



787

Quick Reference Handbook

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Normal Checklists

Chapter NC

PREFLIGHT

Oxygen. Tested, 100%
Flight instruments Heading____, Altimeter____
Parking brake Set
FUEL CONTROL switches CUTOFF

BEFORE START

Flight deck door Closed and locked
Passenger signs ____
MCP V2____, HDG/TRK____, ALTITUDE____
Takeoff speeds V1____, VR____, V2____
CDU preflight. Completed
Trim ____ Units, 0
Taxi and takeoff briefing Completed
BEACON ON

BEFORE TAXI

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

Flaps

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



787 Flight Crew Operations Manual

SHUTDOWN

Hydraulic panelSet
Fuel pumpsOff
FlapsUP
Parking brake
FUEL CONTROL switchesCUTOFF
Weather radarOff

SECURE

IRSOff
Emergency lightsOff
PacksOff



787 Flight Crew Operations Manual

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787 Flight Crew Operations Manual

Non-Normal Checklists

Chapter NNC

Miscellaneous

Section 0

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Ditching	0.1
Overweight Landing	0.4



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Condition: Airplane ditching and evacuation are needed.

- 1 Plan to jettison fuel as needed to reduce VREF speeds.
- 2 **Checklist Complete Except Deferred Items**

Below 5,000 feet

Tuning and control panel GPWS key	Push
GPWS GEAR OVRD line select key	OVRD
GPWS TERR OVRD line select key	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
SEAT BELT SIGNS selector	ON

Do **not** accomplish the following checklists:

PACK L+R

CABIN ALTITUDE AUTO

OUTFLOW VALVE AFT

OUTFLOW VALVE FWD

▼ 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 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 maximum landing weight is needed.

- 1 Refer to the Landing Climb Limit Weight (landing with flaps 25) 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**:

Tuning and control panel
GPWS key Push

GPWS FLAP OVRD
line select key OVRD

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

▶▶ **Go to step 3**

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

Note: Use flaps 25 and VREF 25 for landing and flaps 20 for go-around.

Limit the additives for wind and gusts such that the approach speed does not exceed 175 knots.

▶▶ **Go to step 3**

▼ Continued on next page ▼

▼ **Overweight Landing continued ▼**

3 Checklist Complete Except Deferred Items

Deferred Items

Descent Checklist

Recall Checked

Notes Checked

Autobrake ____

Landing data **VREF 20____ or VREF 25____,**
Minimums____

Approach briefing Completed

Approach Checklist

Altimeters ____

Landing Checklist

Speedbrake ARMED

Landing gear DOWN

Flaps. **20 or 25**



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[1] FD DOOR AUTO UNLOCK

Condition: The correct emergency access code is entered.

- 1 FD DOOR ACCESS selector Rotate to DENY and hold for 1 second

**CREW OXYGEN LOW**

Condition: Crew oxygen pressure is low.



[] DOOR AFT, FWD CARGO

Condition: The cargo door is not closed and secure.

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

1 LDG ALT selectorPULL 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**

▼ **Continued on next page** ▼

▼ DOOR AFT, FWD CARGO continued ▼

- 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 AFT, FWD 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 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 ENTRY 1–4L, R**

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 FD OVHD**

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

Note: The flight deck overhead 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.



DOORS

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



ELT ON

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





EVAC COMMAND

Condition: The evacuation command signal is on.



[] FD DOOR LOCK FAIL

Condition: One or more of these occur:

- The flight deck door power is off
- The lock is failed

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

- 1 FD DOOR POWER switch Off
- 2 The door can be locked with the deadbolt.



FD DOOR OPEN

Condition: The flight deck door is open.



PASS OXYGEN ON

Condition: The passenger oxygen system is on.



Window Damage Fwd L, R

Condition: A 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 PRIMARY 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: A 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 PRIMARY 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.





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[] CABIN ALTITUDE

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

Caution! Autopilot and flight director descent near Vmo/Mmo may result in overspeed excursions due to wind and temperature changes. Pilot intervention via FLCH speed or manually flown pitch adjustment may be necessary to remain below Vmo/Mmo.

▼ Continued on next page ▼



▼ CABIN ALTITUDE continued ▼

- 5 **If** the cabin altitude is controllable:
Continue normal operation.
- 6 If the flight deck or cabin temperature becomes excessively hot or cold, consider doing the Cabin Temp Hot or Cabin Temp Cold checklist.



[] 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
- 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
260	2,000
300	4,000
350	6,000
Above 350	8,000

▼ Continued on next page ▼

▼ CABIN ALTITUDE AUTO continued ▼

3 Checklist Complete Except Deferred Items

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

switches (both). Hold in OPEN
until the outflow
valve indications show fully
open to depressurize the airplane

Landing Checklist

Speedbrake ARMED

Landing gear DOWN

Flaps



[] CABIN TEMPERATURE

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 The packs may not be running even if the switch OFF lights are not shown.
- 2 TRIM AIR switches (both) Off
- 3 **If** airplane altitude is above 10,000 feet:
 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.
- 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 10**
- 5 IFE/PASS SEATS power switch Off
- 6 CABIN/UTILITY power switch Off
- 7 SHOULDER and FOOT HEATERS
 controls (all) LOW

▼ Continued on next page ▼

▼ **CABIN TEMPERATURE** continued ▼

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

Choose one:

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

▶▶ **Go to step 12**

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

▶▶ **Go to step 14**

- 12 Don the oxygen masks.
- 13 Establish crew communications.
- 14 PACK switches (both) Off
- 15 VENTILATION switch ALTN
- 16 Selecting the VENTILATION switch to ALTN will automatically reconfigure both outflow valves to optimal flow positions and may take up to 3 minutes to reduce cabin differential pressure.
- 17 **Wait** 3 minutes.
- 18 The correct outflow valve positions are:

Forward outflow valve approximately 10 o'clock position

Aft outflow valve fully open

▼ **Continued on next page** ▼

▼ **CABIN TEMPERATURE** continued ▼

19 Choose one:

◆ Both outflow valve positions are **correct**:

Note: If the flight deck or cabin temperature becomes too cold or too warm, the crew can cycle the alternate ventilation switch to NORM or ALTN as needed.

►► **Go to step 24**

◆ One or both outflow valve positions are **incorrect**:

►► **Go to step 20**

20 OUTFLOW VALVE switches (both)MAN

21 FWD OUTFLOW VALVE

MANUAL switchMove the forward outflow valve until the indication shows at the 10 o'clock position

22 AFT OUTFLOW VALVE

MANUAL switchHold in OPEN until the outflow valve indication shows fully open

Note: If the flight deck or cabin temperature becomes too cold or too warm, the crew can cycle the alternate ventilation switch to NORM or ALTN as needed.

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

CABIN ALTITUDE AUTO

▼ **Continued on next page** ▼

▼ CABIN TEMPERATURE continued ▼

- 24 If needed to reduce flight deck temperature, open the flight deck door.
- 25 If needed to reduce flight deck temperature, open the flight deck overhead vent.

Note: If the flight deck or cabin temperature becomes too cold, the crew can:

- Push the cabin/utility power switch ON
- Push the IFE/passenger seats power switch ON
- Select the shoulder and foot heaters controls above LOW
- Close the flight deck overhead vent
- Open or close the flight deck door

Note: Bulk cargo heat is inoperative.

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

PACK L+R

TRIM AIR L

TRIM AIR R



Cabin Temp Cold

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

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

1 Choose one:

◆ Airplane altitude is **above 35,000 feet**:

▶▶ **Go to step 2**

◆ Airplane altitude is at or below 35,000 feet:

▶▶ **Go to step 4**

2 Start a descent to 35,000 feet or lower.

3 **When** at or below 35,000 feet:

4 AIR COND RESET switch Push and hold
for 1 second

5 **Wait** 10 minutes.

6 Choose one:

◆ Cabin temperature is **still excessively cold**:

▶▶ **Go to step 7**

◆ Cabin temperature is **becoming warmer**:



▼ Continued on next page ▼

▼ Cabin Temp Cold continued ▼**7 FLT DECK TEMP control C**

Set to full cold. This provides more even distribution of warm air to the aft passenger cabin.

8 CABIN TEMP control C

Set to full cold. This provides more even distribution of warm air to the aft passenger cabin.

9 Start a descent to an altitude where cabin temperatures are becoming warmer, or the lowest safe altitude, whichever is higher.

Under most conditions, cabin temperatures should become warmer above 22,000 feet. Under extreme conditions, a descent to as low as 10,000 feet may be necessary to increase cabin temperature.

10 An airspeed increase will aid in cabin heating.**11 When** at level off:**12 Wait** 10 minutes.**▼ Continued on next page ▼**

▼ Cabin Temp Cold continued ▼

13 Choose one:

◆ Cabin temperature is **still excessively cold**:▶▶ **Go to step 14**◆ Cabin temperature is **becoming warmer**:

Note: If a higher cruise altitude is needed due to range or other operational considerations, the crew may climb, then assess the cabin temperature at the new altitude.

If temperature control is restored, the flight deck temperature control and cabin temperature control may be selected to a warmer temperature.



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

15 Plan to land at the nearest suitable airport.

16 Choose one:

◆ Airplane altitude is **above 10,000 feet**:▶▶ **Go to step 17**◆ Airplane altitude is **at or below 10,000 feet**:▶▶ **Go to step 19**

17 Don the oxygen masks.

▼ Continued on next page ▼

▼ Cabin Temp Cold continued ▼

18 Establish crew communications.

19 PACK switches (both) Off

20 VENTILATION switch ALTN

21 Selecting the VENTILATION switch to ALTN will automatically reconfigure both outflow valves to optimal flow positions and may take up to 3 minutes to reduce cabin differential pressure.

22 **Wait** 3 minutes.

23 The correct outflow valve positions are:

Forward outflow valve approximately 10 o'clock position

Aft outflow valve fully open

24 Choose one:

◆ Both outflow valve positions are **correct**:

Note: If the flight deck or cabin temperature becomes too cold or too warm, the crew can cycle the alternate ventilation switch to NORM or ALTN as needed.

►► **Go to step 29**

◆ One or both outflow valve positions are **incorrect**:

►► **Go to step 25**

25 OUTFLOW VALVE switches (both) MAN

▼ Continued on next page ▼

▼ Cabin Temp Cold continued ▼**26 FWD OUTFLOW VALVE**

MANUAL switch Move the forward
outflow valve until the
indication shows at the 10 o'clock position

27 AFT OUTFLOW VALVE

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

Note: If the flight deck or cabin temperature becomes too cold or too warm, the crew can cycle the alternate ventilation switch to NORM or ALTN as needed.

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

CABIN ALTITUDE AUTO

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

PACK L+R

Note: Bulk cargo heat is inoperative.





Intentionally
Blank



Cabin Temp Hot

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

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

- 1 The packs may not be controlling the temperature correctly, even if the switch OFF lights are not shown.
- 2 TRIM AIR switches (both) Off
- 3 **If** airplane altitude is above 10,000 feet:
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.
- 4 IFE/PASS SEATS power switch Off
- 5 CABIN/UTILITY power switch Off
- 6 SHOULDER and FOOT HEATERS controls (all) LOW
- 7 Minimize flight deck lighting intensity.
- 8 During daylight, install the flight deck sun visors.
- 9 Plan to land at the nearest suitable airport.

▼ Continued on next page ▼

▼ Cabin Temp Hot continued ▼

10 **When** at level off:

Choose one:

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

▶▶ **Go to step 11**

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

▶▶ **Go to step 13**

11 Don the oxygen masks.

12 Establish crew communications.

13 PACK switches (both) Off

14 VENTILATION switch ALTN

15 Selecting the VENTILATION switch to ALTN will automatically reconfigure both outflow valves to optimal flow positions and may take up to 3 minutes to reduce cabin differential pressure.

16 **Wait** 3 minutes.

17 The correct outflow valve positions are:

Forward outflow valve approximately 10 o'clock position

Aft outflow valve fully open

▼ Continued on next page ▼

▼ Cabin Temp Hot continued ▼

18 Choose one:

◆ Both outflow valve positions are **correct**:

Note: If the flight deck or cabin temperature becomes too cold or too warm, the crew can cycle the alternate ventilation switch to NORM or ALTN as needed.

▶▶ **Go to step 23**◆ One or both outflow valve positions are **incorrect**:▶▶ **Go to step 19**

19 OUTFLOW VALVE switches (both)MAN

20 FWD OUTFLOW VALVE

MANUAL switchMove the forward
outflow valve until the
indication shows at the 10 o'clock position

21 AFT OUTFLOW VALVE

MANUAL switchHold in OPEN
until the outflow valve
indication shows fully open

Note: If the flight deck or cabin temperature becomes too cold or too warm, the crew can cycle the alternate ventilation switch to NORM or ALTN as needed.

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

CABIN ALTITUDE AUTO

▼ Continued on next page ▼

▼ Cabin Temp Hot continued ▼

23 If needed to reduce flight deck temperature, open the flight deck door.

24 If needed to reduce flight deck temperature, open the flight deck overhead vent.

Note: If the flight deck or cabin temperature becomes too cold, the crew can:

- Push the cabin/utility power switch ON
- Push the IFE/passenger seats power switch ON
- Select the shoulder and foot heaters controls above LOW
- Close the flight deck overhead vent
- Open or close the flight deck door

Note: Bulk cargo heat is inoperative.

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

PACK L+R

TRIM AIR L

TRIM AIR R



CARGO HEAT BULK, FWD

Condition: Cargo heat is inoperative.



Dual Pack Freezing

Condition: One of the following message combinations shows:

- PACK MODE L and PACK MODE R
- PACK L and PACK MODE R
- PACK R and PACK MODE L

Objective: To descend to an altitude where TAT is above freezing and ice in the air cycle machines (ACMs) will melt. Then, to allow time for the water in the ACMs to evaporate.

- 1 AIR COND RESET switch Push and hold for 1 second
- 2 Descend to an altitude where TAT is 2 degrees C or greater (approximately 20,000 feet) or the lowest safe altitude, whichever is higher. A higher airspeed will increase TAT.
- 3 **When** at level off:
- 4 **Wait** 5 minutes.
- 5 AIR COND RESET switch Push and hold for 1 second

If this condition is present, the AIR COND RESET switch can be pushed more than once per flight.

- 6 Do **not** accomplish the following checklists:
PACK L
PACK R
- 7 **Wait** 2 minutes.

▼ Continued on next page ▼

▼ Dual Pack Freezing continued ▼

8 Choose one:

◆ Both packs have a PACK or PACK MODE message shown:

Plan to land at the nearest suitable airport.

Leave the pack switches in AUTO for the rest of the flight.



◆ One or both packs have no PACK or PACK MODE message shown:

Wait 10 minutes.

Climb to normal cruise altitude and resume normal operation.

Verify that sufficient fuel is available to complete the flight.



[] EQUIP CLG OVRD AFT

Condition: The aft equipment cooling system is in override mode.

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



[] EQUIP CLG OVRD FWD

Condition: The forward equipment cooling system is in override mode.

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

Note: Forward cargo heat is inoperative.

**[] EQUIP COOLING AFT**

Condition: The aft equipment cooling system is inoperative.

1 Plan to land within 345 minutes.

Note: After 345 minutes, critical electronic equipment may fail.

After 30 minutes, non-critical electronic equipment may fail.



[] EQUIP COOLING FWD

Condition: The forward equipment cooling system is inoperative.

1 Plan to land within 345 minutes.

Note: Both HUDs are inoperative.

Note: After 345 minutes, critical electronic equipment may fail.

After 30 minutes, non-critical electronic equipment and EFB displays may fail.

2 TCP MENU key Push

3 SYS POWER key Push

Note: Each component (weather radar, GPWS and transponder/TCAS) may function for as little as 15 minutes before failing. By using both L and R side components, a total of 30 minutes of operation is possible for each function. Select functions OFF when they are not needed for safe operation. Operate one side (L or R) at a time when needed.

To operate only one side at a time, select L or R component power to ON using the SYS PWR menu. Then select the same L or R side using the TRANSPONDER menu and WEATHER RADAR menu (page 2/2).



EQUIP OVBD VLV AFT

Condition: The aft equipment cooling system overboard exhaust valve is failed in the open position on the ground.



EQUIP OVRD VLV AFT, FWD

Condition: The equipment cooling system override valve is failed on the ground.



[] 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



LIQUID CLG QTY L, R

Condition: The liquid cooling system quantity is low.



[] LIQUID COOLING L

Condition: A left liquid cooling system fault occurs.

Note: Cooling for the large motor power system may not be available. The following items may be inoperative:

- L pack
- L center fuel pump
- C1 electric pump
- R demand hydraulic pump

Equipment may become operative or inoperative later in the flight.

If both the LIQUID COOLING L and LIQUID COOLING R messages show at any time, start a descent to the lowest safe altitude or 10,000 feet, whichever is higher. When the PACK L+R message shows, do the PACK L+R checklist.

Do not exceed 260 knots when the airplane is below 6,000 feet.

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

PACK L

HYD PRESS C1

HYD PRESS DEM R



[] LIQUID COOLING R

Condition: A right liquid cooling system fault occurs.

Note: Cooling for the large motor power system may not be available. The following items may be inoperative:

- R pack
- R center fuel pump
- C2 electric pump
- L demand hydraulic pump

Equipment may become operative or inoperative later in the flight.

If both the LIQUID COOLING L and LIQUID COOLING R messages show at any time, start a descent to the lowest safe altitude or 10,000 feet, whichever is higher. When the PACK L+R message shows, do the PACK L+R checklist.

Do not exceed 260 knots when the airplane is below 6,000 feet.

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

PACK R

HYD PRESS C2

HYD PRESS DEM L



[] OUTFLOW VALVE AFT, FWD

Condition: One of these occurs:

- Automatic control of the affected outflow valve is inoperative
- The affected 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
for 30 seconds or
until the outflow valve
indication shows fully closed



[] PACK ALTITUDE LIMIT

Condition: Airplane altitude is limited because pack flow is too low and the equipment cooling system is in the override mode.

- 1 **If** airplane altitude is above 35,000 feet:
Descend to 35,000 feet or lower.

Note: Maintain altitude at or below 35,000 feet.
Cabin temperature may be higher than normal.




[] PACK L, R


Condition: The pack is inoperative.


Note: With a single pack operating, cabin altitude may climb above normal when the airplane is near maximum operating altitude. Pressurization is normal at lower cruise altitudes.

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

Attempt only one reset for this condition per flight.

 **AIR COND RESET** switch. Push and hold for 1 second
- 3 **Wait** 2 minutes.
- 4 Choose one:
 - ◆ **PACK message blanks:**


 - ◆ **PACK message shows:**


- 5 Leave the PACK switch in AUTO for the rest of the flight.

This allows the pack to run if power is restored.





Intentionally
Blank

[] PACK L+R

Condition: Both packs are inoperative.

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

- 1 Don the oxygen masks.
- 2 Establish crew communications.
- 3 **Without delay**, start a descent 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

- 4 Plan to land at the nearest suitable airport.
- 5 AIR COND RESET switch Push and hold for 1 second
- 6 **Wait** 2 minutes unless the PACK L+R message shows again.
- 7 Choose one:

◆ PACK L+R message **blanks**:



◆ PACK L+R message **shows**:

►► **Go to step 8**

▼ **Continued on next page** ▼

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▼ **PACK L+R continued ▼**

- 8 IFE/PASS SEATS power switch Off
- 9 CABIN/UTILITY power switch Off
- 10 SHOULDER and FOOT HEATERS
controls (all) LOW
- 11 Minimize flight deck lighting intensity.
- 12 During daylight, install the flight deck sun visors.
- 13 **When** at level off:

Note: Do not exceed 260 knots when the airplane is below 6,000 feet.

- 14 VENTILATION switch ALTN
- 15 Selecting the VENTILATION switch to ALTN will automatically reconfigure both outflow valves to optimal flow positions and may take up to 3 minutes to reduce cabin differential pressure.
- 16 **Wait** 3 minutes.
- 17 The correct outflow valve positions are:

Forward outflow valve approximately 10 o'clock position

Aft outflow valve fully open

▼ **Continued on next page ▼**

▼ PACK L+R continued ▼

18 Choose one:

◆ Both outflow valve positions are **correct**:

Note: If the flight deck or cabin temperature becomes too cold or too warm, the crew can cycle the alternate ventilation switch to NORM or ALTN as needed.

▶▶ **Go to step 23**◆ One or both outflow valve positions are **incorrect**:▶▶ **Go to step 19**

19 OUTFLOW VALVE switches (both)MAN

20 FWD OUTFLOW VALVE

MANUAL switchMove the forward
outflow valve until the
indication shows at the 10 o'clock position

21 AFT OUTFLOW VALVE

MANUAL switchHold in OPEN
until the outflow valve
indication shows fully open

Note: If the flight deck or cabin temperature becomes too cold or too warm, the crew can cycle the alternate ventilation switch to NORM or ALTN as needed.

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

CABIN ALTITUDE AUTO

▼ Continued on next page ▼

▼ **PACK L+R continued ▼**

23 If needed to reduce flight deck temperature, open the flight deck door.

24 If needed to reduce flight deck temperature, open the flight deck overhead vent.

Note: If the flight deck or cabin temperature becomes too cold, the crew can:

- Push the cabin/utility power switch ON
- Push the IFE/passenger seats power switch ON
- Select the shoulder and foot heaters controls above LOW
- Close the flight deck overhead vent
- Open or close the flight deck door

Note: Bulk cargo heat is inoperative.



[] 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.



RECIRC FAN LWR, UPR OFF

Condition: The recirculation fan switch is Off.



[] 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 **blanks**:

■ ■ ■ ■
 - ◆ TRIM AIR message **shows**:

▶▶ **Go to step 5**
- 5 TRIM AIR switch (affected side) Off

■ ■ ■ ■

VENTILATION ALTN

Condition: The alternate ventilation system is on.





Non-Normal Checklists

Chapter NNC

Anti-Ice, Rain

Section 3

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Intentionally
Blank

[] ANTI-ICE DET WING

Condition: Automatic control of wing anti-ice is failed.

Note: Run the wing anti-ice system manually.



[] ANTI-ICE ENG L, R

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

1 Thrust lever (affected side) Advance to 40% N1

2 Wait 10 seconds.

3 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 4**

4 ENGINE ANTI-ICE selector (affected side) OFF

Note: Avoid icing conditions.



[] ANTI-ICE LEAK ENG L, R


Condition: A bleed air leak occurs in the engine anti-ice 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 ENGINE ANTI-ICE selector (affected side) OFF
- 4 Choose one:
 - ◆ ANTI-ICE LEAK ENG message **blanks**:


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

►► Go to step 5
- 5 A/T ARM switch (affected side) OFF
- 6 Thrust lever (affected side) Retard slowly until the ANTI-ICE LEAK ENG message blanks or the thrust lever is at idle

▼ Continued on next page ▼

▼ ANTI-ICE LEAK ENG L, R continued ▼

7 Choose one:

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

Note: Run the engine at a thrust setting that keeps the ANTI-ICE LEAK ENG message blank.



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

AUTOTHROTTLE

▼ Continued on next page ▼



▼ ANTI-ICE LEAK ENG L, R continued ▼

10 Choose one:

◆ Landing using flaps **20**:

Tuning and control panel

GPWS key Push

GPWS FLAP OVRD

line select key 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 **VREF 20**____, **Minimums**____
- Approach briefing Completed

▼ Continued on next page ▼

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

Approach Checklist

Altimeters _____

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 PACKS

Condition: Both pack inlet anti-ice systems are failed.

Note: Avoid icing conditions.

**[] ANTI-ICE WING**

Condition: Wing anti-ice is degraded or failed.

Note: Avoid icing conditions.

**[] 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 and HUD air data are not affected by the failure of one or two pitot heats.



[] HEAT PITOT L+C+R

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

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

**[] HEAT PITOT R**

Condition: The right pitot probe heat is failed.

Note: The PFD and HUD air data are not affected by the failure of one or two pitot heats.



Ice Crystal Icing

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

- In visible moisture with amber or red weather radar returns below the airplane
- Appearance of liquid water on the windshield at temperatures too cold for rain (the sound is different than rain)
- The autothrottle is unable to maintain the selected airspeed
- TAT indication on EICAS stays near 0 degrees C

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

Objective: To exit the ice crystal icing conditions.

- 1 Minimize time above amber and red weather radar returns. If conditions allow, exit the ice crystal icing conditions.



Additional Information

One or more of the following can indicate ice crystal icing:

- Light to moderate turbulence
- Static discharge around the windshield (St. Elmo's fire)
- Smell of sulfur
- Smell of ozone
- Humidity increase

[] 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.



WINDOW HEAT

Condition: Two or more window heats are off.



[] 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 PRIMARY WINDOW HEAT
switch (affected side) Off
- 2 FWD PRIMARY
WINDOW HEAT switch
(affected side) Wait 10 seconds, then ON
- 3 Choose one:
 - ◆ WINDOW HEAT FWD message **blanks**:

■ ■ ■ ■
 - ◆ WINDOW HEAT FWD message **stays shown**:

FWD PRIMARY WINDOW HEAT
switch (affected side) Off

The window is defogged by the backup system.

■ ■ ■ ■

[] WINDOW HEAT L, R SIDE

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

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

- 1 SIDE PRIMARY WINDOW HEAT
switch (affected side) Off
- 2 SIDE PRIMARY
WINDOW HEAT switch
(affected side) Wait 10 seconds, then ON
- 3 Choose one:
 - ◆ WINDOW HEAT SIDE message **blanks**:

■ ■ ■ ■
 - ◆ WINDOW HEAT SIDE message **stays shown**:

SIDE PRIMARY WINDOW HEAT
switch (affected side) Off

■ ■ ■ ■

WING ANTI-ICE OFF

Condition: The wing anti-ice selector is OFF.

■ ■ ■ ■

Intentionally
Blank



Non-Normal Checklists

Chapter NNC

Automatic Flight

Section 4

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Intentionally
Blank

AUTOPILOT

Condition: One or more of these occur:

- The autopilot 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.



[] A/P BACKDRIVE COLUMN

Condition: The autopilot can no longer backdrive the control column to match the position of the elevator.

- 1 Autopilot operation is not affected.

Note: Control column force override of the autopilot requires much less force.



[] A/P BACKDRIVE PEDAL

Condition: The autopilot can no longer backdrive the rudder pedals to match the position of the rudder during autoland approaches.

- 1 Autopilot operation is not affected.

Note: Rudder pedal force override of the autopilot requires much less force.

If the autopilot is disconnected during the autoland alignment maneuver, expect a minor flight path change because the pedal and rudder positions are mismatched.



[] A/P BACKDRIVE WHEEL

Condition: The autopilot can no longer backdrive the control wheel to match the position of the ailerons.

1 Autopilot operation is not affected.

Note: Bank angle protection is inoperative.

Note: Control wheel force override of the autopilot requires much less force.

If the autopilot is disconnected during the autoland alignment maneuver, expect a minor flight path change because the wheel and aileron positions are mismatched.



NO AUTOLAND

Condition: The autoland system is not available.



NO AUTOLAND GLS

Condition: The autoland system is not available for a GLS approach.



NO AUTOLAND ILS

Condition: The autoland system is not available for an ILS approach.



NO LAND 3

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



T/O THRUST DISAGREE

Condition: The thrust management takeoff thrust calculation disagrees with the EEC takeoff thrust calculation.





**Non-Normal Checklists
Communications**

**Chapter NNC
Section 5**

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Intentionally
Blank

DATALINK LOST

Condition: The ACARS datalink is temporarily lost.



DATALINK SYS

Condition: The datalink system is failed.



HF DATALINK

Condition: The HF datalink is failed.



[] RADIO TRANSMIT CAPT, F/O, OBS

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

Objective: To isolate the stuck microphone switch.

- 1 Transmitter select switches
(affected panel)FLT interphone
- 2 The microphone with the stuck switch transmits on the flight interphone rather than transmitting over a radio.

Note: The affected audio control panel transmitter selector switches 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.

**SATVOICE LOST**

Condition: SATCOM voice communication is temporarily lost.

**VHF DATALINK**

Condition: The VHF datalink is failed.





Non-Normal Checklists

Chapter NNC

Electrical

Section 6

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Intentionally
Blank

[] ELEC AC BUS L1

Condition: The L1 AC bus is not energized.

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

- Attempt only one reset per flight.**
- 1  L1 GEN CTRL switch. Off, then ON

 - 2 Choose one:
 - ◆ ELEC AC BUS L1 message **is blank**:

Wait 1 minute for the FUEL PUMP L AFT message to blank.

Do **not** accomplish the following checklist:

FUEL PUMP L AFT

■ ■ ■ ■
 - ◆ ELEC AC BUS L1 message **stays shown**:

▶▶ **Go to step 3**

 - 3 APU selector
 (if APU available) START, then ON

This supplies another source of electrical power to improve pack performance.

▼ Continued on next page ▼

▼ELEC AC BUS L1 continued▼**Note: Inoperative Items****C1 hydraulic pump inop****Left aft fuel pump inop****Captain's and first officer's HUDs inop**

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

HYD PRESS C1





Intentionally
Blank

[] ELEC AC BUS L2

Condition: The L2 AC bus is not energized.

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

Attempt only one reset per flight.

1  L2 GEN CTRL switch. Off, then ON

2 Choose one:

◆ ELEC AC BUS L2 message **is blank**:

Wait 1 minute for the FUEL PUMP R AFT message to blank.

Do **not** accomplish the following checklist:

FUEL PUMP R AFT

■ ■ ■ ■

◆ ELEC AC BUS L2 message **stays shown**:

▶▶ **Go to step 3**

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

This supplies another source of electrical power for wing anti-ice.

▼ Continued on next page ▼

▼ELEC AC BUS L2 continued ▼

Note: Inoperative Items
One or more spoilers inop

Roll rate may be reduced in flight. Buffet may be felt with flaps extended. Speedbrake effectiveness may be reduced in flight and during landing. Flap retraction is inhibited on the ground. Do not move the flap lever after landing. This prevents unexpected flap motion after maintenance action.

Right demand hydraulic pump inop

Right thrust reverser deployment may be slower than normal.

Right aft fuel pump inop
L2 stabilizer inop

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

SPOILERS

STABILIZER L2

HYD PRESS DEM R



[] ELEC AC BUS R1

Condition: The R1 AC bus is not energized.

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

Attempt only one reset per flight.

1  R1 GEN CTRL switch Off, then ON

2 Choose one:

◆ ELEC AC BUS R1 message **is blank**:

Wait 1 minute for the FUEL PUMP R FWD message to blank.

Do **not** accomplish the following checklist:

FUEL PUMP R FWD

■ ■ ■ ■

◆ ELEC AC BUS R1 message **stays shown**:

▶▶ **Go to step 3**

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

This supplies another source of electrical power to improve pack performance.

▼ Continued on next page ▼

▼ELEC AC BUS R1 continued▼

Note: Inoperative Items**C2 hydraulic pump inop****Right forward fuel pump inop****Captain's and first officer's HUDs inop****Forward cargo heat inop**

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

HYD PRESS C2



[] ELEC AC BUS R2

Condition: The R2 AC bus is not energized.

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

Attempt only one reset per flight.

1  R2 GEN CTRL switch Off, then ON

2 Choose one:

◆ ELEC AC BUS R2 message **is blank**:

Wait 1 minute for the FUEL PUMP L FWD message to blank.

Do **not** accomplish the following checklist:

FUEL PUMP L FWD



◆ ELEC AC BUS R2 message **stays shown**:

►► **Go to step 3**

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

This supplies another source of electrical power for wing anti-ice.

▼ Continued on next page ▼

▼ELEC AC BUS R2 continued ▼

Note: Inoperative Items
One or more spoilers inop

Roll rate may be reduced in flight. Buffet may be felt with flaps extended. Speedbrake effectiveness may be reduced in flight and during landing. Flap retraction is inhibited on the ground. Do not move the flap lever after landing. This prevents unexpected flap motion after maintenance action.

Left demand hydraulic pump inop

Left thrust reverser deployment may be slower than normal.

Left forward fuel pump inop
R2 stabilizer inop

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

SPOILERS

STABILIZER R2

HYD PRESS DEM L


ELEC BATTERY OFF

Condition: The battery switch is Off.


ELEC CABIN/UTIL OFF


Condition: The cabin/utility power switch is Off.



[] ELEC GEN DRIVE L1, L2, R1, R2

Condition: A generator drive fault occurs.

Action is irreversible.

- 1  DRIVE DISC switch
(affected generator). . . 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 L, R

Condition: The APU generator control breaker is open.

Attempt only one reset per flight.


- 1  APU GEN switch
(affected generator). Off, then ON



[] ELEC GEN OFF L1, L2, R1, R2

Condition: The generator control breaker is open.

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

- 1  Attempt only one reset per flight.
GEN CTRL switch
(affected generator) Off, wait 2 seconds,
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 IFE/SEATS OFF

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

Note: If the main battery fails, the failure will be contained and not present a hazard to the flight. If the battery vents, the gases will be directed overboard.

Venting white vapor may be visible on the ground. If vapor is visible or odors are noticed while on the ground, select both packs off during taxi. At the gate, advise ground personnel to stay clear of the vapor if the battery is still venting.

If only standby power is available, the main battery can power the standby system for a minimum of 10 minutes.

**MAIN BATTERY LOW**

Condition: The main battery charge is low.



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Aborted Engine Start L, R

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

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 270 knots.
- 4 APU selector
(if APU available) START, then ON
- 5 The engines may accelerate to idle very slowly,
especially at high altitudes.
- 6 The time from fuel control switch to RUN to stable
idle may be as long as two and a half minutes. 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 STAB cutout switches (both) NORM
The STABILIZER message may show. The
stabilizer will function normally when power is
restored.
- 8 Do **not** accomplish the following checklist:
STABILIZER



[] ENG AUTOSTART L, R

Condition: Autostart did not start the engine.

- 1 FUEL CONTROL switch
(affected side) Confirm CUTOFF

- 2 START selector (affected side) NORM



[] ENG LIMIT EXCEED L, R

Condition: An engine limit exceedance occurs.

- 1 A/T ARM switch
(affected side) Confirm OFF
- 2 Thrust lever
(affected side) Confirm Retard until
ENG LIMIT EXCEED
message blanks or
the thrust lever is at idle

3 Choose one:

◆ ENG LIMIT EXCEED message **blanks**:

▶▶ **Go to step 4**

◆ ENG LIMIT EXCEED message **stays shown**:

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.

Do **not** accomplish the following checklist:

AUTOTHROTTLE

▶▶ **Go to step 6**

▼ Continued on next page ▼

▼ **ENG LIMIT EXCEED L, R continued ▼**

Check that RPM and EGT follow thrust lever movement.

- 4  Thrust lever
(affected side). Advance slowly

Note: Run the engine at a thrust setting that keeps the engine indications within limits.

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

AUTOTHROTTLE



- 6 Choose one:

◆ Landing using flaps **20**:

Tuning and control panel
GPWS key. Push

GPWS FLAP OVRD
line select key OVRD

Note: Use flaps 20 and VREF 20 for landing and flaps 5 for go-around. Buffet may be felt with flaps extended.

▶▶ **Go to step 7**

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

Note: Use flaps 30 and VREF 30 for landing and flaps 20 for go-around. Buffet may be felt with flaps extended.



▼ **Continued on next page ▼**



▼ ENG LIMIT EXCEED L, R continued ▼

7 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**



[] ENG SURGE L, R

Condition: An engine surge or stall that requires crew action is detected.

- 1 A/T ARM switch
(affected side) Confirm. OFF
- 2 Thrust lever
(affected side) Confirm Retard until
the ENG SURGE
message blanks or
the thrust lever is at idle

Check that RPM and EGT follow thrust lever movement.

- 3  Thrust lever
(affected side). Advance slowly

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

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



Eng Svr Damage/Sep L, R

Condition: One or more of these occur:

- Airframe vibrations 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**:

Tuning and control panel

GPWS key. Push

GPWS FLAP OVRD

line select key OVRD

Note: Use flaps 20 and VREF 20 for landing and flaps 5 for go-around. Buffet may be felt with flaps extended.

►► 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. Buffet may be felt with flaps extended.



11 Checklist Complete Except Deferred Items

Deferred Items

Descent Checklist

Recall Checked

Notes Checked

Autobrake _____

▼ Continued on next page ▼

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▼Eng Svr Damage/Sep L, R continued▼

Landing dataVREF 20____, Minimums____
Approach briefing Completed

Approach Checklist

Altimeters _____

Landing Checklist

Speedbrake ARMED
Landing gear DOWN
Flaps 20
■ ■ ■ ■

[] 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 **Wait** 5 minutes.
- 3 APU selector START, then ON
■ ■ ■ ■

ENG CONTROL L, R

Condition: An EEC system fault occurs.

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

Condition: An engine core anti-ice fault occurs.

Note: Avoid icing conditions.



[] 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  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 indications.

- 5 Do **not** accomplish the following checklist:
ENG EEC MODE (for other engine)



[] ENG FAIL L, R

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 The engine will automatically attempt to relight. If N2 is above 30% and steadily increasing, the engine is starting.
- 5 Choose one:
 - ◆ The engine is **starting**:
 - ▶▶ **Go to step 12**
 - ◆ After 1 minute, the engine stays **failed**:

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

 - ▶▶ **Go to step 6**
- 6 A restart may be attempted if there is no abnormal airframe vibration.

▼ Continued on next page ▼

▼ ENG FAIL L, R continued ▼

7 Choose one:

◆ Restart is **needed**:▶▶ **Go to step 8**◆ Restart is **not** needed:▶▶ **Go to step 12**

8 The engine may accelerate to idle very slowly, especially at high altitudes.

9 The time from fuel control switch to RUN to stable idle may be as long as two and a half minutes. 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.

10 Choose one:

◆ X-START is **shown**:

START selector (affected side) START
 FUEL CONTROL switch
 (affected side) RUN

▶▶ **Go to step 12**◆ X-START is **blank**:▶▶ **Go to step 11**

11 FUEL CONTROL switch (affected side) RUN

▼ Continued on next page ▼

▼ ENG FAIL L, R continued ▼

12 Choose one:

◆ Engine **starts** and runs normally:



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

►► **Go to step 13**

13 FUEL CONTROL switch

(affected side) Confirm CUTOFF

14 START selector

(affected side) NORM

15 APU selector

(if APU available) START, then ON

16 TRANSPONDER MODE selector TA ONLY

17 Plan to land at the nearest suitable airport.

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

AUTOTHROTTLE

FUEL PUMP CTR L+R

▼ Continued on next page ▼

▼ ENG FAIL L, R continued ▼

19 Choose one:

◆ Landing using flaps **20**:

Tuning and control panel

GPWS key Push

GPWS FLAP OVRD

line select key OVRD

Note: Use flaps 20 and VREF 20 for landing and flaps 5 for go-around. Buffet may be felt with flaps extended.

▶▶▶ 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. Buffet may be felt with flaps extended.



20 Checklist Complete Except Deferred Items

Deferred Items

Descent Checklist

Recall Checked

Notes. Checked

Autobrake ____

Landing data **VREF 20**____, **Minimums**____

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 FUEL FILTER L, R

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

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



[] ENG FUEL FILTER L+R

Condition: Fuel contamination can cause fuel to bypass the engine fuel filters on both engines.

- 1 Plan to land at the nearest suitable airport.

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

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

ENG FUEL FILTER L

ENG FUEL FILTER R

**ENG FUEL NOZZLE L, R**

Condition: A valve in the engine fuel nozzle system is not in the commanded position.



[] 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

- 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 20 seconds.
- 2 **If** on the ground:

Do not attempt engine start.

**I**

Eng In-Flight Start L, R

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

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

- 1 The engine may accelerate to idle very slowly, especially at high altitudes.
- 2 The time from fuel control switch to RUN to stable idle may be as long as two and a half minutes. 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.

- 3 Choose one:

◆ X-START is **shown**:

EICAS messages may show during the start due to load shed. Do the associated checklists only if the messages show after the engine start is complete.

START selector (affected side) START

FUEL CONTROL switch

(affected side) RUN

▶▶ **Go to step 5**

◆ X-START is **blank**:

▶▶ **Go to step 4**

- 4 FUEL CONTROL switch. RUN

▼ Continued on next page ▼

▼ Eng In-Flight Start L, R continued ▼

5 Choose one:

◆ Engine **starts** and runs normally:

Tuning and control panel
GPWS key. Push
GPWS FLAP OVRD
line select key NORM
TRANSPONDER MODE selector TA/RA


◆ Engine **fails to** start:

FUEL CONTROL switch
(affected side). . . Confirm CUTOFF
START selector
(affected side). NORM
Plan to land at the nearest suitable airport.





[] ENG LIMIT PROT L, R

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

- 1 A/T ARM switch (affected side) OFF
- 2 Thrust lever
(affected side) Retard until
N1 stays below
the amber line
- 3 Do **not** accomplish the following checklist:

AUTOTHROTTLE



[] ENG OIL FILTER L, R

Condition: Oil filter contamination can cause 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 Choose one:
 - ◆ ENG OIL FILTER message **blanks**:

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

Do **not** accomplish the following checklists:

AUTOTHROTTLE

■ ■ ■ ■
 - ◆ ENG OIL FILTER message **stays shown**:

▶▶ **Go to step 4**
- 4 FUEL CONTROL switch
(affected side) Confirm CUTOFF
- 5 APU selector
(if APU available) START, then ON

▼ Continued on next page ▼

▼ ENG OIL FILTER L, R continued ▼

- 6 TRANSPONDER MODE selector TA ONLY
- 7 Plan to land at the nearest suitable airport.
- 8 Do **not** accomplish the following checklist:
AUTOTHROTTLE

- 9 Choose one:

◆ Landing using flaps **20**:

Tuning and control panel
GPWS key Push

GPWS FLAP OVRD
line select key OVRD

Note: Use flaps 20 and VREF 20 for landing and flaps 5 for go-around. Buffet may be felt with flaps extended.

►► 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. Buffet may be felt with flaps extended.



10 Checklist Complete Except Deferred Items

Deferred Items

Descent Checklist

Recall Checked
Notes Checked

▼ Continued on next page ▼

▼ ENG OIL FILTER L, R continued ▼

Autobrake _____

Landing data **VREF 20**____, **Minimums**____

Approach briefing Completed

Approach Checklist

Altimeters _____

Landing Checklist

Speedbrake ARMED

Landing gear DOWN

Flaps. **20**

[] ENG OIL PRESS L, R

Condition: The engine oil pressure is low.

- 1 A/T ARM switch
(affected side) Confirm OFF
- 2 Thrust lever
(affected side) Confirm Retard
slowly until
the ENG OIL PRESS message
blanks or the thrust lever is at idle
- 3 Do **not** accomplish the following checklists:
AUTOTHROTTLE
ENG OIL TEMP

▼ Continued on next page ▼

▼ ENG OIL PRESS L, R continued ▼

4 Choose one:

◆ ENG OIL PRESS message **blanks**:

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


◆ ENG OIL PRESS message **stays shown**:

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 5**

▼ Continued on next page ▼

▼ ENG OIL PRESS L, R continued ▼

5 Choose one:

◆ Landing using flaps **20**:

Tuning and control panel

GPWS key Push

GPWS FLAP OVRD

line select key OVRD

Note: Use flaps 20 and VREF 20 for landing and flaps 5 for go-around. Buffet may be felt with flaps extended.

▶▶ Go to step 6

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

Note: Use flaps 30 and VREF 30 for landing and flaps 20 for go-around. Buffet may be felt with flaps extended.



6 Checklist Complete Except Deferred Items

Deferred Items
Descent Checklist

Recall Checked

Notes Checked

Autobrake ____

Landing data **VREF 20**____, **Minimums**____

Approach briefing Completed

▼ Continued on next page ▼

▼ ENG OIL PRESS L, R continued ▼

Approach Checklist

Altimeters _____

Landing Checklist

Speedbrake ARMED

Landing gear DOWN

Flaps. **20**



[] ENG OIL TEMP L, R

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
oil temperature is below the
amber band or the thrust lever is at idle

3 Choose one:

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

Note: Run the affected engine at a thrust setting that keeps the oil temperature below the amber band.

Do **not** accomplish the following checklist:

AUTOTHROTTLE



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

►► **Go to step 4**

- 4 FUEL CONTROL switch
(affected side) Confirm CUTOFF
- 5 APU selector
(if APU available) START, then ON
- 6 TRANSPONDER MODE selector TA ONLY

▼ Continued on next page ▼

▼ **ENG OIL TEMP L, R continued ▼**

7 Plan to land at the nearest suitable airport.

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

AUTOTHROTTLE

9 Choose one:

◆ Landing using flaps **20**:

Tuning and control panel

GPWS key. Push

GPWS FLAP OVRD

line select key OVRD

Note: Use flaps 20 and VREF 20 for landing and flaps 5 for go-around. Buffet may be felt with flaps extended.

▶▶ **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. Buffet may be felt with flaps extended.



10 Checklist Complete Except Deferred Items

Deferred Items

Descent Checklist

Recall Checked

Notes Checked

▼ **Continued on next page ▼**



▼ENG OIL TEMP L, R continued▼

Autobrake _____
Landing data **VREF 20**____, **Minimums**____
Approach briefing Completed

Approach Checklist

Altimeters _____

Landing Checklist

Speedbrake ARMED
Landing gear DOWN
Flaps **20**



[] ENG REV AIR/GND

Condition: The air/ground thrust reverser logic is failed.

Note: Thrust reverser in-flight protection is failed.
Reversers will deploy in flight if commanded.



ENG REV COMMANDED L, R

Condition: The reverse thrust lever is not in the down position in flight.



[] 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**

Condition: Engine control is limiting engine thrust to prevent N2 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 CUTOUT L, R

Condition: The start selector stays in START when commanded to NORM.

- 1 START selector (affected side) NORM



[] ENG STARTERS L, R

Condition: Both starters on the engine are inoperative.

- 1 Choose one:

◆ On the **ground**:

FUEL CONTROL switch
(affected side) CUTOFF

START selector (affected side) NORM

Do **not** accomplish the following checklist:

ENG AUTOSTART



◆ In **flight**:

START selector (affected side) NORM

Increase airspeed until X-START blanks.



ENG TBV OPEN L, R

Condition: The engine transient bleed valve is failed in the open position.



ENG THRUST L, R

Condition: One of these occurs:

- The thrust is more than the commanded thrust
- The thrust is less than the commanded thrust



[] THRUST ASYM PROT

Condition: Thrust asymmetry protection is inoperative.

Note: Maintain airspeed at or above 130 knots.
This ensures sufficient directional control if
an engine is failed.




Volcanic Ash

Condition: Volcanic ash is suspected when one or more of these occur:

- A static discharge around the windshield
- A bright glow in the engine inlets
- Smoke or dust on the flight deck
- An acrid odor

Objective: To exit the ash cloud and restart engines if needed.

