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B-737-900ER

Operational Data

Manual

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FUNCTION

The Aircraft Operational Data Manual (ODM) serves to provide trained Delta Flight Operations and Operations Control personnel with some of the information and instructions necessary for safe and economical operation of the aircraft.

AUTHORITY

This manual is published by the General Manager – Performance Engineering, Dept. 088, ATL under the authority of the Vice President – Operations Reliability and Control.

The procedures and data contained in this manual include those in the FAA Approved Airplane Flight Manual and aircraft manufacturer's data.

RESPONSIBILITY

The General Manager – Performance Engineering has been designated the responsibility for the quality of this manual.

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Maintenance, safeguard, and revision of this manual are the responsibilities of the individual to whom it is issued.

All manual holders and users are encouraged to contribute their suggestions and criticisms regarding the manual so that its function is well served. Inputs concerning data and technical content should be addressed to Performance Engineering, Dept. 088, ATL.

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Revision Notification

Publication: B-737-900ER OPERATIONAL DATA MANUAL

Date: 23 Sep 16

Revision Number: 15

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TABLE OF CONTENTS	TABLE OF CONTENTS	Date updated to reflect revision.
COVER PAGE	COVER PAGE	Cover page updated to reflect revision.
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QUICK REFERENCE Pages: All	QUICK REFERENCE Pages: All	Changed the table title and eliminated fair nomenclature to make it consistent with new FAA policy

**Pages not displaying a revision date of 23 Sep 16 were unchanged and included only for filing purposes.*

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737-900ER QUICK REFERENCE CHART

OPERATIONAL LANDING DISTANCES

RUNWAY CONDITION ASSESSMENT MATRIX

For additional guidance regarding the classification of the braking action based on existing contaminant types and the ICAO/Runway Condition Code values, please refer to Airway Manual, Supplemental, 4 – Weather, Braking Action.

Reported Braking Action		Reported Runway Surface Conditions			
PIREP	Definition	Runway Contaminant	ICAO/Runway Condition Code	Mu ⁽²⁾	RCR
--	--	• Dry	6		--
Good	Braking deceleration is normal for the wheel braking effort applied AND directional control is normal	- Frost - Wet or Damp 1/8" or less depth of: - Water - Slush - Dry Snow - Wet Snow	5	40 or higher	19 & above
Good to Medium	Braking deceleration OR directional control is between Good and Medium.	-15°C and colder OAT: Compacted Snow	4	39 to 30	
Medium	Braking deceleration is noticeably reduced for the wheel braking effort applied OR directional control is noticeably reduced.	- Wet ("slippery when wet" runway) - Dry Snow or Wet Snow (any depth) over Compacted Snow Greater than 1/8" depth of: - Dry Snow - Wet Snow Warmer than -15°C OAT: - Compacted Snow	3	29 to 21	13 – 18
Medium to Poor	Braking deceleration OR directional control is between Medium and Poor.	Greater than 1/8" depth of: - Water - Slush	2	20 or lower	
Poor	Braking deceleration is significantly reduced for the wheel braking effort applied OR directional control is significantly reduced.	• Ice	1		6 – 12
Nil ⁽¹⁾	Braking deceleration is minimal to non-existent for the wheel braking effort applied OR directional control is uncertain.	- Wet Ice - Water on top of Compacted Snow - Dry Snow or Wet Snow over Ice	0		5 & below
--	--	• Unreliable	9 (ICAO only)	N/A	N/A

⁽¹⁾ Operations on any runway with a PIREP or runway contaminant of nil are prohibited.

⁽²⁾ The overlapping Mu scales reflect the inherent inaccuracies of ground based Mu devices. Do not base the calculation of a landing distance solely on runway friction meter readings.

Braking actions "GOOD TO MEDIUM (4)" and "MEDIUM TO POOR (2)" are not displayed on the following pages. It is acceptable to interpolate between the provided data to calculate the desired landing performance when these conditions are present.

CROSSWIND

On slippery runways, crosswind guidelines are a function of runway surface condition, airplane loading and assume proper pilot technique. The following crosswind guidelines are applicable to all Delta aircraft for takeoff and landing.

	DRY	GOOD	MEDIUM	POOR
Crosswind Limit	Aircraft Limits	Aircraft Limits	20KTS	10KTS
Tailwind Limit	10KTS*	10KTS*	5KTS	0KTS

*Or as permitted by Delta 10-0 special pages.

