 4) is available only by suction feed. The unaffected tank pumps operate normally.

7 Do **not** accomplish the following checklists:

FUEL PRESS ENG

FUEL XFER 1+4

■ ■ ■ ■

PRESS

FUEL PUMP 2, 3 AFT, FWD

Condition: The pump pressure is low.

1 MAIN pump switch (affected pump(s)) . . . . . . .Off

2 Choose one:

◆**At least one** main pump in tank 2 **and at least one** main pump in tank 3 are **operative:**

■ ■ ■ ■

◆**Both** main pumps in tank 2 **or both** main pumps in tank 3 are **inoperative:**

►►**Go to step 3**

3 OVRD 2 pump switches (both) . . . . .ON

4 OVRD 3 pump switches (both) . . . . .ON

570

5 The last 7000 pounds of fuel in the affected tank are available only by suction feed.

109, 405

6 The last 3,200 kgs of fuel in the affected tank are available only by suction feed.

7 **When** the FUEL TANK/ENG message shows:

Do **not** accomplish the fuel tank to engine procedure.

FUEL X FEED 1 and 4 valve switches. . . . . . .Off

8 **When** the FUEL OVRD 2 and 3, AFT and FWD messages show:

OVRD 2 pump switches (both) . . . . .Off

▼ Continued on next page ▼

▼ FUEL PUMP 2, 3 AFT, FWD continued ▼

OVRD 3 pump switches (both) . . . . Off

FUEL X FEED valve switch
(affected tank). . . . . Off

This prevents fuel imbalance and fuel starvation.

570
Fuel in main tanks 2 and 3 is at standpipe level, 7,000 pounds.

109, 405
Fuel in main tanks 2 and 3 is at standpipe level, 3,200 kgs.

Do **not** accomplish the following checklist:

FUEL PRESS ENG

■ ■ ■ ■

FUEL QTY LOW

570

Condition: Fuel quantity 2,000 pounds or less in one or more main tanks.

Objective: To check for indications of an engine fuel leak before configuring the fuel system.

109, 405

Condition: Fuel quantity 900 kgs or less in one or more main tanks.

Objective: To check for indications of an engine fuel leak before configuring the fuel system.

1 The FUEL QTY LOW message may be caused by an engine fuel leak.

2 For indications of an engine fuel leak, check:

Total fuel remaining on EICAS compared to planned fuel remaining

Fuel flow indications, for an engine with excessive fuel flow

Individual tank quantities

Totalizer compared to calculated quantities (PROGRESS page 2). The TOTALIZER value is the sum of the individual tank quantities. The CALCULATED value is the totalizer value at engine start minus fuel used (calculated using fuel flow rates and time)

▼ Continued on next page ▼

▼ **FUEL QTY LOW continued** ▼

3 Choose one:

◆ There is an **indication** of an engine fuel leak:

▶▶ **Go to the Fuel Leak Engine checklist on page 12.10**

■ ■ ■ ■

◆ There is **no** indication of an engine fuel leak:

▶▶ **Go to step 4**

4 FUEL X FEED valve switches (all) . . . . On

5 Fuel pump switches (all tanks that have fuel) . . . . ON

109

6 Choose one:

◆ FUEL STAB XFR message is **not** shown:

▶▶ **Go to step 7**

◆ FUEL STAB XFR message is **shown**:

Do not turn on the center or stabilizer tank pump switches.

OVRD 2 pump switches (both) . . . . ON

OVRD 3 pump switches (both) . . . . ON

Land before tank 2 or 3 reaches 15, 900 kgs to maintain CG within limits.

■ ■ ■ ■

▼ **Continued on next page** ▼

▼ **FUEL QTY LOW continued** ▼

7 Plan to land at the nearest suitable airport.

8 Avoid high nose up attitude and excessive acceleration and deceleration.

■ ■ ■ ■

FUEL RES XFR 2, 3

Condition: The reserve transfer valve is not in the commanded position.

1 Fuel in the affected tank is not available if the quantity does not decrease.

2 Choose one:

◆ Reserve tank fuel **decreases**:

■ ■ ■ ■

◆ Reserve tank fuel does **not** decrease:

Reduce maximum operating speed to 325 KIAS or 0.92 Mach.

■ ■ ■ ■

Intentionally
Blank

FUEL STAB XFR

109

Condition: The stabilizer tank fuel transfer function is failed.

1 STAB pump switches (both) . . . . .ON

2 Choose one:

◆FUEL STAB XFR message **blanks**:

Continue normal operations.

■ ■ ■ ■

◆FUEL STAB XFR message **stays shown**:

▶▶**Go to step 3**

3 CTR pump switches (both). . . . . .Off

4 FUEL X FEED 1 and 4 valve switches . . . . .Off

5 OVRD 2 pump switches (both) . . . . .Off

6 OVRD 3 pump switches (both) . . . . .Off

7 STAB pump switches (both) . . . . .Off

8 Stabilizer and center wing fuel tanks are not available.

Warning! Do not jettison fuel.

9 Usable fuel is all fuel in tanks 1 and 4 plus the fuel in tanks 2 and 3 down to 15,900 kgs remaining in each. Land before tank 2 or 3 reaches 15,900 kgs to maintain CG within limits.

▼ Continued on next page ▼

▼ **FUEL STAB XFR continued** ▼

10 **When** the FUEL QTY LOW message is shown:

FUEL X FEED 1 and 4 valve switches. . . . . . On

OVRD 2 pump switches (both) . . . . ON

OVRD 3 pump switches (both) . . . . ON

Land before tank 2 or 3 reaches 15,900 kgs to maintain CG within limits.

Do **not** accomplish the following checklist:

FUEL QTY LOW

■ ■ ■ ■

>FUEL TANK/ENG

(SB changes 109 ; before SB, FQIS modification not installed)

Condition: One of these occurs with crossfeed valve 1 or 4 open:
- Main tank 2 quantity equal to or less than main tank 1 quantity
- Main tank 3 quantity equal to or less than main tank 4 quantity

■ ■ ■ ■

>FUEL TANK/ENG

405, 570
(SB changes 109 ; installs FQIS modification)

570

Condition: One of these occurs with crossfeed valve 1 or 4 open:
- Main tank 2 quantity is equal to or less than main tank 1 quantity, or main tank 3 quantity is equal to or less than main tank 4 quantity
- On the ground after refueling, after initial electrical power established, or after CMC ground test; main tank 2 quantity less than or equal to main tank 1 quantity plus 1000 pounds and main tank 3 quantity less than or equal to main tank 4 quantity plus 1000 pounds

109, 405

Condition: One of these occurs with crossfeed valve 1 or 4 open:
- Main tank 2 quantity is equal to or less than main tank 1 quantity, or main tank 3 quantity is equal to or less than main tank 4 quantity
- On the ground after refueling, after initial electrical power established, or after CMC ground test; main tank 2 quantity less than or equal to main tank 1 quantity plus 500 kgs and main tank 3 quantity less than or equal to main tank 4 quantity plus 500 kgs

■ ■ ■ ■

FUEL TEMP LOW

Condition: Fuel temperature is near the minimum.

1 Choose one:

◆ Fuel temperature is **not** approaching the fuel temperature limit (3°C above the fuel freeze point):

Check the fuel temperature regularly. Do this checklist if the fuel temperature approaches the fuel temperature limit (3°C above the fuel freeze point).

■ ■ ■ ■

◆ Fuel temperature is **approaching** the fuel temperature limit (3°C above the fuel freeze point):

▶▶**Go to step 2**

2 Increase airspeed, or change altitude, or deviate to a warmer air mass, or all three, to achieve a TAT equal to or higher than the fuel temperature limit.

3 TAT will increase approximately 0.5 to 0.7 degrees C for each .01 Mach increase in speed.

4 In extreme conditions, it may be necessary to descend to as low as FL250.

■ ■ ■ ■

FUEL TEMP SYS

Condition: The fuel temperature indication is failed.

1 Use total air temperature as the indication of fuel temperature.

■ ■ ■ ■

FUEL X FEED 1, 4

405

Condition: The fuel crossfeed valve is not in the commanded position.

1 Choose one:

◆FUEL TANK/ENG message is **not** shown:

■ ■ ■ ■

◆FUEL TANK/ENG message is **shown**:

►►**Go to step 2**

2 FUEL X FEED 2 and 3 valve switches . . . . .Off

Note: A closed crossfeed valve prevents related engine from being provided fuel from any tank other than related main tank.

3 The FUEL X FEED 1, 4 and FUEL TANK/ENG messages stay shown.

4 Do **not** accomplish the following checklist:

X FEED CONFIG

■ ■ ■ ■

Intentionally
Blank

FUEL X FEED 1, 4

109, 570

Condition: The fuel crossfeed valve is not in the commanded position.

1 Choose one:

◆FUEL TANK/ENG message is **not** shown:

■ ■ ■ ■

◆FUEL TANK/ENG message is **shown**:

►►**Go to step 2**

2 FUEL X FEED 2 and 3 valve switches . . . . Off

This maintains tank to engine fuel flow.

3 FUEL X FEED 1 or 4 valve switch (unaffected side) . . . . Open the operable crossfeed valve

4 The FUEL X FEED 1, 4 and the FUEL TANK/ENG messages stay shown.

5 Do **not** accomplish the following checklist:

X FEED CONFIG

6 **If** the FUEL IMBALANCE message shows:

FUEL X FEED 2 and 3 valve switches . . . . . . On

▼ **Continued on next page** ▼

▼ FUEL X FEED 1, 4 continued ▼

MAIN 1 pump switches (both) . . . . Off

MAIN 4 pump switches (both) . . . . Off

Do **not** accomplish the following checklist:

FUEL PUMP 1, 4 AFT, FWD

7 **When** the FUEL IMBALANCE message blanks:

MAIN 1 pump switches (both) . . . . ON

MAIN 4 pump switches (both) . . . . ON

FUEL X FEED 2 and 3 valve switches. . . . . . Off

Note: Steps 6 and 7 may be repeated.

■ ■ ■ ■

FUEL X FEED 2, 3

Condition: The fuel crossfeed valve is not in the commanded position.

1 FUEL X FEED 2 and 3 valve switches . . . . Off

This prevents a lateral imbalance. Fuel in the center wing tank is supplied to engines 1 and 4 only.

Note: A closed crossfeed valve prevents the related engine from being supplied fuel from any tank other than the related main tank.

570

2 With center wing tank fuel, when the FUEL TANK/ENG message is shown, delay tank-to-engine procedure until the FUEL LOW CTR L or R message is shown and center wing tank quantity less than approximately 3,000 pounds.

109, 405

3 With center wing tank fuel, when the FUEL TANK/ENG message is shown, delay tank-to-engine procedure until the FUEL LOW CTR L or R message is shown and center wing tank quantity less than approximately 1,300 kgs.

4 Do **not** accomplish the following checklist:

X FEED CONFIG

■ ■ ■ ■

>FUEL XFER 1+4

Condition: The fuel transfer main 1 & 4 switch is on and one of these occurs:

- The airplane is on the ground
- In flight, the inboard main tank quantities are more than the outboard main tank quantities

■ ■ ■ ■

>JETT NOZ ON

Condition: Both jettison nozzle valves are open.

■ ■ ■ ■

>JETT NOZ ON L, R

Condition: A jettison nozzle valve is open.

■ ■ ■ ■

VALVE

>JETT NOZZLE L, R

Condition: Fuel jettison nozzle valve position disagrees with commanded position.

■ ■ ■ ■

>SCAV PUMP ON

405

Condition: The center wing tank scavenge pump operates while the airplane is on the ground.

■ ■ ■ ■

>X FEED CONFIG

Condition: A fuel crossfeed valve is not in the correct position.

■ ■ ■ ■

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Table of Contents

Intentionally
Blank

HYD CONTROL 1, 4

Condition: The hydraulic control system is inoperative.

Objective: To ensure system hydraulic pressure during high demand.

1 DEMAND PUMP selector (affected system) . . . . ON

2 Affected system indications may be inoperative.

■ ■ ■ ■

SYS FAULT

HYD OVHT SYS 1, 2, 3, 4

Condition: The system temperature is high.

Objective: To cool the system and, if the overheat persists, to configure for landing.

1 Choose one:

◆ HYD OVHT SYS **1** message is shown:

Use the L or R autopilot.

►► **Go to step 2**

◆ HYD OVHT SYS **2** message is shown:

Use the C or L autopilot.

►► **Go to step 2**

◆ HYD OVHT SYS **3** message is shown:

Use the R or C autopilot.

►► **Go to step 2**

◆ HYD OVHT SYS **4** message is shown:

►► **Go to step 2**

Cool down the system

2 ENGINE PUMP switch (affected system). . . . . . .Off

3 DEMAND PUMP selector (affected system) . . . OFF

4 **When** the HYD OVHT SYS message blanks:

DEMAND PUMP
selector (affected system) . . . . AUTO

▼ **Continued on next page** ▼

▼ HYD OVHT SYS 1, 2, 3, 4 continued ▼

Do **not** accomplish the following checklist:

HYD PRESS ENG

5 Choose one:

◆HYD OVHT SYS message **shows again**:

►►**Go to step 6**

◆HYD OVHT SYS message **stays blank**:

Continue normal operation.

■ ■ ■ ■

Depressurize the system

6 DEMAND PUMP selector (affected system). . . OFF

7 Do **not** accomplish the following checklist:

HYD PRESS SYS

8 Note degraded or inoperative system items below.

▼ Continued on next page ▼

HYD OVHT SYS 1, 2, 3, 4 continued

System 1

Inoperative Items

Left outboard elevator inop

Pitch control is reduced.

Inboard trailing edge flap hydraulic operation inop

Trailing edge flaps move in secondary mode. Secondary extension from flaps 1 to 5 requires approximately 4 minutes. During approach, allow extra time for flap extension.

Nose and body gear hydraulic extension and retraction inop

Alternate gear extension is needed.

Nose and body gear steering inop

A tow will be needed after landing.

System 1 alternate brake source inop

System 4 primary and system 2 alternate brake sources are available.

109, 405

Thrust reverser engine 1

Use symmetrical thrust unless stopping distance is critical.

Continued on next page

▼ HYD OVHT SYS 1, 2, 3, 4 continued ▼

System 2
Inoperative Items

Two outboard spoiler panels on each wing inop
Roll rate and spoiler capability are reduced.

System 2 hydraulic power to stabilizer trim inop
System 3 powers the trim at half rate.

System 2 alternate brake source inop
System 4 normal and system 1 alternate brake sources are available.

109, 405

Thrust reverser engine 2
Use symmetrical thrust unless stopping distance is critical.

System 3
Inoperative Items

System 3 hydraulic power to stabilizer trim inop
System 2 powers the trim at half rate.

Two outboard spoiler panels on each wing inop
Roll rate and spoiler capability are reduced.

▼ Continued on next page ▼

HYD OVHT SYS 1, 2, 3, 4 continued

109, 405

Thrust reverser engine 3
Use symmetrical thrust unless stopping distance is critical.

System 4

Inoperative Items

Right outboard elevator inop
Pitch control is reduced.

Outboard trailing edge flap hydraulic operation inop
Trailing edge flaps move in secondary mode. Secondary extension from flaps 1 to 5 requires approximately 4 minutes. During approach, allow extra time for flap extension.

Two inboard spoiler panels on each wing inop
Roll rate and spoiler capability are reduced.

Wing gear hydraulic extension and retraction inop
Alternate gear extension is needed.

System 4 primary brake source inop
System 1 and system 2 alternate brake sources are available.

Autobrake inop
Manual braking is needed.

109, 405

Thrust reverser engine 4
Use symmetrical thrust unless stopping distance is critical.

9 Recall switch . . . . .Push

10 Choose one:

◆**Only one** HYD PRESS SYS message is shown:

▶▶**Go to step 14**

◆**More than one** HYD PRESS SYS message is shown:

▶▶**Go to step 11**

11 Plan to land at the nearest suitable airport.

12 Use flaps 25 and VREF 30+20 for landing.

13 Cross wind limit is 20 knots.

14 **Checklist Complete Except Deferred Items**

Deferred Items

Descent Checklist

Recall . . . . Checked

Autobrake . . . . **___ or OFF with system 4 inoperative**

Landing data . . . .**VREF___ or VREF 30+20 with more than one system inoperative, Minimums___**

Approach briefing . . . . Completed

▼ **Continued on next page** ▼

▼ HYD OVHT SYS 1, 2, 3, 4 continued ▼

Approach Checklist

Altimeters . . . . ____

Choose one:

- ◆ Both Systems **1 and 4** are inoperative:
  - ►►**Go to A) Both Systems 1 and 4 are inoperative**
- ◆ Both Systems **2 and 3** are inoperative:
  - ►►**Go to B) Both Systems 2 and 3 are inoperative**
- ◆ Only System **2** is inoperative:
  - ►►**Go to Landing Checklist**
- ◆ Only System **3** is inoperative:
  - ►►**Go to Landing Checklist**
- ◆ All **other** system failure conditions:
  - ►►**Go to C) All other system failure conditions**

A) Both Systems 1 and 4 are inoperative

Trailing edge flaps move in secondary mode. Secondary extension from flaps 1 to 5 requires approximately 4 minutes. During approach, allow extra time for flap extension.

▼ Continued on next page ▼

▼ HYD OVHT SYS 1, 2, 3, 4 continued ▼

Do **not** accomplish the following checklist:

FLAPS PRIMARY

Alternate Gear Extension

Landing gear lever . . . . OFF

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

Action is not reversible

ALTN NOSE/BODY and
WING GEAR EXTEND switches . . . . ALTN

When all gear are down:

Landing gear lever . . . . DN

AUTOBRAKES selector . . . . OFF

The speedbrake lever does not extend past the flight detent until the nose gear is on the runway.

Extend the ground spoilers manually and slowly. Automatic extension of the outboard ground spoilers, without automatic extension of the inboard ground spoilers, causes the nose to pitch up.

Thrust reversers are only available after the nose gear is on the runway.

►►Go to Landing Checklist

▼ Continued on next page ▼

▼ HYD OVHT SYS 1, 2, 3, 4 continued ▼

B) Both Systems 2 and 3 are inoperative

Stabilizer trim and elevator feel are inoperative. Avoid abrupt elevator movement.

All autopilots are inoperative.

►►Go to Landing Checklist

C) All other system failure conditions

Trailing edge flaps move in secondary mode. Secondary extension from flaps 1 to 5 requires approximately 4 minutes. During approach, allow extra time for flap extension.

Do **not** accomplish the following checklist:

FLAPS PRIMARY

Alternate Gear Extension

Landing gear lever . . . . OFF

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

Action is not reversible

ALTN NOSE/BODY and
WING GEAR EXTEND switches . . . . ALTN

When all gear are down:

Landing gear lever . . . . .DN

▼ Continued on next page ▼

▼ **HYD OVHT SYS 1, 2, 3, 4 continued** ▼

If system 4 is inoperative:

AUTOBRAKES selector . . . . OFF

Extend the ground spoilers manually and slowly. Automatic extension of the outboard ground spoilers, without automatic extension of the inboard ground spoilers, causes the nose to pitch up.

▶▶**Go to Landing Checklist**

Landing Checklist

Speedbrake . . . . **Armed or DN with system 4 inoperative**

Landing gear . . . . DOWN

Flaps . . . . **____ or 25 with more than one system inoperative**

■ ■ ■ ■

PRESS

HYD PRESS DEM 1, 2, 3, 4

Condition: The pump pressure is low.

Objective: To avoid system contamination or pump damage.

1 DEMAND PUMP selector (affected system) . . . . ON

2 Choose one:

◆HYD PRESS DEM message **blanks**:

Continue normal operation.

■ ■ ■ ■

◆HYD PRESS DEM message **stays shown**:

►►**Go to step 3**

3 DEMAND PUMP selector (affected system) . . . OFF

■ ■ ■ ■

PRESS

HYD PRESS ENG 1, 2, 3, 4

Condition: The pump pressure is low.

Objective: To avoid system contamination or pump damage.

1 ENGINE PUMP switch (affected system). . . . . . Off

■ ■ ■ ■

HYD PRESS SYS 1, 2, 3, 4

PRESS	SYS FAULT

Condition: The hydraulic system pressure is low.

Objective: To attempt to restore system pressure, avoid further system damage, and configure for landing using alternate systems.

1 DEMAND PUMP selector (affected system). . . . ON

2 ENGINE PUMP switch (affected system) . . . . . Off

3 Do **not** accomplish the following checklist:

HYD PRESS ENG

4 Choose one:

◆ HYD PRESS SYS message **blanks**:

Continue normal operation.

■ ■ ■ ■

◆ HYD PRESS SYS message **stays shown:**

►► **Go to step 5**

5 DEMAND PUMP selector (affected system). . . OFF

6 Note degraded or inoperative system items below.

▼ **Continued on next page** ▼

▼ HYD PRESS SYS 1, 2, 3, 4 continued ▼

System 1
Inoperative Items

Center autopilot inop
Left and right autopilots are available.

Left outboard elevator inop
Pitch control is reduced.

Inboard trailing edge flap hydraulic operation inop
Trailing edge flaps move in secondary mode. Secondary extension from flaps 1 to 5 requires approximately 4 minutes. During approach, allow extra time for flap extension.

Nose and body gear hydraulic extension and retraction inop
Alternate gear extension is needed.

Nose and body gear steering inop
A tow will be needed after landing.

System 1 alternate brake source inop
System 4 primary and system 2 alternate brake sources are available.

109, 405

Thrust reverser engine 1
Use symmetrical thrust unless stopping distance is critical.

▼ Continued on next page ▼

▼ HYD PRESS SYS 1, 2, 3, 4 continued ▼

System 2

Inoperative Items

Right autopilot inop
Left and center autopilots are available.

Two outboard spoiler panels on each wing inop
Roll rate and spoiler capability are reduced.

System 2 hydraulic power to stabilizer trim inop
System 3 powers the trim at half rate.

System 2 alternate brake source inop
System 4 normal and system 1 alternate brake sources are available.

109, 405

Thrust reverser engine 2
Use symmetrical thrust unless stopping distance is critical.

System 3

Inoperative Items

Left autopilot inop
Center and right autopilots are available.

System 3 hydraulic power to stabilizer trim inop
System 2 powers the trim at half rate.

Two outboard spoiler panels on each wing inop
Roll rate and spoiler capability are reduced.

▼ Continued on next page ▼

▼ HYD PRESS SYS 1, 2, 3, 4 continued ▼

109, 405

Thrust reverser engine 3
Use symmetrical thrust unless stopping distance is critical.

System 4

Inoperative Items

Right outboard elevator inop
Pitch control is reduced.

Outboard trailing edge flap hydraulic operation inop
Trailing edge flaps move in secondary mode. Secondary extension from flaps 1 to 5 requires approximately 4 minutes. During approach, allow extra time for flap extension.

Two inboard spoiler panels on each wing inop
Roll rate and spoiler capability are reduced.

Wing gear hydraulic extension and retraction inop
Alternate gear extension is needed.

System 4 primary brake source inop
System 1 and system 2 alternate brake sources are available.

Autobrake inop
Manual braking is needed.

109, 405

Thrust reverser engine 4
Use symmetrical thrust unless stopping distance is critical.

7 Recall switch . . . . .Push

8 Choose one:

◆**Only one** HYD PRESS SYS message is shown:

▶▶**Go to step 12**

◆**More than one** HYD PRESS SYS message is shown:

▶▶**Go to step 9**

9 Plan to land at the nearest suitable airport.

10 Use flaps 25 and VREF 30+20 for landing.

11 Cross wind limit is 20 knots.

12 **Checklist Complete Except Deferred Items**

Deferred Items

Descent Checklist

Recall . . . . Checked

Autobrake . . . . **____ or OFF with system 4 inoperative**

Landing data . . . . **VREF____ or VREF 30+20 with more than one system inoperative, Minimums_____**

Approach briefing . . . . Completed

▼ Continued on next page ▼

▼ HYD PRESS SYS 1, 2, 3, 4 continued ▼

Approach Checklist

Altimeters . . . . ____

Choose one:

◆ Both Systems **1 and 4** are inoperative:

►►**Go to A) Both Systems 1 and 4 are inoperative**

◆ Both Systems **2 and 3** are inoperative:

►►**Go to B) Both Systems 2 and 3 are inoperative**

◆ Only System **2** is inoperative:

►►**Go to Landing Checklist**

◆ Only System **3** is inoperative:

►►**Go to Landing Checklist**

◆ All **other** system failure conditions:

►►**Go to C) All other system failure conditions**

A) Both Systems 1 and 4 are inoperative

Trailing edge flaps move in secondary mode. Secondary extension from flaps 1 to 5 requires approximately 4 minutes. During approach, allow extra time for flap extension.

▼ Continued on next page ▼

▼ HYD PRESS SYS 1, 2, 3, 4 continued ▼

Do **not** accomplish the following checklist:

FLAPS PRIMARY

Alternate Gear Extension

Landing gear lever . . . . OFF

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

Action is not reversible

ALTN NOSE/BODY and
WING GEAR EXTEND switches . . . . ALTN

When all gear are down:

Landing gear lever . . . . DN

AUTOBRAKES selector . . . . OFF

The speedbrake lever does not extend past the flight detent until the nose gear is on the runway.

Extend the ground spoilers manually and slowly. Automatic extension of the outboard ground spoilers, without automatic extension of the inboard ground spoilers, causes the nose to pitch up.

Thrust reversers are only available after the nose gear is on the runway.

▶▶Go to Landing Checklist

▼ Continued on next page ▼

▼ HYD PRESS SYS 1, 2, 3, 4 continued ▼

B) Both Systems 2 and 3 are inoperative

Stabilizer trim and elevator feel are inoperative. Avoid abrupt elevator movement.

All autopilots are inoperative.

►►**Go to Landing Checklist**

C) All other system failure conditions

Trailing edge flaps move in secondary mode. Secondary extension from flaps 1 to 5 requires approximately 4 minutes. During approach, allow extra time for flap extension.

Do **not** accomplish the following checklist:

FLAPS PRIMARY

Alternate Gear Extension

Landing gear lever . . . . OFF

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

Action is not reversible

ALTN NOSE/BODY and
WING GEAR EXTEND switches . . . . ALTN

When all gear are down:

Landing gear lever . . . . .DN

▼ Continued on next page ▼

▼ HYD PRESS SYS 1, 2, 3, 4 continued ▼

If system 4 is inoperative:

AUTOBRAKES selector . . . . OFF

Extend the ground spoilers manually and slowly. Automatic extension of the outboard ground spoilers, without automatic extension of the inboard ground spoilers, causes the nose to pitch up.

►►Go to Landing Checklist

Landing Checklist

Speedbrake . . . . **Armed or DN with system 4 inoperative**

Landing gear . . . . DOWN

Flaps . . . . ___ **or 25 with more than one system inoperative**

■ ■ ■ ■

SYS FAULT

>HYD QTY LOW 1

Condition: The hydraulic quantity is low.

Objective: If needed, to reconfigure to preclude a progressive loss of systems.

1 Choose one:

◆HYD PRESS SYS 4 is **not** shown:

Continue normal operation.

■ ■ ■ ■

◆HYD PRESS SYS 4 is **shown**:

►►**Go to step 2**

2 **If** C autopilot is engaged:

Autopilot disengage switch . . . . Push

L and R autopilots are available.

3 ENGINE PUMP 1 switch . . . . .Off

4 DEMAND PUMP 1 selector . . . . OFF

5 Plan to land at the nearest suitable airport.

6 Do **not** accomplish the following checklists:

HYD PRESS ENG 1

HYD PRESS SYS 1

▼ **Continued on next page** ▼

▼ HYD QTY LOW 1 continued ▼

Inoperative Items

Left outboard elevator inop

Pitch control is reduced until hydraulic system 1 is repressurized before extending flaps and landing gear.

7 **Checklist Complete Except Deferred Items**

▼ Continued on next page ▼

▼ HYD QTY LOW 1 continued ▼

Deferred Items

Descent Checklist

Recall . . . . Checked

Autobrake . . . . **OFF**

Landing data . . . . VREF___, Minimums___

Approach briefing . . . . Completed

Approach Checklist

Altimeters . . . . ___

Just before extending the flaps and landing gear for approach:

ENGINE PUMP 1 switch . . . . ON

DEMAND PUMP 1 selector. . . . . AUTO

Loss of hydraulic fluid from system 4 followed by loss of hydraulic fluid from system 1 is likely caused by leakage through the brake system. Subsequent fluid loss from system 2 may occur.

Landing Checklist

Speedbrake . . . . **DN**

Landing gear . . . . DOWN

Flaps . . . . ___

■ ■ ■ ■

SYS FAULT

>HYD QTY LOW 2, 3

Condition: The hydraulic quantity is low.

■ ■ ■ ■

SYS FAULT

>HYD QTY LOW 4

Condition: The hydraulic quantity is low.

Objective: If needed, reconfigure to preclude a progressive loss of systems.

1 Choose one:

◆ HYD PRESS SYS 4 message is **shown**:

▶▶**Go to the HYD PRESS SYS 1, 2, 3, 4 checklist on page 13.13**

◆ HYD PRESS SYS 4 message is **not** shown and **less than** one hour from landing:

Continue normal operation.

■ ■ ■ ■

◆ HYD PRESS SYS 4 message is **not** shown and **one hour or more** from landing:

▶▶**Go to step 2**

2 ENGINE PUMP 4 switch . . . . Off

3 DEMAND PUMP 4 selector . . . . OFF

4 Do **not** accomplish the following checklists:

HYD PRESS ENG 4

HYD PRESS SYS 4

▼ **Continued on next page** ▼

▼ HYD QTY LOW 4 continued ▼

Inoperative Items

Two inboard spoiler panels on each wing inop

Roll rate and spoiler capability are reduced.

Right outboard elevator inop

Pitch control is reduced until hydraulic system 4 is repressurized before extending flaps and landing gear.

5 **Checklist Complete Except Deferred Items**

▼ Continued on next page ▼

▼ **HYD QTY LOW 4 continued** ▼

Deferred Items

Descent Checklist

Recall . . . . Checked

Autobrake . . . . **OFF**

Landing data . . . . .VREF___, Minimums___

Approach briefing . . . . Completed

Approach Checklist

Altimeters . . . . ___

Just before extending the flaps and landing gear for approach:

ENGINE PUMP 4 switch . . . . .ON

DEMAND PUMP 4 selector. . . . . AUTO

Landing Checklist

Speedbrake . . . . Armed

Landing gear . . . . DOWN

Flaps . . . . ___

■ ■ ■ ■

Non-Normal Checklists — Chapter NNC

Landing Gear — Section 14

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AIR/GND SYSTEM

Condition: The air/ground system is failed in the air mode.

Objective: To provide information about the thrust reversers, autobrake, and speedbrakes for landing.

(SB changes 109 ; before SB, engine thrust reverser locks not installed)

1 One symmetrical pair of thrust reversers is inoperative.

405, 570
(SB changes 109 ; installs engine thrust reverser locks)

2 The thrust reversers are inoperative.

3 Auto speedbrake deployment is inoperative.

4 The spoilers extend to flight position when deployed manually.

5 The autobrake system is inoperative.

6 **Checklist Complete Except Deferred Items**

▼ Continued on next page ▼

Deferred Items

Descent Checklist

Recall . . . . Checked

Autobrake . . . . **OFF**

Landing data . . . . VREF___, Minimums__________

Approach briefing . . . . Completed

Approach Checklist

Altimeters . . . . ______

Landing Checklist

Speedbrake . . . . **DN**

Landing gear . . . . DOWN

Flaps . . . . ___

■ ■ ■ ■

ANTISKID

Condition: An antiskid system fault occurs.

1 Braking effectiveness may be reduced.

Note: The autobrake system is inoperative. Use minimum braking consistent with the runway conditions to reduce the possibility of a tire blowout.