- 1 Exit the volcanic ash as quickly as possible.
Consider a 180 degree turn. Consider a descending turn.
- 2 Don the oxygen masks and smoke goggles, if needed.
- 3 Establish crew communications, if needed.
- 4 Autothrottle disconnect switch Push
- If conditions allow, run the engines at idle.**

 5  Thrust levers (both) Idle
 This reduces possible engine damage or flameout, or both, by decreasing EGT.
- 6 ENGINE ANTI-ICE selectors (both) ON
- 7 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 CLG OVRD message
- EQUIP COOLING FWD or AFT message
- FIRE CARGO FWD or AFT message

8 Choose one:

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

▶▶ **Go to step 9**

◆ Engines are running **normally**:

Plan to land at the nearest suitable airport.



9 FUEL CONTROL switches

(both) CUTOFF, then RUN

10 RAM AIR TURBINE

switch Push and hold
for 1 second

11 Set airspeed above 270 knots.

12 Engines may accelerate to idle very slowly, especially at high altitudes. The time from fuel control switch to RUN to stable idle may be as long as two and a half minutes.

▼ Continued on next page ▼

▼ Volcanic Ash continued ▼

13 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.

14 STAB cutout switches (both) NORM

The STABILIZER message may show. The stabilizer will function normally when power is restored.

15 Plan to land at the nearest suitable airport.

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

EQUIP CLG OVRD AFT

EQUIP CLG OVRD FWD

STABILIZER



**Non-Normal Checklists****Chapter NNC****Fire Protection****Section 8****Table of Contents**

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

AUTOTHROTTLE

▼ Continued on next page ▼

▼ FIRE ENG L, R continued ▼

OVERHEAT ENG

FUEL PUMP CTR L+R

10 Choose one:

◆ Landing using flaps **20**:

Tuning and control panel

GPWS key. Push

GPWS FLAP OVRD

line select key OVRD

Note: Use flaps 20 and VREF 20 for landing and flaps 5 for go-around. Buffet may be felt with flaps extended.

▶▶ 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. Buffet may be felt with flaps extended.



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 Eng Tailpipe L, R

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

- 1 FUEL CONTROL switch
(affected side) CUTOFF
- 2 Engine fire switch
(affected side) Verify In
- 3 Advise the cabin.
- 4 START selector (affected side) START

This motors the engine if the APU or 2 external power sources are on.
- 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 occur.

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 the oxygen masks and smoke goggles, if needed.
- 3 Establish crew and cabin communications.
- 4 IFE/PASS SEATS power switch Off
- 5 RECIRC FANS switches (both) Off
- 6 Any time the smoke or fumes become the greatest threat:

►► Go to the Smoke or Fumes Removal checklist on page 8.30

▼ Continued on next page ▼

▼ Smoke, Fire or Fumes continued ▼

7 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 8**

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

▶▶ **Go to step 9**

8 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 8.30, if needed**



- ◆ Smoke or fumes **continue**:

▶▶ **Go to step 9**

▼ Continued on next page ▼

▼ Smoke, Fire or Fumes continued ▼

- 9 Advise the cabin that the main cabin lighting will be turned off.
- 10 CABIN/UTILITY power switch Off
- 11 Start a diversion to the nearest suitable airport while continuing the checklist.
- 12 Consider an immediate landing if the smoke, fire, or fumes situation becomes uncontrollable.
- 13 Do not delay landing in an attempt to complete the following steps.
- 14 L PACK switch Off
- 15 L TRIM AIR switch Off
- 16 **Wait** 2 minutes unless the smoke or fumes are increasing. This allows time for the smoke or fumes to clear.
- 17 Do **not** accomplish the following checklists:
PACK L
TRIM AIR L

▼ Continued on next page ▼

▼ Smoke, Fire or Fumes continued ▼

18 Choose one:

◆ Smoke or fumes **continue**:

L PACK switch AUTO

L TRIM AIR switch ON

R PACK switch Off

R TRIM AIR switch Off

►► **Go to step 19**

◆ Smoke or fumes are **decreasing**:

►► **Go to the Smoke or Fumes Removal
checklist on page 8.30, if needed**



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

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

PACK R

TRIM AIR R

▼ Continued on next page ▼

▼ Smoke, Fire or Fumes continued ▼

21 Choose one:

◆ Smoke or fumes **continue**:

R PACK switch AUTO

R TRIM AIR switch ON

Consider an immediate landing.

▶▶ **Go to the Smoke or Fumes Removal checklist on page 8.30, if needed**



◆ Smoke or fumes are **decreasing**:

▶▶ **Go to the Smoke or Fumes Removal checklist on page 8.30, 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: Cargo compartment smoke detection is failed.



[] DET FIRE ENG L, R

Condition: An engine fire detection system fault occurs.

Note: Engine fire detection may not be available.
An engine fire warning that occurs is valid.



[] FIRE CARGO AFT

Condition: Smoke is detected in the aft 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.
- 5 Plan to land at the nearest suitable airport.

▼ Continued on next page ▼



▼ FIRE CARGO AFT continued ▼

Note: Aft equipment cooling normal mode is inoperative. After 30 minutes of operation at low altitude and low cabin differential pressure, non-critical electronic equipment may fail.

- 6 **When** at top of descent:
LDG ALT selector Push off
- 7 Do **not** accomplish the following checklists:
EQUIP CLG OVRD AFT
LANDING ALTITUDE

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 passengers and crew have exited the airplane and fire fighting equipment is nearby.

Landing Checklist

Speedbrake ARMED
Landing gear DOWN
Flaps _____



[] FIRE CARGO FWD

Condition: Smoke is detected in the forward 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: Forward cargo heat is inoperative.

Forward equipment cooling normal mode is inoperative. After 30 minutes of operation at low altitude and low cabin differential pressure, non-critical electronic equipment may fail.

6 **When** at top of descent:

LDG ALT selector Push off

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

EQUIP CLG OVRD FWD

LANDING ALTITUDE

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 WHEEL WELL

Condition: Fire is detected in a main wheel well.

- 1 Do not exceed the gear EXTEND limit speed (270 K/.82M).
- 2 Landing gear lever DN
This attempts to remove and extinguish the fire source.
- 3 ALTN GEAR
extend switch Push to DOWN
and hold for 15 seconds
- 4 Plan to land at the nearest suitable airport.
- 5 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.
- 6 Choose one:

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

▶▶ **Go to step 7**

◆ Gear can stay extended:

Note: Do not arm the speedbrake lever. This prevents inadvertent in-flight speedbrake extension.

Manually extend the speedbrakes after landing.

▶▶ **Go to step 9**

▼ Continued on next page ▼



▼ FIRE WHEEL WELL continued ▼

- 7 **When** the FIRE WHEEL WELL message blanks:
Wait 20 minutes. This ensures the fire is extinguished.
Landing gear lever UP
- 8 Do **not** accomplish the following checklist:
OVERHEAT WHEEL WELL



- 9 Do **not** accomplish the following checklists:
OVERHEAT WHEEL WELL
AUTO SPEEDBRAKE
GEAR DOOR

10 **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 ▼

▼ FIRE WHEEL WELL continued ▼

Approach Checklist

Altimeters _____

Landing ChecklistSpeedbrake **DOWN**

Landing gear DOWN

Flaps _____



[] OVERHEAT ENG L, R

Condition: An overheat is detected in the engine.

- 1 ENGINE ANTI-ICE selector
(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 affected engine at a thrust setting that keeps the OVERHEAT ENG message blank.

Avoid icing conditions.



◆ 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**:

Tuning and control panel

GPWS key. Push

GPWS FLAP OVRD

line select key OVRD

Note: Use flaps 20 and VREF 20 for landing and flaps 5 for go-around. Buffet may be felt with flaps extended.

►► **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. Buffet may be felt with flaps extended.



11 Checklist Complete Except Deferred Items

▼ **Continued on next page** ▼



▼ OVERHEAT 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**



[] OVERHEAT WHEEL WELL

Condition: An overheat is detected in either the left or right wheel well.

Objective: To cool off hot brakes.

- 1 Do not exceed the landing gear EXTEND limit speed (270K/.82M).
- 2 Landing gear lever DN
- 3 **When** the OVERHEAT WHEEL WELL message blanks:

Wait 8 minutes.

Landing gear lever UP

Continue normal operation.



[] SMOKE EQUIP CLG AFT

Condition: Smoke is detected in the aft equipment cooling system.

Objective: To reset the aft equipment cooling system and determine if a divert is needed.

- 1 **Wait** 2 minutes. This allows time for any smoke in the system to clear.
- 2 EQUIP COOLING AFT switch. . . . Off, then AUTO
- 3 **Wait** 30 seconds.
- 4 Do **not** accomplish the following checklist:
EQUIP CLG OVRD AFT
- 5 Choose one:

◆ SMOKE EQUIP CLG AFT message **shows**:

Plan to land at the nearest suitable airport.

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



◆ SMOKE EQUIP CLG AFT message **blanks**:



[] SMOKE EQUIP CLG FWD

Condition: Smoke is detected in the forward equipment cooling system.

Objective: To reset the forward equipment cooling system and determine if a divert is needed.

- 1 **Wait** 2 minutes. This allows time for any smoke in the system to clear.
- 2 EQUIP COOLING FWD switch Off, then AUTO
- 3 **Wait** 30 seconds.
- 4 Do **not** accomplish the following checklist:

EQUIP CLG OVRD FWD

- 5 Choose one:

◆ SMOKE EQUIP CLG FWD message **shows**:

▶▶ **Go to step 6**

◆ SMOKE EQUIP CLG FWD message **blanks**:



- 6 Plan to land at the nearest suitable airport.

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

Note: Forward cargo heat is inoperative.



[] SMOKE EQUIP CLG MISC

Condition: Smoke is detected in the miscellaneous equipment cooling system.

Note: All power is removed from the affected equipment for the rest of the flight. IFE is inoperative.

1 **Wait** 6 minutes.

2 Choose one:

◆ SMOKE EQUIP CLG MISC message **stays shown**:

Plan to land at the nearest suitable airport.

Note: Miscellaneous cooling smoke detection is no longer reliable.



◆ SMOKE EQUIP CLG MISC message **blanks**:



Intentionally
Blank

Smoke or Fumes Removal

Condition: Smoke or fumes removal is needed.

- 1 Do this checklist **only** when directed by the Smoke, Fire or Fumes checklist.
 - 2 Do not delay landing in an attempt to complete the following steps.
 - 3 Close the flight deck door.
 - 4 Choose one:
 - ◆ Most smoke or fumes are in the cabin **forward** of mid-wing:

▶▶ **Go to step 5**
 - ◆ Most smoke or fumes are in the cabin **aft** of mid-wing:

▶▶ **Go to step 9**
 - 5 EQUIP COOLING FWD switch Off
- Note:** After 30 minutes of operation at low altitude and low cabin differential pressure, non-critical electronic equipment may fail.
- 6 AFT OUTFLOW VALVE switch MAN
 - 7 AFT OUTFLOW VALVE
MANUAL switch Hold in CLOSE
until the outflow valve
indication shows fully closed
 - 8 Do **not** accomplish the following checklists:
EQUIP CLG OVRD FWD

▼ Continued on next page ▼

▼ Smoke or Fumes Removal continued ▼

OUTFLOW VALVE AFT

►► **Go to the Smoke, Fire or Fumes checklist on page 8.6, and do the rest of the steps**



9 EQUIP COOLING AFT switch. Off

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

10 FWD OUTFLOW VALVE switch. MAN

11 FWD OUTFLOW

VALVE MANUAL switch Hold in CLOSE
until the outflow valve
indication shows fully closed

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

EQUIP CLG OVRD AFT

OUTFLOW VALVE FWD

►► **Go to the Smoke, Fire or Fumes checklist on page 8.6, and do the rest of the steps**



SMOKE LAVATORY

Condition: Smoke is detected in one or more lavatories.



[] SMOKE REST UPR DR 1

Condition: Smoke is detected in the Overhead Flight 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 4

Condition: Smoke is detected in the Overhead Flight Attendant 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**:



Intentionally
Blank



Non-Normal Checklists

Chapter NNC

Flight Controls

Section 9

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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 Tuning and control panel GPWS key Push

5 GPWS FLAP OVRD line select key OVRD

Note: Use flaps 20 and VREF 30 + 20 for landing. This gives sufficient elevator authority for landing.

6 Checklist Complete Except Deferred Items

▼ Continued on next page ▼



▼ STABILIZER continued ▼

Deferred Items

Descent Checklist

- Recall Checked
- Notes. Checked
- Autobrake ____
- Landing data **VREF 30 + 20** ____
Minimums ____
- Approach briefing Completed

Approach Checklist

- Altimeters ____

Landing Checklist

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



[] 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 ____



[] CRUISE FLAPS SYS

Condition: The cruise flaps system is not in the correct position.

Note: Do not use FMC fuel predictions.

Drag due to incorrect cruise flap position may decrease range.

Use normal flaps for landing.



[] 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 Tuning and control panel GPWS key Push
- 3 GPWS FLAP OVRD line select key OVRD

Note: Do not use FMC fuel predictions with flaps extended.

▼ Continued on next page ▼

▼ FLAPS DRIVE continued ▼

4 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.

Consider reducing gross weight to lower the approach speed.

The autothrottle will maintain a minimum speed of 5 knots above the amber band.

Calculate the non-normal configuration landing distance for an approach speed of 10 knots above VREF.

►► **Go to step 5**

◆ Flap position is **between 5 and 20**:

Note: Use current flaps and VREF 30 + 20 for landing.

►► **Go to step 5**

◆ Flap position is **20 or greater**:

Note: Use current flaps and VREF 20 for landing.

►► **Go to step 5**

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

FLAPS PRIMARY FAIL

▼ Continued on next page ▼

▼ FLAPS DRIVE continued ▼

6 Checklist Complete Except Deferred Items

Deferred Items

Descent Checklist

Recall Checked
Notes Checked
Autobrake ____
Landing data **VREF as directed
by checklist____,
Minimums____**
Approach briefing Completed

Approach Checklist

Altimeters ____

Landing Checklist

Speedbrake ARMED
Landing gear DOWN
Flaps. **As directed by checklist**





[] FLAPS PRIMARY FAIL

Condition: The flaps primary mode is failed.

- 1 Tuning and control panel GPWS key Push
- 2 GPWS FLAP OVRD line select key OVRD

Note: Plan more time for slower flap operation.

Use flaps 20 and VREF 20 for landing. This gives improved go-around performance.

3 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**



Intentionally
Blank

[] 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 V_{mo}/M_{mo} after the flaps are fully retracted.

ALTN FLAPS ARM switch ALTN

Alternate flaps selector RET

Monitor airspeed during retraction.

2 Tuning and control panel GPWS key Push

3 GPWS FLAP OVRD line select key OVRD

Note: Plan more time for alternate flap and slat extension. Allow 3 minutes to extend flaps to 20.

Use flaps 20 and VREF 20 for landing. The alternate mode is limited to a maximum of flaps 20.

4 **Checklist Complete Except Deferred Items**

▼ Continued on next page ▼

▼FLAP/SLAT CONTROL continued ▼

Deferred Items

Descent Checklist

Recall Checked
Notes Checked
Autobrake ____
Landing data **VREF 20**____, **Minimums**____
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. **20**



[] 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**:

Note: Thrust asymmetry protection is inoperative. Maintain airspeed at or above 130 knots.

►► **Go to step 3**

3 Avoid abrupt control inputs and high maneuvering loads. Airplane response is changed by simplified control laws.

4 Tuning and control panel GPWS key Push

5 GPWS FLAP OVRD line select key OVRD

Note: Inoperative Items

Autopilot inop

Envelope protection functions inop

Thrust asymmetry protection 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. If VREF 20 is less than 130 knots, use 130 knots for VREF 20. This ensures sufficient pitch trim and directional control capability for landing.

Do not arm the speedbrake lever. This prevents inadvertent in-flight speedbrake extension.

Manually extend the speedbrakes after landing.

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

THRUST ASYM PROT

AUTO SPEEDBRAKE

7 **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**





Intentionally
Blank

[] 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 Avoid abrupt control inputs and high maneuvering loads. 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 Tuning and control panel GPWS key Push
- 4 GPWS FLAP OVRD line select key 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.

Buffet may be felt with flaps extended.

Flap retraction is inhibited on the ground. Do not move the flap lever after landing. This prevents unexpected flap motion after maintenance action.

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

SPOILER PAIRS

6 Checklist Complete Except Deferred Items

▼ Continued on next page ▼

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▼ **FLIGHT CONTROLS** continued ▼

Deferred Items

Descent Checklist

Recall Checked

Notes Checked

Autobrake ____

Landing data **VREF 30 + 20**____,
Minimums____

Approach briefing Completed

Approach Checklist

Altimeters ____

Landing Checklist

Speedbrake ARMED

Landing gear DOWN

Flaps. **20**



FLT CONTROLS LOCKED

Condition: One or both Flight Control Surfaces switches are in the Off position.



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.

▼ Continued on next page ▼

▼ Jammed Flight Controls continued ▼

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 rudder and rudder trim to counter the effect of the jam.

If the 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 or engage the autopilot 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 needed for landing.

▶▶ **Go to step 5**

▼ Continued on next page ▼



▼ Jammed Flight Controls continued ▼

5 Plan to land at the nearest suitable airport.



[] PITCH DOWN AUTHORITY

Condition: Pitch down authority is restricted.

Note: Slower airspeeds assist nose down pitch control. The airplane is approaching its nose down pitch control limit.

Avoid speedbrake use and rapid thrust increases in flight. Only limited elevator authority is available to counter nose up pitch.

Do not arm the speedbrake lever.

Slowly extend the speedbrakes after landing.

Do not use autoland.

1 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 ▼

▼ PITCH DOWN AUTHORITY continued ▼

Approach Checklist

Altimeters _____

Landing ChecklistSpeedbrake **DOWN**

Landing gear DOWN

Flaps _____



[] 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 Tuning and control panel GPWS key Push
- 3 GPWS FLAP OVRD line select key OVRD

Note: Do not use autoland.

- 4 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.

Consider reducing gross weight to lower the approach speed.

►► **Go to step 5**

◆ 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 5**

- 5 **Checklist Complete Except Deferred Items**

▼ Continued on next page ▼

▼ **PITCH UP AUTHORITY** continued ▼

Deferred Items

Descent Checklist

Recall Checked

Notes Checked

Autobrake ____

Landing data **VREF 30 + 40**____ or
VREF 30 + 20____,
Minimums ____

Approach briefing Completed

Approach Checklist

Altimeters ____

Landing Checklist

Speedbrake ARMED


Landing gear DOWN

Flaps. **5 or 20**


[] 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:**

Note: Thrust asymmetry protection is inoperative. Maintain airspeed at or above 130 knots.

▶▶ **Go to step 3**

- 3 Avoid abrupt control inputs and high maneuvering loads. Airplane response is changed by simplified control laws.
- 4 Tuning and control panel GPWS key Push
- 5 GPWS FLAP OVRD line select key OVRD

Note: Inoperative Items

Autopilot inop

Envelope protection functions inop

Thrust asymmetry protection inop

▼ Continued on next page ▼

▼ **PRI FLIGHT COMPUTERS** continued ▼

Note: The yaw damper is degraded.

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. If VREF 20 is less than 130 knots, use 130 knots for VREF 20. This ensures sufficient pitch trim and directional control capability for landing.

Do not arm the speedbrake lever. This prevents inadvertent in-flight speedbrake extension.

Manually extend the speedbrakes after landing.

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

THRUST ASYM PROT

AUTO SPEEDBRAKE

7 **Checklist Complete Except Deferred Items**

▼ **Continued on next page** ▼



▼PRI FLIGHT COMPUTERS continued ▼

Deferred Items

Descent Checklist

- Recall Checked
- Notes. Checked
- Autobrake ____
- Landing dataVREF 20____, Minimums____
- Approach briefing Completed

Approach Checklist

- Altimeters ____

Landing Checklist

- Speedbrake DOWN
- Landing gear DOWN
- Flaps20





Intentionally
Blank

[] ROLL LEFT AUTHORITY

Condition: The pilot has limited roll control to the left because the ailerons or rudder are near full travel.

- 1 The flight control system is compensating for an airplane asymmetry.
- 2 Plan to land at the nearest suitable airport.
- 3 Tuning and control panel GPWS key Push
- 4 GPWS FLAP OVRD line select key OVRD

Note: An unknown drag condition may decrease range.

Use LRC speed for diversion. Do not use FMC fuel predictions.

Use flaps 20 and VREF 30 + 20 for landing. Higher approach speed improves maneuvering characteristics.

The crosswind limit for landing is 10 knots.

Large slip and bank angles may be needed to maintain course on the approach. A left control wheel input may be needed after landing to control roll asymmetry.

5 Checklist Complete Except Deferred Items

▼ Continued on next page ▼

▼ ROLL LEFT AUTHORITY continued ▼

Deferred Items

Descent Checklist

Recall Checked

Notes Checked

Autobrake _____

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

Approach briefing Completed

Approach Checklist

Altimeters _____

Landing Checklist

Speedbrake ARMED

Landing gear DOWN

Flaps.....20



[] ROLL RIGHT AUTHORITY

Condition: The pilot has limited roll control to the right because the ailerons or rudder are near full travel.

- 1 The flight control system is compensating for an airplane asymmetry.
- 2 Plan to land at the nearest suitable airport.
- 3 Tuning and control panel GPWS key Push
- 4 GPWS FLAP OVRD line select key OVRD

Note: An unknown drag condition may decrease range.

Use LRC speed for diversion. Do not use FMC fuel predictions.

Use flaps 20 and VREF 30 + 20 for landing. Higher approach speed improves maneuvering characteristics.

The crosswind limit for landing is 10 knots.

Large slip and bank angles may be needed to maintain course on the approach. A right control wheel input may be needed after landing to control roll asymmetry.

5 Checklist Complete Except Deferred Items

Deferred Items

Descent Checklist

Recall Checked

Notes. Checked

▼ Continued on next page ▼

▼ ROLL RIGHT AUTHORITY continued ▼

Autobrake _____

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

Approach briefing Completed

Approach Checklist

Altimeters

Landing Checklist

Speedbrake ARMED

Landing gear DOWN

Flaps.....20



[] ROLL/YAW ASYMMETRY

Condition: An airplane roll or yaw asymmetry occurs.

- 1 Plan to land at the nearest suitable airport.

Note: An unknown drag condition may decrease range.

Use LRC speed for diversion. Do not use FMC fuel predictions.

The rudder pedals may move to compensate for the asymmetry.





[] SLATS DRIVE

Condition: The slat drive mechanism is failed.

- 1 Do not use alternate flaps. Asymmetry and uncommanded motion protection are not provided in the alternate mode.
- 2 Tuning and control panel GPWS key Push
- 3 GPWS FLAP OVRD line select key OVRD

Note: Do not use FMC fuel predictions with slats extended.

Consider reducing gross weight to lower the approach speed.

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.

The autothrottle will maintain a minimum speed of 5 knots above the amber band.

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

SLATS PRIMARY FAIL

5 Checklist Complete Except Deferred Items

Deferred Items

Descent Checklist

- Recall Checked
- Notes. Checked
- Autobrake _____

▼ Continued on next page ▼

▼ SLATS DRIVE continued ▼

Landing data **VREF 30 + 30**____,
Minimums____

Approach briefing Completed

Approach Checklist

Altimeters _____

Landing Checklist

Speedbrake ARMED

Landing gear DOWN

Flaps. **20**



[] SLATS PRIMARY FAIL

Condition: The slats primary mode is failed.

Note: Plan more time for slower slat operation.

The slats will extend beyond midrange when the airspeed is below 225 knots. For go-around, do not exceed 225 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

**[] SPOILER DRAG**

Condition: Some spoilers are not stowed because center hydraulic system pressure is low.

Objective: To reduce drag by enabling the center hydraulic system to power and stow two spoiler pairs.

- 1 RAM AIR TURBINE switch Push and hold for 1 second
- 2 Fly LRC speed. This improves range.



[] SPOILER PAIRS

Condition: More than two spoiler panels are failed.

Note: Roll rate may be reduced in flight.
Speedbrake effectiveness may be reduced in flight and during landing.

Buffet may be felt with flaps extended.

For a flaps 25 landing, use VREF 25 + 5. For a flaps 30 landing, use VREF 30 + 5.

Flap retraction is inhibited on the ground. Do not move the flap lever after landing. This prevents unexpected flap motion after maintenance action.



[] SPOILERS

Condition: One or two spoiler panels are failed.

Note: Roll rate may be reduced in flight.
Speedbrake effectiveness may be reduced in flight and during landing.

Buffet may be felt with flaps extended.

Flap retraction is inhibited on the ground. Do not move the flap lever after landing. This prevents unexpected flap motion after maintenance action.



[] 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 CUTOUT**

Condition: Both stabilizer cutout switches are in CUTOUT.



[] STABILIZER L2

Condition: The left stabilizer control path is failed.

1 L2 STAB cutout switch. CUTOUT

Note: The captain's control wheel pitch trim switches may be inoperative.

**[] STABILIZER R2**

Condition: The right stabilizer control path is failed.

1 R2 STAB cutout switch CUTOUT

Note: The first officer's control wheel pitch trim switches may be inoperative.

**[] STALL PROTECTION**

Condition: A stall protection fault occurs.

Note: Any stall indications should be considered valid.



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**Non-Normal Checklists****Chapter NNC****Flight Instruments, Displays****Section 10****Table of Contents**

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Loss of All Displays	10.7

AIRSPEED UNRELIABLE	10.1
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[] AIRSPEED UNRELIABLE

Condition: The airspeed or Mach indications disagree with AOA calculated airspeed.

- 1 Check the pitch attitude and thrust for the phase of flight.
- 2 **If** the pitch attitude or thrust is **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.

Note: The normal pitch attitude, thrust settings, and airspeed are available in the Flight With Unreliable Airspeed table in the Performance Inflight chapter.

- 3 Captain's AIR DATA/ATT
source selector. ALTN

The captain's airspeed and altitude indications change to AOA SPD and GPS ALT.

▼ Continued on next page ▼



▼AIRSPEED UNRELIABLE continued▼

Note: Vertical speed, maximum speed, minimum speed, reference N1, maximum N1, flight path vector, and wind indications may be unreliable.

Groundspeed and radio altitude indications are accurate.

AOA SPD may be erratic during configuration changes, maneuvering, and speedbrake use.

4 Compare the captain’s AOA SPD with the first officer’s indicated airspeed to determine which side is more accurate.

5 AIR DATA/ATT source selectors
(both) ALTN or AUTO

Select the position that gives the more accurate airspeed.

Note: The maximum speed indication may show at 250 knots. Disregard this indication and refer to the table below:

ALTITUDE (feet)	MAXIMUM SPEED (knots)
Above 40,000	250
38,001 to 40,000	260
35,001 to 38,000	270
At or below 35,000	290

Note: Thrust asymmetry protection is inoperative. Maintain airspeed at or above 130 knots.

▼ Continued on next page ▼

▼ **AIRSPEED UNRELIABLE** continued ▼

- 6 Avoid abrupt control inputs and high maneuvering loads. Airplane response is changed by simplified control laws.

Note: WINDSHEAR, OVERSPEED, and AIRSPEED LOW alerts may show erroneously.


If using GPS altitude, the altimeter cannot be used to accurately maintain ATC-assigned altitudes. Transponder altitude and TCAS indications may be erroneous.

Run the engine and wing anti-ice systems manually.

- 7 Thrust levers (both) Retard to mid position

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

Push one switch at a time.

- 8  EEC MODE switches (both) Off

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

- 9 Tuning and control panel
GPWS key Push
- 10 GPWS FLAP OVRD
line select key OVRD

▼ **Continued on next page** ▼

▼ **AIRPEED UNRELIABLE** continued ▼**Note: Inoperative Items****Autopilot inop****Envelope protection functions inop****A ground proximity warning system fault occurs:**

Some or all ground proximity alerts are not available. Ground proximity alerts that occur are valid.

Note: Do not use the autothrottle.

The yaw damper is degraded.

Manual control inputs are needed to compensate for asymmetrical thrust conditions.

Use flaps 20 and VREF 20 for landing. If VREF 20 is less than 130 knots, use 130 knots for VREF 20. This ensures sufficient pitch trim and directional control capability for landing.

Avoid speedbrake use in flight.

Do not arm the speedbrake lever. This prevents inadvertent in-flight speedbrake extension.

Manually extend the speedbrakes after landing.

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

ICE DETECTORS

THRUST ASYM PROT

ENG EEC MODE L

▼ **Continued on next page** ▼

▼ AIRSPEED UNRELIABLE continued ▼

ENG EEC MODE R
AUTO SPEEDBRAKE
FLIGHT CONTROL MODE
ALTN ATTITUDE CAPT
ALTN ATTITUDE F/O
SGL SOURCE ATTITUDE
GND PROX SYS

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



▼AIRSPEED UNRELIABLE continued▼

Deferred Items

Descent Checklist

- Recall Checked
- Notes. Checked
- Autobrake ____
- Landing dataVREF 20____, Minimums____
- Approach briefing Completed

Approach Checklist

- Altimeters ____

Landing Checklist

- Speedbrake DOWN
- Landing gear DOWN
- Flaps20



Loss of All Displays

Condition: All five forward displays and both head-up displays are failed.

Objective: To restore partial display operation.

- 1 Engage the autopilot only in HDG HOLD, TRK HOLD, HDG SEL, or TRK SEL roll mode; and V/S, FPA, or ALTITUDE HOLD pitch mode.
- 2 Do not use LNAV, VNAV, FLCH, LOC/FAC, or APP modes.

Note: Autothrottle is inoperative.

- 3 Use the captain's audio control panel, the left Tuning and Control Panel (TCP), and the left radio for communications.

Note: The following items may be inoperative:

Wing anti-ice:

Avoid icing conditions.

Window heat:

Avoid icing conditions.

- 4 L CCR RESET switch Push
- 5 **Wait** 1 minute.

▼ Continued on next page ▼

▼ Loss of All Displays continued ▼

6 Choose one:

◆ **Partial** forward display operation is **restored**:



◆ **All** displays **stay blank**:

CCR RESET switches (both). Push

Wait 1 minute.

▶▶ **Go to step 7**

7 Choose one:

◆ **Partial** forward display operation is **restored**:



◆ **All** displays **stay blank**:

▶▶ **Go to step 8**

8 Request radar vectors from ATC, if available.

9 Choose one:

◆ Alternate navigation capability is **needed**:

▶▶▶ **Go to step 10**

◆ Alternate navigation capability is **not needed**:

▶▶▶ **Go to step 15**

10 Left TCP NAV key Push

11 Use the left TCP to enter the latitude and longitude of the next waypoint or the destination runway on the ALTN NAV page.

Enter latitude in DDMM.M format.

▼ Continued on next page ▼

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▼ Loss of All Displays continued ▼

Enter longitude in DDDMM.M format.

12 HEADING REF switch TRUE

13 MCP HDG/TRK reference switch TRK

14 Use TRK SEL mode to set the needed track.

Note: Monitor TRK TO on the left TCP ALTN NAV page, and update the MCP-selected track as needed.

15 The crew alerting system is inoperative. This includes Master WARNING/CAUTION lights, aural, voice alerts, and crew alertness messages. Periodically scan indicator lights for non-normal conditions.

Note: Inoperative Items

Landing gear normal extension inop

Alternate gear extension is needed.

Auto speedbrake inop

Note: Do not arm the speedbrake lever. This prevents inadvertent in-flight speedbrake extension.

Manually extend the speedbrakes after landing.

▼ Continued on next page ▼



▼ Loss of All Displays continued ▼

Note: The following items may be inoperative:

- Center tank pumps:**
Center tank fuel may be unusable. Verify that fuel is available in the main tanks to complete the flight.
- Cabin altitude alert**
- Passenger oxygen**
- First officer’s and observer’s audio control panels**
- Center and right TCPs**
- HF and SATCOM communications**
- Thrust reversers**

16 TCP GPWS key Push

17 GPWS FLAP OVRD line select key OVRD

▼ Continued on next page ▼

▼ Loss of All Displays continued ▼

Note: Estimate landing weight based on route and normal fuel flow.

Use flaps 20 and VREF 20 for landing.

Refer to the Flap Maneuver Speed table below:

FLAP POSITION	MANEUVER SPEED
FLAPS UP	VREF 30 + 80 or above lower amber band, whichever is higher
FLAPS 1	VREF 30 + 60
FLAPS 5	VREF 30 + 40
FLAPS 15	VREF 30 + 20
FLAPS 20	VREF 30 + 20
FLAPS 25	VREF 25
FLAPS 30	VREF 30

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

AUTO SPEEDBRAKE

19 **Checklist Complete Except Deferred Items**

Deferred Items

Descent Checklist

Notes Checked

Autobrake ____

Landing data **VREF 20**____, **Minimums**____

▼ Continued on next page ▼



▼ Loss of All Displays continued ▼

Approach briefing Completed

Tune the navigation radio for landing

Left TCP NAV key Push

Left TCP NEXT PAGE key Push

Left TCP CTRL line select key ON

Use the left TCP to tune the ILS frequency and course as published on the instrument approach chart, or the GLS channel.

Confirm magnetic heading with the standby compass.

When below 10,000 feet:

OUTFLOW VALVE switches (both) MAN

OUTFLOW VALVE MANUAL
switches (both) Push to OPEN
and hold for 30 seconds

Approach Checklist

Altimeters _____

Alternate gear extension

Landing gear lever DN

▼ Continued on next page ▼

▼ **Loss of All Displays continued** ▼

ALTN GEAR

extend switch Push to DOWN
and hold for 15 seconds

Landing Checklist

Speedbrake **DOWN**

Landing gear DOWN

Flaps. **20**



Additional Information

To convert true heading to magnetic heading, do one of the following:

- Subtract the eastern variation from true heading
- Add the western variation to true heading

[] ALTN ATTITUDE CAPT, F/O

Condition: The AIR DATA/ATT source selector is in ALTN.

Note: The affected PFD and HUD show attitude information from the ISFD.



BARO SET DISAGREE

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



[] CHKL INCOMPLETE NORM

Condition: A normal checklist needs to be completed.

**[] CHKL NON-NORMAL**

Condition: There is a hidden non-normal checklist. All of these occur:

- A non-normal checklist is not complete
- The ECL is not displayed
- The related EICAS message is not shown

**[] EFIS/DSP PANEL L, R**

Condition: One of these occurs:

- The EFIS/DSP panel is failed
- MFD control of the EFIS/DSP is used

Note: Backup control of the affected EFIS/DSP panel is accessed from the MFD system display, using the EFIS/DSP select key.

The EFIS/DSP BACKUP page can be shown and controlled on any operable MFD.

- 1 Select SYS on the MFD.
- 2 Select EFIS/DSP.
- 3 Select CAPT or F/O.
- 4 Select EFIS CTRL BACKUP.
- 5 Use backup control as needed.



[] HUD SNGL OPERATION

Condition: Only one head-up display functions.

Note: Only one HUD can function. To enable HUD operation for the pilot flying, stow the opposite HUD.



HUD SYS CAPT, F/O

Condition: The head-up display is failed.



ISFD Use

Condition: ISFD airspeed or altitude indications must be used.

- 1 When using standby airspeed and altitude indications, refer to the ISFD Airspeed and Altitude Correction tables in the Performance Inflight chapter.

Note: On final approach in the landing configuration, airspeed correction is not needed.

For a flaps 25 landing, use $V_{REF} 25 + 10$. For a flaps 30 landing, use $V_{REF} 30 + 10$.



[] HUD TAKEOFF

Condition: Head-up display takeoff guidance is not available.

- 1 Deselect HUD TAKEOFF on the FMC DEPARTURES page by selecting the active runway, then selecting EXECUTE.
- 2 Cycle the flight directors.
- 3 **If** visibility is acceptable for takeoff without HUD guidance:

Continue normal operation.





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[] RADIO ALTIMETER L+R

Condition: The left and right radio altimeters are failed.

Note: Flight director and autopilot ILS approach modes are inoperative. Do not arm approach for ILS.

The CONFIG GEAR warning may show due to lack of radio altimeter information.

Autothrottle retard during flare is inoperative.

1 Checklist Complete Except Deferred Items

▼ Continued on next page ▼

▼ RADIO ALTIMETER L+R continued ▼

Deferred Items

Descent Checklist

Recall Checked
Notes Checked
Autobrake ____
Landing data VREF____, Minimums____
Approach briefing Completed

Approach Checklist

Altimeters ____

Landing Checklist

Speedbrake ARMED
Landing gear DOWN
Flaps ____
A/T ARM switches (both) **OFF**



[] SGL SOURCE ATTITUDE

Condition: One of these occurs:

- Both AIR DATA/ATT source selectors are in the ALTN position
- All attitude information is lost from the IRUs and AHRUs

Note: Both PFDs and HUDs show attitude information from the Integrated Standby Flight Display.

**[] SGL SOURCE RAD ALT**

Condition: Both PFDs and HUDs use the same radio altimeter source.

Note: Autothrottle retard during flare is inoperative.





Non-Normal Checklists

Chapter NNC

Flight Management, Navigation

Section 11

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AHRU ATT MODE L, R

Condition: The AHRU is only providing pitch and roll guidance.





[] FMC

Condition: All 3 FMCs are failed.

- 1 LNAV and VNAV modes are inoperative. Select different autopilot roll and pitch modes.

Note: Current latitude and longitude are shown on the ALTN NAV page.

- Note: Inoperative Items**
- LNAV inop**
- VNAV inop**
- All maps inop**
- All CDU pages inop**
- All navigation radios inop except ILS and GLS**
- All navigation functions inop except TCP ALTN NAV**

- 2 **The following steps set up alternate navigation.**
- 3 Tuning and control panel
NAV key Push
- 4 Use the TCP to enter the latitude and longitude of the next waypoint or the destination runway on the ALTN NAV page.

Enter latitude in DDMM.M format.

Enter longitude in DDDMM.M format.
- 5 HEADING REF switch. TRUE
- 6 MCP HDG/TRK reference switch TRK
- 7 Use TRK SEL mode to set the needed track.

▼ Continued on next page ▼

▼ FMC continued ▼

Note: Monitor TRK TO on the TCP ALTN NAV page, and update the MCP-selected track as needed.

Note: For flap maneuvering speeds, refer to the VREF table in the Performance Inflight chapter and to the Flap Maneuver Speed table below:

FLAP POSITION	MANEUVER SPEED
FLAPS UP	VREF 30 + 80 or above lower amber band, whichever is higher
FLAPS 1	VREF 30 + 60
FLAPS 5	VREF 30 + 40
FLAPS 15	VREF 30 + 20
FLAPS 20	VREF 30 + 20
FLAPS 25	VREF 25
FLAPS 30	VREF 30

8 LDG ALT selector PULL ON, set manually

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

LANDING ALTITUDE

10 **Checklist Complete Except Deferred Items**

Deferred Items

Descent Checklist

Recall Checked

Notes Checked

▼ Continued on next page ▼

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▼FMC continued▼

Autobrake ____
Landing data VREF ____, Minimums____
Approach briefing Completed

The following steps tune the ILS.

TCP NAV key Push
TCP NEXT PAGE key Push
TCP CTRL line select key ON

Use the TCP to tune the left ILS or GLS by entering the published ILS frequency and course, or the GLS channel.

ILS or GLS deviation pointers will show on the captain’s PFD. The first officer’s ILS or GLS information may be incorrect. Flight director and ILS or GLS approach mode may be inoperative.

If needed, select NORM on the HEADING REF switch for the approach.

Approach Checklist

Altimeters ____

Landing Checklist

Speedbrake ARMED
Landing gear DOWN

▼ Continued on next page ▼

▼ **FMC continued** ▼

Flaps _____



Additional Information

To convert true heading to magnetic heading, do one of the following:

- Subtract the eastern variation from true heading
- Add the western variation to true heading

[] FMC HOLD AIRSPACE

Condition: The FMC calculated holding pattern is larger than the holding pattern airspace protection.

- 1 Decrease airspeed or advise ATC you are unable to comply with the holding airspace limits.



FMC INTERCEPT HDG

Condition: Both of these occur:

- LNAV is armed
- The airplane is not on an intercept heading to the active leg



FMC MESSAGE

Condition: An alerting message is in the CDU help window.



[] FMC PERF UNAVAIL

Condition: VNAV is selected and one or more of these is not entered:

- Gross weight
- Cost index
- Cruise altitude

- 1 Select the FMC PERF INIT page. Ensure that all needed data is entered.

**FMC RUNWAY DISAGREE**

Condition: The airplane is not on the FMC origin runway when takeoff is attempted.

**FMC UNABLE RTA**

Condition: The FMC is unable to reach the RTA fix at the Required Time of Arrival.



[] FMC VERIFY POSITION

Condition: The inputs to the FMC position disagree.

- 1 On the CDU, go to POS REF Page 4.
- 2 SENSOR SELECT line select key ON
- 3 Find the sensor with the largest position error and select it. The sensor indicates OFF and is not used for the FMC position calculation.
- 4 On the CDU, go to POS REF Page 2.
- 5 Select POS UPDATE ARM key.
- 6 Find the most accurate position.
- 7 Select the NOW key for that position.



[] GPS

Condition: Both GPS receivers are failed.

Note: GPS position data is unavailable. Navigation capability may be reduced. If the equipment and navigation aids for all other approach types are inoperative, instrument approach capability may be unavailable.



[] INSUFFICIENT FUEL

Condition: FMC estimated fuel at the destination is less than the entered RESERVES fuel.

- 1 The INSUFFICIENT FUEL 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 12.22

- 3 Verify that the active route and FMC data are correct.
- 4 Verify that there is sufficient fuel to complete the flight.



[] IRU/AHRU MOTION

Condition: The airplane moves while the IRS aligns.

- 1 The airplane must be stopped to allow IRS alignment to complete.
- 2 **When** the IRU/AHRU align mode memo messages blank:

Continue normal operation.



IRU ATT MODE L, R

Condition: The IRU is only providing pitch and roll guidance.



[] LNAV BANK ANGLE LIM

Condition: The airplane may not follow an LNAV turn because bank angle is limited by available thrust or buffet.

- 1 If unable to stay within protected airspace, advise ATC.





[] NAV AIR DATA SYS

Condition: The three air data sources disagree.

- 1 Avoid abrupt control inputs and high maneuvering loads. Airplane response is changed by simplified control laws.

Note: The maximum speed indication may show at 250 knots. Disregard this indication and refer to the table below:

ALTITUDE (feet)	SPEED (knots)
Above 40,000	250
38,001 to 40,000	260
35,001 to 38,000	270
At or below 35,000	290

Note: Thrust asymmetry protection is inoperative. Maintain airspeed at or above 130 knots.

Note: Airspeed is calculated using angle of attack. AOA SPD may be erratic during configuration changes, maneuvering, and speedbrake use.

Altitude is from GPS and is approximately equal to MSL altitude. Altimeter cannot be used to accurately maintain ATC-assigned altitudes.

- 2 Tuning and control panel GPWS key Push
- 3 GPWS FLAP OVRD line select key OVRD

▼ Continued on next page ▼

▼ NAV AIR DATA SYS continued ▼**Note: Inoperative Items****Autopilot inop****Autothrottles inop****Flight directors inop****Envelope protection functions inop**

Note: Yaw damper is degraded.

Manual control inputs are needed to compensate for asymmetric thrust conditions.

Use flaps 20 and VREF 20 for landing. If VREF 20 is less than 130 knots, use 130 knots for VREF 20. This ensures sufficient pitch trim and directional control capability for landing.

Avoid speedbrake use in flight.

Do not arm the speedbrake lever. This prevents inadvertent in-flight speedbrake extension.

Manually extend the speedbrakes after landing.

Run the engine and wing anti-ice systems manually.

Some or all ground proximity alerts are not available. Ground proximity alerts that occur are valid.

Some or all windshear alerts are not available. Windshear alerts that occur are valid.

▼ Continued on next page ▼



▼NAV AIR DATA SYS continued▼

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

- ICE DETECTORS
- THRUST ASYM PROT
- AUTO SPEEDBRAKE
- FLIGHT CONTROL MODE
- GND PROX SYS
- WINDSHEAR SYS

5 **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 **DOWN**
- Landing gear DOWN

▼ Continued on next page ▼



▼NAV AIR DATA SYS continued▼

Flaps.20





[] NAV AIRSPEED DATA

Condition: Backup source for airspeed is being used instead of air data.

- 1 Avoid abrupt control inputs and high maneuvering loads. Airplane response is changed by simplified control laws.

Note: The maximum speed indication may show at 250 knots. Disregard this indication and refer to the table below:

ALTITUDE (feet)	SPEED (knots)
Above 40,000	250
38,001 to 40,000	260
35,001 to 38,000	270
At or below 35,000	290

Note: Thrust asymmetry protection is inoperative. Maintain airspeed at or above 130 knots.

Note: Airspeed is calculated using angle of attack. AOA SPD may be erratic during configuration changes, maneuvering, and speedbrake use.

- 2 Tuning and control panel GPWS key Push
- 3 GPWS FLAP OVRD line select key OVRD

Note: Inoperative Items

Autopilot inop

Autothrottles inop

Flight directors inop

Envelope protection functions inop

▼ Continued on next page ▼

▼ NAV AIRSPEED DATA continued ▼

Note: Yaw damper is degraded.

Manual control inputs are needed to compensate for asymmetric thrust conditions.

Use flaps 20 and VREF 20 for landing. If VREF 20 is less than 130 knots, use 130 knots for VREF 20. This ensures sufficient pitch trim and directional control capability for landing.

Avoid speedbrake use in flight.

Do not arm the speedbrake lever. This prevents inadvertent in-flight speedbrake extension.

Manually extend the speedbrakes after landing.

Run the engine and wing anti-ice systems manually.

Some or all ground proximity alerts are not available. Ground proximity alerts that occur are valid.

Some or all windshear alerts are not available. Windshear alerts that occur are valid.

▼ Continued on next page ▼



▼NAV AIRSPEED DATA continued▼

- 4 Do **not** accomplish the following checklists:
 - ICE DETECTORS
 - THRUST ASYM PROT
 - AUTO SPEEDBRAKE
 - FLIGHT CONTROL MODE
 - GND PROX SYS
 - WINDSHEAR SYS

5 **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 **DOWN**

Landing gear DOWN

▼ Continued on next page ▼

▼NAV AIRSPEED DATA continued▼Flaps. **20****NAV APPROACH GLS**

Condition: Both GLS systems are failed.

**NAV APPROACH ILS**

Condition: Both ILS systems are failed.



[] NAV INERTIAL SYS

Condition: The IRS cannot supply correct attitude, position, track, heading, and groundspeed data.

- 1 Plan to land at the nearest suitable airport.

Note: Thrust asymmetry protection is inoperative. Maintain airspeed at or above 130 knots.