737-900ER QUICK REFERENCE CHART

OPERATIONAL LANDING DISTANCES FEET

FLAPS 15

Landing Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).							
	DRY (6)					GOOD (5)		
	AB 1	AB 2	AB 3	Max AB	Max Manual	AB 3	Max AB	Max Manual
190,000	13,300	11,800	9,200	6,500	5,600	9,200	7,500	7,000
185,000	13,000	11,600	9,000	6,400	5,500	9,000	7,300	6,800
180,000	12,700	11,400	8,900	6,300	5,300	8,900	7,200	6,700
175,000	12,400	11,100	8,700	6,200	5,200	8,700	7,100	6,600
170,000	12,100	10,900	8,500	6,100	5,000	8,500	6,900	6,500
165,000	11,800	10,600	8,400	6,000	4,900	8,400	6,800	6,400
160,000	11,600	10,400	8,200	5,900	4,800	8,200	6,700	6,200
157,300	11,400	10,300	8,100	5,800	4,700	8,100	6,600	6,200
155,000	11,300	10,100	8,000	5,700	4,600	8,000	6,500	6,100
150,000	11,000	9,900	7,800	5,600	4,500	7,900	6,400	6,000
145,000	10,700	9,600	7,700	5,500	4,400	7,700	6,200	5,900
140,000	10,300	9,400	7,500	5,400	4,300	7,500	6,100	5,700
135,000	10,000	9,100	7,300	5,300	4,200	7,300	6,000	5,600
130,000	9,700	8,900	7,100	5,200	4,100	7,100	5,800	5,500
125,000	9,400	8,600	6,900	5,100	4,000	7,000	5,700	5,400
120,000	9,100	8,300	6,800	5,000	3,900	6,800	5,600	5,200
115,000	8,800	8,100	6,600	4,900	3,800	6,600	5,400	5,100
110,000	8,500	7,800	6,400	4,800	3,700	6,400	5,300	5,000
105,000	8,200	7,600	6,200	4,600	3,600	6,200	5,100	4,900
100,000	7,900	7,300	6,100	4,500	3,600	6,100	5,000	4,700

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Touchdown Speed = VREF15 - 5 •

Data is advisory and includes 15% safety margin and 1,500 ft. air distance from threshold to touchdown.

REFERENCE DISTANCES BASED UPON PRESSURE ALTITUDE OF 2,000 FEET AND ARE CONSERVATIVE FOR ALL LOWER ALTITUDES.

 Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	DRY (6)					GOOD (5)		
0	-700	-600	-400	-200	-200	-400	-300	-300
2,000	0	0	0	0	0	0	0	0
4,000	700	600	400	200	200	400	300	300
6,000	1,300	1,100	800	500	400	800	600	600
8,000	2,000	1,700	1,200	700	600	1,200	900	800
10,000	2,900	2,500	1,800	1,000	900	1,800	1,300	1,200

CORRECTIONS

	DRY (6)					GOOD (5)		
PER 1 KT HEADWIND	-50	-50	-50	0	0	-50	0	0
PER 1 KT TAILWIND	150	150	100	50	50	100	100	100
PER 5 KTS ADD'L SPD	350	400	400	200	150	400	200	200
PER 10°C ABOVE ISA	300	250	200	100	100	200	150	150
PER 10°C BELOW ISA	-300	-250	-200	-100	-100	-200	-150	-150
PER 1% UP SLOPE	-300	-150	0	0	-50	0	-100	-100
PER 1% DOWN SLOPE	250	100	0	0	50	0	100	150
1 REVERSER INOP	800	200	0	0	100	0	300	300
2 REVERSERS INOP	1,100	200	0	0	200	0	600	600
MANUAL SPOILERS	200	200	200	200	200	200	200	200

Note: Do not operate when Braking Action is Nil.

