

# 777

## Quick Reference Handbook

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**PREFLIGHT**

Oxygen .....	Tested, 100%
Flight instruments .....	Heading____, Altimeter____
Parking brake .....	Set
Fuel control switches.....	CUTOFF

---

**BEFORE START**

[Passenger Airplane] Flight deck door .....	Closed and locked
[Passenger Airplane] Passenger signs .....	_____
[Freighter Airplane] Supernumerary signs.....	_____
MCP .....	V2____, HDG/TRK____, ALTITUDE____
Takeoff speeds .....	V1____, VR____, V2____
CDU preflight. ....	Completed
Trim .....	_____ Units, 0, 0
Taxi and takeoff briefing .....	Completed
Beacon .....	ON

---

**BEFORE TAXI**

Anti-ice .....	_____
Recall .....	Checked
Autobrake .....	RTO
Flight controls.....	Checked
Ground equipment .....	Clear

---

**BEFORE TAKEOFF**

Flaps .....	_____
-------------	-------

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**AFTER TAKEOFF**

Landing gear.....	UP
Flaps .....	UP

**DESCENT**

Recall.....	Checked
Notes .....	Checked
Autobrake .....	—
Landing data .....	VREF __, Minimums __
Approach briefing.....	Completed

**APPROACH**

Altimeters .....	—
------------------	---

**LANDING**

Speedbrake .....	ARMED
Landing gear.....	DOWN
Flaps .....	—

**SHUTDOWN**

Hydraulic panel.....	Set
[Auxiliary Fuel Tank]	
Auxiliary fuel switch.....	Off
Fuel pumps .....	Off
Flaps .....	UP
Parking brake .....	—
Fuel control switches.....	CUTOFF
Weather radar .....	Off

**SECURE**

<b>ADIRU</b> .....	<b>OFF</b>
<b>Emergency lights</b> .....	<b>OFF</b>
<b>Packs</b> .....	<b>OFF</b>

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777 Flight Crew Operations Manual

# Non-Normal Checklists

## Miscellaneous

# Chapter NNC

## Section 0

## Table of Contents

Ditching ..... 0.1  
Overweight Landing ..... 0.4

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## Ditching

Condition: Airplane ditching and evacuation are needed.

- 1 Plan to jettison fuel as needed to reduce VREF speeds.

### 2 Checklist Complete Except Deferred Items

#### Deferred Items

#### Below 5,000 feet

GND PROX GEAR OVRD switch ..... OVRD  
GND PROX TERR OVRD switch ..... OVRD  
PACK switches (both) ..... Off  
OUTFLOW VALVE switches (both) ..... MAN  
OUTFLOW VALVE MANUAL switches (both) ..... Hold in CLOSE until the outflow valve indications show fully closed

[Passenger Airplane - Two selectors]

PASS SIGNS selectors (both) ..... ON

[Freighter Airplane]

SEAT BELTS selector ..... ON

Do **not** accomplish the following checklists:

PACK L

PACK R

CABIN ALTITUDE AUTO

▼ Continued on next page ▼

**▼ Ditching continued ▼****On final approach (omit Landing checklist)**

- Landing gear lever . . . . . UP
- Flaps . . . . . 30
- Advise the cabin of imminent touchdown.
- Maintain airspeed at VREF 30 to touchdown. Flare the airplane to achieve the minimum rate of descent at touchdown.

**After impact**

- FUEL CONTROL switches (both) . . . . . CUTOFF
- APU fire switch . . . . . Override and pull



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## Overweight Landing

Condition: A landing at greater than the maximum landing weight is needed.

1 Refer to the Landing Climb Limit Weight table in the Performance Inflight chapter.

2 Choose one:

- ◆ Landing gross weight is **greater than** the Landing Climb Limit Weight, **or one engine is inoperative**:

GND PROX FLAP OV RD switch . . . OV RD

**Note:** Use flaps 20 and VREF 20 for landing and flaps 5 for go-around. This gives greater climb capability.

►► Go to step 7

- ◆ Landing gross weight is **less than or equal to** the Landing Climb Limit Weight, **and both engines are running** normally:

[777-200 or 777-200ER]

►► Go to step 3

[777F, 777-200LR, 777-300, 777-300ER]

►► Go to step 5

[777-200 or 777-200ER]

3 Enter the landing gross weight on the APPROACH REF page.

▼ Continued on next page ▼



## ▼ Overweight Landing continued ▼

## 4 Choose one:

- ◆ VREF 30 + additives (wind and gusts, 5 knots minimum) is **at or below** 160 knots:

**Note:** Use flaps 30 and VREF 30 for landing and flaps 20 for go-around.



- ◆ VREF 30 + additives (wind and gusts, 5 knots minimum) is **above** 160 knots:

**Note:** Use flaps 25 and VREF 25 for landing and flaps 20 for go-around. This gives greater margin to the flap placard speed.

## ►► Go to step 7

[777F, 777-200LR, 777-300, 777-300ER]

## 5 Enter the landing gross weight on the APPROACH REF page.

▼ Continued on next page ▼

▼ Overweight Landing continued ▼

6 Choose one:

- ◆ VREF 30 + additives (wind and gusts, 5 knots minimum) is **at or below** 170 knots:

**Note:** Use flaps 30 and VREF 30 for landing and flaps 20 for go-around.



- ◆ VREF 30 + additives (wind and gusts, 5 knots minimum) is **above** 170 knots:

**Note:** Use flaps 25 and VREF 25 for landing and flaps 20 for go-around. This gives greater margin to the flap placard speed.

►► Go to step 7

7 Checklist Complete Except Deferred Items

**Deferred Items**

**Descent Checklist**

Recall . . . . .	Checked
Notes . . . . .	Checked
Autobrake . . . . .	—
Landing data . . . . .	<b>VREF 20 ____ or VREF 25 ____ , Minimums ____</b>
Approach briefing . . . . .	Completed

▼ Continued on next page ▼

▼ Overweight Landing continued ▼

---

## Approach Checklist

Altimeters . . . . .

---

## Landing Checklist

Speedbrake . . . . . ARMED

Landing gear . . . . . DOWN

Flaps. . . . . 20 or 25



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**Non-Normal Checklists****Chapter NNC****Airplane Gen., Emer. Equip., Doors, Windows****Section 1****Table of Contents**

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## Automatic Unlock

[Flight Deck Security Door]

Condition: The correct emergency access code is entered.

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



## CREW OXYGEN LOW

Condition: Crew oxygen pressure is low.



## [] DOOR AFT CARGO

[Small Aft Cargo Door]

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

**Note:** The aft lower cargo door is in a safe configuration as long as cabin pressurization is normal. Positive cabin differential pressure ensures the door stays in place.



**[ ] DOOR AFT CARGO**

[Large Aft Cargo Door]

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

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

1 LDG ALT selector . . . . . PULL ON, set 8000

2 Choose one:

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

Level off at the lowest safe altitude.

►► Go to step 3

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

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

►► Go to step 3

3 **After** level off, allow sufficient time for the cabin altitude to stabilize. This minimizes discomfort when the airplane is depressurized.

4 Choose one:

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

►► Go to step 5

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

Don the oxygen masks.

Establish crew communications.

►► Go to step 5

- 5 OUTFLOW VALVE switches (both) . . . . . MAN
- 6 OUTFLOW VALVE MANUAL  
switches (both) . . . . . Move to OPEN  
until the outflow  
valve indications show  
fully open to depressurize the  
airplane; use momentary actuation  
of the outflow valve manual control
- 7 **After** the airplane is depressurized, the crew may  
change altitude as needed.
- 8 Do **not** accomplish the following checklists:

CABIN ALTITUDE AUTO

LANDING ALTITUDE



### [ ] DOOR BULK CARGO

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

**Note:** The bulk cargo door is in a safe configuration  
as long as cabin pressurization is normal.  
Positive cabin differential pressure ensures  
the door stays in place.



**[ ] DOOR E/E ACCESS**

Condition: The electrical and electronic access door is not closed and secure.

**Note:** The E/E access door is in a safe configuration as long as cabin pressurization is normal. Positive cabin differential pressure ensures the door stays in place.

**[ ] DOOR ENTRY 1L, 1R**

[77F]

Condition: An entry door is not closed and secure.

**Note:** The entry door is in a safe configuration as long as cabin pressurization is normal. Positive cabin differential pressure ensures the door stays in place.

**[ ] DOOR ENTRY 1-4L, R**

[777-200, 777-200ER, 777-200LR]

Condition: An entry door is not closed and secure.

**Note:** The entry door is in a safe configuration as long as cabin pressurization is normal. Positive cabin differential pressure ensures the door stays in place.



**[ ] DOOR ENTRY 1-5L, R**

[777-300, 777-300ER]

Condition: An entry door is not closed and secure.

**Note:** The entry door is in a safe configuration as long as cabin pressurization is normal. Positive cabin differential pressure ensures the door stays in place.

**[ ] DOOR FWD ACCESS**

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

**Note:** The forward access door is in a safe configuration as long as cabin pressurization is normal. Positive cabin differential pressure ensures the door stays in place.



**[ ] DOOR FWD CARGO**

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

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

- 1 LDG ALT selector . . . . . PULL ON, set 8000
- 2 Choose one:
  - ◆ Airplane altitude is **at or below** 8,000 feet:  
Level off at the lowest safe altitude.  
**►► Go to step 3**
  - ◆ Airplane altitude is **above** 8,000 feet:  
Descend to the lowest safe altitude or 8,000 feet, whichever is higher.  
**►► Go to step 3**
- 3 **After** level off, allow sufficient time for the cabin altitude to stabilize. This minimizes discomfort when the airplane is depressurized.

▼ Continued on next page ▼

**▼DOOR FWD CARGO continued▼**

4 Choose one:

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

**►► Go to step 5**

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

Don the oxygen masks.

Establish crew communications.

**►► Go to step 5**

5 OUTFLOW VALVE switches (both) . . . . . MAN

6 OUTFLOW VALVE MANUAL  
switches (both) . . . . . Move to OPEN  
until the outflow  
valve indications show  
fully open to depressurize the  
airplane; use momentary actuation  
of the outflow valve manual control

7 **After** the airplane is depressurized, the crew may  
change altitude as needed.

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

CABIN ALTITUDE AUTO

LANDING ALTITUDE



**[ ] DOOR MAIN DECK CARGO**

[Freighter Airplane]

Condition: The main deck cargo door is not closed and secure.

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

1 LDG ALT selector . . . . . PULL ON, set 8000

2 Choose one:

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

Level off at the lowest safe altitude.

►► Go to step 3

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

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

►► Go to step 3

3 **After** level off, allow sufficient time for the cabin altitude to stabilize. This minimizes discomfort when the airplane is depressurized.

4 Choose one:

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

►► Go to step 5

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

Don the oxygen masks.

Establish crew communications.

►► Go to step 5

- 5 OUTFLOW VALVE switches (both) . . . . . MAN
- 6 OUTFLOW VALVE MANUAL switches (both) . . . . . Move to OPEN until the outflow valve indications show fully open to depressurize the airplane; use momentary actuation of the outflow valve manual control
- 7 **After** the airplane is depressurized, the crew may change altitude as needed.
- 8 Do **not** accomplish the following checklists:

CABIN ALTITUDE AUTO

LANDING ALTITUDE



### DOOR WING SLIDE L, R

[777-300, 777-300ER]

Condition: The door for the unpressurized wing slide compartment is not closed and secure.



### DOORS

Condition: Two or more doors are not closed and secure.



**ELT ON**

[Option]

Condition: The emergency locator transmitter is on.

**EMER LIGHTS**

Condition: One of these occurs:

- The emergency lights are on
- The emergency lights switch is not ARMED

**Lock Fail**

[Flight Deck Security Door]

Condition: One or more of these occur:

- The FLIGHT DECK ACCESS SYSTEM switch is off
- The lock is failed

Objective: To remove electrical power from the lock to prevent possible overheating.

Do **if** conditions allow a crew member to leave the seat.

- 1  FLIGHT DECK ACCESS SYSTEM switch . . . . OFF
- 2 The door can be locked with the deadbolt.



**PASS OXYGEN LOW**

[Passenger Airplane - Gaseous Oxygen]

Condition: The passenger oxygen pressure is low.

**PASS OXYGEN ON**

[Passenger Airplane - Chemical (and Gas all but KLM pro tempore)]

Condition: The passenger oxygen system is on.

**SUPRNMRY OXYGEN LOW**

[Freighter Airplane]

Condition: The supernumerary oxygen pressure is low.

**SUPRNMRY OXYGEN ON**

[Freighter Airplane]

Condition: The supernumerary oxygen system is on.



## Window Damage FWD L, R

Condition: The forward 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 descend, if needed, to minimize forces on the window.

1 **If** the window is arcing, shattered, or cracked:

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

Do **not** accomplish the following checklist:

WINDOW HEAT FWD

2 **If** the window is deformed, or an air leak occurs:

Plan to land at the nearest suitable airport.

**If** the airplane altitude is above 10,000 feet:

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

**Note:** Sustained flight below 10,000 feet is not recommended due to greater risk of bird strike.





## Window Damage Side L, R

Condition: The side 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 descend, if needed, to minimize forces on the window.

1 **If** the window is arcing, shattered, or cracked:

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

Do **not** accomplish the following checklist:

WINDOW HEAT SIDE

2 **If** the window is deformed, or an air leak occurs:

Plan to land at the nearest suitable airport.

**If** the airplane altitude is above 10,000 feet:

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

**Note:** Sustained flight below 10,000 feet is not recommended due to greater risk of bird strike.



**[ ] WINDOW FLT DECK L, R**

Condition: The side window is not closed and secure.

- 1 Maintain the maneuvering speed for the existing flap setting until the window is closed.
- 2 The force needed to close the window increases with airspeed. It may not be possible to close the window at speeds above 250 knots.
- 3 Close and lock the window.
- 4 Choose one:

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

Continue normal operation.



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

Level off at the lowest safe altitude.

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

**[ ] WINDOWS**

Condition: The left and right side windows are not closed and secure.

- 1 Maintain the maneuvering speed for the existing flap setting until the windows are closed.

▼ Continued on next page ▼

**▼WINDOWS continued▼**

- 2 The force needed to close the windows increases with airspeed. It may not be possible to close the windows at speeds above 250 knots.
- 3 Close and lock the windows.
- 4 Choose one:

◆ Both windows **lock and** pressurization **is normal:**

Continue normal operation.



◆ Any window does **not lock or** pressurization **is not normal:**

Level off at the lowest safe altitude.

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



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**[ ] CABIN ALTITUDE**

[Passenger Airplane - AIMS v14 or later]

Condition: Cabin altitude is excessive.

- 1 Don the oxygen masks.
- 2 Establish crew communications.
- 3 Check the cabin altitude and rate.
- 4 **If** the cabin altitude is uncontrollable:

PASS OXYGEN switch . . . . . Push to ON and hold for 1 second

**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

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

Descend at Vmo/Mmo

- 
- 5 **If** the cabin altitude is controllable:

Continue normal operation.



**[] CABIN ALTITUDE**

[Freighter Airplane]

Condition: Cabin altitude is excessive.

- 1 Don the oxygen masks.
- 2 Establish crew communications.
- 3 Check the cabin altitude and rate.
- 4 **If** the cabin altitude is uncontrollable:

[Gaseous Oxygen (Standard)]

SUPRNMRY OXYGEN

switch . . . . . Push to ON and  
hold for 1 second

**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

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

Descend at Vmo/Mmo

- 
- 5 **If** the cabin altitude is controllable:

Continue normal operation.



**PMDG****DO NOT USE FOR FLIGHT**

777 Flight Crew Operations Manual

2.3

**ALTN VENT SYS****[Freighter Airplane]**

Condition: Alternate ventilation system is inoperative.

**BLEED ISLN CLOSED C, L, R**

Condition: One of the following occurs:

- The isolation valve is failed closed
- The bleed isolation switch is OFF

**BLEED ISLN OPEN C, L, R**

Condition: The isolation valve is failed open.

**[ ] BLEED LEAK BODY**

Condition: A bleed air leak occurs in the body area.

- 1 The air supply controller automatically isolates the heat source within approximately 3 minutes by closing the bleed and isolation valves.
- 2 Pilot action will be needed when a BLEED LOSS message shows.
- 3 Do **not** accomplish the following checklists:

HYD PRESS DEM C1

HYD PRESS DEM C2



**[ ] BLEED LEAK L, R**

Condition: A bleed air leak occurs in the wing or pack bay area.

- 1 The air supply controller automatically isolates the heat source within approximately 5 minutes by closing the bleed and isolation valves.
- 2 Pilot action will be needed when a BLEED LOSS message shows.
- 3 Do **not** accomplish the following checklists:

PACK

HYD PRESS DEM



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**[ ] BLEED LEAK STRUT L, R**

Condition: A bleed air leak occurs in the strut area.

- 1 The air supply controller automatically isolates the heat source by closing the bleed and isolation valves.
- 2 Do **not** accomplish the following checklist:

PACK

- 3 **Wait** 1 minute.

- 4 Choose one:

◆ BLEED LEAK STRUT message **blanks**:



◆ BLEED LEAK STRUT message **stays shown**:

►► Go to step 5

- 5 A/T ARM switch (affected side). . . . . OFF

- 6 Thrust lever (affected side) . . . . . Retard slowly until the BLEED LEAK STRUT message blanks or the thrust lever is at idle

- 7 Do **not** accomplish the following checklist:

AUTOTHROTTLE

▼ Continued on next page ▼

**▼BLEED LEAK STRUT L, R continued▼**

8 Choose one:

- ◆ BLEED LEAK STRUT message **blanks**:

**Note:** Run the engine at a thrust setting that keeps the BLEED LEAK STRUT message blank.



- ◆ BLEED LEAK STRUT message **stays shown**:

Transponder mode selector . . . . TA ONLY

**Note:** Run the engine at idle for the rest of the flight.

**►►Go to step 9**

9 Choose one:

- ◆ Landing using flaps **20**:

GND PROX FLAP OVRD switch . . . . OVRD

**Note:** Use flaps 20 and VREF 20 for landing and flaps 5 for go-around.

**►►Go to step 10**

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

**Note:** Use flaps 30 and VREF 30 for landing and flaps 20 for go-around.



**▼ Continued on next page ▼**

## ▼BLEED LEAK STRUT L, R continued▼

**10 Checklist Complete Except Deferred Items****Deferred Items****Descent Checklist**

Recall .....	.....	Checked
Notes .....	.....	Checked
Autobrake .....	.....	.....
Landing data .....	VREF 20 _____, Minimums _____	
Approach briefing .....	.....	Completed

**Approach Checklist**

Altimeters .....	.....	.....
------------------	-------	-------

**Landing Checklist**

Speedbrake .....	.....	ARMED
Landing gear .....	.....	DOWN
Flaps .....	.....	20



**[ ] BLEED LOSS BODY**

Condition: Bleed air from the left and right body ducts is not available.

- 1 C1 and C2 AIR DEMAND pump selectors . . . . OFF

**Note:** Gear retraction time increases to approximately 3 minutes due to reduced center hydraulic system capacity. HYD PRESS SYS C and GEAR DISAGREE messages show during retraction.

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

HYD PRESS DEM C1

HYD PRESS DEM C2

**[ ] BLEED LOSS BODY L**

Condition: Bleed air from the left body duct is not available.

- 1 C1 AIR DEMAND pump selector . . . . . OFF

- 2 Do **not** accomplish the following checklist:

HYD PRESS DEM C1



**[ ] BLEED LOSS BODY R**

Condition: Bleed air from the right body duct is not available.

1 C2 AIR DEMAND pump selector . . . . . OFF

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

HYD PRESS DEM C2

**[ ] BLEED LOSS WING L, R**

Condition: Bleed air from the wing duct is not available.

Objective: To prevent possible asymmetrical ice buildup on the wings.

1 WING ANTI-ICE selector . . . . . OFF

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

PACK

**BLEED OFF APU**

Condition: One of the following occurs:

- The APU bleed valve is closed because of a system fault
- The APU bleed switch is OFF



**BLEED OFF ENG L, R**

Condition: One of the following occurs:

- The engine bleed valve is closed because of a system fault
- The engine bleed switch is OFF



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**[ ] CABIN ALTITUDE AUTO**

Condition: One of these occurs:

- Automatic pressurization control is failed
- Both outflow valve switches are in manual

1 OUTFLOW VALVE switches (both) . . . . . MAN

Valves may take up to 6 seconds  
to begin moving.

2 ! OUTFLOW VALVE MANUAL  
switches (both) . . . . . Move to  
OPEN or CLOSE  
as needed to control  
cabin rate and altitude

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

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

### 3 Checklist Complete Except Deferred Items

▼ Continued on next page ▼

**▼CABIN ALTITUDE AUTO continued▼****Deferred Items****Descent Checklist**

- |                             |                       |
|-----------------------------|-----------------------|
| Recall . . . . .            | Checked               |
| Notes . . . . .             | Checked               |
| Autobrake . . . . .         | —                     |
| Landing data . . . . .      | VREF ___, Minimums __ |
| Approach briefing . . . . . | Completed             |

**Approach Checklist**

- |                      |   |
|----------------------|---|
| Altimeters . . . . . | — |
|----------------------|---|

**At pattern altitude**

- |   |  |
|---|--|
| OUTFLOW VALVE MANUAL<br>switches (both) . . . . . | Hold in OPEN<br>until the outflow valve<br>indications show fully open<br>to depressurize the airplane |
|---|--|

**Landing Checklist**

- |                        |       |
|------------------------|-------|
| Speedbrake . . . . .   | ARMED |
| Landing gear . . . . . | DOWN  |
| Flaps . . . . .        | —     |



**[ ] CABIN TEMPERATURE**

[Freighter Airplane]

Condition: Flight deck or cabin temperature is excessively hot or cold. The temperature may cause incapacitation.

Objective: To descend and configure to provide alternate ventilation before the cabin or flight deck temperature causes incapacitation.

- 1 TRIM AIR switches (both) ..... Off
- 2 Start a descent to the lowest safe altitude or 10,000 feet, whichever is higher. Use the speedbrakes to increase the rate of descent, if needed.
- 3 Do **not** accomplish the following checklists:
  - TRIM AIR L
  - TRIM AIR R
- 4 Choose one:
  - ◆ Flight deck or cabin temperature is **too warm**:  
**►► Go to step 5**
  - ◆ Flight deck or cabin temperature is **too cold**:  
**►► Go to step 20**
- 5 CABIN/UTILITY power switch ..... Off
- 6 SHOULDER and FOOT HEATERS (all) ..... OFF

▼ Continued on next page ▼

**▼CABIN TEMPERATURE continued▼**

- 7 Minimize the flight deck lighting intensity.
- 8 **During** daylight, install the flight deck sunvisors.
- 9 Plan to land at the nearest suitable airport.
- 10 **When** at level off:

Choose one:

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

**►►Go to step 11**

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

**►►Go to step 14**

11 Don the oxygen masks.

12 Establish crew communications.

[Gaseous Oxygen (Standard)]

Supernumerary oxygen may not  
be needed below 15,000 feet.

- 13  SUPRNMRY OXYGEN switch . . . . . Push to ON and hold for 1 second
- 14 PACK switches (both) . . . . . Off
- 15 ALTN VENT switch. . . . . ON
- 16 OUTFLOW VALVE switches (both) . . . . . MAN
- 17 FWD OUTFLOW VALVE  
MANUAL switch . . . . . Hold in OPEN or CLOSE until the FWD outflow valve indication shows at the 9 o'clock position

**▼ Continued on next page ▼**

**▼CABIN TEMPERATURE continued▼****18 AFT OUTFLOW VALVE**

MANUAL switch . . . . . Hold in OPEN until the AFT outflow valve indication shows fully open

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

CABIN ALTITUDE

CABIN ALTITUDE AUTO

PACK L

PACK R

PACK L+R

**20 Plan to land at the nearest suitable airport.****21 When at level off:**

Choose one:

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

►► **Go to step 22**

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

►► **Go to step 25**

**22 Don the oxygen masks.****23 Establish crew communications.****▼ Continued on next page ▼**



## ▼CABIN TEMPERATURE continued▼

[Gaseous Oxygen (Standard)]

Supernumerary oxygen may not  
be needed below 15,000 feet.

24 ! SUPRNMRY OXYGEN  
switch . . . . . Push to ON and  
hold for 1 second

25 PACK switches (both) . . . . . Off

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

CABIN ALTITUDE

PACK L

PACK R

PACK L+R



### CARGO A/C FWD

[Option on Passenger Airplane]

Condition: Forward lower cargo air conditioning is  
inoperative.



### CARGO A/C LWR AFT

[Option on Freighter Airplane]

Condition: Aft lower cargo air conditioning is  
inoperative.



**CARGO A/C LWR FWD**

[Freighter Airplane]

Condition: Forward lower cargo air conditioning is inoperative.

**CARGO HEAT AFT**

Condition: One of these occurs:

- Aft cargo heat is inoperative
- The aft cargo temperature selector is off

**CARGO HEAT BULK**

[Passenger Airplane]

Condition: One of these occurs:

- Bulk cargo heat is inoperative
- The bulk cargo temperature selector is off

**EQUIP COOLING**

Condition: The forward equipment cooling system is failed.



**[ ] EQUIP COOLING OVRD**

Condition: The equipment cooling system is in override mode.

- 1 **Wait** 2 minutes. This allows time for any smoke in the system to clear.
- 2 EQUIP COOLING switch . . . . . Off, then AUTO  
The EQUIP COOLING OVRD message blanks.
- 3 **Wait** 1 minute. This allows time for the system to reset.
- 4 Choose one:
  - ◆ EQUIP COOLING OVRD message **stays blank**:  
■ ■ ■ ■
  - ◆ EQUIP COOLING OVRD message **shows again**:

**Note:** After 30 minutes of operation at low altitude and low cabin differential pressure, electronic equipment and displays may fail.

**[ ] LANDING ALTITUDE**

Condition: One of these occurs:

- The FMC does not supply a landing altitude
- The landing altitude selector is pulled

- 1 LDG ALT selector . . . . . PULL ON, set manually



**MAIN DECK A/C**

[Freighter Airplane]

Condition: Main deck cargo air conditioning is inoperative.

**[ ] OUTFLOW VALVE AFT, FWD**

Condition: One of these occurs:

- Automatic control of the outflow valve is inoperative
- The outflow valve switch is in manual

Objective: To allow the operable outflow valve to control cabin pressure.

- 1 OUTFLOW VALVE switch (affected side) . . . . . MAN
- 2 OUTFLOW VALVE MANUAL switch (affected side) . . . . . Hold in CLOSE until the outflow valve indication shows fully closed

**[ ] PACK L**

[AIMS 2003 or later]

Condition: The left pack is inoperative.

- 1 **Wait** 2 minutes. This allows time for an overheat condition to cool.

▼ Continued on next page ▼

▼PACK L continued▼

2 AIR COND RESET switch . . . . . Push and hold for 1 second

3 **Wait** 2 minutes.

4 Choose one:

◆ PACK L message **stays blank**:



◆ PACK L message **shows again**:

L PACK switch . . . . . Off

[Freighter Airplane]

RECIRC FANS switch . . . . . Off



**[ ] PACK R**

[AIMS 2003 or later]

Condition: The right pack is inoperative.

- 1 **Wait** 2 minutes. This allows time for an overheat condition to cool.
- 2 AIR COND RESET switch . . . . . Push and hold for 1 second
- 3 **Wait** 2 minutes.
- 4 Choose one:
  - ◆PACK R message **stays blank**:  
[    [    [    [    ]
  - ◆PACK R message **shows again**:  
R PACK switch . . . . . Off  
[    [    [    [    ]

Intentionally  
Blank

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**[ ] PACK L+R**

[AIMS 2003 or later]

Condition: Both packs are inoperative.

Objective: To prevent excessive cabin altitude and temperature by descending and increasing ventilation.

- 1 **Wait** 2 minutes. This allows time for an overheat condition to cool.
- 2 AIR COND RESET switch . . . . . Push and hold for 1 second
- 3 **Wait** 2 minutes unless the PACK L+R message shows again.
- 4 Choose one:
  - ◆PACK L+R message **stays blank**:  

  - ◆PACK L+R message **shows again**:  
**►► Go to step 5**
- 5 Descend to the lowest safe altitude or 10,000 feet, whichever is higher.  
**If** needed to prevent excessive cabin altitude, descend with speedbrakes extended at Vmo/Mmo
- 6 **When** at level off:  
[Passenger Airplane]  
**►► Go to step 7**

▼ Continued on next page ▼

▼PACK L+R continued▼

[Freighter Airplane]

►►Go to step 18

[Passenger Airplane]

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

8 OUTFLOW VALVE switches (both) . . . . . MAN

9 OUTFLOW VALVE MANUAL switches (both) . . . . . Hold in OPEN for 30 seconds

10 IFE/PASS SEATS power switch . . . . . OFF

11 CABIN/UTILITY power switch . . . . . OFF

12 SHOULDER and FOOT HEATERS (all) . . . . . OFF

13 Minimize the flight deck lighting intensity.

14 Open the flight deck door.

15 **During** daylight:

Install the flight deck sunvisors.

Advise the cabin to close the cabin window shades.

▼ Continued on next page ▼

▼PACK L+R continued▼

16 Plan to land at the nearest suitable airport.

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

CABIN ALTITUDE AUTO



[Freighter Airplane]

18 Choose one:

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

►► Go to step 19

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

Don the oxygen masks.

Establish crew communications.

►► Go to step 19

19 ALTN VENT switch ..... ON

20 OUTFLOW VALVE switches (both) ..... MAN

21 OUTFLOW VALVE MANUAL  
switches (both) ..... Hold in OPEN  
for 30 seconds

22 CABIN/UTILITY power switch ..... OFF

23 SHOULDER and FOOT HEATERS (all) ..... OFF

24 Minimize the flight deck lighting intensity.

25 **During** daylight, install the flight deck sunvisors.

26 Plan to land at the nearest suitable airport.

▼ Continued on next page ▼

## ▼PACK L+R continued▼

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

CABIN ALTITUDE AUTO

**[ ] PACK MODE L, R**

Condition: The pack is in the standby mode.

**Note:** At lower altitudes or higher outside air temperatures, the pack may shut down.

**[ ] TRIM AIR L, R**

Condition: The trim air valve is closed.

- 1 **Wait** 2 minutes. This allows time for an overheat condition to cool.
- 2 AIR COND RESET switch . . . . . Push and hold for 1 second
- 3 **Wait** 2 minutes.
- 4 Choose one:

◆ TRIM AIR message **stays blank**:



◆ TRIM AIR message **shows again**:

TRIM AIR switch (affected side). . . . . Off



Intentionally  
Blank

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Non-Normal Checklists  
Anti-Ice, RainChapter NNC  
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DRAFT  
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Blank

**[ ] ANTI-ICE ENG L, R**

Condition: The engine anti-ice valve is closed when commanded open.

1 Choose one:

◆ On the **ground**:

►► Go to step 2

◆ In **flight**:

►► Go to step 6

2 Thrust lever

(affected side) . . . . . Advance until N1 is approximately 3% above idle

3 Choose one:

◆ ANTI-ICE ENG message **blanks**:



◆ ANTI-ICE ENG message **stays shown**:

ENGINE ANTI-ICE selector  
(affected side) . . . . . OFF, then ON

►► Go to step 4

4 Choose one:

◆ ANTI-ICE ENG message **blanks**:



◆ ANTI-ICE ENG message **stays shown**:

►► Go to step 5

▼ Continued on next page ▼

**▼ ANTI-ICE ENG L, R continued ▼**

- 5 ENGINE ANTI-ICE selector  
(affected side) . . . . . OFF

**Note:** Avoid icing conditions.



- 6 ENGINE ANTI-ICE selector  
(affected side) . . . . . OFF, then ON

- 7 Choose one:

◆ ANTI-ICE ENG message **blanks**:

**Note:** Run the affected engine anti-ice system manually.



◆ ANTI-ICE ENG message **stays shown**:

►► Go to step 8

- 8 ENGINE ANTI-ICE selector  
(affected side) . . . . . OFF

**Note:** Avoid icing conditions.



**[ ] ANTI-ICE LEAK ENG L, R**

[GE Engines, PW Engines]

Condition: A bleed air leak occurs in the engine anti-ice or starter duct.

Objective: To reduce the flow of bleed air through the leak.

- 1 The engine anti-ice system automatically isolates the heat source within approximately 2 minutes by closing the engine anti-ice valve.

**Note:** Avoid icing conditions.

- 2 **Wait** 2 minutes.
- 3 Choose one:

◆ ANTI-ICE LEAK ENG message **blanks**:



◆ ANTI-ICE LEAK ENG message **stays shown**:

►► Go to step 4

- 4 A/T ARM switch (affected side). . . . . OFF
- 5 Thrust lever (affected side) . . . . . Retard slowly until the ANTI-ICE LEAK ENG message blanks or the thrust lever is at idle
- 6 Do **not** accomplish the following checklist:

AUTOTHROTTLE

▼ Continued on next page ▼

▼ ANTI-ICE LEAK ENG L, R continued ▼

7 Choose one:

◆ ANTI-ICE LEAK ENG message **blanks**:



◆ ANTI-ICE LEAK ENG message **stays shown**:

►► Go to step 8

8 Transponder mode selector . . . . . TA ONLY

**Note:** Run the engine at idle for the rest of the flight.

9 Choose one:

◆ Landing using flaps **20**:

GND PROX FLAP OVRD switch . . . . OVRD

**Note:** Use flaps 20 and VREF 20 for landing and flaps 5 for go-around.

►► Go to step 10

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

**Note:** Use flaps 30 and VREF 30 for landing and flaps 20 for go-around.



## 10 Checklist Complete Except Deferred Items

### Deferred Items

#### Descent Checklist

Recall . . . . . Checked

▼ Continued on next page ▼

**▼ ANTI-ICE LEAK ENG L, R continued▼**

Notes .....	.....	Checked
Autobrake .....	.....	.....
Landing data .....	<b>VREF 20</b> <u>  </u> , <b>Minimums</b> <u>  </u>	
Approach briefing .....	.....	Completed

**Approach Checklist**

Altimeters .....	.....	.....
------------------	-------	-------

**Landing Checklist**

Speedbrake .....	.....	ARMED
Landing gear .....	.....	DOWN
Flaps .....	.....	<b>20</b>

**[ ] ANTI-ICE LEAK ENG L, R****[RR Engines]**

Condition: A bleed air leak occurs in the engine anti-ice or starter duct.

Objective: To isolate the heat source, or reduce the flow of bleed air through the leak.

- 1 The engine anti-ice system automatically isolates the heat source within approximately 1 minute if the leak is in the engine anti-ice duct by closing the engine anti-ice valve.

**Note:** Avoid icing conditions.

- 2 **Wait** 1 minute.

- 3 Choose one:

◆ ANTI-ICE LEAK ENG message **blanks**:



◆ ANTI-ICE LEAK ENG message **stays shown**:

►►Go to step 4

- 4 BLEED AIR ISLN switch (affected side) . . . . . Off
- 5 ENG BLEED AIR switch (affected side). . . . . Off
- 6 WING ANTI-ICE selector . . . . . OFF

This prevents possible asymmetrical ice buildup on the wings.

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

BLEED LOSS WING

▼ Continued on next page ▼

**▼ ANTI-ICE LEAK ENG L, R continued ▼****PACK**

8 **Wait** 1 minute.

9 Choose one:

◆ ANTI-ICE LEAK ENG message **blanks**:



◆ ANTI-ICE LEAK ENG message **stays shown**:

►► **Go to step 10**

10 A/T ARM switch (affected side). . . . . OFF

11 Thrust lever (affected side) . . . . . Idle

**Note:** Run the engine at idle for the rest of the flight.

12 Transponder mode selector . . . . . TA ONLY

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

AUTOTHROTTLE

▼ Continued on next page ▼

▼ ANTI-ICE LEAK ENG L, R continued ▼

14 Choose one:

- ◆ Landing using flaps **20**:

GND PROX FLAP OVRD switch . . . . OVRD

**Note:** Use flaps 20 and VREF 20 for landing and flaps 5 for go-around.

►► Go to step 15

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

**Note:** Use flaps 30 and VREF 30 for landing and flaps 20 for go-around.



**15 Checklist Complete Except Deferred Items**

**Deferred Items**

**Descent Checklist**

Recall . . . . .	Checked
Notes . . . . .	Checked
Autobrake . . . . .	—
Landing data . . . . .	<b>VREF 20 __, Minimums __</b>
Approach briefing . . . . .	Completed

**Approach Checklist**

Altimeters . . . . .	—
----------------------	---

▼ Continued on next page ▼

**▼ ANTI-ICE LEAK ENG L, R continued ▼****Landing Checklist**

Speedbrake ..... ARMED  
Landing gear ..... DOWN  
Flaps ..... 20

**ANTI-ICE LOSS ENG L, R**

Condition: Anti-ice bleed air for the engine is not available.

**[ ] ANTI-ICE ON**

Condition: All of these occur:

- An ANTI-ICE selector is ON
- TAT is more than 10 degrees C
- Ice is not detected

- 1 ENGINE ANTI-ICE  
selectors (both) ..... AUTO or OFF
- 2 WING ANTI-ICE selector ..... AUTO or OFF



**[ ] ANTI-ICE WING**

Condition: One or both wing anti-ice valves are failed closed.

- 1 WING ANTI-ICE selector . . . . . OFF, then ON
- 2 Choose one:

◆ ANTI-ICE WING message **blanks**:

Run wing anti-ice manually.



◆ ANTI-ICE WING message **stays shown**:

WING ANTI-ICE selector. . . . . OFF

**[ ] HEAT PITOT C**

Condition: The center pitot probe heat is failed.

**Note:** The standby air data is unreliable in icing conditions.

**[ ] HEAT PITOT L**

Condition: The left pitot probe heat is failed.

**Note:** The PFD air data is not affected by a single pitot heat failure. Ensure that the right AIR DATA/ATT source switch stays off.



**[ ] HEAT PITOT L+C+R**

Condition: The left, center and right pitot probe heat are failed.

**Note:** The air data is unreliable in icing conditions.

**[ ] HEAT PITOT R**

Condition: The right pitot probe heat is failed.

**Note:** The PFD air data is not affected by a single pitot heat failure. Ensure that the left AIR DATA/ATT source switch stays off.



## **Ice Crystal Icing**

### **[GE Engines]**

Condition: Ice crystal or TAT probe icing is suspected.  
The following are possible indications:

- Appearance of liquid water on the windshield at temperatures too cold for rain (the sound is different than rain)
- Heavy rain below the airplane, identified by amber or red weather radar returns, with cloud tops above typical cruise levels
- Autothrottle disconnects or is unable to maintain the selected airspeed
- TAT indication on EICAS stays near 0 degrees C

(Additional items that can indicate ice crystal or TAT probe icing are listed in the Additional Information section.)

Objective: To exit the ice crystal icing conditions and reduce the operational effects of the icing.

- 1 Autothrottle disconnect switch . . . . . Push
- 2 Thrust levers (both) . . . . . Set to maintain the needed airspeed and airplane flight path
- 3 Exit the ice crystal icing conditions. Minimize time above red and amber weather radar returns.
- 4 The following may be temporarily unreliable when in ice crystal or TAT probe icing conditions:  
  
Reference/Target N1 indications

▼ Continued on next page ▼

**▼Ice Crystal Icing continued▼**

TAS, TAT, SAT, ECON SPD, and LRC

**Additional Information**

One or more of the following may indicate ice crystal or TAT probe icing:

- Light to moderate turbulence
- Reference/Target N1 indications blank
- Reference/Target N1 indications decrease while flying at a constant altitude and airspeed

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## **Ice Crystal Icing**

[PW Engines, RR Engines]

Condition: Ice crystal or TAT probe icing is suspected.  
The following are possible indications:

- Appearance of liquid water on the windshield at temperatures too cold for rain (the sound is different than rain)
- Heavy rain below the airplane, identified by amber or red weather radar returns, with cloud tops above typical cruise levels
- Autothrottle disconnects and the Reference/Target N1 indications blank
- Autothrottle is unable to maintain the selected airspeed
- TAT indication on EICAS stays near 0 degrees C

(Additional items that can indicate ice crystal or TAT probe icing are listed in the Additional Information section.)

Objective: To exit the ice crystal icing conditions and reduce the operational effects of the icing.

- 1 Autothrottle disconnect switch . . . . . Push
- 2 Thrust levers (both) . . . . . Set to maintain the needed airspeed and airplane flight path
- 3 Exit the ice crystal icing conditions. Minimize time above red and amber weather radar returns.
- 4 Thrust levers (both) . . . . . Retard to mid position

▼ Continued on next page ▼

**▼ Ice Crystal Icing continued ▼**

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

- Push one switch at a time.
- 5  ENGINE EEC MODE switches (both) . . . . . Off  
Maximum thrust limiting is not available. N1 may be used to set thrust.
- 6 Do not engage the autothrottle.  
**Note:** Maximum thrust limiting is not available with autothrottle disconnected. Alternate thrust setting information shows on the N1 indication.
- 7 ENG LIMIT PROT messages may show due to incorrect maximum N1 lines. Set thrust to maintain the needed airspeed and airplane flight path. Maintain EGT below the amber band.
- 8 The following may be temporarily unreliable when in ice crystal or TAT probe icing conditions:  
Reference/Target N1 indications  
Maximum EPR and N1 lines (amber)  
TAS, TAT, SAT, ECON SPD, and LRC
- 9 Do **not** accomplish the following checklists:  
ENG EEC MODE  
ENG LIMIT PROT

**▼ Continued on next page ▼**

**▼ Ice Crystal Icing continued ▼**

10 **When** ice crystal icing conditions are no longer present:

ENGINE EEC MODE switches  
(both) . . . . . NORM

Autothrottle is available.

**Additional Information**

One or more of the following may indicate ice crystal or TAT probe icing:

- Light to moderate turbulence
- Reference/Target EPR and reference EPR blank
- Maximum EPR lines or reference/target EPR indications decrease while flying at a constant altitude and airspeed
- Thrust levers or EPR indications are not aligned
- Unable to achieve maximum continuous or maximum climb thrust

**[ ] ICE DETECTORS**

Condition: The ice detectors are failed.

**Note:** Run the engine and wing anti-ice systems manually.



**ICING ENG**

Condition: Ice is detected and an engine anti-ice selector is OFF.

**ICING WING**

Condition: Ice is detected and one of these occurs:

- The wing anti-ice selector is OFF
- The wing anti-ice takeoff inhibit is active

**WINDOW HEAT**

Condition: Two or more window heats are off.



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**[ ] WINDOW HEAT L, R FWD**

Condition: Primary window heat for the forward window is inoperative.

Objective: To reset the system or remove power to prevent arcing.

- 1 FWD WINDOW HEAT switch (affected side) . . . . . Off
- 2 **Wait** 10 seconds.
- 3 FWD WINDOW HEAT switch (affected side) . . . . . ON
- 4 Choose one:
  - ◆ WINDOW HEAT FWD message **blanks**:  
■ ■ ■ ■
  - ◆ WINDOW HEAT FWD message **stays shown**:  
FWD WINDOW HEAT switch (affected side) . . . . . Off  
The window is defogged by the backup system.  
■ ■ ■ ■

**[ ] WINDOW HEAT L, R SIDE**

Condition: Window heat for the side window is inoperative.

Objective: To reset the system or remove power to prevent arcing.

- 1 SIDE WINDOW HEAT switch (affected side) . . . . . Off
- 2 **Wait** 10 seconds.
- 3 SIDE WINDOW HEAT switch (affected side) . . . . . ON
- 4 Choose one:
  - ◆ WINDOW HEAT SIDE message **blanks**:  
■ ■ ■ ■
  - ◆ WINDOW HEAT SIDE message **stays shown**:  
SIDE WINDOW HEAT switch (affected side) . . . . . Off  
■ ■ ■ ■

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**PMDG DO NOT USE FOR FLIGHT**

## **777 Flight Crew Operations Manual**

# Non-Normal Checklists

## Automatic Flight

# Chapter NNC

## Section 4

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**AUTOPILOT**

Condition: One or more of these occur:

- The autopilot is in a degraded mode other than the selected mode
- The engaged roll mode is failed
- The engaged pitch mode is failed
- The autopilot is in flight envelope protection

**AUTOPILOT DISC**

Condition: All autopilots are disconnected.

**AUTOTHROTTLE DISC**

Condition: Both autothrottles are disconnected.

**[ ] AUTOTHROTTLE L, R**

Condition: The autothrottle is inoperative.

- 1 A/T ARM switch (affected side). . . . . OFF
- 2 The other autothrottle may be re-engaged if needed.



**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.



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**PMDG****DO NOT USE FOR FLIGHT**

777 Flight Crew Operations Manual

5.1

**DATALINK LOST**

Condition: The ACARS datalink is temporarily lost.

**DATALINK SYS**

Condition: The datalink system is failed.

**HF DATALINK**

[HF Datalink and AIMS 2003 or later]

Condition: The HF datalink is failed.

**[] RADIO TRANSMIT**

Condition: A microphone switch is on and causes a radio to transmit for 30 seconds or more.

Objective: To identify and isolate the stuck microphone switch.

- 1 Transmitter select switches (all audio control panels) . . . . . FLT interphone
- 2 The microphone with the stuck switch transmits on the flight interphone rather than over a radio.

**Note:** The affected audio control panel should stay on FLT interphone. All other audio panels may be used normally.



**SATCOM**

Condition: The SATCOM system is failed.

**SATCOM DATALINK**

Condition: The SATCOM datalink is failed.

**SATCOM VOICE**

Condition: SATCOM voice communication is failed.

**SATVOICE LOST**

[Option]

Condition: SATCOM voice communication is temporarily lost.

**VHF DATALINK**

Condition: The VHF datalink is failed.





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[ ] ELEC AC BUS L, R

Condition: The AC bus is not energized.

Objective: To restore power or use the APU to supply another source of power.

- 1  Attempt only one reset.  
GEN CTRL switch  
(affected side) ..... Off, then ON

2 Choose one:

◆ ELEC AC BUS message **blanks**:



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

APU selector  
(if APU available) ..... START, then ON

Do **not** accomplish the following checklist:

ELEC GEN OFF

**When** the APU is running:

►► Go to step 3

3 Choose one:

◆ ELEC AC BUS message **blanks**:



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

►► Go to step 4

▼ Continued on next page ▼

**▼ELEC AC BUS L, R continued▼**

Attempt only one reset.

- 4  BUS TIE switch  
(affected side) . . . . . Off, then AUTO

- 5 Choose one:

◆ ELEC AC BUS message **blanks**:



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

Do **not** accomplish the following checklists:

WINDOW HEAT

HYD PRESS PRI

**[ ] ELEC BACKUP GEN L, R**

Condition: The backup generator is failed.

Attempt only one reset.

- 1  BACKUP GEN switch  
(affected side) . . . . . Off, then ON



**[ ] ELEC BACKUP SYS**

Condition: The backup power system is failed.

- 1 Attempt only one reset.  
L BACKUP GEN switch . . . . . Off, then ON
- 2 Attempt only one reset.  
R BACKUP GEN switch . . . . . Off, then ON

**ELEC BATTERY OFF**

Condition: The battery switch is Off.

**ELEC BUS ISLN L, R**

Condition: The bus tie breaker is open.

**ELEC CABIN/UTIL OFF**

Condition: The cabin/utility power switch is Off.



**[ ] ELEC GEN DRIVE L, R**

Condition: A generator drive fault occurs.

Action is irreversible.

- 1  DRIVE DISC switch  
(affected side) . . . . . Confirm . . . . . Push  
and hold  
for 1 second
- 2 APU selector  
(if APU available) . . . . . START, then ON
- 3 Do **not** accomplish the following checklist:

ELEC GEN OFF

**[ ] ELEC GEN OFF APU**

Condition: The generator control breaker is open.

Attempt only one reset.

- 1  APU GEN switch. . . . . Off, then ON



**[ ] ELEC GEN OFF L, R**

Condition: The generator control breaker is open.

Objective: To reset the generator or use the APU to supply another source of power.

Attempt only one reset.

1 GEN CTRL switch  
(affected side) . . . . . Off, then ON

2 Choose one:

◆ ELEC GEN OFF message **blanks**:



◆ ELEC GEN OFF message **stays shown**:

APU selector  
(if APU available) . . . . . START, then ON

**ELEC GND HDLG BUS**

Condition: A fault occurs in the ground handling bus.

**ELEC IFE/SEATS OFF**

[Passenger Airplane]

Condition: The IFE/passenger seats power switch is Off.



**ELEC STANDBY SYS**

Condition: A standby power system failure occurs.

**[ ] MAIN BATTERY DISCH**

Condition: One of these occurs:

- The main battery is discharging
- The hot battery bus is not energized

**Note:** The main battery can power the standby system for a minimum of 10 minutes.



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Non-Normal Checklists  
Engines, APUChapter NNC  
Section 7

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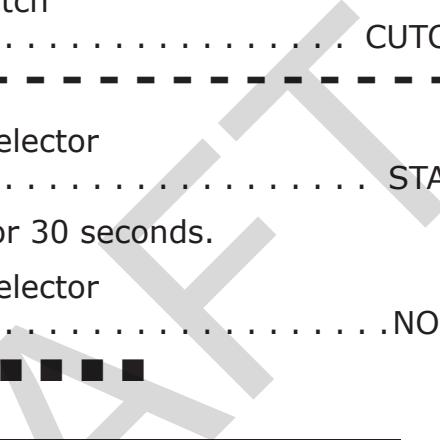
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**Aborted Engine Start L, R**

[GE Engines with CON position, PW Engines]

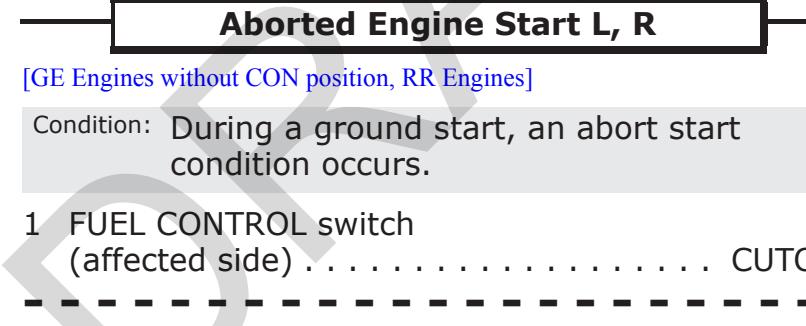
Condition: During a ground start, an abort start condition occurs.

- 1 FUEL CONTROL switch  
(affected side) . . . . . CUTOFF
  - 2 START/IGNITION selector  
(affected side) . . . . . START
  - 3 Motor the engine for 30 seconds.
  - 4 START/IGNITION selector  
(affected side) . . . . . NORM
- 

**Aborted Engine Start L, R**

[GE Engines without CON position, RR Engines]

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

- 1 FUEL CONTROL switch  
(affected side) . . . . . CUTOFF
  - 2 START selector (affected side) . . . . . START
  - 3 Motor the engine for 30 seconds.
  - 4 START selector (affected side) . . . . . NORM
- 



**Dual Eng Fail/Stall****[GE Engines]**

Condition: Engine speed for both engines is below idle.

- 1 FUEL CONTROL switches  
(both) ..... CUTOFF, then RUN
- 2 RAM AIR TURBINE switch ..... Push and hold for 1 second
- 
- 3 Do not manually abort the start if EGT turns red. EGT turns red when EGT exceeds the start limit line (lower red line). Autostart will discontinue the current start attempt before EGT becomes too high for continued engine operation.
- 4 Set airspeed above 270 knots.
- 5 APU selector  
(if APU available) ..... START, then ON
- 6 Engines may accelerate to idle very slowly, especially at high altitudes. The time from fuel control switch to RUN to stabilized idle may be as long as two and a half minutes.
- 7 Slow acceleration may be incorrectly interpreted as a hung start or engine malfunction. If N2 is steadily increasing and EGT stays within limits, the start is progressing normally. Any further cycling of the fuel control switches will result in longer start times.

▼ Continued on next page ▼

**▼ Dual Eng Fail/Stall continued ▼**

8 **When** the HEAT PITOT L+C+R message blanks:

PRIMARY FLIGHT COMPUTERS  
disconnect switch . . . . . DISC,  
then AUTO

This restores the flight control normal mode.

The autopilot can be re-engaged when flight control normal mode is restored.



**Dual Eng Fail/Stall****[PW Engines]**

Condition: Engine speed for both engines is below idle.

- 1 FUEL CONTROL switches  
(both) ..... CUTOFF, then RUN
- 2 RAM AIR TURBINE switch ..... Push and hold for 1 second
- 
- 3 Set airspeed above 240 knots.
- 4 APU selector  
(if APU available) ..... START, then ON
- 5 Engines may accelerate to idle very slowly, especially at high altitudes.
- 6 Slow acceleration may be incorrectly interpreted as a hung start or engine malfunction. If N2 is steadily increasing and EGT stays within limits, the start is progressing normally. Any further cycling of the fuel control switches will result in longer start times.
- 7 **When** the HEAT PITOT L+C+R message blanks:  
PRIMARY FLIGHT COMPUTERS  
disconnect switch ..... DISC, then AUTO

This restores the flight control normal mode.

The autopilot can be re-engaged when flight control normal mode is restored.



## Dual Eng Fail/Stall

[RR Engines]

Condition: Engine speed for both engines is below idle.

- 1 FUEL CONTROL switches  
(both) . . . . . CUTOFF, then RUN
  - 2 RAM AIR TURBINE switch . . . . . Push and hold for 1 second
  - 3 Set airspeed above 250 knots.
  - 4 APU SELECTOR  
(if APU available) . . . . . START, then ON
  - 5 Engines may accelerate to idle very slowly, especially at high altitudes.
  - 6 Slow acceleration may be incorrectly interpreted as a hung start or engine malfunction. If N3 is steadily increasing and EGT stays within limits, the start is progressing normally. Any further cycling of the fuel control switches will result in longer start times.
  - 7 **When** the HEAT PITOT L+C+R message blanks:  
PRIMARY FLIGHT COMPUTERS  
disconnect switch . . . . . DISC,  
then AUTO

This restores the flight control normal mode.

Autopilot can be re-engaged when flight control normal mode is restored.



**[ ] ENG AUTOSTART L, R**

[GE Engines with CON position, PW Engines]

Condition: During a ground start, one of these occurs:

- Autostart did not start the engine
- Fuel control switch is in RUN at low engine RPM with the autostart switch off

- 1 FUEL CONTROL switch  
(affected side) ..... CUTOFF
- 2 START/IGNITION selector  
(affected side) ..... START
- 3 Motor the engine for 30 seconds.
- 4 START/IGNITION selector  
(affected side) ..... NORM

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## [ ] ENG AUTOSTART L, R

[GE Engines without CON position, RR Engines]

Condition: During a ground start, any of the following conditions occurs:

- Autostart did not start the engine
- Fuel control switch is in RUN at low engine RPM with the autostart switch off

- 1 FUEL CONTROL switch  
(affected side) . . . . . CUTOFF
- 2 START selector (affected side) . . . . . START
- 3 Motor the engine for 30 seconds.
- 4 START selector (affected side) . . . . . NORM



## **Eng Lim/Surge/Stall L, R**

Condition: One or more of these occur:

- Engine indications are abnormal
  - Engine indications are quickly nearing or show an exceedance
  - Abnormal engine noises are heard, possibly with airframe vibration
  - There is no response to thrust lever movement or the response is abnormal
  - Flames in the engine inlet or exhaust are reported

1 A/T ARM switch  
(affected side) . . . Confirm . . . . . OFF

2 Thrust lever  
(affected side) . . . Confirm . . . . . Retard until  
engine indications  
stay within appropriate  
limits or the thrust lever is at idle

▼ Continued on next page ▼

## ▼ Eng Lim/Surge/Stall L, R continued ▼

## 3 Choose one:

- ◆ Engine indications are **abnormal or EGT continues to increase**:

FUEL CONTROL switch  
 (affected side) . . . . . Confirm . . . CUTOFF  
 APU selector  
 (if APU available) . . . . . START, then ON  
 Transponder mode selector . . . . . TA ONLY  
 Plan to land at the nearest suitable airport.

**►► Go to step 6**

- ◆ Engine indications are **stabilized and EGT is stabilized or decreasing**:

**►► Go to step 4**

Check that RPM and EGT follow thrust lever movement.

- 4  Thrust lever  
 (affected side) . . . . . Advance slowly
- 5 Run engine normally or at a reduced thrust setting that is surge and stall free.
- 6 Do **not** accomplish the following checklist:

AUTOTHROTTLE

▼ Continued on next page ▼

▼ Eng Lim/Surge/Stall L, R continued ▼

7 Choose one:

◆ Landing using flaps **20**:

GND PROX FLAP OVRD switch . . . . . OVRD

**Note:** Use flaps 20 and VREF 20 for landing and flaps 5 for go-around.

►► Go to step 8

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

**Note:** Use flaps 30 and VREF 30 for landing and flaps 20 for go-around.



## 8 Checklist Complete Except Deferred Items

### Deferred Items

#### Descent Checklist

Recall . . . . . Checked

Notes . . . . . Checked

Autobrake . . . . . —

| Landing data . . . . . **VREF 20 \_\_, Minimums \_\_**

| Approach briefing . . . . . Completed

#### Approach Checklist

Altimeters . . . . . —

▼ Continued on next page ▼

▼ Eng Lim/Surge/Stall L, R continued ▼

## Landing Checklist

Speedbrake . . . . .	ARMED
Landing gear . . . . .	DOWN
Flaps . . . . .	20



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**Eng Srv Damage/Sep L, R**

Condition: One or more of these occur:

- Airframe vibration with abnormal engine indications
- Engine separation

- 1 A/T ARM switch  
(affected side) . . . . . Confirm. . . . . OFF
- 2 Thrust lever  
(affected side) . . . . . Confirm. . . . . Idle
- 3 FUEL CONTROL switch  
(affected side) . . . . . Confirm. . . . . CUTOFF
- 4 Engine fire switch  
(affected side) . . . . . Confirm. . . . . Pull
- 5 **If** high airframe 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 the airspeed may reduce the vibration.
- 6 APU selector  
(if APU available) . . . . . START, then ON
- 7 Transponder mode selector . . . . . TA ONLY
- 8 Plan to land at the nearest suitable airport.

▼ Continued on next page ▼

**▼ Eng Svr Damage/Sep L, R continued ▼**

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

AUTOTHROTTLE

ENG FAIL

10 Choose one:

◆ Landing using flaps **20**:

GND PROX FLAP OVRD switch . . . . OVRD

**Note:** Use flaps 20 and VREF 20 for landing and flaps 5 for go-around.

►► Go to step 11

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

**Note:** Use flaps 30 and VREF 30 for landing and flaps 20 for go-around.



11 Checklist Complete Except Deferred Items

▼ Continued on next page ▼

**▼Eng Svr Damage/Sep L, R continued▼****Deferred Items****Descent Checklist**

- Recall ..... Checked  
Notes. .... Checked  
Autobrake ..... \_\_\_\_\_  
Landing data ..... **VREF 20** \_\_\_, **Minimums** \_\_\_\_  
Approach briefing ..... Completed

**Approach Checklist**

- Altimeters ..... \_\_\_\_\_

**Landing Checklist**

- Speedbrake ..... ARMED  
Landing gear ..... DOWN  
Flaps ..... **20**  


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## Engine Response

Condition: One or both engines do not reach commanded thrust or roll back, and fuel system icing is suspected (indicated EPR is below commanded EPR and fuel temperature is below -10 degrees C).

Objective: To clear ice from the fuel system by reducing engine fuel flow while descending, then checking for proper engine response.

- 1 Select a lower altitude on the MCP.
- 2 FLCH switch . . . . . Push
- 3 Thrust levers (both) . . . . . Idle
- 4 WING ANTI-ICE selector . . . . . OFF
- 5 ENGINE ANTI-ICE selectors (both) . . . . . OFF
- 6 Maintain idle thrust for 30 seconds.
- 7 If thrust asymmetry compensation is inoperative, manual control inputs are required to compensate for asymmetric thrust conditions.
- 8 Left thrust lever . . . . . Advance to maximum
- 9 Check for normal engine indications. Engine may accelerate very slowly especially at high altitudes. The time from idle to maximum thrust may be as long as 30 seconds.
- 10 Left thrust lever . . . . . Retard to idle
- 11 Right thrust lever . . . . . Advance to maximum

▼ Continued on next page ▼

**▼Engine Response continued▼**

- 12 Check for normal engine indications. Engine may accelerate very slowly especially at high altitudes. The time from idle to maximum thrust may be as long as 30 seconds.
  - 13 Right thrust lever . . . . . Retard to idle
  - 14 WING ANTI-ICE selector . . . . . AUTO or ON
  - 15 ENGINE ANTI-ICE  
selectors (both) . . . . . AUTO or ON
  - 16 Resume normal operation.
- ■ ■ ■

**[ ] APU LIMIT**

Condition: An APU limit exceedance occurs.

- 1 APU selector . . . . . OFF
- ■ ■ ■ ■

**[ ] APU SHUTDOWN**

Condition: An APU automatic shutdown occurs.

Objective: To reset the APU controller.

- 1 APU selector . . . . . OFF
  - 2 APU selector . . . . . START, then ON
- ■ ■ ■

**[ ] ENG ANTI-ICE AIR L, R**

[GE 90-9x Engines]

Condition: Engine anti-ice capability is degraded.

**Note:** Avoid icing conditions.

**ENG AUTOSTART OFF**

Condition: The engine autostart switch is OFF.

**ENG CONTROL L, R**

Condition: An EEC system fault occurs.



DPY

**[ ] ENG EEC MODE L, R**

Condition: An EEC is in the alternate control mode.

Objective: To run both engines in the alternate mode.

- 1 Autothrottle disconnect switch . . . . . Push
- 2 Thrust levers (both) . . . . . Retard to mid position

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

- Push one switch at a time.**
- 3  ENGINE EEC MODE switches (both) . . . . . Off
  - 4 Engage the autothrottle.

**Note:** Maximum thrust limiting is not available with autothrottle disconnected. Alternate thrust setting information shows on the N1 indication.

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

ENG EEC MODE (for other engine)



**[ ] ENG FAIL L, R**

[GE Engines with CON position]

Condition: Engine speed is below idle.

Objective: To restart the engine if needed, or configure for single engine operation.

1 If thrust is lost on **both** engines:

**►► Go to the Dual Eng Fail/Stall checklist on page 7.2**

- 2 A/T ARM switch  
(affected side) . . . . . Confirm. . . . . OFF
- 3 Thrust lever  
(affected side) . . . . . Confirm. . . . . Idle
- 4 FUEL CONTROL switch  
(affected side) . . . . . Confirm. . . . . CUTOFF
- 5 A restart may be attempted if there is N1 rotation and no abnormal airframe vibration.
- 6 Choose one:
  - ◆ Restart **is** needed:  
**►► Go to step 7**
  - ◆ Restart **is not** needed:  
**►► Go to step 14**
- 7 Monitor EGT during start to prevent an EGT exceedance. Autostart allows EGT to exceed the in-flight start limit.

▼ Continued on next page ▼

**▼ENG FAIL L, R continued▼**

- 8 Engine may accelerate to idle very slowly, especially at high altitudes. The time from fuel control switch to RUN to stabilized idle may be as long as two and a half minutes.
- 9 Slow acceleration may be incorrectly interpreted as a hung start or engine malfunction. If N2 is steadily increasing and EGT stays within limits, the start is progressing normally. Any further cycling of the fuel control switch will result in longer start times.

[Not include 777-200LR or 777F w/ UPGD12 or earlier]

**10 Choose one:****◆ X-BLD shows:**

START/IGNITION selector  
(affected side) . . . . . START

**►► Go to step 12**

**◆ X-BLD is blank:**

FUEL CONTROL switch  
(affected side) . . . . . RUN

**If** an abort start condition as listed in normal procedures occurs:

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

**►► Go to step 14**

**▼ Continued on next page ▼**

**▼ENG FAIL L, R continued▼**

[777-200LR or 777F w/UPGD12 or earlier]

11 Choose one:

◆ Airspeed is **below** 270 knots:

START/IGNITION selector  
(affected side) . . . . . START

►► Go to step 12

◆ Airspeed is **at or above** 270 knots:

FUEL CONTROL switch  
(affected side) . . . . . RUN

If an abort start condition as listed in  
normal procedures occurs:

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

►► Go to step 14

▼ Continued on next page ▼

## ▼ENG FAIL L, R continued▼

12 Choose one:

◆ Autostart is **on**:

FUEL CONTROL switch  
 (affected side) . . . . . RUN

**►► Go to step 13**

◆ Autostart is **off**:

**When** at maximum motoring:

FUEL CONTROL switch  
 (affected side) . . . . . RUN

**►► Go to step 13**

13 **If** an abort start condition as listed in normal procedures occurs:

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

START/IGNITION selector  
 (affected side) . . . . . NORM

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

AUTOTHROTTLE

▼ Continued on next page ▼

**▼ENG FAIL L, R continued▼**

15 Choose one:

◆ **Both engines run normally:**◆ Engine stays **failed or is damaged:****►► Go to step 16**

- 16 FUEL CONTROL switch  
(affected side) . . . . . Confirm. . . . . CUTOFF
- 17 START/IGNITION selector  
(affected side) . . . . . NORM
- 18 APU selector  
(if APU available) . . . . . START, then ON
- 19 Transponder mode selector . . . . . TA ONLY

**▼ Continued on next page ▼**

**▼ENG FAIL L, R continued▼**

20 Plan to land at the nearest suitable airport.

21 Choose one:

- ◆ Landing using flaps **20**:

GND PROX FLAP OVRD switch . . . . . OVRD

**Note:** Use flaps 20 and VREF 20 for landing and flaps 5 for go-around.

**►► Go to step 22**

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

**Note:** Use flaps 30 and VREF 30 for landing and flaps 20 for go-around.



## 22 Checklist Complete Except Deferred Items

### Deferred Items

#### Descent Checklist

Recall .....	.....	Checked
Notes .....	.....	Checked
Autobrake .....	.....	.....
Landing data .....	<b>VREF 20</b> _____	<b>Minimums</b> _____
Approach briefing .....	.....	Completed

**▼ Continued on next page ▼**

**▼ENG FAIL L, R continued▼****Approach Checklist**

Altimeters . . . . .

**Landing Checklist**

Speedbrake . . . . . ARMED  
Landing gear . . . . . DOWN  
Flaps . . . . . 20



**[ ] ENG FAIL L, R**

[PW Engines]

Condition: Engine speed is below idle.

Objective: To restart the engine if needed, or configure for single engine operation.

1 If thrust is lost on **both** engines:

**►►Go to the Dual Eng Fail/Stall checklist on page 7.4**

- 2 A/T ARM switch  
(affected side) . . . . . Confirm. . . . . OFF
- 3 Thrust lever  
(affected side) . . . . . Confirm. . . . . Idle
- 4 FUEL CONTROL switch  
(affected side) . . . . . Confirm. . . . . CUTOFF
- 5 A restart may be attempted if there is no abnormal airframe vibration.
- 6 Choose one:
  - ◆ Restart **is** needed:  
**►► Go to step 7**
  - ◆ Restart is **not** needed:  
**►► Go to step 12**
- 7 Engine may accelerate to idle very slowly, especially at high altitudes.

▼ Continued on next page ▼

**▼ENG FAIL L, R continued▼**

- 8 Slow acceleration may be incorrectly interpreted as a hung start or engine malfunction. If N2 is steadily increasing and EGT stays within limits, the start is progressing normally. Any further cycling of the fuel control switch will result in longer start times.
- 9 Choose one:

◆ X-BLD **shows:**

START/IGNITION selector  
(affected side) . . . . . START

**►► Go to step 10**

◆ X-BLD **is blank:**

FUEL CONTROL switch  
(affected side) . . . . . RUN

**If** EGT does not increase in 30 seconds, or another abort start condition as listed in normal procedures occurs:

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

**►► Go to step 12**

**▼ Continued on next page ▼**

## ▼ENG FAIL L, R continued▼

10 Choose one:

◆ Autostart is **on**:

FUEL CONTROL switch  
(affected side) . . . . . RUN

►► Go to step 11

◆ Autostart is **off**:

**When** at a minimum of 15% N2:

FUEL CONTROL switch  
(affected side) . . . . . RUN

►► Go to step 11

11 **If** EGT does not increase in 30 seconds, or another abort start condition as listed in normal procedures occurs:

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

START/IGNITION selector  
(affected side) . . . . . NORM

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

AUTOTHROTTLE

▼ Continued on next page ▼

▼ENG FAIL L, R continued▼

13 Choose one:

◆ **Both engines run normally:**



◆ Engine stays **failed or is damaged:**

►► Go to step 14

- 14 FUEL CONTROL switch  
(affected side) . . . . . Confirm. . . . . CUTOFF
- 15 START/IGNITION selector  
(affected side) . . . . . NORM
- 16 APU selector  
(if APU available) . . . . . START, then ON
- 17 Transponder mode selector . . . . . TA ONLY
- 18 Plan to land at the nearest suitable airport.

19 Choose one:

◆ Landing using flaps **20:**

GND PROX FLAP OVRD switch . . . . . OVRD

**Note:** Use flaps 20 and VREF 20 for landing and flaps 5 for go-around.

►► Go to step 20

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

**Note:** Use flaps 30 and VREF 30 for landing and flaps 20 for go-around.



▼ Continued on next page ▼

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**▼ENG FAIL L, R continued▼****20 Checklist Complete Except Deferred Items****Deferred Items****Descent Checklist**

Recall .....	.....	Checked
Notes .....	.....	Checked
Autobrake .....	.....	.....
Landing data .....	<b>VREF 20</b> _____	<b>Minimums</b> _____
Approach briefing .....	.....	Completed

**Approach Checklist**

Altimeters .....	.....	.....
------------------	-------	-------

**Landing Checklist**

Speedbrake .....	.....	ARMED
Landing gear .....	.....	DOWN
Flaps .....	.....	<b>20</b>



Intentionally  
Blank

DRAFT

**[ ] ENG FAIL L, R**

[RR Engines]

Condition: Engine speed is below idle.

Objective: To restart the engine if needed, or configure for single engine operation.

**1 If thrust is lost on both engines:**

**►►Go to the Dual Eng Fail/Stall checklist on page 7.5**

- 2 A/T ARM switch  
(affected side) . . . . . Confirm. . . . . OFF
- 3 Thrust lever  
(affected side) . . . . . Confirm. . . . . Idle
- 4 FUEL CONTROL switch  
(affected side) . . . . . Confirm. . . . . CUTOFF
- 5 A restart may be attempted if there is N1 rotation and no abnormal airframe vibration.
- 6 Choose one:
  - ◆ Restart **is** needed:  
**►► Go to step 7**
  - ◆ Restart is **not** needed:  
**►► Go to step 13**
- 7 Monitor EGT during start to prevent an EGT exceedance. Autostart allows EGT to exceed the in-flight start limit.

▼ Continued on next page ▼

**▼ENG FAIL L, R continued▼**

- 8 Engine may accelerate to idle very slowly, especially at high altitudes.
- 9 Slow acceleration may be incorrectly interpreted as a hung start or engine malfunction. If N3 is steadily increasing and EGT stays within limits, the start is progressing normally. Any further cycling of the fuel control switch will result in longer start times.

10 Choose one:

◆ X-BLD **shows:**

START selector (affected side) . . . . . START

►► Go to step 11

◆ X-BLD is **blank:**

FUEL CONTROL switch  
(affected side) . . . . . RUN

►► Go to step 12

▼ Continued on next page ▼



## ▼ENG FAIL L, R continued▼

11 Choose one:

◆ Autostart is **on**:

FUEL CONTROL switch  
(affected side) . . . . . RUN

**If** an abort start condition as listed in  
normal procedures occurs:

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

START selector  
(affected side) . . . . . NORM

►► Go to step 13

◆ Autostart is **off**:

**When** at maximum motoring:

FUEL CONTROL switch  
(affected side) . . . . . RUN

**If** EGT does not increase in 40 seconds, or  
another abort start condition as listed in  
normal procedures occurs:

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

START selector  
(affected side) . . . . . NORM

►► Go to step 13

▼ Continued on next page ▼

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**▼ENG FAIL L, R continued▼**

12 Choose one:

◆ Autostart is **on**:

If an abort start condition as listed in normal procedures occurs:

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

►►Go to step 13

◆ Autostart is **off**:

If EGT does not increase in 40 seconds, or another abort start condition as listed in normal procedures occurs:

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

►►Go to step 13

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

AUTOTHROTTLE

14 Choose one:

◆ Both engines run **normally**:



◆ Engine stays **failed** or is **damaged**:

►►Go to step 15

▼ Continued on next page ▼

**▼ENG FAIL L, R continued▼**

- 15 FUEL CONTROL switch  
(affected side) . . . . . Confirm. . . . . CUTOFF
- 16 START selector  
(affected side) . . . . . NORM
- 17 APU selector  
(if APU available) . . . . . START, then ON
- 18 Transponder mode selector . . . . . TA ONLY
- 19 Plan to land at the nearest suitable airport.
- 20 Choose one:

◆ Landing using flaps **20**:

GND PROX FLAP OVRD switch . . . . OVRD

**Note:** Use flaps 20 and VREF 20 for landing and flaps 5 for go-around.

**►► Go to step 21**

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

**Note:** Use flaps 30 and VREF 30 for landing and flaps 20 for go-around.



**21 Checklist Complete Except Deferred Items**

**▼ Continued on next page ▼**

**▼ENG FAIL L, R continued▼****Deferred Items****Descent Checklist**

- |                             |                                      |
|-----------------------------|--------------------------------------|
| Recall . . . . .            | Checked                              |
| Notes. . . . .              | Checked                              |
| Autobrake . . . . .         | _____                                |
| Landing data . . . . .      | <b>VREF 20 _____, Minimums _____</b> |
| Approach briefing . . . . . | Completed                            |
- 

**Approach Checklist**

- |                      |       |
|----------------------|-------|
| Altimeters . . . . . | _____ |
|----------------------|-------|
- 

**Landing Checklist**

- |                        |           |
|------------------------|-----------|
| Speedbrake . . . . .   | ARMED     |
| Landing gear . . . . . | DOWN      |
| Flaps . . . . .        | <b>20</b> |
- ■ ■ ■

**[ ] ENG FUEL FILTER L, R**

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

**1 Choose one:**

- ◆ **Only one** ENG FUEL FILTER message, left or right, has shown during the flight:

**Note:** Erratic engine operation and flameout may occur on the affected engine due to fuel contamination.



- ◆ ENG FUEL FILTER messages for **both** engines show or have shown at any time during the flight (either separately or at the same time):

**►► Go to step 2**

**2 Plan to land at the nearest suitable airport.**

**Note:** Erratic engine operation and flameout may occur on either or both engines due to fuel contamination.



**[ ] ENG FUEL VALVE L, R**

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

[\[GE Engines\]](#)

1 **If** the ENG FUEL VALVE message shows when the fuel control switch is moved to CUTOFF, the engine may continue to run for approximately 10 seconds.

[\[PW Engines, RR Engines\]](#)

2 **If** the ENG FUEL VALVE message shows when the fuel control switch is moved to CUTOFF, the engine may continue to run for approximately 1 minute.

3 **If** on the ground:

Do not attempt engine start.

**ENG IDLE DISAGREE**

Condition: One engine is at approach idle and the other engine is at minimum idle.



**Eng In-Flight Start L, R**

[GE Engines with CON position]

Condition: An engine start is needed and all of the following are true:

- There is N1 rotation
- There was **no** engine fire
- There is **no** abnormal airframe vibration

- 1 Monitor EGT during start to prevent an EGT exceedance. Autostart allows EGT to exceed the in-flight start limit.
- 2 The engine may accelerate to idle very slowly, especially at high altitudes. The time from fuel control switch to RUN to stabilized idle may be as long as two and a half minutes.
- 3 Slow acceleration may be incorrectly interpreted as a hung start or engine malfunction. If N2 is steadily increasing and EGT stays within limits, the start is progressing normally. Any further cycling of the fuel control switch will result in longer start times.

▼ Continued on next page ▼

**▼Eng In-Flight Start L, R continued▼**

[Not include 777-200LR or 777F w/ UPGD12 or earlier]

4 Choose one:

◆ X-BLD shows:

START/IGNITION selector  
(affected side) . . . . . START

►► Go to step 6

◆ X-BLD is blank:

FUEL CONTROL switch  
(affected side) . . . . . RUN

If an abort start condition as listed in  
normal procedures occurs:

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

►► Go to step 8

▼ Continued on next page ▼

**▼ Eng In-Flight Start L, R continued▼**

[777-200LR or 777F w/UPGD12 or earlier]

**5 Choose one:**

- ◆ Airspeed is **below** 270 knots:

START/IGNITION selector  
(affected side) . . . . . START

**►► Go to step 6**

- ◆ Airspeed is **at or above** 270 knots:

FUEL CONTROL switch  
(affected side) . . . . . RUN

**If** an abort start condition as listed in  
normal procedures occurs:

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

**►► Go to step 8**

**▼ Continued on next page ▼**

**▼Eng In-Flight Start L, R continued▼**

6 Choose one:

◆ Autostart is **on**:

FUEL CONTROL switch  
(affected side) . . . . . RUN

**►►Go to step 7**

◆ Autostart is **off**:

**When** at maximum motoring:

FUEL CONTROL switch  
(affected side) . . . . . RUN

**►►Go to step 7**

7 **If** an abort start condition as listed in normal procedures occurs:

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

START/IGNITION selector  
(affected side) . . . . . NORM

**▼ Continued on next page ▼**

▼ Eng In-Flight Start L, R continued ▼

8 Choose one:

- ◆ Engine **starts** and runs normally:

GND PROX FLAP OVRD switch . . . . . Off

Transponder mode selector . . . . . TA/RA



- ◆ Engine **fails** to start:

Plan to land at the nearest suitable airport.



Intentionally  
Blank

DRAFT

**Eng In-Flight Start L, R**

[PW Engines]

Condition: An engine start is needed and both of the following are true:

- There was **no** engine fire
- There is **no** abnormal airframe vibration

- 1 Engine may accelerate to idle very slowly, especially at high altitudes.
- 2 Slow acceleration may be incorrectly interpreted as a hung start or engine malfunction. If N2 is steadily increasing and EGT stays within limits, the start is progressing normally. Any further cycling of the fuel control switch will result in longer start times.

▼ Continued on next page ▼

**▼Eng In-Flight Start L, R continued▼**

3 Choose one:

◆ X-BLD **shows:**

START/IGNITION selector  
(affected side) . . . . . START

**►►Go to step 4**

◆ X-BLD is **blank:**

FUEL CONTROL switch  
(affected side) . . . . . RUN

**If** EGT does not increase in 30 seconds, or  
another abort start condition as listed in  
normal procedures occurs:

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

**►►Go to step 6**

**▼ Continued on next page ▼**

## ▼ Eng In-Flight Start L, R continued ▼

## 4 Choose one:

◆ Autostart is **on**:

FUEL CONTROL switch  
(affected side) . . . . . RUN

►► Go to step 5

◆ Autostart is **off**:

**When** at a minimum of 15% N2:

FUEL CONTROL switch  
(affected side) . . . . . RUN

►► Go to step 5

## 5 If EGT does not increase in 30 seconds, or another abort start condition as listed in normal procedures occurs:

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

START/IGNITION selector  
(affected side) . . . . . NORM

▼ Continued on next page ▼

**▼Eng In-Flight Start L, R continued▼**

6 Choose one:

- ◆ Engine **starts** and runs normally:

GND PROX FLAP OVRD switch . . . . . Off

Transponder mode selector . . . . . TA/RA



- ◆ Engine **fails** to start:

Plan to land at the nearest suitable airport.



DRAFT

**Eng In-Flight Start L, R**

[RR Engines]

Condition: An engine start is needed and all of the following are true:

- There is N1 rotation
- There was **no** engine fire
- There is **no** abnormal airframe vibration

- 1 Monitor EGT during start to prevent an EGT exceedance. Autostart allows EGT to exceed the in-flight start limit.
- 2 Engine may accelerate to idle very slowly, especially at high altitudes.
- 3 Slow acceleration may be incorrectly interpreted as a hung start or engine malfunction. If N3 is steadily increasing and EGT stays within limits, the start is progressing normally. Any further cycling of the fuel control switch will result in longer start times.
- 4 Choose one:

◆ X-BLD **shows:**

START selector (affected side) . . . . START

►► **Go to step 5**

◆ X-BLD is **blank:**

FUEL CONTROL switch  
(affected side) . . . . . RUN

►► **Go to step 6**

▼ Continued on next page ▼

**▼Eng In-Flight Start L, R continued▼**

5 Choose one:

◆ Autostart is **on**:

FUEL CONTROL switch  
(affected side) . . . . . RUN

If an abort start condition as listed in  
normal procedures occurs:

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

START selector  
(affected side) . . . . . NORM

►►Go to step 7

◆ Autostart is **off**:

When at maximum motoring:

FUEL CONTROL switch  
(affected side) . . . . . RUN

If EGT does not increase in 40 seconds, or  
another abort start condition as listed in  
normal procedures occurs:

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

START selector  
(affected side) . . . . . NORM

►►Go to step 7

▼ Continued on next page ▼

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**▼ Eng In-Flight Start L, R continued▼**

6 Choose one:

- ◆ Autostart is **on**:

If an abort start condition as listed in normal procedures occurs:

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

**►► Go to step 7**

- ◆ Autostart is **off**:

If EGT does not increase in 40 seconds, or another abort start condition as listed in normal procedures occurs:

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

**►► Go to step 7**

7 Choose one:

- ◆ Engine **starts** and runs normally:

GND PROX FLAP OVRD switch . . . . . Off

Transponder mode selector . . . . . TA/RA



- ◆ Engine **fails** to start:

Plan to land at the nearest suitable airport.



**[ ] ENG LIMIT PROT L, R**

Condition: The EEC is in the alternate mode and the commanded N1 exceeds the limit.

- 1 Thrust lever  
(affected side) . . . . . Retard until N1  
stays below the amber line

**ENG LPC ANTI-ICE L,R**

[GE 90-115B Engines before LN500]

Condition: Engine low pressure compressor anti-ice valve is failed closed.



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**[] ENG OIL FILTER L, R**

[GE Engines]

Condition: Oil filter contamination has caused oil to bypass the oil filter.

Objective: To decrease oil pressure to stop filter bypass, or shut down the engine.

- 1 A/T ARM switch  
(affected side) . . . . . Confirm. . . . . OFF
- 2 Thrust lever  
(affected side) . . . . . Confirm. . . . . Retard slowly until the ENG OIL FILTER message blanks or the thrust lever is at idle
- 3 Do **not** accomplish the following checklist:  
**AUTOTHROTTLE**
- 4 Choose one:
  - ◆ ENG OIL FILTER message **blanks**:  
**Note:** Run the affected engine at a thrust setting that keeps the ENG OIL FILTER message blank.  
■ ■ ■ ■
  - ◆ ENG OIL FILTER message **stays shown**:  
**►► Go to step 5**
- 5 FUEL CONTROL switch  
(affected side) . . . . . Confirm. . . . . CUTOFF

▼ Continued on next page ▼

**▼ENG OIL FILTER L, R continued▼**

- 6 APU selector  
(if APU available) . . . . . START, then ON
- 7 Transponder mode selector . . . . . TA ONLY
- 8 Plan to land at the nearest suitable airport.
- 9 Choose one:

**◆Landing using flaps 20:**

GND PROX FLAP OVRD switch . . . . OVRD

**Note:** Use flaps 20 and VREF 20 for landing and flaps 5 for go-around.

**►►Go to step 10****◆Landing using flaps 30 (if performance allows):**

**Note:** Use flaps 30 and VREF 30 for landing and flaps 20 for go-around.

**10 Checklist Complete Except Deferred Items****▼ Continued on next page ▼**

## ▼ ENG OIL FILTER L, R continued ▼

**Deferred Items****Descent Checklist**

Recall . . . . .	Checked
Notes . . . . .	Checked
Autobrake . . . . .	—
Landing data . . . . .	<b>VREF 20</b> ____, <b>Minimums</b> ____
Approach briefing . . . . .	Completed

**Approach Checklist**

Altimeters . . . . .	—
----------------------	---

**Landing Checklist**

Speedbrake . . . . .	ARMED
Landing gear . . . . .	DOWN
Flaps . . . . .	<b>20</b>

**ENG OIL FILTER L, R**

[PW Engines - Option]

Condition: Primary engine oil filter contamination approaching a bypass condition, oil will be filtered through the secondary filter.



**[ ] ENG OIL PRESS L, R**

[GE Engines, PW Engines]

Condition: The engine oil pressure is low.

- 1 A/T ARM switch  
(affected side) . . . . . Confirm. . . . . OFF
- 2 Thrust lever  
(affected side) . . . . . Confirm. . . . . Idle
- 3 FUEL CONTROL switch  
(affected side) . . . . . Confirm. . . . . CUTOFF
- 4 APU selector  
(if APU available) . . . . . START, then ON
- 5 Transponder mode selector . . . . . TA ONLY
- 6 Plan to land at the nearest suitable airport.
- 7 Do **not** accomplish the following checklist:

AUTOTHROTTLE

▼ Continued on next page ▼

**▼ ENG OIL PRESS L, R continued ▼****8 Choose one:****◆ Landing using flaps **20**:**

GND PROX FLAP OVRD switch . . . . OVRD

**Note:** Use flaps 20 and VREF 20 for landing and flaps 5 for go-around.**►► Go to step 9****◆ Landing using flaps **30 (if performance allows)**:****Note:** Use flaps 30 and VREF 30 for landing and flaps 20 for go-around.**9 Checklist Complete Except Deferred Items****Deferred Items****Descent Checklist**

Recall . . . . .	Checked
Notes . . . . .	Checked
Autobrake . . . . .	—
Landing data . . . . . <b>VREF 20</b> ____ , <b>Minimums</b> ____	
Approach briefing . . . . .	Completed

**Approach Checklist**

Altimeters . . . . .	—
----------------------	---

**▼ Continued on next page ▼**

**▼ENG OIL PRESS L, R continued▼****Landing Checklist**

Speedbrake . . . . .	ARMED
Landing gear . . . . .	DOWN
Flaps . . . . .	<b>20</b>



DRAFT

**[ ] ENG OIL PRESS L, R**

[RR Engines]

Condition: The engine oil pressure is low.

- 1 A/T ARM switch  
(affected side) . . . . . Confirm. . . . . OFF
- 2 Thrust lever  
(affected side) . . . . . Confirm. . . . . Idle
- 3 Do **not** accomplish the following checklist:  
**AUTOTHROTTLE**
- 4 Choose one:
  - ◆ ENG OIL PRESS message **blanks**:  
■ ■ ■ ■ ■
  - ◆ ENG OIL PRESS message **stays shown**:  
**►► Go to step 5**
- 5 FUEL CONTROL switch  
(affected side) . . . . . Confirm. . . . . CUTOFF
- 6 APU selector  
(if APU available) . . . . . START, then ON
- 7 Transponder mode selector . . . . . TA ONLY
- 8 Plan to land at the nearest suitable airport.

▼ Continued on next page ▼

**▼ENG OIL PRESS L, R continued▼**

9 Choose one:

- ◆ Landing using flaps **20**:

GND PROX FLAP OVRD switch . . . . OVRD

**Note:** Use flaps 20 and VREF 20 for landing and flaps 5 for go-around.

►►Go to step 10

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

**Note:** Use flaps 30 and VREF 30 for landing and flaps 20 for go-around.

**10 Checklist Complete Except Deferred Items**

▼ Continued on next page ▼

**▼ ENG OIL PRESS L, R continued▼****Deferred Items****Descent Checklist**

Recall .....	.....	Checked
Notes .....	.....	Checked
Autobrake .....	.....	.....
Landing data .....	<b>VREF 20</b> _____	<b>Minimums</b> _____
Approach briefing .....	.....	Completed

**Approach Checklist**

Altimeters .....	.....	.....
------------------	-------	-------

**Landing Checklist**

Speedbrake .....	.....	ARMED
Landing gear .....	.....	DOWN
Flaps .....	.....	<b>20</b>



[ ] **ENG OIL TEMP L, R**

[GE Engines]

Condition: The engine oil temperature is high.

- 1 A/T ARM switch  
(affected side) . . . . . Confirm. . . . . OFF
- 2 Thrust lever  
(affected side) . . . . . Confirm. . . . . Move to mid position

This allows the oil to cool.

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

**AUTOTHROTTLE**

- 4 Choose one:

◆ Oil temperature is **below** the **red** line limit, or is in the **amber** band for **less than 15 minutes**:

**Note:** Run the engine at a thrust setting that keeps the ENG OIL TEMP message blank.



◆ Oil temperature is **at or above** the **red** line limit, or is in the **amber** band for **15 minutes or more**:

►► Go to step 5

- 5 Thrust lever  
(affected side) . . . . . Confirm. . . . . Idle
- 6 FUEL CONTROL switch  
(affected side) . . . . . Confirm. . . . . CUTOFF

▼ Continued on next page ▼

**▼ENG OIL TEMP L, R continued▼**

- 7 APU selector  
(if APU available) . . . . . START, then ON
- 8 Transponder mode selector . . . . . TA ONLY
- 9 Plan to land at the nearest suitable airport.
- 10 Choose one:

◆ Landing using flaps **20**:

GND PROX FLAP OV RD switch . . . . OV RD

**Note:** Use flaps 20 and VREF 20 for landing and flaps 5 for go-around.

**►► Go to step 11**

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

**Note:** Use flaps 30 and VREF 30 for landing and flaps 20 for go-around.



## 11 Checklist Complete Except Deferred Items

**Deferred Items**

### Descent Checklist

- |                             |                                       |
|-----------------------------|---------------------------------------|
| Recall . . . . .            | Checked                               |
| Notes . . . . .             | Checked                               |
| Autobrake . . . . .         | —                                     |
| Landing data . . . . .      | <b>VREF 20 ____ , Minimums ____  </b> |
| Approach briefing . . . . . | Completed                             |

**▼ Continued on next page ▼**

**▼ENG OIL TEMP L, R continued▼****Approach Checklist**

Altimeters . . . . .

**Landing Checklist**

Speedbrake . . . . . ARMED

Landing gear . . . . . DOWN

Flaps . . . . . 20



DRAFT

**[ ] ENG OIL TEMP L, R**

[PW Engines]

Condition: The engine oil temperature is high.

- 1 A/T ARM switch  
(affected side) . . . . . Confirm. . . . . OFF
- 2 Thrust lever  
(affected side) . . . . . Confirm. . . . . Retard slowly until the ENG OIL TEMP message blanks or the thrust lever is at idle  
This allows the oil to cool.
- 3 Do **not** accomplish the following checklist:  
**AUTOTHROTTLE**
- 4 Choose one:
  - ◆ Oil temperature is **below** the **red** line limit, or is in the **amber** band for **less than 20 minutes**:  
**Note:** Run the engine at a thrust setting that keeps the ENG OIL TEMP message blank.  
■ ■ ■ ■
  - ◆ Oil temperature is **at or above** the **red** line limit, or is in the **amber** band for **20 minutes or more**:
- 5 Thrust lever  
(affected side) . . . . . Confirm. . . . . Idle

▼ Continued on next page ▼

**▼ENG OIL TEMP L, R continued▼**

- 6 FUEL CONTROL switch  
(affected side) . . . . . Confirm. . . . . CUTOFF
- 7 APU selector  
(if APU available) . . . . . START, then ON
- 8 Transponder mode selector . . . . . TA ONLY
- 9 Plan to land at the nearest suitable airport.
- 10 Choose one:

**◆Landing using flaps **20**:**

GND PROX FLAP OVRD switch . . . . . OVRD

**Note:** Use flaps 20 and VREF 20 for landing and flaps 5 for go-around.

**►►Go to step 11****◆Landing using flaps **30 (if performance allows)**:**

**Note:** Use flaps 30 and VREF 30 for landing and flaps 20 for go-around.

**11 Checklist Complete Except Deferred Items****▼ Continued on next page ▼**

**▼ENG OIL TEMP L, R continued▼****Deferred Items****Descent Checklist**

Recall .....	.....	Checked
Notes .....	.....	Checked
Autobrake .....	.....	.....
Landing data .....	<b>VREF 20</b> ___, <b>Minimums</b> ___	
Approach briefing .....	.....	Completed

**Approach Checklist**

Altimeters .....	.....	.....
------------------	-------	-------

**Landing Checklist**

Speedbrake .....	.....	ARMED
Landing gear .....	.....	DOWN
Flaps .....	.....	<b>20</b>



**[ ] ENG OIL TEMP L, R**

[RR Engines]

Condition: The engine oil temperature is high.

- 1 A/T ARM switch  
(affected side) . . . . . Confirm. . . . . OFF
- 2 Thrust lever  
(affected side) . . . . . Confirm. . . . . Move to mid position

This allows the oil to cool.

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

**AUTOTHROTTLE**

- 4 Choose one:

◆ Oil temperature is **below** the **red** line limit:

**Note:** Run the engine at a thrust setting that keeps the ENG OIL TEMP message blank.



◆ Oil temperature is **at or above** the **red** line limit:

►► Go to step 5

- 5 Thrust lever  
(affected side) . . . . . Confirm. . . . . Idle
- 6 FUEL CONTROL switch  
(affected side) . . . . . Confirm. . . . . CUTOFF
- 7 APU selector  
(if APU available) . . . . . START, then ON

▼ Continued on next page ▼

**▼ENG OIL TEMP L, R continued▼**

- 8 Transponder mode selector . . . . . TA ONLY
- 9 Plan to land at the nearest suitable airport.
- 10 Choose one:

◆ Landing using flaps **20**:

GND PROX FLAP OVRD switch . . . . . OVRD

**Note:** Use flaps 20 and VREF 20 for landing and flaps 5 for go-around.

**►► Go to step 11**

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

**Note:** Use flaps 30 and VREF 30 for landing and flaps 20 for go-around.



## 11 Checklist Complete Except Deferred Items

### Deferred Items

#### Descent Checklist

- |                             |                                       |
|-----------------------------|---------------------------------------|
| Recall . . . . .            | Checked                               |
| Notes . . . . .             | Checked                               |
| Autobrake . . . . .         | —                                     |
| Landing data . . . . .      | <b>VREF 20 ____ , Minimums ____  </b> |
| Approach briefing . . . . . | Completed                             |

**▼ Continued on next page ▼**

**▼ENG OIL TEMP L, R continued▼****Approach Checklist**

Altimeters . . . . .

**Landing Checklist**

Speedbrake . . . . .	ARMED
Landing gear . . . . .	DOWN
Flaps . . . . .	20

**[ ] ENG REV LIMITED L, R**

Condition: The engine reverser operation is limited.

**Note:** On landing, the affected thrust reverser will not deploy or affected reverse thrust will be limited to idle.

**ENG REVERSER L, R**

Condition: A fault occurs in the thrust reverser system.



**ENG RPM LIMITED L, R**

[GE Engines, PW Engines]

Condition: Engine thrust is at the N1 or N2 red line limit.

**ENG RPM LIMITED L, R**

[RR Engines]

Condition: Engine control is limiting affected engine thrust to prevent N1, N2, or N3 from exceeding the RPM operating limit.

**ENG SHUTDOWN**

Condition: Both engines were shut down by the fuel control switches or the engine fire switches.

**ENG SHUTDOWN L, R**

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



**[ ] ENG START VALVE L, R**

[GE Engines with CON position, PW Engines]

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

1 Ground or in-flight start using a bleed air source may be unsuccessful.

2 Choose one:

◆ On the **ground**:

FUEL CONTROL switch (affected side) . . . . .	CUTOFF
START/IGNITION selector (affected side) . . . . .	NORM

◆ In **flight**:

►► Go to step 3

3 START/IGNITION selector  
(affected side) . . . . . NORM

[Not include 777-200LR or 777F w/ UPGD12 or earlier]

4 Increase airspeed until X-BLD blanks.

[777-200LR or 777F w/ UPGD12 or earlier]

5 Increase airspeed above 270 knots.





## [ ] ENG START VALVE L, R

[GE Engines without CON position, RR Engines]

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

1 Ground or in-flight start using a bleed air source may be unsuccessful.

2 Choose one:

◆ On the **ground**:

FUEL CONTROL switch  
(affected side) . . . . . CUTOFF

START selector (affected side) . . . . NORM



◆ In **flight**:

►► Go to step 3

3 START selector (affected side) . . . . . NORM

[Not include 777-200LR or 777F w/ UPGD12 or earlier]

4 Increase airspeed until X-BLD blanks.



## [ ] ENG STARTER CUTOUT L, R

[GE Engines with CON position, PW Engines]

Condition: One of these occurs:

- The start valve fails to close
- The start selector stays in start

Objective: To ensure start selector is in normal or to remove bleed air source from the starter and prevent possible asymmetrical ice buildup on the wings.

- 1 START/IGNITION selector (affected side) ..... NORM
- 2 Choose one:
  - ◆ ENG STARTER CUTOUT message **blanks**:  
 █ █ █ █
  - ◆ ENG STARTER CUTOUT message **stays shown**:  
 ►► Go to step 3
- 3 ENG BLEED switch (affected side). .... Off
- 4 BLEED AIR ISLN switch (affected side) .... Off
- 5 If on the ground:  
 Disconnect the ground air source if it is in use.
- 6 WING ANTI-ICE selector ..... OFF
- 7 Do **not** accomplish the following checklists:  
 BLEED LOSS WING  
 PACK  
 █ █ █ █

**[ ] ENG STARTER CUTOUT L, R**

[GE Engines without CON position, RR Engines]

Condition: One of these occurs:

- The start valve fails to close
- The start selector stays in start

Objective: To ensure start selector is in normal or to remove bleed air source from the starter and prevent possible asymmetrical ice buildup on the wings.

1 START selector (affected side) . . . . . NORM

2 Choose one:

◆ ENG STARTER CUTOUT message **blanks**:



◆ ENG STARTER CUTOUT message **stays shown**:

►► Go to step 3

3 ENG BLEED switch (affected side) . . . . . Off

4 BLEED AIR ISLN switch (affected side) . . . . . Off

5 If on the ground:

Disconnect the ground air source if it is in use.

6 WING ANTI-ICE selector . . . . . OFF

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

BLEED LOSS WING

PACK



**ENG THRUST L, R**

Condition: The engine thrust is less than the commanded thrust.



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## Volcanic Ash

[GE Engines]

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.

- 1 Exit volcanic ash as quickly as possible. Consider a 180 degree turn.
- 2 Don the oxygen masks and smoke goggles, if needed.
- 3 Establish crew communications, if needed.
- 4 Autothrottle disconnect switch . . . . . Push
- 5  **If** conditions allow, run the engines at idle. Thrust levers (both) . . . . . Idle  
This reduces possible engine damage or flameout, or both, by decreasing EGT.
- 6 ENGINE ANTI-ICE selectors (both) . . . . . ON
- 7 WING ANTI-ICE selector . . . . . ON  
[Passenger Airplane]
- 8 RECIRC FANS switches (both) . . . . . Off  
[Freighter Airplane]
- 9 RECIRC FANS switch . . . . . Off
- 10 APU selector  
(if APU available) . . . . . START, then ON

▼ Continued on next page ▼

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**▼Volcanic Ash continued▼**

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

- Engine malfunctions, increasing EGT, engine stall, or flameout
- Decrease or loss of airspeed indications
- EQUIP COOLING OVRD message
- FIRE CARGO FWD or AFT messages

11 Choose one:

- ◆ Engines are **flamed out** or **stalled**, or EGT is rapidly **approaching** or **exceeding** the **limit**:  
**►►Go to step 12**
- ◆ Engines run **normally**:

Plan to land at the nearest suitable airport



12 FUEL CONTROL switches

(both) ..... CUTOFF, then RUN

13 RAM AIR TURBINE switch ..... Push and hold for 1 second

14 For a dual engine in-flight start, do not manually abort the start if the EGT display turns red. Autostart allows EGT to exceed the in-flight start limit, however autostart aborts the start before EGT becomes too high for continued engine operation.

15 Set airspeed above 270 knots.

**▼ Continued on next page ▼**

**▼Volcanic Ash continued▼**

- 16 Engines may accelerate to idle very slowly, especially at high altitudes. The time from fuel control switch to RUN to stabilized idle may be as long as two and a half minutes.
- 17 Slow acceleration may be incorrectly interpreted as a hung start or engine malfunction. If N2 is steadily increasing and EGT stays within limits, the start is progressing normally. Any further cycling of the fuel control switches will result in longer start times.

- 18 **When** the HEAT PITOT L+C+R message blanks:

PRIMARY FLIGHT COMPUTERS  
disconnect switch . . . . . DISC,  
then AUTO

This restores flight control normal mode.

The autopilot can be re-engaged when flight control normal mode is restored.

- 19 Plan to land at the nearest suitable airport.



## Volcanic Ash

[PW Engines]

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.

- 1 Exit volcanic ash as quickly as possible. Consider a 180 degree turn.
- 2 Don the oxygen masks and smoke goggles, if needed.
- 3 Establish crew communications, if needed.
- 4 Autothrottle disconnect switch . . . . . Push
- 5  **If** conditions allow, run the engines at idle.  
Thrust levers (both) . . . . . Idle  
This reduces possible engine damage or flameout, or both, by decreasing EGT.
- 6 ENGINE ANTI-ICE selectors (both) . . . . . ON
- 7 WING ANTI-ICE selector . . . . . ON
- 8 RECIRC FANS switches (both) . . . . . Off
- 9 APU selector  
(if APU available) . . . . . START, then ON

▼ Continued on next page ▼

## ▼Volcanic Ash continued▼

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

- Engine malfunctions, increasing EGT, engine stall, or flameout
- Decrease or loss of airspeed indications
- EQUIP COOLING OVRD message
- FIRE CARGO FWD or AFT messages

10 Choose one:

◆ Engines are **flamed out** or **stalled**, or EGT is rapidly **approaching** or **exceeding** the **limit**:

►►Go to step 11

◆ Engines run **normally**:

Plan to land at the nearest suitable airport



11 FUEL CONTROL switches

(both) ..... CUTOFF, then RUN

12 RAM AIR TURBINE switch ..... Push and hold for 1 second

13 Set airspeed above 240 knots.

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

▼ Continued on next page ▼

**▼Volcanic Ash continued▼**

15 Slow acceleration may be incorrectly interpreted as a hung start or engine malfunction. If N2 is steadily increasing and EGT stays within limits, the start is progressing normally. Any further cycling of the fuel control switches will result in longer start times.

16 When the HEAT PITOT L+C+R message blanks:

PRIMARY FLIGHT COMPUTERS  
disconnect switch . . . . . DISC,  
then AUTO

This restores flight control normal mode.

The autopilot can be re-engaged when flight control normal mode is restored.

17 Plan to land at the nearest suitable airport.



## Volcanic Ash

[RR Engines]

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.

- 1 Exit volcanic ash as quickly as possible. Consider a 180 degree turn.
- 2 Don the oxygen masks and smoke goggles, if needed.
- 3 Establish crew communications, if needed.
- 4 Autothrottle disconnect switch . . . . . Push
- 5  **If** conditions allow, run the engines at idle.  
Thrust levers (both) . . . . . Idle  
This reduces possible engine damage or flameout, or both, by decreasing EGT.
- 6 ENGINE ANTI-ICE selectors (both) . . . . . ON
- 7 WING ANTI-ICE selector . . . . . ON
- 8 RECIRC FANS switches (both) . . . . . Off
- 9 APU selector  
(if APU available) . . . . . START, then ON

▼ Continued on next page ▼

**▼Volcanic Ash continued▼**

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

- Engine malfunctions, increasing EGT, engine stall, or flameout
- Decrease or loss of airspeed indications
- EQUIP COOLING OVRD message
- FIRE CARGO FWD or AFT messages

10 Choose one:

- ◆ Engines are **flamed out** or **stalled**, or EGT is rapidly **approaching** or **exceeding** the **limit**:  
**►►Go to step 11**
- ◆ Engines run **normally**:

Plan to land at the nearest suitable airport



11 FUEL CONTROL switches

(both) ..... CUTOFF, then RUN

12 RAM AIR TURBINE switch ..... Push and hold for 1 second

13 Set airspeed above 250 knots.

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

**▼ Continued on next page ▼**

## ▼Volcanic Ash continued▼

- 15 Slow acceleration may be incorrectly interpreted as a hung start or engine malfunction. If N3 is steadily increasing and EGT stays within limits, the start is progressing normally. Any further cycling of the fuel control switches will result in longer start times.

- 16 When the HEAT PITOT L+C+R message blanks:

**PRIMARY FLIGHT COMPUTERS**  
disconnect switch . . . . . DISC,  
then AUTO

This restores flight control normal mode.

The autopilot can be re-engaged when flight control normal mode is restored.

- 17 Plan to land at the nearest suitable airport.



Intentionally  
Blank

DRAFT

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[ ] 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 SHUTDOWN



**[ ] FIRE ENG L, R**

Condition: Fire is detected in the engine.

- 1 A/T ARM switch  
(affected side) . . . . . Confirm. . . . . OFF
- 2 Thrust lever  
(affected side) . . . . . Confirm. . . . . Idle
- 3 FUEL CONTROL switch  
(affected side) . . . . . Confirm. . . . . CUTOFF
- 4 Engine fire switch  
(affected side) . . . . . Confirm. . . . . Pull
- 5 **If** the FIRE ENG message stays shown:  
Engine fire switch  
(affected side) . . . . . Rotate to the stop  
and hold for 1 second  
**If** after 30 seconds, the FIRE ENG message  
stays shown:  
Engine fire switch  
(affected side) . . . . . Rotate to the  
other stop and  
hold for 1 second
- 6 APU selector  
(if APU available) . . . . . START, then ON
- 7 Transponder mode selector . . . . . TA ONLY
- 8 Plan to land at the nearest suitable airport.

▼ Continued on next page ▼

**▼FIRE ENG L, R continued▼**

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

**AUTOTHROTTLE**

10 Choose one:

◆ Landing using flaps **20**:

GND PROX FLAP OVRD switch . . . . OVRD

**Note:** Use flaps 20 and VREF 20 for landing and flaps 5 for go-around.

►► Go to step 11

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

**Note:** Use flaps 30 and VREF 30 for landing and flaps 20 for go-around.



11 Checklist Complete Except Deferred Items

**▼ Continued on next page ▼**

**▼FIRE ENG L, R continued▼****Deferred Items****Descent Checklist**

- Recall ..... Checked  
Notes. .... Checked  
Autobrake ..... \_\_\_\_\_  
| Landing data ..... **VREF 20** \_\_\_, **Minimums** \_\_\_\_  
Approach briefing ..... Completed
- 

**Approach Checklist**

- Altimeters ..... \_\_\_\_\_
- 

**Landing Checklist**

- Speedbrake ..... ARMED  
Landing gear ..... DOWN  
Flaps ..... **20**  


## Fire Engine Tailpipe L, R

[GE Engines with CON Position, PW Engines]

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

- 1 FUEL CONTROL switch  
(affected side) . . . . . CUTOFF
- 2 Advise the cabin.
- 3 Choose one:
  - ◆ Bleed air **is** available:  
**►► Go to step 4**
  - ◆ Bleed air **is not** available:  
Advise the tower.  

- 4 START/IGNITION selector  
(affected side) . . . . . START
- 5 Advise the tower.
- 6 **When** the tailpipe fire is extinguished:  
START/IGNITION selector  
(affected side) . . . . . NORM  


## Fire Engine Tailpipe L, R

[GE Engines without CON Position, RR Engines]

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

- 1 FUEL CONTROL switch  
(affected side) . . . . . CUTOFF
- 2 Advise the cabin.
- 3 Choose one:
  - ◆ Bleed air **is** available:  
**►► Go to step 4**
  - ◆ Bleed air is **not** available:  
Advise the tower.  

- 4 START selector  
(affected side) . . . . . START
- 5 Advise the tower.
- 6 **When** the tailpipe fire is extinguished:  
START selector  
(affected side) . . . . . NORM  


## Smoke, Fire or Fumes

Condition: Smoke, fire or fumes occurs.

Objective: To remove power from the ignition source.  
To land the airplane as soon as possible, if needed.

- 1 Diversion may be needed.
- 2 Don oxygen masks and smoke goggles, if needed.
- 3 Establish crew and cabin communications.  
[Passenger Airplane]
- 4 IFE/PASS SEATS switch ..... OFF  
[Passenger Airplane]
- 5 RECIRC FANS switches (both) ..... Off  
[Freighter Airplane]
- 6 RECIRC FANS switch ..... Off  
[Option]
- 7 GASPER switch ..... Off
- 8 APU BLEED AIR switch ..... Off
- 9 **Any time** the smoke or fumes becomes the greatest threat:

**►►Go to the Smoke or Fumes Removal checklist on page 8.38**

▼ 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 practical, 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 cannot** be extinguished quickly:

**►► Go to step 12**

**▼ Continued on next page ▼**

## ▼ Smoke, Fire or Fumes continued ▼

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 the Smoke or Fumes Removal checklist on page 8.38, if needed.



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

►► Go to step 12

12 Advise the cabin that the main cabin lighting will be turned off.

13 CABIN/UTILITY switch..... OFF

14 Initiate a diversion to the nearest suitable airport while continuing the checklist.

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

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

17 C BLEED AIR ISLN switch ..... Off

18 L PACK switch ..... Off

19 L TRIM AIR switch ..... Off

▼ Continued on next page ▼

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

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

PACK L

TRIM AIR L

21 **Wait** 2 minutes unless the smoke or fumes are increasing.

22 Choose one:

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

- |                             |      |
|-----------------------------|------|
| L PACK switch . . . . .     | AUTO |
| L TRIM AIR switch . . . . . | ON   |
| R PACK switch . . . . .     | Off  |
| R TRIM AIR switch . . . . . | Off  |

►► Go to step 23

◆ Smoke or fumes are **decreasing**:

►► Go to the **Smoke or Fumes Removal checklist on page 8.38, if needed.**



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

PACK R

TRIM AIR R

24 **Wait** 2 minutes unless the smoke or fumes are increasing.

▼ Continued on next page ▼



## ▼Smoke, Fire or Fumes continued▼

25 Choose one:

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

C BLEED AIR ISLN switch . . . . . AUTO

R PACK switch . . . . . AUTO

R TRIM AIR switch . . . . . ON

Consider an immediate landing.

**►► Go to the Smoke or Fumes Removal checklist on page 8.38, if needed.**◆ Smoke or fumes are **decreasing**:**►► Go to the Smoke or Fumes Removal checklist on page 8.38, if needed.****BOTTLE 1, 2 DISCH ENG**

Condition: The engine fire extinguisher bottle pressure is low.

**BOTTLE DISCH APU**

Condition: The APU fire extinguisher bottle pressure is low.



**BOTTLE DISCH CARGO**

Condition: Both rapid discharge cargo fire extinguisher bottle pressures are low.

**[ ] DET FIRE APU**

Condition: APU fire detection is failed.

1 Choose one:

◆ APU is running:

Plan to shut down the APU as soon as practical.



◆ APU is not running:

**Note:** Do not start the APU unless use is needed.

**DET FIRE CARGO AFT, FWD**

Condition: Lower cargo compartment smoke detection is failed.



**DET FIRE CARGO MAIN**

[Freighter Airplane]

Condition: Main deck cargo compartment smoke detection is failed.

**DET FIRE ENG L, R**

Condition: Engine fire and overheat detection is failed.



DRAFT

**[ ] FIRE CARGO AFT**

[Passenger Airplane]

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

- 1 AFT CARGO FIRE ARM switch . . . . . Confirm . . . . . ARMED
- 2 CARGO FIRE DISCH switch . . . . . Push and hold for 1 second
- 3 Choose one:
  - ◆ On the **ground**:  
**Warning! Inform ground personnel  
NOT to open any cargo door  
until all passengers and crew  
have exited the airplane and  
fire fighting equipment is  
nearby.**
  - ◆ In flight:  
**►► Go to step 4**
- 4 LDG ALT selector . . . . . PULL ON, set 8000  
This minimizes extinguisher agent leakage out of the compartment.

[Lower Crew Rest Compartment]

- 5 Establish cabin communications. Advise the cabin to:

▼ Continued on next page ▼

▼ FIRE CARGO AFT continued ▼

Evacuate the lower crew rest compartment.

Close the hatches.

6 Plan to land at the nearest suitable airport.

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

LANDING ALTITUDE

8 **When** at top of descent:

LDG ALT selector ..... Push off

9 **Checklist Complete Except Deferred Items**

▼ Continued on next page ▼

DRAFT

**▼FIRE CARGO AFT continued▼****Deferred Items****Descent Checklist**

- |                             |                            |
|-----------------------------|----------------------------|
| Recall . . . . .            | Checked                    |
| Notes. . . . .              | Checked                    |
| Autobrake . . . . .         | _____                      |
| Landing data . . . . .      | VREF _____, Minimums _____ |
| Approach briefing . . . . . | Completed                  |

**Approach Checklist**

- |                      |       |
|----------------------|-------|
| Altimeters . . . . . | _____ |
|----------------------|-------|

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

**| Landing Checklist**

- |                        |       |
|------------------------|-------|
| Speedbrake . . . . .   | ARMED |
| Landing gear . . . . . | DOWN  |
| Flaps . . . . .        | _____ |



**[ ] FIRE CARGO AFT**

[Freighter Airplane]

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

- 1 LWR AFT CARGO FIRE ARM switch . . . . . Confirm. . . . . ARMED
- 2 CARGO FIRE DEPR/DISCH switch . . . . . Push and hold for 1 second
- 3 Choose one:
  - ◆ On the **ground**:

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

■ ■ ■ ■
  - ◆ In flight:

►► Go to step 4
- 4 LDG ALT selector . . . . . PULL ON, set 8000  
This minimizes extinguisher agent leakage out of the compartment.
- 5 Plan to land at the nearest suitable airport.

▼ Continued on next page ▼

▼FIRE CARGO AFT continued▼

**Note:** Equipment cooling normal mode is inoperative. After 30 minutes of operation at low altitude and low cabin differential pressure, electronic equipment and displays may fail.

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

EQUIP COOLING OVRD

LANDING ALTITUDE

- 7 **When** at top of descent:

LDG ALT selector ..... Push off

**8 Checklist Complete Except Deferred Items**

Deferred Items

**Descent Checklist**

Recall .....	.....	Checked
Notes .....	.....	Checked
Autobrake .....	.....	_____
Landing data .....	VREF ___, Minimums ___,	_____
Approach briefing .....	.....	Completed

**Approach Checklist**

Altimeters .....	.....	_____
------------------	-------	-------

▼ Continued on next page ▼



## ▼FIRE CARGO AFT continued▼

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

**Landing Checklist**

Speedbrake ..... ARMED

Landing gear ..... DOWN

Flaps ..... 

DRAFT

**[ ] FIRE CARGO FWD**

[Passenger Airplane]

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

- 1 FWD CARGO FIRE ARM switch . . . . . Confirm . . . . . ARMED
- 2 CARGO FIRE DISCH switch . . . . . Push and hold for 1 second
- 3 Choose one:
  - ◆ On the **ground**:  
**Warning! Inform ground personnel  
NOT to open any cargo door  
until all passengers and crew  
have exited the airplane and  
fire fighting equipment is  
nearby.**  
◆ In flight:  
**►► Go to step 4**
- 4 LDG ALT selector . . . . . PULL ON, set 8000  
This minimizes extinguisher agent leakage out of the compartment.
- 5 Plan to land at the nearest suitable airport.

▼ Continued on next page ▼

**▼ FIRE CARGO FWD continued ▼**

**Note:** Equipment cooling normal mode is inoperative. After 30 minutes of operation at low altitude and low cabin differential pressure, electronic equipment and displays may fail.

- 6 Do **not** accomplish the following checklists:

EQUIP COOLING OVRD

LANDING ALTITUDE

- 7 **When** at top of descent:

LDG ALT selector . . . . . Push off

- 8 **Checklist Complete Except Deferred Items**

**▼ Continued on next page ▼**

**▼FIRE CARGO FWD continued▼****Deferred Items****Descent Checklist**

- |                             |                            |
|-----------------------------|----------------------------|
| Recall . . . . .            | Checked                    |
| Notes. . . . .              | Checked                    |
| Autobrake . . . . .         | _____                      |
| Landing data . . . . .      | VREF _____, Minimums _____ |
| Approach briefing . . . . . | Completed                  |

**Approach Checklist**

- |                      |       |
|----------------------|-------|
| Altimeters . . . . . | _____ |
|----------------------|-------|

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

**| Landing Checklist**

- |                        |       |
|------------------------|-------|
| Speedbrake . . . . .   | ARMED |
| Landing gear . . . . . | DOWN  |
| Flaps . . . . .        | _____ |



**[] FIRE CARGO FWD**

[Freighter Airplane]

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

- 1 LWR FWD CARGO FIRE ARM switch . . . . . Confirm. . . . . ARMED
- 2 CARGO FIRE DEPR/DISCH switch . . . . . Push and hold for 1 second
- 3 Choose one:
  - ◆ On the **ground**:

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

■ ■ ■ ■
  - ◆ In flight:

**►► Go to step 4**
- 4 LDG ALT selector . . . . . PULL ON, set 8000  
This minimizes extinguisher agent leakage out of the compartment.
- 5 Plan to land at the nearest suitable airport.

▼ Continued on next page ▼

**▼ FIRE CARGO FWD continued ▼**

**Note:** Equipment cooling normal mode is inoperative. After 30 minutes of operation at low altitude and low cabin differential pressure, electronic equipment and displays may fail.

- 6 Do **not** accomplish the following checklists:

EQUIP COOLING OVRD

LANDING ALTITUDE

- 7 **When** at top of descent:

LDG ALT selector ..... Push off

**8 Checklist Complete Except Deferred Items**

**Deferred Items**

**Descent Checklist**

Recall ..... Checked

Notes ..... Checked

Autobrake ..... \_\_\_\_\_

Landing data ..... VREF \_\_\_, Minimums \_\_\_\_

Approach briefing ..... Completed

**Approach Checklist**

Altimeters ..... \_\_\_\_\_

**▼ Continued on next page ▼**

**▼ FIRE CARGO FWD continued ▼**

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

**Landing Checklist**

Speedbrake ..... ARMED

Landing gear ..... DOWN

Flaps ..... 

DRAFT

**[ ] FIRE CARGO MAIN DECK**

[Freighter Airplane]

Condition: Smoke is detected in the main deck cargo compartment.

- 1 Don oxygen masks and smoke goggles.
- 2 Establish crew and cabin communications.
- 3 Choose one:

◆ On the **ground**:

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



◆ In flight:

►► Go to step 4

[Gaseous Oxygen (Standard)]

- 4 SUPRNMRY OXYGEN switch . . . . . Push to ON and hold for 1 second
- 5 MAIN DK ALERT switch . . . . . Push
- 6 FWD OUTFLOW VALVE switch . . . . . MAN
- 7 FWD OUTFLOW VALVE  
MANUAL switch . . . . . Hold in CLOSE until  
the FWD outflow valve  
indication shows fully closed

▼ Continued on next page ▼

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**▼ FIRE CARGO MAIN DECK continued ▼**

- 8 MAIN DECK CARGO  
FIRE ARM switch . . . . . Confirm. . . . . ARMED
- 9 L TRIM AIR switch . . . . . Off
- 10 CARGO FIRE DEPR/DISCH  
switch . . . . . Push and  
hold for 1 second

**Note:** When the trim air system is off, the flight deck and cabin may become very cold.

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

PACK R  
TRIM AIR L  
CABIN ALTITUDE  
OUTFLOW VALVE FWD

- 12 **When** conditions and terrain allow, climb or descend to 23,000 feet.