- 2 Avoid abrupt control inputs and high maneuvering loads. Airplane response is changed by simplified control laws.
- 3 GPS continues to give position and track information.
- 4 ND map display orientation changes from heading up to track up.

▼ Continued on next page ▼

▼ NAV INERTIAL SYS continued ▼

Note: Inoperative Items
Autopilot inop
Flight director inop
Envelope protection functions inop
All attitude information is lost from the IRUs and AHRUs

Both PFDs and HUDs show attitude information from the Integrated Standby Flight Display.

FMC performance information is unavailable
VNAV inop
ND heading bug inop
ND wind information inop
PFD flap maneuvering speeds inop
PFD vertical speed indicator inop
Thrust asymmetry protection inop
Autobrake inop
A windshear system fault occurs

Windshear alerts that occur are valid.

A ground proximity warning system fault occurs

Ground proximity alerts that occur are valid.

A configuration warning system fault occurs

Radio altitude voice callouts and other aural alerts may not be available.

▼ Continued on next page ▼



▼ NAV INERTIAL SYS continued ▼

Terrain position data is lost

Position data for the ND terrain map and look-ahead terrain alerts are lost.

The air/ground thrust reverser logic is failed

Thrust reverser in-flight protection is failed. Reversers will deploy in flight if commanded. The ENG REV AIR/GND EICAS caution message will show at touchdown.

Note: Refer to the Flap Maneuver Speed table below:

FLAP POSITION	MANEUVER SPEED
FLAPS UP	VREF 30 + 80 or above lower amber band, whichever is higher
FLAPS 1	VREF 30 + 60
FLAPS 5	VREF 30 + 40
FLAPS 15	VREF 30 + 20
FLAPS 20	VREF 30 + 20
FLAPS 25	VREF 25
FLAPS 30	VREF 30

Note: If GPS is not available, the ND map mode is inoperative.

- 5 Tuning and control panel
GPWS key Push
- 6 GPWS FLAP OVRD
line select key OVRD

▼ Continued on next page ▼

▼ NAV INERTIAL SYS 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. If VREF 20 is less than 130 knots, use 130 knots for VREF 20. This ensures sufficient pitch trim and directional control capability for landing.

Do not arm the speedbrake lever. This prevents inadvertent in-flight speedbrake extension.

Manually extend the speedbrakes after landing.

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

THRUST ASYM PROT

ENG REV AIR/GND

AUTO SPEEDBRAKE

FLIGHT CONTROL MODE

SGL SOURCE ATTITUDE

CONFIG WARNING SYS

GND PROX SYS

TERR POS

WINDSHEAR SYS

8 **Checklist Complete Except Deferred Items**

▼ Continued on next page ▼



▼ NAV INERTIAL SYS 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**



[] NAV IRU

Condition: Both IRUs are inoperative.

Note: GPS navigation is available. Consider navigation equipment requirements for airspace on the route.



NAV SINGLE GPS

Condition: Only a single GPS is operating.



[] 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.



[] RWY/APP CRS ERROR

Condition: The selected ILS course and the FMC runway course disagree.

- 1 Select the FMC NAV RADIO page.
- 2 Delete the manually entered ILS frequency, or select the correct course for the manually entered frequency.

**[] RWY/APP TUNE ERROR**

Condition: One of these occurs:

- The tuned ILS frequency and the FMC runway frequency disagree
- The tuned GLS channel and the FMC runway channel disagree

- 1 Select the FMC NAV RADIO page.
- 2 Delete manually entered ILS frequency or GLS channel, or select the correct procedure on DEP/ARR page.

**SINGLE FMC**

Condition: Only a single FMC is operating.



SGL SOURCE APPROACH

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



SINGLE SOURCE FD

Condition: Both PFDs and HUDs use the same flight director source.



TCP ALTN NAV

Condition: The tuning and control panel alternate navigation control is used.



TRANSPONDER

Condition: The transponders are failed.





[] TRANSPONDER PANEL

Condition: One of these occurs:

- The transponder panel is failed
- TCP backup control of the transponder is used

- 1 TCP MENU key Push
- 2 ALERT/XPDR CTRL ON
- 3 ALERT/XPDR Select

Note: TCP control of the glideslope inhibit, transponder mode, and aural cancel controls is accessed from the TCP MENU page.



[] VNAV STEP CLIMB

Condition: A FMC-predicted or manually-entered VNAV step climb point has sequenced and the climb has not started.

Objective: To update the VNAV profile so the FMC fuel and ETA predictions are accurate.

1 Choose one:

◆ Step climb is needed **now**:

Start a step climb.



◆ Step climb is needed **later**:

Enter a planned step climb altitude on the RTE LEGS page.



◆ Step climb is **not** needed:

Enter a step size of 0 on the VNAV CRZ page. This ensures the best FMC fuel and ETA predictions.



WEATHER RADAR SYS

Condition: The weather radar system is inoperative.



Intentionally
Blank



Non-Normal Checklists

Chapter NNC

Fuel

Section 12

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Intentionally
Blank

[] FUEL AUTO JETTISON

Condition: One of these occurs:

- The total fuel quantity is less than 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:

◆ One or more tank quantity displays are **blank**:

Determine jettison time using the following rates:

Fuel in center tank: 3000 lbs/minute

Center tank empty: 1250 lbs/minute

▶▶ **Go to step 2**

◆ All tank quantity displays **stay shown**:

▶▶ **Go to step 2**

2 FUEL TO REMAIN selector Pull ON,
set manually

This will enable jettison complete alerting.

3 FUEL JETTISON NOZZLE
valve switches (both) ON

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

Fuel Jettison

▼ 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
- FUEL TO REMAIN selector 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.



◆FUEL line on PERF INIT page **shows**:





Intentionally
Blank



[] FUEL BALANCE SYS

Condition: One of these occurs:

- The fuel balance system is failed
- A center tank pump is on
- On the ground and one or both engines are running
- In flight and the fuel jettison system is active, or the FUEL DISAGREE or FUEL QTY LOW message shows

Objective: To manually balance fuel.

- 1 FUEL BALANCE switch Push to Off
Ensure the ON light is extinguished.
- 2 FUEL CROSSFEED switch On

▼ Continued on next page ▼

▼ FUEL BALANCE SYS continued ▼

3 Choose one:

◆ **Left** main tank quantity is low:

L FUEL PUMPS FWD and AFT
switches (both) Off

Do **not** accomplish the following checklists:

FUEL PUMP L AFT

FUEL PUMP L FWD

►► **Go to step 4**

◆ **Right** main tank quantity is low:

R FUEL PUMPS FWD and AFT
switches (both) Off

Do **not** accomplish the following checklists:

FUEL PUMP R AFT

FUEL PUMP R FWD

►► **Go to step 4**

4 **When** fuel balancing is complete:

FUEL PUMPS FWD and AFT
switches (all) ON

FUEL CROSSFEED switch. Off





[] FUEL CROSSFEED

Condition: The fuel crossfeed valve is not in the commanded position.

1 FUEL CROSSFEED switch Off

2 Choose one:

◆ FUEL CROSSFEED message **shows**:

Note: The fuel crossfeed valve may be open for the rest of the flight.



◆ FUEL CROSSFEED message is **blank**:

Note: Fuel crossfeed is not available.

Do **not** accomplish the following checklist:

FUEL BALANCE SYS





Intentionally
Blank

[] FUEL DISAGREE

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 12.22

- 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
■ ■ ■ ■



[] FUEL FLOW ENG L, R

Condition: Engine fuel flow is abnormally high.

Objective: To confirm if there is an engine fuel leak. If confirmed, to shut down the engine.

- 1 A diversion may be needed.
- 2 FUEL BALANCE switch Push to Off
Ensure the ON light is extinguished.
- 3 FUEL L PUMPS and R PUMPS
switches (all) ON
- 4 FUEL CROSSFEED switch Off
- 5 FUEL CENTER PUMPS switches (both) Off
The FUEL IN CENTER message may show.
- 6 **The following steps check for an engine fuel leak.**
- 7 Record the main tank fuel quantities and the current time.
- 8 An engine fuel leak is confirmed if one or both of the following are true:
 - Fuel spray is observed from an engine
 - A change in fuel imbalance of 1,000 lbs within 30 minutes or less

▼ Continued on next page ▼

▼ FUEL FLOW ENG L, R continued ▼

9 Choose one:

◆ Engine fuel leak is **confirmed**:

▶▶ **Go to step 10**

◆ Engine fuel leak is **not** confirmed:

Resume normal fuel management.



10 The following steps shut down the engine to stop an engine fuel leak.

11 A/T ARM switch

(affected engine) Confirm OFF

12 Thrust lever

(affected engine) Confirm Idle

13 FUEL CONTROL switch

(affected engine) Confirm . . . CUTOFF

This closes the spar valve and stops an engine fuel leak.

14 APU selector

(if APU available) START, then ON

15 TRANSPONDER MODE selector TA ONLY

▼ Continued on next page ▼



▼ FUEL FLOW ENG L, R continued ▼

16 Choose one:

- ◆ FUEL IN CENTER message **shows**:
FUEL CENTER PUMPS switches
(both) ON
▶▶ **Go to step 17**
- ◆ FUEL IN CENTER message is blank:
▶▶ **Go to step 17**

17 Plan to land at the nearest suitable airport.

Note: Do **not** accomplish the Fuel Leak checklist.

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.

The engine fuel leak indicated by the FUEL FLOW ENG message is a leak after the fuel flow sensors. The FUEL DISAGREE message will not show.

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

- Fuel Leak
- AUTOTHROTTLE

▼ Continued on next page ▼

▼ FUEL FLOW ENG L, R continued ▼

19 Choose one:

◆ Landing using flaps **20**:

Tuning and control panel
GPWS key. Push

GPWS FLAP OVRD
line select key OVRD

Note: Use flaps 20 and VREF 20 for landing and flaps 5 for go-around. Buffet may be felt with flaps extended.

▶▶ 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. Buffet may be felt with flaps extended.

▶▶ Go to step 20

20 Checklist Complete Except Deferred Items

▼ Continued on next page ▼

▼ FUEL FLOW ENG L, R continued ▼

Deferred Items

Descent Checklist

Recall Checked

Notes. Checked

Autobrake _____

Landing data VREF 20____ or VREF 30____,
Minimums

Approach briefing Completed

Approach Checklist

Altimeters _____

Landing Checklist

Speedbrake ARMED

Landing gear DOWN

Flaps.....20 or 30



[] 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 engine damage 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 12.22

▼ Continued on next page ▼



▼ FUEL IMBALANCE continued ▼

4 The fuel balance system is inhibited (not available) if any of these occur:

- A center tank pump is on
- On the ground and one or both engines are running
- In flight and the fuel jettison system is active, or the FUEL DISAGREE or FUEL QTY LOW message shows

5 Choose one:

- ◆ Fuel balance system is **available**:
 - ▶▶ Go to step 6
- ◆ Fuel balance system is **not** available:
 - ▶▶▶ Go to step 8

6 FUEL BALANCE switch Push and hold for 1 second

7 The fuel balance system may take up to 30 seconds to activate.



8 FUEL BALANCE switch Push to Off
Ensure the ON light is extinguished.

9 FUEL CROSSFEED switch On

▼ Continued on next page ▼

▼ FUEL IMBALANCE continued ▼

10 Choose one:

◆ **Left** main tank quantity is low:

L FUEL PUMPS FWD and AFT
switches (both) Off

Do **not** accomplish the following checklists:

FUEL PUMP L AFT

FUEL PUMP L FWD

►► **Go to step 11**

◆ **Right** main tank quantity is low:

R FUEL PUMPS FWD and AFT
switches (both) Off

Do **not** accomplish the following checklists:

FUEL PUMP R AFT

FUEL PUMP R FWD

►► **Go to step 11**

11 **When** fuel balancing is complete:

FUEL PUMPS FWD and AFT
switches (all) ON

FUEL CROSSFEED switch. Off





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: The jettison nozzle valve is not in the commanded position.



Fuel Jettison

Condition: Fuel jettison is needed.

Note: Do not jettison fuel at flaps 20, 25, or 30.

1 FUEL JETTISON ARM switch ARMED

2 Choose one:

◆ FUEL TO REMAIN is **acceptable**:

▶▶ **Go to step 3**

◆ FUEL TO REMAIN must be **changed**:

FUEL TO REMAIN
selector PULL ON,
set manually

▶▶ **Go to step 3**

3 FUEL JETTISON NOZZLE
valve switches (both) ON

▼ **Continued on next page** ▼

▼ **Fuel Jettison continued** ▼

4 **When** fuel jettison is complete:

FUEL JETTISON NOZZLE
valve switches (both) Off

FUEL TO REMAIN selector Off

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 checklists:

Fuel Jettison

FUEL AUTO JETTISON

3 **When** the center tank is empty or the FUEL TO REMAIN quantity is reached:

FUEL JETTISON NOZZLE
valve switches (both) Off

FUEL JETTISON ARM switch Off

FUEL TO REMAIN selector Off





[] FUEL JETTISON SYS

Condition: One of these occurs:

- The fuel jettison system is failed
- The fuel to remain selector is ON and the fuel jettison system is not armed

1 FUEL TO REMAIN selector Off

2 **Wait** 5 seconds.

3 Choose one:

◆ FUEL JETTISON SYS message **blanks**:



◆ FUEL JETTISON SYS message **shows**:

Note: The fuel jettison system is failed.
Fuel jettison is not available.

►► Go to step 4

4 FUEL JETTISON NOZZLE
valve switches (both) Off

5 FUEL JETTISON ARM switch Off

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

Fuel Jettison





Intentionally
Blank



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 BALANCE switch Push to Off
Ensure the ON light is extinguished.

3 FUEL L PUMPS and R PUMPS
switches (all) ON

4 FUEL CROSSFEED switch Off

5 FUEL CENTER PUMPS switches (both) Off
The FUEL IN CENTER message may show.

6 **The following steps check for an engine or main tank leak.**

7 Record the main tank fuel quantities and the current time.

8 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

▼ Continued on next page ▼

▼ **Fuel Leak continued ▼**

A change in fuel imbalance of 1,000 lbs within 30 minutes or less

9 Choose one:

◆ Engine/main tank leak is **confirmed**:

▶▶ **Go to step 20**

◆ Engine/main tank leak is **not** confirmed:

▶▶ **Go to step 10**

10 Choose one:

◆ FUEL IN CENTER message **shows**:

▶▶ **Go to step 11**

◆ FUEL IN CENTER message **is blank**:

Resume normal fuel management.



11 The following steps check for a center tank leak.

12 Fuel CENTER PUMPS switches (both) ON

13 Select PROGRESS page 2.

14 Record the totalizer and calculated fuel quantities, and the current time.

15 A center tank leak is confirmed if the difference between calculated and totalizer increases by 1,000 lbs within 30 minutes or less.

▼ **Continued on next page ▼**

▼ Fuel Leak continued ▼

16 Choose one:

◆ Center tank leak is **confirmed**:

▶▶ **Go to step 17**

◆ Center tank leak is **not** confirmed:

Resume normal fuel management.



17 Continue to use all center tank fuel.

18 Verify that sufficient fuel is available in the left and right main tanks to complete the flight.

Note: If the FUEL DISAGREE message shows at any time, go to PROGRESS page 2 and select the TOTALIZER fuel quantity.

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

FUEL DISAGREE



20 **An engine/main tank leak is confirmed. The following steps shut down the engine to stop an engine fuel leak.**

21 The affected engine is on the side where the fuel quantity decreased faster.

22 A/T ARM switch
(affected engine) Confirm OFF

23 Thrust lever
(affected engine) Confirm Idle

▼ Continued on next page ▼

▼ Fuel Leak continued ▼

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

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

26 TRANSPONDER MODE selector TA ONLY

27 Choose one:

◆ FUEL QTY LOW message **shows**:

FUEL CROSSFEED switch On

This ensures that all fuel is available
to the running engine.

▶▶ **Go to step 28**

◆ FUEL QTY LOW message **is blank**:

▶▶ **Go to step 28**

28 Choose one:

◆ FUEL IN CENTER message **shows**:

Fuel CENTER PUMP switch
(on side with running engine) ON

▶▶ **Go to step 29**

◆ FUEL IN CENTER message is blank:

▶▶ **Go to step 29**

29 Plan to land at the nearest suitable airport.

30 Select PROGRESS page 2.

31 TOTALIZER Select

▼ Continued on next page ▼

▼ Fuel Leak continued ▼

32 Choose one:

◆ Landing using flaps **20**:

Tuning and control panel

GPWS key Push

GPWS FLAP OVRD

line select key OVRD

Note: Use flaps 20 and VREF 20 for landing and flaps 5 for go-around. Buffet may be felt with flaps extended.

▶▶ Go to step 33

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

Note: Use flaps 30 and VREF 30 for landing and flaps 20 for go-around. Buffet may be felt with flaps extended.

▶▶ Go to step 33

33 The following steps check for a main tank leak.

34 Select PROGRESS page 2.

35 Record the totalizer and calculated fuel quantities, and the current time.

36 A main tank leak is confirmed if the difference between calculated and totalizer increases by 1,000 lbs within 30 minutes or less.

▼ Continued on next page ▼

▼ Fuel Leak continued ▼

37 Choose one:

◆ A main tank leak is **confirmed**:

▶▶ **Go to step 38**

◆ A main tank leak is **not** confirmed:

▶▶ **Go to step 41**

38 The leak is not an engine fuel leak. The engine may be re-started.

39 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.

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

FUEL IMBALANCE

▶▶ **Go to step 42**

41 The fuel 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.

▼ Continued on next page ▼



▼ Fuel Leak continued ▼

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

- AUTOTHROTTLE L
- AUTOTHROTTLE R
- FUEL DISAGREE

43 Checklist Complete Except Deferred Items

Deferred Items

Descent Checklist

- Recall Checked
- Notes. Checked
- Autobrake _____
- Landing data **VREF 20_____ or VREF 30_____,**
Minimums_____
- Approach briefing Completed

Approach Checklist

- Altimeters _____

Landing Checklist

- Speedbrake ARMED
- Landing gear DOWN
- Flaps. **20 or 30**



▼ 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
- The FUEL DISAGREE message shows
- The FUEL IMBALANCE message shows
- The FUEL QTY LOW message shows
- The INSUFFICIENT FUEL message shows

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 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** 35,000 feet:
 - ▶▶ **Go to step 4**
 - ◆ Airplane altitude is **above** 35,000 feet:
 - ▶▶ **Go to step 2**
- 2 FUEL CROSSFEED switch On
This allows fuel from the operative pump side to feed both engines.
- 3 Descend to 35,000 feet or lower.
- 4 **When** airplane altitude is at or below 35,000 feet:
FUEL CROSSFEED switch Off
This restores main tank-to-engine fuel feed. The FUEL PRESS ENG message shows again.

▼ Continued on next page ▼

▼ **FUEL PRESS ENG L, R continued** ▼

Note: Do not climb above 35,000 feet for the rest of the flight.

Continue suction feed. Do not open the crossfeed valve unless an engine restart is needed.

If engine flameout occurs at any time, immediately open the fuel crossfeed valve. Close the crossfeed valve when the engine is running normally.

The fuel balance system is inoperative. Do not balance fuel.

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

FUEL PUMP AFT (affected side)

FUEL PUMP FWD (affected side)

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 center fuel pump pressure is low.

- 1 FUEL CROSSFEED switch On
- 2 **Wait** 20 seconds.
- 3 Choose one:

◆ FUEL CROSSFEED amber advisory message is **blank**:

FUEL CENTER PUMP switch
(affected pump) Off

When FUEL LOW CENTER message shows:

FUEL CROSSFEED switch Off

FUEL CENTER PUMPS switch
(opposite pump) Off

■ ■ ■ ■

◆ FUEL CROSSFEED amber advisory message **shows**:

►► **Go to step 4**

- 4 FUEL CROSSFEED switch Off
- 5 FUEL CENTER PUMPS switches (both) Off

This prevents a lateral imbalance from developing. The scavenge system will transfer center fuel to the main tanks.

- 6 The FUEL IN CENTER message may show. Leave the center pump switches off.

▼ **Continued on next page** ▼

▼ **FUEL PUMP CENTER L, R continued ▼**

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

FUEL CROSSFEED



[] FUEL PUMP CTR L+R

Condition: Both center fuel pump pressures are low.

- 1 FUEL CROSSFEED switch Off
- 2 FUEL CENTER PUMPS switches (both) Off
- 3 The FUEL IN CENTER message may show. Leave the center pump switches off.
- 4 Center tank fuel is available. The scavenge system will transfer center fuel to the main tanks.



[] FUEL PUMP L AFT, FWD

Condition: The left fuel pump pressure is low.

- 1 L FUEL PUMPS switch (affected pump) Off



[] FUEL PUMP R AFT, FWD

Condition: The right fuel pump pressure is low.

- 1 R FUEL PUMPS switch (affected pump) Off



[] 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 12.22

▼ Continued on next page ▼

▼ FUEL QTY LOW continued ▼

- 3 FUEL CROSSFEED switch On

This ensures that fuel is available to both engines if the low tank empties.

- 4 FUEL PUMPS switches (all). ON

This ensures that all fuel is available for use.

- 5 Plan to land at the nearest suitable airport.

- 6 Tuning and control panel GPWS key Push

- 7 GPWS FLAP OVRD line select key OVRD

Note: Use flaps 20 and VREF 20 for landing.
Increased airspeed at flaps 20 gives improved elevator control for landing flare in the event of a dual engine flameout.

▼ Continued on next page ▼



▼ FUEL QTY LOW continued ▼

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

- FUEL PUMP CTR L+R
- FUEL PUMP L AFT
- FUEL PUMP L FWD
- FUEL PUMP R AFT
- FUEL PUMP R FWD
- HYD OVERHEAT C1
- HYD OVERHEAT C2
- HYD OVERHEAT DEM L
- HYD OVERHEAT DEM R
- HYD OVERHEAT PRI L
- HYD OVERHEAT PRI R

9 Checklist Complete Except Deferred Items

Deferred Items

Descent Checklist

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

▼ Continued on next page ▼

▼ FUEL QTY LOW continued ▼

Approach Checklist

Altimeters _____

Landing Checklist

Speedbrake ARMED

Landing gear DOWN

Flaps. **20**



[] FUEL TEMP HIGH

Condition: Fuel temperature is near the maximum.

Objective: To reduce fuel heating caused by the hydraulic/fuel heat exchanger.

- 1 C1 and C2 ELEC pump selectors (both) AUTO
- 2 L and R ELEC DEMAND
pump selectors (both) AUTO

Note: If TS-1 fuel is loaded, do not exceed 35,000 feet.

Avoid extended operation at low altitude.

Delay flap extension as long as practical.

On the ground, do the engine shutdown procedure without delay. This prevents fuel system damage.

- 3 Do **not** accomplish the following checklists:
FUEL PUMP L AFT
FUEL PUMP L FWD
FUEL PUMP R AFT
FUEL PUMP R FWD



[] 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 UNUSABLE CTR

Condition: Center tank fuel is unusable due to faults in one or more of the following:

- Center tank pumps
- Crossfeed valve
- Center tank scavenge system
- Fuel balance system
- Fuel quantity indicating system

1 FUEL CENTER PUMPS
switches (both) Off

The FUEL IN CENTER message shows.

2 FUEL CROSSFEED switch Off

Note: Center tank fuel may not be available.

- 3 Choose one:
- ◆Center tank quantity is **greater than** 30,000 lbs:
Plan to land at the nearest suitable airport.
▶▶Go to step 5
 - ◆Center tank quantity is **less than or equal to** 30,000 lbs:
▶▶Go to step 4

- 4 Check that left and right main tank quantity is sufficient for the planned flight.
- 5 Select the PERF INIT page.
- 6 Add the center tank fuel quantity to the required reserves.

▼ Continued on next page ▼

▼ **FUEL UNUSABLE CTR** continued ▼

Note: If the FUEL QTY LOW message shows at any time, do the FUEL QTY LOW checklist.

Fuel crossfeed is not available.

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

FUEL CROSSFEED



[] 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



Intentionally
Blank



Non-Normal Checklists

Chapter NNC

Hydraulics

Section 13

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Intentionally
Blank

[] HYD OVERHEAT C1

Condition: The C1 pump temperature is high.

- 1 C1 ELEC pump selector OFF
- 2 Do **not** accomplish the following checklist:

HYD PRESS C1



[] HYD OVERHEAT C2

Condition: The C2 pump temperature is high.

- 1 C2 ELEC pump selector OFF
- 2 Do **not** accomplish the following checklist:

HYD PRESS C2



[] HYD OVERHEAT DEM L, R

Condition: The demand pump temperature is high.

- 1 ELEC DEMAND pump selector
(affected side) OFF

Note: Affected thrust reverser deployment may be slower than normal.

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

HYD PRESS DEM





[] HYD OVERHEAT PRI L, R

Condition: The primary pump temperature is high.

- 1 ENG PRIMARY pump switch
(affected side). Off
- 2 Do **not** accomplish the following checklist:
HYD PRESS PRI
■ ■ ■ ■

[] HYD PRESS C1

Condition: The C1 pump pressure is low.

- 1 C1 ELEC pump selector ON
- 2 Choose one:
 - ◆ HYD PRESS C1 message **blanks**:
■ ■ ■ ■
 - ◆ HYD PRESS C1 message **stays shown**:
C1 ELEC pump selector. OFF
■ ■ ■ ■

[] HYD PRESS C2

Condition: The C2 pump pressure is low.

1 C2 ELEC pump selector ON

2 Choose one:

◆ HYD PRESS C2 message **blanks**:



◆ HYD PRESS C2 message **stays shown**:

C2 ELEC pump selector OFF



[] HYD PRESS DEM L, R

Condition: The demand pump pressure is low when commanded on.

1 ELEC DEMAND pump selector
(affected pump) ON

2 Choose one:

◆ HYD PRESS DEM message **blanks**:



◆ HYD PRESS DEM message **stays shown**:

ELEC DEMAND pump selector
(affected pump) OFF

Note: Affected thrust reverser deployment may be slower than normal.





[] HYD PRESS PRI L, R

Condition: The primary pump pressure is low.

- 1 ENG PRIMARY pump switch (affected side) . . . Off
- ■ ■ ■

[] 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 C2 ELEC pump selector ON

2 Choose one:

◆ HYD PRESS SYS C message **blanks**:



◆ HYD PRESS SYS C message **stays shown**:

►► **Go to step 3**

3 C1 ELEC pump selector AUTO

4 C2 ELEC pump selector OFF

5 Tuning and control panel GPWS key Push

6 GPWS FLAP OVRD line select key OVRD

Note: Inoperative Items

Primary flap and slat operation inop

Plan more time for slower flap and slat operation.

Landing gear normal extension inop

Alternate gear extension is needed.

▼ Continued on next page ▼

▼ HYD PRESS SYS C continued ▼

Note: Nose wheel steering may be inoperative. The NOSE WHEEL STEERING message may show after gear extension.

Slats will extend beyond midrange when airspeed is below 225 knots. For go-around, do not exceed 225 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 flap and slat operation in secondary mode.

The autothrottle will maintain a minimum speed of 5 knots above the amber band.

Calculate the non-normal configuration landing distance for an approach speed of 10 knots above VREF.

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.

Buffet may be felt with flaps extended.

Manually extend the speedbrakes after landing.

For go-around, do not exceed the gear EXTEND limit speed (270K/.82M).

Flap retraction is inhibited on the ground. Do not move the flap lever after landing. This prevents unexpected flap motion after maintenance action.

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

AUTO SPEEDBRAKE

SPOILER PAIRS

▼ **Continued on next page** ▼



▼HYD PRESS SYS C continued▼

8 Checklist Complete Except Deferred Items

Deferred Items

Descent Checklist

- Recall Checked
- Notes. Checked
- Autobrake ____
- Landing dataVREF 20____, Minimums____
- Approach briefing Completed

Approach Checklist

- Altimeters ____

Flap extension

Start flap extension as needed.

Alternate gear extension

- Landing gear leverDN
- ALTN GEAR
extend switchPush to DOWN
and hold until all gear
indicate down or in transit

Do **not** accomplish the following checklists:

- FLAPS PRIMARY FAIL
- SLATS PRIMARY FAIL

▼ Continued on next page ▼

▼HYD PRESS SYS C continued▼**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. The right thrust reverser is available.

Note: Roll rate may be reduced in flight.
Speedbrake effectiveness may be reduced in flight and during landing.

Buffet may be felt with flaps extended.

Flap retraction is inhibited on the ground. Do not move the flap lever after landing. This prevents unexpected flap motion after maintenance action.

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 C2 ELEC 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 L ELEC DEMAND pump selector OFF
- 6 C1 ELEC pump selector AUTO
- 7 C2 ELEC pump selector OFF
- 8 Avoid abrupt control inputs and high maneuvering loads. 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 Tuning and control panel GPWS key Push
- 11 GPWS FLAP OVRD line select key OVRD

▼ **Continued on next page** ▼

▼ HYD PRESS SYS L+C continued ▼**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.

Landing gear normal extension inop

Alternate gear extension is needed.

Left thrust reverser inop

Right thrust reverser is available.

▼ Continued on next page ▼

▼ **HYD PRESS SYS L+C continued** ▼

Note: Nose wheel steering may be inoperative. The NOSE WHEEL STEERING message may show after gear extension.

Slats will extend beyond midrange when airspeed is below 225 knots. For go-around, do not exceed 225 knots until slats retract to midrange.

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.

Buffet may be felt with flaps extended.

Manually extend the speedbrakes after landing.

For go-around, do not exceed the gear EXTEND limit speed (270K/.82M).

Flap retraction is inhibited on the ground. Do not move the flap lever after landing. This prevents unexpected flap motion after maintenance action.

▼ **Continued on next page** ▼



▼HYD PRESS SYS L+C continued▼

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

- AUTO SPEEDBRAKE
- FLIGHT CONTROLS
- SPOILER PAIRS

13 Checklist Complete Except Deferred Items

Deferred Items

Descent Checklist

- Recall Checked
- Notes. Checked
- Autobrake ____
- Landing data **VREF 30 + 20**____,
Minimums____
- Approach briefing Completed

Approach Checklist

- Altimeters ____

Flap extension

Start flap extension as needed.

Alternate gear extension

- Landing gear lever DN

▼ Continued on next page ▼

▼ **HYD PRESS SYS L+C continued** ▼

ALTN GEAR

extend switch Push to **DOWN**
and hold until all gear
indicate down or in transit

Do **not** accomplish the following checklists:

FLAPS PRIMARY FAIL

SLATS PRIMARY FAIL

GEAR DOOR

Landing Checklist

Speedbrake **DOWN**

Landing gear **DOWN**

Flaps. **20**



HYD PRESS SYS L+C+R

Condition: All hydraulic system pressures are low.





[] 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.

- 1 L ELEC DEMAND pump selector ON
- 2 R ELEC DEMAND pump selector ON
- 3 Choose one:

◆ HYD PRESS SYS L+R message **blanks**:



◆ HYD PRESS SYS L+R message **stays shown**:

▶▶ **Go to step 4**

- 4 L ENG PRIMARY pump switch Off
- 5 R ENG PRIMARY pump switch. Off
- 6 L ELEC DEMAND pump selector OFF
- 7 R ELEC DEMAND pump selector OFF
- 8 Avoid abrupt control inputs and high maneuvering loads. 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 Tuning and control panel GPWS key Push
- 11 GPWS FLAP OVRD line select key 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

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.

Buffet may be felt with flaps extended.

Flap retraction is inhibited on the ground. Do not move the flap lever after landing. This prevents unexpected flap motion after maintenance action.

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

FLIGHT CONTROLS

SPOILER PAIRS

13 **Checklist Complete Except Deferred Items**

▼ Continued on next page ▼



▼HYD PRESS SYS L+R continued▼

Deferred Items

Descent Checklist

- Recall Checked
- Notes. Checked
- Autobrake ____
- Landing data **VREF 30 + 20____,**
Minimums____
- Approach briefing Completed

Approach Checklist

- Altimeters ____

Landing Checklist

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



[] 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: The right thrust reverser is inoperative. The left thrust reverser is available.

Note: Roll rate may be reduced in flight.
Speedbrake effectiveness may be reduced in flight and during landing.

Buffet may be felt with flaps extended.

For a flaps 25 landing, use VREF 25 + 5. For a flaps 30 landing, use VREF 30 + 5.

Flap retraction is inhibited on the ground. Do not move the flap lever after landing. This prevents unexpected flap motion after maintenance action.

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

SPOILER PAIRS





[] **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.

- 1 C2 ELEC pump selector ON
- 2 R ELEC DEMAND pump selector ON
- 3 Choose one:
 - ◆ HYD PRESS SYS R+C message **blanks**:

■ ■ ■ ■
 - ◆ HYD PRESS SYS R+C message **stays shown**:

▶▶ **Go to step 4**
- 4 C1 ELEC pump selector AUTO
- 5 C2 ELEC pump selector OFF
- 6 R ENG PRIMARY pump switch. Off
- 7 R ELEC DEMAND pump selector OFF
- 8 Avoid abrupt control inputs and high maneuvering loads. 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 Tuning and control panel GPWS key Push
- 11 GPWS FLAP OVRD line select key OVRD

▼ Continued on next page ▼

▼ HYD PRESS SYS R+C continued ▼**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.

Landing gear normal extension inop

Alternate gear extension is needed.

Right thrust reverser inop

Left thrust reverser is available.

▼ Continued on next page ▼

▼HYD PRESS SYS R+C continued▼

Note: Nose wheel steering may be inoperative. The NOSE WHEEL STEERING message may show after gear extension.

Slats will extend beyond midrange when airspeed is below 225 knots. For go-around, do not exceed 225 knots until slats retract to midrange.

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.

Buffet may be felt with flaps extended.

Manually extend the speedbrakes after landing.

For go-around, do not exceed the gear EXTEND limit speed (270K/.82M).

Flap retraction is inhibited on the ground. Do not move the flap lever after landing. This prevents unexpected flap motion after maintenance action.

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

AUTO SPEEDBRAKE

▼ Continued on next page ▼

▼ HYD PRESS SYS R+C continued ▼**FLIGHT CONTROLS****SPOILER PAIRS****13 Checklist Complete Except Deferred Items****Deferred Items****Descent Checklist**

Recall Checked

Notes Checked

Autobrake ____

Landing data **VREF 30 + 20____,**
Minimums____

Approach briefing Completed

Approach Checklist

Altimeters ____

Flap extension

Start flap extension as needed.

▼ Continued on next page ▼



▼HYD PRESS SYS R+C continued▼

Alternate gear extension

Landing gear leverDN
ALTN GEAR
extend switchPush to DOWN
and hold until all gear
indicate down or in transit

Do **not** accomplish the following checklists:

- FLAPS PRIMARY FAIL
- SLATS PRIMARY FAIL
- GEAR DOOR

Landing Checklist

Speedbrake **DOWN**
Landing gear DOWN
Flaps**20**



HYD QTY LOW C, L, R

Condition: The hydraulic quantity is low.



RAT UNLOCKED

Condition: The ram air turbine is not stowed and locked.





Non-Normal Checklists

Chapter NNC

Landing Gear

Section 14

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Intentionally
Blank

[] ANTISKID

Condition: An antiskid system fault occurs.

1 AUTOBRAKE selector. OFF

Note: The autobrake system is inoperative.

Note: Use minimum braking consistent with runway length and conditions to reduce the possibility of a tire blowout.

Do not apply the brakes until the nose wheel is on the ground and the speedbrakes are extended.

Brake initially using light steady pedal pressure. Increase pressure as groundspeed 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 **OFF**
- 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 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.



[] BRAKES

Condition: One or more of these occur:

- Two or more brakes are failed
- A dragging brake is detected

Note: Braking effectiveness is reduced. Refer to the Non-Normal Configuration Landing Distance table in the Performance Inflight chapter for flight planning.





[] GEAR CONTROL

Condition: A landing gear normal extension fault occurs.

Note: Alternate gear extension is needed.

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) if gear cannot be retracted.

- 1 Do **not** accomplish the following checklist:
AUTO SPEEDBRAKE

2 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 ▼

▼ GEAR CONTROL continued ▼

Approach Checklist

Altimeters _____

Flap extension

Start flap extension as needed.

Alternate gear extension

Landing gear lever DN

ALTN GEAR

extend switch Push to DOWN
and hold until all gear
indicate down or in transit

Do **not** accomplish the following checklists:

GEAR DOOR

Landing Checklist

Speedbrake **DOWN**

Landing gear DOWN

Flaps _____





[] 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 is **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 is **DN**:

▶▶ **Go to step 2**

2 **ALTN GEAR**
extend switch. Push to **DOWN**
and hold until all gear
show down or in transit

▼ **Continued on next page** ▼

▼ **GEAR DISAGREE** continued ▼

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

AUTO SPEEDBRAKE

GEAR DOOR

4 **Wait** 30 seconds.

Note: Do not arm the speedbrake lever. This prevents inadvertent in-flight speedbrake extension.

Manually extend the speedbrakes after landing.

5 Choose one:

◆ **All** gear indicate **DOWN**:



◆ **Any** gear indicate **UP or in transit**:

►► **Go to step 6**

6 Plan to land on the available gear.

7 Tuning and control panel GPWS key Push

8 GPWS GEAR OVRD line select key OVRD

▼ **Continued on next page** ▼



▼GEAR DISAGREE continued▼

Note: Use flaps 30 for landing. This gives the slowest landing speed.

Manual speedbrake extension gives better control of the touchdown.

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
- Notes. Checked
- Autobrake ____
- Landing dataVREF 30____, Minimums____
- Approach briefing Completed

Approach Checklist

- Altimeters ____

At pattern altitude:

- OUTFLOW VALVE switches (both)MAN

▼ Continued on next page ▼

▼ **GEAR DISAGREE** continued ▼

OUTFLOW VALVE MANUAL

switches (both) Hold in OPEN
 until the outflow valve
 indications show fully open
 to depressurize the airplane

FUEL PUMPS switches (all) Off

Do **not** accomplish the following checklists:

CABIN ALTITUDE AUTO

FUEL PRESS ENG L

FUEL PRESS ENG R

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 DRAG BRACE L, R

Condition: The main gear is down with the drag brace unlocked.

- 1

Tuning and control panel GPWS key

Push
- 2

GPWS GEAR OVRD line select key

OVRD
- 3

Increase airspeed until the GEAR DRAG BRACE message blanks. Increase to 270 knots/.82 Mach, if needed.
- 4

Choose one:

◆

GEAR DRAG BRACE message **blanks**:

■

■

■

■

◆

GEAR DRAG BRACE message **stays shown**:
- Note:** Use flaps 30 for landing. This gives the slowest landing speed.

Do not arm the speedbrake lever.

Manually extend the speedbrakes after landing.
- Go to step 5
- 5 Checklist Complete Except Deferred Items
- Deferred Items
- Descent Checklist
- Recall Checked

Notes. Checked

Autobrake _____
- ▼ Continued on next page ▼
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August 17, 2012

▼ **GEAR DRAG BRACE L, R continued ▼**

Landing data **VREF 30**____, **Minimums**____

Approach briefing Completed

Approach Checklist

Altimeters ____

At pattern altitude:

FUEL PUMPS switches (all) Off

Do **not** accomplish the following checklists:

FUEL PRESS ENG L

FUEL PRESS ENG R

Landing Checklist

Speedbrake **DOWN**

Landing gear DOWN

Flaps. **30**


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





[] GEAR SIDE BRACE L, R

Condition: The main gear is down with the side brace unlocked.

- 1 Tuning and control panel GPWS key Push
- 2 GPWS GEAR OVRD line select key OVRD
- 3 Decrease airspeed until the GEAR SIDE BRACE message blanks. Decrease to VREF 30 and flaps 30, if needed.
- 4 Choose one:
 - ◆ GEAR SIDE BRACE message **blanks**:

■ ■ ■ ■
 - ◆ GEAR SIDE BRACE message **stays shown**:

Note: Use flaps 30 for landing. This gives the slowest landing speed.

Do not arm the speedbrake lever.

Manually extend the speedbrakes after landing.

►► Go to step 5

5 Checklist Complete Except Deferred Items

Deferred Items

Descent Checklist

Recall Checked

Notes. Checked

Autobrake ____

▼ Continued on next page ▼

▼ GEAR SIDE BRACE L, R continued ▼

Landing data **VREF 30**____, **Minimums**____

Approach briefing Completed

Approach Checklist

Altimeters ____

At pattern altitude:

FUEL PUMPS switches (all) Off

Do **not** accomplish the following checklists:

FUEL PRESS ENG L

FUEL PRESS ENG R

Landing Checklist

Speedbrake **DOWN**

Landing gear DOWN

Flaps. **30**


[] NOSE WHEEL STEERING

Condition: A nose wheel steering fault occurs.

Note: Nose wheel steering using the rudder pedals is inoperative. Use differential braking. Nose wheel steering using the tillers may be inoperative.



TILLER L, R

Condition: The tiller is failed.

**[] 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.





Non-Normal Checklists

Chapter NNC

Warning Systems

Section 15

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AIRSPPEED 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.



AURAL CANCELED

Condition: The crew canceled the aural alert.



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 idle
- The flaps are in a landing position



CONFIG PARKING BRAKE

Condition: The parking brake is set during takeoff.



CONFIG RUDDER

Condition: Rudder trim is not centered during takeoff.



CONFIG SPOILERS

Condition: The speedbrake lever is not down during takeoff.



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.



GPWS FLAP OVRD

Condition: The GPWS flap override is set to OVRD.





GPWS GEAR OVRD

Condition: The GPWS gear override is set to OVRD.



GPWS TERR OVRD

Condition: The GPWS terrain override is set to OVRD.



OVERSPEED

Condition: Airspeed is more than Vmo/Mmo.



PILOT RESPONSE

Condition: Pilot action is not detected during a specified time.



[] 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 affected PFD and HUD.