2 **Checklist Complete Except Deferred Items**

Deferred Items

Descent Checklist

Recall . . . . Checked

Autobrake . . . . **OFF**

Landing data . . . . VREF___, Minimums___

Approach briefing . . . . Completed

Approach Checklist

Altimeters . . . . ___

Landing Checklist

Speedbrake . . . . Armed

Landing gear . . . . DOWN

Flaps . . . . ___

■ ■ ■ ■

ANTISKID OFF

Condition: One or more of these occur:
- The parking brake valve is not fully open
- The antiskid system power is off

1 Use brakes with caution. Braking effectiveness is reduced.

Note: The autobrake system is inoperative. Use minimum braking consistent with the runway conditions to reduce the possibility of a tire blowout.

2 **Checklist Complete Except Deferred Items**

Deferred Items

Descent Checklist

Recall . . . . Checked

Autobrake . . . . **OFF**

Landing data . . . . .VREF___, Minimums___

Approach briefing . . . . Completed

Approach Checklist

Altimeters . . . . ___

Landing Checklist

Speedbrake . . . . Armed

Landing gear . . . . DOWN

Flaps . . . . ___

■ ■ ■ ■

Intentionally
Blank

AUTOBRAKES

Condition: One of these occurs:
- The autobrake system is disarmed
- The autobrake system is failed
- The autobrake selector is off but the autobrake system stays armed
- RTO is initiated above 85 knots and the autobrake has not been applied

1 AUTOBRAKES selector . . . . OFF, then as needed

2 Choose one:

◆ AUTOBRAKES message **blanks**:

■ ■ ■ ■

◆ AUTOBRAKES message **stays shown**:

AUTOBRAKES selector . . . . OFF

▶▶**Go to step 3**

3 **Checklist Complete Except Deferred Items**

▼ **Continued on next page** ▼

▼ AUTOBRAKES continued ▼

Deferred Items

Descent Checklist

Recall . . . . Checked

Autobrake . . . . **OFF**

Landing data . . . . VREF___, Minimums___

Approach briefing . . . . Completed

Approach Checklist

Altimeters . . . . ___

Landing Checklist

Speedbrake . . . . Armed

Landing gear . . . . DOWN

Flaps . . . . ___

■ ■ ■ ■

>BODY GEAR STRG

Condition: One or more of these occur:
- Body landing gear steering does not lock
- Body landing gear steering pressure fails on

■ ■ ■ ■

BRAKE LIMITER

Condition: One or more of these occur:
- A brake torque limiter fails
- The parking brake valve is not fully open

1 Brake with caution. Heavy braking could exceed the brake torque limit.

■ ■ ■ ■

>BRAKE SOURCE

Condition: Normal and alternate brake system pressures are low.

■ ■ ■ ■

BRAKE TEMP

Condition: One or more brake temperatures are high.

Objective: To allow the brakes to cool.

1 Choose one:

◆In **flight**:

When extending or retracting the landing gear, do not exceed the gear EXTEND limit speed (270K/.82M).

Landing gear lever . . . . DN

This allows cooling air to flow around the brakes.

When the BRAKE TEMP message blanks:

Wait 8 minutes. This ensures sufficient cooling time.

Landing gear lever. . . . UP, then OFF

■ ■ ■ ■

◆On the **ground**:

Refer to the Brake Cooling Schedule in the Advisory Information section of the Performance Inflight chapter for the required cooling time.

70 minutes is the minimum.

■ ■ ■ ■

GEAR DISAGREE or Gear Lever Jammed In Off Position

405, 570

Condition: One or more of these occur:
- The gear position disagrees with the landing gear lever position
- The landing gear lever is jammed in the OFF position

Objective: To configure the gear for landing with the gear disagree.

▼ Continued on next page ▼

▼ GEAR DISAGREE or Gear Lever Jammed In Off Position continued ▼

1 Choose one:

◆ Landing gear lever **UP**:

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

Do not use FMC fuel predictions with the gear extended.

■ ■ ■ ■

◆ Landing gear lever **DN and all** gear indicate **down**:

GND PROX
GEAR OVRD switch . . . . OVRD

Do a normal landing.

■ ■ ■ ■

◆ Landing gear lever **DN and any** gear indicates **not** down:

►►**Go to step 4**

◆ Landing gear lever **jammed OFF**:

►►**Go to step 4**

◆ Landing gear lever **will not move UP**:

►►**Go to step 2**

▼ Continued on next page ▼

▼ **GEAR DISAGREE or Gear Lever Jammed In Off Position continued** ▼

2 Choose one:

◆GEAR TILT **or** BODY GEAR STRG message is **shown**:

Do not exceed the gear extended limit speed (320K/.82M).

Landing gear lever . . . . DN

Do not retract the landing gear.

Do not use FMC fuel predictions with the gear extended.

►►**Go to step 3**

◆GEAR TILT **and** BODY GEAR STRG messages are **not** shown:

Landing gear lever
LOCK OVRD switch. . . . . Push and hold

Landing gear lever . . . . UP, then OFF

►►**Go to step 3**

3 Do **not** accomplish the following checklist:

Gear Lever Will Not Move Up

■ ■ ■ ■

4 Landing gear lever . . . . OFF

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

6 ALT GEAR EXTEND
switch (affected gear) . . . . ALTN

▼ **Continued on next page** ▼

▼ **GEAR DISAGREE or Gear Lever Jammed In Off Position continued** ▼

7 Choose one:

◆All gear indicate **DN**:

Landing gear lever (if possible) . . . DN

If landing gear lever OFF:

GND PROX
GEAR OVRD switch . . . . . . .OVRD

Do a normal landing.

■ ■ ■ ■

◆Nose and both body gear indicate **UP**:

►►**Go to the Nose and Body Gear Up checklist on page 14.32**

■ ■ ■ ■

◆All other combinations of **partial gear extension**:

►►**Go to step 8**

8 Landing gear lever (if possible) . . . . DN

9 GND PROX GEAR OVRD switch . . . . OVRD

▼ **Continued on next page** ▼

10 Land on available gear.

Caution! If any wing or body gear is not extended, deployment of the thrust reversers may affect directional control.

Caution! If the nose gear is not extended, do not deploy the thrust reversers until the nose contacts the runway.

Caution! Delay extending the speedbrakes until the nose and both sides of the airplane have touched down.

Caution! If any wing gear is not extended, use aileron control to keep the wings level during the rollout until the airplane comes to a complete stop.

Caution! If any wing or body gear is not extended, do not attempt to taxi the airplane or use the tiller. Braking effectiveness is reduced.

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Caution! If both body gear are not extended, the airplane may tip tail down on the ground. The UPPER DECK crew service door escape slide is then unusable.

▼ Continued on next page ▼

▼ GEAR DISAGREE or Gear Lever Jammed In Off Position continued ▼

405

Caution! If both body gear are not extended, the airplane may tip tail down on the ground.

Converted Freighter

Caution! If both body gear are not extended, the airplane may tip tail down on the ground.

11 Do **not** accomplish the following checklist:

CONFIG GEAR

12 **Checklist Complete Except Deferred Items**

Deferred Items

Landing Checklist

Speedbrake . . . . **DN**

Landing gear . . . . DOWN

Flaps . . . . ___

■ ■ ■ ■

GEAR DISAGREE
or
Gear Lever Jammed In Off Position

109

Condition: One or more of these occur:
- The gear position disagrees with the landing gear lever position
- The landing gear lever is jammed in the OFF position

Objective: To configure the gear for landing with the gear disagree.

Continued on next page

1 Choose one:

◆ Landing gear lever **UP**:

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

Do not use FMC fuel predictions with the gear extended.

■ ■ ■ ■

◆ Landing gear lever **DN and all** gear indicate **down**:

GND PROX CONFIG
GR OVRD switch . . . . OVRD

Do a normal landing.

■ ■ ■ ■

◆ Landing gear lever **DN and any** gear indicates **not** down:

►►**Go to step 4**

◆ Landing gear lever **jammed OFF**:

►►**Go to step 4**

◆ Landing gear lever **will not move UP**:

►►**Go to step 2**

▼ Continued on next page ▼

▼ GEAR DISAGREE or Gear Lever Jammed In Off Position continued ▼

2 Choose one:

◆ GEAR TILT **or** BODY GEAR STRG message is **shown**:

Do not exceed the gear extended limit speed (320K/.82M).

Landing gear lever . . . . .DN

Do not retract the landing gear.

Do not use FMC fuel predictions with the gear extended.

►► **Go to step 3**

◆ GEAR TILT **and** BODY GEAR STRG messages are **not** shown:

Landing gear lever
LOCK OVRD switch. . . . . Push and hold

Landing gear lever . . . . UP, then OFF

►► **Go to step 3**

3 Do **not** accomplish the following checklist:

Gear Lever Will Not Move Up

■ ■ ■ ■

4 Landing gear lever . . . . OFF

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

6 ALT GEAR EXTEND
switch (affected gear) . . . . ALTN

▼ Continued on next page ▼

▼ GEAR DISAGREE or Gear Lever Jammed In Off Position continued ▼

7 Choose one:

◆ All gear indicate **DN:**

Landing gear lever (if possible) . . . DN

If landing gear lever OFF:

GND PROX CONFIG
GR OVRD switch . . . . .OVRD

Do a normal landing.

■ ■ ■ ■

◆ Nose and both body gear indicate **UP**:

►►Go to the Nose and Body Gear Up checklist on page 14.32

■ ■ ■ ■

◆ All other combinations of **partial gear extension**:

►►Go to step 8

8 Landing gear lever (if possible) . . . . DN

9 GND PROX CONFIG GR OVRD switch . . . . . OVRD

▼ Continued on next page ▼

GEAR DISAGREE or Gear Lever Jammed In Off Position continued

10 Land on available gear.

Caution! If any wing or body gear is not extended, deployment of the thrust reversers may affect directional control.

Caution! If the nose gear is not extended, do not deploy the thrust reversers until the nose contacts the runway.

Caution! Delay extending the speedbrakes until the nose and both sides of the airplane have touched down.

Caution! If any wing gear is not extended, use aileron control to keep the wings level during the rollout until the airplane comes to a complete stop.

Caution! If any wing or body gear is not extended, do not attempt to taxi the airplane or use the tiller. Braking effectiveness is reduced.

Caution! If both body gear are not extended, the airplane may tip tail down on the ground. Door 1 escape slides are then unusable.

Continued on next page

▼ **GEAR DISAGREE or Gear Lever Jammed In Off Position continued** ▼

11 Do **not** accomplish the following checklist:

CONFIG GEAR

12 **Checklist Complete Except Deferred Items**

Deferred Items

Landing Checklist

Speedbrake . . . .**DN**

Landing gear . . . . DOWN

Flaps . . . . ___

■ ■ ■ ■

GEAR DOOR

405

Condition: One or more gear doors are not closed.

Objective: To attempt to close the gear door.

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

2 Choose one:

◆Landing gear lever is **OFF**:

Landing gear lever . . . . UP

■ ■ ■ ■

◆Landing Gear lever is **UP** and the GEAR DOOR message stays shown:

▶▶**Go to step 3**

3 Landing gear lever . . . . OFF

4 ALTN WING GEAR EXTEND switch . . . . ALTN

5 **When** both wing gear indicate down:

ALTN NOSE/BODY
GEAR EXTEND switch . . . . ALTN

The gear doors stay open, and the GEAR DOOR message is inhibited.

6 Do **not** accomplish the following checklist:

GEAR DISAGREE

▼ Continued on next page ▼

▼ GEAR DOOR continued ▼

7 **After** a minimum of 90 seconds:

ALTN GEAR EXTEND switches (both). . . . . . . Off

Landing gear lever . . . . UP

■ ■ ■ ■

GEAR DOOR

109, 570

Condition: One or more gear doors are not closed.

Objective: To attempt to close the gear door.

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

2 Choose one:

◆ Landing gear lever **OFF**:

Landing gear lever. . . . . UP

■ ■ ■ ■

◆ Landing gear lever **UP** or **DN**:

■ ■ ■ ■

Gear Lever Jammed In Up Position

Condition: The landing gear lever is jammed in the UP position.

Objective: If there is enough time and fuel available, to depressurize hydraulic system 1 and allow the nose and body gear to extend.

1 Check the total fuel quantity.

Alternate nose and body gear extension may take up to 15 minutes.

Do not accomplish this checklist unless there is sufficient fuel to extend the gear and then complete an approach, with sufficient reserves.

Land with gear up or land with available gear if fuel is not sufficient.

Note: Do not use FMC fuel prediction with gear extended

2 **Checklist Complete Except Deferred Items**

Deferred Items

Descent Checklist

Recall . . . . Checked

Autobrake . . . . ___

Landing data . . . . .VREF___, Minimums___

Approach briefing . . . . Completed

Continued on next page

▼ Gear Lever Jammed In Up Position continued ▼

Approach Checklist

Altimeters . . . . ___

Depressurize hydraulic system 1

If C autopilot is engaged:

Autopilot disengage switch . . . . .Push

L and R autopilots are available.

Hydraulic DEMAND PUMP 1 selector . . . . OFF

Hydraulic ENGINE PUMP 1 switch . . . . Off

Do **not** accomplish the following checklist:

HYD PRESS SYS 1

Alternate gear extension

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

ALTN NOSE/BODY GEAR
EXTEND switch . . . . ALTN

▼ Continued on next page ▼

▼ Gear Lever Jammed In Up Position continued ▼

Note: If fuel becomes critical while doing this checklist, vigorous cycling of the control wheel helps depressurize the landing gear hydraulic lines, significantly reducing the alternate extension time. (During flight test, 80 cycles of +/-4 units of aileron reduced the depressurization time to 90 seconds.)

Inoperative Items

Left outboard elevator inop
Pitch control is reduced.

Inboard trailing edge flap hydraulic operation inop
Trailing edge flaps move in secondary mode. Secondary extension from flaps 1 to 5 requires approximately 4 minutes. During approach, allow extra time for flap extension.

Nose and body gear hydraulic extension and retraction inop
Alternate gear extension is needed.

Nose and body gear steering inop
A tow will be needed after landing.

System 1 alternate brake source inop
System 4 primary and system 2 alternate brake sources are available.

Automatic ground spoilers inop
Manual extension available.

▼ Continued on next page ▼

▼ Gear Lever Jammed In Up Position continued ▼

109, 405

Thrust reverser engine 1

Use symmetrical thrust unless stopping distance is critical.

▼ Continued on next page ▼

▼ Gear Lever Jammed In Up Position continued ▼

Do **not** accomplish the following checklists:

FLAPS PRIMARY

GEAR DISAGREE or Gear Lever Jammed In Off Position

GEAR DOOR

405, 570

GND PROX GEAR OVRD switch . . . . OVRD

109

GND PROX CONFIG GR OVRD switch . . . . OVRD

Land on available gear.

Do **not** accomplish the following checklist:

CONFIG GEAR

Caution! Do not repressurize hydraulic system 1 in flight or on the ground as the gear will retract.

Caution! Use aileron control to keep the wings level during the rollout until the airplane comes to a complete stop.

Caution! Do not attempt to taxi the airplane or use the tiller. Pin the landing gear after stopping.

Caution! Braking effectiveness will be reduced.

▼ Continued on next page ▼

▼ Gear Lever Jammed In Up Position continued ▼

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

Landing Checklist

Speedbrake . . . .**DN**

Landing gear . . . .**Nose and body down**

Flaps . . . . ___

■ ■ ■ ■

Gear Lever Will Not Move Up

Condition: The landing gear lever cannot move to UP.

1 Choose one:

◆GEAR TILT **or** BODY GEAR STRG message is **shown**:

Do not exceed the gear extended limit speed (320K/.82M).

Landing gear lever . . . . .DN

Do not retract the landing gear.

Do not use FMC fuel predictions with the gear extended.

■ ■ ■ ■

◆GEAR TILT **and** BODY GEAR STRG messages are **not** shown:

►►**Go to step 2**

2 Landing gear lever
LOCK OVRD switch . . . . Push and hold

3 Landing gear lever . . . . UP, then OFF

■ ■ ■ ■

GEAR TILT

Condition: The main landing gear trucks are not in the fully tilted position.

1 Do not retract the landing gear.

2 Do not exceed the gear extended limit speed (320K/.82M).

3 Do not use FMC fuel predictions with gear extended.

■ ■ ■ ■

Nose and Body Gear Up

Condition: The nose and body gear are failed in the up position.

Objective: If there is enough time and fuel available, to depressurize hydraulic system 1 to allow the nose and body gear to extend.

1 Do this checklist only when directed by the GEAR DISAGREE or Gear Lever Jammed in Off Position checklist.

2 Check the total fuel quantity.

Alternate nose and body gear extension may take up to 15 minutes.

Do not accomplish this checklist unless there is sufficient fuel to extend the gear and then complete an approach, with sufficient reserves.

Land with gear up or land with available gear if fuel is not sufficient.

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

3 **If** C autopilot is engaged:

Autopilot disengage switch . . . . Push

L and R autopilots are available.

4 Hydraulic DEMAND PUMP 1 selector . . . . OFF

5 Hydraulic ENGINE PUMP 1 switch . . . . .Off

▼ Continued on next page ▼

Nose and Body Gear Up continued

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

7 ALTN NOSE/BODY GEAR EXTEND switch. . . . . ALTN

Continued on next page

▼ Nose and Body Gear Up continued ▼

Note: If fuel becomes critical while doing this checklist, vigorous cycling of the control wheel helps depressurize the landing gear hydraulic lines, significantly reducing the alternate extension time. (During flight test, 80 cycles of +/-4 units of aileron reduced the depressurization time to 90 seconds.)

Inoperative Items

Left outboard elevator inop
Pitch control is reduced.

Inboard trailing edge flap hydraulic operation inop
Trailing edge flaps move in secondary mode. Secondary extension from flaps 1 to 5 requires approximately 4 minutes. During approach, allow extra time for flap extension.

Nose and body gear hydraulic extension and retraction inop
Alternate gear extension is needed.

Nose and body gear steering inop
A tow will be needed after landing.

System 1 alternate brake source inop
System 4 primary and system 2 alternate brake sources are available.

Automatic ground spoilers inop
Manual extension available.

109, 405

Thrust reverser engine 1
Use symmetrical thrust unless stopping distance is critical.

▼ Continued on next page ▼

▼ **Nose and Body Gear Up continued** ▼

405, 570

8 GND PROX GEAR OVRD switch . . . . OVRD

109

9 GND PROX CONFIG GR OVRD switch . . . . . . OVRD

▼ **Continued on next page** ▼

▼ Nose and Body Gear Up continued ▼

10 Land on available gear.

Caution! **Do not repressurize hydraulic system 1 in flight or on the ground as the gear will retract.**

Caution! **If any wing or body gear is not extended, deployment of the thrust reversers may affect directional control.**

Caution! **If the nose gear is not extended, do not deploy the thrust reversers until the nose contacts the runway.**

Caution! **Delay extending the speedbrakes until the nose and both sides of the airplane have touched down.**

Caution! **If any wing gear is not extended, use aileron control to keep the wings level during the rollout until the airplane comes to a complete stop.**

Caution! **Do not attempt to taxi the airplane or use the tiller. Pin the landing gear after stopping.**

Caution! **Braking effectiveness will be reduced.**

▼ Continued on next page ▼

▼ Nose and Body Gear Up continued ▼

11 Do **not** accomplish the following checklists:

FLAPS PRIMARY

GEAR DISAGREE or Gear Lever Jammed in Off Position

GEAR DOOR

HYD PRESS SYS 1

12 **Checklist Complete Except Deferred Items**

Deferred Items

Landing Checklist

Speedbrake . . . . **DN**

Landing gear . . . . DOWN

Flaps . . . . ___

■ ■ ■ ■

>TIRE PRESSURE

109

Condition: One or more tire pressures are not normal.

■ ■ ■ ■

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>AIRSPEED LOW

Condition: Airspeed is less than minimum maneuvering speed.

■ ■ ■ ■

>ALT CALLOUTS

405, 570

Condition: Altitude and minimums voice annunciations during approach are not supplied.

109

Condition: Altitude voice annunciations during approach are not supplied.

■ ■ ■ ■

>ALTITUDE ALERT

Condition: A deviation from the MCP set altitude occurs.

■ ■ ■ ■

>CONFIG FLAPS

Condition: The flaps are not in a takeoff position during takeoff.

■ ■ ■ ■

>CONFIG GEAR

Condition: A landing gear is not down and locked and one of these occurs:
- A thrust lever is at idle below 800 feet radio altitude
- The flaps are in a landing position

■ ■ ■ ■

>CONFIG GEAR CTR

Condition: Body gear steering is not centered during takeoff.

■ ■ ■ ■

>CONFIG PARK BRK

Condition: The parking brake is set during takeoff.

■ ■ ■ ■

>CONFIG SPOILERS

109

Condition: The speedbrake lever is not down during takeoff.

405, 570

Condition:
- The speedbrake lever is not down during takeoff, or
- The speedbrake lever is extended beyond ARM in flight with climb thrust or greater.

■ ■ ■ ■

>CONFIG STAB

Condition: The stabilizer is not in the greenband during takeoff.

■ ■ ■ ■

>CONFIG WARN SY

Condition: A configuration warning system fault occurs.

■ ■ ■ ■

GND PROX SYS

Condition: A ground proximity warning system fault occurs.

Note: Some or all ground proximity alerts are not available. Ground proximity alerts that occur are valid.

■ ■ ■ ■

>OVERSPEED

Condition: Airspeed is more than Vmo/Mmo.

■ ■ ■ ■

>PILOT RESPONSE

405, 570
(SB changes 109 ; installs EICAS message >PILOT RESPONSE)

Condition: Pilot action is not detected during a specified time.

■ ■ ■ ■

Tailstrike

Condition: The tail hits the runway on takeoff.

Objective: To depressurize the airplane.

Caution! Do not pressurize the airplane. Pressurizing the airplane may cause further structural damage.

1 OUTFLOW VALVES MAN switches (both) . . . . . .ON

2 OUTFLOW VALVES
manual control . . . . .Push to OPEN and hold until both outflow valve indications show fully open

3 Do **not** accomplish the following checklists:

CABIN ALT AUTO

OUTFLOW VLV

■ ■ ■ ■

>TCAS OFF

Condition: TCAS modes TA or TA/RA are not selected.

■ ■ ■ ■

>TCAS RA CAPT, F/O

Condition: TCAS cannot show RA guidance on the PFD.

■ ■ ■ ■

>TCAS SYSTEM

Condition: TCAS is failed.

■ ■ ■ ■

>TERR OVRD

405, 570

Condition: The ground proximity terrain override switch is in OVRD.

■ ■ ■ ■

TERR POS

405, 570

Condition: Terrain position data is lost.

Note: Position data for look-ahead alerting and display are unavailable. Ground proximity alerts that occur are valid.

■ ■ ■ ■

WINDSHEAR SYS

Condition: A windshear system fault occurs.

Note: Some or all windshear alerts are not available. Windshear alerts that occur are valid.

■ ■ ■ ■

Operational Information — Chapter OI

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Introduction

Note: This Section Reserved For Operator-Developed Information.

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Performance Inflight - QRH Chapter PI

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Performance Inflight - QRH — Chapter PI-QRH

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747-400 PW4056 KG FAA JAR

Performance Inflight - QRH — Chapter PI-QRH
General — Section 10

Flight With Unreliable Airspeed / Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

Climb (290/.84)
Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		200	250	300	350	390
40000	**PITCH ATT**	**3.5**	**3.5**			
	V/S (FT/MIN)	1500	700			
35000	**PITCH ATT**	**4.5**	**4.0**	**4.0**	**3.5**	
	V/S (FT/MIN)	2900	1900	1200	500	
30000	**PITCH ATT**	**4.5**	**4.5**	**4.5**	**4.5**	**5.0**
	V/S (FT/MIN)	2700	1900	1400	900	500
20000	**PITCH ATT**	**7.5**	**7.0**	**6.5**	**6.5**	**6.5**
	V/S (FT/MIN)	4100	3100	2400	1800	1400
10000	**PITCH ATT**	**10.5**	**9.5**	**9.0**	**8.5**	**8.5**
	V/S (FT/MIN)	5300	4100	3200	2600	2100
SEA LEVEL	**PITCH ATT**	**13.0**	**11.5**	**10.5**	**10.5**	**10.0**
	V/S (FT/MIN)	6100	4700	3800	3000	2600

Cruise (.84/290)
Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		200	250	300	350	390
40000	**PITCH ATT**	**2.0**	**2.5**			
	EPR	1.16	1.31			
	(Alt Mode %N1)	(83.2)	(88.0)			
35000	**PITCH ATT**	**1.0**	**2.0**	**2.5**	**3.0**	
	EPR	1.08	1.14	1.24	1.43	
	(Alt Mode %N1)	(80.6)	(83.0)	(86.3)	(92.2)	
30000	**PITCH ATT**	**1.0**	**2.0**	**3.0**	**3.5**	**4.0**
	EPR	1.02	1.07	1.13	1.21	1.32
	(Alt Mode %N1)	(77.3)	(79.8)	(82.6)	(85.7)	(89.3)
20000	**PITCH ATT**	**1.5**	**2.5**	**3.0**	**4.0**	**4.5**
	EPR	0.97	0.99	1.03	1.07	1.11
	(Alt Mode %N1)	(70.5)	(72.7)	(75.3)	(78.1)	(80.8)
10000	**PITCH ATT**	**1.5**	**2.5**	**3.5**	**4.5**	**5.0**
	EPR	0.96	0.98	1.00	1.02	1.04
	(Alt Mode %N1)	(64.3)	(66.3)	(68.7)	(71.1)	(73.3)
0	**PITCH ATT**	**1.5**	**2.5**	**3.5**	**4.5**	**5.0**
	EPR	0.97	0.98	0.99	1.00	1.01
	(Alt Mode %N1)	(55.6)	(57.8)	(60.4)	(63.2)	(65.7)

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Descent (.84/290)

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		200	250	300	350	390
40000	**PITCH ATT**	**-1.5**	**-0.5**			
	V/S (FT/MIN)	-2800	-2700			
35000	**PITCH ATT**	**-3.5**	**-2.0**	**-1.5**	**-0.5**	
	V/S (FT/MIN)	-3800	-3400	-3200	-3300	
30000	**PITCH ATT**	**-2.0**	**-0.5**	**0.0**	**1.0**	**1.5**
	V/S (FT/MIN)	-2600	-2300	-2200	-2100	-2200
20000	**PITCH ATT**	**-2.0**	**-1.0**	**0.0**	**1.0**	**1.5**
	V/S (FT/MIN)	-2500	-2200	-2100	-2000	-2000
10000	**PITCH ATT**	**-2.5**	**-1.0**	**0.5**	**1.5**	**2.0**
	V/S (FT/MIN)	-2200	-1900	-1800	-1700	-1700
SEA LEVEL	**PITCH ATT**	**-2.5**	**-1.0**	**0.5**	**1.5**	**2.0**
	V/S (FT/MIN)	-1900	-1700	-1500	-1500	-1500

Holding

Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		200	250	300	350	390
10000	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**5.5**	**5.5**
	EPR	1.01	1.02	1.03	1.04	1.04
	(Alt Mode %N1)	(55.9)	(61.4)	(66.5)	(70.5)	(73.3)
	KIAS	208	224	242	266	283

Terminal Area (5000 FT)

Set Thrust for Level Flight

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)					
		200	250	300	350	400	410
FLAPS UP (VREF30+80) (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**6.5**
	EPR	1.01	1.03	1.04	1.06	1.07	1.08
	(Alt Mode %N1)	(51.4)	(57.5)	(62.5)	(67.1)	(70.8)	(71.5)
	KIAS	208	224	239	253	266	269
FLAPS 1 (VREF30+60) (GEAR UP)	**PITCH ATT**	**6.5**	**7.0**	**7.0**	**7.5**	**7.5**	**7.5**
	EPR	1.03	1.05	1.06	1.08	1.10	1.10
	(Alt Mode %N1)	(53.9)	(60.2)	(64.8)	(68.9)	(72.7)	(73.4)
	KIAS	188	204	219	233	246	249
FLAPS 5 (VREF30+40) (GEAR UP)	**PITCH ATT**	**7.5**	**7.5**	**8.0**	**8.0**	**8.0**	**8.0**
	EPR	1.06	1.08	1.10	1.12	1.15	1.15
	(Alt Mode %N1)	(57.9)	(63.6)	(68.4)	(72.7)	(76.5)	(77.2)
	KIAS	168	184	199	213	226	229
FLAPS 10 (VREF30+20) (GEAR UP)	**PITCH ATT**	**8.5**	**8.5**	**8.5**	**9.0**	**9.0**	**9.0**
	EPR	1.07	1.09	1.11	1.14	1.16	1.17
	(Alt Mode %N1)	(57.8)	(63.8)	(68.8)	(73.1)	(77.0)	(77.7)
	KIAS	148	164	179	193	206	209
FLAPS 20 (VREF30+10) (GEAR DOWN)	**PITCH ATT**	**7.5**	**7.5**	**7.5**	**7.5**	**7.5**	**7.5**
	EPR	1.10	1.13	1.17	1.21	1.25	1.26
	(Alt Mode %N1)	(64.0)	(69.9)	(75.2)	(79.9)	(83.7)	(84.4)
	KIAS	138	154	169	183	196	199

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Final Approach (1500 FT)

Gear Down, EPR for 3° Glideslope

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)					
		200	250	300	350	400	410
FLAPS 25 (VREF25+10)	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**
	EPR	1.05	1.06	1.07	1.08	1.10	1.10
	(Alt Mode %N1)	(48.8)	(54.8)	(59.7)	(63.7)	(67.2)	(67.9)
	KIAS	143	159	175	189	203	205
FLAPS 30 (VREF30+10)	**PITCH ATT**	**0.5**	**1.0**	**1.0**			
	EPR	1.07	1.09	1.11			
	(Alt Mode %N1)	(55.8)	(61.8)	(66.8)			
	KIAS	138	154	168			

Max Climb EPR

Based on engine bleed for 3 packs on, engine and wing anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT) / SPEED (KIAS OR MACH)									
	0	5	10	15	20	25	30	35	40	45
	340	340	340	340	340	340	0.84	0.84	0.84	0.84
60	1.19	1.19	1.18							
50	1.23	1.23	1.22	1.21						
40	1.25	1.29	1.28	1.27	1.25					
30	1.25	1.30	1.35	1.35	1.33	1.32				
20	1.25	1.30	1.35	1.39	1.42	1.42	1.42	1.39		
10	1.25	1.30	1.35	1.39	1.43	1.48	1.52	1.48	1.44	1.41
0	1.25	1.30	1.35	1.39	1.43	1.48	1.57	1.58	1.54	1.51
-10	1.25	1.30	1.35	1.39	1.43	1.48	1.57	1.64	1.61	1.58
-20 & BELOW	1.25	1.30	1.35	1.39	1.43	1.48	1.57	1.64	1.61	1.58

EPR Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	0	10	20	30	40
ENGINE ANTI-ICE ON	-0.01	-0.02	-0.03	-0.04	-0.05
ENGINE & WING ANTI-ICE ON	-0.03	-0.04	-0.06	-0.07	-0.08

VREF (KIAS)

WEIGHT (1000 KG)	FLAPS	
	30	25
400	184	192
380	179	187
360	174	181
340	168	176
320	163	170
300	157	164
280	152	158
260	146	152
240	140	146
220	133	139
200	127	132

Increase VREF 1 knot/4000 ft above sea level.