- 13 **When** at level off:

FWD OUTFLOW VALVE switch . . . . . AUTO  
L TRIM AIR switch . . . . . ON

- 14 Plan to land at the nearest suitable airport.

**▼ Continued on next page ▼**

**▼FIRE CARGO MAIN DECK continued▼**

**Note:** While smoke is detected in the main deck cargo compartment, lower cargo smoke detection is inhibited. Smoke from the main deck may enter lower cargo compartments. After smoke clears from the main deck, a lower cargo fire warning may occur. If the FIRE CARGO AFT or FIRE CARGO FWD warning occurs, do the checklist for that warning.

**15 When at top of descent:**

L TRIM AIR switch ..... Off

**16 Checklist Complete Except Deferred Items****Deferred Items****Descent Checklist**

Recall ..... Checked  
Notes ..... Checked  
Autobrake ..... \_\_\_\_\_  
Landing data ..... VREF \_\_\_, Minimums \_\_\_\_  
Approach briefing ..... Completed

**Approach Checklist**

Altimeters ..... \_\_\_\_\_

**▼ Continued on next page ▼**

**PMDG****DO NOT USE FOR FLIGHT**

777 Flight Crew Operations Manual

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**▼ FIRE CARGO MAIN DECK continued ▼**

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

**Landing Checklist**

Speedbrake ..... ARMED

Landing gear ..... DOWN

Flaps ..... 

DRAFT

**[ ] FIRE WHEEL WELL**

Condition: Fire is detected in a main wheel well.

- 1 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 Plan to land at the nearest suitable airport.
- 4 Flight with the gear down increases fuel consumption and decreases climb performance. Refer to the Gear Down performance tables in the Performance Inflight chapter for flight planning.
- 5 Choose one:
  - ◆ Gear **does not need to be retracted** for airplane performance:  
■ ■ ■ ■
  - ◆ Gear **must be retracted** for airplane performance:  
**►► Go to step 6**
- 6 When the FIRE WHEEL WELL message blanks:  
**Wait** 20 minutes. This ensures the fire is extinguished.  
Landing gear lever . . . . . UP  
■ ■ ■ ■

**[ ] OVERHEAT ENG L, R**

Condition: An overheat is detected in the engine.

- 1 ENG BLEED AIR switch  
(affected side) . . . . . Off
- 2 A/T ARM switch  
(affected side) . . . . Confirm. . . . . OFF
- 3 Thrust lever  
(affected side) . . . . Confirm. . . . Retard  
slowly until the  
OVERHEAT ENG message  
blanks or the thrust lever is at idle
- 4 Do **not** accomplish the following checklist:

**AUTOTHROTTLE**

- 5 Choose one:

**◆ OVERHEAT ENG message **blanks**:**

**Note:** Run the engine at a thrust setting  
that keeps the OVERHEAT ENG  
message blank.


**◆ OVERHEAT ENG message **stays shown**:**

**►► Go to step 6**

- 6 FUEL CONTROL switch  
(affected side) . . . . Confirm. . . . . CUTOFF
- 7 APU selector  
(if APU available) . . . . . START, then ON
- 8 Transponder mode selector . . . . . TA ONLY

▼ Continued on next page ▼

▼OVERHEAT ENG L, R continued▼

9 Plan to land at the nearest suitable airport.

10 Choose one:

- ◆ Landing using flaps **20**:

GND PROX FLAP OVRD switch . . . . OVRD

**Note:** Use flaps 20 and VREF 20 for landing and flaps 5 for go-around.

►►Go to step 11

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

**Note:** Use flaps 30 and VREF 30 for landing and flaps 20 for go-around.



## 11 Checklist Complete Except Deferred Items

### Deferred Items

#### Descent Checklist

Recall . . . . .	Checked
Notes. . . . .	Checked
Autobrake . . . . .	_____
Landing data . . . . .	<b>VREF 20 ____, Minimums ____</b>
Approach briefing . . . . .	Completed

#### Approach Checklist

Altimeters . . . . .	_____
----------------------	-------

▼ Continued on next page ▼

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**▼OVERHEAT ENG L, R continued▼****Landing Checklist**

Speedbrake ..... ARMED  
Landing gear ..... DOWN  
Flaps ..... 20

**SMOKE BBAND UPR DR 2****[Option]**

Condition: Smoke is detected in the Connexion broadband system located in door 2 upper compartment. System power is automatically shutdown.

**[ ] SMOKE BBAND UPR DR 2**

Condition: This is a nuisance message.

**Note:** No crew action is needed.



**[ ] SMOKE COMPT UPR DR 2**

[Option]

Condition: Smoke is detected in a compartment.

Objective: To coordinate with the cabin to locate and remove the source of the smoke.

- 1 Establish cabin communications.
- 2 Choose one:

◆ Smoke is **persistent**:

Plan to land at the nearest suitable airport.



◆ Smoke has **cleared**:



**PMDG****DO NOT USE FOR FLIGHT**

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**[ ] SMOKE COMPT UPR DR 4****[Option]**

Condition: Smoke is detected in a compartment.

Objective: To coordinate with the cabin to locate and remove the source of the smoke.

1 Establish cabin communications.

2 Choose one:

◆ Smoke is **persistent**:

Plan to land at the nearest suitable airport.



◆ Smoke has **cleared**:

**SMOKE CREW REST F/D****[Option]**

Condition: Smoke is detected in the crew rest area.



**[ ] SMOKE CREW REST LWR**

[Option]

Condition: Smoke is detected in the crew rest area.

Objective: To coordinate with the cabin to locate and remove the source of the smoke.

- 1 Establish cabin communications.
- 2 Choose one:

◆Smoke is **persistent**:

Plan to land at the nearest suitable airport.



◆Smoke has **cleared**:

**SMOKE CREW REST MAIN**

[Option]

Condition: Smoke is detected in the crew rest area.

**[ ] SMOKE EQUIP COOLING**

[Freighter Airplane]

Condition: Smoke is detected in the equipment cooling system.

- 1 **Wait** 2 minutes. This allows time for any smoke in the system to clear.
- 2 EQUIP COOLING switch . . . . . Off, then AUTO

▼ Continued on next page ▼

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**▼ SMOKE EQUIP COOLING continued▼**

3 Choose one:

◆ SMOKE EQUIP COOLING message **blanks**:



◆ SMOKE EQUIP COOLING message **stays shown**:

Plan to land at the nearest suitable airport.

**Note:** After 30 minutes of operation at low altitude and low cabin differential pressure, electronic equipment and displays may fail.

Do **not** accomplish the following checklist:

EQUIP COOLING OVRD



## Smoke or Fumes Removal

Condition: Smoke or fumes removal is needed.

- 1 Do this checklist **only** when directed by the Smoke, Fire or Fumes checklist.
- 2 Do not delay landing in an attempt to complete the following steps.  
**[Passenger Airplane]**
- 3 Close the flight deck door.
- 4 EQUIP COOLING switch . . . . . Off

**Note:** After 30 minutes of operation at low altitude and low cabin differential pressure, electronic equipment and displays may fail.

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

EQUIP COOLING OVRD

**[Passenger Airplane]**

- 6 Choose one:
  - ◆ Most smoke or fumes are in the cabin **forward** of mid-wing:  
**►► Go to step 8**
  - ◆ Most smoke or fumes are in the cabin **aft** of mid-wing:  
**►► Go to step 11**

**▼ Continued on next page ▼**



## ▼ Smoke or Fumes Removal continued ▼

[Freighter Airplane]

7 Choose one:

- ◆ Most smoke or fumes are in the **flight deck or supernumerary area**:

►► Go to step 8

- ◆ Most smoke or fumes are in the **main deck cargo compartment**:

►► Go to step 11

8 AFT OUTFLOW VALVE switch . . . . . MAN

9 AFT OUTFLOW VALVE  
MANUAL switch . . . . . Hold in CLOSE until  
the AFT outflow valve  
indication shows fully closed10 Do **not** accomplish the following checklist:

OUTFLOW VALVE AFT

►► Go to the Smoke, Fire or Fumes checklist on  
page 8.7 and do the rest of the steps.



11 FWD OUTFLOW VALVE switch. . . . . MAN

12 FWD OUTFLOW VALVE  
MANUAL switch . . . . . Hold in CLOSE until  
the FWD outflow valve  
indication shows fully closed13 Do **not** accomplish the following checklist:

OUTFLOW VALVE FWD

▼ Continued on next page ▼

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**▼ Smoke or Fumes Removal continued ▼**

►► Go to the Smoke, Fire or Fumes checklist on page 8.7 and do the rest of the steps.

**[ ] SMOKE REST UPR DR 1**

[Option]

Condition: Smoke is detected in the crew rest area.

Objective: To coordinate with the cabin to locate and remove the source of the smoke.

- 1 Establish cabin communications.
- 2 Choose one:

◆ Smoke is **persistent**:

Plan to land at the nearest suitable airport.



◆ Smoke has **cleared**:

**[ ] SMOKE REST UPR DR 3**

[Option]

Condition: Smoke is detected in the crew rest area.

Objective: To coordinate with the cabin to locate and remove the source of the smoke.

- 1 Establish cabin communications.

**▼ Continued on next page ▼**

## ▼SMOKE REST UPR DR 3 continued▼

2 Choose one:

◆ Smoke is **persistent**:

Plan to land at the nearest suitable airport.



◆ Smoke has **cleared**:

**[ ] SMOKE REST UPR DR 4**

[Option]

Condition: Smoke is detected in the crew rest area.

Objective: To coordinate with the cabin to locate and remove the source of the smoke.

1 Establish cabin communications.

2 Choose one:

◆ Smoke is **persistent**:

Plan to land at the nearest suitable airport.



◆ Smoke has **cleared**:



**[ ] SMOKE REST UPR DR 5**

[Option]

Condition: Smoke is detected in the crew rest area.

Objective: To coordinate with the cabin to locate and remove the source of the smoke.

- 1 Establish cabin communications.
- 2 Choose one:

◆Smoke is **persistent**:

Plan to land at the nearest suitable airport.



◆Smoke has **cleared**:

**SMOKE LAVATORY**

[Option on Passenger Airplane]

Condition: Smoke is detected in one or more lavatories.

**SMOKE LAVATORY**

[Freighter Airplane]

Condition: Smoke is detected in the lavatory.



**SMOKE LAV/COMPT**

[Option on Passenger Airplane]

Condition: Smoke is detected in one or more lavatories,  
or other enclosed area.



DRAFT

Intentionally  
Blank

DRAFT

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## [ ] STABILIZER

Condition: One of these occurs:

- Stabilizer movement without a signal to trim
- The stabilizer is failed

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

2 Do not exceed the current airspeed.

3 The stabilizer is inoperative. Pitch trim is available in the normal flight control mode.

4 GND PROX FLAP OVRD switch . . . . . OVRD

**Note:** Use flaps 20 and VREF 30 + 20 for landing.  
This gives sufficient elevator authority for landing.

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

FLIGHT CONTROLS

6 Checklist Complete Except Deferred Items

▼ Continued on next page ▼

**▼STABILIZER continued▼****Deferred Items****Descent Checklist**

Recall . . . . .	Checked
Notes. . . . .	Checked
Autobrake . . . . .	_____
Landing data . . . . .	<b>VREF 30 + 20 _____, Minimums _____</b>
Approach briefing . . . . .	Completed

**Approach Checklist**

Altimeters . . . . .	_____
----------------------	-------

**Landing Checklist**

Speedbrake . . . . .	ARMED
Landing gear . . . . .	DOWN
Flaps . . . . .	<b>20</b>



**[ ] AUTO SPEEDBRAKE**

Condition: An automatic speedbrake fault occurs.

**Note:** Do not arm the speedbrake lever. This prevents inadvertent in-flight speedbrake extension.

Manually extend the speedbrakes after landing.

**1 Checklist Complete Except Deferred Items****Deferred Items****Descent Checklist**

Recall .....	.....	Checked
Notes .....	.....	Checked
Autobrake .....	.....	.....
Landing data .....	VREF ___, Minimums ___,	
Approach briefing .....	.....	Completed

**Approach Checklist**

Altimeters .....	.....
------------------	-------

**Landing Checklist**

Speedbrake .....	.....	DOWN
Landing gear .....	.....	DOWN
Flaps .....	.....	.....



**[ ] FLAPS DRIVE**

Condition: The flap drive mechanism is failed.

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

2 GND PROX FLAP OVRD switch . . . . . OVRD

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

3 Choose one:

◆ Flap position is **5 or less**

**Note:** Move the FLAP lever to 1 and use VREF 30 + 40 for landing. This ensures the slats are extended.

►► Go to step 4

◆ Flap position is **between 5 and 20**

**Note:** Use current flaps and VREF 30 + 20 for landing.

►► Go to step 4

◆ Flap position is **20 or greater**

**Note:** Use current flaps and VREF 20 for landing.

►► Go to step 4

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

FLAPS PRIMARY FAIL

▼ Continued on next page ▼

▼FLAPS DRIVE continued▼

## 5 Checklist Complete Except Deferred Items

### Deferred Items

#### Descent Checklist

Recall .....	..... Checked
Notes .....	..... Checked
Autobrake .....	..... _____
Landing data .....	<b>VREF as directed by checklist, Minimums</b> _____
Approach briefing .....	..... Completed

#### Approach Checklist

Altimeters .....	..... _____
------------------	-------------

#### Landing Checklist

Speedbrake .....	..... ARMED
Landing gear .....	..... DOWN
Flaps .....	<b>As directed by checklist</b>



**[ ] FLAPS PRIMARY FAIL**

Condition: The flaps primary mode is failed.

1 GND PROX FLAP OVRD switch . . . . . OVRD

**Note:** Plan more time for slower flap operation.

Use flaps 20 and VREF 20 for landing. This gives improved go-around performance.

**2 Checklist Complete Except Deferred Items****Deferred Items****Descent Checklist**

Recall . . . . . Checked

Notes. . . . . Checked

Autobrake . . . . . \_\_\_\_\_

| Landing data . . . . . **VREF 20 \_\_\_\_, Minimums \_\_\_\_**

Approach briefing . . . . . Completed

**Approach Checklist**

Altimeters . . . . . \_\_\_\_\_

**Landing Checklist**

Speedbrake . . . . . ARMED

Landing gear . . . . . DOWN

Flaps . . . . . **20**



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**[ ] FLAP/SLAT CONTROL**

Condition: The flap/slat electronics units are failed.

**1 If flap retraction is needed:**

FLAP lever ..... UP

This allows the maximum speed indication on the PFD to increase to Vmo/Mmo.

ALTN FLAPS ARM switch ..... ALTN

Alternate flaps selector ..... RET

Monitor airspeed during retraction.

**2 GND PROX FLAP OVRD switch ..... OVRD**

**Note:** Plan more time for alternate slat and flap extension.

Use flaps 20 and VREF 20 for landing. The alternate mode is limited to a maximum of flaps 20.

**3 Checklist Complete Except Deferred Items**

▼ Continued on next page ▼

## ▼FLAP/SLAT CONTROL continued▼

**Deferred Items**
**Descent Checklist**

Recall . . . . .	Checked
Notes . . . . .	Checked
Autobrake . . . . .	—
Landing data . . . . .	<b>VREF 20</b> ____, <b>Minimums</b> ____
Approach briefing . . . . .	Completed

**Approach Checklist**

Altimeters . . . . .	—
----------------------	---

**Alternate flaps extension**

ALTN FLAPS ARM switch . . . . .	ALTN
Alternate flaps selector . . . . .	EXT
Monitor airspeed during extension.	

**Landing Checklist**

Speedbrake . . . . .	ARMED
Landing gear . . . . .	DOWN
Flaps . . . . .	<b>20</b>



**[ ] FLIGHT CONTROL MODE**

Condition: The flight control system is in the secondary mode.

- 1 PRIMARY FLIGHT COMPUTERS  
disconnect switch . . . . . DISC, then AUTO
- 2 Choose one:
  - ◆ FLIGHT CONTROL MODE message **blanks**:  
■ ■ ■ ■
  - ◆ FLIGHT CONTROL MODE message **stays shown**:  
**►► Go to step 3**
- 3 Avoid abrupt control inputs. The airplane response is changed by simplified elevator feel and rudder ratio systems.
- 4 GND PROX FLAP OVRD switch . . . . . OVRD

**Note: Inoperative Items****Autopilot inop****Envelope protection functions inop****▼ Continued on next page ▼**

**▼ FLIGHT CONTROL MODE continued ▼**

**Note:** The yaw damper is degraded.

Manual control inputs are needed to compensate for asymmetrical thrust conditions.

Use flaps 20 and VREF 20 for landing. This ensures sufficient pitch trim capability for landing

Do not arm the speedbrake lever. This prevents inadvertent in-flight speedbrake extension.

Manually extend the speedbrakes after landing.

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

AUTO SPEEDBRAKE

THRUST ASYM COMP

**6 Checklist Complete Except Deferred Items**

**▼ Continued on next page ▼**

**▼FLIGHT CONTROL MODE continued▼****Deferred Items****Descent Checklist**

- Recall ..... Checked  
Notes. .... Checked  
Autobrake ..... \_\_\_\_\_  
| Landing data ..... **VREF 20** \_\_\_, **Minimums** \_\_\_\_  
Approach briefing ..... Completed
- 

**Approach Checklist**

- Altimeters ..... \_\_\_\_\_
- 

**Landing Checklist**

- Speedbrake ..... **DOWN**  
Landing gear ..... DOWN  
Flaps ..... **20**  


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**[ ] FLIGHT CONTROLS**

Condition: One or more of these occur:

- Two or more flight control surfaces are inoperative
- Other faults in the flight control system are detected

- 1 Handling qualities are degraded. Pitch and roll control capability is reduced with fewer operating control surfaces.
- 2 Plan to land at the nearest suitable airport.
- 3 GND PROX FLAP OVRD switch . . . . . OVRD

**Note:** Use flaps 20 and VREF 30 + 20 for landing. Higher approach speeds improve airplane maneuvering characteristics.

Crosswind limit for landing is 20 knots.

Roll rate may be reduced in flight.

Speedbrake effectiveness may be reduced in flight and during landing.

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

SPOILERS

- 5 **Checklist Complete Except Deferred Items**

▼ Continued on next page ▼



## ▼FLIGHT CONTROLS continued▼

## Deferred Items

## Descent Checklist

Recall . . . . .	Checked
Notes . . . . .	Checked
Autobrake . . . . .	—
Landing data . . . . .	<b>VREF 30 + 20</b> <u>  </u> , <b>Minimums</b> <u>  </u>
Approach briefing . . . . .	Completed

## Approach Checklist

Altimeters . . . . .
----------------------

## Landing Checklist

Speedbrake . . . . .	ARMED
Landing gear . . . . .	DOWN
Flaps . . . . .	<b>20</b>



## FLT CONTROL VALVE

Condition: One or more of these occur:

- One or more flight control shutoff valves are failed closed
- One or more flight control shutoff switches are in shutoff



## Jammed Flight Controls

Condition: Flight controls are jammed or restricted in roll, pitch, or yaw.

- 1 Autopilot disconnect switch . . . . . Push
- 2 Autothrottle disconnect switch . . . . . Push
- 3 Overpower the jammed or restricted system.

Use maximum force, including a combined effort of both pilots, as needed. A maximum two-pilot effort on the controls will not damage the flight controls.

- 4 Choose one:

◆ Controls are **normal**:

►► Go to step 5

◆ Controls stay **jammed or restricted**:

**Note:** Control may be limited to one pilot.

If the aileron controls are jammed, use the rudder and rudder trim to counter the effect of the jam.

▼ Continued on next page ▼



## ▼ Jammed Flight Controls continued ▼

**Note:** If elevator controls are jammed, use pitch trim to counter the effect of the jam. If more pitch trim authority is needed, select DISC on the primary flight computers disconnect switch. This puts the flight control system in direct mode. In direct mode, pitch trim moves slower than in normal mode.

If the rudder controls are jammed, use aileron and aileron trim to counter the effect of the jam.

Do not make abrupt thrust changes.

Extend or retract speedbrake slowly and smoothly.

Limit bank angle to 15 degrees.

The autopilot and autothrottle may be available to control the airplane.

Do not use autoland.

If the rudder controls are jammed, differential braking may be required for landing.

**►► Go to step 5**

5 Plan to land at the nearest suitable airport.



**[ ] PITCH DOWN AUTHORITY**

Condition: Pitch down authority is restricted.

- 1 Slower airspeeds assist nose down pitch control.  
The airplane is approaching its nose down pitch control limit.

**Note:** Avoid speedbrake use and rapid thrust increases. Only limited elevator authority is available to counter nose up pitching.



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**[ ] PITCH UP AUTHORITY**

Condition: Pitch up and flare authority are restricted.

- 1 Do not extend the flaps any further until on approach. The airplane is approaching its nose up pitch control limit.
- 2 GND PROX FLAP OVRD switch . . . . . OVRD

**Note:** Do not use autoland.

- 3 Choose one:

◆ Flap position is **15 or less**

**Note:** Use flaps 5 and VREF 30 + 40 for landing and flaps 5 for go-around. Higher approach speeds give better pitch up control authority.

►► Go to step 4

◆ Flap position is **20 or greater**

**Note:** Use flaps 20 and VREF 30 + 20 for landing. Higher approach speeds give better pitch up control authority.

►► Go to step 4

- 4 Checklist Complete Except Deferred Items

▼ Continued on next page ▼

**PMDG****DO NOT USE FOR FLIGHT**

777 Flight Crew Operations Manual

9.21

**▼PITCH UP AUTHORITY continued▼****Deferred Items****Descent Checklist**

Recall . . . . .	Checked
Notes . . . . .	Checked
Autobrake . . . . .	—
Landing data . . . . .	<b>VREF 30 + 40 ____ or VREF 30 + 20 ____, Minimums ____</b>
Approach briefing . . . . .	Completed

**Approach Checklist**

Altimeters . . . . .	—
----------------------	---

**Landing Checklist**

Speedbrake . . . . .	ARMED
Landing gear . . . . .	DOWN
Flaps . . . . .	<b>5 or 20</b>



**[ ] PRI FLIGHT COMPUTERS**

Condition: The flight control system is operating in the direct mode.

**Do not** accomplish this step if  
direct mode is desired.

- 1  PRIMARY FLIGHT COMPUTERS disconnect switch . . . . . DISC, then AUTO
- 2 Choose one:
  - ◆ PRI FLIGHT COMPUTERS message **blanks**:  
■ ■ ■ ■
  - ◆ PRI FLIGHT COMPUTERS message **stays shown**:  
**►►Go to step 3**
- 3 Avoid abrupt control inputs. The airplane response is changed by simplified elevator feel and rudder ratio systems.
- 4 GND PROX FLAP OVRD switch . . . . . OVRD

**Note: Inoperative Items****Autopilot inop****Envelope protection functions inop****Yaw damping inop****Rudder manual trim cancel switch inop****▼ Continued on next page ▼**

**▼ PRI FLIGHT COMPUTERS continued ▼**

**Note:** Manual control inputs are needed to compensate for asymmetrical thrust conditions.

Pitch trim moves slower than in normal mode.

Use flaps 20 and VREF 20 for landing. This ensures sufficient pitch trim capability for landing.

Do not arm the speedbrake lever. This prevents inadvertent in-flight speedbrake extension.

Manually extend the speedbrakes after landing.

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

AUTO SPEEDBRAKE

THRUST ASYM COMP

**6 Checklist Complete Except Deferred Items****▼ Continued on next page ▼**

**▼PRI FLIGHT COMPUTERS continued▼****Deferred Items****Descent Checklist**

- Recall ..... Checked  
Notes. .... Checked  
Autobrake ..... \_\_\_\_\_  
| Landing data ..... **VREF 20** \_\_\_, **Minimums** \_\_\_  
Approach briefing ..... Completed
- 

**Approach Checklist**

- Altimeters ..... \_\_\_\_\_
- 

**Landing Checklist**

- Speedbrake ..... **DOWN**  
Landing gear ..... DOWN  
Flaps ..... **20**  


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**[ ] SLATS DRIVE**

Condition: The slat drive mechanism is failed.

- 1 Do not use alternate flaps. Asymmetry and uncommanded motion protection are not provided in alternate mode.
- 2 GND PROX FLAP OVRD switch . . . . . OVRD

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

Do not use autoland.

Use flaps 20 and VREF 30 + 30 for landing. This gives better handling qualities when the slats are not fully extended.

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

SLATS PRIMARY FAIL

- 4 **Checklist Complete Except Deferred Items**

▼ Continued on next page ▼



## ▼ SLATS DRIVE continued ▼

**Deferred Items****Descent Checklist**

Recall . . . . .	Checked
Notes . . . . .	Checked
Autobrake . . . . .	—
Landing data . . . . .	<b>VREF 30 + 30</b> <u>  </u> , <b>Minimums</b> <u>  </u>
Approach briefing . . . . .	Completed

**Approach Checklist**

Altimeters . . . . .	—
----------------------	---

**Landing Checklist**

Speedbrake . . . . .	ARMED
Landing gear . . . . .	DOWN
Flaps . . . . .	<b>20</b>



**[ ] SLATS PRIMARY FAIL**

Condition: The slats primary mode is failed.

**Note:** Plan more time for slower srat operation.

[777-200]

**Note:** The slats will extend beyond midrange when the airspeed is below 215 knots. For go-around, do not exceed 215 knots until the slats retract to midrange.



[777-200ER]

**Note:** The slats will extend beyond midrange when the airspeed is below 239 knots. For go-around, do not exceed 239 knots until the slats retract to midrange.



[777-300]

**Note:** The slats will extend beyond midrange when the airspeed is below 246 knots. For go-around, do not exceed 246 knots until the slats retract to midrange.



[777F, 777-200LR, 777-300ER]

**Note:** The slats will extend beyond midrange when the airspeed is below 256 knots. For go-around, do not exceed 256 knots until the slats retract to midrange.



**SPEEDBRAKE EXTENDED**

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
- A thrust lever is not at idle

**[ ] SPOILERS**

Condition: One or more spoiler pairs are failed.

**Note:** Roll rate may be reduced in flight.  
Speedbrake effectiveness may be reduced in flight and during landing.



**[ ] STAB GREENBAND**

Condition: The nose gear pressure sensor disagrees with the computed stabilizer greenband.

Objective: To verify the stabilizer greenband and airplane loading are correct.

1 Verify that takeoff thrust, takeoff flaps, gross weight, and CG are entered correctly.

2 Reset stab trim, if needed.

3 Choose one:

◆ STAB GREENBAND message **blanks**:



◆ STAB GREENBAND message **stays shown**:

►► Go to step 4

4 Verify airplane loading.

**[ ] STABILIZER C**

Condition: The center stabilizer control path is failed.

1 C STAB cutout switch . . . . . CUTOUT

**Note:** The captain's control wheel pitch trim switches may be inoperative.



**STABILIZER CUTOUT**

Condition: Both stabilizer cutout switches are in CUTOUT.

**[ ] STABILIZER R**

Condition: The right stabilizer control path is failed.

- 1 R STAB cutout switch . . . . . CUTOUT

**Note:** The first officer's control wheel pitch trim switches may be inoperative.

**[ ] THRUST ASYM COMP**

Condition: Thrust asymmetry compensation is failed or OFF.

- 1 THRUST ASYM COMP switch. . . . . Off, then AUTO
- 2 Choose one:

◆ THRUST ASYM COMP message **blanks**:



◆ THRUST ASYM COMP message **stays shown**:

**Note:** Manual control inputs are needed to compensate for asymmetric thrust conditions.



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## Airspeed Unreliable

**Condition:** The airspeed or Mach indications are suspected to be unreliable. (Items which may indicate unreliable airspeed are listed in the Additional Information section.)

- 1 Check the pitch attitude and thrust for the phase of flight.
- 2 **If** the pitch attitude or thrust are **not** normal for the phase of flight:

Autopilot disconnect switch . . . . . Push

Autothrottle disconnect switch . . . . . Push

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

Adjust the pitch attitude and thrust.

[GE Engines]

**Note:** The normal pitch attitude and thrust settings are available in the Flight With Unreliable Airspeed table in the Performance Inflight chapter.

Altitude, Vertical Speed, Reference N1, and Maximum N1 may be unreliable.

▼ Continued on next page ▼

**▼ Airspeed Unreliable continued▼****[PW Engines, RR Engines]**

**Note:** The normal pitch attitude and thrust settings are available in the Flight With Unreliable Airspeed table in the Performance Inflight chapter.

Altitude, Vertical Speed, Reference EPR, and Maximum EPR may be unreliable.

- 3 Compare the pitch attitude, thrust setting, and airspeed with the ground speed and the Flight With Unreliable Airspeed table in the Performance Inflight chapter.
- 4 Choose one:
  - ◆ Reliable airspeed data source **can** be determined:  
Use the reliable airspeed indication.  

  - ◆ Reliable airspeed data source can **not** be determined:  
**►► Go to step 5**
- 5 Adjust the pitch attitude and thrust for the phase of flight.
- 6 Maintain a normal pitch attitude and thrust setting for the phase of flight. Refer to the Flight With Unreliable Airspeed table in the Performance Inflight chapter.

**▼ Continued on next page ▼**

**▼Airspeed Unreliable continued▼**

**Note:** Maintain visual conditions if possible.

Establish landing configuration early.

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

Refer to ground speed on the ND and reported wind for approach.

**Additional Information**

The flight path vector is based on inertial sources and may be used as a reference in maintaining proper path control.

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 indications
- An amber line through one or more PFD flight mode annunciations
- Overspeed indications
- Radome damage or loss
- Simultaneous overspeed and stall warnings

One or more of the following EICAS messages may show:

**▼ Continued on next page ▼**

**▼Airspeed Unreliable continued▼**

AIRSPEED LOW  
GND PROX SYS  
HEAT PITOT C  
HEAT PITOT L  
HEAT PITOT R  
HEAT PITOT L+C+R  
NAV AIR DATA SYS  
OVERSPEED  
SGL SOURCE AIR DATA  
SGL SOURCE DISPLAYS  
WINDSHEAR SYS

**[ ] ALTN ATTITUDE**

Condition: Both pilots' AIR DATA/ATT source switches are in ALTN.

[\[Integrated Standby Flight Display\]](#)

**Note:** Both PFDs show the SAARU attitude information.

[\[Standby Flight Instruments\]](#)

**Note:** Both PFDs and the standby attitude indicator show the SAARU attitude information.



**BARO SET DISAGREE**

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

**DISPLAY SELECT PNL**

Condition: Left, center, or right CDU control of the display select panel is used.

**[ ] EFIS CONTROL PNL L, R**

Condition: One of these occurs:

- The EFIS control panel is failed
- CDU control of the EFIS is used

**Note:** Backup control of the EFIS is accessed from the CDU menu page.

**PVD SYS CAPT, F/O**

[Option]

Condition: The affected PVD is failed.

**SGL SOURCE AIR DATA**

Condition: Both PFDs use the same air data source.



**[ ] SGL SOURCE DISPLAYS**

Condition: Some or all display units use a single source of display data.

**Note:** Both PFDs and NDs or just both NDs show information generated from a single source. The lower center display unit may be blank or may not be capable of showing all normal formats. The left EFIS control panel controls either the right PFD and ND or the right ND only.

**SGL SOURCE RAD ALT**

Condition: Both PFDs use the same radio altimeter source.

**SINGLE SOURCE F/D**

Condition: Both PFDs use the same flight director source.



## Non-Normal Checklists

## Chapter NNC

## Flight Management, Navigation

## Section 11

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[] FMC
  

Condition: One of these occurs:

- The FMC selector is in L and the left FMC is failed
- The FMC selector is in R and the right FMC is failed
- Both FMCs are failed

- 1 LNAV and VNAV modes are inoperative. Select different autopilot roll and pitch modes.

**Note:** LNAV can be re-engaged. Plan to enter new waypoints by latitude and longitude into any CDU.

Manually tune navigation radios through the CDUs.

Refer to the Flap Maneuver Speed table below:

FLAP POSITION	MANEUVER SPEED
FLAPS UP	VREF30 + 80
FLAPS 1	VREF30 + 60
FLAPS 5	VREF30 + 40
FLAPS 15	VREF30 + 20
FLAPS 20	VREF30 + 20
FLAPS 25	VREF25
FLAPS 30	VREF30

- 2 LDG ALT selector . . . . . PULL ON, set manually
- 3 Do **not** accomplish the following checklist:

## LANDING ALTITUDE



**FMC L, R**

[Option]

Condition: An FMC is failed.

**FMC MESSAGE**

Condition: An alerting message is in the FMC scratchpad.

**FMC RUNWAY DISAGREE**

[Option]

Condition: Airplane is not on the FMC origin runway when takeoff is attempted.

**[ ] GPS**

[AIMS BP v14 and later]

Condition: Both GPS receivers are failed.

**Note:** The FMC uses inertial inputs only, unless radio updating is enabled.

If radio updating is allowed:

- Select the FMC REF NAV DATA page
- Select OFF for RAD NAV INHIBIT



**[ ] ILS ANTENNA**

Condition: Two or more ILS receivers do not use the correct antenna.

**Note:** AFDS may have difficulty capturing or tracking localizer or glideslope. The airplane path may be lower than indicated by the glideslope pointer.



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**[ ] NAV ADIRU INERTIAL**

Condition: The ADIRU cannot supply correct attitude, position, heading, track, and groundspeed data.

- 1 Heading information shows for 3 minutes after the NAV ADIRU INERTIAL message shows. If the airplane is in the polar region, heading information is removed immediately.
- 2 GPS continues to give position and track information.  
[\[ND Map Heading Up\]](#)
- 3 ND map display orientation changes from heading up to track up.  
[\[Gables ATC Control Panel\]](#)
- 4 Transponder ALT SOURCE selector ..... ALTN  
[\[Bendix ATC Control Panel\]](#)
- 5 XPDR switch..... RIGHT

**Note: Inoperative Items****FMC VNAV pages inop****FMC performance predictions inop****ND wind direction/speed and wind arrow inop****Autobrake inop****PFD flap maneuvering speeds inop**

Refer to the Flap Maneuver Speed table below:

**▼ Continued on next page ▼**



## ▼ NAV ADIRU INERTIAL continued ▼

FLAP POSITION	MANEUVER SPEED
FLAPS UP	VREF30 + 80
FLAPS 1	VREF30 + 60
FLAPS 5	VREF30 + 40
FLAPS 15	VREF30 + 20
FLAPS 20	VREF30 + 20
FLAPS 25	VREF25
FLAPS 30	VREF30

**Note: Inoperative AFDS Modes**

- LNAV
- VNAV
- TO/GA
- LOC
- GS
- FPA
- TRK HOLD/SEL

6 When the heading blanks and the SET HDG line shows on POS INIT page 1:

Enter the heading.

Re-engage the autopilot.

▼ Continued on next page ▼

**▼NAV ADIRU INERTIAL continued▼**

**Note:** Crosscheck heading periodically for drift with the magnetic compass and update heading as necessary. If magnetic compass information is unreliable or unavailable, track information may be used.

VOR course deviation is available in the ND VOR mode. ILS localizer and glideslope deviation raw data is available on both the PFD and the ND.

**Note:** If GPS is not available, the following additional items are inoperative:

- ND map mode
- active leg course and distance
- direct to waypoint function
- alternate page DIVERT NOW function
- navigation radio autotuning



**[ ] NAV AIR DATA SYS**

Condition: The three air data sources disagree.

- 1 Avoid abrupt control inputs. Airplane response is changed by simplified elevator feel and rudder ratio systems.
- 2 Crosscheck airspeed and altitude on the PFDs and standby flight instruments for accuracy. Each display is receiving data from an independent source.

**Note:** Normal pitch attitude and thrust settings are available in the Flight With Unreliable Airspeed table in the Performance Inflight chapter.

Select alternate air data/attitude source if airspeed or altitude on respective PFD is determined to be in error and airspeed or altitude on opposite side PFD is verified to be correct.

- 3 GND PROX FLAP OV RD switch . . . . . OV RD

**Note: Inoperative Items**

**Envelope protection functions inop**

**Autopilot inop**

**Flight directors inop**

**Autothrottles inop**

**PFD flap maneuvering speeds inop**

Refer to the Flap Maneuver Speed table below:

▼ Continued on next page ▼

**▼ NAV AIR DATA SYS continued ▼**

FLAP POSITION	MANEUVER SPEED
FLAPS UP	VREF30 + 80
FLAPS 1	VREF30 + 60
FLAPS 5	VREF30 + 40
FLAPS 15	VREF30 + 20
FLAPS 20	VREF30 + 20
FLAPS 25	VREF25
FLAPS 30	VREF30

**Note:** Yaw damper is degraded.

Manual control inputs are needed to compensate for asymmetric thrust conditions.

Use flaps 20 and VREF 20 for landing. This ensures sufficient pitch control for landing.

Do not arm speedbrake lever. This prevents inadvertent in-flight speedbrake extension.

Manually extend the speedbrakes after landing.

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

AUTO SPEEDBRAKE

FLIGHT CONTROL MODE

THRUST ASYM COMP

5 Checklist Complete Except Deferred Items

▼ Continued on next page ▼

**▼NAV AIR DATA SYS continued▼****Deferred Items****Descent Checklist**

Recall . . . . .	Checked
Notes . . . . .	Checked
Autobrake . . . . .	—
Landing data . . . . .	<b>VREF 20</b> <u>  </u> , <b>Minimums</b> <u>  </u>
Approach briefing . . . . .	Completed

**Approach Checklist**

Altimeters . . . . .	—
----------------------	---

**Landing Checklist**

Speedbrake . . . . .	<b>DOWN</b>
Landing gear . . . . .	DOWN
Flaps . . . . .	<b>20</b>



**[ ] NAV UNABLE RNP**

Condition: The actual navigational performance is not sufficient.

1 Choose one:

◆ On the **ground**:

Message may show with GPS disabled.



◆ In **flight**:

►► Go to step 2

2 Choose one:

◆ On a procedure or an airway **with** an RNP alerting requirement:

Select alternate procedure or airway. During an approach, start a go-around unless suitable visual references can be established and maintained.



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

Verify position.

**SINGLE SOURCE ILS**

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



**TRANSPOUNDER L, R**

Condition: A transponder fault occurs.



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## Non-Normal Checklists

## Fuel

## Chapter NNC

## Section 12

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**[ ] FUEL AUTO JETTISON**

Condition: One of these occurs:

- The total fuel quantity is less than or equal to the fuel to remain and a jettison nozzle valve is open
- The fuel jettison automatic shutoff is failed

Objective: To manually close the fuel jettison nozzle valves when fuel jettison is complete.

1 Choose one:

- ◆ The total fuel quantity is **less than or equal to** the FUEL to REMAIN:

FUEL JETTISON NOZZLE  
valve switches (both) . . . . . Off

FUEL JETTISON ARM switch . . . . . Off



- ◆ The total fuel quantity is **greater than** the FUEL to REMAIN:

[Metric Units]

►► Go to step 2

[English Units]

►► Go to step 3

▼ Continued on next page ▼

**▼ FUEL AUTO JETTISON continued ▼****[Metric Units]****2 Choose one:**

- ◆ One or more tank quantity displays are **blank**:

Determine the approximate jettison time using the following rates:

Fuel in center tank: 2500 kgs/minute

Center tank empty: 1400 kgs/minute

**►► Go to step 4**

- ◆ All tank quantity displays **stay shown**:

**►► Go to step 4**

**[English Units]****3 Choose one:**

- ◆ One or more tank quantity displays are **blank**:

Determine the approximate jettison time using the following rates:

Fuel in center tank: 5400 lbs/minute

Center tank empty: 3100 lbs/minute

**►► Go to step 4**

- ◆ All tank quantity displays **stay shown**:

**►► Go to step 4**

**4 FUEL JETTISON NOZZLE  
valve switches (both) . . . . . ON****▼ Continued on next page ▼**

▼FUEL AUTO JETTISON continued▼

5 When fuel jettison is complete:

- FUEL JETTISON NOZZLE  
valve switches (both) . . . . . Off  
FUEL JETTISON ARM switch . . . . . Off

6 Choose one:

◆ FUEL line on PERF INIT page is **blank**:

**Wait** 5 minutes. Manual entry of fuel quantity is not possible until 5 minutes after jettison is complete.

Enter the current estimated total fuel in the FUEL line box prompts on the PERF INIT page. This gives gross weight data for FMC performance calculations and allows VNAV to be re-engaged.

►► Go to step 7

◆ FUEL line on PERF INIT page **shows a fuel quantity**:

►► Go to step 7

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

FUEL JETTISON



**[] FUEL AUX XFR**

[Auxiliary Fuel Tank - One]

Condition: Auxiliary fuel fails to transfer or is transferring slower than normal.

Attempt only one reset.

- 1  AUX fuel switch . . . . . Off, then ON  
This resets the auxiliary transfer system.  
This allows transfer of fuel if it is transferring slower than normal.

2 **Wait** 10 minutes.

3 Choose one:

- ◆ FUEL AUX XFR message **blanks**:  

- ◆ FUEL AUX XFR message **stays shown** or **shows again**:

[Metric Units]

►► Go to step 4

[English Units]

►► Go to step 5

▼ Continued on next page ▼

**▼FUEL AUX XFR continued▼**

[Metric Units]

**4 Choose one:**

- ◆ FMC TAKEOFF REF CG is **less than 31%**:

All center tank fuel is usable.



- ◆ FMC TAKEOFF REF CG is **31%**:

**When** center tank quantity decreases to 4,600 kgs:

**►► Go to step 6**

- ◆ FMC TAKEOFF REF CG is **32% or 33%**:

**When** center tank quantity decreases to 5,900 kgs:

**►► Go to step 6**

**▼ Continued on next page ▼**

**▼FUEL AUX XFR continued▼**

[English Units]

5 Choose one:

◆ FMC TAKEOFF REF CG is **less than 31%**:

All center tank fuel is usable.



◆ FMC TAKEOFF REF CG is **31%**:

**When** center tank quantity decreases to 10,000 lbs:

**►► Go to step 6**

◆ FMC TAKEOFF REF CG is **32% or 33%**:

**When** center tank quantity decreases to 13,000 lbs:

**►► Go to step 6**

6 Fuel CENTER PUMPS switches (both)..... Off

**Note:** Remaining center tank fuel is unusable.  
Normal scavenge system operation  
decreases center tank quantity.

7 Select the PERF INIT page

8 FUEL..... Enter usable fuel quantity manually

Usable fuel quantity is total fuel minus unusable fuel. Unusable fuel is auxiliary tank quantity plus remaining center tank quantity.

9 ZFW ..... Enter adjusted ZFW manually

Adjusted ZFW is dispatch ZFW plus unusable fuel.



**[ ] FUEL CROSSFEED AFT**

Condition: The aft fuel crossfeed valve is not in the commanded position.

1 Choose one:

- ◆ AFT FUEL CROSSFEED switch is **on**:  
FWD FUEL CROSSFEED switch. . . . . On  
■ ■ ■ ■
- ◆ AFT FUEL CROSSFEED switch is **off**:  
■ ■ ■ ■

**[ ] FUEL CROSSFEED FWD**

Condition: The forward fuel crossfeed valve is not in the commanded position.

1 Choose one:

- ◆ FWD FUEL CROSSFEED switch is **on**:  
AFT FUEL CROSSFEED switch . . . . . On  
■ ■ ■ ■
- ◆ FWD FUEL CROSSFEED switch is **off**:  
■ ■ ■ ■

**[ ] FUEL DISAGREE**

[AIMS Blockpoint 2005 or later]

Condition: The totalizer fuel quantity and the FMC calculated fuel quantity disagree.

Objective: To decide if a fuel leak is suspected, and select the most accurate fuel value.

1 The FUEL DISAGREE message may be caused by a fuel leak. A fuel leak should be suspected if one or more of the following are true:

The total fuel remaining on EICAS is less than the planned fuel remaining.

An engine has excessive fuel flow.

One main tank is abnormally low.

On PROGRESS page 2, the totalizer is less than the calculated fuel.

The TOTALIZER fuel is the sum of the individual tank quantities.

The CALCULATED fuel is the totalizer value at engine start minus fuel used. Fuel used is calculated using the engine fuel flow sensors.

2 If a fuel leak is suspected:

**►►Go to the Fuel Leak checklist on page 12.16**

3 Select PROGRESS page 2.

▼ Continued on next page ▼

▼FUEL DISAGREE continued▼

- 4  Select TOTALIZER unless it is inaccurate.
- TOTALIZER or CALCULATED . . . . . Select the most accurate value
- ■ ■ ■

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**[] FUEL IMBALANCE**

Condition: There is a fuel imbalance between the main tanks.

Objective: To decide if a fuel leak is suspected, and balance fuel.

- 1 **If** an engine has low fuel flow and unusual engine indications, the FUEL IMBALANCE message may show due to an engine malfunction instead of a fuel leak.
- 2 The FUEL IMBALANCE message may be caused by a fuel leak. A fuel leak should be suspected if one or more of the following are true:

The total fuel remaining on EICAS is less than the planned fuel remaining.

An engine has excessive fuel flow.

One main tank is abnormally low.

On PROGRESS page 2, the totalizer is less than the calculated fuel.

The TOTALIZER fuel is the sum of the individual tank quantities.

The CALCULATED fuel is the totalizer value at engine start minus fuel used.

Fuel used is calculated using the engine fuel flow sensors.

- 3 **If** a fuel leak is suspected:

**►►Go to the Fuel Leak checklist on page 12.16**

▼ Continued on next page ▼

**▼ FUEL IMBALANCE continued ▼**

- 4 FUEL CROSSFEED switch (either) . . . . . On  
5 Choose one:

◆ **Left** main tank quantity is low:

L fuel PUMPS FWD and AFT switches (both) . . . . . Off

This allows fuel from the higher quantity tank to feed both engines.

Do **not** accomplish the following checklists:

FUEL PUMP L AFT

FUEL PUMP L FWD

►► Go to step 8

◆ **Right** main tank quantity is low:

►► Go to step 6

- 6 R fuel PUMPS FWD and AFT switches (both) . . . . . Off

This allows fuel from the higher quantity tank to feed both engines.

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

FUEL PUMP R AFT

FUEL PUMP R FWD

▼ Continued on next page ▼

**▼ FUEL IMBALANCE continued ▼****8 When fuel balancing is complete:**

Fuel PUMPS FWD and AFT  
switches (all) . . . . . ON  
FUEL CROSSFEED switches (both) . . . . . Off

**FUEL IN AUX**

[Auxiliary Fuel Tank]

Condition: The aux fuel switch is off with fuel in the auxiliary tank.

**FUEL IN CENTER**

Condition: The center tank fuel quantity is at the level where the pump switches must be ON.

**FUEL JETT NOZZLE L, R**

Condition: A jettison nozzle valve is not in the commanded position.



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## Fuel Jettison

Condition: Fuel jettison is needed.

- 1 FUEL JETTISON ARM switch . . . . . ARMED
- 2 Choose one:
  - ◆ FUEL TO REMAIN is **acceptable**:  
**►► Go to step 5**
  - ◆ FUEL TO REMAIN must be **changed**:  
[Auxiliary Fuel Tank]  
**►► Go to step 3**  
**►► Go to step 4**
- 3 If the FUEL AUX XFR message shows, auxiliary fuel will not be usable. Add the unusable auxiliary fuel quantity to the desired fuel to remain value.
- 4 FUEL TO REMAIN selector . . . . . PULL ON, set manually
- 5 FUEL JETTISON NOZZLE valve switches (both) . . . . . ON
- 6 Do **not** accomplish the following checklists:
  - FUEL AUX XFR
  - FUEL PUMP CENTER L
  - FUEL PUMP CENTER R
- 7 When fuel jettison is complete:  
FUEL JETTISON NOZZLE valve switches (both) . . . . . Off

▼ Continued on next page ▼

▼Fuel Jettison continued▼

FUEL JETTISON ARM switch . . . . . Off



[ ] FUEL JETTISON MAIN

Condition: The main tank fuel jettison system is failed.

- 1 Fuel jettison can occur only from the center tank.
- 2 Do **not** accomplish the following checklist:

FUEL JETTISON

- 3 When the center fuel tank is empty or the FUEL TO REMAIN quantity is reached:

FUEL JETTISON NOZZLE

valve switches (both) . . . . . Off

FUEL JETTISON ARM switch . . . . . Off



[ ] FUEL JETTISON SYS

Condition: The fuel jettison system is failed.

- 1 FUEL JETTISON NOZZLE  
valve switches (both) . . . . . Off
- 2 FUEL JETTISON ARM switch . . . . . Off
- 3 Do **not** accomplish the following checklist:

FUEL JETTISON



## Fuel Leak

Condition: A fuel leak is suspected for the reasons listed in the Additional Information section of this checklist.

Objective: To confirm there is a fuel leak. If confirmed, to isolate the leak to one of the following:

- engine
- main tank
- center tank

- 1 A diversion may be needed.
- 2 Fuel L PUMPS and R PUMPS switches (all) ..... ON
- 3 FUEL CROSSFEED switches (both) ..... Off
- 4 Fuel CENTER PUMPS switches (both) ..... Off

The FUEL IN CENTER message may show.

**[Auxiliary Fuel Tank]**

- 5 AUX fuel switch ..... Off

The FUEL IN AUX message may show.

**[Auxiliary Fuel Tank]**

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

FUEL AUX XFR

- 7 **The following steps check for an engine or main tank leak**
- 8 Record the main tank fuel quantities and the current time.

▼ Continued on next page ▼

▼ Fuel Leak continued ▼

- 9 An engine/main tank leak is confirmed if one or both of the following are true:

Fuel spray is observed from an engine, strut, or wing

[Metric Units]

A change in fuel imbalance of 500 kgs within 30 minutes or less

[English Units]

A change in fuel imbalance of 1,000 lbs within 30 minutes or less

- 10 Choose one:

◆ Engine/main tank leak is **confirmed**:

►► Go to step 26

◆ Engine/main tank leak is **not** confirmed:

►► Go to step 11

- 11 Choose one:

◆ FUEL IN CENTER message **is blank**:

Resume normal fuel management.



◆ FUEL IN CENTER message **shows**:

[777-200]

►► Go to step 12

[777-200ER, 777F, 777-200LR, 777-300, 777-300ER]

►► Go to step 15

▼ Continued on next page ▼

**▼ Fuel Leak continued ▼**

[777-200]

12 The leak may be from the center fuel pumps into the dry center wing area.

**Note:** Do not use center tank fuel.

[AIMS Blockpoint 2005 or later]

**Note:** If the FUEL DISAGREE message shows at any time, go to PROGRESS page 2 and select the CALCULATED fuel quantity.

[AIMS Blockpoint 2005 or later]

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

**FUEL DISAGREE**

**Note:** Do not use FMC fuel predictions.

14 Verify that sufficient fuel is available in the left and right main tanks to complete the flight.



[777-200ER, 777F, 777-200LR, 777-300, 777-300ER]

**15 The following steps check for a center tank leak**

16 Fuel CENTER PUMPS switches (both) . . . . . ON

**▼ Continued on next page ▼**

**▼ Fuel Leak continued ▼**

[Auxiliary Fuel Tank]

17 Choose one:

◆ FUEL IN AUX message **shows**:

AUX fuel switch . . . . . ON

►► Go to step 18

◆ FUEL IN AUX message **is blank**:

►► Go to step 18

18 Select PROGRESS page 2.

19 Record the totalizer and calculated fuel quantities, and the current time.

[Metric Units]

20 A center tank leak is confirmed if the difference between calculated and totalizer increases by 500 kgs within 30 minutes or less.

[English Units]

21 A center tank leak is confirmed if the difference between calculated and totalizer increases by 1,000 lbs within 30 minutes or less.

22 Choose one:

◆ Center tank leak is **confirmed**:

►► Go to step 23

◆ Center tank leak is **not** confirmed:

Resume normal fuel management.



▼ Continued on next page ▼

**▼ Fuel Leak continued ▼**

- 23 Continue to use all center tank fuel.
- 24 Verify that sufficient fuel is available in the left and right main tanks to complete the flight.  
[AIMS Blockpoint 2005 or later]

**Note:** If the FUEL DISAGREE message shows at any time, go to PROGRESS page 2 and select the TOTALIZER fuel quantity.

[AIMS Blockpoint 2005 or later]

- 25 Do **not** accomplish the following checklist:

**FUEL DISAGREE**

- 26 An engine/main tank leak is confirmed. The following steps shut down the engine to stop an engine fuel leak
- 27 The affected engine is on the side where the fuel quantity decreased faster.
- 28 A/T ARM switch  
(affected engine) . . . . . Confirm . . . . . OFF
- 29 Thrust lever  
(affected engine) . . . . . Confirm . . . . . Idle
- 30 FUEL CONTROL switch  
(affected engine) . . . . . Confirm . . . . . CUTOFF  
This closes the spar valve and stops an engine fuel leak.
- 31 APU selector  
(if APU available) . . . . . START, then ON

**▼ Continued on next page ▼**



## ▼ Fuel Leak continued ▼

32 Transponder mode selector . . . . . TA ONLY

[AIMS Blockpoint 2005 or later]

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

AUTOTHROTTLE

FUEL DISAGREE

[No Auxiliary Fuel Tank]

34 Choose one:

◆ FUEL QTY LOW message **shows**:

FUEL CROSSFEED  
switch (either) . . . . . On

This ensures that all fuel is available  
to the running engine.

►► Go to step 35

◆ FUEL QTY LOW message **is blank**:

►► Go to step 35

35 Choose one:

◆ FUEL IN CENTER message **shows**:

Fuel CENTER PUMP  
switch (**on side with**  
**running engine**) . . . . . ON

►► Go to step 39

◆ FUEL IN CENTER message **is blank**:

►► Go to step 39

▼ Continued on next page ▼

**▼ Fuel Leak continued ▼****[Auxiliary Fuel Tank]****36 Choose one:**

- ◆ FUEL QTY LOW message **shows**:  
FUEL CROSSFEED  
switch (either) ..... On  
This ensures that all fuel is available  
to the running engine.  
  
►► Go to step 37
- ◆ FUEL QTY LOW message **is blank**:  
►► Go to step 37

**37 Choose one:**

- ◆ FUEL IN CENTER message **shows**:  
Fuel CENTER PUMP  
switch (**on side with**  
**running engine**) ..... ON  
  
►► Go to step 38
- ◆ FUEL IN CENTER message **is blank**:  
►► Go to step 38

**▼ Continued on next page ▼**

▼ Fuel Leak continued ▼

38 Choose one:

- ◆ FUEL IN AUX message **shows**:  
AUX fuel switch . . . . . ON  
**►► Go to step 39**
- ◆ FUEL IN AUX message **is blank**:  
**►► Go to step 39**

39 Plan to land at the nearest suitable airport.

40 Choose one:

- ◆ Landing using flaps **20**:  
GND PROX FLAP OVRD switch . . . . OVRD  
**Note:** Use flaps 20 and VREF 20 for landing and flaps 5 for go-around.  
**►► Go to step 41**
- ◆ Landing using flaps **30 (if performance allows)**:  
**Note:** Use flaps 30 and VREF 30 for landing and flaps 20 for go-around.  
**►► Go to step 41**

41 **The following steps check for a main tank leak**

42 Select PROGRESS page 2.

▼ Continued on next page ▼

**▼ Fuel Leak continued ▼**

43 Record the totalizer and calculated fuel quantities, and the current time.

[Metric Units]

44 A main tank leak is confirmed if the difference between calculated and totalizer increases by 500 kgs within 30 minutes or less.

[English Units]

45 A main tank leak is confirmed if the difference between calculated and totalizer increases by 1,000 lbs within 30 minutes or less.

46 Choose one:

◆ Main tank leak is **confirmed**:

►► Go to step 47

◆ Main tank leak is **not** confirmed:

►► Go to step 50

47 The leak is not an engine fuel leak. The engine may be re-started.

48 For a long diversion, range may be improved by re-starting the engine and climbing.

**Note:** Do **not** balance fuel.

If the FUEL QTY LOW message shows at any time, do the FUEL QTY LOW checklist.

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

**FUEL IMBALANCE**

[AIMS Blockpoint 2005 or later]

**▼ Continued on next page ▼**



## ▼ Fuel Leak continued ▼

**Note:** If the FUEL DISAGREE message shows at any time, go to PROGRESS page 2 and select the TOTALIZER fuel quantity.

**►►Go to step 51**

50 The leak was an engine fuel leak.

**Note:** All remaining fuel can be used for the running engine. Use normal fuel management. When the FUEL IMBALANCE message shows, do the FUEL IMBALANCE checklist.

[AIMS Blockpoint 2005 or later]

**Note:** If the FUEL DISAGREE message shows at any time, go to PROGRESS page 2 and select the TOTALIZER fuel quantity.

**51 Checklist Complete Except Deferred Items**

▼ Continued on next page ▼

**▼ Fuel Leak continued ▼****Deferred Items****Descent Checklist**

- |                             |  |
|-----------------------------|--|
| Recall . . . . .            | Checked  |
| Notes. . . . .              | Checked  |
| Autobrake . . . . .         |  |
| Landing data . . . . .      | <b>VREF 20 ____ or<br/>VREF 30 ____, Minimums ____</b> |
| Approach briefing . . . . . | Completed  |

**Approach Checklist**

- |                      |  |
|----------------------|--|
| Altimeters . . . . . |  |
|----------------------|--|

**Landing Checklist**

- |                        |                 |
|------------------------|-----------------|
| Speedbrake . . . . .   | ARMED           |
| Landing gear . . . . . | DOWN            |
| Flaps . . . . .        | <b>20 or 30</b> |

**▼ Continued on next page ▼**

**▼ Fuel Leak continued ▼****Additional Information**

Reasons that a fuel leak should be suspected:

- A visual observation of fuel spray
- The total fuel quantity is decreasing at an abnormal rate
- An engine has excessive fuel flow

[AIMS Blockpoint 2005 or later]

- The FUEL DISAGREE message shows on EICAS
- The FUEL IMBALANCE message shows on EICAS
- The FUEL QTY LOW message shows on EICAS
- The INSUFFICIENT FUEL message shows on a CDU scratchpad

**FUEL LOW AUX**

[Auxiliary Fuel Tank]

Condition: The aux fuel switch is on and the auxiliary tank quantity is low.

**FUEL LOW CENTER**

Condition: The center tank fuel quantity is at the level where the pump switches must be off.



**[ ] FUEL PRESS ENG L, R**

Condition: The affected engine is on suction feed.

Objective: To fly at an altitude that ensures a sufficient supply of fuel to the engine.

1 Choose one:

◆ Airplane altitude is **at or below** 38,000 feet:

►► Go to step 6

◆ Airplane altitude is **above** 38,000 feet:

►► Go to step 2

2 FUEL CROSSFEED switch (either) . . . . . On

This allows fuel from the operative pump side to feed both engines.

3 Descend to 38,000 feet or lower.

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

FUEL PUMP AFT

FUEL PUMP FWD

5 **When** airplane altitude is at or below 38,000 feet:

►► Go to step 6

6 FUEL CROSSFEED switches (both) . . . . . Off

This restores main tank-to-engine fuel feed. The FUEL PRESS ENG message may show again.

▼ Continued on next page ▼



## ▼FUEL PRESS ENG L, R continued▼

**Note:** Do not climb above 38,000 feet for the rest of the flight.

Continue suction feed. Do not open the crossfeed valves unless an engine restart is needed.

If engine flameout occurs at any time, immediately open a fuel crossfeed valve. Close the crossfeed valves when the engine is operating normally.

Do not balance fuel.

[Metric Units]

**Note:** 200 kgs of fuel in the affected main tank is unusable.

[English Units]

**Note:** 500 lbs of fuel in the affected main tank is unusable.

7 Select the PERF INIT page.

[Metric Units]

8 Add 200 kgs to the required RESERVES.

[English Units]

9 Add 500 lbs to the required RESERVES.

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

#### FUEL IMBALANCE



**FUEL PRESS ENG L+R**

Condition: Fuel pressure to both engines is low on the ground with the engines shut down.

**[ ] FUEL PUMP CENTER L, R**

Condition: The pump pressure is low.

- 1 FUEL CROSSFEED switch (either) . . . . . On
- 2 Fuel CENTER PUMP switch (affected pump) . . . Off
- 3 Choose one:

◆ **At least one** center fuel pump output pressure is **normal**:



◆ **Both** center fuel pump output pressures are **low**:

►► Go to step 4

- 4 FUEL CROSSFEED switches (both) . . . . . Off
- 5 Check that available left and right main tank quantity is sufficient for the planned flight. The center tank fuel is not available.

**[ ] FUEL PUMP L AFT, FWD**

Condition: The left fuel pump pressure is low.

- 1 Fuel PUMP switch (affected pump) . . . . . Off



**[ ] FUEL PUMP R AFT, FWD**

Condition: The right fuel pump pressure is low.

- 1 Fuel PUMP switch (affected pump) . . . . . Off



DRAFT

**[ ] FUEL QTY LOW**

Condition: The fuel quantity is low in a main tank.

Objective: To decide if a fuel leak is suspected, and ensure that all fuel is available for use.

**Note:** Avoid high nose up attitude. Make thrust changes slowly and smoothly. This reduces the chance of uncovering fuel pumps.

1 The FUEL QTY LOW message may be caused by a fuel leak. A fuel leak should be suspected if one or more of the following are true:

The total fuel remaining on EICAS is less than the planned fuel remaining.

An engine has excessive fuel flow.

One main tank is abnormally low.

On PROGRESS page 2, the totalizer is less than the calculated fuel.

The TOTALIZER fuel is the sum of the individual tank quantities.

The CALCULATED fuel is the totalizer value at engine start minus fuel used.

Fuel used is calculated using the engine fuel flow sensors.

2 If a fuel leak is suspected:

**►►Go to the Fuel Leak checklist on page 12.16, then finish this checklist.**

▼ Continued on next page ▼

**▼FUEL QTY LOW continued▼**

- 3 FUEL CROSSFEED switch (either) . . . . . On

This ensures that fuel is available to both engines if the low tank empties.

[Auxiliary Fuel Tank]

- 4 AUX fuel switch . . . . . ON

- 5 Fuel PUMPS switches (all) . . . . . ON

This ensures that all fuel is available for use.

- 6 Plan to land at the nearest suitable airport.

- 7 GND PROX FLAP OV RD switch . . . . . OV RD

**Note:** Use flaps 20 and VREF 20 for landing.

Increased speed gives improved elevator control for landing flare in the event of a dual engine flameout.

## 8 Checklist Complete Except Deferred Items

▼ Continued on next page ▼

**▼FUEL QTY LOW continued▼****Deferred Items****Descent Checklist**

- Recall ..... Checked  
Notes. .... Checked  
Autobrake ..... \_\_\_\_\_  
| Landing data ..... **VREF 20** \_\_\_, **Minimums** \_\_\_\_  
Approach briefing ..... Completed
- 

**Approach Checklist**

- Altimeters ..... \_\_\_\_\_
- 

**Landing Checklist**

- Speedbrake ..... ARMED  
Landing gear ..... DOWN  
Flaps ..... **20**  


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DRAFT

**[ ] FUEL SCAVENGE SYS**

[AIMS v14 and later]

Condition: The fuel scavenge system is failed.

1 Choose one:

◆ Center tank fuel quantity is **available**:

Select the PERF INIT page.

Add the center tank fuel quantity to the required RESERVES

**►► Go to step 9**

◆ Center tank fuel quantity is **unavailable**:

**►► Go to step 2**

2 Select the PERF INIT page.

[Metric Units]

[777-200]

3 Add 400 kgs to the required RESERVES.

[777-200ER, 777-300]

4 Add 1,100 kgs to the required RESERVES.

[777F, 777-200LR, 777-300ER]

5 Add 1,300 kgs to the required RESERVES.

[English Units]

[777-200]

6 Add 800 lbs to the required RESERVES.

[777-200ER, 777-300]

7 Add 2,400 lbs to the required RESERVES.

[777F, 777-200LR, 777-300ER]

8 Add 2,700 lbs to the required RESERVES.

▼ Continued on next page ▼

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**▼FUEL SCAVENGE SYS continued▼**

- 9 Select the PROGRESS page.
- 10 Check the DESTINATION FUEL ESTIMATE. Verify that adequate fuel is available in the left and right main tanks to complete the flight.

**Note:** Remaining center tank fuel is unusable.

**[ ] FUEL TEMP LOW**

Condition: Fuel temperature is near the minimum.

- 1 Increase airspeed, change altitude or deviate to a warmer air mass to achieve a TAT equal to or higher than the fuel temperature limit (3 degrees C above the fuel freeze point).
- 2 TAT increases approximately 0.5 to 0.7 degrees C for each .01 Mach increase in airspeed. In extreme conditions it may be necessary to descend as low as 25,000 feet.



**[ ] FUEL VALVE APU**

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

- 1 Do not start the APU.

This prevents a potential fire hazard.

**Note:** The APU is not available for the rest of the flight.

- 2 Do **not** accomplish the following checklist:

**APU SHUTDOWN**

DRAFT

Non-Normal Checklists  
HydraulicsChapter NNC  
Section 13**Table of Contents**

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**PMDG****DO NOT USE FOR FLIGHT**

777 Flight Crew Operations Manual

13.1

**[ ] HYD AUTO CONTROL C**

Condition: Both of the following occur:

- Automatic control of both center demand pumps fails
- System indications fail

1 C1 AIR DEMAND pump selector . . . . . ON

**[ ] HYD AUTO CONTROL L, R**

Condition: Both of the following occur:

- Automatic control of demand pump fails
- System indications fail

1 ELEC DEMAND pump selector  
(affected system) . . . . . ON

**[ ] HYD OVERHEAT DEM C1, C2, L, R**

Condition: The pump temperature is high.

1 DEMAND pump selector  
(affected pump) . . . . . OFF

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

HYD PRESS DEM



**[ ] HYD OVERHEAT PRI C1, C2**

Condition: The pump temperature is high.

- 1 ELEC PRIMARY pump switch  
(affected pump) . . . . . Off
- 2 Do **not** accomplish the following checklist:

HYD PRESS PRI

**[ ] HYD OVERHEAT PRI L, R**

Condition: The pump temperature is high.

- 1 ENG PRIMARY pump switch  
(affected side) . . . . . Off
- Note:** Thrust reverser on the affected side may be inoperative.
- 2 Do **not** accomplish the following checklist:

HYD PRESS PRI



**[ ] HYD PRESS DEM C1, C2, L, R**

Condition: The demand pump output pressure is low when commanded on.

1 DEMAND pump selector  
(affected pump) . . . . . ON

2 Choose one:

◆ HYD PRESS DEM message **blanks**:



◆ HYD PRESS DEM message **stays shown**:

DEMAND pump selector  
(affected pump) . . . . . OFF

**[ ] HYD PRESS PRI C1, C2**

Condition: The pump pressure is low.

1 ELEC PRIMARY pump switch  
(affected pump) . . . . . Off

**[ ] HYD PRESS PRI L, R**

Condition: The pump pressure is low.

1 ENG PRIMARY pump switch  
(affected side) . . . . . Off

**Note:** Thrust reverser on the affected side may be inoperative.



**[ ] HYD PRESS SYS C**

Condition: The center hydraulic system pressure is low.

Objective: To restore system pressure and configure for landing using alternate systems, if needed.

- 1 C1 or C2 AIR DEMAND pump selector . . . . . ON
- 2 Choose one:
  - ◆ HYD PRESS SYS C message **blanks**:  
■ ■ ■ ■
  - ◆ HYD PRESS SYS C message **stays shown**:  
**►► Go to step 3**
- 3 C2 ELEC PRIMARY pump switch . . . . . Off
- 4 C1 and C2 AIR DEMAND pump selectors . . . OFF
- 5 GND PROX FLAP OVRD switch . . . . . OVRD
- 6 Do **not** accomplish the following checklists:
  - AUTO SPEEDBRAKE
  - SPOILERS

**Note: Inoperative Items****Primary flap and slat operation inop**

Plan more time for slower flap and slat operation.

**Main landing gear hydraulic operation inop**

Alternate gear extension is needed.

**Main gear steering inop**

Tires may scrub during turns.

▼ Continued on next page ▼

▼ HYD PRESS SYS C continued ▼

[777-200]

**Note:** Slats will extend beyond midrange when airspeed is below 215 knots. For go-around, do not exceed 215 knots until slats retract to midrange.

[777-200ER]

**Note:** Slats will extend beyond midrange when airspeed is below 239 knots. For go-around, do not exceed 239 knots until slats retract to midrange.

[777-300]

**Note:** Slats will extend beyond midrange when airspeed is below 246 knots. For go-around, do not exceed 246 knots until slats retract to midrange.

[777-200FT, 777-200LR, 777-300ER]

**Note:** Slats will extend beyond midrange when airspeed is below 256 knots. For go-around, do not exceed 256 knots until slats retract to midrange.

▼ Continued on next page ▼

**▼HYD PRESS SYS C continued▼**

**Note:** Use flaps 20 and VREF 20 for landing. This ensures adequate go-around performance due to slower slat/flap operation in secondary mode.

The roll rate may be reduced in flight. Speedbrake effectiveness may be reduced in flight and during landing.

Do not arm the speedbrake lever. This prevents inadvertent in-flight speedbrake extension.

Manually extend the speedbrakes after landing.

For go-around, do not exceed the gear EXTEND limit speed (270K/.82M).

## 7 Checklist Complete Except Deferred Items

---

### Deferred Items

---

#### Descent Checklist

Recall .....	..... Checked
Notes .....	..... Checked
Autobrake .....	..... _____
Landing data .....	<b>VREF 20 ____, Minimums ____</b>
Approach briefing .....	..... Completed

---

#### Approach Checklist

Altimeters .....	..... _____
------------------	-------------

**▼ Continued on next page ▼**

▼ HYD PRESS SYS C continued ▼

## Flap extension

Start flap extension as needed.

Do **not** accomplish the following checklists:

FLAPS PRIMARY FAIL

SLATS PRIMARY FAIL

## Alternate gear extension

Landing gear lever ..... DN

ALTN GEAR  
extend switch ..... Push to DOWN and hold  
until all gear indicate in transit

A reduction of airspeed to below 240 knots may be  
necessary for the landing gear to lock down.

Do **not** accomplish the following checklist:

GEAR DOOR

## Landing Checklist

Speedbrake ..... DOWN

Landing gear ..... DOWN

Flaps ..... 20



**[] HYD PRESS SYS L**

Condition: The left hydraulic system pressure is low.

- 1 L ELEC DEMAND pump selector . . . . . ON
- 2 Choose one:

◆ HYD PRESS SYS L message **blanks**:



◆ HYD PRESS SYS L message **stays shown**:

►► Go to step 3

- 3 L ENG PRIMARY pump switch . . . . . Off
- 4 L ELEC DEMAND pump selector . . . . . OFF

**Note:** The left thrust reverser is inoperative.

Roll rate may be reduced in flight.

Speedbrake effectiveness may be reduced in flight and during landing.

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

SPOILERS



**[ ] HYD PRESS SYS L+C**

Condition: The left and center hydraulic system pressures are low.

Objective: To restore system pressure and configure for landing using alternate systems, if needed.

- 1 L ELEC DEMAND pump selector . . . . . ON
- 2 C1 or C2 AIR DEMAND pump selector . . . . . ON
- 3 Choose one:

◆ HYD PRESS SYS L+C message **blanks**:



◆ HYD PRESS SYS L+C message **stays shown**:

**►► Go to step 4**

- 4 L ENG PRIMARY pump switch . . . . . Off
- 5 C2 ELEC PRIMARY pump switch . . . . . Off
- 6 L ELEC DEMAND pump selector . . . . . OFF
- 7 C1 and C2 AIR DEMAND pump selectors . . . . OFF
- 8 Handling qualities are degraded. Pitch and roll control capability is reduced with fewer operating control surfaces.
- 9 Plan to land at the nearest suitable airport.
- 10 GND PROX FLAP OVRD switch . . . . . OVRD
- 11 Do **not** accomplish the following checklists:

AUTO SPEEDBRAKE

▼ Continued on next page ▼

**▼HYD PRESS SYS L+C continued▼****FLIGHT CONTROLS****SPOILERS****Note: Inoperative Items****Multiple flight control surfaces inop**

Handling qualities are degraded.

**Primary flap and slat operation inop**

Plan more time for slower flap and slat operation.

**Main landing gear hydraulic operation inop**

Alternate gear extension is needed.

**Left thrust reverser inop**

Right thrust reverser is available.

**Main gear steering inop**

Tires may scrub during turns.

[777-200]

**Note:** Slats will extend beyond midrange when airspeed is below 215 knots. For go-around, do not exceed 215 knots until slats retract to midrange.

[777-200ER]

**Note:** Slats will extend beyond midrange when airspeed is below 239 knots. For go-around, do not exceed 239 knots until slats retract to midrange.

[777-300]

**Note:** Slats will extend beyond midrange when airspeed is below 246 knots. For go-around, do not exceed 246 knots until slats retract to midrange.

**▼ Continued on next page ▼**

**▼HYD PRESS SYS L+C continued▼****[777-200FT, 777-200LR, 777-300ER]**

**Note:** Slats will extend beyond midrange when airspeed is below 256 knots. For go-around, do not exceed 256 knots until slats retract to midrange.

**Note:** Use flaps 20 and VREF 30 + 20 for landing. Higher approach speeds improve airplane maneuvering characteristics.

Crosswind limit for landing is 20 knots.

Roll rate may be reduced in flight. Speedbrake effectiveness may be reduced in flight and during landing.

Do not arm the speedbrake lever. This prevents inadvertent in-flight speedbrake extension.

Manually extend the speedbrakes after landing.

For go-around, do not exceed the gear EXTEND limit speed (270K/.82M).

**12 Checklist Complete Except Deferred Items****Deferred Items****Descent Checklist**

Recall .....	.....	Checked
Notes .....	.....	Checked
Autobrake .....	.....	_____
Landing data .....	<b>VREF 30 + 20</b> _____, <b>Minimums</b> _____	

**▼ Continued on next page ▼**

**▼HYD PRESS SYS L+C continued▼**

Approach briefing . . . . . Completed

---

**Approach Checklist**

Altimeters . . . . .

---

**Flap extension**

Start flap extension as needed.

Do **not** accomplish the following checklists:

FLAPS PRIMARY FAIL

SLATS PRIMARY FAIL

---

**Alternate gear extension**

Landing gear lever . . . . . DN

ALTN GEAR  
extend switch . . . . . Push to DOWN  
and hold until all  
gear indicate in transit

Reduction of airspeed to below 240 knots may be  
necessary for landing gear to lock down.

Do **not** accomplish the following checklist:

GEAR DOOR

---

**Landing Checklist**

Speedbrake . . . . . **DOWN**

Landing gear . . . . . DOWN

▼ Continued on next page ▼

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▼HYD PRESS SYS L+C continued▼

Flaps.....**20**



**HYD PRESS SYS L+C+R**

Condition: All hydraulic system pressures are low.



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**[] HYD PRESS SYS L+R**

Condition: The left and right hydraulic system pressures are low.

Objective: To restore system pressure and configure for landing using alternate systems, if needed.

[777-300, 777-300ER]

- 1 Do not exceed .87 Mach. This ensures sufficient roll control.
- 2 L ELEC DEMAND pump selector ..... ON
- 3 R ELEC DEMAND pump selector ..... ON
- 4 Choose one:
  - ◆ HYD PRESS SYS L+R message **blanks**:  
■ ■ ■ ■
  - ◆ HYD PRESS SYS L+R message **stays shown**:  
**►► Go to step 5**
- 5 L ENG PRIMARY pump switch ..... Off
- 6 R ENG PRIMARY pump switch ..... Off
- 7 L ELEC DEMAND pump selector ..... OFF
- 8 R ELEC DEMAND pump selector ..... OFF
- 9 Handling qualities are degraded. Pitch and roll control capability is reduced with fewer operating control surfaces.
- 10 Plan to land at the nearest suitable airport.
- 11 GND PROX FLAP OVRD switch ..... OVRD

▼ Continued on next page ▼

**▼HYD PRESS SYS L+R continued▼****Note: Inoperative Items****Multiple flight control surfaces inop**

Handling qualities are degraded.

**Left and right thrust reversers inop**

Manual braking is available.

**Autobrake inop**

Manual braking is available.

**Normal brakes inop**

Alternate brakes are available.

**Note:** Use flaps 20 and VREF 30 + 20 for landing.

Higher approach speeds improve airplane maneuvering characteristics.

Crosswind limit for landing is 20 knots.

Roll rate may be reduced in flight.

Speedbrake effectiveness may be reduced in flight and during landing.

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

FLIGHT CONTROLS

SPOILERS

13 Checklist Complete Except Deferred Items

**Deferred Items****Descent Checklist**

Recall .....	. Checked
Notes .....	. Checked
Autobrake .....	. <b>OFF</b>

▼ Continued on next page ▼

**▼HYD PRESS SYS L+R continued▼**

- |                    |                           |
|--------------------|---------------------------|
| Landing data ..... | <b>VREF 30 + 20</b> _____ |
|                    | <b>Minimums</b> _____     |
- Approach briefing ..... Completed

**Approach Checklist**

Altimeters ..... \_\_\_\_\_

**Landing Checklist**

Speedbrake ..... ARMED

Landing gear ..... DOWN

Flaps ..... **20**



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**[ ] HYD PRESS SYS R**

Condition: The right hydraulic system pressure is low.

1 R ELEC DEMAND pump selector . . . . . ON

2 Choose one:

◆ HYD PRESS SYS R message **blanks**:



◆ HYD PRESS SYS R message **stays shown**:

►► Go to step 3

3 R ENG PRIMARY pump switch. . . . . Off

4 R ELEC DEMAND pump selector . . . . . OFF

**Note: Inoperative Items****Right thrust reverser inop**

Left thrust reverser is available.

**Autobrake inop**

Manual braking is available.

**Normal brakes inop**

Alternate brakes is available.

**Note:** Roll rate may be reduced in flight.

Speedbrake effectiveness may be reduced in flight and during landing.

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

SPOILERS

6 **Checklist Complete Except Deferred Items**

▼ Continued on next page ▼

**▼HYD PRESS SYS R continued▼****Deferred Items****Descent Checklist**

Recall . . . . .	Checked
Notes . . . . .	Checked
Autobrake . . . . .	<b>OFF</b>
Landing data . . . . .	VREF ___, Minimums __
Approach briefing . . . . .	Completed

**Approach Checklist**

Altimeters . . . . .	____
----------------------	------

**Landing Checklist**

Speedbrake . . . . .	ARMED
Landing gear . . . . .	DOWN
Flaps . . . . .	____



**[] HYD PRESS SYS R+C**

Condition: The right and center hydraulic system pressures are low.

Objective: To restore system pressure and configure for landing using alternate systems, if needed.

[777-300, 777-300ER]

- 1 Do not exceed .87 Mach. This ensures sufficient roll control.
- 2 C1 or C2 AIR DEMAND pump selector . . . . . ON
- 3 R ELEC DEMAND pump selector . . . . . ON
- 4 Choose one:
  - ◆ HYD PRESS SYS R+C message **blanks**:  
■ ■ ■ ■
  - ◆ HYD PRESS SYS R+C message **stays shown**:  
**►► Go to step 5**
- 5 STAB cutout switches (both) . . . . . CUTOUT  
This keeps the STABILIZER message blank.
- 6 Do not exceed current airspeed. Nose down elevator authority is limited.
- 7 C2 ELEC PRIMARY pump switch . . . . . Off
- 8 R ENG PRIMARY pump switch. . . . . Off
- 9 C1 and C2 AIR DEMAND pump selectors . . . . OFF
- 10 R ELEC DEMAND pump selector . . . . . OFF

▼ Continued on next page ▼

**▼HYD PRESS SYS R+C continued▼**

- 11 Handling qualities are degraded. Pitch and roll control capability is reduced with fewer operating control surfaces.
- 12 Plan to land at the nearest suitable airport.
- 13 GND PROX FLAP OVRD switch . . . . . OVRD
- 14 Do **not** accomplish the following checklists:
  - AUTO SPEEDBRAKE
  - FLIGHT CONTROLS
  - SPOILERS
  - STABILIZER

**▼ Continued on next page ▼**

**▼HYD PRESS SYS R+C continued▼****Note: Inoperative Items****Multiple flight control surfaces inop**

Handling qualities are degraded.

**Stabilizer inop**

Pitch trim is available in the normal flight control mode.

**Primary flap and slat operation inop**

Plan more time for slower flap and slat operation.

**Main landing gear hydraulic operation inop**

Alternate gear extension is needed.

**Right thrust reverser inop**

Left thrust reverser is available.

**Autobrake inop**

Manual braking is available.

**Normal brakes and alternate brakes from center hydraulic source are inop**

Alternate brakes from the reserve hydraulic source are available.

**Main gear steering inop**

Tires may scrub during turns.

[777-200]

**Note:** Slats will extend beyond midrange when airspeed is below 215 knots. For go-around, do not exceed 215 knots until slats retract to midrange.

[777-200ER]

**Note:** Slats will extend beyond midrange when airspeed is below 239 knots. For go-around, do not exceed 239 knots until slats retract to midrange.

**▼ Continued on next page ▼**

**▼ HYD PRESS SYS R+C continued ▼**

[777-300]

**Note:** Slats will extend beyond midrange when airspeed is below 246 knots. For go-around, do not exceed 246 knots until slats retract to midrange.

[777-200FT, 777-200LR, 777-300ER]

**Note:** Slats will extend beyond midrange when airspeed is below 256 knots. For go-around, do not exceed 256 knots until slats retract to midrange.

**Note:** Use flaps 20 and VREF 30 + 20 for landing. Higher approach speeds improve airplane maneuvering characteristics.

Crosswind limit for landing is 20 knots.

Roll rate may be reduced in flight. Speedbrake effectiveness may be reduced in flight and during landing.

Do not arm the speedbrake lever. This prevents inadvertent in-flight speedbrake extension.

Manually extend the speedbrakes after landing.

For go-around, do not exceed the gear EXTEND limit speed (270K/.82M).

**15 Checklist Complete Except Deferred Items**

▼ Continued on next page ▼

▼HYD PRESS SYS R+C continued▼

### Deferred Items

#### Descent Checklist

Recall . . . . .	Checked
Notes. . . . .	Checked
Autobrake . . . . .	OFF
Landing data . . . . .	<b>VREF 30 + 20</b> <u>  </u> , <b>Minimums</b> <u>  </u>
Approach briefing . . . . .	Completed

#### Approach Checklist

Altimeters . . . . .	
----------------------	--

#### Flap extension

Start flap extension as needed.

Do **not** accomplish the following checklists:

FLAPS PRIMARY FAIL

SLATS PRIMARY FAIL

#### Alternate gear extension

Landing gear lever . . . . .	DN
ALTN GEAR	
extend switch . . . . .	Push to DOWN and hold until all gear indicate in transit

▼ Continued on next page ▼



## ▼HYD PRESS SYS R+C continued▼

Reduction of airspeed to below 240 knots may be necessary for landing gear to lock down.

Do **not** accomplish the following checklist:

## GEAR DOOR

---

**Landing Checklist**

Speedbrake ..... **DOWN**

Landing gear ..... **DOWN**

Flaps ..... **20**



---

[ ] HYD QTY LOW C

---

Condition: The center hydraulic quantity is low.

**Note:** Nose wheel steering may be slow to react. Excessive force on the nose wheel steering tiller may cause abrupt tiller movement in the opposite direction.



---

HYD QTY LOW L, R

---

Condition: The hydraulic quantity is low.



**[ ] HYD QTY LOW L+C**

Condition: The left and center hydraulic quantities are low.

- 1 Plan to land at the nearest suitable airport.

**Note:** Nose wheel steering may be slow to react. Excessive force on the nose wheel steering tiller may cause abrupt tiller movement in the opposite direction.

**[ ] HYD QTY LOW L+C+R**

Condition: All three hydraulic quantities are low.

- 1 Plan to land at the nearest suitable airport.

**Note:** Nose wheel steering may be slow to react. Excessive force on the nose wheel steering tiller may cause abrupt tiller movement in the opposite direction.

**[ ] HYD QTY LOW L+R**

Condition: The left and right hydraulic quantities are low.

- 1 Plan to land at the nearest suitable airport.



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**[ ] HYD QTY LOW R+C**

Condition: The right and center hydraulic quantities are low.

Objective: To prevent fluid loss through the brake system.

- 1 C1 ELEC PRIMARY pump switch . . . . . Off
- 2 Plan to land at the nearest suitable airport.

**Note:** Nose wheel steering may be slow to react. Excessive force on the nose wheel steering tiller may cause abrupt tiller movement in the opposite direction.

Do not taxi with loss of steering.

- 3 Do **not** accomplish the following checklists:

BRAKE SOURCE

RESERVE BRAKES/STRG

**4 Checklist Complete Except Deferred Items****Deferred Items****Descent Checklist**

- |                             |                         |
|-----------------------------|-------------------------|
| Recall . . . . .            | Checked                 |
| Notes. . . . .              | Checked                 |
| Autobrake . . . . .         | _____                   |
| Landing data . . . . .      | VREF ___, Minimums ___, |
| Approach briefing . . . . . | Completed               |

▼ Continued on next page ▼

**PMDG****DO NOT USE FOR FLIGHT**

777 Flight Crew Operations Manual

13.29

**▼HYD QTY LOW R+C continued▼****Approach Checklist**

Altimeters . . . . .

**Landing Checklist**

Speedbrake . . . . . ARMED

Landing gear . . . . . DOWN

Flaps . . . . .

**Before landing**

C1 ELEC PRIMARY pump switch . . . . . ON

This restores alternate brakes from the reserve hydraulic source and may restore steering.

**RAT UNLOCKED**

Condition: The ram air turbine is not stowed and locked.



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Non-Normal Checklists  
Landing GearChapter NNC  
Section 14

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Blank

**[ ] ANTISKID**

Condition: An antiskid system fault occurs.

1 AUTOBRAKE selector. . . . . OFF |

**Note:** The autobrake system is inoperative.

Use minimum braking consistent with runway length and conditions to reduce the possibility of tire blowout.

Do not apply the brakes until the nose wheel is on the ground and the speedbrakes have extended.

Brake initially using light steady pedal pressure. Increase pressure as ground speed decreases. Do not pump the brakes.

## 2 Checklist Complete Except Deferred Items

▼ Continued on next page ▼

**▼ ANTISKID continued ▼****Deferred Items****Descent Checklist**

Recall . . . . .	Checked
Notes. . . . .	Checked
Autobrake . . . . .	<b>OFF</b>
Landing data . . . . .	VREF ___, Minimums __
Approach briefing . . . . .	Completed

**Approach Checklist**

Altimeters . . . . .	_____
----------------------	-------

**Landing Checklist**

Speedbrake . . . . .	ARMED
Landing gear . . . . .	DOWN
Flaps . . . . .	_____

**AUTOBRAKE**

Condition: One of these occurs:

- The autobrake system is disarmed
- The autobrake system is failed





## [ ] BRAKE SOURCE

Condition: Normal and alternate brake system pressures are low, and reserve hydraulic source for alternate brake system is low.

**Note:** Only accumulator pressure is available for braking. During landing rollout, apply steady, increasing brake pressure and hold to a full stop. Do not taxi.



## [ ] BRAKE TEMP

Condition: One or more brake temperatures are high.

1 Choose one:

◆ In flight:

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

Landing gear lever..... DN

**When** the BRAKE TEMP message blanks:

**Wait** 8 minutes.

Landing gear lever..... UP



◆ On the ground:

Refer to the Recommended Brake Cooling Schedule table in the Performance Inflight chapter for the needed cooling time.



**[ ] GEAR DISAGREE**

Condition: The gear position disagrees with the landing gear lever position.

Objective: To extend the gear using alternate gear extension, or land on the available gear.

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

**1 Choose one:****◆ Landing gear lever UP:**

**Note:** Flight with the gear down increases fuel consumption and decreases climb performance. Refer to the Gear Down tables in the Performance Inflight chapter for flight planning.

Do **not** accomplish the following checklists:

AUTO SPEEDBRAKE

GEAR DOOR

**◆ Landing gear lever DN:**

**►► Go to step 2**

**2 ALTN GEAR**

extend switch. . . . . Push to DOWN and hold until all gear indicate in transit

3 Reduction of airspeed to below 240 knots may be necessary for the gear to lock down.

▼ Continued on next page ▼

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**▼ GEAR DISAGREE continued ▼**

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

**GEAR DOOR**

- 5 **Wait** 30 seconds.

- 6 Choose one:

◆ **All** gear indicate **DN**:



◆ **Any** gear indicate **UP or in transit**:

►► Go to step 7

- 7 Plan to land on the available gear.

- 8 GND PROX GEAR OVRD switch . . . . . OVRD

**Note:** Use flaps 30 for landing. This gives the slowest landing speed.

Do not arm the speedbrake lever.

When stopping distance is critical, extend the speedbrakes after all gear, or the nose, or the engine nacelle have contacted the runway.

Do not use the thrust reversers unless stopping distance is critical.

**9 Checklist Complete Except Deferred Items**

---

**Deferred Items**

---

**Descent Checklist**

Recall . . . . . Checked

▼ Continued on next page ▼

▼ GEAR DISAGREE continued ▼

Notes . . . . .	Checked
Autobrake . . . . .	_____
Landing data . . . . .	<b>VREF 30 _____, Minimums _____</b>
Approach briefing . . . . .	Completed

## Approach Checklist

Altimeters . . . . . \_\_\_\_\_

## At pattern altitude

OUTFLOW VALVE switches (both) . . . . . MAN

OUTFLOW VALVE MANUAL  
switches (both) . . . . . Hold in OPEN  
until the outflow  
valve indications show fully  
open to depressurize the airplane

[Auxiliary Fuel Tank]

AUX fuel switch . . . . . Off

Fuel PUMPS switches (all) . . . . . Off

Do **not** accomplish the following checklists:

CABIN ALTITUDE AUTO

FUEL AUX XFR

FUEL PRESS ENG L

FUEL PRESS ENG R

▼ Continued on next page ▼

**▼ GEAR DISAGREE continued ▼****Landing Checklist**

Speedbrake ..... **DOWN**  
Landing gear ..... DOWN  
Flaps ..... **30**  


**[ ] GEAR DOOR**

Condition: One or more gear doors are not closed.

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

**Gear Lever Locked Down**

Condition: The landing gear lever cannot move to UP.

- 1 Landing gear lever  
LOCK OVRD switch ..... Push and hold
- 2 Landing gear lever ..... UP



**[ ] MAIN GEAR BRACE L, R**

Condition: The main gear is down with one brace unlocked.

1 GND PROX GEAR OVRD switch . . . . . OVRD

**Note:** Use flaps 30 for landing. This gives the slowest landing speed.

Do not arm the speedbrake lever.

Manually extend the speedbrakes after landing.

**2 Checklist Complete Except Deferred Items**

---

**Deferred Items**

---

**Descent Checklist**

Recall . . . . .	Checked
Notes. . . . .	Checked
Autobrake . . . . .	
<b>Landing data . . . . . VREF 30 ____ , Minimums ____</b>	
Approach briefing . . . . .	Completed

---

**Approach Checklist**

Altimeters . . . . .	
----------------------	--

---

**At pattern altitude**

<b>[Auxiliary Fuel Tank]</b>	
AUX fuel switch. . . . .	Off
Fuel PUMPS switches (all) . . . . .	Off

▼ Continued on next page ▼

**▼MAIN GEAR BRACE L, R continued▼**

Do **not** accomplish the following checklists:

FUEL AUX XFR

FUEL PRESS ENG L

FUEL PRESS ENG R

---

**Landing Checklist**

Speedbrake ..... **DOWN**

Landing gear ..... **DOWN**

Flaps ..... **30**



---

**MAIN GEAR STEERING**

---

Condition: Main gear steering does not lock.



---

**[ ] RESERVE BRAKES/STRG**

---

Condition: One or more of these are possibly not available:

- Alternate brakes from the reserve hydraulic source
- Normal nose gear extension
- Nose wheel steering

**Note:** Plan for possible alternate gear extension.  
Do not taxi with loss of steering.



**TAIL SKID**

[777-300, 777-300ER]

Condition: The tailskid is not in the commanded position.

**[ ] TIRE PRESS**

Condition: One or more tire pressures are not normal.

**Note:** If it can be determined that a main gear tire is flat, do not use the autobrake.



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Non-Normal Checklists  
Warning SystemsChapter NNC  
Section 15

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15.1

**AIRSPEED LOW**

Condition: Airspeed is less than minimum maneuvering speed.

**ALTITUDE ALERT**

Condition: A deviation from the MCP set altitude occurs.

**ALTITUDE CALLOUTS**

Condition: Altitude and minimums voice callouts during approach are not available.

**CONFIG DOORS**

Condition: An entry, forward cargo, or aft cargo door is not closed and latched and locked during takeoff.

**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:

- Below 800 feet radio altitude and a thrust lever is at or near idle
- The flaps are in a landing position

**CONFIG GEAR STEERING**

Condition: Main gear steering is not locked during takeoff.

**CONFIG PARKING BRAKE**

Condition: The parking brake is set during takeoff.

**CONFIG RUDDER**

Condition: Rudder trim is not centered during takeoff.



**CONFIG SPOILERS**

Condition: One of these occurs:

- The speedbrake lever is not down during takeoff
- The speedbrake lever is extended beyond ARMED in flight with climb thrust or greater

**CONFIG STABILIZER**

Condition: The stabilizer is not in the greenband during takeoff.

**[ ] CONFIG WARNING SYS**

Condition: A configuration warning system fault occurs.

**Note:** Radio altitude voice callouts and other aural alerts may not be available.

**[ ] 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**

Condition: Pilot action is not detected during a specified time.

**RUNWAY OVRD**

[Option + AIMS v14 and later]

Condition: The ground proximity runway override switch is in OVRD.

**[ ] RUNWAY POS**

[Option + AIMS-1 + v14 and later]

Condition: RAAS position data is lost. The condition may be temporary.

**Note:** Position data for RAAS is lost. Ground proximity alerts that occur are valid.



**[ ] RUNWAY SYS**

[Option + AIMS v14 and later]

Condition: RAAS is inoperative.

**Note:** RAAS voice annunciations and alerts are not available. Ground proximity alerts that occur are valid.

**[ ] TAIL STRIKE**

Condition: The tail hits the runway.

**Caution! Do not pressurize the airplane.  
Pressurizing the airplane may cause  
further structural damage.**

- 1 OUTFLOW VALVE switches (both) . . . . . MAN
- 2 OUTFLOW VALVE MANUAL switches (both) . . . . . Hold in OPEN until the outflow valve indications show fully open to depressurize the airplane
- 3 Plan to land at the nearest suitable airport.
- 4 Do **not** accomplish the following checklist:  
  
CABIN ALTITUDE AUTO



**TCAS**

Condition: TCAS is failed.

**TCAS OFF**

Condition: TCAS modes TA or TA/RA are not selected.

**TCAS RA CAPTAIN, F/O**

Condition: TCAS cannot show RA guidance on the PFD.

**TERR OVRD**

Condition: The ground proximity terrain override switch is in OVRD.

**[ ] TERR POS**

Condition: Terrain position data is lost.

**Note:** Position data for the ND terrain map and look-ahead terrain alerts are lost. 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.



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**Operational Information**  
**Ops Info**

**Chapter OI**  
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## Introduction

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# 777 Flight Crew Operations Manual

## Performance Inflight - QRH

## Chapter PI-QRH

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# Performance Inflight - QRH

## General

# Chapter PI-QRH

## Section 10

**Flight With Unreliable Airspeed / Turbulent Air Penetration**  
**Altitude and/or vertical speed indications may also be unreliable.**

### Climb

#### Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)			
		160	200	240	280
40000 (.82M)	PITCH ATT V/S (FT/MIN)	3.5 1300	3.5 600		
30000 (280 KIAS)	PITCH ATT V/S (FT/MIN)	4.5 2100	4.0 1500	4.0 1000	4.0 600
20000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	6.5 3100	6.0 2300	6.0 1700	6.0 1200
10000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	9.5 4200	8.5 3200	8.0 2500	7.5 2000
SEA LEVEL (270 KIAS)	PITCH ATT V/S (FT/MIN)	11.5 4700	10.0 3700	9.0 2900	9.0 2300

### Cruise

#### Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)			
		160	200	240	280
40000 (.82M)	PITCH ATT %N1	1.7 87.5	2.3 91.4		
35000 (280 KIAS)	PITCH ATT %N1	1.4 84.1	1.9 86.7	2.4 89.8	
30000 (280 KIAS)	PITCH ATT %N1	1.5 79.4	2.1 82.2	2.7 85.5	3.4 89.4
25000 (280 KIAS)	PITCH ATT %N1	1.6 75.3	2.2 77.8	2.9 80.7	3.5 84.4
20000 (270 KIAS)	PITCH ATT %N1	1.8 70.2	2.5 72.9	3.2 75.9	4.0 79.3
15000 (270 KIAS)	PITCH ATT %N1	1.7 65.9	2.5 68.4	3.2 71.3	4.0 74.6

### Descent

#### Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)			
		160	200	240	280
40000 (.82M)	PITCH ATT V/S (FT/MIN)	-1.7 -2900	-0.9 -2700		
30000 (280 KIAS)	PITCH ATT V/S (FT/MIN)	-1.3 -2200	-0.4 -2000	0.4 -1900	1.0 -1900
20000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	-1.1 -1800	-0.1 -1600	0.8 -1600	1.6 -1600
10000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	-1.4 -1700	-0.3 -1500	0.7 -1400	1.5 -1400
SEA LEVEL (270 KIAS)	PITCH ATT V/S (FT/MIN)	-1.4 -1400	-0.3 -1200	0.7 -1200	1.5 -1200

**Flight With Unreliable Airspeed / Turbulent Air Penetration**  
**Altitude and/or vertical speed indications may also be unreliable.**
**Holding****Flaps Up, Set Thrust for Level Flight**

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)			
		160	200	240	280
10000	PITCH ATT	<b>4.0</b>	<b>4.5</b>	<b>5.0</b>	<b>5.0</b>
	%N1	55.1	60.4	65.1	69.6
	KIAS	202	216	230	247
5000	PITCH ATT	<b>4.0</b>	<b>4.5</b>	<b>5.0</b>	<b>5.0</b>
	%N1	52.0	57.0	61.5	65.8
	KIAS	202	216	230	246

**Terminal Area (5000 FT)****%N1 for Level Flight**

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)			
		160	200	240	280
FLAPS UP GEAR UP (VREF 30 + 80)	PITCH ATT	<b>4.5</b>	<b>5.0</b>	<b>5.5</b>	<b>5.5</b>
	%N1	52.7	58.3	63.1	67.5
	KIAS	201	216	229	241
FLAPS 1 GEAR UP (VREF 30 + 60)	PITCH ATT	<b>6.0</b>	<b>6.5</b>	<b>7.0</b>	<b>7.5</b>
	%N1	53.1	58.7	64.1	68.6
	KIAS	181	196	209	221
FLAPS 5 GEAR UP (VREF 30 + 40)	PITCH ATT	<b>5.0</b>	<b>5.5</b>	<b>5.5</b>	<b>6.0</b>
	%N1	54.3	60.2	65.4	70.0
	KIAS	161	176	189	201
FLAPS 15 GEAR UP (VREF 30 + 20)	PITCH ATT	<b>6.0</b>	<b>6.0</b>	<b>6.5</b>	<b>6.5</b>
	%N1	55.1	61.6	67.1	72.0
	KIAS	141	156	169	181
FLAPS 20 GEAR DOWN (VREF 30 + 20)	PITCH ATT	<b>4.0</b>	<b>4.5</b>	<b>5.0</b>	<b>5.0</b>
	%N1	61.6	68.3	73.9	78.9
	KIAS	141	156	169	181

**Final Approach (1500 FT)****Gear Down, %N1 for 3° Glideslope**

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)			
		160	200	240	280
FLAPS 20 (VREF 20 + 10)	PITCH ATT	<b>1.0</b>	<b>1.5</b>	<b>1.5</b>	<b>1.5</b>
	%N1	41.0	45.8	49.8	53.4
	KIAS	142	157	172	185
FLAPS 25 (VREF 25 + 10)	PITCH ATT	<b>0.0</b>	<b>0.5</b>	<b>0.5</b>	<b>0.5</b>
	%N1	49.9	55.0	59.6	63.9
	KIAS	138	153	166	179
FLAPS 30 (VREF 30 + 10)	PITCH ATT	<b>-0.5</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
	%N1	55.1	60.7	65.8	70.3
	KIAS	131	146	159	171

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**Max Climb %N1****Based on engine bleed for packs on or off and anti-ice off**

TAT		PRESSURE ALTITUDE (FT)/ SPEED (IAS/MACH)									
		0	5000	10000	15000	20000	25000	30000	35000	40000	43000
°C	°F	310(0.47)	310(0.51)	310(0.56)	310(0.61)	310(0.67)	310(0.74)	310(0.81)	(0.84)	(0.84)	(0.84)
60	140	86.5	87.9	89.4	91.3	93.9	96.3	99.7	103.2	103.1	102.5
50	122	88.7	88.8	89.2	89.9	92.5	94.8	98.2	101.6	101.5	100.9
40	104	90.0	90.5	90.7	90.8	91.3	93.3	96.7	100.1	99.9	99.3
30	86	89.1	93.2	92.9	92.8	93.1	93.6	95.2	98.4	98.3	97.7
20	68	87.6	91.6	93.9	94.6	94.8	95.2	96.5	97.2	96.7	96.1
15	59	86.9	90.8	93.1	95.3	95.5	95.9	97.0	97.8	97.0	96.4
10	50	86.1	90.0	92.3	94.5	96.2	96.5	97.6	98.4	97.6	97.1
5	41	85.4	89.2	91.5	93.7	95.8	97.2	98.2	99.0	98.2	97.7
0	32	84.6	88.4	90.7	92.8	94.9	97.0	98.9	99.6	98.9	98.4
-5	23	83.8	87.6	89.8	92.0	94.1	96.1	98.9	100.4	99.6	99.0
-10	14	83.0	86.8	89.0	91.1	93.2	95.2	98.0	101.6	100.5	99.9
-15	5	82.2	86.0	88.1	90.2	92.3	94.3	97.1	101.5	101.4	100.8
-20	-4	81.4	85.1	87.3	89.4	91.4	93.3	96.1	100.5	100.4	99.9
-25	-13	80.6	84.3	86.4	88.5	90.5	92.4	95.2	99.5	99.4	98.9
-30	-22	79.8	83.4	85.5	87.6	89.6	91.5	94.2	98.5	98.4	97.9
-35	-31	79.0	82.6	84.6	86.7	88.6	90.5	93.2	97.5	97.4	96.9
-40	-40	78.2	81.7	83.8	85.8	87.7	89.6	92.3	96.5	96.4	95.8

**%N1 Adjustments for Engine Bleed**

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (1000 FT)					
	0	10	20	30	40	43
2 PACKS ON - 1 BLEED SOURCE	-0.5	-0.6	-0.8	-0.8	-1.2	-1.4
1 PACK ON - 1 BLEED SOURCE	-0.5	-0.6	-0.8	-0.8	-1.2	-1.4
1 PACK ON - 2 BLEED SOURCES	-0.5	-0.6	-0.8	-0.8	-1.2	-1.4
ENGINE ANTI-ICE ON	-0.3	-0.4	-0.4	-0.4	-0.4	-0.4
ENGINE AND WING ANTI-ICE ON*	-0.5	-0.5	-0.5	-0.9	-1.1	-1.4
ENGINE AND WING ANTI-ICE ON**	-0.6	-0.7	-0.7	-1.4	-1.9	-2.3

\*Wing anti-ice on, packs on, or packs off with 2 bleed sources.

\*\*Wing anti-ice on, packs off, 1 bleed source.

## 777 Flight Crew Operations Manual

**VREF**

WEIGHT (1000 KG)	FLAPS		
	30	25	20
250	151	159	164
240	148	156	161
230	145	152	158
220	142	149	154
210	139	145	150
200	135	142	147
190	132	138	143
180	128	134	139
170	124	131	135
160	121	127	131
150	117	123	127
140	113	118	123

DRAFT

# Performance Inflight - QRH

## Advisory Information

# Chapter PI-QRH

## Section 11

### ADVISORY INFORMATION

#### Normal Configuration Landing Distance

Flaps 30

	LANDING DISTANCE AND ADJUSTMENT (M)							
	REF DIST	WEIGHT 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	200000 KG LANDING WT	PER 5000 KG ABOVE/BELLOW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF30	ONE REV NO REV

#### Dry Runway

MAX MANUAL	880	+25/-5	20	-35/+125	+10/-10	+20/-20	35	15	40
AUTOBRAKE MAX	1180	+20/-5	25	-50/+175	0/0	+30/-30	65	0	0
AUTOBRAKE 4	1455	+25/-10	40	-70/+245	0/-5	+40/-40	80	0	0
AUTOBRAKE 3	1740	+30/-10	45	-90/+305	+10/-10	+50/-50	95	0	0
AUTOBRAKE 2	1935	+40/-20	55	-100/+350	+20/-35	+55/-55	85	20	20
AUTOBRAKE 1	2060	+45/-25	65	-115/+395	+45/-50	+60/-60	90	120	120

#### Good Reported Braking Action

MAX MANUAL	1390	+25/-10	35	-70/+245	+35/-30	+35/-35	60	80	195
AUTOBRAKE MAX	1485	+30/-10	40	-70/+255	+30/-25	+35/-35	70	85	200
AUTOBRAKE 4	1680	+30/-5	45	-80/+290	+5/-5	+45/-45	90	10	50
AUTOBRAKE 3	2000	+35/-10	50	-105/+350	+10/-10	+60/-60	110	0	0
AUTOBRAKE 2	2225	+45/-25	65	-115/+400	+25/-40	+65/-65	100	25	25
AUTOBRAKE 1	2370	+50/-30	75	-130/+455	+50/-60	+70/-70	105	140	140

#### Medium Reported Braking Action

MAX MANUAL	1865	+40/-25	60	-110/+395	+80/-70	+45/-45	70	235	610
AUTOBRAKE MAX	1880	+40/-15	60	-110/+400	+80/-65	+45/-50	80	230	605
AUTOBRAKE 4	1910	+40/-15	60	-110/+400	+80/-60	+50/-50	85	235	620
AUTOBRAKE 3	2100	+40/-15	60	-115/+430	+60/-40	+60/-60	110	125	465
AUTOBRAKE 2	2275	+45/-25	65	-125/+455	+60/-60	+65/-65	100	100	345
AUTOBRAKE 1	2400	+50/-30	75	-130/+485	+75/-70	+70/-70	105	185	345

#### Poor Reported Braking Action

MAX MANUAL	2380	+50/-35	80	-155/+615	+190/-125	+65/-65	80	530	1620
AUTOBRAKE MAX	2385	+60/-35	80	-155/+620	+195/-130	+65/-65	80	535	1625
AUTOBRAKE 4	2405	+60/-35	80	-160/+620	+190/-130	+65/-70	80	535	1640
AUTOBRAKE 3	2440	+50/-30	80	-160/+625	+185/-110	+65/-70	105	510	1620
AUTOBRAKE 2	2535	+60/-35	80	-165/+640	+175/-120	+70/-70	100	430	1520
AUTOBRAKE 1	2600	+60/-35	85	-165/+650	+180/-120	+70/-75	100	465	1455

Reference distance is for sea level, standard day, no wind or slope, VREF30 approach speed, 2 engine reverse thrust, and auto speedbrakes.

For Max Manual braking and manual speedbrakes, increase reference landing distance by 70 m.

For autobrake and manual speedbrakes, increase reference landing distance by 60 m.

Distances for GOOD, MEDIUM, AND POOR are increased by 15%.

Includes distance from 50 ft above threshold (305 meters of unfactored air distance).

**ADVISORY INFORMATION****Normal Configuration Landing Distance**

Flaps 25

	LANDING DISTANCE AND ADJUSTMENT (M)								
	REF DIST	WEIGHT 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	200000 KG LANDING WT	PER 5000 KG ABOVE/BELLOW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF25	ONE REV	NO REV

**Dry Runway**

MAX MANUAL	925	+25/-10	20	-35/+130	+10/-10	+20/-20	35	20	45
AUTOBRAKE MAX	1260	+20/-15	30	-55/+180	0/0	+30/-30	65	0	0
AUTOBRAKE 4	1570	+30/-20	40	-75/+255	0/-5	+40/-40	85	0	0
AUTOBRAKE 3	1880	+35/-25	50	-95/+320	+10/-15	+55/-55	95	0	0
AUTOBRAKE 2	2070	+45/-35	60	-105/+365	+30/-45	+60/-60	85	50	50
AUTOBRAKE 1	2190	+50/-40	70	-115/+405	+50/-55	+60/-60	90	170	180

**Good Reported Braking Action**

MAX MANUAL	1465	+30/-15	40	-70/+255	+35/-30	+35/-35	60	90	225
AUTOBRAKE MAX	1565	+30/-15	40	-75/+260	+30/-25	+35/-40	70	100	235
AUTOBRAKE 4	1805	+35/-25	45	-85/+300	+5/-5	+45/-45	100	10	50
AUTOBRAKE 3	2160	+40/-30	60	-110/+370	+10/-15	+65/-65	110	0	0
AUTOBRAKE 2	2380	+50/-40	70	-120/+420	+35/-50	+70/-70	100	60	60
AUTOBRAKE 1	2520	+60/-45	80	-130/+465	+60/-65	+70/-70	105	195	205

**Medium Reported Braking Action**

MAX MANUAL	1960	+40/-35	60	-110/+410	+85/-70	+50/-50	70	265	695
AUTOBRAKE MAX	1980	+40/-30	60	-110/+410	+85/-65	+50/-50	80	260	685
AUTOBRAKE 4	2025	+40/-30	60	-115/+415	+75/-50	+50/-60	90	245	690
AUTOBRAKE 3	2260	+45/-35	65	-120/+445	+50/-45	+65/-65	110	125	495
AUTOBRAKE 2	2430	+50/-40	75	-130/+470	+65/-70	+70/-70	100	130	395
AUTOBRAKE 1	2545	+60/-45	80	-140/+495	+85/-80	+70/-75	105	240	425

**Poor Reported Braking Action**

MAX MANUAL	2495	+60/-45	85	-160/+625	+190/-130	+65/-70	80	585	1835
AUTOBRAKE MAX	2505	+60/-45	85	-160/+625	+195/-130	+65/-70	85	585	1840
AUTOBRAKE 4	2525	+60/-45	85	-160/+635	+190/-130	+65/-70	80	590	1850
AUTOBRAKE 3	2595	+60/-45	85	-165/+640	+180/-115	+70/-75	105	535	1800
AUTOBRAKE 2	2685	+65/-45	85	-165/+650	+180/-125	+70/-75	90	475	1700
AUTOBRAKE 1	2750	+65/-50	90	-175/+660	+185/-125	+75/-80	100	535	1645

Reference distance is for sea level, standard day, no wind or slope, VREF25 approach speed, 2 engine reverse thrust, and auto speedbrakes.

For Max Manual braking and manual speedbrakes, increase reference landing distance by 70 m.

For autobrake and manual speedbrakes, increase reference landing distance by 65 m.

Distances for GOOD, MEDIUM, and POOR are increased by 15%.

Includes distance from 50 ft above threshold (305 meters of unfactored air distance).

**ADVISORY INFORMATION****Normal Configuration Landing Distance  
Flaps 20**

	LANDING DISTANCE AND ADJUSTMENT (M)							
	REF DIST	WEIGHT 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	200000 KG LANDING WT	PER 5000 KG ABOVE/ BELOW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN/ UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF20	ONE REV NO REV

**Dry Runway**

MAX MANUAL	960	+30/-15	20	-40/+130	+10/-10	+20/-20	35	25	50
AUTOBRAKE MAX	1320	+20/-20	30	-55/+185	0/0	+30/-30	65	0	0
AUTOBRAKE 4	1655	+30/-30	45	-75/+260	0/0	+45/-45	90	0	0
AUTOBRAKE 3	2000	+40/-35	55	-95/+330	+5/-15	+55/-55	100	0	0
AUTOBRAKE 2	2200	+45/-45	65	-110/+380	+25/-45	+60/-60	95	50	50
AUTOBRAKE 1	2335	+55/-50	75	-120/+420	+50/-60	+65/-65	95	180	180

**Good Reported Braking Action**

MAX MANUAL	1540	+30/-25	40	-75/+260	+40/-35	+35/-40	60	110	255
AUTOBRAKE MAX	1635	+30/-30	45	-75/+265	+35/-25	+40/-40	75	110	265
AUTOBRAKE 4	1905	+35/-35	50	-90/+305	+5/-5	+50/-50	105	10	60
AUTOBRAKE 3	2300	+45/-40	65	-110/+380	+5/-15	+65/-65	115	0	0
AUTOBRAKE 2	2530	+50/-50	75	-125/+435	+30/-50	+70/-70	110	60	60
AUTOBRAKE 1	2685	+65/-60	85	-140/+485	+60/-70	+75/-75	110	205	205

**Medium Reported Braking Action**

MAX MANUAL	2075	+45/-40	65	-115/+420	+90/-75	+50/-60	75	300	805
AUTOBRAKE MAX	2085	+45/-40	65	-115/+420	+90/-70	+50/-60	80	295	795
AUTOBRAKE 4	2135	+45/-40	65	-115/+425	+80/-50	+60/-60	100	280	800
AUTOBRAKE 3	2390	+45/-45	70	-125/+455	+50/-45	+65/-70	115	145	585
AUTOBRAKE 2	2590	+50/-50	80	-140/+490	+65/-70	+75/-75	110	130	455
AUTOBRAKE 1	2710	+65/-60	85	-145/+510	+85/-80	+75/-80	110	255	460

**Poor Reported Braking Action**

MAX MANUAL	2650	+65/-60	90	-165/+645	+205/-140	+70/-75	85	665	2140
AUTOBRAKE MAX	2655	+65/-60	90	-165/+645	+205/-145	+70/-75	85	665	2145
AUTOBRAKE 4	2675	+65/-60	90	-165/+650	+200/-140	+70/-75	90	675	2150
AUTOBRAKE 3	2750	+65/-60	90	-175/+655	+185/-120	+75/-80	110	615	2110
AUTOBRAKE 2	2860	+65/-60	90	-175/+665	+185/-130	+75/-80	105	530	1990
AUTOBRAKE 1	2920	+70/-65	100	-180/+685	+195/-130	+80/-80	105	580	1910

Reference distance is for sea level, standard day, no wind or slope, VREF20 approach speed, 2 engine reverse thrust, and auto speedbrakes.

For Max Manual braking and manual speedbrakes, increase reference landing distance by 75 m.

For autobrake and manual speedbrakes, increase reference landing distance by 65 m.

Distances for GOOD, MEDIUM, AND POOR are increased by 15%.