**[] 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 Operator Developed Information

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787 Flight Crew Operations Manual

Performance Inflight - QRH

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Performance Inflight - QRH

Chapter PI-QRH

General

Section 10

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Climb**Flaps Up, Set Max Climb Thrust****Table 1(a): Based on 250 KIAS**

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)					
		130	150	170	190	210	230
40000 (250 KIAS)	PITCH ATT	3.0	3.0				
	V/S (FT/MIN)	1000	700				
30000 (250 KIAS)	PITCH ATT	5.5	5.5	5.5	5.5	5.5	5.5
	V/S (FT/MIN)	2400	2000	1600	1300	1000	700
20000 (250 KIAS)	PITCH ATT	8.5	8.0	7.5	7.5	7.5	7.5
	V/S (FT/MIN)	3700	3100	2600	2200	1800	1600
10000 (250 KIAS)	PITCH ATT	11.5	10.5	10.0	9.5	9.5	9.0
	V/S (FT/MIN)	4800	4000	3400	3000	2600	2100
SEA LEVEL (250 KIAS)	PITCH ATT	14.5	13.5	12.5	11.5	11.5	11.0
	V/S (FT/MIN)	5600	4800	4100	3600	3200	2800

Table 1(b): Based on 290 KIAS/310 KIAS/.84M

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)					
		130	150	170	190	210	230
40000 (.84M)	PITCH ATT	3.5	3.5	3.5			
	V/S (FT/MIN)	1400	1000	700			
30000 (310 KIAS)	PITCH ATT	3.5	3.5	3.5	3.5	3.0	3.0
	V/S (FT/MIN)	2200	1800	1500	1300	1000	800
20000 (290 KIAS)	PITCH ATT	6.5	6.0	6.0	5.5	5.5	5.5
	V/S (FT/MIN)	3600	3000	2600	2200	1900	1600
10000 (290 KIAS)	PITCH ATT	9.5	8.5	8.0	7.5	7.0	7.0
	V/S (FT/MIN)	4700	4000	3500	3000	2600	2300
SEA LEVEL (290 KIAS)	PITCH ATT	12.5	11.0	10.5	9.5	9.0	9.0
	V/S (FT/MIN)	5800	4900	4300	3800	3300	3000

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Cruise

Flaps Up, Set Thrust for Level Flight

Table 1(a): Based on 250 KIAS

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)					
		130	150	170	190	210	230
40000 (250 KIAS)	PITCH ATT %N1	2.0 83.0	2.5 85.2	2.5 87.7	3.0 90.7		
35000 (250 KIAS)	PITCH ATT %N1	2.0 76.8	2.5 78.7	3.0 81.0	3.5 83.6	4.0 87.3	4.5 91.5
30000 (250 KIAS)	PITCH ATT %N1	2.5 72.3	2.5 73.9	3.0 75.9	3.5 78.1	4.0 81.1	4.5 84.1
25000 (250 KIAS)	PITCH ATT %N1	2.0 68.1	2.5 69.7	3.0 71.5	3.5 73.5	4.5 76.1	5.0 78.8
20000 (250 KIAS)	PITCH ATT %N1	2.0 63.8	2.5 65.3	3.0 67.1	3.5 69.1	4.5 71.7	5.0 74.1
15000 (250 KIAS)	PITCH ATT %N1	2.0 60.0	2.5 61.5	3.0 63.2	3.5 65.3	4.0 67.2	5.0 69.4

Table 1(b): Based on 290 KIAS/310 KIAS/.84M

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)					
		130	150	170	190	210	230
40000 (.84M)	PITCH ATT %N1	2.0 83.7	2.0 85.6	2.5 87.9	3.0 90.7		
35000 (.84M)	PITCH ATT %N1	1.5 81.1	1.5 82.4	2.0 83.9	2.0 85.4	2.5 88.0	2.5 90.8
30000 (310 KIAS)	PITCH ATT %N1	1.0 79.4	1.5 80.2	1.5 81.2	2.0 82.4	2.0 84.1	2.5 86.8
25000 (310 KIAS)	PITCH ATT %N1	1.0 75.4	1.5 76.1	1.5 77.0	2.0 78.0	2.0 79.9	2.5 82.1
20000 (290 KIAS)	PITCH ATT %N1	1.5 68.8	2.0 69.8	2.0 71.1	2.5 72.5	3.0 74.0	3.0 76.0
15000 (290 KIAS)	PITCH ATT %N1	1.5 65.0	1.5 65.9	2.0 67.2	2.5 68.5	2.5 70.1	3.0 71.7

Descent

Flaps Up, Set Idle Thrust

Table 1(a): Based on 250 KIAS

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)					
		130	150	170	190	210	230
40000 (250 KIAS)	PITCH ATT V/S (FT/MIN)	0.0 -1600	0.5 -1500	1.0 -1500	1.0 -1500	1.5 -1600	2.0 -1700
30000 (250 KIAS)	PITCH ATT V/S (FT/MIN)	0.0 -1600	0.5 -1500	1.0 -1400	1.5 -1400	2.0 -1500	2.5 -1500
20000 (250 KIAS)	PITCH ATT V/S (FT/MIN)	-0.5 -1500	0.0 -1400	1.0 -1400	1.5 -1300	2.0 -1400	2.5 -1400
10000 (250 KIAS)	PITCH ATT V/S (FT/MIN)	-1.0 -1400	0.0 -1400	0.5 -1300	1.0 -1300	2.0 -1200	2.0 -1400
SEA LEVEL (250 KIAS)	PITCH ATT V/S (FT/MIN)	-1.0 -1200	0.0 -1100	0.5 -1100	1.0 -1100	2.0 -1100	2.5 -1100

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Descent**Table 1(b): Based on 290 KIAS/310 KIAS/.84M**

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)					
		130	150	170	190	210	230
40000	PITCH ATT	-1.0	-0.5	0.0	0.0	0.5	0.5
(.84M)	V/S (FT/MIN)	-2400	-2200	-2200	-2200	-2300	-2600
30000	PITCH ATT	-2.0	-1.5	-1.0	-0.5	-0.5	0.0
(310 KIAS)	V/S (FT/MIN)	-2700	-2400	-2200	-2100	-2000	-2000
20000	PITCH ATT	-2.0	-1.0	-0.5	0.0	0.5	0.5
(290 KIAS)	V/S (FT/MIN)	-2200	-2000	-1900	-1800	-1700	-1700
10000	PITCH ATT	-2.0	-1.5	-1.0	-0.5	0.0	0.5
(290 KIAS)	V/S (FT/MIN)	-2100	-1900	-1700	-1600	-1600	-1500
SEA LEVEL	PITCH ATT	-2.0	-1.5	-1.0	-0.5	0.0	0.5
(290 KIAS)	V/S (FT/MIN)	-1700	-1500	-1400	-1300	-1300	-1200

Holding**Flaps Up, Set Thrust for Level Flight**

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)					
		130	150	170	190	210	230
10000	PITCH ATT	3.5	4.0	4.0	4.5	4.5	5.0
	%N1	52.0	54.9	57.5	60.4	63.8	67.3
	KIAS	207	216	224	232	241	248
5000	PITCH ATT	3.5	4.0	4.5	4.5	4.5	5.0
	%N1	48.5	51.2	53.8	56.2	58.5	61.0
	KIAS	206	216	224	232	240	248

Terminal Area (5000 FT)**Set Thrust for Level Flight**

FLAP/GEAR POSITION		WEIGHT (1000 KG)					
		130	150	170	190	210	230
FLAPS UP GEAR UP	PITCH ATT	4.0	4.0	4.5	4.5	5.0	5.0
	%N1	49.0	51.8	54.7	57.2	59.7	62.0
	KIAS	207	216	224	232	240	248
FLAPS 1 GEAR UP	PITCH ATT	5.5	5.5	6.0	6.0	6.0	6.0
	%N1	48.8	52.0	54.9	57.8	60.4	62.8
	KIAS	182	191	199	209	219	228
FLAPS 5 GEAR UP	PITCH ATT	3.0	3.0	3.5	3.5	4.0	4.0
	%N1	49.6	52.9	55.9	59.1	61.3	63.7
	KIAS	166	175	184	192	200	208
FLAPS 15 GEAR UP	PITCH ATT	3.5	4.0	4.0	4.5	5.0	5.5
	%N1	50.0	53.5	56.8	59.7	62.7	65.7
	KIAS	146	155	163	172	177	179
FLAPS 20 GEAR DOWN	PITCH ATT	3.0	3.0	3.0	3.0	3.5	4.0
	%N1	59.9	63.5	66.6	69.7	72.1	73.9
	KIAS	146	155	163	172	177	179

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

FLAPS (VREF + INCREMENT)		WEIGHT (1000 KG)					
		130	150	170	190	210	230
FLAPS 20 (VREF20 + 10)	PITCH ATT	0.5	0.5	0.5	0.5	0.5	0.5
	%N1	40.8	43.2	45.0	46.9	49.0	51.1
	KIAS	141	150	156	164	172	180
FLAPS 25 (VREF25 + 10)	PITCH ATT	0.5	0.5	0.5	0.5	0.5	
	%N1	40.6	43.4	45.8	48.1	50.3	*
	KIAS	138	148	156	164	172	
FLAPS 30 (VREF30 + 10)	PITCH ATT	0.5	0.5	0.5	0.5	0.5	
	%N1	45.0	47.8	50.5	52.9	55.3	*
	KIAS	135	145	153	161	169	

*Exceeds flap placard speed

Go-Around

Flaps 20, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)					
		130	150	170	190	210	230
10000	PITCH ATT	12.0	10.0	8.5	7.5	7.0	6.5
	V/S (FT/MIN)	3100	2600	2200	1900	1600	1200
	KIAS	147	157	165	173	178	179
5000	PITCH ATT	14.5	12.0	10.5	9.0	8.5	8.0
	V/S (FT/MIN)	3600	3000	2600	2200	1900	1500
	KIAS	147	156	164	172	177	179
SEA LEVEL	PITCH ATT	17.5	14.5	12.5	11.0	10.0	9.0
	V/S (FT/MIN)	4000	3400	3000	2600	2300	1900
	KIAS	147	156	163	171	176	179

ISFD Airspeed and Altitude Correction

Applicable to low speed operations below 15000 ft pressure altitude

Flaps Up and 1**Table 1 of 2: ISFD Airspeed**

TARGET AIRSPEED (KIAS)	WEIGHT (1000 KG)							
	100	120	140	160	180	200	220	240
196	194	194	195	196	197	198	200	202
200	198	198	199	200	201	202	203	205
204	202	202	203	203	204	205	207	208
208	206	206	206	207	208	209	210	212
212	210	210	210	211	211	212	214	215
216	214	214	214	215	215	216	217	218
220	218	218	218	218	219	220	221	222
230	228	228	228	228	228	229	230	231
240	238	238	238	238	238	238	239	240
260	258	258	257	257	258	258	258	258
280	278	278	277	277	277	277	277	278
300	299	298	298	297	297	297	297	297
320	320	319	318	317	317	317	317	317
340	341	339	338	338	337	337	337	337
360		360	359	358	358	357	357	357

Table 2 of 2: Pressure Altitude Adjustment

ISFD AIRSPEED (KIAS)	WEIGHT (1000 KG)							
	100	120	140	160	180	200	220	240
196	40	30	20	0	-20	-50	-80	-120
200	40	40	30	10	-10	-40	-70	-110
204	40	40	30	20	0	-30	-60	-90
208	50	40	40	20	0	-20	-50	-80
212	50	50	40	30	10	-10	-40	-70
216	50	50	40	30	20	0	-30	-60
220	50	50	50	40	30	10	-20	-40
230	60	60	60	50	40	30	10	-20
240	60	60	60	60	50	40	30	10
260	60	70	70	80	70	70	60	40
280	50	70	80	90	90	90	80	70
300	30	60	80	100	100	100	100	100
320	10	50	80	100	110	120	120	120
340	-40	30	60	90	110	120	130	130
360		-10	40	80	100	120	140	150

Actual altitude = ISFD altitude + pressure altitude adjustment.

ISFD Airspeed and Altitude Correction

Applicable to low speed operations below 15000 ft pressure altitude

Flaps 5

Table 1 of 2: ISFD Airspeed

TARGET AIRSPEED (KIAS)	WEIGHT (1000 KG)							
	100	120	140	160	180	200	220	240
156	153	154	155	156	158	161	165	171
160	157	158	158	160	161	164	167	171
164	161	161	162	163	165	167	169	173
168	165	165	166	167	168	170	172	175
172	169	169	170	170	171	173	175	177
176	173	173	173	174	175	176	178	180
180	177	177	177	178	178	180	181	183
190	187	187	187	187	188	188	189	191
200	197	196	196	197	197	197	198	199
210	207	206	206	206	206	207	207	208
220	217	217	216	216	216	216	217	217
230	227	227	226	226	226	226	226	226
240	237	237	236	236	236	236	236	236

Table 2 of 2: Pressure Altitude Adjustment

ISFD AIRSPEED (KIAS)	WEIGHT (1000 KG)							
	100	120	140	160	180	200	220	240
156	40	30	20	-10	-40	-80	-140	-220
160	50	40	30	0	-20	-60	-110	-180
164	50	50	30	10	-10	-50	-90	-150
168	60	50	40	20	0	-30	-70	-120
172	60	60	50	30	10	-20	-50	-90
176	60	60	50	40	20	0	-30	-70
180	60	60	60	50	30	10	-20	-50
190	70	70	70	60	50	30	10	-10
200	70	80	80	80	70	60	40	20
210	70	80	90	90	80	80	60	50
220	70	80	90	100	100	90	80	70
230	70	90	100	100	110	110	100	90
240	70	90	100	110	110	120	110	110

Actual altitude = ISFD altitude + pressure altitude adjustment.

ISFD Airspeed and Altitude Correction

Applicable to low speed operations below 15000 ft pressure altitude

Flaps 15**Table 1 of 2: ISFD Airspeed**

TARGET AIRSPEED (KIAS)	WEIGHT (1000 KG)							
	100	120	140	160	180	200	220	240
136	134	135	137	140	145	154		
140	138	138	140	142	146	152		
144	141	142	143	145	148	153	160	
148	145	146	147	148	151	154	159	171
152	149	149	150	152	154	156	160	167
156	153	153	154	155	157	159	162	167
160	157	157	158	158	160	162	164	168
170	167	167	167	167	168	170	171	173
180	177	177	177	177	177	178	179	181
190	187	187	186	186	187	187	188	189
200	197	197	196	196	196	196	197	198
210		207	206	206	206	206	206	207
220		217	216	216	216	216	216	216

Table 2 of 2: Pressure Altitude Adjustment

ISFD AIRSPEED (KIAS)	WEIGHT (1000 KG)							
	100	120	140	160	180	200	220	240
136	30	20	-10	-50	-110	-220		
140	40	20	0	-30	-90	-160		
144	40	30	10	-20	-60	-120	-220	
148	40	40	20	-10	-40	-90	-160	-300
152	50	40	30	10	-20	-70	-130	-210
156	50	50	40	20	-10	-50	-100	-160
160	50	50	40	30	0	-30	-70	-130
170	60	60	60	50	30	10	-20	-60
180	60	70	70	60	50	40	20	-10
190	60	70	80	80	70	60	40	20
200	60	70	80	90	80	80	70	50
210		70	90	90	90	90	90	80
220		70	90	100	100	100	100	100

Actual altitude = ISFD altitude + pressure altitude adjustment.

ISFD Airspeed and Altitude Correction

Applicable to low speed operations below 15000 ft pressure altitude

Flaps 20

Table 1 of 2: ISFD Airspeed

TARGET AIRSPEED (KIAS)	WEIGHT (1000 KG)							
	100	120	140	160	180	200	220	240
136	133	134	135	136	140	150		
140	137	138	138	139	142	146		
144	141	141	142	143	144	147	154	
148	145	145	146	146	147	150	154	169
152	149	149	149	150	151	152	155	160
156	153	153	153	154	154	155	157	161
160	157	157	157	157	158	159	160	163
170		167	167	167	167	168	168	169
180		177	176	177	177	177	177	178
190			186	186	186	186	187	187
200				196	196	196	196	196
210				206	206	206	206	206
220					216	216	216	216

Table 2 of 2: Pressure Altitude Adjustment

ISFD AIRSPEED (KIAS)	WEIGHT (1000 KG)							
	100	120	140	160	180	200	220	240
136	40	30	20	0	-50	-180		
140	40	40	30	10	-20	-90		
144	40	40	30	20	0	-50	-140	
148	50	40	40	30	10	-20	-80	-280
152	50	50	40	40	20	0	-50	-120
156	50	50	50	40	30	10	-20	-80
160	50	50	50	50	40	20	0	-40
170		60	60	60	50	40	30	10
180		70	70	70	70	60	50	40
190			80	80	80	70	70	60
200				90	90	90	80	80
210				90	100	100	90	90
220					100	110	110	100

Actual altitude = ISFD altitude + pressure altitude adjustment.

GEAR DOWN

ISFD Airspeed and Altitude Correction

Applicable to low speed operations below 15000 ft pressure altitude

Flaps 20

Table 1 of 2: ISFD Airspeed

TARGET AIRSPEED (KIAS)	WEIGHT (1000 KG)							
	100	120	140	160	180	200	220	240
136	133	134	135	136	140	150		
140	137	138	138	139	142	146		
144	141	141	142	143	144	147	154	
148	145	145	146	146	147	150	154	169
152	149	149	149	150	151	152	155	160
156	153	153	153	154	154	155	157	161
160	157	157	157	157	158	159	160	163
170		167	167	167	167	168	168	169
180		177	176	177	177	177	177	178
190			186	186	186	186	187	187
200				196	196	196	196	196
210				206	206	206	206	206
220					216	216	216	216

Table 2 of 2: Pressure Altitude Adjustment

ISFD AIRSPEED (KIAS)	WEIGHT (1000 KG)							
	100	120	140	160	180	200	220	240
136	40	30	20	0	-50	-180		
140	40	40	30	10	-20	-90		
144	40	40	30	20	0	-50	-140	
148	50	40	40	30	10	-20	-80	-280
152	50	50	40	40	20	0	-50	-120
156	50	50	50	40	30	10	-20	-80
160	50	50	50	50	40	20	0	-40
170		60	60	60	50	40	30	10
180		70	70	70	70	60	50	40
190			80	80	80	70	70	60
200				90	90	90	80	80
210				90	100	100	90	90
220					100	110	110	100

Actual altitude = ISFD altitude + pressure altitude adjustment.

GEAR DOWN

ISFD Airspeed and Altitude Correction

Applicable to low speed operations below 15000 ft pressure altitude

Flaps 25

Table 1 of 2: ISFD Airspeed

TARGET AIRSPEED (KIAS)	WEIGHT (1000 KG)							
	100	120	140	160	180	200	220	240
116	115	117	122					
120	118	120	123	132				
124	122	123	125	130				
128	126	126	128	132	139			
132	129	130	131	134	138			
136	133	134	135	136	140	146		
140	137	137	138	140	142	146	156	
144	141	141	142	143	145	148	153	
148	145	145	145	146	148	150	153	160
152	149	149	149	150	151	153	155	160
156	153	153	153	153	154	156	158	161
160	157	157	157	157	158	159	160	163
170		166	166	167	167	167	168	170
180		176	176	176	176	177	177	178
190			186	186	186	186	187	187

Table 2 of 2: Pressure Altitude Adjustment

ISFD AIRSPEED (KIAS)	WEIGHT (1000 KG)							
	100	120	140	160	180	200	220	240
116	20	-10	-70					
120	20	0	-40	-130				
124	30	10	-20	-80				
128	30	20	0	-50	-130			
132	40	30	10	-20	-80			
136	40	30	20	-10	-50	-130		
140	40	40	30	10	-30	-80	-210	
144	50	40	30	20	-10	-50	-120	
148	50	50	40	30	10	-30	-80	-170
152	50	50	50	40	20	-10	-50	-120
156	60	50	50	40	30	10	-30	-80
160	60	60	50	50	40	20	-10	-50
170		70	60	60	60	50	30	10
180		70	70	70	70	60	50	40
190			80	80	80	80	70	60

Actual altitude = ISFD altitude + pressure altitude adjustment.

GEAR DOWN

ISFD Airspeed and Altitude Correction

Applicable to low speed operations below 15000 ft pressure altitude

Flaps 30

Table 1 of 2: ISFD Airspeed

TARGET AIRSPEED (KIAS)	WEIGHT (1000 KG)							
	100	120	140	160	180	200	220	240
116	114	116	121					
120	118	119	122	130				
124	122	123	124	129				
128	125	126	127	130	137			
132	129	130	131	133	137			
136	133	133	134	136	138	144		
140	137	137	138	139	141	145	154	
144	141	141	141	142	144	146	151	
148		145	145	146	147	149	152	158
152		149	149	149	150	151	154	158
156		153	153	153	154	155	156	159
160			157	157	157	158	159	161
170			166	166	167	167	168	169
180				176	176	176	177	177

Table 2 of 2: Pressure Altitude Adjustment

ISFD AIRSPEED (KIAS)	WEIGHT (1000 KG)							
	100	120	140	160	180	200	220	240
116	20	0	-50					
120	30	10	-30	-120				
124	30	20	-10	-60				
128	40	30	10	-30	-120			
132	40	30	20	-10	-70			
136	40	40	30	10	-30	-110		
140	40	40	30	20	-10	-70	-180	
144	50	50	40	30	10	-30	-100	
148		50	50	40	20	-10	-60	-150
152		50	50	40	30	10	-30	-90
156		60	50	50	40	20	-10	-50
160			60	50	50	30	10	-20
170			70	70	60	50	40	20
180				80	70	70	60	50

Actual altitude = ISFD altitude + pressure altitude adjustment.

Max Climb %N1

Based on anti-ice off or on or auto

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	.85	.85	.85
60	87.4	87.5	89.8	92.2	94.4	96.6	98.0	99.7	99.6	99.4
50	88.9	89.0	89.8	90.8	93.0	95.1	96.5	98.2	98.1	97.9
40	90.4	90.6	91.3	91.7	91.9	93.6	95.0	96.7	96.6	96.4
30	89.5	92.0	92.8	93.2	93.5	93.9	93.9	95.1	95.0	94.9
20	88.0	90.4	93.4	94.6	95.0	95.3	95.2	94.4	93.6	93.5
15	87.2	89.7	92.6	95.2	95.7	96.1	95.9	95.1	94.2	94.1
10	86.5	88.9	91.8	94.4	96.4	96.9	96.6	95.7	94.9	94.7
5	85.7	88.1	91.0	93.5	96.0	97.6	97.3	96.4	95.5	95.4
0	84.9	87.3	90.2	92.7	95.1	97.6	98.2	97.1	96.2	96.0
-5	84.1	86.5	89.4	91.8	94.2	96.7	98.3	98.0	97.0	96.8
-10	83.4	85.7	88.5	91.0	93.4	95.7	97.4	98.6	97.8	97.7
-15	82.6	84.9	87.7	90.1	92.5	94.8	96.4	98.0	98.0	98.1
-20	81.8	84.0	86.8	89.2	91.6	93.9	95.5	97.0	97.1	97.1
-25	80.9	83.2	86.0	88.3	90.7	93.0	94.6	96.1	96.1	96.2
-30	80.1	82.4	85.1	87.4	89.7	92.0	93.6	95.1	95.2	95.2
-35	79.3	81.5	84.2	86.5	88.8	91.1	92.6	94.1	94.2	94.2
-40	78.5	80.7	83.3	85.6	87.9	90.1	91.7	93.1	93.2	93.2



787 Flight Crew Operations Manual

VREF

WEIGHT (1000 KG)	FLAPS		
	30	25	20
240	171	174	174
230	167	170	170
220	163	166	166
210	159	162	162
200	155	158	158
190	150	154	154
180	146	149	150
170	142	146	146
160	139	142	143
150	134	137	139
140	130	133	135
130	125	128	131
120	121	123	126
110	119	119	122
100	119	119	121

Intentionally
Blank



Performance Inflight - QRH

Advisory Information

Chapter PI-QRH

Section 11

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

REPORTED BRAKING ACTION	RUNWAY DESCRIPTION
Dry	Dry
Good	Wet (Smooth, Grooved or PFC) or Frost 3 mm (0.12 inches) or less of: Water, Slush, Dry Snow or Wet Snow
Good to Medium	3 mm (0.12 inches) Compacted Snow at or below -15°C OAT
Medium	Wet (Slippery), Dry Snow or Wet Snow (any depth) over Compacted Snow Greater than 3 mm (0.12 inches) of: Dry Snow or Wet Snow Compacted Snow at OAT warmer than -15°C
Medium to Poor	Greater than 3 mm (0.12 inches) of: Water or Slush
Poor	Ice
Nil	Wet Ice, Water on top of Compacted Snow, Dry Snow or Wet Snow over Ice

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF30	ONE REV	NO REV

Dry Runway

MAX MANUAL	1345	35/-25	40	-65/220	0/-15	35/-35	60	30	65
MAX AUTO	1630	40/-30	50	-80/265	5/-5	45/-45	95	0	0
AUTOBRAKE 4	1970	50/-40	65	-105/345	0/0	55/-55	115	0	0
AUTOBRAKE 3	2245	60/-50	75	-120/405	0/-10	65/-65	125	0	0
AUTOBRAKE 2	2445	70/-60	90	-135/455	25/-40	90/-75	120	80	80
AUTOBRAKE 1	2595	75/-65	105	-150/505	55/-60	110/-80	115	255	275

Good Reported Braking Action

MAX MANUAL	1620	45/-35	65	-95/340	30/-25	60/-50	80	85	200
MAX AUTO	1670	45/-30	65	-85/320	15/-5	50/-45	90	60	170
AUTOBRAKE 4	2005	50/-40	65	-105/355	10/-5	60/-60	120	0	0
AUTOBRAKE 3	2260	60/-50	80	-120/410	10/-20	70/-65	125	0	0
AUTOBRAKE 2	2460	70/-60	95	-135/460	35/-45	90/-75	120	85	85
AUTOBRAKE 1	2595	75/-65	105	-150/510	65/-65	110/-80	120	255	275

Good to Medium Reported Braking Action

MAX MANUAL	1760	40/-35	60	-95/340	40/-35	55/-45	75	115	280
MAX AUTO	1800	45/-35	60	-100/340	35/-30	60/-50	90	115	280
AUTOBRAKE 4	2035	50/-40	65	-110/375	20/-15	60/-60	120	20	105
AUTOBRAKE 3	2260	60/-50	75	-120/410	15/-15	65/-65	125	10	30
AUTOBRAKE 2	2460	70/-60	90	-135/460	35/-45	90/-75	120	80	85
AUTOBRAKE 1	2595	75/-65	105	-150/505	60/-60	110/-80	115	255	275

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

		LANDING DISTANCE AND ADJUSTMENTS (M)							
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF30	ONE	NO
								REV	REV

Medium Reported Braking Action

MAX MANUAL	1900	45/-40	65	-110/385	55/-45	65/-50	80	160	400
MAX AUTO	1915	50/-40	70	-110/385	50/-40	65/-55	90	150	385
AUTOBRAKE 4	2090	50/-40	70	-115/410	30/-25	60/-60	115	60	270
AUTOBRAKE 3	2300	60/-50	80	-130/440	25/-30	70/-70	125	25	125
AUTOBRAKE 2	2465	70/-60	95	-140/470	50/-50	90/-75	120	100	135
AUTOBRAKE 1	2595	75/-65	105	-150/505	65/-60	110/-80	115	255	280

Medium to Poor Reported Braking Action

MAX MANUAL	2115	65/-50	95	-140/490	70/-55	85/-65	95	245	660
MAX AUTO	2125	65/-50	95	-140/490	75/-60	90/-65	95	245	670
AUTOBRAKE 4	2185	60/-45	90	-130/450	50/-40	70/-65	100	190	610
AUTOBRAKE 3	2370	60/-55	80	-135/450	45/-40	70/-70	115	65	440
AUTOBRAKE 2	2510	70/-60	95	-145/475	60/-60	90/-75	110	115	290
AUTOBRAKE 1	2615	75/-65	105	-150/510	80/-70	110/-80	115	265	325

Poor Reported Braking Action

MAX MANUAL	2730	75/-65	100	-190/735	230/-140	110/-80	95	560	1770
MAX AUTO	2740	75/-65	100	-190/740	235/-145	115/-80	95	565	1775
AUTOBRAKE 4	2740	75/-60	100	-190/740	235/-140	115/-80	100	565	1775
AUTOBRAKE 3	2810	75/-65	100	-195/745	220/-130	105/-85	115	500	1715
AUTOBRAKE 2	2885	80/-70	105	-200/755	225/-140	115/-85	110	455	1640
AUTOBRAKE 1	2935	85/-70	120	-200/765	235/-150	120/-90	115	525	1585

Reference distance is for sea level, standard day, no wind or slope, VREF30 approach speed and 2 engines at maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

All reference distances and adjustments are increased by 15%.

Includes an air distance from threshold to touchdown associated with a flare time of 7 seconds.

Max Manual and autobrake data valid for auto speedbrakes.

For max manual braking and manual speedbrakes, increase reference landing distance by 30 m.

For autobrake and manual speedbrakes, increase reference landing distance by 25 m.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 25

REPORTED BRAKING ACTION	RUNWAY DESCRIPTION
Dry	Dry
Good	Wet (Smooth, Grooved or PFC) or Frost 3 mm (0.12 inches) or less of: Water, Slush, Dry Snow or Wet Snow
Good to Medium	3 mm (0.12 inches) Compacted Snow at or below -15°C OAT
Medium	Wet (Slippery), Dry Snow or Wet Snow (any depth) over Compacted Snow Greater than 3 mm (0.12 inches) of: Dry Snow or Wet Snow Compacted Snow at OAT warmer than -15°C
Medium to Poor	Greater than 3 mm (0.12 inches) of: Water or Slush
Poor	Ice
Nil	Wet Ice, Water on top of Compacted Snow, Dry Snow or Wet Snow over Ice

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ
	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF25	ONE REV NO REV

Dry Runway

MAX MANUAL	1385	35/-25	40	-65/225	0/-15	35/-35	60	30	70
MAX AUTO	1685	40/-35	50	-80/265	5/-5	45/-45	95	0	0
AUTOBRAKE 4	2045	50/-45	65	-105/350	0/0	60/-60	115	0	0
AUTOBRAKE 3	2325	60/-55	80	-125/410	0/-15	70/-70	125	5	5
AUTOBRAKE 2	2520	70/-65	95	-140/465	30/-45	95/-75	120	100	100
AUTOBRAKE 1	2670	80/-70	110	-150/510	60/-65	115/-80	115	290	310

Good Reported Braking Action

MAX MANUAL	1675	45/-40	65	-95/345	30/-25	60/-50	85	95	225
MAX AUTO	1730	45/-35	65	-85/325	15/-5	55/-50	90	65	190
AUTOBRAKE 4	2085	50/-45	70	-105/360	10/-5	60/-60	120	0	0
AUTOBRAKE 3	2345	60/-55	80	-125/415	10/-20	70/-70	125	5	5
AUTOBRAKE 2	2540	70/-65	95	-140/470	40/-50	95/-75	120	105	105
AUTOBRAKE 1	2675	80/-70	110	-150/515	65/-65	115/-80	120	290	315

Good to Medium Reported Braking Action

MAX MANUAL	1805	45/-40	60	-100/340	40/-35	60/-50	75	125	305
MAX AUTO	1855	45/-40	65	-100/345	35/-25	60/-50	90	125	305
AUTOBRAKE 4	2105	50/-45	70	-110/380	20/-15	60/-60	120	20	110
AUTOBRAKE 3	2345	60/-55	80	-125/415	20/-20	70/-70	125	15	35
AUTOBRAKE 2	2540	70/-65	95	-140/465	40/-45	95/-75	120	100	100
AUTOBRAKE 1	2675	80/-70	110	-150/510	65/-65	115/-80	115	290	310

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 25

		LANDING DISTANCE AND ADJUSTMENTS (M)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG	PER 1000 FT	PER 10 KTS	PER 1%	PER 10°C	PER	PER	ONE	NO
		ABV/BLW 170000 KG	ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN/ UP HILL	ABV/ BLW ISA	5 KTS ABOVE VREF25	REV	REV	

Medium Reported Braking Action

MAX MANUAL	1950	50/-45	70	-110/385	55/-45	65/-55	80	170	435
MAX AUTO	1970	50/-45	70	-110/390	50/-40	65/-55	90	165	420
AUTOBRAKE 4	2165	50/-45	70	-120/415	30/-25	65/-60	120	60	290
AUTOBRAKE 3	2380	60/-55	80	-130/445	30/-35	70/-70	125	30	135
AUTOBRAKE 2	2545	70/-65	95	-140/475	50/-55	95/-75	120	120	155
AUTOBRAKE 1	2675	80/-70	110	-150/515	70/-65	115/-80	120	290	320

Medium to Poor Reported Braking Action

MAX MANUAL	2180	65/-55	95	-140/495	70/-60	90/-70	95	270	750
MAX AUTO	2200	65/-55	100	-140/495	75/-65	95/-70	100	275	760
AUTOBRAKE 4	2265	60/-50	95	-130/455	55/-40	75/-65	105	210	700
AUTOBRAKE 3	2455	60/-60	85	-135/455	45/-45	75/-70	115	75	520
AUTOBRAKE 2	2595	70/-70	100	-145/480	65/-60	95/-75	110	135	375
AUTOBRAKE 1	2700	80/-70	110	-150/515	80/-75	115/-80	115	300	390

Poor Reported Braking Action

MAX MANUAL	2795	75/-70	100	-195/740	235/-140	115/-80	95	595	1925
MAX AUTO	2810	80/-70	100	-195/740	240/-145	120/-80	100	600	1935
AUTOBRAKE 4	2810	80/-65	100	-195/740	240/-140	120/-80	105	600	1935
AUTOBRAKE 3	2890	80/-70	100	-195/750	220/-130	110/-85	115	530	1865
AUTOBRAKE 2	2970	80/-75	105	-200/760	225/-140	120/-85	110	490	1785
AUTOBRAKE 1	3015	85/-80	125	-205/770	240/-155	130/-90	115	565	1735

Reference distance is for sea level, standard day, no wind or slope, VREF25 approach speed and 2 engines at maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

All reference distances and adjustments are increased by 15%.

Includes an air distance from threshold to touchdown associated with a flare time of 7 seconds.

Max Manual and autobrake data valid for auto speedbrakes.

For max manual braking and manual speedbrakes, increase reference landing distance by 30 m.

For autobrake and manual speedbrakes, increase reference landing distance by 25 m.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 20

REPORTED BRAKING ACTION	RUNWAY DESCRIPTION
Dry	Dry
Good	Wet (Smooth, Grooved or PFC) or Frost 3 mm (0.12 inches) or less of: Water, Slush, Dry Snow or Wet Snow
Good to Medium	3 mm (0.12 inches) Compacted Snow at or below -15°C OAT
Medium	Wet (Slippery), Dry Snow or Wet Snow (any depth) over Compacted Snow Greater than 3 mm (0.12 inches) of: Dry Snow or Wet Snow Compacted Snow at OAT warmer than -15°C
Medium to Poor	Greater than 3 mm (0.12 inches) of: Water or Slush
Poor	Ice
Nil	Wet Ice, Water on top of Compacted Snow, Dry Snow or Wet Snow over Ice

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ
	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF20	ONE REV NO REV

Dry Runway

MAX MANUAL	1395	35/-25	40	-70/225	0/-15	35/-35	60	35	75
MAX AUTO	1690	40/-30	50	-80/270	5/-5	45/-45	95	0	0
AUTOBRAKE 4	2050	50/-40	65	-105/350	0/0	60/-60	120	0	0
AUTOBRAKE 3	2335	60/-50	80	-125/410	0/-10	70/-70	130	0	0
AUTOBRAKE 2	2545	70/-65	95	-140/465	30/-40	95/-75	125	80	80
AUTOBRAKE 1	2705	80/-70	110	-150/515	60/-65	115/-80	120	270	280

Good Reported Braking Action

MAX MANUAL	1690	45/-35	70	-95/350	30/-25	60/-50	85	95	235
MAX AUTO	1735	45/-35	70	-85/340	25/-5	55/-50	90	75	205
AUTOBRAKE 4	2090	50/-40	70	-110/360	10/-5	60/-60	120	0	5
AUTOBRAKE 3	2360	60/-55	80	-125/415	10/-20	70/-70	130	0	0
AUTOBRAKE 2	2570	70/-60	95	-140/470	35/-50	95/-75	125	85	85
AUTOBRAKE 1	2710	80/-70	110	-155/520	65/-70	115/-80	120	275	285

Good to Medium Reported Braking Action

MAX MANUAL	1825	45/-35	60	-100/345	40/-35	60/-50	75	125	310
MAX AUTO	1870	45/-35	65	-100/350	35/-30	60/-50	90	125	310
AUTOBRAKE 4	2115	50/-40	70	-110/380	20/-15	60/-60	120	20	120
AUTOBRAKE 3	2360	60/-50	80	-125/420	15/-20	70/-70	130	10	35
AUTOBRAKE 2	2570	70/-60	95	-140/465	35/-45	95/-75	125	85	85
AUTOBRAKE 1	2710	80/-70	110	-150/515	65/-65	115/-80	120	270	280

ADVISORY INFORMATION

Normal Configuration Landing Distance Flaps 20

		LANDING DISTANCE AND ADJUSTMENTS (M)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF20	ONE REV	NO REV	

Medium Reported Braking Action

MAX MANUAL	1970	50/-40	70	-110/390	55/-45	65/-55	80	175	445
MAX AUTO	1990	50/-40	70	-110/390	55/-40	70/-55	90	165	430
AUTOBRAKE 4	2175	50/-45	70	-120/415	30/-25	65/-60	120	65	310
AUTOBRAKE 3	2395	60/-55	80	-130/450	25/-30	70/-70	130	30	145
AUTOBRAKE 2	2575	70/-65	95	-140/480	50/-50	95/-75	125	100	140
AUTOBRAKE 1	2710	80/-70	110	-150/515	70/-70	115/-80	120	270	290

Medium to Poor Reported Braking Action

MAX MANUAL	2210	65/-55	100	-140/500	75/-60	95/-70	100	275	770
MAX AUTO	2230	70/-55	100	-140/505	80/-65	95/-70	100	280	790
AUTOBRAKE 4	2285	65/-50	95	-130/470	60/-40	80/-65	105	235	740
AUTOBRAKE 3	2470	60/-55	85	-135/460	50/-40	75/-70	120	85	555
AUTOBRAKE 2	2625	70/-65	100	-145/485	65/-60	95/-80	115	120	400
AUTOBRAKE 1	2740	80/-70	110	-155/520	85/-80	115/-80	115	285	385

Poor Reported Braking Action

MAX MANUAL	2835	80/-65	100	-195/750	240/-145	120/-80	100	610	1975
MAX AUTO	2855	80/-65	105	-195/750	245/-150	120/-85	100	620	1990
AUTOBRAKE 4	2855	80/-65	105	-195/750	245/-150	120/-85	105	620	1990
AUTOBRAKE 3	2925	80/-65	100	-200/760	230/-130	115/-85	120	555	1930
AUTOBRAKE 2	3010	80/-75	105	-205/770	235/-145	120/-90	115	495	1840
AUTOBRAKE 1	3065	85/-75	125	-205/780	245/-160	130/-90	115	565	1785

Reference distance is for sea level, standard day, no wind or slope, VREF20 approach speed and 2 engines at maximum available reverse thrust.

Max Manual assumes maximum achievable manual braking.

All reference distances and adjustments are increased by 15%.

Includes an air distance from threshold to touchdown associated with a flare time of 7 seconds.

Max Manual and autobrake data valid for auto speedbrakes.

For max manual braking and manual speedbrakes, increase reference landing distance by 30 m.

For autobrake and manual speedbrakes, increase reference landing distance by 25 m.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTI-ICE LEAK ENG L, R (Flaps 20)

VREF20

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1240	35/-20	35	-60/205	15/-15	35/-30	55	0	35
AUTOBRAKE MAX	1470	35/-25	45	-70/235	5/-5	40/-40	80	0	0
AUTOBRAKE 2	2290	60/-50	80	-125/415	0/0	70/-70	140	0	0

Good Reported Braking Action

MAX MANUAL	1555	45/-35	65	-95/340	35/-30	55/-50	80	0	120
AUTOBRAKE MAX	1570	45/-35	65	-85/340	35/-20	55/-50	90	0	110
AUTOBRAKE 2	2315	60/-50	80	-125/420	10/-10	70/-70	140	0	0

Good to Medium Reported Braking Action

MAX MANUAL	1695	40/-35	60	-95/325	45/-40	55/-45	70	0	160
AUTOBRAKE MAX	1735	40/-35	60	-95/325	40/-35	55/-50	85	0	160
AUTOBRAKE 2	2300	60/-50	80	-125/420	10/-10	70/-70	140	0	0

Medium Reported Braking Action

MAX MANUAL	1865	45/-40	65	-105/370	65/-55	60/-50	80	0	235
AUTOBRAKE MAX	1875	45/-40	65	-105/375	65/-50	60/-55	90	0	230
AUTOBRAKE 3	2105	50/-40	75	-115/405	30/-20	65/-60	120	0	100

Medium to Poor Reported Braking Action

MAX MANUAL	2160	65/-55	100	-145/530	95/-75	90/-75	105	0	430
AUTOBRAKE MAX	2185	70/-55	105	-145/530	105/-85	95/-75	105	0	440
AUTOBRAKE 3	2220	65/-50	105	-130/510	85/-45	85/-70	110	0	410

Poor Reported Braking Action

MAX MANUAL	2995	80/-65	110	-215/815	385/-205	120/-85	105	0	1185
AUTOBRAKE MAX	3020	80/-65	110	-215/820	395/-210	120/-90	105	0	1195
AUTOBRAKE 3	3020	80/-65	110	-215/820	390/-205	120/-90	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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTI-ICE LEAK ENG L, R (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

Dry Runway

MAX MANUAL	1195	30/-25	35	-60/200	15/-10	30/-30	55	0	30
AUTOBRAKE MAX	1415	35/-30	45	-70/230	5/-5	40/-40	80	0	0
AUTOBRAKE 2	2195	60/-50	75	-120/405	0/0	65/-65	135	0	0

Good Reported Braking Action

MAX MANUAL	1480	45/-35	60	-90/330	30/-25	55/-50	80	0	105
AUTOBRAKE MAX	1500	40/-35	60	-85/320	25/-20	50/-45	85	0	95
AUTOBRAKE 2	2215	60/-50	80	-125/410	5/-10	70/-70	140	0	0

Good to Medium Reported Braking Action

MAX MANUAL	1630	40/-35	55	-90/315	45/-35	50/-45	70	0	145
AUTOBRAKE MAX	1665	40/-35	55	-95/320	40/-35	50/-45	80	0	145
AUTOBRAKE 2	2205	60/-50	80	-125/410	5/-10	70/-70	140	0	0

Medium Reported Braking Action

MAX MANUAL	1790	45/-40	65	-105/365	60/-50	55/-50	75	0	210
AUTOBRAKE MAX	1795	45/-40	65	-105/365	60/-45	60/-50	85	0	205
AUTOBRAKE 3	2025	50/-45	70	-115/395	30/-20	60/-60	120	0	85

Medium to Poor Reported Braking Action

MAX MANUAL	2050	65/-55	95	-140/515	85/-70	85/-70	100	0	365
AUTOBRAKE MAX	2060	65/-55	100	-140/515	95/-75	85/-70	100	0	370
AUTOBRAKE 3	2115	60/-50	95	-130/480	70/-40	70/-65	105	0	325

Poor Reported Braking Action

MAX MANUAL	2860	75/-65	105	-205/800	365/-195	110/-85	100	0	1050
AUTOBRAKE MAX	2870	75/-65	105	-205/800	375/-200	110/-85	100	0	1055
AUTOBRAKE 3	2875	75/-65	105	-210/800	370/-195	115/-85	105	0	1055

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID (Flaps 25)

VREF25

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1880	45/-40	65	-110/390	65/-50	65/-50	70	190	505
AUTOBRAKE MAX	Autobrake inoperative								
AUTOBRAKE 2	Autobrake inoperative								

Good Reported Braking Action

MAX MANUAL	2050	60/-50	90	-130/490	80/-65	85/-60	85	285	830
AUTOBRAKE MAX	Autobrake inoperative								
AUTOBRAKE 2	Autobrake inoperative								

Good to Medium Reported Braking Action

MAX MANUAL	2285	60/-55	90	-150/560	145/-100	90/-65	80	390	1185
AUTOBRAKE MAX	Autobrake inoperative								
AUTOBRAKE 2	Autobrake inoperative								

Medium Reported Braking Action

MAX MANUAL	2430	65/-60	100	-165/635	195/-120	100/-70	85	480	1540
AUTOBRAKE MAX	Autobrake inoperative								
AUTOBRAKE 3	Autobrake inoperative								

Medium to Poor Reported Braking Action

MAX MANUAL	2535	75/-65	115	-180/695	205/-130	110/-75	90	555	1865
AUTOBRAKE MAX	Autobrake inoperative								
AUTOBRAKE 3	Autobrake inoperative								

Poor Reported Braking Action

MAX MANUAL	3205	90/-80	120	-270/1170	690/-295	135/-95	90	1340	6000
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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

Dry Runway

MAX MANUAL	1835	45/-40	65	-110/390	65/-50	65/-50	70	175	465
AUTOBRAKE MAX	Autobrake inoperative								
AUTOBRAKE 2	Autobrake inoperative								

Good Reported Braking Action

MAX MANUAL	1995	60/-45	85	-125/485	80/-65	80/-60	85	260	750
AUTOBRAKE MAX	Autobrake inoperative								
AUTOBRAKE 2	Autobrake inoperative								

Good to Medium Reported Braking Action

MAX MANUAL	2230	60/-50	85	-150/560	145/-100	85/-65	80	365	1090
AUTOBRAKE MAX	Autobrake inoperative								
AUTOBRAKE 2	Autobrake inoperative								

Medium Reported Braking Action

MAX MANUAL	2375	65/-55	95	-165/630	195/-120	95/-70	85	450	1415
AUTOBRAKE MAX	Autobrake inoperative								
AUTOBRAKE 3	Autobrake inoperative								

Medium to Poor Reported Braking Action

MAX MANUAL	2475	75/-60	110	-180/690	205/-130	110/-75	90	515	1685
AUTOBRAKE MAX	Autobrake inoperative								
AUTOBRAKE 3	Autobrake inoperative								

Poor Reported Braking Action

MAX MANUAL	3150	90/-80	120	-270/1170	695/-295	130/-95	90	1280	6000
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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

BRAKES (Flaps 25)

VREF25

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1555	55/-35	50	-85/290	35/-30	50/-40	65	105	255
AUTOBRAKE MAX	1600	55/-35	55	-85/295	30/-20	50/-45	80	100	255
AUTOBRAKE 2	2200	60/-60	85	-120/405	35/-40	80/-65	105	90	90

Good Reported Braking Action

MAX MANUAL	1815	55/-45	80	-110/410	55/-45	75/-55	80	205	565
AUTOBRAKE MAX	1830	55/-45	80	-110/415	60/-45	75/-55	85	210	570
AUTOBRAKE 2	2225	60/-60	85	-120/415	40/-45	85/-65	100	100	195

Good to Medium Reported Braking Action

MAX MANUAL	2000	50/-45	75	-125/445	85/-65	75/-55	75	270	760
AUTOBRAKE MAX	2010	55/-45	75	-125/445	90/-70	75/-55	80	270	765
AUTOBRAKE 2	2325	65/-60	90	-140/490	80/-70	85/-70	105	165	495

Medium Reported Braking Action

MAX MANUAL	2145	55/-50	85	-135/505	115/-85	85/-60	80	345	1010
AUTOBRAKE MAX	2155	60/-50	85	-135/505	120/-85	85/-60	80	345	1015
AUTOBRAKE 3	2305	60/-55	85	-145/525	95/-70	80/-65	100	225	890

Medium to Poor Reported Braking Action

MAX MANUAL	2290	70/-60	105	-155/580	130/-95	105/-70	90	435	1360
AUTOBRAKE MAX	2310	70/-60	105	-155/580	135/-100	105/-70	90	440	1380
AUTOBRAKE 3	2365	65/-60	105	-150/555	120/-80	90/-70	95	390	1325

Poor Reported Braking Action

MAX MANUAL	2920	85/-75	110	-230/950	670/-220	125/-85	90	960	3980
AUTOBRAKE MAX	2940	85/-75	110	-230/955	675/-225	130/-90	90	970	4000
AUTOBRAKE 3	2955	85/-75	110	-230/955	670/-225	125/-90	95	955	3990

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

BRAKES (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

Dry Runway

MAX MANUAL	1515	50/-30	50	-85/290	35/-30	50/-40	65	95	235
AUTOBRAKE MAX	1555	50/-30	50	-85/295	30/-20	50/-40	75	95	230
AUTOBRAKE 2	2130	60/-55	80	-120/400	30/-35	80/-65	105	70	70

Good Reported Braking Action

MAX MANUAL	1765	55/-40	75	-110/405	50/-45	70/-55	80	190	510
AUTOBRAKE MAX	1770	55/-40	75	-110/410	55/-45	70/-55	85	190	510
AUTOBRAKE 2	2155	60/-55	85	-120/410	40/-40	80/-65	100	80	150

Good to Medium Reported Braking Action

MAX MANUAL	1950	50/-45	75	-120/445	85/-65	75/-55	75	255	700
AUTOBRAKE MAX	1955	50/-45	75	-120/445	90/-65	75/-55	80	250	700
AUTOBRAKE 2	2255	60/-55	85	-135/485	75/-65	80/-65	100	145	450

Medium Reported Braking Action

MAX MANUAL	2090	55/-50	80	-135/500	115/-80	80/-60	80	320	925
AUTOBRAKE MAX	2095	55/-50	85	-135/505	120/-85	80/-60	80	325	930
AUTOBRAKE 3	2230	60/-50	85	-140/520	95/-70	75/-65	100	215	820

Medium to Poor Reported Braking Action

MAX MANUAL	2230	70/-55	100	-155/575	125/-90	100/-70	90	400	1220
AUTOBRAKE MAX	2240	70/-55	100	-155/575	130/-95	100/-70	90	405	1230
AUTOBRAKE 3	2295	65/-55	100	-150/555	120/-80	85/-65	95	355	1180

Poor Reported Braking Action

MAX MANUAL	2865	80/-70	110	-230/950	670/-220	125/-85	90	915	3680
AUTOBRAKE MAX	2875	85/-70	110	-230/950	680/-225	125/-85	90	920	3690
AUTOBRAKE 3	2885	80/-70	110	-230/955	675/-220	120/-85	95	910	3680

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ENG SHUTDOWN L, R (Flaps 20)

VREF20

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1225	35/-20	35	-60/200	15/-15	30/-30	55	0	35
AUTOBRAKE MAX	1465	35/-25	45	-70/235	5/-5	40/-40	80	0	0
AUTOBRAKE 2	2290	60/-50	80	-125/415	0/0	70/-70	140	0	0

Good Reported Braking Action

MAX MANUAL	1525	45/-35	65	-90/330	30/-30	55/-50	80	0	110
AUTOBRAKE MAX	1555	45/-30	65	-85/320	25/-20	55/-50	85	0	105
AUTOBRAKE 2	2305	60/-50	80	-125/420	10/-10	70/-70	140	0	0

Good to Medium Reported Braking Action

MAX MANUAL	1660	40/-35	55	-90/315	45/-35	50/-45	70	0	150
AUTOBRAKE MAX	1710	40/-35	55	-95/320	40/-35	55/-50	85	0	150
AUTOBRAKE 2	2295	60/-50	80	-125/420	10/-10	70/-70	140	0	0