Intentionally
Blank

Performance Inflight - QRH — Chapter PI-QRH

Advisory Information — Section 11

ADVISORY INFORMATION

Normal Configuration Landing Distance

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		APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	250000 KG LANDING WEIGHT	PER 5000 KG ABOVE/ BELOW 250000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD WIND	TAIL WIND	DOWN HILL	UP HILL	ABV ISA	BLW ISA	PER 10 KTS ABOVE VREF30	2 REV	NO REV
MAX MANUAL	1055	20/-15	30	-55	180	15	-15	30	-30	115	25	55
MAX AUTO	1270	20/-20	40	-65	215	0	0	35	-35	150	0	0
AUTOBRAKE 4	1555	30/-30	50	-85	280	0	0	45	-45	190	0	0
AUTOBRAKE 3	1825	35/-35	60	-100	340	10	-15	55	-55	210	5	10
AUTOBRAKE 2	2055	40/-40	70	-115	395	30	-40	70	-65	190	30	35
AUTOBRAKE 1	2275	45/-45	80	-135	460	60	-70	80	-70	190	145	210

Good Reported Braking Action

MAX MANUAL	1600	30/-30	50	-85	310	45	-40	50	-45	165	85	195
MAX AUTO	1655	30/-30	50	-90	315	35	-30	50	-45	180	85	200
AUTOBRAKES 4	1800	35/-35	55	-100	335	10	-5	50	-50	220	10	70
AUTOBRAKES 3	2100	40/-40	70	-115	390	15	-15	65	-65	240	5	10

Medium Reported Braking Action

MAX MANUAL	2145	40/-40	75	-130	490	105	-85	75	-65	190	220	530
MAX AUTO	2145	40/-40	75	-130	490	105	-75	75	-65	215	215	520
AUTOBRAKES 4	2145	45/-40	75	-130	490	105	-75	75	-65	205	220	535
AUTOBRAKES 3	2265	45/-45	75	-140	500	85	-55	75	-70	240	150	455

Poor Reported Braking Action

MAX MANUAL	2770	60/-60	100	-195	780	275	-165	105	-80	215	460	1210
MAX AUTO	2770	60/-60	100	-195	775	275	-160	105	-80	220	465	1225
AUTOBRAKES 4	2770	60/-60	100	-195	775	275	-160	105	-80	220	460	1220
AUTOBRAKES 3	2770	60/-60	100	-195	785	275	-150	105	-80	240	465	1230

Reference distance is for sea level, standard day, no wind or slope, and four engine max reverse.
Max manual braking reference distance assumes use of auto spoilers. For manual spoilers, add 85 m.
Autobrake reference distance good for auto or manual spoilers.
Reference distances include distance from 50 ft above threshold (approximately 305 m flare distance).
Good, Medium, and Poor Reported Braking Action distances and adjustments have been factored by 1.15.
Assumes VREF30 approach speed.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 25

Dry Runway

	LANDING DISTANCE AND ADJUSTMENTS (M)											
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ PER 10 KTS		SLOPE ADJ PER 1%		TEMP ADJ PER 10°C		APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	250000 KG LANDING WEIGHT	PER 5000 KG ABOVE/ BELOW 250000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD WIND	TAIL WIND	DOWN HILL	UP HILL	ABV ISA	BLW ISA	PER 10 KTS ABOVE VREF25	2 REV	NO REV
MAX MANUAL	1120	30/-20	35	-55	185	20	-15	30	-30	115	30	60
MAX AUTO	1360	25/-25	40	-65	220	0	0	40	-40	155	0	0
AUTOBRAKES 4	1670	30/-30	55	-85	290	0	0	50	-50	200	0	0
AUTOBRAKES 3	1985	40/-40	65	-105	350	5	-15	60	-60	225	5	10
AUTOBRAKES 2	2250	45/-45	75	-120	410	20	-45	75	-70	210	25	25
AUTOBRAKES 1	2495	50/-50	90	-140	480	65	-75	90	-75	210	180	220

Good Reported Braking Action

MAX MANUAL	1695	35/-30	55	-90	315	45	-40	50	-45	165	105	230
MAX AUTO	1750	35/-35	55	-90	320	40	-35	55	-50	180	105	235
AUTOBRAKES 4	1930	35/-35	65	-105	345	10	-5	55	-60	230	10	75
AUTOBRAKES 3	2285	45/-45	75	-120	405	5	-15	70	-70	260	5	10

Medium Reported Braking Action

MAX MANUAL	2305	45/-45	80	-140	500	120	-90	80	-70	200	265	655
MAX AUTO	2305	45/-45	80	-140	500	115	-80	80	-70	220	255	645
AUTOBRAKES 4	2305	45/-45	80	-140	500	110	-75	80	-70	220	265	650
AUTOBRAKES 3	2450	45/-45	80	-145	520	80	-55	80	-75	260	175	565

Poor Reported Braking Action

MAX MANUAL	2995	65/-65	110	-200	805	295	-185	115	-85	225	560	1530
MAX AUTO	2995	65/-55	110	-200	800	300	-170	115	-85	225	565	1545
AUTOBRAKES 4	2995	65/-55	110	-200	800	295	-170	115	-85	230	565	1545
AUTOBRAKES 3	2995	65/-55	110	-200	805	285	-155	115	-85	255	570	1560

Reference distance is for sea level, standard day, no wind or slope, and four engine max reverse.
Max manual braking reference distance assumes use of auto spoilers. For manual spoilers, add 85 m.
Autobrake reference distance good for auto or manual spoilers.
Reference distances include distance from 50 ft above threshold (approximately 305 m flare distance).
Good, Medium, and Poor Reported Braking Action distances and adjustments have been factored by 1.15.
Assumes VREF25 approach speed.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

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	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	250000 KG LANDING WEIGHT	PER 5000 KG ABOVE/ BELOW 250000 KG	PER 1000 FT ABV SEA LEVEL	HEAD/ TAIL	DOWN HILL/ UP HILL	ABV ISA/ BLW ISA	PER 10 KTS ABV VREF	TWO REV	NO REV
AIR/GROUND LOGIC IN AIR MODE FLAPS 30	VREF30	1265	25/ -20	45	-65/ 220	30/ -30	40/ -40	180		
ANTI-SKID INOPERATIVE FLAPS 30	VREF30	1910	35/ -35	75	-125/ 455	115/ -85	75/ -65	180	205	485
ASYMMETRIC/ SPLIT TRAILING EDGE FLAPS FLAPS 25	VREF30+25	1385	25/ -20	50	-65/ 215	25/ -25	45/ -45	140	50	105
FLAPS UP	VREF30+70	1950	75/ -35	120	-100/ 410	45/ -40	105/ -95	230	115	310
JAMMED STABILIZER FLAPS 25	VREF30+20	1265	30/ -20	45	-65/ 210	25/ -20	45/ -40	115	45	95
LEADING EDGE FLAPS INOP FLAPS 25	VREF30+25	1345	30/ -20	45	-65/ 210	25/ -25	45/ -45	125	45	100
ONE BODY GEAR UP FLAPS 30	VREF30	1135	35/ -25	45	-70/ 230	30/ -25	40/ -40	120	50	105
ONE WING GEAR UP FLAPS 30	VREF30	1185	35/ -20	45	-70/ 230	35/ -30	45/ -40	130		60
TWO WING GEAR UP FLAPS 30	VREF30	1455	60/ -40	85	-95/ 450	65/ -55	70/ -55	205		125
TWO HYDRAULIC SYSTEMS INOP FLAPS 25	VREF30+20	1840	30/ -30	65	-85/ 285	70/ -60	60/ -60	280		
REVERSER UNLOCKED FLAPS 25	VREF30+20	1305	30/ -20	45	-65/ 215	30/ -25	45/ -45	120		50

Actual (unfactored) distances are shown.
Includes distances from 50 ft above threshold (4.22 sec flare time).
Assumes max manual braking and maximum available reverse thrust.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Good Reported Braking Action

		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	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	250000 KG LANDING WEIGHT	PER 5000 KG ABOVE/ BELOW 250000 KG	PER 1000 FT ABV SEA LEVEL	HEAD/ TAIL	DOWN HILL/ UP HILL	ABV ISA/ BLW ISA	PER 10 KTS ABV VREF	TWO REV	NO REV
AIR/GROUND LOGIC IN AIR MODE FLAPS 30	VREF30	1780	30/ -30	65	-105/ 345	90/ -70	60/ -60	230		
ANTI-SKID INOPERATIVE FLAPS 30	VREF30	1910	35/ -35	75	-125/ 455	115/ -85	75/ -65	180	205	485
ASYMMETRIC/ SPLIT TRAILING EDGE FLAPS FLAPS 25	VREF30+25	1785	30/ -30	70	-90/ 310	55/ -50	65/ -60	160	125	280
FLAPS UP	VREF30+70	2495	40/ -35	95	-105/ 355	75/ -65	95/ -85	170	195	510
JAMMED STABILIZER FLAPS 25	VREF30+20	1680	30/ -30	65	-90/ 305	55/ -45	60/ -55	160	115	260
LEADING EDGE FLAPS INOP FLAPS 25	VREF30+25	1775	30/ -30	70	-90/ 310	60/ -50	65/ -60	165	125	290
ONE BODY GEAR UP FLAPS 30	VREF30	1390	25/ -25	55	-85/ 285	45/ -40	50/ -45	155	80	185
ONE WING GEAR UP FLAPS 30	VREF30	1590	30/ -30	60	-95/ 315	70/ -60	60/ -55	200		130
TWO WING GEAR UP FLAPS 30	VREF30	1475	55/ -25	85	-95/ 450	65/ -55	70/ -55	205		125
TWO HYDRAULIC SYSTEMS INOP FLAPS 25	VREF30+20	2440	40/ -40	90	-125/ 405	150/ -120	85/ -85	330		
REVERSER UNLOCKED FLAPS 25	VREF30+20	1785	30/ -30	65	-95/ 325	65/ -55	65/ -60	170		145

Actual (unfactored) distances are shown.
Includes distances from 50 ft above threshold (4.22 sec flare time).
Assumes max manual braking and maximum available reverse thrust.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Medium Reported Braking Action

		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	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	250000 KG LANDING WEIGHT	PER 5000 KG ABOVE/ BELOW 250000 KG	PER 1000 FT ABV SEA LEVEL	HEAD/ TAIL	DOWN HILL/ UP HILL	ABV ISA/ BLW ISA	PER 10 KTS ABV VREF	TWO REV	NO REV
AIR/GROUND LOGIC IN AIR MODE FLAPS 30	VREF30	2665	45/ -45	95	-170/ 595	270/ -185	95/ -90	290		
ANTI-SKID INOPERATIVE FLAPS 30	VREF30	2450	50/ -50	105	-185/ 715	275/ -170	105/ -85	200	425	1095
ASYMMETRIC/ SPLIT TRAILING EDGE FLAPS FLAPS 25	VREF30+25	2310	40/ -40	95	-135/ 480	125/ -100	95/ -80	180	280	670
FLAPS UP	VREF30+70	3435	55/ -55	145	-165/ 565	180/ -145	145/ -120	215	505	1300
JAMMED STABILIZER FLAPS 25	VREF30+20	2250	40/ -40	90	-135/ 480	130/ -100	90/ -80	185	285	695
LEADING EDGE FLAPS INOP FLAPS 25	VREF30+25	2370	45/ -45	100	-140/ 490	135/ -105	95/ -85	190	310	755
ONE BODY GEAR UP FLAPS 30	VREF30	1875	35/ -35	75	-125/ 450	115/ -90	75/ -65	180	210	500
ONE WING GEAR UP FLAPS 30	VREF30	2215	45/ -40	90	-145/ 515	175/ -130	85/ -80	230		355
TWO WING GEAR UP FLAPS 30	VREF30	2090	40/ -40	80	-140/ 495	155/ -115	80/ -75	205		300
TWO HYDRAULIC SYSTEMS INOP FLAPS 25	VREF30+20	3655	60/ -60	135	-205/ 695	420/ -285	130/ -125	385		
REVERSER UNLOCKED FLAPS 25	VREF30+20	2515	45/ -45	100	-150/ 530	175/ -130	100/ -90	210		410

Actual (unfactored) distances are shown.
Includes distances from 50 ft above threshold (4.22 sec flare time).
Assumes max manual braking and maximum available reverse thrust.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Poor Reported Braking Action

		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	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	250000 KG LANDING WEIGHT	PER 5000 KG ABOVE/ BELOW 250000 KG	PER 1000 FT ABV SEA LEVEL	HEAD/ TAIL	DOWN HILL/ UP HILL	ABV ISA/ BLW ISA	PER 10 KTS ABV VREF	TWO REV	NO REV
AIR/GROUND LOGIC IN AIR MODE FLAPS 30	VREF30	3975	65/ -65	140	-290/ 1060	925/ -450	145/ -130	335		
ANTI-SKID INOPERATIVE FLAPS 30	VREF30	3370	65/ -65	135	-320/ 1570	1335/ -410	150/ -100	215	1080	3490
ASYMMETRIC/ SPLIT TRAILING EDGE FLAPS FLAPS 25	VREF30+25	2870	55/ -55	120	-195/ 740	285/ -180	125/ -100	190	520	1355
FLAPS UP	VREF30+70	4450	80/ -80	200	-240/ 885	425/ -280	210/ -160	250	1050	2935
JAMMED STABILIZER FLAPS 25	VREF30+20	2875	55/ -55	125	-200/ 755	305/ -195	125/ -105	205	575	1535
LEADING EDGE FLAPS INOP FLAPS 25	VREF30+25	3015	60/ -55	130	-205/ 765	320/ -205	135/ -110	210	615	1645
ONE BODY GEAR UP FLAPS 30	VREF30	2420	50/ -50	105	-185/ 710	280/ -175	105/ -85	200	435	1125
ONE WING GEAR UP FLAPS 30	VREF30	2985	60/ -55	120	-225/ 845	465/ -265	125/ -105	250		800
TWO WING GEAR UP FLAPS 30	VREF30	2870	55/ -55	115	-220/ 825	435/ -250	115/ -100	235		715
TWO HYDRAULIC SYSTEMS INOP FLAPS 25	VREF30+20	5405	80/ -80	185	-345/ 1225	1350/ -645	195/ -180	420		
REVERSER UNLOCKED FLAPS 25	VREF30+20	3410	60/ -60	140	-235/ 880	480/ -280	140/ -120	240		955

Actual (unfactored) distances are shown.
Includes distances from 50 ft above threshold (4.22 sec flare time).
Assumes max manual braking and maximum available reverse thrust.

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy per Brake (Millions of Foot Pounds)

		BRAKES ON SPEED (KIAS)																	
		80			100			120			140			160			180		
WEIGHT (1000 KG)	OAT (°C)	PRESS ALT			PRESS ALT			PRESS ALT			PRESS ALT			PRESS ALT			PRESS ALT		
		0	4	8	0	4	8	0	4	8	0	4	8	0	4	8	0	4	8
400	0	19.9	21.8	24.1	28.8	32.1	35.8	39.1	43.7	49.0	50.5	56.5	63.4	62.4	69.9	78.4	74.3	83.2	
	15	20.8	22.9	25.2	30.3	33.7	37.5	41.1	45.9	51.4	53.0	59.3	66.6	65.5	73.3	82.2	77.9	87.1	
	20	21.1	23.2	25.6	30.7	34.2	38.1	41.7	46.6	52.2	53.8	60.3	67.6	66.5	74.4	83.4	79.1	88.4	
	40	21.8	24.0	26.6	32.0	35.6	39.8	43.5	48.7	54.6	56.3	63.1	70.8	69.6	78.0	87.5	82.9	92.7	
	60	21.7	24.0	26.6	32.1	36.0	40.4	44.3	49.7	55.9	57.6	64.7	72.8	71.6	80.3	90.3	85.5	95.9	
350	0	18.0	19.7	21.6	25.9	28.8	32.0	35.0	39.1	43.7	45.0	50.4	56.6	55.7	62.4	70.1	66.4	74.4	83.5
	15	18.8	20.6	22.6	27.2	30.2	33.6	36.8	41.0	45.9	47.3	52.9	59.4	58.5	65.5	73.5	69.7	78.0	87.4
	20	19.1	20.9	23.0	27.6	30.7	34.1	37.4	41.7	46.7	48.1	53.8	60.3	59.4	66.5	74.6	70.8	79.2	88.7
	40	19.6	21.6	23.8	28.7	31.9	35.5	38.9	43.5	48.8	50.2	56.2	63.1	62.2	69.7	78.2	74.2	83.0	93.1
	60	19.5	21.5	23.7	28.8	32.0	35.9	39.5	44.3	49.7	51.3	57.5	64.8	63.8	71.6	80.5	76.3	85.7	96.2
300	0	16.1	17.5	19.1	23.1	25.5	28.2	31.0	34.5	38.5	39.7	44.3	49.7	49.0	54.9	61.6	58.5	65.5	73.6
	15	16.8	18.3	20.0	24.2	26.7	29.6	32.5	36.2	40.4	41.6	46.5	52.2	51.4	57.6	64.6	61.4	68.8	77.1
	20	17.1	18.6	20.3	24.5	27.1	30.1	33.0	36.8	41.1	42.3	47.3	53.0	52.3	58.5	65.6	62.4	69.8	78.3
	40	17.5	19.1	21.0	25.4	28.2	31.3	34.4	38.3	42.9	44.2	49.4	55.4	54.7	61.2	68.7	65.3	73.2	82.1
	60	17.2	18.9	20.8	25.5	28.3	31.4	34.7	38.9	43.6	44.9	50.4	56.7	55.9	62.8	70.6	67.0	75.3	84.6
250	0	14.2	15.4	16.7	20.1	22.1	24.4	26.8	29.7	33.1	34.0	38.0	42.5	41.8	46.7	52.4	50.2	56.2	63.1
	15	14.8	16.1	17.4	21.1	23.2	25.6	28.1	31.2	34.7	35.7	39.9	44.6	43.9	49.1	55.0	52.7	59.0	66.2
	20	15.0	16.3	17.7	21.4	23.6	26.0	28.5	31.7	35.3	36.3	40.5	45.3	44.6	49.8	55.9	53.5	59.9	67.2
	40	15.4	16.7	18.2	22.1	24.4	27.0	29.6	33.0	36.8	37.8	42.3	47.3	46.6	52.1	58.5	56.0	62.7	70.4
	60	15.0	16.4	17.9	22.0	24.4	27.0	29.8	33.2	37.2	38.3	42.9	48.2	47.4	53.2	59.9	57.3	64.3	72.4
200	0	12.4	13.3	14.3	17.3	18.9	20.7	22.6	25.0	27.6	28.3	31.5	35.1	34.4	38.3	42.9	40.7	45.5	51.1
	15	13.0	13.9	15.0	18.1	19.8	21.7	23.7	26.2	29.0	29.7	33.0	36.8	36.1	40.2	45.0	42.8	47.8	53.6
	20	13.1	14.1	15.2	18.3	20.1	22.0	24.1	26.6	29.5	30.2	33.6	37.4	36.7	40.9	45.8	43.5	48.6	54.5
	40	13.4	14.4	15.5	18.9	20.7	22.7	24.9	27.6	30.6	31.4	34.9	39.0	38.2	42.7	47.8	45.4	50.8	57.0
	60	13.0	14.0	15.2	18.7	20.5	22.7	24.9	27.7	30.8	31.5	35.3	39.6	38.7	43.4	48.7	46.2	51.8	58.3

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, altitude, and OAT effects, and enter table at sea level and 15°C.

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	3.5	12.6	21.7	30.8	39.9	49.1	58.3	67.7	77.2
	MAX AUTO	3.5	11.9	20.5	29.2	38.2	47.3	56.5	66.0	75.7
	AUTOBRAKE 4	3.2	11.3	19.2	27.2	35.3	43.7	52.5	61.9	71.9
	AUTOBRAKE 3	3.2	10.7	18.2	25.6	33.1	40.8	48.9	57.5	66.7
	AUTOBRAKE 2	3.2	10.2	17.0	23.8	30.7	37.7	45.1	52.8	61.1
	AUTOBRAKE 1	2.7	9.1	15.2	21.1	26.9	32.8	38.8	45.1	51.8

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Four Engine Reverse

		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	3.6	11.8	20.1	28.3	36.5	44.8	53.0	61.3	69.5
	MAX AUTO		7.7	16.1	24.5	32.9	41.3	49.7	58.1	66.6
	AUTOBRAKE 4		5.0	12.4	19.8	27.1	34.5	41.9	49.3	56.7
	AUTOBRAKE 3		3.6	9.9	16.2	22.5	28.7	35.0	41.3	47.6
	AUTOBRAKE 2		2.2	7.2	12.2	17.2	22.1	27.1	32.1	37.1
	AUTOBRAKE 1		0.7	4.3	7.8	11.3	14.8	18.4	21.9	25.4

Cooling Time (Minutes)

	ADJUSTED BRAKE ENERGY PER BRAKE (MILLION OF FOOT POUNDS)								
	15 & BELOW	16	20	22	24	27	31	34 TO 45	45 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	3	4	5	6	7	CAUTION	FUSE PLUG MELT ZONE
GROUND		10	28	35	42	52	62		
BTMS	UP TO 2	2	2	3	3	3	4	5 TO 6	7 & ABOVE

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 for each taxi mile.
For one brake deactivated, increase brake energy by 7 percent.
For two brakes deactivated, increase brake energy by 15 percent.
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 8 minutes.
When in fuse plug melt zone, clear runway immediately. Unless required, do not set parking brake. Do not 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 EICAS 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.

1 ENGINE INOP

Max Continuous EPR

45000 FT to 25000 FT Pressure Altitudes

Based on engine bleed for 3 packs on

PRESSURE ALTITUDE (FT)		KIAS					MACH NUMBER				
		150	200	250	300	350	.70	.75	.80	.85	.90
45000	EPR		1.61	1.52			1.61	1.61	1.59	1.56	1.52
	MAX TAT		-16	-4			-19	-15	-12	-8	-4
	EPR CORR		0.08	0.10			0.07	0.08	0.09	0.10	0.10
43000	EPR		1.62	1.55	1.43		1.62	1.62	1.60	1.57	1.53
	MAX TAT		-18	-7	7		-19	-15	-12	-8	-4
	EPR CORR		0.07	0.09	0.10		0.07	0.08	0.09	0.10	0.10
41000	EPR		1.64	1.59	1.48		1.64	1.63	1.62	1.59	1.55
	MAX TAT		-20	-9	3		-19	-15	-12	-8	-4
	EPR CORR		0.06	0.09	0.10		0.07	0.08	0.09	0.10	0.10
39000	EPR		1.67	1.63	1.53		1.66	1.65	1.64	1.61	1.57
	MAX TAT		-22	-12	0		-19	-15	-12	-8	-4
	EPR CORR		0.05	0.09	0.10		0.07	0.08	0.09	0.10	0.10
37000	EPR		1.69	1.66	1.58		1.68	1.67	1.65	1.62	1.59
	MAX TAT		-24	-14	-4		-19	-15	-12	-8	-4
	EPR CORR		0.04	0.09	0.10		0.07	0.08	0.09	0.10	0.10
35000	EPR		1.70	1.67	1.61		1.68	1.67	1.66	1.63	1.59
	MAX TAT		-18	-12	-4		-16	-13	-9	-6	-2
	EPR CORR		0.05	0.08	0.10		0.07	0.08	0.09	0.10	0.10
33000	EPR		1.71	1.67	1.62		1.67	1.66	1.64	1.61	1.57
	MAX TAT		-18	-11	-2		-12	-8	-4	-1	3
	EPR CORR		0.05	0.08	0.10		0.08	0.09	0.09	0.10	0.10
31000	EPR		1.72	1.66	1.61	1.52	1.65	1.64	1.61	1.57	1.53
	MAX TAT		-16	-8	1	8	-7	-4	0	4	8
	EPR CORR		0.06	0.08	0.10	0.10	0.08	0.09	0.09	0.10	0.10
29000	EPR		1.71	1.65	1.58	1.49	1.62	1.60	1.57	1.53	1.48
	MAX TAT		-14	-6	3	12	-3	0	4	8	12
	EPR CORR		0.06	0.08	0.09	0.10	0.08	0.09	0.10	0.10	0.10
27000	EPR	1.69	1.69	1.64	1.56	1.47	1.58	1.56	1.52	1.48	1.43
	MAX TAT	-12	-9	-4	4	13	1	5	9	13	17
	EPR CORR	0.06	0.07	0.08	0.09	0.10	0.09	0.09	0.10	0.10	0.10
25000	EPR	1.68	1.67	1.62	1.53	1.45	1.54	1.52	1.48	1.43	
	MAX TAT	-10	-6	-1	7	15	6	9	13	17	
	EPR CORR	0.07	0.08	0.09	0.09	0.10	0.09	0.09	0.10	0.10	

Decrease EPR by the EPR CORR for every 10°C above the MAX TAT shown.

EPR Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	0	10	20	30	40	45
1 PACK OFF	0.01	0.01	0.01	0.01	0.01	0.01
2 PACKS OFF	0.02	0.02	0.02	0.02	0.02	0.02
ENGINE ANTI-ICE ON	-0.01	-0.02	-0.03	-0.04	-0.05	-0.05
ENGINE & WING ANTI-ICE ON	-0.03	-0.04	-0.06	-0.07	-0.08	-0.08

1 ENGINE INOP

Max Continuous EPR

24000 FT to Sea Level Pressure Altitudes

Based on engine bleed for 3 packs on

PRESSURE ALTITUDE (FT)		KIAS					MACH NUMBER				
		150	200	250	300	350	.70	.75	.80	.85	.90
24000	EPR	1.68	1.66	1.61	1.52	1.45	1.52	1.49	1.46	1.41	
	MAX TAT	-10	-5	0	8	16	8	11	15	19	
	EPR CORR	0.07	0.08	0.09	0.09	0.10	0.09	0.09	0.10	0.10	
22000	EPR	1.67	1.64	1.58	1.50	1.43	1.48	1.45	1.41		
	MAX TAT	-7	-3	4	11	18	12	16	20		
	EPR CORR	0.07	0.09	0.09	0.09	0.09	0.09	0.09	0.09		
20000	EPR	1.65	1.61	1.56	1.48	1.40	1.44	1.41			
	MAX TAT	-3	1	6	13	20	17	20			
	EPR CORR	0.08	0.09	0.09	0.09	0.09	0.09	0.09			
18000	EPR	1.63	1.59	1.54	1.47	1.39	1.41	1.38			
	MAX TAT	0	4	9	15	23	21	24			
	EPR CORR	0.08	0.09	0.09	0.09	0.08	0.08	0.09			
16000	EPR	1.60	1.56	1.51	1.45	1.38	1.38				
	MAX TAT	4	8	12	18	25	25				
	EPR CORR	0.09	0.09	0.09	0.09	0.08	0.08				
14000	EPR	1.57	1.54	1.49	1.43	1.36	1.34				
	MAX TAT	8	11	15	21	27	30				
	EPR CORR	0.09	0.09	0.09	0.08	0.08	0.08				
12000	EPR	1.54	1.51	1.46	1.40	1.35					
	MAX TAT	11	15	19	24	30					
	EPR CORR	0.08	0.08	0.08	0.08	0.07					
10000	EPR	1.51	1.48	1.44	1.38	1.33					
	MAX TAT	16	18	22	27	33					
	EPR CORR	0.08	0.08	0.08	0.07	0.07					
5000	EPR	1.43	1.41	1.38	1.33	1.28					
	MAX TAT	25	27	30	34	40					
	EPR CORR	0.06	0.06	0.06	0.06	0.06					
1500	EPR	1.38	1.37	1.33	1.29	1.25					
	MAX TAT	31	33	37	41	45					
	EPR CORR	0.05	0.05	0.05	0.05	0.05					
0	EPR	1.37	1.35	1.32	1.28	1.24					
	MAX TAT	33	36	39	43	47					
	EPR CORR	0.05	0.05	0.05	0.05	0.05					

Decrease EPR by the EPR CORR for every 10°C above the MAX TAT shown.

EPR Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	0	10	20	30	40	45
1 PACK OFF	0.01	0.01	0.01	0.01	0.01	0.01
2 PACKS OFF	0.02	0.02	0.02	0.02	0.02	0.02
ENGINE ANTI-ICE ON	-0.01	-0.02	-0.03	-0.04	-0.05	-0.05
ENGINE & WING ANTI-ICE ON	-0.03	-0.04	-0.06	-0.07	-0.08	-0.08

1 ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
400	390	304	25000	24900	23800
380	371	297	26600	26600	25500
360	351	290	28300	28300	27300
340	332	282	29900	29900	29000
320	313	275	31600	31500	30700
300	294	267	33100	33100	32300
280	274	259	34600	34600	33900
260	255	249	36000	36000	35400
240	235	239	37500	37400	36900
220	215	229	39000	39000	38400
200	196	217	40700	40700	40100

Altitude reduced by 1000 ft for additional margin.

Long Range Cruise Altitude Capability
Based on engine bleed for packs on or off

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
400	22200	22100	20100
390	23200	23100	21200
380	24200	24100	22300
370	25200	25100	23400
360	26200	26100	24500
350	27200	27100	25500
340	28200	28100	26600
330	29200	29100	27600
320	30100	30000	28700
310	31000	31000	29700
300	32000	31900	30700
290	32800	32700	31700
280	33600	33500	32600
270	34400	34300	33400
260	35100	35100	34300
250	35800	35800	35200
240	36600	36500	35900
230	37300	37300	36600
220	38100	38000	37400
210	38900	38900	38200
200	39800	39700	39000

Altitude reduced by 1000 ft for additional margin.
With engine anti-ice on, decrease altitude capabilty by 1800 ft.
With engine and wing anti-ice on, decrease altitude capability by 3500 ft.