Includes distance from 50 ft above threshold (305 meters of unfactored air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****ANTISKID - Flaps 25****VREF25**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1705	+40/-30	50	-95/+355	+75/-60	+45/-45	60	230	605
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 2					Autobrake inoperative				

**Good Reported Braking Action**

MAX MANUAL	1705	+40/-30	50	-95/+355	+75/-60	+45/-45	60	230	605
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 2					Autobrake inoperative				

**Medium Reported Braking Action**

MAX MANUAL	2170	+55/-45	75	-140/+545	+165/-115	+55/-60	70	510	1595
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 3					Autobrake inoperative				

**Poor Reported Braking Action**

MAX MANUAL	2930	+85/-70	110	-235/+1045	+1350/-260	+75/-85	80	1790	5000
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 3					Autobrake inoperative				

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****ANTISKID - Flaps 30****VREF30**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN/ UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV  NO REV

**Dry Runway**

MAX MANUAL	1620	+35/-20	50	-95/+345	+70/-60	+40/-40	60	205	530
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 2						Autobrake inoperative			

**Good Reported Braking Action**

MAX MANUAL	1620	+35/-20	50	-95/+345	+70/-60	+40/-40	60	205	530
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 2						Autobrake inoperative			

**Medium Reported Braking Action**

MAX MANUAL	2070	+50/-30	70	-135/+535	+165/-110	+55/-55	70	460	1410
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 3						Autobrake inoperative			

**Poor Reported Braking Action**

MAX MANUAL	2805	+80/-55	100	-230/+1035	+1310/-255	+70/-85	80	1675	5000
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 3						Autobrake inoperative			

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance**

ENG SHUTDOWN L, R - Flaps 20

VREF20

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	970	+35/-15	20	-40/+135	+15/-10	+20/-20	35	0	25
AUTOBRAKE MAX	1320	+25/-20	30	-55/+185	0/0	+30/-30	65	0	0
AUTOBRAKE 2	2240	+50/-45	65	-110/+385	+10/-10	+65/-65	125	0	0

**Good Reported Braking Action**

MAX MANUAL	1400	+30/-25	35	-65/+235	+40/-35	+35/-35	55	0	120
AUTOBRAKE MAX	1490	+30/-30	40	-70/+245	+35/-30	+35/-40	65	0	125
AUTOBRAKE 2	2240	+50/-45	65	-110/+385	+10/-10	+65/-65	125	0	0

**Medium Reported Braking Action**

MAX MANUAL	1980	+45/-40	60	-110/+400	+105/-80	+55/-55	75	0	385
AUTOBRAKE MAX	1985	+45/-45	60	-110/+400	+105/-75	+55/-55	85	0	380
AUTOBRAKE 3	2135	+50/-45	65	-115/+415	+80/-50	+60/-60	105	0	310

**Poor Reported Braking Action**

MAX MANUAL	2665	+70/-65	90	-170/+645	+265/-170	+75/-75	90	0	990
AUTOBRAKE MAX	2675	+70/-65	90	-170/+645	+270/-175	+75/-80	90	0	995
AUTOBRAKE 3	2705	+70/-65	90	-170/+645	+270/-170	+75/-80	95	0	1005

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****ENG SHUTDOWN L, R - Flaps 30****VREF30**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	890	+25/-5	20	-35/+125	+10/-10	+20/-20	35	0	20
AUTOBRAKE MAX	1180	+20/-5	25	-50/+175	0/0	+30/-30	65	0	0
AUTOBRAKE 2	1945	+40/-15	55	-105/+355	+10/-10	+55/-55	115	0	0

**Good Reported Braking Action**

MAX MANUAL	1250	+25/-10	30	-65/+220	+35/-30	+30/-30	55	0	85
AUTOBRAKE MAX	1340	+25/-10	35	-65/+230	+30/-25	+35/-35	65	0	90
AUTOBRAKE 2	1945	+40/-15	55	-105/+355	+10/-10	+55/-55	115	0	0

**Medium Reported Braking Action**

MAX MANUAL	1750	+40/-20	50	-100/+375	+95/-70	+45/-45	70	0	280
AUTOBRAKE MAX	1755	+40/-20	50	-105/+375	+90/-65	+50/-50	80	0	280
AUTOBRAKE 3	1875	+40/-15	55	-105/+390	+75/-45	+50/-50	95	0	235

**Poor Reported Braking Action**

MAX MANUAL	2335	+60/-35	75	-160/+605	+235/-150	+65/-65	85	0	725
AUTOBRAKE MAX	2340	+60/-35	75	-160/+605	+235/-150	+65/-70	85	0	725
AUTOBRAKE 3	2370	+60/-35	75	-160/+610	+240/-150	+65/-70	85	0	735

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****FLAP / SLAT CONTROL - Flaps 20**

VREF20

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	955	+30/-15	20	-40/+130	+10/-10	+20/-20	35	20	50
AUTOBRAKE MAX	1320	+25/-20	30	-55/+185	0/0	+30/-30	65	0	0
AUTOBRAKE 2	2180	+50/-50	65	-110/+375	+30/-45	+60/-60	90	60	60

**Good Reported Braking Action**

MAX MANUAL	1325	+25/-25	35	-65/+220	+30/-30	+30/-30	50	90	215
AUTOBRAKE MAX	1415	+30/-25	35	-65/+230	+25/-20	+35/-35	65	95	220
AUTOBRAKE 2	2180	+50/-50	65	-110/+375	+30/-45	+60/-60	90	60	60

**Medium Reported Braking Action**

MAX MANUAL	1780	+40/-40	55	-100/+360	+75/-60	+45/-45	65	250	670
AUTOBRAKE MAX	1795	+40/-40	55	-100/+360	+75/-55	+45/-50	70	245	660
AUTOBRAKE 3	2070	+45/-40	60	-110/+395	+45/-40	+55/-60	95	115	470

**Poor Reported Braking Action**

MAX MANUAL	2270	+60/-55	75	-145/+555	+175/-115	+60/-65	75	555	1765
AUTOBRAKE MAX	2275	+60/-55	80	-145/+555	+175/-120	+60/-65	75	555	1770
AUTOBRAKE 3	2365	+60/-55	75	-145/+565	+155/-105	+65/-65	95	500	1725

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****FLAPS DRIVE - (Flaps ≤ 5)****VREF30+40**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN/ UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1170	+45/-15	30	-45/+150	+15/-15	+25/-25	40	40	95
AUTOBRAKE MAX	1710	+30/-5	45	-65/+215	0/0	+45/-45	75	0	0
AUTOBRAKE 2	2845	+65/-45	95	-130/+430	+50/-70	+85/-85	95	220	220

**Good Reported Braking Action**

MAX MANUAL	1585	+30/-15	45	-70/+240	+35/-30	+40/-40	50	135	325
AUTOBRAKE MAX	1780	+30/-10	50	-75/+260	+15/-10	+45/-45	75	85	285
AUTOBRAKE 2	2845	+65/-45	95	-130/+430	+50/-70	+85/-85	95	220	220

**Medium Reported Braking Action**

MAX MANUAL	2170	+50/-30	70	-110/+390	+85/-70	+60/-60	65	375	1055
AUTOBRAKE MAX	2200	+50/-25	70	-110/+390	+80/-65	+60/-60	75	370	1040
AUTOBRAKE 3	2725	+55/-35	85	-130/+450	+50/-60	+75/-80	105	175	675

**Poor Reported Braking Action**

MAX MANUAL	2785	+70/-45	100	-155/+600	+195/-135	+75/-80	80	815	2845
AUTOBRAKE MAX	2795	+70/-45	100	-160/+600	+195/-135	+75/-80	80	815	2855
AUTOBRAKE 3	3005	+70/-45	105	-165/+620	+170/-120	+85/-85	100	665	2720

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****FLAPS DRIVE - (5 < Flaps < 20)****VREF30+20**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1020	+35/-5	25	-40/+135	+15/-10	+20/-20	35	25	60
AUTOBRAKE MAX	1430	+25/-5	35	-60/+195	0/0	+35/-35	70	0	0
AUTOBRAKE 2	2425	+55/-30	75	-115/+400	+25/-50	+70/-70	100	60	60

**Good Reported Braking Action**

MAX MANUAL	1430	+30/-15	40	-65/+230	+35/-30	+35/-35	55	110	260
AUTOBRAKE MAX	1525	+30/-10	40	-70/+240	+30/-20	+40/-40	65	110	270
AUTOBRAKE 2	2425	+55/-30	75	-115/+400	+25/-50	+70/-70	100	60	60

**Medium Reported Braking Action**

MAX MANUAL	1945	+45/-25	60	-105/+375	+85/-70	+50/-50	70	305	840
AUTOBRAKE MAX	1965	+45/-25	60	-105/+380	+85/-65	+50/-55	70	300	835
AUTOBRAKE 3	2280	+45/-20	65	-115/+415	+40/-40	+65/-65	105	135	610

**Poor Reported Braking Action**

MAX MANUAL	2495	+65/-40	90	-150/+580	+190/-130	+65/-70	80	675	2250
AUTOBRAKE MAX	2515	+65/-40	90	-150/+585	+195/-135	+65/-70	80	680	2265
AUTOBRAKE 3	2610	+65/-35	90	-155/+590	+170/-110	+70/-75	100	625	2220

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****FLAPS DRIVE - (Flaps ≥ 20)****VREF20**

LANDING DISTANCES AND ADJUSTMENTS (M)									
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN/ UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

**Dry Runway**

MAX MANUAL	960	+30/-15	20	-40/+130	+10/-10	+20/-20	35	25	50
AUTOBRAKE MAX	1320	+25/-20	30	-55/+185	0/0	+30/-30	65	0	0
AUTOBRAKE 2	2200	+50/-50	65	-110/+380	+25/-45	+60/-60	95	50	50

**Good Reported Braking Action**

MAX MANUAL	1340	+25/-25	35	-65/+225	+35/-30	+30/-35	50	95	220
AUTOBRAKE MAX	1420	+30/-25	40	-65/+230	+30/-20	+35/-35	65	95	230
AUTOBRAKE 2	2200	+50/-50	65	-110/+380	+25/-45	+60/-60	95	50	50

**Medium Reported Braking Action**

MAX MANUAL	1805	+40/-40	55	-100/+365	+80/-65	+45/-50	65	260	700
AUTOBRAKE MAX	1815	+45/-40	55	-100/+365	+80/-60	+45/-50	70	255	690
AUTOBRAKE 3	2080	+45/-40	60	-110/+395	+45/-40	+55/-60	100	125	510

**Poor Reported Braking Action**

MAX MANUAL	2305	+60/-55	80	-145/+560	+180/-120	+60/-65	75	580	1860
AUTOBRAKE MAX	2310	+60/-55	80	-145/+560	+180/-125	+60/-65	75	580	1865
AUTOBRAKE 3	2390	+60/-55	80	-150/+570	+160/-105	+65/-70	95	535	1835

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****FLAPS PRIMARY FAIL - Flaps 20**

VREF20

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1080	+30/-15	25	-40/+145	+15/-15	+25/-25	45	30	60
AUTOBRAKE MAX	1320	+25/-20	30	-55/+185	0/0	+30/-30	65	0	0
AUTOBRAKE 2	2245	+50/-50	65	-110/+385	+5/-25	+65/-65	115	10	10

**Good Reported Braking Action**

MAX MANUAL	1475	+30/-25	40	-70/+240	+35/-35	+35/-35	60	110	265
AUTOBRAKE MAX	1485	+30/-30	40	-70/+240	+35/-30	+35/-35	70	110	265
AUTOBRAKE 2	2245	+50/-50	65	-110/+385	+5/-25	+65/-65	115	10	10

**Medium Reported Braking Action**

MAX MANUAL	1965	+45/-40	60	-105/+385	+90/-70	+50/-50	75	305	835
AUTOBRAKE MAX	1955	+45/-40	60	-105/+380	+95/-75	+50/-50	80	305	830
AUTOBRAKE 3	2120	+45/-40	60	-110/+405	+55/-35	+60/-60	110	175	710

**Poor Reported Braking Action**

MAX MANUAL	2480	+65/-60	85	-155/+585	+195/-130	+65/-70	85	660	2200
AUTOBRAKE MAX	2490	+65/-60	85	-155/+585	+200/-140	+65/-70	85	660	2205
AUTOBRAKE 3	2515	+65/-55	85	-155/+590	+190/-120	+65/-70	100	645	2195

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****FLIGHT CONTROL MODE - Flaps 20****VREF20**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1105	+30/-15	25	-45/+145	+15/-15	+25/-25	50	30	70
AUTOBRAKE MAX	1320	+25/-20	30	-55/+185	0/0	+30/-30	65	0	0
AUTOBRAKE 2	2260	+50/-50	65	-115/+385	0/-15	+65/-65	125	0	0

**Good Reported Braking Action**

MAX MANUAL	1520	+30/-30	40	-70/+245	+40/-35	+35/-35	65	125	300
AUTOBRAKE MAX	1510	+30/-30	40	-70/+245	+35/-30	+40/-40	70	120	290
AUTOBRAKE 2	2260	+50/-50	65	-115/+385	0/-15	+65/-65	125	0	0

**Medium Reported Braking Action**

MAX MANUAL	2030	+50/-45	65	-110/+390	+95/-75	+50/-55	80	340	945
AUTOBRAKE MAX	2020	+50/-45	65	-110/+390	+100/-80	+55/-55	85	335	940
AUTOBRAKE 3	2140	+50/-40	65	-115/+405	+70/-35	+60/-60	110	245	855

**Poor Reported Braking Action**

MAX MANUAL	2570	+70/-60	90	-155/+600	+210/-140	+65/-70	95	725	2515
AUTOBRAKE MAX	2580	+70/-60	90	-155/+600	+215/-145	+70/-70	95	730	2525
AUTOBRAKE 3	2585	+70/-60	90	-160/+600	+215/-130	+70/-75	105	725	2520

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS C - Flaps 20****VREF20**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1080	+30/-15	25	-40/+145	+15/-15	+25/-25	45	30	60
AUTOBRAKE MAX	1320	+25/-20	30	-55/+185	0/0	+30/-30	65	0	0
AUTOBRAKE 2	2245	+50/-50	65	-110/+385	+5/-25	+65/-65	115	10	10

**Good Reported Braking Action**

MAX MANUAL	1475	+30/-25	40	-70/+240	+35/-35	+35/-35	60	110	265
AUTOBRAKE MAX	1485	+30/-30	40	-70/+240	+35/-30	+35/-35	70	110	265
AUTOBRAKE 2	2245	+50/-50	65	-110/+385	+5/-25	+65/-65	115	10	10

**Medium Reported Braking Action**

MAX MANUAL	1965	+45/-40	60	-105/+385	+90/-70	+50/-50	75	305	835
AUTOBRAKE MAX	1955	+45/-40	60	-105/+380	+95/-75	+50/-50	80	305	830
AUTOBRAKE 3	2120	+45/-40	60	-110/+405	+55/-35	+60/-60	110	175	710

**Poor Reported Braking Action**

MAX MANUAL	2480	+65/-60	85	-155/+585	+195/-130	+65/-70	85	660	2200
AUTOBRAKE MAX	2490	+65/-60	85	-155/+585	+200/-140	+65/-70	85	660	2205
AUTOBRAKE 3	2515	+65/-55	85	-155/+590	+190/-120	+65/-70	100	645	2195

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS L - Flaps 25****VREF25**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	990	+30/-10	20	-40/+140	+15/-15	+20/-20	40	0	30
AUTOBRAKE MAX	1260	+25/-15	30	-55/+180	0/0	+30/-30	65	0	0
AUTOBRAKE 2	2135	+45/-30	60	-110/+375	0/-10	+60/-60	125	0	0

**Good Reported Braking Action**

MAX MANUAL	1435	+30/-20	40	-70/+250	+45/-40	+35/-35	65	0	135
AUTOBRAKE MAX	1495	+30/-20	40	-75/+255	+40/-30	+40/-40	70	0	135
AUTOBRAKE 2	2135	+45/-30	60	-110/+375	0/-10	+60/-60	125	0	0

**Medium Reported Braking Action**

MAX MANUAL	2065	+45/-35	65	-120/+435	+125/-95	+55/-60	85	0	455
AUTOBRAKE MAX	2070	+45/-35	65	-120/+435	+130/-100	+55/-60	85	0	455
AUTOBRAKE 3	2145	+45/-35	65	-120/+445	+115/-75	+60/-60	105	0	455

**Poor Reported Braking Action**

MAX MANUAL	2875	+70/-55	100	-195/+765	+380/-215	+80/-85	100	0	1310
AUTOBRAKE MAX	2885	+70/-55	100	-195/+765	+385/-220	+80/-85	100	0	1315
AUTOBRAKE 3	2910	+70/-55	100	-195/+765	+375/-220	+85/-85	100	0	1325

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS L - Flaps 30****VREF30**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	945	+25/-5	20	-40/+135	+15/-15	+20/-20	40	0	25
AUTOBRAKE MAX	1180	+20/-5	25	-50/+175	0/0	+30/-30	65	0	0
AUTOBRAKE 2	1970	+40/-10	55	-105/+355	0/-5	+55/-55	120	0	0

**Good Reported Braking Action**

MAX MANUAL	1365	+25/-10	35	-70/+245	+45/-35	+35/-35	65	0	120
AUTOBRAKE MAX	1410	+25/-10	35	-70/+250	+35/-30	+35/-35	70	0	115
AUTOBRAKE 2	1970	+40/-10	55	-105/+355	0/-5	+55/-55	120	0	0

**Medium Reported Braking Action**

MAX MANUAL	1965	+45/-20	60	-115/+430	+125/-95	+55/-55	85	0	400
AUTOBRAKE MAX	1965	+45/-20	60	-115/+430	+130/-95	+55/-55	85	0	405
AUTOBRAKE 3	2020	+45/-20	60	-120/+435	+120/-75	+55/-55	95	0	415

**Poor Reported Braking Action**

MAX MANUAL	2745	+65/-35	95	-190/+750	+375/-210	+75/-80	100	0	1180
AUTOBRAKE MAX	2755	+65/-35	95	-190/+750	+380/-215	+80/-80	100	0	1185
AUTOBRAKE 3	2775	+65/-35	95	-195/+755	+370/-210	+80/-80	105	0	1190

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS L+C - Flaps 20****VREF30+20**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN/ UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1245	+30/-5	30	-50/+165	+20/-20	+30/-30	55	0	50
AUTOBRAKE MAX	1430	+25/-5	35	-60/+195	0/0	+35/-35	70	0	0
AUTOBRAKE 2	2485	+50/-10	70	-120/+405	0/0	+75/-75	140	0	0

**Good Reported Braking Action**

MAX MANUAL	1810	+35/-10	50	-85/+285	+60/-50	+45/-50	80	0	215
AUTOBRAKE MAX	1790	+35/-10	50	-85/+285	+60/-45	+50/-50	90	0	205
AUTOBRAKE 2	2485	+50/-10	70	-120/+405	0/0	+75/-75	140	0	0

**Medium Reported Braking Action**

MAX MANUAL	2595	+55/-25	85	-140/+495	+170/-125	+75/-75	105	0	710
AUTOBRAKE MAX	2585	+55/-25	85	-140/+495	+175/-135	+75/-75	110	0	705
AUTOBRAKE 3	2610	+55/-25	85	-140/+495	+170/-115	+75/-75	115	0	715

**Poor Reported Braking Action**

MAX MANUAL	3580	+85/-50	130	-225/+845	+480/-275	+105/-105	125	0	2015
AUTOBRAKE MAX	3590	+85/-50	135	-225/+850	+490/-285	+105/-110	125	0	2020
AUTOBRAKE 3	3595	+85/-50	135	-225/+850	+490/-275	+105/-110	130	0	2020

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS L+R - Flaps 20****VREF30+20**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1360	+25/-5	35	-60/+195	+35/-30	+35/-35	65	0	0
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 2					Autobrake inoperative				

**Good Reported Braking Action**

MAX MANUAL	2180	+40/-10	65	-110/+375	+120/-95	+65/-65	100	0	0
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 2					Autobrake inoperative				

**Medium Reported Braking Action**

MAX MANUAL	3580	+65/-20	115	-210/+750	+450/-280	+110/-115	145	0	0
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 3					Autobrake inoperative				

**Poor Reported Braking Action**

MAX MANUAL	6125	+85/15	215	-445/+1775	+3390/-875	+200/-205	180	0	0
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 3					Autobrake inoperative				

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

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**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS R - Flaps 25****VREF25**

LANDING DISTANCES AND ADJUSTMENTS (M)									
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

**Dry Runway**

MAX MANUAL	1090	+20/-15	25	-45/+165	+20/-20	+25/-25	50	0	45
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 2						Autobrake inoperative			

**Good Reported Braking Action**

MAX MANUAL	1580	+30/-25	45	-80/+290	+60/-50	+40/-40	70	0	190
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 2						Autobrake inoperative			

**Medium Reported Braking Action**

MAX MANUAL	2240	+50/-40	70	-135/+500	+165/-115	+60/-65	85	0	590
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 3						Autobrake inoperative			

**Poor Reported Braking Action**

MAX MANUAL	3070	+70/-55	110	-220/+880	+535/-255	+85/-90	100	0	1675
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 3						Autobrake inoperative			

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS R - Flaps 30****VREF30**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1035	+20/-5	25	-45/+160	+20/-15	+25/-25	45	0	40
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 2					Autobrake inoperative				

**Good Reported Braking Action**

MAX MANUAL	1480	+30/-10	40	-80/+280	+55/-45	+40/-40	65	0	160
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 2					Autobrake inoperative				

**Medium Reported Braking Action**

MAX MANUAL	2090	+45/-25	65	-130/+485	+155/-110	+60/-60	85	0	495
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 3					Autobrake inoperative				

**Poor Reported Braking Action**

MAX MANUAL	2860	+65/-40	100	-210/+855	+505/-240	+80/-85	95	0	1415
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 3					Autobrake inoperative				

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS R+C - Flaps 20****VREF30+20**

LANDING DISTANCES AND ADJUSTMENTS (M)									
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

**Dry Runway**

MAX MANUAL	1550	+25/-5	40	-65/+225	+40/-35	+40/-40	75	0	120
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 2						Autobrake inoperative			

**Good Reported Braking Action**

MAX MANUAL	2240	+45/-20	70	-110/+385	+110/-90	+60/-60	100	0	440
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 2						Autobrake inoperative			

**Medium Reported Braking Action**

MAX MANUAL	3130	+70/-35	110	-180/+655	+290/-195	+90/-90	120	0	1290
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 3						Autobrake inoperative			

**Poor Reported Braking Action**

MAX MANUAL	4220	+100/-60	165	-290/+1150	+1095/-405	+120/-130	135	0	3680
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 3						Autobrake inoperative			

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****PITCH UP AUTHORITY - (Flaps ≤ 15)**

VREF30+40

	LANDING DISTANCES AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1150	+40/-10	25	-45/+150	+15/-15	+25/-25	40	35	75
AUTOBRAKE MAX	1710	+30/-5	45	-65/+215	0/0	+45/-45	75	0	0
AUTOBRAKE 2	2750	+60/-40	90	-125/+420	+60/-65	+80/-80	90	245	265

**Good Reported Braking Action**

MAX MANUAL	1575	+30/-15	45	-70/+240	+35/-30	+40/-40	50	120	285
AUTOBRAKE MAX	1795	+30/-10	50	-75/+260	+20/-15	+45/-50	75	80	245
AUTOBRAKE 2	2750	+60/-40	90	-125/+420	+60/-65	+80/-80	90	245	265

**Medium Reported Braking Action**

MAX MANUAL	2135	+45/-30	70	-105/+390	+85/-70	+55/-60	60	325	865
AUTOBRAKE MAX	2210	+50/-30	70	-110/+395	+80/-65	+60/-60	75	325	870
AUTOBRAKE 3	2655	+55/-35	85	-125/+445	+70/-65	+75/-75	85	190	565

**Poor Reported Braking Action**

MAX MANUAL	2720	+65/-45	95	-155/+595	+190/-130	+75/-75	75	690	2225
AUTOBRAKE MAX	2750	+65/-45	100	-155/+595	+190/-130	+75/-80	80	685	2225
AUTOBRAKE 3	2940	+70/-50	100	-165/+615	+180/-130	+80/-85	85	585	2090

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## ADVISORY INFORMATION

### Non-Normal Configuration Landing Distance

#### PITCH UP AUTHORITY - (Flaps ≥ 20)

VREF30+20

LANDING DISTANCES AND ADJUSTMENTS (M)									
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

#### Dry Runway

MAX MANUAL	990	+35/-5	20	-40/+130	+10/-10	+20/-20	35	25	50
AUTOBRAKE MAX	1430	+25/-5	35	-60/+195	0/0	+35/-35	70	0	0
AUTOBRAKE 2	2320	+55/-35	75	-115/+385	+45/-50	+65/-65	85	130	130

#### Good Reported Braking Action

MAX MANUAL	1380	+25/-15	35	-65/+225	+30/-30	+35/-35	45	95	220
AUTOBRAKE MAX	1520	+30/-10	40	-70/+240	+20/-15	+40/-40	70	80	215
AUTOBRAKE 2	2320	+55/-35	75	-115/+385	+45/-50	+65/-65	85	130	130

#### Medium Reported Braking Action

MAX MANUAL	1855	+40/-25	55	-100/+365	+75/-60	+50/-50	60	260	680
AUTOBRAKE MAX	1895	+45/-20	60	-100/+370	+70/-55	+50/-50	70	255	670
AUTOBRAKE 3	2225	+45/-25	65	-115/+410	+55/-50	+60/-65	90	125	440

#### Poor Reported Braking Action

MAX MANUAL	2365	+60/-40	80	-145/+560	+175/-120	+65/-65	70	565	1775
AUTOBRAKE MAX	2375	+60/-40	80	-145/+565	+175/-120	+65/-65	75	565	1775
AUTOBRAKE 3	2505	+60/-40	85	-150/+575	+160/-110	+70/-70	85	470	1690

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****PRIMARY FLIGHT COMPUTERS - Flaps 20**

VREF20

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1105	+30/-15	25	-45/+145	+15/-15	+25/-25	50	30	70
AUTOBRAKE MAX	1320	+25/-20	30	-55/+185	0/0	+30/-30	65	0	0
AUTOBRAKE 2	2260	+50/-50	65	-115/+385	0/-15	+65/-65	125	0	0

**Good Reported Braking Action**

MAX MANUAL	1520	+30/-30	40	-70/+245	+40/-35	+35/-35	65	125	300
AUTOBRAKE MAX	1510	+30/-30	40	-70/+245	+35/-30	+40/-40	70	120	290
AUTOBRAKE 2	2260	+50/-50	65	-115/+385	0/-15	+65/-65	125	0	0

**Medium Reported Braking Action**

MAX MANUAL	2030	+50/-45	65	-110/+390	+95/-75	+50/-55	80	340	945
AUTOBRAKE MAX	2020	+50/-45	65	-110/+390	+100/-80	+55/-55	85	335	940
AUTOBRAKE 3	2140	+50/-40	65	-115/+405	+70/-35	+60/-60	110	245	855

**Poor Reported Braking Action**

MAX MANUAL	2570	+70/-60	90	-155/+600	+210/-140	+65/-70	95	725	2515
AUTOBRAKE MAX	2580	+70/-60	90	-155/+600	+215/-145	+70/-70	95	730	2525
AUTOBRAKE 3	2585	+70/-60	90	-160/+600	+215/-130	+70/-75	105	725	2520

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## ADVISORY INFORMATION

### Non-Normal Configuration Landing Distance

#### SLATS DRIVE - Flaps 20

VREF30+30

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

#### Dry Runway

MAX MANUAL	1110	+35/-5	25	-40/+145	+15/-15	+25/-25	40	30	70
AUTOBRAKE MAX	1565	+25/-5	40	-60/+205	+5/0	+40/-40	75	0	0
AUTOBRAKE 2	2550	+55/-35	80	-120/+405	+55/-60	+75/-75	90	170	175

#### Good Reported Braking Action

MAX MANUAL	1545	+30/-15	45	-70/+240	+40/-35	+40/-40	55	120	285
AUTOBRAKE MAX	1670	+30/-10	45	-75/+250	+25/-20	+45/-45	75	115	290
AUTOBRAKE 2	2550	+55/-35	80	-120/+405	+55/-60	+75/-75	90	170	175

#### Medium Reported Braking Action

MAX MANUAL	2065	+45/-30	65	-105/+385	+90/-70	+55/-55	65	315	840
AUTOBRAKE MAX	2100	+45/-25	65	-105/+390	+80/-65	+55/-60	75	310	825
AUTOBRAKE 3	2455	+50/-30	75	-120/+430	+65/-60	+70/-70	90	160	565

#### Poor Reported Braking Action

MAX MANUAL	2605	+65/-45	90	-155/+585	+190/-130	+70/-75	75	655	2095
AUTOBRAKE MAX	2615	+65/-45	90	-155/+590	+190/-130	+70/-75	80	655	2095
AUTOBRAKE 3	2755	+65/-45	95	-160/+600	+175/-125	+75/-80	90	555	2000

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****STABILIZER - Flaps 20****VREF30+20**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1030	+30/-5	25	-40/+135	+15/-10	+25/-25	35	25	60
AUTOBRAKE MAX	1430	+25/-5	35	-60/+195	0/0	+35/-35	70	0	0
AUTOBRAKE 2	2360	+55/-35	75	-115/+390	+40/-50	+65/-65	90	100	100

**Good Reported Braking Action**

MAX MANUAL	1435	+30/-15	40	-65/+230	+35/-30	+35/-35	50	105	255
AUTOBRAKE MAX	1535	+30/-10	40	-70/+240	+30/-20	+40/-40	70	110	260
AUTOBRAKE 2	2360	+55/-35	75	-115/+390	+40/-50	+65/-65	90	100	100

**Medium Reported Braking Action**

MAX MANUAL	1925	+45/-25	60	-105/+375	+85/-65	+50/-50	65	285	770
AUTOBRAKE MAX	1945	+45/-25	60	-105/+375	+80/-60	+50/-55	75	280	755
AUTOBRAKE 3	2250	+45/-25	65	-115/+410	+55/-45	+65/-65	95	135	535

**Poor Reported Braking Action**

MAX MANUAL	2440	+60/-40	85	-150/+575	+185/-125	+65/-70	75	615	1965
AUTOBRAKE MAX	2450	+65/-40	85	-150/+575	+185/-125	+65/-70	75	615	1970
AUTOBRAKE 3	2555	+60/-35	85	-155/+585	+165/-110	+70/-75	95	540	1905

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Recommended Brake Cooling Schedule****Reference Brake Energy (Millions of Foot Pounds)**

WEIGHT (1000 KG)	OAT (°C)	BRAKES ON SPEED (KIAS)																	
		80		100		120		140		160		180							
		PRESSURE ALTITUDE (1000 FT)																	
300	0	18.3	19.2	20.2	27.3	28.8	30.5	37.8	40.0	42.4	49.5	52.5	55.8	62.2	66.0	70.2	75.2	79.8	84.8
	10	18.8	19.7	20.7	28.2	29.7	31.4	39.0	41.3	43.8	51.1	54.2	57.6	64.2	68.2	72.4	77.5	82.3	87.4
	15	19.2	20.1	21.1	28.7	30.3	32.0	39.7	42.1	44.6	52.0	55.2	58.6	65.3	69.4	73.7	78.8	83.7	88.8
	20	19.5	20.4	21.5	29.2	30.8	32.5	40.4	42.8	45.3	52.9	56.1	59.6	66.4	70.5	74.9	80.1	85.0	90.2
	30	19.9	20.9	22.0	29.9	31.6	33.3	41.5	43.9	46.6	54.4	57.7	61.3	68.3	72.5	77.0	82.3	87.3	92.6
	40	20.1	21.1	22.2	30.3	32.0	33.8	42.2	44.7	47.4	55.4	58.9	62.5	69.7	74.0	78.7	84.1	89.2	94.6
280	0	17.3	18.2	19.1	25.8	27.2	28.8	35.7	37.7	40.0	46.7	49.5	52.5	58.6	62.2	66.1	70.9	75.3	80.0
	10	17.8	18.7	19.6	26.6	28.1	29.6	36.8	38.9	41.2	48.2	51.1	54.2	60.5	64.2	68.2	73.2	77.7	82.5
	15	18.1	19.0	20.0	27.1	28.6	30.2	37.5	39.6	42.0	49.1	52.0	55.2	61.6	65.3	69.4	74.4	79.0	83.9
	20	18.4	19.3	20.3	27.6	29.1	30.7	38.1	40.3	42.7	49.9	52.9	56.1	62.6	66.4	70.6	75.6	80.3	85.2
	30	18.9	19.8	20.8	28.3	29.8	31.5	39.1	41.4	43.9	51.3	54.4	57.7	64.4	68.3	72.6	77.8	82.5	87.6
	40	19.0	20.0	21.0	28.6	30.2	31.9	39.8	42.1	44.6	52.2	55.4	58.9	65.7	69.8	74.1	79.5	84.3	89.5
260	0	16.4	17.2	18.0	24.4	25.7	27.1	33.5	35.5	37.5	43.8	46.4	49.3	54.9	58.3	62.0	66.5	70.7	75.1
	10	16.8	17.6	18.5	25.1	26.4	27.9	34.6	36.6	38.7	45.2	47.9	50.8	56.7	60.2	63.9	68.7	72.9	77.5
	15	17.1	18.0	18.9	25.6	26.9	28.4	35.2	37.3	39.4	46.0	48.8	51.7	57.7	61.3	65.1	69.9	74.2	78.8
	20	17.4	18.3	19.2	26.0	27.4	28.9	35.8	37.9	40.1	46.8	49.6	52.6	58.7	62.3	66.2	71.0	75.4	80.1
	30	17.8	18.7	19.6	26.6	28.0	29.6	36.8	38.9	41.2	48.1	51.0	54.1	60.3	64.0	68.0	73.0	77.5	82.3
	40	18.0	18.8	19.8	26.9	28.4	30.0	37.3	39.5	41.9	49.0	51.9	55.2	61.6	65.4	69.5	74.6	79.2	84.1
240	0	15.5	16.2	17.0	22.9	24.1	25.4	31.4	33.2	35.1	40.9	43.3	45.9	51.2	54.3	57.7	62.0	65.9	70.0
	10	15.9	16.6	17.4	23.5	24.8	26.1	32.4	34.2	36.2	42.2	44.7	47.4	52.8	56.1	59.6	64.0	68.0	72.3
	15	16.2	16.9	17.7	24.0	25.3	26.6	33.0	34.8	36.9	43.0	45.5	48.3	53.8	57.1	60.6	65.1	69.2	73.5
	20	16.4	17.2	18.0	24.4	25.7	27.0	33.5	35.4	37.5	43.7	46.3	49.1	54.7	58.0	61.6	66.2	70.3	74.7
	30	16.8	17.6	18.4	25.0	26.3	27.7	34.4	36.3	38.5	44.9	47.5	50.4	56.2	59.7	63.4	68.1	72.3	76.8
	40	16.9	17.7	18.6	25.3	26.6	28.1	34.9	36.9	39.1	45.7	48.4	51.4	57.3	60.9	64.7	69.6	73.9	78.5
220	0	14.5	15.2	15.9	21.4	22.5	23.7	29.2	30.9	32.6	37.9	40.2	42.6	47.4	50.3	53.4	57.4	60.9	64.8
	10	14.9	15.6	16.4	22.0	23.2	24.4	30.1	31.8	33.6	39.1	41.4	43.9	48.9	51.9	55.1	59.2	62.9	66.8
	15	15.2	15.9	16.7	22.4	23.6	24.8	30.7	32.4	34.2	39.8	42.2	44.7	49.8	52.8	56.1	60.3	64.0	68.0
	20	15.5	16.2	17.0	22.8	24.0	25.2	31.2	32.9	34.8	40.5	42.9	45.5	50.6	53.7	57.0	61.3	65.1	69.1
	30	15.8	16.5	17.3	23.3	24.6	25.9	32.0	33.8	35.7	41.4	44.1	46.7	52.1	55.2	58.6	63.0	66.9	71.1
	40	15.9	16.6	17.4	23.6	24.8	26.2	32.5	34.3	36.3	42.3	44.8	47.6	53.0	56.3	59.8	64.3	68.3	72.6
200	0	13.6	14.3	14.9	19.9	20.9	22.0	27.1	28.5	30.1	35.0	37.0	39.2	43.5	46.1	48.9	52.6	55.8	59.3
	10	14.0	14.6	15.3	20.5	21.5	22.6	27.9	29.4	31.1	36.0	38.1	40.4	44.9	47.6	50.5	54.3	57.6	61.2
	15	14.3	14.9	15.6	20.9	21.9	23.0	28.4	29.9	31.7	36.7	38.8	41.1	45.7	48.5	51.4	55.3	58.7	62.3
	20	14.5	15.1	15.8	21.2	22.3	23.4	28.9	30.4	32.2	37.3	39.5	41.8	46.5	49.3	52.3	56.2	59.7	63.4
	30	14.8	15.5	16.2	21.7	22.8	24.0	29.6	31.2	33.0	38.3	40.6	43.0	47.8	50.7	53.8	57.8	61.3	65.2
	40	14.9	15.6	16.3	21.9	23.1	24.3	30.0	31.7	33.5	38.9	41.2	43.7	48.7	51.6	54.8	58.9	62.6	66.5
180	0	12.8	13.3	13.9	18.4	19.4	20.3	24.9	26.2	27.6	31.9	33.8	35.7	39.6	41.9	44.4	47.7	50.6	53.7
	10	13.1	13.7	14.3	19.0	19.9	20.9	25.6	27.0	28.5	32.9	34.8	36.8	40.8	43.2	45.9	49.2	52.2	55.4
	15	13.3	13.9	14.6	19.3	20.3	21.3	26.1	27.5	29.0	33.5	35.4	37.5	41.6	44.0	46.7	50.1	53.2	56.4
	20	13.5	14.1	14.8	19.6	20.6	21.7	26.5	27.9	29.5	34.1	36.0	38.1	42.3	44.8	47.5	51.0	54.1	57.4
	30	13.8	14.4	15.1	20.1	21.1	22.2	27.2	28.6	30.2	35.0	37.0	39.2	43.4	46.0	48.8	52.4	55.6	59.0
	40	13.9	14.5	15.2	20.3	21.3	22.4	27.5	29.0	30.7	35.5	37.6	39.8	44.2	46.8	49.7	53.4	56.7	60.2

To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind.

If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 15°C.

**ADVISORY INFORMATION****Recommended Brake Cooling Schedule****Event Adjusted Brake Energy (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	100
RTO MAX MAN		10	20	30	40	50	60	70	80	90	100
LANDING	MAX MAN	5.5	14.9	24.1	33.2	42.3	51.4	60.6	69.9	79.3	88.9
	MAX AUTO	5.5	14.0	22.4	31.0	39.6	48.5	57.6	67.0	76.7	86.9
	AUTOBRAKE 4	5.5	13.5	21.4	29.3	37.3	45.5	54.1	63.1	72.6	82.8
	AUTOBRAKE 3	5.5	12.9	20.3	27.6	35.0	42.5	50.5	58.8	67.8	77.4
	AUTOBRAKE 2	5.4	12.4	19.2	25.9	32.7	39.7	46.9	54.6	62.8	71.7
	AUTOBRAKE 1	5.4	11.9	18.2	24.4	30.6	37.0	43.7	50.8	58.5	66.8

**2 Engine Reverse Thrust**

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)									
EVENT		10	20	30	40	50	60	70	80	90	100
RTO MAX MAN		10	20	30	40	50	60	70	80	90	100
LANDING	MAX MAN	4.8	13.6	22.1	30.5	38.8	47.0	55.2	63.4	71.7	80.0
	MAX AUTO	3.0	10.1	17.3	24.5	31.9	39.6	47.5	55.9	64.7	74.0
	AUTOBRAKE 4	2.5	7.9	13.5	19.4	25.6	32.1	39.1	46.6	54.7	63.4
	AUTOBRAKE 3	1.6	5.5	9.7	14.2	19.1	24.5	30.3	36.6	43.4	50.7
	AUTOBRAKE 2	0.9	3.6	6.6	10.0	13.7	17.8	22.4	27.4	32.8	38.7
	AUTOBRAKE 1	0.6	2.7	5.0	7.5	10.3	13.4	16.8	20.7	25.1	30.1

**Cooling Time (Minutes)**

		EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)									
16 & BELOW		17	18	20	24	28	32	35	36 TO 44	45 & ABOVE	
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE	1	1	2	4	5	6	7	CAUTION	FUSE PLUG MELT ZONE	
GROUND	REQUIRED	10	13	23	40	53	66	73			
BTMS	UP TO 2.4	2.4	2.5	2.9	3.4	4.0	4.4	4.9	5.0 TO 6.3	6.3 & 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 10 percent.

For two brakes deactivated, increase brake energy by 20 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 approach gear or attempt to taxi for one hour. Tire, wheel and brake replacement may be required. If overheat occurs after takeoff, extend gear soon for at least 12 minutes.

Brake temperature monitor system (BTMS) indication on EICAS may be used 12 to 15 minutes after airplane has come to a complete stop, or inflight with gear retracted, to determine recommended cooling schedule. (Inflight gear extended, the BTMS indications may vary between individual brakes, due to airstream effects, gear tilt, and position of the gear temperature probes.)

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Landing Climb Limit Weight**

Valid for approach with flaps 20 and landing with flaps 25 or 30

AIRPORT OAT		CLIMB LIMIT WEIGHT (1000 KG)			
		AIRPORT PRESSURE ALTITUDE (FT)			
°C	°F	0	1000	2000	3000
54	130	199			
50	122	214	205	196	
45	113	229	220	212	202
40	104	245	235	226	216
35	95	258	252	242	230
30	86	263	260	255	243
25	77	263	261	258	255
20	68	264	261	258	255
15	59	264	261	259	256
10 & BELOW	50 & BELOW	264	262	259	256

Based on engine bleed for 2 packs on and engine anti-ice on or off and wing anti-ice off.

With packs off, increase allowable weight by 2100 kg.

With engine and wing anti-ice on, decrease allowable weight by 900 kg.

Decrease allowable weight by 18000 kg for ice accumulation when operating in icing conditions during any part of the flight with forecast landing temperatures below 10°C.

Intentionally  
Blank

DRAFT

**Performance Inflight - QRH**  
**Engine Inoperative**
**Chapter PI-QRH**  
**Section 12**
**ENGINE INOP**
**Initial Max Continuous %N1**
**Based on .84M, engine bleed for packs on and anti-ice off**

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	27	29	31	33	35	37	39	41	43
20	98.7	98.2	97.7	97.3	97.2	96.8	96.9	96.5	96.1
15	99.3	98.8	98.3	97.8	97.8	97.1	97.2	96.8	96.4
10	99.9	99.4	98.9	98.4	98.4	97.7	97.8	97.4	97.1
5	100.3	100.1	99.5	99.1	99.0	98.3	98.4	98.1	97.7
0	99.4	100.3	100.2	99.7	99.6	99.0	99.1	98.7	98.4
-5	98.5	99.4	100.4	100.6	100.4	99.6	99.8	99.4	99.0
-10	97.6	98.5	99.5	100.7	101.6	100.6	100.7	100.3	99.9
-15	96.6	97.6	98.5	99.7	101.5	101.5	101.6	101.2	100.8
-20	95.7	96.6	97.6	98.7	100.5	100.6	100.6	100.2	99.9
-25	94.8	95.6	96.6	97.7	99.5	99.6	99.6	99.3	98.9
-30	93.8	94.7	95.6	96.8	98.5	98.6	98.6	98.2	97.9
-35	92.8	93.7	94.6	95.8	97.5	97.5	97.6	97.2	96.9
-40	91.8	92.7	93.6	94.7	96.5	96.5	96.5	96.2	95.8

**ENGINE INOP****Max Continuous %N1****Based on engine bleed for packs on or off and anti-ice off****37000 FT to 27000 FT Pressure Altitudes**

37000 FT PRESS ALT			TAT (°C)										
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
200	0.63	95.1	96.1	97.2	98.2	99.2	100.2	100.8	100.4	99.6	98.9	98.2	98.0
240	0.74	95.1	96.1	97.2	98.2	99.3	100.3	101.0	100.9	100.2	99.3	98.6	98.0
280	0.86	94.0	95.1	96.1	97.1	98.2	99.2	100.2	101.1	100.7	99.7	99.0	98.4
35000 FT PRESS ALT			TAT (°C)										
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
200	0.60	94.8	95.9	96.9	98.0	99.0	100.0	101.0	101.2	100.4	99.6	98.8	98.5
240	0.71	94.9	95.9	97.0	98.0	99.0	100.0	101.0	101.6	100.9	99.9	99.2	98.7
280	0.82	94.7	95.8	96.8	97.9	98.9	99.9	100.9	101.9	101.3	100.3	99.6	98.9
33000 FT PRESS ALT			TAT (°C)										
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
200	0.58	94.8	95.8	96.9	97.9	98.9	99.9	100.9	101.3	100.6	99.7	98.9	98.1
240	0.68	94.7	95.7	96.8	97.8	98.8	99.8	100.8	101.2	100.8	100.0	99.3	98.6
280	0.79	93.8	94.8	95.8	96.9	97.9	98.9	99.9	100.9	101.3	100.4	99.6	98.9
320	0.89	91.4	92.5	93.5	94.5	95.5	96.4	97.4	98.4	99.3	100.2	99.9	99.2
31000 FT PRESS ALT			TAT (°C)										
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
200	0.55	95.8	96.8	97.8	98.9	99.9	100.8	101.4	101.1	100.2	99.3	98.5	97.8
240	0.66	95.5	96.5	97.6	98.6	99.6	100.6	101.4	101.2	100.4	99.6	99.0	98.3
280	0.76	94.4	95.4	96.4	97.4	98.4	99.4	100.4	101.3	100.8	99.9	99.3	98.6
320	0.85	92.3	93.3	94.3	95.2	96.2	97.2	98.1	99.1	100.0	100.3	99.5	98.9
29000 FT PRESS ALT			TAT (°C)										
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
200	0.53	96.7	97.7	98.7	99.7	100.7	101.5	101.6	100.8	99.8	98.9	98.0	98.1
240	0.63	96.2	97.2	98.2	99.2	100.2	101.2	101.5	101.0	100.1	99.4	98.7	98.0
280	0.73	95.1	96.2	97.2	98.2	99.1	100.1	101.1	101.3	100.4	99.7	99.1	98.5
320	0.82	93.1	94.1	95.1	96.1	97.0	98.0	98.9	99.9	100.8	100.0	99.4	98.7
360	0.91	91.0	92.0	93.0	93.9	94.9	95.8	96.7	97.6	98.5	99.4	99.7	99.1
27000 FT PRESS ALT			TAT (°C)										
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
200	0.51	96.5	97.5	98.6	99.6	100.6	101.5	101.9	101.4	100.4	99.4	98.5	97.5
240	0.60	95.9	96.9	97.9	98.9	99.9	100.9	101.7	101.5	100.7	99.9	99.2	98.4
280	0.70	94.8	95.8	96.8	97.8	98.7	99.7	100.7	101.6	101.0	100.2	99.5	98.9
320	0.79	92.9	93.9	94.9	95.9	96.8	97.8	98.7	99.7	100.6	100.5	99.8	99.2
360	0.88	90.9	91.9	92.9	93.8	94.8	95.7	96.6	97.5	98.4	99.3	100.0	99.4

**%N1 Adjustments for Engine Bleed**

BLEED CONFIGURATION		PRESS ALT (1000 FT)					
		37	35	33	31	29	27
ENGINE ANTI-ICE ON		-0.4	-0.4	-0.4	-0.4	-0.4	-0.4
ENGINE & WING ANTI-ICE ON (packs on)		-1.0	-1.0	-0.9	-0.9	-0.8	-0.8
ENGINE & WING ANTI-ICE ON (packs off)		-1.7	-1.6	-1.5	-1.4	-1.3	-1.2

**ENGINE INOP****Max Continuous %N1****Based on engine bleed for packs on or off and anti-ice off****25000 FT to 18000 FT Pressure Altitudes**

25000 FT PRESS ALT			TAT (°C)											
KIAS	M		-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	0.49	97.5	98.5	99.5	100.5	101.5	102.2	101.9	100.9	99.9	98.9	97.9	97.7	
240	0.58	96.7	97.7	98.7	99.7	100.6	101.6	101.8	101.1	100.3	99.6	98.8	98.0	
280	0.67	95.3	96.3	97.2	98.2	99.2	100.1	101.1	101.3	100.6	100.0	99.3	98.7	
320	0.76	93.6	94.6	95.5	96.5	97.4	98.4	99.3	100.2	100.9	100.2	99.6	99.0	
360	0.85	91.8	92.7	93.7	94.6	95.5	96.5	97.4	98.3	99.2	100.1	99.8	99.2	

24000 FT PRESS ALT			TAT (°C)											
KIAS	M		-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	0.48	97.4	98.4	99.4	100.4	101.4	102.2	102.2	101.2	100.2	99.2	98.2	97.4	
240	0.57	96.4	97.4	98.4	99.4	100.4	101.4	102.0	101.5	100.6	99.9	99.1	98.2	
280	0.66	95.1	96.1	97.1	98.0	99.0	100.0	100.9	101.6	100.9	100.2	99.6	98.9	
320	0.75	93.5	94.4	95.4	96.4	97.3	98.3	99.2	100.1	101.0	100.5	99.8	99.3	
360	0.83	91.7	92.7	93.6	94.6	95.5	96.4	97.3	98.2	99.1	100.0	100.1	99.4	

22000 FT PRESS ALT			TAT (°C)											
KIAS	M		-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
200	0.46	98.1	99.1	100.1	101.0	102.0	102.4	101.7	100.7	99.7	98.7	97.8	97.7	
240	0.55	97.0	98.0	99.0	100.0	101.0	101.9	101.9	101.2	100.4	99.6	98.8	98.0	
280	0.63	95.8	96.8	97.7	98.7	99.6	100.6	101.5	101.4	100.7	100.1	99.4	98.7	
320	0.72	94.2	95.1	96.1	97.0	98.0	98.9	99.8	100.7	100.9	100.3	99.7	99.1	
360	0.80	92.5	93.5	94.4	95.3	96.3	97.2	98.1	99.0	99.9	100.5	99.9	99.3	

20000 FT PRESS ALT			TAT (°C)											
KIAS	M		-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
200	0.44	97.7	98.7	99.7	100.7	101.7	102.6	102.3	101.3	100.3	99.3	98.4	97.7	
240	0.53	96.7	97.7	98.7	99.7	100.6	101.6	102.4	101.8	101.0	100.2	99.3	98.6	
280	0.61	95.5	96.5	97.5	98.4	99.4	100.3	101.3	102.0	101.3	100.6	99.9	99.2	
320	0.69	93.9	94.8	95.8	96.7	97.7	98.6	99.5	100.4	101.3	100.8	100.0	99.2	
360	0.77	92.4	93.4	94.3	95.2	96.1	97.0	98.0	98.8	99.7	100.6	100.3	99.6	

18000 FT PRESS ALT			TAT (°C)											
KIAS	M		-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	0.42	98.3	99.2	100.2	101.2	102.1	102.6	101.6	100.5	99.5	98.6	97.8	97.4	
240	0.51	97.2	98.1	99.1	100.0	101.0	101.9	102.0	101.1	100.2	99.4	98.7	98.0	
280	0.59	95.6	96.5	97.5	98.4	99.3	100.3	101.2	101.2	100.4	99.8	99.2	98.6	
320	0.67	94.1	95.0	95.9	96.9	97.8	98.7	99.6	100.5	100.7	100.1	99.5	98.9	
360	0.75	92.7	93.6	94.5	95.4	96.3	97.2	98.1	99.0	99.9	100.3	99.8	99.2	

**%N1 Adjustments for Engine Bleed**

BLEED CONFIGURATION			PRESS ALT (1000 FT)				
			25	24	22	20	18
ENGINE ANTI-ICE ON			-0.4	-0.4	-0.4	-0.4	-0.4
ENGINE & WING ANTI-ICE ON (packs on)			-0.8	-0.7	-0.7	-0.5	-0.5
ENGINE & WING ANTI-ICE ON (packs off)			-1.1	-1.1	-1.0	-0.7	-0.7

**ENGINE INOP****Max Continuous %N1****Based on engine bleed for packs on or off and anti-ice off****16000 FT to 5000 FT Pressure Altitudes**

16000 FT PRESS ALT			TAT (°C)											
KIAS	M		-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	0.41	97.1	98.1	99.0	100.0	100.9	101.9	101.7	100.6	99.6	98.7	97.9	97.1	
240	0.49	96.2	97.1	98.1	99.0	100.0	100.9	101.8	101.2	100.2	99.4	98.6	97.9	
280	0.57	94.7	95.7	96.6	97.6	98.5	99.4	100.3	101.2	100.5	99.8	99.1	98.3	
320	0.64	93.4	94.3	95.2	96.1	97.0	97.9	98.8	99.7	100.6	100.0	99.5	98.8	
360	0.72	92.1	93.0	93.9	94.8	95.7	96.6	97.5	98.3	99.2	100.1	99.8	99.2	
14000 FT PRESS ALT			TAT (°C)											
KIAS	M		-20	-15	-10	-5	0	5	10	15	20	25	30	35
200	0.39	96.7	97.7	98.6	99.6	100.5	101.4	100.5	99.5	98.6	97.8	97.1	96.3	
240	0.47	95.9	96.8	97.8	98.7	99.6	100.5	101.1	100.2	99.4	98.5	97.8	97.0	
280	0.54	94.9	95.8	96.7	97.6	98.5	99.4	100.3	100.7	100.0	99.2	98.3	97.5	
320	0.62	93.8	94.7	95.6	96.5	97.4	98.3	99.2	100.1	100.4	99.7	99.0	98.1	
360	0.69	92.5	93.4	94.3	95.2	96.1	96.9	97.8	98.7	99.5	99.9	99.3	98.6	
12000 FT PRESS ALT			TAT (°C)											
KIAS	M		-15	-10	-5	0	5	10	15	20	25	30	35	40
200	0.38	96.4	97.4	98.3	99.2	100.1	100.6	99.7	98.7	97.9	97.1	96.3	95.5	
240	0.45	95.8	96.7	97.7	98.6	99.5	100.4	100.3	99.4	98.6	97.7	96.8	96.0	
280	0.52	95.0	96.0	96.9	97.8	98.7	99.5	100.4	100.0	99.2	98.5	97.5	96.7	
320	0.60	93.9	94.8	95.7	96.6	97.5	98.4	99.2	100.1	99.7	99.0	98.2	97.3	
360	0.67	92.7	93.6	94.5	95.4	96.3	97.1	98.0	98.8	99.7	99.3	98.6	97.8	
10000 FT PRESS ALT			TAT (°C)											
KIAS	M		-15	10	-5	0	5	10	15	20	25	30	35	40
200	0.36	95.4	96.3	97.2	98.1	99.0	99.9	99.8	98.9	98.1	97.3	96.5	95.7	
240	0.43	94.8	95.7	96.6	97.5	98.4	99.3	100.1	99.5	98.7	97.9	96.9	96.1	
280	0.51	94.1	95.0	95.9	96.8	97.7	98.6	99.4	100.1	99.3	98.5	97.7	96.8	
320	0.58	93.1	94.0	94.9	95.8	96.7	97.5	98.4	99.3	99.7	99.0	98.2	97.4	
360	0.65	92.0	92.9	93.8	94.6	95.5	96.3	97.2	98.0	98.9	99.2	98.6	97.8	
5000 FT PRESS ALT			TAT (°C)											
KIAS	M		-10	-5	0	5	10	15	20	25	30	35	40	45
200	0.33	92.4	93.3	94.1	95.0	95.8	96.7	97.5	97.3	96.6	95.8	94.9	94.1	
240	0.40	92.0	92.9	93.7	94.6	95.4	96.3	97.1	97.7	97.0	96.2	95.3	94.5	
280	0.46	91.6	92.4	93.3	94.2	95.0	95.8	96.7	97.5	97.5	96.7	95.9	95.0	
320	0.53	91.0	91.8	92.7	93.5	94.4	95.2	96.0	96.8	97.6	97.2	96.4	95.6	
360	0.59	90.2	91.0	91.9	92.7	93.5	94.4	95.2	96.0	96.8	97.6	96.9	96.1	

**%N1 Adjustments for Engine Bleed**

BLEED CONFIGURATION			PRESS ALT (1000 FT)				
			16	14	12	10	5
ENGINE ANTI-ICE ON			-0.4	-0.4	-0.4	-0.4	-0.3
ENGINE & WING ANTI-ICE ON (packs on)			-0.5	-0.5	-0.5	-0.5	-0.5
ENGINE & WING ANTI-ICE ON (packs off)			-0.7	-0.7	-0.7	-0.7	-0.7

**ENGINE INOP****MAX CONTINUOUS THRUST****Driftdown Speed/Level Off Altitude**

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
260	252	263	19700	18400	16600
240	232	253	22000	21000	19700
220	213	243	24200	23500	22300
200	194	232	26600	26000	25000
180	174	220	29000	28700	27900
160	155	208	31600	31500	31000

**Driftdown/LRC Cruise Range Capability****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	
134	125	118	111	105	100	95	91	87	83	80	
273	255	238	224	211	200	190	181	172	165	158	
412	383	358	337	317	300	285	271	258	246	236	
550	511	478	449	423	400	379	361	344	329	314	
686	639	597	561	529	500	474	451	430	411	393	
822	765	716	673	634	600	569	541	516	493	472	
958	892	835	784	740	700	664	632	603	576	552	
1093	1018	953	896	845	800	759	723	689	659	631	
1227	1144	1071	1007	951	900	854	813	776	742	711	
1362	1270	1190	1119	1056	1000	950	904	863	825	790	
1496	1395	1308	1230	1161	1100	1045	995	949	908	870	
1630	1521	1426	1342	1267	1200	1140	1085	1036	991	949	
1765	1647	1544	1453	1372	1300	1235	1176	1123	1074	1029	
1900	1773	1662	1565	1478	1400	1330	1267	1209	1157	1108	
2035	1900	1781	1676	1583	1500	1425	1357	1296	1239	1188	
2171	2027	1900	1788	1689	1600	1520	1448	1382	1322	1267	
2308	2154	2019	1900	1795	1700	1615	1538	1468	1404	1346	
2445	2282	2139	2012	1900	1800	1710	1628	1554	1486	1424	

# ENGINE INOP

## MAX CONTINUOUS THRUST

### Driftdown/LRC Cruise Range Capability

#### Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 KG)						TIME (HR:MIN)	
	WEIGHT AT START OF DRIFTDOWN (1000 KG)							
	160	180	200	220	240	260		
100	0.9	1.0	1.0	1.1	1.2	1.3	0:15	
200	2.1	2.3	2.5	2.7	2.9	3.1	0:32	
300	3.4	3.7	4.1	4.4	4.8	5.2	0:49	
400	4.7	5.2	5.7	6.2	6.7	7.2	1:05	
500	6.0	6.6	7.3	8.0	8.6	9.3	1:21	
600	7.2	8.0	8.8	9.6	10.4	11.2	1:37	
700	8.4	9.3	10.3	11.3	12.2	13.1	1:53	
800	9.6	10.7	11.8	12.9	13.9	15.0	2:09	
900	10.8	12.0	13.3	14.5	15.7	16.9	2:24	
1000	12.0	13.3	14.7	16.1	17.5	18.8	2:39	
1100	13.2	14.7	16.2	17.7	19.2	20.7	2:55	
1200	14.4	16.0	17.6	19.3	20.9	22.5	3:10	
1300	15.5	17.3	19.1	20.9	22.6	24.4	3:25	
1400	16.7	18.6	20.5	22.4	24.3	26.2	3:41	
1500	17.8	19.8	21.9	24.0	26.0	28.0	3:57	
1600	18.9	21.1	23.3	25.5	27.6	29.8	4:13	
1700	20.0	22.3	24.7	27.0	29.3	31.6	4:29	
1800	21.1	23.6	26.1	28.5	30.9	33.4	4:45	

APU fuel included.

Driftdown at optimum speed and cruise at LRC speed.

### Long Range Cruise Altitude Capability

#### 100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
260	15400	13400	10700
240	18500	16300	14400
220	21300	20100	18000
200	23900	22900	21500
180	26600	25800	24600
160	29500	28900	27900
140	32400	32200	31400

With engine anti-ice on, decrease altitude capability by 700 ft.

With engine and wing anti-ice on, decrease altitude capability by 1100 ft.

**ENGINE INOP****MAX CONTINUOUS THRUST****Long Range Cruise Control**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)						
		10	15	17	19	21	23	25
260	%N1	91.5	95.9	97.6				
	MACH	.557	.602	.624				
	KIAS	309	305	304				
	FF/ENG	7544	7611	7718				
240	%N1	89.2	93.5	95.2	97.1			
	MACH	.541	.582	.602	.625			
	KIAS	300	294	293	293			
	FF/ENG	6945	6927	6973	7082			
220	%N1	86.6	90.9	92.6	94.4	96.3		
	MACH	.523	.563	.581	.601	.624		
	KIAS	290	285	283	281	281		
	FF/ENG	6360	6291	6302	6339	6448		
200	%N1	83.9	88.3	89.9	91.7	93.5	95.3	98.2
	MACH	.504	.544	.561	.578	.598	.621	.653
	KIAS	279	275	272	270	269	268	272
	FF/ENG	5797	5700	5677	5683	5711	5811	6096
180	%N1	81.3	85.3	87.0	88.7	90.4	92.2	94.0
	MACH	.486	.523	.539	.556	.574	.593	.615
	KIAS	269	263	262	259	257	256	255
	FF/ENG	5264	5145	5101	5071	5067	5086	5163
160	%N1	78.6	82.1	83.8	85.5	87.2	88.9	90.6
	MACH	.468	.499	.515	.532	.549	.566	.585
	KIAS	259	251	250	248	246	244	242
	FF/ENG	4777	4580	4553	4511	4470	4457	4468
140	%N1	75.8	79.0	80.4	81.9	83.6	85.4	87.0
	MACH	.449	.477	.490	.505	.522	.539	.557
	KIAS	248	240	237	235	233	232	230
	FF/ENG	4333	4071	4015	3973	3925	3879	3863
3881								

**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	
289	266	245	228	213	200	191	182	174	167	160	
581	534	492	457	427	400	381	364	348	333	320	
873	802	739	686	641	600	572	545	521	500	480	
1166	1071	987	916	855	800	762	726	694	665	639	
1460	1340	1235	1145	1069	1000	952	908	867	831	798	
1755	1611	1483	1375	1283	1200	1142	1089	1040	996	956	
2051	1881	1732	1605	1497	1400	1333	1270	1213	1161	1114	
2348	2153	1980	1836	1711	1600	1523	1451	1386	1326	1272	
2645	2424	2230	2066	1925	1800	1713	1632	1558	1491	1430	
2943	2697	2479	2297	2140	2000	1902	1812	1730	1655	1588	

**Reference Fuel and Time Required at Check Point**

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	3.3	0:40	2.9	0:39	2.6	0:38	2.4	0:36	2.2	0:34
400	7.0	1:18	6.4	1:15	5.9	1:12	5.5	1:09	5.3	1:05
600	10.6	1:56	9.8	1:51	9.1	1:46	8.6	1:42	8.4	1:35
800	14.1	2:34	13.1	2:27	12.3	2:21	11.6	2:15	11.4	2:06
1000	17.7	3:12	16.5	3:04	15.4	2:56	14.7	2:48	14.4	2:37
1200	21.2	3:51	19.8	3:41	18.5	3:31	17.6	3:21	17.3	3:08
1400	24.7	4:30	23.0	4:18	21.6	4:06	20.6	3:55	20.2	3:40
1600	28.1	5:09	26.3	4:56	24.7	4:42	23.5	4:29	23.0	4:12

**Fuel Required Adjustment (1000 KG)**

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)						
	140	160	180	200	220	240	260
5	-0.7	-0.5	-0.2	0.0	0.5	1.0	1.5
10	-1.4	-1.0	-0.5	0.0	1.1	2.2	3.4
15	-2.2	-1.5	-0.8	0.0	1.7	3.4	5.2
20	-2.9	-2.0	-1.0	0.0	2.2	4.5	7.0
25	-3.6	-2.5	-1.3	0.0	2.7	5.6	8.8
30	-4.3	-3.0	-1.6	0.0	3.2	6.7	10.5

## ENGINE INOP

### MAX CONTINUOUS THRUST

#### Holding Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)					
		1500	5000	10000	15000	20000	25000
260	%N1	79.8	82.7	87.5	92.4		
	KIAS	236	237	238	240		
	FF/ENG	6860	6650	6630	6770		
240	%N1	77.5	80.3	84.8	89.8	94.9	
	KIAS	229	229	229	229	242	
	FF/ENG	6320	6110	6090	6160	6380	
220	%N1	75.0	77.8	82.0	87.0	92.0	
	KIAS	223	223	223	223	224	
	FF/ENG	5800	5600	5560	5570	5660	
200	%N1	72.4	75.1	79.2	84.0	88.9	94.3
	KIAS	216	216	216	216	216	225
	FF/ENG	5260	5120	5060	5040	5050	5310
180	%N1	69.5	72.2	76.2	80.9	85.7	90.7
	KIAS	209	209	209	209	209	209
	FF/ENG	4730	4670	4580	4520	4480	4570

This table includes 5% additional fuel for holding in a racetrack pattern.

# ENGINE INOP

## ADVISORY INFORMATION

### Gear Down Landing Rate of Climb Available

#### Flaps 20

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	240	140				
50	280	200	60			
48	320	240	110			
46	360	290	170			
44	400	330	210	50		
42	440	380	260	100	-60	
40	470	430	300	150	-10	
38	510	470	350	190	40	
36	530	510	400	230	80	-80
34	530	540	450	280	120	-30
32	530	560	480	320	160	0
30	540	560	520	370	200	40
20	550	580	560	520	400	240
10	570	600	570	530	450	340
0	590	610	590	550	460	350
-20	610	640	610	570	480	370
-40	640	670	640	590	500	380

Rate of climb capability shown is valid for 180000 kg, gear down at VREF20 + 5.

Decrease rate of climb 45 ft/min per 5000 kg greater than 180000 kg.

Increase rate of climb 55 ft/min per 5000 kg less than 180000 kg.

#### Flaps 30

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	-210	-320				
50	-180	-270	-400			
48	-150	-230	-360			
46	-110	-190	-310	-470		
44	-70	-150	-270	-430		
42	-40	-110	-230	-380	-540	
40	-10	-60	-180	-340	-500	
38	20	-20	-140	-300	-450	-620
36	40	10	-100	-260	-420	-570
34	40	40	-60	-220	-380	-530
32	40	50	-30	-180	-340	-500
30	40	60	10	-140	-310	-460
20	50	60	30	-10	-130	-290
10	60	70	40	-10	-100	-210
0	70	80	40	0	-100	-210
-20	70	80	50	0	-100	-210
-40	70	90	50	0	-100	-220

Rate of climb capability shown is valid for 180000 kg, gear down at VREF30 + 5.

Decrease rate of climb 50 ft/min per 5000 kg greater than 180000 kg.

Increase rate of climb 60 ft/min per 5000 kg less than 180000 kg.

**Performance Inflight - QRH**  
**Gear Down**
**Chapter PI-QRH**  
**Section 13**
**GEAR DOWN**
**Long Range Cruise Altitude Capability**
**Max Climb Thrust, 300 ft/min residual rate of climb**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
260	17400	15300	12200
240	20900	18400	15600
220	24500	22000	19600
200	27800	26400	23800
180	30900	30500	28900
160	33400	33300	32900
140	36100	36100	36100

**Long Range Cruise Control**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (1000 FT)									
	10	15	17	19	21	23	25	27	29	31
260	%N1 .453	84.5	89.2	90.9						
	MACH	.453	.492	.508						
	KIAS	251	248	246						
	FF/ENG	5792	5756	5759						
240	%N1 .438	82.1	86.8	88.6	90.4	92.1				
	MACH	.438	.476	.492	.508	.525				
	KIAS	242	240	238	237	235				
	FF/ENG	5337	5288	5273	5275	5290				
220	%N1 .421	79.5	84.1	86.0	87.8	89.6	91.4	93.3		
	MACH	.421	.459	.475	.491	.508	.525	.543		
	KIAS	232	231	230	228	227	225	224		
	FF/ENG	4886	4841	4810	4793	4791	4806	4864		
200	%N1 .403	76.8	81.4	83.1	85.0	86.8	88.6	90.5	92.7	
	MACH	.403	.441	.456	.473	.489	.506	.526	.548	
	KIAS	223	221	220	219	218	217	216	216	
	FF/ENG	4448	4391	4371	4333	4309	4314	4361	4463	
180	%N1 .384	73.8	78.4	80.0	81.8	83.9	85.9	87.9	89.9	92.1
	MACH	.384	.420	.436	.452	.470	.489	.509	.531	.554
	KIAS	212	211	210	210	209	209	209	209	
	FF/ENG	4011	3934	3926	3975	3941	3878	3931	3984	4071
160	%N1 .366	70.7	75.6	77.2	79.0	81.1	83.2	85.1	87.1	89.2
	MACH	.366	.403	.419	.436	.454	.472	.492	.513	.535
	KIAS	202	202	202	202	202	202	202	202	202
	FF/ENG	3693	3613	3608	3609	3595	3563	3512	3564	3604
140	%N1 .352	67.8	72.7	74.4	76.1	78.1	80.2	82.2	84.1	86.1
	MACH	.352	.387	.403	.419	.436	.454	.473	.493	.515
	KIAS	194	194	194	194	194	194	194	194	194
	FF/ENG	3358	3267	3255	3251	3245	3228	3206	3208	3194

**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	
322	287	258	235	216	200	189	178	169	160	153	
655	584	522	474	434	400	377	357	338	321	306	
992	882	788	714	653	600	566	535	507	482	460	
1332	1183	1055	954	872	800	755	713	676	642	612	
1675	1485	1323	1195	1091	1000	943	891	844	802	765	
2021	1790	1592	1436	1310	1200	1131	1069	1012	962	917	
2371	2096	1862	1678	1529	1400	1320	1246	1180	1121	1069	
2725	2406	2134	1921	1749	1600	1508	1424	1348	1280	1221	
3081	2717	2407	2164	1969	1800	1696	1601	1515	1439	1372	
3442	3031	2681	2408	2190	2000	1884	1778	1683	1598	1523	
3805	3346	2956	2653	2410	2200	2072	1955	1850	1756	1674	
4172	3664	3233	2899	2631	2400	2260	2132	2017	1914	1824	
4543	3985	3512	3145	2853	2600	2447	2308	2183	2072	1974	
4919	4308	3791	3392	3074	2800	2635	2485	2349	2229	2124	
5298	4634	4073	3640	3296	3000	2822	2661	2515	2386	2273	
5681	4963	4355	3889	3519	3200	3010	2837	2681	2543	2422	
6069	5294	4639	4138	3742	3400	3197	3012	2846	2699	2570	
6460	5627	4925	4388	3965	3600	3384	3188	3012	2855	2719	
6856	5963	5212	4639	4188	3800	3571	3363	3177	3011	2867	
7255	6302	5500	4891	4412	4000	3758	3538	3341	3166	3014	

**Reference Fuel and Time Required at Check Point**

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	
200	6.6	0:46	6.0	0:45	5.2	0:43	4.9	0:42	4.7	0:40
400	13.2	1:36	12.1	1:32	10.7	1:25	10.1	1:22	9.7	1:17
600	19.7	2:25	18.2	2:18	16.3	2:08	15.3	2:01	14.8	1:54
800	26.2	3:15	24.3	3:05	21.9	2:50	20.5	2:41	19.8	2:32
1000	32.7	4:05	30.3	3:51	27.4	3:33	25.7	3:21	24.9	3:09
1200	38.9	4:57	36.1	4:40	32.7	4:17	30.6	4:02	29.5	3:47
1400	45.1	5:49	41.9	5:29	38.0	5:01	35.5	4:43	34.2	4:26
1600	51.3	6:41	47.6	6:18	43.3	5:45	40.4	5:24	38.9	5:04
1800	57.5	7:33	53.4	7:06	48.6	6:29	45.4	6:05	43.6	5:42
2000	63.7	8:26	59.1	7:55	53.9	7:13	50.3	6:46	48.3	6:21
2200	69.3	9:21	64.4	8:47	58.7	7:59	54.8	7:29	52.7	7:01
2400	75.0	10:17	69.7	9:38	63.6	8:46	59.4	8:12	57.0	7:41
2600	80.7	11:12	75.0	10:30	68.4	9:32	64.0	8:55	61.4	8:21
2800	86.3	12:08	80.3	11:22	73.3	10:18	68.6	9:38	65.7	9:01
3000	92.0	13:03	85.6	12:13	78.2	11:05	73.2	10:21	70.1	9:41
3200	97.2	14:03	90.5	13:08	82.7	11:53	77.4	11:07	74.0	10:23
3400	102.3	15:02	95.3	14:03	87.1	12:42	81.7	11:52	78.0	11:05
3600	107.5	16:01	100.2	14:57	91.6	13:31	85.9	12:37	82.0	11:47
3800	112.7	17:00	105.0	15:52	96.1	14:20	90.2	13:22	86.0	12:29
4000	117.8	17:59	109.9	16:47	100.6	15:08	94.4	14:07	90.0	13:10

## 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)				
	160	180	200	220	240
10	-0.7	-0.3	0.0	0.9	2.0
20	-1.6	-0.8	0.0	1.7	3.8
30	-2.6	-1.2	0.0	2.5	5.4
40	-3.6	-1.7	0.0	3.2	6.9
50	-4.5	-2.2	0.0	3.9	8.3
60	-5.5	-2.7	0.0	4.5	9.7
70	-6.6	-3.2	0.0	5.1	10.9
80	-7.6	-3.7	0.0	5.7	12.0
90	-8.7	-4.2	0.0	6.2	13.0
100	-9.7	-4.7	0.0	6.7	13.9
110	-10.8	-5.3	0.0	7.1	14.7
120	-11.9	-5.9	0.0	7.5	15.4
130	-13.0	-6.5	0.0	7.9	15.9

Based on Long Range Cruise and VREF30+80 descent.

#### Descent at VREF30 + 80

PRESSURE ALTITUDE (1000 FT)	17	19	21	23	25	27	29	31	33	35
DISTANCE (NM)	40	44	48	52	56	60	64	68	72	76
TIME (MINUTES)	11	12	13	13	14	15	16	16	17	18

**GEAR DOWN****Holding  
Flaps Up**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)							
	1500	5000	10000	15000	20000	25000	30000	35000
260	%N1	75.2	78	82.5	87.6	92.7		
	KIAS	236	236	236	236	236		
	FF/ENG	5840	5660	5660	5700	5850		
240	%N1	73.2	76.1	80.3	85.4	90.5		
	KIAS	229	229	229	229	229		
	FF/ENG	5440	5300	5260	5280	5360		
220	%N1	71.2	73.9	78.1	83	88	93.2	
	KIAS	223	223	223	223	223		
	FF/ENG	5060	4950	4880	4880	4900	5090	
200	%N1	69	71.7	75.8	80.6	85.5	90.5	
	KIAS	216	216	216	216	216		
	FF/ENG	4680	4610	4510	4480	4470	4580	
180	%N1	66.7	69.3	73.3	78.2	82.8	87.9	93.4
	KIAS	209	209	209	209	209	209	
	FF/ENG	4320	4260	4150	4090	4150	4130	4340
160	%N1	64.2	66.8	70.7	75.6	79.9	85.1	90.2
	KIAS	202	202	202	202	202	202	
	FF/ENG	4030	3990	3880	3790	3790	3690	3810
140	%N1	61.5	64.1	67.8	72.7	77	82.2	87.1
	KIAS	194	194	194	194	194	194	194
	FF/ENG	3660	3630	3530	3430	3410	3370	3370

**Flaps 1**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)					
	1500	5000	10000	15000	20000	
260	%N1	73.8	76.7	81.2	86.4	91.5
	KIAS	216	216	216	216	216
	FF/ENG	5530	5380	5380	5440	5530
240	%N1	71.6	74.5	78.9	84.0	89.1
	KIAS	209	209	209	209	209
	FF/ENG	5130	5020	4980	5020	5060
220	%N1	69.3	72.1	76.5	81.5	86.6
	KIAS	203	203	203	203	203
	FF/ENG	4730	4670	4600	4600	4600
200	%N1	66.8	69.6	73.9	78.9	83.8
	KIAS	196	196	196	196	196
	FF/ENG	4330	4310	4210	4180	4170
180	%N1	64.2	66.9	71.1	76.2	80.8
	KIAS	189	189	189	189	189
	FF/ENG	4030	4010	3910	3860	3870
160	%N1	61.4	64.1	68.1	73.2	77.7
	KIAS	182	182	182	182	182
	FF/ENG	3650	3630	3530	3470	3480
140	%N1	58.4	61.0	64.9	69.9	74.4
	KIAS	174	174	174	174	174
	FF/ENG	3270	3250	3160	3100	3100

These tables include 5% additional fuel for holding in a racetrack pattern.

**Performance Inflight - QRH**  
**Gear Down, Engine INOP**
**Chapter PI-QRH**  
**Section 14**
**GEAR DOWN****ENGINE INOP****MAX CONTINUOUS THRUST****Driftdown Speed/Level Off Altitude****100 ft/min residual rate of climb****Includes APU fuel burn**

WEIGHT (1000 KG)		VREF + 80 DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
220	208	221	4700		
200	190	214	9400	6200	3800
180	172	208	13000	11000	8100
160	154	200	16400	14900	12800

**Long Range Cruise Altitude Capability****100 ft/min residual rate of climb**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
200	6400	4100	
180	11700	8200	5900
160	15200	13600	11200
140	18700	17700	15800

**Long Range Cruise Control**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (1000 FT)					
	5	7	9	11	13	15
200	%N1	92.5	94.5	96.5		
	MACH	.358	.371	.385		
	KIAS	216	216	216		
	FF/ENG	8649	8653	8728		
180	%N1	89.6	91.6	93.6	95.6	97.9
	MACH	.346	.359	.373	.387	.402
	KIAS	209	209	209	209	209
	FF/ENG	7860	7852	7900	7957	8109
160	%N1	86.5	88.5	90.5	92.5	94.5
	MACH	.334	.346	.359	.373	.388
	KIAS	202	202	202	202	202
	FF/ENG	7101	7080	7111	7147	7207
140	%N1	83.1	85.1	87.1	89.1	91.1
	MACH	.321	.333	.345	.359	.373
	KIAS	194	194	194	194	194
	FF/ENG	6375	6348	6356	6373	6409

**GEAR DOWN****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	20	40	60	80	100
349	305	269	241	219	200	186	174	163	154	146
529	462	406	363	329	300	279	261	244	230	218
710	620	544	486	440	400	372	347	325	306	289
891	777	681	608	550	500	465	433	405	381	361
1074	936	819	730	660	600	557	519	486	457	432
1258	1095	957	853	771	700	650	606	567	533	504
1443	1255	1096	976	881	800	743	692	647	608	575
1629	1415	1235	1099	992	900	836	778	727	683	646
1815	1576	1374	1222	1102	1000	928	864	808	759	717
2003	1737	1515	1346	1213	1100	1021	950	888	834	788
2191	1900	1655	1470	1324	1200	1114	1036	968	909	859
2381	2062	1795	1593	1435	1300	1206	1122	1048	984	930
2571	2226	1936	1717	1546	1400	1298	1207	1127	1058	1000
2763	2390	2077	1841	1658	1500	1391	1293	1207	1133	1070
2955	2554	2219	1966	1769	1600	1483	1379	1287	1207	1140

**Reference Fuel and Time Required at Check Point**

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	6		8		10		12		14	
	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	6.6	0:54	6.3	0:53	6.1	0:51	5.8	0:51	5.7	0:49
300	10.0	1:21	9.6	1:19	9.3	1:16	9.0	1:15	8.8	1:13
400	13.4	1:47	12.9	1:45	12.6	1:42	12.2	1:39	11.9	1:37
500	16.7	2:15	16.2	2:11	15.7	2:07	15.3	2:04	15.0	2:01
600	20.0	2:42	19.4	2:37	18.9	2:33	18.3	2:29	18.0	2:25
700	23.3	3:09	22.6	3:04	22.0	2:58	21.4	2:54	21.0	2:49
800	26.6	3:36	25.8	3:30	25.1	3:24	24.4	3:19	24.0	3:13
900	29.7	4:04	28.9	3:57	28.1	3:50	27.4	3:44	26.9	3:37
1000	32.9	4:32	32.0	4:24	31.1	4:16	30.3	4:09	29.8	4:02
1100	36.1	5:00	35.0	4:51	34.1	4:43	33.2	4:35	32.6	4:27
1200	39.2	5:28	38.0	5:18	37.1	5:09	36.1	5:00	35.4	4:51
1300	42.2	5:57	41.0	5:46	40.0	5:36	38.9	5:26	38.2	5:16
1400	45.3	6:25	44.0	6:14	42.9	6:02	41.8	5:52	41.0	5:42
1500	48.3	6:54	46.9	6:42	45.7	6:29	44.6	6:18	43.7	6:07
1600	51.3	7:23	49.8	7:09	48.5	6:56	47.3	6:44	46.4	6:32

## GEAR DOWN

## 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)					
	140	160	180	200	220	240
5	-0.6	-0.3	0.0	0.5	1.1	1.7
10	-1.2	-0.6	0.0	1.0	2.2	3.5
15	-1.8	-0.9	0.0	1.5	3.3	5.2
20	-2.4	-1.2	0.0	1.9	4.3	6.8
25	-2.9	-1.5	0.0	2.3	5.2	8.3
30	-3.5	-1.8	0.0	2.7	6.1	9.7
35	-4.1	-2.1	0.0	3.1	6.8	11.1
40	-4.7	-2.4	0.0	3.4	7.6	12.3
45	-5.3	-2.7	0.0	3.7	8.2	13.4
50	-5.9	-3.0	0.0	4.0	8.8	14.4
55	-6.4	-3.3	0.0	4.3	9.3	15.3

Based on Long Range Cruise and VREF30+80 descent. Includes APU fuel burn.

#### Holding Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)			
		1500	5000	10000	15000
200	%N1	89.0	92.5		
	KIAS	216	216		
	FF/ENG	9240	9080		
180	%N1	86.1	89.6	94.6	
	KIAS	209	209	209	
	FF/ENG	8370	8250	8320	
160	%N1	83.2	86.5	91.5	96.7
	KIAS	202	202	202	202
	FF/ENG	7540	7460	7480	7690
140	%N1	80.1	83.1	88.2	93.0
	KIAS	194	194	194	194
	FF/ENG	6740	6690	6680	6780

This table includes 5% additional fuel for holding in a racetrack pattern.

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**Performance Inflight - QRH****Text****Chapter PI-QRH****Section 15**

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**Introduction**

This chapter contains information to supplement performance data from the Flight Management Computer. 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.

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**General****Flight with Unreliable Airspeed / Turbulent Air Penetration**

Body 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 may also cause unreliable airspeed/Mach indications. Climb, cruise and descent information is based on the recommended turbulent air penetration speed schedule: 270 knots below 25,000 feet, 280 knots or 0.82 Mach whichever is lower at 25,000 feet and above; maintain a minimum speed of 15 knots above the minimum maneuvering speed when below 0.82 Mach. This schedule provides ample protection from stall and high speed buffet, while also providing protection from exceeding structural limits.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed may also be unreliable.

**Max Climb %N1**

This table shows Max Climb %N1 for a 310/.84 climb speed schedule, normal engine bleed for 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 Speeds**

This table contains flaps 30, 25 and 20 reference speeds for a given weight.

## Advisory Information

### Normal Configuration Landing Distance

Tables are provided as advisory information for normal configuration landing distances on dry runways and slippery runways with good, medium, and poor reported braking action. Landing distances for slippery runways are 115% of the actual landing distances.

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 appropriate 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 and adjustments are provided for dry runways and runways with good, medium, and poor reported braking action.

Enter the table with the applicable non-normal configuration and read the normal approach speed. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and speed at sea level, zero wind, and zero slope. Subsequent columns provide corrections for off-reference landing weight, altitude,

wind, slope, and speed conditions. Each correction is independently added to the reference landing distance. Landing distance includes the effects of max manual braking and reverse thrust.

For an engine inoperative autoland, check the rate of climb capability shown in Gear Down Landing Rate of Climb Available tables to ensure adequate climb performance.

## 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 appropriate Event Adjusted Brake Energy Table (No Reverse Thrust or 2 Engine Reverse) with the reference brake energy per brake and the type of braking used during landing (Max Manual, Max Auto, or Autobrake). The resulting number is the adjusted brake energy per brake and represents the energy absorbed in each brake during the landing. The recommended cooling time is found in the final table by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

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 5.0 or higher on the EICAS indication and disappear as the hottest brake cools with an EICAS indication of 3.5. Note that even without an EICAS advisory message, brake cooling is recommended.

## Landing Climb Limit Weight

In the event an overweight landing is necessary and the fuel dump system is unavailable, landing climb limits should be checked if a Flaps 30 landing is planned. Enter the table with airport OAT and pressure altitude to read landing climb limit weight. Apply the noted adjustments as required. At weights exceeding those shown, plan a Flaps 20 landing.

## Engine Inoperative

### Initial Max Continuous %N1

The Initial Max Continuous %N1 setting for use following an engine failure is shown. The table is based on the typical all engine cruise Mach number of .84 to provide a target %N1 setting at the start of driftdown. Once driftdown is established, the Max Continuous %N1 Table should be used to determine %N1 for the given conditions.

### Max Continuous %N1

Power setting is based on one engine operating with engine bleed for packs on or off and all anti-ice bleeds off. Enter the table with pressure altitude and IAS or Mach to read %N1.

It is desirable to maintain engine thrust level within the limits of the Max Cruise thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous thrust rating. The Max Continuous thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

### Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

### Driftdown/Cruise Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to long range cruise speed. Cruise is continued at level off altitude and long range cruise speed.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and correct for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude is used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Diversion Fuel and Time table.

## **Long Range Cruise Altitude Capability**

Tables show the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on LRC speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

## **Long Range Cruise Control**

The table provides target %N1, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

## **Long Range Cruise Diversion Fuel and Time**

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .84/310/250 descent. Enter with Air Distance as determined from the Ground to Air Miles Conversion Table and read Fuel and Time required at the cruise pressure altitude. Adjust the fuel obtained for deviation from the reference weight at checkpoint as required by entering the off reference fuel corrections table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel and time required for the actual weight.

## **Holding**

Single engine holding data is provided in the same format as the all engine holding data and is based on the same assumptions.

## **Gear Down Landing Rate of Climb Available**

Rate of climb data is provided as guidance information in the event an engine inoperative autoland is planned. The tables show gear down rate of climb available for Flaps 20 and Flaps 30. Enter the table with TAT and pressure altitude to read rate of climb available. Apply adjustments shown to correct for weight.

## 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 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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# Performance Inflight - QRH

## General

# Chapter PI-QRH

## Section 20

**Flight With Unreliable Airspeed / Turbulent Air Penetration**  
**Altitude and/or vertical speed indications may also be unreliable.**

### Climb

#### Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)			
		160	200	240	280
40000 (.82M)	PITCH ATT V/S (FT/MIN)	4.0 1600	3.5 800		
30000 (280 KIAS)	PITCH ATT V/S (FT/MIN)	4.5 2300	4.5 1600	4.0 1100	4.5 700
20000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	7.5 3700	7.0 2700	6.5 2100	6.5 1600
10000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	10.0 4500	8.5 3400	8.0 2700	8.0 2100
SEA LEVEL (270 KIAS)	PITCH ATT V/S (FT/MIN)	12.0 5100	10.5 3900	9.5 3100	9.0 2500

### Cruise

#### Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)			
		160	200	240	280
40000 (.82 M)	PITCH ATT EPR (Alt Mode %N1)	2.0 1.129 (79.0)	2.5 1.249 (83.4)		
35000 (280 KIAS)	PITCH ATT EPR (Alt Mode %N1)	1.5 1.065 (76.7)	2.0 1.118 (78.9)	2.5 1.203 (82.3)	3.0 1.356 (87.2)
30000 (280 KIAS)	PITCH ATT EPR (Alt Mode %N1)	1.5 1.021 (73.1)	2.0 1.059 (75.2)	3.0 1.119 (78.2)	3.5 1.196 (81.7)
25000 (280 KIAS)	PITCH ATT EPR (Alt Mode %N1)	1.5 0.997 (69.7)	2.0 1.024 (71.7)	3.0 1.067 (74.4)	3.5 1.124 (77.5)
20000 (270 KIAS)	PITCH ATT EPR (Alt Mode %N1)	2.0 0.986 (65.2)	2.5 1.008 (67.7)	3.0 1.039 (70.5)	4.0 1.081 (73.6)
15000 (270 KIAS)	PITCH ATT EPR (Alt Mode %N1)	1.5 0.977 (61.8)	2.5 0.994 (64.0)	3.0 1.018 (66.8)	4.0 1.048 (70.0)

**Flight With Unreliable Airspeed / Turbulent Air Penetration**  
**Altitude and/or vertical speed indications may also be unreliable.**
**Descent****Flaps Up, Set Idle Thrust**

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)			
		160	200	240	280
40000 (.82M)	PITCH ATT V/S (FT/MIN)	-1.0 -2500	-0.5 -2400		
30000 (280 KIAS)	PITCH ATT V/S (FT/MIN)	-1.5 -2200	-0.5 -1900	0.5 -1900	1.0 -1900
20000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	-1.0 -1800	0.0 -1600	0.5 -1600	1.5 -1600
10000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	-1.5 -1700	-0.5 -1500	0.5 -1400	1.5 -1400
SEA LEVEL (270 KIAS)	PITCH ATT V/S (FT/MIN)	-1.5 -1500	-0.5 -1400	0.5 -1300	1.5 -1300

**Holding****Flaps Up, Set Thrust for Level Flight**

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)			
		160	200	240	280
10000	PITCH ATT EPR (Alt Mode %N1) KIAS	4.0 1.004 (51.3)	4.5 1.017 (56.8)	5.0 1.029 (61.7)	5.0 1.040 (65.9)
		202	216	234	253
	PITCH ATT EPR (Alt Mode %N1) KIAS	4.0 0.999 (47.4)	4.5 1.009 (52.6)	5.0 1.019 (57.4)	5.0 1.027 (61.8)
5000		202	216	233	251

**Terminal Area (5000 FT)****Set Thrust for Level Flight**

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)			
		160	200	240	280
FLAPS 0 (GEAR UP) (VREF30 + 80)	PITCH ATT EPR (Alt Mode %N1) KIAS	4.5 1.000 (48.3)	5.0 1.010 (53.9)	5.5 1.020 (58.8)	5.5 1.040 (63.2)
		201	216	229	241
	PITCH ATT EPR (Alt Mode %N1) KIAS	6.0 1.020 (49.5)	6.5 1.030 (55.4)	7.0 1.050 (60.9)	7.0 1.060 (65.4)
FLAPS 1 (GEAR UP) (VREF30 + 60)		181	196	209	221
	PITCH ATT EPR (Alt Mode %N1) KIAS	5.0 1.030 (50.1)	5.5 1.050 (57.2)	5.5 1.070 (62.4)	6.0 1.090 (66.7)
		161	176	189	201
FLAPS 15 (GEAR UP) (VREF30 + 20)	PITCH ATT EPR (Alt Mode %N1) KIAS	6.0 1.040 (51.5)	6.0 1.060 (58.9)	6.5 1.090 (64.4)	6.5 1.110 (68.9)
		141	156	169	181
	PITCH ATT EPR (Alt Mode %N1) KIAS	4.0 1.070 (58.6)	4.5 1.100 (65.7)	5.0 1.130 (70.6)	5.0 1.170 (74.9)
FLAPS 20 (GEAR DOWN) (VREF30 + 20)		141	156	169	181

## 777 Flight Crew Operations Manual

**Flight With Unreliable Airspeed / Turbulent Air Penetration**  
**Altitude and/or vertical speed indications may also be unreliable.**

**Final Approach (1500 FT)****Gear Down, Set Thrust for 3° Glideslope**

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)			
		160	200	240	280
FLAPS 20 (VREF20 + 10)	PITCH ATT	<b>1.0</b>	<b>1.5</b>	<b>1.5</b>	<b>1.5</b>
	EPR (Alt Mode %N1)	1.010 (34.7)	1.010 (40.2)	1.020 (45.0)	1.020 (49.3)
	KIAS	142	157	172	185
FLAPS 25 (VREF25 + 10)	PITCH ATT	<b>0.0</b>	<b>0.5</b>	<b>0.5</b>	<b>0.5</b>
	EPR (Alt Mode %N1)	1.030 (44.1)	1.040 (50.7)	1.050 (56.2)	1.070 (60.6)
	KIAS	138	153	166	179
FLAPS 30 (VREF30 + 10)	PITCH ATT	<b>-0.5</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
	EPR (Alt Mode %N1)	1.050 (50.5)	1.070 (56.9)	1.090 (62.4)	1.110 (66.8)
	KIAS	131	146	159	171

**Max Climb EPR**

Based on engine bleed for packs on and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)/SPEED (IAS OR MACH)									
	0	5	10	15	20	25	30	35	40	43
310	310	310	310	310	310	310	0.84	0.84	0.84	0.84
60	1.132	1.122	1.127	1.146	1.166	1.159	1.152	1.174	1.178	1.170
50	1.168	1.161	1.147	1.146	1.166	1.159	1.152	1.174	1.178	1.170
40	1.209	1.205	1.191	1.184	1.173	1.159	1.152	1.174	1.178	1.170
30	1.217	1.253	1.243	1.237	1.228	1.196	1.157	1.174	1.178	1.170
20	1.217	1.253	1.284	1.298	1.292	1.259	1.228	1.191	1.178	1.170
10	1.217	1.253	1.284	1.329	1.364	1.337	1.307	1.273	1.260	1.257
0	1.217	1.253	1.284	1.329	1.374	1.399	1.402	1.367	1.351	1.348
-10	1.217	1.253	1.284	1.329	1.374	1.399	1.434	1.482	1.468	1.465
-15 & BELOW	1.217	1.253	1.284	1.329	1.374	1.399	1.434	1.506	1.521	1.518

**EPR Adjustments for Engine Bleed**

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)									
	0	5	10	15	20	25	30	35	40	43
ENGINE ONLY	-0.008	-0.010	-0.015	-0.015	-0.006	-0.005	-0.003	-0.003	-0.004	-0.005
ENGINE & WING*	-0.010	-0.012	-0.018	-0.020	-0.012	-0.012	-0.011	-0.014	-0.017	-0.019
ENGINE & WING**	-0.012	-0.014	-0.021	-0.025	-0.018	-0.019	-0.020	-0.024	-0.029	-0.033

\*Wing anti-ice on, packs on.

\*\*Wing anti-ice on, single bleed source and both packs off.

**777 Flight Crew Operations Manual****VREF****Flaps 30**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
300	164	164	165	165	165	166
280	159	159	159	160	160	161
260	154	154	154	154	155	155
240	148	148	148	148	148	149
220	142	142	142	142	142	142
200	135	135	135	135	135	135
180	128	128	128	128	128	128
160	123	121	121	121	121	121
140	123	121	118	116	114	113

**Flaps 25**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
300	172	172	173	173	173	173
280	167	167	167	167	167	168
260	162	162	162	162	162	162
240	155	155	156	156	156	156
220	149	149	149	149	149	149
200	142	142	142	142	142	142
180	134	134	134	135	135	135
160	127	127	127	127	127	127
140	123	121	118	118	118	118

**Flaps 20**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
300	178	178	179	179	180	181
280	173	173	173	173	174	174
260	167	167	168	168	168	168
240	161	161	161	161	161	162
220	154	154	154	154	154	154
200	147	147	147	147	147	147
180	139	139	139	139	139	139
160	131	131	131	131	131	131
140	123	122	122	123	123	123

DRAFT

Intentionally  
Blank

# Performance Inflight - QRH

## Advisory Information

# Chapter PI-QRH

## Section 21

### ADVISORY INFORMATION

#### Normal Configuration Landing Distance

Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT 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	200000 KG LANDING WT	PER 5000 KG ABOVE / BELOW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD / TAIL WIND	DOWN / UP HILL	ABOVE / BELOW ISA	PER 5 KTS ABOVE VREF30	ONE REV NO REV

#### Dry Runway

MAX MANUAL	885	+25/-5	20	-35/+125	+10/-10	+20/-20	35	10	25
AUTOBRAKE MAX	1180	+20/-5	25	-50/+175	0/0	+30/-30	65	0	0
AUTOBRAKE 4	1455	+25/-10	40	-70/+245	0/-5	+40/-40	80	0	0
AUTOBRAKE 3	1735	+30/-10	45	-90/+305	+10/-10	+50/-50	95	0	0
AUTOBRAKE 2	1940	+40/-20	55	-100/+355	+15/-30	+55/-55	95	5	5
AUTOBRAKE 1	2090	+45/-25	65	-115/+395	+40/-55	+60/-60	85	90	90

#### Good Reported Braking Action

MAX MANUAL	1220	+20/-10	30	-60/+215	+30/-25	+30/-30	50	55	125
AUTOBRAKE MAX	1300	+25/-10	35	-65/+225	+25/-20	+30/-30	60	55	130
AUTOBRAKE 4	1460	+25/-10	40	-70/+250	+10/-5	+40/-40	80	5	25
AUTOBRAKE 3	1735	+30/-10	45	-90/+305	+10/-10	+50/-50	95	0	0
AUTOBRAKE 2	1940	+40/-20	55	-100/+355	+15/-30	+55/-55	95	5	5
AUTOBRAKE 1	2090	+45/-25	65	-115/+395	+40/-55	+60/-60	85	90	90

#### Medium Reported Braking Action

MAX MANUAL	1640	+35/-20	50	-95/+350	+75/-60	+40/-40	65	160	390
AUTOBRAKE MAX	1650	+35/-15	50	-95/+355	+70/-50	+40/-40	75	150	385
AUTOBRAKE 4	1670	+35/-15	50	-95/+355	+75/-55	+45/-45	70	165	400
AUTOBRAKE 3	1825	+35/-15	50	-105/+375	+50/-30	+50/-50	95	80	285
AUTOBRAKE 2	1990	+40/-20	55	-110/+400	+45/-45	+55/-55	95	45	180
AUTOBRAKE 1	2115	+45/-25	65	-120/+425	+65/-65	+60/-60	85	110	185

#### Poor Reported Braking Action

MAX MANUAL	2100	+45/-30	70	-140/+550	+175/-115	+55/-55	75	345	945
AUTOBRAKE MAX	2105	+50/-30	70	-140/+550	+175/-115	+55/-55	75	345	945
AUTOBRAKE 4	2120	+50/-30	70	-140/+550	+175/-120	+55/-55	75	350	955
AUTOBRAKE 3	2140	+50/-25	70	-140/+555	+175/-100	+55/-55	85	345	950
AUTOBRAKE 2	2225	+50/-30	70	-145/+565	+150/-100	+60/-60	95	260	860
AUTOBRAKE 1	2300	+50/-30	75	-150/+580	+155/-110	+60/-60	85	285	800

Reference distance is for sea level, standard day, no wind or slope, VREF30 approach speed, 2 engine reverse thrust, and auto speedbrakes.

For Max Manual braking and manual speedbrakes, increase reference landing distance by 60 m.

For autobrake and manual speedbrakes, increase reference landing distance by 50 m.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Normal Configuration Landing Distance**

Flaps 25

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LANDING WT	PER 5000 KG ABOVE / BELOW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN / UP HILL	ABOVE / BELOW ISA	PER 5 KTS ABOVE VREF25	ONE REV	NO REV

**Dry Runway**

MAX MANUAL	925	+25/-10	20	-35/+130	+10/-10	+20/-20	35	15	30
AUTOBRAKE MAX	1260	+20/-15	30	-55/+180	0/0	+30/-30	65	0	0
AUTOBRAKE 4	1565	+30/-20	40	-75/+255	0/-5	+40/-40	85	0	0
AUTOBRAKE 3	1875	+35/-25	50	-95/+315	+10/-10	+55/-55	100	0	0
AUTOBRAKE 2	2080	+45/-35	60	-105/+365	+25/-40	+60/-60	90	30	30
AUTOBRAKE 1	2215	+50/-40	70	-120/+410	+50/-60	+60/-60	85	145	150

**Good Reported Braking Action**

MAX MANUAL	1280	+25/-15	35	-60/+220	+30/-25	+30/-30	50	65	145
AUTOBRAKE MAX	1370	+25/-15	35	-65/+230	+25/-25	+35/-35	60	70	155
AUTOBRAKE 4	1570	+30/-20	40	-75/+260	+10/-5	+40/-40	85	5	25
AUTOBRAKE 3	1875	+35/-25	50	-95/+315	+10/-10	+55/-55	100	0	0
AUTOBRAKE 2	2080	+45/-35	60	-105/+365	+25/-40	+60/-60	90	30	30
AUTOBRAKE 1	2215	+50/-40	70	-120/+410	+50/-60	+60/-60	85	145	150

**Medium Reported Braking Action**

MAX MANUAL	1720	+35/-30	50	-95/+360	+75/-60	+45/-45	65	180	460
AUTOBRAKE MAX	1735	+35/-25	50	-95/+360	+70/-55	+45/-45	75	175	450
AUTOBRAKE 4	1760	+35/-25	50	-100/+360	+75/-50	+45/-45	75	180	465
AUTOBRAKE 3	1960	+40/-25	55	-105/+390	+50/-35	+55/-55	100	80	305
AUTOBRAKE 2	2130	+45/-35	65	-115/+415	+55/-55	+60/-60	90	70	215
AUTOBRAKE 1	2240	+50/-40	70	-125/+435	+75/-70	+65/-65	85	170	250

**Poor Reported Braking Action**

MAX MANUAL	2200	+50/-40	70	-145/+560	+175/-115	+55/-55	75	390	1105
AUTOBRAKE MAX	2205	+50/-40	75	-145/+560	+180/-120	+60/-60	75	390	1105
AUTOBRAKE 4	2220	+50/-40	75	-145/+560	+175/-120	+60/-60	75	395	1115
AUTOBRAKE 3	2255	+50/-35	75	-145/+565	+170/-95	+60/-60	95	370	1095
AUTOBRAKE 2	2360	+50/-40	75	-150/+580	+155/-105	+65/-65	90	290	985
AUTOBRAKE 1	2430	+55/-45	80	-155/+590	+165/-115	+65/-65	85	345	935

Reference distance is for sea level, standard day, no wind or slope, VREF25 approach speed, 2 engine reverse thrust, and auto speedbrakes.

For Max Manual braking and manual speedbrakes, increase reference landing distance by 60 m.

For autobrake and manual speedbrakes, increase reference landing distance by 50 m.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Normal Configuration Landing Distance****Flaps 20**

	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT 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	200000 KG LANDING WT	PER 5000 KG ABOVE / BELOW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN / UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF20	ONE REV NO REV

**Dry Runway**

MAX MANUAL	965	+30/-15	20	-40/+130	+10/-10	+20/-20	35	15	35
AUTOBRAKE MAX	1320	+25/-20	30	-55/+185	0/0	+30/-30	65	0	0
AUTOBRAKE 4	1655	+30/-30	45	-75/+260	0/-5	+45/-45	90	0	0
AUTOBRAKE 3	1990	+40/-35	55	-95/+330	+5/-10	+55/-55	105	0	0
AUTOBRAKE 2	2215	+45/-45	65	-110/+380	+20/-40	+65/-65	100	30	30
AUTOBRAKE 1	2365	+55/-50	75	-125/+425	+50/-65	+65/-65	95	145	150

**Good Reported Braking Action**

MAX MANUAL	1345	+25/-20	35	-65/+225	+35/-30	+30/-35	50	75	170
AUTOBRAKE MAX	1435	+25/-25	40	-65/+235	+30/-25	+35/-35	60	75	180
AUTOBRAKE 4	1660	+30/-30	45	-80/+270	+5/-5	+45/-45	90	5	30
AUTOBRAKE 3	1990	+40/-35	55	-95/+330	+5/-10	+55/-55	105	0	0
AUTOBRAKE 2	2215	+45/-45	65	-110/+380	+20/-40	+65/-65	100	30	30
AUTOBRAKE 1	2365	+55/-50	75	-125/+425	+50/-65	+65/-65	95	145	150

**Medium Reported Braking Action**

MAX MANUAL	1820	+40/-35	55	-100/+370	+80/-65	+45/-45	65	210	540
AUTOBRAKE MAX	1830	+40/-35	55	-100/+370	+80/-60	+50/-50	75	200	530
AUTOBRAKE 4	1865	+40/-35	55	-100/+370	+75/-55	+50/-50	80	205	545
AUTOBRAKE 3	2080	+40/-35	60	-110/+400	+45/-35	+55/-60	105	90	370
AUTOBRAKE 2	2265	+45/-45	70	-120/+425	+55/-55	+65/-65	100	70	250
AUTOBRAKE 1	2390	+55/-50	80	-130/+450	+75/-75	+70/-70	95	170	265

**Poor Reported Braking Action**

MAX MANUAL	2335	+55/-50	80	-150/+575	+185/-125	+60/-60	75	450	1305
AUTOBRAKE MAX	2340	+55/-50	80	-150/+575	+190/-125	+60/-60	75	450	1310
AUTOBRAKE 4	2355	+55/-50	80	-150/+575	+185/-125	+60/-60	80	455	1320
AUTOBRAKE 3	2400	+55/-50	80	-150/+580	+175/-105	+65/-65	95	425	1295
AUTOBRAKE 2	2505	+55/-50	80	-155/+595	+160/-110	+70/-70	100	330	1185
AUTOBRAKE 1	2585	+60/-55	85	-160/+605	+170/-125	+70/-70	95	370	1100

Reference distance is for sea level, standard day, no wind or slope, VREF20 approach speed, 2 engine reverse thrust, and auto speedbrakes.

For Max Manual braking and manual speedbrakes, increase reference landing distance by 65 m.

For autobrake and manual speedbrakes, increase reference landing distance by 50 m.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****ANTISKID - Flaps 25****VREF25**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN/ UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1720	+35/-30	50	-95/+360	+75/-60	+45/-45	65	180	460
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 2						Autobrake inoperative			

**Good Reported Braking Action**

MAX MANUAL	1720	+35/-30	50	-95/+360	+75/-60	+45/-45	65	180	460
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 2						Autobrake inoperative			

**Medium Reported Braking Action**

MAX MANUAL	2200	+50/-40	70	-145/+560	+175/-115	+55/-55	75	390	1105
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 3						Autobrake inoperative			

**Poor Reported Braking Action**

MAX MANUAL	3010	+75/-60	110	-250/+1110	+1695/-280	+75/-75	80	1055	5000
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 3						Autobrake inoperative			

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****ANTISKID - Flaps 30****VREF30**

LANDING DISTANCES AND ADJUSTMENTS (M)									
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN/ UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

**Dry Runway**

MAX MANUAL	1640	+35/-20	50	-95/+350	+75/-60	+40/-40	65	160	390
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 2						Autobrake inoperative			

**Good Reported Braking Action**

MAX MANUAL	1640	+35/-20	50	-95/+350	+75/-60	+40/-40	65	160	390
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 2						Autobrake inoperative			

**Medium Reported Braking Action**

MAX MANUAL	2100	+45/-30	70	-140/+550	+175/-115	+55/-55	75	345	945
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 3						Autobrake inoperative			

**Poor Reported Braking Action**

MAX MANUAL	2895	+70/-50	100	-245/+1095	+1635/-275	+75/-75	80	965	5000
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 3						Autobrake inoperative			

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance**

ENG SHUTDOWN L, R - Flaps 20

VREF20

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	975	+30/-15	20	-40/+135	+15/-10	+20/-20	35	0	20
AUTOBRAKE MAX	1320	+25/-20	30	-55/+185	0/0	+30/-30	65	0	0
AUTOBRAKE 2	2240	+45/-40	65	-110/+380	+10/-10	+65/-65	125	0	0

**Good Reported Braking Action**

MAX MANUAL	1405	+25/-25	35	-70/+235	+40/-35	+35/-35	55	0	95
AUTOBRAKE MAX	1495	+25/-25	40	-70/+245	+35/-30	+40/-40	65	0	100
AUTOBRAKE 2	2240	+45/-40	65	-110/+380	+10/-10	+65/-65	125	0	0

**Medium Reported Braking Action**

MAX MANUAL	1990	+40/-40	60	-110/+400	+105/-85	+55/-55	75	0	310
AUTOBRAKE MAX	1995	+40/-40	60	-110/+400	+105/-75	+55/-55	85	0	305
AUTOBRAKE 3	2135	+45/-40	65	-115/+415	+80/-50	+60/-60	105	0	250

**Poor Reported Braking Action**

MAX MANUAL	2685	+60/-55	90	-170/+650	+270/-170	+75/-75	90	0	775
AUTOBRAKE MAX	2690	+65/-60	90	-170/+650	+275/-175	+75/-75	90	0	775
AUTOBRAKE 3	2725	+65/-60	90	-175/+655	+275/-175	+75/-75	90	0	785

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).



## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****ENG SHUTDOWN L, R - Flaps 30****VREF30**

LANDING DISTANCES AND ADJUSTMENTS (M)									
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN/ UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

**Dry Runway**

MAX MANUAL	890	+25/-5	20	-35/+125	+10/-10	+20/-20	35	0	15
AUTOBRAKE MAX	1180	+20/-5	25	-50/+175	0/0	+30/-30	65	0	0
AUTOBRAKE 2	1940	+40/-10	55	-105/+355	+10/-10	+55/-55	115	0	0

**Good Reported Braking Action**

MAX MANUAL	1255	+20/-10	30	-65/+225	+35/-30	+30/-30	55	0	65
AUTOBRAKE MAX	1345	+25/-10	35	-65/+235	+30/-25	+35/-35	65	0	70
AUTOBRAKE 2	1940	+40/-10	55	-105/+355	+10/-10	+55/-55	115	0	0

**Medium Reported Braking Action**

MAX MANUAL	1760	+35/-20	50	-105/+380	+95/-75	+45/-45	70	0	215
AUTOBRAKE MAX	1765	+35/-15	50	-105/+380	+90/-65	+50/-50	85	0	215
AUTOBRAKE 3	1875	+40/-15	55	-110/+390	+75/-45	+50/-50	95	0	180

**Poor Reported Braking Action**

MAX MANUAL	2355	+55/-35	75	-160/+615	+240/-150	+65/-65	85	0	540
AUTOBRAKE MAX	2360	+55/-35	75	-160/+615	+245/-155	+65/-65	85	0	540
AUTOBRAKE 3	2390	+55/-35	75	-160/+615	+245/-155	+65/-65	85	0	545

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****FLAP / SLAT CONTROL - Flaps 20**

VREF20

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	955	+30/-15	20	-40/+130	+10/-10	+20/-20	35	15	35
AUTOBRAKE MAX	1320	+25/-20	30	-55/+185	0/0	+30/-30	65	0	0
AUTOBRAKE 2	2200	+45/-45	65	-110/+375	+25/-45	+60/-60	95	40	40

**Good Reported Braking Action**

MAX MANUAL	1335	+25/-20	35	-65/+225	+30/-30	+30/-30	50	70	165
AUTOBRAKE MAX	1425	+25/-25	35	-65/+235	+30/-25	+35/-35	60	75	175
AUTOBRAKE 2	2200	+45/-45	65	-110/+375	+25/-45	+60/-60	95	40	40

**Medium Reported Braking Action**

MAX MANUAL	1800	+40/-35	55	-100/+365	+80/-65	+45/-45	65	200	515
AUTOBRAKE MAX	1810	+40/-35	55	-100/+365	+75/-55	+45/-45	75	195	505
AUTOBRAKE 3	2070	+40/-35	60	-110/+400	+50/-35	+55/-55	100	80	335

**Poor Reported Braking Action**

MAX MANUAL	2300	+55/-50	75	-145/+570	+180/-120	+60/-60	75	430	1235
AUTOBRAKE MAX	2305	+55/-50	80	-145/+570	+185/-125	+60/-60	75	430	1240
AUTOBRAKE 3	2370	+55/-45	75	-150/+575	+175/-100	+65/-65	100	400	1220

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****FLAPS DRIVE - (Flaps ≤ 5)**

VREF30+40

LANDING DISTANCES AND ADJUSTMENTS (M)									
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN/ UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

**Dry Runway**

MAX MANUAL	1180	+40/-10	30	-45/+155	+15/-15	+25/-25	40	30	70
AUTOBRAKE MAX	1710	+25/-5	45	-65/+215	0/0	+45/-45	75	0	0
AUTOBRAKE 2	2870	+55/-40	95	-130/+430	+50/-70	+85/-85	105	190	190

**Good Reported Braking Action**

MAX MANUAL	1595	+25/-15	45	-70/+240	+35/-30	+40/-40	50	110	270
AUTOBRAKE MAX	1775	+30/-10	50	-75/+260	+15/-10	+45/-45	75	75	245
AUTOBRAKE 2	2870	+55/-40	95	-130/+430	+50/-70	+85/-85	105	190	190

**Medium Reported Braking Action**

MAX MANUAL	2185	+45/-25	70	-110/+395	+90/-70	+60/-60	70	320	865
AUTOBRAKE MAX	2220	+45/-25	70	-110/+395	+80/-65	+60/-60	75	310	850
AUTOBRAKE 3	2740	+50/-30	85	-130/+455	+50/-60	+80/-80	110	120	495

**Poor Reported Braking Action**

MAX MANUAL	2810	+65/-40	100	-160/+610	+200/-135	+75/-75	80	670	2145
AUTOBRAKE MAX	2825	+65/-40	100	-160/+610	+205/-135	+75/-75	85	670	2155
AUTOBRAKE 3	3015	+65/-40	100	-165/+630	+175/-115	+85/-85	105	535	2035

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****FLAPS DRIVE - (5 < Flaps < 20)****VREF30+20**

	LANDING DISTANCES AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1020	+30/-5	25	-40/+135	+15/+10	+20/-20	35	20	45
AUTOBRAKE MAX	1430	+25/-5	35	-60/+195	0/0	+35/-35	70	0	0
AUTOBRAKE 2	2420	+50/-30	75	-115/+395	+25/-45	+70/-70	105	65	65

**Good Reported Braking Action**

MAX MANUAL	1435	+25/-10	40	-65/+235	+35/-30	+35/-35	55	90	215
AUTOBRAKE MAX	1525	+25/-10	40	-70/+240	+30/-20	+40/-40	65	95	225
AUTOBRAKE 2	2420	+50/-30	75	-115/+395	+25/-45	+70/-70	105	65	65

**Medium Reported Braking Action**

MAX MANUAL	1940	+40/-25	60	-105/+375	+85/-65	+50/-50	70	255	685
AUTOBRAKE MAX	1960	+40/-20	60	-105/+380	+85/-65	+50/-50	75	250	675
AUTOBRAKE 3	2280	+40/-20	65	-115/+420	+40/-40	+65/-65	105	90	455

**Poor Reported Braking Action**

MAX MANUAL	2485	+60/-35	85	-150/+585	+190/-130	+65/-65	80	540	1660
AUTOBRAKE MAX	2500	+60/-35	85	-155/+585	+195/-130	+65/-65	80	545	1670
AUTOBRAKE 3	2595	+55/-30	85	-155/+595	+170/-110	+70/-70	100	490	1635

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****FLAPS DRIVE - (Flaps ≥ 20)****VREF20**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN/ UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	965	+30/-15	20	-40/+130	+10/-10	+20/-20	35	15	35
AUTOBRAKE MAX	1320	+20/-20	30	-55/+185	0/0	+30/-30	65	0	0
AUTOBRAKE 2	2215	+45/-45	65	-110/+380	+20/-40	+65/-65	100	30	30

**Good Reported Braking Action**

MAX MANUAL	1345	+25/-20	35	-65/+225	+35/-30	+30/-35	50	75	170
AUTOBRAKE MAX	1435	+25/-25	40	-65/+235	+30/-25	+35/-35	60	75	180
AUTOBRAKE 2	2215	+45/-45	65	-110/+380	+20/-40	+65/-65	100	30	30

**Medium Reported Braking Action**

MAX MANUAL	1820	+40/-35	55	-100/+370	+80/-65	+45/-45	65	210	540
AUTOBRAKE MAX	1830	+40/-35	55	-100/+370	+80/-60	+50/-50	75	200	530
AUTOBRAKE 3	2080	+40/-35	60	-110/+400	+45/-35	+55/-60	105	90	370

**Poor Reported Braking Action**

MAX MANUAL	2335	+55/-50	80	-150/+575	+185/-125	+60/-60	75	450	1305
AUTOBRAKE MAX	2340	+55/-50	80	-150/+575	+190/-125	+60/-60	75	450	1310
AUTOBRAKE 3	2400	+55/-50	80	-150/+580	+175/-105	+65/-65	95	425	1295

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****FLAPS PRIMARY FAIL - Flaps 20**

VREF20

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1085	+25/-15	25	-45/+145	+15/-15	+25/-25	45	20	45
AUTOBRAKE MAX	1320	+20/-20	30	-55/+185	0/0	+30/-30	65	0	0
AUTOBRAKE 2	2255	+45/-45	65	-115/+385	0/-20	+65/-65	120	5	5

**Good Reported Braking Action**

MAX MANUAL	1485	+25/-25	40	-70/+240	+40/-35	+35/-35	60	90	210
AUTOBRAKE MAX	1500	+30/-25	40	-70/+245	+35/-30	+35/-35	70	85	205
AUTOBRAKE 2	2255	+45/-45	65	-115/+385	0/-20	+65/-65	120	5	5

**Medium Reported Braking Action**

MAX MANUAL	1980	+40/-40	60	-105/+390	+90/-70	+50/-50	75	245	645
AUTOBRAKE MAX	1980	+40/-40	60	-105/+385	+95/-75	+50/-50	80	245	640
AUTOBRAKE 3	2115	+40/-35	60	-115/+405	+60/-35	+60/-60	110	140	545

**Poor Reported Braking Action**

MAX MANUAL	2515	+60/-55	85	-155/+595	+205/-135	+65/-65	90	515	1550
AUTOBRAKE MAX	2515	+60/-55	85	-155/+595	+210/-140	+65/-65	90	515	1555
AUTOBRAKE 3	2535	+60/-50	85	-155/+600	+200/-125	+70/-70	100	510	1555

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).



## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****FLIGHT CONTROL MODE - Flaps 20**

VREF20

LANDING DISTANCES AND ADJUSTMENTS (M)									
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN/ UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

**Dry Runway**

MAX MANUAL	1110	+25/-15	25	-45/+150	+15/-15	+25/-25	50	25	50
AUTOBRAKE MAX	1320	+20/-20	30	-55/+185	0/0	+30/-30	65	0	0
AUTOBRAKE 2	2260	+45/-40	65	-115/+385	0/-10	+65/-65	130	0	0

**Good Reported Braking Action**

MAX MANUAL	1530	+30/-25	40	-70/+250	+40/-35	+35/-35	65	100	235
AUTOBRAKE MAX	1530	+30/-25	40	-70/+245	+35/-30	+40/-40	70	95	225
AUTOBRAKE 2	2260	+45/-40	65	-115/+385	0/-10	+65/-65	130	0	0

**Medium Reported Braking Action**

MAX MANUAL	2050	+45/-40	65	-110/+395	+95/-75	+55/-55	85	275	735
AUTOBRAKE MAX	2050	+45/-40	65	-110/+395	+105/-85	+55/-55	85	270	725
AUTOBRAKE 3	2135	+45/-40	65	-115/+410	+75/-35	+60/-60	110	200	665

**Poor Reported Braking Action**

MAX MANUAL	2605	+65/-55	90	-160/+610	+215/-145	+70/-70	95	575	1780
AUTOBRAKE MAX	2610	+65/-55	90	-160/+610	+225/-150	+70/-70	95	575	1785
AUTOBRAKE 3	2615	+65/-55	90	-160/+610	+225/-135	+70/-70	105	575	1785

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS C - Flaps 20****VREF20**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN/ UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1085	+25/-15	25	-45/+145	+15/-15	+25/-25	45	20	45
AUTOBRAKE MAX	1320	+20/-20	30	-55/+185	0/0	+30/-30	65	0	0
AUTOBRAKE 2	2255	+45/-45	65	-115/+385	0/-20	+65/-65	120	5	5

**Good Reported Braking Action**

MAX MANUAL	1485	+25/-25	40	-70/+240	+40/-35	+35/-35	60	90	210
AUTOBRAKE MAX	1500	+30/-25	40	-70/+245	+35/-30	+35/-35	70	85	205
AUTOBRAKE 2	2255	+45/-45	65	-115/+385	0/-20	+65/-65	120	5	5

**Medium Reported Braking Action**

MAX MANUAL	1980	+40/-40	60	-105/+390	+90/-70	+50/-50	75	245	645
AUTOBRAKE MAX	1980	+40/-40	60	-105/+385	+95/-75	+50/-50	80	245	640
AUTOBRAKE 3	2115	+40/-35	60	-115/+405	+60/-35	+60/-60	110	140	545

**Poor Reported Braking Action**

MAX MANUAL	2515	+60/-55	85	-155/+595	+205/-135	+65/-65	90	515	1550
AUTOBRAKE MAX	2515	+60/-55	85	-155/+595	+210/-140	+65/-65	90	515	1555
AUTOBRAKE 3	2535	+60/-50	85	-155/+600	+200/-125	+70/-70	100	510	1555

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS L - Flaps 25****VREF25**

LANDING DISTANCES AND ADJUSTMENTS (M)									
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN/ UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

**Dry Runway**

MAX MANUAL	985	+25/-10	20	-40/+140	+15/-15	+20/-20	40	0	20
AUTOBRAKE MAX	1260	+20/-15	30	-55/+180	0/0	+30/-30	65	0	0
AUTOBRAKE 2	2130	+40/-30	60	-110/+370	0/-10	+60/-60	120	0	0

**Good Reported Braking Action**

MAX MANUAL	1425	+25/-20	40	-70/+245	+45/-35	+35/-35	65	0	100
AUTOBRAKE MAX	1485	+25/-20	40	-70/+250	+35/-30	+40/-40	70	0	105
AUTOBRAKE 2	2130	+40/-30	60	-110/+370	0/-10	+60/-60	120	0	0

**Medium Reported Braking Action**

MAX MANUAL	2030	+40/-30	60	-115/+420	+120/-90	+55/-55	85	0	340
AUTOBRAKE MAX	2030	+40/-30	60	-115/+420	+125/-95	+55/-55	85	0	340
AUTOBRAKE 3	2100	+45/-30	60	-120/+430	+110/-65	+60/-60	100	0	340

**Poor Reported Braking Action**

MAX MANUAL	2770	+60/-50	90	-185/+705	+320/-195	+80/-80	100	0	870
AUTOBRAKE MAX	2780	+60/-50	90	-185/+705	+325/-200	+80/-80	100	0	870
AUTOBRAKE 3	2810	+65/-50	90	-185/+705	+320/-200	+80/-80	100	0	880

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS L - Flaps 30****VREF30**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN/ UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	940	+25/-5	20	-40/+135	+15/-10	+20/-20	40	0	15
AUTOBRAKE MAX	1180	+20/-5	25	-50/+175	0/0	+30/-30	65	0	0
AUTOBRAKE 2	1970	+40/-10	55	-105/+355	0/-10	+55/-55	115	0	0

**Good Reported Braking Action**

MAX MANUAL	1350	+25/-10	35	-70/+240	+40/-35	+35/-35	65	0	85
AUTOBRAKE MAX	1405	+25/-10	35	-70/+245	+35/-30	+35/-35	70	0	85
AUTOBRAKE 2	1970	+40/-10	55	-105/+355	0/-10	+55/-55	115	0	0

**Medium Reported Braking Action**

MAX MANUAL	1930	+40/-20	55	-115/+415	+115/-90	+50/-50	85	0	290
AUTOBRAKE MAX	1930	+40/-20	55	-115/+415	+120/-90	+55/-55	85	0	290
AUTOBRAKE 3	1990	+40/-20	60	-115/+420	+115/-75	+55/-55	90	0	300

**Poor Reported Braking Action**

MAX MANUAL	2645	+60/-35	85	-180/+695	+320/-190	+75/-75	100	0	750
AUTOBRAKE MAX	2655	+60/-35	85	-180/+695	+325/-195	+75/-75	100	0	755
AUTOBRAKE 3	2685	+60/-35	85	-180/+695	+315/-195	+75/-75	100	0	765

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).



## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS L+C - Flaps 20****VREF30+20**

LANDING DISTANCES AND ADJUSTMENTS (M)									
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN/ UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

**Dry Runway**

MAX MANUAL	1240	+30/-5	30	-50/+165	+20/-20	+30/-30	55	0	35
AUTOBRAKE MAX	1430	+25/-5	35	-60/+195	0/0	+35/-35	70	0	0
AUTOBRAKE 2	2485	+45/-10	70	-120/+405	0/0	+75/-75	140	0	0

**Good Reported Braking Action**

MAX MANUAL	1795	+30/-10	50	-80/+285	+60/-50	+45/-45	80	0	170
AUTOBRAKE MAX	1795	+30/-10	50	-80/+280	+55/-45	+50/-50	90	0	160
AUTOBRAKE 2	2485	+45/-10	70	-120/+405	0/0	+75/-75	140	0	0

**Medium Reported Braking Action**

MAX MANUAL	2550	+50/-25	80	-135/+475	+160/-120	+70/-70	105	0	545
AUTOBRAKE MAX	2550	+50/-25	80	-135/+475	+165/-125	+70/-70	110	0	540
AUTOBRAKE 3	2565	+55/-25	80	-135/+480	+160/-105	+75/-75	110	0	550

**Poor Reported Braking Action**

MAX MANUAL	3455	+75/-45	115	-210/+785	+410/-250	+100/-100	125	0	1380
AUTOBRAKE MAX	3465	+80/-45	120	-210/+785	+420/-260	+100/-100	125	0	1380
AUTOBRAKE 3	3470	+80/-45	120	-210/+785	+420/-250	+100/-100	130	0	1385

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS L+R - Flaps 20****VREF30+20**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN/ UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1340	+20/-5	35	-55/+190	+30/-25	+35/-35	65	0	0
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 2						Autobrake inoperative			

**Good Reported Braking Action**

MAX MANUAL	2105	+35/-10	60	-105/+355	+105/-85	+60/-60	100	0	0
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 2						Autobrake inoperative			

**Medium Reported Braking Action**

MAX MANUAL	3310	+60/-25	95	-185/+655	+355/-235	+100/-100	140	0	0
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 3						Autobrake inoperative			

**Poor Reported Braking Action**

MAX MANUAL	5110	+95/-45	140	-335/+1240	+1455/-590	+165/-165	170	0	0
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 3						Autobrake inoperative			

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS R - Flaps 25****VREF25**

LANDING DISTANCES AND ADJUSTMENTS (M)									
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN/ UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

**Dry Runway**

MAX MANUAL	1085	+20/-10	25	-45/+160	+20/-20	+25/-25	50	0	35
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 2						Autobrake inoperative			

**Good Reported Braking Action**

MAX MANUAL	1565	+30/-20	45	-80/+285	+55/-45	+40/-40	70	0	145
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 2						Autobrake inoperative			

**Medium Reported Braking Action**

MAX MANUAL	2195	+45/-35	65	-130/+480	+150/-110	+60/-60	85	0	430
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 3						Autobrake inoperative			

**Poor Reported Braking Action**

MAX MANUAL	2940	+65/-55	95	-205/+795	+425/-225	+85/-85	100	0	1035
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 3						Autobrake inoperative			

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS R - Flaps 30****VREF30**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN/ UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1030	+15/-5	25	-45/+155	+20/-15	+25/-25	45	0	25
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 2					Autobrake inoperative				

**Good Reported Braking Action**

MAX MANUAL	1465	+25/-10	40	-75/+275	+55/-45	+40/-40	65	0	115
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 2					Autobrake inoperative				

**Medium Reported Braking Action**

MAX MANUAL	2045	+40/-25	60	-125/+465	+145/-105	+55/-55	85	0	350
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 3					Autobrake inoperative				

**Poor Reported Braking Action**

MAX MANUAL	2740	+60/-35	85	-195/+775	+400/-215	+75/-75	95	0	840
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 3					Autobrake inoperative				

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS R+C - Flaps 20****VREF30+20**

LANDING DISTANCES AND ADJUSTMENTS (M)									
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN/ UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

**Dry Runway**

MAX MANUAL	1540	+25/-5	40	-65/+220	+40/-35	+40/-40	75	0	95
AUTOBRAKE MAX Autobrake inoperative									
AUTOBRAKE 2 Autobrake inoperative									

**Good Reported Braking Action**

MAX MANUAL	2210	+40/-15	65	-110/+380	+105/-85	+60/-60	100	0	345
AUTOBRAKE MAX Autobrake inoperative									
AUTOBRAKE 2 Autobrake inoperative									

**Medium Reported Braking Action**

MAX MANUAL	3050	+65/-35	100	-170/+625	+265/-185	+85/-85	120	0	950
AUTOBRAKE MAX Autobrake inoperative									
AUTOBRAKE 3 Autobrake inoperative									

**Poor Reported Braking Action**

MAX MANUAL	4015	+95/-55	140	-265/+1015	+760/-355	+115/-115	135	0	2165
AUTOBRAKE MAX Autobrake inoperative									
AUTOBRAKE 3 Autobrake inoperative									

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****PITCH UP AUTHORITY - (Flaps ≤ 15)**

VREF30+40

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN/ UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1150	+40/-10	25	-45/+150	+15/-15	+25/-25	40	25	60
AUTOBRAKE MAX	1710	+25/-5	45	-65/+215	0/0	+45/-45	75	0	0
AUTOBRAKE 2	2750	+55/-40	90	-125/+420	+65/-70	+80/-80	85	245	265

**Good Reported Braking Action**

MAX MANUAL	1580	+25/-15	45	-70/+240	+35/-30	+40/-40	50	100	235
AUTOBRAKE MAX	1790	+30/-10	50	-75/+260	+20/-15	+45/-45	80	65	210
AUTOBRAKE 2	2750	+55/-40	90	-125/+420	+65/-70	+80/-80	85	245	265

**Medium Reported Braking Action**

MAX MANUAL	2130	+40/-25	65	-105/+390	+85/-70	+55/-55	65	275	720
AUTOBRAKE MAX	2205	+45/-25	70	-110/+395	+75/-60	+60/-60	75	275	725
AUTOBRAKE 3	2660	+50/-35	80	-125/+445	+65/-65	+75/-75	95	140	420

**Poor Reported Braking Action**

MAX MANUAL	2710	+60/-40	95	-155/+600	+190/-130	+75/-75	75	560	1675
AUTOBRAKE MAX	2735	+60/-40	95	-155/+600	+190/-125	+75/-75	80	555	1680
AUTOBRAKE 3	2930	+60/-40	100	-165/+620	+175/-125	+80/-80	90	445	1535

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****PITCH UP AUTHORITY - (Flaps ≥ 20)**

VREF30+20

LANDING DISTANCES AND ADJUSTMENTS (M)									
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN/ UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

**Dry Runway**

MAX MANUAL	995	+30/-5	20	-40/+135	+10/-10	+20/-20	35	15	35
AUTOBRAKE MAX	1430	+25/-5	35	-60/+195	0/0	+35/-35	70	0	0
AUTOBRAKE 2	2345	+50/-30	75	-115/+390	+40/-55	+65/-65	85	95	95

**Good Reported Braking Action**

MAX MANUAL	1385	+25/-10	35	-65/+225	+30/-30	+35/-35	50	75	170
AUTOBRAKE MAX	1515	+25/-5	40	-70/+240	+25/-15	+40/-40	70	75	180
AUTOBRAKE 2	2345	+50/-30	75	-115/+390	+40/-55	+65/-65	85	95	95

**Medium Reported Braking Action**

MAX MANUAL	1875	+40/-20	55	-100/+370	+80/-65	+50/-50	60	210	525
AUTOBRAKE MAX	1920	+40/-20	60	-100/+375	+70/-55	+50/-50	75	205	520
AUTOBRAKE 3	2235	+40/-20	65	-115/+415	+50/-45	+60/-65	95	80	305

**Poor Reported Braking Action**

MAX MANUAL	2395	+55/-35	80	-150/+575	+180/-120	+65/-65	70	440	1255
AUTOBRAKE MAX	2400	+55/-35	80	-150/+575	+185/-120	+65/-65	75	440	1255
AUTOBRAKE 3	2520	+55/-30	80	-155/+585	+160/-105	+70/-70	95	360	1185

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****PRIMARY FLIGHT COMPUTERS - Flaps 20**

VREF20

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN/ UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1110	+25/-15	25	-45/+150	+15/-15	+25/-25	50	25	50
AUTOBRAKE MAX	1320	+20/-20	30	-55/+185	0/0	+30/-30	65	0	0
AUTOBRAKE 2	2260	+45/-40	65	-115/+385	0/-10	+65/-65	130	0	0

**Good Reported Braking Action**

MAX MANUAL	1530	+30/-25	40	-70/+250	+40/-35	+35/-35	65	100	235
AUTOBRAKE MAX	1530	+30/-25	40	-70/+245	+35/-30	+40/-40	70	95	225
AUTOBRAKE 2	2260	+45/-40	65	-115/+385	0/-10	+65/-65	130	0	0

**Medium Reported Braking Action**

MAX MANUAL	2050	+45/-40	65	-110/+395	+95/-75	+55/-55	85	275	735
AUTOBRAKE MAX	2050	+45/-40	65	-110/+395	+105/-85	+55/-55	85	270	725
AUTOBRAKE 3	2135	+45/-40	65	-115/+410	+75/-35	+60/-60	110	200	665

**Poor Reported Braking Action**

MAX MANUAL	2605	+65/-55	90	-160/+610	+215/-145	+70/-70	95	575	1780
AUTOBRAKE MAX	2610	+65/-55	90	-160/+610	+225/-150	+70/-70	95	575	1785
AUTOBRAKE 3	2615	+65/-55	90	-160/+610	+225/-135	+70/-70	105	575	1785

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****SLATS DRIVE - Flaps 20**

VREF30+30

LANDING DISTANCES AND ADJUSTMENTS (M)									
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN/ UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

**Dry Runway**

MAX MANUAL	1115	+30/-5	25	-40/+145	+15/-15	+25/-25	40	25	50
AUTOBRAKE MAX	1565	+25/-5	40	-60/+205	0/0	+40/-40	75	0	0
AUTOBRAKE 2	2585	+50/-35	85	-120/+410	+50/-60	+75/-75	90	135	135

**Good Reported Braking Action**

MAX MANUAL	1555	+25/-15	45	-70/+245	+40/-35	+40/-40	55	95	225
AUTOBRAKE MAX	1675	+30/-10	45	-75/+255	+30/-20	+45/-45	70	100	240
AUTOBRAKE 2	2585	+50/-35	85	-120/+410	+50/-60	+75/-75	90	135	135

**Medium Reported Braking Action**

MAX MANUAL	2090	+40/-25	65	-110/+390	+90/-70	+55/-55	65	255	660
AUTOBRAKE MAX	2125	+45/-25	65	-110/+395	+80/-65	+55/-55	80	255	650
AUTOBRAKE 3	2470	+45/-25	75	-120/+435	+60/-50	+70/-70	100	105	400

**Poor Reported Braking Action**

MAX MANUAL	2640	+60/-40	90	-155/+600	+200/-135	+70/-70	75	520	1510
AUTOBRAKE MAX	2645	+60/-40	90	-155/+600	+200/-135	+70/-70	80	520	1510
AUTOBRAKE 3	2775	+60/-35	95	-160/+610	+180/-115	+75/-75	100	430	1430

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****STABILIZER - Flaps 20****VREF30+20**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	200000 KG LDG WT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1035	+30/-5	25	-40/+140	+15/-10	+25/-25	40	20	45
AUTOBRAKE MAX	1430	+25/-5	35	-60/+195	0/0	+35/-35	70	0	0
AUTOBRAKE 2	2390	+50/-30	75	-115/+395	+35/-55	+70/-70	90	70	70

**Good Reported Braking Action**

MAX MANUAL	1445	+25/-10	40	-65/+235	+35/-30	+35/-35	55	85	200
AUTOBRAKE MAX	1545	+25/-10	40	-70/+245	+30/-25	+40/-40	65	90	210
AUTOBRAKE 2	2390	+50/-30	75	-115/+395	+35/-55	+70/-70	90	70	70

**Medium Reported Braking Action**

MAX MANUAL	1945	+40/-25	60	-105/+380	+85/-70	+50/-50	65	230	600
AUTOBRAKE MAX	1965	+40/-20	60	-105/+380	+80/-60	+50/-50	75	225	585
AUTOBRAKE 3	2255	+45/-20	65	-115/+415	+50/-40	+65/-65	100	90	380

**Poor Reported Braking Action**

MAX MANUAL	2475	+55/-35	85	-150/+585	+190/-130	+65/-65	75	480	1395
AUTOBRAKE MAX	2480	+55/-35	85	-150/+585	+195/-130	+65/-65	75	480	1400
AUTOBRAKE 3	2565	+55/-30	85	-155/+595	+180/-110	+70/-70	100	430	1355

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).



## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Recommended Brake Cooling Schedule****Reference Brake Energy (Millions of Foot Pounds)**

WEIGHT (1000 KG)	OAT (°C)	BRAKES ON SPEED (KIAS)																	
		80			100			120			140			160			180		
		PRESSURE ALTITUDE (1000 FT)																	
300	0	17.3	19.1	21.2	26.1	29.1	32.6	36.4	40.8	46.0	47.9	53.9	61.0	60.4	68.1	77.1	73.2	82.4	93.0
	10	17.9	19.7	21.8	27.0	30.0	33.7	37.6	42.1	47.5	49.5	55.7	63.0	62.4	70.4	79.6	75.6	85.0	95.8
	15	18.2	20.0	22.2	27.4	30.5	34.2	38.2	42.9	48.3	50.3	56.7	64.1	63.5	71.5	80.8	76.8	86.3	97.2
	20	18.4	20.3	22.5	27.9	31.0	34.8	38.9	43.6	49.1	51.2	57.6	65.1	64.5	72.7	82.1	78.0	87.6	98.5
	30	18.8	20.8	23.1	28.6	31.8	35.7	39.9	44.7	50.5	52.6	59.2	66.9	66.3	74.7	84.3	80.2	90.0	101.1
	40	19.1	21.0	23.4	29.0	32.4	36.3	40.6	45.6	51.5	53.7	60.5	68.4	67.8	76.4	86.3	82.0	92.0	103.3
280	0	16.4	18.0	20.0	24.7	27.4	30.7	34.3	38.4	43.2	45.1	50.7	57.3	56.9	64.1	72.6	69.0	77.8	87.9
	10	16.9	18.6	20.6	25.5	28.3	31.7	35.4	39.7	44.7	46.6	52.4	59.3	58.8	66.3	74.9	71.3	80.3	90.6
	15	17.2	18.9	20.9	25.9	28.8	32.2	36.0	40.4	45.5	47.4	53.3	60.3	59.8	67.4	76.2	72.5	81.6	92.0
	20	17.4	19.2	21.3	26.3	29.3	32.8	36.6	41.0	46.2	48.2	54.2	61.2	60.7	68.5	77.3	73.6	82.8	93.3
	30	17.8	19.6	21.8	27.0	30.0	33.6	37.6	42.1	47.5	49.5	55.7	63.0	62.5	70.4	79.5	75.7	85.1	95.8
	40	18.0	19.8	22.0	27.4	30.5	34.2	38.3	42.9	48.4	50.5	56.9	64.4	63.8	72.0	81.3	77.4	87.0	97.9
260	0	15.5	17.0	18.8	23.2	25.8	28.8	32.2	36.0	40.5	42.3	47.5	53.7	53.3	60.0	67.9	64.7	73.0	82.6
	10	15.9	17.5	19.4	24.0	26.6	29.7	33.3	37.2	41.9	43.7	49.1	55.5	55.0	62.0	70.2	66.9	75.4	85.1
	15	16.2	17.8	19.7	24.4	27.0	30.2	33.8	37.8	42.6	44.4	49.9	56.4	56.0	63.1	71.3	68.0	76.6	86.5
	20	16.5	18.1	20.0	24.8	27.5	30.7	34.4	38.5	43.3	45.2	50.8	57.3	56.9	64.1	72.5	69.1	77.8	87.8
	30	16.8	18.5	20.4	25.4	28.2	31.5	35.3	39.5	44.5	46.4	52.2	58.9	58.5	65.9	74.5	71.0	79.9	90.1
	40	17.0	18.7	20.7	25.7	28.6	32.0	35.9	40.2	45.3	47.3	53.3	60.2	59.8	67.4	76.2	72.6	81.8	92.2
240	0	14.6	15.9	17.6	21.8	24.1	26.9	30.1	33.6	37.8	39.4	44.2	49.9	49.6	55.8	63.2	60.3	68.0	76.9
	10	15.0	16.4	18.1	22.5	24.9	27.8	31.1	34.7	39.0	40.7	45.7	51.6	51.2	57.7	65.3	62.3	70.2	79.4
	15	15.2	16.7	18.4	22.8	25.3	28.3	31.6	35.3	39.7	41.4	46.5	52.5	52.1	58.7	66.3	63.3	71.4	80.7
	20	15.5	16.9	18.7	23.2	25.7	28.7	32.1	35.9	40.3	42.1	47.3	53.3	53.0	59.7	67.4	64.4	72.5	81.9
	30	15.8	17.3	19.2	23.7	26.3	29.4	32.9	36.8	41.4	43.2	48.6	54.8	54.4	61.3	69.3	66.2	74.6	84.2
	40	15.9	17.5	19.4	24.1	26.7	29.9	33.5	37.5	42.2	44.1	49.6	56.0	55.6	62.7	70.9	67.7	76.3	86.1
220	0	13.6	14.9	16.4	20.3	22.4	25.0	28.0	31.2	35.0	36.5	40.9	46.1	45.8	51.6	58.3	55.7	62.8	71.1
	10	14.1	15.4	16.9	20.9	23.2	25.8	28.9	32.2	36.1	37.7	42.3	47.7	47.3	53.3	60.2	57.6	64.9	73.4
	15	14.3	15.6	17.2	21.3	23.5	26.2	29.4	32.7	36.7	38.4	43.0	48.5	48.2	54.2	61.2	58.5	66.0	74.6
	20	14.5	15.9	17.5	21.6	23.9	26.7	29.8	33.3	37.3	39.0	43.7	49.3	49.0	55.1	62.2	59.5	67.0	75.8
	30	14.8	16.2	17.9	22.1	24.5	27.3	30.6	34.1	38.3	40.0	44.9	50.6	50.3	56.6	64.0	61.2	68.9	77.9
	40	14.9	16.3	18.1	22.4	24.8	27.7	31.1	34.7	39.0	40.8	45.8	51.7	51.3	57.9	65.4	62.5	70.5	79.7
200	0	12.7	13.9	15.3	18.8	20.8	23.1	25.8	28.7	32.2	33.6	37.5	42.3	42.0	47.2	53.3	51.0	57.4	65.0
	10	13.1	14.3	15.7	19.4	21.4	23.8	26.6	29.6	33.2	34.7	38.8	43.7	43.4	48.8	55.1	52.7	59.4	67.1
	15	13.3	14.5	16.0	19.7	21.8	24.2	27.1	30.1	33.8	35.2	39.5	44.4	44.1	49.6	56.0	53.6	60.4	68.2
	20	13.5	14.8	16.3	20.0	22.1	24.6	27.5	30.6	34.3	35.8	40.1	45.2	44.9	50.4	56.9	54.5	61.3	69.3
	30	13.8	15.1	16.6	20.5	22.6	25.2	28.2	31.4	35.2	36.8	41.2	46.4	46.1	51.8	58.5	56.0	63.1	71.3
	40	13.9	15.2	16.8	20.8	22.9	25.6	28.6	31.9	35.8	37.4	42.0	47.3	47.0	52.9	59.8	57.2	64.5	72.9
180	0	11.8	12.9	14.1	17.4	19.1	21.2	23.6	26.2	29.3	30.6	34.1	38.4	38.1	42.7	48.2	46.1	51.9	58.6
	10	12.2	13.3	14.6	17.9	19.7	21.9	24.4	27.1	30.3	31.6	35.3	39.6	39.3	44.1	49.8	47.6	53.6	60.6
	15	12.4	13.5	14.8	18.2	20.0	22.2	24.8	27.5	30.8	32.1	35.9	40.3	40.0	44.9	50.7	48.5	54.5	61.6
	20	12.6	13.7	15.0	18.5	20.3	22.6	25.2	28.0	31.3	32.6	36.4	41.0	40.7	45.6	51.5	49.2	55.4	62.6
	30	12.8	14.0	15.3	18.9	20.8	23.1	25.8	28.7	32.1	33.5	37.4	42.1	41.8	46.9	52.9	50.6	57.0	64.4
	40	12.9	14.1	15.5	19.1	21.1	23.4	26.2	29.1	32.6	34.0	38.1	42.9	42.6	47.8	54.0	51.7	58.2	65.8

To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind.

If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 15°C.

**ADVISORY INFORMATION****Recommended Brake Cooling Schedule****Event Adjusted Brake Energy (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	6.3	15.6	24.9	34.0	43.2	52.3	61.6	70.9	80.4
	MAX AUTO	6.1	14.4	22.8	31.3	40.0	49.0	58.2	67.7	77.6
	AUTOBRAKE 4	5.9	13.6	21.2	29.1	37.1	45.5	54.2	63.3	73.0
	AUTOBRAKE 3	5.6	12.7	19.7	26.9	34.2	41.9	49.8	58.3	67.3
	AUTOBRAKE 2	5.3	11.8	18.2	24.8	31.5	38.4	45.6	53.3	61.5
	AUTOBRAKE 1	5.2	11.0	16.8	22.8	28.9	35.2	41.9	48.9	56.4

**2 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	5.8	14.7	23.4	32.0	40.4	48.8	57.2	65.6	74.2
	MAX AUTO	4.3	11.6	18.9	26.4	34.1	42.0	50.2	58.9	68.0
	AUTOBRAKE 4	3.6	9.2	15.0	21.1	27.5	34.4	41.7	49.6	58.2
	AUTOBRAKE 3	2.5	6.6	11.1	15.9	21.0	26.7	32.8	39.5	46.8
	AUTOBRAKE 2	1.4	4.4	7.6	11.3	15.3	19.7	24.5	29.8	35.6
	AUTOBRAKE 1	1.0	3.0	5.3	7.8	10.6	13.9	17.5	21.7	26.4

**Cooling Time (Minutes)**

		EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)									
		16 & BELOW	17	18	20	24	28	32	35	36 TO 44	45 & ABOVE
GEAR DOWN INFLIGHT	NO SPECIAL PROCEDURE	1	2	3	4	6	7	7	7	CAUTION	FUSE PLUG MELT ZONE
GROUND	REQUIRED	11	18	26	42	55	66	73	73		
BTMS	UP TO 2.4	2.4	2.6	2.9	3.4	4.0	4.5	4.9	5.0 TO 6.3	6.3 & 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 10 percent.

For two brakes deactivated, increase brake energy by 20 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. (When inflight with gear extended, the BTMS indications may vary between individual brakes, due to air-stream effects.)

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Landing Climb Limit Weight****Valid for approach with flaps 20 and landing with flaps 25 or 30**

AIRPORT OAT		LANDING CLIMB LIMIT WEIGHT (1000 KG)						
		AIRPORT PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	
54	129	258.6	243.7					
52	126	264.6	249.6					
50	122	270.9	255.3	236.3				
48	118	277.2	261.0	242.0				
46	115	283.6	266.6	247.5	227.9			
44	111	289.9	272.9	253.0	232.3			
42	108	294.5	279.4	258.3	236.5	219.7		
40	104	298.9	285.7	263.4	240.9	223.4		
38	100	303.1	290.9	268.8	244.9	226.8	209.6	
36	97	307.2	296.1	273.9	249.0	230.3	212.9	
34	93	311.2	300.9	278.2	253.1	233.7	216.1	
32	90	311.3	305.3	282.4	256.9	237.2	219.3	
30	86	311.3	309.7	286.6	260.6	240.8	222.4	
28	82	311.4	309.7	290.4	264.4	244.5	225.8	
26	79	311.4	309.7	294.1	267.9	248.0	229.2	
24	75	311.5	309.8	294.9	271.1	251.4	232.5	
22	72	311.6	309.8	294.9	274.2	253.5	234.1	
20	68	311.6	309.9	294.9	274.8	254.5	235.5	
18	64	311.6	309.9	295.0	274.9	255.6	237.2	
16	61	311.6	310.0	295.1	274.9	256.1	239.0	
14	57	311.7	310.0	295.1	275.0	256.1	240.5	
12	54	311.7	310.1	295.2	275.0	256.2	240.6	
10	50	311.8	310.2	295.2	275.1	256.2	240.7	
-40	-40	312.9	311.5	296.6	276.3	257.3	241.7	

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off.

With engine bleed for packs off, increase weight by 900 kg.

With engine and wing anti-ice on, decrease weight by 1450 kg.

When operating in icing conditions during any part of the flight with forecast landing temperature is below 10°C, decrease weight by 20800 kg.

Intentionally  
Blank

DRAFT

**Performance Inflight - QRH**  
**Engine Inoperative**
**Chapter PI-QRH**  
**Section 22**
**ENGINE INOP**
**Initial Max Continuous EPR**
**Based on .84M, engine bleed for packs on and anti-ice off**

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	27	29	31	33	35	37	39	41	43
20 & ABOVE	1.243	1.234	1.226	1.211	1.192	1.183	1.181	1.175	1.170
15	1.284	1.275	1.263	1.250	1.232	1.222	1.220	1.216	1.212
10	1.327	1.319	1.307	1.288	1.273	1.264	1.262	1.259	1.257
5	1.364	1.366	1.354	1.337	1.314	1.306	1.304	1.302	1.300
0	1.364	1.402	1.406	1.388	1.368	1.355	1.354	1.351	1.349
-5	1.364	1.402	1.439	1.444	1.424	1.412	1.411	1.408	1.406
-10	1.364	1.402	1.439	1.473	1.482	1.471	1.469	1.467	1.465
-15	1.364	1.402	1.439	1.473	1.506	1.523	1.523	1.521	1.518
-20 & BELOW	1.364	1.402	1.439	1.473	1.506	1.523	1.523	1.521	1.518

**Max Continuous EPR**
**Based on engine bleed for packs on or off and anti-ice off**
**37000 FT to 29000 FT Pressure Altitudes**

37000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
200	0.63	1.531	1.531	1.531	1.531	1.531	1.489	1.436	1.385	1.341	1.302	1.263	1.233
240	0.74	1.534	1.534	1.534	1.534	1.534	1.534	1.517	1.455	1.402	1.349	1.308	1.268
280	0.86	1.506	1.506	1.506	1.506	1.506	1.506	1.506	1.506	1.469	1.413	1.356	1.304
35000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
200	0.60	1.517	1.517	1.517	1.517	1.517	1.486	1.433	1.385	1.341	1.304	1.267	1.234
240	0.71	1.514	1.514	1.514	1.514	1.514	1.514	1.502	1.444	1.394	1.344	1.305	1.266
280	0.82	1.519	1.519	1.519	1.519	1.519	1.519	1.519	1.519	1.476	1.417	1.362	1.311
33000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
200	0.58	1.499	1.499	1.499	1.499	1.499	1.499	1.447	1.401	1.358	1.323	1.290	1.257
240	0.68	1.491	1.491	1.491	1.491	1.491	1.491	1.491	1.452	1.402	1.355	1.314	1.278
280	0.79	1.489	1.489	1.489	1.489	1.489	1.489	1.489	1.489	1.472	1.414	1.363	1.314
320	0.89	1.427	1.427	1.427	1.427	1.427	1.427	1.427	1.427	1.427	1.427	1.389	1.338
31000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
200	0.55	1.480	1.480	1.480	1.480	1.480	1.461	1.414	1.372	1.332	1.303	1.274	1.245
240	0.66	1.471	1.471	1.471	1.471	1.471	1.471	1.461	1.410	1.365	1.322	1.291	1.260
280	0.76	1.459	1.459	1.459	1.459	1.459	1.459	1.459	1.459	1.415	1.366	1.321	1.281
320	0.85	1.426	1.426	1.426	1.426	1.426	1.426	1.426	1.426	1.426	1.406	1.353	1.306
29000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
200	0.53	1.493	1.493	1.493	1.493	1.493	1.454	1.411	1.369	1.334	1.302	1.270	1.252
240	0.63	1.475	1.475	1.475	1.475	1.475	1.475	1.441	1.395	1.352	1.315	1.286	1.255
280	0.73	1.446	1.446	1.446	1.446	1.446	1.446	1.446	1.426	1.378	1.334	1.293	1.259
320	0.82	1.413	1.413	1.413	1.413	1.413	1.413	1.413	1.413	1.413	1.362	1.317	1.273
360	0.91	1.351	1.351	1.351	1.351	1.351	1.351	1.351	1.351	1.351	1.351	1.330	1.284

**ENGINE INOP****Max Continuous EPR****Based on engine bleed for packs on or off and anti-ice off****37000 FT to 29000 FT Pressure Altitudes****EPR Adjustments for Engine Bleed**

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	37	35	33	31	29
ENGINE ONLY	-0.004	-0.003	-0.003	-0.003	-0.003
ENGINE & WING*	-0.015	-0.014	-0.013	-0.012	-0.012
ENGINE & WING**	-0.026	-0.024	-0.022	-0.021	-0.020

\* Wing anti-ice on, packs on.

\*\*Wing anti-ice on, packs off.

**27000 FT to 20000 Pressure Altitudes**

27000 FT PRESS ALT							TAT (°C)						
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
200	0.51	1.507	1.507	1.507	1.507	1.507	1.499	1.452	1.409	1.368	1.336	1.302	1.268
240	0.60	1.488	1.488	1.488	1.488	1.488	1.488	1.483	1.434	1.391	1.349	1.317	1.286
280	0.70	1.443	1.443	1.443	1.443	1.443	1.443	1.443	1.443	1.398	1.355	1.314	1.279
320	0.79	1.395	1.395	1.395	1.395	1.395	1.395	1.395	1.395	1.395	1.368	1.323	1.282
360	0.88	1.330	1.330	1.330	1.330	1.330	1.330	1.330	1.330	1.330	1.330	1.325	1.281

25000 FT PRESS ALT							TAT (°C)						
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	0.49	1.521	1.521	1.521	1.521	1.521	1.496	1.450	1.407	1.369	1.337	1.303	1.278
240	0.58	1.502	1.502	1.502	1.502	1.502	1.502	1.477	1.431	1.389	1.350	1.316	1.282
280	0.67	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.430	1.384	1.344	1.305	1.273
320	0.76	1.386	1.386	1.386	1.386	1.386	1.386	1.386	1.386	1.380	1.335	1.296	1.257
360	0.85	1.319	1.319	1.319	1.319	1.319	1.319	1.319	1.319	1.319	1.319	1.288	1.249

24000 FT PRESS ALT							TAT (°C)						
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	0.48	1.523	1.523	1.523	1.523	1.523	1.512	1.465	1.420	1.379	1.346	1.312	1.278
240	0.57	1.502	1.502	1.502	1.502	1.502	1.502	1.490	1.443	1.399	1.357	1.324	1.289
280	0.66	1.455	1.455	1.455	1.455	1.455	1.455	1.455	1.447	1.400	1.358	1.316	1.283
320	0.75	1.392	1.392	1.392	1.392	1.392	1.392	1.392	1.392	1.392	1.350	1.309	1.269
360	0.83	1.324	1.324	1.324	1.324	1.324	1.324	1.324	1.324	1.324	1.324	1.300	1.259

22000 FT PRESS ALT							TAT (°C)						
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
200	0.46	1.523	1.523	1.523	1.523	1.523	1.496	1.449	1.404	1.364	1.330	1.295	1.271
240	0.55	1.505	1.505	1.505	1.505	1.505	1.505	1.473	1.426	1.380	1.341	1.307	1.273
280	0.63	1.463	1.463	1.463	1.463	1.463	1.463	1.463	1.433	1.387	1.342	1.302	1.269
320	0.72	1.407	1.407	1.407	1.407	1.407	1.407	1.407	1.407	1.385	1.340	1.297	1.255
360	0.80	1.336	1.336	1.336	1.336	1.336	1.336	1.336	1.336	1.336	1.329	1.287	1.246

20000 FT PRESS ALT							TAT (°C)						
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
200	0.44	1.519	1.519	1.519	1.519	1.519	1.519	1.477	1.429	1.383	1.346	1.311	1.275
240	0.53	1.512	1.512	1.512	1.512	1.512	1.512	1.509	1.461	1.413	1.366	1.329	1.294
280	0.61	1.469	1.469	1.469	1.469	1.469	1.469	1.469	1.465	1.417	1.368	1.321	1.287
320	0.69	1.422	1.422	1.422	1.422	1.422	1.422	1.422	1.422	1.422	1.376	1.329	1.283
360	0.77	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.317	1.274

**ENGINE INOP****Max Continuous EPR****Based on engine bleed for packs on or off and anti-ice off****27000 FT to 20000 Pressure Altitudes****EPR Adjustments for Engine Bleed**

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	27	25	24	22	20
ENGINE ONLY	-0.004	-0.005	-0.006	-0.007	-0.006
ENGINE & WING*	-0.012	-0.012	-0.012	-0.013	-0.012
ENGINE & WING**	-0.019	-0.019	-0.019	-0.019	-0.018

\* Wing anti-ice on, packs on.

\*\*Wing anti-ice on, packs off.

**ENGINE INOP****Max Continuous EPR**

Based on engine bleed for packs on or off and anti-ice off

18000 FT to 5000 FT Pressure Altitudes

18000 FT PRESS ALT			TAT (°C)											
KIAS	M		-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	0.42	1.511	1.511	1.511	1.511	1.511	1.500	1.455	1.411	1.369	1.337	1.305	1.275	
240	0.51	1.515	1.515	1.515	1.515	1.515	1.515	1.495	1.449	1.403	1.362	1.328	1.293	
280	0.59	1.472	1.472	1.472	1.472	1.472	1.472	1.472	1.447	1.400	1.354	1.313	1.282	
320	0.67	1.424	1.424	1.424	1.424	1.424	1.424	1.424	1.424	1.402	1.356	1.311	1.269	
360	0.75	1.362	1.362	1.362	1.362	1.362	1.362	1.362	1.362	1.362	1.349	1.305	1.262	
16000 FT PRESS ALT			TAT (°C)											
KIAS	M		-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	0.41	1.504	1.504	1.504	1.504	1.504	1.504	1.479	1.438	1.396	1.360	1.332	1.304	
240	0.49	1.511	1.511	1.511	1.511	1.511	1.511	1.511	1.477	1.432	1.389	1.354	1.322	
280	0.57	1.474	1.474	1.474	1.474	1.474	1.474	1.474	1.474	1.432	1.387	1.344	1.310	
320	0.64	1.427	1.427	1.427	1.427	1.427	1.427	1.427	1.427	1.427	1.384	1.340	1.296	
360	0.72	1.372	1.372	1.372	1.372	1.372	1.372	1.372	1.372	1.372	1.337	1.307	1.294	
14000 FT PRESS ALT			TAT (°C)											
KIAS	M		-20	-15	-10	-5	0	5	10	15	20	25	30	35
200	0.39	1.488	1.488	1.488	1.488	1.488	1.488	1.452	1.413	1.373	1.343	1.315	1.288	
240	0.47	1.491	1.491	1.491	1.491	1.491	1.491	1.484	1.444	1.402	1.361	1.330	1.298	
280	0.54	1.463	1.463	1.463	1.463	1.463	1.463	1.463	1.449	1.407	1.365	1.324	1.293	
320	0.62	1.417	1.417	1.417	1.417	1.417	1.417	1.417	1.417	1.400	1.357	1.315	1.275	
360	0.69	1.368	1.368	1.368	1.368	1.368	1.368	1.368	1.368	1.368	1.354	1.313	1.272	
12000 FT PRESS ALT			TAT (°C)											
KIAS	M		-15	-10	-5	0	5	10	15	20	25	30	35	40
200	0.38	1.475	1.475	1.475	1.475	1.475	1.468	1.431	1.393	1.355	1.329	1.302	1.276	
240	0.45	1.473	1.473	1.473	1.473	1.473	1.473	1.453	1.415	1.375	1.339	1.308	1.277	
280	0.52	1.452	1.452	1.452	1.452	1.452	1.452	1.452	1.424	1.385	1.344	1.308	1.275	
320	0.60	1.407	1.407	1.407	1.407	1.407	1.407	1.407	1.407	1.373	1.333	1.292	1.257	
360	0.67	1.359	1.359	1.359	1.359	1.359	1.359	1.359	1.359	1.359	1.327	1.288	1.248	
10000 FT PRESS ALT			TAT (°C)											
KIAS	M		-15	-10	-5	0	5	10	15	20	25	30	35	40
200	0.36	1.462	1.462	1.462	1.462	1.462	1.462	1.444	1.408	1.371	1.338	1.311	1.284	
240	0.43	1.452	1.452	1.452	1.452	1.452	1.452	1.452	1.421	1.383	1.345	1.313	1.283	
280	0.51	1.438	1.438	1.438	1.438	1.438	1.438	1.438	1.433	1.397	1.358	1.318	1.286	
320	0.58	1.392	1.392	1.392	1.392	1.392	1.392	1.392	1.392	1.382	1.344	1.305	1.265	
360	0.65	1.344	1.344	1.344	1.344	1.344	1.344	1.344	1.344	1.344	1.332	1.295	1.258	
5000 FT PRESS ALT			TAT (°C)											
KIAS	M		-10	-5	0	5	10	15	20	25	30	35	40	45
200	0.33	1.422	1.422	1.422	1.422	1.422	1.422	1.422	1.399	1.367	1.334	1.306	1.282	
240	0.40	1.400	1.400	1.400	1.400	1.400	1.400	1.400	1.394	1.361	1.328	1.295	1.269	
280	0.46	1.382	1.382	1.382	1.382	1.382	1.382	1.382	1.382	1.365	1.330	1.295	1.263	
320	0.53	1.349	1.349	1.349	1.349	1.349	1.349	1.349	1.349	1.349	1.323	1.288	1.253	
360	0.59	1.303	1.303	1.303	1.303	1.303	1.303	1.303	1.303	1.303	1.303	1.270	1.237	

**EPR Adjustments for Engine Bleed**

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	18	16	14	12	10	5
ENGINE ONLY	-0.010	-0.013	-0.015	-0.015	-0.015	-0.010
ENGINE & WING*	-0.015	-0.018	-0.019	-0.019	-0.018	-0.012
ENGINE & WING**	-0.021	-0.024	-0.024	-0.023	-0.022	-0.014

\* Wing anti-ice on, packs on.

\*\* Wing anti-ice on, packs off.

**ENGINE INOP****MAX CONTINUOUS THRUST****Driftdown Speed/Level Off Altitude**

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
300	290	282	17500	16100	14600
280	271	273	19400	18000	16600
260	252	264	21300	20000	18600
240	232	253	23300	22100	20700
220	213	243	25400	24200	22900
200	194	231	27400	26200	25100
180	174	219	29500	28300	27200
160	154	206	32200	30600	29500

**Driftdown/LRC Cruise Range Capability****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	
136	127	119	112	106	100	95	90	86	82	79	
272	254	238	224	211	200	190	181	173	165	158	
407	380	356	335	317	300	285	271	259	248	238	
541	505	474	447	422	400	380	362	346	331	317	
675	631	592	558	527	500	475	453	433	414	397	
808	755	709	669	633	600	571	544	520	498	477	
940	880	827	780	738	700	666	635	607	581	558	
1072	1004	944	890	843	800	761	726	694	665	638	
1204	1128	1061	1001	948	900	857	817	782	749	719	
1335	1251	1177	1112	1053	1000	952	909	869	833	799	
1467	1375	1294	1222	1158	1100	1048	1000	957	917	880	
1598	1499	1411	1333	1263	1200	1143	1091	1044	1001	961	
1729	1622	1527	1443	1368	1300	1239	1183	1132	1085	1042	
1860	1746	1644	1554	1473	1400	1334	1274	1219	1169	1122	
1992	1869	1761	1664	1578	1500	1429	1365	1306	1253	1203	
2123	1993	1878	1775	1683	1600	1525	1456	1394	1336	1284	
2255	2117	1995	1886	1788	1700	1620	1548	1481	1420	1364	
2388	2241	2112	1997	1893	1800	1716	1639	1568	1504	1445	

**ENGINE INOP****MAX CONTINUOUS THRUST****Driftdown/LRC Cruise Range Capability****Driftdown/Cruise Fuel and Time**

AIR DIST (NM)	FUEL REQUIRED (1000 KG)								TIME (HR:MIN)	
	WEIGHT AT START OF DRIFTDOWN (1000 KG)									
	160	180	200	220	240	260	280	300		
100	1.2	1.2	1.3	1.3	1.3	1.4	1.4	1.4	0:16	
200	2.5	2.6	2.8	2.9	3.1	3.2	3.3	3.4	0:32	
300	3.8	4.1	4.4	4.7	5.0	5.2	5.5	5.7	0:47	
400	5.1	5.6	6.0	6.5	6.9	7.4	7.8	8.2	1:03	
500	6.4	7.0	7.6	8.2	8.9	9.4	10.0	10.6	1:18	
600	7.7	8.4	9.1	9.9	10.7	11.4	12.1	12.9	1:33	
700	8.9	9.8	10.6	11.5	12.5	13.3	14.2	15.1	1:47	
800	10.1	11.1	12.1	13.1	14.2	15.2	16.3	17.3	2:02	
900	11.3	12.5	13.6	14.7	16.0	17.2	18.3	19.5	2:16	
1000	12.5	13.8	15.1	16.4	17.7	19.1	20.4	21.6	2:31	
1100	13.6	15.1	16.5	18.0	19.5	20.9	22.4	23.8	2:45	
1200	14.8	16.4	18.0	19.5	21.2	22.8	24.4	25.9	2:59	
1300	16.0	17.7	19.4	21.1	22.9	24.7	26.4	28.1	3:14	
1400	17.1	19.0	20.8	22.7	24.6	26.5	28.4	30.2	3:28	
1500	18.3	20.3	22.3	24.2	26.3	28.3	30.3	32.3	3:42	
1600	19.4	21.6	23.7	25.8	28.0	30.1	32.3	34.4	3:57	
1700	20.6	22.8	25.1	27.3	29.7	32.0	34.2	36.5	4:11	
1800	21.7	24.1	26.5	28.8	31.3	33.7	36.2	38.5	4:26	

Includes APU fuel burn.

Driftdown at optimum driftdown speed and cruise at LRC speed.

**Long Range Cruise Altitude Capability****100 ft/min residual rate of climb**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
300	15000	12700	10300
290	15700	13600	11200
280	16300	14400	12000
270	17000	15300	13000
260	18100	16500	14600
250	19200	17600	15800
240	20300	18800	17000
230	21400	20000	18200
220	22500	21100	19400
210	23600	22300	20700
200	24800	23500	22000
190	26000	24800	23400
180	27300	26000	24800
170	28600	27300	26100
160	30000	28600	27400

**ENGINE INOP****MAX CONTINUOUS THRUST****Long Range Cruise Control**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)						
		10	15	17	19	21	23	25
300	EPR	1.259	1.366					
	MACH	.585	.641					
	KIAS	325	325					
	FF/ENG	8919	9092					
280	EPR	1.236	1.333	1.383				
	MACH	.585	.641	.665				
	KIAS	325	325	325				
	FF/ENG	8548	8681	8780				
260	EPR	1.213	1.297	1.341	1.398			
	MACH	.577	.627	.651	.680			
	KIAS	321	318	318	320			
	FF/ENG	8069	8080	8152	8331			
240	EPR	1.188	1.260	1.298	1.344	1.402		
	MACH	.558	.606	.627	.652	.681		
	KIAS	310	307	306	306	308		
	FF/ENG	7412	7389	7412	7482	7658		
220	EPR	1.164	1.226	1.258	1.297	1.343	1.402	
	MACH	.538	.585	.605	.626	.651	.681	
	KIAS	298	296	294	294	294	296	
	FF/ENG	6764	6736	6728	6748	6810	6972	
200	EPR	1.141	1.195	1.223	1.254	1.293	1.339	1.398
	MACH	.516	.562	.581	.601	.623	.648	.677
	KIAS	286	284	283	282	281	281	282
	FF/ENG	6126	6094	6085	6077	6089	6140	6273
180	EPR	1.119	1.166	1.189	1.217	1.247	1.284	1.330
	MACH	.492	.537	.556	.576	.596	.617	.642
	KIAS	272	271	270	269	268	267	268
	FF/ENG	5490	5462	5451	5443	5434	5438	5475
160	EPR	1.098	1.139	1.158	1.181	1.207	1.237	1.272
	MACH	.466	.510	.529	.548	.568	.588	.609
	KIAS	258	257	256	256	255	254	253
	FF/ENG	4862	4838	4827	4817	4809	4800	4796

**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	
287	264	244	227	213	200	191	182	174	167	160	
576	530	489	455	426	400	381	364	348	334	321	
865	796	735	684	640	600	572	546	522	501	482	
1156	1064	982	913	853	800	763	729	698	669	643	
1448	1332	1229	1142	1067	1000	953	910	871	835	803	
1742	1602	1477	1372	1281	1200	1144	1092	1045	1002	963	
2036	1871	1725	1602	1495	1400	1335	1274	1219	1168	1122	
2332	2141	1973	1831	1709	1600	1525	1456	1392	1334	1282	
2629	2414	2223	2062	1924	1800	1715	1637	1565	1500	1441	

**Reference Fuel and Time Required at Check Point**

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)							
	10		14		18		22	
	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	3.4	0:40	3.0	0:38	2.6	0:37	2.4	0:36
400	7.1	1:17	6.5	1:13	6.0	1:10	5.5	1:07
600	10.9	1:54	10.0	1:48	9.3	1:43	8.7	1:38
800	14.5	2:31	13.5	2:24	12.6	2:17	11.8	2:10
1000	18.2	3:09	16.9	2:59	15.8	2:51	14.9	2:42
1200	21.8	3:47	20.3	3:35	19.1	3:25	17.9	3:14
1400	25.3	4:26	23.7	4:12	22.2	3:59	20.9	3:47
1600	28.8	5:05	27.0	4:48	25.4	4:33	23.9	4:19
1800	32.3	5:44	30.3	5:25	28.5	5:08	26.9	4:52

**Fuel Required Adjustment (1000 KG)**

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)							
	160	180	200	220	240	260	280	300
2	-0.1	-0.1	0.0	0.1	0.3	0.4	0.6	0.7
4	-0.4	-0.2	0.0	0.4	0.7	1.1	1.5	1.9
6	-0.6	-0.3	0.0	0.6	1.2	1.8	2.4	3.1
8	-0.9	-0.4	0.0	0.8	1.6	2.5	3.4	4.3
10	-1.1	-0.5	0.0	1.0	2.1	3.2	4.3	5.4
12	-1.3	-0.7	0.0	1.2	2.5	3.8	5.2	6.6
14	-1.6	-0.8	0.0	1.4	2.9	4.5	6.1	7.7
16	-1.8	-0.9	0.0	1.6	3.3	5.1	6.9	8.8
18	-2.0	-1.0	0.0	1.8	3.7	5.7	7.8	10.0
20	-2.3	-1.1	0.0	2.0	4.1	6.3	8.6	11.1
22	-2.5	-1.2	0.0	2.2	4.5	6.9	9.5	12.1
24	-2.8	-1.4	0.0	2.4	4.9	7.5	10.3	13.2
26	-3.0	-1.5	0.0	2.5	5.2	8.1	11.1	14.3
28	-3.2	-1.6	0.0	2.7	5.6	8.7	11.9	15.4
30	-3.5	-1.7	0.0	2.9	5.9	9.2	12.7	16.4
32	-3.7	-1.8	0.0	3.0	6.2	9.7	13.5	17.4
34	-3.9	-2.0	0.0	3.1	6.6	10.3	14.2	18.5

**ENGINE INOP****MAX CONTINUOUS THRUST**

**Holding**  
**Flaps up**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
300	EPR	1.163	1.200	1.271	1.363	
	KIAS	260	260	262	277	
	FF/ENG	8080	8090	8160	8510	
280	EPR	1.147	1.179	1.242	1.327	1.460
	KIAS	251	251	253	261	286
	FF/ENG	7480	7480	7530	7730	8420
260	EPR	1.131	1.159	1.215	1.294	1.401
	KIAS	242	242	243	246	266
	FF/ENG	6890	6900	6910	7010	7430
240	EPR	1.116	1.141	1.189	1.259	1.352
	KIAS	232	233	234	235	247
	FF/ENG	6310	6310	6320	6370	6620
220	EPR	1.102	1.124	1.165	1.225	1.310
	KIAS	222	223	224	224	230
	FF/ENG	5750	5740	5740	5760	5880
200	EPR	1.088	1.106	1.142	1.193	1.269
	KIAS	215	215	215	215	229
	FF/ENG	5230	5190	5190	5180	5230
180	EPR	1.075	1.090	1.119	1.161	1.225
	KIAS	208	208	208	208	209
	FF/ENG	4840	4680	4650	4650	4670
160	EPR	1.061	1.074	1.097	1.133	1.183
	KIAS	203	203	203	203	203
	FF/ENG	4360	4310	4160	4160	4160
140	EPR	1.047	1.058	1.076	1.105	1.146
	KIAS	203	203	203	203	203
	FF/ENG	3960	3910	3760	3740	3750

This table includes 5% additional fuel for holding in a racetrack pattern.

# ENGINE INOP

## ADVISORY INFORMATION

### Gear Down Landing Rate of Climb Available

#### Flaps 20

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	550	460				
50	600	510	380			
48	650	550	420			
46	690	600	470	310		
44	720	650	510	340		
42	760	690	550	370	230	
40	790	730	580	400	260	
38	820	760	610	440	290	150
36	840	800	650	470	320	180
34	840	830	680	500	350	200
32	850	850	710	530	380	230
30	850	850	730	550	410	260
20	870	870	760	620	480	340
10	890	890	770	630	490	360
0	900	900	790	650	500	370
-20	940	940	820	670	520	390
-40	990	990	860	710	550	400

Rate of climb capability shown is valid for 200000 kg, gear down at VREF20 + 5.

Decrease rate of climb 40 ft/min per 5000 kg greater than 200000 kg.

Increase rate of climb 60 ft/min per 5000 kg less than 200000 kg.

#### Flaps 30

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	50	-50				
50	90	-10	-140			
48	130	30	-100			
46	170	80	-60	-220		
44	200	120	-20	-190		
42	230	160	20	-160	-290	
40	260	190	50	-130	-270	
38	290	230	80	-100	-240	-380
36	310	260	110	-70	-220	-360
34	310	290	130	-40	-190	-340
32	320	310	160	-20	-170	-310
30	320	310	180	10	-140	-290
20	320	320	200	60	-80	-220
10	330	330	210	70	-80	-210
0	340	330	210	70	-80	-210
-20	360	350	220	70	-80	-210
-40	380	370	240	80	-80	-220

Rate of climb capability shown is valid for 200000 kg, gear down at VREF30 + 5.

Decrease rate of climb 40 ft/min per 5000 kg greater than 200000 kg.

Increase rate of climb 60 ft/min per 5000 kg less than 200000 kg.

**Performance Inflight - QRH**  
**Gear Down**
**Chapter PI-QRH**  
**Section 23**
**GEAR DOWN**
**220 KIAS Max Climb EPR**

TAT (°C)	PRESSURE ALTITUDE (1000 FT)														
	0	5	10	12	14	16	18	20	22	24	26	28	30	32	34
55	1.187	1.185	1.206	1.210	1.216	1.222	1.232	1.244	1.254	1.262	1.260	1.251	1.246	1.235	1.225
50	1.204	1.199	1.206	1.210	1.216	1.222	1.232	1.244	1.254	1.262	1.260	1.251	1.246	1.235	1.225
45	1.223	1.219	1.206	1.210	1.216	1.222	1.232	1.244	1.254	1.262	1.260	1.251	1.246	1.235	1.225
40	1.243	1.239	1.229	1.218	1.216	1.222	1.232	1.244	1.254	1.262	1.260	1.251	1.246	1.235	1.225
35	1.264	1.262	1.253	1.243	1.233	1.223	1.232	1.244	1.254	1.262	1.260	1.251	1.246	1.235	1.225
30	1.280	1.286	1.276	1.268	1.259	1.250	1.243	1.244	1.254	1.262	1.260	1.251	1.246	1.235	1.225
25	1.280	1.311	1.303	1.293	1.284	1.276	1.271	1.267	1.259	1.262	1.260	1.251	1.246	1.235	1.225
20	1.280	1.323	1.331	1.321	1.312	1.304	1.299	1.296	1.290	1.280	1.260	1.251	1.246	1.235	1.225
15	1.280	1.323	1.360	1.350	1.342	1.334	1.329	1.326	1.321	1.313	1.293	1.264	1.246	1.235	1.225
10	1.280	1.323	1.366	1.377	1.373	1.366	1.362	1.359	1.352	1.345	1.325	1.295	1.270	1.246	1.225
5	1.280	1.323	1.366	1.377	1.391	1.399	1.396	1.394	1.389	1.380	1.359	1.326	1.298	1.276	1.256
0	1.280	1.323	1.366	1.377	1.391	1.406	1.428	1.431	1.426	1.419	1.397	1.359	1.325	1.306	1.292
-5	1.280	1.323	1.366	1.377	1.391	1.406	1.428	1.452	1.468	1.461	1.439	1.401	1.363	1.337	1.327
-10	1.280	1.323	1.366	1.377	1.391	1.406	1.428	1.452	1.474	1.495	1.484	1.444	1.406	1.381	1.369
-15	1.280	1.323	1.366	1.377	1.391	1.406	1.428	1.452	1.474	1.495	1.501	1.491	1.454	1.427	1.417
-20	1.280	1.323	1.366	1.377	1.391	1.406	1.428	1.452	1.474	1.495	1.501	1.491	1.480	1.480	1.469

**Anti-Ice Adjustment**

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)							
	0	5	10	15	20	25	30	35
ENGINE ONLY	-0.008	-0.010	-0.015	-0.014	-0.006	-0.005	-0.003	-0.003
ENGINE AND WING*	-0.010	-0.012	-0.018	-0.019	-0.012	-0.012	-0.011	-0.013
ENGINE AND WING**	-0.012	-0.014	-0.021	-0.024	-0.018	-0.019	-0.020	-0.023

\*Wing anti-ice on, packs on.

\*\*Wing anti-ice on, single bleed source and both packs off.

**Long Range Cruise Altitude Capability**
**Max Climb Thrust, 300 ft/min residual rate of climb**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
300	13000	10400	7300
280	16200	13700	11000
260	19500	17200	14600
240	22500	20500	18200
220	25300	23600	21700
200	27300	26100	25000
180	29400	28200	27100
160	32100	30500	29300
140	35700	34000	32300

**GEAR DOWN****Long Range Cruise Control**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)								
		10	15	17	19	21	23	25	27	31
300	EPR	1.240								
	MACH	.488								
	KIAS	.270								
	FF/ENG	7412								
280	EPR	1.216	1.292	1.334						
	MACH	.474	.518	.538						
	KIAS	.262	.261	.261						
	FF/ENG	6899	6901	6969						
260	EPR	1.192	1.261	1.295	1.338					
	MACH	.458	.501	.519	.540					
	KIAS	.253	.252	.252	.252					
	FF/ENG	6367	6344	6363	6431					
240	EPR	1.169	1.231	1.261	1.296	1.340	1.395			
	MACH	.441	.484	.501	.520	.541	.563			
	KIAS	.244	.243	.243	.242	.242	.242			
	FF/ENG	5839	5818	5811	5829	5893	5962			
220	EPR	1.147	1.202	1.229	1.259	1.295	1.339	1.394		
	MACH	.422	.465	.482	.500	.519	.541	.563		
	KIAS	.233	.234	.233	.233	.232	.232	.232		
	FF/ENG	5304	5300	5291	5283	5299	5356	5419		
200	EPR	1.127	1.174	1.197	1.224	1.255	1.290	1.334	1.389	
	MACH	.402	.445	.462	.480	.498	.517	.538	.561	
	KIAS	.222	.223	.223	.223	.222	.222	.222	.222	
	FF/ENG	4772	4784	4779	4771	4763	4773	4820	4879	
180	EPR	1.110	1.147	1.167	1.190	1.218	1.247	1.281	1.324	1.378
	MACH	.387	.422	.439	.457	.475	.493	.512	.534	.557
	KIAS	.213	.212	.212	.212	.212	.211	.211	.211	.211
	FF/ENG	4327	4262	4268	4264	4257	4249	4252	4286	4341
160	EPR	1.094	1.125	1.141	1.160	1.185	1.211	1.240	1.275	1.317
	MACH	.372	.403	.419	.436	.454	.472	.492	.513	.535
	KIAS	.205	.202	.202	.202	.202	.202	.202	.202	.202
	FF/ENG	3925	3818	3812	3805	3799	3797	3802	3815	3845
140	EPR	1.079	1.106	1.120	1.136	1.157	1.180	1.205	1.233	1.267
	MACH	.352	.387	.403	.419	.436	.454	.473	.493	.515
	KIAS	.194	.194	.194	.194	.194	.194	.194	.194	.194
	FF/ENG	3474	3496	3491	3486	3475	3468	3407	3409	3419
										3444

**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	
324	290	260	236	217	200	189	179	170	161	154	
656	584	523	474	435	400	378	357	339	323	308	
991	882	788	714	653	600	567	536	509	484	462	
1329	1181	1053	953	871	800	755	714	677	644	615	
1670	1482	1320	1193	1090	1000	943	892	845	804	767	
2014	1785	1589	1434	1309	1200	1132	1070	1014	964	919	
2362	2091	1859	1676	1528	1400	1320	1248	1182	1123	1071	
2715	2400	2130	1919	1748	1600	1508	1425	1349	1282	1223	
3073	2711	2403	2163	1968	1800	1696	1602	1517	1441	1373	
3434	3026	2678	2407	2189	2000	1884	1779	1684	1599	1524	
3799	3343	2954	2652	2410	2200	2072	1955	1850	1756	1674	
4169	3662	3232	2898	2631	2400	2259	2132	2016	1914	1824	
4542	3984	3511	3145	2853	2600	2447	2308	2183	2071	1974	
4921	4309	3792	3393	3075	2800	2635	2485	2349	2229	2123	
5303	4637	4074	3641	3297	3000	2822	2661	2515	2386	2272	
5689	4968	4358	3890	3519	3200	3010	2837	2681	2542	2421	
6081	5301	4643	4140	3742	3400	3197	3012	2846	2698	2569	
6477	5638	4930	4391	3966	3600	3384	3188	3011	2854	2717	
6877	5977	5220	4643	4190	3800	3571	3363	3176	3010	2865	
7283	6320	5510	4896	4414	4000	3758	3538	3340	3165	3012	

**Reference Fuel and Time Required at Check Point**

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	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	6.7	0:49	6.1	0:47	5.3	0:44	4.8	0:42	4.4	0:40
400	13.9	1:37	12.9	1:31	11.5	1:24	10.7	1:20	10.1	1:16
600	21.0	2:25	19.5	2:17	17.5	2:06	16.4	1:59	15.6	1:53
800	27.9	3:15	26.0	3:04	23.4	2:48	22.0	2:39	20.9	2:30
1000	34.7	4:04	32.4	3:51	29.3	3:30	27.5	3:19	26.2	3:07
1200	41.3	4:55	38.6	4:40	35.0	4:14	32.9	3:59	31.3	3:45
1400	47.8	5:46	44.7	5:28	40.6	4:58	38.2	4:40	36.3	4:23
1600	54.2	6:38	50.8	6:17	46.2	5:42	43.4	5:22	41.3	5:02
1800	60.5	7:31	56.7	7:07	51.7	6:27	48.5	6:03	46.1	5:41
2000	66.7	8:24	62.6	7:57	57.2	7:12	53.6	6:45	51.0	6:20
2200	72.9	9:19	68.3	8:48	62.4	7:58	58.5	7:28	55.6	7:00
2400	79.0	10:14	74.0	9:39	67.7	8:44	63.4	8:11	60.2	7:39
2600	85.1	11:10	79.5	10:31	72.8	9:31	68.2	8:54	64.8	8:20
2800	91.0	12:07	85.0	11:24	77.8	10:18	73.0	9:38	69.2	9:01
3000	96.9	13:04	90.4	12:17	82.8	11:06	77.7	10:22	73.6	9:41
3200	102.5	14:03	95.7	13:12	87.6	11:54	82.3	11:07	77.9	10:23
3400	108.1	15:02	101.0	14:06	92.4	12:43	86.8	11:53	82.2	11:05
3600	113.6	16:02	106.2	15:02	97.1	13:33	91.3	12:38	86.4	11:47
3800	119.0	17:04	111.3	15:58	101.7	14:23	95.6	13:24	90.5	12:30
4000	124.4	18:05	116.4	16:54	106.3	15:13	100.0	14:11	94.7	13:13

**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)							
	160	180	200	220	240	260	280	300
10	-1.4	-0.7	0.0	0.8	2.0	3.5	5.4	7.6
20	-2.1	-1.1	0.0	1.6	3.7	6.3	9.4	13.1
30	-2.9	-1.5	0.0	2.3	5.3	8.9	13.2	18.1
40	-3.7	-1.9	0.0	3.0	6.8	11.4	16.6	22.7
50	-4.6	-2.4	0.0	3.7	8.2	13.6	19.8	26.8
60	-5.4	-2.8	0.0	4.3	9.5	15.6	22.6	30.5
70	-6.3	-3.3	0.0	4.9	10.7	17.5	25.1	33.7
80	-7.2	-3.7	0.0	5.5	11.8	19.1	27.4	36.5
90	-8.1	-4.2	0.0	6.0	12.8	20.6	29.3	38.8
100	-9.1	-4.7	0.0	6.4	13.7	21.9	30.9	40.7
110	-10.1	-5.1	0.0	6.9	14.5	22.9	32.1	42.1
120	-11.1	-5.6	0.0	7.3	15.2	23.8	33.1	43.1
130	-12.1	-6.1	0.0	7.6	15.8	24.5	33.8	43.6

Based on Long Range Cruise and VREF30+80 descent.

**Descent at VREF30+80**

PRESSURE ALT (1000 FT)	17	19	21	23	25	27	29	31	33	35
DISTANCE (NM)	41	45	49	53	57	61	65	69	73	78
TIME (MINUTES)	12	12	13	14	15	16	16	17	18	18

**GEAR DOWN****Holding  
Flaps Up**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)					
		1500	5000	10000	15000	20000	25000
300	EPR	1.138	1.167	1.227	1.313		
	KIAS	244	244	244	244		
	FF/ENG	7090	7090	7110	7210		
280	EPR	1.123	1.150	1.203	1.278		
	KIAS	239	239	239	239		
	FF/ENG	6610	6620	6620	6670		
260	EPR	1.110	1.134	1.179	1.247	1.345	
	KIAS	234	234	234	234	234	
	FF/ENG	6160	6150	6150	6180	6300	
240	EPR	1.097	1.119	1.158	1.217	1.302	
	KIAS	228	228	228	228	228	
	FF/ENG	5720	5690	5690	5690	5750	
220	EPR	1.086	1.104	1.140	1.190	1.263	1.376
	KIAS	222	222	222	222	222	222
	FF/ENG	5290	5260	5240	5230	5250	5390
200	EPR	1.076	1.092	1.123	1.166	1.230	1.322
	KIAS	215	215	215	215	215	215
	FF/ENG	5000	4840	4810	4790	4800	4860
180	EPR	1.067	1.081	1.106	1.144	1.199	1.277
	KIAS	208	208	208	208	208	208
	FF/ENG	4600	4440	4390	4380	4370	4390
160	EPR	1.059	1.071	1.093	1.126	1.173	1.242
	KIAS	203	203	203	203	203	203
	FF/ENG	4270	4220	4060	4040	4030	4100
140	EPR	1.053	1.064	1.084	1.114	1.157	1.219
	KIAS	203	203	203	203	203	203
	FF/ENG	4110	4060	3900	3870	3910	3830
140							

This table includes 5% additional fuel for holding in a racetrack pattern.

**GEAR DOWN****Holding****Flaps 1**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
300	EPR	1.140	1.168	1.225	1.307	
	KIAS	224	224	224	224	
	FF/ENG	6760	6760	6760	6820	
280	EPR	1.126	1.153	1.202	1.276	1.384
	KIAS	219	219	219	219	219
	FF/ENG	6320	6310	6300	6330	6470
260	EPR	1.113	1.137	1.181	1.247	1.342
	KIAS	214	214	214	214	214
	FF/ENG	5890	5870	5860	5880	5960
240	EPR	1.101	1.122	1.161	1.218	1.301
	KIAS	208	208	208	208	208
	FF/ENG	5460	5430	5420	5410	5450
220	EPR	1.090	1.107	1.143	1.191	1.264
	KIAS	202	202	202	202	202
	FF/ENG	5030	4990	4970	4960	4980
200	EPR	1.080	1.095	1.125	1.167	1.229
	KIAS	195	195	195	195	195
	FF/ENG	4730	4570	4530	4530	4530
180	EPR	1.069	1.083	1.107	1.144	1.196
	KIAS	188	188	188	188	188
	FF/ENG	4310	4270	4110	4100	4090
160	EPR	1.059	1.072	1.093	1.125	1.169
	KIAS	183	183	183	183	183
	FF/ENG	3960	3920	3770	3800	3790
140	EPR	1.053	1.064	1.083	1.111	1.151
	KIAS	183	183	183	183	183
	FF/ENG	3770	3720	3640	3600	3580

This table includes 5% additional fuel for holding in a racetrack pattern.



**Performance Inflight - QRH****Gear Down, Engine INOP****Chapter PI-QRH****Section 24****GEAR DOWN****ENGINE INOP****MAX CONTINUOUS THRUST****Driftdown Speed/Level Off Altitude****100 ft/min residual rate of climb****Includes APU fuel burn**

WEIGHT (1000 KG)		VREF + 80 DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
260	246	233	2200		
240	228	227	5600	3300	400
220	210	221	8500	6600	4200
200	191	214	11300	9700	7500
180	172	208	14100	12500	10700
160	153	200	16800	15400	13700
140	134	192	19500	18100	16500

**Long Range Cruise Altitude Capability****100 ft/min residual rate of climb**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
240	3500		
220	6900	4800	1700
200	10100	8100	5800
180	13000	11300	9300
160	15900	14400	12500
140	18700	17200	15700

**GEAR DOWN****ENGINE INOP****MAX CONTINUOUS THRUST****Long Range Cruise Control**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)					
		5	7	9	11	13	15
240	EPR	1.394					
	MACH	.379					
	KIAS	229					
	FF/ENG	10859					
230	EPR	1.372	1.420				
	MACH	.374	.388				
	KIAS	226	226				
	FF/ENG	10399	10514				
220	EPR	1.350	1.395				
	MACH	.369	.382				
	KIAS	223	223				
	FF/ENG	9949	10039				
210	EPR	1.330	1.371	1.420			
	MACH	.363	.377	.391			
	KIAS	220	220	220			
	FF/ENG	9514	9582	9688			
200	EPR	1.310	1.348	1.393	1.447		
	MACH	.358	.371	.385	.400		
	KIAS	216	216	216	216		
	FF/ENG	9096	9139	9222	9351		
190	EPR	1.291	1.326	1.367	1.417	1.478	
	MACH	.352	.365	.379	.393	.408	
	KIAS	213	213	213	213	213	
	FF/ENG	8689	8712	8774	8870	9037	
180	EPR	1.273	1.305	1.343	1.388	1.442	
	MACH	.346	.359	.373	.387	.402	
	KIAS	209	209	209	209	209	
	FF/ENG	8291	8303	8340	8414	8529	
170	EPR	1.255	1.285	1.320	1.361	1.409	1.470
	MACH	.340	.353	.366	.380	.395	.410
	KIAS	206	206	206	206	206	206
	FF/ENG	7892	7901	7919	7971	8055	8200
160	EPR	1.238	1.266	1.298	1.335	1.379	1.432
	MACH	.334	.346	.359	.373	.388	.403
	KIAS	202	202	202	202	202	202
	FF/ENG	7496	7504	7513	7541	7605	7701
150	EPR	1.221	1.247	1.276	1.310	1.350	1.397
	MACH	.327	.340	.353	.366	.380	.395
	KIAS	198	198	198	198	198	198
	FF/ENG	7109	7109	7116	7129	7168	7238
140	EPR	1.205	1.228	1.256	1.287	1.323	1.365
	MACH	.321	.333	.345	.359	.373	.387
	KIAS	194	194	194	194	194	194
	FF/ENG	6729	6721	6725	6732	6750	6799
							6877

**GEAR DOWN****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	
170	150	132	119	109	100	93	88	83	78	75	
349	305	269	241	219	200	187	175	164	154	146	
529	462	406	363	329	300	279	260	244	230	218	
710	620	544	486	440	400	372	347	325	306	290	
892	778	681	608	550	500	465	433	406	381	361	
1075	936	819	730	660	600	558	520	487	458	433	
1259	1096	958	853	771	700	651	606	567	533	504	
1444	1256	1097	976	882	800	743	692	647	608	575	
1630	1416	1236	1100	992	900	836	778	727	683	646	
1817	1577	1375	1223	1103	1000	928	864	808	759	717	

**Reference Fuel and Time Required at Check Point**

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	6		8		10		12		14	
	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)
100	3.3	0:28	3.1	0:27	2.9	0:27	2.7	0:26	2.6	0:26
200	6.9	0:54	6.6	0:53	6.4	0:52	6.1	0:50	5.9	0:49
300	10.5	1:21	10.1	1:19	9.8	1:17	9.5	1:15	9.2	1:13
400	14.1	1:48	13.6	1:45	13.2	1:42	12.8	1:39	12.5	1:36
500	17.6	2:15	17.0	2:11	16.5	2:07	16.1	2:04	15.7	2:00
600	21.1	2:42	20.4	2:37	19.8	2:33	19.3	2:29	18.9	2:24
700	24.6	3:09	23.8	3:04	23.1	2:59	22.5	2:54	22.0	2:49
800	28.0	3:37	27.1	3:31	26.3	3:25	25.6	3:19	25.1	3:13
900	31.3	4:05	30.4	3:58	29.5	3:51	28.8	3:44	28.1	3:37
1000	34.7	4:33	33.6	4:25	32.7	4:17	31.8	4:09	31.2	4:02

**GEAR DOWN****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)					
	140	160	180	200	220	240
4	-0.4	-0.2	0.0	0.3	0.8	1.3
6	-0.7	-0.3	0.0	0.5	1.2	2.0
8	-0.9	-0.5	0.0	0.7	1.6	2.7
10	-1.2	-0.6	0.0	0.9	2.0	3.3
12	-1.4	-0.7	0.0	1.0	2.4	4.0
14	-1.7	-0.8	0.0	1.2	2.7	4.6
16	-1.9	-1.0	0.0	1.4	3.1	5.2
18	-2.1	-1.1	0.0	1.5	3.5	5.8
20	-2.4	-1.2	0.0	1.7	3.8	6.4
22	-2.6	-1.3	0.0	1.8	4.1	7.0
24	-2.9	-1.4	0.0	2.0	4.5	7.5
26	-3.1	-1.6	0.0	2.1	4.8	8.0
28	-3.3	-1.7	0.0	2.3	5.1	8.5
30	-3.6	-1.8	0.0	2.4	5.4	9.0
32	-3.8	-1.9	0.0	2.6	5.7	9.5
34	-4.1	-2.0	0.0	2.7	6.0	10.0
36	-4.3	-2.2	0.0	2.8	6.2	10.4

Based on Long Range Cruise and VREF30+80 descent. Includes APU fuel burn.

**Holding  
Flaps Up**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)			
	1500	5000	10000	15000
240	EPR	1.319	1.390	
	KIAS	228	228	
	FF/ENG	11170	11310	
220	EPR	1.285	1.347	
	KIAS	222	222	
	FF/ENG	10300	10360	
200	EPR	1.253	1.307	1.414
	KIAS	215	215	215
	FF/ENG	9440	9470	9650
180	EPR	1.223	1.270	1.360
	KIAS	208	208	208
	FF/ENG	8620	8620	8700
160	EPR	1.199	1.240	1.319
	KIAS	203	203	203
	FF/ENG	7950	7940	7970
140	EPR	1.185	1.222	1.295
	KIAS	203	203	203
	FF/ENG	7590	7570	7590

This table includes 5% additional fuel for holding in a racetrack pattern.

**Performance Inflight - QRH**  
**Text**

**Chapter PI-QRH**  
**Section 25**

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## **Introduction**

This chapter contains information to supplement performance data from the Flight Management Computer. 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.

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## **General**

### **Flight with Unreliable Airspeed / Turbulent Air Penetration**

Body 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 may also cause unreliable airspeed/Mach indications. Climb, cruise and descent information is based on the recommended turbulent air penetration speed schedule: 270 knots below 25,000 feet, 280 knots or 0.82 Mach whichever is lower at 25,000 feet and above; maintain a minimum speed of 15 knots above the minimum maneuvering speed when below 0.82 Mach. This schedule provides ample protection from stall and high speed buffet, while also providing protection from exceeding structural limits.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed may also be unreliable.

### **Max Climb EPR**

This table shows Max Climb EPR for a 310/.84 climb speed schedule, normal engine bleed for 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 Speeds**

This table contains flaps 30, 25 and 20 reference speeds for a given weight.

## Advisory Information

### Normal Configuration Landing Distance

Tables are provided as advisory information for normal configuration landing distances 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 appropriate 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 and adjustments are provided for dry runways and runways with good, medium, and poor reported braking action.

Enter the table with the applicable non-normal configuration and read the normal approach speed. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and speed at sea level, zero wind, and zero slope. Subsequent columns provide corrections for off-reference landing weight, altitude,

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wind, slope, and speed conditions. Each correction is independently added to the reference landing distance. Landing distance includes the effects of max manual braking and reverse thrust.

For an engine inoperative autoland, check the rate of climb capability shown in Gear Down Landing Rate of Climb Available tables to ensure adequate climb performance.

### **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 appropriate Event Adjusted Brake Energy Table (No Reverse Thrust or 2 Engine Reverse) with the reference brake energy per brake and the type of braking used during landing (Max Manual, Max Auto, or Autobrake). The resulting number is the adjusted brake energy per brake and represents the energy absorbed in each brake during the landing. The recommended cooling time is found in the final table by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

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 5.0 or higher on the EICAS indication and disappear as the hottest brake cools with an EICAS indication of 3.5. Note that even without an EICAS advisory message, brake cooling is recommended.

## Landing Climb Limit Weight

In the event an overweight landing is necessary and the fuel dump system is unavailable, landing climb limits should be checked if a Flaps 25 or 30 landing is planned. Enter the table with airport OAT and pressure altitude to read landing climb limit weight. Apply the noted adjustments as required. At weights exceeding those shown, plan a Flaps 20 landing.

## Engine Inoperative

### Initial Max Continuous EPR

The Initial Max Continuous EPR setting for use following an engine failure is shown. The table is based on the typical all engine cruise Mach number of .84 to provide a target EPR setting at the start of driftdown. Once driftdown is established, the Max Continuous EPR table should be used to determine EPR for the given conditions.

### Max Continuous EPR

Power setting is based on one engine operating with one bleed source for pack(s) operating and all anti-ice bleeds off. Enter the table for appropriate pressure altitude with IAS or Mach and TAT to read Max Continuous EPR. Apply the anti-ice corrections below the table as required.

It is desirable to maintain engine thrust level within the limits of the Max Cruise thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous thrust rating. The Max Continuous thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

### Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

## Driftdown/Cruise Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to long range cruise speed. Cruise is continued at level off altitude and long range cruise speed.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and correct for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude is used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Diversion Fuel and Time table.

## Long Range Cruise Altitude Capability

Table show the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on LRC speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

## Long Range Cruise Control

The table provides target EPR, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

## Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .84/310/250 descent. Enter with Air Distance as determined from the Ground to Air Miles Conversion Table and read Fuel and Time required at the cruise pressure altitude. Adjust the fuel obtained for deviation from the reference weight at checkpoint as required by entering the off reference fuel corrections table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel and time required for the actual weight.

## Holding

Single engine holding data is provided in the same format as the all engine holding data and is based on the same assumptions.

## Gear Down Landing Rate of Climb Available

Rate of climb data is provided as guidance information in the event an engine inoperative autoland is planned. The tables show gear down rate of climb available for Flaps 20 and Flaps 30. Enter the table with TAT and pressure altitude to read rate of climb available. Apply adjustments shown to correct for weight.

### 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 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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**DO NOT USE FOR FLIGHT**

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DRAFT

Intentionally  
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# Performance Inflight - QRH

## General

# Chapter PI-QRH

## Section 30

**Flight With Unreliable Airspeed / Turbulent Air Penetration**  
**Altitude and/or vertical speed indications may also be unreliable.**

### Climb

#### Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)				
		150	200	250	300	350
40000 (.82M)	PITCH ATT	5.0	4.5			
	V/S (FT/MIN)	2500	1500			
30000 (280 KIAS)	PITCH ATT	6.5	5.5	5.5	5.0	4.5
	V/S (FT/MIN)	3700	2600	1800	1300	900
20000 (270 KIAS)	PITCH ATT	9.5	8.5	8.0	7.5	7.5
	V/S (FT/MIN)	5000	3600	2700	2000	1400
10000 (270 KIAS)	PITCH ATT	14.0	11.5	10.0	9.5	9.5
	V/S (FT/MIN)	6700	4900	3700	2900	2200
SEA LEVEL (270 KIAS)	PITCH ATT	17.5	14.5	12.5	11.5	11.0
	V/S (FT/MIN)	7800	5700	4400	3500	2800

### Cruise

#### Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)				
		150	200	250	300	350
40000 (.82M)	PITCH ATT	2.0	3.0			
	%N1	78.6	83.2			
35000 (.82M)	PITCH ATT	1.5	2.0	3.0	3.5	
	%N1	76.5	78.9	82.8	88.0	
30000 (280 KIAS)	PITCH ATT	1.5	2.5	3.0	3.5	3.5
	%N1	72.6	74.7	78.1	82.4	87.3
25000 (280 KIAS)	PITCH ATT	1.5	2.5	3.5	4.0	4.0
	%N1	68.6	70.7	73.8	77.7	82.3
20000 (270 KIAS)	PITCH ATT	2.0	2.5	3.5	4.5	5.5
	%N1	63.4	65.8	69.0	72.8	77.4
15000 (270 KIAS)	PITCH ATT	1.5	2.5	3.5	4.5	5.5
	%N1	59.6	61.8	65.0	68.2	72.5

### Descent

#### Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)				
		150	200	250	300	350
40000 (.82M)	PITCH ATT	-1.5	0.0			
	V/S (FT/MIN)	-2900	-2600			
30000 (280 KIAS)	PITCH ATT	-1.5	-0.5	0.5	1.0	0.5
	V/S (FT/MIN)	-2500	-2000	-1900	-1900	-2400
20000 (270 KIAS)	PITCH ATT	-1.0	0.5	1.5	2.5	3.0
	V/S (FT/MIN)	-1900	-1600	-1500	-1400	-1400
10000 (270 KIAS)	PITCH ATT	-1.5	0.0	1.0	2.0	3.0
	V/S (FT/MIN)	-1700	-1400	-1300	-1300	-1300
SEA LEVEL (270 KIAS)	PITCH ATT	-2.0	-0.5	1.0	2.0	3.0
	V/S (FT/MIN)	-1500	-1300	-1200	-1200	-1200

In shaded areas, data reflects the minimum speed limitation of 15 knots above minimum maneuvering speed.

**Flight With Unreliable Airspeed / Turbulent Air Penetration**  
**Altitude and/or vertical speed indications may also be unreliable.**

**Holding****Flaps Up, Set Thrust for Level Flight**

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		150	200	250	300	350
10000	PITCH ATT	<b>3.0</b>	<b>4.5</b>	<b>5.5</b>	<b>6.0</b>	<b>6.0</b>
	%N1	50.2	54.4	59.1	63.9	68.2
	KIAS	216	216	226	244	262
5000	PITCH ATT	<b>3.0</b>	<b>4.5</b>	<b>5.5</b>	<b>6.0</b>	<b>6.0</b>
	%N1	46.6	50.9	55.4	59.7	64.2
	KIAS	216	216	226	244	262

**Terminal Area (5000 FT)****%N1 for Level Flight**

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		150	200	250	300	350
FLAPS UP GEAR UP (VREF 30 + 80)	PITCH ATT	<b>3.5</b>	<b>5.0</b>	<b>6.0</b>	<b>6.5</b>	<b>6.5</b>
	%N1	47.7	52.3	57.2	61.9	66.4
	KIAS	217	217	225	243	263
FLAPS 1 GEAR UP (VREF 30 + 60)	PITCH ATT	<b>5.0</b>	<b>6.5</b>	<b>8.0</b>	<b>8.0</b>	<b>8.0</b>
	%N1	48.5	53.4	58.8	63.9	68.2
	KIAS	197	197	205	223	243
FLAPS 5 GEAR UP (VREF 30 + 40)	PITCH ATT	<b>3.5</b>	<b>5.5</b>	<b>7.0</b>	<b>7.0</b>	<b>6.5</b>
	%N1	48.8	54.0	59.7	64.7	69.0
	KIAS	177	177	185	203	223
FLAPS 15 GEAR UP (VREF 30 + 20)	PITCH ATT	<b>3.5</b>	<b>6.5</b>	<b>8.0</b>	<b>7.5</b>	<b>7.0</b>
	%N1	49.0	55.2	61.9	66.8	71.2
	KIAS	157	157	165	183	203
FLAPS 20 GEAR DOWN (VREF 30 + 20)	PITCH ATT	<b>2.0</b>	<b>4.5</b>	<b>6.5</b>	<b>6.0</b>	<b>5.5</b>
	%N1	56.2	61.4	67.3	73.1	78.1
	KIAS	157	157	165	183	203

**Final Approach (1500 FT)****Gear Down, %N1 for 3° Glideslope**

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		150	200	250	300	350
FLAPS 20 (VREF 20 + 10)	PITCH ATT	<b>0.0</b>	<b>2.0</b>	<b>2.0</b>	<b>2.5</b>	<b>2.5</b>
	%N1	36.8	40.7	45.1	49.3	52.6
	KIAS	147	155	172	187	201
FLAPS 25 (VREF 25 + 10)	PITCH ATT	<b>1.0</b>	<b>2.0</b>	<b>2.0</b>	<b>2.5</b>	<b>2.5</b>
	%N1	51.5	49.8	54.7	59.2	63.3
	KIAS	147	147	163	178	191
FLAPS 30 (VREF 30 + 10)	PITCH ATT	<b>0.0</b>	<b>1.0</b>	<b>2.0</b>	<b>1.5</b>	
	%N1	56.9	55.6	60.2	65.3	
	KIAS	147	147	155	172	

**Max Climb %N1****Based on engine bleed for packs on or off and anti-ice off**

TAT (°C)	PRESSURE ALTITUDE (1000 FT) / SPEED (KIAS OR MACH)									
	0	5	10	15	20	25	30	35	40	43
	310	310	310	310	310	310	310	.84	.84	.84
60	88.3	88.1	90.3	91.0	93.1	96.7	99.6	101.7	101.8	101.3
50	90.6	90.4	90.2	89.6	91.7	95.3	98.0	100.1	100.2	99.7
40	92.5	92.4	92.4	92.2	90.5	93.8	96.5	98.6	98.7	98.2
30	91.6	94.1	94.2	94.0	93.1	94.2	95.2	97.0	97.1	96.6
20	90.1	92.5	95.1	95.8	95.9	95.9	96.9	95.9	95.5	95.0
15	89.3	91.7	94.3	96.9	96.9	96.9	97.8	96.6	95.8	95.4
10	88.6	90.9	93.5	96.1	98.4	98.1	98.8	97.2	96.5	96.0
5	87.8	90.1	92.7	95.2	98.1	99.6	100.1	98.1	97.2	96.8
0	87.0	89.3	91.8	94.4	97.3	99.9	101.5	99.3	98.1	97.6
-5	86.2	88.5	91.0	93.5	96.4	99.0	101.9	100.5	99.5	98.8
-10	85.4	87.7	90.1	92.6	95.5	98.1	100.9	101.3	100.5	100.0
-15	84.6	86.8	89.3	91.7	94.5	97.1	100.0	101.0	100.9	100.5
-20	83.7	86.0	88.4	90.8	93.6	96.2	99.0	100.1	99.9	99.5
-25	82.9	85.1	87.5	89.9	92.7	95.2	98.0	99.1	98.9	98.5
-30	82.1	84.3	86.7	89.0	91.8	94.3	97.0	98.1	97.9	97.5
-35	81.2	83.4	85.8	88.1	90.8	93.3	96.0	97.0	96.9	96.5
-40	80.4	82.5	84.9	87.2	89.8	92.3	95.0	96.0	95.9	95.5

**%N1 Adjustments for Engine Bleed**

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (1000 FT)									
	0	5	10	15	20	25	30	35	40	43
2 PACKS ON - 1 BLEED SOURCE	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4	-0.4	-0.5
1 PACK ON - 1 OR 2 BLEED SOURCES	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4	-0.4	-0.5
ENGINE ANTI-ICE ON	-0.3	-0.5	-0.4	-0.3	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2
ENGINE AND WING ANTI-ICE ON*	-0.6	-0.8	-0.7	-0.5	-0.2	-0.3	-0.3	-0.4	-0.4	-0.4
ENGINE AND WING ANTI-ICE ON**	-1.1	-0.9	-0.9	-0.6	-0.3	-0.4	-0.5	-0.5	-0.6	-0.6

\*Packs on or packs off with 2 bleed sources.

\*\*Packs off with 1 bleed source.

**VREF****Flaps 30**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
360	184	184	184	184	184	184
340	180	180	180	180	180	180
320	173	173	173	173	173	173
300	164	164	164	164	164	165
280	158	158	158	158	158	158
260	149	149	149	150	150	150
240	143	144	144	144	144	144
220	137	137	138	138	138	138
200	137	134	131	131	131	131
180	137	134	130	126	124	124
160	137	134	130	126	121	117

**Flaps 25**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
360	183	183	183	183	183	183
340	180	180	180	180	181	181
320	175	175	175	175	175	176
300	169	170	170	170	170	170
280	164	164	164	164	164	164
260	158	158	158	158	158	158
240	152	152	152	152	152	152
220	145	145	146	146	146	146
200	139	139	139	139	139	139
180	137	134	131	131	131	132
160	137	134	130	126	124	124

**Flaps 20**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
360	193	193	193	193	194	195
340	190	190	190	191	191	192
320	185	185	185	185	185	186
300	179	179	179	179	180	180
280	173	173	173	173	174	174
260	167	167	167	167	167	167
240	160	160	161	161	161	161
220	154	154	154	154	154	154
200	147	147	147	147	147	147
180	139	139	139	139	139	139
160	137	134	131	131	131	131

# Performance Inflight - QRH

## Advisory Information

# Chapter PI-QRH

## Section 31

### ADVISORY INFORMATION

#### Normal Configuration Landing Distance

Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT 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	220000 KG LANDING WT	PER 5000 KG ABOVE / BELOW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD / TAIL WIND	DOWN / UP HILL	ABOVE / BELOW ISA	PER 5 KTS ABOVE VREF30	ONE REV NO REV

#### Dry Runway

MAX MANUAL	910	+25/0	20	-35/+125	+10/-10	+20/-20	35	20	40
AUTOBRAKE MAX	1215	+25/0	25	-50/+180	0/0	+30/-30	65	0	0
AUTOBRAKE 4	1575	+35/0	40	-75/+255	0/0	+40/-40	90	0	0
AUTOBRAKE 3	1855	+45/-10	45	-90/+315	0/-10	+50/-50	100	0	0
AUTOBRAKE 2	2045	+50/-20	60	-105/+365	+25/-45	+55/-55	80	65	65
AUTOBRAKE 1	2205	+55/-25	70	-120/+420	+65/-70	+60/-60	80	250	305

#### Good Reported Braking Action

MAX MANUAL	1270	+25/-5	30	-60/+220	+30/-25	+30/-30	50	80	195
AUTOBRAKE MAX	1320	+25/-5	35	-65/+225	+30/-20	+30/-30	60	85	205
AUTOBRAKE 4	1580	+35/0	40	-75/+260	+10/-5	+40/-40	90	5	35
AUTOBRAKE 3	1855	+45/-10	45	-90/+315	+5/-10	+50/-50	100	0	0
AUTOBRAKE 2	2045	+50/-20	60	-105/+365	+25/-45	+55/-55	80	65	65
AUTOBRAKE 1	2205	+55/-25	70	-120/+420	+65/-70	+60/-60	80	250	305

#### Medium Reported Braking Action

MAX MANUAL	1695	+40/-15	50	-95/+350	+75/-60	+45/-45	60	215	575
AUTOBRAKE MAX	1695	+40/-15	50	-95/+350	+75/-60	+45/-45	65	210	570
AUTOBRAKE 4	1755	+40/-5	50	-100/+360	+60/-35	+50/-50	90	195	565
AUTOBRAKE 3	1955	+45/-10	50	-105/+385	+40/-35	+55/-55	100	85	390
AUTOBRAKE 2	2095	+50/-20	60	-115/+405	+55/-65	+60/-60	80	115	310
AUTOBRAKE 1	2210	+55/-25	70	-125/+435	+90/-70	+60/-65	80	275	415

#### Poor Reported Braking Action

MAX MANUAL	2145	+50/-25	70	-140/+540	+165/-110	+60/-60	70	445	1380
AUTOBRAKE MAX	2150	+55/-25	70	-140/+540	+170/-115	+60/-60	70	445	1385
AUTOBRAKE 4	2150	+55/-20	70	-140/+540	+170/-110	+60/-60	75	445	1385
AUTOBRAKE 3	2220	+55/-20	70	-140/+545	+140/-90	+65/-65	100	395	1340
AUTOBRAKE 2	2320	+55/-25	75	-145/+560	+145/-115	+65/-65	80	345	1265
AUTOBRAKE 1	2380	+60/-30	80	-150/+570	+170/-120	+70/-70	80	440	1220

Reference distance is for sea level, standard day, no wind or slope, VREF30 approach speed, 2 engine reverse thrust, and auto speedbrakes.

For Max Manual braking and manual speedbrakes, increase reference landing distance by 65 m.

For autobrake and manual speedbrakes, increase reference landing distance by 50 m.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Normal Configuration Landing Distance**

Flaps 25

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	220000 KG LANDING WT	PER 5000 KG ABOVE / BELOW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN / UP HILL	ABOVE / BELOW ISA	PER 5 KTS ABOVE VREF25	ONE REV	NO REV

**Dry Runway**

MAX MANUAL	940	+20/-5	20	-35/+130	+10/-10	+20/-20	35	20	45
AUTOBRAKE MAX	1285	+20/-5	30	-55/+185	0/0	+30/-30	65	0	0
AUTOBRAKE 4	1670	+30/-10	45	-80/+265	0/0	+45/-45	95	0	0
AUTOBRAKE 3	1975	+35/-15	55	-95/+330	0/-15	+55/-55	100	5	5
AUTOBRAKE 2	2165	+40/-25	70	-110/+375	+30/-50	+60/-60	85	90	90
AUTOBRAKE 1	2330	+50/-30	80	-125/+435	+75/-75	+65/-65	80	295	365

**Good Reported Braking Action**

MAX MANUAL	1325	+20/-10	35	-65/+225	+30/-30	+35/-35	50	90	215
AUTOBRAKE MAX	1380	+25/-10	35	-65/+230	+30/-20	+35/-35	65	95	225
AUTOBRAKE 4	1680	+30/-10	45	-80/+270	+10/-5	+45/-45	95	5	35
AUTOBRAKE 3	1975	+35/-15	55	-95/+330	+5/-15	+55/-55	100	5	5
AUTOBRAKE 2	2165	+40/-25	70	-110/+375	+30/-50	+60/-60	85	90	90
AUTOBRAKE 1	2330	+50/-30	80	-125/+435	+75/-75	+65/-65	80	295	365

**Medium Reported Braking Action**

MAX MANUAL	1775	+35/-20	55	-100/+360	+75/-60	+50/-50	60	235	635
AUTOBRAKE MAX	1775	+35/-20	55	-100/+360	+80/-60	+50/-50	65	235	630
AUTOBRAKE 4	1855	+35/-10	55	-100/+370	+55/-35	+50/-50	95	195	610
AUTOBRAKE 3	2075	+35/-20	60	-110/+395	+40/-40	+60/-60	100	90	410
AUTOBRAKE 2	2220	+40/-25	70	-120/+420	+65/-70	+65/-65	85	145	350
AUTOBRAKE 1	2340	+50/-30	80	-125/+445	+95/-80	+65/-65	80	315	480

**Poor Reported Braking Action**

MAX MANUAL	2250	+45/-30	80	-145/+550	+170/-115	+65/-65	70	485	1535
AUTOBRAKE MAX	2255	+50/-30	80	-145/+550	+175/-120	+65/-65	70	490	1535
AUTOBRAKE 4	2255	+50/-30	80	-145/+550	+175/-110	+65/-65	80	490	1535
AUTOBRAKE 3	2350	+45/-25	80	-145/+560	+145/-95	+70/-70	100	415	1470
AUTOBRAKE 2	2445	+50/-35	85	-150/+575	+155/-120	+70/-70	80	390	1395
AUTOBRAKE 1	2510	+55/-35	90	-155/+585	+175/-125	+75/-75	80	490	1360

Reference distance is for sea level, standard day, no wind or slope, VREF25 approach speed, 2 engine reverse thrust, and auto speedbrakes.

For Max Manual braking and manual speedbrakes, increase reference landing distance by 65 m.

For autobrake and manual speedbrakes, increase reference landing distance by 55 m.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Normal Configuration Landing Distance****Flaps 20**

	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT 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	220000 KG LANDING WT	PER 5000 KG ABOVE / BELOW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN / UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF20	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1005	+25/-10	25	-40/+135	+10/-10	+20/-20	35	25	55
AUTOBRAKE MAX	1390	+20/-15	35	-60/+195	0/0	+35/-35	70	0	0
AUTOBRAKE 4	1820	+30/-20	50	-80/+280	0/0	+50/-50	100	0	0
AUTOBRAKE 3	2160	+40/-30	65	-100/+345	+5/-15	+60/-60	105	5	5
AUTOBRAKE 2	2370	+45/-40	75	-115/+395	+35/-55	+70/-70	90	105	105
AUTOBRAKE 1	2560	+55/-45	90	-135/+455	+80/-85	+75/-75	90	345	420

**Good Reported Braking Action**

MAX MANUAL	1430	+25/-20	40	-65/+230	+35/-30	+35/-35	50	105	250
AUTOBRAKE MAX	1485	+25/-20	40	-70/+240	+30/-20	+40/-40	65	105	265
AUTOBRAKE 4	1825	+30/-20	50	-85/+285	+10/0	+50/-50	100	10	40
AUTOBRAKE 3	2160	+40/-30	65	-100/+345	+5/-15	+60/-60	105	5	5
AUTOBRAKE 2	2370	+45/-40	75	-115/+395	+35/-55	+70/-70	90	105	105
AUTOBRAKE 1	2560	+55/-45	90	-135/+455	+80/-85	+75/-75	90	345	420

**Medium Reported Braking Action**

MAX MANUAL	1925	+35/-30	65	-105/+375	+85/-65	+55/-55	65	275	750
AUTOBRAKE MAX	1925	+40/-30	65	-105/+375	+85/-65	+55/-55	70	270	745
AUTOBRAKE 4	2010	+40/-25	65	-105/+385	+60/-40	+55/-60	100	225	710
AUTOBRAKE 3	2260	+40/-35	70	-115/+415	+45/-45	+65/-65	105	100	490
AUTOBRAKE 2	2425	+50/-40	80	-125/+440	+65/-75	+70/-70	90	160	410
AUTOBRAKE 1	2565	+55/-45	95	-135/+470	+100/-90	+75/-75	90	370	550

**Poor Reported Braking Action**

MAX MANUAL	2450	+55/-45	90	-150/+570	+185/-125	+70/-70	75	565	1815
AUTOBRAKE MAX	2455	+55/-45	90	-150/+570	+190/-130	+70/-70	75	565	1815
AUTOBRAKE 4	2455	+55/-40	90	-150/+570	+190/-120	+70/-70	80	565	1815
AUTOBRAKE 3	2550	+55/-40	90	-155/+580	+160/-100	+75/-75	105	480	1740
AUTOBRAKE 2	2665	+55/-45	95	-160/+595	+165/-125	+80/-80	90	445	1650
AUTOBRAKE 1	2745	+60/-50	100	-165/+610	+190/-140	+80/-80	85	565	1600

Reference distance is for sea level, standard day, no wind or slope, VREF20 approach speed, 2 engine reverse thrust, and auto speedbrakes.

For Max Manual braking and manual speedbrakes, increase reference landing distance by 70 m.

For autobrake and manual speedbrakes, increase reference landing distance by 55 m.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****ANTISKID - Flaps 25**

VREF25

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	220000 KG LDG WT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1775	+35/-20	55	-100/+360	+75/-60	+50/-50	60	235	635
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 2					Autobrake inoperative				

**Good Reported Braking Action**

MAX MANUAL	1775	+35/-20	55	-100/+360	+75/-60	+50/-50	60	235	635
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 2					Autobrake inoperative				

**Medium Reported Braking Action**

MAX MANUAL	2250	+45/-30	80	-145/+550	+170/-115	+65/-65	70	485	1535
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 3					Autobrake inoperative				

**Poor Reported Braking Action**

MAX MANUAL	3005	+70/-50	115	-235/+1010	+900/-260	+90/-90	80	1335	5000
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 3					Autobrake inoperative				

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****ANTISKID - Flaps 30****VREF30**

LANDING DISTANCES AND ADJUSTMENTS (M)									
	REF DIST	WEIGHT 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	220000 KG LDG WT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

**Dry Runway**

MAX MANUAL	1695	+40/-15	50	-95/+350	+75/-60	+45/-45	60	215	575
AUTOBRAKE MAX									
Autobrake inoperative									

**Good Reported Braking Action**

MAX MANUAL	1695	+40/-15	50	-95/+350	+75/-60	+45/-45	60	215	575
AUTOBRAKE MAX									
Autobrake inoperative									

**Medium Reported Braking Action**

MAX MANUAL	2145	+50/-25	70	-140/+540	+165/-110	+60/-60	70	445	1380
AUTOBRAKE MAX									
Autobrake inoperative									

**Poor Reported Braking Action**

MAX MANUAL	2865	+75/-40	105	-230/+990	+865/-250	+85/-85	80	1240	5000
AUTOBRAKE MAX									
Autobrake inoperative									

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance**

ENG SHUTDOWN L, R - Flaps 20

VREF20

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	220000 KG LDG WT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1015	+30/-10	25	-40/+135	+15/-10	+25/-25	40	0	30
AUTOBRAKE MAX	1390	+20/-15	35	-60/+195	0/0	+35/-35	70	0	0
AUTOBRAKE 2	2470	+45/-35	75	-120/+405	+5/-25	+75/-75	125	0	0

**Good Reported Braking Action**

MAX MANUAL	1495	+25/-20	40	-70/+245	+40/-35	+40/-40	60	0	140
AUTOBRAKE MAX	1560	+25/-20	45	-70/+250	+40/-35	+40/-40	65	0	150
AUTOBRAKE 2	2470	+45/-35	75	-120/+405	+5/-25	+75/-75	125	0	0

**Medium Reported Braking Action**

MAX MANUAL	2115	+40/-35	65	-115/+410	+110/-85	+60/-60	75	0	430
AUTOBRAKE MAX	2115	+40/-35	70	-115/+410	+115/-80	+60/-60	85	0	430
AUTOBRAKE 3	2315	+45/-30	70	-120/+435	+70/-50	+70/-70	115	0	320

**Poor Reported Braking Action**

MAX MANUAL	2835	+60/-50	100	-175/+655	+275/-180	+85/-85	95	0	1060
AUTOBRAKE MAX	2835	+60/-50	100	-175/+655	+275/-180	+85/-85	95	0	1060
AUTOBRAKE 3	2865	+60/-50	100	-175/+660	+265/-165	+85/-85	105	0	1070

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****ENG SHUTDOWN L, R - Flaps 30****VREF30**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	220000 KG LDG WT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	915	+25/0	20	-35/+125	+10/-10	+20/-20	35	0	20
AUTOBRAKE MAX	1215	+25/0	25	-50/+180	0/0	+30/-30	65	0	0
AUTOBRAKE 2	2100	+50/-10	55	-110/+370	+10/-20	+60/-60	115	0	0

**Good Reported Braking Action**

MAX MANUAL	1315	+25/-5	30	-65/+230	+35/-30	+35/-35	55	0	105
AUTOBRAKE MAX	1375	+30/-5	35	-65/+235	+35/-30	+35/-35	60	0	115
AUTOBRAKE 2	2100	+50/-10	55	-110/+370	+10/-20	+60/-60	115	0	0

**Medium Reported Braking Action**

MAX MANUAL	1830	+40/-15	50	-105/+380	+95/-75	+50/-50	70	0	325
AUTOBRAKE MAX	1835	+45/-10	55	-105/+380	+95/-70	+50/-50	80	0	320
AUTOBRAKE 3	1995	+45/-5	55	-110/+400	+65/-50	+55/-55	100	0	250

**Poor Reported Braking Action**

MAX MANUAL	2430	+60/-25	80	-160/+610	+235/-150	+70/-70	85	0	790
AUTOBRAKE MAX	2435	+60/-25	80	-160/+610	+240/-155	+70/-70	85	0	790
AUTOBRAKE 3	2465	+60/-20	80	-160/+615	+230/-145	+75/-75	90	0	800

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****FLAP / SLAT CONTROL - Flaps 20**

VREF20

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	220000 KG LDG WT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1005	+25/-10	25	-40/+135	+10/-10	+20/-20	35	25	55
AUTOBRAKE MAX	1390	+20/-15	35	-60/+195	0/0	+35/-35	70	0	0
AUTOBRAKE 2	2375	+45/-40	75	-115/+395	+35/-55	+70/-70	90	105	105

**Good Reported Braking Action**

MAX MANUAL	1430	+25/-20	40	-65/+230	+35/-30	+35/-35	50	105	250
AUTOBRAKE MAX	1485	+25/-20	40	-70/+240	+30/-20	+40/-40	65	105	265
AUTOBRAKE 2	2375	+45/-40	75	-115/+395	+35/-55	+70/-70	90	105	105

**Medium Reported Braking Action**

MAX MANUAL	1925	+35/-30	60	-105/+375	+85/-65	+55/-55	65	275	750
AUTOBRAKE MAX	1925	+35/-30	65	-105/+375	+85/-65	+55/-55	70	270	745
AUTOBRAKE 3	2260	+40/-35	70	-115/+415	+45/-45	+65/-65	105	100	490

**Poor Reported Braking Action**

MAX MANUAL	2450	+55/-45	90	-150/+570	+185/-125	+70/-70	75	565	1815
AUTOBRAKE MAX	2455	+55/-45	90	-150/+570	+190/-130	+70/-70	75	565	1815
AUTOBRAKE 3	2550	+55/-40	90	-155/+580	+160/-100	+75/-75	105	480	1740

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****FLAPS DRIVE - (Flaps ≤ 5)****VREF30+40**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	220000 KG LDG WT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1155	+45/-5	25	-40/+140	+15/-10	+25/-25	35	35	75
AUTOBRAKE MAX	1760	+30/0	45	-65/+220	0/0	+50/-50	80	0	0
AUTOBRAKE 2	2950	+65/-35	100	-130/+440	+60/-70	+85/-85	100	295	295

**Good Reported Braking Action**

MAX MANUAL	1675	+30/-10	45	-70/+250	+40/-35	+45/-45	50	145	360
AUTOBRAKE MAX	1830	+30/0	45	-75/+260	+15/-10	+50/-50	80	75	300
AUTOBRAKE 2	2950	+65/-35	100	-130/+440	+60/-70	+85/-85	100	295	295

**Medium Reported Braking Action**

MAX MANUAL	2280	+45/-20	75	-110/+400	+90/-75	+65/-65	65	385	1120
AUTOBRAKE MAX	2280	+50/-20	75	-110/+400	+95/-70	+65/-65	75	380	1110
AUTOBRAKE 3	2830	+55/-25	85	-130/+460	+65/-60	+85/-85	110	170	675

**Poor Reported Braking Action**

MAX MANUAL	2915	+65/-35	105	-160/+605	+200/-140	+85/-85	80	790	2805
AUTOBRAKE MAX	2915	+65/-35	110	-160/+605	+205/-140	+85/-85	80	790	2800
AUTOBRAKE 3	3120	+70/-35	110	-170/+625	+180/-120	+95/-95	105	615	2620

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****FLAPS DRIVE - (5 < Flaps < 20)****VREF30+20**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	220000 KG LDG WT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1050	+35/-5	20	-40/+135	+15/-10	+25/-25	35	30	65
AUTOBRAKE MAX	1470	+25/0	35	-60/+200	0/0	+40/-40	70	0	0
AUTOBRAKE 2	2520	+55/-25	80	-120/+405	+35/-50	+75/-75	100	125	125

**Good Reported Braking Action**

MAX MANUAL	1500	+30/-10	40	-70/+235	+35/-30	+40/-40	55	120	290
AUTOBRAKE MAX	1555	+30/0	40	-70/+240	+30/-15	+40/-40	70	115	295
AUTOBRAKE 2	2520	+55/-25	80	-120/+405	+35/-50	+75/-75	100	125	125

**Medium Reported Braking Action**

MAX MANUAL	2030	+45/-20	65	-105/+380	+85/-70	+55/-55	70	315	890
AUTOBRAKE MAX	2030	+45/-15	65	-105/+380	+90/-70	+55/-55	70	310	885
AUTOBRAKE 3	2395	+50/-15	65	-120/+425	+45/-45	+70/-70	110	110	590

**Poor Reported Braking Action**

MAX MANUAL	2590	+60/-30	90	-155/+585	+190/-130	+75/-75	80	650	2190
AUTOBRAKE MAX	2590	+60/-30	90	-155/+585	+195/-135	+75/-75	80	650	2195
AUTOBRAKE 3	2695	+65/-25	90	-160/+595	+175/-105	+80/-80	105	550	2095

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****FLAPS DRIVE - (Flaps ≥ 20)****VREF20**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	220000 KG LDG WT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1005	+25/-10	25	-40/+135	+10/-10	+20/-20	35	25	55
AUTOBRAKE MAX	1390	+20/-15	35	-60/+195	0/0	+35/-35	70	0	0
AUTOBRAKE 2	2375	+45/-40	75	-115/+395	+35/-55	+70/-70	90	105	105

**Good Reported Braking Action**

MAX MANUAL	1430	+25/-20	40	-65/+230	+35/-30	+35/-35	50	105	250
AUTOBRAKE MAX	1485	+25/-20	40	-70/+240	+30/-20	+40/-40	65	105	265
AUTOBRAKE 2	2375	+45/-40	75	-115/+395	+35/-55	+70/-70	90	105	105

**Medium Reported Braking Action**

MAX MANUAL	1925	+35/-30	60	-105/+375	+85/-65	+55/-55	65	275	750
AUTOBRAKE MAX	1925	+35/-30	65	-105/+375	+85/-65	+55/-55	70	270	745
AUTOBRAKE 3	2260	+40/-35	70	-115/+415	+45/-45	+65/-65	105	100	490

**Poor Reported Braking Action**

MAX MANUAL	2450	+55/-45	90	-150/+570	+185/-125	+70/-70	75	565	1815
AUTOBRAKE MAX	2455	+55/-45	90	-150/+570	+190/-130	+70/-70	75	565	1815
AUTOBRAKE 3	2550	+55/-40	90	-155/+580	+160/-100	+75/-75	105	480	1740

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****FLAPS PRIMARY FAIL - Flaps 20**

VREF20

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	220000 KG LDG WT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1150	+25/-10	25	-45/+150	+15/-15	+25/-25	45	30	75
AUTOBRAKE MAX	1390	+20/-15	35	-60/+195	0/0	+35/-35	70	0	0
AUTOBRAKE 2	2435	+45/-40	75	-120/+400	+20/-35	+70/-70	115	40	40

**Good Reported Braking Action**

MAX MANUAL	1600	+25/-20	45	-70/+250	+40/-35	+40/-40	65	130	320
AUTOBRAKE MAX	1600	+25/-20	45	-70/+250	+40/-35	+40/-40	70	125	310
AUTOBRAKE 2	2435	+45/-40	75	-120/+400	+20/-35	+70/-70	115	40	40

**Medium Reported Braking Action**

MAX MANUAL	2115	+40/-35	70	-110/+395	+95/-75	+60/-60	80	325	925
AUTOBRAKE MAX	2115	+40/-35	70	-110/+395	+100/-80	+60/-60	80	325	915
AUTOBRAKE 3	2305	+40/-30	70	-120/+420	+55/-40	+65/-65	115	145	730

**Poor Reported Braking Action**

MAX MANUAL	2650	+55/-45	95	-160/+595	+205/-140	+75/-75	90	655	2195
AUTOBRAKE MAX	2650	+60/-45	100	-160/+595	+210/-145	+75/-75	90	655	2190
AUTOBRAKE 3	2690	+55/-45	95	-160/+600	+195/-125	+80/-80	105	610	2150

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****FLIGHT CONTROL MODE - Flaps 20****VREF20**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	220000 KG LDG WT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1160	+25/-10	25	-45/+150	+15/-15	+25/-25	50	35	75
AUTOBRAKE MAX	1390	+20/-15	35	-60/+195	0/0	+35/-35	70	0	0
AUTOBRAKE 2	2455	+45/-40	75	-120/+405	+15/-35	+70/-70	120	25	25

**Good Reported Braking Action**

MAX MANUAL	1625	+25/-20	45	-75/+255	+45/-35	+40/-40	65	135	340
AUTOBRAKE MAX	1625	+25/-20	45	-75/+250	+45/-35	+40/-40	70	130	330
AUTOBRAKE 2	2455	+45/-40	75	-120/+405	+15/-35	+70/-70	120	25	25

**Medium Reported Braking Action**

MAX MANUAL	2155	+40/-35	70	-110/+400	+100/-80	+60/-60	80	350	995
AUTOBRAKE MAX	2155	+40/-35	70	-110/+400	+105/-85	+60/-60	85	345	985
AUTOBRAKE 3	2315	+40/-30	70	-120/+420	+65/-40	+65/-70	120	180	820

**Poor Reported Braking Action**

MAX MANUAL	2710	+60/-50	100	-160/+605	+210/-145	+80/-80	95	695	2385
AUTOBRAKE MAX	2710	+60/-50	100	-160/+605	+220/-150	+80/-80	90	695	2380
AUTOBRAKE 3	2735	+60/-45	100	-160/+605	+205/-130	+80/-80	105	665	2350

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS C - Flaps 20****VREF20**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	220000 KG LDG WT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1150	+25/-10	25	-45/+150	+15/-15	+25/-25	45	30	75
AUTOBRAKE MAX	1390	+20/-15	35	-60/+195	0/0	+35/-35	70	0	0
AUTOBRAKE 2	2435	+45/-40	75	-120/+400	+20/-35	+70/-70	115	40	40

**Good Reported Braking Action**

MAX MANUAL	1600	+25/-20	45	-70/+250	+40/-35	+40/-40	65	130	320
AUTOBRAKE MAX	1600	+25/-20	45	-70/+250	+40/-35	+40/-40	70	125	310
AUTOBRAKE 2	2435	+45/-40	75	-120/+400	+20/-35	+70/-70	115	40	40

**Medium Reported Braking Action**

MAX MANUAL	2115	+40/-35	70	-110/+395	+95/-75	+60/-60	80	325	925
AUTOBRAKE MAX	2115	+40/-35	70	-110/+395	+100/-80	+60/-60	80	325	915
AUTOBRAKE 3	2305	+40/-30	70	-120/+420	+55/-40	+65/-65	115	145	730

**Poor Reported Braking Action**

MAX MANUAL	2650	+55/-45	95	-160/+595	+205/-140	+75/-75	90	655	2195
AUTOBRAKE MAX	2650	+60/-45	100	-160/+595	+210/-145	+75/-75	90	655	2190
AUTOBRAKE 3	2690	+55/-45	95	-160/+600	+195/-125	+80/-80	105	610	2150

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS L - Flaps 25****VREF25**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	220000 KG LDG WT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1015	+20/-5	25	-40/+140	+15/-15	+25/-25	45	0	30
AUTOBRAKE MAX	1285	+20/-5	30	-55/+185	0/0	+30/-30	65	0	0
AUTOBRAKE 2	2260	+40/-15	65	-115/+385	0/0	+65/-65	135	0	0

**Good Reported Braking Action**

MAX MANUAL	1500	+25/-10	40	-75/+255	+45/-40	+40/-40	65	0	155
AUTOBRAKE MAX	1530	+25/-10	45	-75/+255	+40/-35	+40/-40	70	0	160
AUTOBRAKE 2	2260	+40/-15	65	-115/+385	0/0	+65/-65	135	0	0

**Medium Reported Braking Action**

MAX MANUAL	2140	+40/-20	70	-120/+435	+125/-95	+60/-60	85	0	485
AUTOBRAKE MAX	2140	+40/-20	70	-120/+435	+130/-100	+60/-60	85	0	485
AUTOBRAKE 3	2200	+40/-15	70	-125/+445	+110/-60	+65/-65	115	0	475

**Poor Reported Braking Action**

MAX MANUAL	2925	+60/-35	105	-190/+735	+345/-205	+90/-90	100	0	1270
AUTOBRAKE MAX	2935	+60/-35	105	-190/+735	+350/-210	+90/-90	100	0	1275
AUTOBRAKE 3	2935	+60/-35	105	-190/+735	+350/-205	+90/-90	105	0	1275

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS L - Flaps 30****VREF30**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	220000 KG LDG WT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	975	+25/0	20	-40/+135	+15/-15	+20/-20	45	0	30
AUTOBRAKE MAX	1215	+25/0	25	-50/+180	0/0	+30/-30	65	0	0
AUTOBRAKE 2	2115	+50/0	55	-110/+370	0/0	+60/-60	130	0	0

**Good Reported Braking Action**

MAX MANUAL	1440	+30/-5	35	-70/+250	+45/-40	+35/-35	65	0	140
AUTOBRAKE MAX	1460	+30/-5	35	-70/+250	+40/-35	+40/-40	70	0	145
AUTOBRAKE 2	2115	+50/0	55	-110/+370	0/0	+60/-60	130	0	0

**Medium Reported Braking Action**

MAX MANUAL	2050	+45/-15	60	-120/+425	+125/-95	+55/-60	85	0	445
AUTOBRAKE MAX	2050	+45/-15	60	-120/+425	+125/-95	+60/-60	85	0	445
AUTOBRAKE 3	2085	+50/-5	60	-120/+430	+115/-65	+60/-60	105	0	450

**Poor Reported Braking Action**

MAX MANUAL	2795	+65/-25	95	-185/+720	+335/-200	+85/-85	100	0	1170
AUTOBRAKE MAX	2805	+65/-25	95	-185/+720	+340/-205	+85/-85	100	0	1175
AUTOBRAKE 3	2805	+65/-25	95	-185/+720	+340/-200	+85/-85	100	0	1175

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS L+C - Flaps 20****VREF30+20**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	220000 KG LDG WT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1315	+30/0	30	-50/+165	+20/-20	+30/-30	60	0	55
AUTOBRAKE MAX	1470	+25/0	35	-60/+200	0/0	+40/-40	70	0	0
AUTOBRAKE 2	2655	+55/0	70	-125/+420	0/0	+80/-80	145	0	0

**Good Reported Braking Action**

MAX MANUAL	1930	+35/-5	50	-85/+295	+65/-55	+50/-50	85	0	255
AUTOBRAKE MAX	1930	+35/-5	50	-85/+290	+70/-55	+50/-50	90	0	240
AUTOBRAKE 2	2655	+55/0	70	-125/+420	0/0	+80/-80	145	0	0

**Medium Reported Braking Action**

MAX MANUAL	2715	+60/-15	85	-140/+495	+170/-130	+80/-80	110	0	760
AUTOBRAKE MAX	2715	+60/-15	85	-140/+495	+180/-135	+80/-80	110	0	750
AUTOBRAKE 3	2715	+60/-10	85	-140/+495	+175/-115	+80/-80	115	0	755

**Poor Reported Braking Action**

MAX MANUAL	3645	+85/-35	130	-220/+810	+435/-260	+110/-110	125	0	1895
AUTOBRAKE MAX	3645	+85/-35	130	-220/+810	+445/-270	+110/-110	125	0	1895
AUTOBRAKE 3	3645	+85/-35	130	-220/+810	+445/-270	+110/-110	125	0	1895

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS L+R - Flaps 20****VREF30+20**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	220000 KG LDG WT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1415	+30/0	35	-60/+195	+35/-30	+35/-35	70	0	0
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 2					Autobrake inoperative				

**Good Reported Braking Action**

MAX MANUAL	2330	+45/0	60	-110/+385	+125/-100	+70/-70	110	0	0
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 2					Autobrake inoperative				

**Medium Reported Braking Action**

MAX MANUAL	3730	+70/-10	110	-205/+725	+435/-280	+115/-115	150	0	0
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 3					Autobrake inoperative				

**Poor Reported Braking Action**

MAX MANUAL	6005	+100/-20	185	-395/+1490	+2470/-760	+195/-195	185	0	0
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 3					Autobrake inoperative				

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS R - Flaps 25****VREF25**

LANDING DISTANCES AND ADJUSTMENTS (M)									
	REF DIST	WEIGHT 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	220000 KG LDG WT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

**Dry Runway**

MAX MANUAL	1115	+15/-5	25	-45/+160	+20/-20	+25/-25	50	0	50
AUTOBRAKE MAX Autobrake inoperative									
AUTOBRAKE 2 Autobrake inoperative									

**Good Reported Braking Action**

MAX MANUAL	1645	+25/-15	45	-85/+290	+60/-50	+45/-45	70	0	210
AUTOBRAKE MAX Autobrake inoperative									
AUTOBRAKE 2 Autobrake inoperative									

**Medium Reported Braking Action**

MAX MANUAL	2305	+45/-25	75	-135/+495	+160/-115	+65/-65	90	0	610
AUTOBRAKE MAX Autobrake inoperative									
AUTOBRAKE 3 Autobrake inoperative									

**Poor Reported Braking Action**

MAX MANUAL	3095	+60/-40	115	-210/+825	+450/-240	+95/-95	100	0	1530
AUTOBRAKE MAX Autobrake inoperative									
AUTOBRAKE 3 Autobrake inoperative									

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS R - Flaps 30****VREF30**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	220000 KG LDG WT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1065	+20/0	25	-45/+155	+20/-15	+25/-25	45	0	45
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 2					Autobrake inoperative				

**Good Reported Braking Action**

MAX MANUAL	1555	+30/-5	40	-80/+285	+55/-45	+40/-40	65	0	185
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 2					Autobrake inoperative				

**Medium Reported Braking Action**

MAX MANUAL	2165	+50/-15	65	-130/+480	+150/-110	+60/-60	85	0	530
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 3					Autobrake inoperative				

**Poor Reported Braking Action**

MAX MANUAL	2890	+65/-30	100	-205/+800	+420/-225	+85/-85	95	0	1320
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 3					Autobrake inoperative				

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS R+C - Flaps 20****VREF30+20**

LANDING DISTANCES AND ADJUSTMENTS (M)									
	REF DIST	WEIGHT 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	220000 KG LDG WT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

**Dry Runway**

MAX MANUAL	1610	+30/0	40	-65/+225	+40/-35	+40/-40	75	0	130
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 2						Autobrake inoperative			

**Good Reported Braking Action**

MAX MANUAL	2345	+50/-10	70	-115/+390	+110/-90	+65/-65	100	0	480
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 2						Autobrake inoperative			

**Medium Reported Braking Action**

MAX MANUAL	3210	+70/-25	110	-180/+645	+275/-190	+95/-95	120	0	1280
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 3						Autobrake inoperative			

**Poor Reported Braking Action**

MAX MANUAL	4200	+100/-45	160	-275/+1055	+810/-370	+130/-130	135	0	3045
AUTOBRAKE MAX						Autobrake inoperative			
AUTOBRAKE 3						Autobrake inoperative			

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****PITCH UP AUTHORITY - (Flaps ≤ 15)**

VREF30+40

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	220000 KG LDG WT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1190	+40/-5	25	-45/+145	+15/-15	+30/-30	35	35	80
AUTOBRAKE MAX	1760	+30/0	45	-65/+220	0/0	+50/-50	80	0	0
AUTOBRAKE 2	2875	+60/-35	95	-130/+430	+70/-75	+85/-85	85	325	345

**Good Reported Braking Action**

MAX MANUAL	1705	+30/-10	45	-75/+250	+40/-35	+45/-45	55	145	355
AUTOBRAKE MAX	1845	+30/0	50	-75/+265	+20/-15	+50/-50	80	90	310
AUTOBRAKE 2	2875	+60/-35	95	-130/+430	+70/-75	+85/-85	85	325	345

**Medium Reported Braking Action**

MAX MANUAL	2280	+45/-20	75	-110/+400	+90/-75	+65/-65	65	360	1010
AUTOBRAKE MAX	2290	+50/-20	75	-110/+400	+90/-70	+65/-65	75	360	1010
AUTOBRAKE 3	2800	+55/-30	85	-130/+455	+70/-75	+80/-80	90	205	640

**Poor Reported Braking Action**

MAX MANUAL	2870	+65/-35	105	-160/+600	+200/-140	+85/-85	75	710	2350
AUTOBRAKE MAX	2875	+65/-35	105	-160/+600	+200/-140	+85/-85	75	710	2350
AUTOBRAKE 3	3090	+70/-35	105	-165/+625	+175/-135	+90/-90	90	575	2200

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****PITCH UP AUTHORITY - (Flaps ≥ 20)****VREF30+20**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	220000 KG LDG WT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1060	+30/-5	25	-40/+135	+15/-10	+25/-25	35	25	60
AUTOBRAKE MAX	1470	+25/0	35	-60/+200	0/0	+40/-40	70	0	0
AUTOBRAKE 2	2480	+55/-25	75	-120/+400	+45/-60	+70/-70	85	160	160

**Good Reported Braking Action**

MAX MANUAL	1500	+30/-10	40	-70/+240	+35/-30	+40/-40	55	110	270
AUTOBRAKE MAX	1565	+30/0	40	-70/+245	+30/-15	+40/-40	70	110	280
AUTOBRAKE 2	2480	+55/-25	75	-120/+400	+45/-60	+70/-70	85	160	160

**Medium Reported Braking Action**

MAX MANUAL	2010	+45/-20	60	-105/+380	+85/-70	+55/-55	65	285	785
AUTOBRAKE MAX	2010	+45/-15	60	-105/+380	+90/-65	+55/-55	70	285	780
AUTOBRAKE 3	2385	+50/-20	70	-120/+425	+55/-55	+70/-70	100	120	500

**Poor Reported Braking Action**

MAX MANUAL	2535	+60/-30	90	-150/+575	+185/-130	+75/-75	75	580	1855
AUTOBRAKE MAX	2540	+60/-30	90	-150/+575	+190/-130	+75/-75	75	580	1855
AUTOBRAKE 3	2675	+60/-30	90	-155/+590	+160/-110	+80/-80	100	475	1760

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****PRIMARY FLIGHT COMPUTERS - Flaps 20**

VREF20

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	220000 KG LDG WT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1160	+25/-10	25	-45/+150	+15/-15	+25/-25	50	35	75
AUTOBRAKE MAX	1390	+20/-15	35	-60/+195	0/0	+35/-35	70	0	0
AUTOBRAKE 2	2455	+45/-40	75	-120/+405	+15/-35	+70/-70	120	25	25

**Good Reported Braking Action**

MAX MANUAL	1625	+25/-20	45	-75/+255	+45/-35	+40/-40	65	135	340
AUTOBRAKE MAX	1625	+25/-20	45	-75/+250	+45/-35	+40/-40	70	130	330
AUTOBRAKE 2	2455	+45/-40	75	-120/+405	+15/-35	+70/-70	120	25	25

**Medium Reported Braking Action**

MAX MANUAL	2155	+40/-35	70	-110/+400	+100/-80	+60/-60	80	350	995
AUTOBRAKE MAX	2155	+40/-35	70	-110/+400	+105/-85	+60/-60	85	345	985
AUTOBRAKE 3	2315	+40/-30	70	-120/+420	+65/-40	+65/-70	120	180	820

**Poor Reported Braking Action**

MAX MANUAL	2710	+60/-50	100	-160/+605	+210/-145	+80/-80	95	695	2385
AUTOBRAKE MAX	2710	+60/-50	100	-160/+605	+220/-150	+80/-80	90	695	2380
AUTOBRAKE 3	2735	+60/-45	100	-160/+605	+205/-130	+80/-80	105	665	2350

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****SLATS DRIVE - Flaps 20****VREF30+30**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	220000 KG LDG WT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1135	+35/-5	25	-40/+145	+15/-15	+25/-25	40	30	75
AUTOBRAKE MAX	1610	+30/0	40	-65/+210	0/0	+45/-45	75	0	0
AUTOBRAKE 2	2675	+55/-30	85	-125/+415	+60/-70	+80/-80	85	230	240

**Good Reported Braking Action**

MAX MANUAL	1615	+30/-10	45	-70/+245	+40/-35	+40/-40	55	125	310
AUTOBRAKE MAX	1710	+30/0	45	-75/+255	+25/-15	+45/-45	75	110	305
AUTOBRAKE 2	2675	+55/-30	85	-125/+415	+60/-70	+80/-80	85	230	240

**Medium Reported Braking Action**

MAX MANUAL	2160	+45/-20	70	-110/+390	+90/-75	+60/-60	65	320	875
AUTOBRAKE MAX	2165	+45/-20	70	-110/+395	+90/-70	+60/-60	75	320	870
AUTOBRAKE 3	2600	+55/-25	75	-125/+440	+65/-70	+75/-75	90	160	555

**Poor Reported Braking Action**

MAX MANUAL	2715	+65/-35	95	-155/+590	+195/-135	+80/-80	75	635	2020
AUTOBRAKE MAX	2720	+65/-35	95	-155/+590	+200/-135	+80/-80	75	635	2025
AUTOBRAKE 3	2895	+65/-35	100	-165/+610	+170/-130	+85/-85	90	510	1905

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****STABILIZER - Flaps 20****VREF30+20**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	220000 KG LDG WT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1060	+30/-5	25	-40/+135	+15/-10	+25/-25	35	25	60
AUTOBRAKE MAX	1470	+25/0	35	-60/+200	0/0	+40/-40	70	0	0
AUTOBRAKE 2	2480	+55/-25	75	-120/+400	+45/-60	+70/-70	85	160	160

**Good Reported Braking Action**

MAX MANUAL	1500	+30/-10	40	-70/+240	+35/-30	+40/-40	55	110	270
AUTOBRAKE MAX	1565	+30/0	40	-70/+245	+30/-15	+40/-40	70	110	280
AUTOBRAKE 2	2480	+55/-25	75	-120/+400	+45/-60	+70/-70	85	160	160

**Medium Reported Braking Action**

MAX MANUAL	2010	+45/-20	60	-105/+380	+85/-70	+55/-55	65	285	785
AUTOBRAKE MAX	2010	+45/-15	60	-105/+380	+90/-65	+55/-55	70	285	780
AUTOBRAKE 3	2385	+50/-20	70	-120/+425	+55/-55	+70/-70	100	120	500

**Poor Reported Braking Action**

MAX MANUAL	2535	+60/-30	90	-150/+575	+185/-130	+75/-75	75	580	1855
AUTOBRAKE MAX	2540	+60/-30	90	-150/+575	+190/-130	+75/-75	75	580	1855
AUTOBRAKE 3	2675	+60/-30	90	-155/+590	+160/-110	+80/-80	100	475	1760

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Recommended Brake Cooling Schedule****Reference Brake Energy (Millions of Foot Pounds)**

WEIGHT (1000 KG)	OAT (°C)	BRAKES ON SPEED (KIAS)																	
		80		100		120		140		160		180							
		PRESSURE ALTITUDE (1000 FT)																	
360	0	23.3	25.7	28.3	33.8	37.7	41.9	46.1	51.6	57.8	59.8	67.3	75.6	74.5	84.0	94.5	89.8	101.1	113.6
	10	23.9	26.4	29.2	34.8	38.8	43.2	47.5	53.2	59.6	61.7	69.4	78.0	76.9	86.6	97.4	92.6	104.1	116.9
	15	24.4	26.9	29.7	35.5	39.5	44.0	48.4	54.2	60.7	62.8	70.6	79.4	78.3	88.1	99.1	94.2	105.9	118.8
	20	24.8	27.4	30.2	36.1	40.2	44.8	49.2	55.2	61.8	63.9	71.9	80.8	79.6	89.6	100.8	95.8	107.6	120.6
	30	25.5	28.1	31.0	37.1	41.3	46.1	50.6	56.7	63.6	65.8	74.0	83.1	81.9	92.2	103.6	98.5	110.6	123.9
	40	25.7	28.4	31.4	37.7	42.0	46.8	51.5	57.8	64.8	67.1	75.5	84.9	83.7	94.2	105.8	100.7	113.0	126.4
340	0	22.2	24.5	27.0	32.3	35.9	39.9	43.9	49.1	55.0	56.9	64.0	71.9	71.0	79.9	90.0	85.6	96.4	108.4
	10	22.9	25.2	27.8	32.3	37.0	41.1	45.2	50.6	56.7	58.7	66.0	74.2	73.2	82.4	92.8	88.3	99.3	111.6
	15	23.3	25.7	28.3	33.9	37.7	41.9	46.1	51.6	57.7	59.8	67.2	75.5	74.5	83.9	94.4	89.8	101.0	113.4
	20	23.7	26.2	28.8	34.5	38.4	42.7	46.9	52.5	58.8	60.8	68.4	76.8	75.8	85.4	96.0	91.3	102.7	115.3
	30	24.3	26.8	29.6	35.4	39.4	43.9	48.2	54.0	60.5	62.6	70.3	79.0	78.0	87.8	98.7	94.0	105.6	118.4
	40	24.6	27.1	30.0	35.9	40.0	44.6	49.0	55.0	61.6	63.8	71.8	80.7	79.7	89.7	100.8	96.0	107.9	120.9
320	0	21.2	23.4	25.7	30.7	34.2	37.9	41.7	46.6	52.2	54.0	60.7	68.1	67.3	75.8	85.3	81.3	91.5	103.0
	10	21.8	24.0	26.5	31.6	35.2	39.1	43.0	48.1	53.8	55.7	62.6	70.3	69.5	78.2	88.0	83.8	94.4	106.1
	15	22.2	24.5	27.0	32.2	35.8	39.8	43.8	49.0	54.8	56.7	63.7	71.5	70.7	79.6	89.5	85.3	96.0	107.9
	20	22.6	24.9	27.5	32.8	36.5	40.5	44.6	49.8	55.7	57.7	64.8	72.8	72.0	81.0	91.1	86.8	97.6	109.7
	30	23.2	25.6	28.2	33.7	37.5	41.6	45.8	51.2	57.3	59.4	66.7	74.9	74.0	83.3	93.7	89.3	100.4	112.7
	40	23.4	25.8	28.5	34.2	38.0	42.3	46.6	52.2	58.4	60.5	68.0	76.5	75.6	85.1	95.7	91.2	102.6	115.1
300	0	20.2	22.2	24.5	29.2	32.4	36.0	39.5	44.1	49.3	51.1	57.3	64.3	63.7	71.6	80.6	76.8	86.6	97.5
	10	20.8	22.9	25.1	30.0	33.4	37.0	40.7	45.5	50.8	52.7	59.1	66.4	65.7	73.9	83.1	79.3	89.3	100.4
	15	21.2	23.3	25.6	30.6	34.0	37.7	41.5	46.3	51.8	53.6	60.2	67.6	66.8	75.2	84.6	80.7	90.8	102.1
	20	21.6	23.7	26.1	31.2	34.6	38.4	42.2	47.2	52.7	54.6	61.3	68.8	68.0	76.5	86.1	82.1	92.4	103.8
	30	22.1	24.3	26.8	32.0	35.5	39.4	43.4	48.5	54.2	56.1	63.0	70.7	70.0	78.8	88.5	84.4	95.0	106.7
	40	22.3	24.6	27.1	32.4	36.0	40.1	44.1	49.3	55.2	57.2	64.3	72.2	71.4	80.4	90.5	86.3	97.1	109.0
260	0	18.2	20.0	21.9	28.9	32.0	35.1	39.1	43.6	45.2	50.6	56.6	56.1	63.1	70.9	67.7	76.2	85.8	
	10	18.7	20.6	22.5	26.9	29.7	32.9	36.2	40.3	44.9	46.5	52.1	58.4	57.9	65.1	73.1	69.8	78.6	88.5
	15	19.1	20.9	23.0	27.4	30.3	33.6	36.8	41.1	45.8	47.4	53.1	59.5	58.9	66.2	74.4	71.1	80.0	90.0
	20	19.4	21.3	23.4	27.9	30.9	34.2	37.5	41.8	46.6	48.3	54.1	60.6	60.0	67.4	75.7	72.4	81.4	91.6
	30	19.9	21.9	24.0	28.6	31.7	35.1	38.5	43.0	47.9	49.6	55.6	62.3	61.7	69.4	77.9	74.4	83.8	94.2
	40	20.1	22.1	24.2	28.9	32.1	35.6	39.1	43.7	48.7	50.5	56.6	63.5	62.9	70.8	79.6	76.0	85.6	96.2
220	0	16.3	17.8	19.5	23.1	25.4	28.1	30.7	34.1	37.9	39.2	43.7	48.9	48.4	54.2	60.8	58.2	65.4	73.5
	10	16.7	18.3	20.0	23.7	26.2	28.9	31.6	35.1	39.0	40.3	45.1	50.4	49.9	55.9	62.7	60.0	67.4	75.8
	15	17.1	18.7	20.4	24.2	26.7	29.4	32.2	35.8	39.8	41.1	45.9	51.3	50.8	57.0	63.9	61.1	68.7	77.2
	20	17.4	19.0	20.8	24.6	27.1	30.0	32.8	36.4	40.5	41.8	46.7	52.2	51.7	58.0	65.0	62.2	69.9	78.5
	30	17.8	19.5	21.3	25.2	27.8	30.7	33.7	37.4	41.6	43.0	48.1	53.7	53.2	59.6	66.9	63.9	71.9	80.8
	40	17.9	19.6	21.5	25.5	28.2	31.1	34.1	38.0	42.3	43.7	48.9	54.7	54.1	60.8	68.2	65.2	73.4	82.5
180	0	14.4	15.7	17.1	20.0	22.0	24.2	26.3	29.1	32.2	33.1	36.8	41.0	40.4	45.2	50.5	48.2	54.0	60.6
	10	14.8	16.1	17.6	20.6	22.6	24.9	27.0	29.9	33.1	34.1	37.9	42.2	41.6	46.5	52.0	49.7	55.7	62.5
	15	15.1	16.4	17.9	21.0	23.0	25.3	27.5	30.5	33.7	34.7	38.6	43.0	42.4	47.4	53.0	50.6	56.7	63.6
	20	15.4	16.7	18.2	21.3	23.5	25.8	28.0	31.0	34.4	35.3	39.3	43.8	43.2	48.3	53.9	51.5	57.8	64.8
	30	15.7	17.1	18.7	21.9	24.1	26.5	28.8	31.8	35.3	36.3	40.4	45.0	44.4	49.6	55.5	53.0	59.4	66.6
	40	15.8	17.2	18.8	22.1	24.3	26.8	29.1	32.3	35.8	36.8	41.0	45.7	45.1	50.5	56.5	53.9	60.5	68.0

To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind.