Medium Reported Braking Action

MAX MANUAL	1820	45/-40	65	-105/360	60/-50	60/-50	75	0	215
AUTOBRAKE MAX	1840	45/-40	65	-105/360	55/-45	60/-55	90	0	210
AUTOBRAKE 3	2090	50/-40	70	-115/395	30/-20	60/-60	120	0	80

Medium to Poor Reported Braking Action

MAX MANUAL	2100	65/-55	95	-140/510	90/-70	90/-70	105	0	390
AUTOBRAKE MAX	2115	70/-55	95	-140/510	95/-75	90/-75	105	0	400
AUTOBRAKE 3	2180	65/-50	95	-125/475	65/-40	75/-65	110	0	355

Poor Reported Braking Action

MAX MANUAL	2830	80/-70	100	-195/730	295/-175	115/-85	105	0	1005
AUTOBRAKE MAX	2845	80/-70	100	-195/730	305/-180	115/-85	105	0	1015
AUTOBRAKE 3	2855	80/-70	100	-195/730	300/-175	115/-85	110	0	1020

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ENG SHUTDOWN L, R (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

Dry Runway

MAX MANUAL	1185	30/-25	35	-60/195	15/-10	30/-30	55	0	30
AUTOBRAKE MAX	1415	35/-30	45	-70/230	5/-5	40/-40	80	0	0
AUTOBRAKE 2	2195	60/-50	75	-120/405	0/-5	65/-65	135	0	0

Good Reported Braking Action

MAX MANUAL	1455	45/-35	60	-90/320	30/-25	50/-45	80	0	95
AUTOBRAKE MAX	1485	40/-30	60	-80/305	20/-15	50/-45	85	0	90
AUTOBRAKE 2	2210	60/-50	80	-125/410	5/-15	70/-70	135	0	0

Good to Medium Reported Braking Action

MAX MANUAL	1595	40/-35	55	-90/305	40/-35	50/-45	70	0	135
AUTOBRAKE MAX	1640	40/-35	55	-90/310	35/-30	50/-45	80	0	135
AUTOBRAKE 2	2200	60/-50	80	-125/410	5/-15	70/-70	135	0	0

Medium Reported Braking Action

MAX MANUAL	1745	45/-40	60	-100/350	55/-45	55/-50	75	0	195
AUTOBRAKE MAX	1765	45/-40	60	-100/355	50/-40	55/-50	85	0	190
AUTOBRAKE 3	2005	50/-45	70	-110/385	25/-20	60/-60	120	0	70

Medium to Poor Reported Braking Action

MAX MANUAL	1990	65/-55	90	-135/490	80/-65	80/-70	100	0	330
AUTOBRAKE MAX	1995	65/-55	90	-135/490	85/-70	85/-70	100	0	335
AUTOBRAKE 3	2080	60/-50	85	-125/445	55/-35	70/-60	105	0	275

Poor Reported Braking Action

MAX MANUAL	2700	75/-65	95	-190/715	280/-165	105/-80	100	0	890
AUTOBRAKE MAX	2705	75/-65	95	-190/715	285/-170	110/-80	100	0	895
AUTOBRAKE 3	2720	75/-65	95	-190/715	280/-165	110/-80	105	0	900

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS/SLAT CONTROL (Flaps 20)

VREF20

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1215	30/-20	35	-60/195	15/-10	30/-30	50	30	65
AUTOBRAKE MAX	1530	35/-30	45	-70/240	5/-5	40/-40	85	0	0
AUTOBRAKE 2	2300	65/-55	85	-125/410	30/-40	85/-70	110	95	95

Good Reported Braking Action

MAX MANUAL	1470	40/-30	60	-85/305	25/-25	55/-45	75	85	205
AUTOBRAKE MAX	1570	40/-30	60	-75/300	20/-5	50/-45	85	70	195
AUTOBRAKE 2	2320	65/-55	90	-125/415	35/-45	90/-70	110	100	100

Good to Medium Reported Braking Action

MAX MANUAL	1585	35/-30	55	-85/300	35/-30	50/-45	65	110	270
AUTOBRAKE MAX	1685	40/-35	55	-90/305	35/-25	55/-45	80	115	285
AUTOBRAKE 2	2310	65/-55	90	-125/415	35/-45	90/-70	110	100	100

Medium Reported Braking Action

MAX MANUAL	1715	40/-35	60	-95/340	50/-40	60/-45	70	150	385
AUTOBRAKE MAX	1790	45/-35	65	-100/345	50/-35	60/-50	80	155	395
AUTOBRAKE 3	2170	55/-50	75	-115/395	25/-30	65/-65	115	30	130

Medium to Poor Reported Braking Action

MAX MANUAL	1925	60/-45	85	-120/435	65/-55	80/-60	85	240	670
AUTOBRAKE MAX	2010	60/-50	90	-125/440	70/-60	85/-65	90	260	735
AUTOBRAKE 3	2230	55/-50	80	-120/405	40/-40	70/-65	105	75	520

Poor Reported Braking Action

MAX MANUAL	2465	70/-60	90	-170/650	210/-125	105/-70	85	535	1715
AUTOBRAKE MAX	2550	70/-60	95	-170/655	215/-135	110/-75	90	555	1780
AUTOBRAKE 3	2625	70/-60	90	-175/665	200/-120	105/-80	105	485	1715

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS DRIVE (1 < Flaps ≤ 5)

VREF30+40

		LANDING DISTANCE AND ADJUSTMENTS (M)							
		REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1585	50/-25	45	-65/215	15/-15	45/-40	55	45	105
AUTOBRAKE MAX	2070	40/-35	65	-85/270	5/-5	55/-60	95	0	5
AUTOBRAKE 2	3015	75/-70	120	-140/460	60/-65	125/-90	105	320	375

Good Reported Braking Action

MAX MANUAL	2010	50/-40	85	-100/345	35/-30	80/-65	75	150	380
AUTOBRAKE MAX	2115	45/-35	80	-85/310	10/-5	65/-60	95	105	330
AUTOBRAKE 2	3015	75/-70	120	-140/460	65/-70	125/-90	105	325	390

Good to Medium Reported Braking Action

MAX MANUAL	2050	45/-40	70	-95/320	40/-35	70/-55	65	160	395
AUTOBRAKE MAX	2220	45/-40	75	-100/335	30/-20	70/-60	95	110	355
AUTOBRAKE 2	3015	75/-70	120	-140/460	65/-70	125/-90	105	325	390

Medium Reported Braking Action

MAX MANUAL	2215	50/-45	80	-105/365	55/-45	80/-60	70	215	550
AUTOBRAKE MAX	2310	50/-40	80	-110/375	45/-35	80/-65	95	195	540
AUTOBRAKE 3	2880	65/-65	105	-130/445	60/-60	105/-85	105	160	260

Medium to Poor Reported Braking Action

MAX MANUAL	2580	70/-60	115	-135/480	80/-70	115/-80	85	395	1145
AUTOBRAKE MAX	2590	70/-60	115	-135/480	85/-70	115/-80	90	390	1145
AUTOBRAKE 3	2910	65/-65	110	-130/450	65/-65	110/-85	95	190	855

Poor Reported Braking Action

MAX MANUAL	3130	80/-70	115	-185/690	225/-140	140/-90	90	705	2295
AUTOBRAKE MAX	3140	80/-70	115	-185/690	230/-145	140/-95	90	700	2295
AUTOBRAKE 3	3305	85/-75	120	-190/710	220/-145	140/-100	95	615	2160

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.



787 Flight Crew Operations Manual

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS DRIVE (5 < Flaps < 20)

VREF30+20

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1385	35/-25	40	-60/205	15/-15	40/-35	55	35	85
AUTOBRAKE MAX	1745	35/-30	55	-75/250	5/-5	45/-50	90	0	0
AUTOBRAKE 2	2570	70/-65	100	-130/430	45/-50	105/-75	105	185	190

Good Reported Braking Action

MAX MANUAL	1720	45/-35	70	-90/325	30/-25	65/-55	75	120	295
AUTOBRAKE MAX	1775	45/-30	70	-80/305	20/-5	60/-50	85	90	260
AUTOBRAKE 2	2590	70/-65	100	-130/435	50/-55	105/-80	105	195	200

Good to Medium Reported Braking Action

MAX MANUAL	1805	40/-35	60	-90/310	40/-35	60/-50	65	135	345
AUTOBRAKE MAX	1890	40/-35	65	-95/320	30/-25	60/-50	85	130	340
AUTOBRAKE 2	2580	70/-65	100	-130/435	50/-55	105/-80	105	195	200

Medium Reported Braking Action

MAX MANUAL	1950	45/-40	70	-100/350	50/-45	70/-55	70	185	485
AUTOBRAKE MAX	1995	45/-40	70	-105/355	45/-40	70/-55	85	185	480
AUTOBRAKE 3	2450	60/-55	90	-120/415	40/-45	85/-75	110	65	165

Medium to Poor Reported Braking Action

MAX MANUAL	2220	65/-50	100	-125/455	70/-60	95/-70	85	320	935
AUTOBRAKE MAX	2240	65/-50	100	-125/455	75/-65	100/-70	90	330	955
AUTOBRAKE 3	2505	60/-60	90	-125/425	50/-55	85/-75	105	105	705

Poor Reported Braking Action

MAX MANUAL	2765	75/-65	100	-175/670	215/-135	120/-80	85	625	2070
AUTOBRAKE MAX	2785	75/-65	105	-175/670	220/-140	120/-80	90	630	2090
AUTOBRAKE 3	2895	75/-65	105	-180/685	205/-130	120/-85	105	535	1995

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS DRIVE (Flaps ≥ 20)

VREF20

	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

Dry Runway

MAX MANUAL	1215	30/-20	35	-60/195	15/-10	30/-30	50	30	65
AUTOBRAKE MAX	1470	35/-25	45	-70/235	5/-5	40/-40	80	0	0
AUTOBRAKE 2	2215	60/-55	85	-120/405	25/-35	80/-65	105	70	70

Good Reported Braking Action

MAX MANUAL	1470	40/-30	60	-85/305	25/-25	55/-45	75	85	205
AUTOBRAKE MAX	1510	40/-30	60	-75/295	20/-5	50/-40	80	65	175
AUTOBRAKE 2	2235	60/-55	85	-120/410	30/-40	85/-65	110	75	75

Good to Medium Reported Braking Action

MAX MANUAL	1585	35/-30	55	-85/300	35/-30	50/-45	65	110	270
AUTOBRAKE MAX	1625	40/-30	55	-90/300	30/-25	55/-45	80	110	270
AUTOBRAKE 2	2225	60/-55	85	-120/410	30/-40	85/-65	110	75	75

Medium Reported Braking Action

MAX MANUAL	1715	40/-35	60	-95/340	50/-40	60/-45	70	150	385
AUTOBRAKE MAX	1730	45/-35	60	-95/340	50/-35	60/-50	80	145	375
AUTOBRAKE 3	2080	50/-45	70	-115/390	25/-25	60/-60	115	25	125

Medium to Poor Reported Braking Action

MAX MANUAL	1925	60/-45	85	-120/435	65/-55	80/-60	85	240	670
AUTOBRAKE MAX	1940	60/-45	85	-120/435	70/-60	85/-60	85	245	685
AUTOBRAKE 3	2150	55/-50	75	-115/400	40/-35	65/-65	105	70	485

Poor Reported Braking Action

MAX MANUAL	2465	70/-60	90	-170/650	210/-125	105/-70	85	535	1715
AUTOBRAKE MAX	2485	70/-60	90	-170/650	215/-130	105/-75	85	535	1730
AUTOBRAKE 3	2545	70/-60	90	-175/660	200/-115	100/-75	105	480	1675

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS PRIMARY FAIL (Flaps 20)

VREF20

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1235	30/-20	35	-60/200	15/-10	35/-30	55	30	70
AUTOBRAKE MAX	1470	35/-25	45	-70/235	5/-5	40/-40	80	0	0
AUTOBRAKE 2	2230	60/-55	85	-120/410	20/-35	80/-65	110	55	55

Good Reported Braking Action

MAX MANUAL	1505	45/-35	60	-85/310	30/-25	55/-45	75	95	230
AUTOBRAKE MAX	1525	40/-30	60	-80/305	25/-15	55/-45	80	80	210
AUTOBRAKE 2	2250	60/-55	85	-125/415	30/-40	80/-70	115	60	60

Good to Medium Reported Braking Action

MAX MANUAL	1620	40/-35	55	-90/305	40/-35	55/-45	70	120	300
AUTOBRAKE MAX	1645	40/-35	55	-90/305	35/-30	55/-45	80	115	290
AUTOBRAKE 2	2240	60/-55	85	-125/415	30/-40	80/-70	115	60	60

Medium Reported Braking Action

MAX MANUAL	1750	45/-35	60	-100/345	50/-40	60/-50	75	165	425
AUTOBRAKE MAX	1765	45/-35	65	-100/345	55/-45	60/-50	75	155	415
AUTOBRAKE 3	2085	50/-45	70	-115/390	25/-25	60/-60	115	25	155

Medium to Poor Reported Braking Action

MAX MANUAL	1965	60/-50	90	-125/445	70/-55	85/-60	90	265	750
AUTOBRAKE MAX	1985	60/-50	90	-125/445	75/-60	85/-65	90	270	770
AUTOBRAKE 3	2175	55/-50	75	-120/400	45/-40	65/-65	105	85	580

Poor Reported Braking Action

MAX MANUAL	2515	70/-60	90	-175/660	215/-130	110/-75	90	570	1875
AUTOBRAKE MAX	2535	70/-60	95	-175/660	225/-135	110/-75	90	575	1895
AUTOBRAKE 3	2585	70/-60	90	-175/665	210/-120	100/-75	105	530	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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLIGHT CONTROL MODE (Flaps 20)

VREF20

	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

Dry Runway

MAX MANUAL	1255	30/-20	35	-60/200	15/-10	35/-30	55	30	70
AUTOBRAKE MAX	1475	35/-25	45	-70/235	5/-5	40/-40	85	0	0
AUTOBRAKE 2	2235	60/-55	85	-120/410	20/-30	80/-65	115	50	50

Good Reported Braking Action

MAX MANUAL	1515	40/-35	60	-85/310	25/-25	55/-45	75	90	220
AUTOBRAKE MAX	1535	40/-30	60	-80/310	25/-15	55/-45	80	75	200
AUTOBRAKE 2	2260	60/-55	85	-125/415	30/-40	80/-70	115	55	55

Good to Medium Reported Braking Action

MAX MANUAL	1635	40/-35	55	-90/305	35/-30	55/-45	70	115	290
AUTOBRAKE MAX	1655	40/-35	55	-90/305	35/-30	55/-45	80	115	285
AUTOBRAKE 2	2250	60/-55	85	-125/415	30/-40	80/-70	115	55	55

Medium Reported Braking Action

MAX MANUAL	1765	45/-35	60	-100/345	50/-40	60/-50	75	160	410
AUTOBRAKE MAX	1770	45/-35	65	-100/345	55/-45	60/-50	75	155	405
AUTOBRAKE 3	2090	50/-45	70	-115/390	25/-25	60/-60	120	25	145

Medium to Poor Reported Braking Action

MAX MANUAL	1975	60/-50	85	-125/445	65/-55	85/-60	90	255	725
AUTOBRAKE MAX	1995	60/-50	90	-125/445	75/-60	85/-65	90	260	745
AUTOBRAKE 3	2190	55/-50	75	-120/405	45/-40	65/-65	105	80	555

Poor Reported Braking Action

MAX MANUAL	2530	70/-60	90	-175/660	215/-130	105/-75	90	560	1840
AUTOBRAKE MAX	2550	70/-60	95	-175/660	220/-135	110/-75	90	565	1855
AUTOBRAKE 3	2600	70/-60	90	-175/665	210/-120	100/-75	105	520	1810

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLIGHT CONTROLS (Flaps 20)

VREF30+20

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1490	35/-25	45	-65/215	20/-15	45/-40	65	55	120
AUTOBRAKE MAX	1745	35/-30	55	-75/250	5/-5	45/-50	90	0	0
AUTOBRAKE 2	2665	70/-65	100	-135/440	30/-45	100/-80	125	85	85

Good Reported Braking Action

MAX MANUAL	1865	50/-40	80	-100/350	40/-35	75/-60	90	165	425
AUTOBRAKE MAX	1885	50/-35	80	-95/350	40/-30	75/-60	90	160	425
AUTOBRAKE 2	2695	70/-65	105	-135/445	45/-50	105/-80	120	95	95

Good to Medium Reported Braking Action

MAX MANUAL	1950	45/-40	70	-95/330	50/-40	70/-55	80	180	465
AUTOBRAKE MAX	1970	45/-40	70	-95/330	50/-40	70/-55	85	175	450
AUTOBRAKE 2	2685	70/-65	105	-135/445	45/-50	105/-80	120	95	95

Medium Reported Braking Action

MAX MANUAL	2105	50/-45	80	-110/370	65/-55	80/-60	85	240	645
AUTOBRAKE MAX	2125	50/-45	80	-110/375	65/-55	80/-60	85	235	640
AUTOBRAKE 3	2505	55/-55	85	-125/425	35/-35	75/-75	120	30	300

Medium to Poor Reported Braking Action

MAX MANUAL	2395	70/-55	110	-135/485	90/-75	110/-75	100	415	1280
AUTOBRAKE MAX	2420	70/-60	115	-135/485	95/-80	115/-80	100	420	1305
AUTOBRAKE 3	2600	60/-55	100	-130/440	55/-50	85/-75	110	245	1130

Poor Reported Braking Action

MAX MANUAL	2970	80/-70	115	-185/700	250/-155	135/-90	100	755	2635
AUTOBRAKE MAX	2995	85/-70	115	-185/705	255/-160	140/-90	100	765	2660
AUTOBRAKE 3	3055	80/-70	115	-190/710	240/-145	130/-90	110	705	2605

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Fuel Leak (Flaps 20)

VREF20

	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

Dry Runway

MAX MANUAL	1225	35/-20	35	-60/200	15/-15	30/-30	55	0	35
AUTOBRAKE MAX	1465	35/-25	45	-70/235	5/-5	40/-40	80	0	0
AUTOBRAKE 2	2290	60/-50	80	-125/415	0/0	70/-70	140	0	0

Good Reported Braking Action

MAX MANUAL	1525	45/-35	65	-90/330	30/-30	55/-50	80	0	110
AUTOBRAKE MAX	1555	45/-30	65	-85/320	25/-20	55/-50	85	0	105
AUTOBRAKE 2	2305	60/-50	80	-125/420	10/-10	70/-70	140	0	0

Good to Medium Reported Braking Action

MAX MANUAL	1660	40/-35	55	-90/315	45/-35	50/-45	70	0	150
AUTOBRAKE MAX	1710	40/-35	55	-95/320	40/-35	55/-50	85	0	150
AUTOBRAKE 2	2295	60/-50	80	-125/420	10/-10	70/-70	140	0	0

Medium Reported Braking Action

MAX MANUAL	1820	45/-40	65	-105/360	60/-50	60/-50	75	0	215
AUTOBRAKE MAX	1840	45/-40	65	-105/360	55/-45	60/-55	90	0	210
AUTOBRAKE 3	2090	50/-40	70	-115/395	30/-20	60/-60	120	0	80

Medium to Poor Reported Braking Action

MAX MANUAL	2100	65/-55	95	-140/510	90/-70	90/-70	105	0	390
AUTOBRAKE MAX	2115	70/-55	95	-140/510	95/-75	90/-75	105	0	400
AUTOBRAKE 3	2180	65/-50	95	-125/475	65/-40	75/-65	110	0	355

Poor Reported Braking Action

MAX MANUAL	2830	80/-70	100	-195/730	295/-175	115/-85	105	0	1005
AUTOBRAKE MAX	2845	80/-70	100	-195/730	305/-180	115/-85	105	0	1015
AUTOBRAKE 3	2855	80/-70	100	-195/730	300/-175	115/-85	110	0	1020

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.



ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Fuel Leak (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1185	30/-25	35	-60/195	15/-10	30/-30	55	0	30
AUTOBRAKE MAX	1415	35/-30	45	-70/230	5/-5	40/-40	80	0	0
AUTOBRAKE 2	2195	60/-50	75	-120/405	0/-5	65/-65	135	0	0

Good Reported Braking Action

MAX MANUAL	1455	45/-35	60	-90/320	30/-25	50/-45	80	0	95
AUTOBRAKE MAX	1485	40/-30	60	-80/305	20/-15	50/-45	85	0	90
AUTOBRAKE 2	2210	60/-50	80	-125/410	5/-15	70/-70	135	0	0

Good to Medium Reported Braking Action

MAX MANUAL	1595	40/-35	55	-90/305	40/-35	50/-45	70	0	135
AUTOBRAKE MAX	1640	40/-35	55	-90/310	35/-30	50/-45	80	0	135
AUTOBRAKE 2	2200	60/-50	80	-125/410	5/-15	70/-70	135	0	0

Medium Reported Braking Action

MAX MANUAL	1745	45/-40	60	-100/350	55/-45	55/-50	75	0	195
AUTOBRAKE MAX	1765	45/-40	60	-100/355	50/-40	55/-50	85	0	190
AUTOBRAKE 3	2005	50/-45	70	-110/385	25/-20	60/-60	120	0	70

Medium to Poor Reported Braking Action

MAX MANUAL	1990	65/-55	90	-135/490	80/-65	80/-70	100	0	330
AUTOBRAKE MAX	1995	65/-55	90	-135/490	85/-70	85/-70	100	0	335
AUTOBRAKE 3	2080	60/-50	85	-125/445	55/-35	70/-60	105	0	275

Poor Reported Braking Action

MAX MANUAL	2700	75/-65	95	-190/715	280/-165	105/-80	100	0	890
AUTOBRAKE MAX	2705	75/-65	95	-190/715	285/-170	110/-80	100	0	895
AUTOBRAKE 3	2720	75/-65	95	-190/715	280/-165	110/-80	105	0	900

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FUEL QTY LOW (Flaps 20)

VREF20

	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

Dry Runway

MAX MANUAL	1225	35/-20	35	-60/200	15/-15	30/-30	55	0	35
AUTOBRAKE MAX	1465	35/-25	45	-70/235	5/-5	40/-40	80	0	0
AUTOBRAKE 2	2290	60/-50	80	-125/415	0/0	70/-70	140	0	0

Good Reported Braking Action

MAX MANUAL	1525	45/-35	65	-90/330	30/-30	55/-50	80	0	110
AUTOBRAKE MAX	1555	45/-30	65	-85/320	25/-20	55/-50	85	0	105
AUTOBRAKE 2	2305	60/-50	80	-125/420	10/-10	70/-70	140	0	0

Good to Medium Reported Braking Action

MAX MANUAL	1660	40/-35	55	-90/315	45/-35	50/-45	70	0	150
AUTOBRAKE MAX	1710	40/-35	55	-95/320	40/-35	55/-50	85	0	150
AUTOBRAKE 2	2295	60/-50	80	-125/420	10/-10	70/-70	140	0	0

Medium Reported Braking Action

MAX MANUAL	1820	45/-40	65	-105/360	60/-50	60/-50	75	0	215
AUTOBRAKE MAX	1840	45/-40	65	-105/360	55/-45	60/-55	90	0	210
AUTOBRAKE 3	2090	50/-40	70	-115/395	30/-20	60/-60	120	0	80

Medium to Poor Reported Braking Action

MAX MANUAL	2100	65/-55	95	-140/510	90/-70	90/-70	105	0	390
AUTOBRAKE MAX	2115	70/-55	95	-140/510	95/-75	90/-75	105	0	400
AUTOBRAKE 3	2180	65/-50	95	-125/475	65/-40	75/-65	110	0	355

Poor Reported Braking Action

MAX MANUAL	2830	80/-70	100	-195/730	295/-175	115/-85	105	0	1005
AUTOBRAKE MAX	2845	80/-70	100	-195/730	305/-180	115/-85	105	0	1015
AUTOBRAKE 3	2855	80/-70	100	-195/730	300/-175	115/-85	110	0	1020

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS C (Flaps 20)

VREF20

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1250	30/-20	35	-60/200	15/-10	35/-30	55	30	70
AUTOBRAKE MAX	1465	35/-25	45	-70/235	5/-5	40/-40	85	0	0
AUTOBRAKE 2	2230	60/-55	85	-120/405	20/-35	80/-65	110	55	55

Good Reported Braking Action

MAX MANUAL	1515	40/-35	60	-85/310	25/-25	55/-45	75	90	215
AUTOBRAKE MAX	1530	40/-30	60	-80/305	25/-10	55/-45	80	75	195
AUTOBRAKE 2	2250	60/-55	85	-125/415	30/-40	80/-70	115	60	60

Good to Medium Reported Braking Action

MAX MANUAL	1630	40/-30	55	-90/305	35/-30	50/-45	70	115	285
AUTOBRAKE MAX	1645	40/-35	55	-90/305	35/-30	55/-45	80	115	280
AUTOBRAKE 2	2235	60/-55	85	-125/415	30/-40	80/-70	115	60	60

Medium Reported Braking Action

MAX MANUAL	1760	45/-35	60	-100/345	50/-40	60/-50	70	155	405
AUTOBRAKE MAX	1765	45/-35	65	-100/345	55/-40	60/-50	75	150	395
AUTOBRAKE 3	2085	50/-45	70	-115/390	25/-25	60/-60	115	25	140

Medium to Poor Reported Braking Action

MAX MANUAL	1965	60/-45	85	-125/440	65/-55	85/-60	90	250	710
AUTOBRAKE MAX	1985	60/-50	90	-125/445	75/-60	85/-65	90	255	725
AUTOBRAKE 3	2180	55/-50	75	-120/400	45/-40	65/-65	105	80	530

Poor Reported Braking Action

MAX MANUAL	2515	70/-60	90	-170/655	215/-130	105/-75	90	550	1795
AUTOBRAKE MAX	2535	70/-60	90	-175/660	220/-135	110/-75	90	555	1810
AUTOBRAKE 3	2585	70/-60	90	-175/665	205/-120	100/-75	105	505	1765

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS L (Flaps 25)

VREF25

	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

Dry Runway

MAX MANUAL	1245	35/-25	35	-60/205	15/-15	35/-30	55	0	35
AUTOBRAKE MAX	1465	35/-30	45	-70/235	5/-5	40/-40	80	0	0
AUTOBRAKE 2	2285	60/-55	80	-125/415	0/0	70/-70	140	0	0

Good Reported Braking Action

MAX MANUAL	1555	45/-40	65	-95/340	35/-30	55/-50	80	0	125
AUTOBRAKE MAX	1570	45/-35	65	-85/340	35/-20	55/-50	90	0	115
AUTOBRAKE 2	2305	60/-55	80	-125/420	10/-10	70/-70	140	0	0

Good to Medium Reported Braking Action

MAX MANUAL	1700	40/-35	60	-95/325	45/-40	55/-45	75	0	165
AUTOBRAKE MAX	1730	40/-40	60	-95/325	40/-35	55/-50	85	0	165
AUTOBRAKE 2	2295	60/-55	80	-125/420	10/-10	70/-70	140	0	0

Medium Reported Braking Action

MAX MANUAL	1865	45/-40	65	-105/375	65/-55	60/-50	80	0	240
AUTOBRAKE MAX	1875	45/-40	70	-105/375	65/-50	60/-55	90	0	235
AUTOBRAKE 3	2100	50/-45	75	-115/400	30/-20	60/-60	120	0	105

Medium to Poor Reported Braking Action

MAX MANUAL	2160	70/-60	105	-145/530	95/-75	90/-75	105	0	445
AUTOBRAKE MAX	2180	70/-60	105	-145/530	105/-80	95/-75	105	0	455
AUTOBRAKE 3	2215	65/-55	105	-130/510	85/-45	85/-70	110	0	425

Poor Reported Braking Action

MAX MANUAL	2990	80/-70	110	-210/815	385/-205	120/-85	105	0	1215
AUTOBRAKE MAX	3005	80/-70	110	-215/815	390/-210	120/-90	105	0	1220
AUTOBRAKE 3	3010	80/-70	110	-215/815	390/-205	120/-90	110	0	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 a distance from threshold to touchdown associated with a flare time of 7 seconds.



ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS L (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1205	30/-25	35	-60/200	15/-15	30/-30	55	0	35
AUTOBRAKE MAX	1415	35/-30	45	-70/230	5/-5	40/-40	80	0	0
AUTOBRAKE 2	2195	60/-50	75	-120/405	0/0	65/-65	135	0	0

Good Reported Braking Action

MAX MANUAL	1495	45/-35	65	-90/335	30/-30	55/-50	80	0	110
AUTOBRAKE MAX	1510	45/-35	65	-85/325	30/-20	50/-45	85	0	100
AUTOBRAKE 2	2215	60/-50	80	-125/410	5/-5	70/-70	140	0	0

Good to Medium Reported Braking Action

MAX MANUAL	1645	40/-35	55	-90/320	45/-40	50/-45	70	0	150
AUTOBRAKE MAX	1675	40/-35	60	-95/320	40/-35	50/-45	85	0	150
AUTOBRAKE 2	2205	60/-50	80	-125/410	5/-5	70/-70	140	0	0

Medium Reported Braking Action

MAX MANUAL	1805	45/-40	65	-105/370	65/-50	60/-50	75	0	220
AUTOBRAKE MAX	1810	45/-40	65	-105/370	65/-45	60/-50	85	0	210
AUTOBRAKE 3	2025	50/-45	70	-115/395	30/-20	60/-60	120	0	95

Medium to Poor Reported Braking Action

MAX MANUAL	2075	65/-55	100	-145/520	90/-70	85/-70	100	0	385
AUTOBRAKE MAX	2085	65/-55	100	-145/520	95/-80	90/-70	105	0	385
AUTOBRAKE 3	2125	65/-50	95	-130/495	75/-40	75/-65	110	0	355

Poor Reported Braking Action

MAX MANUAL	2895	75/-65	105	-210/805	375/-200	115/-85	100	0	1095
AUTOBRAKE MAX	2905	75/-65	110	-210/805	380/-205	115/-85	100	0	1095
AUTOBRAKE 3	2910	80/-65	110	-210/805	380/-200	115/-85	105	0	1100

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS L+C (Flaps 20)

VREF30+20

	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

Dry Runway

MAX MANUAL	1515	35/-25	45	-70/225	20/-20	40/-40	65	0	55
AUTOBRAKE MAX	1745	35/-30	55	-75/250	5/-5	45/-50	90	0	0
AUTOBRAKE 2	2755	65/-55	95	-135/450	0/0	85/-85	150	0	0

Good Reported Braking Action

MAX MANUAL	1965	55/-45	85	-110/390	50/-40	75/-65	95	0	215
AUTOBRAKE MAX	1975	55/-45	90	-110/390	55/-45	75/-65	100	0	215
AUTOBRAKE 2	2790	65/-55	100	-140/455	10/-10	85/-85	155	0	0

Good to Medium Reported Braking Action

MAX MANUAL	2070	45/-40	70	-105/355	60/-50	65/-60	85	0	240
AUTOBRAKE MAX	2095	45/-40	75	-105/355	55/-45	70/-60	95	0	235
AUTOBRAKE 2	2775	65/-55	100	-140/455	10/-10	85/-85	155	0	0

Medium Reported Braking Action

MAX MANUAL	2275	50/-45	85	-120/405	80/-65	75/-65	90	0	340
AUTOBRAKE MAX	2280	55/-45	85	-120/410	85/-70	80/-65	95	0	340
AUTOBRAKE 3	2525	55/-50	90	-130/435	40/-25	75/-75	135	0	165

Medium to Poor Reported Braking Action

MAX MANUAL	2690	80/-65	130	-160/590	130/-100	120/-90	115	0	705
AUTOBRAKE MAX	2720	80/-65	130	-165/590	140/-110	120/-95	115	0	715
AUTOBRAKE 3	2720	80/-55	130	-150/590	140/-80	120/-95	120	0	715

Poor Reported Braking Action

MAX MANUAL	3575	90/-80	135	-230/875	445/-240	150/-105	115	0	1595
AUTOBRAKE MAX	3600	95/-80	140	-235/880	455/-250	150/-105	115	0	1610
AUTOBRAKE 3	3600	95/-80	140	-235/880	455/-245	150/-105	120	0	1610

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS L+R (Flaps 20)

VREF30+20

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1545	40/-25	45	-70/230	25/-20	40/-40	65	0	0
AUTOBRAKE MAX	1750	40/-30	55	-75/250	10/-5	45/-50	90	0	0
AUTOBRAKE 2	2755	65/-55	95	-135/450	0/0	85/-85	155	0	0

Good Reported Braking Action

MAX MANUAL	2145	60/-50	100	-130/470	75/-60	80/-80	115	0	0
AUTOBRAKE MAX	2165	60/-50	100	-130/475	80/-65	80/-80	120	0	0
AUTOBRAKE 2	2790	65/-55	100	-135/455	10/-10	85/-85	155	0	0

Good to Medium Reported Braking Action

MAX MANUAL	2280	50/-40	80	-115/395	90/-70	65/-65	95	0	0
AUTOBRAKE MAX	2315	50/-45	80	-115/400	85/-65	65/-70	110	0	0
AUTOBRAKE 2	2780	65/-55	100	-135/455	10/-10	85/-85	155	0	0

Medium Reported Braking Action

MAX MANUAL	2585	55/-50	95	-135/470	130/-100	75/-75	105	0	0
AUTOBRAKE MAX	2600	55/-50	95	-135/470	135/-105	75/-75	110	0	0
AUTOBRAKE 3	2685	60/-50	95	-140/475	115/-70	80/-80	135	0	0

Medium to Poor Reported Braking Action

MAX MANUAL	3350	100/-80	170	-225/850	265/-190	130/-130	155	0	0
AUTOBRAKE MAX	3390	100/-80	175	-225/855	280/-200	135/-130	155	0	0
AUTOBRAKE 3	3395	100/-85	175	-225/855	280/-195	135/-130	165	0	0

Poor Reported Braking Action

MAX MANUAL	5110	105/-80	175	-340/1265	1325/-530	150/-145	155	0	0
AUTOBRAKE MAX	5150	105/-80	180	-340/1265	1340/-540	150/-150	155	0	0
AUTOBRAKE 3	5155	105/-80	180	-340/1265	1335/-535	150/-150	160	0	0

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS R (Flaps 25)

VREF25+5

	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

Dry Runway

MAX MANUAL	1310	35/-25	40	-65/210	15/-15	35/-35	55	0	40
AUTOBRAKE MAX	1545	35/-30	45	-75/240	5/-5	40/-40	85	0	0
AUTOBRAKE 2	2420	60/-55	85	-125/425	0/0	75/-75	145	0	0

Good Reported Braking Action

MAX MANUAL	1660	45/-40	70	-95/355	35/-30	60/-55	85	0	145
AUTOBRAKE MAX	1670	50/-40	70	-90/355	40/-25	60/-55	90	0	140
AUTOBRAKE 2	2445	60/-55	85	-130/430	10/-10	75/-75	145	0	0

Good to Medium Reported Braking Action

MAX MANUAL	1795	40/-40	60	-95/330	50/-40	55/-50	75	0	185
AUTOBRAKE MAX	1830	45/-40	65	-95/335	45/-40	60/-50	85	0	185
AUTOBRAKE 2	2435	60/-55	85	-130/430	10/-10	75/-75	145	0	0

Medium Reported Braking Action

MAX MANUAL	1970	45/-45	70	-110/380	70/-55	65/-55	80	0	270
AUTOBRAKE MAX	1980	50/-45	70	-110/380	70/-50	65/-55	90	0	265
AUTOBRAKE 3	2225	55/-50	75	-120/410	35/-25	65/-65	125	0	115

Medium to Poor Reported Braking Action

MAX MANUAL	2300	70/-60	110	-150/545	105/-85	100/-80	105	0	515
AUTOBRAKE MAX	2320	70/-60	110	-150/545	110/-90	100/-80	105	0	525
AUTOBRAKE 3	2345	70/-55	110	-130/530	100/-50	95/-75	110	0	505

Poor Reported Braking Action

MAX MANUAL	3140	80/-75	115	-215/830	400/-215	125/-90	105	0	1315
AUTOBRAKE MAX	3160	85/-75	120	-220/830	405/-220	130/-90	105	0	1325
AUTOBRAKE 3	3160	85/-75	120	-220/830	405/-215	130/-95	110	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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS R (Flaps 30)

VREF30+5

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1270	35/-25	40	-60/205	15/-15	35/-35	55	0	40
AUTOBRAKE MAX	1495	35/-30	45	-70/235	5/-5	40/-40	85	0	0
AUTOBRAKE 2	2330	60/-50	80	-125/420	0/0	70/-70	140	0	0

Good Reported Braking Action

MAX MANUAL	1595	45/-35	70	-95/345	35/-30	60/-50	85	0	125
AUTOBRAKE MAX	1600	45/-35	70	-90/340	35/-20	60/-50	90	0	115
AUTOBRAKE 2	2355	60/-50	85	-125/425	10/-10	70/-75	145	0	0

Good to Medium Reported Braking Action

MAX MANUAL	1735	40/-35	60	-95/325	50/-40	55/-50	75	0	165
AUTOBRAKE MAX	1765	40/-35	60	-95/330	45/-35	55/-50	85	0	165
AUTOBRAKE 2	2345	60/-50	85	-125/425	10/-10	70/-75	145	0	0

Medium Reported Braking Action

MAX MANUAL	1905	45/-40	70	-110/375	65/-55	60/-55	80	0	240
AUTOBRAKE MAX	1910	45/-40	70	-110/375	65/-50	65/-55	90	0	235
AUTOBRAKE 3	2145	50/-45	75	-120/405	35/-25	65/-65	125	0	100

Medium to Poor Reported Braking Action

MAX MANUAL	2205	70/-55	105	-145/530	100/-80	95/-75	105	0	440
AUTOBRAKE MAX	2215	70/-55	105	-145/535	105/-85	95/-75	105	0	445
AUTOBRAKE 3	2250	70/-50	105	-130/515	90/-45	85/-70	110	0	420

Poor Reported Braking Action

MAX MANUAL	3035	80/-70	110	-215/820	390/-205	120/-90	105	0	1175
AUTOBRAKE MAX	3045	80/-70	115	-215/820	395/-210	120/-90	105	0	1180
AUTOBRAKE 3	3050	80/-70	115	-215/820	390/-205	120/-90	110	0	1180

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS R+C (Flaps 20)

VREF30+20

	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

Dry Runway

MAX MANUAL	1530	35/-25	45	-70/225	20/-20	40/-40	65	0	60
AUTOBRAKE MAX	1745	35/-30	55	-75/250	5/-5	45/-50	90	0	0
AUTOBRAKE 2	2755	65/-55	95	-135/450	0/0	85/-85	150	0	0

Good Reported Braking Action

MAX MANUAL	1990	55/-45	90	-110/395	50/-45	75/-65	100	0	225
AUTOBRAKE MAX	2000	55/-45	90	-110/400	60/-45	80/-65	100	0	230
AUTOBRAKE 2	2790	65/-55	100	-140/455	10/-10	85/-85	155	0	0

Good to Medium Reported Braking Action

MAX MANUAL	2100	45/-40	75	-105/355	60/-50	70/-60	85	0	250
AUTOBRAKE MAX	2110	50/-40	75	-105/360	65/-50	70/-60	95	0	245
AUTOBRAKE 2	2775	65/-55	100	-140/455	10/-10	85/-85	155	0	0

Medium Reported Braking Action

MAX MANUAL	2305	55/-45	85	-120/410	85/-70	80/-65	90	0	360
AUTOBRAKE MAX	2310	55/-45	85	-120/410	90/-75	80/-65	95	0	360
AUTOBRAKE 3	2525	55/-50	90	-130/435	50/-25	75/-75	135	0	195

Medium to Poor Reported Braking Action

MAX MANUAL	2740	80/-65	135	-165/600	135/-105	125/-95	120	0	760
AUTOBRAKE MAX	2770	85/-70	135	-165/600	145/-115	125/-95	120	0	775
AUTOBRAKE 3	2770	85/-60	135	-155/600	145/-95	125/-95	120	0	775

Poor Reported Braking Action

MAX MANUAL	3640	95/-80	140	-235/885	460/-250	155/-105	120	0	1700
AUTOBRAKE MAX	3665	95/-80	140	-235/885	470/-260	155/-110	120	0	1715
AUTOBRAKE 3	3665	95/-80	140	-235/885	470/-255	155/-110	120	0	1715

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance NAV AIR DATA SYS / NAV AIRSPEED DATA (Flaps 20) VREF20

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1235	30/-20	35	-60/200	15/-10	35/-30	50	30	65
AUTOBRAKE MAX	1475	35/-25	45	-70/235	5/-5	40/-40	85	0	0
AUTOBRAKE 2	2220	60/-55	85	-120/405	25/-35	80/-65	110	65	65

Good Reported Braking Action

MAX MANUAL	1495	40/-30	60	-85/305	25/-25	55/-45	75	85	200
AUTOBRAKE MAX	1525	40/-30	60	-75/300	20/-10	50/-40	80	65	180
AUTOBRAKE 2	2245	60/-55	85	-125/410	30/-40	85/-70	110	70	70

Good to Medium Reported Braking Action

MAX MANUAL	1610	40/-30	55	-85/300	35/-30	50/-45	65	110	270
AUTOBRAKE MAX	1640	40/-30	55	-90/305	35/-25	55/-45	80	110	270
AUTOBRAKE 2	2235	60/-55	85	-125/410	30/-40	85/-70	110	70	70

Medium Reported Braking Action

MAX MANUAL	1735	40/-35	60	-95/340	50/-40	60/-45	70	150	385
AUTOBRAKE MAX	1750	45/-35	60	-100/340	50/-35	60/-50	80	145	375
AUTOBRAKE 3	2090	50/-45	70	-115/390	25/-25	60/-60	115	25	125

Medium to Poor Reported Braking Action

MAX MANUAL	1945	60/-45	85	-125/435	65/-55	80/-60	85	240	665
AUTOBRAKE MAX	1965	60/-45	85	-125/440	70/-60	85/-60	90	245	680
AUTOBRAKE 3	2170	55/-50	75	-120/400	45/-40	65/-65	105	70	480

Poor Reported Braking Action

MAX MANUAL	2485	70/-60	90	-170/650	210/-125	105/-70	85	530	1710
AUTOBRAKE MAX	2505	70/-60	90	-170/655	215/-135	105/-75	90	535	1725
AUTOBRAKE 3	2565	70/-60	90	-175/660	200/-115	100/-75	105	480	1675

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PITCH UP AUTHORITY (Flaps ≤ 15)

VREF30+40

	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

Dry Runway

MAX MANUAL	1600	45/-25	50	-65/215	15/-15	45/-40	55	50	110
AUTOBRAKE MAX	2085	40/-35	65	-85/270	5/-5	55/-60	100	0	0
AUTOBRAKE 2	2995	75/-70	120	-140/460	55/-65	125/-90	100	320	370

Good Reported Braking Action

MAX MANUAL	2035	50/-45	85	-100/350	35/-35	80/-65	80	160	410
AUTOBRAKE MAX	2125	50/-35	85	-85/320	15/-5	70/-60	95	130	375
AUTOBRAKE 2	3020	75/-70	120	-140/460	65/-70	125/-90	100	325	385

Good to Medium Reported Braking Action

MAX MANUAL	2080	45/-40	70	-95/325	45/-40	70/-55	70	170	420
AUTOBRAKE MAX	2235	45/-40	75	-100/340	30/-25	70/-60	95	125	390
AUTOBRAKE 2	3010	75/-70	120	-140/460	65/-70	125/-90	100	325	385

Medium Reported Braking Action

MAX MANUAL	2240	50/-45	80	-105/370	55/-50	80/-60	70	225	585
AUTOBRAKE MAX	2330	50/-40	80	-110/375	45/-35	80/-65	95	215	580
AUTOBRAKE 3	2885	65/-65	105	-130/445	55/-60	105/-85	105	155	270

Medium to Poor Reported Braking Action

MAX MANUAL	2585	70/-60	115	-135/475	80/-70	115/-80	90	400	1180
AUTOBRAKE MAX	2610	70/-60	115	-135/480	85/-70	115/-85	90	405	1195
AUTOBRAKE 3	2915	65/-65	110	-130/450	65/-65	110/-85	95	190	915

Poor Reported Braking Action

MAX MANUAL	3125	80/-70	115	-185/690	225/-140	140/-90	90	710	2335
AUTOBRAKE MAX	3150	80/-70	115	-185/690	230/-145	140/-95	90	710	2345
AUTOBRAKE 3	3305	85/-75	120	-190/710	225/-145	140/-100	95	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 a distance from threshold to touchdown associated with a flare time of 7 seconds.