1 ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		10	14	20	25	27	29	31	33	35	37
400	EPR	1.11	1.17	1.29							
	MACH	.627	.680	.765							
	KIAS	349	352	356							
	FF/ENG	4632	4772	4958							
380	EPR	1.10	1.15	1.26	1.42						
	MACH	.612	.662	.750	.806						
	KIAS	340	343	348	340						
	FF/ENG	4361	4455	4670	4752						
360	EPR	1.09	1.13	1.23	1.37	1.46					
	MACH	.596	.644	.732	.792	.815					
	KIAS	331	333	340	334	331					
	FF/ENG	4100	4164	4375	4424	4511					
340	EPR	1.08	1.11	1.20	1.32	1.40	1.50				
	MACH	.580	.626	.711	.778	.800	.824				
	KIAS	322	323	329	327	324	321				
	FF/ENG	3850	3893	4066	4135	4180	4283				
320	EPR	1.06	1.10	1.18	1.28	1.35	1.43	1.53			
	MACH	.565	.607	.688	.762	.784	.807	.833			
	KIAS	313	313	318	320	317	314	311			
	FF/ENG	3609	3632	3752	3865	3877	3937	4078			
300	EPR	1.05	1.08	1.15	1.25	1.30	1.37	1.46	1.57		
	MACH	.549	.589	.665	.743	.768	.791	.815	.841		
	KIAS	304	304	307	312	310	306	303	301		
	FF/ENG	3381	3385	3447	3593	3610	3628	3706	3868		
280	EPR	1.05	1.07	1.13	1.22	1.26	1.32	1.39	1.49		
	MACH	.533	.571	.642	.719	.749	.773	.796	.821		
	KIAS	296	294	296	301	302	299	296	293		
	FF/ENG	3168	3148	3170	3305	3344	3359	3389	3481		
260	EPR	1.04	1.06	1.11	1.19	1.23	1.27	1.33	1.42	1.52	
	MACH	.517	.552	.619	.691	.724	.754	.778	.801	.827	
	KIAS	287	284	284	288	291	291	288	285	282	
	FF/ENG	2967	2919	2913	3001	3063	3097	3114	3155	3248	
240	EPR	1.03	1.05	1.09	1.15	1.19	1.23	1.28	1.35	1.43	1.54
	MACH	.502	.534	.595	.662	.693	.727	.757	.781	.805	.831
	KIAS	278	274	273	276	278	280	280	277	274	271
	FF/ENG	2775	2699	2667	2709	2763	2820	2853	2871	2911	3031
220	EPR	1.03	1.04	1.07	1.13	1.16	1.19	1.24	1.29	1.35	1.45
	MACH	.485	.516	.572	.633	.662	.694	.729	.759	.783	.807
	KIAS	269	265	262	263	264	266	269	268	265	262
	FF/ENG	2584	2496	2432	2441	2471	2524	2579	2611	2627	2685
200	EPR	1.02	1.03	1.06	1.10	1.13	1.15	1.19	1.24	1.29	1.36
	MACH	.468	.497	.548	.604	.631	.660	.693	.728	.758	.783
	KIAS	259	255	251	250	251	252	254	256	256	253
	FF/ENG	2383	2306	2205	2193	2201	2233	2285	2339	2366	2394

1 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
281	260	242	226	212	200	191	183	175	168	162
843	781	726	679	637	600	575	553	531	512	494
1410	1306	1212	1132	1063	1000	960	922	887	855	825
1982	1833	1700	1587	1489	1400	1343	1291	1242	1197	1155
2556	2362	2190	2043	1915	1800	1727	1659	1596	1538	1485
3135	2895	2682	2500	2342	2200	2111	2028	1951	1879	1814
3718	3431	3176	2958	2769	2600	2494	2396	2305	2220	2143
4306	3970	3671	3417	3197	3000	2878	2764	2658	2561	2472
4899	4512	4169	3878	3626	3400	3261	3131	3011	2900	2799
5496	5058	4668	4339	4055	3800	3644	3499	3364	3240	3126
6099	5607	5171	4802	4484	4200	4027	3866	3716	3578	3452
6708	6160	5676	5267	4915	4600	4410	4233	4068	3916	3777
7323	6718	6183	5733	5346	5000	4792	4599	4419	4253	4102

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT) 10		22		25		29		33	
	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	5.4	0:37	3.9	0:33	3.5	0:32	3.2	0:32	3.0	0:32
600	16.5	1:47	13.4	1:31	12.8	1:27	12.1	1:24	12.0	1:22
1000	27.7	2:58	22.9	2:30	22.1	2:23	21.1	2:16	20.9	2:12
1400	38.6	4:10	32.2	3:30	31.1	3:19	29.7	3:09	29.5	3:02
1800	49.3	5:23	41.2	4:30	39.9	4:16	38.2	4:03	37.8	3:53
2200	59.8	6:38	50.1	5:32	48.5	5:14	46.5	4:57	46.0	4:45
2600	70.1	7:53	58.7	6:35	56.9	6:14	54.7	5:51	53.9	5:37
3000	80.3	9:10	67.2	7:38	65.1	7:14	62.6	6:47	61.6	6:30
3400	90.2	10:28	75.4	8:43	73.0	8:15	70.3	7:43	69.0	7:23
3800	99.8	11:48	83.5	9:50	80.8	9:18	77.9	8:41	76.3	8:17
4200	109.3	13:09	91.4	10:57	88.4	10:21	85.2	9:40	83.5	9:11
4600	118.6	14:31	99.2	12:05	95.9	11:26	92.4	10:39	90.4	10:06
5000	127.7	15:56	106.7	13:15	103.1	12:32	99.4	11:40	97.3	11:02

1 ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	200	250	300	350	400
10	-1.7	-0.8	0.0	2.1	4.9
20	-3.4	-1.6	0.0	4.1	9.4
30	-5.1	-2.5	0.0	6.1	13.7
40	-6.9	-3.3	0.0	7.9	17.7
50	-8.7	-4.2	0.0	9.6	21.5
60	-10.5	-5.1	0.0	11.2	24.9
70	-12.3	-6.0	0.0	12.6	28.1
80	-14.2	-6.9	0.0	14.0	31.0
90	-16.1	-7.8	0.0	15.2	33.6
100	-18.0	-8.7	0.0	16.3	35.9
110	-20.0	-9.7	0.0	17.2	38.0
120	-21.9	-10.6	0.0	18.1	39.8
130	-23.9	-11.6	0.0	18.8	41.3
140	-26.0	-12.6	0.0	19.4	42.5

1 ENGINE INOP

MAX CONTINUOUS THRUST

Holding
Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	40000
400	EPR	1.07	1.10	1.14	1.22	1.29	1.47			
	KIAS	286	286	286	286	313	317			
	FF/ENG	4320	4280	4330	4430	4690	4950			
380	EPR	1.07	1.09	1.13	1.19	1.26	1.41			
	KIAS	280	280	280	280	306	310			
	FF/ENG	4100	4050	4060	4150	4390	4580			
360	EPR	1.06	1.08	1.11	1.18	1.23	1.37			
	KIAS	271	271	271	271	297	300			
	FF/ENG	3890	3830	3810	3880	4090	4250			
340	EPR	1.06	1.07	1.11	1.16	1.21	1.33	1.54		
	KIAS	261	261	261	261	288	291	295		
	FF/ENG	3680	3620	3580	3620	3790	3940	4280		
320	EPR	1.06	1.07	1.10	1.14	1.18	1.29	1.47		
	KIAS	251	251	251	251	279	282	286		
	FF/ENG	3460	3410	3360	3370	3510	3650	3870		
300	EPR	1.05	1.06	1.09	1.13	1.16	1.25	1.40		
	KIAS	242	242	242	242	270	272	276		
	FF/ENG	3250	3210	3150	3130	3250	3360	3520		
280	EPR	1.05	1.06	1.08	1.11	1.14	1.22	1.35	1.61	
	KIAS	233	233	233	233	260	262	266	270	
	FF/ENG	3030	3000	2950	2910	3000	3070	3220	3590	
260	EPR	1.04	1.05	1.07	1.10	1.12	1.19	1.30	1.50	
	KIAS	228	228	228	228	251	253	255	259	
	FF/ENG	2800	2780	2740	2680	2750	2800	2930	3160	
240	EPR	1.03	1.04	1.06	1.08	1.10	1.16	1.26	1.42	
	KIAS	221	221	221	221	240	242	244	248	
	FF/ENG	2580	2560	2540	2470	2510	2550	2650	2800	
220	EPR	1.03	1.03	1.05	1.07	1.08	1.13	1.22	1.35	
	KIAS	215	215	215	215	229	231	234	236	
	FF/ENG	2360	2350	2330	2270	2280	2300	2380	2500	
200	EPR	1.02	1.03	1.04	1.05	1.07	1.11	1.18	1.29	1.49
	KIAS	208	208	208	208	219	220	222	224	228
	FF/ENG	2160	2150	2140	2090	2080	2060	2110	2220	2430

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

Performance Inflight - QRH — Chapter PI-QRH
Gear Down — Section 13

GEAR DOWN

Takeoff Climb Limit
Based on engine bleed for 3 packs on and anti-ice off
Weight (1000 KG)

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)												
°C	°F	-2000	-1000	SL	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	131	284	272											
50	122	300	288	276	265	253								
45	113	317	304	292	280	268	256	245						
40	104	335	322	309	296	283	271	259	247	236	225			
35	95	355	342	328	314	301	287	275	263	251	239	228	217	
30	86	359	353	348	334	320	306	293	280	267	255	243	230	218
25	77	359	353	348	342	336	326	312	298	285	272	259	246	233
20	68	359	353	348	342	336	330	323	316	303	289	275	262	248
15	59	359	353	348	342	336	330	323	316	309	302	292	278	264
10 & BELOW	50 & BELOW	359	353	348	341	335	329	323	316	309	302	294	286	278

Applicable for flaps 10 or 20 takeoff.

Weight Adjustment for Bleed Configuration

BLEED CONFIGURATION	WEIGHT ADJUSTMENT (KG)	
	A/C PACKS OFF	A/C PACKS ON
A/I OFF	+6650	0
NACELLE A/I ON	-950	-10500
NACELLE AND WING A/I ON	-10350	-21200

Landing Climb Limit
Based on engine bleed for 3 packs on and anti-ice off
Weight (1000 KG)

AIRPORT OAT	AIRPORT PRESSURE ALTITUDE (FT)												
°C	-2000	-1000	SL	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	328	316	305	294	284	276							
50	300	348	337	326	318	303	292	281	272	263			
45	371	358	346	334	322	310	299	287	278	268	258		
40	392	378	365	352	339	327	315	303	292	280	270	260	250
35	395	389	385	369	354	342	330	318	307	294	283	271	261
30	395	389	385	380	370	356	343	331	318	306	295	283	272
25	396	389	385	380	372	363	354	342	329	316	304	292	281
20	396	389	385	380	372	363	355	346	339	326	314	301	290
15	396	389	385	380	372	363	355	346	340	331	322	308	297
10 & BELOW	396	389	385	380	372	364	355	346	340	331	322	313	304

Applicable for flaps 25 or 30 landing.
For 1 A/C Pack ON, add 3300 kg.
For A/C Packs OFF and 4900 kg.
Reduce Landing Climb Limit Weight by 36700 kg. when operating in icing conditions during any part of the flight with forecast landing temperature below 8°C.

GEAR DOWN

Max Climb EPR

Based on engine bleed for 3 packs on, engine and wing anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT) / SPEED (KIAS OR MACH)												
	0	5	10	12	14	16	18	20	22	24	26	28	30
	240	240	240	240	240	240	240	240	240	240	240	0.60	0.60
55	1.25												
50	1.27	1.27											
45	1.29	1.29	1.29										
40	1.32	1.32	1.32	1.31	1.30								
35	1.33	1.35	1.35	1.34	1.34	1.33							
30	1.33	1.38	1.38	1.38	1.37	1.37	1.36	1.36					
25	1.33	1.39	1.42	1.42	1.41	1.41	1.40	1.40	1.40	1.40			
20	1.33	1.39	1.46	1.46	1.45	1.45	1.45	1.45	1.45	1.45	1.45		
15	1.33	1.39	1.46	1.48	1.50	1.49	1.49	1.49	1.49	1.49	1.49	1.49	
10	1.33	1.39	1.46	1.48	1.50	1.53	1.54	1.54	1.54	1.54	1.54	1.54	1.54
5	1.33	1.39	1.46	1.48	1.50	1.53	1.56	1.58	1.58	1.58	1.58	1.58	1.58
0	1.33	1.39	1.46	1.48	1.50	1.53	1.56	1.58	1.61	1.62	1.62	1.62	1.63
-5	1.33	1.39	1.46	1.48	1.50	1.53	1.56	1.58	1.61	1.63	1.65	1.66	1.66
-10	1.33	1.39	1.46	1.48	1.50	1.53	1.56	1.58	1.61	1.63	1.65	1.68	1.70
-15	1.33	1.39	1.46	1.48	1.50	1.53	1.56	1.58	1.61	1.63	1.65	1.68	1.71
-20	1.33	1.39	1.46	1.48	1.50	1.53	1.56	1.58	1.61	1.63	1.65	1.68	1.71

EPR Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	0	10	20	30
ENGINE ANTI-ICE ON	-0.01	-0.02	-0.03	-0.04
ENGINE & WING ANTI-ICE ON	-0.03	-0.04	-0.06	-0.07

Long Range Cruise Altitude Capability

Max Climb Thrust, 100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
400	19100	19000	17300
380	20600	20600	18900
360	22000	21900	20400
340	23200	23200	21700
320	24900	24800	23600
300	26800	26800	25700
280	28900	28800	27900
260	31000	31000	30000
240	32900	32800	32100
220	34800	34800	34100
200	36700	36700	36200

GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		10	14	17	20	23	25	27	29	31	33
400	EPR	1.25	1.33								
	MACH	.488	.525								
	KIAS	270	270								
	FF/ENG	5036	5128								
380	EPR	1.23	1.30	1.37							
	MACH	.488	.525	.556							
	KIAS	270	270	270							
	FF/ENG	4841	4920	4929							
360	EPR	1.21	1.28	1.35							
	MACH	.488	.525	.556							
	KIAS	270	270	270							
	FF/ENG	4671	4737	4736							
340	EPR	1.20	1.26	1.32							
	MACH	.488	.524	.552							
	KIAS	270	269	268							
	FF/ENG	4524	4561	4533							
320	EPR	1.18	1.23	1.29	1.36						
	MACH	.481	.511	.538	.570						
	KIAS	266	263	261	261						
	FF/ENG	4297	4271	4231	4281						
300	EPR	1.16	1.21	1.26	1.32	1.41					
	MACH	.468	.499	.523	.552	.589					
	KIAS	259	256	254	252	254					
	FF/ENG	4021	3999	3936	3958	4030					
280	EPR	1.15	1.19	1.23	1.28	1.36	1.42	1.50			
	MACH	.456	.485	.509	.536	.568	.595	.624			
	KIAS	252	249	246	245	245	246	248			
	FF/ENG	3760	3724	3657	3664	3695	3755	3840			
260	EPR	1.13	1.17	1.21	1.25	1.31	1.37	1.44	1.52		
	MACH	.441	.471	.494	.520	.548	.572	.599	.630		
	KIAS	244	242	239	237	236	236	238	240		
	FF/ENG	3500	3454	3395	3380	3376	3415	3477	3564		
240	EPR	1.12	1.15	1.18	1.22	1.27	1.32	1.37	1.45	1.53	
	MACH	.426	.456	.479	.503	.529	.550	.574	.602	.634	
	KIAS	235	234	232	229	227	227	227	229	231	
	FF/ENG	3239	3191	3129	3110	3086	3092	3134	3197	3279	
220	EPR	1.10	1.13	1.16	1.19	1.24	1.27	1.32	1.38	1.45	1.54
	MACH	.409	.439	.462	.486	.511	.529	.550	.575	.604	.636
	KIAS	226	225	223	221	219	218	217	218	219	222
	FF/ENG	2979	2935	2869	2848	2812	2801	2812	2853	2917	2992
200	EPR	1.09	1.11	1.14	1.17	1.20	1.23	1.27	1.32	1.37	1.45
	MACH	.390	.421	.444	.468	.492	.509	.528	.548	.574	.603
	KIAS	215	215	214	213	211	209	208	207	208	209
	FF/ENG	2713	2680	2622	2588	2553	2532	2523	2535	2577	2636

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
285	264	245	228	213	200	191	183	175	168	161
597	545	500	462	429	400	381	364	348	333	320
906	825	754	695	644	600	571	545	521	499	479
1215	1105	1008	928	860	800	762	726	694	664	638
1527	1386	1263	1161	1076	1000	952	907	866	829	796
1841	1669	1519	1396	1292	1200	1141	1088	1038	993	953
2159	1955	1777	1631	1508	1400	1331	1268	1210	1157	1110
2480	2243	2036	1867	1725	1600	1521	1448	1381	1321	1266
2804	2533	2297	2104	1942	1800	1710	1628	1552	1484	1423
3133	2826	2559	2342	2160	2000	1900	1807	1723	1646	1578
3466	3122	2823	2581	2378	2200	2089	1986	1892	1808	1732
3804	3421	3089	2821	2597	2400	2277	2165	2062	1969	1886
4147	3724	3357	3061	2816	2600	2466	2343	2231	2130	2040
4495	4030	3627	3303	3035	2800	2655	2522	2401	2291	2193
4850	4340	3900	3547	3255	3000	2844	2700	2569	2451	2346
5210	4654	4175	3791	3476	3200	3032	2878	2737	2611	2498
5578	4973	4453	4038	3697	3400	3220	3055	2905	2770	2650
5954	5297	4733	4286	3919	3600	3408	3232	3072	2928	2800
6338	5627	5017	4535	4142	3800	3596	3409	3239	3086	2950
6731	5962	5304	4786	4366	4000	3784	3585	3405	3244	3100

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT) 10		14		18		22		25	
	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	10.3	0:40	9.6	0:39	8.7	0:38	8.0	0:36	7.5	0:35
400	20.3	1:23	19.0	1:19	17.5	1:16	16.4	1:12	15.7	1:09
600	30.3	2:05	28.4	2:00	26.4	1:54	24.9	1:48	23.9	1:43
800	40.3	2:48	37.9	2:40	35.3	2:33	33.4	2:24	32.1	2:17
1000	50.3	3:30	47.3	3:20	44.2	3:11	41.8	3:01	40.3	2:52
1200	59.9	4:15	56.3	4:02	52.6	3:50	49.8	3:38	48.1	3:27
1400	69.4	4:59	65.2	4:44	61.1	4:30	57.8	4:15	55.8	4:03
1600	78.6	5:45	74.0	5:26	69.3	5:10	65.6	4:53	63.3	4:39
1800	87.7	6:31	82.5	6:10	77.3	5:51	73.2	5:32	70.6	5:16
2000	96.7	7:18	91.0	6:54	85.3	6:32	80.8	6:11	77.9	5:53
2200	105.3	8:07	99.1	7:39	92.8	7:14	88.0	6:50	84.9	6:31
2400	113.8	8:56	107.2	8:24	100.4	7:57	95.2	7:30	91.8	7:09
2600	122.2	9:46	115.1	9:11	107.8	8:40	102.2	8:11	98.5	7:48
2800	130.3	10:38	122.8	9:59	115.1	9:24	109.1	8:52	105.1	8:27
3000	138.5	11:30	130.5	10:47	122.3	10:08	115.9	9:34	111.7	9:07
3200	146.2	12:26	137.8	11:37	129.2	10:54	122.4	10:16	117.9	9:47
3400	153.8	13:21	145.1	12:28	136.0	11:41	128.8	10:59	124.2	10:28
3600	161.3	14:19	152.2	13:19	142.8	12:28	135.2	11:43	130.2	11:10
3800	168.5	15:18	159.1	14:13	149.3	13:16	141.4	12:28	136.1	11:52
4000	175.7	16:18	166.0	15:07	155.9	14:05	147.5	13:12	142.1	12:34

GEAR DOWN

Long Range Cruise Enroute Fuel and Time

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	200	250	300	350	400
20	-3.7	-1.9	0.0	2.5	5.8
30	-5.5	-2.8	0.0	3.9	8.5
40	-7.4	-3.7	0.0	5.2	11.2
50	-9.3	-4.6	0.0	6.6	13.9
60	-11.2	-5.5	0.0	8.0	16.6
70	-13.2	-6.4	0.0	9.3	19.3
80	-15.3	-7.4	0.0	10.7	21.9
90	-17.4	-8.4	0.0	12.0	24.6
100	-19.6	-9.5	0.0	13.4	27.3
110	-21.8	-10.5	0.0	14.7	30.0
120	-24.1	-11.6	0.0	16.0	32.6
130	-26.5	-12.7	0.0	17.4	35.3
140	-28.9	-13.9	0.0	18.7	38.0
150	-31.4	-15.0	0.0	20.0	40.6
160	-33.9	-16.2	0.0	21.3	43.3

Descent at .66/240

PRESSURE ALT (1000 FT)	5	10	15	17	19	21	23	25	27	29	31	33	35	37
DISTANCE (NM)	18	27	37	40	44	48	52	55	59	63	67	71	74	77
TIME (MINUTES)	5	7	9	10	11	12	12	13	14	14	15	15	16	16

GEAR DOWN

Holding
Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
400	EPR	1.14	1.18	1.25	1.35			
	KIAS	270	270	270	270			
	FF/ENG	5230	5210	5290	5350			
380	EPR	1.13	1.16	1.23	1.32			
	KIAS	270	270	270	270			
	FF/ENG	5060	5030	5080	5130			
360	EPR	1.13	1.15	1.21	1.30			
	KIAS	270	270	270	270			
	FF/ENG	4910	4870	4910	4940			
340	EPR	1.11	1.14	1.19	1.27			
	KIAS	261	261	261	261			
	FF/ENG	4600	4560	4550	4580			
320	EPR	1.10	1.13	1.17	1.24	1.38		
	KIAS	251	251	251	251	270		
	FF/ENG	4280	4240	4210	4220	4700		
300	EPR	1.09	1.12	1.15	1.21	1.35		
	KIAS	242	242	242	242	270		
	FF/ENG	4000	3950	3910	3900	4540		
280	EPR	1.09	1.10	1.14	1.19	1.31		
	KIAS	233	233	233	233	260		
	FF/ENG	3720	3660	3620	3580	4180		
260	EPR	1.08	1.09	1.12	1.17	1.27	1.41	
	KIAS	228	228	228	228	251	253	
	FF/ENG	3510	3450	3400	3350	3830	3930	
240	EPR	1.07	1.08	1.11	1.15	1.24	1.35	1.53
	KIAS	221	221	221	221	240	242	244
	FF/ENG	3270	3220	3160	3100	3470	3550	3690
220	EPR	1.06	1.07	1.10	1.13	1.20	1.30	1.46
	KIAS	215	215	215	215	229	231	234
	FF/ENG	3050	3010	2940	2890	3140	3190	3320
200	EPR	1.06	1.07	1.09	1.12	1.17	1.25	1.38
	KIAS	208	208	208	208	219	220	222
	FF/ENG	2810	2780	2730	2660	2820	2850	2940

This table includes 5% additional fuel for holding in a racetrack pattern.

GEAR DOWN

1 ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

Based on engine bleed for 3 packs on

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
400	383	266	8400	8400	6200
390	374	264	9500	9500	7400
380	365	261	10500	10500	8600
370	356	259	11600	11500	9700
360	347	256	12600	12600	10800
350	337	254	13700	13600	11900
340	328	251	14700	14700	13000
330	319	248	15700	15700	14100
320	309	246	16700	16700	15200
310	300	243	17700	17700	16300
300	291	240	18800	18800	17500
290	281	237	19800	19800	18600
280	271	234	20900	20900	19800
270	262	231	22000	21900	20900
260	252	228	23100	23100	22100
250	242	225	24200	24200	23300
240	233	222	25200	25200	24400
230	223	219	26400	26300	25600
220	213	215	27500	27400	26700
210	204	212	28500	28500	27900
200	195	209	29500	29500	29000

Altitude reduced by 1000 ft for additional margin.

GEAR DOWN
1 ENGINE INOP
MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability
Based on engine bleed for 3 packs on

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
400	6200	6100	3100
390	7200	7100	4200
380	8100	8100	5400
370	9000	8900	6400
360	9800	9700	7300
350	10500	10500	8200
340	11400	11300	9100
330	12700	12600	10500
320	14000	13900	11900
310	15200	15100	13300
300	16400	16300	14700
290	17600	17500	16100
280	18800	18800	17400
270	20000	20000	18800
260	21200	21200	20100
250	22500	22400	21400
240	23700	23700	22800
230	25000	24900	24100
220	26200	26200	25500
210	27500	27500	26800
200	28800	28700	28200

Altitude reduced by 1000 ft for additional margin.

GEAR DOWN
1 ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)							
		10	14	17	20	23	25	27	29
360	EPR	1.39							
	MACH	.488							
	KIAS	270							
	FF/ENG	6506							
340	EPR	1.37							
	MACH	.487							
	KIAS	270							
	FF/ENG	6240							
320	EPR	1.33	1.44						
	MACH	.474	.510						
	KIAS	262	262						
	FF/ENG	5806	5930						
300	EPR	1.29	1.39	1.50					
	MACH	.461	.494	.525					
	KIAS	255	254	254					
	FF/ENG	5392	5459	5579					
280	EPR	1.26	1.34	1.43					
	MACH	.447	.479	.507					
	KIAS	247	246	246					
	FF/ENG	4974	5030	5082					
260	EPR	1.24	1.30	1.38	1.48				
	MACH	.433	.464	.489	.519				
	KIAS	239	238	237	237				
	FF/ENG	4578	4623	4612	4746				
240	EPR	1.21	1.27	1.33	1.41	1.53			
	MACH	.419	.448	.472	.499	.533			
	KIAS	231	229	228	228	229			
	FF/ENG	4199	4217	4191	4266	4422			
220	EPR	1.18	1.23	1.28	1.35	1.44	1.53	1.64	
	MACH	.402	.432	.455	.480	.510	.532	.560	
	KIAS	222	221	220	219	219	219	222	
	FF/ENG	3829	3829	3796	3832	3922	4023	4197	
200	EPR	1.16	1.20	1.24	1.30	1.37	1.44	1.52	1.64
	MACH	.385	.414	.436	.461	.487	.507	.530	.558
	KIAS	212	212	211	210	208	209	209	211
	FF/ENG	3469	3459	3412	3434	3466	3530	3622	3774

GEAR DOWN
1 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
311	281	255	233	216	200	190	181	173	166	159
632	568	513	469	432	400	380	362	346	331	318
956	859	774	706	650	600	570	543	518	495	475
1284	1151	1036	943	867	800	759	722	689	658	631
1616	1446	1300	1182	1085	1000	949	902	859	820	786
1952	1744	1565	1421	1303	1200	1138	1082	1030	983	941
2293	2045	1832	1662	1522	1400	1327	1259	1198	1144	1095
2639	2350	2101	1903	1741	1600	1516	1438	1368	1304	1248
2990	2657	2372	2146	1961	1800	1704	1616	1536	1464	1400
3348	2969	2645	2389	2181	2000	1892	1793	1703	1623	1551

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		25	
	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	8.8	0:46	8.1	0:44	7.5	0:42	7.0	0:40	6.8	0:38
400	18.2	1:31	17.1	1:27	16.0	1:23	15.3	1:18	15.0	1:14
600	27.3	2:17	25.8	2:10	24.2	2:04	23.3	1:57	23.0	1:51
800	36.2	3:04	34.3	2:55	32.2	2:45	31.1	2:36	30.6	2:28
1000	44.9	3:52	42.6	3:40	40.1	3:28	38.6	3:16	38.1	3:06
1200	53.5	4:41	50.6	4:26	47.7	4:11	46.0	3:56	45.3	3:44
1400	61.8	5:31	58.5	5:12	55.2	4:55	53.1	4:38	52.3	4:23
1600	69.9	6:22	66.2	6:00	62.4	5:39	60.1	5:19	59.1	5:03
1800	77.8	7:14	73.7	6:48	69.5	6:24	66.9	6:02	65.7	5:44
2000	85.5	8:07	81.1	7:37	76.5	7:10	73.5	6:45	72.1	6:25

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	200	250	300	350	400
10	-1.1	0.0	1.3	2.8	5.1
20	-2.3	0.0	3.1	5.8	10.1
30	-3.6	0.0	5.0	9.0	15.1
40	-4.8	0.0	7.0	12.5	20.3
50	-6.1	0.0	9.0	16.2	25.5
60	-7.4	0.0	11.1	20.2	30.8
70	-8.7	0.0	13.3	24.4	36.1
80	-10.0	0.0	15.5	28.8	41.6
90	-11.3	0.0	17.8	33.5	47.1

GEAR DOWN
1 ENGINE INOP
MAX CONTINUOUS THRUST

Holding
Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)					
		1500	5000	10000	15000	20000	25000
400	EPR	1.26	1.32				
	KIAS	270	270				
	FF/ENG	7080	7220				
380	EPR	1.24	1.30				
	KIAS	270	270				
	FF/ENG	6790	6910				
360	EPR	1.23	1.28	1.39			
	KIAS	270	270	270			
	FF/ENG	6540	6630	6830			
340	EPR	1.20	1.25	1.35			
	KIAS	261	261	261			
	FF/ENG	6080	6130	6310			
320	EPR	1.19	1.23	1.31	1.45		
	KIAS	251	251	251	251		
	FF/ENG	5640	5650	5790	5960		
300	EPR	1.17	1.20	1.28	1.40		
	KIAS	242	242	242	242		
	FF/ENG	5230	5220	5320	5430		
280	EPR	1.15	1.18	1.25	1.35		
	KIAS	233	233	233	233		
	FF/ENG	4840	4820	4870	4940		
260	EPR	1.14	1.17	1.22	1.31	1.53	
	KIAS	228	228	228	228	251	
	FF/ENG	4530	4510	4520	4570	5400	
240	EPR	1.12	1.15	1.20	1.27	1.45	
	KIAS	221	221	221	221	240	
	FF/ENG	4190	4170	4160	4170	4840	
220	EPR	1.11	1.13	1.18	1.24	1.38	1.58
	KIAS	215	215	215	215	229	231
	FF/ENG	3890	3870	3850	3830	4320	4570
200	EPR	1.10	1.12	1.15	1.21	1.32	1.48
	KIAS	208	208	208	208	219	220
	FF/ENG	3590	3560	3540	3500	3840	4020

This table includes 5% additional fuel for holding in a racetrack pattern.

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Performance Inflight - QRH — Chapter PI-QRH

Text — Section 15

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 Flight Manual, the Flight Manual shall always take precedence.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Pitch attitude and average EPR 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 EPR

This table shows Max Climb EPR for a 340/.84 climb speed schedule, normal engine bleed for 3 packs on and anti-ice off. Enter the table with airport pressure altitude and TAT and read EPR. EPR adjustments are shown for anti-ice operation.

VREF

The Reference Speed table contains flaps 30 and 25 landing speeds for a given weight. Apply adjustments shown as required.

Advisory Information

Normal Configuration Landing Distance

Tables are provided as advisory information for normal configuration landing distance on dry runways and slippery runways with good, medium, and poor reported braking action. These values are actual landing distances and do not include the 1.67 regulatory factor. Therefore, they cannot be used to determine the dispatch required landing field length. Landing distances for slippery runways are 115% of the actual landing distance.

To use these tables, determine the reference landing distance for the selected braking configuration. Then adjust the reference distance for landing weight, altitude, wind, slope, temperature, approach speed, and the number of operative thrust reversers to obtain landing distance.

When landing on slippery runways or runways contaminated with ice, snow, slush, or standing water, the reported braking action must be considered. 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.

Use of the autobrake system commands the airplane to a constant deceleration rate. In some conditions, such as a runway with "poor" braking action, the airplane may not be able to achieve these deceleration rates. In these cases, runway slope and inoperative reversers influence the stopping distance. Since it cannot be determined quickly when this becomes a factor, it is conservative to add the effects of slope and inoperative reversers when using the autobrake system.

Non-normal Configuration Landing Distance

Advisory information is provided to support non-normal configurations that affect landing performance of the airplane. Landing distances are provided for dry runway 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 (VREF). The reference landing distance is measured from 50 ft above the threshold to stop and is based on reference weight and speed at sea level, zero wind, zero slope and max manual braking with maximum reverse thrust. Subsequent columns provide corrections for off-reference landing weight, altitude, wind, slope, temperature, approach speed, and the number of operative thrust reversers. Each correction is independently added to the reference landing distance. Landing distance includes the effect of maximum manual braking and reverse thrust.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding 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.

To determine the energy per brake absorbed during landing, enter the table with the reference brake energy per brake and the type of braking used during landing (Max Manual or Max Auto). 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.

Brake Temperature Monitor System (BTMS) indications are also shown. If brake cooling is determined from the BTMS, the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted, may be used to determine recommended cooling schedule by entering at the bottom of the chart. An EICAS advisory message, BRAKE TEMP, will appear when any brake registers 5 on the GEAR synoptic display and disappears as the hottest brake cools to an indication of 4. Note that even without an EICAS advisory message, brake cooling is recommended.

One Engine Inoperative

Max Continuous EPR

Power setting is based on one engine inoperative with 3 packs on and all anti-ice bleeds off. Enter the table with pressure altitude and KIAS or Mach to read EPR.

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.

The level off altitude is dependent on air temperature (ISA deviation). The level off altitude shown is 1000 ft below the maximum altitude. This reduction in altitude is consistent with the FMC logic.

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 and Max Continuous thrust. Note that the maximum altitude shown has been reduced by 1000 ft. This reduction in altitude is consistent with the FMC logic.

Long Range Cruise Control

The table provides target EPR, one engine inoperative Long Range Cruise Mach number, KIAS, 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 three engine Long Range Cruise speed and .84/290/250 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 Fuel Required Adjustment table with the fuel required for the reference weight and the actual weight at checkpoint.

Holding

EPR required, indicated airspeed and fuel flow are shown for one engine inoperative holding based on the recommended speeds. Fuel flow is based on a racetrack holding pattern and may be reduced by 5% for holding in straight and level flight.

Gear Down

This section contains performance for airplane operation with the landing gear extended for all phases of flight. The data is based on engine bleeds for normal air conditioning.

NOTE: The Flight Management Computer System (FMCS) does not contain special provisions for operation with landing gear extended. As a result, the FMCS will generate inaccurate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. To obtain accurate ETA predictions, gear down cruise speed and altitude should be entered on the CLB and CRZ pages. Gear down cruise speed should also be entered on the DES page and a STEP SIZE of zero should be entered on the PERF INIT or CRZ page. Use of the VNAV during descent under these circumstances is not recommended.