If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 15°C.

**ADVISORY INFORMATION****Recommended Brake Cooling Schedule****Event Adjusted Brake Energy (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	100	110	120
LANDING	RTO MAX MAN	10	20	30	40	50	60	70	80	90	100	110	120
	MAX MAN	3.6	13.6	23.5	33.2	42.8	52.3	61.8	71.4	81.0	90.6	100.5	110.4
	MAX AUTO	3.5	12.5	21.4	30.2	39.0	47.8	56.8	66.0	75.5	85.5	95.9	106.8
	AUTOBRAKE 4	3.2	11.7	20.0	28.0	36.0	44.0	52.2	60.6	69.4	78.7	88.6	99.2
	AUTOBRAKE 3	2.7	11.0	18.8	26.3	33.7	41.0	48.4	56.1	64.2	72.8	82.0	92.2
	AUTOBRAKE 2	2.3	10.2	17.5	24.5	31.2	37.9	44.6	51.5	58.9	66.7	75.2	84.6
	AUTOBRAKE 1	1.9	9.0	15.6	21.8	27.8	33.8	39.8	45.9	52.4	59.4	66.9	75.1

**2 Engine Reverse Thrust**

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
EVENT		10	20	30	40	50	60	70	80	90	100	110	120
LANDING	RTO MAX MAN	10	20	30	40	50	60	70	80	90	100	110	120
	MAX MAN	3.4	12.0	21.2	30.6	39.7	48.6	57.4	65.9	74.4	82.8	91.3	99.7
	MAX AUTO	2.0	8.8	15.9	23.2	30.5	38.0	45.7	53.7	62.1	71.0	80.6	90.9
	AUTOBRAKE 4	1.3	5.6	10.9	16.6	22.5	28.3	34.3	40.7	47.5	54.9	63.0	72.0
	AUTOBRAKE 3	0.8	3.1	7.0	11.6	16.2	20.9	25.8	30.9	36.6	42.7	49.6	57.3
	AUTOBRAKE 2	0.0	2.3	5.0	7.8	10.8	14.0	17.4	21.2	25.6	30.4	36.0	42.4
	AUTOBRAKE 1	0.0	1.6	3.3	5.2	7.2	9.4	11.8	14.4	17.4	20.8	24.7	29.2

**Cooling Time (Minutes)**

		EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)											
16 & BELOW		17	18	20	24	28	32	35	36 TO 44	45 & ABOVE			
GEAR DOWN	NO SPECIAL PROCEDURE	1	2	3	4	6	7	7			CAUTION		
INFLIGHT	REQUIRED	11	18	26	42	55	66	73			FUSE PLUG MELT ZONE		
BTMS	UP TO 2.4	2.4	2.6	2.9	3.4	4.0	4.5	4.9	5.0 TO 6.3	6.3 & 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 10 percent.

For two brakes deactivated, increase brake energy by 20 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. (When inflight with gear extended, the BTMS indications may vary between individual brakes, due to air-stream effects.)

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Landing Climb Limit Weight**

Valid for approach with flaps 20 and landing with flaps 30

AIRPORT OAT		LANDING CLIMB LIMIT WEIGHT (1000 KG)						
		AIRPORT PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	
54	129	297.3	279.1					
52	126	306.3	287.0					
50	122	315.2	294.5	269.7				
48	118	323.5	303.4	276.9				
46	115	331.8	312.4	284.1	259.6			
44	111	340.4	321.1	291.5	267.7			
42	108	352.1	329.0	299.1	275.0	251.6		
40	104	359.1	337.3	307.2	281.4	257.0		
38	100	366.2	349.6	316.0	287.8	262.8	233.8	
36	97	369.0	356.4	323.2	293.4	269.2	238.4	
34	93	369.3	363.2	330.4	299.7	274.4	243.0	
32	90	369.5	365.7	338.2	306.4	278.7	247.1	
30	86	369.8	365.9	346.1	312.9	282.9	250.9	
28	82	370.1	366.0	352.5	318.7	287.3	254.6	
26	79	370.3	366.1	352.7	322.6	292.2	258.2	
24	75	370.6	366.3	352.8	326.0	297.0	263.1	
22	72	370.8	366.4	352.9	327.4	300.3	268.1	
20	68	371.1	366.5	352.9	327.5	302.5	272.4	
18	64	371.3	366.7	353.0	327.6	304.7	275.2	
16	61	371.6	366.8	353.1	327.6	304.7	276.9	
14	57	371.8	366.9	353.2	327.7	304.8	278.5	
12	54	372.0	367.0	353.3	327.8	304.9	278.6	
10	50	372.2	367.2	353.3	327.9	304.9	278.7	
8	46	372.3	367.3	353.4	327.9	304.9	278.7	
6	43	372.5	367.4	350.4	328.0	304.9	272.8	
4	40	372.6	367.4	341.5	313.7	286.7	254.9	
2	36	372.7	367.5	341.6	313.8	286.8	254.9	
0	32	372.8	367.5	341.6	313.8	286.8	255.0	
-40	-40	373.4	367.8	341.6	313.8	286.8	255.0	

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off.

With engine bleed for packs off, increase weight by 1250 kg.

With engine and wing anti-ice on, decrease weight by 2350 kg.

When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 26950 kg.

**ADVISORY INFORMATION****Landing Climb Limit Weight****Valid for approach with flaps 20 and landing with flaps 25**

AIRPORT OAT	°C	°F	LANDING CLIMB LIMIT WEIGHT (1000 KG)					
			AIRPORT PRESSURE ALTITUDE (FT)					
-2000	0	2000	4000	6000	8000			
54	129	302.7	284.5					
52	126	310.0	292.5					
50	122	317.6	300.2	275.6				
48	118	325.1	307.8	282.4				
46	115	332.9	315.3	289.8	267.1			
44	111	340.7	322.9	297.4	273.6			
42	108	351.0	330.3	304.4	280.1	258.9		
40	104	357.8	337.9	311.1	286.7	264.5		
38	100	365.0	348.4	318.5	293.4	269.9	241.1	
36	97	367.8	355.1	325.0	299.2	275.1	245.9	
34	93	368.0	361.9	331.6	305.0	279.9	250.6	
32	90	368.3	364.3	338.6	310.6	284.3	254.9	
30	86	368.5	364.5	345.5	315.9	288.7	259.0	
28	82	368.8	364.6	351.2	320.8	293.2	262.9	
26	79	369.1	364.8	351.4	324.4	298.1	266.5	
24	75	369.3	364.9	351.5	327.7	302.6	270.7	
22	72	369.6	365.0	351.6	329.0	305.5	274.7	
20	68	369.8	365.2	351.6	329.1	307.3	278.2	
18	64	370.1	365.3	351.7	329.1	309.0	281.0	
16	61	370.3	365.4	351.8	329.2	309.1	282.8	
14	57	370.5	365.5	351.9	329.3	309.1	284.4	
12	54	370.7	365.7	351.9	329.3	309.2	284.5	
10	50	370.9	365.8	352.0	329.4	309.2	284.5	
8	46	371.1	365.9	352.1	329.5	309.3	284.6	
6	43	371.2	366.0	352.1	329.5	309.3	284.5	
4	40	371.3	366.0	352.2	329.6	309.3	278.4	
2	36	371.4	366.1	352.2	329.6	309.4	278.4	
0	32	371.5	366.1	352.3	329.7	309.4	278.4	
-40	-40	372.1	366.4	352.4	329.8	309.5	278.5	

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off.

With engine bleed for packs off, increase weight by 1400 kg.

With engine and wing anti-ice on, decrease weight by 2300 kg.

When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 24500 kg.

**Performance Inflight - QRH****Engine Inoperative****Chapter PI-QRH****Section 32****ENGINE INOP****Initial Max Continuous %N1****Based on .84M, engine bleed for packs on and anti-ice off**

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	27	29	31	33	35	37	39	41	43
20	97.4	97.0	96.7	96.3	95.9	95.9	95.6	95.3	95.0
15	98.2	97.8	97.3	97.0	96.6	96.3	96.0	95.7	95.4
10	99.2	98.9	98.3	97.7	97.2	97.0	96.6	96.3	96.0
5	100.2	100.1	99.7	98.8	98.1	97.8	97.4	97.1	96.8
0	99.3	100.9	101.0	99.9	99.3	98.8	98.3	97.9	97.6
-5	98.4	99.9	101.2	101.3	100.5	100.2	99.7	99.3	98.8
-10	97.4	99.0	100.3	101.6	101.3	101.3	100.7	100.3	100.0
-15	96.5	98.1	99.3	100.6	101.0	102.0	101.1	100.8	100.5
-20	95.6	97.1	98.3	99.6	100.1	101.0	100.1	99.8	99.5
-25	94.6	96.1	97.4	98.6	99.1	100.0	99.1	98.8	98.5
-30	93.7	95.2	96.4	97.6	98.1	99.0	98.1	97.8	97.5
-35	92.7	94.2	95.4	96.6	97.0	97.9	97.1	96.8	96.5
-40	91.7	93.2	94.4	95.6	96.0	96.9	96.1	95.8	95.5

**ENGINE INOP****Max Continuous %N1**

Based on engine bleed for packs on or off and anti-ice off

37000 FT to 27000 FT Pressure Altitudes

37000 FT PRESS ALT			TAT (°C)										
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
280	0.86	94.3	95.4	96.4	97.4	98.4	99.5	100.5	101.4	101.2	100.2	98.9	97.7
240	0.74	96.1	97.2	98.3	99.3	100.4	101.4	102.1	101.9	100.9	99.5	98.1	97.1
200	0.63	95.7	96.7	97.8	98.8	99.9	100.8	101.4	100.9	100.0	98.5	97.0	96.3
35000 FT PRESS ALT			TAT (°C)										
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
280	0.82	94.6	95.6	96.6	97.7	98.7	99.7	100.7	101.7	101.4	100.4	99.2	98.1
240	0.71	95.1	96.2	97.2	98.3	99.3	100.3	101.3	101.8	100.9	99.8	98.3	97.2
200	0.60	94.8	95.8	96.9	97.9	98.9	99.9	100.9	101.0	100.2	98.8	97.1	96.1
33000 FT PRESS ALT			TAT (°C)										
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
320	0.89	91.4	92.4	93.4	94.4	95.4	96.4	97.4	98.3	99.3	100.2	99.8	98.8
280	0.79	95.0	96.0	97.1	98.1	99.2	100.2	101.2	102.2	102.4	101.0	100.0	98.7
240	0.68	95.6	96.7	97.8	98.8	99.8	100.9	101.9	102.4	101.8	100.2	98.9	97.5
200	0.58	95.9	97.0	98.0	99.1	100.1	101.1	101.6	101.6	101.0	99.3	97.9	96.4
31000 FT PRESS ALT			TAT (°C)										
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
320	0.85	92.7	93.8	94.8	95.7	96.7	97.7	98.7	99.6	100.5	100.8	99.7	98.4
280	0.76	96.3	97.4	98.4	99.5	100.5	101.5	102.5	103.5	102.0	100.6	99.1	98.0
240	0.66	97.4	98.4	99.5	100.5	101.5	102.6	103.3	103.0	101.0	99.5	98.1	96.9
200	0.55	97.6	98.7	99.7	100.8	101.8	102.6	102.8	102.0	100.7	98.7	97.2	96.1
29000 FT PRESS ALT			TAT (°C)										
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
320	0.82	93.8	94.8	95.8	96.8	97.8	98.7	99.7	100.6	101.6	100.1	98.9	97.8
280	0.73	96.6	97.6	98.6	99.6	100.6	101.6	102.6	102.5	101.0	99.5	98.1	97.1
240	0.63	98.1	99.2	100.2	101.3	102.3	103.3	103.1	101.6	99.8	98.4	97.1	96.0
200	0.53	98.6	99.7	100.7	101.7	102.7	103.2	102.7	101.2	99.4	97.7	96.3	96.2
27000 FT PRESS ALT			TAT (°C)										
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
360	0.88	90.2	91.2	92.1	93.0	94.0	94.9	95.8	96.7	97.6	98.5	99.2	98.1
320	0.79	93.4	94.4	95.3	96.3	97.3	98.2	99.2	100.1	101.1	100.6	99.2	98.1
280	0.70	95.4	96.4	97.4	98.4	99.4	100.4	101.3	102.3	101.3	99.7	98.2	97.1
240	0.60	97.2	98.2	99.2	100.3	101.3	102.3	103.0	102.0	99.9	98.5	97.2	96.2
200	0.51	98.4	99.4	100.4	101.5	102.5	103.2	102.7	101.8	99.9	98.1	96.5	95.6

**%N1 Adjustments for Engine Bleed**

BLEED CONFIGURATION			PRESSURE ALTITUDE (1000 FT)					
			37	35	33	31	29	27
ENGINE A/I ON			-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
WING A/I ON - PACKS ON			-0.4	-0.4	-0.4	-0.3	-0.3	-0.3
WING A/I ON - PACKS OFF			-0.6	-0.5	-0.5	-0.5	-0.5	-0.4

**ENGINE INOP****Max Continuous %N1****Based on engine bleed for packs on or off and anti-ice off****25000 FT to 18000 FT Pressure Altitudes**

25000 FT PRESS ALT			TAT (°C)											
KIAS	M		-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
360	0.85	91.2	92.2	93.1	94.1	95.0	95.9	96.8	97.7	98.6	99.5	98.9	98.1	
320	0.76	93.9	94.8	95.8	96.8	97.7	98.7	99.6	100.5	101.1	99.6	98.5	97.6	
280	0.67	95.5	96.5	97.5	98.5	99.4	100.4	101.3	101.5	100.4	98.8	97.5	96.7	
240	0.58	97.4	98.5	99.5	100.5	101.5	102.4	102.3	100.9	99.3	97.8	96.7	95.9	
200	0.49	99.3	100.3	101.4	102.4	103.4	103.1	102.0	100.6	98.5	97.1	96.1	95.9	
24000 FT PRESS ALT			TAT (°C)											
KIAS	M		-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
360	0.83	91.3	92.3	93.2	94.2	95.1	96.0	96.9	97.8	98.7	99.6	99.4	98.4	
320	0.75	93.6	94.6	95.6	96.5	97.5	98.4	99.4	100.3	101.2	100.0	98.8	97.8	
280	0.66	95.4	96.4	97.4	98.3	99.3	100.3	101.2	101.8	100.7	99.1	97.8	96.9	
240	0.57	97.3	98.3	99.3	100.3	101.3	102.2	102.6	101.4	99.8	98.3	97.1	96.2	
200	0.48	98.8	99.9	100.9	101.9	102.9	103.4	102.3	101.0	98.9	97.4	96.3	95.6	
22000 FT PRESS ALT			TAT (°C)											
KIAS	M		-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
360	0.80	92.1	93.0	94.0	94.9	95.8	96.7	97.6	98.5	99.4	100.0	99.0	98.3	
320	0.72	94.3	95.3	96.3	97.2	98.1	99.1	100.0	100.9	100.7	99.3	98.2	97.5	
280	0.63	96.1	97.1	98.1	99.0	100.0	100.9	101.9	101.3	99.8	98.4	97.3	96.6	
240	0.55	97.7	98.7	99.7	100.7	101.7	102.7	102.3	100.9	99.3	97.7	96.8	96.1	
200	0.46	99.5	100.5	101.5	102.5	103.5	103.0	101.5	99.9	97.9	96.8	95.9	95.8	
20000 FT PRESS ALT			TAT (°C)											
KIAS	M		-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
360	0.77	93.7	94.6	95.6	96.5	97.4	98.4	99.3	100.2	101.1	102.0	101.3	100.1	
320	0.69	95.9	96.9	97.8	98.8	99.7	100.7	101.6	102.6	103.5	101.8	100.4	99.1	
280	0.61	97.7	98.7	99.6	100.6	101.6	102.6	103.5	104.3	102.8	100.9	99.4	98.3	
240	0.53	98.5	99.5	100.5	101.5	102.4	103.4	104.3	104.1	102.4	100.7	98.7	97.2	
200	0.44	98.0	99.0	99.9	100.9	101.9	102.9	103.8	102.6	100.5	98.0	96.2	95.3	
18000 FT PRESS ALT			TAT (°C)											
KIAS	M		-25	-20	-15	-10	-5	0	5	10	15	20	25	30
360	0.75	94.4	95.4	96.3	97.2	98.2	99.1	100	100.9	101.8	102.0	100.6	99.4	
320	0.67	96.7	97.7	98.6	99.6	100.5	101.4	102.4	103.3	102.9	101.2	99.7	98.6	
280	0.59	98.5	99.5	100.5	101.5	102.4	103.4	104.3	104.0	102.3	100.4	98.9	97.8	
240	0.51	99.6	100.6	101.6	102.6	103.6	104.5	104.9	103.9	101.9	100.0	98.4	97.2	
200	0.42	97.2	98.2	99.2	100.1	101.1	101.9	102.0	100.8	98.8	97.3	95.8	94.4	

**%N1 Adjustments for Engine Bleed**

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	25	24	22	20	18
ENGINE A/I ON	-0.2	-0.2	-0.2	-0.2	-0.2
WING A/I ON - PACKS ON	-0.3	-0.3	-0.3	-0.2	-0.3
WING A/I ON - PACKS OFF	-0.4	-0.4	-0.4	-0.3	-0.5

**ENGINE INOP****Max Continuous %N1****Based on engine bleed for packs on or off and anti-ice off****16000 FT to 5000 FT Pressure Altitudes**

16000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
360	0.72	94.8	95.8	96.7	97.6	98.6	99.5	100.4	101.3	102.2	103.1	101.7	100.2
320	0.64	96.9	97.9	98.8	99.8	100.7	101.7	102.6	103.5	104.4	102.7	100.9	99.4
280	0.57	98.7	99.7	100.7	101.6	102.6	103.5	104.5	105.4	104.1	102.2	100.3	98.8
240	0.49	99.1	100.1	101.1	102.0	103.0	104.0	104.9	104.5	103.0	100.9	99.2	97.9
200	0.41	96.2	97.2	98.1	99.1	100.0	100.9	101.5	101.3	99.8	98.3	97.0	95.4
14000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
360	0.69	94.9	95.9	96.8	97.7	98.6	99.5	100.4	101.3	102.2	102.2	100.8	99.5
320	0.62	97.1	98.1	99.0	99.9	100.9	101.8	102.7	103.6	103.4	101.5	100.0	98.9
280	0.54	99.2	100.1	101.1	102.1	103.0	103.9	104.9	104.9	103.0	101.0	99.5	98.4
240	0.47	97.3	98.2	99.2	100.1	101.0	102.0	102.7	102.5	100.6	99.0	97.8	96.7
200	0.39	96.1	97.0	98.0	98.9	99.8	100.7	101.4	100.7	99.0	97.6	96.5	95.6
12000 FT PRESS ALT		TAT (°C)											
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40
360	0.67	95.4	96.3	97.2	98.1	99.0	99.9	100.8	101.6	102.5	101.3	100.0	99.0
320	0.60	97.3	98.2	99.2	100.1	101.0	101.9	102.8	103.7	102.3	100.6	99.4	98.4
280	0.52	99.7	100.6	101.6	102.5	103.5	104.4	105.3	104.0	102.0	100.2	99.1	98.1
240	0.45	96.5	97.4	98.3	99.3	100.2	101.1	101.4	100.6	99.2	98.0	96.9	96.0
200	0.38	96.7	97.7	98.6	99.5	100.4	101.2	101.3	100.2	98.7	97.4	96.4	95.8
10000 FT PRESS ALT		TAT (°C)											
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40
360	0.65	94.2	95.2	96.1	96.9	97.8	98.7	99.6	100.4	101.3	101.5	100.2	99.1
320	0.58	96.1	97.1	98.0	98.9	99.8	100.7	101.6	102.4	102.6	101.0	99.7	98.6
280	0.51	98.5	99.4	100.4	101.3	102.2	103.1	104.0	104.6	102.3	100.5	99.4	98.4
240	0.43	95.6	96.6	97.5	98.4	99.3	100.2	101.0	101.1	100.3	99.1	97.8	96.9
200	0.36	96.6	97.5	98.4	99.3	100.2	101.1	101.6	101.2	100.1	98.5	97.5	96.6
5000 FT PRESS ALT		TAT (°C)											
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
360	0.59	92.6	93.5	94.3	95.2	96.0	96.9	97.7	98.5	99.4	100.2	99.3	98.5
320	0.53	94.0	94.9	95.8	96.7	97.5	98.4	99.2	100.1	100.9	100.1	99.1	98.2
280	0.46	95.0	95.9	96.8	97.6	98.5	99.4	100.2	101.1	100.9	99.8	98.8	97.8
240	0.40	95.7	96.6	97.5	98.4	99.3	100.2	101.0	101.6	100.5	99.4	98.3	97.4
200	0.33	97.0	97.9	98.8	99.7	100.6	101.5	102.4	101.7	100.3	99.1	98.1	97.3

**%N1 Adjustments for Engine Bleed**

BLEED CONFIGURATION		PRESSURE ALTITUDE (1000 FT)					
		16	14	12	10	5	
ENGINE A/I ON		-0.3	-0.2	-0.4	-0.5	-0.5	
WING A/I ON - PACKS ON		-0.4	-0.5	-0.6	-0.7	-0.8	
WING A/I ON - PACKS OFF		-0.6	-0.7	-0.8	-0.9	-1.1	

**ENGINE INOP****MAX CONTINUOUS THRUST****Driftdown Speed/Level Off Altitude**

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
360	350	301	18000	16900	15700
340	331	293	19500	18400	17300
320	312	285	20900	20200	19100
300	291	276	22400	21500	20600
280	272	266	24200	23200	22000
260	252	257	26200	25300	24000
240	233	248	28500	27700	26300
220	214	238	30500	30000	28900
200	195	227	32300	32000	31300
180	175	215	34300	34100	33800
160	155	203	36500	36400	36200

**Driftdown/LRC Cruise Range Capability  
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	
134	125	118	111	105	100	95	90	86	82	79	
268	251	236	222	210	200	190	181	173	166	159	
402	376	354	333	316	300	285	272	260	249	239	
535	501	471	445	421	400	380	363	347	332	319	
668	626	588	555	526	500	476	454	434	416	399	
800	750	706	666	631	600	571	545	521	499	479	
932	874	823	777	736	700	666	636	608	583	560	
1064	998	940	888	841	800	762	727	696	667	640	
1196	1122	1057	998	946	900	857	818	783	751	721	
1327	1246	1173	1109	1051	1000	952	910	870	835	801	
1459	1369	1290	1220	1156	1100	1048	1001	958	918	882	
1590	1493	1407	1330	1262	1200	1143	1092	1045	1002	963	
1722	1617	1524	1441	1367	1300	1239	1183	1133	1086	1043	
1854	1741	1641	1552	1472	1400	1334	1275	1220	1170	1124	
1986	1865	1758	1662	1577	1500	1430	1366	1307	1254	1205	
2118	1989	1875	1773	1682	1600	1525	1457	1395	1338	1285	
2250	2113	1992	1884	1787	1700	1620	1548	1482	1421	1365	
2383	2238	2109	1995	1892	1800	1716	1639	1569	1505	1446	

**ENGINE INOP****MAX CONTINUOUS THRUST****Driftdown/LRC Cruise Range Capability****Driftdown/Cruise Fuel and Time**

AIR DIST (NM)	FUEL REQUIRED (1000 KG)										TIME (HR:MIN)	
	WEIGHT AT START OF DRIFTDOWN (1000 KG)											
	160	180	200	220	240	260	280	300	320	340		
100	1.0	1.1	1.2	1.4	1.4	1.6	1.7	1.7	1.8	1.9	2.0	
200	2.3	2.5	2.8	3.0	3.2	3.4	3.6	3.8	4.1	4.3	4.5	
300	3.6	3.9	4.4	4.8	5.1	5.4	5.8	6.1	6.5	6.9	7.2	
400	4.9	5.4	6.0	6.6	7.0	7.5	7.9	8.4	8.9	9.5	10.0	
500	6.2	6.8	7.5	8.2	8.8	9.4	10.0	10.6	11.2	11.9	12.6	
600	7.4	8.1	9.0	9.8	10.6	11.3	12.0	12.7	13.4	14.3	15.2	
700	8.6	9.4	10.4	11.4	12.3	13.1	13.9	14.8	15.6	16.6	17.7	
800	9.7	10.7	11.9	13.0	14.0	14.9	15.9	16.8	17.8	19.0	20.2	
900	10.9	12.0	13.3	14.5	15.6	16.8	17.8	18.9	20.0	21.3	22.7	
1000	12.1	13.3	14.7	16.1	17.3	18.5	19.7	20.9	22.1	23.6	25.2	
1100	13.2	14.6	16.1	17.6	19.0	20.3	21.6	22.9	24.3	25.9	27.6	
1200	14.4	15.9	17.5	19.1	20.6	22.1	23.5	24.9	26.4	28.1	30.0	
1300	15.5	17.2	18.9	20.6	22.3	23.8	25.4	26.9	28.5	30.4	32.4	
1400	16.6	18.4	20.3	22.1	23.9	25.6	27.2	28.9	30.6	32.6	34.8	
1500	17.7	19.6	21.7	23.6	25.5	27.3	29.1	30.9	32.7	34.8	37.2	
1600	18.8	20.9	23.0	25.1	27.1	29.0	30.9	32.8	34.8	37.0	39.5	
1700	19.9	22.1	24.4	26.6	28.7	30.7	32.8	34.8	36.8	39.2	41.9	
1800	21.0	23.3	25.7	28.0	30.2	32.4	34.6	36.7	38.9	41.4	44.2	

Includes APU fuel burn.

Driftdown at optimum driftdown speed and cruise at LRC speed.

**ENGINE INOP****MAX CONTINUOUS THRUST****Long Range Cruise Altitude Capability**  
**100 ft/min residual rate of climb**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
360	15600	14200	12700
350	16000	14700	13200
340	16900	15200	13700
330	17800	16300	14600
320	18800	17300	15600
310	19800	18300	16600
300	20500	19300	17700
290	21100	20200	18700
280	21800	20800	19800
270	22700	21500	20600
260	23600	22300	21200
250	24600	23400	21900
240	25800	24600	23100
230	27100	25900	24300
220	28500	27300	25600
210	29900	28600	27100
200	30900	30000	28500
190	31900	31200	30100
180	32900	32500	31400
170	34000	33700	32800
160	35200	35100	34300

With engine anti-ice on, no altitude capability adjustment is required.

With engine and wing anti-ice on, decrease altitude capability by 300 ft.

**ENGINE INOP****MAX CONTINUOUS THRUST****Long Range Cruise Control**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (1000 FT)									
	10	15	17	19	21	23	25	27	29	31
360	%N1 MACH KIAS FF/ENG	90.9 .602 334 10070	96.3 .664 337 10778							
	%N1 MACH KIAS FF/ENG	89.9 .602 334 9696	94.9 .664 337 10338	97.6 .683 335 10505						
	%N1 MACH KIAS FF/ENG	88.7 .602 334 9267	92.9 .653 332 9589	94.8 .670 328 9644	97.7 .689 325 9735					
	%N1 MACH KIAS FF/ENG	86.8 .592 329 8693	91.0 .638 324 8874	92.7 .657 321 8919	94.7 .674 317 8944	97.9 .694 315 9073				
300	%N1 MACH KIAS FF/ENG	85.0 .574 319 8068	89.2 .622 315 8218	90.8 .641 313 8264	92.6 .660 310 8284	94.8 .677 306 8332	97.9 .694 305 8544			
	%N1 MACH KIAS FF/ENG	82.9 .557 309 7484	87.2 .605 306 7593	88.8 .623 304 7619	90.5 .643 302 7642	92.3 .662 299 7676	94.7 .679 295 7747	98.4 .704 294 8011		
	%N1 MACH KIAS FF/ENG	80.8 .540 299 6926	84.8 .585 296 6949	86.8 .605 295 7005	88.3 .624 293 7013	90.0 .644 291 7041	91.8 .663 288 7088	94.5 .681 284 7163	98.3 .707 283 7427	
	%N1 MACH KIAS FF/ENG	78.6 .522 289 6372	82.5 .564 285 6314	84.2 .584 284 6372	86.1 .604 283 6413	87.7 .623 281 6419	89.4 .644 279 6456	91.2 .663 276 6501	93.8 .681 272 6563	97.8 .708 272 6820
200	%N1 MACH KIAS FF/ENG	76.2 .503 278 5827	79.9 .543 274 5717	81.7 .561 272 5752	83.4 .581 271 5795	85.3 .601 270 5829	86.9 .621 268 5836	88.6 .642 267 5870	90.4 .661 264 5906	93.0 .680 260 5957
	%N1 MACH KIAS FF/ENG	73.8 .484 268 5301	77.2 .521 263 5135	78.9 .538 261 5167	80.7 .556 259 5198	82.3 .575 258 5215	84.2 .596 257 5244	85.8 .616 256 5254	87.5 .638 254 5279	89.3 .658 251 5309
	%N1 MACH KIAS FF/ENG	71.0 .464 257 4797	74.3 .498 251 4574	76.0 .514 249 4596	77.6 .530 247 4632	79.3 .548 246 4637	81.0 .567 244 4636	82.7 .589 243 4658	84.5 .609 242 4673	86.1 .631 240 4689
	%N1 MACH KIAS FF/ENG	69.0 .444 246 4497	72.3 .478 240 4474	74.0 .498 238 4496	75.6 .514 236 4532	77.2 .530 234 4563	78.8 .550 232 4594	80.4 .570 230 4625	82.0 .590 228 4656	83.6 .610 226 4687

**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	
284	263	244	227	213	200	190	181	173	166	159	
565	523	485	453	425	400	381	364	348	334	321	
847	784	728	680	638	600	572	546	522	501	482	
1129	1045	970	906	850	800	763	729	698	669	643	
1413	1308	1214	1133	1063	1000	954	911	872	836	804	
1697	1570	1457	1361	1276	1200	1145	1094	1047	1004	965	
1982	1834	1701	1588	1489	1400	1336	1276	1221	1171	1125	
2268	2097	1945	1815	1702	1600	1526	1458	1395	1338	1286	
2554	2362	2190	2043	1915	1800	1717	1640	1569	1505	1446	
2842	2626	2434	2270	2128	2000	1908	1822	1743	1671	1606	

**Reference Fuel and Time Required at Check Point**

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	3.8	0:39	3.3	0:38	3.0	0:36	2.7	0:36	2.5	0:35
400	8.0	1:13	7.3	1:10	6.8	1:08	6.4	1:05	6.1	1:03
600	12.1	1:48	11.2	1:44	10.6	1:39	10.0	1:35	9.7	1:32
800	16.2	2:23	15.1	2:17	14.3	2:11	13.6	2:06	13.2	2:01
1000	20.2	2:59	18.9	2:50	18.0	2:43	17.1	2:36	16.7	2:30
1200	24.2	3:34	22.7	3:24	21.7	3:15	20.7	3:06	20.2	2:59
1400	28.2	4:10	26.5	3:58	25.3	3:47	24.1	3:37	23.6	3:29
1600	32.1	4:46	30.2	4:33	28.9	4:19	27.6	4:08	26.9	3:58
1800	36.0	5:22	33.8	5:07	32.4	4:52	31.0	4:39	30.2	4:28
2000	39.8	5:59	37.5	5:42	36.0	5:25	34.4	5:10	33.5	4:58

**Fuel Required Adjustment (1000 KG)**

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)										
	150	170	190	210	230	250	270	290	310	330	350
5	-1.0	-0.8	-0.6	-0.4	-0.2	0.0	0.3	0.7	1.1	1.7	2.4
10	-2.1	-1.7	-1.3	-0.9	-0.4	0.0	0.7	1.5	2.5	3.7	5.0
15	-3.3	-2.6	-2.0	-1.3	-0.7	0.0	1.0	2.3	3.8	5.6	7.6
20	-4.4	-3.5	-2.7	-1.8	-0.9	0.0	1.4	3.1	5.1	7.4	9.9
25	-5.5	-4.4	-3.4	-2.2	-1.1	0.0	1.8	3.9	6.3	9.1	12.2
30	-6.7	-5.4	-4.0	-2.7	-1.3	0.0	2.1	4.6	7.5	10.7	14.3
35	-7.8	-6.3	-4.7	-3.2	-1.6	0.0	2.5	5.3	8.6	12.2	16.2
40	-8.9	-7.2	-5.4	-3.6	-1.8	0.0	2.8	6.0	9.7	13.7	18.1

Includes APU fuel burn.

**ENGINE INOP****MAX CONTINUOUS THRUST****Holding  
Flaps Up**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)						
	1500	5000	10000	15000	20000	25000	30000
360	%N1	80.5	83.9	88.6	93.4		
	KIAS	264	264	265	269		
	FF/ENG	9070	9130	9370	9670		
340	%N1	78.7	81.9	86.7	91.4	100.4	
	KIAS	260	260	260	260	299	
	FF/ENG	8520	8560	8730	8950	10320	
320	%N1	76.7	79.7	84.6	89.2	96.4	
	KIAS	253	253	253	253	289	
	FF/ENG	7930	7940	8050	8210	9240	
300	%N1	74.7	77.7	82.3	87.1	92.4	
	KIAS	244	244	244	244	259	
	FF/ENG	7380	7360	7430	7550	8120	
280	%N1	72.8	75.7	80.1	85.0	90.1	
	KIAS	238	238	238	238	238	
	FF/ENG	6880	6850	6880	6950	7350	
260	%N1	70.7	73.6	77.8	82.8	87.8	95.1
	KIAS	229	229	229	229	229	262
	FF/ENG	6380	6340	6330	6380	6690	7470
240	%N1	68.5	71.5	75.6	80.3	85.4	90.5
	KIAS	223	223	223	223	223	228
	FF/ENG	5910	5870	5820	5850	6110	6420
220	%N1	66.2	69.1	73.2	77.7	82.8	87.7
	KIAS	217	217	217	217	217	242
	FF/ENG	5440	5400	5330	5350	5530	5760
200	%N1	64.1	66.7	71.0	75.3	80.1	85.0
	KIAS	217	217	217	217	217	226
	FF/ENG	5010	4970	4910	4900	5040	5200
180	%N1	62.0	64.6	68.6	72.9	77.6	82.5
	KIAS	217	217	217	217	217	217
	FF/ENG	4630	4580	4520	4500	4630	4730
160	%N1	59.9	62.6	66.3	70.7	75.2	80.0
	KIAS	217	217	217	217	217	217
	FF/ENG	4300	4240	4160	4140	4250	4340

This table includes 5% additional fuel for holding in a racetrack pattern.

**ENGINE INOP****ADVISORY INFORMATION****Gear Down Landing Rate of Climb Available  
Flaps 20**

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	460	370				
50	510	420	260			
48	560	470	310			
46	600	510	360	210		
44	650	560	400	260		
42	690	610	450	300	150	
40	720	660	490	340	190	
38	730	700	540	380	220	20
36	730	720	580	410	250	50
34	730	730	610	450	280	80
32	740	730	650	490	310	100
30	740	730	650	520	350	130
20	760	750	660	550	420	240
10	780	770	620	440	300	150
0	800	780	610	410	210	-30
-20	830	810	630	430	220	-30
-40	870	850	650	440	220	-30

Rate of climb capability shown is valid for 220000 kg, gear down at VREF20 + 5.

Decrease rate of climb 40 ft/min per 5000 kg greater than 220000 kg.

Increase rate of climb 50 ft/min per 5000 kg less than 220000 kg.

**Flaps 30**

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	-100	-190				
50	-50	-150	-300			
48	-10	-110	-260			
46	30	-60	-220	-360		
44	70	-20	-180	-320		
42	110	20	-140	-280	-420	
40	140	60	-100	-250	-400	
38	150	100	-60	-210	-370	-560
36	150	130	-30	-190	-340	-540
34	150	130	10	-150	-320	-510
32	150	130	30	-120	-290	-490
30	150	140	50	-90	-260	-470
20	160	140	50	-60	-190	-370
10	170	150	10	-110	-220	-610
0	180	150	-20	-210	-410	-640
-20	180	160	-30	-220	-420	-660
-40	190	160	-30	-230	-440	-690

Rate of climb capability shown is valid for 220000 kg, gear down at VREF30 + 5.

Decrease rate of climb 40 ft/min per 5000 kg greater than 220000 kg.

Increase rate of climb 40 ft/min per 5000 kg less than 220000 kg.

DRAFT

Intentionally  
Blank

# Performance Inflight - QRH

## Gear Down

# Chapter PI-QRH

## Section 33

### GEAR DOWN

#### 220 KIAS Max Climb %N1

TAT (°C)	PRESSURE ALTITUDE (1000 FT)														
	0	5	10	12	14	16	18	20	22	24	26	28	30	32	34
55	88.2	88.3	91.4	91.1	92.1	91.3	94.0	95.2	95.4	98.1	99.9	101.1	102.4	102.9	103.4
50	89.5	88.8	90.7	90.4	91.4	92.1	93.3	94.5	94.7	97.3	99.2	100.3	101.6	102.1	102.6
45	90.5	90.1	90.0	89.7	90.7	91.4	92.6	93.8	93.9	96.6	98.4	99.6	100.8	101.3	101.8
40	91.6	91.2	91.2	89.7	89.9	90.7	91.9	93.0	93.2	95.8	97.6	98.8	100.0	100.5	101.0
35	92.6	92.3	92.2	92.1	90.6	89.9	91.1	92.3	92.5	95.0	96.8	98.0	99.2	99.7	100.2
30	93.0	93.2	93.2	93.0	92.2	91.2	90.9	91.5	91.7	94.3	96.0	97.2	98.4	98.9	99.4
25	92.2	94.2	94.1	94.0	93.7	92.8	92.1	92.0	91.1	93.5	95.2	96.4	97.6	98.0	98.5
20	91.4	94.2	95.1	95.0	94.9	94.4	93.4	93.0	92.8	93.6	94.4	95.6	96.8	97.2	97.7
15	90.7	93.4	96.7	96.4	96.3	96.1	94.8	94.1	94.5	94.8	95.2	95.3	96.0	96.4	96.9
10	89.9	92.6	96.3	97.9	98.1	98.1	96.8	95.5	96.5	96.2	96.4	96.4	96.6	96.1	96.0
5	89.1	91.7	95.4	97.1	98.9	100.3	99.0	97.9	98.2	97.8	97.8	97.9	97.9	97.3	96.8
0	88.3	90.9	94.6	96.2	98.0	100.1	100.8	100.3	100.1	99.7	99.4	99.4	99.5	98.6	98.1
-5	87.4	90.1	93.7	95.3	97.1	99.1	99.9	100.8	101.9	101.5	101.1	101.1	101.1	100.2	99.6
-10	86.6	89.2	92.8	94.4	96.1	98.2	98.9	99.8	101.4	102.8	102.6	102.6	103.0	101.6	100.8
-15	85.8	88.4	91.9	93.5	95.2	97.3	98.0	98.9	100.4	101.8	102.5	103.2	103.8	102.5	101.4
-20	85.0	87.5	91.1	92.6	94.3	96.3	97.0	97.9	99.4	100.8	101.5	102.2	103.3	102.4	101.3

#### Anti-ice Adjustment

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)							
	0	5	10	15	20	25	30	35
2 PACKS ON - 1 BLEED SOURCE	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4
1 PACK ON - 1 OR 2 BLEED SOURCES	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4
ENGINE ANTI-ICE ON	-0.3	-0.5	-0.4	-0.3	-0.1	-0.2	-0.2	-0.2
ENGINE AND WING ANTI-ICE ON*	-0.6	-0.8	-0.7	-0.5	-0.2	-0.3	-0.3	-0.4
ENGINE AND WING ANTI-ICE ON**	-1.1	-0.9	-0.9	-0.6	-0.3	-0.4	-0.5	-0.5

\* Packs on or off with 2 bleed sources.

\*\* Packs off with 1 bleed source.

**GEAR DOWN****Long Range Cruise Altitude Capability****Max Climb Thrust, 300 ft/min residual rate of climb**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
360	18500	16600	14200
350	19200	17300	14800
340	19700	18000	15500
330	20600	18900	16300
320	21700	20100	17600
310	22800	21300	19000
300	23900	22400	20300
290	25000	23500	21800
280	26000	24600	23000
270	27100	25900	24300
260	28200	27200	25700
250	29400	28600	27100
240	30400	30000	28500
230	31200	30800	29900
220	32000	31700	31000
210	32800	32600	32000
200	33500	33200	32700
190	34000	33900	33400
180	34600	34500	34100
170	35200	35100	34700
160	35800	35700	35300

**GEAR DOWN****Long Range Cruise Control**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		10	15	17	19	21	23	25	27	29	31
360	%N1	84.4	88.7	90.7	93.0						
	MACH	.488	.535	.556	.578						
	KIAS	270	270	270	270						
	FF/ENG	7524	7653	7775	7993						
340	%N1	83.5	87.8	89.7	91.8						
	MACH	.488	.535	.556	.578						
	KIAS	270	270	270	270						
	FF/ENG	7296	7405	7486	7646						
320	%N1	82.6	86.7	88.3	90.0	92.1					
	MACH	.488	.534	.550	.568	.588					
	KIAS	270	269	267	265	264					
	FF/ENG	7058	7105	7101	7142	7267					
300	%N1	81.2	84.9	86.6	88.2	89.9	92.1				
	MACH	.481	.520	.537	.554	.572	.594				
	KIAS	266	262	260	258	257	256				
	FF/ENG	6725	6632	6624	6623	6679	6806				
280	%N1	79.3	83.1	84.9	86.4	87.9	89.7	92.3			
	MACH	.468	.507	.523	.540	.557	.576	.598			
	KIAS	259	255	253	252	250	248	248			
	FF/ENG	6283	6189	6167	6168	6164	6230	6361			
260	%N1	77.2	81.1	82.9	84.6	86.0	87.6	89.4	92.3	96.7	
	MACH	.453	.492	.508	.525	.542	.559	.579	.602	.628	
	KIAS	251	248	246	244	243	241	239	239	239	
	FF/ENG	5831	5754	5724	5709	5711	5706	5778	5910	6239	
240	%N1	75.0	79.0	80.8	82.4	84.1	85.5	87.1	89.0	92.0	
	MACH	.438	.476	.492	.508	.525	.543	.561	.581	.605	
	KIAS	242	240	238	237	235	233	231	230	230	
	FF/ENG	5377	5317	5292	5266	5254	5253	5252	5320	5450	
220	%N1	72.6	76.7	78.4	80.2	81.7	83.4	84.9	86.4	88.4	91.5
	MACH	.421	.459	.475	.491	.508	.525	.543	.561	.582	.606
	KIAS	232	231	230	228	227	225	224	222	221	220
	FF/ENG	4925	4872	4859	4836	4811	4800	4799	4799	4859	4983
200	%N1	69.9	74.1	75.8	77.5	79.3	80.9	82.7	84.4	86.3	88.5
	MACH	.403	.441	.456	.473	.489	.506	.526	.548	.571	.596
	KIAS	223	221	220	219	218	217	217	216	217	217
	FF/ENG	4476	4425	4418	4408	4384	4360	4387	4432	4481	4565
180	%N1	67.8	72.2	74.1	75.9	77.9	79.8	81.5	83.3	85.1	87.0
	MACH	.392	.431	.448	.466	.485	.505	.526	.548	.571	.596
	KIAS	217	217	217	217	217	217	217	216	217	217
	FF/ENG	4152	4138	4141	4159	4170	4182	4208	4249	4283	4335
160	%N1	66.8	71.3	73.1	74.9	76.9	78.7	80.5	82.4	84.1	85.9
	MACH	.392	.431	.448	.466	.485	.505	.526	.548	.571	.596
	KIAS	217	217	217	217	217	217	217	216	217	217
	FF/ENG	4013	3995	3994	4006	4019	4031	4053	4088	4125	4159

**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	
310	280	254	233	216	200	189	179	170	162	155	
622	562	510	467	431	400	378	358	340	324	311	
936	845	766	702	648	600	567	538	511	487	466	
1253	1131	1024	937	864	800	757	718	682	650	621	
1573	1418	1283	1173	1081	1000	946	897	852	812	776	
1896	1706	1542	1409	1298	1200	1135	1076	1022	973	930	
2222	1997	1803	1646	1515	1400	1324	1254	1191	1134	1084	
2552	2291	2066	1884	1733	1600	1513	1433	1361	1296	1238	
2883	2586	2329	2122	1951	1800	1702	1612	1530	1457	1392	
3215	2881	2593	2361	2169	2000	1890	1790	1699	1618	1545	
3547	3177	2857	2600	2387	2200	2079	1968	1868	1778	1699	
3880	3472	3120	2838	2604	2400	2268	2147	2038	1940	1853	
4213	3768	3384	3076	2822	2600	2457	2326	2207	2101	2007	
4545	4063	3648	3315	3040	2800	2646	2505	2377	2262	2161	
4878	4359	3912	3554	3258	3000	2835	2683	2546	2424	2315	
5211	4655	4176	3792	3476	3200	3023	2862	2716	2585	2468	
5544	4951	4440	4031	3694	3400	3212	3041	2885	2746	2622	
5876	5246	4703	4269	3912	3600	3401	3220	3055	2907	2776	
6209	5541	4967	4507	4130	3800	3590	3398	3224	3068	2930	
6542	5837	5230	4746	4348	4000	3778	3576	3393	3229	3084	

**Reference Fuel and Time Required at Check Point**

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	
200	7.4	0:46	6.7	0:44	5.8	0:42	5.3	0:41	5.0	0:39
400	15.0	1:29	13.9	1:25	12.4	1:20	11.6	1:17	11.1	1:13
600	22.6	2:13	21.1	2:06	19.0	1:58	17.9	1:53	17.2	1:48
800	30.0	2:57	28.0	2:48	25.4	2:37	24.0	2:30	23.0	2:23
1000	37.3	3:42	34.9	3:30	31.8	3:15	30.1	3:07	28.9	2:57
1200	44.4	4:28	41.6	4:14	38.0	3:55	35.9	3:44	34.5	3:33
1400	51.5	5:14	48.3	4:57	44.1	4:35	41.8	4:22	40.1	4:09
1600	58.3	6:01	54.7	5:41	50.1	5:15	47.5	5:00	45.6	4:45
1800	65.1	6:49	61.2	6:26	56.1	5:56	53.1	5:38	51.0	5:21
2000	71.7	7:37	67.5	7:11	61.9	6:37	58.7	6:17	56.3	5:57
2200	78.3	8:25	73.7	7:56	67.7	7:18	64.2	6:55	61.6	6:33
2400	84.8	9:13	79.9	8:41	73.4	7:59	69.6	7:34	66.8	7:09
2600	91.3	10:00	86.0	9:26	79.1	8:40	75.0	8:12	72.0	7:45
2800	97.6	10:48	92.0	10:11	84.6	9:21	80.3	8:51	77.1	8:21
3000	104.0	11:36	98.0	10:56	90.2	10:02	85.6	9:29	82.1	8:57
3200	110.2	12:24	103.9	11:41	95.7	10:43	90.8	10:08	87.1	9:33
3400	116.5	13:12	109.8	12:27	101.1	11:24	96.0	10:46	92.1	10:09
3600	122.6	14:00	115.6	13:12	106.5	12:05	101.1	11:25	97.0	10:45
3800	128.7	14:48	121.4	13:57	111.9	12:46	106.2	12:03	101.9	11:21
4000	134.8	15:36	127.2	14:42	117.2	13:27	111.3	12:42	106.8	11:57

## 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)										
	150	170	190	210	230	250	270	290	310	330	350
10	-1.8	-1.6	-1.3	-0.9	-0.4	0.0	0.8	1.8	2.9	4.1	5.5
20	-3.6	-3.2	-2.6	-1.8	-0.9	0.0	1.6	3.4	5.5	7.9	10.5
30	-5.3	-4.7	-3.8	-2.7	-1.4	0.0	2.2	4.9	7.9	11.3	15.1
40	-6.8	-6.0	-5.0	-3.5	-1.8	0.0	2.9	6.2	10.1	14.4	19.2
50	-8.3	-7.3	-6.0	-4.2	-2.2	0.0	3.4	7.4	12.0	17.1	22.9
60	-9.5	-8.4	-6.9	-4.9	-2.5	0.0	3.9	8.4	13.7	19.6	26.1
70	-10.7	-9.5	-7.8	-5.5	-2.8	0.0	4.3	9.3	15.1	21.6	28.9
80	-11.7	-10.4	-8.5	-6.1	-3.1	0.0	4.6	10.1	16.3	23.4	31.2
90	-12.6	-11.2	-9.2	-6.5	-3.4	0.0	4.9	10.7	17.3	24.8	33.1
100	-13.4	-11.9	-9.8	-7.0	-3.7	0.0	5.1	11.1	18.0	25.9	34.6
110	-14.1	-12.5	-10.3	-7.3	-3.9	0.0	5.2	11.4	18.5	26.6	35.6
120	-14.6	-12.9	-10.7	-7.6	-4.0	0.0	5.3	11.6	18.8	27.0	36.1
130	-15.0	-13.3	-11.0	-7.9	-4.2	0.0	5.3	11.6	18.8	27.0	36.2
140	-15.2	-13.5	-11.2	-8.1	-4.3	0.0	5.2	11.5	18.6	26.7	35.8

Based on Long Range Cruise and VREF30+80 descent.

#### Descent at VREF30 + 80

PRESSURE ALTITUDE (1000 FT)	17	19	21	23	25	27	29	31	33	35
DISTANCE (NM)	35	40	44	48	52	57	61	65	69	74
TIME (MINUTES)	11	12	13	14	15	15	16	17	18	18

**GEAR DOWN****Holding  
Flaps Up**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)					
		1500	5000	10000	15000	20000	25000
360	%N1 KIAS FF/ENG	76.1 264 7750					
340	%N1 KIAS FF/ENG	74.6 260 7360	77.7 260 7350				
320	%N1 KIAS FF/ENG	72.8 253 6890	75.8 253 6870				
300	%N1 KIAS FF/ENG	70.6 244 6380	73.7 244 6370	78.1 244 6340			
280	%N1 KIAS FF/ENG	68.8 238 5970	72.0 238 5960	76.3 238 5920			
260	%N1 KIAS FF/ENG	66.7 229 5520	69.7 229 5510	74.1 229 5470	78.6 229 5490		
240	%N1 KIAS FF/ENG	64.9 223 5150	67.7 223 5130	72.2 223 5100	76.7 223 5100		
220	%N1 KIAS FF/ENG	63.1 217 4800	65.8 217 4770	70.1 217 4730	74.6 217 4730	79.4 217 4770	
200	%N1 KIAS FF/ENG	61.9 217 4610	64.7 217 4570	68.8 217 4520	73.3 217 4520	78.0 217 4550	82.7 217 4610
180	%N1 KIAS FF/ENG	61.0 217 4450	63.8 217 4410	67.8 217 4360	72.2 217 4350	76.9 217 4370	81.5 217 4420
160	%N1 KIAS FF/ENG	60.1 217 4320	62.9 217 4270	66.8 217 4210	71.3 217 4190	75.9 217 4210	80.5 217 4260

This table includes 5% additional fuel for holding in a racetrack pattern.

**GEAR DOWN****Holding  
Flaps 1**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
360	%N1	75.9	79.0	83.8	88.3	94.3
	KIAS	244	244	244	244	244
	FF/ENG	7660	7700	7690	7810	8200
340	%N1	74.3	77.4	82.1	86.8	91.8
	KIAS	240	240	240	240	240
	FF/ENG	7240	7260	7250	7350	7630
320	%N1	72.5	75.5	80.0	84.9	89.7
	KIAS	233	233	233	233	233
	FF/ENG	6770	6780	6770	6830	7040
300	%N1	70.3	73.4	77.8	82.9	87.6
	KIAS	224	224	224	224	224
	FF/ENG	6270	6270	6270	6320	6450
280	%N1	68.3	71.5	75.8	80.6	85.6
	KIAS	218	218	218	218	218
	FF/ENG	5840	5840	5820	5870	5980
260	%N1	66.0	69.1	73.5	78.1	83.3
	KIAS	209	209	209	209	209
	FF/ENG	5380	5370	5340	5400	5460
240	%N1	64.1	66.9	71.4	75.9	81.0
	KIAS	203	203	203	203	203
	FF/ENG	4980	4960	4930	4970	5020
220	%N1	62.0	64.7	69.0	73.6	78.4
	KIAS	197	197	197	197	197
	FF/ENG	4600	4570	4530	4550	4610
200	%N1	60.5	63.2	67.3	71.8	76.5
	KIAS	197	197	197	197	197
	FF/ENG	4350	4310	4260	4270	4310
180	%N1	59.1	61.8	65.8	70.3	74.9
	KIAS	197	197	197	197	197
	FF/ENG	4140	4100	4040	4050	4070
160	%N1	57.9	60.7	64.6	69.0	73.5
	KIAS	197	197	197	197	197
	FF/ENG	3970	3920	3860	3860	3860

This table includes 5% additional fuel for holding in a racetrack pattern.

DRAFT

Intentionally  
Blank

**Performance Inflight - QRH**  
**Gear Down, Engine INOP**
**Chapter PI-QRH**  
**Section 34**
**GEAR DOWN****ENGINE INOP****MAX CONTINUOUS THRUST****Driftdown Speed/Level Off Altitude****100 ft/min residual rate of climb****Includes APU fuel burn**

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
320	307	254	5600	4400	2200
300	288	246	7700	6800	5300
280	269	238	9800	9100	8100
260	250	230	12100	11400	10300
240	230	223	14000	13500	12400
220	210	217	15900	15400	14400
200	191	216	17300	16700	15700
180	172	216	18500	18100	16900
160	153	216	19700	19400	18200

**Long Range Cruise Altitude Capability****100 ft/min residual rate of climb**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
340	1800		
330	3300	1000	
320	4500	2700	
310	5700	4400	1900
300	6800	5700	3800
290	7800	7000	5300
280	8800	8100	6700
270	9800	9100	8100
260	11100	10400	9300
250	12100	11400	10300
240	13100	12500	11300
230	14000	13600	12400
220	15100	14600	13600
210	15900	15400	14400
200	16700	16100	15100
190	17400	16700	15800
180	18000	17500	16400
170	18700	18200	16900
160	19300	18900	17700

**GEAR DOWN****ENGINE INOP****MAX CONTINUOUS THRUST****Long Range Cruise Control**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (1000 FT)							
	5	7	9	11	13	15	17	19
300	%N1	94.3	96.8					
	MACH	.403	.418					
	KIAS	244	244					
	FF/ENG	12328	12507					
280	%N1	92.3	94.1	96.8				
	MACH	.393	.407	.422				
	KIAS	238	238	238				
	FF/ENG	11514	11566	11807				
260	%N1	90.5	91.6	93.6	96.4			
	MACH	.385	.393	.408	.423			
	KIAS	233	229	229	229			
	FF/ENG	10870	10626	10714	10945			
240	%N1	88.9	89.8	91.3	93.4	96.5		
	MACH	.379	.385	.397	.412	.428		
	KIAS	229	225	223	223	223		
	FF/ENG	10228	9966	9915	10023	10245		
220	%N1	86.6	88.0	89.1	90.9	93.1	96.4	
	MACH	.368	.377	.387	.401	.417	.433	
	KIAS	223	220	217	217	217	217	
	FF/ENG	9452	9309	9167	9222	9323	9542	
200	%N1	84.2	86.0	87.8	89.5	91.4	94.0	98.1
	MACH	.358	.371	.385	.400	.415	.431	.448
	KIAS	217	217	217	217	217	217	217
	FF/ENG	8693	8698	8718	8773	8844	8956	9300
180	%N1	82.9	84.7	86.7	88.4	90.2	92.3	95.5
	MACH	.358	.371	.385	.400	.415	.431	.448
	KIAS	217	217	217	217	217	217	217
	FF/ENG	8330	8328	8342	8399	8458	8533	8740
160	%N1	81.7	83.6	85.4	87.3	89.0	90.9	93.5
	MACH	.358	.371	.385	.400	.415	.431	.448
	KIAS	217	217	217	217	217	217	217
	FF/ENG	8019	8011	8010	8058	8115	8168	8310

**GEAR DOWN****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	
165	145	129	118	108	100	95	90	84	78	73	
332	295	263	238	218	200	187	175	165	155	147	
500	444	396	358	327	300	280	262	246	233	221	
669	593	528	477	436	400	374	350	329	310	294	
837	742	661	597	545	500	467	437	410	387	367	
1007	893	795	718	655	600	560	524	492	464	440	
1177	1043	928	838	764	700	653	611	574	541	513	
1347	1193	1061	958	873	800	746	698	655	618	586	
1519	1344	1195	1078	983	900	839	785	737	695	659	
1691	1496	1329	1198	1092	1000	933	873	819	772	731	

**Reference Fuel and Time Required at Check Point**

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	6		8		10		12		14	
	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)
100	4.0	0:27	3.8	0:26	3.5	0:26	3.4	0:25	3.3	0:25
200	8.2	0:51	7.8	0:50	7.5	0:49	7.3	0:48	7.2	0:47
300	12.3	1:15	11.8	1:14	11.4	1:12	11.1	1:10	11.1	1:09
400	16.4	1:40	15.8	1:38	15.3	1:36	14.9	1:33	14.9	1:30
500	20.5	2:04	19.7	2:02	19.1	1:59	18.7	1:56	18.7	1:53
600	24.5	2:29	23.6	2:27	22.9	2:23	22.5	2:19	22.4	2:15
700	28.5	2:53	27.5	2:51	26.7	2:46	26.1	2:42	26.0	2:37
800	32.5	3:18	31.3	3:16	30.4	3:10	29.8	3:05	29.6	2:59
900	36.4	3:43	35.1	3:40	34.1	3:34	33.4	3:28	33.2	3:22
1000	40.3	4:08	38.8	4:05	37.8	3:58	37.0	3:51	36.7	3:44

**Fuel Required Adjustment (1000 KG)**

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	150	200	250	300	350
5	-0.8	-0.5	0.0	1.6	2.6
10	-1.8	-1.1	0.0	3.0	5.6
15	-2.8	-1.6	0.0	4.4	8.6
20	-3.7	-2.2	0.0	5.6	11.6
25	-4.5	-2.7	0.0	6.8	14.4
30	-5.4	-3.2	0.0	7.8	17.3
35	-6.2	-3.7	0.0	8.7	20.0
40	-7.0	-4.2	0.0	9.5	22.7
45	-7.7	-4.7	0.0	10.2	25.3

Based on Long Range Cruise and VREF30+80 descent. Includes APU fuel burn.

**GEAR DOWN**  
**ENGINE INOP**  
**MAX CONTINUOUS THRUST**

**Holding**  
**Flaps Up**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)			
	1500	5000	10000	15000
340	%N1	95.5		
	KIAS	260		
	FF/ENG	14970		
320	%N1	93.4	97.2	
	KIAS	253	253	
	FF/ENG	13980	14120	
300	%N1	91.1	94.3	
	KIAS	244	244	
	FF/ENG	12970	12940	
280	%N1	89.3	92.3	98.8
	KIAS	238	238	238
	FF/ENG	12100	12090	12660
260	%N1	86.8	90.0	94.8
	KIAS	229	229	229
	FF/ENG	11100	11180	11340
240	%N1	84.6	88.0	92.2
	KIAS	223	223	223
	FF/ENG	10310	10380	10460
220	%N1	82.3	85.7	90.0
	KIAS	217	217	217
	FF/ENG	9540	9590	9650
200	%N1	80.8	84.2	88.6
	KIAS	217	217	217
	FF/ENG	9080	9130	9180
180	%N1	79.6	82.9	87.5
	KIAS	217	217	217
	FF/ENG	8700	8750	8780
160	%N1	78.6	81.7	86.4
	KIAS	217	217	217
	FF/ENG	8380	8420	8430

This table includes 5% additional fuel for holding in a racetrack pattern.

**Performance Inflight - QRH****Text****Chapter PI-QRH****Section 35****Introduction**

This chapter contains information to supplement performance data from the Flight Management Computer. 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.

**General****Flight with Unreliable Airspeed / Turbulent Air Penetration**

Body 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 may also cause unreliable airspeed/Mach indications. Climb, cruise and descent information is based on the recommended turbulent air penetration speed schedule: 270 knots below 25,000 feet, 280 knots or 0.82 Mach whichever is lower at 25,000 feet and above; maintain a minimum speed of 15 knots above the minimum maneuvering speed when below 0.82 Mach. This schedule provides ample protection from stall and high speed buffet, while also providing protection from exceeding structural limits.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed may also be unreliable.

**Max Climb %N1**

This table shows Max Climb %N1 for a 310/.84 climb speed schedule, normal engine bleed for 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 Speeds**

This table contains flaps 30, 25 and 20 reference speeds for a given weight.

---

## Advisory Information

### Normal Configuration Landing Distance

Tables are provided as advisory information for normal configuration landing distances 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 appropriate 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 and adjustments are provided for dry runways and runways with good, medium, and poor reported braking action.

Enter the table with the applicable non-normal configuration and read the normal approach speed. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and speed at sea level, zero wind, and zero slope. Subsequent columns provide corrections for off-reference landing weight, altitude,

wind, slope, and speed conditions. Each correction is independently added to the reference landing distance. Landing distance includes the effects of max manual braking and reverse thrust.

For an engine inoperative autoland, check the rate of climb capability shown in Gear Down Landing Rate of Climb Available tables to ensure adequate climb performance.

## 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 appropriate Event Adjusted Brake Energy Table (No Reverse Thrust or 2 Engine Reverse) with the reference brake energy per brake and the type of braking used during landing (Max Manual, Max Auto, or Autobrake). The resulting number is the adjusted brake energy per brake and represents the energy absorbed in each brake during the landing. The recommended cooling time is found in the final table by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

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 5.0 or higher on the EICAS indication and disappear as the hottest brake cools with an EICAS indication of 3.5. Note that even without an EICAS advisory message, brake cooling is recommended.

## Landing Climb Limit Weight

In the event an overweight landing is necessary and the fuel dump system is unavailable, landing climb limits should be checked if a Flaps 25 or 30 landing is planned. Enter the table with airport OAT and pressure altitude to read landing climb limit weight. Apply the noted adjustments as required. At weights exceeding those shown, plan a Flaps 20 landing.

## Engine Inoperative

### Initial Max Continuous %N1

The Initial Max Continuous %N1 setting for use following an engine failure is shown. The table is based on the typical all engine cruise Mach number of .84 to provide a target %N1 setting at the start of driftdown. Once driftdown is established, the Max Continuous %N1 Table should be used to determine %N1 for the given conditions.

### Max Continuous %N1

Power setting is based on one engine operating with engine bleed for packs on or off and all anti-ice bleeds off. Enter the table with pressure altitude and IAS or Mach to read %N1.

It is desirable to maintain engine thrust level within the limits of the Max Cruise thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous thrust rating. The Max Continuous thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

### Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

### Driftdown/Cruise Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to long range cruise speed. Cruise is continued at level off altitude and long range cruise speed.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and correct for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude is used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Diversion Fuel and Time table.

## **Long Range Cruise Altitude Capability**

Tables show the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on LRC speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

## **Long Range Cruise Control**

The table provides target %N1, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

## **Long Range Cruise Diversion Fuel and Time**

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .84/310/250 descent. Enter with Air Distance as determined from the Ground to Air Miles Conversion Table and read Fuel and Time required at the cruise pressure altitude. Adjust the fuel obtained for deviation from the reference weight at checkpoint as required by entering the off reference fuel corrections table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel and time required for the actual weight.

## **Holding**

Single engine holding data is provided in the same format as the all engine holding data and is based on the same assumptions.

## **Gear Down Landing Rate of Climb Available**

Rate of climb data is provided as guidance information in the event an engine inoperative autoland is planned. The tables show gear down rate of climb available for Flaps 20 and Flaps 30. Enter the table with TAT and pressure altitude to read rate of climb available. Apply adjustments shown to correct for weight.

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## 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 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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### General

## Chapter PI-QRH

### Section 40

**Flight With Unreliable Airspeed / Turbulent Air Penetration**  
**Altitude and/or vertical speed indications may also be unreliable.**

Climb

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)				
		150	200	250	300	350
40000 (.82M)	PITCH ATT	5.0	4.5			
	V/S (FT/MIN)	2500	1500			
30000 (280 KIAS)	PITCH ATT	6.5	5.5	5.5	5.0	4.5
	V/S (FT/MIN)	3700	2600	1800	1300	900
20000 (270 KIAS)	PITCH ATT	9.5	8.5	8.0	7.5	7.5
	V/S (FT/MIN)	5000	3600	2700	2000	1400
10000 (270 KIAS)	PITCH ATT	14.0	11.5	10.0	9.5	9.5
	V/S (FT/MIN)	6700	4900	3700	2900	2200
SEA LEVEL (270 KIAS)	PITCH ATT	17.5	14.5	12.5	11.5	11.0
	V/S (FT/MIN)	7800	5700	4400	3500	2800

Cruise

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)				
		150	200	250	300	350
40000 (.82M)	PITCH ATT	2.0	3.0			
	%N1	78.6	83.2			
35000 (.82M)	PITCH ATT	1.5	2.0	3.0	3.5	
	%N1	76.5	78.9	82.8	88.0	
30000 (280 KIAS)	PITCH ATT	1.5	2.5	3.0	3.5	3.5
	%N1	72.6	74.7	78.1	82.4	87.3
25000 (280 KIAS)	PITCH ATT	1.5	2.5	3.5	4.0	4.0
	%N1	68.6	70.7	73.8	77.7	82.3
20000 (270 KIAS)	PITCH ATT	2.0	2.5	3.5	4.5	5.5
	%N1	63.4	65.8	69.0	72.8	77.4
15000 (270 KIAS)	PITCH ATT	1.5	2.5	3.5	4.5	5.5
	%N1	59.6	61.8	65.0	68.2	72.5

Descent

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)				
		150	200	250	300	350
40000 (.82M)	PITCH ATT	-1.5	0.0			
	V/S (FT/MIN)	-2900	-2600			
30000 (280 KIAS)	PITCH ATT	-1.5	-0.5	0.5	1.0	0.5
	V/S (FT/MIN)	-2500	-2000	-1900	-1900	-2400
20000 (270 KIAS)	PITCH ATT	-1.0	0.5	1.5	2.5	3.0
	V/S (FT/MIN)	-1900	-1600	-1500	-1400	-1400
10000 (270 KIAS)	PITCH ATT	-1.5	0.0	1.0	2.0	3.0
	V/S (FT/MIN)	-1700	-1400	-1300	-1300	-1300
SEA LEVEL (270 KIAS)	PITCH ATT	-2.0	-0.5	1.0	2.0	3.0
	V/S (FT/MIN)	-1500	-1300	-1200	-1200	-1200

In shaded areas, data reflects the minimum speed limitation of 15 knots above minimum maneuvering speed.

**Flight With Unreliable Airspeed / Turbulent Air Penetration**  
**Altitude and/or vertical speed indications may also be unreliable.**
**Holding****Flaps Up, Set Thrust for Level Flight**

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		150	200	250	300	350
10000	PITCH ATT	<b>3.0</b>	<b>4.5</b>	<b>5.5</b>	<b>6.0</b>	<b>6.0</b>
	%N1	50.2	54.4	59.1	63.9	68.2
	KIAS	216	216	226	244	262
5000	PITCH ATT	<b>3.0</b>	<b>4.5</b>	<b>5.5</b>	<b>6.0</b>	<b>6.0</b>
	%N1	46.6	50.9	55.4	59.7	64.2
	KIAS	216	216	226	244	262

**Terminal Area (5000 FT)****%N1 for Level Flight**

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		150	200	250	300	350
FLAPS UP GEAR UP (VREF 30 + 80)	PITCH ATT	<b>3.5</b>	<b>5.0</b>	<b>6.0</b>	<b>6.5</b>	<b>6.5</b>
	%N1	47.7	52.3	57.2	61.9	66.4
	KIAS	217	217	225	243	263
FLAPS 1 GEAR UP (VREF 30 + 60)	PITCH ATT	<b>5.0</b>	<b>6.5</b>	<b>8.0</b>	<b>8.0</b>	<b>8.0</b>
	%N1	48.5	53.4	58.8	63.9	68.2
	KIAS	197	197	205	223	243
FLAPS 5 GEAR UP (VREF 30 + 40)	PITCH ATT	<b>3.5</b>	<b>5.5</b>	<b>7.0</b>	<b>7.0</b>	<b>6.5</b>
	%N1	48.8	54.0	59.7	64.7	69.0
	KIAS	177	177	185	203	223
FLAPS 15 GEAR UP (VREF 30 + 20)	PITCH ATT	<b>3.5</b>	<b>6.5</b>	<b>8.0</b>	<b>7.5</b>	<b>7.0</b>
	%N1	49.0	55.2	61.9	66.8	71.2
	KIAS	157	157	165	183	203
FLAPS 20 GEAR DOWN (VREF 30 + 20)	PITCH ATT	<b>2.0</b>	<b>4.5</b>	<b>6.5</b>	<b>6.0</b>	<b>5.5</b>
	%N1	56.2	61.4	67.3	73.1	78.1
	KIAS	157	157	165	183	203

**Final Approach (1500 FT)****Gear Down, %N1 for 3° Glideslope**

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		150	200	250	300	350
FLAPS 20 (VREF 20 + 10)	PITCH ATT	<b>0.0</b>	<b>2.0</b>	<b>2.0</b>	<b>2.5</b>	<b>2.5</b>
	%N1	36.8	40.7	45.1	49.3	52.6
	KIAS	147	155	172	187	201
FLAPS 25 (VREF 25 + 10)	PITCH ATT	<b>1.0</b>	<b>2.0</b>	<b>2.0</b>	<b>2.5</b>	<b>2.5</b>
	%N1	51.5	49.8	54.7	59.2	63.3
	KIAS	147	147	163	178	191
FLAPS 30 (VREF 30 + 10)	PITCH ATT	<b>0.0</b>	<b>1.0</b>	<b>2.0</b>	<b>1.5</b>	
	%N1	56.9	55.6	60.2	65.3	
	KIAS	147	147	155	172	

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**Max Climb %N1****Based on engine bleed for packs on or off and anti-ice off**

TAT (°C)	PRESSURE ALTITUDE (1000 FT) / SPEED (KIAS OR MACH)									
	0	5	10	15	20	25	30	35	40	43
	310	310	310	310	310	310	310	.84	.84	.84
60	88.3	88.1	90.3	91.0	93.1	96.7	99.6	101.7	101.8	101.3
50	90.6	90.4	90.2	89.6	91.7	95.3	98.0	100.1	100.2	99.7
40	92.5	92.4	92.4	92.2	90.5	93.8	96.5	98.6	98.7	98.2
30	91.6	94.1	94.2	94.0	93.1	94.2	95.2	97.0	97.1	96.6
20	90.1	92.5	95.1	95.8	95.9	95.9	96.9	95.9	95.5	95.0
15	89.3	91.7	94.3	96.9	96.9	96.9	97.8	96.6	95.8	95.4
10	88.6	90.9	93.5	96.1	98.4	98.1	98.8	97.2	96.5	96.0
5	87.8	90.1	92.7	95.2	98.1	99.6	100.1	98.1	97.2	96.8
0	87.0	89.3	91.8	94.4	97.3	99.9	101.5	99.3	98.1	97.6
-5	86.2	88.5	91.0	93.5	96.4	99.0	101.9	100.5	99.5	98.8
-10	85.4	87.7	90.1	92.6	95.5	98.1	100.9	101.3	100.5	100.0
-15	84.6	86.8	89.3	91.7	94.5	97.1	100.0	101.0	100.9	100.5
-20	83.7	86.0	88.4	90.8	93.6	96.2	99.0	100.1	99.9	99.5
-25	82.9	85.1	87.5	89.9	92.7	95.2	98.0	99.1	98.9	98.5
-30	82.1	84.3	86.7	89.0	91.8	94.3	97.0	98.1	97.9	97.5
-35	81.2	83.4	85.8	88.1	90.8	93.3	96.0	97.0	96.9	96.5
-40	80.4	82.5	84.9	87.2	89.8	92.3	95.0	96.0	95.9	95.5

**%N1 Adjustments for Engine Bleed**

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (1000 FT)									
	0	5	10	15	20	25	30	35	40	43
2 PACKS ON - 1 BLEED SOURCE	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4	-0.4	-0.5
1 PACK ON - 1 OR 2 BLEED SOURCES	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4	-0.4	-0.5
ENGINE ANTI-ICE ON	-0.3	-0.5	-0.4	-0.3	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2
ENGINE AND WING ANTI-ICE ON*	-0.6	-0.8	-0.7	-0.5	-0.2	-0.3	-0.3	-0.4	-0.4	-0.4
ENGINE AND WING ANTI-ICE ON**	-1.1	-0.9	-0.9	-0.6	-0.3	-0.4	-0.5	-0.5	-0.6	-0.6

\*Packs on or packs off with 2 bleed sources.

\*\*Packs off with 1 bleed source.

**VREF****Flaps 30**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
360	186	186	186	186	187	187
340	180	180	180	180	180	180
320	173	173	173	173	173	173
300	164	164	164	164	164	165
280	158	158	158	158	158	158
260	149	149	149	150	150	150
240	143	144	144	144	144	144
220	137	137	138	138	138	138
200	137	134	131	131	131	131
180	137	134	130	126	124	124
160	137	134	130	126	121	117

**Flaps 25**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
360	185	185	185	185	185	185
340	180	180	180	180	181	181
320	175	175	175	175	175	176
300	169	170	170	170	170	170
280	164	164	164	164	164	164
260	158	158	158	158	158	158
240	152	152	152	152	152	152
220	145	145	146	146	146	146
200	139	139	139	139	139	139
180	137	134	131	131	131	132
160	137	134	130	126	124	124

**Flaps 20**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
360	195	195	195	196	196	198
340	190	190	190	191	191	192
320	185	185	185	185	185	186
300	179	179	179	179	180	180
280	173	173	173	173	174	174
260	167	167	167	167	167	167
240	160	160	161	161	161	161
220	154	154	154	154	154	154
200	147	147	147	147	147	147
180	139	139	139	139	139	139
160	137	134	131	131	131	131

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**Advisory Information**

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**ADVISORY INFORMATION**

**Normal Configuration Landing Distance**

**Flaps 30**

	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT 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	260000 KG LANDING WT	PER 5000 KG ABOVE / BELOW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD / TAIL WIND	DOWN / UP HILL	ABOVE / BELOW ISA	PER 5 KTS ABOVE VREF30	ONE REV NO REV

**Dry Runway**

MAX MANUAL	990	+25/-5	20	-40/+130	+10/-10	+20/-20	35	20	45
AUTOBRAKE MAX	1335	+25/-5	35	-55/+190	0/0	+35/-35	65	0	0
AUTOBRAKE 4	1740	+40/-5	45	-80/+270	0/0	+45/-50	95	0	0
AUTOBRAKE 3	2065	+45/-15	60	-100/+335	0/-5	+60/-60	115	0	0
AUTOBRAKE 2	2315	+50/-25	70	-115/+390	+20/-50	+65/-65	90	45	45
AUTOBRAKE 1	2530	+60/-30	85	-130/+455	+75/-80	+75/-75	90	245	285

**Good Reported Braking Action**

MAX MANUAL	1620	+35/-10	45	-75/+265	+40/-35	+40/-40	65	100	230
AUTOBRAKE MAX	1680	+35/-10	45	-80/+270	+35/-30	+40/-40	70	105	245
AUTOBRAKE 4	2010	+45/-5	60	-90/+315	+10/-5	+60/-60	110	5	40
AUTOBRAKE 3	2375	+50/-15	70	-115/+385	0/-5	+70/-70	130	0	0
AUTOBRAKE 2	2660	+60/-30	80	-130/+450	+25/-60	+75/-75	105	50	50
AUTOBRAKE 1	2910	+70/-35	100	-150/+525	+85/-90	+85/-85	105	280	330

**Medium Reported Braking Action**

MAX MANUAL	2195	+45/-25	70	-120/+430	+100/-80	+60/-60	80	265	690
AUTOBRAKE MAX	2200	+45/-25	70	-120/+430	+105/-80	+60/-60	80	265	690
AUTOBRAKE 4	2260	+50/-10	70	-120/+435	+85/-50	+65/-65	110	255	690
AUTOBRAKE 3	2505	+60/-15	75	-130/+470	+50/-40	+75/-75	130	115	475
AUTOBRAKE 2	2730	+60/-30	85	-145/+500	+70/-80	+75/-80	105	115	350
AUTOBRAKE 1	2920	+70/-35	100	-155/+535	+115/-100	+85/-85	105	305	455

**Poor Reported Braking Action**

MAX MANUAL	2825	+65/-35	100	-180/+665	+230/-155	+80/-80	90	550	1650
AUTOBRAKE MAX	2835	+65/-35	105	-180/+665	+230/-155	+80/-80	90	560	1655
AUTOBRAKE 4	2835	+65/-30	105	-180/+665	+230/-150	+80/-80	100	560	1655
AUTOBRAKE 3	2900	+70/-30	100	-180/+680	+200/-120	+85/-85	125	520	1620
AUTOBRAKE 2	3040	+70/-35	105	-185/+690	+195/-150	+85/-85	105	425	1505
AUTOBRAKE 1	3150	+75/-40	110	-190/-715	+225/-160	+90/-90	105	525	1430

Reference distance is for sea level, standard day, no wind or slope, VREF30 approach speed, 2 engine reverse thrust, and auto speedbrakes.

For Max Manual braking and manual speedbrakes, increase reference landing distance by 75 m.

For autobrake and manual speedbrakes, increase reference landing distance by 60 m.

Distances for GOOD, MEDIUM, and POOR are increased by 15%.

Includes distance from 50 ft above threshold (305 meters of unfactored air distance).

**ADVISORY INFORMATION****Normal Configuration Landing Distance**

Flaps 25

	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT 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	260000 KG LANDING WT	PER 5000 KG ABOVE / BELOW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN / UP HILL	ABOVE / BELOW ISA	PER 5 KTS ABOVE VREF25	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1045	+25/-10	25	-40/+135	+15/-10	+25/-25	35	25	50
AUTOBRAKE MAX	1445	+20/-10	35	-60/+195	0/0	+35/-35	70	0	0
AUTOBRAKE 4	1900	+30/-15	50	-85/+285	0/0	+55/-55	100	0	0
AUTOBRAKE 3	2265	+35/-25	65	-105/+350	0/-15	+65/-65	110	0	0
AUTOBRAKE 2	2510	+40/-35	80	-120/+405	+30/-60	+70/-70	90	80	80
AUTOBRAKE 1	2735	+50/-40	95	-140/+470	+85/-90	+80/-80	90	295	370

**Good Reported Braking Action**

MAX MANUAL	1725	+25/-15	45	-80/+275	+45/-40	+45/-45	65	110	265
AUTOBRAKE MAX	1800	+30/-15	50	-80/+280	+40/-30	+45/-45	75	115	280
AUTOBRAKE 4	2195	+35/-15	65	-100/+335	+10/-5	+65/-65	115	5	45
AUTOBRAKE 3	2605	+40/-30	75	-120/+400	0/-15	+75/-75	125	0	0
AUTOBRAKE 2	2885	+45/-40	90	-140/+465	+35/-70	+80/-80	105	90	90
AUTOBRAKE 1	3145	+60/-45	110	-160/+540	+100/-105	+90/-90	105	340	425

**Medium Reported Braking Action**

MAX MANUAL	2350	+40/-30	75	-120/+450	+105/-85	+65/-65	80	295	775
AUTOBRAKE MAX	2350	+40/-30	75	-125/+450	+110/-80	+65/-65	85	295	775
AUTOBRAKE 4	2450	+40/-25	75	-125/+455	+80/-50	+70/-70	115	260	755
AUTOBRAKE 3	2735	+40/-30	80	-140/+490	+50/-50	+80/-80	125	115	500
AUTOBRAKE 2	2955	+50/-40	90	-150/+520	+80/-90	+85/-85	105	155	410
AUTOBRAKE 1	3155	+60/-45	110	-160/+560	+125/-110	+90/-90	105	360	560

**Poor Reported Braking Action**

MAX MANUAL	3020	+60/-40	110	-185/+685	+235/-160	+85/-85	90	615	1855
AUTOBRAKE MAX	3030	+60/-40	110	-185/+685	+240/-165	+85/-85	90	615	1865
AUTOBRAKE 4	3030	+60/-40	110	-185/+685	+240/-155	+85/-85	105	620	1865
AUTOBRAKE 3	3140	+60/-40	110	-185/+695	+200/-130	+90/-90	125	540	1795
AUTOBRAKE 2	3275	+60/-45	115	-190/+715	+215/-160	+100/-100	105	490	1680
AUTOBRAKE 1	3390	+65/-50	120	-195/+730	+240/-175	+100/-100	105	590	1620

Reference distance is for sea level, standard day, no wind or slope, VREF25 approach speed, 2 engine reverse thrust, and auto speedbrakes.

For Max Manual braking and manual speedbrakes, increase reference landing distance by 80 m.

For autobrake and manual speedbrakes, increase reference landing distance by 65 m.

Distances for GOOD, MEDIUM, and POOR are increased by 15%.

Includes distance from 50 ft above threshold (305 meters of unfactored air distance).

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**ADVISORY INFORMATION**

**Normal Configuration Landing Distance  
Flaps 20**

	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT 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	260000 KG LANDING WT	PER 5000 KG ABOVE / BELOW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN / UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF20	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1120	+30/-10	25	-40/+140	+15/-15	+25/-25	40	25	60
AUTOBRAKE MAX	1570	+20/-20	40	-60/+205	0/0	+40/-40	75	0	0
AUTOBRAKE 4	2080	+30/-25	60	-90/+295	0/0	+60/-60	105	0	0
AUTOBRAKE 3	2480	+40/-35	70	-110/+370	0/-15	+75/-75	120	0	0
AUTOBRAKE 2	2760	+45/-45	90	-125/+425	+35/-60	+80/-80	100	95	95
AUTOBRAKE 1	3010	+55/-50	105	-145/+495	+90/-100	+90/-90	100	350	425

**Good Reported Braking Action**

MAX MANUAL	1870	+30/-25	50	-80/+290	+45/-40	+45/-45	65	130	310
AUTOBRAKE MAX	1945	+30/-25	60	-85/+295	+40/-30	+50/-50	80	140	330
AUTOBRAKE 4	2400	+35/-30	70	-105/+350	+10/0	+70/-70	120	10	50
AUTOBRAKE 3	2850	+45/-40	80	-125/+425	0/-15	+85/-85	140	0	0
AUTOBRAKE 2	3175	+50/-50	105	-145/+490	+40/-70	+90/-90	115	110	110
AUTOBRAKE 1	3460	+65/-60	120	-165/+570	+105/-115	+105/-105	115	400	490

**Medium Reported Braking Action**

MAX MANUAL	2560	+45/-40	85	-130/+465	+115/-90	+70/-70	85	345	920
AUTOBRAKE MAX	2560	+45/-40	85	-130/+465	+120/-90	+75/-75	85	345	915
AUTOBRAKE 4	2660	+45/-35	85	-130/+475	+85/-60	+75/-75	120	300	885
AUTOBRAKE 3	2990	+45/-45	90	-145/+510	+60/-50	+85/-85	140	130	590
AUTOBRAKE 2	3245	+60/-50	105	-155/+545	+85/-100	+100/-100	115	180	475
AUTOBRAKE 1	3475	+65/-60	120	-175/+585	+130/-120	+105/-105	115	430	640

**Poor Reported Braking Action**

MAX MANUAL	3300	+65/-50	120	-190/+715	+260/-180	+100/-100	100	720	2200
AUTOBRAKE MAX	3305	+65/-50	120	-190/+715	+265/-180	+100/-100	100	720	2200
AUTOBRAKE 4	3305	+65/-50	120	-190/+715	+265/-165	+100/-100	105	720	2200
AUTOBRAKE 3	3425	+65/-50	120	-195/+725	+220/-140	+105/-105	130	625	2120
AUTOBRAKE 2	3580	+65/-60	125	-200/+740	+225/-175	+110/-110	115	565	1995
AUTOBRAKE 1	3720	+70/-65	140	-205/+765	+260/-190	+110/-110	110	690	1910

Reference distance is for sea level, standard day, no wind or slope, VREF20 approach speed, 2 engine reverse thrust, and auto speedbrakes.

For Max Manual braking and manual speedbrakes, increase reference landing distance by 85 m.

For autobrake and manual speedbrakes, increase reference landing distance by 70 m.

Distances for GOOD, MEDIUM, and POOR are increased by 15%.

Includes distance from 50 ft above threshold (305 meters of unfactored air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****ANTISKID - Flaps 25**

VREF25

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	260000 KG LDG WT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	2045	+35/-25	65	-105/+390	+90/-75	+55/-55	70	255	675
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 2					Autobrake inoperative				

**Good Reported Braking Action**

MAX MANUAL	2045	+35/-25	65	-105/+390	+90/-75	+55/-55	70	255	675
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 2					Autobrake inoperative				

**Medium Reported Braking Action**

MAX MANUAL	2625	+50/-35	95	-160/+595	+205/-140	+75/-75	80	535	1615
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 3					Autobrake inoperative				

**Poor Reported Braking Action**

MAX MANUAL	3565	+75/-60	140	-265/+1110	+1265/-315	+110/-110	90	1435	5000
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 3					Autobrake inoperative				

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## ADVISORY INFORMATION

### Non-Normal Configuration Landing Distance

ANTISKID - Flaps 30

VREF30

	REF DIST	LANDING DISTANCES AND ADJUSTMENTS (M)							
		WEIGHT 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	260000 KG LDG WT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

### Dry Runway

MAX MANUAL	1910	+40/-20	60	-105/+375	+85/-70	+50/-50	70	230	600
AUTOBRAKE MAX									
Autobrake inoperative									

### Good Reported Braking Action

MAX MANUAL	1910	+40/-20	60	-105/+375	+85/-70	+50/-50	70	230	600
AUTOBRAKE MAX									
Autobrake inoperative									

### Medium Reported Braking Action

MAX MANUAL	2455	+55/-30	85	-155/+580	+200/-135	+70/-70	80	480	1435
AUTOBRAKE MAX									
Autobrake inoperative									

### Poor Reported Braking Action

MAX MANUAL	3345	+80/-45	130	-255/+1090	+1220/-305	+100/-100	90	1320	5000
AUTOBRAKE MAX									
Autobrake inoperative									

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance**

ENG SHUTDOWN L, R - Flaps 20

VREF20

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	260000 KG LDG WT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1130	+35/-10	25	-45/+145	+15/-15	+25/-25	40	0	30
AUTOBRAKE MAX	1570	+20/-20	40	-60/+205	0/0	+40/-40	75	0	0
AUTOBRAKE 2	2840	+45/-40	85	-130/+435	+5/-20	+85/-85	140	0	0

**Good Reported Braking Action**

MAX MANUAL	1700	+25/-20	50	-75/+265	+50/-45	+45/-45	60	0	150
AUTOBRAKE MAX	1775	+25/-25	50	-80/+270	+45/-40	+50/-50	70	0	160
AUTOBRAKE 2	2840	+45/-40	85	-130/+435	+5/-20	+85/-85	140	0	0

**Medium Reported Braking Action**

MAX MANUAL	2445	+40/-35	80	-125/+445	+135/-105	+70/-70	85	0	460
AUTOBRAKE MAX	2450	+40/-35	80	-125/+445	+135/-95	+70/-70	95	0	455
AUTOBRAKE 3	2675	+45/-35	85	-135/+465	+90/-60	+80/-80	125	0	345

**Poor Reported Braking Action**

MAX MANUAL	3325	+60/-55	115	-195/+710	+330/-215	+100/-100	105	0	1125
AUTOBRAKE MAX	3330	+60/-55	120	-195/+710	+335/-215	+100/-100	105	0	1130
AUTOBRAKE 3	3365	+65/-55	120	-195/+715	+320/-205	+100/-105	110	0	1140

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****ENG SHUTDOWN L, R - Flaps 30****VREF30**

	LANDING DISTANCES AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT 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	260000 KG LDG WT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	995	+30/-5	20	-40/+135	+15/-10	+20/-20	40	0	25
AUTOBRAKE MAX	1335	+25/-5	35	-55/+190	0/0	+35/-35	65	0	0
AUTOBRAKE 2	2345	+55/-15	70	-115/+390	+10/-15	+70/-70	125	0	0

**Good Reported Braking Action**

MAX MANUAL	1460	+30/-10	40	-70/+245	+40/-35	+40/-40	60	0	110
AUTOBRAKE MAX	1525	+30/-10	40	-70/+250	+40/-35	+40/-40	65	0	120
AUTOBRAKE 2	2345	+55/-15	70	-115/+390	+10/-15	+70/-70	125	0	0

**Medium Reported Braking Action**

MAX MANUAL	2070	+45/-20	65	-115/+410	+110/-85	+60/-60	80	0	340
AUTOBRAKE MAX	2070	+45/-15	65	-115/+410	+115/-80	+60/-60	85	0	340
AUTOBRAKE 3	2235	+50/-15	70	-120/+425	+80/-55	+65/-65	110	0	270

**Poor Reported Braking Action**

MAX MANUAL	2790	+65/-30	95	-175/+655	+280/-180	+85/-85	95	0	825
AUTOBRAKE MAX	2795	+65/-30	95	-175/+655	+285/-180	+85/-85	95	0	830
AUTOBRAKE 3	2830	+65/-30	95	-175/+660	+270/-180	+85/-85	95	0	840

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****FLAP / SLAT CONTROL - Flaps 20**

VREF20

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	260000 KG LDG WT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1120	+30/-10	25	-40/+140	+15/-15	+25/-25	40	25	60
AUTOBRAKE MAX	1570	+20/-20	40	-60/+205	0/0	+40/-40	75	0	0
AUTOBRAKE 2	2760	+45/-45	90	-125/+425	+35/-60	+80/-80	100	95	95

**Good Reported Braking Action**

MAX MANUAL	1625	+25/-20	45	-70/+250	+40/-35	+40/-40	55	115	270
AUTOBRAKE MAX	1690	+25/-20	50	-75/+255	+35/-25	+45/-45	70	120	285
AUTOBRAKE 2	2760	+45/-45	90	-125/+425	+35/-60	+80/-80	100	95	95

**Medium Reported Braking Action**

MAX MANUAL	2225	+40/-35	75	-115/+405	+100/-80	+60/-60	75	300	800
AUTOBRAKE MAX	2225	+40/-35	75	-115/+405	+105/-80	+65/-65	75	300	795
AUTOBRAKE 3	2600	+40/-40	80	-125/+445	+50/-45	+75/-75	120	115	515

**Poor Reported Braking Action**

MAX MANUAL	2870	+55/-45	105	-165/+620	+225/-155	+85/-85	85	625	1915
AUTOBRAKE MAX	2875	+55/-45	105	-165/+620	+230/-155	+85/-85	85	625	1915
AUTOBRAKE 3	2980	+55/-45	105	-170/+630	+190/-120	+90/-90	115	545	1845

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## ADVISORY INFORMATION

### Non-Normal Configuration Landing Distance

#### FLAPS DRIVE - (Flaps ≤ 5)

VREF30+40

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	260000 KG LDG WT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

### Dry Runway

MAX MANUAL	1300	+55/-10	45	-45/+205	+20/-15	+40/-35	55	55	130
AUTOBRAKE MAX	1910	+35/-5	50	-70/+230	0/0	+50/-50	80	0	0
AUTOBRAKE 2	3345	+70/-40	115	-140/+470	+60/-75	+100/-100	115	225	225

### Good Reported Braking Action

MAX MANUAL	1850	+30/-15	55	-75/+265	+45/-40	+50/-50	55	155	375
AUTOBRAKE MAX	1995	+35/-5	55	-80/+275	+20/-15	+55/-55	80	95	330
AUTOBRAKE 2	3345	+70/-40	115	-140/+470	+60/-75	+100/-100	115	225	225

### Medium Reported Braking Action

MAX MANUAL	2570	+50/-25	90	-120/+425	+110/-90	+75/-75	75	415	1170
AUTOBRAKE MAX	2570	+50/-25	90	-120/+425	+110/-80	+75/-75	80	410	1160
AUTOBRAKE 3	3160	+60/-30	100	-140/+485	+60/-60	+95/-95	120	150	690

### Poor Reported Braking Action

MAX MANUAL	3335	+70/-40	130	-175/+655	+245/-170	+100/-100	90	870	2925
AUTOBRAKE MAX	3335	+70/-40	130	-175/+655	+245/-170	+100/-100	90	870	2925
AUTOBRAKE 3	3530	+75/-40	130	-185/+670	+215/-140	+105/-110	120	690	2750

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****FLAPS DRIVE - (5 < Flaps < 20)****VREF30+20**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	260000 KG LDG WT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1135	+40/-5	25	-40/+145	+15/-15	+25/-25	40	30	65
AUTOBRAKE MAX	1605	+30/-5	40	-65/+210	0/0	+40/-40	75	0	0
AUTOBRAKE 2	2845	+60/-30	90	-130/+435	+35/-50	+85/-85	115	85	85

**Good Reported Braking Action**

MAX MANUAL	1660	+30/-10	50	-75/+250	+40/-35	+45/-45	60	125	305
AUTOBRAKE MAX	1715	+35/-5	50	-75/+255	+35/-25	+45/-45	70	125	315
AUTOBRAKE 2	2845	+60/-30	90	-130/+435	+35/-50	+85/-85	115	85	85

**Medium Reported Braking Action**

MAX MANUAL	2290	+50/-20	75	-115/+410	+105/-85	+65/-65	75	340	930
AUTOBRAKE MAX	2290	+50/-20	75	-115/+410	+105/-85	+65/-65	75	335	925
AUTOBRAKE 3	2665	+55/-20	80	-130/+450	+50/-45	+80/-80	125	120	625

**Poor Reported Braking Action**

MAX MANUAL	2965	+65/-35	110	-170/+630	+230/-160	+85/-85	90	710	2280
AUTOBRAKE MAX	2970	+65/-35	110	-170/+630	+235/-160	+90/-90	90	710	2285
AUTOBRAKE 3	3055	+70/-30	110	-170/+640	+210/-125	+90/-90	120	630	2205

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## ADVISORY INFORMATION

### Non-Normal Configuration Landing Distance

#### FLAPS DRIVE - (Flaps ≥ 20)

VREF20

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	260000 KG LDG WT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

#### Dry Runway

MAX MANUAL	1120	+30/-10	25	-40/+140	+15/-15	+25/-25	40	25	60
AUTOBRAKE MAX	1570	+20/-20	40	-60/+205	0/0	+40/-40	75	0	0
AUTOBRAKE 2	2760	+45/-45	90	-125/+425	+35/-60	+80/-80	100	95	95

#### Good Reported Braking Action

MAX MANUAL	1625	+25/-20	45	-70/+250	+40/-35	+40/-40	55	115	270
AUTOBRAKE MAX	1690	+25/-20	50	-75/+255	+35/-25	+45/-45	70	120	285
AUTOBRAKE 2	2760	+45/-45	90	-125/+425	+35/-60	+80/-80	100	95	95

#### Medium Reported Braking Action

MAX MANUAL	2225	+40/-35	75	-115/+405	+100/-80	+60/-60	75	300	800
AUTOBRAKE MAX	2225	+40/-35	75	-115/+405	+105/-80	+65/-65	75	300	795
AUTOBRAKE 3	2600	+40/-40	80	-125/+445	+50/-45	+75/-75	120	115	515

#### Poor Reported Braking Action

MAX MANUAL	2870	+55/-45	105	-165/+620	+225/-155	+85/-85	85	625	1915
AUTOBRAKE MAX	2875	+55/-45	105	-165/+620	+230/-155	+85/-85	85	625	1915
AUTOBRAKE 3	2980	+55/-45	105	-170/+630	+190/-120	+90/-90	115	545	1845

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****FLAPS PRIMARY FAIL - Flaps 20**

VREF20

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	260000 KG LDG WT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1280	+30/-15	30	-45/+155	+15/-15	+30/-30	50	35	80
AUTOBRAKE MAX	1570	+20/-20	40	-60/+205	0/0	+40/-40	75	0	0
AUTOBRAKE 2	2825	+45/-45	85	-130/+430	+15/-35	+85/-85	125	30	30

**Good Reported Braking Action**

MAX MANUAL	1820	+25/-25	50	-80/+270	+50/-45	+45/-45	70	140	340
AUTOBRAKE MAX	1820	+25/-25	55	-80/+270	+50/-40	+50/-50	75	140	335
AUTOBRAKE 2	2825	+45/-45	85	-130/+430	+15/-35	+85/-85	125	30	30

**Medium Reported Braking Action**

MAX MANUAL	2445	+40/-35	80	-120/+430	+115/-90	+70/-70	85	360	985
AUTOBRAKE MAX	2445	+40/-35	80	-120/+425	+120/-95	+70/-70	85	360	975
AUTOBRAKE 3	2640	+40/-35	80	-130/+450	+70/-45	+80/-80	130	180	795

**Poor Reported Braking Action**

MAX MANUAL	3110	+60/-50	115	-175/+650	+250/-170	+90/-90	100	725	2315
AUTOBRAKE MAX	3110	+60/-50	115	-175/+650	+255/-175	+90/-90	100	725	2315
AUTOBRAKE 3	3135	+60/-50	115	-175/+650	+245/-150	+95/-95	115	700	2285

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## ADVISORY INFORMATION

### Non-Normal Configuration Landing Distance

#### FLIGHT CONTROL MODE - Flaps 20

VREF20

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	260000 KG LDG WT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

#### Dry Runway

MAX MANUAL	1295	+30/-15	30	-50/+160	+20/-15	+30/-30	50	35	85
AUTOBRAKE MAX	1570	+20/-20	40	-60/+205	0/0	+40/-40	75	0	0
AUTOBRAKE 2	2845	+45/-45	85	-130/+435	+5/-30	+85/-85	135	10	10

#### Good Reported Braking Action

MAX MANUAL	1850	+30/-25	55	-80/+275	+50/-45	+50/-50	75	150	365
AUTOBRAKE MAX	1850	+30/-25	55	-80/+270	+50/-45	+50/-50	75	145	355
AUTOBRAKE 2	2845	+45/-45	85	-130/+435	+5/-30	+85/-85	135	10	10

#### Medium Reported Braking Action

MAX MANUAL	2495	+45/-35	85	-125/+435	+120/-95	+70/-70	90	385	1060
AUTOBRAKE MAX	2495	+45/-35	85	-120/+435	+125/-100	+70/-70	90	380	1050
AUTOBRAKE 3	2650	+40/-35	80	-130/+450	+80/-45	+80/-80	130	225	895

#### Poor Reported Braking Action

MAX MANUAL	3180	+60/-50	120	-180/+655	+260/-175	+95/-95	105	775	2515
AUTOBRAKE MAX	3180	+60/-50	120	-180/+655	+265/-185	+95/-95	105	775	2515
AUTOBRAKE 3	3195	+60/-50	120	-180/+660	+260/-160	+95/-95	115	760	2500

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS C - Flaps 20****VREF20**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	260000 KG LDG WT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1280	+30/-15	30	-45/+155	+15/-15	+30/-30	50	35	80
AUTOBRAKE MAX	1570	+20/-20	40	-60/+205	0/0	+40/-40	75	0	0
AUTOBRAKE 2	2825	+45/-45	85	-130/+430	+15/-35	+85/-85	125	30	30

**Good Reported Braking Action**

MAX MANUAL	1820	+25/-25	50	-80/+270	+50/-45	+45/-45	70	140	340
AUTOBRAKE MAX	1820	+25/-25	55	-80/+270	+50/-40	+50/-50	75	140	335
AUTOBRAKE 2	2825	+45/-45	85	-130/+430	+15/-35	+85/-85	125	30	30

**Medium Reported Braking Action**

MAX MANUAL	2445	+40/-35	80	-120/+430	+115/-90	+70/-70	85	360	985
AUTOBRAKE MAX	2445	+40/-35	80	-120/+425	+120/-95	+70/-70	85	360	975
AUTOBRAKE 3	2640	+40/-35	80	-130/+450	+70/-45	+80/-80	130	180	795

**Poor Reported Braking Action**

MAX MANUAL	3110	+60/-50	115	-175/+650	+250/-170	+90/-90	100	725	2315
AUTOBRAKE MAX	3110	+60/-50	115	-175/+650	+255/-175	+90/-90	100	725	2315
AUTOBRAKE 3	3135	+60/-50	115	-175/+650	+245/-150	+95/-95	115	700	2285

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## ADVISORY INFORMATION

### Non-Normal Configuration Landing Distance

HYD PRESS SYS L - Flaps 25

VREF25

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	260000 KG LDG WT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

### Dry Runway

MAX MANUAL	1125	+25/-10	25	-45/+150	+15/-15	+25/-25	45	0	35
AUTOBRAKE MAX	1445	+20/-10	35	-60/+195	0/0	+35/-35	70	0	0
AUTOBRAKE 2	2595	+40/-25	75	-125/+415	0/0	+75/-75	145	0	0

### Good Reported Braking Action

MAX MANUAL	1700	+25/-15	50	-80/+270	+55/-45	+45/-45	70	0	160
AUTOBRAKE MAX	1740	+25/-15	50	-80/+275	+50/-40	+45/-45	75	0	165
AUTOBRAKE 2	2595	+40/-25	75	-125/+415	0/0	+75/-75	145	0	0

### Medium Reported Braking Action

MAX MANUAL	2460	+40/-30	80	-130/+465	+150/-115	+70/-70	90	0	510
AUTOBRAKE MAX	2465	+40/-30	80	-130/+465	+155/-115	+70/-70	95	0	510
AUTOBRAKE 3	2530	+40/-25	80	-135/+470	+130/-70	+75/-75	125	0	500

### Poor Reported Braking Action

MAX MANUAL	3395	+60/-45	120	-210/+780	+400/-245	+105/-105	110	0	1310
AUTOBRAKE MAX	3405	+60/-45	125	-210/+780	+405/-245	+105/-105	110	0	1310
AUTOBRAKE 3	3405	+60/-45	125	-210/+780	+405/-235	+105/-105	120	0	1310

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS L - Flaps 30****VREF30**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	260000 KG LDG WT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1060	+30/-5	25	-40/+145	+15/-15	+25/-25	45	0	30
AUTOBRAKE MAX	1335	+25/-5	35	-55/+190	0/0	+35/-35	65	0	0
AUTOBRAKE 2	2360	+55/-10	70	-115/+395	0/0	+70/-70	140	0	0

**Good Reported Braking Action**

MAX MANUAL	1595	+30/-10	45	-75/+265	+50/-45	+40/-40	70	0	145
AUTOBRAKE MAX	1620	+35/-10	45	-75/+265	+45/-40	+45/-45	75	0	145
AUTOBRAKE 2	2360	+55/-10	70	-115/+395	0/0	+70/-70	140	0	0