787 Flight Crew Operations Manual

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PITCH UP AUTHORITY (Flaps ≥ 20)

VREF30+20

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1405	35/-25	40	-65/205	15/-15	40/-35	55	40	90
AUTOBRAKE MAX	1760	35/-30	55	-75/250	5/-5	45/-50	90	0	0
AUTOBRAKE 2	2580	70/-60	100	-130/430	50/-55	100/-75	110	185	185

Good Reported Braking Action

MAX MANUAL	1735	45/-40	70	-90/330	30/-30	65/-55	75	120	295
AUTOBRAKE MAX	1785	45/-30	70	-80/320	30/-5	65/-50	85	105	275
AUTOBRAKE 2	2600	70/-65	100	-130/435	50/-55	105/-80	105	195	195

Good to Medium Reported Braking Action

MAX MANUAL	1825	40/-35	65	-90/315	40/-35	60/-50	70	140	345
AUTOBRAKE MAX	1905	40/-35	65	-95/320	35/-25	60/-50	85	135	345
AUTOBRAKE 2	2595	70/-65	100	-130/435	50/-55	105/-80	105	195	195

Medium Reported Braking Action

MAX MANUAL	1970	45/-40	70	-100/355	55/-45	70/-55	70	185	480
AUTOBRAKE MAX	2015	45/-40	70	-105/360	50/-40	70/-55	85	185	475
AUTOBRAKE 3	2465	60/-55	90	-125/415	40/-45	85/-75	110	65	175

Medium to Poor Reported Braking Action

MAX MANUAL	2230	65/-50	100	-125/455	75/-60	95/-70	85	310	880
AUTOBRAKE MAX	2250	65/-50	100	-130/460	80/-65	100/-70	90	315	900
AUTOBRAKE 3	2500	60/-55	90	-125/425	50/-50	85/-75	100	100	670

Poor Reported Braking Action

MAX MANUAL	2770	75/-65	100	-175/670	220/-135	120/-80	85	605	1950
AUTOBRAKE MAX	2795	75/-65	105	-180/675	225/-140	120/-80	90	610	1965
AUTOBRAKE 3	2900	75/-65	105	-180/685	210/-130	120/-85	100	520	1880

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PRI FLIGHT COMPUTERS (Flaps 20)

VREF20

	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

Dry Runway

MAX MANUAL	1270	30/-25	35	-60/205	15/-15	35/-30	55	35	75
AUTOBRAKE MAX	1475	35/-25	45	-70/235	5/-5	40/-40	85	0	0
AUTOBRAKE 2	2245	60/-55	80	-120/410	20/-30	80/-70	115	40	40

Good Reported Braking Action

MAX MANUAL	1540	45/-35	60	-90/315	30/-25	55/-45	80	95	235
AUTOBRAKE MAX	1555	45/-30	65	-80/315	30/-20	55/-45	80	85	225
AUTOBRAKE 2	2270	60/-55	85	-125/415	30/-40	80/-70	115	45	45

Good to Medium Reported Braking Action

MAX MANUAL	1655	40/-35	55	-90/305	40/-35	55/-45	70	125	310
AUTOBRAKE MAX	1665	40/-35	55	-90/310	40/-30	55/-45	80	120	300
AUTOBRAKE 2	2255	60/-55	85	-125/415	30/-40	80/-70	115	45	45

Medium Reported Braking Action

MAX MANUAL	1790	45/-35	65	-100/350	50/-45	60/-50	75	170	440
AUTOBRAKE MAX	1795	45/-35	65	-100/350	55/-45	60/-50	80	165	435
AUTOBRAKE 3	2090	50/-45	70	-115/390	30/-25	60/-60	120	25	175

Medium to Poor Reported Braking Action

MAX MANUAL	2005	60/-50	90	-125/450	70/-60	85/-65	90	270	785
AUTOBRAKE MAX	2025	60/-50	90	-125/450	75/-65	90/-65	95	280	805
AUTOBRAKE 3	2205	55/-50	80	-120/405	45/-40	65/-65	105	100	625

Poor Reported Braking Action

MAX MANUAL	2560	70/-60	95	-175/665	220/-135	110/-75	95	585	1945
AUTOBRAKE MAX	2580	70/-60	95	-175/665	230/-140	110/-75	95	590	1965
AUTOBRAKE 3	2625	70/-60	90	-175/670	215/-125	105/-75	105	550	1925

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ROLL LEFT AUTHORITY / ROLL RIGHT AUTHORITY (Flaps 20)

VREF30+20

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1385	35/-25	40	-60/205	15/-15	40/-35	55	35	80
AUTOBRAKE MAX	1745	35/-30	55	-75/250	5/-5	45/-50	90	0	0
AUTOBRAKE 2	2560	65/-60	100	-130/430	45/-50	100/-75	105	185	190

Good Reported Braking Action

MAX MANUAL	1715	45/-35	70	-90/325	30/-25	65/-55	75	110	275
AUTOBRAKE MAX	1775	45/-30	70	-80/305	20/-5	60/-50	85	90	250
AUTOBRAKE 2	2585	70/-65	100	-130/435	50/-55	105/-80	100	195	200

Good to Medium Reported Braking Action

MAX MANUAL	1805	40/-35	60	-90/310	40/-35	60/-50	65	130	325
AUTOBRAKE MAX	1890	40/-35	65	-95/320	30/-25	60/-50	85	125	325
AUTOBRAKE 2	2580	70/-65	100	-130/435	50/-55	105/-80	100	195	200

Medium Reported Braking Action

MAX MANUAL	1945	45/-40	70	-100/350	50/-45	70/-55	70	180	455
AUTOBRAKE MAX	1995	45/-40	70	-105/355	45/-40	70/-55	85	175	455
AUTOBRAKE 3	2450	60/-55	90	-120/415	40/-45	85/-75	105	65	165

Medium to Poor Reported Braking Action

MAX MANUAL	2205	65/-50	95	-125/455	70/-60	95/-70	85	300	845
AUTOBRAKE MAX	2225	65/-50	100	-125/455	75/-65	95/-70	85	305	855
AUTOBRAKE 3	2490	60/-55	90	-125/420	50/-55	85/-75	95	95	620

Poor Reported Braking Action

MAX MANUAL	2750	75/-65	100	-175/670	215/-135	120/-80	85	590	1885
AUTOBRAKE MAX	2770	75/-65	100	-175/670	220/-135	120/-80	85	595	1900
AUTOBRAKE 3	2885	75/-65	105	-180/685	205/-130	115/-85	95	505	1810

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

SLATS DRIVE (Flaps 20)

VREF30+30

	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

Dry Runway

MAX MANUAL	1500	40/-25	45	-65/210	15/-15	40/-40	55	45	95
AUTOBRAKE MAX	1935	40/-30	60	-80/260	5/-5	50/-55	95	0	0
AUTOBRAKE 2	2785	70/-65	110	-135/445	55/-60	110/-85	105	255	285

Good Reported Braking Action

MAX MANUAL	1875	50/-40	75	-95/335	35/-30	70/-60	75	135	335
AUTOBRAKE MAX	1950	45/-35	75	-80/320	20/-5	65/-55	90	115	310
AUTOBRAKE 2	2795	70/-65	110	-135/445	60/-60	115/-85	100	260	290

Good to Medium Reported Braking Action

MAX MANUAL	1950	40/-40	65	-95/320	40/-35	65/-55	65	150	365
AUTOBRAKE MAX	2070	45/-35	70	-95/330	30/-25	65/-55	90	130	360
AUTOBRAKE 2	2795	70/-65	110	-135/445	60/-60	115/-85	100	260	290

Medium Reported Braking Action

MAX MANUAL	2095	45/-40	75	-105/360	55/-45	75/-60	70	200	510
AUTOBRAKE MAX	2170	50/-40	75	-105/365	50/-40	75/-60	90	200	515
AUTOBRAKE 3	2665	60/-60	95	-125/430	50/-55	95/-80	100	110	215

Medium to Poor Reported Braking Action

MAX MANUAL	2390	65/-55	105	-130/465	75/-65	105/-75	85	340	960
AUTOBRAKE MAX	2415	65/-55	105	-130/465	80/-65	105/-75	90	340	975
AUTOBRAKE 3	2690	65/-60	100	-130/435	60/-60	95/-80	95	135	720

Poor Reported Braking Action

MAX MANUAL	2935	75/-65	110	-180/680	220/-140	125/-85	85	630	2015
AUTOBRAKE MAX	2960	75/-70	110	-180/680	225/-140	130/-85	90	635	2030
AUTOBRAKE 3	3090	80/-70	110	-185/695	220/-140	130/-90	95	550	1925

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.



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ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

SPOILER PAIRS (Flaps 25)

VREF25+5

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1280	30/-25	40	-60/200	15/-15	35/-30	55	35	75
AUTOBRAKE MAX	1545	35/-30	45	-75/240	5/-5	40/-40	85	0	0
AUTOBRAKE 2	2320	65/-60	90	-125/415	30/-40	90/-70	105	95	95

Good Reported Braking Action

MAX MANUAL	1560	45/-35	65	-90/315	30/-25	60/-50	75	100	245
AUTOBRAKE MAX	1590	45/-35	65	-80/305	25/-10	55/-45	80	85	220
AUTOBRAKE 2	2340	65/-60	90	-125/420	35/-45	90/-70	110	100	100

Good to Medium Reported Braking Action

MAX MANUAL	1670	40/-35	55	-90/305	40/-35	55/-45	70	125	310
AUTOBRAKE MAX	1705	40/-35	60	-90/310	35/-25	55/-45	80	125	305
AUTOBRAKE 2	2330	65/-60	90	-125/420	35/-45	90/-70	110	100	100

Medium Reported Braking Action

MAX MANUAL	1800	45/-40	65	-100/345	50/-40	65/-50	70	170	440
AUTOBRAKE MAX	1815	45/-40	65	-100/345	50/-40	65/-50	80	165	425
AUTOBRAKE 3	2190	55/-55	75	-115/400	25/-30	65/-65	115	30	145

Medium to Poor Reported Braking Action

MAX MANUAL	2025	60/-50	90	-125/445	70/-55	85/-65	90	275	790
AUTOBRAKE MAX	2040	60/-50	90	-125/445	75/-60	90/-65	90	280	805
AUTOBRAKE 3	2255	55/-55	80	-120/405	45/-40	70/-65	105	90	595

Poor Reported Braking Action

MAX MANUAL	2570	70/-65	95	-170/660	215/-130	110/-75	90	575	1890
AUTOBRAKE MAX	2585	70/-65	95	-175/660	220/-135	110/-75	90	580	1905
AUTOBRAKE 3	2650	70/-65	95	-175/665	205/-120	105/-80	105	515	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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

SPOILER PAIRS (Flaps 30)

VREF30+5

	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

Dry Runway

MAX MANUAL	1240	30/-25	35	-60/200	15/-10	35/-30	55	30	70
AUTOBRAKE MAX	1495	35/-30	45	-70/235	5/-5	40/-40	85	0	0
AUTOBRAKE 2	2245	60/-55	85	-120/410	25/-35	85/-65	105	80	80

Good Reported Braking Action

MAX MANUAL	1505	40/-35	60	-85/310	25/-25	55/-45	75	90	215
AUTOBRAKE MAX	1535	40/-30	60	-75/300	25/-5	50/-45	80	70	190
AUTOBRAKE 2	2265	60/-55	85	-125/410	35/-45	85/-70	105	85	85

Good to Medium Reported Braking Action

MAX MANUAL	1620	40/-35	55	-85/300	35/-30	50/-45	65	115	280
AUTOBRAKE MAX	1655	40/-35	55	-90/305	35/-25	55/-45	80	110	275
AUTOBRAKE 2	2255	60/-55	85	-125/410	35/-45	85/-70	105	85	85

Medium Reported Braking Action

MAX MANUAL	1750	45/-35	60	-95/340	50/-40	60/-50	70	155	395
AUTOBRAKE MAX	1760	45/-35	65	-100/345	50/-35	60/-50	80	150	380
AUTOBRAKE 3	2115	50/-50	75	-115/390	25/-30	65/-65	110	25	130

Medium to Poor Reported Braking Action

MAX MANUAL	1960	60/-50	85	-120/440	65/-55	85/-60	85	245	685
AUTOBRAKE MAX	1965	60/-50	90	-120/440	70/-60	85/-65	85	250	690
AUTOBRAKE 3	2175	55/-50	75	-115/400	40/-40	65/-65	105	75	490

Poor Reported Braking Action

MAX MANUAL	2500	70/-60	90	-170/655	210/-130	105/-75	85	535	1710
AUTOBRAKE MAX	2510	70/-60	90	-170/655	215/-135	105/-75	85	535	1715
AUTOBRAKE 3	2575	70/-60	90	-175/660	200/-115	100/-75	105	480	1660

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.



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ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

SPOILERS (Flaps 25)

VREF25

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1215	30/-25	35	-60/195	15/-10	30/-30	50	30	65
AUTOBRAKE MAX	1465	35/-30	45	-70/235	5/-5	40/-40	80	0	0
AUTOBRAKE 2	2200	60/-60	85	-120/405	25/-35	80/-65	105	75	75

Good Reported Braking Action

MAX MANUAL	1470	40/-35	60	-85/305	25/-25	55/-45	75	85	210
AUTOBRAKE MAX	1505	40/-30	60	-75/295	20/-5	50/-40	80	65	180
AUTOBRAKE 2	2220	60/-60	85	-120/410	30/-40	85/-65	105	80	80

Good to Medium Reported Braking Action

MAX MANUAL	1585	40/-35	55	-85/300	35/-30	50/-45	65	110	280
AUTOBRAKE MAX	1620	40/-35	55	-85/300	30/-25	55/-45	80	110	275
AUTOBRAKE 2	2210	60/-60	85	-120/410	30/-40	85/-65	105	80	80

Medium Reported Braking Action

MAX MANUAL	1710	40/-40	60	-95/340	50/-40	60/-45	70	155	395
AUTOBRAKE MAX	1725	45/-40	60	-95/340	50/-35	60/-50	80	145	385
AUTOBRAKE 3	2075	50/-50	70	-115/390	25/-30	60/-60	110	25	130

Medium to Poor Reported Braking Action

MAX MANUAL	1915	60/-50	85	-120/435	65/-55	80/-60	85	245	685
AUTOBRAKE MAX	1930	60/-50	85	-120/435	70/-55	80/-60	85	250	700
AUTOBRAKE 3	2145	55/-55	75	-115/395	45/-35	65/-60	105	75	495

Poor Reported Braking Action

MAX MANUAL	2455	70/-60	90	-170/645	205/-125	105/-70	85	535	1745
AUTOBRAKE MAX	2470	70/-60	90	-170/650	210/-130	105/-70	85	540	1760
AUTOBRAKE 3	2530	70/-60	90	-170/655	200/-115	100/-75	105	480	1700

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

SPOILERS (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV NO REV

Dry Runway

MAX MANUAL	1180	30/-20	35	-60/195	10/-10	30/-30	50	25	60
AUTOBRAKE MAX	1415	35/-30	45	-70/230	5/-5	40/-40	80	0	0
AUTOBRAKE 2	2130	60/-55	80	-120/400	20/-35	75/-65	105	60	60

Good Reported Braking Action

MAX MANUAL	1420	40/-30	55	-85/300	25/-20	50/-45	70	75	185
AUTOBRAKE MAX	1455	40/-30	55	-75/285	15/-5	45/-40	80	55	155
AUTOBRAKE 2	2145	60/-55	80	-120/405	30/-40	80/-65	105	65	65

Good to Medium Reported Braking Action

MAX MANUAL	1540	35/-30	50	-85/295	35/-30	50/-40	65	105	255
AUTOBRAKE MAX	1575	40/-35	55	-85/300	30/-25	50/-45	75	100	250
AUTOBRAKE 2	2140	60/-55	80	-120/405	30/-40	80/-65	105	65	65

Medium Reported Braking Action

MAX MANUAL	1665	40/-35	60	-95/335	45/-40	55/-45	70	140	360
AUTOBRAKE MAX	1675	40/-35	60	-95/335	50/-35	55/-45	80	135	345
AUTOBRAKE 3	2000	50/-45	70	-110/385	25/-25	60/-60	110	25	115

Medium to Poor Reported Braking Action

MAX MANUAL	1855	55/-45	80	-120/430	60/-50	75/-60	85	220	600
AUTOBRAKE MAX	1865	55/-45	85	-120/430	65/-55	80/-60	85	220	610
AUTOBRAKE 3	2065	50/-50	70	-120/390	40/-35	60/-60	105	60	415

Poor Reported Braking Action

MAX MANUAL	2395	65/-55	85	-170/645	205/-125	100/-70	85	500	1595
AUTOBRAKE MAX	2400	65/-60	90	-170/645	210/-130	100/-70	85	505	1600
AUTOBRAKE 3	2455	65/-60	85	-170/650	195/-110	95/-70	105	455	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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

STABILIZER (Flaps 20)

VREF30+20

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	170000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 170000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1480	35/-25	45	-65/215	20/-15	40/-40	60	50	115
AUTOBRAKE MAX	1760	35/-30	55	-75/250	5/-5	45/-50	90	0	0
AUTOBRAKE 2	2660	70/-65	100	-130/440	40/-50	100/-80	125	105	105

Good Reported Braking Action

MAX MANUAL	1845	50/-40	80	-100/345	40/-35	75/-60	85	160	405
AUTOBRAKE MAX	1875	50/-35	80	-95/345	40/-30	75/-60	90	150	405
AUTOBRAKE 2	2680	70/-65	105	-135/445	40/-55	105/-80	115	115	115

Good to Medium Reported Braking Action

MAX MANUAL	1935	45/-40	70	-95/325	50/-40	65/-55	75	175	445
AUTOBRAKE MAX	1960	45/-40	70	-95/330	50/-40	70/-55	85	170	435
AUTOBRAKE 2	2675	70/-65	105	-135/445	40/-55	105/-80	115	115	115

Medium Reported Braking Action

MAX MANUAL	2085	50/-45	75	-105/370	60/-50	75/-60	80	230	615
AUTOBRAKE MAX	2110	50/-45	80	-110/370	65/-55	80/-60	85	225	615
AUTOBRAKE 3	2500	55/-55	85	-125/420	35/-35	75/-75	120	35	265

Medium to Poor Reported Braking Action

MAX MANUAL	2365	70/-55	110	-135/480	85/-70	110/-75	95	395	1195
AUTOBRAKE MAX	2390	70/-55	110	-135/480	90/-75	110/-75	100	400	1220
AUTOBRAKE 3	2580	60/-55	100	-125/435	55/-50	85/-75	110	215	1030

Poor Reported Braking Action

MAX MANUAL	2930	80/-70	110	-185/695	245/-150	135/-85	95	725	2480
AUTOBRAKE MAX	2955	80/-70	115	-185/695	250/-155	135/-90	100	730	2505
AUTOBRAKE 3	3020	80/-70	110	-190/705	235/-140	125/-90	110	670	2445

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 a distance from threshold to touchdown associated with a flare time of 7 seconds.

ADVISORY INFORMATION

Landing Climb Limit Weight

Valid for approach with flaps 20 and landing with flaps 30

Based on anti-ice off

AIRPORT OAT (°C)	LANDING CLIMB LIMIT WEIGHT (1000 KG)								
	AIRPORT PRESSURE ALTITUDE (FT)								
	-2000	0	2000	4000	6000	8000	10000	12000	14000
54	188.2	178.7							
52	191.5	182.6							
50	194.7	186.7	172.5						
48	197.9	189.9	175.5						
46	201.0	193.2	178.5	162.3					
44	204.3	196.4	181.5	165.1					
42	207.7	199.6	184.6	169.7	154.8				
40	210.9	202.9	187.7	173.4	157.4				
38	214.3	206.1	190.6	176.2	159.9	147.5			
36	217.7	209.4	193.6	179.0	162.5	149.9			
34	221.1	212.7	196.7	181.9	165.2	152.2	139.3		
32	221.3	216.2	199.9	184.8	169.6	154.8	141.6		
30	221.4	219.6	203.2	187.8	173.4	157.4	143.9		
28	221.6	219.7	206.5	190.9	176.2	160.0	146.4		
26	221.7	219.9	209.9	194.1	179.2	162.7	148.8		
24	221.8	220.0	210.0	197.3	182.2	165.4	151.3	137.1	
22	221.9	220.1	210.1	200.3	185.1	169.9	153.9	139.5	
20	222.1	220.2	210.2	200.4	188.1	173.6	156.4	141.9	128.5
18	222.2	220.3	210.3	200.4	190.9	176.5	159.0	144.2	130.7
16	222.2	220.4	210.3	200.5	191.0	179.4	161.6	146.6	132.8
14	222.3	220.4	210.4	200.5	191.0	182.1	164.4	149.0	134.9
12	222.3	220.5	210.5	200.6	191.1	182.1	168.1	151.6	137.1
10	222.4	220.5	210.5	200.7	191.1	182.2	171.9	154.1	139.5
0	222.7	220.7	210.7	200.8	191.2	182.3	172.0	158.6	148.3
-10	223.0	220.9	210.8	200.9	191.2	182.2	172.0	158.7	148.4
-20	223.3	221.1	211.0	200.9	191.2	182.1	171.9	158.7	
-30	223.2	221.2	211.1	201.0	191.2	182.2	171.9		
-40	223.0	221.0	210.9	200.9	191.2	182.3			

For OAT<10°C:

With engine anti-ice on, decrease weight by 4250 kg.

With engine and wing anti-ice on, decrease weight by 4250 kg.

When operating in icing conditions during any part of the flight with forecast landing temperature at or below 10°C, decrease weight by 31400 kg.

For 10°C≤OAT≤20°C:

With engine anti-ice on, decrease weight by 7050 kg.

With engine and wing anti-ice on, decrease weight by 7050 kg.

ADVISORY INFORMATION

Landing Climb Limit Weight

Valid for approach with flaps 20 and landing with flaps 25

Based on anti-ice off

AIRPORT OAT (°C)	LANDING CLIMB LIMIT WEIGHT (1000 KG)								
	AIRPORT PRESSURE ALTITUDE (FT)								
	-2000	0	2000	4000	6000	8000	10000	12000	14000
54	188.7	179.0							
52	192.0	183.0							
50	195.2	187.1	172.8						
48	198.4	190.3	175.8						
46	201.6	193.6	178.8	162.6					
44	204.8	196.8	181.9	165.4					
42	208.2	200.0	185.0	170.1	155.1				
40	211.4	203.3	188.0	173.7	157.7				
38	214.8	206.6	191.0	176.5	160.2	147.8			
36	218.2	209.9	194.0	179.4	162.9	150.2			
34	221.6	213.4	197.2	182.3	165.6	152.6	139.7		
32	221.8	216.8	200.5	185.2	170.3	155.2	142.0		
30	222.0	220.3	203.8	188.3	173.8	157.8	144.3		
28	222.1	220.4	207.1	191.4	176.7	160.4	146.8		
26	222.2	220.5	210.5	194.6	179.7	163.1	149.2		
24	222.3	220.6	210.6	197.8	182.6	166.1	151.8	137.5	
22	222.5	220.7	210.7	200.8	185.6	170.6	154.3	139.9	
20	222.6	220.8	210.8	200.9	188.6	174.0	156.8	142.3	128.8
18	222.7	220.9	210.8	200.9	191.4	176.9	159.4	144.6	131.0
16	222.8	221.0	210.9	201.0	191.4	179.8	162.1	146.9	133.1
14	222.8	221.1	211.0	201.1	191.5	182.5	164.8	149.4	135.2
12	222.9	221.1	211.1	201.1	191.5	182.6	168.9	152.0	137.4
10	222.9	221.2	211.1	201.2	191.6	182.6	172.5	154.5	139.8
0	223.2	221.4	211.3	201.3	191.7	182.7	172.5	159.0	148.6
-10	223.5	221.6	211.4	201.4	191.7	182.6	172.5	159.1	148.8
-20	223.8	221.8	211.5	201.5	191.7	182.6	172.5	159.1	
-30	223.8	221.9	211.7	201.5	191.7	182.6	172.5		
-40	223.6	221.6	211.5	201.5	191.7	182.7			

For OAT<10°C:

With engine anti-ice on, decrease weight by 4250 kg.

With engine and wing anti-ice on, decrease weight by 4250 kg.

When operating in icing conditions during any part of the flight with forecast landing temperature at or below 10°C, decrease weight by 31850 kg.

For 10°C≤OAT≤20°C:

With engine anti-ice on, decrease weight by 6800 kg.

With engine and wing anti-ice on, decrease weight by 6800 kg.

ADVISORY INFORMATION**Recommended Brake Cooling Schedule****Reference Brake Energy (Millions of Foot Pounds)****Table 1(a) of 3: Sea Level to 10000 ft Pressure Altitude**

		BRAKES ON SPEED (KIAS)														
		100			120			140			160			180		
WEIGHT (1000 KG)	OAT (°C)	PRESSURE ALTITUDE (1000 FT)														
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
240	0	33.5	38.5	44.6	45.8	53.0	61.5	59.5	69.1	80.6	74.0	86.4	101.1	88.9	104.3	122.5
	10	34.6	39.8	46.1	47.3	54.8	63.6	61.5	71.5	83.3	76.5	89.4	104.6	92.0	107.9	126.8
	15	35.1	40.5	46.8	48.1	55.6	64.6	62.5	72.7	84.7	77.8	90.8	106.3	93.5	109.7	128.9
	20	35.7	41.1	47.6	48.9	56.5	65.7	63.5	73.8	86.1	79.0	92.3	108.0	95.0	111.5	131.0
	30	36.7	42.3	49.0	50.3	58.2	67.6	65.4	76.1	88.7	81.5	95.2	111.4	98.0	115.0	135.3
	40	37.3	43.0	49.8	51.2	59.3	69.0	66.7	77.7	90.8	83.3	97.5	114.5	100.5	118.3	139.6
220	0	31.1	35.8	41.4	42.4	49.0	56.8	55.0	63.8	74.3	68.5	79.8	93.3	82.4	96.4	113.1
	10	32.1	37.0	42.8	43.8	50.6	58.8	56.9	66.0	76.8	70.9	82.6	96.5	85.2	99.8	117.0
	15	32.6	37.6	43.5	44.5	51.5	59.7	57.8	67.1	78.1	72.0	83.9	98.1	86.6	101.4	119.0
	20	33.1	38.2	44.1	45.2	52.3	60.7	58.7	68.1	79.3	73.2	85.3	99.7	88.0	103.1	120.9
	30	34.1	39.3	45.4	46.6	53.8	62.5	60.5	70.2	81.8	75.4	87.9	102.8	90.7	106.3	124.8
	40	34.6	39.9	46.2	47.3	54.8	63.7	61.6	71.6	83.6	77.0	90.0	105.5	92.9	109.1	128.5
200	0	28.7	33.0	38.1	39.0	45.0	52.2	50.5	58.5	68.0	63.0	73.3	85.5	75.8	88.6	103.7
	10	29.6	34.1	39.4	40.3	46.5	54.0	52.2	60.5	70.4	65.2	75.8	88.5	78.4	91.6	107.3
	15	30.1	34.6	40.1	41.0	47.3	54.8	53.1	61.5	71.5	66.2	77.1	89.9	79.7	93.1	109.1
	20	30.6	35.2	40.7	41.6	48.0	55.7	53.9	62.5	72.7	67.3	78.3	91.4	81.0	94.6	110.8
	30	31.5	36.2	41.9	42.8	49.5	57.4	55.5	64.3	74.9	69.3	80.7	94.2	83.5	97.6	114.4
	40	31.9	36.7	42.5	43.5	50.3	58.4	56.5	65.6	76.5	70.7	82.5	96.5	85.4	100.1	117.6
180	0	26.3	30.2	34.9	35.6	41.1	47.6	46.0	53.2	61.7	57.2	66.4	77.3	69.2	80.7	94.2
	10	27.2	31.2	36.1	36.8	42.4	49.2	47.5	55.0	63.8	59.1	68.7	80.0	71.6	83.4	97.5
	15	27.6	31.7	36.7	37.4	43.1	49.9	48.3	55.8	64.9	60.1	69.8	81.3	72.7	84.8	99.1
	20	28.0	32.2	37.2	38.0	43.8	50.7	49.0	56.7	65.9	61.1	70.9	82.6	73.9	86.2	100.7
	30	28.9	33.2	38.3	39.1	45.1	52.2	50.5	58.4	67.9	62.9	73.0	85.1	76.1	88.8	103.9
	40	29.2	33.6	38.9	39.7	45.8	53.1	51.3	59.5	69.2	64.1	74.6	87.1	77.8	90.9	106.6
160	0	23.9	27.5	31.7	32.2	37.1	42.9	41.4	47.8	55.5	51.3	59.5	69.2	62.0	72.1	84.1
	10	24.7	28.4	32.8	33.3	38.3	44.4	42.8	49.4	57.3	53.1	61.5	71.6	64.1	74.5	86.9
	15	25.1	28.8	33.3	33.8	39.0	45.1	43.5	50.2	58.3	53.9	62.5	72.7	65.1	75.8	88.4
	20	25.5	29.3	33.8	34.4	39.6	45.8	44.2	51.0	59.2	54.8	63.5	73.9	66.2	77.0	89.8
	30	26.2	30.1	34.8	35.4	40.7	47.1	45.5	52.5	61.0	56.4	65.4	76.1	68.2	79.3	92.6
	40	26.6	30.5	35.3	35.9	41.4	47.9	46.2	53.4	62.1	57.4	66.7	77.8	69.5	81.1	94.8
140	0	21.5	24.7	28.5	28.8	33.1	38.3	36.8	42.4	49.1	45.5	52.6	61.0	54.7	63.5	73.9
	10	22.3	25.5	29.5	29.7	34.2	39.5	38.0	43.8	50.8	47.0	54.4	63.1	56.6	65.7	76.5
	15	22.6	25.9	29.9	30.2	34.8	40.2	38.6	44.5	51.6	47.7	55.2	64.1	57.5	66.7	77.7
	20	23.0	26.4	30.4	30.7	35.3	40.8	39.2	45.2	52.4	48.5	56.1	65.2	58.4	67.8	79.0
	30	23.6	27.1	31.3	31.6	36.3	42.0	40.4	46.6	54.0	49.9	57.8	67.1	60.2	69.8	81.4
	40	23.9	27.5	31.7	32.0	36.9	42.7	41.0	47.3	54.9	50.8	58.8	68.5	61.3	71.3	83.2
120	0	19.2	22.0	25.3	25.3	29.1	33.6	32.1	37.0	42.8	39.4	45.5	52.8	47.3	54.7	63.6
	10	19.8	22.7	26.2	26.2	30.1	34.7	33.2	38.2	44.2	40.8	47.0	54.5	48.9	56.6	65.7
	15	20.1	23.1	26.6	26.6	30.6	35.3	33.7	38.8	44.9	41.4	47.8	55.4	49.7	57.5	66.8
	20	20.4	23.4	27.0	27.0	31.0	35.8	34.2	39.4	45.6	42.1	48.6	56.3	50.5	58.4	67.9
	30	21.0	24.1	27.8	27.8	31.9	36.9	35.2	40.6	47.0	43.3	50.0	58.0	51.9	60.1	69.9
	40	21.2	24.4	28.1	28.1	32.4	37.4	35.7	41.2	47.7	44.0	50.8	59.0	52.8	61.3	71.3

To correct for wind, enter table with the brakes-on speed minus one-half the headwind or plus 1.5 times the tailwind. If ground speed is used for brakes-on speed, ignore wind and enter table with sea level, 15°C.



ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy (Millions of Foot Pounds)

Table 1(b) of 3: 10000 ft to 14000 ft Pressure Altitude

		BRAKES ON SPEED (KIAS)														
		100			120			140			160			180		
WEIGHT (1000 KG)	OAT (°C)	PRESSURE ALTITUDE (1000 FT)														
		10	12	14	10	12	14	10	12	14	10	12	14	10	12	14
240	0	44.6	47.4	50.4	61.5	65.4	69.6	80.6	85.8	91.5	101.1	107.8	115.1	122.5		
	10	46.1	49.0	52.1	63.6	67.6	72.0	83.3	88.8	94.7	104.6	111.5	119.1	126.8		
	15	46.8	49.8	52.9	64.6	68.7	73.2	84.7	90.2	96.2	106.3	113.4	121.1	128.9		
	20	47.6	50.5	53.7	65.7	69.8	74.4	86.1	91.7	97.8	108.0	115.2	123.1	131.0		
	30	49.0	52.0	55.3	67.6	71.9	76.6	88.7	94.5	100.8	111.4	118.9	127.1	135.3		
	40	49.8	52.9	56.3	69.0	73.4	78.3	90.8	96.9	103.4	114.5	122.4	130.9	139.6		
220	0	41.4	43.9	46.7	56.8	60.4	64.3	74.3	79.1	84.3	93.3	99.4	106.1	113.1	120.7	
	10	42.8	45.4	48.3	58.8	62.5	66.5	76.8	81.8	87.2	96.5	102.9	109.8	117.0	124.9	
	15	43.5	46.1	49.0	59.7	63.5	67.6	78.1	83.1	88.6	98.1	104.6	111.6	119.0	127.0	
	20	44.1	46.9	49.8	60.7	64.5	68.7	79.3	84.5	90.0	99.7	106.3	113.4	120.9	129.1	
	30	45.4	48.2	51.3	62.5	66.4	70.7	81.8	87.1	92.8	102.8	109.6	117.1	124.8	133.3	
	40	46.2	49.0	52.2	63.7	67.8	72.2	83.6	89.1	95.1	105.5	112.6	120.4	128.5	137.5	
200	0	38.1	40.5	43.0	52.2	55.5	59.0	68.0	72.4	77.1	85.5	91.1	97.2	103.7	110.6	118.1
	10	39.4	41.8	44.5	54.0	57.3	61.0	70.4	74.9	79.8	88.5	94.2	100.5	107.3	114.4	122.3
	15	40.1	42.5	45.2	54.8	58.3	62.0	71.5	76.1	81.1	89.9	95.8	102.2	109.1	116.4	124.3
	20	40.7	43.2	45.9	55.7	59.2	63.0	72.7	77.3	82.4	91.4	97.4	103.9	110.8	118.3	126.4
	30	41.9	44.5	47.2	57.4	61.0	64.9	74.9	79.7	84.9	94.2	100.4	107.1	114.4	122.0	130.4
	40	42.5	45.2	48.0	58.4	62.1	66.1	76.5	81.4	86.9	96.5	103.0	110.0	117.6	125.6	134.5
180	0	34.9	37.1	39.4	47.6	50.5	53.7	61.7	65.6	69.9	77.3	82.3	87.8	94.2	100.5	107.2
	10	36.1	38.3	40.7	49.2	52.2	55.5	63.8	67.9	72.3	80.0	85.2	90.8	97.5	103.9	111.0
	15	36.7	38.9	41.4	49.9	53.1	56.4	64.9	69.0	73.5	81.3	86.6	92.3	99.1	105.7	112.8
	20	37.2	39.5	42.0	50.7	53.9	57.3	65.9	70.1	74.6	82.6	88.0	93.8	100.7	107.4	114.7
	30	38.3	40.7	43.2	52.2	55.5	59.0	67.9	72.2	76.9	85.1	90.7	96.7	103.9	110.8	118.3
	40	38.9	41.3	43.9	53.1	56.5	60.1	69.2	73.7	78.6	87.1	92.9	99.1	106.6	113.8	121.7
160	0	31.7	33.6	35.7	42.9	45.6	48.5	55.5	58.9	62.7	69.2	73.6	78.4	84.1	89.5	95.5
	10	32.8	34.8	36.9	44.4	47.1	50.1	57.3	60.9	64.9	71.6	76.1	81.1	86.9	92.6	98.8
	15	33.3	35.3	37.5	45.1	47.9	50.9	58.3	61.9	65.9	72.7	77.4	82.4	88.4	94.1	100.4
	20	33.8	35.9	38.1	45.8	48.6	51.7	59.2	62.9	67.0	73.9	78.6	83.8	89.8	95.7	102.1
	30	34.8	36.9	39.2	47.1	50.1	53.2	61.0	64.8	69.0	76.1	81.0	86.4	92.6	98.6	105.3
	40	35.3	37.5	39.8	47.9	50.9	54.2	62.1	66.1	70.4	77.8	82.8	88.4	94.8	101.2	108.1
140	0	28.5	30.2	32.1	38.3	40.6	43.2	49.1	52.2	55.5	61.0	64.9	69.1	73.9	78.7	83.9
	10	29.5	31.3	33.2	39.5	42.0	44.6	50.8	54.0	57.4	63.1	67.1	71.5	76.5	81.4	86.7
	15	29.9	31.8	33.7	40.2	42.7	45.3	51.6	54.8	58.3	64.1	68.2	72.6	77.7	82.7	88.2
	20	30.4	32.3	34.3	40.8	43.3	46.0	52.4	55.7	59.3	65.2	69.3	73.8	79.0	84.0	89.6
	30	31.3	33.2	35.2	42.0	44.6	47.4	54.0	57.4	61.0	67.1	71.4	76.0	81.4	86.6	92.4
	40	31.7	33.7	35.7	42.7	45.3	48.2	54.9	58.4	62.2	68.5	72.9	77.7	83.2	88.7	94.6
120	0	25.3	26.8	28.5	33.6	35.7	37.9	42.8	45.4	48.3	52.8	56.1	59.7	63.6	67.6	72.0
	10	26.2	27.7	29.5	34.7	36.9	39.2	44.2	46.9	49.9	54.5	58.0	61.7	65.7	69.9	74.4
	15	26.6	28.2	29.9	35.3	37.5	39.8	44.9	47.7	50.7	55.4	58.9	62.7	66.8	71.0	75.7
	20	27.0	28.6	30.4	35.8	38.0	40.4	45.6	48.5	51.5	56.3	59.8	63.7	67.9	72.2	76.9
	30	27.8	29.5	31.3	36.9	39.2	41.6	47.0	49.9	53.0	58.0	61.6	65.6	69.9	74.4	79.2
	40	28.1	29.8	31.7	37.4	39.7	42.2	47.7	50.7	54.0	59.0	62.8	66.9	71.3	75.9	81.1

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)

Table 2(a) of 3: 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	8.0	16.4	25.1	34.2	43.6	53.2	63.0	72.9	82.9	92.9	102.9	112.8
	MAX AUTO	7.5	15.3	23.4	31.9	40.6	49.7	58.9	68.5	78.2	88.1	98.3	108.6
	AUTOBRAKE 4	7.2	14.7	22.4	30.3	38.5	46.9	55.6	64.5	73.7	83.1	92.7	102.6
	AUTOBRAKE 3	6.9	14.1	21.4	29.0	36.7	44.7	52.9	61.3	69.9	78.8	87.9	97.3
	AUTOBRAKE 2	6.7	13.5	20.5	27.7	35.0	42.5	50.2	58.1	66.2	74.5	83.1	91.9
	AUTOBRAKE 1	6.3	12.8	19.3	25.9	32.6	39.5	46.5	53.7	61.1	68.8	76.6	84.8

Table 2(b) of 3: 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	7.1	14.7	22.8	31.1	39.8	48.6	57.6	66.6	75.6	84.4	93.1	101.6
	MAX AUTO	5.3	11.1	17.4	24.3	31.6	39.3	47.3	55.6	64.2	73.0	82.0	91.0
	AUTOBRAKE 4	3.8	8.2	13.2	18.7	24.7	31.1	37.9	45.0	52.4	59.9	67.6	75.4
	AUTOBRAKE 3	2.5	5.7	9.5	14.0	18.9	24.4	30.2	36.3	42.8	49.4	56.1	62.8
	AUTOBRAKE 2	1.9	4.3	7.1	10.3	14.0	18.0	22.4	27.1	32.2	37.5	43.2	49.1
	AUTOBRAKE 1	1.6	3.5	5.5	7.8	10.4	13.2	16.3	19.6	23.3	27.4	31.7	36.5

Table 3 of 3: Cooling Time (Minutes)

		EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)									
		16 & BELOW	17	18	22	26	30	34	35	36 TO 50	51 & ABOVE
GEAR DOWN INFLIGHT	NO SPECIAL PROCEDURE REQUIRED	1.3	2.0	3.4	4.9	6.2	7.1	7.3	CAUTION	FUSE PLUG MELT ZONE	
GROUND		13	20	34	49	62	71	73			
BRAKE TEMPERATURE INDICATION	UP TO 2.4	2.4	2.6	3.1	3.7	4.3	4.8	4.9	5.0 TO 7.0	7.1 & 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.

With one brake deactivated, increase brake energy by 15 percent.

With two brakes deactivated, increase brake energy by 34 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 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 indication on Multifunction Display may be used 10 to 15 minutes after airplane has come to a complete stop, or in flight with gear retracted, to determine recommended cooling schedule.



Performance Inflight - QRH

Engine Inoperative

Chapter PI-QRH

Section 12

ENGINE INOP

Initial Max Continuous %N1

Anti-ice off or on or auto

TAT (°C)	PRESSURE ALTITUDE (1000 FT)/SPEED (KIAS OR MACH)								
	27	29	31	33	35	37	39	41	43
	310	310	310	.85	.85	.85	.85	.85	.85
20	95.3	95.2	95.3	95.1	94.4	93.8	93.7	93.6	93.5
15	96.0	95.9	95.9	95.8	95.1	94.4	94.3	94.2	94.1
10	96.8	96.6	96.6	96.4	95.7	95.0	94.9	94.8	94.7
5	97.6	97.3	97.3	97.1	96.4	95.7	95.5	95.4	95.4
0	98.3	98.3	98.1	97.8	97.1	96.5	96.2	96.1	96.0
-5	97.4	98.0	98.6	98.8	98.0	97.3	97.1	97.0	96.8
-10	96.5	97.1	97.7	98.6	98.6	98.0	97.9	97.8	97.7
-15	95.6	96.2	96.8	97.6	98.0	98.0	98.0	98.1	98.1
-20	94.6	95.2	95.8	96.7	97.0	97.1	97.1	97.1	97.1
-25	93.7	94.3	94.9	95.7	96.1	96.1	96.1	96.1	96.2
-30	92.7	93.3	93.9	94.7	95.1	95.1	95.1	95.2	95.2
-35	91.8	92.4	92.9	93.8	94.1	94.1	94.2	94.2	94.2
-40	90.8	91.4	91.9	92.8	93.1	93.1	93.2	93.2	93.2

ENGINE INOP

Max Continuous %N1

Based on anti-ice off or on or auto

37000 FT Pressure Altitude

		TAT (°C)											
KLAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
280	.86	91.0	92.0	93.0	94.0	95.0	96.0	97.0	97.9	97.9	97.3	96.5	95.7
240	.74	91.4	92.4	93.4	94.4	95.4	96.3	97.3	98.1	97.7	96.8	95.9	95.1
200	.63	91.6	92.7	93.7	94.7	95.7	96.6	97.5	97.8	97.3	96.2	95.3	94.8

35000 FT Pressure Altitude

		TAT (°C)											
KLAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
280	.82	91.2	92.2	93.2	94.2	95.2	96.2	97.1	98.1	98.4	97.9	97.0	96.3
240	.71	91.4	92.5	93.5	94.5	95.4	96.4	97.4	98.2	98.4	97.4	96.5	95.7
200	.60	91.7	92.7	93.7	94.7	95.7	96.7	97.7	98.2	97.9	96.8	95.9	95.2

33000 FT Pressure Altitude

		TAT (°C)											
KLAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
320	.89	89.6	90.6	91.6	92.6	93.5	94.5	95.5	96.4	97.3	98.2	97.8	97.0
280	.79	91.2	92.2	93.2	94.2	95.2	96.2	97.2	98.1	98.8	98.5	97.5	96.8
240	.68	91.5	92.5	93.5	94.5	95.5	96.5	97.4	98.4	98.6	98.0	97.0	96.2
200	.58	91.7	92.7	93.8	94.8	95.7	96.7	97.7	98.6	98.4	97.5	96.5	95.7

31000 FT Pressure Altitude

		TAT (°C)											
KLAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
320	.85	90.4	91.4	92.3	93.3	94.2	95.2	96.1	97.1	98.0	98.2	97.4	96.7
280	.76	92.2	93.2	94.2	95.2	96.1	97.1	98.1	99.0	98.6	97.7	96.9	96.2
240	.66	92.5	93.5	94.5	95.5	96.5	97.4	98.3	98.8	98.2	97.2	96.4	95.6
200	.55	92.8	93.8	94.8	95.8	96.8	97.7	98.6	98.9	97.8	96.8	96.0	95.2

29000 FT Pressure Altitude

		TAT (°C)											
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
320	.82	90.9	91.9	92.8	93.8	94.7	95.7	96.6	97.5	98.4	97.5	96.8	96.1
280	.73	92.6	93.6	94.6	95.6	96.5	97.5	98.4	98.7	97.9	97.0	96.2	95.5
240	.63	93.2	94.2	95.2	96.2	97.1	98.1	98.6	98.2	97.3	96.5	95.7	94.9
200	.53	93.8	94.8	95.8	96.7	97.7	98.4	98.7	98.0	97.0	96.1	95.3	95.2

27000 FT Pressure Altitude

		TAT (°C)											
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
360	.88	88.5	89.5	90.4	91.3	92.2	93.1	94.0	94.9	95.8	96.7	97.4	96.5
320	.79	90.3	91.3	92.3	93.2	94.1	95.1	96.0	96.9	97.8	97.7	96.9	96.2
280	.70	91.9	92.9	93.8	94.8	95.7	96.7	97.6	98.5	98.0	97.2	96.4	95.6
240	.60	93.0	94.0	94.9	95.9	96.9	97.8	98.6	98.3	97.4	96.6	95.7	95.0
200	.51	93.8	94.8	95.8	96.8	97.8	98.6	98.6	98.2	97.3	96.3	95.4	94.6

ENGINE INOP

Max Continuous %N1

Based on anti-ice off or on or auto

25000 FT Pressure Altitude

		TAT (°C)											
KLAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
360	.85	89.2	90.1	91.1	92.0	92.9	93.8	94.6	95.5	96.4	97.3	96.9	96.1
320	.76	90.7	91.6	92.5	93.5	94.4	95.3	96.2	97.1	97.7	97.0	96.3	95.5
280	.67	92.4	93.3	94.3	95.2	96.2	97.1	98.0	98.1	97.2	96.4	95.6	94.8
240	.58	94.0	95.0	96.0	96.9	97.9	98.8	98.6	97.5	96.6	95.8	95.0	94.2
200	.49	94.8	95.8	96.8	97.8	98.7	98.9	98.2	97.2	96.3	95.4	94.5	94.1

24000 FT Pressure Altitude

		TAT (°C)											
KLAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
360	.83	89.1	90.1	91.0	91.9	92.8	93.7	94.6	95.5	96.3	97.2	97.2	96.5
320	.75	90.7	91.6	92.6	93.5	94.4	95.3	96.2	97.1	98.0	97.4	96.7	95.9
280	.66	92.3	93.2	94.2	95.1	96.1	97.0	97.9	98.5	97.6	96.8	96.0	95.2
240	.57	93.9	94.8	95.8	96.8	97.7	98.7	99.1	98.0	97.0	96.3	95.4	94.6
200	.48	94.6	95.6	96.5	97.5	98.5	99.1	98.5	97.5	96.6	95.7	94.7	93.9

22000 FT Pressure Altitude

		TAT (°C)											
KLAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
360	.80	90.0	90.9	91.9	92.8	93.7	94.5	95.4	96.3	97.2	97.8	97.1	96.5
320	.72	91.6	92.5	93.4	94.4	95.3	96.2	97.1	97.9	98.1	97.4	96.6	95.9
280	.63	93.1	94.0	95.0	95.9	96.8	97.7	98.6	98.4	97.5	96.8	96.0	95.1
240	.55	94.4	95.4	96.4	97.3	98.2	99.2	98.8	97.8	97.0	96.2	95.3	94.4
200	.46	95.1	96.1	97.1	98.0	99.0	99.0	98.1	97.2	96.2	95.3	94.4	94.1

20000 FT Pressure Altitude

		TAT (°C)											
KLAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
360	.77	90.0	91.0	91.9	92.8	93.7	94.6	95.4	96.3	97.2	98.0	97.8	97.2
320	.69	91.5	92.4	93.3	94.2	95.1	96.0	96.9	97.8	98.7	98.0	97.4	96.6
280	.61	92.8	93.8	94.7	95.6	96.6	97.5	98.4	99.1	98.2	97.5	96.8	95.9
240	.53	93.9	94.9	95.9	96.8	97.7	98.7	99.5	98.5	97.6	96.8	95.9	95.1
200	.44	94.8	95.8	96.7	97.7	98.6	99.6	98.8	97.8	96.9	95.9	95.0	94.2