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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Flight With Unreliable Airspeed / Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

Climb (290/.84)
Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)					
		450	550	650	750	850	870
40000	**PITCH ATT**	**4.0**	**4.0**				
	V/S (FT/MIN)	+1600	+900				
35000	**PITCH ATT**	**4.5**	**4.0**	**4.0**	**4.0**		
	V/S (FT/MIN)	+2900	+2000	+1300	+700		
30000	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	V/S (FT/MIN)	+2900	+2100	+1600	+1100	+700	+600
20000	**PITCH ATT**	**8.0**	**7.0**	**7.0**	**7.0**	**7.0**	**7.0**
	V/S (FT/MIN)	+4300	+3300	+2600	+2100	+1600	+1500
10000	**PITCH ATT**	**11.0**	**10.0**	**9.5**	**9.0**	**9.0**	**9.0**
	V/S (FT/MIN)	+5700	+4500	+3700	+3000	+2500	+2400
SEA LEVEL	**PITCH ATT**	**14.0**	**12.5**	**11.5**	**11.0**	**11.0**	**11.0**
	V/S (FT/MIN)	+6500	+5200	+4300	+3500	+3000	+2900

Cruise (.84/290)
Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)					
		450	550	650	750	850	870
40000	**PITCH ATT**	**2.0**	**3.0**				
	%N1	88.4	92.6				
35000	**PITCH ATT**	**1.0**	**2.0**	**2.5**	**3.0**		
	%N1	85.8	88.1	90.9	95.0		
30000	**PITCH ATT**	**1.0**	**2.0**	**3.0**	**3.5**	**4.0**	**4.0**
	%N1	81.8	84.4	86.9	89.9	93.7	94.6
20000	**PITCH ATT**	**1.5**	**2.0**	**3.0**	**4.0**	**4.5**	**4.5**
	%N1	74.4	76.6	79.2	81.8	84.9	85.5
10000	**PITCH ATT**	**1.5**	**2.0**	**3.0**	**4.0**	**5.0**	**5.0**
	%N1	67.1	69.1	71.4	73.9	76.8	77.4
SEA LEVEL	**PITCH ATT**	**1.5**	**2.5**	**3.0**	**4.0**	**5.0**	**5.0**
	%N1	60.0	61.9	64.0	66.3	68.9	69.5

Descent (.84/290)
Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)					
		450	550	650	750	850	870
40000	**PITCH ATT**	**-1.5**	**-0.5**				
	V/S (FT/MIN)	-3000	-2900				
35000	**PITCH ATT**	**-3.0**	**-2.0**	**-1.0**	**-0.5**		
	V/S (FT/MIN)	-3600	-3300	-3100	-3200		
30000	**PITCH ATT**	**-2.0**	**-0.5**	**0.0**	**1.0**	**1.5**	**1.5**
	V/S (FT/MIN)	-2500	-2200	-2100	-2100	-2100	-2100
20000	**PITCH ATT**	**-1.5**	**-0.5**	**0.0**	**1.0**	**2.0**	**2.0**
	V/S (FT/MIN)	-2200	-2000	-1900	-1800	-1800	-1800
10000	**PITCH ATT**	**-2.0**	**-0.5**	**0.5**	**1.5**	**2.0**	**2.5**
	V/S (FT/MIN)	-2000	-1800	-1700	-1600	-1600	-1600
SEA LEVEL	**PITCH ATT**	**-1.5**	**-0.5**	**0.5**	**1.5**	**2.5**	**2.5**
	V/S (FT/MIN)	-1600	-1400	-1300	-1300	-1300	-1300

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Holding (VREF30+80)

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)					
		450	550	650	750	850	870
10000	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**5.5**	**5.5**	**5.5**
	%N1	59.7	64.9	69.3	73.2	76.8	77.4
	KIAS	209	224	240	261	282	284

Terminal Area (5000 FT)

%N1 for Level Flight

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)					
		400	500	600	700	800	900
FLAPS UP (VREF30+80) (GEAR UP)	**PITCH ATT**	**4.5**	**5**	**5.5**	**6**	**6**	**6.5**
	%N1	54.3	59.9	64.8	69.1	72.9	76.3
	KIAS	202	217	231	244	256	268
FLAPS 1 (VREF30+60) (GEAR UP)	**PITCH ATT**	**6**	**6.5**	**7**	**7**	**7.5**	**7.5**
	%N1	56.6	62.0	66.9	71.2	75.0	78.3
	KIAS	182	197	211	224	236	248
FLAPS 5 (VREF30+40) (GEAR UP)	**PITCH ATT**	**7**	**7.5**	**8**	**8**	**8**	**8**
	%N1	59.4	65.5	70.7	75.1	79.0	82.4
	KIAS	162	177	191	204	216	228
FLAPS 10 (VREF30+20) (GEAR UP)	**PITCH ATT**	**8.5**	**8.5**	**8.5**	**8.5**	**9**	**9**
	%N1	66.5	72.8	78.2	82.8	86.7	90.2
	KIAS	142	157	171	184	196	208
FLAPS 20 (VREF30+10) (GEAR DOWN)	**PITCH ATT**	**7.5**	**7.5**	**7.5**	**7.5**	**7.5**	**7.5**
	%N1	71.1	77.6	83.1	87.7	91.9	95.5
	KIAS	132	147	161	174	186	198

Final Approach (1500 FT)

Gear Down, %N1 for 3° Glideslope

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)					
		400	500	600	700	800	900
FLAPS 25 (VREF25+10)	**PITCH ATT**	**2**	**2**	**2**	**2**	**2**	**2**
	%N1	50.9	56.3	61.2	65.2	68.9	72.2
	KIAS	136	152	166	180	193	205
FLAPS 30 (VREF30+10)	**PITCH ATT**	**0.5**	**0.5**	**1**	**1**	**1**	
	%N1	56.6	62.5	67.5	71.9	75.8	
	KIAS	131	146	160	173	185	

Max Climb %N1

Based on engine bleed for 3 packs on, engine and wing anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT) / SPEED (KIAS OR MACH)									
	0	5	10	15	20	25	30	35	40	45
	340	340	340	340	340	340	0.84	0.84	0.84	0.84
50	99.4	100.8								
45	99.9	101.3	102.0	101.1						
40	100.3	101.9	102.6	101.6						
35	99.7	102.5	103.1	102.1	102.0					
30	99.0	102.3	103.7	102.8	102.6					
25	98.2	101.6	103.9	103.4	103.2	103.2	101.9			
20	97.4	100.8	103.2	104.1	103.6	104.1	102.7			
15	96.6	99.9	102.4	103.5	104.3	104.9	103.6	101.1	100.9	
10	95.8	99.1	101.6	102.7	104.1	105.9	104.4	101.9	101.5	101.1
5	95.0	98.3	100.7	101.8	103.3	105.8	105.2	102.7	102.3	101.9
0	94.1	97.4	99.9	100.9	102.6	105.0	106.3	103.7	103.2	102.8
-5	93.3	96.6	99.0	100.0	101.7	104.2	105.7	104.6	104.1	103.7
-10	92.5	95.7	98.1	99.1	100.8	103.2	104.9	105.6	105.0	104.5
-15	91.6	94.8	97.2	98.2	99.9	102.3	104.0	105.5	105.4	105.1
-20	90.7	93.9	96.3	97.3	99.0	101.3	103.0	104.7	104.6	104.3
-25	89.9	93.0	95.4	96.4	98.1	100.4	102.1	103.9	103.8	103.5
-30	89.0	92.1	94.5	95.5	97.1	99.4	101.1	102.9	102.8	102.5
-35	88.1	91.2	93.6	94.5	96.2	98.4	100.1	101.8	101.8	101.5
-40	87.2	90.3	92.6	93.6	95.2	97.4	99.0	100.8	100.8	100.4

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)									
	0	5	10	15	20	25	30	35	40	45
ENGINE ANTI-ICE ON	-0.5	-0.5	-0.6	-0.6	-0.7	-0.8	-0.9	-1.1	-1.6	-2.0
ENGINE & WING ANTI-ICE ON	-0.9	-1.0	-1.2	-1.1	-1.3	-1.5	-1.7	-2.0	-3.0	-4.0

VREF (KIAS)

WEIGHT (1000 LB)	FLAPS	
	30	25
900	186	194
850	181	188
800	175	182
750	169	176
700	162	169
650	156	163
600	150	156
550	143	149
500	136	141
450	128	134
400	121	126

Increase VREF 1 knot/4000 ft above sea level.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

Dry Runway

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENT (FT)											
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ PER 10 KTS		SLOPE ADJ PER 1%		TEMP ADJ PER 10°C		APP SPD ADJ	REVERSE THRUST ADJ	
	550000 LB LANDING WEIGHT	PER 10000 LB ABOVE/ BELOW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	HEAD WIND	TAIL WIND	DOWN HILL	UP HILL	ABV ISA	BLW ISA	PER 10 KTS ABOVE VREF30	2 REV	NO REV
MAX MANUAL	3310	60/-50	100	-170	580	50	-50	90	-90	360	110	250
MAX AUTO	4160	70/-70	120	-210	700	0	-10	120	-120	470	0	0
AUTOBRAKES 4	5090	90/-90	160	-270	920	0	-20	150	-150	600	0	0
AUTOBRAKES 3	5900	100/-100	200	-320	1100	60	-90	190	-180	580	70	100
AUTOBRAKES 2	6430	120/-120	220	-370	1250	140	-150	220	-200	570	380	410
AUTOBRAKES 1	6950	140/-140	260	-420	1440	220	-230	250	-210	570	760	1190

Good Reported Braking Action

MAX MANUAL	4300	70/-70	140	-240	850	110	-100	130	-120	440	310	720
MAX AUTO	4530	80/-80	150	-250	870	90	-80	140	-130	460	320	750
AUTOBRAKES 4	5120	90/-90	160	-280	960	20	-30	150	-150	600	30	200
AUTOBRAKES 3	5900	100/-100	200	-320	1100	70	-90	190	-180	580	70	100

Medium Reported Braking Action

MAX MANUAL	5650	100/-100	190	-360	1340	270	-210	180	-160	500	730	1880
MAX AUTO	5690	110/-100	200	-360	1340	250	-190	190	-160	540	710	1840
AUTOBRAKES 4	5760	110/-100	200	-360	1350	210	-150	190	-170	600	670	1830
AUTOBRAKES 3	6250	110/-110	210	-380	1410	200	-170	200	-180	580	420	1490

Poor Reported Braking Action

MAX MANUAL	7170	130/-130	250	-530	2180	730	-400	240	-190	550	1400	4040
MAX AUTO	7170	140/-130	250	-520	2180	720	-390	240	-190	560	1400	4100
AUTOBRAKE 4	7170	140/-130	250	-520	2180	720	-390	240	-190	560	1400	4090
AUTOBRAKE 3	7310	140/-130	260	-530	2200	700	-380	250	-190	580	1300	4030

Reference distance is for sea level, standard day, no wind or slope, and four engine reverse.
Max manual braking reference distance assumes use of auto spoilers. For manual spoilers add 240 ft.
Autobrake reference distance good for auto or manual spoilers.
Actual (unfactored) distances are shown and include distance from 50 ft above threshold (approximately 1000 ft flare distance).
Assumes VREF30 approach speed.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 25

Dry Runway

BRAKING CONFIGURATION	REF DIST 550000 LB LANDING WEIGHT	WT ADJ PER 10000 LB ABOVE/BELOW 550000 LB	ALT ADJ PER 1000 FT ABOVE SEA LEVEL	WIND ADJ PER 10 KTS HEAD WIND	WIND ADJ PER 10 KTS TAIL WIND	SLOPE ADJ PER 1% DOWN HILL	SLOPE ADJ PER 1% UP HILL	TEMP ADJ PER 10°C ABV ISA	TEMP ADJ PER 10°C BLW ISA	APP SPD ADJ PER 10 KTS ABOVE VREF25	REVERSE THRUST ADJ 2 REV	REVERSE THRUST ADJ NO REV
MAX MANUAL	3480	80/-50	100	-170	590	50	-50	100	-90	360	130	280
MAX AUTO	4450	70/-70	130	-220	720	0	-10	130	-130	500	0	0
AUTOBRAKES 4	5460	90/-90	180	-280	950	0	-10	170	-170	640	0	0
AUTOBRAKES 3	6410	110/-110	220	-340	1150	40	-100	210	-200	630	80	110
AUTOBRAKES 2	7000	130/-130	250	-380	1310	140	-170	240	-210	610	420	440
AUTOBRAKES 1	7550	150/-150	290	-430	1500	240	-260	280	-230	610	960	1320

Good Reported Braking Action

MAX MANUAL	4560	80/-80	150	-250	870	120	-100	140	-130	440	360	850
MAX AUTO	4780	80/-80	160	-250	890	90	-70	150	-130	490	360	870
AUTOBRAKES 4	5490	90/-90	180	-290	990	20	-20	170	-170	640	20	210
AUTOBRAKES 3	6410	110/-110	220	-340	1150	50	-100	210	-200	630	80	110

Medium Reported Braking Action

MAX MANUAL	6030	110/-110	210	-370	1370	280	-220	200	-170	520	860	2290
MAX AUTO	6030	110/-110	210	-370	1370	270	-190	200	-170	570	830	2240
AUTOBRAKES 4	6130	110/-110	210	-370	1380	220	-140	200	-180	650	770	2190
AUTOBRAKES 3	6750	120/-120	230	-400	1460	180	-170	220	-200	630	460	1810

Poor Reported Braking Action

MAX MANUAL	7690	150/-140	270	-540	2250	770	-420	260	-200	580	1670	5060
MAX AUTO	7690	150/-140	280	-540	2240	770	-410	260	-200	600	1680	5130
AUTOBRAKES 4	7690	150/-140	280	-540	2240	760	-410	260	-200	590	1670	5120
AUTOBRAKES 3	7850	150/-140	280	-550	2270	720	-390	270	-210	630	1550	5040

Reference distance is for sea level, standard day, no wind or slope, and four engine reverse.
Max manual braking reference distance assumes use of auto spoilers. For manual spoilers, add 240 ft.
Autobrake reference distance good for auto or manual spoilers.
Actual (unfactored) distances are shown and include distance from 50 ft above threshold (approximately 1000 ft flare distance).
Assumes VREF25 approach speed.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Dry Runway

		LANDING DISTANCE AND ADJUSTMENT (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ PER 10 KTS	SLOPE ADJ PER 1%	TEMP ADJ PER 10°C	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	550000 LB LANDING WEIGHT	PER 10000 LB ABOVE/ BELOW 550000 LB	PER 1000 FT ABV SEA LEVEL	HEAD/ TAIL	DOWN HILL/ UP HILL	ABV ISA/ BLW ISA	PER 10 KTS ABV VREF	TWO REV	NO REV
AIR/GROUND LOGIC IN AIR MODE FLAPS 30	VREF30	4150	70/ -60	150	-220/ 730	110/ -90	130/ -130	580		
ANTI-SKID INOPERATIVE FLAPS 30	VREF30	5910	110/ -100	290	-400/ 1440	320/ -250	220/ -190	560	790	1970
ASYMMETRIC/ SPLIT TRAILING EDGE FLAPS FLAPS 25	VREF30+25	4410	70/ -60	170	-210/ 680	80/ -70	150/ -140	440	220	480
FLAPS UP	VREF30+70	6140	190/ -100	410	-310/ 1270	140/ -120	320/ -280	690	500	1150
JAMMED STABILIZER FLAPS 25	VREF30+20	4040	80/ -60	160	-200/ 670	70/ -70	140/ -130	360	190	430
LEADING EDGE FLAPS INOP FLAPS 25	VREF30+25	4280	80/ -60	160	-210/ 680	80/ -70	140/ -130	390	210	460
ONE BODY GEAR UP FLAPS 30	VREF30	3610	90/ -70	150	-220/ 740	90/ -80	130/ -120	370	210	480
ONE WING GEAR UP FLAPS 30	VREF30	3650	90/ -60	160	-220/ 710	90/ -80	130/ -120	390	220	500
TWO WING GEAR UP FLAPS 30	VREF30	4350	140/ -100	270	-280/ 1290	160/ -140	200/ -150	570	400	940
TWO HYDRAULIC SYSTEMS INOP FLAPS 25	VREF30+20	4820	70/ -70	210	-230/ 740	120/ -110	170/ -150	640	350	810
REVERSER UNLOCKED FLAPS 25	VREF30+20	4210	90/ -60	160	-210/ 700	90/ -80	140/ -130	390		230

Actual (unfactored) distances are shown.
Includes distances from 50 ft above threshold (4.22 sec flare time).
Assumes max manual braking and maximum available reverse thrust.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Good Reported Braking Action

		LANDING DISTANCE AND ADJUSTMENT (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ PER 10 KTS	SLOPE ADJ PER 1%	TEMP ADJ PER 10°C	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	550000 LB LANDING WEIGHT	PER 10000 LB ABOVE/ BELOW 550000 LB	PER 1000 FT ABV SEA LEVEL	HEAD/ TAIL	DOWN HILL/ UP HILL	ABV ISA/ BLW ISA	PER 10 KTS ABV VREF	TWO REV	NO REV
AIR/GROUND LOGIC IN AIR MODE FLAPS 30	VREF30	5820	90/ -90	220	-340/ 1140	290/ -230	200/ -180	760		
ANTI-SKID INOPERATIVE FLAPS 30	VREF30	5910	110/ -100	290	-400/ 1440	320/ -250	220/ -190	560	790	1970
ASYMMETRIC/ SPLIT TRAILING EDGE FLAPS FLAPS 25	VREF30+25	5590	90/ -90	250	-290/ 990	160/ -140	200/ -180	500	500	1180
FLAPS UP	VREF30+70	7710	100/ -110	340	-330/ 1110	200/ -180	280/ -250	520	800	1900
JAMMED STABILIZER FLAPS 25	VREF30+20	5260	80/ -80	230	-280/ 970	160/ -140	190/ -170	490	470	1100
LEADING EDGE FLAPS INOP FLAPS 25	VREF30+25	5550	90/ -90	250	-290/ 990	170/ -150	200/ -180	510	520	1220
ONE BODY GEAR UP FLAPS 30	VREF30	4380	70/ -70	190	-260/ 910	140/ -120	150/ -140	480	340	790
ONE WING GEAR UP FLAPS 30	VREF30	4670	80/ -80	210	-280/ 950	160/ -140	170/ -150	560	430	1010
TWO WING GEAR UP FLAPS 30	VREF30	4400	140/ -70	270	-280/ 1290	160/ -140	200/ -150	570	400	940
TWO HYDRAULIC SYSTEMS INOP FLAPS 25	VREF30+20	6130	100/ -100	300	-320/ 1080	230/ -200	230/ -200	700	780	1960
REVERSER UNLOCKED FLAPS 25	VREF30+20	5690	90/ -90	230	-310/ 1040	200/ -170	200/ -180	550		630

Actual (unfactored) distances are shown.
Includes distances from 50 ft above threshold (4.22 sec flare time).
Assumes max manual braking and maximum available reverse thrust.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Medium Reported Braking Action

		LANDING DISTANCE AND ADJUSTMENT (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ PER 10 KTS	SLOPE ADJ PER 1%	TEMP ADJ PER 10°C	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	550000 LB LANDING WEIGHT	PER 10000 LB ABOVE/ BELOW 550000 LB	PER 1000 FT ABV SEA LEVEL	HEAD/ TAIL	DOWN HILL/ UP HILL	ABV ISA/ BLW ISA	PER 10 KTS ABV VREF	TWO REV	NO REV
AIR/GROUND LOGIC IN AIR MODE FLAPS 30	VREF30	8700	140/ -140	340	-560/ 1950	880/ -610	320/ -260	950		
ANTI-SKID INOPERATIVE FLAPS 30	VREF30	7490	140/ -130	400	-590/ 2310	840/ -500	290/ -240	610	1520	4200
ASYMMETRIC/ SPLIT TRAILING EDGE FLAPS FLAPS 25	VREF30+25	7090	120/ -120	360	-420/ 1520	360/ -280	270/ -240	550	1060	2680
FLAPS UP	VREF30+70	10260	160/ -160	550	-500/ 1750	480/ -390	410/ -350	640	1920	5100
JAMMED STABILIZER FLAPS 25	VREF30+20	6890	120/ -110	350	-420/ 1520	370/ -290	270/ -230	570	1080	2780
LEADING EDGE FLAPS INOP FLAPS 25	VREF30+25	7240	120/ -120	370	-430/ 1550	380/ -300	280/ -240	590	1170	3020
ONE BODY GEAR UP FLAPS 30	VREF30	5770	110/ -100	290	-390/ 1430	330/ -260	220/ -190	550	810	2030
ONE WING GEAR UP FLAPS 30	VREF30	6070	110/ -110	320	-410/ 1480	370/ -280	230/ -200	620	950	2440
TWO WING GEAR UP FLAPS 30	VREF30	5820	110/ -100	290	-400/ 1440	330/ -260	220/ -190	560	830	2090
TWO HYDRAULIC SYSTEMS INOP FLAPS 25	VREF30+20	7800	140/ -130	440	-460/ 1640	480/ -370	320/ -270	750	1590	4390
REVERSER UNLOCKED FLAPS 25	VREF30+20	7870	130/ -130	370	-480/ 1690	520/ -400	300/ -260	660		1700

Actual (unfactored) distances are shown.
Includes distances from 50 ft above threshold (4.22 sec flare time).
Assumes max manual braking and maximum available reverse thrust.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Poor Reported Braking Action

		LANDING DISTANCE AND ADJUSTMENT (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ PER 10 KTS	SLOPE ADJ PER 1%	TEMP ADJ PER 10°C	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	550000 LB LANDING WEIGHT	PER 10000 LB ABOVE/ BELOW 550000 LB	PER 1000 FT ABV SEA LEVEL	HEAD/ TAIL	DOWN HILL/ UP HILL	ABV ISA/ BLW ISA	PER 10 KTS ABV VREF	TWO REV	NO REV
AIR/GROUND LOGIC IN AIR MODE FLAPS 30	VREF30	12990	190/ -190	520	-960/ 3480	3040/ -1470	490/ -320	1090		
ANTI-SKID INOPERATIVE FLAPS 30	VREF30	11000	160/ -110	540	-1160/ 6020	4940/ -1480	400/ -180	650	3600	12060
ASYMMETRIC/ SPLIT TRAILING EDGE FLAPS FLAPS 25	VREF30+25	8730	150/ -140	480	-610/ 2400	880/ -530	340/ -280	580	1860	5170
FLAPS UP	VREF30+70	12960	220/ -210	800	-730/ 2770	1180/ -750	550/ -430	730	3650	11210
JAMMED STABILIZER FLAPS 25	VREF30+20	8690	150/ -150	490	-620/ 2430	930/ -560	350/ -280	630	2030	5820
LEADING EDGE FLAPS INOP FLAPS 25	VREF30+25	9090	160/ -150	520	-630/ 2460	960/ -580	370/ -290	640	2160	6230
ONE BODY GEAR UP FLAPS 30	VREF30	7370	140/ -130	400	-580/ 2300	850/ -510	290/ -240	600	1560	4310
ONE WING GEAR UP FLAPS 30	VREF30	7660	140/ -140	430	-600/ 2350	910/ -540	300/ -250	650	1750	4940
TWO WING GEAR UP FLAPS 30	VREF30	7450	140/ -130	410	-590/ 2320	870/ -510	290/ -240	620	1610	4480
TWO HYDRAULIC SYSTEMS INOP FLAPS 25	VREF30+20	9630	180/ -170	600	-670/ 2570	1100/ -670	400/ -320	770	2750	8510
REVERSER UNLOCKED FLAPS 25	VREF30+20	10540	180/ -170	540	-750/ 2820	1450/ -830	420/ -320	740		3790

Actual (unfactored) distances are shown.
Includes distances from 50 ft above threshold (4.22 sec flare time).
Assumes max manual braking and maximum available reverse thrust.

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy per Brake (Millions of Foot Pounds)

		BRAKES ON SPEED (KIAS)																	
		80			100			120			140			160			180		
WEIGHT (1000 LB)	OAT (°F)	PRESS ALT			PRESS ALT			PRESS ALT			PRESS ALT			PRESS ALT			PRESS ALT		
		0	4	8	0	4	8	0	4	8	0	4	8	0	4	8	0	4	8
900	20	19.9	21.9	24.0	28.9	32.1	35.7	39.2	43.8	49.1	50.6	56.7	63.8	62.5	70.2	78.9	74.5	83.6	93.7
	60	21.4	23.5	26.0	31.1	34.5	38.5	42.2	47.1	52.9	54.4	60.9	68.6	67.1	75.2	84.6	79.8	89.3	100.0
	100	22.3	24.6	27.1	32.7	36.4	40.6	44.5	49.8	55.9	57.5	64.5	72.6	71.1	79.6	89.5	84.4	94.3	105.4
	140	22.3	24.6	27.1	33.1	37.0	41.1	45.5	51.0	57.2	59.2	66.5	74.7	73.5	82.4	92.5	87.5	97.8	109.0
800	20	18.2	19.9	21.8	26.3	29.1	32.3	35.5	39.6	44.3	45.7	51.2	57.5	56.6	63.5	71.4	67.5	75.8	85.1
	60	19.5	21.3	23.5	28.3	31.3	34.9	38.2	42.6	47.8	49.2	55.1	62.0	60.8	68.2	76.7	72.5	81.2	91.2
	100	20.3	22.3	24.5	29.7	32.9	36.7	40.3	45.0	50.5	52.0	58.3	63.0	64.4	72.2	81.2	76.7	85.8	96.3
	140	20.2	22.3	24.4	30.0	33.4	37.1	41.1	46.0	51.5	53.4	60.0	67.4	66.4	74.6	83.7	79.4	89.0	99.5
700	20	16.4	17.9	19.5	23.7	26.1	28.9	31.9	35.4	39.6	40.9	45.7	51.3	50.6	56.7	63.8	60.4	67.8	76.2
	60	17.6	19.2	21.1	25.4	28.1	31.1	34.2	38.1	42.6	44.0	49.1	55.3	54.4	60.9	68.6	64.9	72.7	81.9
	100	18.3	20.0	22.0	26.6	29.5	32.7	36.1	40.2	45.0	46.4	51.9	58.4	57.5	64.5	72.6	68.7	77.0	86.6
	140	18.1	19.9	21.7	26.8	29.8	33.0	36.7	41.0	45.8	47.5	53.3	59.8	59.2	66.6	74.7	71.0	79.7	89.4
600	20	14.6	15.9	17.2	21.0	23.1	25.5	28.1	31.2	34.7	36.0	40.1	44.9	44.4	49.6	55.8	53.1	59.6	67.0
	60	15.7	17.0	18.6	22.5	24.8	27.4	30.2	33.5	37.4	38.7	43.1	48.4	47.7	53.4	60.0	57.1	64.0	72.1
	100	16.3	17.7	19.4	23.6	26.0	28.8	31.8	35.3	39.5	40.8	45.6	51.1	50.4	56.5	63.5	60.4	67.8	76.2
	140	16.0	17.5	19.0	23.6	26.1	28.8	32.2	35.9	40.0	41.6	46.6	52.2	51.8	58.1	65.3	62.3	70.0	78.6
500	20	13.1	14.1	15.3	18.5	20.2	22.2	24.4	27.0	29.9	30.9	34.3	38.3	37.8	42.2	47.2	45.0	50.3	56.6
	60	14.0	15.1	16.4	19.8	21.7	23.9	26.2	29.0	32.2	33.2	36.9	41.3	40.6	45.4	50.9	48.4	54.1	60.9
	100	14.5	15.7	17.1	20.7	22.7	25.1	27.5	30.5	33.9	35.0	38.9	43.6	42.9	47.9	53.9	51.1	57.3	64.4
	140	14.1	15.4	16.6	20.6	22.7	24.9	27.7	30.8	34.1	35.5	39.7	44.3	43.8	49.1	55.0	52.5	59.0	66.2
400	20	11.6	12.4	13.4	16.0	17.4	19.0	20.7	22.8	25.1	25.8	28.5	31.7	31.0	34.5	38.4	36.5	40.7	45.6
	60	12.4	13.3	14.4	17.1	18.6	20.4	22.2	24.4	27.0	27.7	30.6	34.1	33.4	37.1	41.5	39.2	43.8	49.1
	100	12.8	13.8	14.9	17.8	19.4	21.3	23.3	25.6	28.4	29.1	32.2	36.0	35.1	39.1	43.7	41.4	46.2	51.9
	140	12.4	13.4	14.4	17.6	19.3	21.1	23.3	25.7	28.4	29.3	32.6	36.2	35.7	39.9	44.5	42.3	47.3	53.1

To correct for wind, enter the table with the brakes-on speed minus 0.5 times headwind or plus 1.5 times tailwind.

If ground speed is used for brakes-on speed, ignore wind, altitude and OAT effects, and enter the table at sea level and 60°F.

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	4.2	12.9	21.9	30.8	39.8	48.8	58.0	67.4	77.0
	MAX AUTO	4.2	12.4	20.8	29.3	38.1	47.0	56.3	65.7	75.5
	AUTOBRAKE 4	3.6	11.7	19.5	27.4	35.4	43.6	52.4	61.7	71.8
	AUTOBRAKE 3	3.5	11.2	18.5	25.8	33.2	40.8	48.8	57.4	66.8
	AUTOBRAKE 2	3.5	10.6	17.4	24.1	30.9	37.8	45.1	52.9	61.4
	AUTOBRAKE 1	3.1	9.6	15.7	21.6	27.3	33.0	39.1	45.5	52.4

Four Engine 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	2.7	11.2	19.5	27.6	35.7	43.7	51.9	60.1	68.6
	MAX AUTO	1.4	8.9	16.1	23.4	30.7	38.3	46.4	55.0	64.3
	AUTOBRAKE 4	0.0	6.5	12.6	18.7	24.9	31.5	38.8	47.0	56.5
	AUTOBRAKE 3		4.6	9.6	14.4	19.3	24.6	30.6	37.8	46.4
	AUTOBRAKE 2		3.0	7.0	10.6	14.1	18.0	22.5	28.2	35.3
	AUTOBRAKE 1		1.8	4.7	7.2	9.6	12.1	15.2	19.3	24.5

Cooling Time (Minutes)

	ADJUSTED BRAKE ENERGY PER BRAKE (MILLION OF FOOT POUNDS)								
	15 & BELOW	16	20	24	28	32	34	35 TO 45	45 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	3	5	6	8	8	CAUTION	FUSE PLUG MELT ZONE
GROUND		10	28	42	55	65	70		
BTMS	UP TO 2	2	2	3	4	4	4	5 TO 6	7 & ABOVE

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 for each taxi mile.
For one brake deactivated, increase brake energy by 7 percent.
For two brakes deactivated, increase brake energy by 15 percent.
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 8 minutes.
When in fuse plug melt zone, clear runway immediately. Unless required, do not set parking brake. Do not 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 EICAS 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.