**Medium Reported Braking Action**

MAX MANUAL	2305	+50/-20	75	-125/+455	+145/-110	+65/-65	90	0	460
AUTOBRAKE MAX	2305	+50/-20	75	-125/+455	+145/-110	+65/-65	95	0	460
AUTOBRAKE 3	2345	+55/-15	75	-130/+455	+135/-75	+70/-70	110	0	465

**Poor Reported Braking Action**

MAX MANUAL	3185	+70/-35	115	-200/+760	+385/-230	+95/-95	110	0	1190
AUTOBRAKE MAX	3195	+70/-35	115	-200/+760	+390/-235	+95/-95	110	0	1195
AUTOBRAKE 3	3195	+70/-35	115	-200/+760	+390/-230	+95/-95	110	0	1195

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS L+C - Flaps 20****VREF30+20**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	260000 KG LDG WT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1420	+40/-5	35	-50/+175	+25/-20	+35/-35	65	0	55
AUTOBRAKE MAX	1605	+30/-5	40	-65/+210	0/0	+40/-40	75	0	0
AUTOBRAKE 2	2930	+60/-10	85	-130/+440	0/0	+90/-90	155	0	0

**Good Reported Braking Action**

MAX MANUAL	2125	+40/-10	60	-90/+310	+75/-65	+60/-60	90	0	255
AUTOBRAKE MAX	2125	+40/-10	60	-90/+305	+80/-60	+60/-60	95	0	245
AUTOBRAKE 2	2930	+60/-10	85	-130/+440	0/0	+90/-90	155	0	0

**Medium Reported Braking Action**

MAX MANUAL	3040	+65/-25	100	-150/+525	+195/-150	+90/-90	120	0	770
AUTOBRAKE MAX	3040	+65/-25	100	-150/+520	+205/-155	+90/-90	120	0	760
AUTOBRAKE 3	3040	+65/-20	100	-150/+520	+205/-140	+90/-90	125	0	765

**Poor Reported Braking Action**

MAX MANUAL	4140	+90/-45	155	-235/+860	+500/-305	+125/-125	140	0	1920
AUTOBRAKE MAX	4140	+90/-45	155	-235/+860	+515/-315	+130/-130	140	0	1915
AUTOBRAKE 3	4140	+90/-45	155	-235/+860	+515/-315	+130/-130	140	0	1915

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS L+R - Flaps 20****VREF30+20**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	260000 KG LDG WT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1530	+40/-5	40	-60/+205	+35/-30	+40/-40	70	0	0
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 2					Autobrake inoperative				

**Good Reported Braking Action**

MAX MANUAL	2545	+50/-10	75	-120/+400	+135/-110	+75/-75	115	0	0
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 2					Autobrake inoperative				

**Medium Reported Braking Action**

MAX MANUAL	4095	+75/-20	125	-215/+745	+470/-305	+130/-130	160	0	0
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 3					Autobrake inoperative				

**Poor Reported Braking Action**

MAX MANUAL	6545	+110/-35	210	-400/+1475	+2250/-810	+210/-210	200	0	0
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 3					Autobrake inoperative				

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## ADVISORY INFORMATION

### Non-Normal Configuration Landing Distance

HYD PRESS SYS R - Flaps 25

VREF25

LANDING DISTANCES AND ADJUSTMENTS (M)									
	REF DIST	WEIGHT 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	260000 KG LDG WT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

### Dry Runway

MAX MANUAL	1245	+20/-10	30	-50/+170	+25/-20	+30/-30	50	0	50
AUTOBRAKE MAX Autobrake inoperative									
AUTOBRAKE 2 Autobrake inoperative									

### Good Reported Braking Action

MAX MANUAL	1870	+30/-20	55	-90/+310	+70/-60	+50/-50	75	0	220
AUTOBRAKE MAX Autobrake inoperative									
AUTOBRAKE 2 Autobrake inoperative									

### Medium Reported Braking Action

MAX MANUAL	2660	+45/-30	90	-145/+525	+185/-135	+80/-80	95	0	640
AUTOBRAKE MAX Autobrake inoperative									
AUTOBRAKE 3 Autobrake inoperative									

### Poor Reported Braking Action

MAX MANUAL	3595	+65/-50	130	-230/+875	+515/-280	+110/-110	110	0	1565
AUTOBRAKE MAX Autobrake inoperative									
AUTOBRAKE 3 Autobrake inoperative									

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****HYD PRESS SYS R - Flaps 30****VREF30**

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	260000 KG LDG WT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1165	+20/-5	30	-50/+165	+20/-20	+30/-30	50	0	45
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 2					Autobrake inoperative				

**Good Reported Braking Action**

MAX MANUAL	1730	+35/-10	50	-85/+300	+65/-55	+45/-45	75	0	190
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 2					Autobrake inoperative				

**Medium Reported Braking Action**

MAX MANUAL	2440	+55/-20	80	-140/+505	+170/-125	+70/-70	90	0	545
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 3					Autobrake inoperative				

**Poor Reported Braking Action**

MAX MANUAL	3295	+70/-35	120	-220/+845	+480/-260	+100/-100	105	0	1330
AUTOBRAKE MAX					Autobrake inoperative				
AUTOBRAKE 3					Autobrake inoperative				

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## ADVISORY INFORMATION

### Non-Normal Configuration Landing Distance

HYD PRESS SYS R+C - Flaps 20

VREF30+20

	LANDING DISTANCES AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT 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	260000 KG LDG WT	PER 5000 KG ABV/BLW	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

### Dry Runway

MAX MANUAL	1755	+30/-5	50	-70/+235	+45/-40	+45/-45	80	0	130
AUTOBRAKE MAX Autobrake inoperative									
AUTOBRAKE 2 Autobrake inoperative									

### Good Reported Braking Action

MAX MANUAL	2605	+55/-15	80	-120/+410	+130/-105	+75/-75	110	0	480
AUTOBRAKE MAX Autobrake inoperative									
AUTOBRAKE 2 Autobrake inoperative									

### Medium Reported Braking Action

MAX MANUAL	3625	+80/-35	130	-190/+680	+325/-225	+110/-110	135	0	1295
AUTOBRAKE MAX Autobrake inoperative									
AUTOBRAKE 3 Autobrake inoperative									

### Poor Reported Braking Action

MAX MANUAL	4795	+105/-55	185	-295/+1110	+915/-430	+150/-150	150	0	3035
AUTOBRAKE MAX Autobrake inoperative									
AUTOBRAKE 3 Autobrake inoperative									

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****PITCH UP AUTHORITY - (Flaps ≤ 15)**

VREF30+40

	LANDING DISTANCES AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT 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	260000 KG LDG WT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1290	+50/-5	35	-45/+175	+15/-15	+30/-30	40	40	85
AUTOBRAKE MAX	1910	+35/-5	50	-70/+230	0/0	+50/-50	80	0	0
AUTOBRAKE 2	3265	+65/-40	110	-140/+460	+70/-85	+95/-95	100	280	290

**Good Reported Braking Action**

MAX MANUAL	1880	+35/-15	55	-80/+265	+45/-40	+50/-50	60	150	365
AUTOBRAKE MAX	2010	+35/-10	55	-80/+280	+25/-20	+55/-55	80	110	335
AUTOBRAKE 2	3265	+65/-40	110	-140/+460	+70/-85	+95/-95	100	280	290

**Medium Reported Braking Action**

MAX MANUAL	2570	+50/-25	85	-120/+430	+110/-90	+75/-75	75	385	1050
AUTOBRAKE MAX	2580	+50/-25	90	-120/+430	+105/-85	+75/-75	80	385	1050
AUTOBRAKE 3	3135	+60/-30	100	-140/+485	+75/-75	+95/-95	105	185	640

**Poor Reported Braking Action**

MAX MANUAL	3285	+70/-40	125	-175/+650	+240/-165	+100/-100	85	775	2450
AUTOBRAKE MAX	3290	+70/-40	125	-175/+650	+240/-170	+100/-100	85	775	2450
AUTOBRAKE 3	3505	+75/-40	125	-180/+670	+210/-155	+105/-105	105	620	2295

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

777 Flight Crew Operations Manual

**ADVISORY INFORMATION**

**Non-Normal Configuration Landing Distance**

**PITCH UP AUTHORITY - (Flaps ≥ 20)**

VREF30+20

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	260000 KG LDG WT	PER 5000 KG ABV/BLW	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1145	+40/-5	25	-45/+145	+15/-15	+25/-25	40	30	65
AUTOBRAKE MAX	1605	+30/-5	40	-65/+210	0/0	+40/-40	75	0	0
AUTOBRAKE 2	2805	+60/-30	90	-130/+430	+40/-65	+80/-80	95	120	120

**Good Reported Braking Action**

MAX MANUAL	1660	+30/-10	45	-75/+250	+45/-35	+45/-45	55	115	280
AUTOBRAKE MAX	1725	+35/-5	50	-75/+260	+40/-25	+45/-45	75	120	295
AUTOBRAKE 2	2805	+60/-30	90	-130/+430	+40/-65	+80/-80	95	120	120

**Medium Reported Braking Action**

MAX MANUAL	2265	+45/-20	75	-115/+405	+100/-80	+65/-65	75	310	815
AUTOBRAKE MAX	2265	+50/-20	75	-115/+405	+105/-75	+65/-65	80	305	815
AUTOBRAKE 3	2660	+55/-25	80	-130/+450	+55/-55	+80/-80	115	120	520

**Poor Reported Braking Action**

MAX MANUAL	2905	+65/-35	105	-165/+620	+225/-155	+85/-85	85	630	1925
AUTOBRAKE MAX	2910	+65/-35	105	-165/+625	+230/-155	+85/-85	85	630	1930
AUTOBRAKE 3	3035	+65/-35	105	-170/+635	+190/-130	+90/-90	110	540	1845

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****PRIMARY FLIGHT COMPUTERS - Flaps 20**

VREF20

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	260000 KG LDG WT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1295	+30/-15	30	-50/+160	+20/-15	+30/-30	50	35	85
AUTOBRAKE MAX	1570	+20/-20	40	-60/+205	0/0	+40/-40	75	0	0
AUTOBRAKE 2	2845	+45/-45	85	-130/+435	+5/-30	+85/-85	135	10	10

**Good Reported Braking Action**

MAX MANUAL	1850	+30/-25	55	-80/+275	+50/-45	+50/-50	75	150	365
AUTOBRAKE MAX	1850	+30/-25	55	-80/+270	+50/-45	+50/-50	75	145	355
AUTOBRAKE 2	2845	+45/-45	85	-130/+435	+5/-30	+85/-85	135	10	10

**Medium Reported Braking Action**

MAX MANUAL	2495	+45/-35	85	-125/+435	+120/-95	+70/-70	90	385	1060
AUTOBRAKE MAX	2495	+45/-35	85	-120/+435	+125/-100	+70/-70	90	380	1050
AUTOBRAKE 3	2650	+40/-35	80	-130/+450	+80/-45	+80/-80	130	225	895

**Poor Reported Braking Action**

MAX MANUAL	3180	+60/-50	120	-180/+655	+260/-175	+95/-95	105	775	2515
AUTOBRAKE MAX	3180	+60/-50	120	-180/+655	+265/-185	+95/-95	105	775	2515
AUTOBRAKE 3	3195	+60/-50	120	-180/+660	+260/-160	+95/-95	115	760	2500

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

777 Flight Crew Operations Manual

**ADVISORY INFORMATION**

**Non-Normal Configuration Landing Distance**

**SLATS DRIVE - Flaps 20**

VREF30+30

LANDING DISTANCES AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT 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	260000 KG LDG WT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1230	+45/-5	30	-45/+150	+15/-15	+30/-30	40	35	75
AUTOBRAKE MAX	1750	+30/-5	45	-65/+220	0/0	+45/-45	80	0	0
AUTOBRAKE 2	3030	+60/-35	100	-135/+445	+60/-75	+90/-90	95	190	190

**Good Reported Braking Action**

MAX MANUAL	1785	+30/-15	50	-75/+260	+45/-40	+50/-50	60	135	320
AUTOBRAKE MAX	1875	+35/-5	55	-80/+270	+35/-20	+50/-50	80	130	325
AUTOBRAKE 2	3030	+60/-35	100	-135/+445	+60/-75	+90/-90	95	190	190

**Medium Reported Braking Action**

MAX MANUAL	2430	+50/-25	80	-120/+420	+110/-85	+70/-70	75	340	905
AUTOBRAKE MAX	2440	+50/-25	80	-120/+420	+110/-80	+70/-70	80	340	905
AUTOBRAKE 3	2905	+55/-30	90	-135/+470	+65/-70	+85/-85	105	150	565

**Poor Reported Braking Action**

MAX MANUAL	3110	+65/-40	115	-170/+640	+235/-160	+90/-90	85	685	2100
AUTOBRAKE MAX	3115	+65/-40	115	-170/+640	+240/-165	+95/-95	85	690	2100
AUTOBRAKE 3	3280	+70/-40	115	-175/+655	+200/-150	+100/-100	105	565	1990

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****STABILIZER - Flaps 20****VREF30+20**

	LANDING DISTANCES AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT 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	260000 KG LDG WT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

**Dry Runway**

MAX MANUAL	1145	+40/-5	25	-45/+145	+15/-15	+25/-25	40	30	65
AUTOBRAKE MAX	1605	+30/-5	40	-65/+210	0/0	+40/-40	75	0	0
AUTOBRAKE 2	2805	+60/-30	90	-130/+430	+40/-65	+80/-80	95	120	120

**Good Reported Braking Action**

MAX MANUAL	1660	+30/-10	45	-75/+250	+45/-35	+45/-45	55	115	280
AUTOBRAKE MAX	1725	+35/-5	50	-75/+260	+40/-25	+45/-45	75	120	295
AUTOBRAKE 2	2805	+60/-30	90	-130/+430	+40/-65	+80/-80	95	120	120

**Medium Reported Braking Action**

MAX MANUAL	2265	+45/-20	75	-115/+405	+100/-80	+65/-65	75	310	815
AUTOBRAKE MAX	2265	+50/-20	75	-115/+405	+105/-75	+65/-65	80	305	815
AUTOBRAKE 3	2660	+55/-25	80	-130/+450	+55/-55	+80/-80	115	120	520

**Poor Reported Braking Action**

MAX MANUAL	2905	+65/-35	105	-165/+620	+225/-155	+85/-85	85	630	1925
AUTOBRAKE MAX	2910	+65/-35	105	-165/+625	+230/-155	+85/-85	85	630	1930
AUTOBRAKE 3	3035	+65/-35	105	-170/+635	+190/-130	+90/-90	110	540	1845

Reference distance is for sea level, standard day, no wind or slope, and maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Recommended Brake Cooling Schedule**  
**Reference Brake Energy (Millions of Foot Pounds)**

WEIGHT (1000 KG)	OAT (°C)	BRAKES ON SPEED (KIAS)																	
		80		100		120		140		160		180							
		PRESSURE ALTITUDE (1000 FT)																	
360	0	23.3	25.7	28.3	33.8	37.7	41.9	46.1	51.6	57.8	59.8	67.3	75.6	74.5	84.0	94.5	89.8	101.1	113.6
	10	23.9	26.4	29.2	34.8	38.8	43.2	47.5	53.2	59.6	61.7	69.4	78.0	76.9	86.6	97.4	92.6	104.1	116.9
	15	24.4	26.9	29.7	35.5	39.5	44.0	48.4	54.2	60.7	62.8	70.6	79.4	78.3	88.1	99.1	94.2	105.9	118.8
	20	24.8	27.4	30.2	36.1	40.2	44.8	49.2	55.2	61.8	63.9	71.9	80.8	79.6	89.6	100.8	95.8	107.6	120.6
	30	25.5	28.1	31.0	37.1	41.3	46.1	50.6	56.7	63.6	65.8	74.0	83.1	81.9	92.2	103.6	98.5	110.6	123.9
	40	25.7	28.4	31.4	37.7	42.0	46.8	51.5	57.8	64.8	67.1	75.5	84.9	83.7	94.2	105.8	100.7	113.0	126.4
340	0	22.2	24.5	27.0	32.3	35.9	39.9	43.9	49.1	55.0	56.9	64.0	71.9	71.0	79.9	90.0	85.6	96.4	108.4
	10	22.9	25.2	27.8	32.3	37.0	41.1	45.2	50.6	56.7	58.7	66.0	74.2	73.2	82.4	92.8	88.3	99.3	111.6
	15	23.3	25.7	28.3	33.9	37.7	41.9	46.1	51.6	57.7	59.8	67.2	75.5	74.5	83.9	94.4	89.8	101.0	113.4
	20	23.7	26.2	28.8	34.5	38.4	42.7	46.9	52.5	58.8	60.8	68.4	76.8	75.8	85.4	96.0	91.3	102.7	115.3
	30	24.3	26.8	29.6	35.4	39.4	43.9	48.2	54.0	60.5	62.6	70.3	79.0	78.0	87.8	98.7	94.0	105.6	118.4
	40	24.6	27.1	30.0	35.9	40.0	44.6	49.0	55.0	61.6	63.8	71.8	80.7	79.7	89.7	100.8	96.0	107.9	120.9
320	0	21.2	23.4	25.7	30.7	34.2	37.9	41.7	46.6	52.2	54.0	60.7	68.1	67.3	75.8	85.3	81.3	91.5	103.0
	10	21.8	24.0	26.5	31.6	35.2	39.1	43.0	48.1	53.8	55.7	62.6	70.3	69.5	78.2	88.0	83.8	94.4	106.1
	15	22.2	24.5	27.0	32.2	35.8	39.8	43.8	49.0	54.8	56.7	63.7	71.5	70.7	79.6	89.5	85.3	96.0	107.9
	20	22.6	24.9	27.5	32.8	36.5	40.5	44.6	49.8	55.7	57.7	64.8	72.8	72.0	81.0	91.1	86.8	97.6	109.7
	30	23.2	25.6	28.2	33.7	37.5	41.6	45.8	51.2	57.3	59.4	66.7	74.9	74.0	83.3	93.7	89.3	100.4	112.7
	40	23.4	25.8	28.5	34.2	38.0	42.3	46.6	52.2	58.4	60.5	68.0	76.5	75.6	85.1	95.7	91.2	102.6	115.1
300	0	20.2	22.2	24.5	29.2	32.4	36.0	39.5	44.1	49.3	51.1	57.3	64.3	63.7	71.6	80.6	76.8	86.6	97.5
	10	20.8	22.9	25.1	30.0	33.4	37.0	40.7	45.5	50.8	52.7	59.1	66.4	65.7	73.9	83.1	79.3	89.3	100.4
	15	21.2	23.3	25.6	30.6	34.0	37.7	41.5	46.3	51.8	53.6	60.2	67.6	66.8	75.2	84.6	80.7	90.8	102.1
	20	21.6	23.7	26.1	31.2	34.6	38.4	42.2	47.2	52.7	54.6	61.3	68.8	68.0	76.5	86.1	82.1	92.4	103.8
	30	22.1	24.3	26.8	32.0	35.5	39.4	43.4	48.5	54.2	56.1	63.0	70.7	70.0	78.8	88.5	84.4	95.0	106.7
	40	22.3	24.6	27.1	32.4	36.0	40.1	44.1	49.3	55.2	57.2	64.3	72.2	71.4	80.4	90.5	86.3	97.1	109.0
260	0	18.2	20.0	21.9	28.9	32.0	35.1	39.1	43.6	45.2	50.6	56.6	56.1	63.1	70.9	67.7	76.2	85.8	
	10	18.7	20.6	22.5	26.9	29.7	32.9	36.2	40.3	44.9	46.5	52.1	58.4	57.9	65.1	73.1	69.8	78.6	88.5
	15	19.1	20.9	23.0	27.4	30.3	33.6	36.8	41.1	45.8	47.4	53.1	59.5	58.9	66.2	74.4	71.1	80.0	90.0
	20	19.4	21.3	23.4	27.9	30.9	34.2	37.5	41.8	46.6	48.3	54.1	60.6	60.0	67.4	75.7	72.4	81.4	91.6
	30	19.9	21.9	24.0	28.6	31.7	35.1	38.5	43.0	47.9	49.6	55.6	62.3	61.7	69.4	77.9	74.4	83.8	94.2
	40	20.1	22.1	24.2	28.9	32.1	35.6	39.1	43.7	48.7	50.5	56.6	63.5	62.9	70.8	79.6	76.0	85.6	96.2
220	0	16.3	17.8	19.5	23.1	25.4	28.1	30.7	34.1	37.9	39.2	43.7	48.9	48.4	54.2	60.8	58.2	65.4	73.5
	10	16.7	18.3	20.0	23.7	26.2	28.9	31.6	35.1	39.0	40.3	45.1	50.4	49.9	55.9	62.7	60.0	67.4	75.8
	15	17.1	18.7	20.4	24.2	26.7	29.4	32.2	35.8	39.8	41.1	45.9	51.3	50.8	57.0	63.9	61.1	68.7	77.2
	20	17.4	19.0	20.8	24.6	27.1	30.0	32.8	36.4	40.5	41.8	46.7	52.2	51.7	58.0	65.0	62.2	69.9	78.5
	30	17.8	19.5	21.3	25.2	27.8	30.7	33.7	37.4	41.6	43.0	48.1	53.7	53.2	59.6	66.9	63.9	71.9	80.8
	40	17.9	19.6	21.5	25.5	28.2	31.1	34.1	38.0	42.3	43.7	48.9	54.7	54.1	60.8	68.2	65.2	73.4	82.5
180	0	14.4	15.7	17.1	20.0	22.0	24.2	26.3	29.1	32.2	33.1	36.8	41.0	40.4	45.2	50.5	48.2	54.0	60.6
	10	14.8	16.1	17.6	20.6	22.6	24.9	27.0	29.9	33.1	34.1	37.9	42.2	41.6	46.5	52.0	49.7	55.7	62.5
	15	15.1	16.4	17.9	21.0	23.0	25.3	27.5	30.5	33.7	34.7	38.6	43.0	42.4	47.4	53.0	50.6	56.7	63.6
	20	15.4	16.7	18.2	21.3	23.5	25.8	28.0	31.0	34.4	35.3	39.3	43.8	43.2	48.3	53.9	51.5	57.8	64.8
	30	15.7	17.1	18.7	21.9	24.1	26.5	28.8	31.8	35.3	36.3	40.4	45.0	44.4	49.6	55.5	53.0	59.4	66.6
	40	15.8	17.2	18.8	22.1	24.3	26.8	29.1	32.3	35.8	36.8	41.0	45.7	45.1	50.5	56.5	53.9	60.5	68.0

To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind.

If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 15°C.

**ADVISORY INFORMATION****Recommended Brake Cooling Schedule****Event Adjusted Brake Energy (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	100	110	120
LANDING	RTO MAX MAN	10	20	30	40	50	60	70	80	90	100	110	120
	MAX MAN	3.6	13.6	23.5	33.2	42.8	52.3	61.8	71.4	81.0	90.6	100.5	110.4
	MAX AUTO	3.5	12.5	21.4	30.2	39.0	47.8	56.8	66.0	75.5	85.5	95.9	106.8
	AUTOBRAKE 4	3.2	11.7	20.0	28.0	36.0	44.0	52.2	60.6	69.4	78.7	88.6	99.2
	AUTOBRAKE 3	2.7	11.0	18.8	26.3	33.7	41.0	48.4	56.1	64.2	72.8	82.0	92.2
	AUTOBRAKE 2	2.3	10.2	17.5	24.5	31.2	37.9	44.6	51.5	58.9	66.7	75.2	84.6
	AUTOBRAKE 1	1.9	9.0	15.6	21.8	27.8	33.8	39.8	45.9	52.4	59.4	66.9	75.1

**2 Engine Reverse Thrust**

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
EVENT		10	20	30	40	50	60	70	80	90	100	110	120
LANDING	RTO MAX MAN	10	20	30	40	50	60	70	80	90	100	110	120
	MAX MAN	3.4	12.0	21.2	30.6	39.7	48.6	57.4	65.9	74.4	82.8	91.3	99.7
	MAX AUTO	2.0	8.8	15.9	23.2	30.5	38.0	45.7	53.7	62.1	71.0	80.6	90.9
	AUTOBRAKE 4	1.3	5.6	10.9	16.6	22.5	28.3	34.3	40.7	47.5	54.9	63.0	72.0
	AUTOBRAKE 3	0.8	3.1	7.0	11.6	16.2	20.9	25.8	30.9	36.6	42.7	49.6	57.3
	AUTOBRAKE 2	0.0	2.3	5.0	7.8	10.8	14.0	17.4	21.2	25.6	30.4	36.0	42.4
	AUTOBRAKE 1	0.0	1.6	3.3	5.2	7.2	9.4	11.8	14.4	17.4	20.8	24.7	29.2

**Cooling Time (Minutes)**

		EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)											
16 & BELOW		17	18	20	24	28	32	35	36 TO 44	45 & ABOVE			
GEAR DOWN	NO SPECIAL PROCEDURE	1	2	3	4	6	7	7			CAUTION		
INFLIGHT	REQUIRED	11	18	26	42	55	66	73			FUSE PLUG MELT ZONE		
BTMS	UP TO 2.4	2.4	2.6	2.9	3.4	4.0	4.5	4.9	5.0 TO 6.3	6.3 & 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 10 percent.

For two brakes deactivated, increase brake energy by 20 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. (When inflight with gear extended, the BTMS indications may vary between individual brakes, due to air-stream effects.)

**ADVISORY INFORMATION****Landing Climb Limit Weight**

Valid for approach with flaps 20 and landing with flaps 30

AIRPORT OAT		LANDING CLIMB LIMIT WEIGHT (1000 KG)						
		AIRPORT PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	
54	129	297.3	279.1					
52	126	306.3	287.0					
50	122	315.2	294.5	269.7				
48	118	323.5	303.4	276.9				
46	115	331.8	312.4	284.1	259.6			
44	111	340.4	321.1	291.5	267.7			
42	108	349.8	329.0	299.1	275.0	251.6		
40	104	356.7	337.3	307.2	281.4	257.0		
38	100	363.8	347.0	316.0	287.8	262.8	233.8	
36	97	366.6	354.0	323.2	293.4	269.2	238.4	
34	93	366.8	360.8	330.4	299.7	274.4	243.0	
32	90	367.1	363.3	337.6	306.4	278.7	247.1	
30	86	367.3	363.4	344.5	312.9	282.9	250.9	
28	82	367.6	363.6	350.2	318.7	287.3	254.6	
26	79	367.9	363.7	350.4	322.6	292.2	258.2	
24	75	368.1	363.9	350.5	326.0	297.0	263.1	
22	72	368.4	364.0	350.5	327.4	300.3	268.1	
20	68	368.6	364.1	350.6	327.5	302.5	272.4	
18	64	368.9	364.3	350.7	327.6	304.7	275.2	
16	61	369.2	364.4	350.8	327.6	304.7	276.9	
14	57	369.4	364.5	350.8	327.7	304.8	278.5	
12	54	369.6	364.6	350.9	327.8	304.9	278.6	
10	50	369.8	364.7	351.0	327.9	304.9	278.7	
8	46	369.9	364.8	351.1	327.9	304.9	278.7	
6	43	370.0	364.9	349.7	328.0	304.9	272.8	
4	40	370.1	365.0	341.5	313.7	286.7	254.9	
2	36	370.2	365.1	341.5	313.8	286.8	254.9	
0	32	370.3	365.1	341.5	313.8	286.8	255.0	
-40	-40	371.0	365.4	341.6	313.8	286.8	255.0	

Based on engine bleed for packs on, engine anti-ice off, and wing anti-ice off.

With engine bleed for packs off, increase weight by 1250 kg.

With engine anti-ice on, decrease weight by 150 kg.

With engine and wing anti-ice on, decrease weight by 2350 kg.

When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 24600 kg.

**ADVISORY INFORMATION****Landing Climb Limit Weight****Valid for approach with flaps 20 and landing with flaps 25**

AIRPORT OAT	°C	°F	LANDING CLIMB LIMIT WEIGHT (1000 KG)					
			AIRPORT PRESSURE ALTITUDE (FT)					
-2000	0	2000	4000	6000	8000			
54	129	302.7	284.5					
52	126	310.0	292.5					
50	122	317.6	300.2	275.6				
48	118	325.1	307.8	282.4				
46	115	332.9	315.3	289.8	267.1			
44	111	340.7	322.9	297.4	273.6			
42	108	348.8	330.3	304.4	280.1	258.9		
40	104	355.6	337.9	311.1	286.7	264.5		
38	100	362.7	345.9	318.5	293.4	269.9	241.1	
36	97	365.5	352.9	325.0	299.2	275.1	245.9	
34	93	365.7	359.6	331.6	305.0	279.9	250.6	
32	90	366.0	362.1	338.2	310.6	284.3	254.9	
30	86	366.3	362.2	344.3	315.9	288.7	259.0	
28	82	366.5	362.4	349.1	320.8	293.2	262.9	
26	79	366.8	362.5	349.3	324.4	298.1	266.5	
24	75	367.0	362.7	349.4	327.7	302.6	270.7	
22	72	367.3	362.8	349.4	329.0	305.5	274.7	
20	68	367.5	362.9	349.5	329.1	307.3	278.2	
18	64	367.8	363.0	349.6	329.1	309.0	281.0	
16	61	368.1	363.2	349.7	329.2	309.1	282.8	
14	57	368.3	363.3	349.7	329.3	309.1	284.4	
12	54	368.5	363.4	349.8	329.3	309.2	284.5	
10	50	368.6	363.5	349.9	329.4	309.2	284.5	
8	46	368.8	363.6	350.0	329.5	309.3	284.6	
6	43	368.9	363.7	350.0	329.5	309.3	284.5	
4	40	369.0	363.8	350.1	329.6	309.3	278.4	
2	36	369.1	363.8	350.1	329.6	309.4	278.4	
0	32	369.2	363.9	350.1	329.7	309.4	278.4	
-40	-40	369.8	364.1	350.3	329.8	309.6	278.5	

Based on engine bleed for packs on, engine anti-ice off, and wing anti-ice off.

With engine bleed for packs off, increase weight by 1400 kg.

With engine anti-ice on, decrease weight by 100 kg.

With engine and wing anti-ice on, decrease weight by 2300 kg.

When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 22400 kg.

**ENGINE INOP****Initial Max Continuous %N1****Based on .84M, engine bleed for packs on and anti-ice off**

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	27	29	31	33	35	37	39	41	43
20	97.4	97.0	96.7	96.3	95.9	95.9	95.6	95.3	95.0
15	98.2	97.8	97.3	97.0	96.6	96.3	96.0	95.7	95.4
10	99.2	98.9	98.3	97.7	97.2	97.0	96.6	96.3	96.0
5	100.2	100.1	99.7	98.8	98.1	97.8	97.4	97.1	96.8
0	99.3	100.9	101.0	99.9	99.3	98.8	98.3	97.9	97.6
-5	98.4	99.9	101.2	101.3	100.5	100.2	99.7	99.3	98.8
-10	97.4	99.0	100.3	101.6	101.3	101.3	100.7	100.3	100.0
-15	96.5	98.1	99.3	100.6	101.0	102.0	101.1	100.8	100.5
-20	95.6	97.1	98.3	99.6	100.1	101.0	100.1	99.8	99.5
-25	94.6	96.1	97.4	98.6	99.1	100.0	99.1	98.8	98.5
-30	93.7	95.2	96.4	97.6	98.1	99.0	98.1	97.8	97.5
-35	92.7	94.2	95.4	96.6	97.0	97.9	97.1	96.8	96.5
-40	91.7	93.2	94.4	95.6	96.0	96.9	96.1	95.8	95.5

**ENGINE INOP****Max Continuous %N1**

Based on engine bleed for packs on or off and anti-ice off

37000 FT to 27000 FT Pressure Altitudes

37000 FT PRESS ALT			TAT (°C)										
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
280	0.86	94.3	95.4	96.4	97.4	98.4	99.5	100.5	101.4	101.2	100.2	98.9	97.7
240	0.74	96.1	97.2	98.3	99.3	100.4	101.4	102.1	101.9	100.9	99.5	98.1	97.1
200	0.63	95.7	96.7	97.8	98.8	99.9	100.8	101.4	100.9	100.0	98.5	97.0	96.3
35000 FT PRESS ALT			TAT (°C)										
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
280	0.82	94.6	95.6	96.6	97.7	98.7	99.7	100.7	101.7	101.4	100.4	99.2	98.1
240	0.71	95.1	96.2	97.2	98.3	99.3	100.3	101.3	101.8	100.9	99.8	98.3	97.2
200	0.60	94.8	95.8	96.9	97.9	98.9	99.9	100.9	101.0	100.2	98.8	97.1	96.1
33000 FT PRESS ALT			TAT (°C)										
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
320	0.89	91.4	92.4	93.4	94.4	95.4	96.4	97.4	98.3	99.3	100.2	99.8	98.8
280	0.79	95.0	96.0	97.1	98.1	99.2	100.2	101.2	102.2	102.4	101.0	100.0	98.7
240	0.68	95.6	96.7	97.8	98.8	99.8	100.9	101.9	102.4	101.8	100.2	98.9	97.5
200	0.58	95.9	97.0	98.0	99.1	100.1	101.1	101.6	101.6	101.0	99.3	97.9	96.4
31000 FT PRESS ALT			TAT (°C)										
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
320	0.85	92.7	93.8	94.8	95.7	96.7	97.7	98.7	99.6	100.5	100.8	99.7	98.4
280	0.76	96.3	97.4	98.4	99.5	100.5	101.5	102.5	103.5	102.0	100.6	99.1	98.0
240	0.66	97.4	98.4	99.5	100.5	101.5	102.6	103.3	103.0	101.0	99.5	98.1	96.9
200	0.55	97.6	98.7	99.7	100.8	101.8	102.6	102.8	102.0	100.7	98.7	97.2	96.1
29000 FT PRESS ALT			TAT (°C)										
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
320	0.82	93.8	94.8	95.8	96.8	97.8	98.7	99.7	100.6	101.6	100.1	98.9	97.8
280	0.73	96.6	97.6	98.6	99.6	100.6	101.6	102.6	102.5	101.0	99.5	98.1	97.1
240	0.63	98.1	99.2	100.2	101.3	102.3	103.3	103.1	101.6	99.8	98.4	97.1	96.0
200	0.53	98.6	99.7	100.7	101.7	102.7	103.2	102.7	101.2	99.4	97.7	96.3	96.2
27000 FT PRESS ALT			TAT (°C)										
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
360	0.88	90.2	91.2	92.1	93.0	94.0	94.9	95.8	96.7	97.6	98.5	99.2	98.1
320	0.79	93.4	94.4	95.3	96.3	97.3	98.2	99.2	100.1	101.1	100.6	99.2	98.1
280	0.70	95.4	96.4	97.4	98.4	99.4	100.4	101.3	102.3	101.3	99.7	98.2	97.1
240	0.60	97.2	98.2	99.2	100.3	101.3	102.3	103.0	102.0	99.9	98.5	97.2	96.2
200	0.51	98.4	99.4	100.4	101.5	102.5	103.2	102.7	101.8	99.9	98.1	96.5	95.6

**%N1 Adjustments for Engine Bleed**

BLEED CONFIGURATION			PRESSURE ALTITUDE (1000 FT)					
			37	35	33	31	29	27
ENGINE A/I ON			-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
WING A/I ON - PACKS ON			-0.4	-0.4	-0.4	-0.3	-0.3	-0.3
WING A/I ON - PACKS OFF			-0.6	-0.5	-0.5	-0.5	-0.5	-0.4

## ENGINE INOP

### Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off

25000 FT to 18000 FT Pressure Altitudes

25000 FT PRESS ALT			TAT (°C)											
KIAS	M		-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
360	0.85	91.2	92.2	93.1	94.1	95.0	95.9	96.8	97.7	98.6	99.5	98.9	98.1	
320	0.76	93.9	94.8	95.8	96.8	97.7	98.7	99.6	100.5	101.1	99.6	98.5	97.6	
280	0.67	95.5	96.5	97.5	98.5	99.4	100.4	101.3	101.5	100.4	98.8	97.5	96.7	
240	0.58	97.4	98.5	99.5	100.5	101.5	102.4	102.3	100.9	99.3	97.8	96.7	95.9	
200	0.49	99.3	100.3	101.4	102.4	103.4	103.1	102.0	100.6	98.5	97.1	96.1	95.9	
24000 FT PRESS ALT			TAT (°C)											
KIAS	M		-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
360	0.83	91.3	92.3	93.2	94.2	95.1	96.0	96.9	97.8	98.7	99.6	99.4	98.4	
320	0.75	93.6	94.6	95.6	96.5	97.5	98.4	99.4	100.3	101.2	100.0	98.8	97.8	
280	0.66	95.4	96.4	97.4	98.3	99.3	100.3	101.2	101.8	100.7	99.1	97.8	96.9	
240	0.57	97.3	98.3	99.3	100.3	101.3	102.2	102.6	101.4	99.8	98.3	97.1	96.2	
200	0.48	98.8	99.9	100.9	101.9	102.9	103.4	102.3	101.0	98.9	97.4	96.3	95.6	
22000 FT PRESS ALT			TAT (°C)											
KIAS	M		-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
360	0.80	92.1	93.0	94.0	94.9	95.8	96.7	97.6	98.5	99.4	100.0	99.0	98.3	
320	0.72	94.3	95.3	96.3	97.2	98.1	99.1	100.0	100.9	100.7	99.3	98.2	97.5	
280	0.63	96.1	97.1	98.1	99.0	100.0	100.9	101.9	101.3	99.8	98.4	97.3	96.6	
240	0.55	97.7	98.7	99.7	100.7	101.7	102.7	102.3	100.9	99.3	97.7	96.8	96.1	
200	0.46	99.5	100.5	101.5	102.5	103.5	103.0	101.5	99.9	97.9	96.8	95.9	95.8	
20000 FT PRESS ALT			TAT (°C)											
KIAS	M		-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
360	0.77	93.7	94.6	95.6	96.5	97.4	98.4	99.3	100.2	101.1	102.0	101.3	100.1	
320	0.69	95.9	96.9	97.8	98.8	99.7	100.7	101.6	102.6	103.5	101.8	100.4	99.1	
280	0.61	97.7	98.7	99.6	100.6	101.6	102.6	103.5	104.3	102.8	100.9	99.4	98.3	
240	0.53	98.5	99.5	100.5	101.5	102.4	103.4	104.3	104.1	102.4	100.7	98.7	97.2	
200	0.44	98.0	99.0	99.9	100.9	101.9	102.9	103.8	102.6	100.5	98.0	96.2	95.3	
18000 FT PRESS ALT			TAT (°C)											
KIAS	M		-25	-20	-15	-10	-5	0	5	10	15	20	25	30
360	0.75	94.4	95.4	96.3	97.2	98.2	99.1	100	100.9	101.8	102.0	100.6	99.4	
320	0.67	96.7	97.7	98.6	99.6	100.5	101.4	102.4	103.3	102.9	101.2	99.7	98.6	
280	0.59	98.5	99.5	100.5	101.5	102.4	103.4	104.3	104.0	102.3	100.4	98.9	97.8	
240	0.51	99.6	100.6	101.6	102.6	103.6	104.5	104.9	103.9	101.9	100.0	98.4	97.2	
200	0.42	97.2	98.2	99.2	100.1	101.1	101.9	102.0	100.8	98.8	97.3	95.8	94.4	

### %N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	25	24	22	20	18
ENGINE A/I ON	-0.2	-0.2	-0.2	-0.2	-0.2
WING A/I ON - PACKS ON	-0.3	-0.3	-0.3	-0.2	-0.3
WING A/I ON - PACKS OFF	-0.4	-0.4	-0.4	-0.3	-0.5

**ENGINE INOP****Max Continuous %N1****Based on engine bleed for packs on or off and anti-ice off****16000 FT to 5000 FT Pressure Altitudes**

16000 FT PRESS ALT			TAT (°C)											
KIAS	M		-25	-20	-15	-10	-5	0	5	10	15	20	25	30
360	0.72	94.8	95.8	96.7	97.6	98.6	99.5	100.4	101.3	102.2	103.1	101.7	100.2	
320	0.64	96.9	97.9	98.8	99.8	100.7	101.7	102.6	103.5	104.4	102.7	100.9	99.4	
280	0.57	98.7	99.7	100.7	101.6	102.6	103.5	104.5	105.4	104.1	102.2	100.3	98.8	
240	0.49	99.1	100.1	101.1	102.0	103.0	104.0	104.9	104.5	103.0	100.9	99.2	97.9	
200	0.41	96.2	97.2	98.1	99.1	100.0	100.9	101.5	101.3	99.8	98.3	97.0	95.4	
14000 FT PRESS ALT			TAT (°C)											
KIAS	M		-20	-15	-10	-5	0	5	10	15	20	25	30	35
360	0.69	94.9	95.9	96.8	97.7	98.6	99.5	100.4	101.3	102.2	102.2	100.8	99.5	
320	0.62	97.1	98.1	99.0	99.9	100.9	101.8	102.7	103.6	103.4	101.5	100.0	98.9	
280	0.54	99.2	100.1	101.1	102.1	103.0	103.9	104.9	104.9	103.0	101.0	99.5	98.4	
240	0.47	97.3	98.2	99.2	100.1	101.0	102.0	102.7	102.5	100.6	99.0	97.8	96.7	
200	0.39	96.1	97.0	98.0	98.9	99.8	100.7	101.4	100.7	99.0	97.6	96.5	95.6	
12000 FT PRESS ALT			TAT (°C)											
KIAS	M		-15	-10	-5	0	5	10	15	20	25	30	35	40
360	0.67	95.4	96.3	97.2	98.1	99.0	99.9	100.8	101.6	102.5	101.3	100.0	99.0	
320	0.60	97.3	98.2	99.2	100.1	101.0	101.9	102.8	103.7	102.3	100.6	99.4	98.4	
280	0.52	99.7	100.6	101.6	102.5	103.5	104.4	105.3	104.0	102.0	100.2	99.1	98.1	
240	0.45	96.5	97.4	98.3	99.3	100.2	101.1	101.4	100.6	99.2	98.0	96.9	96.0	
200	0.38	96.7	97.7	98.6	99.5	100.4	101.2	101.3	100.2	98.7	97.4	96.4	95.8	
10000 FT PRESS ALT			TAT (°C)											
KIAS	M		-15	-10	-5	0	5	10	15	20	25	30	35	40
360	0.65	94.2	95.2	96.1	96.9	97.8	98.7	99.6	100.4	101.3	101.5	100.2	99.1	
320	0.58	96.1	97.1	98.0	98.9	99.8	100.7	101.6	102.4	102.6	101.0	99.7	98.6	
280	0.51	98.5	99.4	100.4	101.3	102.2	103.1	104.0	104.6	102.3	100.5	99.4	98.4	
240	0.43	95.6	96.6	97.5	98.4	99.3	100.2	101.0	101.1	100.3	99.1	97.8	96.9	
200	0.36	96.6	97.5	98.4	99.3	100.2	101.1	101.6	101.2	100.1	98.5	97.5	96.6	
5000 FT PRESS ALT			TAT (°C)											
KIAS	M		-10	-5	0	5	10	15	20	25	30	35	40	45
360	0.59	92.6	93.5	94.3	95.2	96.0	96.9	97.7	98.5	99.4	100.2	99.3	98.5	
320	0.53	94.0	94.9	95.8	96.7	97.5	98.4	99.2	100.1	100.9	100.1	99.1	98.2	
280	0.46	95.0	95.9	96.8	97.6	98.5	99.4	100.2	101.1	100.9	99.8	98.8	97.8	
240	0.40	95.7	96.6	97.5	98.4	99.3	100.2	101.0	101.6	100.5	99.4	98.3	97.4	
200	0.33	97.0	97.9	98.8	99.7	100.6	101.5	102.4	101.7	100.3	99.1	98.1	97.3	

**%N1 Adjustments for Engine Bleed**

BLEED CONFIGURATION			PRESSURE ALTITUDE (1000 FT)				
			16	14	12	10	5
ENGINE A/I ON			-0.3	-0.2	-0.4	-0.5	-0.5
WING A/I ON - PACKS ON			-0.4	-0.5	-0.6	-0.7	-0.8
WING A/I ON - PACKS OFF			-0.6	-0.7	-0.8	-0.9	-1.1

**ENGINE INOP****MAX CONTINUOUS THRUST****Driftdown Speed/Level Off Altitude**

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
360	350	301	18000	16900	15700
340	331	293	19500	18400	17300
320	312	285	20900	20200	19100
300	291	276	22400	21500	20600
280	272	266	24200	23200	22000
260	252	257	26200	25300	24000
240	233	248	28500	27700	26300
220	214	238	30500	30000	28900
200	195	227	32300	32000	31300
180	175	215	34300	34100	33800
160	155	203	36500	36400	36200

**Driftdown/LRC Cruise Range Capability  
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	
134	125	118	111	105	100	95	90	86	82	79	
268	251	236	222	210	200	190	181	173	166	159	
402	376	354	333	316	300	285	272	260	249	239	
535	501	471	445	421	400	380	363	347	332	319	
668	626	588	555	526	500	476	454	434	416	399	
800	750	706	666	631	600	571	545	521	499	479	
932	874	823	777	736	700	666	636	608	583	560	
1064	998	940	888	841	800	762	727	696	667	640	
1196	1122	1057	998	946	900	857	818	783	751	721	
1327	1246	1173	1109	1051	1000	952	910	870	835	801	
1459	1369	1290	1220	1156	1100	1048	1001	958	918	882	
1590	1493	1407	1330	1262	1200	1143	1092	1045	1002	963	
1722	1617	1524	1441	1367	1300	1239	1183	1133	1086	1043	
1854	1741	1641	1552	1472	1400	1334	1275	1220	1170	1124	
1986	1865	1758	1662	1577	1500	1430	1366	1307	1254	1205	
2118	1989	1875	1773	1682	1600	1525	1457	1395	1338	1285	
2250	2113	1992	1884	1787	1700	1620	1548	1482	1421	1365	
2383	2238	2109	1995	1892	1800	1716	1639	1569	1505	1446	

**ENGINE INOP****MAX CONTINUOUS THRUST****Driftdown/LRC Cruise Range Capability****Driftdown/Cruise Fuel and Time**

AIR DIST (NM)	FUEL REQUIRED (1000 KG)										TIME (HR:MIN)	
	WEIGHT AT START OF DRIFTDOWN (1000 KG)											
	160	180	200	220	240	260	280	300	320	340		
100	1.0	1.1	1.2	1.4	1.4	1.6	1.7	1.7	1.8	1.9	2.0	
200	2.3	2.5	2.8	3.0	3.2	3.4	3.6	3.8	4.1	4.3	4.5	
300	3.6	3.9	4.4	4.8	5.1	5.4	5.8	6.1	6.5	6.9	7.2	
400	4.9	5.4	6.0	6.6	7.0	7.5	7.9	8.4	8.9	9.5	10.0	
500	6.2	6.8	7.5	8.2	8.8	9.4	10.0	10.6	11.2	11.9	12.6	
600	7.4	8.1	9.0	9.8	10.6	11.3	12.0	12.7	13.4	14.3	15.2	
700	8.6	9.4	10.4	11.4	12.3	13.1	13.9	14.8	15.6	16.6	17.7	
800	9.7	10.7	11.9	13.0	14.0	14.9	15.9	16.8	17.8	19.0	20.2	
900	10.9	12.0	13.3	14.5	15.6	16.8	17.8	18.9	20.0	21.3	22.7	
1000	12.1	13.3	14.7	16.1	17.3	18.5	19.7	20.9	22.1	23.6	25.2	
1100	13.2	14.6	16.1	17.6	19.0	20.3	21.6	22.9	24.3	25.9	27.6	
1200	14.4	15.9	17.5	19.1	20.6	22.1	23.5	24.9	26.4	28.1	30.0	
1300	15.5	17.2	18.9	20.6	22.3	23.8	25.4	26.9	28.5	30.4	32.4	
1400	16.6	18.4	20.3	22.1	23.9	25.6	27.2	28.9	30.6	32.6	34.8	
1500	17.7	19.6	21.7	23.6	25.5	27.3	29.1	30.9	32.7	34.8	37.2	
1600	18.8	20.9	23.0	25.1	27.1	29.0	30.9	32.8	34.8	37.0	39.5	
1700	19.9	22.1	24.4	26.6	28.7	30.7	32.8	34.8	36.8	39.2	41.9	
1800	21.0	23.3	25.7	28.0	30.2	32.4	34.6	36.7	38.9	41.4	44.2	

Includes APU fuel burn.

Driftdown at optimum driftdown speed and cruise at LRC speed.

## ENGINE INOP

### MAX CONTINUOUS THRUST

#### Long Range Cruise Altitude Capability 100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
360	15600	14200	12700
350	16000	14700	13200
340	16900	15200	13700
330	17800	16300	14600
320	18800	17300	15600
310	19800	18300	16600
300	20500	19300	17700
290	21100	20200	18700
280	21800	20800	19800
270	22700	21500	20600
260	23600	22300	21200
250	24600	23400	21900
240	25800	24600	23100
230	27100	25900	24300
220	28500	27300	25600
210	29900	28600	27100
200	30900	30000	28500
190	31900	31200	30100
180	32900	32500	31400
170	34000	33700	32800
160	35200	35100	34300

With engine anti-ice on, no altitude capability adjustment is required.

With engine and wing anti-ice on, decrease altitude capability by 300 ft.

**ENGINE INOP****MAX CONTINUOUS THRUST****Long Range Cruise Control**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (1000 FT)									
	10	15	17	19	21	23	25	27	29	31
360	%N1 MACH KIAS FF/ENG	90.9 .602 334 10070	96.3 .664 337 10778							
	%N1 MACH KIAS FF/ENG	89.9 .602 334 9696	94.9 .664 337 10338	97.6 .683 335 10505						
	%N1 MACH KIAS FF/ENG	88.7 .602 334 9267	92.9 .653 332 9589	94.8 .670 328 9644	97.7 .689 325 9735					
	%N1 MACH KIAS FF/ENG	86.8 .592 329 8693	91.0 .638 324 8874	92.7 .657 321 8919	94.7 .674 317 8944	97.9 .694 315 9073				
300	%N1 MACH KIAS FF/ENG	85.0 .574 319 8068	89.2 .622 315 8218	90.8 .641 313 8264	92.6 .660 310 8284	94.8 .677 306 8332	97.9 .694 305 8544			
	%N1 MACH KIAS FF/ENG	82.9 .557 309 7484	87.2 .605 306 7593	88.8 .623 304 7619	90.5 .643 302 7642	92.3 .662 299 7676	94.7 .679 295 7747	98.4 .704 294 8011		
	%N1 MACH KIAS FF/ENG	80.8 .540 299 6926	84.8 .585 296 6949	86.8 .605 295 7005	88.3 .624 293 7013	90.0 .644 291 7041	91.8 .663 288 7088	94.5 .681 284 7163	98.3 .707 283 7427	
	%N1 MACH KIAS FF/ENG	78.6 .522 289 6372	82.5 .564 285 6314	84.2 .584 284 6372	86.1 .604 283 6413	87.7 .623 281 6419	89.4 .644 279 6456	91.2 .663 276 6501	93.8 .681 272 6563	97.8 .708 272 6820
200	%N1 MACH KIAS FF/ENG	76.2 .503 278 5827	79.9 .543 274 5717	81.7 .561 272 5752	83.4 .581 271 5795	85.3 .601 270 5829	86.9 .621 268 5836	88.6 .642 267 5870	90.4 .661 264 5906	93.0 .680 260 5957
	%N1 MACH KIAS FF/ENG	73.8 .484 268 5301	77.2 .521 263 5135	78.9 .538 261 5167	80.7 .556 259 5198	82.3 .575 258 5215	84.2 .596 257 5244	85.8 .616 256 5254	87.5 .638 254 5279	89.3 .658 251 5309
	%N1 MACH KIAS FF/ENG	71.0 .464 257 4797	74.3 .498 251 4574	76.0 .514 249 4596	77.6 .530 247 4632	79.3 .548 246 4637	81.0 .567 244 4636	82.7 .589 243 4658	84.5 .609 242 4673	86.1 .631 240 4689
	%N1 MACH KIAS FF/ENG	69.0 .444 246 4497	72.3 .478 240 4474	74.0 .498 238 4496	75.6 .514 236 4532	77.2 .530 234 4567	78.8 .550 232 4596	80.4 .570 230 4621	82.0 .590 228 4646	83.6 .610 226 4671

## 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	
284	263	244	227	213	200	190	181	173	166	159	
565	523	485	453	425	400	381	364	348	334	321	
847	784	728	680	638	600	572	546	522	501	482	
1129	1045	970	906	850	800	763	729	698	669	643	
1413	1308	1214	1133	1063	1000	954	911	872	836	804	
1697	1570	1457	1361	1276	1200	1145	1094	1047	1004	965	
1982	1834	1701	1588	1489	1400	1336	1276	1221	1171	1125	
2268	2097	1945	1815	1702	1600	1526	1458	1395	1338	1286	
2554	2362	2190	2043	1915	1800	1717	1640	1569	1505	1446	
2842	2626	2434	2270	2128	2000	1908	1822	1743	1671	1606	

#### Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	3.8	0:39	3.3	0:38	3.0	0:36	2.7	0:36	2.5	0:35
400	8.0	1:13	7.3	1:10	6.8	1:08	6.4	1:05	6.1	1:03
600	12.1	1:48	11.2	1:44	10.6	1:39	10.0	1:35	9.7	1:32
800	16.2	2:23	15.1	2:17	14.3	2:11	13.6	2:06	13.2	2:01
1000	20.2	2:59	18.9	2:50	18.0	2:43	17.1	2:36	16.7	2:30
1200	24.2	3:34	22.7	3:24	21.7	3:15	20.7	3:06	20.2	2:59
1400	28.2	4:10	26.5	3:58	25.3	3:47	24.1	3:37	23.6	3:29
1600	32.1	4:46	30.2	4:33	28.9	4:19	27.6	4:08	26.9	3:58
1800	36.0	5:22	33.8	5:07	32.4	4:52	31.0	4:39	30.2	4:28
2000	39.8	5:59	37.5	5:42	36.0	5:25	34.4	5:10	33.5	4:58

#### Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)										
	150	170	190	210	230	250	270	290	310	330	350
5	-1.0	-0.8	-0.6	-0.4	-0.2	0.0	0.3	0.7	1.1	1.7	2.4
10	-2.1	-1.7	-1.3	-0.9	-0.4	0.0	0.7	1.5	2.5	3.7	5.0
15	-3.3	-2.6	-2.0	-1.3	-0.7	0.0	1.0	2.3	3.8	5.6	7.6
20	-4.4	-3.5	-2.7	-1.8	-0.9	0.0	1.4	3.1	5.1	7.4	9.9
25	-5.5	-4.4	-3.4	-2.2	-1.1	0.0	1.8	3.9	6.3	9.1	12.2
30	-6.7	-5.4	-4.0	-2.7	-1.3	0.0	2.1	4.6	7.5	10.7	14.3
35	-7.8	-6.3	-4.7	-3.2	-1.6	0.0	2.5	5.3	8.6	12.2	16.2
40	-8.9	-7.2	-5.4	-3.6	-1.8	0.0	2.8	6.0	9.7	13.7	18.1

Includes APU fuel burn.

**ENGINE INOP****MAX CONTINUOUS THRUST****Holding  
Flaps Up**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)						
	1500	5000	10000	15000	20000	25000	30000
360	%N1	80.5	83.9	88.6	93.4		
	KIAS	264	264	265	269		
	FF/ENG	9070	9130	9370	9670		
340	%N1	78.7	81.9	86.7	91.4	100.4	
	KIAS	260	260	260	260	299	
	FF/ENG	8520	8560	8730	8950	10320	
320	%N1	76.7	79.7	84.6	89.2	96.4	
	KIAS	253	253	253	253	289	
	FF/ENG	7930	7940	8050	8210	9240	
300	%N1	74.7	77.7	82.3	87.1	92.4	
	KIAS	244	244	244	244	259	
	FF/ENG	7380	7360	7430	7550	8120	
280	%N1	72.8	75.7	80.1	85.0	90.1	
	KIAS	238	238	238	238	238	
	FF/ENG	6880	6850	6880	6950	7350	
260	%N1	70.7	73.6	77.8	82.8	87.8	95.1
	KIAS	229	229	229	229	229	262
	FF/ENG	6380	6340	6330	6380	6690	7470
240	%N1	68.5	71.5	75.6	80.3	85.4	90.5
	KIAS	223	223	223	223	223	228
	FF/ENG	5910	5870	5820	5850	6110	6420
220	%N1	66.2	69.1	73.2	77.7	82.8	87.7
	KIAS	217	217	217	217	217	242
	FF/ENG	5440	5400	5330	5350	5530	5760
200	%N1	64.1	66.7	71.0	75.3	80.1	85.0
	KIAS	217	217	217	217	217	226
	FF/ENG	5010	4970	4910	4900	5040	5200
180	%N1	62.0	64.6	68.6	72.9	77.6	82.5
	KIAS	217	217	217	217	217	217
	FF/ENG	4630	4580	4520	4500	4630	4730
160	%N1	59.9	62.6	66.3	70.7	75.2	80.0
	KIAS	217	217	217	217	217	217
	FF/ENG	4300	4240	4160	4140	4250	4340

This table includes 5% additional fuel for holding in a racetrack pattern.

**ENGINE INOP****ADVISORY INFORMATION****Gear Down Landing Rate of Climb Available  
Flaps 20**

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	170	80				
50	220	130	-10			
48	260	170	30			
46	300	220	70	-70		
44	340	260	110	-30		
42	380	300	150	10	-130	
40	400	340	190	40	-100	
38	400	380	230	80	-70	-260
36	410	390	270	110	-50	-230
34	410	400	300	150	-20	-210
32	410	400	320	180	10	-180
30	420	400	320	200	40	-160
20	430	410	330	220	100	-70
10	440	420	290	170	60	-310
0	450	430	270	80	-110	-320
-20	470	450	280	90	-110	-330
-40	500	470	290	90	-110	-350

Rate of climb capability shown is valid for 260000 kg, gear down at VREF20 + 5.

Decrease rate of climb 30 ft/min per 5000 kg greater than 260000 kg.

Increase rate of climb 40 ft/min per 5000 kg less than 260000 kg.

**Flaps 30**

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	-400	-490				
50	-360	-450	-600			
48	-320	-410	-560			
46	-290	-380	-520	-660		
44	-250	-340	-490	-620		
42	-220	-300	-450	-590	-730	
40	-190	-260	-420	-560	-700	
38	-190	-230	-380	-530	-680	-860
36	-190	-210	-350	-500	-660	-840
34	-190	-210	-330	-470	-630	-820
32	-190	-210	-300	-450	-610	-800
30	-190	-210	-290	-430	-580	-780
20	-180	-210	-300	-410	-530	-700
10	-180	-210	-310	-540	-690	-840
0	-180	-210	-380	-550	-740	-960
-20	-190	-220	-390	-570	-770	-990
-40	-190	-230	-410	-600	-800	-1030

Rate of climb capability shown is valid for 260000 kg, gear down at VREF30 + 5.

Decrease rate of climb 40 ft/min per 5000 kg greater than 260000 kg.

Increase rate of climb 40 ft/min per 5000 kg less than 260000 kg.

Intentionally  
Blank

DRAFT

Performance Inflight - QRH  
Gear Down

Chapter PI-QRH  
Section 43

**GEAR DOWN**

**220 KIAS Max Climb %N1**

TAT (°C)	PRESSURE ALTITUDE (1000 FT)														
	0	5	10	12	14	16	18	20	22	24	26	28	30	32	34
55	88.2	88.3	91.4	91.1	92.1	91.3	94.0	95.2	95.4	98.1	99.9	101.1	102.4	102.9	103.4
50	89.5	88.8	90.7	90.4	91.4	92.1	93.3	94.5	94.7	97.3	99.2	100.3	101.6	102.1	102.6
45	90.5	90.1	90.0	89.7	90.7	91.4	92.6	93.8	93.9	96.6	98.4	99.6	100.8	101.3	101.8
40	91.6	91.2	91.2	89.7	89.9	90.7	91.9	93.0	93.2	95.8	97.6	98.8	100.0	100.5	101.0
35	92.6	92.3	92.2	92.1	90.6	89.9	91.1	92.3	92.5	95.0	96.8	98.0	99.2	99.7	100.2
30	93.0	93.2	93.2	93.0	92.2	91.2	90.9	91.5	91.7	94.3	96.0	97.2	98.4	98.9	99.4
25	92.2	94.2	94.1	94.0	93.7	92.8	92.1	92.0	91.1	93.5	95.2	96.4	97.6	98.0	98.5
20	91.4	94.2	95.1	95.0	94.9	94.4	93.4	93.0	92.8	93.6	94.4	95.6	96.8	97.2	97.7
15	90.7	93.4	96.7	96.4	96.3	96.1	94.8	94.1	94.5	94.8	95.2	95.3	96.0	96.4	96.9
10	89.9	92.6	96.3	97.9	98.1	98.1	96.8	95.5	96.5	96.2	96.4	96.4	96.6	96.1	96.0
5	89.1	91.7	95.4	97.1	98.9	100.3	99.0	97.9	98.2	97.8	97.8	97.9	97.9	97.3	96.8
0	88.3	90.9	94.6	96.2	98.0	100.1	100.8	100.3	100.1	99.7	99.4	99.4	99.5	98.6	98.1
-5	87.4	90.1	93.7	95.3	97.1	99.1	99.9	100.8	101.9	101.5	101.1	101.1	101.1	100.2	99.6
-10	86.6	89.2	92.8	94.4	96.1	98.2	98.9	99.8	101.4	102.8	102.6	102.6	103.0	101.6	100.8
-15	85.8	88.4	91.9	93.5	95.2	97.3	98.0	98.9	100.4	101.8	102.5	103.2	103.8	102.5	101.4
-20	85.0	87.5	91.1	92.6	94.3	96.3	97.0	97.9	99.4	100.8	101.5	102.2	103.3	102.4	101.3

**Anti-ice Adjustment**

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)							
	0	5	10	15	20	25	30	35
2 PACKS ON - 1 BLEED SOURCE	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4
1 PACK ON - 1 OR 2 BLEED SOURCES	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4
ENGINE ANTI-ICE ON	-0.3	-0.5	-0.4	-0.3	-0.1	-0.2	-0.2	-0.2
ENGINE AND WING ANTI-ICE ON*	-0.6	-0.8	-0.7	-0.5	-0.2	-0.3	-0.3	-0.4
ENGINE AND WING ANTI-ICE ON**	-1.1	-0.9	-0.9	-0.6	-0.3	-0.4	-0.5	-0.5

\* Packs on or off with 2 bleed sources.

\*\* Packs off with 1 bleed source.

**GEAR DOWN****Long Range Cruise Altitude Capability****Max Climb Thrust, 300 ft/min residual rate of climb**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
360	18500	16600	14200
350	19200	17300	14800
340	19700	18000	15500
330	20600	18900	16300
320	21700	20100	17600
310	22800	21300	19000
300	23900	22400	20300
290	25000	23500	21800
280	26000	24600	23000
270	27100	25900	24300
260	28200	27200	25700
250	29400	28600	27100
240	30400	30000	28500
230	31200	30800	29900
220	32000	31700	31000
210	32800	32600	32000
200	33500	33200	32700
190	34000	33900	33400
180	34600	34500	34100
170	35200	35100	34700
160	35800	35700	35300

## GEAR DOWN

### Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		10	15	17	19	21	23	25	27	29	31
360	%N1	84.4	88.7	90.7	93.0						
	MACH	.488	.535	.556	.578						
	KIAS	270	270	270	270						
	FF/ENG	7524	7653	7775	7993						
340	%N1	83.5	87.8	89.7	91.8						
	MACH	.488	.535	.556	.578						
	KIAS	270	270	270	270						
	FF/ENG	7296	7405	7486	7646						
320	%N1	82.6	86.7	88.3	90.0	92.1					
	MACH	.488	.534	.550	.568	.588					
	KIAS	270	269	267	265	264					
	FF/ENG	7058	7105	7101	7142	7267					
300	%N1	81.2	84.9	86.6	88.2	89.9	92.1				
	MACH	.481	.520	.537	.554	.572	.594				
	KIAS	266	262	260	258	257	256				
	FF/ENG	6725	6632	6624	6623	6679	6806				
280	%N1	79.3	83.1	84.9	86.4	87.9	89.7	92.3			
	MACH	.468	.507	.523	.540	.557	.576	.598			
	KIAS	259	255	253	252	250	248	248			
	FF/ENG	6283	6189	6167	6168	6164	6230	6361			
260	%N1	77.2	81.1	82.9	84.6	86.0	87.6	89.4	92.3	96.7	
	MACH	.453	.492	.508	.525	.542	.559	.579	.602	.628	
	KIAS	251	248	246	244	243	241	239	239	239	
	FF/ENG	5831	5754	5724	5709	5711	5706	5778	5910	6239	
240	%N1	75.0	79.0	80.8	82.4	84.1	85.5	87.1	89.0	92.0	
	MACH	.438	.476	.492	.508	.525	.543	.561	.581	.605	
	KIAS	242	240	238	237	235	233	231	230	230	
	FF/ENG	5377	5317	5292	5266	5254	5253	5252	5320	5450	
220	%N1	72.6	76.7	78.4	80.2	81.7	83.4	84.9	86.4	88.4	91.5
	MACH	.421	.459	.475	.491	.508	.525	.543	.561	.582	.606
	KIAS	232	231	230	228	227	225	224	222	221	220
	FF/ENG	4925	4872	4859	4836	4811	4800	4799	4799	4859	4983
200	%N1	69.9	74.1	75.8	77.5	79.3	80.9	82.7	84.4	86.3	88.5
	MACH	.403	.441	.456	.473	.489	.506	.526	.548	.571	.596
	KIAS	223	221	220	219	218	217	217	216	217	217
	FF/ENG	4476	4425	4418	4408	4384	4360	4387	4432	4481	4565
180	%N1	67.8	72.2	74.1	75.9	77.9	79.8	81.5	83.3	85.1	87.0
	MACH	.392	.431	.448	.466	.485	.505	.526	.548	.571	.596
	KIAS	217	217	217	217	217	217	217	216	217	217
	FF/ENG	4152	4138	4141	4159	4170	4182	4208	4249	4283	4335
160	%N1	66.8	71.3	73.1	74.9	76.9	78.7	80.5	82.4	84.1	85.9
	MACH	.392	.431	.448	.466	.485	.505	.526	.548	.571	.596
	KIAS	217	217	217	217	217	217	217	216	217	217
	FF/ENG	4013	3995	3994	4006	4019	4031	4053	4088	4125	4159

**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	
310	280	254	233	216	200	189	179	170	162	155	
622	562	510	467	431	400	378	358	340	324	311	
936	845	766	702	648	600	567	538	511	487	466	
1253	1131	1024	937	864	800	757	718	682	650	621	
1573	1418	1283	1173	1081	1000	946	897	852	812	776	
1896	1706	1542	1409	1298	1200	1135	1076	1022	973	930	
2222	1997	1803	1646	1515	1400	1324	1254	1191	1134	1084	
2552	2291	2066	1884	1733	1600	1513	1433	1361	1296	1238	
2883	2586	2329	2122	1951	1800	1702	1612	1530	1457	1392	
3215	2881	2593	2361	2169	2000	1890	1790	1699	1618	1545	
3547	3177	2857	2600	2387	2200	2079	1968	1868	1778	1699	
3880	3472	3120	2838	2604	2400	2268	2147	2038	1940	1853	
4213	3768	3384	3076	2822	2600	2457	2326	2207	2101	2007	
4545	4063	3648	3315	3040	2800	2646	2505	2377	2262	2161	
4878	4359	3912	3554	3258	3000	2835	2683	2546	2424	2315	
5211	4655	4176	3792	3476	3200	3023	2862	2716	2585	2468	
5544	4951	4440	4031	3694	3400	3212	3041	2885	2746	2622	
5876	5246	4703	4269	3912	3600	3401	3220	3055	2907	2776	
6209	5541	4967	4507	4130	3800	3590	3398	3224	3068	2930	
6542	5837	5230	4746	4348	4000	3778	3576	3393	3229	3084	

**Reference Fuel and Time Required at Check Point**

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	
200	7.4	0:46	6.7	0:44	5.8	0:42	5.3	0:41	5.0	0:39
400	15.0	1:29	13.9	1:25	12.4	1:20	11.6	1:17	11.1	1:13
600	22.6	2:13	21.1	2:06	19.0	1:58	17.9	1:53	17.2	1:48
800	30.0	2:57	28.0	2:48	25.4	2:37	24.0	2:30	23.0	2:23
1000	37.3	3:42	34.9	3:30	31.8	3:15	30.1	3:07	28.9	2:57
1200	44.4	4:28	41.6	4:14	38.0	3:55	35.9	3:44	34.5	3:33
1400	51.5	5:14	48.3	4:57	44.1	4:35	41.8	4:22	40.1	4:09
1600	58.3	6:01	54.7	5:41	50.1	5:15	47.5	5:00	45.6	4:45
1800	65.1	6:49	61.2	6:26	56.1	5:56	53.1	5:38	51.0	5:21
2000	71.7	7:37	67.5	7:11	61.9	6:37	58.7	6:17	56.3	5:57
2200	78.3	8:25	73.7	7:56	67.7	7:18	64.2	6:55	61.6	6:33
2400	84.8	9:13	79.9	8:41	73.4	7:59	69.6	7:34	66.8	7:09
2600	91.3	10:00	86.0	9:26	79.1	8:40	75.0	8:12	72.0	7:45
2800	97.6	10:48	92.0	10:11	84.6	9:21	80.3	8:51	77.1	8:21
3000	104.0	11:36	98.0	10:56	90.2	10:02	85.6	9:29	82.1	8:57
3200	110.2	12:24	103.9	11:41	95.7	10:43	90.8	10:08	87.1	9:33
3400	116.5	13:12	109.8	12:27	101.1	11:24	96.0	10:46	92.1	10:09
3600	122.6	14:00	115.6	13:12	106.5	12:05	101.1	11:25	97.0	10:45
3800	128.7	14:48	121.4	13:57	111.9	12:46	106.2	12:03	101.9	11:21
4000	134.8	15:36	127.2	14:42	117.2	13:27	111.3	12:42	106.8	11:57

**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)										
	150	170	190	210	230	250	270	290	310	330	350
10	-1.8	-1.6	-1.3	-0.9	-0.4	0.0	0.8	1.8	2.9	4.1	5.5
20	-3.6	-3.2	-2.6	-1.8	-0.9	0.0	1.6	3.4	5.5	7.9	10.5
30	-5.3	-4.7	-3.8	-2.7	-1.4	0.0	2.2	4.9	7.9	11.3	15.1
40	-6.8	-6.0	-5.0	-3.5	-1.8	0.0	2.9	6.2	10.1	14.4	19.2
50	-8.3	-7.3	-6.0	-4.2	-2.2	0.0	3.4	7.4	12.0	17.1	22.9
60	-9.5	-8.4	-6.9	-4.9	-2.5	0.0	3.9	8.4	13.7	19.6	26.1
70	-10.7	-9.5	-7.8	-5.5	-2.8	0.0	4.3	9.3	15.1	21.6	28.9
80	-11.7	-10.4	-8.5	-6.1	-3.1	0.0	4.6	10.1	16.3	23.4	31.2
90	-12.6	-11.2	-9.2	-6.5	-3.4	0.0	4.9	10.7	17.3	24.8	33.1
100	-13.4	-11.9	-9.8	-7.0	-3.7	0.0	5.1	11.1	18.0	25.9	34.6
110	-14.1	-12.5	-10.3	-7.3	-3.9	0.0	5.2	11.4	18.5	26.6	35.6
120	-14.6	-12.9	-10.7	-7.6	-4.0	0.0	5.3	11.6	18.8	27.0	36.1
130	-15.0	-13.3	-11.0	-7.9	-4.2	0.0	5.3	11.6	18.8	27.0	36.2
140	-15.2	-13.5	-11.2	-8.1	-4.3	0.0	5.2	11.5	18.6	26.7	35.8

Based on Long Range Cruise and VREF30+80 descent.

**Descent at VREF30 + 80**

PRESSURE ALTITUDE (1000 FT)	17	19	21	23	25	27	29	31	33	35
DISTANCE (NM)	35	40	44	48	52	57	61	65	69	74
TIME (MINUTES)	11	12	13	14	15	15	16	17	18	18

**GEAR DOWN****Holding  
Flaps Up**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)						
	1500	5000	10000	15000	20000	25000	30000
360	%N1 KIAS FF/ENG	76.1 264 7750					
340	%N1 KIAS FF/ENG	74.6 260 7360	77.7 260 7350				
320	%N1 KIAS FF/ENG	72.8 253 6890	75.8 253 6870				
300	%N1 KIAS FF/ENG	70.6 244 6380	73.7 244 6370	78.1 244 6340			
280	%N1 KIAS FF/ENG	68.8 238 5970	72.0 238 5960	76.3 238 5920			
260	%N1 KIAS FF/ENG	66.7 229 5520	69.7 229 5510	74.1 229 5470	78.6 229 5490		
240	%N1 KIAS FF/ENG	64.9 223 5150	67.7 223 5130	72.2 223 5100	76.7 223 5100		
220	%N1 KIAS FF/ENG	63.1 217 4800	65.8 217 4770	70.1 217 4730	74.6 217 4730	79.4 217 4770	
200	%N1 KIAS FF/ENG	61.9 217 4610	64.7 217 4570	68.8 217 4520	73.3 217 4520	78.0 217 4550	82.7 217 4610
180	%N1 KIAS FF/ENG	61.0 217 4450	63.8 217 4410	67.8 217 4360	72.2 217 4350	76.9 217 4370	81.5 217 4420
160	%N1 KIAS FF/ENG	60.1 217 4320	62.9 217 4270	66.8 217 4210	71.3 217 4190	75.9 217 4210	80.5 217 4260

This table includes 5% additional fuel for holding in a racetrack pattern.

**GEAR DOWN****Holding  
Flaps 1**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
360	%N1	75.9	79.0	83.8	88.3	94.3
	KIAS	244	244	244	244	244
	FF/ENG	7660	7700	7690	7810	8200
340	%N1	74.3	77.4	82.1	86.8	91.8
	KIAS	240	240	240	240	240
	FF/ENG	7240	7260	7250	7350	7630
320	%N1	72.5	75.5	80.0	84.9	89.7
	KIAS	233	233	233	233	233
	FF/ENG	6770	6780	6770	6830	7040
300	%N1	70.3	73.4	77.8	82.9	87.6
	KIAS	224	224	224	224	224
	FF/ENG	6270	6270	6270	6320	6450
280	%N1	68.3	71.5	75.8	80.6	85.6
	KIAS	218	218	218	218	218
	FF/ENG	5840	5840	5820	5870	5980
260	%N1	66.0	69.1	73.5	78.1	83.3
	KIAS	209	209	209	209	209
	FF/ENG	5380	5370	5340	5400	5460
240	%N1	64.1	66.9	71.4	75.9	81.0
	KIAS	203	203	203	203	203
	FF/ENG	4980	4960	4930	4970	5020
220	%N1	62.0	64.7	69.0	73.6	78.4
	KIAS	197	197	197	197	197
	FF/ENG	4600	4570	4530	4550	4610
200	%N1	60.5	63.2	67.3	71.8	76.5
	KIAS	197	197	197	197	197
	FF/ENG	4350	4310	4260	4270	4310
180	%N1	59.1	61.8	65.8	70.3	74.9
	KIAS	197	197	197	197	197
	FF/ENG	4140	4100	4040	4050	4070
160	%N1	57.9	60.7	64.6	69.0	73.5
	KIAS	197	197	197	197	197
	FF/ENG	3970	3920	3860	3860	3860

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally  
Blank

DRAFT

**Performance Inflight - QRH**  
**Gear Down, Engine INOP**

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**GEAR DOWN**  
**ENGINE INOP**  
**MAX CONTINUOUS THRUST**

**Driftdown Speed/Level Off Altitude**

**100 ft/min residual rate of climb**

**Includes APU fuel burn**

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
320	307	254	5600	4400	2200
300	288	246	7700	6800	5300
280	269	238	9800	9100	8100
260	250	230	12100	11400	10300
240	230	223	14000	13500	12400
220	210	217	15900	15400	14400
200	191	216	17300	16700	15700
180	172	216	18500	18100	16900
160	153	216	19700	19400	18200

**Long Range Cruise Altitude Capability**

**100 ft/min residual rate of climb**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
340	1800		
330	3300	1000	
320	4500	2700	
310	5700	4400	1900
300	6800	5700	3800
290	7800	7000	5300
280	8800	8100	6700
270	9800	9100	8100
260	11100	10400	9300
250	12100	11400	10300
240	13100	12500	11300
230	14000	13600	12400
220	15100	14600	13600
210	15900	15400	14400
200	16700	16100	15100
190	17400	16700	15800
180	18000	17500	16400
170	18700	18200	16900
160	19300	18900	17700

**GEAR DOWN****ENGINE INOP****MAX CONTINUOUS THRUST****Long Range Cruise Control**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (1000 FT)							
	5	7	9	11	13	15	17	19
300	%N1	94.3	96.8					
	MACH	.403	.418					
	KIAS	244	244					
	FF/ENG	12328	12507					
280	%N1	92.3	94.1	96.8				
	MACH	.393	.407	.422				
	KIAS	238	238	238				
	FF/ENG	11514	11566	11807				
260	%N1	90.5	91.6	93.6	96.4			
	MACH	.385	.393	.408	.423			
	KIAS	233	229	229	229			
	FF/ENG	10870	10626	10714	10945			
240	%N1	88.9	89.8	91.3	93.4	96.5		
	MACH	.379	.385	.397	.412	.428		
	KIAS	229	225	223	223	223		
	FF/ENG	10228	9966	9915	10023	10245		
220	%N1	86.6	88.0	89.1	90.9	93.1	96.4	
	MACH	.368	.377	.387	.401	.417	.433	
	KIAS	223	220	217	217	217	217	
	FF/ENG	9452	9309	9167	9222	9323	9542	
200	%N1	84.2	86.0	87.8	89.5	91.4	94.0	98.1
	MACH	.358	.371	.385	.400	.415	.431	.448
	KIAS	217	217	217	217	217	217	217
	FF/ENG	8693	8698	8718	8773	8844	8956	9300
180	%N1	82.9	84.7	86.7	88.4	90.2	92.3	95.5
	MACH	.358	.371	.385	.400	.415	.431	.448
	KIAS	217	217	217	217	217	217	217
	FF/ENG	8330	8328	8342	8399	8458	8533	8740
160	%N1	81.7	83.6	85.4	87.3	89.0	90.9	93.5
	MACH	.358	.371	.385	.400	.415	.431	.448
	KIAS	217	217	217	217	217	217	217
	FF/ENG	8019	8011	8010	8058	8115	8168	8310

## GEAR DOWN

## 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	
165	145	129	118	108	100	95	90	84	78	73	
332	295	263	238	218	200	187	175	165	155	147	
500	444	396	358	327	300	280	262	246	233	221	
669	593	528	477	436	400	374	350	329	310	294	
837	742	661	597	545	500	467	437	410	387	367	
1007	893	795	718	655	600	560	524	492	464	440	
1177	1043	928	838	764	700	653	611	574	541	513	
1347	1193	1061	958	873	800	746	698	655	618	586	
1519	1344	1195	1078	983	900	839	785	737	695	659	
1691	1496	1329	1198	1092	1000	933	873	819	772	731	

#### Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)							
	6		8		10		12	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
100	4.0	0:27	3.8	0:26	3.5	0:26	3.4	0:25
200	8.2	0:51	7.8	0:50	7.5	0:49	7.3	0:48
300	12.3	1:15	11.8	1:14	11.4	1:12	11.1	1:10
400	16.4	1:40	15.8	1:38	15.3	1:36	14.9	1:33
500	20.5	2:04	19.7	2:02	19.1	1:59	18.7	1:56
600	24.5	2:29	23.6	2:27	22.9	2:23	22.5	2:19
700	28.5	2:53	27.5	2:51	26.7	2:46	26.1	2:42
800	32.5	3:18	31.3	3:16	30.4	3:10	29.8	3:05
900	36.4	3:43	35.1	3:40	34.1	3:34	33.4	3:28
1000	40.3	4:08	38.8	4:05	37.8	3:58	37.0	3:51

#### Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	150	200	250	300	350
5	-0.8	-0.5	0.0	1.6	2.6
10	-1.8	-1.1	0.0	3.0	5.6
15	-2.8	-1.6	0.0	4.4	8.6
20	-3.7	-2.2	0.0	5.6	11.6
25	-4.5	-2.7	0.0	6.8	14.4
30	-5.4	-3.2	0.0	7.8	17.3
35	-6.2	-3.7	0.0	8.7	20.0
40	-7.0	-4.2	0.0	9.5	22.7
45	-7.7	-4.7	0.0	10.2	25.3

Based on Long Range Cruise and VREF30+80 descent. Includes APU fuel burn.

**GEAR DOWN**  
**ENGINE INOP**  
**MAX CONTINUOUS THRUST**

**Holding**  
**Flaps Up**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)			
	1500	5000	10000	15000
340	%N1	95.5		
	KIAS	260		
	FF/ENG	14970		
320	%N1	93.4	97.2	
	KIAS	253	253	
	FF/ENG	13980	14120	
300	%N1	91.1	94.3	
	KIAS	244	244	
	FF/ENG	12970	12940	
280	%N1	89.3	92.3	98.8
	KIAS	238	238	238
	FF/ENG	12100	12090	12660
260	%N1	86.8	90.0	94.8
	KIAS	229	229	229
	FF/ENG	11100	11180	11340
240	%N1	84.6	88.0	92.2
	KIAS	223	223	223
	FF/ENG	10310	10380	10460
220	%N1	82.3	85.7	90.0
	KIAS	217	217	217
	FF/ENG	9540	9590	9650
200	%N1	80.8	84.2	88.6
	KIAS	217	217	217
	FF/ENG	9080	9130	9180
180	%N1	79.6	82.9	87.5
	KIAS	217	217	217
	FF/ENG	8700	8750	8780
160	%N1	78.6	81.7	86.4
	KIAS	217	217	217
	FF/ENG	8380	8420	8430

This table includes 5% additional fuel for holding in a racetrack pattern.

**Performance Inflight - QRH**  
**Text**

**Chapter PI-QRH**  
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## **Introduction**

This chapter contains information to supplement performance data from the Flight Management Computer. 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.

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## **General**

### **Flight with Unreliable Airspeed / Turbulent Air Penetration**

Body 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 may also cause unreliable airspeed/Mach indications. Climb, cruise and descent information is based on the recommended turbulent air penetration speed schedule: 270 knots below 25,000 feet, 280 knots or 0.82 Mach whichever is lower at 25,000 feet and above; maintain a minimum speed of 15 knots above the minimum maneuvering speed when below 0.82 Mach. This schedule provides ample protection from stall and high speed buffet, while also providing protection from exceeding structural limits.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed may also be unreliable.

### **Max Climb %N1**

This table shows Max Climb %N1 for a 310/.84 climb speed schedule, normal engine bleed for 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 Speeds**

This table contains flaps 30, 25 and 20 reference speeds for a given weight.

## Advisory Information

### Normal Configuration Landing Distance

Tables are provided as advisory information for normal configuration landing distances on dry runways and slippery runways with good, medium, and poor reported braking action. Landing distances for slippery runways are 115% of the actual landing distances.

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 appropriate 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 and adjustments are provided for dry runways and runways with good, medium, and poor reported braking action.

Enter the table with the applicable non-normal configuration and read the normal approach speed. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and speed at sea level, zero wind, and zero slope. Subsequent columns provide corrections for off-reference landing weight, altitude,

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wind, slope, and speed conditions. Each correction is independently added to the reference landing distance. Landing distance includes the effects of max manual braking and reverse thrust.

For an engine inoperative autoland, check the rate of climb capability shown in Gear Down Landing Rate of Climb Available tables to ensure adequate climb performance.

## **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 appropriate Event Adjusted Brake Energy Table (No Reverse Thrust or 2 Engine Reverse) with the reference brake energy per brake and the type of braking used during landing (Max Manual, Max Auto, or Autobrake). The resulting number is the adjusted brake energy per brake and represents the energy absorbed in each brake during the landing. The recommended cooling time is found in the final table by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

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 5.0 or higher on the EICAS indication and disappear as the hottest brake cools with an EICAS indication of 3.5. Note that even without an EICAS advisory message, brake cooling is recommended.

## Landing Climb Limit Weight

In the event an overweight landing is necessary and the fuel dump system is unavailable, landing climb limits should be checked if a Flaps 25 or 30 landing is planned. Enter the table with airport OAT and pressure altitude to read landing climb limit weight. Apply the noted adjustments as required. At weights exceeding those shown, plan a Flaps 20 landing.

## Engine Inoperative

### Initial Max Continuous %N1

The Initial Max Continuous %N1 setting for use following an engine failure is shown. The table is based on the typical all engine cruise Mach number of .84 to provide a target %N1 setting at the start of driftdown. Once driftdown is established, the Max Continuous %N1 Table should be used to determine %N1 for the given conditions.

### Max Continuous %N1

Power setting is based on one engine operating with engine bleed for packs on or off and all anti-ice bleeds off. Enter the table with pressure altitude and IAS or Mach to read %N1.

It is desirable to maintain engine thrust level within the limits of the Max Cruise thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous thrust rating. The Max Continuous thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

### Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

### Driftdown/Cruise Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to long range cruise speed. Cruise is continued at level off altitude and long range cruise speed.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and correct for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude is used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Diversion Fuel and Time table.

## **Long Range Cruise Altitude Capability**

Tables show the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on LRC speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

## **Long Range Cruise Control**

The table provides target %N1, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

## **Long Range Cruise Diversion Fuel and Time**

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .84/310/250 descent. Enter with Air Distance as determined from the Ground to Air Miles Conversion Table and read Fuel and Time required at the cruise pressure altitude. Adjust the fuel obtained for deviation from the reference weight at checkpoint as required by entering the off reference fuel corrections table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel and time required for the actual weight.

## **Holding**

Single engine holding data is provided in the same format as the all engine holding data and is based on the same assumptions.

## **Gear Down Landing Rate of Climb Available**

Rate of climb data is provided as guidance information in the event an engine inoperative autoland is planned. The tables show gear down rate of climb available for Flaps 20 and Flaps 30. Enter the table with TAT and pressure altitude to read rate of climb available. Apply adjustments shown to correct for weight.

## 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 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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## General

# Chapter PI-QRH

## Section 50

**Flight With Unreliable Airspeed / Turbulent Air Penetration**  
**Altitude and/or vertical speed indications may also be unreliable.**

**Climb**

**Flaps Up, Set Max Climb Thrust**

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)			
		400	500	600	700
40000 (.82M)	PITCH ATT	3.5			
	V/S (FT/MIN)	800			
30000 (280 KIAS)	PITCH ATT	4.0	4.0	4.0	
	V/S (FT/MIN)	1800	1200	700	
20000 (270 KIAS)	PITCH ATT	6.5	6.0	6.0	6.5
	V/S (FT/MIN)	2900	2100	1500	1000
10000 (270 KIAS)	PITCH ATT	9.0	8.0	8.0	8.0
	V/S (FT/MIN)	3900	2900	2200	1700
SEA LEVEL (270 KIAS)	PITCH ATT	11.5	10.5	9.5	9.5
	V/S (FT/MIN)	4700	3600	2800	2300

**Cruise**

**Flaps Up, Set Thrust for Level Flight**

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)			
		400	500	600	700
40000 (.82M)	PITCH ATT	2.5			
	EPR	1.211			
35000 (280 KIAS)	PITCH ATT	1.5	2.0	3.0	
	EPR	1.092	1.18	1.370	
30000 (280 KIAS)	PITCH ATT	2.0	2.5	3.0	4.0
	EPR	1.027	1.082	1.168	1.336
25000 (280 KIAS)	PITCH ATT	2.0	2.5	3.5	4.0
	EPR	0.988	1.024	1.084	1.162
20000 (270 KIAS)	PITCH ATT	2.0	3.0	4.0	5.0
	EPR	0.973	1.001	1.042	1.101
15000 (270 KIAS)	PITCH ATT	2.0	3.0	4.0	5.0
	EPR	0.969	0.988	1.018	1.057

**Flight With Unreliable Airspeed / Turbulent Air Penetration**  
**Altitude and/or vertical speed indications may also be unreliable.**
**Descent****Flaps Up, Set Idle Thrust**

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)			
		400	500	600	700
40000 (.82M)	PITCH ATT V/S (FT/MIN)	-0.5 -2500			
30000 (280 KIAS)	PITCH ATT V/S (FT/MIN)	-1.0 -2100	0.0 -1900	1.0 -1900	
20000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	-0.5 -1700	0.5 -1600	1.5 -1600	2.0 -1600
10000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	-1.0 -1600	0.0 -1500	1.0 -1400	2.0 -1400
SEA LEVEL (270 KIAS)	PITCH ATT V/S (FT/MIN)	-1.5 -1600	-0.5 -1400	1.0 -1400	2.0 -1400

**Holding****Flaps Up, Set Thrust for Level Flight**

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)			
		400	500	600	700
10000	PITCH ATT EPR (Alt Mode %N1) KIAS	4.5 1.002 (55.8) 210	5.0 1.012 (61.5) 227	5.0 1.019 (66.3) 249	4.5 1.028 (70.0) 271
	PITCH ATT EPR (Alt Mode %N1) KIAS	4.0 0.998 (51.5) 210	4.5 1.006 (57.2) 226	5.0 1.010 (62.2) 248	5.0 1.016 (66.3) 268

**Terminal Area (5000 FT)****Set Thrust for Level Flight**

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)			
		400	500	600	700
FLAPS 0 (GEAR UP) (VREF30 + 80)	PITCH ATT EPR (Alt Mode %N1) KIAS	4.5 1.000 (52.3) 210	5.0 1.010 (58.1) 226	5.5 1.020 (63.5) 240	5.5 1.030 (67.9) 255
	PITCH ATT EPR (Alt Mode %N1) KIAS	6.0 1.010 (52.7) 190	6.5 1.020 (59.0) 206	7.0 1.040 (64.6) 220	7.0 1.060 (69.5) 235
	PITCH ATT EPR (Alt Mode %N1) KIAS	5.0 1.030 (54.0) 170	5.5 1.040 (60.7) 186	6.0 1.060 (66.1) 200	6.0 1.080 (70.8) 215
FLAPS 15 (GEAR UP) (VREF30 + 20)	PITCH ATT EPR (Alt Mode %N1) KIAS	5.5 1.040 (55.6) 150	6.0 1.060 (62.5) 166	6.5 1.090 (68.1) 180	6.5 1.110 (72.5) 195
	PITCH ATT EPR (Alt Mode %N1) KIAS	4.5 1.070 (62.4) 150	5.0 1.100 (69.2) 166	5.5 1.140 (74.4) 180	5.0 1.170 (79.0) 195
FLAPS 20 (GEAR DOWN) (VREF30 + 20)					

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**Flight With Unreliable Airspeed / Turbulent Air Penetration**  
**Altitude and/or vertical speed indications may also be unreliable.**

**Final Approach (1500 FT)****Gear Down, Set Thrust for 3° Glideslope**

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)			
		400	500	600	700
FLAPS 20 (VREF20 + 10)	PITCH ATT	<b>1.0</b>	<b>1.5</b>	<b>1.5</b>	<b>1.5</b>
	EPR (Alt Mode %N1)	1.000 (41.3)	1.010 (45.7)	1.010 (49.9)	1.020 (53.5)
	KIAS	153	170	185	198
FLAPS 25 (VREF25 + 10)	PITCH ATT	<b>1.0</b>	<b>1.0</b>	<b>1.0</b>	<b>1.5</b>
	EPR (Alt Mode %N1)	1.030 (50.6)	1.040 (56.1)	1.060 (60.9)	1.070 (65.0)
	KIAS	146	162	176	189
FLAPS 30 (VREF30 + 10)	PITCH ATT	<b>0.5</b>	<b>0.5</b>	<b>0.5</b>	<b>0.5</b>
	EPR (Alt Mode %N1)	1.050 (55.6)	1.070 (61.1)	1.090 (65.9)	1.110 (70.7)
	KIAS	140	156	170	184

**Max Climb EPR****Based on engine bleed for packs on and anti-ice off**

TAT (°C)	PRESSURE ALTITUDE (1000 FT)/SPEED (IAS OR MACH)									
	0	5	10	15	20	25	30	35	40	43
310	310	310	310	310	310	310	0.84	0.84	0.84	0.84
60	1.148	1.134	1.141	1.151	1.154	1.104	1.100	1.171	1.186	1.201
50	1.186	1.171	1.158	1.151	1.154	1.104	1.100	1.171	1.186	1.201
40	1.210	1.212	1.198	1.186	1.161	1.104	1.100	1.171	1.186	1.201
30	1.210	1.234	1.252	1.241	1.209	1.153	1.113	1.171	1.186	1.201
20	1.210	1.234	1.264	1.301	1.277	1.248	1.223	1.193	1.186	1.201
10	1.210	1.234	1.264	1.301	1.330	1.382	1.338	1.294	1.281	1.289
0	1.210	1.234	1.264	1.301	1.330	1.410	1.441	1.401	1.384	1.384
-10	1.210	1.234	1.264	1.301	1.330	1.410	1.458	1.487	1.474	1.472
-15 & BELOW	1.210	1.234	1.264	1.301	1.330	1.410	1.458	1.503	1.505	1.504

**EPR Adjustments for Engine Bleed**

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	0	10	20	30	40	43
ENGINE ONLY	-0.016	-0.015	-0.017	-0.019	-0.019	-0.021
ENGINE & WING*	-0.022	-0.025	-0.030	-0.034	-0.038	-0.042
ENGINE & WING**	-0.029	-0.035	-0.043	-0.048	-0.056	-0.063

\*Wing anti-ice on, packs on.

\*\*Wing anti-ice on, single bleed source and both packs off.

**VREF**

WEIGHT (1000 LB)	FLAPS		
	30	25	20
660	169	174	183
640	165	172	181
620	163	169	178
600	160	167	175
580	157	164	172
560	155	161	169
540	152	158	166
520	149	155	163
500	146	152	160
480	143	149	157
460	140	146	154
440	137	143	150
420	133	139	147
400	130	136	143
380	126	132	139
360	123	128	135
340	119	124	131

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# Performance Inflight - QRH

## Advisory Information

# Chapter PI-QRH

## Section 51

### ADVISORY INFORMATION

#### Normal Configuration Landing Distance

Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (FT)							
	REF DIST	WEIGHT 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	520000 LB LANDING WT	PER 10000 LB ABOVE / BELOW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN / UP HILL	ABOVE / BELOW ISA	PER 5 KTS ABOVE VREF30	ONE REV NO REV

#### Dry Runway

MAX MANUAL	3330	+80/-40	80	-130/+460	+50/-40	+70/-70	120	70	160
AUTOBRAKE MAX	4400	+60/-60	110	-180/+620	+10/0	+110/-110	230	0	0
AUTOBRAKE 4	5500	+80/-80	150	-250/+870	+10/-20	+150/-150	290	0	0
AUTOBRAKE 3	6610	+100/-100	190	-320/+1080	+30/-50	+190/-190	340	0	0
AUTOBRAKE 2	7330	+120/-120	220	-370/+1250	+90/-130	+210/-210	310	120	120
AUTOBRAKE 1	7870	+140/-140	250	-410/+1400	+160/-200	+230/-230	310	450	510

#### Good Reported Braking Action

MAX MANUAL	4510	+70/-70	120	-210/+760	+120/-100	+110/-110	180	240	540
AUTOBRAKE MAX	4820	+70/-70	130	-220/+790	+100/-80	+120/-120	220	250	560
AUTOBRAKE 4	5520	+80/-80	150	-260/+890	+30/-30	+150/-150	290	20	90
AUTOBRAKE 3	6610	+100/-100	190	-320/+1080	+30/-50	+190/-190	340	0	0
AUTOBRAKE 2	7330	+120/-120	220	-370/+1250	+90/-130	+210/-210	310	120	120
AUTOBRAKE 1	7870	+140/-140	250	-410/+1400	+160/-200	+230/-230	310	450	510

#### Medium Reported Braking Action

MAX MANUAL	6130	+100/-100	190	-340/+1240	+290/-230	+170/-160	220	640	1560
AUTOBRAKE MAX	6190	+110/-100	190	-340/+1240	+280/-200	+170/-170	260	620	1530
AUTOBRAKE 4	6290	+100/-100	190	-340/+1250	+280/-190	+170/-170	270	610	1550
AUTOBRAKE 3	6940	+110/-110	200	-370/+1330	+200/-130	+200/-200	340	320	1040
AUTOBRAKE 2	7510	+120/-130	230	-400/+1420	+210/-190	+220/-210	310	280	760
AUTOBRAKE 1	7960	+140/-140	250	-430/+1500	+260/-240	+240/-230	310	530	850

#### Poor Reported Braking Action

MAX MANUAL	7930	+150/-140	270	-510/+1940	+680/-450	+230/-220	260	1350	3610
AUTOBRAKE MAX	7950	+150/-140	270	-510/+1940	+690/-450	+230/-220	260	1360	3620
AUTOBRAKE 4	8000	+150/-140	270	-510/+1950	+680/-460	+230/-220	260	1370	3640
AUTOBRAKE 3	8160	+150/-140	270	-510/+1960	+640/-390	+240/-230	330	1250	3540
AUTOBRAKE 2	8440	+150/-150	280	-520/+2000	+630/-420	+240/-240	310	1100	3240
AUTOBRAKE 1	8680	+160/-160	290	-540/+2030	+630/-430	+250/-250	300	1220	3110

Reference distance is for sea level, standard day, no wind or slope, VREF30 approach speed, 2 engine reverse thrust, and auto speedbrakes.

For Max Manual braking and manual speedbrakes, increase reference landing by 200 ft.

For autobrake and manual speedbrakes, increase reference landing distance by 170 ft.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (1000 ft of air distance.)

**ADVISORY INFORMATION****Normal Configuration Landing Distance**

Flaps 25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WEIGHT 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	520000 LB LANDING WT	PER 10000 LB ABOVE/BELLOW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN / UP HILL	ABOVE/Below ISA	PER 5 KTS ABOVE VREF25	ONE REV	NO REV

**Dry Runway**

MAX MANUAL	3500	+80/-50	80	-140/+480	+50/-50	+80/-80	130	90	190
AUTOBRAKE MAX	4660	+70/-70	110	-190/+640	+10/0	+120/-120	230	0	0
AUTOBRAKE 4	5870	+90/-90	160	-270/+900	+10/-20	+160/-160	300	0	0
AUTOBRAKE 3	7060	+110/-110	200	-330/+1120	+40/-70	+200/-200	330	0	0
AUTOBRAKE 2	7770	+130/-140	240	-380/+1290	+120/-160	+230/-230	310	220	220
AUTOBRAKE 1	8290	+150/-150	270	-420/+1440	+190/-220	+250/-240	310	600	710

**Good Reported Braking Action**

MAX MANUAL	4690	+70/-70	130	-220/+770	+120/-100	+120/-120	170	270	630
AUTOBRAKE MAX	5050	+70/-70	140	-230/+800	+100/-70	+130/-130	230	280	650
AUTOBRAKE 4	5890	+90/-90	160	-270/+920	+30/-30	+160/-160	300	20	90
AUTOBRAKE 3	7060	+110/-110	200	-330/+1120	+40/-70	+200/-200	330	0	0
AUTOBRAKE 2	7770	+130/-140	240	-380/+1290	+120/-160	+230/-230	310	220	220
AUTOBRAKE 1	8290	+150/-150	270	-420/+1440	+190/-220	+250/-240	310	600	710

**Medium Reported Braking Action**

MAX MANUAL	6380	+110/-110	200	-350/+1260	+290/-230	+180/-170	220	730	1810
AUTOBRAKE MAX	6460	+110/-110	200	-350/+1260	+280/-210	+180/-180	260	710	1770
AUTOBRAKE 4	6610	+110/-110	200	-350/+1280	+260/-180	+190/-180	290	640	1740
AUTOBRAKE 3	7390	+120/-120	220	-380/+1370	+190/-150	+210/-210	330	320	1130
AUTOBRAKE 2	7950	+130/-140	250	-410/+1450	+230/-210	+230/-230	310	380	910
AUTOBRAKE 1	8380	+150/-150	280	-440/+1530	+280/-270	+250/-240	310	680	1070

**Poor Reported Braking Action**

MAX MANUAL	8230	+150/-150	280	-510/+1960	+680/-450	+240/-230	260	1520	4170
AUTOBRAKE MAX	8260	+150/-150	290	-510/+1960	+690/-460	+240/-230	260	1520	4180
AUTOBRAKE 4	8310	+150/-150	290	-510/+1970	+690/-460	+240/-230	260	1530	4210
AUTOBRAKE 3	8560	+150/-150	290	-520/+1990	+630/-410	+250/-240	320	1330	4010
AUTOBRAKE 2	8840	+160/-160	300	-530/+2030	+640/-430	+260/-250	310	1250	3710
AUTOBRAKE 1	9090	+170/-170	310	-550/+2060	+640/-440	+260/-260	310	1380	3590

Reference distance is for sea level, standard day, no wind or slope, VREF25 approach speed, 2 engine reverse thrust, and auto speedbrakes.

For Max Manual braking and manual speedbrakes, increase reference landing by 210 ft.

For autobrake and manual speedbrakes, increase reference landing distance by 180 ft.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (1000 ft of air distance.)

**ADVISORY INFORMATION****Normal Configuration Landing Distance  
Flaps 20**

	LANDING DISTANCE AND ADJUSTMENTS (FT)							
	REF DIST	WEIGHT 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	520000 LB LANDING WT	PER 10000 LB ABOVE / BELOW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN / UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF20	ONE REV NO REV

**Dry Runway**

MAX MANUAL	3760	+90/-50	90	-150/+510	+50/-50	+90/-90	140	110	230
AUTOBRAKE MAX	5010	+70/-70	130	-200/+670	0/0	+130/-130	230	0	0
AUTOBRAKE 4	6370	+90/-100	180	-280/+940	0/-20	+180/-180	310	0	0
AUTOBRAKE 3	7710	+120/-130	220	-350/+1180	+40/-80	+230/-230	350	0	0
AUTOBRAKE 2	8500	+140/-150	270	-400/+1350	+130/-170	+250/-250	340	240	240
AUTOBRAKE 1	9080	+160/-170	310	-450/+1510	+210/-240	+280/-270	340	680	760

**Good Reported Braking Action**

MAX MANUAL	5050	+80/-80	140	-230/+800	+130/-110	+130/-130	180	320	740
AUTOBRAKE MAX	5410	+80/-80	150	-240/+830	+100/-70	+140/-140	240	320	750
AUTOBRAKE 4	6390	+90/-100	180	-280/+960	+20/-30	+180/-180	310	20	100
AUTOBRAKE 3	7710	+120/-130	220	-350/+1180	+40/-80	+230/-230	350	0	0
AUTOBRAKE 2	8500	+140/-150	270	-400/+1350	+130/-170	+250/-250	340	240	240
AUTOBRAKE 1	9080	+160/-170	310	-450/+1510	+210/-240	+280/-270	340	680	760

**Medium Reported Braking Action**

MAX MANUAL	6920	+120/-120	220	-360/+1310	+320/-260	+190/-190	240	860	2140
AUTOBRAKE MAX	6980	+120/-120	230	-360/+1310	+310/-230	+200/-190	270	830	2090
AUTOBRAKE 4	7170	+120/-120	230	-370/+1330	+280/-200	+200/-200	300	740	2060
AUTOBRAKE 3	8040	+130/-130	240	-400/+1430	+200/-160	+230/-230	350	370	1360
AUTOBRAKE 2	8680	+150/-150	270	-430/+1520	+240/-230	+260/-250	340	410	1050
AUTOBRAKE 1	9160	+160/-170	310	-460/+1600	+300/-280	+280/-270	340	770	1190

**Poor Reported Braking Action**

MAX MANUAL	8960	+170/-160	320	-540/+2040	+740/-490	+260/-250	280	1770	4960
AUTOBRAKE MAX	8970	+170/-160	320	-540/+2040	+750/-500	+260/-250	280	1780	4970
AUTOBRAKE 4	9040	+170/-170	320	-540/+2040	+740/-500	+260/-250	280	1790	5000
AUTOBRAKE 3	9310	+170/-170	320	-550/+2070	+680/-440	+270/-270	340	1560	4790
AUTOBRAKE 2	9630	+180/-170	330	-560/+2110	+690/-460	+280/-270	330	1430	4450
AUTOBRAKE 1	9900	+180/-180	350	-570/+2150	+690/-470	+290/-280	330	1590	4240

Reference distance is for sea level, standard day, no wind or slope, VREF20 approach speed, 2 engine reverse thrust, and auto speedbrakes.

For Max Manual braking and manual speedbrakes, increase reference landing by 220 ft.

For autobrake and manual speedbrakes, increase reference landing distance by 190 ft.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (1000 ft of air distance.)

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****Dry Runway**

		LANDING DISTANCES AND ADJUSTMENTS (FT)									
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ PER 10 KTS	SLOPE ADJ PER 1% 10°C	TEMP ADJ PER 10°C	APP SPD ADJ	REVERSE THRUST ADJ	PER 10 KTS ABV VREF	ONE REV
EICAS MESSAGE	VREF	450000 LB LDG WT	PER 10000 LB ABV/BLW 450000 LB	PER 1000 FT ABV S.L.	HEAD/ TAIL WIND	DOWN/ UP HILL	ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV	
ANTISKID (FLAPS 25)	VREF25	5630	110/-110	180	-320/1210	260/-200	80/-80	410	660	1680	
ANTISKID (FLAPS 30)	VREF30	5420	100/-100	170	-310/1190	250/-190	80/-80	410	580	1450	
ENG SHUTDOWN L, R (FLAPS 20)	VREF20	3300	100/-50	80	-130/480	50/-40	40/-40	270	-	100	
ENG SHUTDOWN L, R (FLAPS 30)	VREF30	2980	80/-40	70	-120/450	40/-40	40/-40	250	-	70	
FLAPS DRIVE (FLAPS $\leq$ 5)	VREF30+40	3970	130/-70	120	-150/600	60/-50	50/-50	290	160	390	
FLAPS DRIVE ( $5 < \text{FLAPS} < 20$ )	VREF30+20	3400	100/-40	80	-130/490	50/-40	40/-40	260	110	250	
FLAPS DRIVE (FLAPS $\geq 20$ )	VREF20	3240	90/-50	80	-130/470	50/-40	40/-40	250	90	190	
FLAPS PRIMARY FAIL	VREF20	3630	90/-50	90	-140/500	50/-40	50/-40	290	100	220	
FLAP/SLAT CONTROL	VREF20	3220	90/-50	80	-130/470	50/-40	40/-40	240	90	190	
FLIGHT CONTROL MODE	VREF20	3730	90/-50	90	-140/500	50/-50	50/-50	310	110	240	
HYD PRESS SYS C	VREF20	3630	90/-50	90	-140/500	50/-40	50/-40	290	100	220	
HYD PRESS SYS L+C	VREF30+20	4140	100/-60	100	-160/550	70/-60	50/-50	380	-	160	
HYD PRESS SYS L+R	VREF30+20	4840	80/-70	130	-210/720	130/-110	70/-70	480	-	-	
HYD PRESS SYS R+C	VREF30+20	5140	70/-80	140	-220/750	130/-110	70/-70	500	-	380	
HYD PRESS SYS L (FLAPS 25)	VREF25	3270	90/-50	80	-140/480	50/-50	40/-40	280	-	100	
HYD PRESS SYS L (FLAPS 30)	VREF30	3150	80/-40	70	-130/470	50/-40	40/-40	280	-	90	
HYD PRESS SYS R (FLAPS 25)	VREF25	3810	60/-60	100	-170/590	80/-70	50/-50	340	-	180	
HYD PRESS SYS R (FLAPS 30)	VREF30	3640	60/-60	90	-160/580	70/-60	50/-50	340	-	150	
PITCH UP AUTHORITY (FLAPS 5)	VREF30+40	3870	120/-60	110	-150/570	60/-50	50/-50	270	140	320	
PITCH UP AUTHORITY (FLAPS 20)	VREF30+20	3340	100/-40	80	-130/480	50/-40	40/-40	250	90	200	
PRI FLIGHT COMPUTERS	VREF20	3730	90/-50	90	-140/500	50/-50	50/-50	310	110	240	
SLATS DRIVE	VREF30+30	3690	110/-50	100	-140/510	50/-50	50/-50	260	120	260	
STABILIZER	VREF30+20	3440	90/-50	80	-140/480	50/-40	40/-40	260	100	220	

Actual (unfactored) distances are shown.

Includes distances from 50 ft above threshold (1000 ft air distance).

Assumes maximum manual braking and maximum available reverse thrust.

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance  
Good Reported Braking Action**

		LANDING DISTANCES AND ADJUSTMENTS (FT)									
EICAS MESSAGE	VREF	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	PER 10 KTS ONE REV	NO REV
ANTISKID (FLAPS 25)	VREF25	5630	110/-110	180	-320/1210	260/-200	80/-80	410	660	1680	
ANTISKID (FLAPS 30)	VREF30	5420	100/-100	170	-310/1190	250/-190	80/-80	410	580	1450	
ENG SHUTDOWN L, R (FLAPS 20)	VREF20	4740	80/-80	130	-220/810	140/-110	70/-70	380	-	370	
ENG SHUTDOWN L, R (FLAPS 30)	VREF30	4210	70/-70	110	-200/760	120/-100	60/-60	350	-	270	
FLAPS DRIVE (FLAPS $\leq$ 5)	VREF30+40	5290	80/-80	160	-220/820	120/-100	80/-70	330	420	1020	
FLAPS DRIVE (5 < FLAPS < 20)	VREF30+20	4750	80/-80	140	-210/780	120/-100	70/-60	340	360	850	
FLAPS DRIVE (FLAPS $\geq$ 20)	VREF20	4510	80/-80	130	-210/760	120/-100	60/-60	340	290	680	
FLAPS PRIMARY FAIL	VREF20	4970	80/-90	140	-220/820	130/-110	70/-70	410	350	820	
FLAP/SLAT CONTROL	VREF20	4460	80/-80	120	-210/760	110/-90	60/-60	330	280	650	
FLIGHT CONTROL MODE	VREF20	5120	90/-90	150	-230/840	140/-120	70/-70	440	380	920	
HYD PRESS SYS C	VREF20	4970	80/-90	140	-220/820	130/-110	70/-70	410	350	820	
HYD PRESS SYS L+C	VREF30+20	5980	100/-90	180	-270/960	210/-160	90/-90	540	-	640	
HYD PRESS SYS L+R	VREF30+20	6320	90/-100	190	-300/1030	270/-220	100/-100	610	-	-	
HYD PRESS SYS R+C	VREF30+20	6140	100/-100	180	-280/970	220/-180	90/-90	590	-	700	
HYD PRESS SYS L (FLAPS 25)	VREF25	4710	80/-80	130	-230/830	150/-120	70/-70	410	-	400	
HYD PRESS SYS L (FLAPS 30)	VREF30	4530	80/-80	130	-220/820	140/-120	60/-60	420	-	350	
HYD PRESS SYS R (FLAPS 25)	VREF25	4710	80/-80	130	-230/830	150/-120	70/-70	410	-	400	
HYD PRESS SYS R (FLAPS 30)	VREF30	4480	80/-70	120	-220/810	140/-120	60/-60	410	-	340	
PITCH UP AUTHORITY (FLAPS 5)	VREF30+40	5220	80/-80	150	-220/810	120/-100	80/-70	310	390	930	
PITCH UP AUTHORITY (FLAPS 20)	VREF30+20	4590	70/-70	130	-210/770	110/-90	60/-60	310	280	660	
PRI FLIGHT COMPUTERS	VREF20	5120	90/-90	150	-230/840	140/-120	70/-70	440	380	920	
SLATS DRIVE	VREF30+30	5150	80/-80	150	-220/820	130/-110	70/-70	350	370	860	
STABILIZER	VREF30+20	4790	80/-80	140	-220/790	120/-100	70/-70	350	330	760	

Actual (unfactored) distances are shown.

Includes distances from 50 ft above threshold (1000 ft air distance).

Assumes maximum manual braking and maximum available reverse thrust.

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance  
Medium Reported Braking Action**

		LANDING DISTANCES AND ADJUSTMENTS (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	PER 10 KTS ABV VREF	ONE REV	NO REV
EICAS MESSAGE	VREF	450000 LB LDG WT	PER 10000 LB ABV/BLW 450000 LB	PER 1000 FT ABV S.L.	HEAD/ TAIL WIND	DOWN/ UP HILL	ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV		
ANTISKID (FLAPS 25)	VREF25	7180	150/-150	250	-460/1900	610/-380	110/-100	470	1370	3890		
ANTISKID (FLAPS 30)	VREF30	6930	150/-140	230	-460/1880	610/-380	110/-100	470	1230	3380		
ENG SHUTDOWN L, R (FLAPS 20)	VREF20	6720	130/-130	210	-360/1380	380/-280	110/-100	500	-	1130		
ENG SHUTDOWN L, R (FLAPS 30)	VREF30	5870	110/-110	180	-340/1290	330/-240	90/-90	460	-	810		
FLAPS DRIVE (FLAPS ≤ 5)	VREF30+40	7240	130/-130	250	-350/1340	310/-240	110/-110	440	1130	3070		
FLAPS DRIVE (5 < FLAPS < 20)	VREF30+20	6400	120/-120	210	-340/1280	290/-220	100/-90	440	940	2510		
FLAPS DRIVE (FLAPS ≥ 20)	VREF20	6090	120/-120	200	-330/1260	290/-210	90/-90	430	770	1980		
FLAPS PRIMARY FAIL	VREF20	6610	130/-130	220	-350/1320	320/-240	100/-90	500	900	2370		
FLAP/SLAT CONTROL	VREF20	6000	120/-110	190	-320/1240	280/-210	90/-90	420	740	1890		
FLIGHT CONTROL MODE	VREF20	6840	140/-130	230	-360/1350	350/-260	100/-100	550	1000	2680		
HYD PRESS SYS C	VREF20	6610	130/-130	220	-350/1320	320/-240	100/-90	500	900	2370		
HYD PRESS SYS L+C	VREF30+20	8480	150/-150	290	-440/1620	570/-400	140/-130	700	-	1940		
HYD PRESS SYS L+R	VREF30+20	9960	160/-160	330	-530/1920	920/-620	170/-170	840	-	-		
HYD PRESS SYS R+C	VREF30+20	8660	160/-160	300	-450/1640	580/-420	140/-140	730	-	2070		
HYD PRESS SYS L (FLAPS 25)	VREF25	6710	130/-130	220	-380/1430	410/-300	100/-100	540	-	1230		
HYD PRESS SYS L (FLAPS 30)	VREF30	6450	120/-120	210	-370/1410	410/-300	100/-100	550	-	1070		
HYD PRESS SYS R (FLAPS 25)	VREF25	6660	120/-120	220	-380/1430	410/-300	100/-100	530	-	1200		
HYD PRESS SYS R (FLAPS 30)	VREF30	6300	120/-120	200	-370/1390	390/-280	100/-100	520	-	1000		
PITCH UP AUTHORITY (FLAPS 5)	VREF30+40	7020	130/-120	230	-340/1310	290/-220	110/-100	400	990	2610		
PITCH UP AUTHORITY (FLAPS 20)	VREF30+20	6190	110/-110	200	-330/1250	280/-210	90/-90	400	750	1900		
PRI FLIGHT COMPUTERS	VREF20	6840	140/-130	230	-360/1350	350/-260	100/-100	550	1000	2680		
SLATS DRIVE	VREF30+30	6890	130/-120	230	-350/1320	310/-240	110/-100	440	920	2360		
STABILIZER	VREF30+20	6430	120/-120	210	-340/1280	300/-220	100/-90	440	840	2150		

Actual (unfactored) distances are shown.

Includes distances from 50 ft above threshold (1000 ft air distance).

Assumes maximum manual braking and maximum available reverse thrust.

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****Poor Reported Braking Action**

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
EICAS MESSAGE	VREF	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	
ANTISKID (FLAPS 25)	VREF25	9800	230/-210	350	-800/3800	2900/-910	150/-140	520	3630	15000
ANTISKID (FLAPS 30)	VREF30	9490	220/-210	340	-790/3770	2800/-900	150/-140	520	3340	15000
ENG SHUTDOWN L, R (FLAPS 20)	VREF20	9060	190/-190	310	-560/2240	1020/-580	150/-140	600	-	2730
ENG SHUTDOWN L, R (FLAPS 30)	VREF30	7860	170/-160	260	-520/2100	900/-500	130/-120	550	-	1930
FLAPS DRIVE (FLAPS $\leq$ 5)	VREF30+40	9310	190/-180	350	-520/2080	740/-460	150/-140	520	2330	7390
FLAPS DRIVE (5 < FLAPS < 20)	VREF30+20	8160	170/-160	300	-490/1990	700/-420	130/-120	510	1900	5880
FLAPS DRIVE (FLAPS $\geq$ 20)	VREF20	7790	170/-160	280	-480/1960	690/-410	120/-110	500	1600	4620
FLAPS PRIMARY FAIL	VREF20	8360	180/-180	300	-510/2040	760/-500	130/-120	570	1830	5480
FLAP/SLAT CONTROL	VREF20	7670	170/-160	270	-480/1950	670/-400	120/-110	480	1530	4380
FLIGHT CONTROL MODE	VREF20	8680	190/-180	320	-520/2080	810/-480	140/-130	620	2030	6270
HYD PRESS SYS C	VREF20	8360	180/-180	300	-510/2040	760/-500	130/-120	570	1830	5480
HYD PRESS SYS L+C	VREF30+20	11510	230/-220	440	-690/2690	1580/-830	190/-180	820	-	4770
HYD PRESS SYS L+R	VREF30+20	15410	250/-240	570	-960/3630	3590/-1580	270/-270	1050	-	-
HYD PRESS SYS R+C	VREF30+20	11670	230/-230	450	-700/2710	1530/-850	200/-190	840	-	4970
HYD PRESS SYS L (FLAPS 25)	VREF25	9150	190/-180	330	-600/2420	1160/-640	150/-140	640	-	3050
HYD PRESS SYS L (FLAPS 30)	VREF30	8830	180/-170	320	-600/2390	1150/-640	140/-140	650	-	2690
HYD PRESS SYS R (FLAPS 25)	VREF25	9040	180/-180	330	-600/2400	1130/-630	150/-140	630	-	2940
HYD PRESS SYS R (FLAPS 30)	VREF30	8510	170/-170	300	-580/2340	1080/-600	140/-130	600	-	2420
PITCH UP AUTHORITY (FLAPS 5)	VREF30+40	8890	180/-170	330	-500/2030	690/-420	140/-130	470	1970	5900
PITCH UP AUTHORITY (FLAPS 20)	VREF30+20	7910	160/-160	280	-480/1960	670/-400	120/-120	470	1550	4390
PRI FLIGHT COMPUTERS	VREF20	8680	190/-180	320	-520/2080	810/-480	140/-130	620	2030	6270
SLATS DRIVE	VREF30+30	8720	180/-170	320	-510/2040	730/-440	140/-130	500	1820	5240
STABILIZER	VREF30+20	8170	170/-160	290	-500/2000	720/-430	130/-120	500	1690	4870

Actual (unfactored) distances are shown.

Includes distances from 50 ft above threshold (1000 ft air distance).

Assumes maximum manual braking and maximum available reverse thrust.