18000 FT Pressure Altitude

		TAT (°C)											
KLAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
360	.75	90.1	91.0	91.9	92.8	93.7	94.6	95.4	96.3	97.1	97.5	96.9	96.2
320	.67	91.6	92.5	93.4	94.3	95.2	96.1	97.0	97.8	98.0	97.3	96.6	95.8
280	.59	92.8	93.7	94.6	95.5	96.4	97.3	98.2	98.2	97.5	96.7	95.9	95.1
240	.51	93.5	94.5	95.4	96.3	97.2	98.1	98.2	97.3	96.5	95.6	94.8	94.0
200	.42	94.3	95.2	96.2	97.1	98.0	98.5	97.6	96.7	95.7	94.8	93.9	93.1

ENGINE INOP

Max Continuous %N1

Based on anti-ice off or on or auto

16000 FT Pressure Altitude

		TAT (°C)											
KLAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
360	.72	89.5	90.4	91.2	92.1	93.0	93.9	94.7	95.6	96.4	97.2	96.8	96.2
320	.64	90.8	91.7	92.6	93.5	94.4	95.3	96.1	97.0	97.8	97.3	96.6	95.8
280	.57	91.6	92.5	93.4	94.3	95.2	96.1	97.0	97.9	97.2	96.5	95.7	94.9
240	.49	92.1	93.0	94.0	94.9	95.8	96.6	97.5	96.9	96.1	95.2	94.4	93.6
200	.41	92.9	93.9	94.8	95.7	96.6	97.5	97.3	96.4	95.5	94.6	93.8	92.9

14000 FT Pressure Altitude

		TAT (°C)											
KLAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
360	.69	89.8	90.7	91.6	92.5	93.3	94.2	95.0	95.9	96.7	97.0	96.3	95.6
320	.62	90.9	91.8	92.7	93.6	94.4	95.3	96.1	97.0	97.2	96.5	95.8	95.0
280	.54	91.3	92.2	93.1	94.0	94.8	95.7	96.6	96.8	96.0	95.3	94.5	93.8
240	.47	91.7	92.6	93.5	94.4	95.3	96.2	96.7	95.8	94.9	94.1	93.4	92.6
200	.39	92.4	93.3	94.2	95.1	96.0	96.8	96.0	95.0	94.2	93.4	92.6	91.8

12000 FT Pressure Altitude

		TAT (°C)											
KLAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40
360	.67	88.9	89.7	90.6	91.4	92.3	93.1	93.9	94.7	95.5	95.1	94.4	93.7
320	.60	89.6	90.5	91.4	92.2	93.0	93.9	94.7	95.5	95.1	94.4	93.6	92.8
280	.52	90.5	91.4	92.3	93.1	94.0	94.8	95.6	95.3	94.5	93.7	93.0	92.2
240	.45	91.4	92.2	93.1	94.0	94.8	95.7	95.6	94.7	94.0	93.2	92.4	91.6
200	.38	91.6	92.5	93.4	94.2	95.1	95.6	94.6	93.8	93.0	92.2	91.4	90.6

10000 FT Pressure Altitude

		TAT (°C)											
KLAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40
360	.65	87.0	87.9	88.7	89.5	90.4	91.2	92.0	92.8	93.5	93.9	93.2	92.4
320	.58	87.9	88.8	89.6	90.5	91.3	92.1	92.9	93.7	94.1	93.4	92.6	91.9
280	.51	88.9	89.8	90.6	91.5	92.3	93.1	94.0	94.6	93.8	93.1	92.3	91.5
240	.43	89.6	90.5	91.3	92.2	93.0	93.8	94.7	94.1	93.3	92.5	91.7	91.0
200	.36	89.6	90.5	91.4	92.2	93.0	93.9	93.9	93.1	92.3	91.5	90.7	89.8

5000 FT Pressure Altitude

		TAT (°C)											
KLAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
360	.59	85.3	86.1	86.9	87.7	88.5	89.2	90.0	90.8	91.5	92.3	91.7	91.0
320	.53	86.1	86.9	87.7	88.5	89.3	90.1	90.9	91.7	92.4	92.0	91.3	90.5
280	.46	86.8	87.6	88.4	89.2	90.0	90.8	91.6	92.4	92.4	91.6	90.8	90.0
240	.40	87.3	88.1	88.9	89.7	90.5	91.3	92.1	92.6	91.9	91.1	90.3	89.4
200	.33	87.1	87.9	88.7	89.5	90.3	91.1	91.9	91.5	90.8	89.9	89.0	88.1

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
240	231	266	17200	15500	13200
230	222	260	18900	17300	15400
220	213	255	20500	19100	17400
210	203	250	22000	20700	19300
200	194	244	23400	22100	20900
190	184	238	24900	23700	22400
180	175	232	26100	25200	24000
170	165	226	27400	26800	25700
160	155	219	28700	28400	27500
150	145	212	30100	30000	29400
140	136	206	31500	31500	31300
130	126	198	33000	32900	32900
120	116	191	34600	34500	34500
110	107	184	36200	36200	36100
100	97	177	38100	38000	37900

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown/LRC Cruise Range Capability

Table 1 of 2: 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
277	257	240	225	211	200	189	179	171	163	156
553	514	479	449	423	400	378	360	342	327	313
827	769	718	674	634	600	568	540	515	491	470
1100	1023	956	897	846	800	758	721	687	656	628
1371	1276	1194	1121	1057	1000	948	902	860	821	786
1642	1529	1431	1344	1268	1200	1138	1083	1033	987	945
1912	1782	1668	1568	1479	1400	1328	1264	1206	1152	1104
2182	2034	1905	1791	1690	1600	1518	1445	1379	1318	1262
2453	2287	2142	2014	1901	1800	1708	1626	1552	1483	1421
2724	2540	2379	2238	2112	2000	1899	1807	1724	1649	1579
2996	2794	2617	2461	2323	2200	2088	1988	1897	1814	1738
3269	3048	2855	2685	2534	2400	2278	2169	2069	1978	1895
3544	3304	3094	2910	2746	2600	2468	2349	2241	2143	2053
3821	3561	3334	3135	2958	2800	2657	2529	2413	2306	2209

Table 2 of 2: Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 KG)									TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 KG)									
	100	120	140	160	180	200	220	240	260	
200	1.3	1.4	1.5	1.7	1.9	2.1	2.3	2.5	2.7	0:34
400	2.8	3.2	3.6	4.0	4.5	5.0	5.5	6.0	6.4	1:07
600	4.2	4.9	5.6	6.3	7.0	7.8	8.7	9.6	10.4	1:39
800	5.6	6.5	7.4	8.4	9.4	10.5	11.7	12.9	14.0	2:11
1000	7.0	8.1	9.3	10.5	11.8	13.1	14.6	16.1	17.5	2:43
1200	8.4	9.7	11.1	12.6	14.1	15.7	17.5	19.3	21.0	3:14
1400	9.7	11.3	12.9	14.7	16.4	18.3	20.4	22.4	24.5	3:45
1600	11.0	12.9	14.7	16.7	18.7	20.8	23.2	25.6	27.9	4:16
1800	12.3	14.4	16.5	18.8	21.0	23.4	26.0	28.6	31.3	4:48
2000	13.6	15.9	18.3	20.8	23.2	25.9	28.8	31.7	34.7	5:19
2200	14.9	17.5	20.0	22.8	25.4	28.3	31.5	34.7	38.0	5:51
2400	16.2	19.0	21.7	24.7	27.6	30.8	34.2	37.6	41.3	6:23
2600	17.5	20.4	23.5	26.7	29.8	33.2	36.8	40.5	44.6	6:56
2800	18.7	21.9	25.1	28.6	32.0	35.6	39.5	43.4	47.8	7:29

Includes APU fuel burn.

Driftdown at optimum driftdown speed and cruise at Long Range Cruise speed.



ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

Based on anti-ice on or off

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
250	7300	5200	3000
240	8800	6900	4700
230	14700	8600	6600
220	16700	14600	8400
210	18500	16800	11400
200	20300	18700	17000
190	21900	20400	19000
180	23500	22000	20600
170	25100	23500	22100
160	26600	25200	23700
150	28200	27200	25500
140	29800	29200	27700
130	31400	31200	30000
120	33000	32900	32300
110	34700	34600	34300
100	36400	36300	36200



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	33	35
260	%N1	93.3											
	MACH	.597											
	KIAS	332											
	FF/ENG	7346											
240	%N1	90.8	95.0										
	MACH	.578	.626										
	KIAS	321	317										
	FF/ENG	6709	6640										
220	%N1	87.9	92.0	94.0	96.4								
	MACH	.558	.604	.625	.646								
	KIAS	310	306	305	304								
	FF/ENG	6050	5962	6003	6107								
200	%N1	84.7	89.2	90.6	92.7	95.0							
	MACH	.537	.582	.601	.621	.643							
	KIAS	298	294	293	291	290							
	FF/ENG	5396	5383	5310	5382	5460							
180	%N1	81.6	86.0	87.5	89.1	91.3	93.4	95.5					
	MACH	.514	.557	.576	.595	.616	.638	.661					
	KIAS	285	281	280	279	277	276	275					
	FF/ENG	4822	4819	4770	4733	4788	4833	4829					
160	%N1	78.2	82.7	84.3	85.9	87.7	89.7	91.7	94.0	96.9			
	MACH	.488	.532	.549	.568	.587	.608	.630	.653	.678			
	KIAS	270	268	267	265	264	262	261	260	260			
	FF/ENG	4293	4269	4245	4217	4207	4215	4231	4267	4340			
140	%N1	74.6	79.0	80.7	82.4	84.1	85.9	87.9	89.8	92.0	94.7		
	MACH	.459	.502	.521	.538	.556	.576	.596	.618	.641	.666		
	KIAS	254	253	252	251	249	248	247	246	245	244		
	FF/ENG	3768	3744	3741	3717	3698	3681	3669	3678	3695	3729		
120	%N1	70.4	74.7	76.5	78.3	80.1	81.8	83.7	85.6	87.5	89.6	92.0	95.1
	MACH	.427	.468	.486	.504	.523	.541	.560	.581	.602	.625	.649	.675
	KIAS	236	235	235	235	234	233	231	230	229	228	227	226
	FF/ENG	3237	3227	3229	3228	3215	3180	3161	3137	3122	3118	3144	3216
100	%N1	65.4	69.8	71.5	73.2	75.1	77.0	78.9	80.7	82.5	84.5	86.6	88.7
	MACH	.390	.431	.447	.465	.483	.501	.521	.540	.559	.580	.602	.626
	KIAS	215	216	216	216	215	215	214	213	212	210	209	208
	FF/ENG	2697	2705	2716	2724	2719	2698	2673	2642	2610	2567	2572	2591

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Table 1 of 3: 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
290	266	245	228	213	200	190	181	173	166	159
579	533	492	457	427	400	381	363	347	332	319
869	800	738	686	640	600	571	544	520	498	479
1160	1067	984	914	854	800	762	727	694	665	638
1451	1334	1231	1143	1068	1000	953	909	868	831	798
1744	1603	1478	1373	1282	1200	1143	1090	1041	997	957
2038	1873	1726	1602	1495	1400	1333	1271	1214	1163	1117
2333	2143	1974	1832	1709	1600	1523	1452	1387	1328	1275
2630	2414	2223	2062	1924	1800	1713	1633	1560	1494	1434
2927	2686	2472	2293	2138	2000	1904	1815	1733	1659	1593
3226	2959	2722	2524	2353	2200	2094	1996	1906	1824	1751
3526	3232	2973	2755	2567	2400	2284	2177	2079	1990	1909
3827	3506	3223	2986	2782	2600	2474	2358	2251	2154	2067
4129	3782	3475	3218	2997	2800	2664	2539	2424	2319	2225

Table 2 of 3: 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	2.8	0:41	2.4	0:39	2.1	0:38	1.9	0:36	1.7	0:35
400	5.8	1:17	5.3	1:14	4.8	1:11	4.5	1:08	4.1	1:05
600	8.7	1:55	8.1	1:49	7.4	1:45	7.0	1:40	6.5	1:35
800	11.7	2:32	10.9	2:25	10.1	2:18	9.5	2:12	8.9	2:05
1000	14.6	3:10	13.7	3:01	12.7	2:52	12.0	2:44	11.3	2:36
1200	17.5	3:48	16.4	3:37	15.2	3:26	14.4	3:16	13.7	3:06
1400	20.4	4:26	19.2	4:13	17.8	4:01	16.9	3:49	16.0	3:37
1600	23.3	5:05	21.9	4:49	20.3	4:35	19.3	4:22	18.3	4:08
1800	26.1	5:44	24.5	5:26	22.9	5:10	21.6	4:55	20.6	4:39
2000	28.9	6:23	27.2	6:03	25.4	5:45	24.0	5:28	22.8	5:11
2200	31.7	7:03	29.8	6:41	27.8	6:21	26.3	6:01	25.1	5:42
2400	34.5	7:43	32.4	7:18	30.3	6:56	28.7	6:35	27.3	6:14
2600	37.2	8:23	35.0	7:56	32.7	7:32	31.0	7:09	29.5	6:46
2800	39.9	9:04	37.5	8:34	35.2	8:08	33.3	7:43	31.7	7:18

Table 3 of 3: Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)									
	100	120	140	160	180	200	220	240	260	
5	-1.1	-0.8	-0.5	-0.3	0.0	0.6	1.3	1.9	2.4	
10	-2.3	-1.7	-1.1	-0.5	0.0	1.1	2.6	3.9	5.1	
15	-3.5	-2.6	-1.7	-0.8	0.0	1.6	3.8	5.8	7.6	
20	-4.8	-3.5	-2.3	-1.1	0.0	2.0	4.9	7.6	10.1	
25	-6.0	-4.4	-2.9	-1.4	0.0	2.4	5.8	9.3	12.4	
30	-7.2	-5.4	-3.5	-1.7	0.0	2.8	6.7	10.9	14.7	
35	-8.5	-6.3	-4.1	-2.0	0.0	3.1	7.4	12.3	16.8	
40	-9.7	-7.2	-4.7	-2.3	0.0	3.3	7.9	13.6	18.9	

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
260	%N1	79.7	84.2	89.8	95.3			
	KIAS	258	259	284	286			
	FF/ENG	6070	6330	6610	6830			
240	%N1	77.2	81.0	88.7	92.3			
	KIAS	251	251	252	275			
	FF/ENG	5580	5690	6270	6170			
220	%N1	74.6	77.9	84.9	89.0	94.8		
	KIAS	243	244	245	263	264		
	FF/ENG	5100	5120	5530	5490	5700		
200	%N1	71.8	75.0	80.6	84.9	91.4		
	KIAS	235	236	237	238	252		
	FF/ENG	4620	4630	4800	4730	5070		
180	%N1	68.8	72.0	76.7	81.6	87.3	92.7	
	KIAS	227	227	228	229	238	240	
	FF/ENG	4170	4170	4210	4230	4410	4480	
160	%N1	65.8	68.9	73.4	78.1	83.1	88.7	95.8
	KIAS	220	220	221	222	223	226	228
	FF/ENG	3750	3740	3750	3760	3800	3890	4060
140	%N1	62.6	65.4	69.9	74.5	79.3	84.6	90.5
	KIAS	211	211	211	212	213	213	213
	FF/ENG	3330	3310	3310	3330	3360	3370	3430
120	%N1	59.1	61.9	66.1	70.6	75.1	80.3	85.8
	KIAS	202	202	202	203	203	203	203
	FF/ENG	2940	2920	2900	2900	2940	2920	2910
100	%N1	56.0	58.7	62.8	67.2	71.6	76.5	81.7
	KIAS	198	198	198	198	198	199	199
	FF/ENG	2630	2600	2580	2570	2610	2580	2540

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	10000	12000	14000
52	-60	-110							
50	-40	-90	-200						
48	-20	-70	-180						
46	0	-50	-150	-260					
44	30	-30	-130	-240					
42	50	0	-110	-220	-320				
40	70	20	-90	-200	-300				
38	100	40	-70	-180	-290	-390			
36	110	70	-50	-160	-270	-370			
34	110	90	-20	-140	-250	-350	-470		
32	110	100	0	-120	-230	-330	-450		
30	110	100	20	-90	-210	-310	-430	-560	
20	120	110	30	-40	-120	-210	-340	-470	-600
10	120	110	30	-40	-120	-190	-280	-380	-510
0	120	110	40	-40	-120	-200	-290	-390	-490
-20	130	120	40	-40	-130	-210	-300	-410	-510
-40	130	120	40	-50	-130	-210	-310	-420	-530

Rate of climb capability shown is valid for 170000 kg, gear down at VREF20+5.

Decrease rate of climb 40 ft/min per 5000 kg greater than 170000 kg.

Increase rate of climb 50 ft/min per 5000 kg less than 170000 kg.

Flaps 30

TAT (°C)	RATE OF CLIMB (FT/MIN)								
	PRESSURE ALTITUDE (FT)								
	-2000	0	2000	4000	6000	8000	10000	12000	14000
52	-220	-280							
50	-200	-260	-370						
48	-180	-240	-350						
46	-160	-220	-330	-430					
44	-140	-190	-300	-420					
42	-120	-170	-280	-400	-510				
40	-90	-150	-270	-380	-490				
38	-70	-130	-240	-360	-470	-580			
36	-60	-110	-220	-340	-450	-560			
34	-60	-80	-200	-320	-430	-540	-660		
32	-60	-70	-180	-300	-410	-530	-650		
30	-60	-70	-160	-270	-390	-510	-630	-760	
20	-60	-70	-150	-230	-310	-410	-540	-670	-810
10	-50	-70	-150	-230	-310	-390	-490	-590	-720
0	-50	-70	-150	-230	-320	-400	-500	-600	-710
-20	-50	-70	-160	-240	-330	-420	-520	-620	-730
-40	-60	-80	-160	-250	-350	-430	-530	-650	-760

Rate of climb capability shown is valid for 170000 kg, gear down at VREF30+5.

Decrease rate of climb 40 ft/min per 5000 kg greater than 170000 kg.

Increase rate of climb 50 ft/min per 5000 kg less than 170000 kg.

Intentionally
Blank



Performance Inflight - QRH

Chapter PI-QRH

Gear Down

Section 13

GEAR DOWN

220 KIAS Max Climb %N1

Based on anti-ice off or on or auto

TAT (°C)	PRESSURE ALTITUDE (1000 FT)														
	0	5	10	12	14	16	18	20	22	24	26	28	30	32	34
55	86.5	87.0	90.7	91.1	90.6	88.3	94.9	96.0	97.2	98.4	99.4	100.3	101.1	101.9	102.3
50	87.2	87.4	90.0	91.2	91.7	89.4	94.2	95.3	96.5	97.7	98.7	99.5	100.4	101.1	101.6
45	88.1	88.2	89.3	90.5	91.5	90.4	93.5	94.5	95.7	96.9	97.9	98.8	99.6	100.3	100.8
40	88.9	89.1	90.2	90.3	90.7	91.4	92.7	93.8	95.0	96.1	97.1	98.0	98.8	99.5	100.0
35	89.7	89.9	91.0	91.1	91.1	91.0	92.0	93.0	94.2	95.4	96.4	97.2	98.0	98.7	99.2
30	90.0	90.7	91.7	91.9	91.9	91.9	91.8	92.3	93.5	94.6	95.6	96.4	97.2	97.9	98.4
25	89.2	91.5	92.5	92.7	92.8	92.7	92.7	92.7	92.9	93.8	94.8	95.6	96.4	97.1	97.6
20	88.5	91.4	93.3	93.5	93.5	93.6	93.5	93.5	93.7	93.9	94.0	94.8	95.6	96.3	96.7
15	87.7	90.6	94.1	94.2	94.3	94.4	94.4	94.3	94.5	94.8	94.8	94.7	94.8	95.5	95.9
10	87.0	89.8	93.5	94.9	95.2	95.3	95.3	95.3	95.4	95.6	95.7	95.5	95.4	95.2	95.1
5	86.2	89.0	92.7	94.1	95.3	96.2	96.2	96.2	96.3	96.5	96.5	96.3	96.2	96.0	95.6
0	85.4	88.2	91.9	93.2	94.5	95.7	96.9	97.2	97.2	97.4	97.4	97.2	97.0	96.8	96.5
-5	84.6	87.4	91.0	92.4	93.6	94.8	96.0	97.2	98.3	98.3	98.2	98.1	98.0	97.8	97.4
-10	83.8	86.6	90.2	91.5	92.7	93.9	95.1	96.3	97.7	98.8	98.9	98.5	98.7	98.7	98.2
-15	83.0	85.8	89.3	90.6	91.8	93.0	94.2	95.4	96.8	97.9	98.5	98.4	98.5	98.4	98.2
-20	82.2	84.9	88.4	89.7	90.9	92.1	93.3	94.5	95.8	96.9	97.6	97.4	97.5	97.6	97.5

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
250	17200	15400	13400
240	18700	17100	15200
230	20200	18500	16900
220	21600	19900	18300
210	23100	21300	19700
200	24800	23000	21200
190	25900	24800	23000
180	27000	26200	24900
170	28100	27500	26400
160	29200	28900	27900
150	30400	30400	29600
140	31600	31600	31200
130	32900	32900	32800
120	34200	34200	34100
110	35200	35200	35200
100	36100	36100	36100

GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)											
		10	15	17	19	21	23	25	27	29	31	33	35
260	%N1	85.2	89.6										
	MACH	.477	.521										
	KIAS	264	263										
	FF/ENG	5367	5320										
240	%N1	82.9	86.7	88.9	91.4								
	MACH	.460	.502	.522	.543								
	KIAS	254	253	253	253								
	FF/ENG	4961	4809	4882	4991								
220	%N1	79.9	84.1	86.2	88.6	91.1							
	MACH	.443	.488	.507	.528	.550							
	KIAS	245	245	246	246	246							
	FF/ENG	4488	4404	4445	4537	4625							
200	%N1	76.6	81.3	83.4	85.7	88.2	90.5	93.1					
	MACH	.428	.473	.492	.513	.534	.556	.579					
	KIAS	237	238	238	239	239	239	239					
	FF/ENG	4006	4017	4044	4104	4188	4242	4318					
180	%N1	73.5	78.4	80.5	82.6	85.0	87.3	89.6	92.3				
	MACH	.413	.456	.475	.494	.515	.537	.559	.582				
	KIAS	228	229	229	230	230	231	231	231				
	FF/ENG	3587	3633	3663	3687	3745	3795	3830	3914				
160	%N1	70.8	75.6	77.6	79.7	81.9	84.2	86.4	88.8	91.5			
	MACH	.400	.441	.460	.479	.499	.520	.541	.564	.588			
	KIAS	221	222	222	222	223	223	223	223	223			
	FF/ENG	3259	3301	3329	3357	3377	3415	3435	3479	3536			
140	%N1	67.7	72.5	74.3	76.3	78.5	80.7	82.9	85.2	87.6	90.2		
	MACH	.383	.423	.440	.458	.478	.498	.519	.540	.563	.587		
	KIAS	211	212	212	213	213	213	213	213	213	213		
	FF/ENG	2922	2957	2982	3007	3025	3028	3046	3061	3087	3124		
120	%N1	64.6	69.2	71.0	72.8	74.8	77.0	79.2	81.4	83.7	86.1	88.7	
	MACH	.367	.404	.421	.438	.456	.475	.495	.516	.538	.561	.585	
	KIAS	202	203	203	203	203	203	203	203	203	203	203	
	FF/ENG	2620	2627	2651	2676	2688	2685	2679	2688	2688	2697	2742	
100	%N1	62.4	66.8	68.6	70.4	72.4	74.4	76.6	78.8	81.0	83.3	85.7	88.4
	MACH	.359	.396	.412	.428	.446	.465	.484	.504	.526	.549	.573	.599
	KIAS	198	198	198	198	198	199	199	199	199	199	199	199
	FF/ENG	2416	2413	2435	2462	2477	2472	2459	2456	2455	2445	2481	2526

GEAR DOWN

Long Range Cruise Enroute Fuel and Time

Table 1 of 3: 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
321	288	259	236	217	200	189	179	170	161	154
646	578	520	473	434	400	378	358	340	324	310
972	869	781	710	651	600	568	538	511	487	465
1300	1162	1043	947	869	800	757	717	681	649	620
1630	1455	1305	1185	1086	1000	946	896	851	811	775
1962	1751	1569	1423	1304	1200	1135	1075	1021	973	930
2297	2048	1833	1662	1522	1400	1324	1254	1191	1134	1084
2634	2346	2099	1902	1741	1600	1513	1433	1361	1296	1238
2973	2646	2365	2142	1959	1800	1702	1612	1530	1457	1392
3315	2948	2633	2383	2178	2000	1891	1790	1699	1618	1545
3659	3251	2901	2624	2397	2200	2079	1968	1868	1778	1698
4006	3556	3170	2865	2617	2400	2267	2146	2037	1938	1851
4354	3862	3440	3107	2836	2600	2456	2324	2205	2098	2004
4705	4169	3710	3349	3055	2800	2644	2502	2374	2258	2156
5056	4476	3981	3591	3275	3000	2833	2680	2542	2418	2308
5408	4785	4252	3834	3495	3200	3021	2857	2709	2576	2460
5761	5094	4524	4077	3715	3400	3209	3034	2876	2735	2611
6116	5404	4797	4320	3935	3600	3397	3212	3044	2894	2762
6472	5715	5069	4563	4155	3800	3585	3389	3212	3053	2913
6828	6026	5342	4807	4375	4000	3773	3566	3379	3212	3064

Table 2 of 3: 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	5.1	0:48	4.6	0:46	4.1	0:43	3.8	0:41	3.5	0:39
400	10.3	1:35	9.6	1:29	8.7	1:22	8.3	1:18	7.9	1:14
600	15.6	2:21	14.7	2:13	13.4	2:01	12.7	1:55	12.2	1:48
800	20.7	3:08	19.5	2:57	17.9	2:41	17.1	2:32	16.4	2:23
1000	25.8	3:55	24.4	3:41	22.5	3:21	21.4	3:09	20.6	2:58
1200	30.7	4:43	29.1	4:26	26.9	4:02	25.6	3:47	24.6	3:33
1400	35.7	5:31	33.8	5:11	31.3	4:42	29.8	4:25	28.6	4:09
1600	40.4	6:20	38.4	5:57	35.5	5:23	33.9	5:03	32.5	4:45
1800	45.2	7:09	42.9	6:42	39.8	6:05	37.9	5:42	36.4	5:21
2000	49.9	7:59	47.3	7:29	44.0	6:47	41.9	6:21	40.2	5:57
2200	54.5	8:49	51.8	8:16	48.1	7:29	45.8	7:00	44.0	6:34
2400	59.0	9:41	56.0	9:04	52.2	8:12	49.7	7:40	47.6	7:11
2600	63.5	10:32	60.3	9:51	56.2	8:55	53.5	8:20	51.2	7:48
2800	67.9	11:23	64.5	10:40	60.1	9:38	57.2	9:01	54.8	8:26
3000	72.2	12:15	68.6	11:28	64.1	10:22	60.9	9:41	58.3	9:04
3200	76.5	13:07	72.7	12:17	67.9	11:06	64.5	10:22	61.8	9:42
3400	80.8	13:59	76.7	13:06	71.7	11:50	68.2	11:04	65.2	10:21
3600	84.9	14:52	80.7	13:55	75.5	12:35	71.7	11:45	68.5	10:59
3800	89.1	15:44	84.6	14:44	79.2	13:19	75.2	12:27	71.9	11:38
4000	93.2	16:37	88.5	15:34	82.9	14:04	78.7	13:08	75.2	12:17

GEAR DOWN

Long Range Cruise Enroute Fuel and Time

Table 3 of 3: Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)								
	100	120	140	160	180	200	220	240	260
10	-2.1	-1.6	-1.1	-0.6	0.0	0.9	2.0	3.6	5.2
20	-4.3	-3.3	-2.3	-1.2	0.0	1.8	3.9	6.7	9.8
30	-6.3	-5.0	-3.5	-1.8	0.0	2.6	5.7	9.6	14.0
40	-8.3	-6.5	-4.5	-2.3	0.0	3.4	7.3	12.2	17.8
50	-10.2	-8.0	-5.6	-2.9	0.0	4.1	8.8	14.5	21.1
60	-11.9	-9.4	-6.6	-3.4	0.0	4.8	10.2	16.7	24.0
70	-13.5	-10.7	-7.5	-3.9	0.0	5.4	11.5	18.5	26.4
80	-15.0	-11.9	-8.4	-4.3	0.0	6.0	12.7	20.1	28.4
90	-16.4	-13.1	-9.2	-4.8	0.0	6.5	13.7	21.5	30.0
100	-17.7	-14.2	-9.9	-5.2	0.0	7.0	14.6	22.6	31.1

Based on Long Range Cruise speed and 220 KIAS descent.

Descent at 220 KIAS

PRESSURE ALTITUDE (1000 FT)	17	19	21	23	25	27	29	31	33	35
DISTANCE (NM)	39	43	48	53	58	63	67	72	77	82
TIME (MINUTES)	12	13	13	14	15	16	17	18	18	19

GEAR DOWN

Holding Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
260	%N1	75.0	79.0	85.2	89.3			
	KIAS	258	259	260	261			
	FF/ENG	5190	5350	5630	5520			
240	%N1	72.8	76.4	83.0	86.7	92.7		
	KIAS	251	251	252	253	253		
	FF/ENG	4800	4890	5220	5050	5290		
220	%N1	70.5	73.9	79.9	84.1	89.8		
	KIAS	243	244	245	245	246		
	FF/ENG	4430	4460	4710	4620	4810		
200	%N1	68.1	71.4	76.6	81.3	86.9	93.1	
	KIAS	235	236	237	238	239	239	
	FF/ENG	4070	4090	4210	4220	4360	4530	
180	%N1	65.5	68.7	73.5	78.4	83.7	89.6	
	KIAS	227	227	228	229	230	231	
	FF/ENG	3720	3720	3770	3810	3900	4020	
160	%N1	63.2	66.2	70.8	75.6	80.8	86.4	93.0
	KIAS	220	220	221	222	223	223	223
	FF/ENG	3410	3410	3420	3470	3540	3610	3740
140	%N1	60.3	63.2	67.7	72.5	77.4	82.9	88.8
	KIAS	211	211	211	212	213	213	213
	FF/ENG	3080	3070	3070	3100	3170	3200	3260
120	%N1	57.6	60.3	64.6	69.2	73.8	79.2	84.9
	KIAS	202	202	202	203	203	203	203
	FF/ENG	2780	2760	2750	2760	2820	2810	2820
100	%N1	55.5	58.2	62.4	66.8	71.4	76.6	82.1
	KIAS	198	198	198	198	198	199	199
	FF/ENG	2580	2550	2540	2530	2600	2580	2570

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
260	%N1	74.7	77.9	82.7	87.8	93.5
	KIAS	239	239	240	241	241
	FF/ENG	5100	5110	5140	5200	5370
240	%N1	72.3	75.5	80.2	85.2	90.7
	KIAS	231	232	232	233	233
	FF/ENG	4710	4710	4730	4770	4880
220	%N1	69.9	73.0	77.7	82.6	88.2
	KIAS	223	224	225	226	228
	FF/ENG	4320	4320	4340	4370	4480
200	%N1	67.3	70.3	74.9	79.8	85.5
	KIAS	214	215	216	218	223
	FF/ENG	3930	3920	3940	3980	4110
180	%N1	64.2	67.2	71.6	76.4	81.6
	KIAS	203	204	204	206	208
	FF/ENG	3530	3510	3510	3530	3600
160	%N1	61.4	64.2	68.5	73.1	77.9
	KIAS	195	195	196	197	198
	FF/ENG	3180	3160	3140	3160	3200
140	%N1	58.3	61.0	65.2	69.6	74.2
	KIAS	186	186	186	187	188
	FF/ENG	2840	2810	2790	2790	2840
120	%N1	55.1	57.8	61.7	65.9	70.4
	KIAS	177	177	177	178	178
	FF/ENG	2540	2500	2460	2440	2490
100	%N1	52.7	55.3	59.1	63.2	67.6
	KIAS	173	173	173	173	173
	FF/ENG	2330	2280	2240	2220	2250

This table includes 5% additional fuel for holding in a racetrack pattern.



Performance Inflight - QRH

Chapter PI-QRH

Gear Down, Engine INOP

Section 14

GEAR DOWN**ENGINE INOP****MAX CONTINUOUS THRUST****Driftdown Speed/Level Off Altitude****100 ft/min residual rate of climb**

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
210	200	238	600		
200	190	235	2500	400	
190	181	231	4400	2400	300
180	171	227	6500	4400	2300
170	162	224	8400	6300	4200
160	153	220	11200	8600	6400
150	144	216	13500	11500	8900
140	135	212	15600	13900	12000
130	125	208	17600	16200	14300
120	115	203	19500	18300	16700
110	106	200	20700	19700	18300
100	96	199	21700	20900	19800

Includes APU fuel burn.

Long Range Cruise Altitude Capability**100 ft/min residual rate of climb**

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
190	2100		
180	4500	2400	
170	6800	4600	2500
160	8800	6700	4600
150	12100	9100	6900
140	14500	12500	9700
130	16600	14900	12900
120	18700	17300	15500
110	20200	19100	17500
100	21300	20400	19100



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
200	%N1	92.4	94.7						
	MACH	.392	.404						
	KIAS	237	236						
	FF/ENG	7734	7799						
190	%N1	90.8	92.9	95.7					
	MACH	.386	.398	.413					
	KIAS	233	232	232					
	FF/ENG	7361	7376	7543					
180	%N1	89.0	91.2	93.7	96.4				
	MACH	.377	.390	.405	.421				
	KIAS	228	228	228	228				
	FF/ENG	6940	6980	7083	7246				
170	%N1	87.2	89.5	91.9	94.5				
	MACH	.370	.384	.399	.414				
	KIAS	224	224	224	225				
	FF/ENG	6558	6621	6704	6822				
160	%N1	85.7	87.9	90.3	92.7	95.4			
	MACH	.364	.378	.393	.408	.424			
	KIAS	220	220	221	221	221			
	FF/ENG	6234	6290	6359	6445	6579			
150	%N1	83.9	86.1	88.4	90.8	93.3	96.2		
	MACH	.356	.370	.384	.399	.415	.432		
	KIAS	215	216	216	216	217	217		
	FF/ENG	5878	5924	5979	6050	6144	6293		
140	%N1	81.9	84.1	86.4	88.7	91.1	93.7	96.9	
	MACH	.348	.362	.376	.391	.406	.423	.440	
	KIAS	211	211	211	211	212	212	212	
	FF/ENG	5527	5567	5611	5668	5741	5848	6004	
130	%N1	80.1	82.2	84.4	86.7	89.1	91.5	94.2	
	MACH	.341	.354	.368	.382	.398	.414	.430	
	KIAS	206	207	207	207	207	207	208	
	FF/ENG	5202	5236	5272	5315	5372	5445	5565	
120	%N1	78.4	80.4	82.5	84.7	87.0	89.3	91.8	94.8
	MACH	.335	.347	.360	.374	.389	.404	.421	.438
	KIAS	202	202	202	203	203	203	203	203
	FF/ENG	4897	4925	4955	4986	5027	5079	5156	5278
110	%N1	77.0	78.9	81.0	83.2	85.4	87.7	90.1	92.8
	MACH	.331	.343	.356	.370	.384	.399	.415	.432
	KIAS	200	200	200	200	200	200	200	200
	FF/ENG	4671	4696	4722	4750	4782	4826	4884	4984
100	%N1	75.7	77.7	79.7	81.8	84.0	86.3	88.7	91.2
	MACH	.328	.340	.353	.366	.381	.396	.412	.428
	KIAS	198	198	198	198	198	198	198	198
	FF/ENG	4475	4499	4523	4549	4579	4615	4664	4740

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Table 1 of 3: 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
333	296	264	239	218	200	187	175	165	156	148
672	595	530	478	436	400	374	351	330	311	295
1012	896	796	718	655	600	561	525	494	466	442
1354	1197	1063	958	874	800	747	700	657	620	588
1699	1501	1333	1200	1093	1000	934	874	821	774	734
2047	1807	1602	1442	1312	1200	1120	1048	984	928	880
2398	2114	1872	1684	1532	1400	1306	1222	1147	1081	1025
2751	2423	2144	1927	1752	1600	1492	1395	1309	1234	1170
3108	2734	2417	2170	1972	1800	1678	1569	1472	1387	1314
3467	3047	2691	2414	2192	2000	1864	1742	1634	1539	1458
3829	3362	2966	2658	2413	2200	2050	1915	1795	1690	1601
4194	3678	3241	2903	2633	2400	2235	2088	1957	1842	1745
4560	3996	3518	3149	2854	2600	2421	2261	2118	1993	1887
4928	4315	3796	3395	3076	2800	2606	2432	2278	2144	2030

Table 2 of 3: 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	5.5	0:51	5.3	0:50	5.1	0:48	5.0	0:47	4.9	0:46
400	11.1	1:40	10.8	1:37	10.5	1:35	10.3	1:32	10.2	1:29
600	16.6	2:30	16.2	2:25	15.8	2:21	15.6	2:17	15.4	2:13
800	22.0	3:20	21.5	3:14	21.0	3:08	20.7	3:02	20.5	2:57
1000	27.3	4:10	26.6	4:02	26.1	3:55	25.7	3:48	25.5	3:41
1200	32.5	5:01	31.7	4:52	31.1	4:43	30.6	4:34	30.3	4:26
1400	37.6	5:53	36.7	5:42	35.9	5:31	35.4	5:21	35.0	5:11
1600	42.6	6:45	41.6	6:32	40.7	6:20	40.1	6:09	39.7	5:57
1800	47.5	7:38	46.4	7:24	45.4	7:10	44.7	6:56	44.2	6:43
2000	52.3	8:31	51.1	8:15	50.0	8:00	49.2	7:45	48.6	7:30
2200	57.0	9:25	55.7	9:07	54.6	8:50	53.7	8:33	53.0	8:17
2400	61.7	10:19	60.3	10:00	59.0	9:41	58.0	9:23	57.3	9:05
2600	66.2	11:14	64.8	10:53	63.4	10:32	62.3	10:12	61.5	9:53
2800	70.7	12:09	69.2	11:46	67.7	11:24	66.5	11:02	65.6	10:42

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Table 3 of 3: Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)								
	100	120	140	160	180	200	220	240	260
5	-1.1	-0.9	-0.6	-0.3	0.0	0.6	1.3	1.8	2.3
10	-2.3	-1.9	-1.3	-0.6	0.0	1.2	2.5	3.7	4.9
15	-3.5	-2.8	-2.0	-1.0	0.0	1.7	3.6	5.5	7.4
20	-4.7	-3.8	-2.6	-1.3	0.0	2.1	4.7	7.3	9.8
25	-5.9	-4.7	-3.3	-1.7	0.0	2.6	5.7	8.9	12.1
30	-7.0	-5.6	-3.9	-2.0	0.0	3.1	6.7	10.5	14.3
35	-8.0	-6.4	-4.5	-2.3	0.0	3.5	7.6	12.0	16.3
40	-9.1	-7.3	-5.1	-2.6	0.0	3.9	8.5	13.4	18.3
45	-10.1	-8.1	-5.7	-2.9	0.0	4.3	9.3	14.7	20.1
50	-11.1	-8.8	-6.2	-3.2	0.0	4.6	10.1	15.9	21.9
55	-12.0	-9.6	-6.8	-3.5	0.0	5.0	10.8	17.0	23.5
60	-12.9	-10.3	-7.3	-3.8	0.0	5.3	11.4	18.1	25.1
65	-13.8	-11.0	-7.8	-4.1	0.0	5.6	12.0	19.0	26.5
70	-14.7	-11.7	-8.3	-4.3	0.0	5.9	12.6	19.9	27.8
75	-15.5	-12.4	-8.7	-4.6	0.0	6.2	13.0	20.7	29.0

Includes APU fuel burn.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Holding Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
220	%N1	91.1				
	KIAS	243				
	FF/ENG	8720				
210	%N1	89.6				
	KIAS	239				
	FF/ENG	8310				
200	%N1	88.1	92.1			
	KIAS	235	236			
	FF/ENG	7920	8060			
190	%N1	86.6	90.5			
	KIAS	231	232			
	FF/ENG	7530	7650			
180	%N1	85.0	88.8	95.0		
	KIAS	227	227	228		
	FF/ENG	7140	7250	7520		
170	%N1	83.4	87.2	93.1		
	KIAS	223	224	224		
	FF/ENG	6790	6890	7090		
160	%N1	81.9	85.7	91.5		
	KIAS	220	220	221		
	FF/ENG	6460	6550	6720		
150	%N1	80.2	83.9	89.5	96.2	
	KIAS	215	215	216	217	
	FF/ENG	6100	6170	6310	6610	
140	%N1	78.4	81.9	87.5	93.7	
	KIAS	211	211	211	212	
	FF/ENG	5750	5800	5920	6140	
130	%N1	76.7	80.1	85.5	91.5	
	KIAS	206	206	207	207	
	FF/ENG	5420	5460	5560	5720	
120	%N1	75.0	78.4	83.6	89.3	96.5
	KIAS	202	202	202	203	203
	FF/ENG	5100	5140	5220	5330	5620
110	%N1	73.6	77.0	82.1	87.7	94.3
	KIAS	200	200	200	200	200
	FF/ENG	4870	4900	4970	5070	5290
100	%N1	72.4	75.7	80.8	86.3	92.6
	KIAS	198	198	198	198	198
	FF/ENG	4660	4700	4760	4850	5040

This table includes 5% additional fuel for holding in a racetrack pattern.

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Performance Inflight - QRH

Chapter PI-QRH

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Section 15

Introduction

This chapter contains information to supplement performance data from the Flight Management System (FMS). In addition, sufficient inflight data is provided to complete a flight with the FMS 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 of the pitot system. Loss of radome may also cause unreliable airspeed/Mach indications. Climb, cruise and descent information are provided for 250 KIAS and the recommended turbulent air penetration speed schedule: 290 knots below 25000 feet, 310 knots or .84 Mach whichever is lower at 25000 feet and above. The turbulent air penetration speed provides ample protection from stall and high speed buffet, while also providing protection from exceeding the structural limits.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed may also be unreliable.

ISFD Airspeed and Altitude Correction

In the event of loss of primary air data, Integrated Standby Flight Display (ISFD) airspeed and pressure altitude correction are provided. The first table provides the ISFD airspeed for a given gross weight and target airspeed. The second table provides a pressure altitude adjustment for a given gross weight and ISFD airspeed. The pressure altitude adjustment is added to the ISFD altitude to get the actual pressure altitude.

Max Climb %N1

This table shows Max Climb %N1 for a 310/.85 climb speed schedule. Enter the table with airport pressure altitude and TAT and read %N1.

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, good to medium, medium, medium to poor, and poor reported braking action. Landing distances are 115% of the actual landing distance. The Normal Configuration Landing Distance tables should be used enroute to make a landing distance assessment for the time of arrival.

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, good to medium, medium, medium to poor, and poor reported braking action. The Non-Normal Configuration Landing Distance tables should be used enroute to make a landing distance assessment for the time of arrival.

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, temperature, speed and reverser conditions. Each correction is independently added to the reference landing distance. The reference landing distance includes the effects of max manual braking and maximum available 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.

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.

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 Reference Brake Energy table (Table 1) 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 Event Adjusted Brake Energy table (Table 2) for no reverse thrust or 2 engine reverse thrust 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 (Table 3) by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

Brake temperature indications on Multifunction Display are also shown. 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 gear synoptic display and disappear as the hottest brake cools below 3.0. Note that even without an EICAS advisory message, brake cooling is recommended.

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 310 KIAS or .85 Mach 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 310 KIAS or .85 Mach. 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 (Table 1) 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 (Table 2) 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

The table shows 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 .85/310/250 descent.

To determine the remaining fuel and time required, first enter the Ground to Air Miles Conversion table (Table 1) to convert ground distance and enroute wind to an equivalent still air distance. Next, enter the Reference Fuel and Time table (Table 2) with air distance from Table 1 and the desired altitude and read reference fuel and time required. Lastly, enter the Fuel Required Adjustment table (Table 3) with the reference fuel and the actual weight at checkpoint to obtain fuel required to destination.

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 landing 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.

Note: The Flight Management System (FMS) does not contain special provisions for operation with landing gear extended. As a result, the (FMS) 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. An accurate estimated time of arrival is available if current speed or Mach is entered into the VNAV cruise page. Estimates of fuel remaining at waypoints or the destination may be computed by the crew based on current fuel flow indications, but should be updated frequently.

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

Introduction

Chapter Man

Section 05

General

Non-Normal Maneuvers and Flight Patterns are included for training and review purposes.

Non-Normal Maneuvers

Flight crews are expected to do non-normal maneuvers from memory.

Flight Patterns

Flight patterns show procedures for some all-engine and engine-inoperative situations.

Flight patterns do not include all procedural items but show required/recommended:

- configuration changes
- thrust changes
- Mode Control Panel (MCP) changes
- pitch mode and roll mode changes
- checklist calls



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**Maneuvers****Chapter Man****Non - Normal Maneuvers****Section 1****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 disengaged.

Pilot Flying	Pilot Monitoring
<ul style="list-style-type: none">• Initiate the recovery:<ul style="list-style-type: none">• Smoothly apply nose down elevator to reduce the angle of attack until buffet or stick shaker stops	<ul style="list-style-type: none">• Monitor altitude and airspeed• Verify all required actions have been done and call out any omissions• Call out any trend toward terrain contact
<ul style="list-style-type: none">• Continue the recovery:<ul style="list-style-type: none">• Roll in the shortest direction to wings level if needed*• Advance thrust levers as needed• Retract the speedbrakes• Do not change gear or flap configuration, except<ul style="list-style-type: none">• During liftoff, if flaps are up, call for flaps 1	<ul style="list-style-type: none">• Monitor altitude and airspeed• Verify all required actions have been done and call out any omissions• Call out any trend toward terrain contact• Set the FLAP lever as directed
<ul style="list-style-type: none">• Complete the recovery:<ul style="list-style-type: none">• Check airspeed and adjust thrust as needed• Establish pitch attitude• Return to the desired flight path• Re-engage the autopilot and autothrottle if desired	<ul style="list-style-type: none">• Monitor altitude and airspeed• Verify all required actions have been done and call out any omissions• Call out any trend toward terrain contact

WARNING: *Excessive use of pitch trim or rudder may aggravate the condition, or may result in 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 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.