Performance Inflight - QRH — Chapter PI-QRH

One Engine Inoperative — Section 22

1 ENGINE INOP

Max Continuous %N1

39000 FT to 29000 FT Pressure Altitudes
Based on engine bleed for 3 packs on

39000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
200	.66	100.4	101.5	102.6	103.6	104.7	105.8	106.8	106.0	105.0	104.2	103.4	102.9
240	.78	100.0	101.1	102.1	103.2	104.2	105.0	105.8	105.5	104.7	103.7	102.8	102.1
280	.89	96.8	97.8	98.9	99.9	100.9	102.0	102.9	103.6	104.3	103.8	102.9	101.9

37000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
200	.63	100.4	101.5	102.6	103.6	104.7	105.8	106.8	106.0	105.1	104.3	103.6	101.4
240	.74	100.4	101.5	102.6	103.6	104.7	105.8	106.4	105.6	104.7	103.7	102.9	102.1
280	.86	97.7	98.7	99.7	100.8	101.8	102.8	103.6	104.4	104.2	103.4	102.5	101.5

35000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
200	.60	100.4	101.5	102.6	103.6	104.7	105.8	106.8	106.9	106.0	105.1	104.3	102.7
240	.71	100.4	101.5	102.6	103.6	104.7	105.8	106.8	106.7	105.7	104.7	103.9	103.1
280	.82	98.8	99.9	100.9	102.0	103.0	104.0	104.9	105.6	105.2	104.3	103.3	102.4

33000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
200	.58	101.5	102.6	103.6	104.7	105.8	106.8	107.9	107.2	106.3	105.4	104.7	100.9
240	.68	101.5	102.6	103.6	104.7	105.8	106.8	107.9	106.9	106.0	105.0	104.2	103.5
280	.79	100.3	101.4	102.4	103.5	104.5	105.4	106.2	106.5	105.4	104.6	103.6	102.8
320	.89	97.5	98.5	99.5	100.5	101.5	102.5	103.5	104.3	105.1	104.6	103.7	102.8

31000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
200	.55	101.5	102.6	103.6	104.7	105.8	106.8	107.9	108.3	107.4	106.5	105.7	104.4
240	.65	101.5	102.6	103.6	104.7	105.8	106.8	107.9	107.9	107.0	106.1	105.3	104.4
280	.76	100.6	101.6	102.7	103.7	104.7	105.7	106.5	107.4	106.5	105.6	104.8	103.9
320	.85	97.5	98.6	99.6	100.6	101.6	102.6	103.5	104.4	105.2	105.4	104.3	103.5

29000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
200	.53	102.6	103.6	104.7	105.8	106.8	107.9	108.9	108.0	107.1	106.2	105.5	102.3
240	.63	102.6	103.6	104.7	105.8	106.8	107.9	108.6	107.6	106.8	105.9	105.0	104.2
280	.72	101.5	102.5	103.5	104.5	105.5	106.4	107.3	107.4	106.3	105.5	104.6	103.8
320	.82	98.7	99.8	100.8	101.7	102.7	103.7	104.6	105.4	106.3	105.2	104.4	103.5
360	.91	96.5	97.5	98.5	99.5	100.5	101.4	102.4	103.3	104.1	104.9	104.9	103.9

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	29	31	33	35	37	39
PACKS OFF	0.4	0.4	0.4	0.5	0.6	0.6
ENGINE ANTI-ICE ON	-0.8	-0.9	-1.0	-1.1	-1.3	-1.5
ENGINE & WING ANTI-ICE ON	-1.6	-1.8	-1.9	-2.1	-2.5	-2.9

1 ENGINE INOP

Max Continuous %N1

27000 FT to 18000 FT Pressure Altitudes

Based on engine bleed for 3 packs on

27000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.50	103.6	104.7	105.8	106.8	107.9	108.9	108.1	107.2	106.3	105.5	104.9	100.0
240	.60	103.6	104.7	105.8	106.8	107.9	108.8	107.8	106.9	106.0	105.1	104.3	103.7
280	.69	101.6	102.6	103.6	104.6	105.6	106.4	107.3	106.4	105.5	104.6	103.8	102.9
320	.79	99.5	100.5	101.5	102.5	103.4	104.4	105.2	106.1	105.8	104.9	104.0	103.2
360	.87	97.5	98.5	99.5	100.4	101.4	102.3	103.2	104.1	104.9	105.5	104.5	103.7
25000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.48	103.6	104.7	105.8	106.8	107.9	108.9	108.1	107.2	106.3	105.4	104.7	102.6
240	.57	103.2	104.2	105.2	106.2	107.1	108.0	107.8	106.8	105.9	105.1	104.2	103.5
280	.66	100.6	101.6	102.6	103.6	104.5	105.4	106.3	106.4	105.4	104.5	103.6	102.8
320	.75	98.8	99.8	100.7	101.7	102.7	103.6	104.5	105.3	105.9	104.9	104.1	103.2
360	.84	97.3	98.3	99.2	100.2	101.1	102.1	103.0	103.9	104.7	105.5	105.0	104.1
24000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
200	.47	104.7	105.8	106.8	107.9	108.9	108.1	107.3	106.4	105.6	104.8	103.9	99.2
240	.56	103.7	104.7	105.7	106.6	107.4	107.8	106.9	106.0	105.2	104.4	103.6	103.0
280	.65	101.3	102.3	103.2	104.2	105.1	105.9	106.5	105.5	104.7	103.9	103.1	102.3
320	.74	99.3	100.3	101.3	102.2	103.2	104.1	104.9	105.7	104.9	104.1	103.3	102.5
360	.82	97.9	98.8	99.8	100.7	101.6	102.5	103.4	104.3	105.1	104.9	104.1	103.3
22000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
200	.45	104.5	105.5	106.4	107.3	108.1	108.0	107.2	106.5	105.8	105.0	104.4	102.0
240	.54	102.5	103.5	104.5	105.4	106.2	107.1	106.7	106.0	105.3	104.6	103.9	103.2
280	.62	100.5	101.4	102.4	103.3	104.2	105.1	105.9	105.6	104.9	104.2	103.5	102.8
320	.71	98.4	99.4	100.3	101.3	102.2	103.1	103.9	104.7	104.8	104.0	103.3	102.7
360	.79	97.0	97.9	98.9	99.8	100.7	101.6	102.5	103.3	104.1	104.6	103.8	103.2
20000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.43	104.0	104.9	105.9	106.7	107.4	106.8	106.2	105.7	105.1	104.4	103.8	99.9
240	.51	102.1	103.1	104.0	104.9	105.7	106.3	105.6	105.1	104.5	103.9	103.2	102.7
280	.60	100.3	101.2	102.1	103.0	103.9	104.7	105.3	104.6	104.1	103.6	102.9	102.3
320	.68	98.4	99.3	100.3	101.2	102.1	102.9	103.7	104.4	103.7	103.2	102.7	102.1
360	.76	97.0	97.9	98.8	99.7	100.6	101.4	102.3	103.0	103.8	103.4	102.9	102.4
18000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.41	103.0	103.9	104.8	105.7	106.6	107.2	106.5	106.0	105.5	104.8	104.1	102.6
240	.49	101.1	102.1	103.0	103.9	104.8	105.7	105.9	105.3	104.8	104.2	103.6	102.8
280	.57	99.4	100.4	101.3	102.2	103.1	104.0	104.8	104.9	104.3	103.9	103.3	102.7
320	.65	97.9	98.8	99.7	100.6	101.5	102.4	103.2	104.1	104.3	103.7	103.2	102.7
360	.72	96.4	97.3	98.2	99.1	100.0	100.9	101.7	102.6	103.4	103.9	103.2	102.8

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	18	20	22	24	25	27
PACKS OFF	0.4	0.4	0.4	0.4	0.4	0.4
ENGINE ANTI-ICE ON	-0.6	-0.7	-0.7	-0.7	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-1.2	-1.4	-1.4	-1.4	-1.6	-1.6

1 ENGINE INOP

Max Continuous %N1

16000 FT to 5000 FT Pressure Altitudes
Based on engine bleed for 3 packs on

16000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.39	101.5	102.4	103.4	104.3	105.2	106.0	106.0	105.4	104.8	104.2	103.6	102.9
240	.47	100.2	101.1	102.0	103.0	103.9	104.7	105.6	105.2	104.6	104.0	103.4	102.8
280	.54	98.8	99.7	100.6	101.5	102.4	103.3	104.2	105.0	104.4	103.8	103.2	102.7
320	.62	97.3	98.2	99.1	100.0	100.9	101.8	102.7	103.5	104.3	103.8	103.2	102.6
360	.69	95.8	96.7	97.6	98.5	99.4	100.3	101.1	102.0	102.8	103.6	103.3	102.7
14000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
200	.37	100.0	100.9	101.8	102.7	103.6	104.4	103.9	103.3	102.6	102.1	101.5	100.8
240	.45	99.4	100.3	101.2	102.1	103.0	103.9	104.4	103.8	103.1	102.5	101.9	101.4
280	.52	98.7	99.6	100.5	101.4	102.3	103.2	104.0	104.3	103.7	103.0	102.4	101.9
320	.59	97.7	98.6	99.5	100.4	101.3	102.1	103.0	103.8	104.0	103.4	102.8	102.1
360	.67	95.9	96.8	97.7	98.6	99.4	100.3	101.2	102.0	102.8	103.1	102.5	101.9
12000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
200	.36	99.2	100.1	101.0	102.0	102.8	103.7	104.2	103.6	103.0	102.3	101.8	101.2
240	.43	98.7	99.6	100.5	101.4	102.3	103.1	103.9	104.0	103.4	102.8	102.2	101.6
280	.50	98.0	98.9	99.8	100.7	101.6	102.5	103.3	104.1	103.9	103.3	102.7	102.1
320	.57	97.3	98.2	99.1	100.0	100.9	101.7	102.6	103.4	104.2	103.8	103.2	102.6
360	.64	95.6	96.5	97.4	98.3	99.2	100.0	100.9	101.7	102.5	103.3	102.9	102.3
10000 FT PRESS ALT		TAT (°C)											
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40
200	.34	99.3	100.2	101.1	102.0	102.8	103.6	103.7	103.1	102.6	102.0	101.4	100.9
240	.41	98.8	99.7	100.6	101.4	102.3	103.1	103.9	103.5	103.0	102.4	101.8	101.3
280	.48	98.2	99.1	99.9	100.8	101.7	102.5	103.3	103.9	103.4	102.8	102.3	101.7
320	.54	97.5	98.4	99.3	100.1	101.0	101.9	102.7	103.4	103.9	103.3	102.8	102.2
360	.61	96.1	97.0	97.9	98.8	99.6	100.5	101.3	102.1	102.9	103.2	102.7	102.2
5000 FT PRESS ALT		TAT (°C)											
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
200	.30	97.3	98.2	99.1	99.9	100.8	101.6	102.3	102.1	101.5	100.9	100.3	99.7
240	.36	96.9	97.7	98.6	99.5	100.3	101.2	101.9	102.4	101.8	101.2	100.6	100.1
280	.42	96.4	97.2	98.1	99.0	99.8	100.7	101.4	102.2	102.2	101.6	101.0	100.4
320	.48	95.8	96.7	97.5	98.4	99.2	100.1	100.9	101.6	102.3	102.3	102.1	101.5
360	.55	95.2	96.0	96.9	97.7	98.6	99.4	100.2	101.0	101.8	102.5	102.0	101.4

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	5	10	12	14	16
PACKS OFF	0.2	0.2	0.3	0.3	0.4
ENGINE ANTI-ICE ON	-0.5	-0.6	-0.6	-0.6	-0.6
ENGINE & WING ANTI-ICE ON	-1.0	-1.2	-1.2	-1.2	-1.2

1 ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

WEIGHT (1000 LB)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10 °C & BELOW	ISA + 15°C	ISA + 20°C
900	883	309	26300	24800	23000
850	838	301	27900	26600	25100
800	790	293	29500	28500	27300
750	739	284	31200	30200	29200
700	689	275	32900	32000	31000
650	639	265	34500	33800	32800
600	593	255	36000	35300	34500
550	543	245	37700	37100	36300
500	494	234	39500	39000	38200
450	444	222	41500	41000	40200
400	395	209	43800	43200	42400

Altitude reduced by 1000 ft for additional margin.

Long Range Cruise Altitude Capability

Based on engine bleed for packs on or off

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
880	25100	22800	20400
860	25900	23700	21400
840	26600	24600	22300
820	27300	25400	23200
800	28100	26200	24100
780	28800	27000	25100
760	29500	27800	26000
740	30100	28600	26900
720	30800	29300	27700
700	31500	30100	28600
680	32200	30800	29400
660	32900	31600	30200
640	33600	32400	31000
620	34300	33200	31800
600	35000	34000	32600
580	35600	34700	33400
560	36300	35400	34300
540	37000	36200	35000
520	37700	36900	35800
500	38500	37700	36600
480	39300	38500	37400
460	40100	39300	38200
440	40900	40100	39000

Altitude reduced by 1000 ft for additional margin.
With engine anti-ice on, decrease altitude capability by 1300 ft.
With engine and wing anti-ice on, decrease altitude capability by 2400 ft.

1 ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT) 10	14	20	25	27	29	31	33	35	37
880	%N1	88.5	91.4	96.0	100.2						
	MACH	.633	.678	.755	.818						
	KIAS	352	351	351	346						
	FF/ENG	9860	10013	10174	10472						
840	%N1	87.2	90.1	94.7	98.8	100.8					
	MACH	.621	.663	.741	.805	.828					
	KIAS	345	343	344	340	336					
	FF/ENG	9360	9473	9611	9863	9977					
800	%N1	86.0	88.8	93.4	97.3	99.2	101.4				
	MACH	.609	.649	.726	.791	.816	.836				
	KIAS	339	336	336	334	331	326				
	FF/ENG	8884	8959	9065	9262	9407	9474				
760	%N1	84.7	87.5	92.0	95.9	97.6	99.6				
	MACH	.597	.636	.709	.775	.802	.826				
	KIAS	332	329	328	326	325	321				
	FF/ENG	8429	8467	8523	8694	8811	8922				
720	%N1	83.3	86.1	90.5	94.4	96.1	97.9	100.1			
	MACH	.584	.622	.691	.759	.786	.812	.834			
	KIAS	325	321	319	319	318	316	311			
	FF/ENG	7982	7982	7997	8157	8234	8364	8439			
680	%N1	81.9	84.7	89.1	93.0	94.5	96.3	98.2	100.7		
	MACH	.571	.608	.674	.742	.768	.795	.821	.840		
	KIAS	317	314	311	311	310	309	306	300		
	FF/ENG	7547	7520	7495	7634	7686	7782	7888	7990		
640	%N1	80.5	83.2	87.5	91.4	93.0	94.6	96.4	98.4		
	MACH	.558	.594	.656	.723	.750	.777	.804	.828		
	KIAS	310	306	302	303	302	301	299	296		
	FF/ENG	7130	7076	7004	7121	7175	7230	7327	7418		
600	%N1	78.9	81.7	85.9	89.7	91.3	92.9	94.6	96.5	98.7	
	MACH	.544	.579	.638	.701	.730	.758	.785	.812	.834	
	KIAS	302	298	294	293	293	293	291	289	285	
	FF/ENG	6715	6642	6541	6604	6663	6712	6775	6857	6926	
560	%N1	77.2	80.0	84.2	88.0	89.6	91.2	92.8	94.5	96.5	99.5
	MACH	.529	.563	.620	.680	.708	.736	.764	.792	.819	.840
	KIAS	293	290	285	283	284	284	283	281	279	274
	FF/ENG	6300	6218	6085	6112	6152	6204	6248	6308	6370	6515
520	%N1	75.3	78.2	82.5	86.1	87.7	89.3	90.9	92.5	94.3	96.8
	MACH	.513	.547	.603	.657	.684	.713	.742	.770	.798	.824
	KIAS	284	282	277	273	274	274	274	273	271	268
	FF/ENG	5883	5801	5649	5627	5653	5697	5744	5787	5831	5945
480	%N1	73.3	76.3	80.6	84.2	85.7	87.3	88.9	90.5	92.2	94.4
	MACH	.495	.530	.584	.636	.660	.687	.716	.746	.774	.803
	KIAS	274	272	268	264	263	263	264	263	262	261
	FF/ENG	5464	5382	5227	5172	5168	5195	5243	5284	5322	5400
440	%N1	71.2	74.2	78.5	82.1	83.6	85.1	86.7	88.3	90.0	92.1
	MACH	.476	.511	.564	.613	.636	.660	.688	.718	.748	.777
	KIAS	263	262	258	254	253	252	252	253	253	251
	FF/ENG	5045	4964	4820	4733	4714	4712	4742	4786	4821	4884

1 ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
705	652	605	566	531	500	479	460	442	426	411
1415	1309	1215	1134	1063	1000	959	922	887	855	826
2133	1971	1827	1703	1596	1500	1440	1384	1331	1283	1239
2857	2637	2441	2274	2130	2000	1920	1845	1776	1712	1653
3589	3309	3060	2848	2665	2500	2400	2306	2219	2139	2065
4329	3986	3682	3424	3200	3000	2879	2766	2662	2565	2477
5079	4670	4308	4001	3737	3500	3358	3226	3104	2991	2888
5840	5361	4938	4581	4274	4000	3838	3687	3546	3416	3297
6612	6061	5574	5165	4814	4500	4316	4145	3986	3840	3706
7398	6770	6216	5752	5354	5000	4795	4603	4426	4263	4113

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		22		29		33	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
500	28.0	1:31	25.7	1:27	21.9	1:20	19.3	1:14	18.2	1:11
1000	56.4	3:00	52.5	2:52	45.7	2:36	41.1	2:22	39.2	2:16
1500	84.1	4:31	78.6	4:18	68.8	3:54	62.4	3:32	59.6	3:21
2000	111.2	6:04	104.0	5:46	91.3	5:13	83.0	4:42	79.5	4:28
2500	137.6	7:39	128.8	7:16	113.3	6:33	103.1	5:54	98.8	5:35
3000	163.3	9:16	153.0	8:47	134.7	7:55	122.7	7:07	117.6	6:43
3500	188.4	10:57	176.6	10:21	155.6	9:18	141.8	8:22	135.8	7:53
4000	213.0	12:40	199.6	11:57	176.0	10:43	160.4	9:38	153.6	9:04
4500	236.9	14:27	222.1	13:36	195.9	12:10	178.5	10:55	171	10:15
5000	260.2	16:17	244.0	15:17	215.4	13:38	196.1	12:14	187.8	11:29

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)				
	400	500	600	700	800
20	-3.0	-1.6	0.0	4.8	13.4
40	-6.4	-3.2	0.0	9.2	24.3
60	-9.8	-4.9	0.0	13.2	34.3
80	-13.2	-6.5	0.0	17.0	43.2
100	-16.6	-8.2	0.0	20.4	51.2
120	-20.0	-9.9	0.0	23.6	58.3
140	-23.4	-11.6	0.0	26.4	64.3
160	-26.8	-13.3	0.0	28.9	69.4
180	-30.2	-15.0	0.0	31.1	73.5
200	-33.6	-16.7	0.0	33.1	76.6
220	-37.0	-18.4	0.0	34.7	78.8
240	-40.3	-20.2	0.0	36.0	80.0
260	-43.7	-21.9	0.0	37.0	80.2
280	-47.1	-23.6	0.0	37.8	79.5

1 ENGINE INOP

MAX CONTINUOUS THRUST

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	40000
880	%N1	78.6	81.4	85.6	89.7	94.0	98.9			
	KIAS	286	286	286	286	304	308			
	FF/ENG	8900	8870	8960	9150	9460	9950			
840	%N1	77.2	80.1	84.2	88.3	92.6	97.3			
	KIAS	280	280	280	280	297	300			
	FF/ENG	8460	8430	8500	8650	8910	9290			
800	%N1	75.8	78.6	82.7	86.9	91.2	95.7	101.9		
	KIAS	272	272	272	272	289	292	297		
	FF/ENG	8030	8000	8040	8160	8370	8680	9350		
760	%N1	74.3	77.1	81.2	85.4	89.8	94.1	99.7		
	KIAS	263	263	263	263	282	285	289		
	FF/ENG	7600	7560	7590	7680	7860	8130	8670		
720	%N1	72.7	75.6	79.6	83.9	88.3	92.5	97.6		
	KIAS	255	255	255	255	274	277	280		
	FF/ENG	7170	7140	7160	7220	7370	7590	8000		
680	%N1	71.1	73.9	78.1	82.2	86.6	90.8	95.7		
	KIAS	246	246	246	246	266	268	272		
	FF/ENG	6760	6720	6740	6780	6900	7060	7370		
640	%N1	69.2	72.2	76.3	80.5	85.0	89.2	93.8	100.3	
	KIAS	238	238	238	238	258	260	263	267	
	FF/ENG	6340	6310	6320	6350	6440	6560	6800	7330	
600	%N1	67.3	70.4	74.6	78.7	83.2	87.5	91.9	97.6	
	KIAS	231	231	231	231	249	251	254	257	
	FF/ENG	5950	5910	5910	5930	6000	6070	6270	6650	
560	%N1	65.5	68.4	72.6	76.8	81.3	85.6	89.9	95.1	
	KIAS	226	226	226	226	240	242	245	248	
	FF/ENG	5560	5520	5510	5510	5560	5610	5770	6030	
520	%N1	63.4	66.3	70.6	74.8	79.3	83.6	87.9	92.7	
	KIAS	219	219	219	219	231	233	235	238	
	FF/ENG	5180	5130	5120	5100	5140	5160	5260	5470	
480	%N1	61.2	64.3	68.5	72.7	77.1	81.4	85.8	90.3	98.2
	KIAS	214	214	214	214	222	223	226	228	231
	FF/ENG	4820	4770	4740	4710	4740	4730	4790	4950	5400
440	%N1	59.1	61.9	66.1	70.4	74.7	79.1	83.5	87.9	94.9
	KIAS	207	207	207	207	212	214	215	218	221
	FF/ENG	4460	4400	4360	4320	4350	4330	4330	4440	4790

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

GEAR DOWN

Takeoff Climb Limit

Based on engine bleed for 3 packs on and anti-ice off

Weight (1000 LB)

AIRPORT OAT (°F)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
130	621	595	562										
120	663	639	616	588	567	537							
110	703	681	658	633	609	585	559	527					
100	745	723	698	673	648	623	598	571	541	512	485		
90	790	768	741	715	689	663	636	609	583	557	530	499	466
80	814	802	785	759	732	705	677	648	620	592	566	537	506
70	817	810	800	785	769	748	719	688	657	629	601	572	543
60	817	810	800	789	777	763	746	728	696	666	636	606	577
50	817	810	800	789	777	763	748	731	714	695	672	640	609
41 & BELOW	817	810	800	789	777	763	748	731	713	695	677	659	639

Anti-Ice Adjustments

BLEED CONFIGURATION	WEIGHT ADJUSTMENT (LB)	
	PACKS OFF	PACKS ON
ANTI-ICE OFF	4800	0
ENGINE ANTI-ICE ON	-13400	-21300
ENGINE AND WING ANTI-ICE ON	-32900	-38000

Landing Climb Limit

Based on engine bleed for 3 packs on and anti-ice off

Weight (1000 LB)

AIRPORT OAT (°F)	AIRPORT PRESSURE ALTITUDE												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
130	710	669	665	661	601								
120	757	740	726	694	662	627	593						
110	794	780	767	744	717	681	646	617	587	552			
100	828	818	804	781	755	723	692	666	638	605	572	538	
90	844	841	833	816	790	758	727	703	678	649	621	586	553
80	844	844	842	831	815	792	762	736	710	683	656	623	594
70	844	844	842	831	820	802	782	764	738	711	706	698	692
60	844	844	842	831	820	802	785	769	753	732	713	685	660
50 & BELOW	844	844	842	831	820	802	785	769	754	734	717	694	675

Applicable for flaps 25 or 30 landing.

Anti-Ice Adjustments

BLEED CONFIGURATION	WEIGHT ADJUSTMENT (LB)		
	3 A/C PACKS ON	1 A/C PACKS ON	A/C PACKS OFF
ANTI-ICE OFF	0	13600	20400
ENGINE ANTI-ICE ON	-12500	-800	6100

Reduce landing climb limit weight by 78150 lb when operating in icing conditions during any part of the flight with forecast landing temperature below 46°F.

GEAR DOWN

Max Climb %N1

Based on engine bleed for 3 packs on, engine and wing anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT) / SPEED (KIAS OR MACH)												
	0	5	10	12	14	16	18	20	22	24	26	28	30
	240	240	240	240	240	240	240	240	240	240	240	0.60	0.60
55	97.8												
50	98.4	99.7											
45	99.0	100.3	101.0										
40	99.6	100.8	101.5	101.3	101.0								
35	100.1	101.4	102.0	101.9	101.7	102.4							
30	100.1	102.0	102.6	102.5	102.3	103.2	103.2	103.0					
25	99.4	102.6	103.2	103.1	102.8	103.7	103.9	103.6	103.6	103.4			
20	98.7	102.1	103.7	103.7	103.5	104.3	104.6	104.3	104.2	104.0	104.0		
15	97.8	101.3	104.2	104.3	104.1	105.0	105.1	104.9	105.0	104.8	104.7	104.8	
10	97.0	100.5	103.4	104.2	104.8	105.6	105.6	105.4	105.7	105.6	105.5	105.6	105.5
5	96.2	99.7	102.6	103.4	104.2	105.9	106.2	105.9	106.4	106.4	106.4	106.4	106.4
0	95.3	98.8	101.7	102.6	103.3	105.0	106.0	106.7	107.1	107.2	107.3	107.3	107.3
-5	94.5	97.9	100.8	101.7	102.5	104.2	105.1	106.0	107.4	108.2	108.2	108.2	108.1
-10	93.6	97.0	99.9	100.8	101.6	103.3	104.2	105.2	106.6	107.8	108.9	108.9	108.9
-15	92.8	96.1	99.0	99.9	100.6	102.4	103.3	104.3	105.7	107.0	107.9	107.9	107.9
-20	91.9	95.2	98.1	99.0	99.7	101.4	102.3	103.4	104.8	106.0	106.8	106.8	106.8

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)												
	0	5	10	12	14	16	18	20	22	24	26	28	30
ENGINE ANTI-ICE ON	-0.5	-0.5	-0.6	-0.6	-0.6	-0.6	-0.6	-0.7	-0.7	-0.7	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-0.9	-1.0	-1.2	-1.2	-1.1	-1.2	-1.2	-1.3	-1.4	-1.5	-1.6	-1.6	-1.7

GEAR DOWN

Long Range Cruise Altitude Capability

Max Climb Thrust, 100 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
880	21000	19500	18300
860	21800	20100	18900
840	22400	20800	19400
820	23000	21500	19900
800	23600	22200	20600
780	24100	22700	21200
760	24900	23500	22100
740	25600	24500	23100
720	26400	25400	24100
700	27300	26300	25000
680	28000	27200	26000
660	28800	28100	27100
640	29600	29000	28100
620	30300	29900	29100
600	31000	30600	30100
580	31700	31400	30900
560	32500	32200	31700
540	33200	33100	32600
520	34000	33900	33500
500	34800	34800	34300
480	35700	35600	35200
460	36500	36400	36100
440	37400	37300	36900

GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		10	14	17	20	23	25	27	29	31	33
880	%N1	91.3	94.6	97.4	100.7						
	MACH	.488	.525	.556	.589						
	KIAS	270	270	270	270						
	FF/ENG	10408	10554	10690	10935						
840	%N1	90.5	93.7	96.3	99.5						
	MACH	.488	.525	.556	.589						
	KIAS	270	270	270	270						
	FF/ENG	10088	10206	10300	10496						
800	%N1	89.7	92.8	95.4	98.3	101.8					
	MACH	.488	.525	.556	.589	.624					
	KIAS	270	270	270	270	270					
	FF/ENG	9802	9904	9964	10102	10383					
760	%N1	88.9	92.0	94.5	97.1	100.3	103.2				
	MACH	.488	.525	.555	.585	.620	.646				
	KIAS	270	270	270	268	268	268				
	FF/ENG	9537	9626	9640	9683	9892	10184				
720	%N1	87.7	90.7	93.0	95.4	98.4	100.7	104.1			
	MACH	.480	.515	.543	.572	.605	.629	.657			
	KIAS	266	265	263	262	261	261	262			
	FF/ENG	9106	9136	9084	9078	9207	9412	9735			
680	%N1	86.1	89.2	91.4	93.8	96.5	98.6	101.2			
	MACH	.468	.503	.530	.558	.589	.613	.639			
	KIAS	259	258	257	255	254	254	254			
	FF/ENG	8571	8596	8543	8504	8565	8691	8930			
640	%N1	84.4	87.5	89.8	92.1	94.6	96.6	98.8	101.8		
	MACH	.454	.489	.516	.544	.574	.596	.621	.648		
	KIAS	251	251	250	249	247	247	247	247		
	FF/ENG	8040	8060	8013	7952	7971	8031	8185	8442		
600	%N1	82.6	85.8	88.1	90.4	92.7	94.6	96.6	99.0	102.4	
	MACH	.440	.475	.502	.530	.559	.580	.603	.628	.656	
	KIAS	243	243	243	242	240	240	239	239	240	
	FF/ENG	7511	7530	7486	7412	7411	7431	7499	7675	7950	
560	%N1	80.7	83.9	86.3	88.6	90.9	92.5	94.4	96.5	99.0	103.1
	MACH	.425	.459	.486	.514	.543	.563	.584	.608	.635	.664
	KIAS	235	235	235	235	233	232	232	231	231	232
	FF/ENG	6980	7002	6962	6887	6868	6873	6889	6970	7147	7466
520	%N1	78.6	81.8	84.2	86.7	88.9	90.5	92.2	94.1	96.3	99.0
	MACH	.410	.443	.470	.498	.526	.546	.566	.588	.613	.640
	KIAS	226	227	227	227	226	225	224	223	223	223
	FF/ENG	6450	6474	6440	6372	6341	6335	6335	6351	6439	6615
480	%N1	76.3	79.6	82.1	84.5	86.9	88.4	90.0	91.7	93.7	95.9
	MACH	.394	.426	.452	.480	.508	.528	.547	.568	.591	.617
	KIAS	217	218	218	218	218	217	216	215	215	215
	FF/ENG	5923	5946	5921	5862	5827	5812	5805	5801	5826	5898
440	%N1	73.7	77.2	79.7	82.1	84.6	86.2	87.7	89.3	91.1	93.1
	MACH	.377	.408	.433	.460	.489	.508	.528	.548	.569	.593
	KIAS	208	208	209	209	209	209	208	207	206	206
	FF/ENG	5402	5416	5406	5354	5322	5305	5287	5281	5279	5307

GEAR DOWN

Long Range Cruise Enroute Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
780	704	638	584	540	500	474	451	430	411	394
1586	1426	1287	1175	1082	1000	948	901	858	819	784
2418	2165	1947	1772	1627	1500	1421	1349	1283	1224	1172
3278	2923	2617	2374	2174	2000	1893	1796	1707	1627	1556
4170	3702	3300	2983	2725	2500	2365	2242	2129	2028	1938
5099	4505	3998	3600	3279	3000	2835	2685	2549	2426	2318
6068	5334	4710	4225	3836	3500	3305	3127	2966	2821	2694
7084	6192	5438	4858	4397	4000	3774	3567	3380	3213	3066
8147	7080	6182	5499	4962	4500	4241	4005	3792	3602	3434
9257	7998	6942	6148	5530	5000	4708	4442	4202	3987	3798

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		25	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
500	50.6	1:51	47.2	1:45	43.7	1:39	40.6	1:34	38.6	1:31
1000	100.2	3:45	94.3	3:31	87.8	3:19	82.0	3:08	78.4	3:00
1500	147.3	5:45	139.0	5:23	129.8	5:03	121.4	4:45	116.3	4:33
2000	191.8	7:51	181.3	7:20	169.8	6:51	159.0	6:26	152.4	6:09
2500	233.8	10:04	221.4	9:23	207.9	8:45	194.9	8:11	186.8	7:48
3000	273.5	12:25	259.3	11:33	244.1	10:43	229.0	10:00	219.6	9:31
3500	311.0	14:53	295.1	13:49	278.7	12:48	261.7	11:54	250.9	11:18
4000	346.5	17:29	329.1	16:14	311.5	15:00	292.9	13:53	280.7	13:09

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)				
	400	500	600	700	800
40	-7.6	-3.6	0.0	6.4	13.6
60	-11.9	-5.7	0.0	9.4	20.1
80	-16.1	-7.9	0.0	12.2	26.4
100	-20.3	-10.0	0.0	15.0	32.5
120	-24.5	-12.1	0.0	17.6	38.2
140	-28.7	-14.2	0.0	20.2	43.8
160	-32.9	-16.3	0.0	22.7	49.1
180	-37.0	-18.4	0.0	25.2	54.1
200	-41.2	-20.4	0.0	27.5	58.9
220	-45.3	-22.5	0.0	29.7	63.5
240	-49.3	-24.6	0.0	31.9	67.8
260	-53.4	-26.6	0.0	34.0	71.8
280	-57.4	-28.7	0.0	36.0	75.6
300	-61.4	-30.8	0.0	37.9	79.2
320	-65.4	-32.8	0.0	39.7	82.5

Descent at .66/240

PRESSURE ALT (1000 FT)	5	10	15	17	19	21	23	25	27	29	31	33	35	37
DISTANCE (NM)	18	28	37	41	45	49	53	57	61	65	70	73	76	80
TIME (MINUTES)	6	8	9	10	11	12	13	13	14	15	15	16	16	17

GEAR DOWN

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
880	%N1	84.6	87.3	91.3	95.5	100.7		
	KIAS	270	270	270	270	270		
	FF/ENG	10850	10830	10930	11130	11480		
840	%N1	83.8	86.5	90.5	94.5	99.5		
	KIAS	270	270	270	270	270		
	FF/ENG	10550	10520	10590	10750	11020		
800	%N1	83.1	85.8	89.7	93.7	98.3		
	KIAS	270	270	270	270	270		
	FF/ENG	10280	10240	10290	10420	10610		
760	%N1	81.6	84.3	88.2	92.2	97.3	103.4	
	KIAS	263	263	263	263	270	270	
	FF/ENG	9740	9690	9730	9830	10250	10770	
720	%N1	79.8	82.5	86.4	90.5	96.4	101.8	
	KIAS	255	255	255	255	270	270	
	FF/ENG	9130	9080	9100	9180	9930	10350	
680	%N1	77.9	80.7	84.6	88.6	95.1	100.4	
	KIAS	246	246	246	246	266	268	
	FF/ENG	8530	8490	8500	8540	9430	9860	
640	%N1	75.9	78.8	82.8	86.8	93.2	98.2	
	KIAS	238	238	238	238	258	260	
	FF/ENG	7960	7920	7920	7950	8750	9080	
600	%N1	74.2	77.0	81.1	85.1	91.2	96.0	102.8
	KIAS	231	231	231	231	249	251	254
	FF/ENG	7470	7430	7430	7440	8090	8310	8900
560	%N1	72.4	75.3	79.4	83.4	89.3	93.9	99.6
	KIAS	226	226	226	226	240	242	245
	FF/ENG	7040	6990	6990	6990	7470	7640	8050
520	%N1	70.6	73.5	77.6	81.6	87.2	91.5	96.8
	KIAS	219	219	219	219	231	233	235
	FF/ENG	6590	6540	6530	6530	6850	6960	7230
480	%N1	68.7	71.6	75.8	79.8	85.0	89.2	94.2
	KIAS	214	214	214	214	222	223	226
	FF/ENG	6170	6120	6100	6090	6290	6330	6500
440	%N1	66.6	69.5	73.7	77.8	82.6	86.8	91.4
	KIAS	207	207	207	207	212	214	215
	FF/ENG	5740	5680	5660	5650	5720	5730	5830

This table includes 5% additional fuel for holding in a racetrack pattern.