**ADVISORY INFORMATION****Recommended Brake Cooling Schedule**  
**Reference Brake Energy (Millions of Foot Pounds)**

WEIGHT (1000 LB)	OAT (°C)	BRAKES ON SPEED (KIAS)																	
		80			100			120			140			160			180		
		0	2	4	0	2	4	0	2	4	0	2	4	0	2	4			
680	0	19.3	20.2	21.0	28.6	30.1	31.5	39.3	41.5	43.7	51.2	54.2	57.3	64.1	67.9	71.8	77.0	81.7	86.3
	10	19.8	20.7	21.6	29.4	31.0	32.5	40.5	42.8	45.0	52.8	55.9	59.1	66.1	70.1	74.1	79.4	84.1	88.9
	15	20.2	21.1	22.0	30.0	31.6	33.1	41.2	43.6	45.9	53.8	56.9	60.2	67.3	71.3	75.4	80.7	85.5	90.3
	20	20.6	21.5	22.4	30.5	32.1	33.6	41.9	44.3	46.7	54.7	57.9	61.2	68.4	72.5	76.6	82.0	86.8	91.7
	30	21.0	22.0	22.9	31.3	32.9	34.5	43.1	45.5	47.9	56.2	59.5	62.8	70.2	74.4	78.7	84.2	89.2	94.1
	40	21.2	22.1	23.1	31.6	33.3	34.9	43.7	46.2	48.7	57.2	60.6	64.0	71.6	75.9	80.2	85.9	91.0	96.0
640	0	18.5	19.3	20.1	27.3	28.7	30.0	37.4	39.5	41.6	48.7	51.6	54.4	60.9	64.6	68.3	73.4	77.8	82.3
	10	19.0	19.8	20.6	28.1	29.5	30.9	38.6	40.7	42.8	50.2	53.2	56.1	62.8	66.6	70.4	75.6	80.2	84.7
	15	19.3	20.2	21.0	28.6	30.1	31.5	39.3	41.5	43.6	51.1	54.2	57.1	63.9	67.8	71.6	76.9	81.5	86.1
	20	19.6	20.5	21.4	29.1	30.6	32.0	39.9	42.2	44.4	52.0	55.1	58.1	65.0	68.9	72.8	78.2	82.8	87.5
	30	20.1	21.0	21.8	29.8	31.3	32.8	41.0	43.3	45.6	53.4	56.6	59.7	66.8	70.8	74.8	80.3	85.1	89.8
	40	20.2	21.1	22.0	30.1	31.7	33.2	41.6	43.9	46.3	54.4	57.6	60.8	68.1	72.2	76.3	81.9	86.8	91.6
600	0	17.6	18.4	19.1	26.0	27.3	28.5	35.5	37.5	39.4	46.2	48.8	51.5	57.7	61.2	64.7	69.6	73.8	78.0
	10	18.1	18.9	19.6	26.7	28.0	29.4	36.6	38.6	40.6	47.6	50.4	53.1	59.5	63.1	66.7	71.8	76.1	80.4
	15	18.4	19.2	20.0	27.2	28.5	29.9	37.3	39.3	41.4	48.5	51.3	54.1	60.6	64.2	67.9	73.0	77.4	81.8
	20	18.7	19.5	20.3	27.7	29.0	30.4	37.9	40.0	42.1	49.3	52.2	55.0	61.6	65.3	69.0	74.2	78.6	83.1
	30	19.2	20.0	20.8	28.3	29.8	31.2	38.9	41.0	43.2	50.6	53.6	56.5	63.3	67.1	70.9	76.2	80.8	85.3
	40	19.2	20.1	20.9	28.6	30.1	31.5	39.4	41.6	43.8	51.5	54.7	57.6	64.5	68.4	72.3	77.8	82.4	87.1
560	0	16.8	17.5	18.2	24.6	25.8	27.0	33.6	35.4	37.2	43.6	46.1	48.6	54.4	57.7	60.9	65.7	69.7	73.7
	10	17.2	17.9	18.7	25.3	26.6	27.8	34.6	36.5	38.4	44.9	47.5	50.1	56.1	59.5	62.8	67.7	71.8	75.9
	15	17.5	18.3	19.0	25.8	27.1	28.3	35.3	37.2	39.1	45.8	48.4	51.0	57.1	60.6	63.9	68.9	73.1	77.2
	20	17.8	18.6	19.3	26.3	27.5	28.8	35.9	37.8	39.7	46.6	49.2	51.9	58.1	61.6	65.0	70.1	74.3	78.5
	30	18.2	19.0	19.8	26.9	28.2	29.5	36.8	38.8	40.8	47.8	50.6	53.3	59.7	63.3	66.8	72.0	76.3	80.6
	40	18.3	19.1	19.9	27.1	28.5	29.8	37.3	39.3	41.4	48.6	51.4	54.2	60.8	64.5	68.1	73.4	77.8	82.3
520	0	15.9	16.6	17.2	23.3	24.4	25.5	31.7	33.4	35.1	41.0	43.3	45.6	51.1	54.1	57.1	61.7	65.4	69.1
	10	16.4	17.0	17.7	24.0	25.1	26.3	32.6	34.4	36.1	42.3	44.7	47.1	52.7	55.8	58.9	63.6	67.4	71.3
	15	16.7	17.3	18.0	24.4	25.6	26.8	33.2	35.0	36.8	43.1	45.5	47.9	53.7	56.8	60.0	64.7	68.6	72.5
	20	17.0	17.6	18.3	24.8	26.0	27.2	33.8	35.6	37.4	43.8	46.3	48.7	54.6	57.8	61.0	65.8	69.8	73.7
	30	17.3	18.0	18.7	25.4	26.6	27.9	34.7	36.5	38.4	44.9	47.5	50.1	56.1	59.4	62.7	67.6	71.7	75.7
	40	17.4	18.1	18.8	25.6	26.9	28.2	35.1	37.0	38.9	45.6	48.3	50.9	57.1	60.5	63.9	68.9	73.1	77.2
480	0	15.1	15.7	16.3	22.0	23.0	24.0	29.8	31.3	32.9	38.4	40.5	42.6	47.7	50.5	53.3	57.5	61.0	64.4
	10	15.5	16.1	16.7	22.6	23.7	24.7	30.6	32.2	33.8	39.5	41.7	44.0	49.2	52.1	54.9	59.3	62.9	66.4
	15	15.8	16.4	17.0	23.0	24.1	25.2	31.2	32.8	34.5	40.3	42.5	44.8	50.1	53.0	55.9	60.4	64.0	67.6
	20	16.1	16.7	17.3	23.4	24.5	25.6	31.8	33.4	35.1	41.0	43.2	45.5	50.9	53.9	56.9	61.4	65.1	68.7
	30	16.4	17.1	17.7	24.0	25.1	26.2	32.5	34.2	36.0	42.0	44.4	46.7	52.3	55.4	58.4	63.1	66.9	70.6
	40	16.5	17.1	17.8	24.2	25.3	26.5	32.9	34.7	36.4	42.7	45.1	47.5	53.2	56.4	59.5	64.3	68.2	72.0
440	0	14.3	14.9	15.4	20.7	21.6	22.5	27.8	29.2	30.6	35.7	37.7	39.6	44.2	46.8	49.3	53.2	56.4	59.6
	10	14.7	15.2	15.8	21.2	22.2	23.2	28.6	30.1	31.6	36.8	38.8	40.8	45.6	48.2	50.9	54.9	58.2	61.4
	15	15.0	15.5	16.1	21.6	22.6	23.6	29.2	30.7	32.2	37.5	39.5	41.6	46.4	49.1	51.8	55.9	59.2	62.5
	20	15.2	15.8	16.4	22.0	23.0	24.0	29.7	31.2	32.7	38.1	40.2	42.3	47.2	49.9	52.7	56.8	60.2	63.6
	30	15.5	16.1	16.7	22.5	23.5	24.6	30.4	32.0	33.5	39.1	41.2	43.4	48.5	51.3	54.1	58.4	61.9	65.3
	40	15.6	16.2	16.8	22.7	23.7	24.8	30.7	32.3	33.9	39.6	41.9	44.1	49.3	52.2	55.1	59.5	63.0	66.6

To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind.

If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 15°C.

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Recommended Brake Cooling Schedule****Event Adjusted Brake Energy (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	100
LANDING	RTO MAX MAN	10	20	30	40	50	60	70	80	90	100
	MAX MAN	5.1	14.1	23.1	32.1	41.2	50.3	59.5	68.8	78.3	87.9
	MAX AUTO	5.1	13.1	21.2	29.6	38.1	46.9	56.0	65.5	75.3	85.6
	AUTOBRAKE 4	4.9	12.4	19.9	27.5	35.4	43.5	52.1	61.1	70.6	80.8
	AUTOBRAKE 3	4.6	11.6	18.5	25.5	32.7	40.1	47.9	56.2	65.0	74.5
	AUTOBRAKE 2	4.3	10.8	17.2	23.6	30.1	36.9	43.9	51.4	59.4	68.0
	AUTOBRAKE 1	4.2	10.1	15.9	21.8	27.7	33.8	40.3	47.1	54.5	62.4

**2 Engine Reverse Thrust**

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)									
EVENT		10	20	30	40	50	60	70	80	90	100
LANDING	RTO MAX MAN	10	20	30	40	50	60	70	80	90	100
	MAX MAN	4.4	13.0	21.4	29.7	37.9	46.1	54.3	62.6	71.1	79.7
	MAX AUTO	2.4	9.4	16.4	23.5	30.9	38.6	46.6	55.0	64.0	73.5
	AUTOBRAKE 4	1.9	7.2	12.7	18.4	24.5	31.0	37.9	45.5	53.6	62.5
	AUTOBRAKE 3	1.1	4.9	9.0	13.4	18.2	23.4	29.0	35.2	42.0	49.3
	AUTOBRAKE 2	0.3	3.1	6.1	9.4	13.0	16.9	21.3	26.1	31.4	37.2
	AUTOBRAKE 1	0.1	2.3	4.6	7.1	9.8	12.7	16.1	19.9	24.2	29.2

**Cooling Time (Minutes)**

		EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)									
16 & BELOW		17	18	20	24	28	32	35	36 TO 44	45 & ABOVE	
GEAR DOWN	NO SPECIAL PROCEDURE	1.0	1.6	2.6	4.2	5.5	6.6	7.3	CAUTION	FUSE PLUG MELT ZONE	
INFLIGHT	REQUIRED	10	16	26	42	55	66	73			
GROUND	BTMS	UP TO 2.4	2.4	2.6	2.9	3.4	4.0	4.5	4.9	5.0 TO 6.3	6.3 & 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 10 percent.

For two brakes deactivated, increase brake energy by 20 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 12 to 15 minutes after airplane has come to a complete stop, or inflight with gear retracted, to determine recommended cooling schedule. (Inflight gear extended, the BTMS indications may vary between individual brakes, due to airstream effects, gear tilt, and position of the gear temperature probes.)

**ADVISORY INFORMATION****Landing Climb Limit Weight****Valid for approach with flaps 20 and landing with flaps 25 or 30**

AIRPORT OAT	°C	°F	LANDING CLIMB LIMIT WEIGHT (1000 LB)			
			AIRPORT PRESSURE ALTITUDE (FT)			
			0	1000	2000	3000
54	129	509.5				
52	126	524.1	504.0			
50	122	539.1	519.0	497.5		
48	118	555.3	533.9	512.5	493.3	
46	115	571.0	549.5	526.9	506.8	
44	111	586.0	564.3	541.8	520.4	
42	108	600.7	578.4	555.9	533.9	
40	104	614.6	591.8	569.1	546.8	
38	100	628.0	604.4	581.5	559.3	
36	97	640.3	616.1	592.9	570.6	
34	93	651.1	627.0	603.2	581.0	
32	90	660.2	636.1	612.5	588.7	
30	86	668.7	644.0	619.6	596.1	
28	82	668.8	651.9	625.1	601.9	
26	79	668.9	652.0	630.4	606.1	
24	75	669.0	652.2	633.1	610.0	
22	72	669.2	652.3	633.3	612.9	
20	68	669.3	652.4	633.4	615.3	
18	64	669.4	652.5	633.5	615.4	
16	61	669.5	652.6	633.6	615.5	
14	57	669.6	652.8	633.7	615.6	
12	54	669.8	652.9	633.8	615.7	
10 & BELOW	50 & BELOW	669.9	653.0	634.0	615.9	

Based on engine bleed for 2 packs on and engine anti-ice off and wing anti-ice off.

With engine bleed for packs off, increase weight by 4800 lb.

With engine anti-ice on, decrease weight by 1100 lb.

With engine and wing anti-ice on, decrease weight by 4800 lb.

When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 43300 lb.

# Performance Inflight - QRH

## Engine Inoperative

# Chapter PI-QRH

## Section 52

### **ENGINE INOP**

#### **Initial Max Continuous EPR**

Based on .84M, engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	27	29	31	33	35	37	39	41	43
20	1.260	1.236	1.217	1.204	1.193	1.176	1.182	1.192	1.203
15	1.320	1.295	1.272	1.256	1.244	1.224	1.229	1.237	1.245
10	1.376	1.351	1.328	1.311	1.295	1.275	1.280	1.285	1.290
5	1.378	1.404	1.382	1.365	1.352	1.329	1.333	1.335	1.337
0	1.378	1.420	1.431	1.415	1.402	1.381	1.385	1.385	1.384
-5	1.378	1.420	1.460	1.460	1.488	1.429	1.433	1.431	1.430
-10	1.378	1.420	1.460	1.482	1.488	1.472	1.475	1.473	1.472
-15	1.378	1.420	1.460	1.482	1.504	1.505	1.506	1.505	1.504
-20	1.378	1.420	1.460	1.482	1.504	1.505	1.506	1.505	1.504
-25	1.378	1.420	1.460	1.482	1.504	1.505	1.506	1.505	1.504
-30	1.378	1.420	1.460	1.482	1.504	1.505	1.506	1.505	1.504
-35	1.378	1.420	1.460	1.482	1.504	1.505	1.506	1.505	1.504
-40	1.378	1.420	1.460	1.482	1.504	1.505	1.506	1.505	1.504

#### **Max Continuous EPR**

#### **37000 FT to 31000 FT Pressure Altitudes**

37000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
150		1.480	1.480	1.480	1.477	1.464	1.445	1.421	1.392	1.359	1.326	1.324	1.324
200		1.495	1.495	1.495	1.495	1.495	1.480	1.453	1.419	1.379	1.336	1.292	1.258
250		1.530	1.530	1.530	1.530	1.530	1.530	1.530	1.499	1.460	1.416	1.367	1.316
300		1.463	1.463	1.463	1.463	1.463	1.463	1.463	1.463	1.463	1.434	1.393	1.346
35000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
150		1.479	1.479	1.479	1.479	1.464	1.445	1.421	1.392	1.362	1.332	1.323	1.323
200		1.484	1.484	1.484	1.484	1.484	1.473	1.451	1.421	1.385	1.350	1.315	1.283
250		1.528	1.528	1.528	1.528	1.528	1.528	1.528	1.498	1.459	1.413	1.360	1.303
300		1.480	1.480	1.480	1.480	1.480	1.480	1.480	1.480	1.480	1.448	1.404	1.355
33000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
150		1.486	1.486	1.486	1.486	1.480	1.460	1.435	1.407	1.375	1.345	1.317	1.317
200		1.493	1.493	1.493	1.493	1.493	1.493	1.471	1.444	1.409	1.372	1.336	1.299
250		1.530	1.530	1.530	1.530	1.530	1.530	1.530	1.516	1.478	1.430	1.370	1.301
300		1.482	1.482	1.482	1.482	1.482	1.482	1.482	1.482	1.482	1.460	1.415	1.365
330		1.439	1.439	1.439	1.439	1.439	1.439	1.439	1.439	1.439	1.439	1.426	1.383
31000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
150		1.492	1.492	1.492	1.492	1.478	1.453	1.425	1.393	1.362	1.333	1.315	1.315
200		1.506	1.506	1.506	1.506	1.506	1.497	1.470	1.438	1.400	1.361	1.322	1.284
250		1.530	1.530	1.530	1.530	1.530	1.530	1.530	1.498	1.454	1.395	1.326	1.262
300		1.482	1.482	1.482	1.482	1.482	1.482	1.482	1.482	1.477	1.435	1.386	1.334
333		1.432	1.432	1.432	1.432	1.432	1.432	1.432	1.432	1.432	1.432	1.385	1.335

**ENGINE INOP****Max Continuous EPR****37000 FT to 31000 FT Pressure Altitudes****EPR Adjustments for Engine Bleed**

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	31	33	35	37
ENGINE ONLY	-0.018	-0.017	-0.016	-0.017
ENGINE & WING *	-0.033	-0.032	-0.032	-0.034
ENGINE & WING **	-0.048	-0.047	-0.048	-0.051

\*Wing anti-ice on, packs on.

\*\*Wing anti-ice on, packs off.

**29000 FT to 24000 FT Pressure Altitudes**

29000 FT PRESS ALT			TAT (°C)										
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
150	0.40	1.504	1.504	1.504	1.504	1.488	1.459	1.429	1.394	1.363	1.334	1.326	1.326
200	0.53	1.509	1.509	1.509	1.509	1.509	1.497	1.464	1.427	1.388	1.350	1.313	1.293
250	0.65	1.504	1.504	1.504	1.504	1.504	1.504	1.504	1.457	1.405	1.350	1.294	1.251
300	0.78	1.466	1.466	1.466	1.466	1.466	1.466	1.466	1.466	1.450	1.397	1.340	1.281
330	0.85	1.417	1.417	1.417	1.417	1.417	1.417	1.417	1.417	1.417	1.406	1.354	1.298
27000 FT PRESS ALT			TAT (°C)										
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
150	0.38	1.523	1.523	1.523	1.523	1.523	1.505	1.473	1.440	1.404	1.372	1.343	1.343
200	0.51	1.512	1.512	1.512	1.512	1.512	1.512	1.496	1.458	1.416	1.376	1.341	1.306
250	0.63	1.479	1.479	1.479	1.479	1.479	1.479	1.479	1.474	1.423	1.372	1.325	1.285
300	0.75	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.417	1.350	1.288
330	0.81	1.395	1.395	1.395	1.395	1.395	1.395	1.395	1.395	1.395	1.395	1.370	1.311
25000 FT PRESS ALT			TAT (°C)										
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
150	0.37	1.540	1.540	1.540	1.540	1.540	1.522	1.488	1.451	1.415	1.380	1.360	1.360
200	0.49	1.511	1.511	1.511	1.511	1.511	1.511	1.490	1.447	1.404	1.366	1.332	1.307
250	0.60	1.461	1.461	1.461	1.461	1.461	1.461	1.461	1.451	1.400	1.354	1.315	1.282
300	0.72	1.429	1.429	1.429	1.429	1.429	1.429	1.429	1.429	1.429	1.371	1.302	1.248
330	0.78	1.375	1.375	1.375	1.375	1.375	1.375	1.375	1.375	1.375	1.375	1.327	1.260
24000 FT PRESS ALT			TAT (°C)										
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
150	0.36	1.536	1.536	1.536	1.536	1.536	1.530	1.494	1.459	1.421	1.387	1.355	1.355
200	0.48	1.507	1.507	1.507	1.507	1.507	1.507	1.497	1.455	1.412	1.372	1.339	1.307
250	0.59	1.463	1.463	1.463	1.463	1.463	1.463	1.463	1.453	1.408	1.363	1.324	1.289
300	0.70	1.432	1.432	1.432	1.432	1.432	1.432	1.432	1.432	1.424	1.381	1.310	1.257
330	0.77	1.382	1.382	1.382	1.382	1.382	1.382	1.382	1.382	1.382	1.378	1.336	1.270

**EPR Adjustments for Engine Bleed**

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	24	25	27	29
ENGINE ONLY	-0.022	-0.023	-0.021	-0.020
ENGINE & WING*	-0.037	-0.038	-0.036	-0.035
ENGINE & WING**	-0.051	-0.053	-0.051	-0.050

\*Wing anti-ice on, packs on.

\*\*Wing anti-ice on, packs off.

## ENGINE INOP

### Max Continuous EPR

#### 22000 FT to 16000 FT Pressure Altitudes

22000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
150	0.35	1.529	1.529	1.529	1.529	1.529	1.511	1.474	1.399	1.399	1.367	1.346	1.346
200	0.46	1.500	1.500	1.500	1.500	1.500	1.496	1.470	1.428	1.389	1.353	1.322	1.301
250	0.57	1.466	1.466	1.466	1.466	1.466	1.466	1.455	1.423	1.380	1.339	1.302	1.270
300	0.68	1.426	1.426	1.426	1.426	1.426	1.426	1.426	1.424	1.387	1.325	1.273	1.234
330	0.74	1.392	1.392	1.392	1.392	1.392	1.392	1.392	1.392	1.386	1.347	1.283	1.228

20000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
150	0.33	1.523	1.523	1.523	1.523	1.523	1.523	1.493	1.453	1.412	1.378	1.347	1.336
200	0.44	1.492	1.492	1.492	1.492	1.492	1.492	1.484	1.444	1.404	1.365	1.334	1.305
250	0.55	1.465	1.465	1.465	1.465	1.465	1.465	1.465	1.435	1.395	1.355	1.317	1.285
300	0.65	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.393	1.338	1.291	1.250
330	0.71	1.394	1.394	1.394	1.394	1.394	1.394	1.394	1.394	1.394	1.351	1.291	1.238

18000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
150	0.32	1.496	1.496	1.496	1.496	1.496	1.494	1.455	1.415	1.380	1.351	1.322	1.321
200	0.42	1.474	1.474	1.474	1.474	1.474	1.471	1.452	1.409	1.369	1.336	1.309	1.283
250	0.53	1.498	1.498	1.498	1.498	1.498	1.498	1.485	1.429	1.373	1.325	1.288	1.260
300	0.63	1.461	1.461	1.461	1.461	1.461	1.461	1.461	1.461	1.398	1.337	1.285	1.238
330	0.69	1.426	1.426	1.426	1.426	1.426	1.426	1.426	1.426	1.415	1.352	1.293	1.240

16000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
150	0.31	1.473	1.473	1.473	1.473	1.473	1.472	1.456	1.418	1.383	1.353	1.326	1.306
200	0.41	1.454	1.454	1.454	1.454	1.454	1.454	1.442	1.412	1.375	1.342	1.314	1.288
250	0.51	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.465	1.408	1.354	1.309	1.273
300	0.60	1.465	1.465	1.465	1.465	1.465	1.465	1.465	1.465	1.436	1.375	1.318	1.271
330	0.66	1.423	1.423	1.423	1.423	1.423	1.423	1.423	1.423	1.423	1.381	1.321	1.267

#### EPR Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION		PRESSURE ALTITUDE (1000 FT)											
		16	18	20	22	24	26	28	30	32	34	36	38
ENGINE ONLY		-0.011	-0.014	-0.018	-0.020								
ENGINE & WING*		-0.022	-0.026	-0.031	-0.034								
ENGINE & WING**		-0.033	-0.038	-0.044	-0.047								

\*Wing anti-ice on, packs on.

\*\*Wing anti-ice on, packs off.

**ENGINE INOP****Max Continuous EPR****14000 FT to 5000 FT Pressure Altitudes**

14000 FT PRESS ALT			TAT (°C)											
KIAS	M		-20	-15	-10	-5	0	5	10	15	20	25	30	35
150	0.29	1.446	1.446	1.446	1.446	1.446	1.443	1.417	1.381	1.351	1.325	1.301	1.290	
200	0.39	1.437	1.437	1.437	1.437	1.437	1.437	1.407	1.372	1.341	1.315	1.291	1.267	
250	0.49	1.490	1.490	1.490	1.490	1.490	1.490	1.490	1.435	1.379	1.329	1.286	1.252	
300	0.58	1.466	1.466	1.466	1.466	1.466	1.466	1.466	1.466	1.410	1.350	1.300	1.256	
330	0.64	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.416	1.354	1.298	1.250	
12000 FT PRESS ALT			TAT (°C)											
KIAS	M		-15	-10	-5	0	5	10	15	20	25	30	35	
150	0.28	1.444	1.444	1.444	1.444	1.444	1.431	1.415	1.388	1.351	1.317	1.285	1.278	
200	0.38	1.433	1.433	1.433	1.433	1.433	1.430	1.415	1.397	1.367	1.325	1.285	1.247	
250	0.47	1.478	1.478	1.478	1.478	1.478	1.478	1.462	1.416	1.371	1.329	1.289	1.252	
300	0.56	1.471	1.471	1.471	1.471	1.471	1.471	1.471	1.453	1.393	1.338	1.293	1.254	
330	0.62	1.439	1.439	1.439	1.439	1.439	1.439	1.439	1.439	1.403	1.344	1.294	1.251	
10000 FT PRESS ALT			TAT (°C)											
KIAS	M		-15	-10	5	0	5	10	15	20	25	30	35	
150	0.27	1.425	1.425	1.425	1.425	1.425	1.422	1.403	1.384	1.355	1.320	1.299	1.280	
200	0.36	1.401	1.401	1.401	1.401	1.401	1.401	1.394	1.380	1.358	1.323	1.291	1.270	
250	0.45	1.411	1.411	1.411	1.411	1.411	1.411	1.411	1.387	1.353	1.318	1.282	1.252	
300	0.54	1.411	1.411	1.411	1.411	1.411	1.411	1.411	1.411	1.372	1.323	1.282	1.254	
330	0.59	1.383	1.383	1.383	1.383	1.383	1.383	1.383	1.383	1.382	1.327	1.285	1.246	
5000 FT PRESS ALT			TAT (°C)											
KIAS	M		-10	-5	0	5	10	15	20	25	30	35	40	
150	0.25	1.385	1.385	1.385	1.385	1.385	1.385	1.377	1.348	1.323	1.302	1.281	1.260	
200	0.33	1.367	1.367	1.367	1.367	1.367	1.367	1.367	1.353	1.336	1.316	1.291	1.265	
250	0.41	1.341	1.341	1.341	1.341	1.341	1.341	1.341	1.341	1.326	1.311	1.287	1.253	
300	0.49	1.333	1.333	1.333	1.333	1.333	1.333	1.333	1.333	1.327	1.289	1.254	1.221	
330	0.54	1.311	1.311	1.311	1.311	1.311	1.311	1.311	1.311	1.311	1.289	1.252	1.218	

**EPR Adjustments for Engine Bleed**

ANTI-ICE CONFIGURATION		PRESSURE ALTITUDE (1000 FT)				
		5	10	12	14	
ENGINE ONLY		-0.015	-0.015	-0.013	-0.010	
ENGINE & WING*		-0.023	-0.025	-0.023	-0.020	
ENGINE & WING**		-0.031	-0.035	-0.033	-0.030	

\*Wing anti-ice on, packs on.

\*\*Wing anti-ice on, packs off.

## ENGINE INOP

### MAX CONTINUOUS THRUST

**Driftdown Speed/Level Off Altitude**

**100 ft/min residual rate of climb**

**Includes APU fuel burn**

START DRIFT DOWN	LEVEL OFF	OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE (FT)		
			ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
660	638	281	16200	14700	13100
620	600	273	17700	16300	14700
580	562	264	19000	18000	16400
540	522	255	20400	19600	18300
500	483	246	22300	21700	20500
460	444	236	24300	24100	22900
420	406	226	26400	26200	25300
380	367	215	28700	28300	27500
340	329	204	31200	30600	29900

**ENGINE INOP****MAX CONTINUOUS THRUST****Driftdown/LRC Cruise Range Capability****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
134	125	118	111	105	100	95	91	87	83	80
274	255	239	224	211	200	190	181	172	165	158
413	384	359	337	317	300	284	270	258	246	236
551	512	479	449	423	400	379	360	343	328	314
688	640	598	561	529	500	474	451	429	410	393
825	768	717	674	635	600	569	541	516	492	471
961	895	836	785	740	700	664	631	602	575	550
1097	1021	955	897	846	800	759	722	688	658	629
1233	1148	1074	1009	951	900	854	812	775	740	709
1368	1274	1192	1121	1057	1000	949	903	861	823	788
1503	1401	1311	1232	1162	1100	1044	993	947	906	867
1639	1527	1430	1344	1268	1200	1139	1084	1034	988	947
1774	1654	1548	1456	1373	1300	1234	1174	1120	1071	1026
1910	1781	1667	1567	1479	1400	1329	1265	1207	1153	1105
2047	1908	1786	1679	1585	1500	1424	1355	1293	1236	1184
2184	2035	1906	1792	1690	1600	1519	1445	1379	1318	1263
2321	2163	2025	1904	1796	1700	1614	1536	1465	1400	1341
2460	2292	2145	2016	1902	1800	1708	1626	1550	1482	1419

**Driftdown/Cruise Fuel and Time**

AIR DIST (NM)	FUEL REQUIRED (1000 LB)								TIME (HR:MIN)	
	WEIGHT AT START OF DRIFTDOWN (1000 LB)									
340	380	420	460	500	540	580	620	660		
100	2.1	2.3	2.5	2.8	3.0	3.2	3.2	3.4	3.6	0:15
200	4.9	5.4	5.8	6.3	6.8	7.2	7.5	8.0	8.6	0:32
300	8.0	8.8	9.5	10.3	11.1	11.9	12.5	13.4	14.2	0:49
400	11.2	12.3	13.4	14.5	15.6	16.7	17.7	18.9	20.1	1:06
500	14.2	15.7	17.1	18.5	20.0	21.4	22.6	24.2	25.8	1:22
600	17.2	19.0	20.7	22.4	24.1	25.9	27.4	29.3	31.2	1:38
700	20.2	22.2	24.2	26.2	28.3	30.4	32.2	34.4	36.5	1:54
800	23.1	25.4	27.7	30.0	32.4	34.8	36.9	39.4	41.8	2:10
900	26.0	28.6	31.2	33.8	36.4	39.1	41.6	44.4	47.1	2:26
1000	28.8	31.7	34.6	37.5	40.5	43.4	46.2	49.4	52.3	2:41
1100	31.6	34.8	38.0	41.2	44.4	47.7	50.8	54.2	57.5	2:57
1200	34.4	37.9	41.4	44.8	48.4	51.9	55.3	59.1	62.6	3:13
1300	37.1	40.9	44.7	48.4	52.2	56.1	59.8	63.8	67.7	3:29
1400	39.8	43.9	47.9	52.0	56.1	60.2	64.2	68.6	72.7	3:44
1500	42.5	46.9	51.2	55.5	59.9	64.3	68.6	73.3	77.6	4:00
1600	45.1	49.8	54.4	59.0	63.7	68.4	73.0	77.9	82.5	4:17
1700	47.8	52.7	57.6	62.5	67.4	72.4	77.3	82.5	87.4	4:33
1800	50.3	55.5	60.7	65.9	71.1	76.4	81.5	87.0	92.2	4:50

Includes APU fuel burn.

Driftdown at optimum driftdown speed and cruise at LRC speed.

## ENGINE INOP

### MAX CONTINUOUS THRUST

**Long Range Cruise Altitude Capability**  
**100 ft/min residual rate of climb**

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
660	13200	12000	7600
640	14000	12800	9700
620	14800	13600	12200
600	15700	14400	13000
580	16500	15300	13800
560	17400	16200	14700
540	18300	17100	15600
520	19000	18000	16600
500	19700	18800	17600
480	20600	19600	18600
460	21600	20700	19700
440	22700	22000	20900
420	23700	23300	22200
400	24900	24800	23600
380	26100	25900	24900
360	27400	27100	26200
340	28800	28400	27500

**ENGINE INOP****MAX CONTINUOUS THRUST****Long Range Cruise Control**

WEIGHT (1000 LB)	PRESSURE ALTITUDE (1000 FT)									
	10	13	15	17	19	21	23	25	27	29
660	EPR .577 MACH .321 KIAS 20270 FF/ENG 21145	1.263 .577 1.355 .615 323 20270								
620	EPR .567 MACH .315 KIAS 19027 FF/ENG 19136	1.235 .567 1.302 .591 310 19027	1.379 .622 315 20113							
580	EPR .555 MACH .308 KIAS 17754 FF/ENG 17668	1.209 .555 1.263 .575 302 17754	1.315 .595 1.404 .628 301 17936	1.404 .628 1.426 .633 306 19053						
540	EPR .541 MACH .300 KIAS 16495 FF/ENG 16470	1.185 .541 1.233 .564 296 16495	1.270 .577 1.327 .599 292 16382	1.327 .599 1.426 .633 292 16765	1.426 .633 1.448 .644 297 17916					
500	EPR .526 MACH .292 KIAS 15293 FF/ENG 15222	1.164 .526 1.204 .549 288 15293	1.236 .564 1.274 .578 285 15189	1.274 .578 1.336 .601 281 15142	1.336 .601 1.342 .601 281 15546					
460	EPR .512 MACH .284 KIAS 14164 FF/ENG 14013	1.145 .512 1.179 .532 279 14164	1.205 .548 1.235 .564 277 13947	1.235 .564 1.274 .577 274 13934	1.274 .577 1.342 .601 270 13868	1.342 .601 1.348 .601 270 14271				
420	EPR .497 MACH .275 KIAS 13077 FF/ENG 12883	1.127 .497 1.157 .516 279 13077	1.178 .530 1.201 .546 270 12883	1.201 .546 1.233 .563 267 12744	1.233 .563 1.273 .576 265 12662	1.273 .576 1.342 .599 263 12641	1.342 .599 1.448 .634 263 12582	1.448 .634 1.448 .634 263 12936	1.448 .634 1.448 .634 263 13947	
380	EPR .482 MACH .267 KIAS 12119 FF/ENG 11793	1.110 .482 1.136 .499 261 12119	1.154 .513 1.172 .527 258 11793	1.172 .527 1.198 .543 255 11631	1.198 .543 1.231 .559 253 11445	1.231 .559 1.274 .574 251 11375	1.274 .574 1.333 .594 247 11331	1.333 .594 1.440 .630 246 11311	1.440 .630 1.440 .630 246 11574	1.440 .630 1.440 .630 246 12465
340	EPR .461 MACH .255 KIAS 11113 FF/ENG 10789	1.092 .461 1.116 .483 253 11113	1.131 .495 1.146 .508 249 10789	1.146 .508 1.168 .522 246 10555	1.168 .522 1.193 .537 243 10335	1.193 .537 1.227 .554 240 10202	1.227 .554 1.267 .570 238 10115	1.267 .570 1.321 .587 235 10047	1.321 .587 1.419 .620 233 10033	1.419 .620 1.419 .620 233 10187
										10906

## 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	
288	265	245	228	213	200	190	181	173	165	158	
573	528	489	455	426	400	380	362	346	331	318	
860	793	734	683	639	600	571	544	519	497	477	
1147	1057	978	911	852	800	761	725	692	662	635	
1435	1323	1224	1139	1066	1000	951	906	865	828	794	
1724	1589	1469	1367	1279	1200	1141	1086	1037	992	952	
2014	1856	1716	1596	1493	1400	1331	1268	1210	1157	1109	
2305	2123	1962	1825	1706	1600	1521	1448	1381	1321	1266	
2596	2391	2208	2054	1920	1800	1710	1628	1552	1484	1423	

#### Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)							
	10		14		18		22	
	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	8.6	0:40	7.5	0:39	6.8	0:38	6.5	0:36
300	13.1	0:58	11.9	0:56	11.0	0:54	10.9	0:51
400	17.7	1:16	16.2	1:13	15.2	1:11	15.2	1:06
500	22.3	1:34	20.6	1:31	19.4	1:28	19.4	1:22
600	26.8	1:52	24.9	1:48	23.5	1:44	23.6	1:37
700	31.3	2:10	29.2	2:05	27.6	2:01	27.8	1:53
800	35.8	2:29	33.4	2:23	31.7	2:18	31.9	2:08
900	40.2	2:47	37.7	2:41	35.7	2:35	35.9	2:24
1000	44.6	3:05	41.9	2:58	39.8	2:52	40.0	2:40
1100	49.0	3:24	46.1	3:16	43.8	3:09	43.9	2:56
1200	53.4	3:42	50.2	3:34	47.8	3:26	47.9	3:12
1300	57.8	4:01	54.4	3:52	51.7	3:43	51.8	3:28
1400	62.1	4:19	58.5	4:09	55.7	4:00	55.7	3:44
1500	66.4	4:38	62.6	4:27	59.6	4:17	59.5	4:01
1600	70.7	4:57	66.7	4:45	63.5	4:34	63.3	4:17
1700	75.0	5:16	70.7	5:03	67.3	4:52	67.0	4:33
1800	79.2	5:35	74.8	5:22	71.2	5:09	70.8	4:50

**ENGINE INOP****MAX CONTINUOUS THRUST****Long Range Cruise Diversion Fuel and Time****Fuel Required Adjustment (1000 LB)**

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)							
	300	350	400	450	500	550	600	650
5	-0.7	-0.6	-0.4	-0.2	0.0	0.5	0.8	1.2
10	-1.7	-1.4	-1.0	-0.5	0.0	1.3	2.3	3.1
15	-2.8	-2.2	-1.5	-0.8	0.0	2.1	3.7	5.1
20	-3.8	-3.0	-2.1	-1.1	0.0	2.8	5.2	7.0
25	-4.9	-3.8	-2.6	-1.3	0.0	3.6	6.6	9.0
30	-5.9	-4.6	-3.1	-1.6	0.0	4.3	8.0	10.9
35	-6.9	-5.3	-3.6	-1.9	0.0	5.1	9.3	12.9
40	-7.9	-6.1	-4.2	-2.1	0.0	5.8	10.7	14.8
45	-9.0	-6.9	-4.7	-2.4	0.0	6.5	12.0	16.7
50	-10.0	-7.6	-5.2	-2.7	0.0	7.1	13.4	18.7
55	-11.0	-8.4	-5.7	-2.9	0.0	7.8	14.7	20.6
60	-12.0	-9.1	-6.2	-3.2	0.0	8.5	16.0	22.5
65	-13.0	-9.9	-6.6	-3.4	0.0	9.1	17.2	24.4
70	-14.0	-10.6	-7.1	-3.7	0.0	9.7	18.5	26.4
75	-15.0	-11.3	-7.6	-3.9	0.0	10.3	19.7	28.3
80	-16.0	-12.0	-8.0	-4.2	0.0	10.9	20.9	30.2

APU fuel included

## ENGINE INOP

### MAX CONTINUOUS THRUST

**Holding**  
**Flaps Up**

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)					
		1500	5000	10000	15000	20000	25000
660	EPR	1.150	1.186	1.256	1.382		
	KIAS	259	260	261	277		
	FF/ENG	17910	17770	18030	19530		
620	EPR	1.136	1.168	1.231	1.333		
	KIAS	251	252	253	262		
	FF/ENG	16750	16610	16750	17560		
580	EPR	1.122	1.152	1.208	1.294		
	KIAS	243	244	245	248		
	FF/ENG	15690	15450	15560	15900		
540	EPR	1.109	1.136	1.186	1.261	1.400	
	KIAS	234	235	236	237	252	
	FF/ENG	14630	14330	14410	14510	16030	
500	EPR	1.097	1.120	1.165	1.229	1.334	
	KIAS	226	226	227	228	235	
	FF/ENG	13600	13270	13270	13280	14050	
460	EPR	1.085	1.105	1.144	1.199	1.283	1.470
	KIAS	220	220	220	220	220	238
	FF/ENG	12610	12350	12200	12140	12400	14260
420	EPR	1.073	1.090	1.124	1.171	1.241	1.371
	KIAS	213	213	213	213	213	220
	FF/ENG	11610	11430	11230	11090	11140	12000
380	EPR	1.061	1.076	1.105	1.145	1.201	1.303
	KIAS	206	206	206	206	206	206
	FF/ENG	10630	10450	10290	10050	10030	10340
340	EPR	1.051	1.063	1.087	1.121	1.164	1.252
	KIAS	199	199	199	199	199	199
	FF/ENG	9660	9480	9370	9050	9000	9150

# ENGINE INOP

## ADVISORY INFORMATION

### Gear Down Landing Rate of Climb Available

#### Flaps 20

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
-2000	0	2000	4000	6000	8000	
52	290	160				
50	340	210	70			
48	400	260	120			
46	450	310	170	30		
44	500	360	220	80		
42	550	410	270	130	-20	
40	600	460	310	170	20	
38	620	510	360	210	60	-100
36	620	550	400	250	100	-60
34	620	590	430	280	130	-20
32	620	620	460	320	160	-10
30	630	650	490	340	180	0
20	640	660	550	410	240	60
10	650	680	560	430	280	100
0	670	690	570	440	290	120
-20	700	720	600	460	300	130
-40	730	750	620	480	320	130

Rate of climb capability shown is valid for 450000 lb, gear down at VREF20 + 5.

Decrease rate of climb 40 ft/min per 10000 lb greater than 450000 lb.

Increase rate of climb 50 ft/min per 10000 lb less than 450000 lb.

#### Flaps 30

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
-2000	0	2000	4000	6000	8000	
52	-200	-330				
50	-150	-290	-420			
48	-100	-240	-380			
46	-50	-190	-330	-470		
44	-10	-150	-290	-430		
42	40	-110	-250	-390	-540	
40	80	-60	-210	-350	-500	
38	90	-20	-170	-320	-460	-620
36	90	20	-130	-280	-430	-590
34	90	50	-100	-250	-400	-560
32	90	80	-70	-220	-380	-550
30	90	110	-50	-200	-360	-540
20	100	110	-10	-150	-320	-500
10	100	110	-10	-140	-290	-460
0	110	110	-10	-140	-290	-460
-20	110	120	-10	-140	-300	-470
-40	120	130	0	-150	-310	-490

Rate of climb capability shown is valid for 450000 lb, gear down at VREF30 + 5.

Decrease rate of climb 40 ft/min per 10000 lb greater than 450000 lb.

Increase rate of climb 50 ft/min per 10000 lb less than 450000 lb.

# Performance Inflight - QRH

## Gear Down

# Chapter PI-QRH

## Section 53

### GEAR DOWN

#### 220 KIAS Max Climb EPR

TAT (°C)	PRESSURE ALTITUDE (1000 FT)															
	0	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35
55	1.204	1.203	1.223	1.231	1.241	1.252	1.262	1.276	1.279	1.281	1.282	1.274	1.265	1.252	1.238	1.219
50	1.221	1.215	1.223	1.231	1.241	1.252	1.262	1.276	1.279	1.281	1.282	1.274	1.265	1.252	1.238	1.219
45	1.239	1.232	1.223	1.231	1.241	1.252	1.262	1.276	1.279	1.281	1.282	1.274	1.265	1.252	1.238	1.219
40	1.258	1.250	1.242	1.239	1.241	1.252	1.262	1.276	1.279	1.281	1.282	1.274	1.265	1.252	1.238	1.219
35	1.271	1.270	1.260	1.260	1.257	1.252	1.262	1.276	1.279	1.281	1.282	1.274	1.265	1.252	1.238	1.219
30	1.271	1.293	1.284	1.283	1.282	1.278	1.273	1.276	1.279	1.281	1.282	1.274	1.265	1.252	1.238	1.219
25	1.271	1.303	1.311	1.309	1.307	1.304	1.301	1.299	1.284	1.281	1.282	1.274	1.265	1.252	1.238	1.219
20	1.271	1.303	1.339	1.337	1.335	1.334	1.331	1.329	1.316	1.300	1.291	1.274	1.265	1.252	1.238	1.219
15	1.271	1.303	1.343	1.361	1.367	1.368	1.365	1.363	1.348	1.333	1.325	1.299	1.271	1.252	1.238	1.219
10	1.271	1.303	1.343	1.361	1.385	1.404	1.403	1.402	1.386	1.369	1.360	1.334	1.308	1.277	1.243	1.219
5	1.271	1.303	1.343	1.361	1.385	1.410	1.435	1.444	1.429	1.410	1.400	1.372	1.345	1.317	1.288	1.253
0	1.271	1.303	1.343	1.361	1.385	1.410	1.435	1.464	1.471	1.455	1.447	1.413	1.385	1.359	1.332	1.306
-5	1.271	1.303	1.343	1.361	1.385	1.410	1.435	1.464	1.475	1.486	1.492	1.456	1.426	1.402	1.380	1.359
-10	1.271	1.303	1.343	1.361	1.385	1.410	1.435	1.464	1.475	1.486	1.492	1.494	1.464	1.441	1.426	1.407
-15	1.271	1.303	1.343	1.361	1.385	1.410	1.435	1.464	1.475	1.486	1.492	1.494	1.495	1.475	1.463	1.450
-20	1.271	1.303	1.343	1.361	1.385	1.410	1.435	1.464	1.475	1.486	1.492	1.494	1.495	1.499	1.493	1.484

#### Anti-Ice Adjustment

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)							
	0	5	10	15	20	25	30	35
ENGINE ONLY	-.016	-.015	-.015	-.009	-.017	-.023	-.019	-.016
ENGINE AND WING*	-.022	-.023	-.025	-.020	-.030	-.038	-.034	-.032
ENGINE AND WING**	-.029	-.031	-.035	-.030	-.043	-.053	-.048	-.048

\*Wing anti-ice on, dual bleed source and packs on or off.

\*\*Wing anti-ice on, single bleed source and both packs off.

#### Long Range Cruise Altitude Capability

#### Max Climb Thrust, 300 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
660	14400	14300	12000
640	15800	15700	13600
620	17100	17000	15100
600	18400	18300	16500
580	19700	19600	17900
560	20800	20700	19300
540	21900	21800	20500
520	23000	22900	21700
500	24200	24100	22800
480	25300	25200	24000
460	26300	26100	25100
440	27300	27100	26200
420	28300	28000	27200
400	29400	29100	28300
380	30600	30100	29400
360	31500	31200	30600
340	32200	31900	31500

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**GEAR DOWN****Long Range Cruise Control**

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)										
		10	13	15	17	19	21	23	25	27	29	31
660	EPR	1.204	1.253	1.291								
	MACH	.479	.499	.511								
	KIAS	265	261	258								
	FF/ENG	15529	15395	15416								
620	EPR	1.186	1.228	1.261	1.301							
	MACH	.469	.489	.501	.514							
	KIAS	259	256	252	249							
	FF/ENG	14589	14433	14371	14499							
580	EPR	1.167	1.205	1.234	1.266	1.312						
	MACH	.457	.478	.491	.504	.517						
	KIAS	253	250	247	244	241						
	FF/ENG	13649	13497	13400	13407	13541						
540	EPR	1.150	1.183	1.208	1.236	1.272	1.322					
	MACH	.444	.465	.479	.492	.505	.519					
	KIAS	245	243	241	238	235	232					
	FF/ENG	12713	12572	12457	12394	12420	12552					
500	EPR	1.132	1.162	1.184	1.208	1.239	1.277	1.326				
	MACH	.430	.452	.466	.480	.493	.507	.527				
	KIAS	238	236	234	232	229	226	226				
	FF/ENG	11769	11644	11535	11422	11399	11426	11779				
460	EPR	1.115	1.141	1.160	1.182	1.209	1.241	1.285	1.347			
	MACH	.415	.436	.451	.465	.480	.493	.513	.534			
	KIAS	229	228	226	225	223	220	220	220			
	FF/ENG	10894	10707	10614	10495	10443	10413	10634	10992			
420	EPR	1.099	1.121	1.138	1.157	1.178	1.208	1.246	1.291	1.357		
	MACH	.398	.420	.434	.449	.464	.478	.498	.519	.540		
	KIAS	220	219	218	217	215	213	213	213	213		
	FF/ENG	10010	9791	9683	9581	9527	9501	9605	9792	10171		
380	EPR	1.083	1.103	1.117	1.132	1.149	1.177	1.212	1.247	1.294	1.361	
	MACH	.381	.402	.416	.431	.446	.463	.482	.502	.523	.546	
	KIAS	210	209	209	208	207	206	206	206	206	206	
	FF/ENG	9133	8911	8771	8660	8625	8650	8724	8803	8956	9326	
340	EPR	1.070	1.086	1.098	1.110	1.121	1.147	1.180	1.209	1.245	1.293	1.360
	MACH	.362	.382	.397	.412	.429	.446	.465	.484	.505	.527	.549
	KIAS	199	199	199	199	199	199	199	199	199	199	199
	FF/ENG	8341	8164	8039	7946	7798	7838	7883	7931	7997	8134	8478

**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	
315	285	258	236	217	200	190	180	171	162	154	
634	570	515	471	433	400	378	359	340	324	309	
955	858	774	706	650	600	567	537	509	485	463	
1280	1149	1035	943	867	800	756	715	679	646	617	
1609	1441	1297	1180	1084	1000	944	894	848	807	771	
1940	1736	1560	1419	1302	1200	1133	1072	1017	968	924	
2276	2034	1825	1658	1520	1400	1322	1251	1186	1128	1077	
2615	2334	2091	1898	1739	1600	1510	1429	1354	1288	1229	
2959	2636	2359	2139	1958	1800	1699	1606	1523	1448	1382	
3307	2942	2629	2381	2177	2000	1887	1784	1691	1607	1534	
3660	3251	2901	2623	2397	2200	2075	1961	1859	1767	1685	
4017	3563	3174	2867	2617	2400	2263	2139	2026	1925	1837	
4378	3877	3449	3112	2838	2600	2451	2316	2193	2084	1987	
4743	4194	3725	3357	3059	2800	2639	2493	2360	2242	2138	
5112	4514	4003	3603	3280	3000	2827	2669	2527	2400	2288	
5485	4835	4282	3850	3502	3200	3014	2845	2693	2557	2437	
5862	5160	4563	4098	3724	3400	3202	3021	2858	2714	2587	
6245	5488	4845	4346	3946	3600	3389	3197	3024	2870	2735	
6632	5819	5129	4596	4169	3800	3577	3373	3190	3027	2884	
7023	6152	5415	4846	4392	4000	3764	3549	3356	3183	3032	

**Reference Fuel and Time Required at Check Point**

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)						
	10		14		20		24
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)
200	17.0	0:45	15.5	0:44	13.7	0:42	13.4
400	33.1	1:31	30.5	1:27	27.5	1:23	26.8
600	49.2	2:18	45.5	2:11	41.2	2:03	40.2
800	65.3	3:04	60.5	2:55	55.0	2:44	53.6
1000	81.4	3:50	75.5	3:38	68.7	3:24	67.0
1200	96.8	4:39	89.7	4:24	81.8	4:06	79.6
1400	112.2	5:27	104.0	5:09	94.9	4:48	92.2
1600	127.2	6:16	117.9	5:55	107.7	5:30	104.5
1800	142.0	7:07	131.6	6:43	120.1	6:13	116.4
2000	156.7	7:57	145.2	7:30	132.6	6:56	128.4
2200	170.9	8:50	158.4	8:19	144.5	7:40	139.8
2400	185.1	9:43	171.6	9:08	156.4	8:24	151.2
2600	198.9	10:37	184.5	9:58	168.1	9:09	162.3
2800	212.5	11:32	197.3	10:49	179.6	9:54	173.2
3000	226.0	12:27	210.0	11:40	191.1	10:40	184.0
3200	238.9	13:23	222.1	12:32	202.2	11:27	194.4
3400	251.8	14:20	234.3	13:25	213.3	12:13	204.8
3600	264.5	15:18	246.2	14:18	224.2	13:01	214.9
3800	276.8	16:17	257.9	15:12	234.9	13:49	224.8
4000	289.2	17:16	269.6	16:06	245.5	14:37	234.7

**GEAR DOWN****Long Range Cruise Enroute Fuel and Time****Fuel Required Adjustment (1000 LB)**

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)								
	300	350	400	450	500	550	600	650	700
20	-3.7	-2.9	-2.0	-1.1	0.0	2.6	5.2	8.0	10.9
40	-7.8	-5.9	-4.0	-2.0	0.0	5.4	11.1	17.1	23.5
60	-11.9	-8.9	-5.9	-3.0	0.0	8.0	16.5	25.6	35.2
80	-16.1	-12.0	-7.9	-4.0	0.0	10.4	21.5	33.4	46.1
100	-20.2	-15.0	-9.9	-5.0	0.0	12.6	26.2	40.7	56.1
120	-24.4	-18.1	-12.0	-6.1	0.0	14.6	30.4	47.2	65.2
140	-28.5	-21.2	-14.0	-7.1	0.0	16.5	34.2	53.2	73.5
160	-32.7	-24.3	-16.1	-8.1	0.0	18.1	37.6	58.6	81.0
180	-36.9	-27.4	-18.1	-9.1	0.0	19.5	40.6	63.3	87.6
200	-41.0	-30.6	-20.2	-10.2	0.0	20.7	43.2	67.4	93.4
220	-45.2	-33.7	-22.3	-11.2	0.0	21.8	45.4	70.9	98.3
240	-49.4	-36.9	-24.5	-12.3	0.0	22.6	47.2	73.8	102.3
260	-53.6	-40.1	-26.6	-13.3	0.0	23.2	48.6	76.0	105.5
280	-57.9	-43.3	-28.8	-14.4	0.0	23.7	49.5	77.6	107.9
300	-62.1	-46.5	-31.0	-15.5	0.0	23.9	50.1	78.6	109.4

Based on Long Range Cruise and VREF30+80 descent.

**Descent at VREF30+80**

PRESSURE ALT (1000 FT)	25	27	29	31	33	35	37	39	41	43
DISTANCE (NM)	54	58	63	67	71	75	79	84	88	92
TIME (MINUTES)	13	14	15	16	16	17	17	18	19	19

**GEAR DOWN****Holding  
Flaps Up**

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)					
		1500	5000	10000	15000	20000	25000
660	EPR	1.111	1.139	1.194	1.281		
	KIAS	249	249	249	249		
	FF/ENG	15280	15000	15140	15520		
620	EPR	1.100	1.125	1.174	1.250		
	KIAS	242	242	242	242		
	FF/ENG	14400	14090	14160	14360		
580	EPR	1.090	1.113	1.157	1.223	1.339	
	KIAS	237	237	237	237	237	
	FF/ENG	13620	13290	13290	13370	14160	
540	EPR	1.081	1.101	1.140	1.199	1.292	
	KIAS	232	232	232	232	232	
	FF/ENG	12860	12580	12460	12470	12970	
500	EPR	1.072	1.090	1.125	1.175	1.255	
	KIAS	226	226	226	226	226	
	FF/ENG	12060	11860	11680	11600	11850	
460	EPR	1.063	1.079	1.110	1.154	1.222	1.347
	KIAS	220	220	220	220	220	
	FF/ENG	11250	11110	10910	10750	10850	11540
420	EPR	1.054	1.068	1.095	1.134	1.191	1.291
	KIAS	213	213	213	213	213	
	FF/ENG	10450	10300	10150	9880	9920	10280
380	EPR	1.047	1.059	1.081	1.115	1.161	1.247
	KIAS	206	206	206	206	206	206
	FF/ENG	9660	9490	9380	9080	9050	9240
340	EPR	1.040	1.050	1.069	1.098	1.133	1.209
	KIAS	199	199	199	199	199	199
	FF/ENG	9020	8860	8720	8440	8210	8330

This table includes 5% additional fuel for holding in a racetrack pattern.

**GEAR DOWN****Holding****Flaps 1**

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
660	EPR	1.115	1.143	1.198	1.284	
	KIAS	229	229	229	229	
	FF/ENG	14670	14390	14570	14830	
620	EPR	1.103	1.129	1.177	1.252	
	KIAS	222	222	222	222	
	FF/ENG	13770	13480	13560	13700	
580	EPR	1.093	1.115	1.159	1.223	1.332
	KIAS	217	217	217	217	217
	FF/ENG	12930	12690	12630	12720	13310
540	EPR	1.083	1.103	1.142	1.197	1.285
	KIAS	212	212	212	212	
	FF/ENG	12130	11960	11820	11820	12130
500	EPR	1.073	1.091	1.125	1.174	1.247
	KIAS	206	206	206	206	206
	FF/ENG	11300	11160	11010	10920	11050
460	EPR	1.064	1.079	1.109	1.152	1.211
	KIAS	200	200	200	200	200
	FF/ENG	10490	10340	10230	10020	10080
420	EPR	1.054	1.068	1.094	1.131	1.177
	KIAS	193	193	193	193	193
	FF/ENG	9680	9520	9440	9150	9170
380	EPR	1.047	1.058	1.080	1.111	1.146
	KIAS	186	186	186	186	186
	FF/ENG	9010	8870	8750	8490	8310
340	EPR	1.039	1.049	1.067	1.093	1.115
	KIAS	179	179	179	179	179
	FF/ENG	8200	8080	7950	7730	7610

This table includes 5% additional fuel for holding in a racetrack pattern.



**Performance Inflight - QRH**  
**Gear Down, Engine INOP**
**Chapter PI-QRH**  
**Section 54**
**GEAR DOWN****ENGINE INOP****MAX CONTINUOUS THRUST****Driftdown Speed/Level Off Altitude****100 ft/min residual rate of climb****Includes APU fuel burn**

WEIGHT (1000 LB)		VREF30 + 80 DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
500	476	224	4100	2800	
460	438	218	6700	5900	5000
420	401	211	9300	8700	7900
380	364	204	12400	11900	11100
340	326	197	14900	14000	13200

**Long Range Cruise Altitude Capability****100 ft/min residual rate of climb**

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
500			
480	2100		
460	4000	2400	
440	5800	4800	3200
420	7500	6700	5800
400	9200	8500	7700
380	11200	10300	9500
360	12700	12200	11500
340	13900	13200	12600

**GEAR DOWN****ENGINE INOP****MAX CONTINUOUS THRUST****Long Range Cruise Control**

WEIGHT (1000 LB)	PRESSURE ALTITUDE (1000 FT)					
	5	7	9	11	13	15
480	EPR MACH KIAS FF/ENG					
440	EPR .366 .379 MACH 221 KIAS 211 FF/ENG 20938	1.312 .366 .379 221 21487	1.361 221 21487			
400	EPR .349 .362 MACH 211 KIAS 211 FF/ENG 18577	1.263 .349 .362 211 18792	1.302 .349 .362 211 19254	1.351 .375 .389 211 19826	1.409 .389 .389 210 19826	
360	EPR .335 .347 MACH 202 KIAS 202 FF/ENG 16667	1.227 .335 .347 202 16770	1.257 .335 .347 203 16958	1.294 .360 .374 203 17332	1.342 .374 .389 203 17890	1.403 .389 .389 203 17890
340	EPR .329 .341 MACH 199 KIAS 199 FF/ENG 15842	1.212 .329 .341 199 15909	1.239 .329 .341 199 16058	1.271 .354 .367 199 16265	1.313 .367 .382 199 16688	1.366 .382 .397 199 17379

**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	20	40	60	80	100
353	309	271	242	220	200	186	174	163	153	145
533	465	408	364	330	300	279	260	244	229	217
714	622	545	486	440	400	372	347	324	305	288
897	781	684	609	550	500	464	433	404	380	360
1080	940	822	732	661	600	557	518	485	456	431
1265	1100	961	855	772	700	650	604	565	531	502
1450	1260	1100	978	882	800	742	690	645	606	573
1637	1420	1239	1101	993	900	835	777	725	681	643
1824	1582	1378	1224	1104	1000	927	863	805	756	714
2013	1744	1518	1348	1214	1100	1020	949	886	831	785
2202	1907	1659	1472	1325	1200	1113	1035	966	906	856

## GEAR DOWN

## ENGINE INOP

### MAX CONTINUOUS THRUST

#### Long Range Cruise Diversion Fuel and Time

#### Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)							
	6		8		10		12	
	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	15.9	0:55	15.5	0:54	15.2	0:53	15.0	0:51
300	23.9	1:22	23.3	1:20	22.9	1:18	22.7	1:16
400	31.8	1:49	31.1	1:46	30.7	1:43	30.4	1:40
500	39.4	2:16	38.5	2:12	38.0	2:09	37.8	2:05
600	47.1	2:43	46.0	2:39	45.4	2:34	45.1	2:30
700	54.7	3:11	53.5	3:05	52.8	3:00	52.5	2:55
800	62.4	3:38	61.0	3:32	60.1	3:26	59.8	3:20
900	69.7	4:06	68.2	3:59	67.2	3:52	66.8	3:46
1000	77.1	4:34	75.5	4:26	74.3	4:18	73.7	4:11
1100	84.3	5:02	82.5	4:54	81.2	4:45	80.5	4:37
1200	91.5	5:31	89.5	5:21	88.1	5:12	87.3	5:03

#### Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)					
	300	350	400	450	500	550
10	-1.4	-0.7	0.0	1.3	2.3	3.4
20	-2.8	-1.5	0.0	2.9	5.5	7.8
30	-4.3	-2.2	0.0	4.5	8.6	12.2
40	-5.7	-2.9	0.0	5.9	11.6	16.5
50	-7.1	-3.7	0.0	7.3	14.4	20.8
60	-8.5	-4.4	0.0	8.7	17.2	25.0
70	-9.8	-5.1	0.0	9.9	19.9	29.2
80	-11.2	-5.8	0.0	11.0	22.6	33.3
90	-12.5	-6.5	0.0	12.1	25.1	37.4
100	-13.8	-7.2	0.0	13.1	27.5	41.4

**GEAR DOWN**  
**ENGINE INOP**  
**MAX CONTINUOUS THRUST**

**Holding**  
**Flaps Up**

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)			
	1500	5000	10000	15000
500	EPR	1.286		
	KIAS	226		
	FF/ENG	23810		
460	EPR	1.255	1.320	
	KIAS	220	220	
	FF/ENG	22000	22290	
420	EPR	1.227	1.278	
	KIAS	213	213	
	FF/ENG	20230	20240	
380	EPR	1.200	1.243	1.345
	KIAS	206	206	206
	FF/ENG	18490	18390	19110
340	EPR	1.175	1.212	1.291
	KIAS	199	199	199
	FF/ENG	16750	16630	16950
				1.439
				199
				18250

This table includes 5% additional fuel for holding in a racetrack pattern.

**Performance Inflight - QRH**  
**Text**

**Chapter PI-QRH**  
**Section 55**

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## **Introduction**

This chapter contains information to supplement performance data from the Flight Management Computer. 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.

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## **General**

### **Flight with Unreliable Airspeed / Turbulent Air Penetration**

Body 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 may also cause unreliable airspeed/Mach indications. Climb, cruise and descent information is based on the recommended turbulent air penetration speed schedule: 270 knots below 25,000 feet, 280 knots or 0.82 Mach whichever is lower at 25,000 feet and above; maintain a minimum speed of 15 knots above the minimum maneuvering speed when below 0.82 Mach. This schedule provides ample protection from stall and high speed buffet, while also providing protection from exceeding structural limits.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed may also be unreliable.

### **Max Climb EPR**

This table shows Max Climb EPR for a 310/.84 climb speed schedule, normal engine bleed for 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 Speeds**

This table contains flaps 30, 25 and 20 reference speeds for a given weight.

## Advisory Information

### Normal Configuration Landing Distance

Tables are provided as advisory information for normal configuration landing distances 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 appropriate 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 and adjustments are provided for dry runways and runways with good, medium, and poor reported braking action.

Enter the table with the applicable non-normal configuration and read the normal approach speed. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and speed at sea level, zero wind, and zero slope. Subsequent columns provide corrections for off-reference landing weight, altitude,

wind, slope, and speed conditions. Each correction is independently added to the reference landing distance. Landing distance includes the effects of max manual braking and reverse thrust.

For an engine inoperative autoland, check the rate of climb capability shown in Gear Down Landing Rate of Climb Available tables to ensure adequate climb performance.

## 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 appropriate Event Adjusted Brake Energy Table (No Reverse Thrust or 2 Engine Reverse) with the reference brake energy per brake and the type of braking used during landing (Max Manual, Max Auto, or Autobrake). The resulting number is the adjusted brake energy per brake and represents the energy absorbed in each brake during the landing. The recommended cooling time is found in the final table by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

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 5.0 or higher on the EICAS indication and disappear as the hottest brake cools with an EICAS indication of 3.5. Note that even without an EICAS advisory message, brake cooling is recommended.

## Landing Climb Limit Weight

In the event an overweight landing is necessary and the fuel dump system is unavailable, landing climb limits should be checked if a Flaps 30 landing is planned. Enter the table with airport OAT and pressure altitude to read landing climb limit weight. Apply the noted adjustments as required. At weights exceeding those shown, plan a Flaps 20 landing.

## Engine Inoperative

### Initial Max Continuous EPR

The Initial Max Continuous EPR setting for use following an engine failure is shown. The table is based on the typical all engine cruise Mach number of .84 to provide a target EPR setting at the start of driftdown. Once driftdown is established, the Max Continuous EPR table should be used to determine EPR for the given conditions.

### Max Continuous EPR

Power setting is based on one engine operating with one bleed source for pack(s) operating and all anti-ice bleeds off. Enter the table for appropriate pressure altitude with IAS or Mach and TAT to read Max Continuous EPR. Apply the anti-ice corrections below the table as required.

It is desirable to maintain engine thrust level within the limits of the Max Cruise thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous thrust rating. The Max Continuous thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

### Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

## Driftdown/Cruise Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to long range cruise speed. Cruise is continued at level off altitude and long range cruise speed.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and correct for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude is used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Diversion Fuel and Time table.

## Long Range Cruise Altitude Capability

Table show the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on LRC speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

## Long Range Cruise Control

The table provides target EPR, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

## Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .84/310/250 descent. Enter with Air Distance as determined from the Ground to Air Miles Conversion Table and read Fuel and Time required at the cruise pressure altitude. Adjust the fuel obtained for deviation from the reference weight at checkpoint as required by entering the off reference fuel corrections table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel and time required for the actual weight.

## Holding

Single engine holding data is provided in the same format as the all engine holding data and is based on the same assumptions.

## Gear Down Landing Rate of Climb Available

Rate of climb data is provided as guidance information in the event an engine inoperative autoland is planned. The tables show gear down rate of climb available for Flaps 20 and Flaps 30. Enter the table with TAT and pressure altitude to read rate of climb available. Apply adjustments shown to correct for weight.

### 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 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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# Performance Inflight - QRH

## General

# Chapter PI-QRH

## Section 60

**Flight With Unreliable Airspeed / Turbulent Air Penetration**  
**Altitude and/or vertical speed indications may also be unreliable.**

### Climb

#### Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)				
		400	500	600	700	800
40000 (.82M)	PITCH ATT V/S (FT/MIN)	4.5 1100	4.0 700			
30000 (280 KIAS)	PITCH ATT V/S (FT/MIN)	5.5 2800	5.0 2100	5.0 1500	4.5 1100	4.0 800
20000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	8.5 4100	7.5 3100	7.5 2400	7.5 1700	7.0 1300
10000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	11.5 5400	10.5 4100	9.5 3300	9.5 2600	9.0 2100
SEA LEVEL (270 KIAS)	PITCH ATT V/S (FT/MIN)	15.0 6300	13.0 4900	12.0 3900	11.5 3200	11.0 2600

### Cruise

#### Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)				
		400	500	600	700	800
40000 (.82M)	PITCH ATT %N1	2.5 82.1	3.0 87.2			
35000 (280 KIAS)	PITCH ATT %N1	1.5 78.9	2.5 81.6	3.0 85.3	3.5 92.0	
30000 (280 KIAS)	PITCH ATT %N1	2.0 74.5	2.5 77.2	3.0 80.7	3.0 84.8	3.0 88.8
25000 (280 KIAS)	PITCH ATT %N1	2.0 70.6	2.5 73.0	3.5 76.1	3.5 80.0	3.5 83.7
20000 (270 KIAS)	PITCH ATT %N1	2.0 65.8	3.0 68.3	4.0 71.4	4.0 75.2	4.0 78.9
15000 (270 KIAS)	PITCH ATT %N1	2.0 61.8	3.0 64.4	4.0 67.2	4.5 70.4	4.5 74.3

### Descent

#### Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)				
		400	500	600	700	800
40000 (.82M)	PITCH ATT V/S (FT/MIN)	-1.0 -2700	0.0 -2700			
30000 (280 KIAS)	PITCH ATT V/S (FT/MIN)	-1.0 -2200	0.0 -2000	1.0 -1900	0.5 -2100	0.5 -2500
20000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	-0.5 -1800	0.5 -1600	1.5 -1500	2.0 -1500	1.5 -1600
10000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	-1.0 -1600	0.0 -1400	1.5 -1400	2.5 -1400	2.5 -1400
SEA LEVEL (270 KIAS)	PITCH ATT V/S (FT/MIN)	-1.0 -1400	0.0 -1300	1.0 -1200	2.0 -1200	2.5 -1300

In shaded areas, data reflects the minimum speed limitation of 15 knots above minimum maneuvering speed.

**Flight With Unreliable Airspeed / Turbulent Air Penetration**  
**Altitude and/or vertical speed indications may also be unreliable.**
**Holding****Flaps Up, Set Thrust for Level Flight**

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)				
		400	500	600	700	800
10000	PITCH ATT	<b>4.5</b>	<b>5.0</b>	<b>5.5</b>	<b>5.5</b>	<b>5.5</b>
	%N1	52.8	57.5	62.0	66.1	69.7
	KIAS	207	222	238	258	276
5000	PITCH ATT	<b>4.5</b>	<b>5.0</b>	<b>5.5</b>	<b>5.5</b>	<b>5.5</b>
	%N1	49.3	53.8	58.0	61.9	65.6
	KIAS	207	222	237	256	274

**Terminal Area (5000 FT)****Set Thrust for Level Flight**

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)				
		400	500	600	700	800
FLAPS UP	PITCH ATT	<b>5.0</b>	<b>5.5</b>	<b>6.0</b>	<b>6.0</b>	<b>6.5</b>
	GEAR UP	50.3	55.2	59.5	63.8	67.6
	VREF30+80	208	223	237	253	266
FLAPS 1	PITCH ATT	<b>6.5</b>	<b>7.0</b>	<b>7.5</b>	<b>7.5</b>	<b>8.0</b>
	GEAR UP	51.2	56.4	61.1	65.5	69.3
	VREF30+60	188	203	217	233	246
FLAPS 5	PITCH ATT	<b>5.5</b>	<b>6.0</b>	<b>6.5</b>	<b>6.5</b>	<b>6.5</b>
	GEAR UP	51.9	57.0	62.2	66.3	70.3
	VREF30+40	168	183	197	213	226
FLAPS 15	PITCH ATT	<b>6.5</b>	<b>7.0</b>	<b>7.0</b>	<b>7.0</b>	<b>7.0</b>
	GEAR UP	52.9	58.7	63.7	68.1	72.4
	VREF30+20	148	163	177	193	206
FLAPS 20	PITCH ATT	<b>5.0</b>	<b>5.0</b>	<b>5.5</b>	<b>5.0</b>	<b>5.5</b>
	GEAR DOWN	58.8	64.9	70.4	75.3	79.5
	VREF30+20	148	163	177	193	206

**Final Approach (1500 FT)****Gear Down, Set Thrust for 3° Glideslope**

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)				
		400	500	600	700	800
FLAPS 20	PITCH ATT	<b>1.0</b>	<b>1.0</b>	<b>1.5</b>	<b>1.5</b>	<b>2.0</b>
	%N1	39.2	43.4	47.2	50.5	53.3
	KIAS	154	171	186	200	210
FLAPS 25	PITCH ATT	<b>1.5</b>	<b>2.0</b>	<b>2.0</b>	<b>2.0</b>	<b>2.0</b>
	%N1	49.2	53.8	57.7	61.3	64.0
	KIAS	145	160	174	187	197
FLAPS 30	PITCH ATT	<b>1.0</b>	<b>1.5</b>	<b>1.5</b>		
	%N1	53.4	58.6	62.8		
	KIAS	138	153	166		

**Max Climb %N1**

Based on engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT) / SPEED (KIAS OR MACH)									
	0	5	10	15	20	25	30	35	40	43
	310	310	310	310	310	310	310	0.84	0.84	0.84
60	88.3	88.1	90.3	91.0	93.1	96.7	99.6	101.7	101.8	101.3
50	90.6	90.4	90.2	89.6	91.7	95.3	98.0	100.1	100.2	99.7
40	92.5	92.4	92.4	92.2	90.5	93.8	96.5	98.6	98.7	98.2
30	91.6	94.1	94.2	94.0	93.1	94.2	95.2	97.0	97.1	96.6
20	90.1	92.5	95.1	95.8	95.9	95.9	96.9	95.9	95.5	95.0
15	89.3	91.7	94.3	96.9	96.9	96.9	97.8	96.6	95.8	95.4
10	88.6	90.9	93.5	96.1	98.4	98.1	98.8	97.2	96.5	96.0
5	87.8	90.1	92.7	95.2	98.1	99.6	100.1	98.1	97.2	96.8
0	87.0	89.3	91.8	94.4	97.3	99.9	101.5	99.3	98.1	97.6
-5	86.2	88.5	91.0	93.5	96.4	99.0	101.9	100.5	99.5	98.8
-10	85.4	87.7	90.1	92.6	95.5	98.1	100.9	101.3	100.5	100.0
-15	84.6	86.8	89.3	91.7	94.5	97.1	100.0	101.0	100.9	100.5
-20	83.7	86.0	88.4	90.8	93.6	96.2	99.0	100.1	99.9	99.5
-25	82.9	85.1	87.5	89.9	92.7	95.2	98.0	99.1	98.9	98.5
-30	82.1	84.3	86.7	89.0	91.8	94.3	97.0	98.1	97.9	97.5
-35	81.2	83.4	85.8	88.1	90.8	93.3	96.0	97.0	96.9	96.5
-40	80.4	82.5	84.9	87.2	89.8	92.3	95.0	96.0	95.9	95.5

**%N1 Adjustments for Engine Bleed**

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)									
	0	5	10	15	20	25	30	35	40	43
2 PACKS ON - 1 BLEED SOURCE	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4	-0.4	-0.5
1 PACK ON - 1 OR 2 BLEED SOURCES	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4	-0.4	-0.5
ENGINE ANTI-ICE ON	-0.3	-0.5	-0.4	-0.3	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2
ENGINE & WING ANTI-ICE ON*	-0.6	-0.8	-0.7	-0.5	-0.2	-0.3	-0.3	-0.4	-0.4	-0.4
ENGINE & WING ANTI-ICE ON**	-1.1	-0.9	-0.9	-0.6	-0.3	-0.4	-0.5	-0.5	-0.6	-0.6

\*Packs on or off with 2 bleed sources.

\*\*Packs off with 1 bleed source.

**VREF**

WEIGHT (1000 LB)	FLAPS		
	30	25	20
800	185	187	200
750	180	183	196
700	173	177	189
650	162	171	183
600	156	164	176
550	149	157	168
500	142	150	161
450	135	142	152
400	127	134	144
350	118	125	134

DRAFT

# Performance Inflight - QRH

## Advisory Information

# Chapter PI-QRH

## Section 61

### ADVISORY INFORMATION

#### Normal Configuration Landing Distance

Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (FT)							
	REF DIST	WEIGHT 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	550000 LB LANDING WT	PER 10000 LB ABOVE / BELOW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN/ UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF30	ONE REV NO REV

#### Dry Runway

MAX MANUAL	3220	+80/-40	70	-130/+430	+40/-40	+70/-70	120	70	160
AUTOBRAKE MAX	4360	+70/-60	110	-180/+620	+0/0	+110/-110	220	0	0
AUTOBRAKE 4	5690	+100/-80	150	-260/+880	+0/0	+160/-160	310	0	0
AUTOBRAKE 3	6750	+120/-100	190	-320/+1100	+0/-40	+190/-190	350	0	0
AUTOBRAKE 2	7490	+140/-120	230	-370/+1260	+90/-170	+210/-210	280	210	210
AUTOBRAKE 1	8140	+160/-140	270	-430/+1470	+250/-260	+230/-230	280	840	1050

#### Good Reported Braking Action

MAX MANUAL	4550	+70/-60	120	-210/+750	+110/-100	+110/-110	170	300	700
AUTOBRAKE MAX	4730	+80/-60	130	-220/+770	+100/-80	+120/-120	200	320	740
AUTOBRAKE 4	5720	+100/-80	150	-260/+900	+30/-10	+160/-160	310	20	120
AUTOBRAKE 3	6750	+120/-100	190	-320/+1100	+10/-40	+190/-190	350	0	0
AUTOBRAKE 2	7490	+140/-120	230	-370/+1260	+90/-170	+210/-210	280	210	210
AUTOBRAKE 1	8140	+160/-140	270	-430/+1470	+250/-260	+230/-230	280	840	1050

#### Medium Reported Braking Action

MAX MANUAL	6110	+110/-90	190	-330/+1210	+270/-210	+160/-160	220	800	2050
AUTOBRAKE MAX	6110	+110/-90	190	-330/+1210	+270/-210	+160/-160	230	790	2040
AUTOBRAKE 4	6320	+120/-90	190	-340/+1230	+210/-130	+170/-170	310	740	2020
AUTOBRAKE 3	7050	+130/-110	200	-370/+1320	+130/-120	+200/-200	350	340	1380
AUTOBRAKE 2	7640	+140/-120	230	-400/+1410	+190/-220	+210/-210	280	390	1070
AUTOBRAKE 1	8160	+160/-140	280	-430/+1510	+310/-280	+230/-240	280	910	1400

#### Poor Reported Braking Action

MAX MANUAL	7750	+150/-130	270	-480/+1840	+580/-400	+210/-210	250	1660	4870
AUTOBRAKE MAX	7760	+150/-130	270	-480/+1840	+590/-410	+210/-210	250	1660	4870
AUTOBRAKE 4	7760	+160/-130	270	-480/+1840	+590/-380	+210/-210	280	1660	4870
AUTOBRAKE 3	8020	+160/-130	260	-490/+1870	+490/-320	+220/-230	340	1490	4730
AUTOBRAKE 2	8370	+160/-140	280	-500/+1910	+510/-390	+230/-230	280	1330	4430
AUTOBRAKE 1	8680	+170/-150	300	-520/+1960	+580/-420	+240/-240	280	1570	4250

Reference distance is for sea level, standard day, no wind or slope, VREF30 approach speed, 2 engine reverse thrust, and auto speedbrakes.

For Max Manual braking and manual speedbrakes, increase reference landing distance by 210 ft.

For autobrake and manual speedbrakes, increase reference landing distance by 170 ft.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (1000 ft of air distance).

**ADVISORY INFORMATION****Normal Configuration Landing Distance**

Flaps 25

	LANDING DISTANCE AND ADJUSTMENTS (FT)							
	REF DIST	WEIGHT 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	550000 LB LANDING WT	PER 10000 LB ABOVE/BELOW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	HEAD/TAIL WIND	DOWN/UP HILL	ABOVE/BELOW ISA	PER 5 KTS ABOVE VREF25	ONE REV NO REV

**Dry Runway**

MAX MANUAL	3380	+70/-40	80	-130/+440	+40/-40	+70/-70	120	80	180
AUTOBRAKE MAX	4690	+60/-60	120	-190/+640	+0/0	+120/-120	230	0	0
AUTOBRAKE 4	6160	+80/-90	170	-270/+920	+0/0	+170/-170	320	0	0
AUTOBRAKE 3	7320	+100/-110	210	-340/+1150	+0/-70	+210/-210	350	10	10
AUTOBRAKE 2	8050	+120/-130	250	-390/+1310	+120/-190	+230/-230	290	320	320
AUTOBRAKE 1	8720	+150/-150	300	-450/+1520	+280/-290	+250/-250	290	990	1300

**Good Reported Braking Action**

MAX MANUAL	4820	+60/-70	130	-220/+770	+120/-100	+120/-120	170	330	780
AUTOBRAKE MAX	5020	+70/-70	140	-230/+790	+110/-60	+130/-130	220	350	830
AUTOBRAKE 4	6190	+80/-90	170	-280/+940	+30/-10	+170/-170	330	20	120
AUTOBRAKE 3	7320	+100/-110	210	-340/+1150	+10/-70	+210/-210	350	10	10
AUTOBRAKE 2	8050	+120/-130	250	-390/+1310	+120/-190	+230/-230	290	320	320
AUTOBRAKE 1	8720	+150/-150	300	-450/+1520	+280/-290	+250/-250	290	990	1300

**Medium Reported Braking Action**

MAX MANUAL	6490	+100/-100	210	-340/+1240	+280/-230	+170/-170	220	880	2280
AUTOBRAKE MAX	6490	+100/-100	210	-340/+1240	+290/-210	+170/-170	240	880	2280
AUTOBRAKE 4	6800	+100/-100	210	-350/+1270	+200/-130	+190/-190	330	750	2190
AUTOBRAKE 3	7620	+110/-120	220	-380/+1370	+140/-150	+210/-220	340	370	1460
AUTOBRAKE 2	8210	+120/-130	260	-410/+1450	+220/-240	+230/-230	290	510	1230
AUTOBRAKE 1	8750	+150/-150	300	-450/+1570	+340/-300	+250/-250	290	1060	1670

**Poor Reported Braking Action**

MAX MANUAL	8230	+140/-140	290	-490/+1880	+610/-420	+230/-230	250	1830	5420
AUTOBRAKE MAX	8250	+140/-140	290	-490/+1880	+620/-430	+230/-230	260	1830	5430
AUTOBRAKE 4	8260	+140/-140	290	-490/+1880	+610/-390	+230/-230	280	1830	5440
AUTOBRAKE 3	8610	+140/-140	290	-510/+1920	+500/-350	+240/-240	340	1570	5210
AUTOBRAKE 2	8950	+150/-150	310	-520/+1960	+550/-410	+250/-250	290	1500	4920
AUTOBRAKE 1	9280	+160/-160	320	-540/+2020	+600/-450	+260/-260	290	1750	4770

Reference distance is for sea level, standard day, no wind or slope, VREF25 approach speed, 2 engine reverse thrust, and auto speedbrakes.

For Max Manual braking and manual speedbrakes, increase reference landing distance by 220 ft.

For autobrake and manual speedbrakes, increase reference landing distance by 190 ft.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (1000 ft of air distance).

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Normal Configuration Landing Distance  
Flaps 20**

	LANDING DISTANCE AND ADJUSTMENTS (FT)							
	REF DIST	WEIGHT 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	550000 LB LANDING WT	PER 10000 LB ABOVE / BELOW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN/ UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF20	ONE REV NO REV

**Dry Runway**

MAX MANUAL	3670	+90/-40	90	-140/+460	+50/-40	+80/-80	130	100	210
AUTOBRAKE MAX	5190	+70/-70	130	-200/+680	+0/0	+140/-140	240	0	0
AUTOBRAKE 4	6880	+90/-100	190	-290/+980	+0/0	+200/-200	350	0	0
AUTOBRAKE 3	8180	+120/-130	240	-360/+1220	+10/-80	+240/-240	370	30	30
AUTOBRAKE 2	9000	+140/-150	290	-410/+1390	+140/-220	+260/-260	310	430	430
AUTOBRAKE 1	9740	+170/-170	350	-470/+1610	+310/-330	+290/-290	310	1220	1590

**Good Reported Braking Action**

MAX MANUAL	5290	+70/-80	150	-230/+810	+130/-120	+140/-140	180	400	940
AUTOBRAKE MAX	5520	+80/-80	160	-240/+830	+110/-60	+140/-140	240	400	970
AUTOBRAKE 4	6890	+90/-100	190	-300/+1000	+30/-10	+200/-200	350	20	140
AUTOBRAKE 3	8180	+120/-130	240	-360/+1220	+10/-80	+240/-240	370	30	30
AUTOBRAKE 2	9000	+140/-150	290	-410/+1390	+140/-220	+260/-260	310	430	430
AUTOBRAKE 1	9740	+170/-170	350	-470/+1610	+310/-330	+290/-290	310	1220	1590

**Medium Reported Braking Action**

MAX MANUAL	7160	+110/-110	230	-360/+1300	+310/-250	+190/-200	230	1050	2730
AUTOBRAKE MAX	7160	+110/-110	240	-360/+1300	+320/-230	+200/-200	250	1040	2720
AUTOBRAKE 4	7540	+110/-120	240	-370/+1330	+220/-140	+210/-210	350	840	2570
AUTOBRAKE 3	8490	+120/-130	260	-410/+1440	+160/-160	+240/-240	370	430	1740
AUTOBRAKE 2	9150	+140/-150	300	-440/+1530	+240/-270	+260/-260	310	630	1490
AUTOBRAKE 1	9770	+170/-170	350	-480/+1660	+380/-340	+290/-290	310	1290	2020

**Poor Reported Braking Action**

MAX MANUAL	9110	+160/-160	330	-520/+1960	+660/-460	+250/-250	270	2150	6480
AUTOBRAKE MAX	9120	+160/-160	330	-520/+1970	+670/-470	+260/-260	270	2150	6490
AUTOBRAKE 4	9120	+160/-160	330	-520/+1970	+670/-430	+260/-260	310	2150	6490
AUTOBRAKE 3	9540	+160/-160	330	-540/+2010	+550/-390	+270/-270	360	1820	6190
AUTOBRAKE 2	9930	+170/-170	350	-550/+2050	+600/-450	+280/-280	300	1780	5880
AUTOBRAKE 1	10300	+180/-180	370	-570/+2110	+660/-490	+300/-300	310	2070	5690

Reference distance is for sea level, standard day, no wind or slope, VREF20 approach speed, 2 engine reverse thrust, and auto speedbrakes.

For Max Manual braking and manual speedbrakes, increase reference landing distance by 240 ft.

For autobrake and manual speedbrakes, increase reference landing distance by 200 ft.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (1000 ft of air distance).

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance****Dry Runway**

		LANDING DISTANCES AND ADJUSTMENTS (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	
EICAS MESSAGE	VREF	500000 LB LDG WT	PER 10000 LB ABV/BLW 500000 LB	PER 1000 FT ABV S.L.	HEAD/ TAIL WIND	DOWN/ UP HILL	ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
ANTISKID (FLAPS 25)	VREF25	5980	100/-100	190	-320/1210	260/-200	90/-90	410	840	2200
ANTISKID (FLAPS 30)	VREF30	5640	110/-80	180	-310/1180	250/-190	80/-80	410	760	1980
ENG SHUTDOWN L, R (FLAPS 20)	VREF20	3500	100/-50	90	-130/490	50/-40	40/-40	260	-	160
ENG SHUTDOWN L, R (FLAPS 30)	VREF30	3060	80/-30	70	-120/430	40/-40	40/-40	240	-	130
FLAPS DRIVE (FLAPS $\leq$ 5)	VREF30+40	3850	150/-40	110	-150/570	60/-50	70/-70	280	160	370
FLAPS DRIVE ( $5 < \text{FLAPS} < 20$ )	VREF30+20	3500	110/-30	90	-130/500	40/-40	40/-40	260	100	220
FLAPS DRIVE (FLAPS $\geq$ 20)	VREF20	3460	90/-50	80	-130/470	40/-40	40/-40	240	90	200
FLAPS PRIMARY FAIL	VREF20	3950	80/-50	90	-150/500	50/-50	50/-50	320	120	260
FLAP/SLAT CONTROL	VREF20	3460	90/-50	80	-130/470	40/-40	40/-40	240	90	200
FLIGHT CONTROL MODE	VREF20	4000	80/-50	100	-150/510	50/-50	50/-50	330	130	280
HYD PRESS SYS C	VREF20	3950	80/-50	90	-150/500	50/-50	50/-50	320	120	260
HYD PRESS SYS L+C	VREF30+20	4380	100/-40	110	-160/560	70/-60	60/-60	410	-	190
HYD PRESS SYS L+R	VREF30+20	4740	90/-40	120	-190/660	110/-100	70/-70	460	-	-
HYD PRESS SYS R+C	VREF30+20	5380	80/-50	150	-220/760	140/-120	80/-80	520	-	440
HYD PRESS SYS L (FLAPS 25)	VREF25	3440	70/-40	80	-140/470	50/-50	40/-40	290	-	110
HYD PRESS SYS L (FLAPS 30)	VREF30	3270	70/-30	70	-130/460	50/-40	40/-40	290	-	100
HYD PRESS SYS R (FLAPS 25)	VREF25	3790	50/-50	90	-160/550	70/-60	50/-50	330	-	170
HYD PRESS SYS R (FLAPS 30)	VREF30	3580	60/-40	90	-150/530	60/-60	50/-50	320	-	150
PITCH UP AUTHORITY (FLAPS 5)	VREF30+40	3970	130/-40	110	-150/560	60/-50	60/-60	280	150	340
PITCH UP AUTHORITY (FLAPS 20)	VREF30+20	3530	100/-30	80	-130/460	40/-40	40/-40	250	100	210
PRI FLIGHT COMPUTERS	VREF20	4000	80/-50	100	-150/510	50/-50	50/-50	330	130	280
SLATS DRIVE	VREF30+30	3800	110/-40	100	-140/520	50/-40	40/-40	260	110	250
STABILIZER	VREF30+20	3530	100/-30	80	-130/460	40/-40	40/-40	250	100	210

Actual (unfactored) distances are shown.

Includes distances from 50 ft above threshold (1000 ft air distance).

Assumes maximum manual braking and maximum available reverse thrust.

777 Flight Crew Operations Manual

**ADVISORY INFORMATION**

**Non-Normal Configuration Landing Distance  
Good Reported Braking Action**

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
EICAS MESSAGE	VREF	REF DIST	WT ADJ	ALT ADJ	WIND ADJ PER 10 KTS	SLOPE ADJ PER 1% PER 10°C	TEMP ADJ PER 10°C	APP SPD ADJ	REVERSE THRUST ADJ	
ANTISKID (FLAPS 25)	VREF25	5980	100/-100	190	-320/1210	260/-200	90/-90	410	840	2200
ANTISKID (FLAPS 30)	VREF30	5640	110/-80	180	-310/1180	250/-190	80/-80	410	760	1980
ENG SHUTDOWN L, R (FLAPS 20)	VREF20	5170	80/-80	150	-240/840	150/-120	80/-80	380	-	640
ENG SHUTDOWN L, R (FLAPS 30)	VREF30	4430	80/-60	120	-210/780	130/-100	60/-60	360	-	500
FLAPS DRIVE (FLAPS $\leq$ 5)	VREF30+40	5580	90/-70	160	-230/830	130/-110	90/-90	340	510	1240
FLAPS DRIVE (5 < FLAPS < 20)	VREF30+20	5020	80/-60	140	-220/800	120/-110	70/-70	350	420	1000
FLAPS DRIVE (FLAPS $\geq$ 20)	VREF20	4920	70/-80	140	-220/790	120/-100	70/-70	350	380	890
FLAPS PRIMARY FAIL	VREF20	5500	80/-90	160	-240/850	140/-120	80/-80	430	470	1130
FLAP/SLAT CONTROL	VREF20	4920	70/-80	140	-220/790	120/-100	70/-70	350	380	890
FLIGHT CONTROL MODE	VREF20	5590	80/-90	160	-240/860	150/-130	80/-80	450	490	1200
HYD PRESS SYS C	VREF20	5500	80/-90	160	-240/850	140/-120	80/-80	430	470	1130
HYD PRESS SYS L+C	VREF30+20	6460	110/-70	190	-290/1000	230/-190	100/-100	580	-	840
HYD PRESS SYS L+R	VREF30+20	6910	110/-70	200	-320/1110	320/-250	110/-110	650	-	-
HYD PRESS SYS R+C	VREF30+20	6550	110/-70	190	-290/1010	240/-190	100/-100	600	-	880
HYD PRESS SYS L (FLAPS 25)	VREF25	5110	70/-80	140	-240/870	160/-140	70/-70	430	-	530
HYD PRESS SYS L (FLAPS 30)	VREF30	4840	90/-60	130	-230/850	160/-130	70/-70	430	-	480
HYD PRESS SYS R (FLAPS 25)	VREF25	5110	70/-80	140	-240/870	160/-140	70/-70	430	-	530
HYD PRESS SYS R (FLAPS 30)	VREF30	4790	80/-60	130	-230/840	150/-130	70/-70	420	-	460
PITCH UP AUTHORITY (FLAPS 5)	VREF30+40	5690	90/-70	170	-240/840	140/-120	80/-80	350	500	1200
PITCH UP AUTHORITY (FLAPS 20)	VREF30+20	5020	80/-60	140	-220/800	120/-110	60/-60	350	390	930
PRI FLIGHT COMPUTERS	VREF20	5590	80/-90	160	-240/860	150/-130	80/-80	450	490	1200
SLATS DRIVE	VREF30+30	5400	90/-70	160	-230/830	130/-110	70/-70	360	440	1050
STABILIZER	VREF30+20	5020	80/-60	140	-220/800	120/-110	60/-60	350	390	930

Actual (unfactored) distances are shown.

Includes distances from 50 ft above threshold (1000 ft air distance).

Assumes maximum manual braking and maximum available reverse thrust.

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance  
Medium Reported Braking Action**

		LANDING DISTANCES AND ADJUSTMENTS (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	
EICAS MESSAGE	VREF	500000 LB LDG WT	PER 10000 LB ABV/BLW 500000 LB	PER 1000 FT ABV S.L.	HEAD/TAIL WIND	DOWN/UP HILL	ABV/BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
ANTISKID (FLAPS 25)	VREF25	7490	140/-140	270	-450/1820	550/-360	110/-110	470	1730	5310
ANTISKID (FLAPS 30)	VREF30	7050	150/-110	240	-440/1780	530/-340	100/-100	460	1570	4780
ENG SHUTDOWN L, R (FLAPS 20)	VREF20	7310	130/-130	230	-380/1410	400/-300	110/-110	510	-	1910
ENG SHUTDOWN L, R (FLAPS 30)	VREF30	6160	120/-90	190	-340/1300	340/-250	90/-90	470	-	1460
FLAPS DRIVE (FLAPS $\leq$ 5)	VREF30+40	7580	140/-110	260	-360/1320	300/-240	130/-130	440	1350	3810
FLAPS DRIVE ( $5 < \text{FLAPS} < 20$ )	VREF30+20	6750	130/-100	220	-340/1270	290/-230	100/-100	450	1110	3040
FLAPS DRIVE (FLAPS $\geq$ 20)	VREF20	6580	120/-110	220	-340/1260	290/-220	100/-100	430	990	2630
FLAPS PRIMARY FAIL	VREF20	7230	130/-130	240	-360/1330	330/-250	110/-110	520	1180	3230
FLAP/SLAT CONTROL	VREF20	6580	120/-110	220	-340/1260	290/-220	100/-100	430	990	2630
FLIGHT CONTROL MODE	VREF20	7380	130/-130	250	-370/1350	340/-260	110/-110	540	1250	3480
HYD PRESS SYS C	VREF20	7230	130/-130	240	-360/1330	330/-250	110/-110	520	1180	3230
HYD PRESS SYS L+C	VREF30+20	9090	170/-120	300	-460/1670	600/-430	140/-140	720	-	2530
HYD PRESS SYS L+R	VREF30+20	11120	180/-120	350	-590/2100	1160/-730	190/-190	910	-	-
HYD PRESS SYS R+C	VREF30+20	9200	170/-120	310	-460/1680	620/-440	140/-140	740	-	2630
HYD PRESS SYS L (FLAPS 25)	VREF25	7290	120/-120	240	-400/1490	460/-330	110/-110	560	-	1660
HYD PRESS SYS L (FLAPS 30)	VREF30	6880	130/-90	220	-390/1460	440/-310	110/-110	560	-	1510
HYD PRESS SYS R (FLAPS 25)	VREF25	7240	120/-120	230	-400/1490	450/-320	110/-110	550	-	1630
HYD PRESS SYS R (FLAPS 30)	VREF30	6720	130/-90	210	-380/1440	420/-300	100/-100	530	-	1410
PITCH UP AUTHORITY (FLAPS 5)	VREF30+40	7590	140/-110	260	-360/1330	310/-240	110/-120	440	1260	3430
PITCH UP AUTHORITY (FLAPS 20)	VREF30+20	6690	130/-100	220	-340/1270	290/-220	80/-80	430	1010	2680
PRI FLIGHT COMPUTERS	VREF20	7380	130/-130	250	-370/1350	340/-260	110/-110	540	1250	3480
SLATS DRIVE	VREF30+30	7190	130/-100	240	-350/1310	310/-240	90/-90	440	1110	2970
STABILIZER	VREF30+20	6690	130/-100	220	-340/1270	290/-220	80/-80	430	1010	2680

Actual (unfactored) distances are shown.

Includes distances from 50 ft above threshold (1000 ft air distance).

Assumes maximum manual braking and maximum available reverse thrust.

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Non-Normal Configuration Landing Distance  
Poor Reported Braking Action**

		LANDING DISTANCES AND ADJUSTMENTS (FT)							
EICAS MESSAGE	VREF	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
ANTISKID (FLAPS 25)	VREF25	9650	210/-190	380	-690/3260	2660/-720	150/-150	530	4340 15000
ANTISKID (FLAPS 30)	VREF30	9090	220/-160	350	-670/3200	2580/-690	140/-140	510	4010 15000
ENG SHUTDOWN L, R (FLAPS 20)	VREF20	9740	190/-180	350	-570/2230	990/-590	160/-160	610	- 4850
ENG SHUTDOWN L, R (FLAPS 30)	VREF30	8140	170/-130	280	-520/2070	840/-490	130/-130	550	- 3690
FLAPS DRIVE (FLAPS $\leq$ 5)	VREF30+40	9580	200/-150	370	-500/1990	640/-430	170/-170	530	2770 9540
FLAPS DRIVE (5 < FLAPS < 20)	VREF30+20	8510	180/-140	320	-480/1920	620/-410	130/-130	520	2280 7500
FLAPS DRIVE (FLAPS $\geq$ 20)	VREF20	8270	160/-150	300	-470/1900	610/-400	130/-130	500	2020 6320
FLAPS PRIMARY FAIL	VREF20	8950	180/-170	330	-500/1980	670/-440	140/-140	580	2330 7610
FLAP/SLAT CONTROL	VREF20	8270	160/-150	300	-470/1900	610/-400	130/-130	500	2020 6320
FLIGHT CONTROL MODE	VREF20	9150	180/-170	340	-510/2000	700/-460	140/-140	610	2480 8260
HYD PRESS SYS C	VREF20	8950	180/-170	330	-500/1980	670/-440	140/-140	580	2330 7610
HYD PRESS SYS L+C	VREF30+20	12140	240/-180	450	-700/2730	1560/-850	200/-200	820	- 6360
HYD PRESS SYS L+R	VREF30+20	17790	270/-160	590	-1100/4220	5750/-1980	320/-320	1140	- -
HYD PRESS SYS R+C	VREF30+20	12260	250/-190	460	-710/2750	1590/-870	200/-200	840	- 6540
HYD PRESS SYS L (FLAPS 25)	VREF25	9910	180/-170	360	-630/2520	1310/-690	160/-160	660	- 4300
HYD PRESS SYS L (FLAPS 30)	VREF30	9370	190/-140	330	-610/2470	1270/-660	150/-150	660	- 3950
HYD PRESS SYS R (FLAPS 25)	VREF25	9790	170/-170	350	-620/2500	1280/-670	160/-160	640	- 4150
HYD PRESS SYS R (FLAPS 30)	VREF30	9040	180/-130	320	-600/2420	1190/-620	140/-140	610	- 3570
PITCH UP AUTHORITY (FLAPS 5)	VREF30+40	9450	190/-150	360	-500/1980	640/-430	150/-150	500	2480 8010
PITCH UP AUTHORITY (FLAPS 20)	VREF30+20	8360	180/-130	300	-480/1900	610/-400	110/-110	500	2030 6340
PRI FLIGHT COMPUTERS	VREF20	9150	180/-170	340	-510/2000	700/-460	140/-140	610	2480 8260
SLATS DRIVE	VREF30+30	8960	190/-140	330	-490/1950	630/-420	120/-120	500	2210 6900
STABILIZER	VREF30+20	8360	180/-130	300	-480/1900	610/-400	110/-110	500	2030 6340

Actual (unfactored) distances are shown.

Includes distances from 50 ft above threshold (1000 ft air distance).

Assumes maximum manual braking and maximum available reverse thrust.

**ADVISORY INFORMATION****Recommended Brake Cooling Schedule**  
**Reference Brake Energy (Millions of Foot Pounds)**

WEIGHT (1000 LB)	OAT (°C)	BRAKES ON SPEED (KIAS)																	
		80			100			120			140			160			180		
		PRESSURE ALTITUDE (1000 FT)	0	4	8	0	4	8	0	4	8	0	4	8	0	4	8		
780	0	21.8	23.8	26.1	32.5	35.8	39.7	45.4	50.5	56.5	59.5	66.5	74.6	74.6	83.6	94.0	90.2	101.1	113.5
	10	22.4	24.5	26.9	33.4	36.9	40.9	46.8	52.1	58.2	61.4	68.6	77.0	77.0	86.3	96.9	93.1	104.2	116.8
	15	22.8	24.9	27.4	34.0	37.6	41.7	47.7	53.1	59.3	62.5	69.9	78.4	78.3	87.8	98.6	94.7	106.0	118.7
	20	23.2	25.4	27.8	34.7	38.2	42.4	48.5	54.0	60.3	63.5	71.1	79.7	79.7	89.3	100.2	96.2	107.7	120.6
	30	23.8	26.0	28.5	35.5	39.2	43.5	49.8	55.4	62.0	65.3	73.0	81.9	81.9	91.7	102.9	98.9	110.6	123.7
	40	23.9	26.1	28.7	35.9	39.7	43.4	50.1	56.3	63.0	66.4	74.4	83.5	83.4	93.5	105.0	100.8	112.8	126.0
740	0	21.0	22.8	25.0	31.1	34.3	38.0	43.5	48.3	53.9	56.8	63.5	71.2	71.3	79.9	89.8	86.3	96.8	108.7
	10	21.5	23.5	25.7	32.0	35.3	39.1	44.8	49.8	55.6	58.6	65.5	73.5	73.6	82.5	92.6	89.1	99.8	111.9
	15	21.9	23.9	26.2	32.6	36.0	39.8	45.6	50.7	56.6	59.7	66.7	74.8	74.9	83.9	94.2	90.6	101.5	113.8
	20	22.3	24.3	26.7	33.2	36.6	40.5	46.4	51.6	57.6	60.7	67.9	76.1	76.2	85.3	95.8	92.1	103.1	115.6
	30	22.8	24.9	27.3	34.0	37.5	41.6	47.6	53.0	59.2	62.4	69.7	78.2	78.3	87.7	98.4	94.7	105.9	118.6
	40	23.0	25.1	27.5	34.4	37.9	42.1	48.3	53.8	60.1	63.4	71.0	79.7	79.7	89.4	100.4	96.5	108.1	120.9
700	0	20.1	21.9	23.9	29.8	32.8	36.2	41.5	46.1	51.4	54.2	60.5	67.8	68.0	76.2	85.6	82.4	92.4	103.8
	10	20.6	22.5	24.6	30.6	33.7	37.3	42.8	47.5	53.0	55.9	62.4	70.0	70.1	78.6	88.3	85.0	95.2	106.9
	15	21.0	22.9	25.1	31.2	34.3	38.0	43.6	48.4	53.9	56.9	63.5	71.2	71.4	80.0	89.8	86.4	96.9	108.7
	20	21.4	23.3	25.5	31.8	35.0	38.7	44.3	49.2	54.9	57.9	64.6	72.4	72.6	81.3	91.3	87.9	98.5	110.4
	30	21.9	23.8	26.1	32.5	35.8	39.7	45.5	50.5	56.4	59.5	66.4	74.4	74.6	83.6	93.8	90.3	101.2	113.4
	40	22.0	24.0	26.3	32.9	36.2	40.2	46.1	51.3	57.3	60.5	67.6	75.8	76.0	85.2	95.7	92.1	103.2	115.6
620	0	18.4	20.0	21.8	27.1	29.7	32.8	37.6	41.6	46.3	48.8	54.4	60.9	61.2	68.4	76.8	74.1	83.1	93.4
	10	18.9	20.5	22.4	27.9	30.6	33.8	38.7	42.9	47.7	50.4	56.1	62.8	63.1	70.6	79.3	76.5	85.7	96.3
	15	19.3	20.9	22.8	28.4	31.2	34.4	39.4	43.6	48.6	51.3	57.1	63.9	64.2	71.9	80.7	77.8	87.2	97.9
	20	19.6	21.3	23.2	28.9	31.7	35.0	40.1	44.4	49.4	52.2	58.1	65.0	65.4	73.1	82.0	79.2	88.7	99.6
	30	20.0	21.7	23.8	29.6	32.5	35.9	41.1	45.6	50.7	53.6	59.7	66.8	67.1	75.1	84.3	81.4	91.2	102.3
	40	20.1	21.9	23.9	29.9	32.8	36.3	41.7	46.2	51.5	54.4	60.7	68.0	68.3	76.5	85.9	82.9	93.0	104.3
540	0	16.8	18.1	19.8	24.4	26.7	29.4	33.6	37.1	41.2	43.4	48.3	53.9	54.2	60.5	67.8	65.5	73.4	82.5
	10	17.2	18.6	20.3	25.1	27.5	30.3	34.6	38.2	42.4	44.8	49.8	55.5	55.9	62.4	69.9	67.6	75.7	85.1
	15	17.5	19.0	20.7	25.6	28.0	30.8	35.2	38.9	43.2	45.6	50.7	56.5	56.9	63.5	71.2	68.8	77.1	86.5
	20	17.8	19.3	21.0	26.0	28.5	31.4	35.9	39.6	44.0	46.4	51.5	57.5	57.9	64.6	72.4	70.0	78.4	88.0
	30	18.2	19.7	21.5	26.6	29.2	32.1	36.8	40.6	45.1	47.6	52.9	59.1	59.4	66.4	74.4	71.9	80.6	90.4
	40	18.3	19.8	21.6	26.9	29.4	32.5	37.2	41.1	45.7	48.3	53.7	60.1	60.4	67.6	75.8	73.3	82.1	92.2
460	0	15.2	16.4	17.7	21.8	23.8	26.1	29.6	32.6	36.0	37.9	42.0	46.7	47.0	52.3	58.5	56.6	63.3	70.9
	10	15.6	16.8	18.2	22.4	24.4	26.8	30.5	33.5	37.1	39.1	43.3	48.2	48.4	53.9	60.3	58.4	65.3	73.2
	15	15.9	17.1	18.6	22.8	24.9	27.3	31.0	34.2	37.8	39.8	44.1	49.1	49.3	54.9	61.4	59.4	66.4	74.5
	20	16.1	17.4	18.9	23.2	25.3	27.8	31.6	34.8	38.5	40.5	44.9	49.9	50.2	55.9	62.5	60.5	67.6	75.8
	30	16.5	17.8	19.3	23.7	25.9	28.4	32.4	35.6	39.4	41.5	46.0	51.3	51.5	57.4	64.2	62.1	69.4	77.8
	40	16.5	17.8	19.4	23.9	26.1	28.7	32.7	36.0	39.9	42.1	46.7	52.0	52.3	58.3	65.3	63.2	70.7	79.3
380	0	13.6	14.6	15.8	19.2	20.8	22.7	25.6	28.1	30.9	32.4	35.7	39.6	39.6	43.9	48.9	47.3	52.7	58.9
	10	14.0	15.0	16.2	19.7	21.4	23.4	26.3	28.9	31.8	33.3	36.8	40.8	40.8	45.3	50.4	48.8	54.3	60.7
	15	14.2	15.3	16.5	20.0	21.8	23.8	26.8	29.4	32.4	33.9	37.4	41.5	41.6	46.1	51.4	49.7	55.3	61.8
	20	14.5	15.5	16.8	20.4	22.2	24.2	27.3	29.9	33.0	34.5	38.1	42.3	42.3	46.9	52.3	50.5	56.3	62.9
	30	14.8	15.9	17.2	20.8	22.7	24.8	28.0	30.6	33.8	35.4	39.1	43.3	43.4	48.1	53.6	51.9	57.8	64.6
	40	14.8	15.9	17.2	20.9	22.8	25.0	28.2	30.9	34.2	35.8	39.6	43.9	44.0	48.8	54.5	52.7	58.7	65.8

To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind.

If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 15°C.

## 777 Flight Crew Operations Manual

**ADVISORY INFORMATION****Recommended Brake Cooling Schedule****Event Adjusted Brake Energy (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	100	110	120
LANDING	RTO MAX MAN	10	20	30	40	50	60	70	80	90	100	110	120
	MAX MAN	4.4	14.1	23.7	33.2	42.6	51.9	61.2	70.5	79.9	89.3	98.9	108.7
	MAX AUTO	4.4	13.1	21.7	30.2	38.7	47.3	56.0	65.0	74.3	83.9	94.0	104.6
	AUTOBRAKE 4	4.3	12.5	20.4	28.1	35.7	43.4	51.2	59.3	67.7	76.6	86.1	96.4
	AUTOBRAKE 3	4.2	11.9	19.2	26.3	33.3	40.3	47.4	54.8	62.6	70.8	79.7	89.3
	AUTOBRAKE 2	4.1	11.2	17.9	24.4	30.8	37.2	43.7	50.5	57.6	65.1	73.2	81.9
	AUTOBRAKE 1	4.0	10.3	16.3	22.1	27.8	33.4	39.1	45.1	51.3	58.0	65.1	72.9

**2 Engine Reverse Thrust**

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
EVENT		10	20	30	40	50	60	70	80	90	100	110	120
LANDING	RTO MAX MAN	10	20	30	40	50	60	70	80	90	100	110	120
	MAX MAN	3.3	12.0	21.0	30.0	38.9	47.5	56.1	64.5	72.8	81.0	89.2	97.5
	MAX AUTO	2.0	8.7	15.5	22.3	29.3	36.4	43.8	51.5	59.6	68.3	77.5	87.4
	AUTOBRAKE 4	1.4	5.6	10.4	15.6	20.9	26.4	32.2	38.3	44.8	51.9	59.6	68.0
	AUTOBRAKE 3	0.9	3.2	6.4	10.3	14.3	18.5	23.0	27.9	33.2	39.0	45.4	52.4
	AUTOBRAKE 2	0.3	1.8	4.0	6.5	9.3	12.3	15.6	19.2	23.3	27.9	33.0	38.7
	AUTOBRAKE 1	0.2	1.2	2.6	4.3	6.1	8.1	10.3	12.8	15.6	18.8	22.3	26.4

**Cooling Time (Minutes)**

		EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)									
16 & BELOW		17	18	20	24	28	32	35	36 TO 44	45 & ABOVE	
GEAR DOWN	NO SPECIAL PROCEDURE	1	2	3	4	6	7	7	CAUTION	FUSE PLUG MELT ZONE	
INFLIGHT	REQUIRED	11	18	26	42	55	66	73			
GROUND	BTMS	UP TO 2.4	2.4	2.6	2.9	3.4	4.0	4.5	4.9	5.0 TO 6.3	6.3 & 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 10 percent.

For two brakes deactivated, increase brake energy by 20 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. (When inflight with gear extended, the BTMS indications may vary between individual brakes, due to air-stream effects.)

**ADVISORY INFORMATION****Landing Climb Limit Weight****Valid for approach with flaps 20 and landing with flaps 30**

AIRPORT OAT	°C	°F	LANDING CLIMB LIMIT WEIGHT (1000 LB)					
			AIRPORT PRESSURE ALTITUDE (FT)					
-2000	0	2000	4000	6000	8000			
54	129	672.3	628.0					
52	126	690.0	643.1					
50	122	707.8	659.3	605.6				
48	118	725.5	677.8	619.9				
46	115	743.7	696.5	635.4	585.0			
44	111	761.0	714.1	652.5	600.2			
42	108	777.3	732.3	671.6	614.6	563.6		
40	104	793.0	750.7	689.9	629.6	576.5		
38	100	809.0	769.5	707.1	644.2	589.2	523.7	
36	97	823.4	785.6	722.9	658.1	600.0	534.2	
34	93	834.9	801.0	739.6	671.9	609.6	544.6	
32	90	835.0	816.7	753.4	684.7	618.5	554.2	
30	86	835.0	830.3	765.2	699.0	627.8	562.5	
28	82	835.0	830.6	775.5	709.9	638.0	570.7	
26	79	835.0	830.8	787.4	718.4	648.3	578.8	
24	75	835.0	831.0	787.5	725.5	659.0	587.6	
22	72	835.0	831.2	787.7	732.4	666.4	596.9	
20	68	835.0	831.5	787.8	732.6	671.0	604.8	
18	64	835.0	831.6	788.0	732.8	675.5	610.3	
16	61	835.0	831.8	788.2	732.9	675.6	614.2	
14	57	835.0	831.9	788.4	733.1	675.8	617.6	
12	54	835.0	832.1	788.5	733.3	675.9	617.8	
10	50	835.0	832.1	788.7	733.4	675.9	617.9	
8	46	835.0	832.2	788.9	733.6	676.0	617.9	
6	43	835.0	832.3	788.9	733.7	676.0	617.8	
4	40	835.0	832.4	781.7	706.6	645.9	570.9	
2	36	835.0	832.4	781.9	706.7	646.0	570.9	
0	32	835.0	832.5	781.9	706.8	646.1	571.0	
-40	-40	835.0	832.7	781.9	706.8	646.1	571.1	

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off.

With engine bleed for packs off, increase weight by 2900 lb.

With engine and wing anti-ice on, decrease weight by 4800 lb.

When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 48400 lb.

**ADVISORY INFORMATION****Landing Climb Limit Weight****Valid for approach with flaps 20 and landing with flaps 25**

AIRPORT OAT		LANDING CLIMB LIMIT WEIGHT (1000 LB)						
		AIRPORT PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	
54	129	680.0	637.9					
52	126	695.9	653.6					
50	122	712.4	668.9	615.7				
48	118	729.4	684.9	630.1				
46	115	746.7	701.5	645.6	594.1			
44	111	763.5	718.1	662.4	609.4			
42	108	779.7	735.6	679.3	624.3	572.7		
40	104	795.5	753.2	695.5	639.7	586.1		
38	100	811.6	771.9	711.8	655.4	599.2	533.2	
36	97	826.3	788.0	727.2	668.7	611.1	543.8	
34	93	835.0	803.5	743.1	681.2	620.9	554.2	
32	90	835.0	819.5	756.3	692.2	630.5	564.5	
30	86	835.0	833.3	767.7	705.0	639.8	573.1	
28	82	835.0	833.5	778.2	715.2	650.4	581.7	
26	79	835.0	833.7	790.3	723.4	660.6	589.8	
24	75	835.0	834.0	790.5	730.1	670.3	598.7	
22	72	835.0	834.2	790.6	736.7	676.8	608.2	
20	68	835.0	834.4	790.8	736.9	680.7	616.4	
18	64	835.0	834.6	791.0	737.0	684.6	622.2	
16	61	835.0	834.7	791.2	737.2	684.7	626.3	
14	57	835.0	834.9	791.3	737.4	684.8	629.8	
12	54	835.0	835.0	791.5	737.5	684.9	630.0	
10	50	835.0	835.0	791.7	737.7	685.0	630.1	
8	46	835.0	835.0	791.8	737.9	685.1	630.1	
6	43	835.0	835.0	791.9	738.0	685.2	630.0	
4	40	835.0	835.0	792.0	738.1	685.2	618.9	
2	36	835.0	835.0	792.1	738.2	685.3	619.0	
0	32	835.0	835.0	792.1	738.2	685.4	619.0	
-40	-40	835.0	835.0	792.4	738.4	685.8	619.3	

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off.

With engine bleed for packs off, increase weight by 3200 lb.

With engine and wing anti-ice on, decrease weight by 4000 lb.

When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 49000 lb.