737-900ER QUICK REFERENCE CHART

OPERATIONAL LANDING DISTANCES FEET

FLAPS 15

Landing Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).					
	MEDIUM (3)			POOR (1)		
	AB 3	Max AB	Max Manual	AB 3	Max AB	Max Manual
190,000	10,400	9,900	9,700	13,100	13,000	13,000
185,000	10,100	9,700	9,500	12,800	12,700	12,700
180,000	9,900	9,500	9,300	12,500	12,400	12,400
175,000	9,700	9,300	9,100	12,200	12,100	12,100
170,000	9,500	9,100	9,000	11,900	11,800	11,800
165,000	9,300	8,900	8,800	11,600	11,500	11,500
160,000	9,100	8,700	8,600	11,300	11,200	11,200
157,300	9,000	8,600	8,500	11,200	11,100	11,100
155,000	8,900	8,500	8,400	11,000	11,000	10,900
150,000	8,700	8,300	8,200	10,800	10,700	10,700
145,000	8,500	8,100	8,000	10,500	10,400	10,400
140,000	8,300	7,900	7,800	10,200	10,100	10,100
135,000	8,100	7,700	7,600	9,900	9,800	9,800
130,000	7,800	7,500	7,400	9,600	9,500	9,500
125,000	7,600	7,300	7,200	9,300	9,200	9,200
120,000	7,400	7,100	7,000	9,000	8,900	8,900
115,000	7,200	6,900	6,800	8,700	8,700	8,600
110,000	7,000	6,700	6,600	8,400	8,400	8,400
105,000	6,800	6,400	6,400	8,100	8,100	8,100
100,000	6,600	6,200	6,200	7,800	7,800	7,800

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Touchdown Speed = VREF15 - 5 •

Data is advisory and includes 15% safety margin and 1,500 ft. air distance from threshold to touchdown.

REFERENCE DISTANCES BASED UPON PRESSURE ALTITUDE OF 2,000 FEET AND ARE CONSERVATIVE FOR ALL LOWER ALTITUDES.



Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	MEDIUM (3)			POOR (1)		
0	-500	-500	-500	-700	-700	-700
2,000	0	0	0	0	0	0
4,000	500	500	500	700	700	700
6,000	1,000	900	900	1,400	1,300	1,300
8,000	1,400	1,400	1,400	2,100	2,000	2,000
10,000	2,100	2,100	2,000	3,100	3,000	3,000

CORRECTIONS

	MEDIUM (3)			POOR (1)		
PER 1 KT HEADWIND	-50	-50	-50	-50	-50	-50
PER 1 KT TAILWIND	150	150	150	200	200	200
PER 5 KTS ADD'L SPD	400	300	250	350	300	300
PER 10°C ABOVE ISA	200	200	200	300	300	300
PER 10°C BELOW ISA	-250	-200	-200	-300	-300	-300
PER 1% UP SLOPE	-150	-250	-250	-500	-550	-550
PER 1% DOWN SLOPE	250	300	350	800	850	850
1 REVERSER INOP	500	700	700	1,600	1,600	1,600
2 REVERSERS INOP	1,500	1,700	1,700	4,200	4,200	4,200
MANUAL SPOILERS	200	200	200	200	200	200

Note: Do not operate when Braking Action is Nil.

737-900ER QUICK REFERENCE CHART

OPERATIONAL LANDING DISTANCES FEET

FLAPS 30

Landing Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).							
	DRY (6)					GOOD (5)		
	AB 1	AB 2	AB 3	Max AB	Max Manual	AB 3	Max AB	Max Manual
190,000	12,200	10,900	8,600	6,100	5,200	8,600	7,100	6,600
185,000	11,900	10,700	8,400	6,000	5,100	8,400	6,900	6,500
180,000	11,600	10,500	8,200	5,900	5,000	8,300	6,800	6,400
175,000	11,400	10,300	8,100	5,800	4,900	8,100	6,700	6,300
170,000	11,100	10,000	7,900	5,700	4,800	7,900	6,600	6,200
165,000	10,900	9,800	7,800	5,600	4,600	7,800	6,500	6,100
160,000	10,600	9,600	7,600	5,500	4,500	7,600	6,300	5,900
157,300	10,500	9,500	7,500	5,500	4,500	7,600	6,300	5,900
155,000	10,300	9,400	7,500	5,400	4,400	7,500	6,200	5,800
150,000	10,100	9,100	7,300	5,300	4,300	7,300	6,100	5,700
145,000	9,800	8,900	7,100	5,200	4,200	7,100	6,000	5,600
140,000	9,500	8,700	7,000	5,100	4,200	7,000	5,800	5,500
135,000	9,300	8,500	6,800	5,000	4,100	6,800	5,700	5,400
130,000	9,000	8,200	6,600	4,900	4,000	6,600	5,600	5,200
125,000	8,700	8,000	6,500	4,800	3,900	6,500	5,500	5,100
120,000	8,500	7,800	6,300	4,700	3,800	6,300	5,300	5,000
115,000	8,200	7,500	6,100	4,600	3,700	6,100	5,200	4,900
110,000	7,900	7,300	6,000	4,500	3,600	6,000	5,100	4,800
105,000	7,600	7,100	5,800	4,400	3,600	5,800	4,900	4,700
100,000	7,400	6,800	5,600	4,300	3,500	5,600	4,800	4,600