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Gear Down, One Engine Inop — Section 24

GEAR DOWN

1 ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

Based on engine bleed for 3 packs on

WEIGHT (1000 LB)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
880	847	266	10300	8600	6600
860	829	264	11200	9500	7600
840	810	261	12000	10400	8600
820	791	259	12900	11300	9600
800	770	256	13900	12200	10500
780	752	254	14800	13100	11500
760	734	252	15800	14000	12400
740	715	250	16800	15100	13300
720	696	248	17600	16200	14400
700	676	245	18400	17100	15600
680	656	243	19400	18100	16800
660	638	240	20500	19000	17700
640	619	237	21400	20100	18600
620	600	235	22400	21200	19800
600	582	232	23300	22200	20900
580	562	229	24100	23200	22000
560	543	227	24900	24200	23000
540	525	224	25800	25200	24100
520	505	221	26500	26100	25200
500	486	218	27300	27000	26200
480	466	215	28100	27900	27200
460	447	212	28800	28800	28200
440	429	209	29600	29600	29200

Altitude reduced by 1000 ft for additional margin.

GEAR DOWN
1 ENGINE INOP
MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability
Based on engine bleed for 3 packs on

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
880	8500	6400	3700
860	9200	7100	4700
840	9800	7800	5500
820	10400	8500	6200
800	11000	9100	6900
780	11900	9900	7600
760	13000	11000	9000
740	14100	12200	10200
720	15400	13300	11300
700	16600	14500	12500
680	17700	16000	13600
660	18700	17300	15300
640	20000	18300	17000
620	21200	19600	18100
600	22400	21000	19300
580	23500	22300	20800
560	24400	23500	22100
540	25400	24700	23400
520	26300	25800	24800
500	27200	26800	26000
480	28100	27900	27200
460	29000	28900	28400
440	30000	29900	29600

Altitude reduced by 1000 ft for additional margin.
With engine bleed for 1 pack on, increase altitude capability by 300 ft.
With engine anti-ice on, decrease altitude capability by 1900 ft.
With engine and wing anti-ice on, decrease altitude capability by 3600 ft.

GEAR DOWN
1 ENGINE INOP
MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)							
		10	14	17	20	23	25	27	29
840	%N1	99.2							
	MACH	.488							
	KIAS	270							
	FF/ENG	13801							
800	%N1	98.3							
	MACH	.488							
	KIAS	270							
	FF/ENG	13367							
760	%N1	96.9	100.6						
	MACH	.481	.514						
	KIAS	266	264						
	FF/ENG	12746	12910						
720	%N1	95.3	98.8						
	MACH	.471	.502						
	KIAS	260	258						
	FF/ENG	12019	12112						
680	%N1	93.7	96.9	99.9					
	MACH	.460	.491	.516					
	KIAS	254	252	250					
	FF/ENG	11312	11362	11478					
640	%N1	92.0	95.1	97.8	101.0				
	MACH	.448	.479	.503	.530				
	KIAS	247	245	244	242				
	FF/ENG	10614	10631	10665	10860				
600	%N1	90.1	93.2	95.8	98.7	102.7			
	MACH	.435	.466	.490	.516	.545			
	KIAS	240	239	237	235	234			
	FF/ENG	9914	9920	9913	10016	10291			
560	%N1	88.2	91.3	93.7	96.4	99.7	102.9		
	MACH	.421	.452	.476	.501	.529	.549		
	KIAS	233	232	230	228	227	226		
	FF/ENG	9210	9229	9189	9200	9365	9629		
520	%N1	86.1	89.3	91.6	94.1	97.1	99.4	102.8	
	MACH	.406	.438	.462	.486	.512	.531	.552	
	KIAS	224	224	223	221	220	219	218	
	FF/ENG	8503	8542	8486	8450	8509	8659	8934	
480	%N1	83.8	87.1	89.4	91.8	94.5	96.5	99.0	102.6
	MACH	.390	.422	.446	.470	.496	.514	.533	.554
	KIAS	215	216	215	214	212	211	210	210
	FF/ENG	7794	7847	7799	7742	7734	7781	7951	8210

GEAR DOWN
1 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
308	279	253	233	215	200	190	180	172	164	158
625	564	511	467	432	400	380	361	344	328	314
945	851	769	703	648	600	569	540	514	491	470
1268	1140	1030	940	866	800	758	720	685	653	625
1596	1433	1291	1177	1083	1000	947	899	855	815	780
1927	1727	1554	1415	1301	1200	1136	1077	1024	976	934
2263	2025	1819	1655	1519	1400	1325	1256	1194	1138	1088
2603	2325	2086	1895	1738	1600	1513	1434	1362	1298	1241
2948	2629	2354	2136	1957	1800	1702	1613	1531	1458	1393
3298	2936	2625	2378	2176	2000	1890	1790	1699	1618	1546

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT) 10		14		18		22		25	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	19.6	0:45	18.0	0:43	16.5	0:42	15.3	0:40	14.8	0:39
400	40.6	1:30	37.8	1:25	35.3	1:21	33.5	1:17	33.0	1:15
600	61.1	2:15	57.3	2:08	53.7	2:01	51.2	1:55	50.5	1:51
800	81.2	3:01	76.4	2:51	71.7	2:42	68.4	2:34	67.5	2:28
1000	100.9	3:47	95.1	3:35	89.3	3:23	85.2	3:13	84.0	3:05
1200	120.2	4:35	113.4	4:19	106.6	4:05	101.6	3:53	100.0	3:43
1400	139.1	5:24	131.4	5:04	123.5	4:48	117.6	4:33	115.5	4:22
1600	157.5	6:13	148.9	5:51	140.0	5:31	133.3	5:13	130.7	5:00
1800	175.5	7:04	166.1	6:38	156.2	6:15	148.6	5:54	145.5	5:40
2000	193.2	7:56	182.9	7:26	172.1	6:59	163.6	6:36	159.9	6:20

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB) 400	500	600	700	800
20	-3.6	-1.8	0.0	3.8	8.2
40	-7.7	-3.7	0.0	8.3	17.4
60	-11.8	-5.8	0.0	12.6	26.2
80	-15.9	-7.8	0.0	16.8	34.8
100	-20.0	-9.8	0.0	20.7	43.0
120	-24.2	-11.9	0.0	24.4	50.9
140	-28.4	-13.9	0.0	28.0	58.5
160	-32.6	-16.0	0.0	31.4	65.8
180	-36.8	-18.1	0.0	34.5	72.7
200	-41.0	-20.3	0.0	37.5	79.4
220	-45.3	-22.4	0.0	40.3	85.7

GEAR DOWN
1 ENGINE INOP
MAX CONTINUOUS THRUST

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)					
		1500	5000	10000	15000	20000	25000
880	%N1	92.8	95.6				
	KIAS	270	270				
	FF/ENG	14560	14610				
840	%N1	92.0	94.8	99.2			
	KIAS	270	270	270			
	FF/ENG	14140	14170	14490			
800	%N1	91.2	93.9	98.3			
	KIAS	270	270	270			
	FF/ENG	13760	13770	14040			
760	%N1	89.7	92.4	96.6			
	KIAS	263	263	263			
	FF/ENG	13000	13000	13200			
720	%N1	87.9	90.6	94.6	99.5		
	KIAS	255	255	255	255		
	FF/ENG	12150	12150	12290	12610		
680	%N1	85.9	88.7	92.7	97.2		
	KIAS	246	246	246	246		
	FF/ENG	11320	11320	11430	11650		
640	%N1	83.9	86.8	90.8	95.0		
	KIAS	238	238	238	238		
	FF/ENG	10540	10530	10630	10780		
600	%N1	82.1	84.9	89.0	93.1	100.9	
	KIAS	231	231	231	231	249	
	FF/ENG	9880	9860	9940	10040	11400	
560	%N1	80.3	83.2	87.3	91.4	98.3	
	KIAS	226	226	226	226	240	
	FF/ENG	9300	9270	9320	9400	10400	
520	%N1	78.4	81.3	85.4	89.5	95.6	102.2
	KIAS	219	219	219	219	231	233
	FF/ENG	8680	8660	8690	8750	9410	10010
480	%N1	76.5	79.4	83.5	87.6	93.1	98.6
	KIAS	214	214	214	214	222	223
	FF/ENG	8110	8080	8110	8150	8550	8880
440	%N1	74.4	77.3	81.4	85.5	90.4	95.4
	KIAS	207	207	207	207	212	214
	FF/ENG	7520	7490	7510	7530	7700	7890

This table includes 5% additional fuel for holding in a racetrack pattern.

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Performance Inflight - QRH Chapter PI-QRH
Text Section 25

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 Flight Manual, the Flight Manual shall always take precedence.

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 340/.84 climb speed schedule, normal engine bleed for 3 packs on and anti-ice off. Enter the table with airport pressure altitude and TAT and read %N1. %N1 adjustments are shown for anti-ice operation.

VREF

The Reference Speed table contains flaps 30 and 25 landing speeds for a given weight. Apply adjustments shown as required.

Advisory Information

Normal Configuration Landing Distance

Tables are provided as advisory information for normal configuration landing distance on dry runways and slippery runways with good, medium, and poor reported braking action. These values are actual landing distances and do not include the 1.67 regulatory factor. Therefore, they cannot be used to determine the dispatch required landing field length.

To use these tables, determine the reference landing distance for the selected braking configuration. Then adjust the reference distance for landing weight, altitude, wind, slope, temperature, approach speed, and the number of operative thrust reversers to obtain the actual landing distance.

When landing on slippery runways or runways contaminated with ice, snow, slush, or standing water, the reported braking action must be considered. 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.

Use of the autobrake system commands the airplane to a constant deceleration rate. In some conditions, such as a runway with "poor" braking action, the airplane may not be able to achieve these deceleration rates. In these cases, runway slope and inoperative reversers influence the stopping distance. Since it cannot be determined quickly when this becomes a factor, it is conservative to add the effects of slope and inoperative reversers when using the autobrake system.

Non-normal Configuration Landing Distance

Advisory information is provided to support non-normal configurations that affect landing performance of the airplane. Landing distances are provided for dry runway 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 (VREF). The reference landing distance is measured from 50 ft above the threshold to stop and is based on reference weight and speed at sea level, zero wind, zero slope and max manual braking with maximum reverse thrust. Subsequent columns provide corrections for off-reference landing weight, altitude, wind, slope, temperature, approach speed, and the number of operative thrust reversers. Each correction is independently added to the reference landing distance. Landing distance includes the effect of maximum manual braking and reverse thrust.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding 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.

To determine the energy per brake absorbed during landing, enter the table with the reference brake energy per brake and the type of braking used during landing (Max Manual or Max Auto). 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.

Brake Temperature Monitor System (BTMS) indications are also shown. If brake cooling is determined from the BTMS, the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted, may be used to determine recommended cooling schedule by entering at the bottom of the chart. An EICAS advisory message, BRAKE TEMP, will appear when any brake registers 5 on the GEAR synoptic display and disappears as the hottest brake cools to an indication of 4. Note that even without an EICAS advisory message, brake cooling is recommended.

One Engine Inoperative

Max Continuous %N1

Power setting is based on one engine inoperative with 3 packs on and all anti-ice bleeds off. Enter the table with pressure altitude and KIAS 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.

The level off altitude is dependent on air temperature (ISA deviation). The level off altitude shown is 1000 ft below the maximum altitude. This reduction in altitude is consistent with the FMC logic.

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 and Max Continuous thrust. Note that the maximum altitude shown has been reduced by 1000 ft. This reduction in altitude is consistent with the FMC logic.

Long Range Cruise Control

The table provides target %N1, one engine inoperative Long Range Cruise Mach number, KIAS, 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 three engine Long Range Cruise speed and .84/290/250 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 Fuel Required Adjustment table with the fuel required for the reference weight and the actual weight at checkpoint.

Holding

%N1 required, indicated airspeed and fuel flow are shown for one engine inoperative holding based on the recommended speeds. Fuel flow is based on a racetrack holding pattern and may be reduced by 5% for holding in straight and level flight.

Gear Down

This section contains performance for airplane operation with the landing gear extended for all phases of flight. The data is based on engine bleeds for normal air conditioning.

NOTE: The Flight Management Computer System (FMCS) does not contain special provisions for operation with landing gear extended. As a result, the FMCS will generate inaccurate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. To obtain accurate ETA predictions, gear down cruise speed and altitude should be entered on the CLB and CRZ pages. Gear down cruise speed should also be entered on the DES page and a STEP SIZE of zero should be entered on the PERF INIT or CRZ page. Use of the VNAV during descent under these circumstances is not recommended.

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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Maneuvers — Chapter MAN

Introduction — Section 05

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

Immediately accomplish the following at first indication of stall buffet or stick shaker.

Pilot Flying	Pilot Monitoring
• Advance the thrust levers to maximum thrust • Smoothly adjust the pitch attitude* to avoid ground contact or obstacles • Level the wings (do not change flaps or landing gear configuration. • Retract the speedbrakes.	• Verify maximum thrust. • Monitor alitude and airspeed. • Call out any trend toward terrain contact. • Verify all required actions have been completed and call out any omissions.
When ground contact is no longer a factor:. • Adjust the pitch attitude to accelerate while minimizing altitude loss. • Return to a speed appropriate for the configuration.	

Note: *At high altitudes, it may be necessary to decrease pitch attitude below the horizon to achieve acceleration.

Rejected Takeoff

The captain has the sole responsiblity 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.

Prior to 80 knots, the takeoff should be rejected for any of the following:

- activation of the master caution system
- system failure
- unusual noise or vibration
- tire failure
- abnormally slow acceleration
- takeoff configuration warning
- fire or fire warning

- engine failure
- predictive windshear warning (as installed)
- 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 (as installed)
- if the airplane is unsafe or unable to fly

During takeoff, the crew member observing the non-normal situation will immediately call it out as clearly as possible.

<table>
<tr><th>Captain</th><th>First Officer</th></tr>
<tr><td>Without delay:
Simultaneously close Thrust levers, disconnect autothrottles, and apply maximum manual wheel brakes or verify operation of RTO autobrake.
If RTO autobrake selected, monitor system performance and apply manual wheel brakes if AUTOBRAKES message displayed or deceleration not adequate.
Raise Speedbrake lever.
Apply the maximum amount of reverse thrust on symmetric engines consistent with conditions.
Continue maximum braking until certain the airplane will stop on the runway.</td><td>Verify actions as follows:
Thrust levers closed.
Autothrottles disconnected.
Maximum brakes applied.
Verify Speedbrake lever UP and call “SPEEDBRAKES UP.” If Speedbrake lever not UP, call “SPEEDBRAKES NOT UP.”
Reverse thrust applied symmetrically.
Call out any omitted action items.</td></tr>
<tr><td>Field length permitting:
Initiate movement of Reverse Thrust levers to reach reverse idle detent by taxi speed.</td><td>Call out 60 knots.
Communicate reject decision to control tower and cabin as soon as practical.</td></tr>
<tr><td colspan="2">When the airplane is stopped, perform procedures as required.
Review Brake Cooling Schedule for brake cooling time and precautions (refer to Performance Inflight chapter).
Consider the following:
• the possibility of wheel fuse plugs melting
• the need to clear the runway
• the requirement for remote parking
• wind direction in case of fire
• alerting fire equipment
• not setting parking brake unless passenger evacuation is necessary
• advising the ground crew of the hot brake hazard
• advising the passengers of the need to remain seated or evacuate
• completion of the Non-Normal checklist (if appropriate) for conditions which caused the RTO</td></tr>
</table>

Terrain Avoidance

Ground Proximity Caution

Accomplish the following maneuver for any of these aural alerts*:

- CAUTION OBSTACLE
- CAUTION TERRAIN
- SINK RATE
- TERRAIN
- DON’T SINK
- TOO LOW FLAPS
- TOO LOW GEAR
- TOO LOW TERRAIN
- GLIDESLOPE
- BANK ANGLE

Pilot Flying	Pilot Monitoring
Correct flight path or 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: *As installed, some repeat.

Ground Proximity Warning

Accomplish the following maneuver for any of these conditions**:

- activation of “PULL UP” or "OBSTACLE OBSTACLE PULLUP" or “TERRAIN TERRAIN PULL UP” warning
- other situations resulting in unacceptable flight toward terrain.

Pilot Flying	Pilot Monitoring
Disengage autopilot. Disconnect autothrottle(s). Aggressively apply maximum* thrust. Simultaneously roll wings level and rotate to an initial pitch attitude of 20°. Retract speedbrakes. If terrain remains a threat, continue rotation up to the pitch limit indicator or stick shaker or initial buffet.	Assure maximum* thrust. Verify all required actions have been completed and call out any omissions.
Do not change gear or flap configuration until terrain separation is assured. Monitor radio altimeter for sustained or increasing terrain separation. 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). Call out any trend toward terrain contact.

Note: Aft control column force increases as 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 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 when the EECs 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.

** as installed

Traffic Avoidance

Immediately accomplish the following by recall whenever a TCAS traffic advisory (TA) or resolution advisory (RA) occurs.

WARNING: Comply with the RA if there is a direct conflict between the RA and air traffic control.

WARNING: Once an RA has been issued, safe separation can 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 other 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.

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Note: Do not use flight director commands until clear of conflict.

109, 405

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 1,000 feet AGL should not be followed.

Pilot Flying	Pilot Monitoring
If maneuvering is required, disengage autopilot and disconnect 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 autopilot and disconnect autothrottle. Advance Thrust levers forward to ensure maximum thrust is attained and call for FLAPS 20. 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 20 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". 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

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 the actions may be necessary once recovery is underway. 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 the airplane is not stalled. A stalled condition can exist at any altitude 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	
• Disengage autopilot and disconnect autothrottle • Apply as much as full nose-down elevator • *Apply appropriate nose-down stabilizer trim • Reduce thrust • *Roll (adjust bank angle) to obtain a nose down pitch rate • Complete the recovery: - When approaching the horizon, roll to wings level - Check airspeed and adjust thrust - Establish pitch attitude	• Call out attitude, airspeed and altitude throughout the recovery • Verify all required actions have been completed and call out any omissions

Nose Low Recovery

Pilot Flying	Pilot Monitoring
• Recognize and confirm the situation	
• Disengage autopilot and disconnect autothrottle • Recover from stall, if required • *Roll in the shortest direction to wings level (unload and roll if bank angle is more than 90 degrees) • Recover to level flight: - Apply nose up elevator - *Apply nose-up trim, if required - Adjust thrust and drag as required	• Call out attitude, airspeed and altitude throughout the recovery • 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 (Predictive Windshear, As installed)

For predictive windshear caution alert (“MONITOR RADAR DISPLAY” aural):

Pilot Flying	Pilot Monitoring
Maneuver as required to avoid windshear.	

Windshear Warning

Predictive windshear warning during takeoff roll (“WINDSHEAR AHEAD, WINDSHEAR AHEAD” aural):

- prior to V1, reject takeoff
- after V1, perform Windshear Escape Maneuver.

Windshear encountered during takeoff roll:

- if windshear 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 in flight, perform Windshear Escape Maneuver
- if windshear encountered near 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 Windshear Escape Maneuver, or at pilot’s discretion, perform a normal go-around.

Windshear encountered in flight:

- perform 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 1,000 feet AGL, in excess of any of the following:

- 15 knots indicated airspeed
- 500 FPM vertical speed
- 5 degrees pitch attitude
- 1 dot displacement from the glideslope
- unusual thrust lever position for a significant period of time.

Windshear Escape Maneuver

Pilot Flying	Pilot Monitoring
MANUAL FLIGHT: Disengage autopilot. Push either TO/GA switch. Aggressively apply maximum* thrust. Disconnect autothrottle. Simultaneously roll wings level and rotate toward an initial pitch attitude of 15°. Retract speedbrakes. Follow flight director TO/GA guidance (if available). AUTOMATIC FLIGHT: Press either TO/GA switch.** Verify TO/GA mode annunciation. Verify thrust advances to GA power. Retract speedbrakes. Monitor system performance***.	Assure maximum* thrust. Verify all required actions have been completed and call out any omissions.

Pilot Flying	Pilot Monitoring
Do not change gear or flap configuration until windshear is no longer a factor. Monitor vertical speed and altitude. Do not attempt to regain lost airspeed until windshear is no longer a factor.	Monitor vertical speed and altitude. Call out any trend toward terrain contact, descending flight path, or significant airspeed changes.

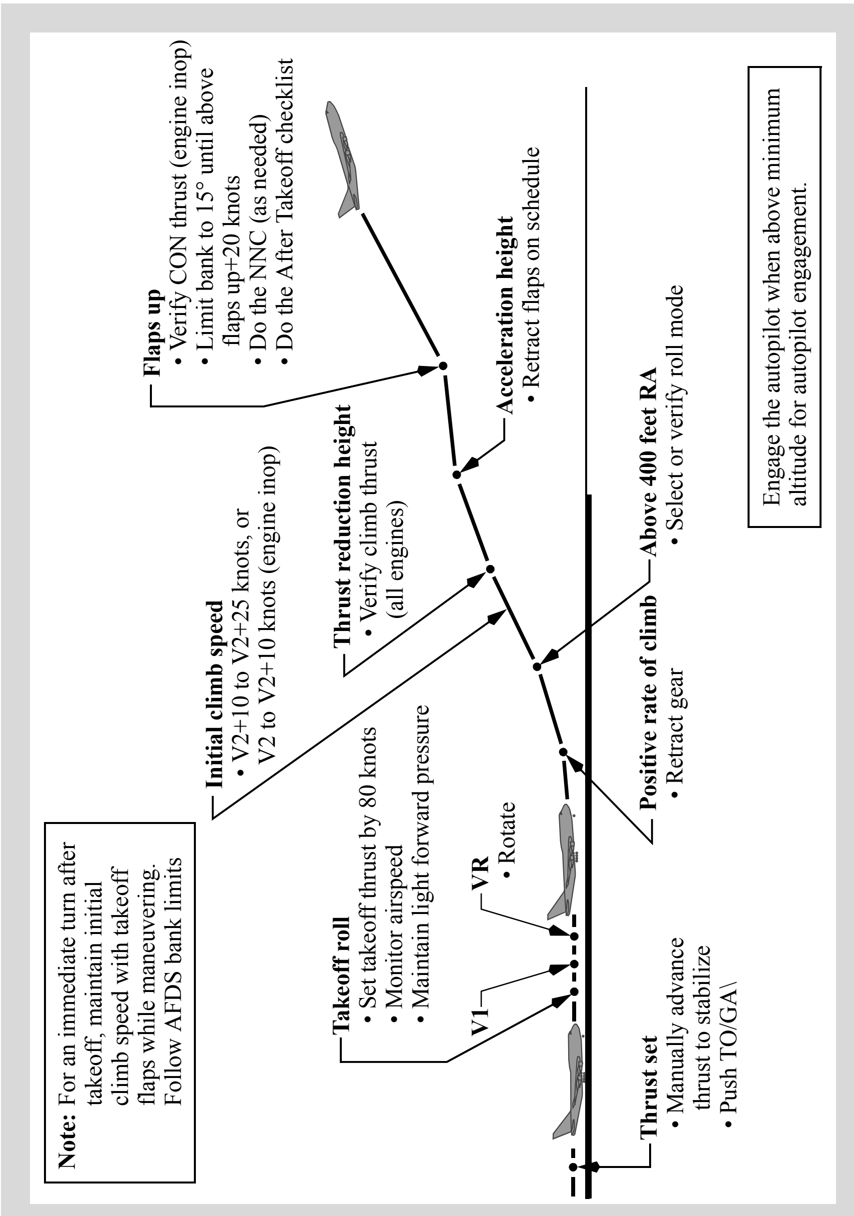
Note: Aft control column force increases as the airspeed decreases. In all cases, the pitch attitude that results in intermittent stick shaker or initial buffet is the upper pitch attitude limit. Flight at intermittent stick shaker may be required to obtain positive terrain separation. Smooth, steady control will avoid a pitch attitude overshoot and stall.

Note: * Maximum thrust can be obtained by advancing the Thrust levers full forward when the EECs are in the normal mode. If terrain contact is imminent, advance Thrust levers full forward.

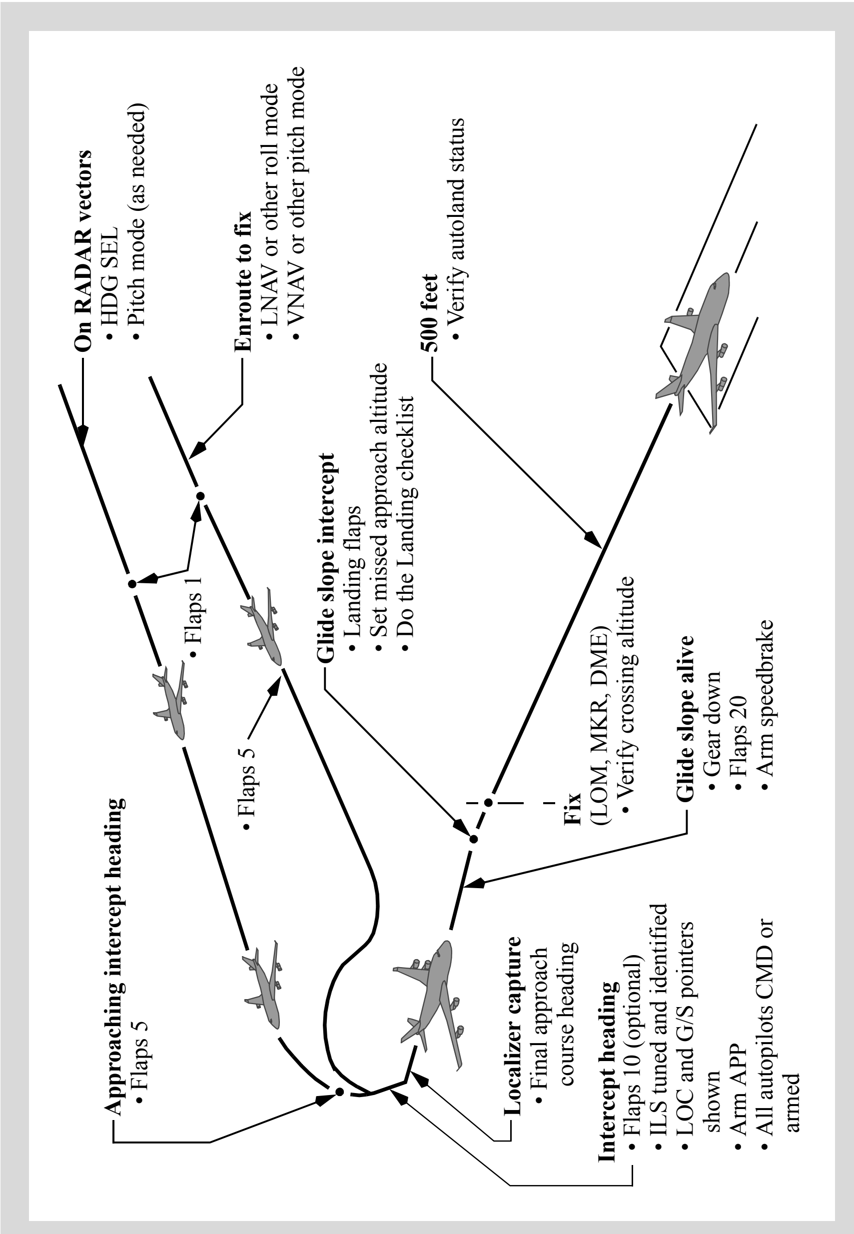
Note: ** If TO/GA is not available, disengage autopilot and disconnect autothrottle and fly manually.

WARNING: * Severe windshear may exceed the performance capability of the AFDS. The pilot flying must be prepared to disengage the autopilot and disconnect the autothrottle and fly manually.**

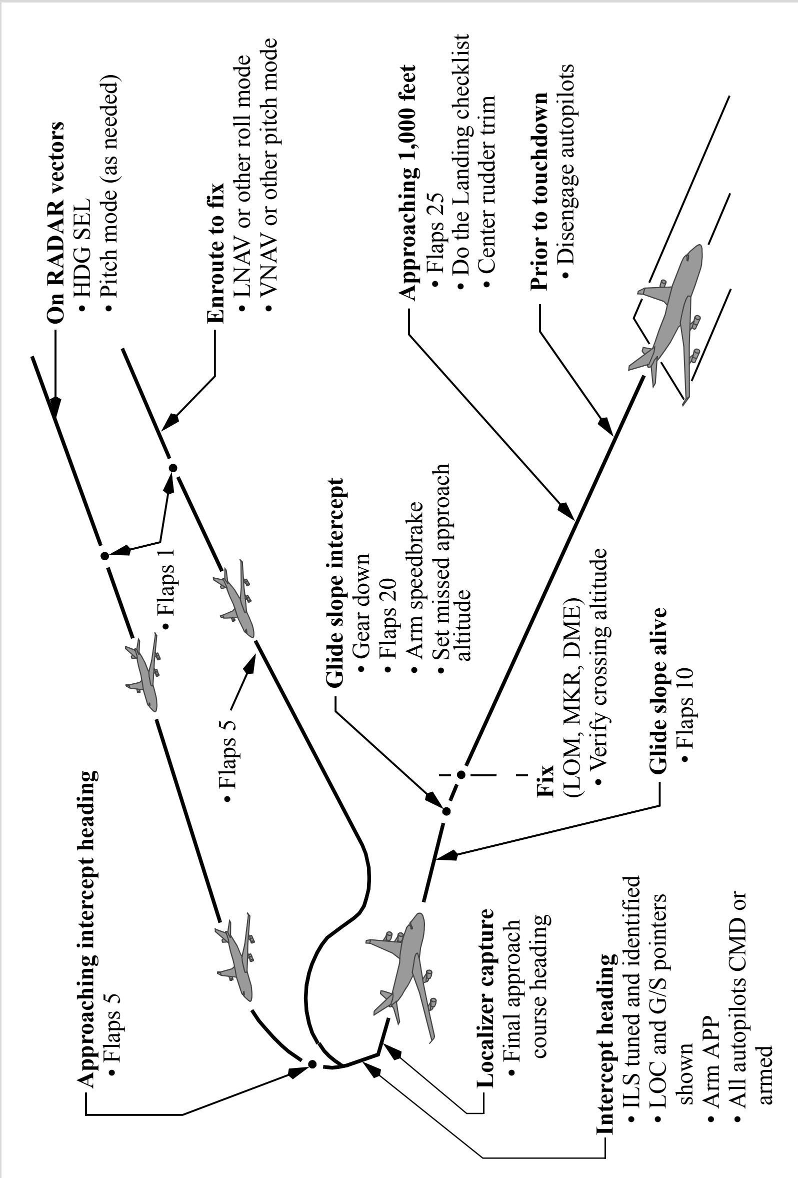
Takeoff


Note: For an immediate turn after takeoff, maintain initial climb speed with takeoff flaps while maneuvering. Follow AFDS bank limits
Initial climb speed
• V2+10 to V2+25 knots, or V2 to V2+10 knots (engine inop)
Flaps up
• Verify CON thrust (engine inop)
• Limit bank to 15° until above flaps up+20 knots
• Do the NNC (as needed)
• Do the After Takeoff checklist
Thrust reduction height
• Verify climb thrust (all engines)
Takeoff roll
• Set takeoff thrust by 80 knots
• Monitor airspeed
• Maintain light forward pressure
V1
VR
• Rotate
Acceleration height
• Retract flaps on schedule
Positive rate of climb
• Retract gear
Above 400 feet RA
• Select or verify roll mode
Thrust set
• Manually advance thrust to stabilize
• Push TO/GA\
Engage the autopilot when above minimum altitude for autopilot engagement.