787 Flight Crew Operations Manual

Captain	First Officer
<p>Without delay:</p> <p>Simultaneously close the thrust levers, disengage the autothrottles, and apply maximum manual wheel brakes or verify operation of RTO autobrake.</p> <p>If RTO autobrake is selected, monitor system performance and apply manual wheel brakes if the AUTOBRAKE message is displayed or deceleration is not adequate.</p> <p>Apply reverse thrust up to the maximum amount consistent with conditions.</p> <p>Verify the speedbrakes are extended.</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 disengaged.</p> <p>Maximum brakes applied.</p> <p>Reverse thrust applied.</p> <p>Verify speedbrake lever UP and call “SPEEDBRAKES UP.” If speedbrake lever not UP call “SPEEDBRAKES NOT UP.”</p> <p>When both REV indications are green, call “REVERSERS NORMAL.”</p> <p>If there is no REV indication(s) or the indication(s) stays amber, call “NO REVERSER LEFT ENGINE,” or “NO REVERSER RIGHT ENGINE,” or “NO REVERSERS.”</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>Communicate the reject decision to the control tower and cabin as soon as practical.</p>
<p>When the airplane is stopped, perform procedures as required.</p> <p>Review Brake Cooling Schedule for brake cooling time and precautions (refer to the Performance Inflight chapter).</p> <p>Consider the following:</p> <ul style="list-style-type: none"> • the possibility of wheel fuse plugs melting • the need to clear the runway • the requirement for remote parking • wind direction in case of fire • alerting fire equipment • not setting the parking brake unless passenger evacuation is necessary • advising the ground crew of the hot brake hazard • advising passengers of the need to remain seated or evacuate • completion of Non-Normal checklist (if appropriate) for conditions which caused the RTO 	

Ground Proximity Warning System (GPWS) Response

GPWS Caution

Accomplish the following maneuver for any of these aural alerts*:

- CAUTION OBSTACLE
- CAUTION TERRAIN
- SINK RATE
- TERRAIN
- DON'T SINK
- TOO LOW FLAPS
- TOO LOW GEAR
- TOO LOW TERRAIN
- GLIDESLOPE
- BANK ANGLE

Pilot Flying	Pilot Monitoring
Correct the flight path or the airplane configuration.	

The below glideslope deviation alert may be cancelled or inhibited for:

- localizer or back course 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 PULL UP” or “TERRAIN TERRAIN PULL UP” warning
- other situations resulting in unacceptable flight toward terrain

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Pilot Flying	Pilot Monitoring
<ul style="list-style-type: none"> • Disconnect autopilot • Disconnect autothrottle(s) • Aggressively apply maximum* thrust • Simultaneously roll wings level and rotate to an initial pitch attitude of 20° • Verify the speedbrakes are retracted • If terrain remains a threat, continue rotation up to the pitch limit indicator or stick shaker or initial buffet 	<ul style="list-style-type: none"> • Assure maximum* thrust • Verify all required actions have been completed and call out any omissions
<ul style="list-style-type: none"> • Do not change gear or flap configuration until terrain separation is assured • Monitor radio altimeter for sustained or increasing terrain separation • When clear of the terrain, slowly decrease pitch attitude and accelerate 	<ul style="list-style-type: none"> • Monitor vertical speed and altitude (radio altitude for terrain clearance and barometric altitude for a minimum safe altitude) • Call out any trend toward terrain contact

Note: Aft control column force increases as 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 a conflict between RA and air traffic control.

WARNING: Once an RA has been issued, safe separation can be compromised if current vertical speed is changed, except as necessary to comply with the RA. This is because TCAS II-to-TCAS II coordination may be in progress with the intruder aircraft, and any change in vertical speed that does not comply with the RA may negate the effectiveness of the other aircraft's compliance with the RA.

Note: If stick shaker or initial buffet occurs during the maneuver, immediately accomplish the APPROACH TO STALL RECOVERY procedure.

Note: If high speed buffet occurs during the maneuver, relax pitch force as necessary to reduce buffet, but continue the maneuver.

Note: Do not use flight director pitch commands until clear of conflict.

For TA:

Pilot Flying	Pilot Monitoring
Look for traffic using traffic display as a guide. Call out any conflicting traffic	
If traffic is sighted, maneuver if needed.	

Note: Maneuvers based solely on a TA may result in reduced separation and are not recommended.

For RA, except a climb in landing configuration:

WARNING: A DESCEND (fly down) RA issued below 1000 feet AGL should not be followed.

Pilot Flying	Pilot Monitoring
If maneuvering is required, disengage the autopilot and autothrottle. Smoothly adjust pitch and thrust to satisfy the RA command. Follow the planned lateral flight path unless visual contact with the conflicting traffic requires other action.	
Attempt to establish visual contact. Call out any conflicting traffic.	

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For a climb RA in landing configuration:

Pilot Flying	Pilot Monitoring
Disengage the autopilot and autothrottle. Advance thrust levers forward to ensure maximum thrust is attained and call for FLAPS 20. Smoothly adjust pitch to satisfy the RA command. Follow the planned lateral flight path unless visual contact with the conflicting traffic requires other action.	Verify maximum thrust set. Position flap lever to 20 detent.
Verify a positive rate of climb on the altimeter and call “GEAR UP.”	Verify a positive rate of climb on the altimeter and call “POSITIVE RATE.” Set the landing gear lever to UP.
Attempt to establish visual contact. Call out any conflicting traffic.	

Upset Recovery

An upset can generally be defined as unintentionally exceeding the following conditions:

- pitch attitude greater than 25 degrees nose up, or
- pitch attitude greater than 10 degrees nose down, or
- bank angle greater than 45 degrees, or
- within above parameters but flying at airspeeds inappropriate for the conditions

The following techniques represent a logical progression for recovering the airplane. The sequence of actions is for guidance only and represents a series of options to be considered and used depending on the situation. Not all the actions may be necessary once recovery is underway. If needed, use pitch trim sparingly. Careful use of rudder to aid roll control should be considered only if roll control is ineffective and the airplane is not stalled.

These techniques assume 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">• Recognize and confirm the situation	
<ul style="list-style-type: none">• Disconnect autopilot and autothrottle• Apply as much as full nose down elevator• *Apply appropriate nose down stabilizer trim• Reduce thrust• *Roll (adjust bank angle) to obtain a nose down pitch rate• Complete the recovery:<ul style="list-style-type: none">• when approaching the horizon, roll to wings level• check airspeed and adjust thrust• establish pitch attitude	<ul style="list-style-type: none">• Call out attitude, airspeed and altitude throughout the recovery• Verify all required actions have been completed and call out any omissions

Nose Low Recovery

Pilot Flying	Pilot Monitoring
<ul style="list-style-type: none">• Recognize and confirm the situation	
<ul style="list-style-type: none">• Disconnect autopilot and autothrottle• Recover from stall, if required• *Roll in the shortest direction to wings level (unload and roll if bank angle is more than 90 degrees)• Recover to level flight:<ul style="list-style-type: none">• apply nose up elevator• *apply nose up trim, if required• adjust thrust and drag as required	<ul style="list-style-type: none">• Call out attitude, airspeed and altitude throughout the recovery• Verify all required actions have been completed and call out any omissions

WARNING: * Excessive use of pitch trim or rudder may aggravate an upset situation or may result in loss of control and/or high structural loads.

Windshear Caution

For predictive windshear caution alert: (“MONITOR RADAR DISPLAY” aural)



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Pilot Flying	Pilot Monitoring
• Maneuver as required to avoid the windshear	

Windshear Warning

Predictive windshear warning during takeoff roll: (“WINDSHEAR AHEAD, WINDSHEAR AHEAD” aural)

- prior to V1, reject takeoff
- after V1, perform the Windshear Escape Maneuver

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
MANUAL FLIGHT <ul style="list-style-type: none">• Disconnect autopilot• Push either TO/GA switch• Aggressively apply maximum* thrust• Disconnect autothrottle(s)• Simultaneously roll wings level and rotate toward an initial pitch attitude of 15°• Verify the speedbrakes are retracted• Follow flight director TO/GA guidance (if available)	<ul style="list-style-type: none">• Assure maximum* thrust• Verify all required actions have been completed and call out any omissions

Pilot Flying	Pilot Monitoring
AUTOMATIC FLIGHT <ul style="list-style-type: none">• Press either TO/GA switch.**• Verify TO/GA mode annunciation• Verify thrust advances to GA power• Verify the speedbrakes are retracted• Monitor system performance***	<ul style="list-style-type: none">• Assure maximum* thrust• Verify all required actions have been completed and call out any omissions



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Pilot Flying	Pilot Monitoring
<ul style="list-style-type: none">• Do not change gear or flap configuration until windshear is no longer a factor• Monitor vertical speed and altitude• Do not attempt to regain lost airspeed until windshear is no longer a factor	<ul style="list-style-type: none">• Monitor vertical speed and altitude• Call out any trend toward terrain contact, descending flight path, or significant airspeed changes

Note: Aft control column force increases as the airspeed decreases. In all cases, the pitch attitude that results in intermittent stick shaker or initial buffet is the upper pitch attitude limit. Flight at intermittent stick shaker may be required to obtain positive terrain separation. Smooth, steady control will avoid a pitch attitude overshoot and stall.

Note: * Maximum thrust can be obtained by advancing the thrust levers full forward if the EECs are in the normal mode. If terrain contact is imminent, advance thrust levers full forward.

Note: ** If TO/GA is not available, disconnect autopilot and autothrottle(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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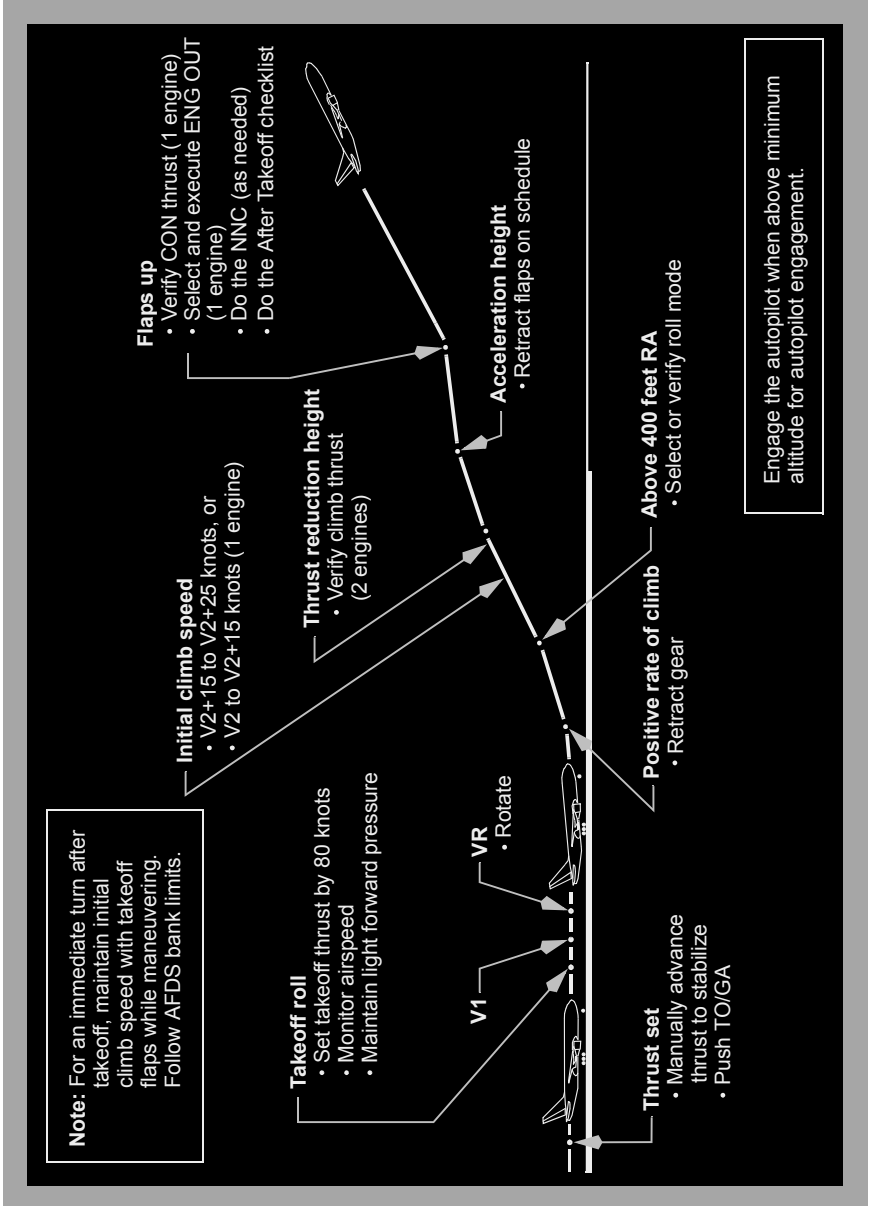
Maneuvers

Flight Patterns

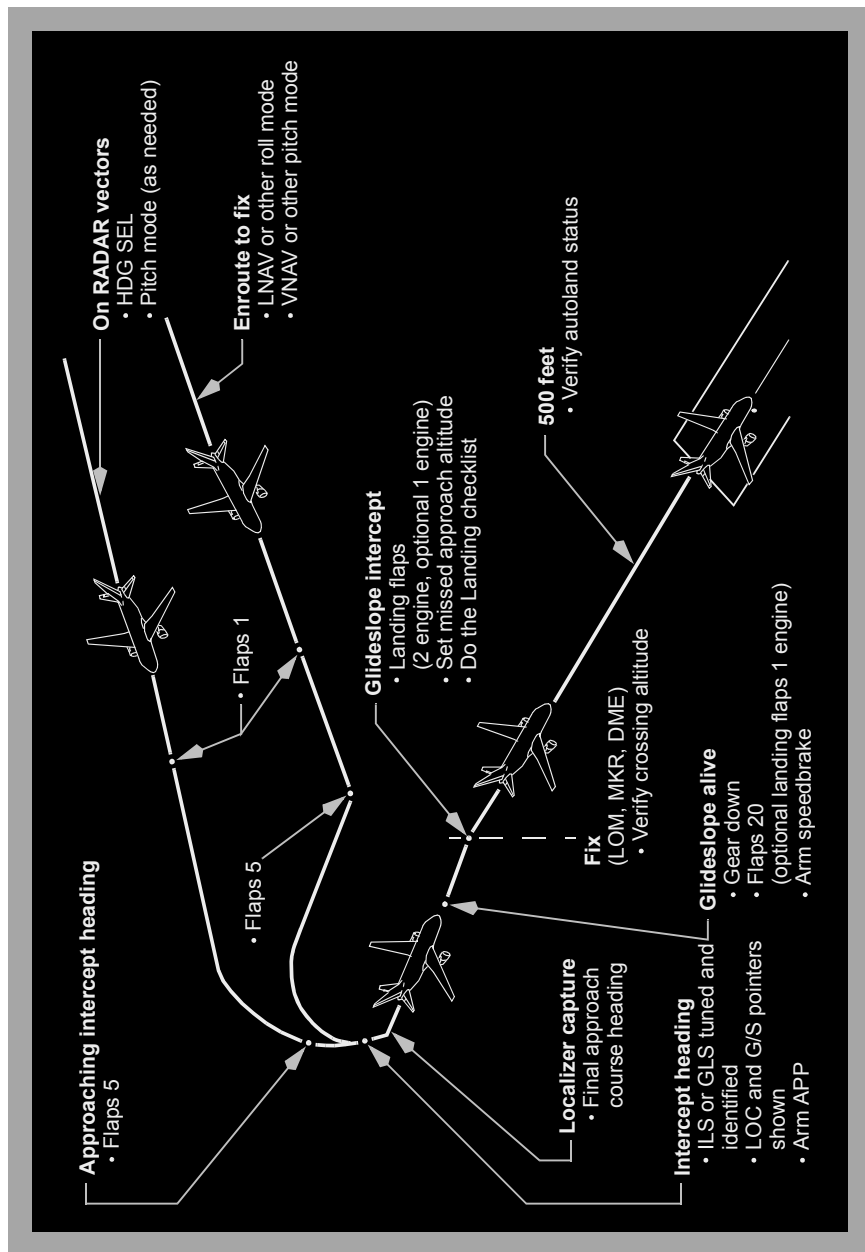
Chapter Man

Section 2

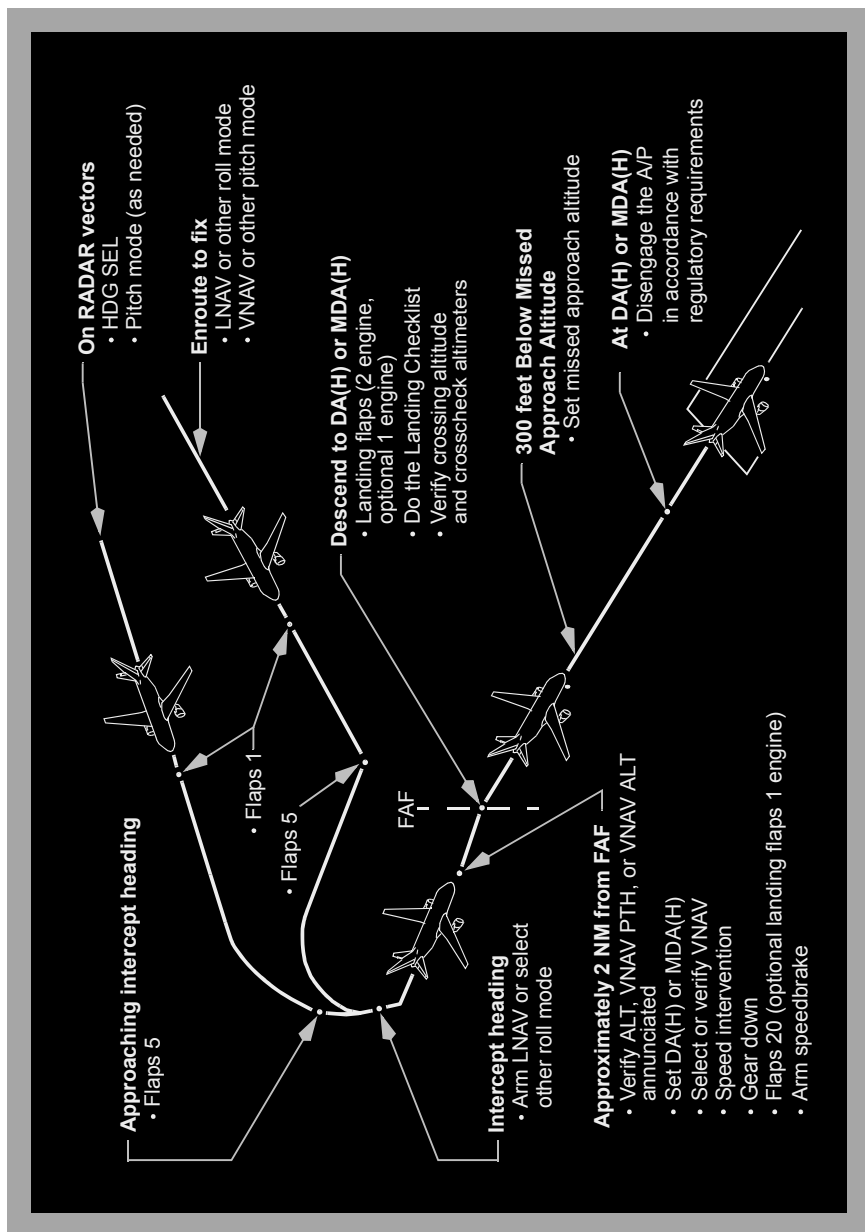
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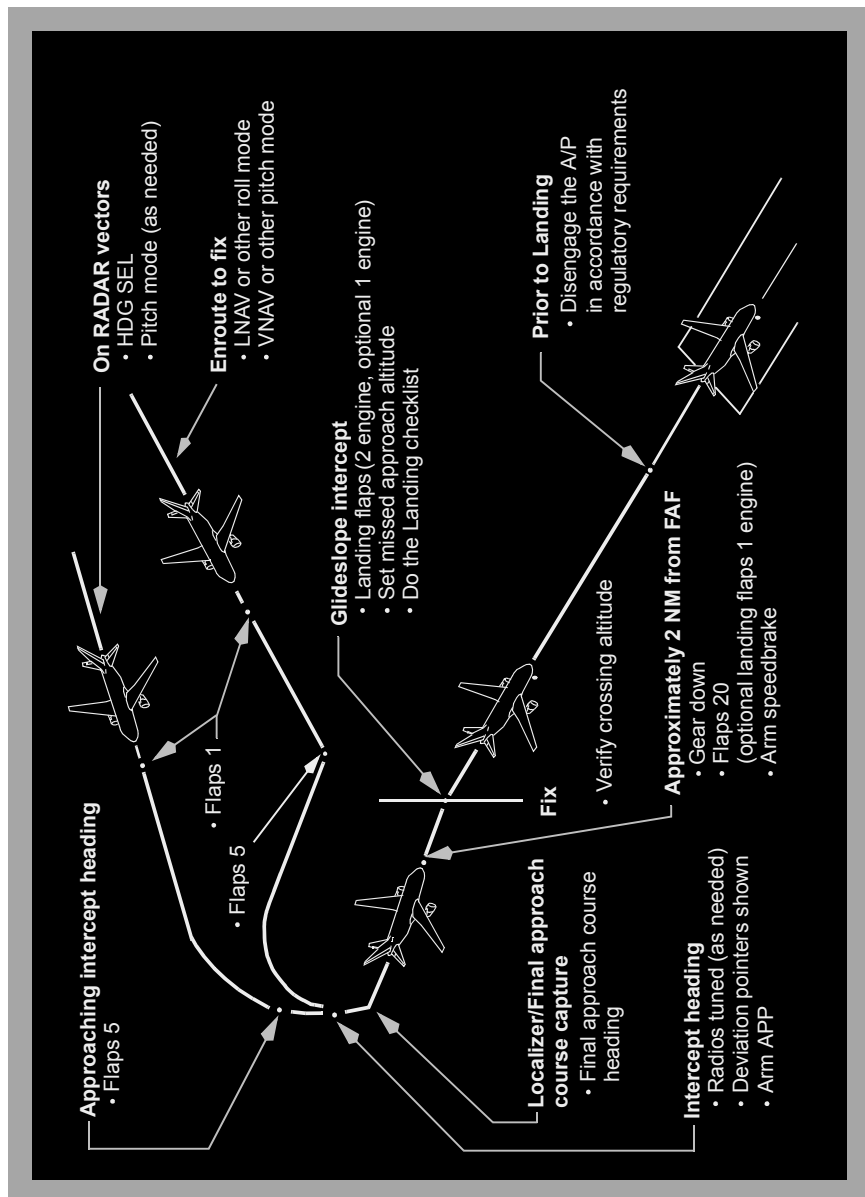
ILS or GLS Approach - Fail Operational



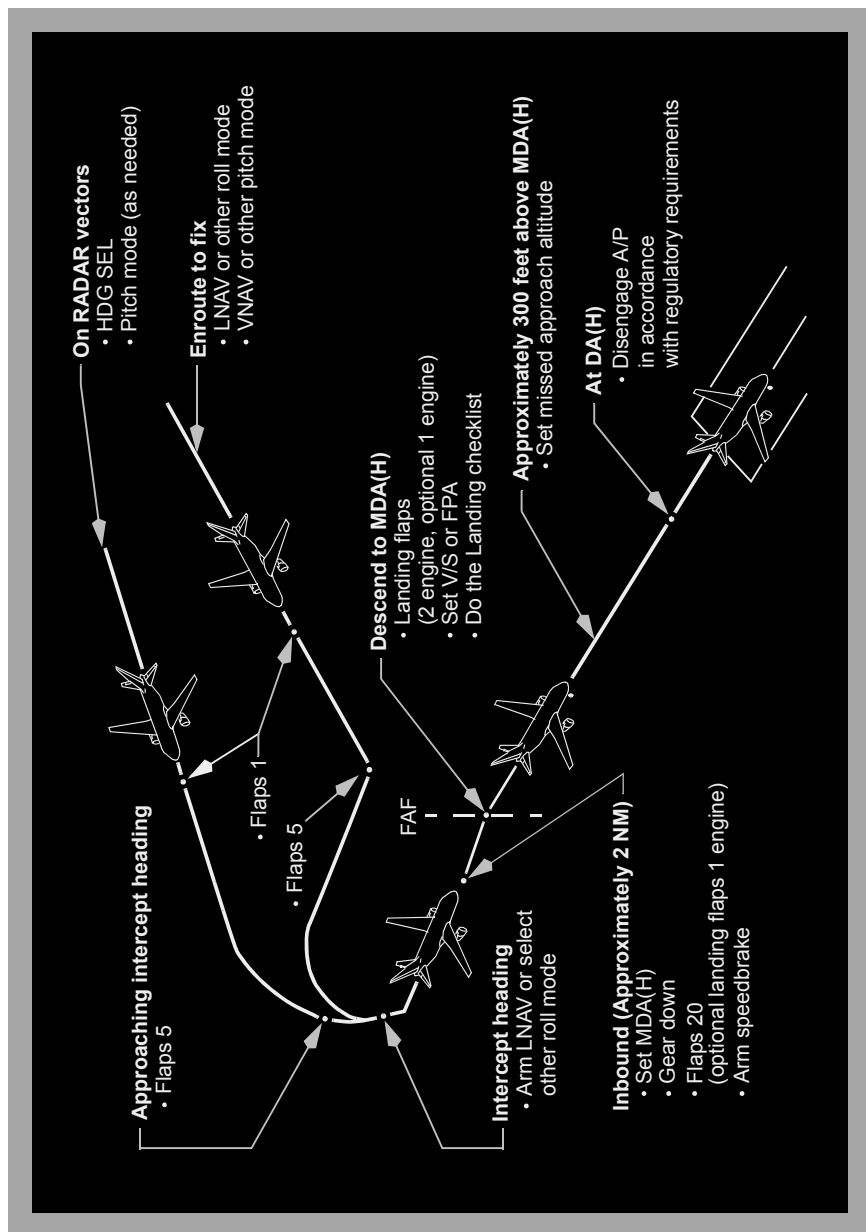
Instrument Approach Using VNAV



Instrument Approach Using IAN

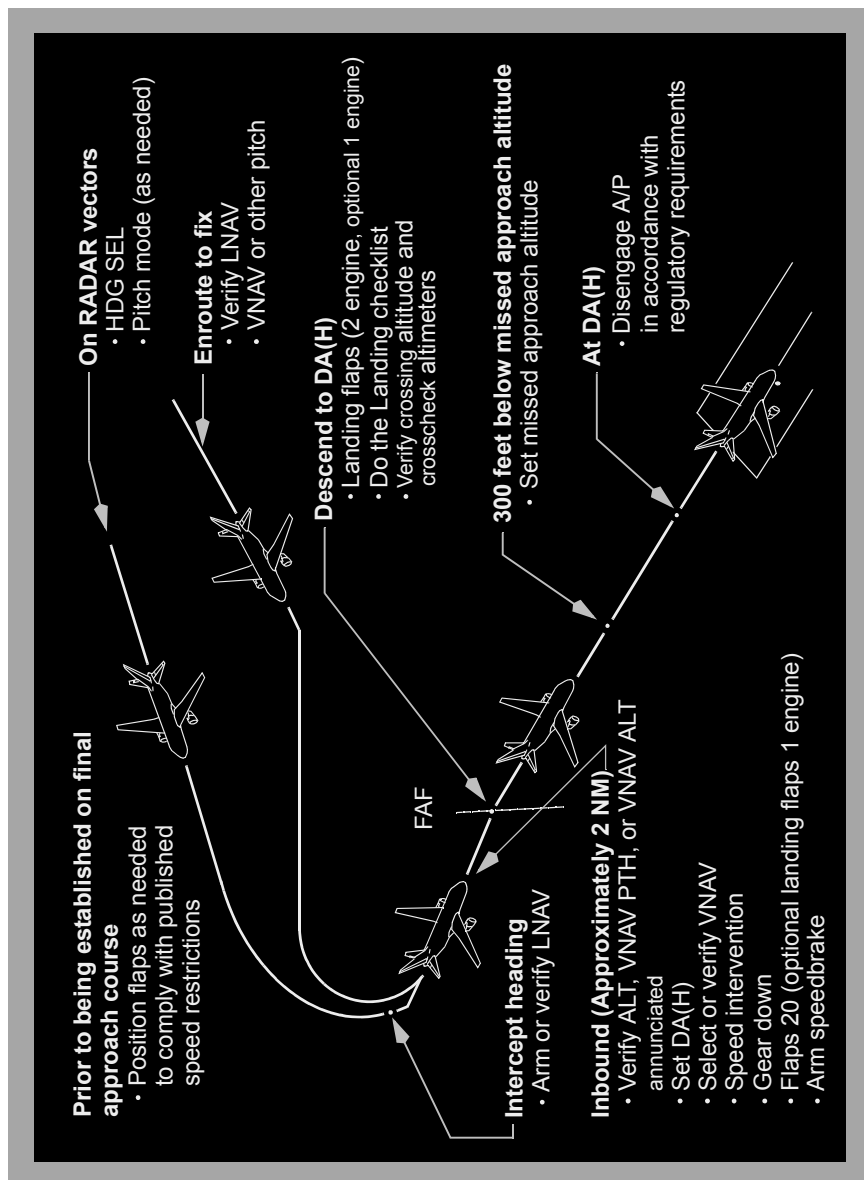


Instrument Approach Using V/S or FPA

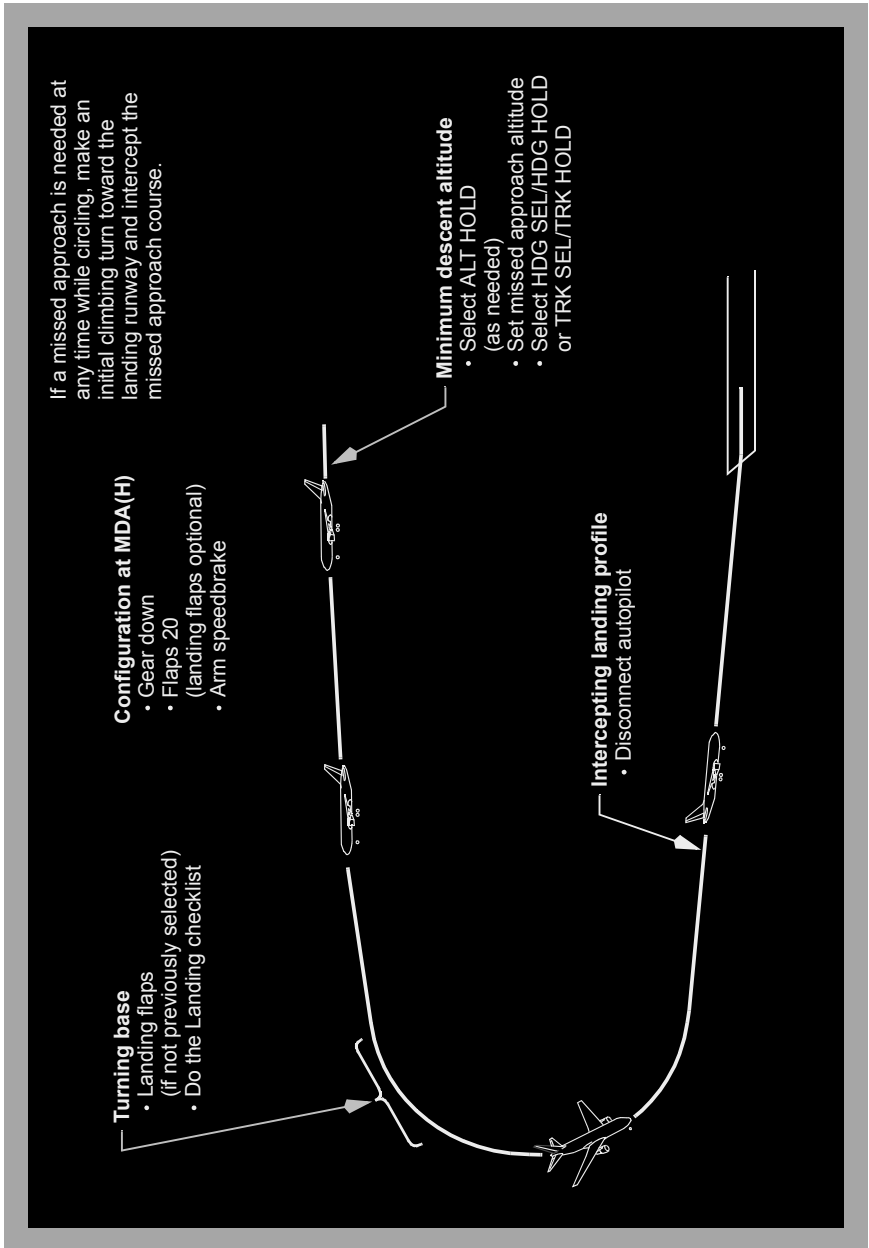


Non - ILS Instrument Approaches

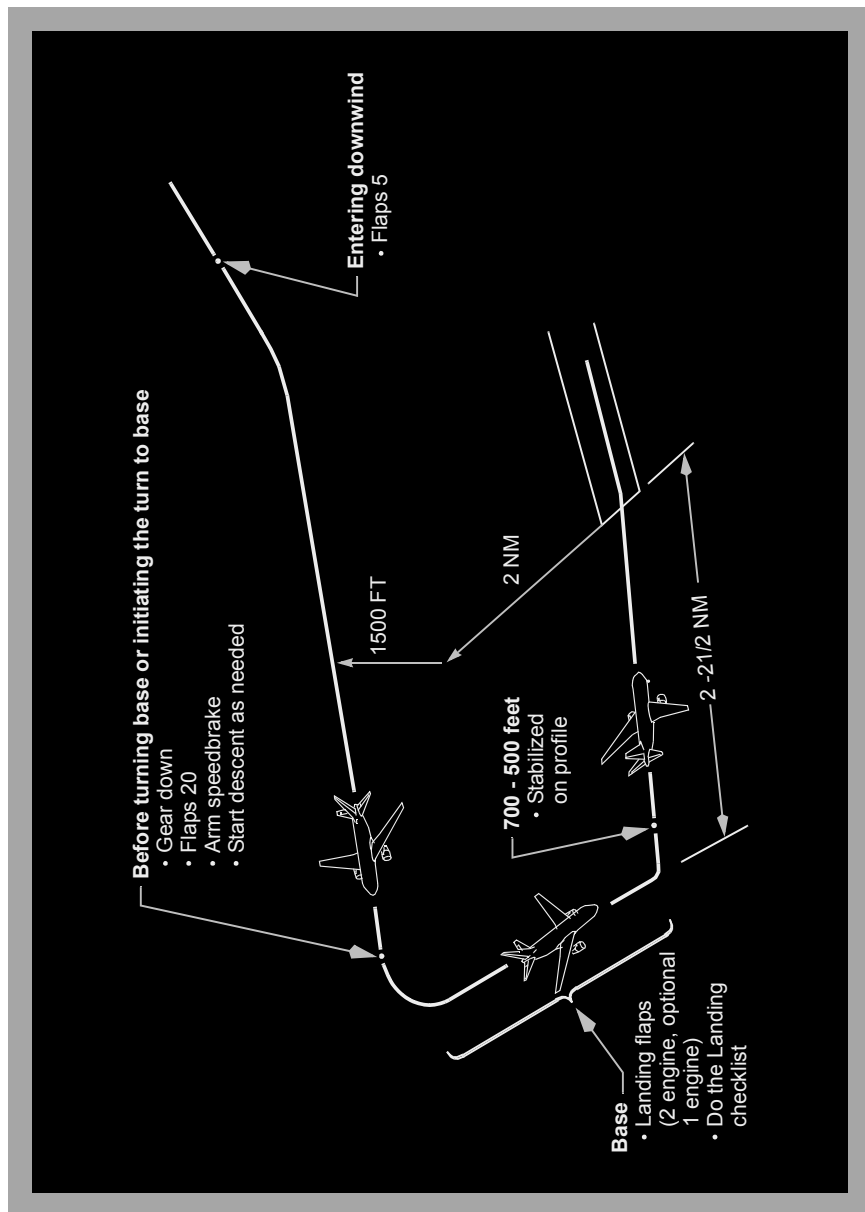
Instrument Approach - RNAV (RNP) AR



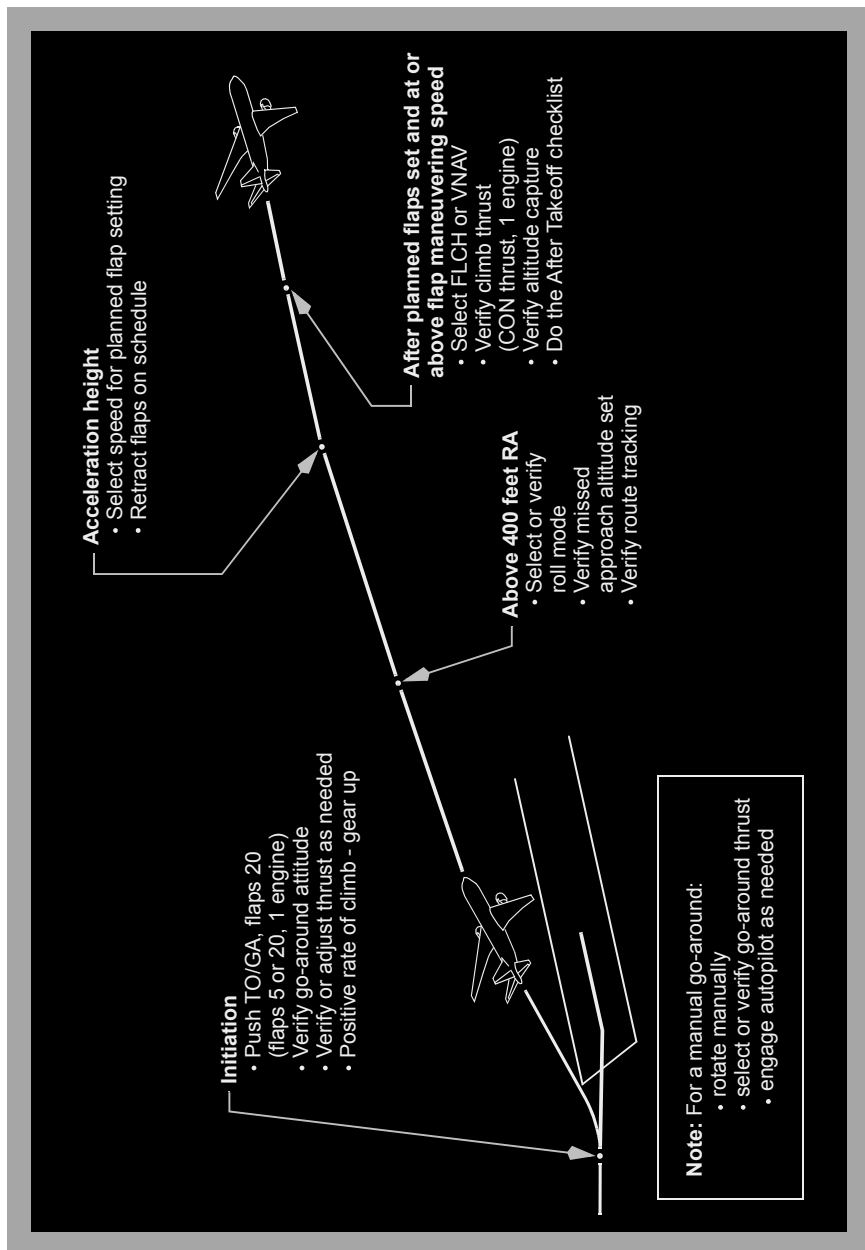
Circling Approach



Visual Traffic Pattern



Go-Around and Missed Approach



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Checklist Instructions

Chapter CI

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**Checklist Instructions**
Model Identification**Chapter CI**
Section ModID**General**

The airplanes listed in the table below are covered in this manual. The numbers are used to distinguish data peculiar to one or more, but not all of the airplanes. Where data applies to all airplanes listed, no reference is made to individual airplane numbers.

The table permits flight crew correlation of configuration differences by Registry Number in alpha/numeric order within an operator's fleet for airplanes covered in this manual. Configuration data reflects the airplane as delivered configuration and is updated for service bulletin incorporations in conformance with the policy stated in the introduction section of this chapter.

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
002	B-2722	34939	ZA431
004	B-2723	34944	ZA433
001	B-2728	34938	ZA430
003	B-2729	34941	ZA432
005	ZA434	34943	ZA434
ZA435	ZA435	34945	ZA435
ZA436	ZA436	34940	ZA436



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Checklist Instructions

Revision Record

Chapter CI

Section RR

Revision Transmittal Letter

To: All holders of Hainan Airlines Co., Ltd. 787 Flight Crew Operations Manual, Boeing Document Number D615Z003-HNA.

Subject: Flight Crew Operations Manual Revision.

This revision reflects the most current information available to The Boeing Company 45 days before the subject revision date. The following revision highlights explain changes in this revision. General information below explains the use of revision bars to identify new or revised information.

Revision Record

No.	Revision Date	Date Filed
0	August 15, 2011	
2	April 6, 2012	
4	February 18, 2013	

No.	Revision Date	Date Filed
1	February 17, 2012	
3	August 17, 2012	
5	April 5, 2013	

General

The Boeing Company issues flight crew operations manual revisions to provide new or revised procedures and information. Formal revisions also incorporate appropriate information from previously issued flight crew operations manual bulletins.

The revision date is the approximate date the manual is mailed to the customer.

Formal revisions include a Transmittal Letter, a new Revision Record, Revision Highlights, and a current List of Effective Pages. Use the information on the new Revision Record and List of Effective Pages to verify the manual content.

Pages containing revised technical material have revision bars associated with the changed text or illustration. Editorial revisions (for example, spelling corrections) may have revision bars with no associated highlight.

The record above should be completed by the person incorporating the revision into the manual.

Filing Instructions

Consult the List of Effective Pages (CI.LEP). Pages identified with an asterisk (*) are either replacement pages or new (original) issue pages. Remove corresponding old pages and replace or add new pages. Remove pages that are marked DELETED; there are no replacement pages for deleted pages.

Revision Highlights

This section (CI.RR) replaces the existing section CI.RR in your manual.

Be careful when inserting changes not to throw away pages from the manual that are not replaced. Using the List of Effective Pages (CI.LEP) can help determine the correct content of the manual.

Throughout the manual, airplane effectivity may be updated to reflect coverage as listed on the Preface - Model Identification page, or to show service bulletin airplane effectivity. Highlights are not supplied.

This manual is published from a database; the text and illustrations are marked with configuration information. Occasionally, because the editors rearrange the database markers, or mark items with configuration information due to the addition of new database content, some customers may receive revision bars on content that appears to be unchanged. Pages may also be republished without revision bars due to slight changes in the flow of the document.

Chapter NNC - Non-Normal Checklists

Section 6 - Electrical

MAIN BATTERY DISCH

6.12 - Revised due to changes to main battery system.

Section 7 - Engines, APU

ENG FUEL VALVE L, R

7.19 - Deleted ENG HPC VALVE EICAS message since it will not be used.



787 Flight Crew Operations Manual

Checklist Instructions QRH List of Effective Pages

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* QA.Index.1-2	April 5, 2013
EICAS Messages (tab)	
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Unannounced (tab)	
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Alphabetical (tab)	
* Alpha.Index.1-12	April 5, 2013
* Alpha.Index.13-14	Deleted
Normal Checklists (tab)	
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0 Miscellaneous (tab)	
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April 5, 2013

D615Z003-HNA

CI.LEP.1



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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
- items needed to meet regulatory requirements, or
- items needed to maintain fleet commonality between the 737, 747-400, 757, 767, 777, and 787, or
- items that enhance safety of flight and are not monitored by an alerting system (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.



Intentionally
Blank



Checklist Instructions

Non-Normal Checklists

Chapter CI


Section 2

Introduction

The non-normal checklists chapter contains checklists used by the flight crew to manage non-normal situations. The checklists are grouped in sections which match the system description chapters in Volume 2.

Most checklists correspond to an EICAS alert message. The EICAS alert message indicates a non-normal condition, and is the cue to select and do the associated checklist.

Checklists without an EICAS alert message (such as Ditching) are called unannunciated checklists. Most unannunciated checklists are in the associated system section. For example, Fuel Leak is in section 12, Fuel. Unannunciated 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 alert 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. Unannunciated checklists also have condition statements to help in understanding the reason for the checklist.

Some checklists have objective statements. The objective statement briefly describes the expected result of doing the checklist or briefly describes the reason for steps in the checklist.

Checklists can have both memory and reference items. Memory items are critical steps that must be done before reading the checklist. 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 considerations/additional information at the end of the checklist. The considerations/additional information provides data the crew may wish to consider. The considerations/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. 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, in-flight troubleshooting by the flight crew may cause further loss of system function or system failure.

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

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- only two AC power sources remain (two main engine generators, or one main engine generator and both APU 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

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- in flight, reset of a tripped circuit breaker is not recommended.
 - however, a tripped circuit breaker may be reset once, after a short cooling period (approximately 2 minutes), if in the judgment of the captain, the situation resulting from the circuit breaker trip has a significant adverse effect on safety
 - on the ground, flight crew reset of a tripped circuit breaker should only be done after maintenance has determined that it is safe to reset the circuit breaker
 - 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
 - when an electrical non-normal checklist directs the flight crew to attempt only one reset of a switch per flight, a second reset of the switch should not be done until maintenance has cleared the malfunction. After the one reset attempt, the flight crew should select ITEM OVRD for any additional checklist steps directing the flight crew to attempt a reset of the same switch.

Non-Normal Checklist Use

If a checklist or a step in a checklist is not applicable to all airplanes, airplane effectivity information is included in the checklist. Airplane effectivity can be listed by airplane number, registry number, serial number or tabulation number. If a checklist is applicable to some but not all airplanes, airplane effectivity is centered below the checklist title. If a step in a checklist is applicable to some but not all airplanes, airplane effectivity is included above the step. If a checklist or a step in a checklist is applicable to all airplanes, airplane effectivity information is not included.

Non-normal checklist use starts when the airplane flight path and configuration are correctly established. Only a few situations need an immediate response (such as CABIN ALTITUDE). 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

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For checklists with memory items, the pilot monitoring first verifies that each memory item has been done. The checklist is normally read aloud during this verification. The pilot flying does not need to respond except for items that are not in agreement with the checklist. 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 the first officer take action based on preflight and postflight areas of responsibility

With the airplane in flight or in motion on the ground:

- the pilot flying and the pilot monitoring take action based on each crewmember’s Area 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 flight 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.

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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 checklist, 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."

Considerations/additional information at the end of the checklist is not required to be read.

The flight crew must be aware that checklists cannot be created for all conceivable situations and are not intended to replace good judgment. In some situations, at the captain's discretion, deviation from a checklist may be needed.

Non-Normal Checklist Legend

Redirection Symbol



This 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



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.**



Evacuation

Condition: An evacuation is needed.

- 1 PARKING BRAKE Set C
- 2 OUTFLOW VALVE
switches (both) MAN F/O
- 3 OUTFLOW VALVE MANUAL
switches (both) Hold in OPEN
until the outflow valve
indications show fully open
to depressurize the airplane F/O
- 4 FUEL CONTROL
switches (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:
Related fire
switch Rotate to the stop
and hold for 1 second F/O