DRAFT

Intentionally  
Blank

**Performance Inflight - QRH**  
**Engine Inoperative**
**Chapter PI-QRH**  
**Section 62**
**ENGINE INOP**
**Initial Max Continuous %N1**
**Based on .84M, engine bleed for one pack on and anti-ice off**

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	27	29	31	33	35	37	39	41	43
20	97.4	97.0	96.7	96.3	95.9	95.9	95.6	95.3	95.0
15	98.2	97.8	97.3	97.0	96.6	96.3	96.0	95.7	95.4
10	99.2	98.9	98.3	97.7	97.2	97.0	96.6	96.3	96.0
5	100.2	100.1	99.7	98.8	98.1	97.8	97.4	97.1	96.8
0	99.3	100.9	101.0	99.9	99.3	98.8	98.3	97.9	97.6
-5	98.4	99.9	101.2	101.3	100.5	100.2	99.7	99.3	98.8
-10	97.4	99.0	100.3	101.6	101.3	101.3	100.7	100.3	100.0
-15	96.5	98.1	99.3	100.6	101.0	102.0	101.1	100.8	100.5
-20	95.6	97.1	98.3	99.6	100.1	101.0	100.1	99.8	99.5
-25	94.6	96.1	97.4	98.6	99.1	100.0	99.1	98.8	98.5
-30	93.7	95.2	96.4	97.6	98.1	99.0	98.1	97.8	97.5
-35	92.7	94.2	95.4	96.6	97.0	97.9	97.1	96.8	96.5
-40	91.7	93.2	94.4	95.6	96.0	96.9	96.1	95.8	95.5

**ENGINE INOP****Max Continuous %N1**

Based on engine bleed for packs on or off and anti-ice off

37000 FT to 27000 FT Pressure Altitudes

37000 FT PRESS ALT			TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	
280	0.86	94.3	95.4	96.4	97.4	98.4	99.5	100.5	101.4	101.2	100.2	98.9	97.7	
240	0.74	96.1	97.2	98.3	99.3	100.4	101.4	102.1	101.9	100.9	99.5	98.1	97.1	
200	0.63	95.7	96.7	97.8	98.8	99.9	100.8	101.4	100.9	100.0	98.5	97.0	96.3	
35000 FT PRESS ALT			TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	
280	0.82	94.6	95.6	96.6	97.7	98.7	99.7	100.7	101.7	101.4	100.4	99.2	98.1	
240	0.71	95.1	96.2	97.2	98.3	99.3	100.3	101.3	101.8	100.9	99.8	98.3	97.2	
200	0.60	94.8	95.8	96.9	97.9	98.9	99.9	100.9	101.0	100.2	98.8	97.1	96.1	
33000 FT PRESS ALT			TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	
320	0.89	91.4	92.4	93.4	94.4	95.4	96.4	97.4	98.3	99.3	100.2	99.8	98.8	
280	0.79	95.0	96.0	97.1	98.1	99.2	100.2	101.2	102.2	102.4	101.0	100.0	98.7	
240	0.68	95.6	96.7	97.8	98.8	99.8	100.9	101.9	102.4	101.8	100.2	98.9	97.5	
200	0.58	95.9	97.0	98.0	99.1	100.1	101.1	101.6	101.6	101.0	99.3	97.9	96.4	
31000 FT PRESS ALT			TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	
320	0.85	92.7	93.8	94.8	95.7	96.7	97.7	98.7	99.6	100.5	100.8	99.7	98.4	
280	0.76	96.3	97.4	98.4	99.5	100.5	101.5	102.5	103.5	102.0	100.6	99.1	98.0	
240	0.66	97.4	98.4	99.5	100.5	101.5	102.6	103.3	103.0	101.0	99.5	98.1	96.9	
200	0.55	97.6	98.7	99.7	100.8	101.8	102.6	102.8	102.0	100.7	98.7	97.2	96.1	
29000 FT PRESS ALT			TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	
320	0.82	93.8	94.8	95.8	96.8	97.8	98.7	99.7	100.6	101.6	100.1	98.9	97.8	
280	0.73	96.6	97.6	98.6	99.6	100.6	101.6	102.6	102.5	101.0	99.5	98.1	97.1	
240	0.63	98.1	99.2	100.2	101.3	102.3	103.3	103.1	101.6	99.8	98.4	97.1	96.0	
200	0.53	98.6	99.7	100.7	101.7	102.7	103.2	102.7	101.2	99.4	97.7	96.3	96.2	
27000 FT PRESS ALT			TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	
360	0.88	90.2	91.2	92.1	93.0	94.0	94.9	95.8	96.7	97.6	98.5	99.2	98.1	
320	0.79	93.4	94.4	95.3	96.3	97.3	98.2	99.2	100.1	101.1	100.6	99.2	98.1	
280	0.70	95.4	96.4	97.4	98.4	99.4	100.4	101.3	102.3	101.3	99.7	98.2	97.1	
240	0.60	97.2	98.2	99.2	100.3	101.3	102.3	103.0	102.0	99.9	98.5	97.2	96.2	
200	0.51	98.4	99.4	100.4	101.5	102.5	103.2	102.7	101.8	99.9	98.1	96.5	95.6	

**%N1 Adjustments for Engine Bleed**

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	37	35	33	31	29	27
ENGINE A/I ON	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
WING A/I ON - PACKS ON	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3
WING A/I ON - PACKS OFF	-0.6	-0.5	-0.5	-0.5	-0.5	-0.4

## ENGINE INOP

### Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off

25000 FT to 18000 FT Pressure Altitudes

25000 FT PRESS ALT			TAT (°C)											
KIAS	M		-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
360	0.85	91.2	92.2	93.1	94.1	95.0	95.9	96.8	97.7	98.6	99.5	98.9	98.1	
320	0.76	93.9	94.8	95.8	96.8	97.7	98.7	99.6	100.5	101.1	99.6	98.5	97.6	
280	0.67	95.5	96.5	97.5	98.5	99.4	100.4	101.3	101.5	100.4	98.8	97.5	96.7	
240	0.58	97.4	98.5	99.5	100.5	101.5	102.4	102.3	100.9	99.3	97.8	96.7	95.9	
200	0.49	99.3	100.3	101.4	102.4	103.4	103.1	102.0	100.6	98.5	97.1	96.1	95.9	

24000 FT PRESS ALT			TAT (°C)											
KIAS	M		-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
360	0.83	91.3	92.3	93.2	94.2	95.1	96.0	96.9	97.8	98.7	99.6	99.4	98.4	
320	0.75	93.6	94.6	95.6	96.5	97.5	98.4	99.4	100.3	101.2	100.0	98.8	97.8	
280	0.66	95.4	96.4	97.4	98.3	99.3	100.3	101.2	101.8	100.7	99.1	97.8	96.9	
240	0.57	97.3	98.3	99.3	100.3	101.3	102.2	102.6	101.4	99.8	98.3	97.1	96.2	
200	0.48	98.8	99.9	100.9	101.9	102.9	103.4	102.3	101.0	98.9	97.4	96.3	95.6	

22000 FT PRESS ALT			TAT (°C)											
KIAS	M		-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
360	0.80	92.1	93.0	94.0	94.9	95.8	96.7	97.6	98.5	99.4	100.0	99.0	98.3	
320	0.72	94.3	95.3	96.3	97.2	98.1	99.1	100.0	100.9	100.7	99.3	98.2	97.5	
280	0.63	96.1	97.1	98.1	99.0	100.0	100.9	101.9	101.3	99.8	98.4	97.3	96.6	
240	0.55	97.7	98.7	99.7	100.7	101.7	102.7	102.3	100.9	99.3	97.7	96.8	96.1	
200	0.46	99.5	100.5	101.5	102.5	103.5	103.0	101.5	99.9	97.9	96.8	95.9	95.8	

20000 FT PRESS ALT			TAT (°C)											
KIAS	M		-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
360	0.77	93.7	94.6	95.6	96.5	97.4	98.4	99.3	100.2	101.1	102.0	101.3	100.1	
320	0.69	95.9	96.9	97.8	98.8	99.7	100.7	101.6	102.6	103.5	101.8	100.4	99.1	
280	0.61	97.7	98.7	99.6	100.6	101.6	102.6	103.5	104.3	102.8	100.9	99.4	98.3	
240	0.53	98.5	99.5	100.5	101.5	102.4	103.4	104.3	104.1	102.4	100.7	98.7	97.2	
200	0.44	98.0	99.0	99.9	100.9	101.9	102.9	103.8	102.6	100.5	98.0	96.2	95.3	

18000 FT PRESS ALT			TAT (°C)											
KIAS	M		-25	-20	-15	-10	-5	0	5	10	15	20	25	30
360	0.75	94.4	95.4	96.3	97.2	98.2	99.1	100.0	100.9	101.8	102.0	100.6	99.4	
320	0.67	96.7	97.7	98.6	99.6	100.5	101.4	102.4	103.3	102.9	101.2	99.7	98.6	
280	0.59	98.5	99.5	100.5	101.5	102.4	103.4	104.3	104.0	102.3	100.4	98.9	97.8	
240	0.51	99.6	100.6	101.6	102.6	103.6	104.5	104.9	103.9	101.9	100.0	98.4	97.2	
200	0.42	97.2	98.2	99.2	100.1	101.1	101.9	102.0	100.8	98.8	97.3	95.8	94.4	

### %N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	25	24	22	20	18
ENGINE A/ION	-0.2	-0.2	-0.2	-0.2	-0.2
WING A/I ON - PACKS ON	-0.3	-0.3	-0.3	-0.2	-0.3
WING A/I ON - PACKS OFF	-0.4	-0.4	-0.4	-0.3	-0.5

**ENGINE INOP****Max Continuous %N1**

Based on engine bleed for packs on or off and anti-ice off

16000 FT to 5000 FT Pressure Altitudes

16000 FT PRESS ALT			TAT (°C)											
KIAS	M		-25	-20	-15	-10	-5	0	5	10	15	20	25	30
360	0.72	94.8	95.8	96.7	97.6	98.6	99.5	100.4	101.3	102.2	103.1	101.7	100.2	
320	0.64	96.9	97.9	98.8	99.8	100.7	101.7	102.6	103.5	104.4	102.7	100.9	99.4	
280	0.57	98.7	99.7	100.7	101.6	102.6	103.5	104.5	105.4	104.1	102.2	100.3	98.8	
240	0.49	99.1	100.1	101.1	102.0	103.0	104.0	104.9	104.5	103.0	100.9	99.2	97.9	
200	0.41	96.2	97.2	98.1	99.1	100.0	100.9	101.5	101.3	99.8	98.3	97.0	95.4	
14000 FT PRESS ALT			TAT (°C)											
KIAS	M		-20	-15	-10	-5	0	5	10	15	20	25	30	35
360	0.69	94.9	95.9	96.8	97.7	98.6	99.5	100.4	101.3	102.2	102.2	100.8	99.5	
320	0.62	97.1	98.1	99.0	99.9	100.9	101.8	102.7	103.6	103.4	101.5	100.0	98.9	
280	0.54	99.2	100.1	101.1	102.1	103.0	103.9	104.9	104.9	103.0	101.0	99.5	98.4	
240	0.47	97.3	98.2	99.2	100.1	101.1	102.0	102.8	102.5	100.6	99.0	97.8	96.7	
200	0.39	96.1	97.0	98.0	98.9	99.8	100.7	101.4	100.7	99.0	97.6	96.5	95.6	
12000 FT PRESS ALT			TAT (°C)											
KIAS	M		-15	-10	-5	0	5	10	15	20	25	30	35	40
360	0.67	95.4	96.3	97.2	98.1	99.0	99.9	100.8	101.6	102.5	101.3	100.0	99.0	
320	0.60	97.3	98.2	99.2	100.1	101.0	101.9	102.8	103.7	102.3	100.6	99.4	98.4	
280	0.52	99.7	100.6	101.6	102.5	103.5	104.4	105.3	104.0	102.0	100.2	99.1	98.1	
240	0.45	96.5	97.4	98.3	99.3	100.2	101.1	101.4	100.6	99.2	98.0	96.9	96.0	
200	0.38	96.7	97.7	98.6	99.5	100.4	101.2	101.3	100.2	98.7	97.4	96.4	95.8	
10000 FT PRESS ALT			TAT (°C)											
KIAS	M		-15	-10	-5	0	5	10	15	20	25	30	35	40
360	0.65	94.2	95.2	96.1	96.9	97.8	98.7	99.6	100.4	101.3	101.5	100.2	99.1	
320	0.58	96.1	97.1	98.0	98.9	99.8	100.7	101.6	102.4	102.6	101.0	99.7	98.6	
280	0.51	98.5	99.4	100.4	101.3	102.2	103.1	104.0	104.6	102.3	100.5	99.4	98.4	
240	0.43	95.6	96.6	97.5	98.4	99.3	100.2	101.0	101.1	100.3	99.1	97.8	96.9	
200	0.36	96.6	97.5	98.4	99.3	100.2	101.1	101.6	101.2	100.1	98.5	97.5	96.6	
5000 FT PRESS ALT			TAT (°C)											
KIAS	M		-10	-5	0	5	10	15	20	25	30	35	40	45
360	0.59	92.6	93.5	94.3	95.2	96.0	96.9	97.7	98.5	99.4	100.2	99.3	98.5	
320	0.53	94.0	94.9	95.8	96.7	97.5	98.4	99.2	100.1	100.9	100.1	99.1	98.2	
280	0.46	95.0	95.9	96.8	97.6	98.5	99.4	100.2	101.1	100.9	99.8	98.8	97.8	
240	0.40	95.7	96.6	97.5	98.4	99.3	100.2	101.0	101.6	100.5	99.4	98.3	97.4	
200	0.33	97.0	97.9	98.8	99.7	100.6	101.5	102.4	101.7	100.3	99.1	98.1	97.3	

**%N1 Adjustments for Engine Bleed**

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	16	14	12	10	5	
ENGINE A/I ON	-0.3	-0.2	-0.4	-0.5	-0.5	
WING A/I ON - PACKS ON	-0.4	-0.5	-0.6	-0.7	-0.8	
WING A/I ON - PACKS OFF	-0.6	-0.7	-0.8	-0.9	-1.1	

## ENGINE INOP

### MAX CONTINUOUS THRUST

#### Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 LB)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
780	758	298	18000	16800	15600
740	720	290	19300	18200	17000
700	682	283	20500	19600	18500
660	642	275	21700	20900	20000
620	601	267	23200	22200	21200
580	562	258	25000	24000	22800
540	524	249	27000	26100	24700
500	485	241	29100	28400	27000
460	448	231	30900	30500	29400
420	409	221	32600	32300	31700
380	369	211	34400	34300	34000

**ENGINE INOP****MAX CONTINUOUS THRUST****Driftdown/LRC Cruise Range Capability****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	
134	126	118	111	105	100	95	90	86	82	79	
269	251	236	222	210	200	190	181	173	165	159	
403	377	354	334	316	300	285	272	260	248	238	
536	502	472	445	421	400	380	362	346	332	318	
670	627	589	556	526	500	475	453	433	415	398	
803	752	707	667	632	600	571	544	520	498	478	
936	877	824	778	737	700	666	635	607	582	558	
1068	1001	942	889	842	800	761	726	695	665	639	
1201	1126	1059	1000	947	900	856	817	782	749	719	
1333	1250	1176	1111	1052	1000	952	908	869	833	799	
1466	1374	1293	1222	1157	1100	1047	1000	956	916	880	
1598	1499	1411	1332	1262	1200	1142	1091	1043	1000	960	
1731	1623	1528	1443	1368	1300	1238	1182	1131	1084	1040	
1863	1747	1645	1554	1473	1400	1333	1273	1218	1167	1121	
1996	1872	1762	1665	1578	1500	1428	1364	1305	1251	1201	
2129	1997	1880	1776	1683	1600	1524	1455	1392	1334	1281	
2262	2121	1997	1887	1788	1700	1619	1546	1479	1418	1361	
2395	2246	2115	1998	1894	1800	1714	1637	1566	1501	1441	

**Driftdown/Cruise Fuel and Time**

AIR DIST (NM)	FUEL REQUIRED (1000 LB)										TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 LB)										
380	420	460	500	540	580	620	660	700	740	780	
100	2.4	2.6	2.9	3.1	3.3	3.5	3.7	3.9	4.0	4.2	0:16
200	5.4	6.0	6.5	7.1	7.4	7.8	8.3	8.7	9.0	9.5	0:31
300	8.7	9.5	10.4	11.2	11.8	12.5	13.2	13.9	14.5	15.4	0:46
400	11.9	13.1	14.2	15.4	16.3	17.2	18.2	19.2	20.1	21.2	1:01
500	14.9	16.4	17.8	19.3	20.5	21.7	23.0	24.2	25.3	26.8	1:16
600	17.9	19.6	21.3	23.1	24.6	26.1	27.5	29.0	30.4	32.2	1:31
700	20.8	22.8	24.8	26.9	28.6	30.4	32.1	33.8	35.4	37.5	1:46
800	23.7	26.0	28.3	30.6	32.5	34.6	36.5	38.5	40.4	42.7	2:01
900	26.6	29.2	31.7	34.3	36.5	38.8	41.0	43.2	45.4	48.0	2:15
1000	29.5	32.3	35.1	37.9	40.4	42.9	45.4	47.9	50.3	53.2	2:30
1100	32.3	35.4	38.4	41.5	44.3	47.1	49.8	52.5	55.2	58.3	2:44
1200	35.1	38.5	41.8	45.1	48.1	51.2	54.1	57.1	60.1	63.5	2:59
1300	37.9	41.5	45.1	48.7	51.9	55.2	58.5	61.7	64.9	68.6	3:14
1400	40.7	44.6	48.4	52.2	55.7	59.3	62.8	66.2	69.7	73.6	3:28
1500	43.4	47.6	51.6	55.7	59.5	63.3	67.0	70.7	74.5	78.6	3:43
1600	46.1	50.5	54.9	59.2	63.2	67.3	71.3	75.2	79.2	83.6	3:58
1700	48.8	53.5	58.1	62.7	66.9	71.2	75.5	79.7	83.9	88.6	4:13
1800	51.5	56.4	61.2	66.1	70.6	75.2	79.6	84.1	88.6	93.5	4:27

Includes APU fuel burn.

Driftdown at optimum driftdown speed and cruise at LRC speed.

**ENGINE INOP****MAX CONTINUOUS THRUST****Long Range Cruise Altitude Capability**  
**100 ft/min residual rate of climb**

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
780	15300	14000	12400
760	16000	14400	12900
740	16700	15200	13300
720	17500	16000	14200
700	18300	16800	15100
680	19100	17600	16000
660	20000	18500	16800
640	20500	19300	17700
620	21100	20100	18700
600	21700	20800	19700
580	22500	21400	20400
560	23400	22100	21100
540	24300	23100	21700
520	25400	24200	22600
500	26600	25300	23700
480	27900	26600	24900
460	29300	27900	26200
440	30400	29200	27600
420	31300	30400	29000
400	32200	31600	30400
380	33200	32700	31700
360	34200	33900	33000

With engine anti-ice on, no altitude capability adjustment is required.

With engine and wing anti-ice on, decrease altitude capability by 300 ft.

**ENGINE INOP****MAX CONTINUOUS THRUST****Long Range Cruise Control**

WEIGHT (1000 LB)	PRESSURE ALTITUDE (1000 FT)									
	10	15	17	19	21	23	25	27	29	31
780	%N1 MACH KIAS FF/ENG	91.3 .602 334 22536	96.8 .664 337 24156							
	%N1 MACH KIAS FF/ENG	90.4 .602 334 21826	95.1 .660 335 22989	97.9 .678 332 23330						
	%N1 MACH KIAS FF/ENG	89.4 .599 333 21042	93.5 .649 329 21608	95.6 .665 325 21727	98.8 .684 322 22025					
	%N1 MACH KIAS FF/ENG	87.7 .583 324 19683	91.9 .637 323 20284	93.6 .653 319 20323	96.1 .670 315 20423					
740	%N1 MACH KIAS FF/ENG	85.9 .567 315 18411	90.2 .621 315 18905	91.9 .641 313 19032	93.6 .657 309 19011	96.5 .675 305 19194				
	%N1 MACH KIAS FF/ENG	84.1 .551 306 17177	88.4 .602 305 17504	90.1 .625 305 17683	91.8 .644 302 17733	93.7 .661 298 17760	96.8 .680 295 18050			
	%N1 MACH KIAS FF/ENG	82.1 .534 296 15983	86.3 .582 294 16124	88.2 .605 295 16312	89.9 .627 294 16429	91.6 .646 292 16476	93.7 .663 288 16562	97.0 .683 285 16922		
	%N1 MACH KIAS FF/ENG	80.1 .516 286 14812	84.1 .563 284 14796	86.0 .583 284 14951	87.8 .606 284 15098	89.5 .629 284 15202	91.2 .648 281 15263	93.5 .665 277 15363	97.0 .686 274 15748	
700	%N1 MACH KIAS FF/ENG	77.9 .498 276 13638	81.8 .543 274 13500	83.6 .563 273 13643	85.5 .583 273 13767	87.2 .607 273 13886	88.9 .630 272 13996	90.7 .649 270 14052	93.1 .666 266 14137	96.7 .688 264 14531
	%N1 MACH KIAS FF/ENG	75.5 .480 266 12483	79.3 .521 263 12254	81.2 .540 262 12367	82.9 .560 262 12495	84.8 .581 261 12575	86.5 .605 261 12676	88.2 .628 261 12787	90.0 .648 258 12829	92.4 .666 255 12899
	%N1 MACH KIAS FF/ENG	73.1 .462 255 11350	76.7 .500 252 11040	78.5 .517 251 11139	80.3 .536 250 11257	82.0 .556 249 11323	83.8 .578 249 11376	85.6 .601 249 11460	87.3 .625 249 11565	89.1 .646 247 11610
	%N1 MACH KIAS FF/ENG	70.3 .443 245 10261	73.9 .478 240 9890	75.7 .494 239 9952	77.4 .511 238 10062	79.1 .530 237 10110	80.8 .550 236 10131	82.5 .571 236 10176	84.3 .594 236 10235	86.1 .620 236 10339
660	%N1 MACH KIAS FF/ENG	68.4 .425 235 9483	71.9 .467 234 9160	74.5 .497 233 8847	76.9 .527 232 8534	79.1 .557 231 8221	81.2 .587 230 7908	83.3 .617 229 7595	85.4 .647 228 7282	87.5 .677 227 6969
	%N1 MACH KIAS FF/ENG	66.9 .406 225 8756	69.4 .448 224 8433	72.0 .478 223 8120	74.4 .508 222 7807	76.6 .538 221 7494	78.7 .568 220 7181	80.7 .598 219 6868	82.7 .628 218 6555	84.7 .658 217 6242
	%N1 MACH KIAS FF/ENG	65.4 .387 215 8049	67.9 .429 214 7736	70.5 .459 213 7423	72.8 .489 212 7110	75.0 .519 211 6797	77.1 .549 210 6484	79.1 .579 209 6171	81.1 .609 208 5858	83.1 .639 207 5545
	%N1 MACH KIAS FF/ENG	64.0 .368 205 7342	66.4 .411 204 6929	69.0 .441 203 6616	71.2 .471 202 6303	73.3 .501 201 5990	75.4 .531 200 5677	77.4 .561 199 5364	79.4 .591 198 5051	81.4 .621 197 4738
620	%N1 MACH KIAS FF/ENG	62.5 .349 195 6635	64.9 .391 194 6322	67.5 .421 193 5909	69.8 .451 192 5596	72.0 .481 191 5283	74.1 .511 190 4970	76.2 .541 189 4657	78.2 .571 188 4344	80.2 .601 187 4031
	%N1 MACH KIAS FF/ENG	61.0 .330 185 5928	63.4 .372 184 5615	66.0 .402 183 5302	68.3 .432 182 4989	70.4 .462 181 4676	72.5 .492 180 4363	74.6 .522 179 4050	76.6 .552 178 3737	78.6 .582 177 3424
	%N1 MACH KIAS FF/ENG	59.5 .311 175 5221	61.9 .353 174 4908	64.5 .383 173 4595	66.8 .413 172 4282	69.0 .443 171 3969	71.1 .473 170 3656	73.2 .503 169 3343	75.2 .533 168 3030	77.2 .563 167 2717
	%N1 MACH KIAS FF/ENG	58.0 .292 165 4514	60.4 .334 164 4201	63.0 .364 163 3888	65.3 .394 162 3575	67.5 .424 161 3262	69.7 .454 160 2949	71.7 .484 159 2636	73.7 .514 158 2323	75.7 .544 157 2010
580	%N1 MACH KIAS FF/ENG	56.5 .273 155 3807	58.9 .315 154 3494	61.5 .345 153 3181	63.8 .375 152 2868	66.0 .405 151 2555	68.2 .435 150 2242	70.3 .465 149 1929	72.3 .495 148 1616	74.3 .525 147 1303
	%N1 MACH KIAS FF/ENG	55.0 .254 145 3100	57.4 .296 144 2787	59.6 .326 143 2474	61.9 .356 142 2161	64.1 .386 141 1848	66.3 .416 140 1535	68.4 .446 139 1222	70.4 .476 138 899	72.4 .506 137 586
	%N1 MACH KIAS FF/ENG	53.5 .235 135 2399	55.9 .277 134 2086	58.1 .307 133 1773	60.3 .337 132 1460	62.5 .367 131 1147	64.7 .397 130 834	66.8 .427 129 521	68.8 .457 128 208	70.8 .487 127 -1
	%N1 MACH KIAS FF/ENG	52.0 .216 125 1702	54.4 .258 124 1389	56.6 .288 123 1076	58.8 .318 122 763	61.0 .348 121 450	63.2 .378 120 137	65.3 .408 119 -1	67.3 .438 118 -1	69.3 .468 117 -1
460	%N1 MACH KIAS FF/ENG	49.5 .197 115 1092	51.9 .239 114 779	54.1 .269 113 466	56.3 .299 112 153	58.5 .329 111 -1	60.6 .359 110 -1	62.7 .389 109 -1	64.8 .419 108 -1	66.8 .449 107 -1
	%N1 MACH KIAS FF/ENG	48.0 .178 105 721	50.4 .220 104 408	52.6 .250 103 95	54.8 .280 102 -1	57.0 .310 101 -1	59.1 .340 100 -1	61.2 .370 99 -1	63.3 .400 98 -1	65.3 .430 97 -1
	%N1 MACH KIAS FF/ENG	46.5 .159 95 374	48.9 .199 94 651	51.1 .229 93 318	53.3 .259 92 -1	55.5 .289 91 -1	57.6 .319 90 -1	59.7 .349 89 -1	61.8 .379 88 -1	63.8 .409 87 -1
	%N1 MACH KIAS FF/ENG	45.0 .140 85 127	47.4 .181 84 434	49.6 .211 83 -1	51.8 .241 82 -1	54.0 .271 81 -1	56.1 .301 80 -1	58.2 .331 79 -1	60.3 .361 78 -1	62.3 .391 77 -1
420	%N1 MACH KIAS FF/ENG	43.5 .121 75 610	45.9 .162 74 307	48.1 .192 73 -1	50.3 .222 72 -1	52.5 .252 71 -1	54.6 .282 70 -1	56.7 .312 69 -1	58.8 .342 68 -1	60.8 .372 67 -1
	%N1 MACH KIAS FF/ENG	42.0 .102 65 253	44.4 .143 64 140	46.6 .173 63 -1	48.8 .203 62 -1	51.0 .233 61 -1	53.1 .263 60 -1	55.2 .293 59 -1	57.3 .323 58 -1	59.3 .353 57 -1
	%N1 MACH KIAS FF/ENG	40.5 .83 55 196	42.9 .124 54 87	45.1 .154 53 -1	47.3 .184 52 -1	49.5 .214 51 -1	51.6 .244 50 -1	53.7 .274 49 -1	55.8 .304 48 -1	57.8 .334 47 -1
	%N1 MACH KIAS FF/ENG	39.0 .64 45 139	41.4 .105 44 76	43.6 .135 43 -1	45.8 .165 42 -1	48.0 .195 41 -1	50.1 .225 40 -1	52.2 .255 39 -1	54.3 .285 38 -1	56.3 .315 37 -1
380	%N1 MACH KIAS FF/ENG	37.5 .45 35 102	39.9 .86 34 91	42.1 .116 33 -1	44.3 .146 32 -1	46.5 .176 31 -1	48.6 .206 30 -1	50.7 .236 29 -1	52.8 .266 28 -1	54.9 .296 27 -1
	%N1 MACH KIAS FF/ENG	36.0 .26 25 65	38.4 .67 24 54	40.2 .97 23 -1	42.5 .127 22 -1	44.7 .157 21 -1	46.9 .187 20 -1	49.1 .217 19 -1	51.3 .247 18 -1	53.4 .277 17 -1
	%N1 MACH KIAS FF/ENG	34.5 .07 15 28	36.9 .48 14 17	39.1 .78 13 -1	41.3 .108 12 -1	43.5 .138 11 -1	45.7 .168 10 -1	47.9 .198 9 -1	50.1 .228 8 -1	52.2 .258 7 -1
	%N1 MACH KIAS FF/ENG	33.0 .88 5 21	35.4 .69 4 10	37.6 .99 3 -1	39.8 .129 2 -1	42.0 .159 1 -1	44.2 .189 -1 -1	46.4 .219 -1 -1	48.6 .249 -1 -1	50.7 .279 -1 -1
340	%N1 MACH KIAS FF/ENG	31.5 .69 5 14	33.9 .50 4 4	36.1 .80 3 -1	38.3 .110 2 -1	40.5 .140 1 -1	42.7 .170 -1 -1	44.9 .200 -1 -1	47.1 .230 -1 -1	49.2 .260 -1 -1
	%N1 MACH KIAS FF/ENG	30.0 .50 5 8	32.4 .31 4 7	34.6 .61 3 -1	36.8 .91 2 -1	39.0 .121 1 -1	41.2 .151 -1 -1	43.4 .181 -1 -1	45.6 .211 -1 -1	47.7 .241 -1 -1
	%N1 MACH KIAS FF/ENG	28.5 .31 5 2	30.9 .12 4 1	33.1 .41 3 -1	35.3 .71 2 -1	37.5 .101 1 -1	39.7 .131 -1 -1	41.9 .161 -1 -1	44.1 .191 -1 -1	46.2 .221 -1 -1
	%N1 MACH KIAS FF/ENG	27.0 .12 5 -1	29.4 .03 4 -1	31.6 .33 3 -1	33.8 .63 2 -1	36.0 .93 1 -1	38.2 .123 -1 -1	40.4 .153 -1 -1	42.6 .183 -1 -1	44.7 .213 -1 -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	
286	264	244	227	213	200	190	181	173	166	159	
569	525	487	454	425	400	381	364	348	333	320	
853	788	730	681	638	600	572	546	522	501	482	
1138	1051	974	908	851	800	763	729	698	669	643	
1424	1316	1219	1136	1064	1000	954	911	872	836	803	
1711	1580	1464	1364	1278	1200	1144	1093	1046	1003	964	
1999	1846	1709	1592	1491	1400	1335	1275	1220	1170	1124	
2288	2111	1954	1820	1704	1600	1526	1457	1394	1337	1285	
2578	2378	2201	2049	1918	1800	1717	1639	1568	1504	1445	
2869	2646	2447	2278	2132	2000	1907	1821	1742	1670	1605	

#### Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)							
	10		14		18		22	
	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	9.2	0:38	8.1	0:37	7.3	0:36	6.5	0:35
400	19.3	1:12	17.7	1:09	16.5	1:06	15.6	1:04
600	29.2	1:46	27.2	1:41	25.7	1:37	24.5	1:34
800	39.0	2:21	36.6	2:14	34.7	2:07	33.2	2:03
1000	48.7	2:56	45.9	2:47	43.7	2:38	41.9	2:33
1200	58.4	3:31	55.1	3:20	52.6	3:09	50.5	3:03
1400	67.9	4:06	64.2	3:53	61.4	3:41	59.0	3:33
1600	77.4	4:41	73.2	4:27	70.1	4:12	67.4	4:03
1800	86.8	5:17	82.1	5:01	78.6	4:44	75.6	4:33
2000	96.1	5:53	90.9	5:35	87.2	5:16	83.8	5:03

#### Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)								
	400	450	500	550	600	650	700	750	800
10	-1.7	-1.3	-0.8	-0.4	0.0	0.8	1.8	2.9	4.2
20	-3.7	-2.7	-1.8	-0.9	0.0	1.8	3.9	6.3	9.0
30	-5.7	-4.2	-2.7	-1.4	0.0	2.8	6.0	9.6	13.7
40	-7.7	-5.7	-3.7	-1.9	0.0	3.8	8.0	12.8	18.1
50	-9.8	-7.2	-4.7	-2.4	0.0	4.7	10.0	15.9	22.4
60	-11.8	-8.7	-5.7	-2.8	0.0	5.6	11.9	18.9	26.6
70	-13.9	-10.2	-6.7	-3.3	0.0	6.5	13.7	21.8	30.6
80	-15.9	-11.7	-7.7	-3.8	0.0	7.3	15.5	24.5	34.5
90	-18.0	-13.2	-8.7	-4.3	0.0	8.1	17.2	27.2	38.1
100	-20.1	-14.8	-9.7	-4.8	0.0	8.9	18.8	29.7	41.7

Includes APU fuel burn.

**ENGINE INOP****MAX CONTINUOUS THRUST****Holding  
Flaps Up**

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
800	%N1	81.3	84.8	89.5	94.9			
	KIAS	273	275	276	301			
	FF/ENG	20620	20800	21460	23060			
760	%N1	79.7	83.0	87.8	92.7			
	KIAS	266	268	269	285			
	FF/ENG	19500	19610	20160	21200			
720	%N1	78.2	81.2	86.1	90.8	99.6		
	KIAS	259	260	261	271	297		
	FF/ENG	18410	18460	18870	19520	22300		
680	%N1	76.5	79.4	84.3	88.9	96.1		
	KIAS	252	253	254	256	286		
	FF/ENG	17340	17340	17630	18000	20240		
640	%N1	74.7	77.7	82.3	87.1	92.7		
	KIAS	245	245	246	248	267		
	FF/ENG	16280	16250	16430	16710	18210		
600	%N1	72.9	75.8	80.2	85.1	90.3		
	KIAS	236	237	238	239	251		
	FF/ENG	15240	15180	15250	15440	16560		
560	%N1	70.9	73.8	78.1	83.0	88.0	96.0	
	KIAS	231	231	231	231	234	263	
	FF/ENG	14210	14140	14130	14260	15010	16930	
520	%N1	68.8	71.9	76.0	80.8	85.8	91.6	
	KIAS	225	225	225	225	225	243	
	FF/ENG	13210	13140	13070	13140	13740	14810	
480	%N1	66.7	69.6	73.8	78.3	83.5	88.4	98.4
	KIAS	220	220	220	220	220	224	245
	FF/ENG	12240	12170	12060	12090	12540	13170	15210
440	%N1	64.6	67.3	71.6	75.9	80.8	85.7	93.3
	KIAS	213	213	213	213	213	213	232
	FF/ENG	11280	11200	11070	11080	11390	11800	13060
400	%N1	62.4	65.0	69.1	73.4	78.1	83.2	88.3
	KIAS	207	207	207	207	207	207	209
	FF/ENG	10360	10250	10130	10120	10320	10640	11140
360	%N1	60.0	62.6	66.4	70.7	75.3	80.3	85.0
	KIAS	200	200	200	200	200	200	200
	FF/ENG	9480	9350	9220	9210	9310	9520	9830

This table includes 5% additional fuel for holding in a racetrack pattern.

**ENGINE INOP****ADVISORY INFORMATION****Gear Down Landing Rate of Climb Available  
Flaps 20**

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	430	320				
50	480	370	210			
48	530	420	270			
46	570	470	320	160		
44	620	530	370	210		
42	670	570	410	250	90	
40	710	620	460	290	120	
38	740	670	510	330	150	
36	740	710	540	370	180	-20
34	740	760	580	400	210	0
32	750	760	610	440	240	30
30	750	770	640	460	280	60
20	770	780	650	510	350	170
10	790	800	600	420	260	130
0	810	810	590	360	130	-110
-20	840	850	610	370	130	-110
-40	880	880	640	390	140	-120

Rate of climb capability shown is valid for 500000 lb, gear down at VREF20 + 5.

Decrease rate of climb 30 ft/min per 10000 lb greater than 500000 lb.

Increase rate of climb 40 ft/min per 10000 lb less than 500000 lb.

**Flaps 30**

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	-140	-250				
50	-100	-210	-360			
48	-60	-160	-320			
46	-10	-120	-270	-420		
44	30	-70	-220	-380		
42	70	-30	-180	-340	-500	
40	100	20	-150	-310	-470	
38	140	60	-110	-280	-450	
36	140	100	-70	-250	-420	-620
34	140	130	-40	-210	-400	-600
32	140	150	-10	-180	-370	-580
30	140	150	10	-160	-340	-550
20	150	150	20	-120	-270	-460
10	160	160	0	-150	-300	-660
0	160	160	-50	-270	-500	-730
-20	170	170	-60	-280	-510	-750
-40	180	170	-60	-300	-530	-780

Rate of climb capability shown is valid for 500000 lb, gear down at VREF30 + 5.

Decrease rate of climb 30 ft/min per 10000 lb greater than 500000 lb.

Increase rate of climb 40 ft/min per 10000 lb less than 500000 lb.

DRAFT

Intentionally  
Blank

**Performance Inflight - QRH****Chapter PI-QRH****Gear Down****Section 63****GEAR DOWN****220 KIAS Max Climb %N1**

TAT (°C)	PRESSURE ALTITUDE (1000 FT)														
	0	5	10	12	14	16	18	20	22	24	26	28	30	32	34
55	88.2	88.3	91.4	91.1	92.1	91.3	94.0	95.2	95.4	98.1	99.9	101.1	102.4	102.9	103.4
50	89.5	88.8	90.7	90.4	91.4	92.1	93.3	94.5	94.7	97.3	99.2	100.3	101.6	102.1	102.6
45	90.5	90.1	90.0	89.7	90.7	91.4	92.6	93.8	93.9	96.6	98.4	99.6	100.8	101.3	101.8
40	91.6	91.2	91.2	89.7	89.9	90.7	91.9	93.0	93.2	95.8	97.6	98.8	100.0	100.5	101.0
35	92.6	92.3	92.2	92.1	90.6	89.9	91.1	92.3	92.5	95.0	96.8	98.0	99.2	99.7	100.2
30	93.0	93.2	93.2	93.0	92.2	91.2	90.9	91.5	91.7	94.3	96.0	97.2	98.4	98.9	99.4
25	92.2	94.2	94.1	94.0	93.7	92.8	92.1	92.0	91.1	93.5	95.2	96.4	97.6	98.0	98.5
20	91.4	94.2	95.1	95.0	94.9	94.4	93.4	93.0	92.8	93.6	94.4	95.6	96.8	97.2	97.7
15	90.7	93.4	96.7	96.4	96.3	96.1	94.8	94.1	94.5	94.8	95.2	95.3	96.0	96.4	96.9
10	89.9	92.6	96.3	97.9	98.1	98.1	96.8	95.5	96.5	96.2	96.4	96.4	96.6	96.1	96.0
5	89.1	91.7	95.4	97.1	98.9	100.3	99.0	97.9	98.2	97.8	97.8	97.9	97.9	97.3	96.8
0	88.3	90.9	94.6	96.2	98.0	100.1	100.8	100.3	100.1	99.7	99.4	99.4	99.5	98.6	98.1
-5	87.4	90.1	93.7	95.3	97.1	99.1	99.9	100.8	101.9	101.5	101.1	101.1	101.1	100.2	99.6
-10	86.6	89.2	92.8	94.4	96.1	98.2	98.9	99.8	101.4	102.8	102.6	102.6	103.0	101.6	100.8
-15	85.8	88.4	91.9	93.5	95.2	97.3	98.0	98.9	100.4	101.8	102.5	103.2	103.8	102.5	101.4
-20	85.0	87.5	91.1	92.6	94.3	96.3	97.0	97.9	99.4	100.8	101.5	102.2	103.3	102.4	101.3

**%N1 Adjustments for Engine Bleed**

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)							
	0	5	10	15	20	25	30	35
2 PACKS ON - 1 BLEED SOURCE	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4
1 PACK ON - 1 OR 2 BLEED SOURCES	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4
ENGINE ANTI-ICE ON	-0.3	-0.5	-0.4	-0.3	-0.1	-0.2	-0.2	-0.2
ENGINE & WING ANTI-ICE ON*	-0.6	-0.8	-0.7	-0.5	-0.2	-0.3	-0.3	-0.4
ENGINE & WING ANTI-ICE ON**	-1.1	-0.9	-0.9	-0.6	-0.3	-0.4	-0.5	-0.5

\*Packs on or off with 2 bleed sources.

\*\*Packs off with 1 bleed source.

**GEAR DOWN****Long Range Cruise Altitude Capability****Max Climb Thrust, 300 ft/min residual rate of climb**

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
780	18600	16600	14200
760	19100	17200	14800
740	19700	17900	15500
720	20200	18500	16100
700	21000	19400	17100
680	21900	20400	18200
660	22900	21500	19400
640	23900	22500	20600
620	25000	23500	21900
600	25900	24600	23000
580	27000	25700	24200
560	28000	27000	25400
540	29100	28200	26700
520	30100	29500	28000
500	30900	30500	29300
480	31600	31300	30500
460	32400	32200	31500
440	33300	33100	32600
420	34100	33900	33600
400	34900	34800	34600
380	35800	35700	35600
360	36700	36600	36400

**GEAR DOWN****Long Range Cruise Control**

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		10	15	17	19	21	23	25	27	29	31
800	%N1	84.9	89.2	91.3	93.9						
	MACH	.488	.535	.556	.578						
	KIAS	270	270	270	270						
	FF/ENG	16879	17230	17550	18041						
760	%N1	84.0	88.3	90.3	92.5						
	MACH	.488	.535	.556	.578						
	KIAS	270	270	270	270						
	FF/ENG	16350	16643	16893	17295						
720	%N1	83.2	87.5	89.4	91.4	94.2					
	MACH	.488	.535	.556	.578	.600					
	KIAS	270	270	270	270	270					
	FF/ENG	15899	16146	16324	16639	17073					
680	%N1	81.4	85.8	87.8	89.6	91.8					
	MACH	.475	.521	.542	.564	.587					
	KIAS	263	263	263	263	264					
	FF/ENG	14938	15104	15281	15498	15865					
640	%N1	79.5	83.9	86.0	87.8	89.7	92.1				
	MACH	.461	.506	.526	.548	.570	.594				
	KIAS	255	255	255	255	256	256				
	FF/ENG	13989	14087	14216	14393	14638	14997				
600	%N1	77.6	82.1	84.1	86.0	87.7	89.7	92.5			
	MACH	.447	.491	.511	.531	.553	.576	.600			
	KIAS	247	247	247	247	248	248	248			
	FF/ENG	13042	13113	13185	13337	13490	13756	14123			
560	%N1	75.5	80.0	82.0	84.0	85.8	87.6	89.6	92.7		
	MACH	.433	.475	.494	.514	.535	.557	.581	.606		
	KIAS	239	239	239	239	239	240	240	240		
	FF/ENG	12107	12162	12207	12291	12445	12584	12856	13237		
520	%N1	73.3	77.8	79.8	81.8	83.7	85.4	87.3	89.4	92.8	
	MACH	.418	.459	.477	.496	.516	.538	.560	.584	.610	
	KIAS	231	231	231	231	231	231	231	232	232	
	FF/ENG	11193	11213	11263	11306	11394	11539	11679	11939	12332	
480	%N1	71.1	75.5	77.4	79.4	81.3	83.2	85.0	86.8	89.1	92.8
	MACH	.402	.442	.459	.478	.497	.517	.539	.562	.587	.614
	KIAS	222	222	222	222	222	222	222	222	223	223
	FF/ENG	10294	10279	10324	10368	10407	10495	10627	10769	11006	11406
440	%N1	68.6	73.1	75.0	76.8	78.9	80.7	82.7	84.4	86.2	88.5
	MACH	.387	.425	.442	.460	.478	.498	.519	.540	.563	.588
	KIAS	213	213	213	213	213	213	213	213	213	214
	FF/ENG	9429	9422	9440	9486	9514	9547	9627	9739	9856	10065
400	%N1	66.5	71.0	72.8	74.7	76.7	78.7	80.4	82.3	84.0	85.9
	MACH	.375	.413	.429	.446	.465	.484	.504	.525	.548	.571
	KIAS	207	207	207	207	207	207	207	207	207	207
	FF/ENG	8736	8731	8729	8756	8786	8810	8845	8930	9028	9136
360	%N1	64.3	68.7	70.5	72.3	74.4	76.4	78.2	79.9	81.8	83.6
	MACH	.363	.399	.415	.432	.450	.468	.488	.508	.530	.553
	KIAS	200	200	200	200	200	200	200	200	200	200
	FF/ENG	8041	8029	8026	8031	8049	8072	8095	8137	8220	8303

**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	
316	284	257	235	216	200	189	180	171	162	155	
634	570	515	470	433	400	379	359	341	326	312	
956	859	774	706	650	600	568	539	512	489	468	
1282	1149	1035	943	867	800	757	718	683	651	623	
1610	1442	1297	1180	1084	1000	947	898	853	813	778	
1942	1737	1560	1419	1302	1200	1136	1077	1024	976	933	
2276	2034	1825	1658	1520	1400	1325	1256	1193	1137	1087	
2614	2333	2091	1898	1739	1600	1514	1434	1362	1298	1241	
2954	2634	2358	2138	1958	1800	1702	1613	1531	1459	1394	
3297	2936	2626	2379	2176	2000	1891	1791	1701	1619	1547	
3642	3240	2894	2620	2396	2200	2080	1969	1869	1780	1700	
3991	3546	3164	2862	2615	2400	2268	2147	2037	1939	1852	
4342	3853	3435	3104	2835	2600	2456	2324	2205	2098	2004	
4697	4164	3707	3347	3055	2800	2644	2502	2373	2258	2156	
5054	4476	3981	3591	3275	3000	2832	2679	2541	2416	2307	
5414	4789	4255	3836	3495	3200	3020	2856	2708	2575	2458	
5778	5105	4531	4081	3716	3400	3208	3033	2875	2734	2609	
6146	5424	4808	4326	3937	3600	3396	3210	3041	2891	2759	
6516	5744	5086	4572	4159	3800	3584	3386	3208	3049	2909	
6889	6066	5365	4819	4380	4000	3772	3564	3375	3207	3059	

**Reference Fuel and Time Required at Check Point**

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	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	15.5	0:49	14.1	0:47	12.4	0:44	11.4	0:42	10.6	0:40
400	31.3	1:36	29.1	1:31	26.2	1:24	24.6	1:20	23.3	1:15
600	47.2	2:24	44.0	2:16	40.0	2:04	37.8	1:57	36.1	1:51
800	62.4	3:12	58.4	3:02	53.3	2:46	50.5	2:36	48.3	2:27
1000	77.7	4:01	72.9	3:47	66.7	3:27	63.2	3:15	60.5	3:03
1200	92.4	4:51	86.8	4:34	79.6	4:10	75.4	3:55	72.2	3:40
1400	107.2	5:41	100.8	5:21	92.5	4:52	87.7	4:34	84.0	4:17
1600	121.4	6:32	114.3	6:08	105.0	5:35	99.5	5:14	95.4	4:55
1800	135.6	7:23	127.8	6:56	117.5	6:18	111.4	5:55	106.8	5:32
2000	149.4	8:15	140.8	7:45	129.6	7:02	122.9	6:36	117.8	6:10
2200	163.1	9:07	153.9	8:34	141.7	7:46	134.4	7:17	128.8	6:49
2400	176.4	10:01	166.5	9:23	153.4	8:31	145.6	7:58	139.5	7:28
2600	189.6	10:54	179.1	10:13	165.0	9:16	156.7	8:40	150.1	8:07
2800	202.5	11:49	191.2	11:04	176.4	10:02	167.5	9:23	160.4	8:46
3000	215.3	12:44	203.4	11:55	187.7	10:47	178.3	10:05	170.7	9:26
3200	227.7	13:40	215.1	12:47	198.7	11:34	188.7	10:49	180.7	10:06
3400	240.1	14:36	226.9	13:39	209.6	12:21	199.2	11:32	190.7	10:46
3600	252.1	15:33	238.3	14:32	220.3	13:08	209.3	12:16	200.3	11:27
3800	264.1	16:30	249.6	15:26	230.9	13:56	219.4	13:00	210.0	12:08
4000	275.9	17:28	260.7	16:20	241.3	14:44	229.3	13:45	219.4	12:50

**GEAR DOWN****Long Range Cruise Enroute Fuel and Time****Fuel Required Adjustment (1000 LB)**

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)							
	350	400	450	500	550	600	650	700
20	-2.9	-2.0	-1.1	0.0	1.7	4.0	6.6	9.5
40	-6.3	-4.3	-2.2	0.0	3.2	7.4	12.3	18.0
60	-9.7	-6.5	-3.3	0.0	4.7	10.7	17.8	25.9
80	-12.9	-8.7	-4.4	0.0	6.2	13.9	22.9	33.3
100	-16.1	-10.8	-5.5	0.0	7.6	16.8	27.7	40.2
120	-19.2	-12.9	-6.5	0.0	8.9	19.7	32.2	46.5
140	-22.2	-15.0	-7.6	0.0	10.2	22.3	36.3	52.3
160	-25.2	-17.0	-8.6	0.0	11.5	24.8	40.2	57.6
180	-28.0	-19.0	-9.6	0.0	12.7	27.2	43.7	62.3
200	-30.8	-20.9	-10.6	0.0	13.8	29.4	46.9	66.5
220	-33.5	-22.8	-11.6	0.0	14.9	31.5	49.8	70.1
240	-36.2	-24.7	-12.6	0.0	16.0	33.4	52.3	73.3
260	-38.7	-26.5	-13.6	0.0	17.0	35.1	54.5	75.8
280	-41.2	-28.2	-14.5	0.0	17.9	36.7	56.4	77.9

Based on Long Range Cruise and VREF30+80 descent.

**Descent at VREF30+80**

PRESSURE ALTITUDE (1000 FT)	17	19	21	23	25	27	29	31	33	35
DISTANCE (NM)	35	39	43	48	52	56	60	64	69	73
TIME (MINUTES)	11	12	12	13	14	15	15	16	17	17

**GEAR DOWN****Holding  
Flaps Up**

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
800	%N1 KIAS FF/ENG	76.4 262 17280						
760	%N1 KIAS FF/ENG	75.4 262 16690	78.5 262 16710					
720	%N1 KIAS FF/ENG	73.9 256 15790	76.9 256 15760					
680	%N1 KIAS FF/ENG	72.1 248 14820	75.1 248 14790	79.6 248 14740				
640	%N1 KIAS FF/ENG	70.2 241 13860	73.3 241 13840	77.7 241 13780				
600	%N1 KIAS FF/ENG	68.5 236 13050	71.7 236 13040	76.1 236 12960				
560	%N1 KIAS FF/ENG	66.9 231 12270	69.9 231 12260	74.3 231 12180	78.9 231 12240			
520	%N1 KIAS FF/ENG	65.3 225 11520	68.1 225 11490	72.5 225 11400	77.1 225 11430	81.9 225 11550		
480	%N1 KIAS FF/ENG	63.6 220 10800	66.3 220 10750	70.7 220 10660	75.2 220 10660	80.0 220 10770		
440	%N1 KIAS FF/ENG	61.7 213 10080	64.5 213 10000	68.6 213 9900	73.1 213 9890	77.8 213 9980	82.7 213 10110	
400	%N1 KIAS FF/ENG	59.8 207 9380	62.5 207 9290	66.5 207 9170	71.0 207 9170	75.6 207 9210	80.4 207 9290	85.0 207 9520
360	%N1 KIAS FF/ENG	57.7 200 8670	60.4 200 8580	64.3 200 8440	68.7 200 8430	73.3 200 8440	78.2 200 8500	82.7 200 8680

This table includes 5% additional fuel for holding in a racetrack pattern.

**GEAR DOWN****Holding  
Flaps 1**

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
800	%N1	76.0	79.1	84.0	88.5	94.6
	KIAS	242	242	242	242	242
	FF/ENG	16960	17050	17030	17300	18200
760	%N1	74.9	78.0	82.7	87.3	92.6
	KIAS	242	242	242	242	242
	FF/ENG	16320	16370	16340	16570	17270
720	%N1	73.3	76.4	80.9	85.7	90.6
	KIAS	236	236	236	236	236
	FF/ENG	15370	15390	15380	15540	16070
680	%N1	71.5	74.5	78.9	83.9	88.7
	KIAS	228	228	228	228	228
	FF/ENG	14380	14390	14380	14500	14850
640	%N1	69.4	72.6	77.0	81.9	86.7
	KIAS	221	221	221	221	221
	FF/ENG	13410	13410	13390	13510	13770
600	%N1	67.6	70.8	75.2	79.9	84.9
	KIAS	216	216	216	216	216
	FF/ENG	12590	12580	12530	12660	12860
560	%N1	65.9	68.9	73.3	77.9	83.0
	KIAS	211	211	211	211	211
	FF/ENG	11790	11760	11700	11810	11950
520	%N1	64.1	66.9	71.3	75.8	81.0
	KIAS	205	205	205	205	205
	FF/ENG	11000	10950	10880	10950	11070
480	%N1	62.2	64.9	69.3	73.8	78.7
	KIAS	200	200	200	200	200
	FF/ENG	10250	10170	10090	10130	10240
440	%N1	60.1	62.8	66.9	71.4	76.2
	KIAS	193	193	193	193	193
	FF/ENG	9480	9380	9290	9300	9400
400	%N1	57.9	60.7	64.6	69.1	73.7
	KIAS	187	187	187	187	187
	FF/ENG	8740	8640	8520	8500	8570
360	%N1	55.6	58.2	62.2	66.4	71.0
	KIAS	180	180	180	180	180
	FF/ENG	8010	7900	7760	7710	7760

This table includes 5% additional fuel for holding in a racetrack pattern.

DRAFT

Intentionally  
Blank

**Performance Inflight - QRH**  
**Gear Down, Engine INOP**
**Chapter PI-QRH**  
**Section 64**
**GEAR DOWN****ENGINE INOP****MAX CONTINUOUS THRUST****Driftdown Speed/Level Off Altitude****100 ft/min residual rate of climb****Includes APU fuel burn**

WEIGHT (1000 LB)		VREF30 + 80 DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
700	674	253	5200	4000	1700
660	635	246	7100	6200	4600
620	596	239	9100	8400	7200
580	557	232	10900	10200	9100
540	519	227	12700	12100	10900
500	480	222	14500	14000	12900
460	442	216	16500	15900	15000
420	404	210	18600	18200	17000
380	366	203	20800	20500	19700

**Long Range Cruise Altitude Capability****100 ft/min residual rate of climb**

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
740	800		
720	2200		
700	3600	1100	
680	4600	2700	
660	5600	4200	1400
640	6600	5400	3200
620	7600	6700	4800
600	8700	7900	6300
580	9700	9000	7900
560	10700	10100	9000
540	11700	11000	9900
520	12700	12000	10900
500	13600	13000	11800
480	14500	14000	12900
460	15500	15100	14000
440	16600	16000	15100
420	17700	17000	16100
400	18800	18400	17200
380	20000	19800	18700
360	21200	20800	20100

**GEAR DOWN****ENGINE INOP****MAX CONTINUOUS THRUST****Long Range Cruise Control**

WEIGHT (1000 LB)	PRESSURE ALTITUDE (1000 FT)							
	5	7	9	11	13	15	17	19
680	%N1 MACH KIAS FF/ENG	97.1 .418 253 29597						
	%N1 MACH KIAS FF/ENG	94.7 .407 246 27548	97.1 .421 246 27915					
	%N1 MACH KIAS FF/ENG	92.6 .395 239 25711	94.4 .409 239 25775	97.1 .423 238 26281				
	%N1 MACH KIAS FF/ENG	90.5 .383 232 23975	92.1 .396 231 23881	94.1 .410 231 24040	97.1 .425 231 24623			
560	%N1 MACH KIAS FF/ENG	88.5 .372 225 22233	90.1 .386 225 22269	91.9 .400 225 22345	94.1 .415 225 22621	97.5 .431 225 23249		
	%N1 MACH KIAS FF/ENG	86.4 .363 220 20677	88.2 .376 220 20727	89.8 .391 220 20792	91.7 .405 220 20944	94.1 .421 220 21208	97.9 .437 220 21887	
	%N1 MACH KIAS FF/ENG	84.0 .353 213 19092	85.9 .366 213 19110	87.7 .380 213 19166	89.4 .394 213 19293	91.3 .409 213 19457	93.8 .425 213 19720	97.9 .442 213 20473
	%N1 MACH KIAS FF/ENG	81.5 .342 207 17577	83.5 .355 207 17577	85.3 .368 207 17585	87.2 .382 207 17695	89.0 .397 207 17852	90.9 .413 207 18003	93.5 .429 207 18297
440	%N1 MACH KIAS FF/ENG	78.9 .331 200 16044	80.7 .343 200 16055	82.7 .356 200 16035	84.6 .370 200 16082	86.5 .384 200 16230	88.3 .399 200 16375	90.2 .415 200 16525
	%N1 MACH KIAS FF/ENG	76.7 .320 198 15844	78.5 .334 198 15955	80.4 .348 198 16035	82.3 .362 198 16082	84.2 .376 198 16230	86.1 .390 198 16375	87.9 .404 198 16525
	%N1 MACH KIAS FF/ENG	74.5 .309 196 15644	76.3 .323 196 15755	78.2 .337 196 15835	80.1 .351 196 15982	82.0 .365 196 16082	83.9 .379 196 16230	85.7 .393 196 16375
	%N1 MACH KIAS FF/ENG	72.3 .298 194 15444	74.1 .312 194 15555	76.0 .326 194 15635	77.9 .340 194 15782	79.8 .354 194 16082	81.7 .368 194 16230	83.5 .382 194 16375
400	%N1 MACH KIAS FF/ENG	70.1 .287 192 15244	71.9 .301 192 15355	73.8 .315 192 15435	75.7 .333 192 15582	77.6 .347 192 15803	79.5 .361 192 16003	81.3 .375 192 16203
	%N1 MACH KIAS FF/ENG	67.9 .276 190 15044	69.7 .290 190 15155	71.6 .304 190 15235	73.5 .322 190 15382	75.4 .336 190 15603	77.3 .350 190 15803	79.1 .364 190 16003
	%N1 MACH KIAS FF/ENG	65.7 .265 188 14844	67.5 .279 188 14955	69.4 .293 188 15035	71.3 .311 188 15182	73.2 .325 188 15403	75.1 .343 188 15603	76.9 .357 188 15803
	%N1 MACH KIAS FF/ENG	63.5 .254 186 14644	65.3 .268 186 14755	67.2 .282 186 14835	69.1 .300 186 14982	71.0 .314 186 15203	72.9 .332 186 15403	74.7 .346 186 15603
360	%N1 MACH KIAS FF/ENG	61.3 .243 184 14444	63.1 .257 184 14555	65.0 .271 184 14635	66.9 .289 184 14782	68.8 .303 184 15003	70.7 .321 184 15203	72.5 .335 184 15403
	%N1 MACH KIAS FF/ENG	59.1 .232 182 14244	60.9 .246 182 14355	62.8 .260 182 14435	64.7 .278 182 14582	66.6 .292 182 14803	68.4 .310 182 15003	70.2 .324 182 15203
	%N1 MACH KIAS FF/ENG	56.9 .221 180 14044	58.7 .235 180 14155	60.6 .249 180 14235	62.5 .267 180 14382	64.4 .281 180 14603	66.2 .299 180 14803	68.0 .318 180 15003
	%N1 MACH KIAS FF/ENG	54.7 .210 178 13844	56.5 .224 178 13955	58.4 .238 178 14035	60.3 .256 178 14182	62.2 .270 178 14403	64.0 .288 178 14603	65.8 .302 178 14803

# GEAR DOWN

## 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	
165	145	129	117	108	100	93	87	81	77	73	
332	295	263	238	218	200	187	175	165	156	148	
500	444	396	358	327	300	281	263	247	234	222	
669	593	528	477	436	400	374	350	329	311	295	
839	743	662	597	545	500	467	438	411	388	368	
1009	894	795	718	655	600	561	525	494	466	442	
1180	1044	928	838	764	700	654	612	575	543	515	
1351	1196	1063	958	874	800	747	700	657	620	588	
1523	1347	1197	1079	983	900	840	787	739	697	661	
1696	1499	1331	1199	1093	1000	933	874	820	773	733	

#### Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	6		8		10		12		14	
	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)
100	8.6	0:27	8.1	0:27	7.6	0:26	7.2	0:26	6.9	0:25
200	17.4	0:52	16.7	0:51	16.0	0:50	15.4	0:49	15.0	0:47
300	26.2	1:18	25.2	1:15	24.3	1:13	23.6	1:11	23.1	1:10
400	34.9	1:43	33.7	1:40	32.6	1:37	31.7	1:35	31.1	1:32
500	43.4	2:08	42.0	2:05	40.8	2:01	39.7	1:58	39.0	1:54
600	52.0	2:34	50.3	2:29	48.8	2:25	47.6	2:21	46.8	2:17
700	60.4	3:00	58.5	2:54	56.9	2:49	55.4	2:45	54.5	2:40
800	68.7	3:25	66.6	3:20	64.8	3:14	63.2	3:08	62.1	3:03
900	76.9	3:51	74.7	3:45	72.6	3:38	70.9	3:32	69.6	3:26
1000	85.1	4:18	82.6	4:10	80.4	4:03	78.5	3:56	77.0	3:49

**GEAR DOWN****ENGINE INOP****MAX CONTINUOUS THRUST****Long Range Cruise Diversion Fuel and Time****Fuel Required Adjustment (1000 LB)**

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)							
	350	400	450	500	550	600	650	700
15	-2.5	-1.7	-0.8	0.0	1.6	3.3	5.2	7.3
20	-3.4	-2.3	-1.1	0.0	2.1	4.4	7.0	9.9
25	-4.3	-2.8	-1.4	0.0	2.6	5.5	8.8	12.5
30	-5.2	-3.4	-1.7	0.0	3.0	6.5	10.5	14.9
35	-6.0	-4.0	-2.0	0.0	3.5	7.6	12.2	17.4
40	-6.9	-4.6	-2.3	0.0	3.9	8.5	13.8	19.7
45	-7.8	-5.2	-2.6	0.0	4.4	9.5	15.4	22.0
50	-8.7	-5.8	-2.9	0.0	4.8	10.4	16.9	24.3
55	-9.6	-6.4	-3.2	0.0	5.2	11.3	18.4	26.5
60	-10.5	-7.0	-3.5	0.0	5.6	12.2	19.9	28.6
65	-11.4	-7.6	-3.8	0.0	6.0	13.1	21.3	30.7
70	-12.3	-8.2	-4.0	0.0	6.3	13.9	22.7	32.7
75	-13.1	-8.7	-4.3	0.0	6.7	14.7	24.0	34.6
80	-14.0	-9.3	-4.6	0.0	7.0	15.4	25.3	36.5
85	-14.9	-9.9	-4.9	0.0	7.3	16.1	26.5	38.4
90	-15.8	-10.5	-5.2	0.0	7.6	16.8	27.7	40.1

Based on Long Range Cruise and VREF30+80 descent. Includes APU fuel burn.

**GEAR DOWN**  
**ENGINE INOP**  
**MAX CONTINUOUS THRUST**

**Holding  
Flaps Up**

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)			
		1500	5000	10000	15000
760	%N1	96.6			
	KIAS	262			
	FF/ENG	34160			
720	%N1	94.7			
	KIAS	256			
	FF/ENG	32150			
680	%N1	92.8	96.4		
	KIAS	248	248		
	FF/ENG	30210	30360		
640	%N1	90.8	94.0		
	KIAS	241	241		
	FF/ENG	28280	28220		
600	%N1	89.1	92.1	98.5	
	KIAS	236	236	236	
	FF/ENG	26550	26560	27770	
560	%N1	87.2	90.3	95.3	
	KIAS	231	231	231	
	FF/ENG	24850	25010	25470	
520	%N1	85.2	88.5	92.8	
	KIAS	225	225	225	
	FF/ENG	23170	23340	23590	
480	%N1	83.0	86.4	90.7	97.9
	KIAS	220	220	220	220
	FF/ENG	21570	21710	21890	22980
440	%N1	80.7	84.0	88.5	93.8
	KIAS	213	213	213	213
	FF/ENG	19930	20050	20190	20710
400	%N1	78.4	81.5	86.3	90.9
	KIAS	207	207	207	207
	FF/ENG	18360	18460	18510	18900
360	%N1	76.0	78.9	83.6	88.3
	KIAS	200	200	200	200
	FF/ENG	16800	16850	16850	17190

This table includes 5% additional fuel for holding in a racetrack pattern.

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**Performance Inflight - QRH****Text****Chapter PI-QRH****Section 65****Introduction**

This chapter contains information to supplement performance data from the Flight Management Computer. 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.

**General****Flight with Unreliable Airspeed / Turbulent Air Penetration**

Body 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 may also cause unreliable airspeed/Mach indications. Climb, cruise and descent information is based on the recommended turbulent air penetration speed schedule: 270 knots below 25,000 feet, 280 knots or 0.82 Mach whichever is lower at 25,000 feet and above; maintain a minimum speed of 15 knots above the minimum maneuvering speed when below 0.82 Mach. This schedule provides ample protection from stall and high speed buffet, while also providing protection from exceeding structural limits.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed may also be unreliable.

**Max Climb %N1**

This table shows Max Climb %N1 for a 310/.84 climb speed schedule, normal engine bleed for 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 Speeds**

This table contains flaps 30, 25 and 20 reference speeds for a given weight.

---

## Advisory Information

### Normal Configuration Landing Distance

Tables are provided as advisory information for normal configuration landing distances 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 appropriate 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 and adjustments are provided for dry runways and runways with good, medium, and poor reported braking action.

Enter the table with the applicable non-normal configuration and read the normal approach speed. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and speed at sea level, zero wind, and zero slope. Subsequent columns provide corrections for off-reference landing weight, altitude,

wind, slope, and speed conditions. Each correction is independently added to the reference landing distance. Landing distance includes the effects of max manual braking and reverse thrust.

For an engine inoperative autoland, check the rate of climb capability shown in Gear Down Landing Rate of Climb Available tables to ensure adequate climb performance.

## 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 appropriate Event Adjusted Brake Energy Table (No Reverse Thrust or 2 Engine Reverse) with the reference brake energy per brake and the type of braking used during landing (Max Manual, Max Auto, or Autobrake). The resulting number is the adjusted brake energy per brake and represents the energy absorbed in each brake during the landing. The recommended cooling time is found in the final table by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

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 5.0 or higher on the EICAS indication and disappear as the hottest brake cools with an EICAS indication of 3.5. Note that even without an EICAS advisory message, brake cooling is recommended.

## Landing Climb Limit Weight

In the event an overweight landing is necessary and the fuel dump system is unavailable, landing climb limits should be checked if a Flaps 25 or 30 landing is planned. Enter the table with airport OAT and pressure altitude to read landing climb limit weight. Apply the noted adjustments as required. At weights exceeding those shown, plan a Flaps 20 landing.

## Engine Inoperative

### Initial Max Continuous %N1

The Initial Max Continuous %N1 setting for use following an engine failure is shown. The table is based on the typical all engine cruise Mach number of .84 to provide a target %N1 setting at the start of driftdown. Once driftdown is established, the Max Continuous %N1 Table should be used to determine %N1 for the given conditions.

### Max Continuous %N1

Power setting is based on one engine operating with engine bleed for packs on or off and all anti-ice bleeds off. Enter the table with pressure altitude and IAS or Mach to read %N1.

It is desirable to maintain engine thrust level within the limits of the Max Cruise thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous thrust rating. The Max Continuous thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

### Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

### Driftdown/Cruise Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to long range cruise speed. Cruise is continued at level off altitude and long range cruise speed.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and correct for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude is used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Diversion Fuel and Time table.

## **Long Range Cruise Altitude Capability**

Tables show the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on LRC speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

## **Long Range Cruise Control**

The table provides target %N1, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

## **Long Range Cruise Diversion Fuel and Time**

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .84/310/250 descent. Enter with Air Distance as determined from the Ground to Air Miles Conversion Table and read Fuel and Time required at the cruise pressure altitude. Adjust the fuel obtained for deviation from the reference weight at checkpoint as required by entering the off reference fuel corrections table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel and time required for the actual weight.

## **Holding**

Single engine holding data is provided in the same format as the all engine holding data and is based on the same assumptions.

## **Gear Down Landing Rate of Climb Available**

Rate of climb data is provided as guidance information in the event an engine inoperative autoland is planned. The tables show gear down rate of climb available for Flaps 20 and Flaps 30. Enter the table with TAT and pressure altitude to read rate of climb available. Apply adjustments shown to correct for weight.

---

## 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 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

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## General

Non-Normal Maneuvers and Flight Patterns are included for training and review purposes.

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### Non-Normal Maneuvers

Flight crews are expected to do non-normal maneuvers from memory.

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### 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 or Stall Recovery**

All recoveries from approach to stall should be done as if an actual stall has occurred.

Immediately do the following at the first indication of stall (buffet or stick shaker):

**Note:** Do not use flight director commands during the recovery.

**Note:** If autopilot response is not acceptable, it should be disengaged.

**Note:** If autothrottle response is not acceptable, it should be disconnected.

<b>Pilot Flying</b>	<b>Pilot Monitoring</b>
<ul style="list-style-type: none"> <li>Initiate the recovery:           <ul style="list-style-type: none"> <li>Smoothly apply nose down elevator to reduce the angle of attack until buffet or stick shaker stops</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Monitor altitude and airspeed</li> <li>Verify all required actions have been done and call out any omissions</li> <li>Call out any trend toward terrain contact</li> </ul>
<ul style="list-style-type: none"> <li>Continue the recovery:           <ul style="list-style-type: none"> <li>Roll in the shortest direction to wings level if needed*</li> <li>Advance thrust levers as needed</li> <li>Retract the speedbrakes</li> <li>Do not change gear or flap configuration, except:               <ul style="list-style-type: none"> <li>During liftoff, if flaps are up, call for flaps 1</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Monitor altitude and airspeed</li> <li>Verify all required actions have been done and call out any omissions</li> <li>Call out any trend toward terrain contact</li> <li>Set the FLAP lever as directed</li> </ul>
<ul style="list-style-type: none"> <li>Complete the recovery:           <ul style="list-style-type: none"> <li>Check airspeed and adjust thrust as needed</li> <li>Establish pitch attitude</li> <li>Return to desired flight path</li> </ul> </li> <li>Re-engage the autopilot and activate the autothrottle, if desired</li> </ul>	<ul style="list-style-type: none"> <li>Monitor altitude and airspeed</li> <li>Verify all required actions have been done and call out any omissions</li> <li>Call out any trend toward terrain contact</li> </ul>

**WARNING:** \*Excessive use of pitch trim or rudder may aggravate the condition, or may result in the loss of control or in high structural loads.

## Rejected Takeoff

The Captain has the sole responsibility for the decision to reject the takeoff. The decision must be made in time to start the rejected takeoff maneuver by V1. If the decision is to reject the takeoff, the Captain must clearly announce "REJECT," immediately start the rejected takeoff maneuver, and assume control of the airplane. If the First Officer is making the takeoff, the First Officer must maintain control of the airplane until the Captain makes a positive input to the controls.

Prior to 80 knots, the takeoff should be rejected for any of the following:

- activation of the master caution system
- system failure(s)
- unusual noise or vibration
- tire failure
- abnormally slow acceleration
- takeoff configuration warning
- fire or fire warning
- engine failure
- predictive windshear warning
- if a side window opens
- if the airplane is unsafe or unable to fly

Above 80 knots and prior to V1, the takeoff should be rejected for any of the following:

- fire or fire warning
- engine failure
- predictive windshear warning
- if the airplane is unsafe or unable to fly

During the takeoff, the crew member observing the non-normal situation will immediately call it out as clearly as possible.

**DO NOT USE FOR FLIGHT**

777 Flight Crew Operations Manual

Maneuvers -  
Non\_Normal Maneuvers

Captain	First Officer
<p>Without delay:</p> <p>Simultaneously close thrust levers, disconnect autothrottles, and apply maximum manual wheel brakes or verify operation of RTO autobrakes.</p> <p>If RTO autobrakes is selected, monitor system performance and apply manual wheel brakes if the AUTOBRAKE message is displayed or deceleration is not adequate.</p> <p>Raise speedbrake lever.</p> <p>Apply the maximum amount of reverse thrust consistent with conditions.</p> <p>Continue maximum braking until certain the airplane will stop on the runway.</p>	<p>Verify actions as follows:</p> <p>Thrust levers closed.</p> <p>Autothrottles disconnected.</p> <p>Maximum brakes applied.</p> <p>Verify speedbrake lever UP and call “SPEEDBRAKES UP.” If speedbrake lever not UP call “SPEEDBRAKES NOT UP.”</p> <p>Reverse thrust applied.</p> <p>Call out any omitted action items.</p>
<p>Field length permitting:</p> <p>Initiate movement of the reverse thrust levers to reach the reverse idle detent by taxi speed.</p>	<p>Call out 60 knots.</p> <p><b>[777 Passenger]</b> Communicate the reject decision to the control tower and cabin as soon as practical.</p> <p><b>[777 Freighter]</b> Communicate the reject decision to the control tower as soon as practical.</p>

Captain	First Officer
When the airplane is stopped, perform procedures as required.	
Review Brake Cooling Schedule for brake cooling time and precautions (refer to the Performance Inflight chapter).	
Consider the following:	
<ul style="list-style-type: none"><li>• the possibility of wheel fuse plugs melting</li><li>• the need to clear the runway</li><li>• the requirement for remote parking</li><li>• wind direction in case of fire</li><li>• alerting fire equipment</li><li>• not setting the parking brake unless passenger evacuation is necessary</li><li>• advising the ground crew of the hot brake hazard</li></ul>	
<b>[777 Passenger]</b> <ul style="list-style-type: none"><li>• advising passengers of the need to remain seated or evacuate</li></ul>	
<b>[777 Freighter]</b> <ul style="list-style-type: none"><li>• advising supernumeraries of the need to remain seated or evacuate</li><li>• completion of Non-Normal checklist (if appropriate) for conditions which caused the RTO</li></ul>	

## Runway Awareness and Advisory System (RAAS)

### **[Option - Runway Awareness and Advisory System (RAAS) installed]**

Accomplish the following if a RAAS voice annunciation or alert differs from the flight crew's expectation:

Pilot Flying	Pilot Monitoring
Verify position. Contact ATC for assistance, if needed.	

## Ground Proximity Warning System (GPWS) Response

### GPWS Caution

Accomplish the following maneuver for any of these aural alerts\*:

- CAUTION OBSTACLE
- CAUTION TERRAIN

**Note:** For JAA certificated airplanes, CAUTION OBSTACLE is replaced with OBSTACLE AHEAD, and CAUTION TERRAIN is replaced with TERRAIN AHEAD.

- SINK RATE
- TERRAIN
- DON'T SINK
- TOO LOW FLAPS
- TOO LOW GEAR
- TOO LOW TERRAIN
- GLIDESLOPE
- BANK ANGLE

Pilot Flying	Pilot Monitoring
Correct the flight path or the airplane configuration.	

The below glideslope deviation alert may be cancelled or inhibited for:

- localizer or backcourse approach
- circling approach from an ILS
- when conditions require a deliberate approach below glideslope
- unreliable glideslope signal

**Note:** If a terrain caution occurs when flying under daylight VMC, and positive visual verification is made that no obstacle or terrain hazard exists, the alert may be regarded as cautionary and the approach may be continued.

**Note:** \*As installed, some repeat.

## GPWS Warning

Accomplish the following maneuver for any of these conditions:

- activation of the “PULL UP”, “OBSTACLE OBSTACLE PULL UP”, or “TERRAIN TERRAIN PULL UP” warning
- other situations resulting in unacceptable flight toward terrain

Pilot Flying	Pilot Monitoring
<ul style="list-style-type: none"><li>• Disengage autopilot</li><li>• Disconnect autothrottle(s)</li><li>• Aggressively apply maximum* thrust</li><li>• Simultaneously roll wings level and rotate to an initial pitch attitude of 20°</li><li>• Retract speedbrakes</li><li>• If terrain remains a threat, continue rotation up to the pitch limit indicator or stick shaker or initial buffet</li></ul>	<ul style="list-style-type: none"><li>• Assure maximum* thrust</li><li>• Verify all required actions have been completed and call out any omissions</li></ul>
<ul style="list-style-type: none"><li>• Do not change gear or flap configuration until terrain separation is assured</li><li>• Monitor radio altimeter for sustained or increasing terrain separation</li><li>• When clear of the terrain, slowly decrease pitch attitude and accelerate</li></ul>	<ul style="list-style-type: none"><li>• Monitor vertical speed and altitude (radio altitude for terrain clearance and barometric altitude for a minimum safe altitude)</li><li>• Call out any trend toward terrain contact</li></ul>

**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:** Do not use flight director commands.

**Note:** \* Maximum thrust can be obtained by advancing the thrust levers full forward if 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 (as installed) warning, the alert may be regarded as cautionary and the approach may be continued.

## Traffic Avoidance

Immediately accomplish the following by recall whenever a TCAS traffic advisory (TA) or resolution advisory (RA) occurs.

**WARNING: Comply with RA if there is conflict between RA and air traffic control.**

**WARNING:** Once an RA has been issued, safe separation could be compromised if current vertical speed is changed, except as necessary to comply with the RA. This is because TCAS II-to-TCAS II coordination may be in progress with the intruder aircraft, and any change in vertical speed that does not comply with the RA may negate the effectiveness of the 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.

**Note:** Do not use flight director commands (integrated cue)/flight director pitch commands (split cue) until clear of conflict.

#### For TA:

Pilot Flying	Pilot Monitoring
Look for traffic using traffic display as a guide. Call out any conflicting traffic	
If traffic is sighted, maneuver if needed.	

**Note:** Maneuvers based solely on a TA may result in reduced separation and are not recommended.

#### For RA, except a climb in landing configuration:

**WARNING:** A DESCEND (fly down) RA issued below 1000 feet AGL should not be followed.

Pilot Flying	Pilot Monitoring
<p>If maneuvering is required, disengage the autopilot and disconnect the 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.</p>	
Attempt to establish visual contact. Call out any conflicting traffic.	

### For a climb RA in landing configuration:

Pilot Flying	Pilot Monitoring
<p>Disengage the autopilot and disconnect the 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.</p>	<p>Verify maximum thrust set. Position flap lever to 20 detent.</p>
<p>Verify a positive rate of climb on the altimeter and call "GEAR UP."</p>	<p>Verify a positive rate of climb on the altimeter and call "POSITIVE RATE." Set landing gear lever to UP.</p>
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 that the airplane is not stalled. A stalled condition can exist at any attitude and may be recognized by continuous stick shaker activation accompanied by one or more of the following:

- buffeting, which could be heavy at times
- lack of pitch authority and/or roll control
- inability to arrest descent rate

If the airplane is stalled, recovery from the stall must be accomplished first by applying and maintaining nose down elevator until stall recovery is complete and stick shaker activation ceases.

## Nose High Recovery

Pilot Flying	Pilot Monitoring
<ul style="list-style-type: none"><li>• Recognize and confirm the situation.</li><li>• Disengage autopilot and disconnect autothrottle</li><li>• Apply as much as full nose down elevator</li><li>• *Apply appropriate nose down stabilizer trim</li><li>• Reduce thrust</li><li>• *Roll (adjust bank angle) to obtain a nose down pitch rate</li><li>• Complete the recovery:<ul style="list-style-type: none"><li>• - when approaching the horizon, roll to wings level</li><li>• - check airspeed and adjust thrust</li><li>• - establish pitch attitude</li></ul></li></ul>	<ul style="list-style-type: none"><li>• Call out attitude, airspeed and altitude throughout the recovery</li><li>• Verify all required actions have been completed and call out any omissions</li></ul>

## Nose Low Recovery

Pilot Flying	Pilot Monitoring
<ul style="list-style-type: none"><li>• Recognize and confirm the situation.</li><li>• Disengage autopilot and disconnect autothrottle</li><li>• Recover from stall, if required</li><li>• *Roll in the shortest direction to wings level (unload and roll if bank angle is more than 90 degrees)</li><li>• Recover to level flight:<ul style="list-style-type: none"><li>• - apply nose up elevator</li><li>• - *apply nose up trim, if required</li><li>• - adjust thrust and drag as required</li></ul></li></ul>	<ul style="list-style-type: none"><li>-</li><li>• Call out attitude, airspeed and altitude throughout the recovery</li><li>• Verify all required actions have been completed and call out any omissions</li></ul>

**WARNING: \* EXCESSIVE USE OF PITCH TRIM OR RUDDER MAY AGGRAVATE AN UPSET SITUATION OR MAY RESULT IN LOSS OF CONTROL AND/OR HIGH STRUCTURAL LOADS.**

## Windshear

### Windshear Caution

For predictive windshear caution alert: (“MONITOR RADAR DISPLAY” aural)

Pilot Flying	Pilot Monitoring
<ul style="list-style-type: none"><li>• Maneuver as required to avoid the windshear</li></ul>	

### Windshear Warning

Predictive windshear warning during takeoff roll: (“WINDSHEAR AHEAD, WINDSHEAR AHEAD” aural)

- Prior to V1, reject takeoff
- After V1, perform the Windshear Escape Maneuver

Windshear encountered during takeoff roll:

- If windshear is encountered prior to V1, there may not be sufficient runway remaining to stop if an RTO is initiated at V1. At VR, rotate at a normal rate toward a 15 degree pitch attitude. Once airborne, perform the Windshear Escape Maneuver.
- If windshear is encountered near the normal rotation speed and airspeed suddenly decreases, there may not be sufficient runway left to accelerate back to normal takeoff speed. If there is insufficient runway left to stop, initiate a normal rotation at least 2,000 feet before the end of the runway even if airspeed is low. Higher than normal attitudes may be required to lift off in the remaining runway. Ensure maximum thrust is set.

Predictive windshear warning during approach: (“GO-AROUND, WINDSHEAR AHEAD” aural)

- perform Windshear Escape Maneuver or, at pilot’s discretion, perform a normal go-around

Windshear encountered in flight:

- perform the Windshear Escape Maneuver

**Note:** The following are indications the airplane is in windshear:

- windshear warning (two-tone siren followed by “WINDSHEAR, WINDSHEAR, WINDSHEAR”) or
- unacceptable flight path deviations

**Note:** Unacceptable flight path deviations are recognized as uncontrolled changes from normal steady state flight conditions below 1000 feet AGL, in excess of any of the following:

- 15 knots indicated airspeed
- 500 FPM vertical speed
- 5 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
<p><b>MANUAL FLIGHT</b></p> <ul style="list-style-type: none"> <li>• Disengage autopilot</li> <li>• Push either TO/GA switch</li> <li>• Aggressively apply maximum* thrust</li> <li>• Disconnect autothrottle(s)</li> <li>• Simultaneously roll wings level and rotate toward an initial pitch attitude of 15°</li> <li>• Retract speedbrakes</li> <li>• Follow flight director TO/GA guidance (if available)</li> </ul>	<ul style="list-style-type: none"> <li>• Assure maximum* thrust</li> <li>• Verify all required actions have been completed and call out any omissions</li> </ul>
<p><b>AUTOMATIC FLIGHT</b></p> <ul style="list-style-type: none"> <li>• Press either TO/GA switch**</li> <li>• Verify TO/GA mode annunciation</li> <li>• Verify thrust advances to GA power</li> <li>• Retract speedbrakes</li> <li>• Monitor system performance***</li> </ul> <ul style="list-style-type: none"> <li>• Do not change gear or flap configuration until windshear is no longer a factor</li> <li>• Monitor vertical speed and altitude</li> <li>• Do not attempt to regain lost airspeed until windshear is no longer a factor</li> </ul>	<ul style="list-style-type: none"> <li>• Assure maximum* thrust</li> <li>• Verify all required actions have been completed and call out any omissions</li> </ul> <ul style="list-style-type: none"> <li>• Monitor vertical speed and altitude</li> <li>• Call out any trend toward terrain contact, descending flight path, or significant airspeed changes</li> </ul>

**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 if the EECs are in the normal mode. If terrain contact is imminent, advance thrust levers full forward.



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777 Flight Crew Operations Manual

Maneuvers -  
Non\_Normal Maneuvers

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**Note:** \*\* If TO/GA is not available, disconnect autopilot and autothrottle(s) and fly manually.

**WARNING:** \*\*\* Severe windshear may exceed the performance capability of the AFDS. The pilot flying must be prepared to disconnect the autopilot and autothrottle(s) and fly manually.

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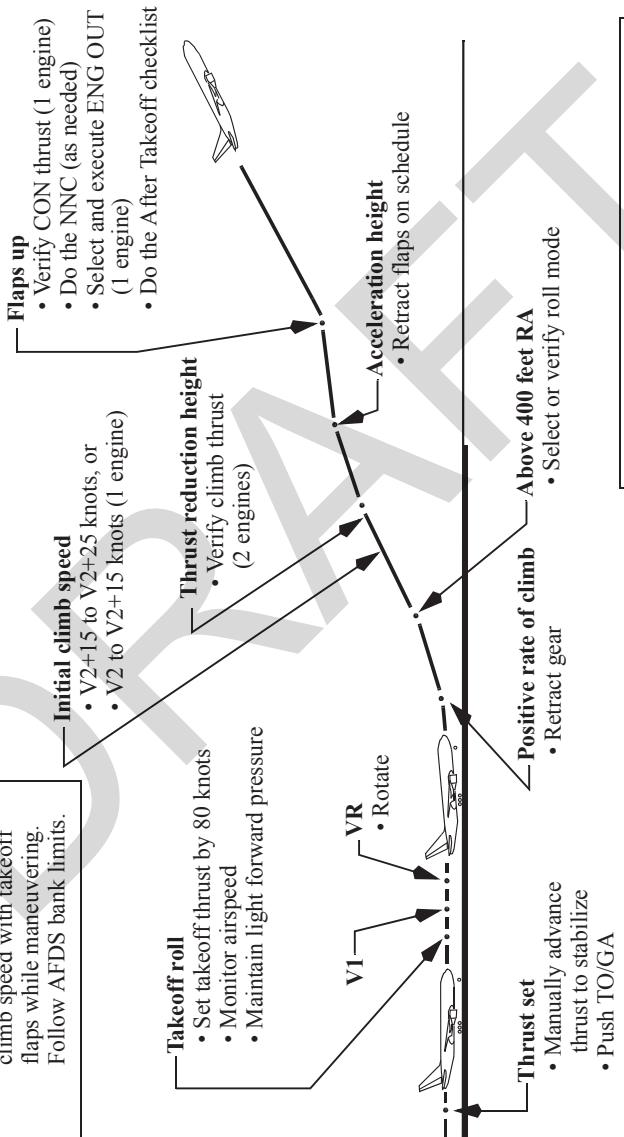
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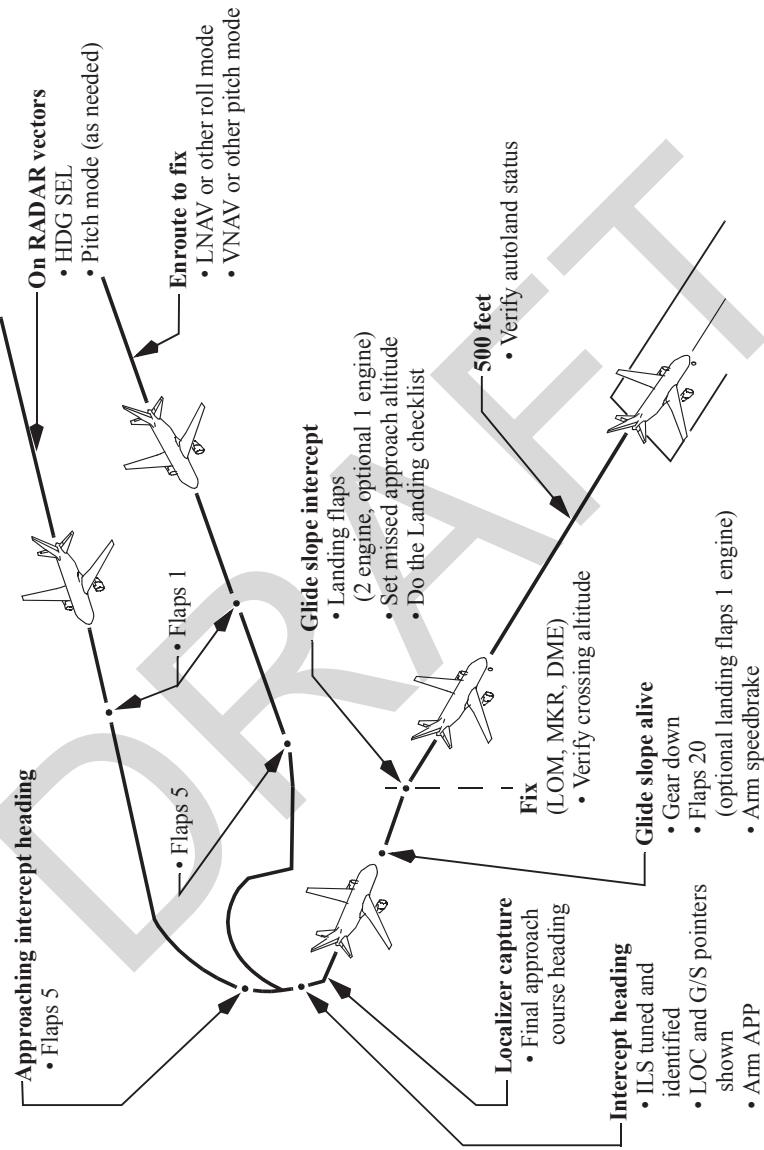


## Takeoff

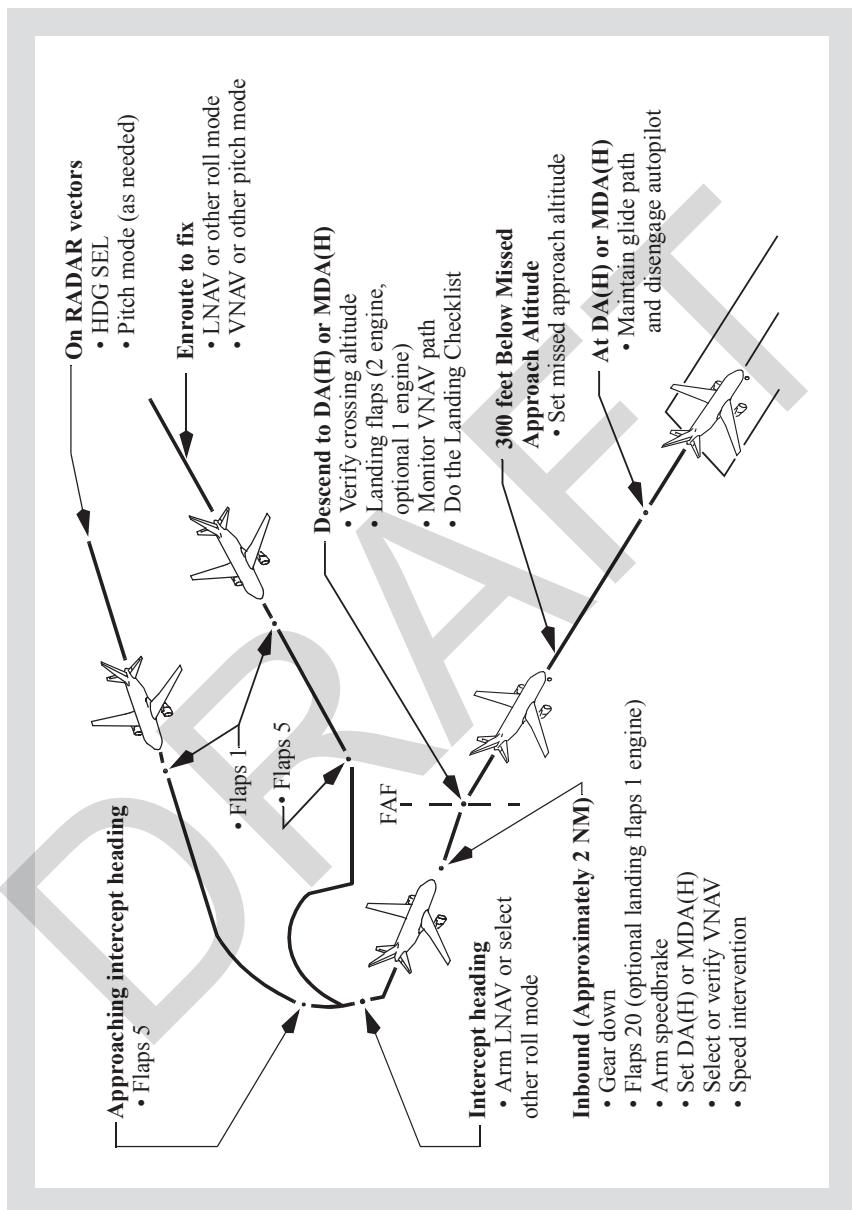
**Note:** For an immediate turn after takeoff, maintain initial climb speed with takeoff flaps while maneuvering. Follow AFDS bank limits.



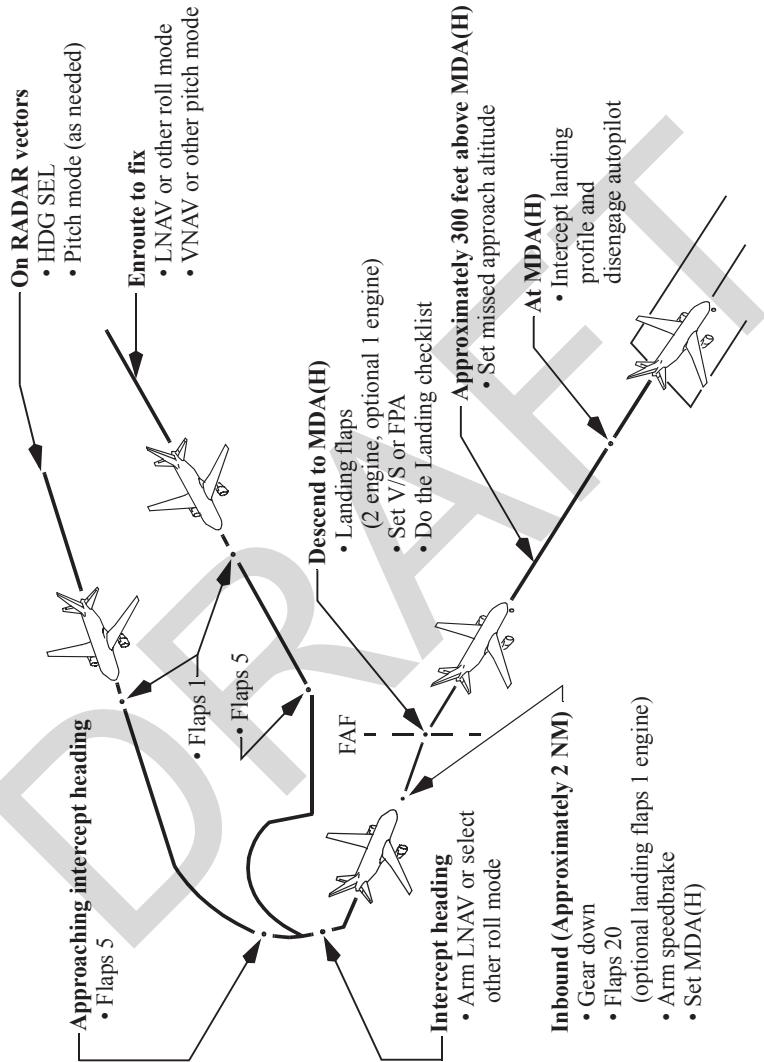
## ILS Approach



## Instrument Approach Using VNAV



## Instrument Approach Using V/S or FPA



## Circling Approach

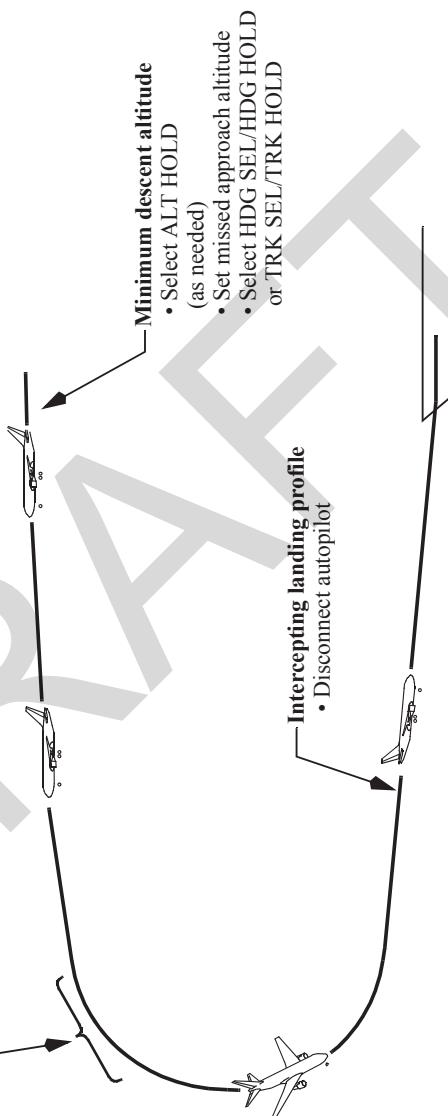
If a missed approach is needed at any time while circling, make an initial climbing turn toward the landing runway and intercept the missed approach course.

**Before turning base or initiating the turn to base**

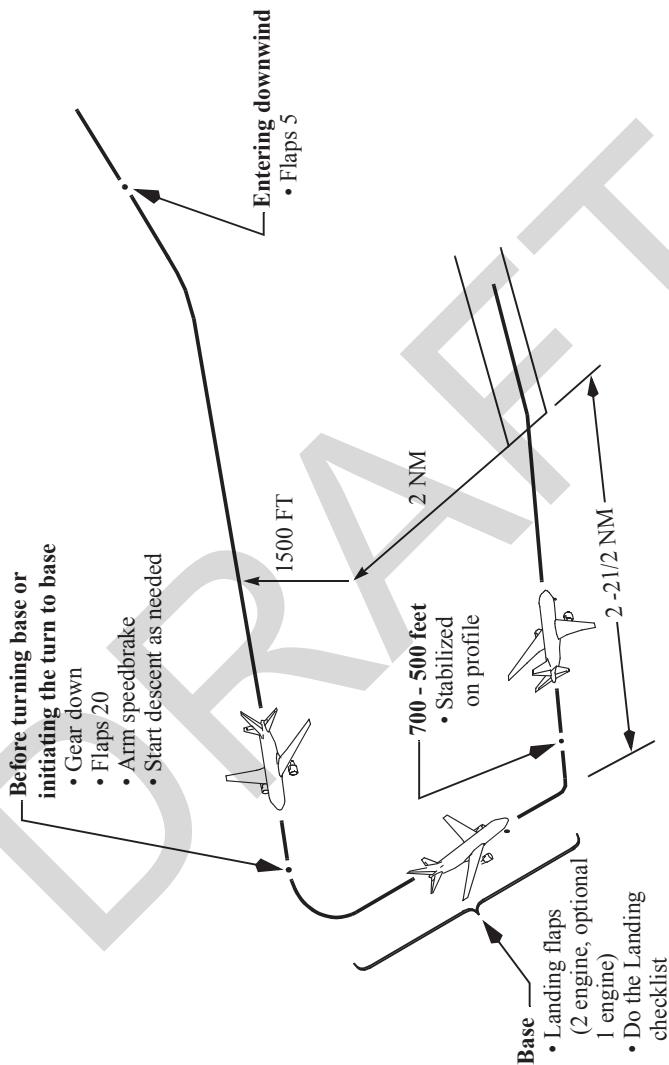
- Landing flaps (if not previously selected)
- Do the Landing checklist

**Configuration at MDA(H)**

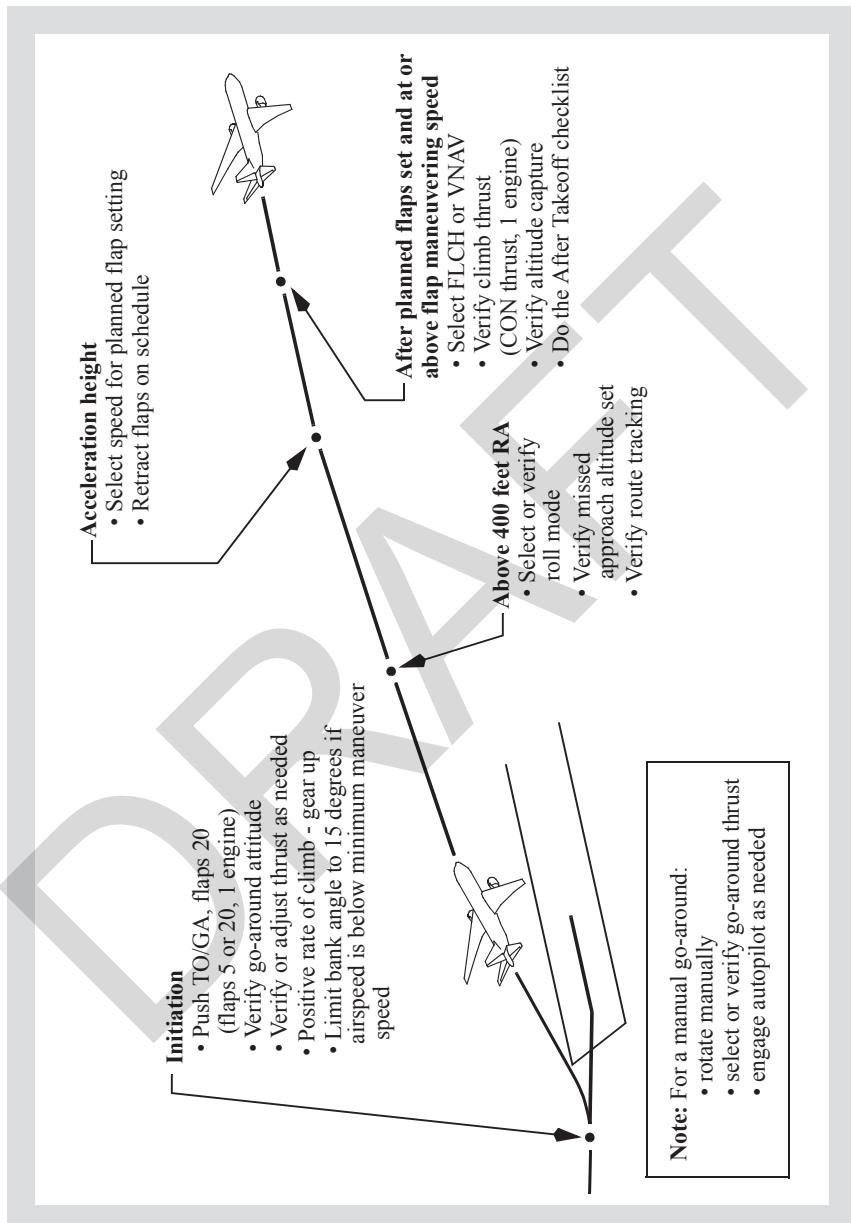
- Gear down
- Flaps 20 (landing flaps optional)
- Arm speedbrake



## Visual Traffic Pattern



## Go-Around and Missed Approach



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## **Checklist Instructions**

## Chapter CI

## Table of Contents

## Section 0

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**Checklist Instructions**  
**Model Identification****Chapter CI**  
**Section ModID****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	Serial Number	Tabulation Number
200	777-200	7200	WY200
200ER	777-200ER	7250	WY250
200F	777-200F	7270	WY270
200LR	777-200LR	7260	WY260
300	777-300	7300	WY300
300ER	777-300ER	7350	WY350

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**Checklist Instructions**  
**Revision Record**
**Chapter CI**  
**Section RR**
**QRH Revision Transmittal Letter**

To: All holders of The Boeing Company 777 Flight Crew Operations Manual, Boeing Document Number D632W001-TBC.

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.

General information below explains the use of revision bars to identify new or revised information. Highlights in the Revision Highlights section explain the revision bar changes in this revision.

**Revision Record**

No.	Revision Date	Date Filed
1	June 1, 1994	
3	October 17, 1994	
5	January 6, 1995	
7	April 10, 1995	
9	August 11, 1995	
11	November 28, 1995	
13	May 10, 1996	
15	November 7, 1996	
17	January 22, 1997	
19	August 18, 1997	
21	May 4, 1998	
23	December 18, 1998	
25	December 9, 1999	
27	December 11, 2000	
29	December 7, 2001	
31	December 16, 2002	

No.	Revision Date	Date Filed
2	September 1, 1994	
4	November 23, 1994	
6	February 10, 1995	
8	June 13, 1995	
10	September 15, 1995	
12	February 9, 1996	
14	August 12, 1996	
16	January 15, 1997	
18	March 11, 1997	
20	December 10, 1997	
22	August 10, 1998	
24	July 1, 1999	
26	June 26, 2000	
28	June 18, 2001	
30	June 17, 2002	
32	June 16, 2003	

No.	Revision Date	Date Filed
33	December 15, 2003	
35	December 13, 2004	
37	December 12, 2005	
39	December 11, 2006	
41	December 10, 2007	
43	December 15, 2008	
45	December 14, 2009	
47	December 13, 2010	
49	December 12, 2011	

No.	Revision Date	Date Filed
34	June 14, 2004	
36	June 13, 2005	
38	June 12, 2006	
40	June 11, 2007	
42	June 16, 2008	
44	June 15, 2009	
46	June 14, 2010	
48	June 13, 2011	

## 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 Revision 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

This section (CI.RR) replaces the existing section CI.RR in your manual.

Be careful when inserting changes not to throw away pages from the manual that are not replaced. Using the QRH List of Effective Pages (CI.LEP) can help determine the correct content of the QRH.

Throughout the QRH, airplane effectiveness may be updated to reflect coverage as listed on the Model Identification page (CI.ModID), or to show service bulletin airplane effectiveness. Highlights are not supplied for these types of changes.

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.

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## Chapter NNC - Non-Normal Checklists

### Section 0 - Unannounced Checklists

#### Overweight Landing

0.6 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

### Section 2 - Air Systems

#### BLEED LEAK STRUT L, R

2.7 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

#### CABIN TEMPERATURE

2.14 - Editorial change - Added a text instructing to use speedbrakes if needed to minimize the time during descent with packs off.

### Section 3 - Anti-Ice, Rain

#### ANTI-ICE LEAK ENG L, R

3.5,8 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

#### Ice Crystal Icing

3.12,14 - Added new "Ice Crystal Icing" checklist. This replaces the "TAT Probe Icing" checklist.

#### ICING WING

3.17 - Deleted the "TAT Probe Icing" checklist. It is replaced by the new "Ice Crystal Icing" checklist.

## Section 6 - Electrical

ELEC AC BUS L, R

6.2 - Added the words "affected side".

ELEC BACKUP GEN L, R

6.2 - Added the words "affected side".

MAIN BATTERY DISCH

6.6 - Added checklist icon.

6.6 - Changed "A" to "The".

6.6 - Added note with battery discharge time.

## Section 7 - Engines, APU

Eng Lim/Surge/Stall L, R

7.10 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

Eng Srv Damage/Sep L, R

7.14 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

ENG FAIL L, R

7.25,31,38 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

ENG FUEL FILTER L, R

7.39 - Revised the checklist to include reference to the message showing on more than one engine during flight. This is to standardize with the new models.

ENG OIL FILTER L, R

7.57 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

ENG OIL PRESS L, R

7.59,63 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

ENG OIL TEMP L, R

7.65,69,71 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

## Section 8 - Fire Protection

### FIRE ENG L, R

8.4 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

### FIRE CARGO AFT

8.14,17 - Added a "Choose one" step divided into "on the ground" and "in flight". Some crews in training were stopping the checklist on the ground at "Checklist complete except deferred items", and not reading the warning.

8.16,19 - Removed line for cross model standardization.

### FIRE CARGO FWD

8.20,23 - Added a "Choose one" step divided into "on the ground" and "in flight". Some crews in training were stopping the checklist on the ground at "Checklist complete except deferred items", and not reading the warning.

8.22,25 - Removed line for cross model standardization.

### FIRE CARGO MAIN DECK

8.26 - Added a "Choose one" step divided into "on the ground" and "in flight". Some crews in training were stopping the checklist on the ground at "Checklist complete except deferred items", and not reading the warning.

8.29 - Removed line for cross model standardization.

### OVERHEAT ENG L, R

8.32 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

### SMOKE BBAND UPR DR 2

8.33 - Added checklist for nuisance message.

## Section 9 - Flight Controls

### STABILIZER

9.2 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

### FLAPS PRIMARY FAIL

9.6 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

### FLAP/SLAT CONTROL

9.9 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

## FLIGHT CONTROL MODE

9.12 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

## FLIGHT CONTROLS

9.15 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

### Jammed Flight Controls

9.16 - Added Jammed Flight Controls checklist.

## PITCH UP AUTHORITY

9.20 - Added "and flaps 5 for go-around."

9.21 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

## PRI FLIGHT COMPUTERS

9.22 - Added precautionary text if Direct mode is desired.

9.23 - Added note that pitch trim moves slower.

9.24 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

## SLATS DRIVE

9.27 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

## Section 11 - Flight Management, Navigation

### NAV AIR DATA SYS

11.9 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

## Section 12 - Fuel

### Fuel Leak

12.18 - Added note not to use FMC fuel predictions.

12.18 - Changed "adequate" to "sufficient" for standardization.

12.22 - Added checklist to reflect the installation of the auxiliary fuel tank.

12.26 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

### FUEL QTY LOW

12.34 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

## Section 13 - Hydraulics

### HYD PRESS SYS C

13.6 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

### HYD PRESS SYS L+C

13.11 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

### HYD PRESS SYS L+R

13.16 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

### HYD PRESS SYS R+C

13.22 - Revised normal and alternate brakes inoperative items note.

13.24 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

### HYD QTY LOW R+C

13.29 - Revised alternate brake terminology.

## Section 14 - Landing Gear

### ANTISKID

14.1 - Added "selector".

### BRAKE SOURCE

14.3 - Revised Condition statement with new brake system terminology.

### GEAR DISAGREE

14.6 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

### MAIN GEAR BRACE L, R

14.8 - Revised the deferred normal checklist response to include a line for the VREF value the same as the normal checklists.

### RESERVE BRAKES/STRG

14.9 - Revised Condition statement with new brake system terminology.

---

## Chapter PI-QRH - Performance Inflight - QRH

### Section 11 - Advisory Information

Normal Configuration Landing Distance

PI-QRH.11.2 - Corrected tables for Good and Medium Reported Braking Action, which had been inadvertently swapped during the last revision of this data.

### Section 13 - Gear Down

Long Range Cruise Enroute Fuel and Time

PI-QRH.13.3 - Added information for the calculation conditions.

### Section 14 - Gear Down, Engine INOP

Long Range Cruise Diversion Fuel and Time

PI-QRH.14.3 - Added information for the calculation conditions.

### Section 23 - Gear Down

Long Range Cruise Enroute Fuel and Time

PI-QRH.23.4 - Added information for the calculation conditions.

### Section 24 - Gear Down, Engine INOP

Long Range Cruise Diversion Fuel and Time

PI-QRH.24.4 - Added information for the calculation conditions.

### Section 33 - Gear Down

Long Range Cruise Enroute Fuel and Time

PI-QRH.33.5 - Added information for the calculation conditions.

### Section 34 - Gear Down, Engine INOP

Long Range Cruise Diversion Fuel and Time

PI-QRH.34.3 - Added information for the calculation conditions.

### Section 43 - Gear Down

Long Range Cruise Enroute Fuel and Time

PI-QRH.43.5 - Added information for the calculation conditions.

### Section 44 - Gear Down, Engine INOP

Long Range Cruise Diversion Fuel and Time

PI-QRH.44.3 - Added information for the calculation conditions.

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## Section 53 - Gear Down

Long Range Cruise Enroute Fuel and Time

PI-QRH.53.4 - Added information for the calculation conditions.

## Section 63 - Gear Down

Long Range Cruise Enroute Fuel and Time

PI-QRH.63.5 - Added information for the calculation conditions.

## Section 64 - Gear Down, Engine INOP

Long Range Cruise Diversion Fuel and Time

PI-QRH.64.4 - Added information for the calculation conditions.

---

## Chapter MAN - Maneuvers

### Section 1 - Non\_Normal Maneuvers

Approach to Stall or Stall Recovery

MAN.1.1 - Revised title for standardization.

---

## Chapter NNC - Non-Normal Checklists

### Section Back Cover - Unannunciated Checklists

Back Cover.2 - Revised step due to fleet standardization.

Back Cover.2 - Revised step due to fleet standardization. Replaced "Illuminated" with "Related".

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**Checklist Instructions**
**List of Effective Pages**
**Chapter CI**
**Section LEP**

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<b>Quick Reference Handbook</b>	
Quick Action Index	
* QA.Index.1-2	December 12, 2011
EICAS Messages (tab)	
* EICAS.Index.1-12	December 12, 2011
Unannunciated Index (tab)	
* Unann.Index.1-2	December 12, 2011
Alphabetical Index (tab)	
* Alpha.Index.1-14	December 12, 2011
Normal Checklists (tab)	
NC.1-3	June 13, 2011
NC.4	June 16, 2008
0 Miscellaneous (tab)	
0.TOC.1-2	June 16, 2008
0.1	December 13, 2010
0.2	December 14, 2009
0.3	December 10, 2007
0.4-5	December 13, 2010
* 0.6-7	December 12, 2011
0.8	December 10, 2007
1 Airplane General, Emergency Equipment, Doors, Windows (tab)	
* 1.TOC.1-2	December 12, 2011
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* 1.2-5	December 12, 2011
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* 1.8-16	December 12, 2011

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* 2.TOC.1-2	December 12, 2011
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* 2.7	December 12, 2011
2.8-9	December 10, 2007
2.10-11	June 16, 2008
2.12-13	December 13, 2010
* 2.14-15	December 12, 2011
2.16-19	December 13, 2010
* 2.20-28	December 12, 2011
3 Anti-Ice, Rain (tab)	
* 3.TOC.1-2	December 12, 2011
3.1-4	December 13, 2010
* 3.5	December 12, 2011
3.6	December 13, 2010
3.7	December 14, 2009
* 3.8	December 12, 2011
3.9-10	December 13, 2010
* 3.11-20	December 12, 2011
4 Automatic Flight (tab)	
4.TOC.1-2	June 16, 2008
4.1-2	December 13, 2010
5 Communications (tab)	
5.TOC.1-2	December 13, 2010
5.1-2	December 13, 2010

\* = Revised, Added, or Deleted

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* 6.1-2	December 12, 2011	9.1	December 13, 2010
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* 6.6	December 12, 2011	9.3-5	December 13, 2010
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7.20-21	June 13, 2011	11.2	June 13, 2011
* 7.22-88	December 12, 2011	11.3	December 10, 2007
	8 Fire Protection (tab)	11.4	December 13, 2010
* 8.TOC.1-2	December 12, 2011	11.5-6	December 14, 2009
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* 8.7-44	December 12, 2011	11.11-12	December 10, 2007

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Checklist Instructions -  
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CI.LEP.3

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**CLEP.6**

**D632W001-TBC**

**December 12, 2011**

## Checklist Instructions

### Normal Checklists

## Chapter CI

### Section 1

## Introduction

This introduction gives guidelines for use of the printed version of the Normal Checklist (NC) as well as the Electronic Checklist (ECL).

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."

---

## Electronic Checklist Operation

Operation with the electronic normal checklist is the same as the printed normal checklist except that, there is no need to read aloud or visually confirm items that are complete (green). For the BEFORE TAKEOFF and LANDING checklists, the PM announces “\_\_\_\_ CHECKLIST COMPLETE,” the PF visually confirms that the CHECKLIST COMPLETE indication is shown, and announces “CHECKLIST COMPLETE.”

Closed loop (sensed) checklist items change from white to green when the action is taken. The PM is responsible to check off any open loop (not sensed) item and to verify that all closed loop items are green. See Chapter 10, Flight Instruments, Displays, for a complete description of the electronic checklist system.

---

## 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
- 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.

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## Introduction

The non-normal checklists chapter contains checklists used by the flight crew to manage non-normal situations. The checklists are grouped in sections which match the system description chapters in Volume 2.

Most checklists correspond to 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 EICAS alert message (such as Ditching) are called unannounced checklists. Most unannounced checklists are in the associated system section. For example, Fuel Leak is in section 12, Fuel. Unannounced checklists with no associated system are in section 0, Miscellaneous.

A rectangle icon [ ] precedes all EICAS alert messages that have procedural steps, notes, or other information of which the flight crew should be aware. The rectangle icon is removed from the EICAS message when the checklist has been completed. In the printed non-normal checklists, the titles also have the rectangle icon to agree with the EICAS alert message. EICAS alert messages without rectangle icons are informational, have no procedural steps or notes, or the action is obvious (such as OVERSPEED).

All checklists have condition statements. The condition statement briefly describes the situation that caused the EICAS alert message. Unannounced 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. In the printed non-normal checklists, the last memory item is followed by a dashed horizontal line. In the electronic checklists, memory items are not identified. Reference items are actions to be done while reading the checklist.

Some checklists have additional information at the end of the checklist. The additional information provides data the crew may wish to consider. The additional information does not need to be read.

Checklists that need a quick response are listed in the Quick Action Index. In each system section, Quick Action Index checklists are listed first, followed by checklists that are not in the Quick Action Index. The titles of Quick Action Index checklists are printed in **bold** type. Checklist titles in upper case (such as AUTOBRAKE) are annunciated by an EICAS alert message or other indication. Checklist titles in upper and lower case (such as Window Damage L, R) are not annunciated.

---

## Electronic Checklist Operation

A non-normal menu is given for the electronic checklist.

The primary purposes of the non-normal menu are to access unannunciated checklists and to access the condition statements for EICAS alert messages without rectangle icons.

The non-normal menu is also used to access checklists for EICAS alert messages with rectangle icons to allow review of the checklist. Operation of the electronic checklist is described in section 10; Flight Instruments, Displays.

---

## 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. In the printed non-normal checklists, when special items are needed to configure the airplane for landing, the items are included in the Deferred Items section of the checklist. In the electronic checklists, deferred items are automatically added to the end of the applicable normal checklist. Flight patterns for some non-normal situations are located in the Maneuvers chapter and show the sequence of configuration changes.

While every attempt is made to supply needed non-normal checklists, it is not possible to develop checklists for all conceivable situations. In some smoke, fire, or fumes situations, the flight crew may need to move between the Smoke, Fire or Fumes checklist and the Smoke or Fumes Removal checklist. In some multiple failure situations, the flight crew may need to combine the elements of more than one checklist. In all situations, the captain must assess the situation and use good judgment to determine the safest course of action.

It should be noted that, in determining the safest course of action, troubleshooting, i.e. taking steps beyond published non-normal checklist steps, may cause further loss of system function or system failure. Troubleshooting should only be considered when completion of the published non-normal checklist results in an unacceptable situation.

There are some situations where the flight crew must land at the nearest suitable airport. These situations include, but are not limited to, conditions where:

- the non-normal checklist includes the item "Plan to land at the nearest suitable airport."
- fire or smoke continues
- only one AC power source remains (main engine generator, APU generator, or backup power system [both generators])
- 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.
- In flight, flight crew reset of a tripped circuit breaker is not recommended. However, a tripped circuit breaker may be reset once, after a short cooling period (approximately 2 minutes), if in the judgment of the captain, the situation resulting from the circuit breaker trip has a significant adverse effect on safety. On the ground, flight crew reset of a tripped circuit breaker should only be done after maintenance has determined that it is safe to reset the circuit breaker.
- 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 effectiveness information is included in the checklist. Airplane effectiveness 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 effectiveness is centered below the checklist title. If a step in a checklist is applicable to some but not all airplanes, airplane effectiveness is included above the step. If a checklist or a step in a checklist is applicable to all airplanes, airplane effectiveness 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). 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.

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. With the electronic checklist, items that are complete (green) do not need to be read or verified. The item numbers do not need to be read.

Non-memory items are called reference items. The pilot monitoring reads aloud the reference items, including:

- the precaution (if any)
- the response or action
- any amplifying information.

The pilot flying does not need to repeat this information but must acknowledge that the information was heard and understood. The item numbers do not need to be read.

The word "Confirm" is added to checklist items when both crewmembers must verbally agree before action is taken. During an inflight non-normal situation, verbal confirmation is required for:

- an autothrottle arm switch
- 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.

This does not apply to the Dual Eng Fail/Stall checklist.

With the airplane stationary on the ground:

- the captain and 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 crewmember's areas of responsibility.

After moving the control, the crewmember taking the action also states the checklist response.

Closed loop (sensed) checklist items change from white to green when the action is taken. The pilot monitoring must "check off" any open loop (not sensed) items and verify that all closed loop items are green.

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 AUTO SPEEDBRAKE as a result of HYD PRESS SYS C) or as a result of doing a non-normal checklist (such as PACK L or PACK R as a result of doing the Smoke, Fire or Fumes checklist). Consequential messages are shown for flight crew awareness, with the rectangle icons automatically removed. The flight crew does not do the checklists for consequential EICAS alert messages. In the printed primary checklist, the statement "Do not accomplish the following checklists:" is included to inform the flight crew of consequential checklists. In the electronic primary checklist, the statement "Inhibited checklists:" is included to inform the crew of consequential checklists. When doing the electronic primary checklist, the statement and the list of checklists do not need to be read. 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. In the printed non-normal checklists, 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. In the electronic checklists, these items are automatically added to the end of the applicable normal 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.

In the printed non-normal checklists, 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. In the electronic checklists, when there are deferred items, the items are automatically added to the end of the usual DESCENT, APPROACH, or LANDING normal checklist. 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.

In the printed non-normal checklists, each checklist has a checklist complete symbol at the end. The following symbol indicates that the checklist is complete.



The checklist complete symbol can also be in the body of the checklist. This only occurs when a checklist divides into two or more paths. Each path can have a checklist complete symbol at the end. The flight crew does not need to continue reading the checklist after a checklist complete symbol in the body of the checklist. In the electronic checklists, each checklist has a "Checklist Complete" item at the end. There is only one checklist complete item.

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 the checklists cannot be created for all conceivable situations and are not intended to replace good judgement. In some situations, at the captain's discretion, deviation from a checklist may be needed.

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## Non-Normal Checklist Legend

### Redirection Symbol



The redirection symbol is used in a non-normal checklist, with the words "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.

**Evacuation Checklist is on the  
reverse side of this page.**

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**Evacuation**

Condition: An evacuation is needed.

- |   |   |  |     |
|---|---|--|-----|
| 1 | Parking brake.....  | Set  | C   |
| 2 | OUTFLOW VALVE switches<br>(both) .....                                      | MAN  | F/O |
| 3 | OUTFLOW VALVE MANUAL<br>switches (both) .....                               | Hold in OPEN<br>until the outflow<br>valve indications show fully<br>open to depressurize the airplane | F/O |
| 4 | FUEL CONTROL switches<br>(both) .....                                       | CUTOFF   | C   |
| 5 | Advise the cabin to evacuate.   |  | C   |
| 6 | Advise the tower.   |  | F/O |
| 7 | Engine fire switches (both) .....   | Pull   | F/O |
| 8 | APU fire switch.....  | Override and pull  | F/O |
| 9 | If an engine or APU fire warning occurs:<br><br>Related fire<br>switch..... | Rotate to the stop<br>and hold for 1 second  | F/O |