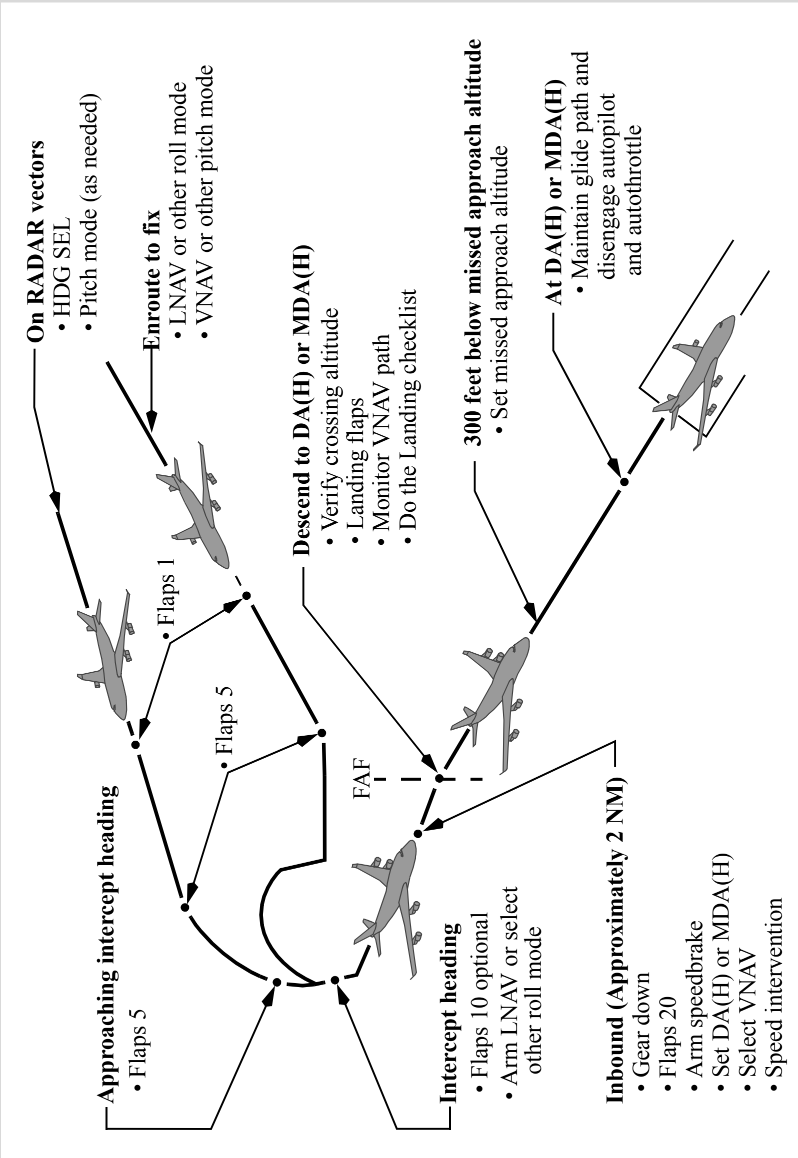
ILS Approach - Normal/One Engine Inoperative



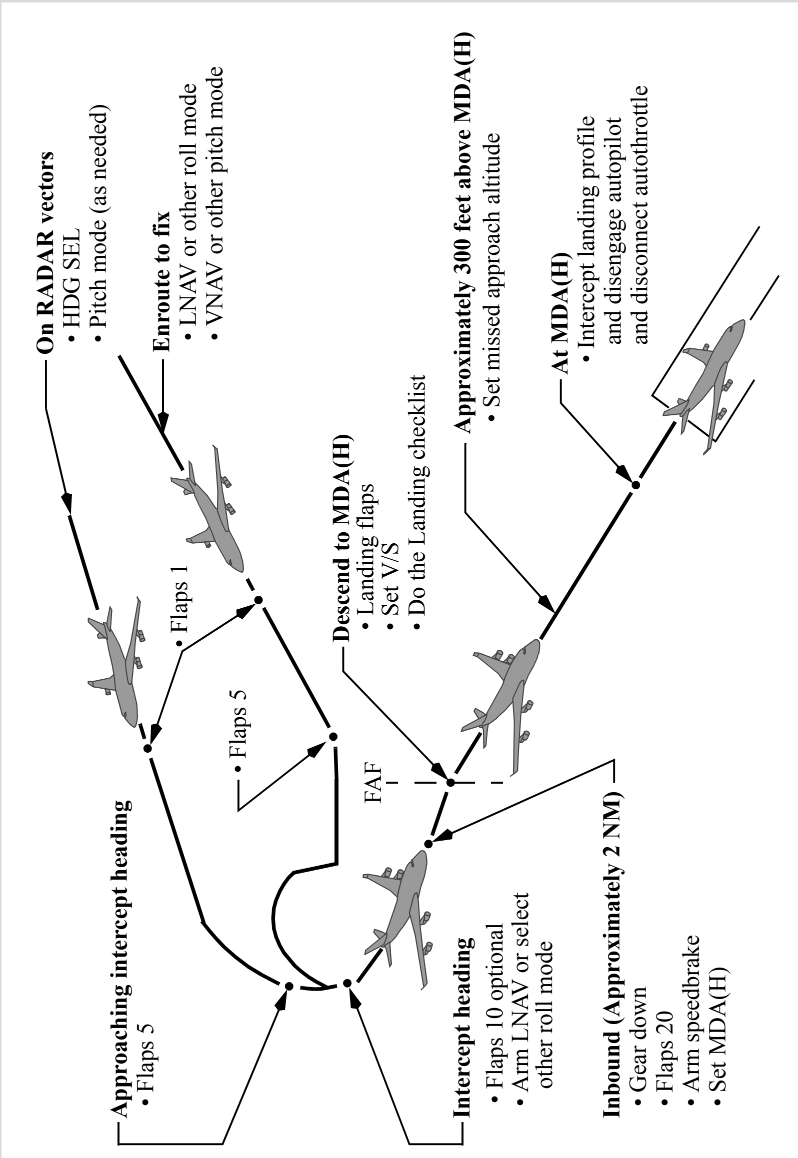
ILS Approach - Two Engines Inoperative



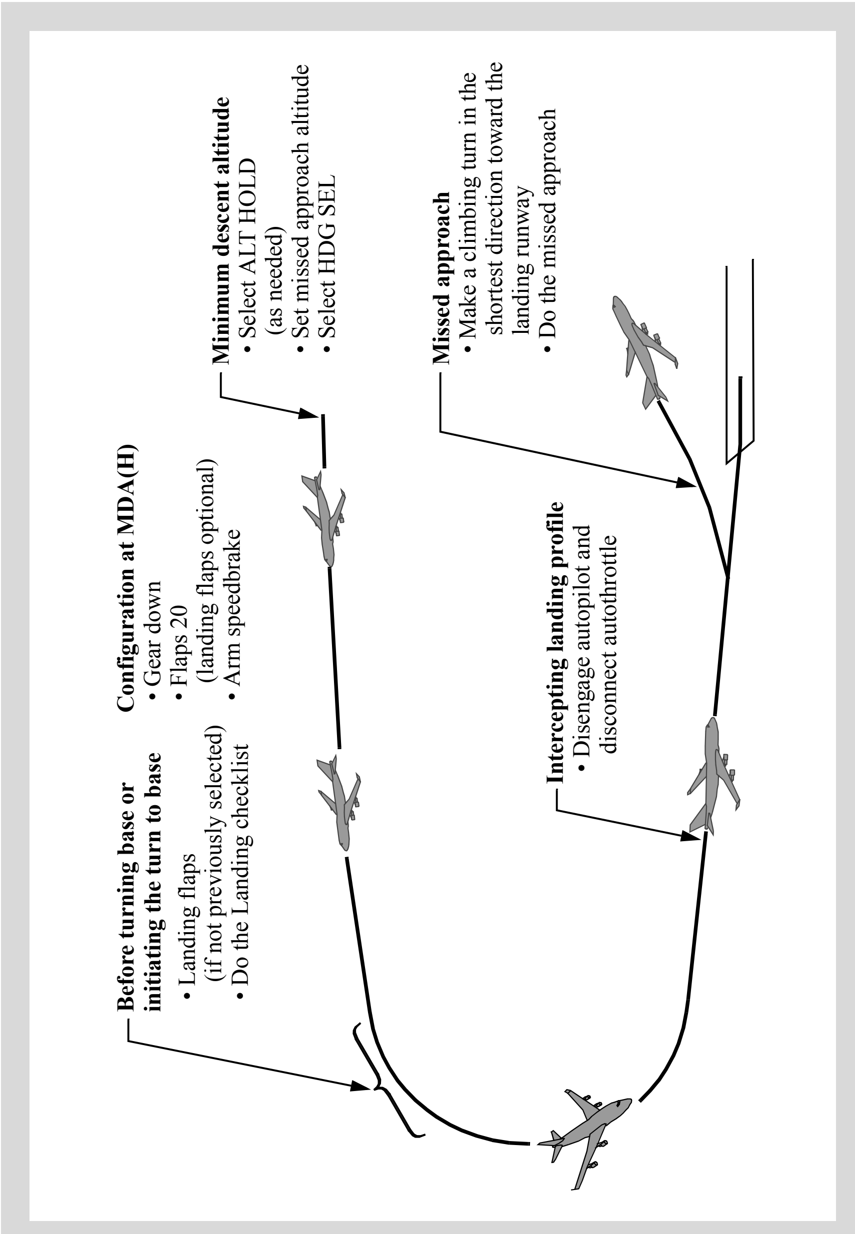
Instrument Approach Using VNAV



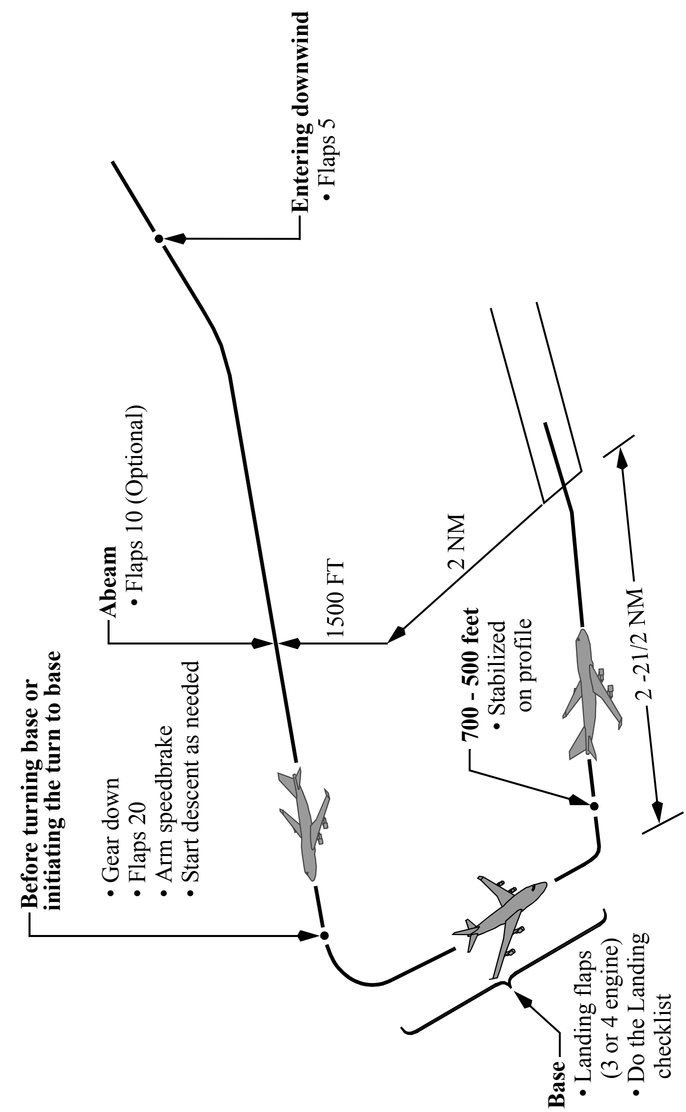
Instrument Approach Using V/S



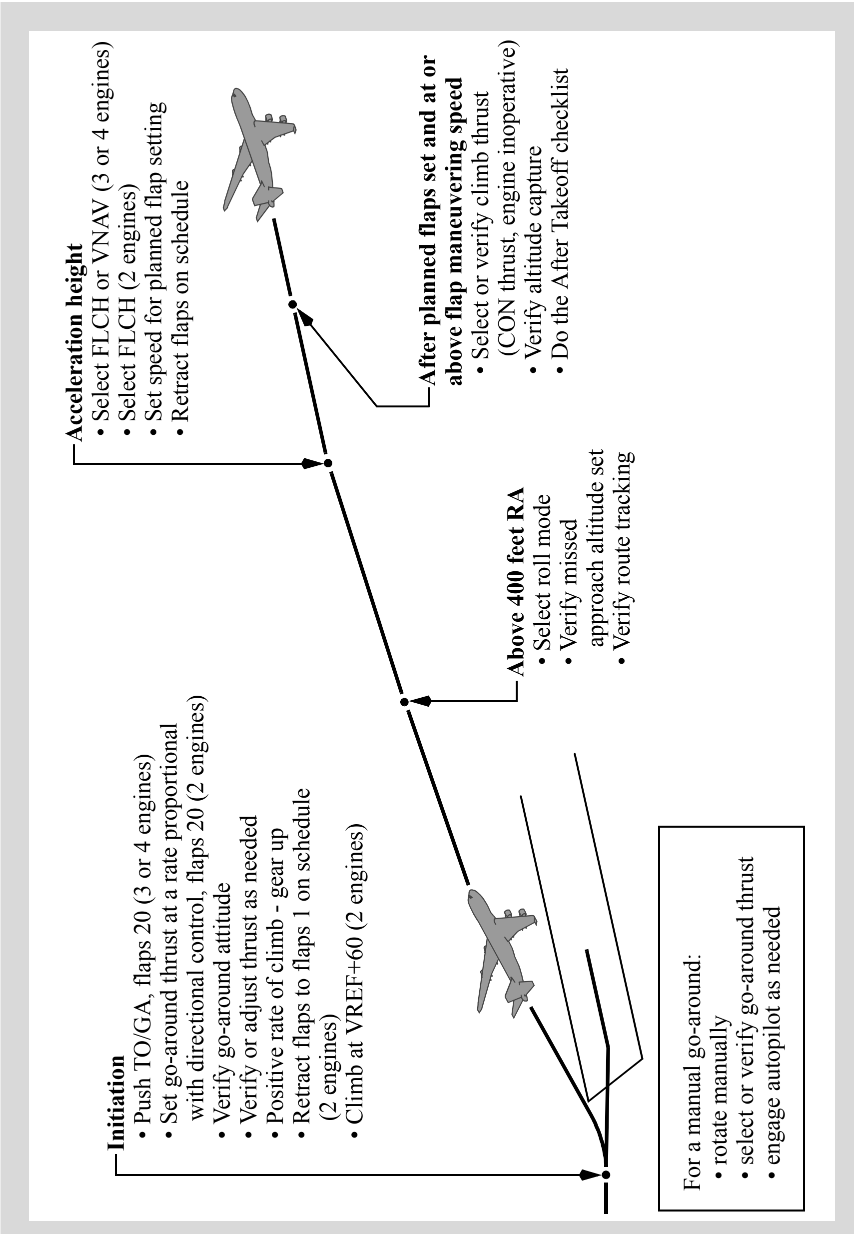
Circling Approach



Visual Traffic Pattern



Go-Around and Missed Approach - All Approaches



Checklist Instructions — Chapter CI
Table of Contents — Section 0

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General

The airplanes listed in the table below are covered in this QRH. 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 handbook. 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 chapter 0 of volume 1 of this handbook's associated Flight Crew Operations Manual.

Airplane number is supplied by the operator. Registry number is supplied by the national regulatory agency. Serial and tabulation numbers are supplied by Boeing.

Airplane Number	Registry Number	Engine
405	Boeing Converted Freighter	P&W
109	Passenger	P&W
570	Freighter	GE

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Checklist Instructions — Chapter CI
Revision Record — Section RR

QRH Revision Transmittal Letter

To: All holders of The Boeing Company 747 Flight Crew Operations Manual, Boeing Document Number D6-30151-400.

Subject: Quick Reference Handbook (QRH) 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	April 1, 1999		2	July 15, 1999	
3	October 1, 1999		4	April 1, 2000	
5	October 1, 2000		6	April 1, 2001	
7	November 1, 2001		8	May 1, 2002	
9	November 1, 2002		10	May 1, 2003	
11	November 1, 2003		12	May 1, 2004	
13	October 1, 2004		14	April 1, 2005	
15	October 1, 2005		16	April 1, 2006	
17	October 1, 2006		18	April 1, 2007	
19	October 1, 2007		20	April 1, 2008	
21	October 1, 2008		22	April 1, 2009	
23	October 1, 2009				

General

The Boeing Company issues flight crew operations manual and QRH revisions to provide new or revised procedures and information. Formal revisions also incorporate appropriate information from previously issued flight crew operations manual bulletins.

The revision date is the approximate date the manual is mailed to the customer.

QRH revisions, part of the formal FCOM revisions, include a QRH Transmittal Letter, a new QRH Revision Record, QRH Revision Highlights, and a current QRH List of Effective Pages. Use the information on the new QRH Revision Record and QRH List of Effective Pages to verify the QRH 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.

QRH Filing Instructions

Consult the QRH 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.

QRH Revision Highlights

Be careful when inserting changes not to throw away pages from the manual that are not replaced. Using the QRH List of Effective Pages (CI.LEP) can help determine the correct content of the QRH.

Throughout the QRH, airplane effectivity may be updated to reflect coverage as listed on the Model Identification page (CI.ModID), or to show service bulletin airplane effectivity. Highlights are not supplied.

This QRH 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 Gen. Emer. Equip., Doors, Windows

DOOR AFT CARGO

1.4 - Removed the step: Do not accomplish the following checklist - CABIN ALTITUDE or Rapid Depressurization. With the previous deletion of the step to turn on passenger/supernumerary oxygen, the CABIN ALTITUDE or Rapid Depressurization checklist provides the prompt to turn off passenger or supernumerary oxygen if the lowest safe altitude is above 15,000 feet. Below 15,000 feet, it may not be needed to drop all the masks.

DOOR FWD CARGO

1.12 - Removed the step: Do not accomplish the following checklist - CABIN ALTITUDE or Rapid Depressurization. With the previous deletion of the step to turn on passenger/supernumerary oxygen, the CABIN ALTITUDE or Rapid Depressurization checklist provides the prompt to turn off passenger or supernumerary oxygen if the lowest safe altitude is above 15,000 feet. Below 15,000 feet, it may not be needed to drop all the masks.

DOOR NOSE CARGO

1.19 - Removed the step: Do not accomplish the following checklist - CABIN ALTITUDE or Rapid Depressurization. With the previous deletion of the step to turn on passenger/supernumerary oxygen, the CABIN ALTITUDE or Rapid Depressurization checklist provides the prompt to turn off passenger or supernumerary oxygen if the lowest safe altitude is above 15,000 feet. Below 15,000 feet, it may not be needed to drop all the masks.

DOOR SIDE CARGO

1.21 - Removed the step: Do not accomplish the following checklist - CABIN ALTITUDE or Rapid Depressurization. With the previous deletion of the step to turn on passenger/supernumerary oxygen, the CABIN ALTITUDE or Rapid Depressurization checklist provides the prompt to turn off passenger or supernumerary oxygen if the lowest safe altitude is above 15,000 feet. Below 15,000 feet, it may not be needed to drop all the masks.

Section 2 - Air Systems

BLEED 1, 2, 3, 4

2.10 - Added "valve" to condition for clarity.

Section 6 - Electrical

ELEC AC BUS 1, 2, 3, 4

6.2 - If the bus is recovered, revised to reset the EEC for only the affected engine. Revised to reference affected generator, rather than the affected side for clarity.

Section 7 - Engines, APU

Engine Limit or Surge or Stall

7.10 - Revised formatting to improve readability.

7.11 - Revised to accomodate fleet configurations.

APU DOOR

7.15 - Corrected second choice to "APU DOOR".

Section 8 - Fire Protection

Fire Engine Tailpipe

8.4 - Revised to reflect there is only one autostart switch installed on GE airplanes.

8.6 - Revised to correct Decision symbol.

Smoke, Fire or Fumes

8.10 - Revised to correct Decision symbol.

FIRE CARGO FWD

8.32 - EICAS messages FIRE MN DK AFT, MID are not installed on combi airplanes with IDS 501 or later software.

FIRE MN DK AFT, FWD, MID

8.34 - Added "Rapid Depressurization" to complete the checklist title.

SMOKE DR 5 REST

8.40 - Revised text for standardization.

8.40 - Revised to ensure packs are not reset before Crew Reset switch is pushed.

Section 9 - Flight Controls

FLAPS CONTROL

9.8 - Procedural steps not required on airplanes with upgraded flap control units.

Section 10 - Flight Instruments, Displays

ALT DISAGREE

10.7,9 - Revised to more accurately reflect airplane does not meet RVSM requirements; it is possible airplane may be allowed to remain in RVSM airspace.

Section 11 - Flight Management, Navigation

IRS CENTER, LEFT, RIGHT

11.4 - Added "confirm; checklist step is not reversible.

Section 12 - Fuel

Fuel Jettison

12.8 - Revised for clarity and commonality.

12.9 - Revised to reflect fuel ballast option not installed on operator airplanes.

Fuel Leak Engine

12.13 - Revised for clarity and commonality.

FUEL QTY LOW

12.33 - Revised for clarity and commonality.

12.33 - Revised procedure to keep pumps off which should not be turned on except in emergency.

12.33 - Revised to add inadvertently deleted step.

Section 13 - Hydraulics

HYD QTY LOW 1

13.22 - Revised for consistency.

Section 14 - Landing Gear

GEAR DISAGREE or Gear Lever Jammed In Off Position

14.14 - Corrected spelling of "the".

14.14 - Added "UPPER DECK" for nomenclature consistency.

14.20 - Corrected spelling of "the".

Nose and Body Gear Up

14.36 - Corrected spelling of "deploy".

Chapter PI-QRH - Performance Inflight - QRH

Section 10 - Table of Contents

PI-QRH.TOC.10.1 - 747-400 PW4056 KG FAA JAR was added as Section 10.

Section 10 - General

General

PI-QRH.10.1 - 747-400 PW4056 KG FAA JAR was added as Section 10.

Section 20 - Table of Contents

PI-QRH.TOC.20.1 - 747-400F CF6-80C2B1F LB FAA was added as Section 20.

Section 20 - General

General

PI-QRH.20.1 - 747-400F CF6-80C2B1F LB FAA was added as Section 20.

Chapter CI - Checklist Instructions

Section 2 - Non-Normal Checklists

Non–Normal Checklist Use

CI.2.5 - Added IRS mode selector to list of items requiring verbal agreement before action; step is not reversible.

Checklist Instructions — Chapter CI
List of Effective Pages — Section LEP

Page	Date
Quick Reference Handbook	
Quick Action Index	
* QA.Index.1-2	October 1, 2009
EICAS Messages (tab)	
* EICAS.Index.1-12	October 1, 2009
Unannunciated Index (tab)	
* Unann.Index.1-2	October 1, 2009
Alphabetical Index (tab)	
* Alpha.Index.1-12	October 1, 2009
Normal Checklists (tab)	
* NC.1	October 1, 2009
NC.2-4	April 1, 2008
0 Miscellaneous (tab)	
0.TOC.1-2	April 1, 2008
* 0.1	October 1, 2009
0.2	April 1, 2009
1 Airplane General, Emergency Equipment, Doors, Windows (tab)	
* 1.TOC.1-2	October 1, 2009
* 1.1-32	October 1, 2009
2 Air Systems (tab)	
* 2.TOC.1-2	October 1, 2009
* 2.1-2	October 1, 2009
2.3	April 1, 2008
* 2.4-13	October 1, 2009
2.14	April 1, 2008
2.15	April 1, 2009
2.16	April 1, 2008

Page	Date
2 Air Systems (cont)	
2.17-18	April 1, 2009
* 2.19-21	October 1, 2009
2.22-23	April 1, 2008
2.24-26	April 1, 2009
* 2.27-29	October 1, 2009
2.30	April 1, 2008
3 Anti-Ice, Rain (tab)	
* 3.TOC.1-2	October 1, 2009
* 3.1-12	October 1, 2009
* 3.13-16	Deleted
4 Automatic Flight (tab)	
4.TOC.1-2	April 1, 2008
4.1-2	April 1, 2008
5 Communications (tab)	
* 5.TOC.1-2	October 1, 2009
* 5.1-4	October 1, 2009
6 Electrical (tab)	
* 6.TOC.1-2	October 1, 2009
6.1	April 1, 2008
* 6.2-10	October 1, 2009
7 Engines, APU (tab)	
* 7.TOC.1-2	October 1, 2009
* 7.1-54	October 1, 2009

* = Revised, Added, or Deleted

Page	Date
8 Fire Protection (tab)	
* 8.TOC.1-2	October 1, 2009
8.1-2	April 1, 2009
* 8.3-4	October 1, 2009
8.5	October 1, 2008
* 8.6-48	October 1, 2009
9 Flight Controls (tab)	
9.TOC.1-2	October 1, 2008
9.1-3	April 1, 2008
* 9.4	October 1, 2009
9.5	October 1, 2008
* 9.6	October 1, 2009
9.7	October 1, 2008
* 9.8	October 1, 2009
9.9	October 1, 2008
9.10	April 1, 2009
* 9.11-12	October 1, 2009
9.13-14	April 1, 2009
9.15	October 1, 2008
9.16-20	April 1, 2009
10 Flight Instruments, Displays (tab)	
* 10.TOC.1-2	October 1, 2009
* 10.1-14	October 1, 2009
11 Flight Management, Navigation (tab)	
* 11.TOC.1-2	October 1, 2009
11.1	April 1, 2009
* 11.2-6	October 1, 2009
* 11.7-8	Deleted

Page	Date
12 Fuel (tab)	
* 12.TOC.1-2	October 1, 2009
* 12.1-2	October 1, 2009
12.3	April 1, 2008
* 12.4-46	October 1, 2009
* 12.47-54	Deleted
13 Hydraulics (tab)	
* 13.TOC.1-2	October 1, 2009
13.1-3	April 1, 2009
* 13.4-28	October 1, 2009
14 Landing Gear (tab)	
* 14.TOC.1-2	October 1, 2009
* 14.1	October 1, 2009
14.2-5	April 1, 2008
14.6-7	April 1, 2009
14.8-9	April 1, 2008
* 14.10	October 1, 2009
14.11-12	April 1, 2009
* 14.13-16	October 1, 2009
14.17-18	April 1, 2009
* 14.19-38	October 1, 2009
15 Warning Systems (tab)	
* 15.TOC.1-2	October 1, 2009
* 15.1-6	October 1, 2009
Operations Information (tab)	
OI.TOC.0.1-2	April 1, 2008
OI.1.1-2	April 1, 2008
Performance - Inflight (tab)	
* PI.TOC.1-2	October 1, 2009
* PI-QRH.TOC.10.1-2	October 1, 2009
* PI-QRH.10.1-6	October 1, 2009

* = Revised, Added, or Deleted

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Checklist Instructions — Chapter CI
Normal Checklists — Section 1

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

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 autobrake), 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, “FUEL CONTROL switches...CUTOFF” refers to the position of the switches.

Checklist Instructions — Chapter CI
Non-Normal Checklists — Section 2

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 an EICAS alert message. The EICAS alert message indicates a non-normal condition, and is the cue to select and do the associated checklist.

Checklists without an alert EICAS message (such as Ditching) are called unannunciated checklists. Most unannunciated checklists are in the associated system section. For example, Fuel Leak Engine is in section 12, Fuel. Unannunciated checklists with no associated system are in section 0, Miscellaneous.

A caret symbol > precedes all EICAS alert messages where the associated checklist is informational, has no procedural steps, or the action is obvious (such as Overspeed). The checklist titles also have the caret symbol to agree with the EICAS alert message. The flight crew does not need to refer to the checklists for EICAS alert messages preceeded by caret symbols.

All checklists have condition statements. The condition statement briefly describes the situation that caused the EICAS alert message. 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 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 AUTOBRAKES) are annunciated by an EICAS alert message or other indication. Checklist titles in upper and lower case (such as Window Damage) are not annunciated.

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 situations and use good judgement 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 main power source remains
- 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 an EICAS alert message shows or a limit is exceeded.

Non–normal checklists also assume:

- During engine start and before takeoff, the associated non–normal checklist is done if an EICAS alert message is shown or 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.
- Aural alerts are silenced and the system is reset by the flight crew as soon as the cause of the alert is recognized.
- The EICAS message list is cancelled after all checklists are complete or on hold- so that future messages are more noticeable.
- 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.
- Flight crew reset of a tripped fuel pump or refuel circuit breakers is prohibited. In flight, reset of any other tripped circuit breaker is not recommended. However, these other tripped breakers 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 any other 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.

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 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.

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 in-flight non-normal situation, verbal confirmation is required for:

- an engine thrust lever
- a fuel control switch
- an engine or APU fire switch, or a cargo fire arm switch
- a generator drive disconnect switch
- an IRS mode selector

With the airplane stationary on the ground:

- the captain and the first officer take action based on preflight and postflight areas of responsibility

With the airplane in flight or in motion on the ground:

- the pilot flying and the pilot monitoring take action based on each crewmembers’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 and the condition is not shown on EICAS. 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.

Consequential EICAS alert messages can show as a result of a primary failure condition (such as FUEL IMBAL 1-4 as a result of FUEL LEAK ENGINE) or as a result of doing a non–normal checklist (such as HYD PRESS ENG as a result of doing the HYD OVHT SYS 1, 2, 3, 4 checklist). The flight crew should do the checklists for consequential EICAS alert messages, unless the statement “Do not accomplish the following checklists:” is included. All consequential EICAS alert messages may not show while doing the primary checklist, depending on operational circumstances.

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:

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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.

Non–Normal Checklist Legend

Redirection Symbol

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The redirection symbol is used 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.

Intentionally
Blank

Evacuation Checklist is on the reverse side of this page.

Evacuation

Condition: Evacuation is needed.

1 Parking brake . . . . Set

2 OUTFLOW VALVES MAN switches (both) . . . . . ON

3 OUTFLOW VALVES
manual control . . . . Push to OPEN
and hold until outflow
valve indications show fully open

4 FUEL CONTROL switches (all) . . . . CUTOFF

5 Advise the cabin to evacuate.

6 Advise the tower.

7 Engine fire switches (all) . . . . Pull

8 APU fire switch . . . . Override and pull

9 **If** an engine or APU fire warning occurs:

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

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