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Touchdown Speed = VREF30 - 5 •

Data is advisory and includes 15% safety margin and 1,500 ft. air distance from threshold to touchdown.

REFERENCE DISTANCES BASED UPON PRESSURE ALTITUDE OF 2,000 FEET AND ARE CONSERVATIVE FOR ALL LOWER ALTITUDES.

 Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	DRY (6)					GOOD (5)		
0	-600	-500	-300	-200	-200	-300	-300	-300
2,000	0	0	0	0	0	0	0	0
4,000	600	500	300	200	200	300	300	300
6,000	1,200	1,000	700	400	300	700	600	500
8,000	1,800	1,500	1,000	600	500	1,000	800	800
10,000	2,600	2,100	1,500	900	700	1,500	1,200	1,100

CORRECTIONS

	DRY (6)					GOOD (5)		
PER 1 KT HEADWIND	-50	-50	-50	0	0	-50	0	0
PER 1 KT TAILWIND	150	150	100	50	50	100	100	100
PER 5 KTS ADD'L SPD	300	350	350	200	150	350	200	200
PER 10°C ABOVE ISA	250	250	200	100	100	200	150	150
PER 10°C BELOW ISA	-250	-250	-200	-100	-100	-200	-150	-150
PER 1% UP SLOPE	-300	-150	0	0	-50	0	-100	-100
PER 1% DOWN SLOPE	250	100	0	0	50	0	100	100
1 REVERSER INOP	600	200	0	0	100	0	200	200
2 REVERSERS INOP	1,000	200	0	0	100	0	500	500
MANUAL SPOILERS	200	200	200	200	200	200	200	200

Note: Do not operate when Braking Action is Nil.

737-900ER QUICK REFERENCE CHART

OPERATIONAL LANDING DISTANCES FEET

FLAPS 30

Landing Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).					
	MEDIUM (3)			POOR (1)		
	AB 3	Max AB	Max Manual	AB 3	Max AB	Max Manual
190,000	9,700	9,300	9,100	12,100	12,100	12,000
185,000	9,500	9,100	8,900	11,900	11,800	11,700
180,000	9,300	9,000	8,700	11,600	11,500	11,500
175,000	9,100	8,800	8,600	11,400	11,300	11,200
170,000	8,900	8,600	8,400	11,100	11,000	10,900
165,000	8,700	8,400	8,200	10,800	10,700	10,700
160,000	8,500	8,200	8,000	10,600	10,500	10,400
157,300	8,400	8,100	7,900	10,400	10,300	10,300
155,000	8,300	8,000	7,800	10,300	10,200	10,200
150,000	8,100	7,800	7,700	10,000	9,900	9,900
145,000	8,000	7,700	7,500	9,800	9,700	9,600
140,000	7,800	7,500	7,300	9,500	9,400	9,400
135,000	7,600	7,300	7,100	9,200	9,200	9,100
130,000	7,400	7,100	6,900	9,000	8,900	8,900
125,000	7,200	6,900	6,700	8,700	8,700	8,600
120,000	7,000	6,700	6,600	8,400	8,400	8,300
115,000	6,800	6,500	6,400	8,200	8,100	8,100
110,000	6,600	6,300	6,200	7,900	7,900	7,800
105,000	6,400	6,100	6,000	7,700	7,600	7,600
100,000	6,200	5,900	5,800	7,400	7,400	7,300

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Touchdown Speed = VREF30 - 5 •

Data is advisory and includes 15% safety margin and 1,500 ft. air distance from threshold to touchdown.

REFERENCE DISTANCES BASED UPON PRESSURE ALTITUDE OF 2,000 FEET AND ARE CONSERVATIVE FOR ALL LOWER ALTITUDES.



Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	MEDIUM (3)			POOR (1)		
0	-400	-400	-400	-600	-600	-600
2,000	0	0	0	0	0	0
4,000	400	400	400	600	600	600
6,000	900	900	800	1,200	1,200	1,200
8,000	1,300	1,300	1,200	1,900	1,900	1,800
10,000	1,900	1,900	1,800	2,800	2,800	2,600

CORRECTIONS

	MEDIUM (3)			POOR (1)		
PER 1 KT HEADWIND	-50	-50	-50	-50	-50	-50
PER 1 KT TAILWIND	150	150	150	200	200	200
PER 5 KTS ADD'L SPD	350	300	250	300	300	300
PER 10°C ABOVE ISA	200	200	200	250	250	250
PER 10°C BELOW ISA	-200	-200	-200	-300	-300	-300
PER 1% UP SLOPE	-200	-250	-250	-500	-500	-500
PER 1% DOWN SLOPE	250	300	300	750	800	750
1 REVERSER INOP	500	600	600	1,400	1,300	1,300
2 REVERSERS INOP	1,300	1,500	1,500	3,500	3,500	3,500
MANUAL SPOILERS	200	200	200	200	200	200

Note: Do not operate when Braking Action is Nil.

737-900ER QUICK REFERENCE CHART

OPERATIONAL LANDING DISTANCES FEET

FLAPS 40

Landing Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).							
	DRY (6)					GOOD (5)		
	AB 1	AB 2	AB 3	Max AB	Max Manual	AB 3	Max AB	Max Manual
190,000	11,800	10,600	8,300	5,900	5,000	8,400	7,000	6,600
185,000	11,500	10,300	8,100	5,800	4,900	8,200	6,900	6,400
180,000	11,200	10,100	8,000	5,700	4,800	8,000	6,700	6,300
175,000	11,000	9,800	7,800	5,600	4,700	7,800	6,600	6,200
170,000	10,700	9,600	7,600	5,500	4,600	7,600	6,400	6,000
165,000	10,400	9,400	7,400	5,400	4,500	7,400	6,300	5,900
160,000	10,100	9,100	7,200	5,300	4,400	7,200	6,200	5,800
157,300	10,000	9,000	7,100	5,200	4,300	7,100	6,100	5,700
155,000	9,800	8,900	7,000	5,100	4,300	7,100	6,000	5,700
150,000	9,600	8,600	6,900	5,100	4,200	6,900	5,900	5,500
145,000	9,300	8,400	6,700	5,000	4,100	6,800	5,800	5,400
140,000	9,100	8,200	6,600	4,900	4,000	6,600	5,700	5,300
135,000	8,800	8,000	6,400	4,800	3,900	6,400	5,500	5,200
130,000	8,600	7,800	6,300	4,700	3,800	6,300	5,400	5,100
125,000	8,300	7,500	6,100	4,600	3,800	6,100	5,300	5,000
120,000	8,100	7,300	6,000	4,500	3,700	6,000	5,200	4,800
115,000	7,800	7,100	5,800	4,400	3,600	5,800	5,100	4,700
110,000	7,500	6,900	5,600	4,300	3,500	5,700	4,900	4,600
105,000	7,300	6,700	5,500	4,200	3,400	5,500	4,800	4,500
100,000	7,000	6,500	5,300	4,100	3,300	5,400	4,700	4,400

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Touchdown Speed = VREF40 - 5 •

Data is advisory and includes 15% safety margin and 1,500 ft. air distance from threshold to touchdown.

REFERENCE DISTANCES BASED UPON PRESSURE ALTITUDE OF 2,000 FEET AND ARE CONSERVATIVE FOR ALL LOWER ALTITUDES.

 Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	DRY (6)					GOOD (5)		
0	-600	-500	-400	-200	-200	-400	-300	-300
2,000	0	0	0	0	0	0	0	0
4,000	600	500	400	200	200	400	300	300
6,000	1,200	1,000	700	400	300	700	600	600
8,000	1,700	1,500	1,100	600	500	1,100	900	800
10,000	2,500	2,200	1,600	900	700	1,600	1,300	1,200

CORRECTIONS

	DRY (6)					GOOD (5)		
PER 1 KT HEADWIND	-50	-50	-50	0	0	-50	0	0
PER 1 KT TAILWIND	150	100	100	50	50	100	100	50
PER 5 KTS ADD'L SPD	350	350	350	200	150	350	200	200
PER 10°C ABOVE ISA	300	250	200	100	100	200	150	150
PER 10°C BELOW ISA	-300	-250	-200	-100	-100	-200	-150	-150
PER 1% UP SLOPE	-250	-150	0	0	-50	0	-100	-100
PER 1% DOWN SLOPE	200	50	0	0	50	50	100	100
1 REVERSER INOP	500	100	0	0	100	0	200	200
2 REVERSERS INOP	800	100	0	0	100	0	500	400
MANUAL SPOILERS	200	200	200	200	200	200	200	200

Note: Do not operate when Braking Action is Nil.

737-900ER QUICK REFERENCE CHART

OPERATIONAL LANDING DISTANCES FEET

FLAPS 40

Landing Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).					
	MEDIUM (3)			POOR (1)		
	AB 3	Max AB	Max Manual	AB 3	Max AB	Max Manual
190,000	9,500	9,200	9,000	12,000	11,800	11,800
185,000	9,200	9,000	8,800	11,700	11,600	11,500
180,000	9,000	8,800	8,600	11,400	11,300	11,200
175,000	8,800	8,600	8,400	11,100	11,000	10,900
170,000	8,600	8,400	8,200	10,800	10,700	10,700
165,000	8,400	8,100	8,000	10,500	10,400	10,400
160,000	8,100	7,900	7,800	10,200	10,100	10,100
157,300	8,000	7,800	7,700	10,000	10,000	9,900
155,000	7,900	7,700	7,600	9,900	9,800	9,800
150,000	7,700	7,500	7,400	9,600	9,600	9,500
145,000	7,600	7,400	7,200	9,400	9,300	9,300
140,000	7,400	7,200	7,000	9,100	9,100	9,000
135,000	7,200	7,000	6,900	8,900	8,800	8,800
130,000	7,000	6,800	6,700	8,600	8,600	8,500
125,000	6,800	6,600	6,500	8,400	8,300	8,300
120,000	6,600	6,400	6,300	8,100	8,100	8,000
115,000	6,500	6,200	6,100	7,800	7,800	7,800
110,000	6,300	6,100	6,000	7,600	7,600	7,500
105,000	6,100	5,900	5,800	7,300	7,300	7,300
100,000	5,900	5,700	5,600	7,100	7,100	7,000

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Touchdown Speed = VREF40 - 5 •

Data is advisory and includes 15% safety margin and 1,500 ft. air distance from threshold to touchdown.

REFERENCE DISTANCES BASED UPON PRESSURE ALTITUDE OF 2,000 FEET AND ARE CONSERVATIVE FOR ALL LOWER ALTITUDES.



Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	MEDIUM (3)			POOR (1)		
0	-400	-400	-400	-600	-600	-600
2,000	0	0	0	0	0	0
4,000	400	400	400	600	600	600
6,000	900	900	800	1,200	1,200	1,200
8,000	1,300	1,300	1,200	1,900	1,900	1,800
10,000	1,900	1,900	1,800	2,800	2,800	2,700

CORRECTIONS

	MEDIUM (3)			POOR (1)		
PER 1 KT HEADWIND	-50	-50	-50	-50	-50	-50
PER 1 KT TAILWIND	150	150	100	200	200	200
PER 5 KTS ADD'L SPD	350	300	250	300	300	300
PER 10°C ABOVE ISA	200	200	200	300	300	300
PER 10°C BELOW ISA	-250	-200	-200	-300	-300	-300
PER 1% UP SLOPE	-150	-250	-250	-500	-500	-500
PER 1% DOWN SLOPE	250	300	300	750	750	750
1 REVERSER INOP	500	600	600	1,300	1,300	1,200
2 REVERSERS INOP	1,300	1,300	1,300	3,200	3,200	3,200
MANUAL SPOILERS	200	200	200	200	200	200

Note: Do not operate when Braking Action is Nil.

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DEFINITIONS AND ASSUMPTIONS

ISA - International Standard Atmosphere temperature, in °C, for a given pressure altitude. ISA temperature for Sea Level is 15°C (59°F).

ISA DEVIATION - The difference between the standard ISA temperature and the ambient temperature in °C.

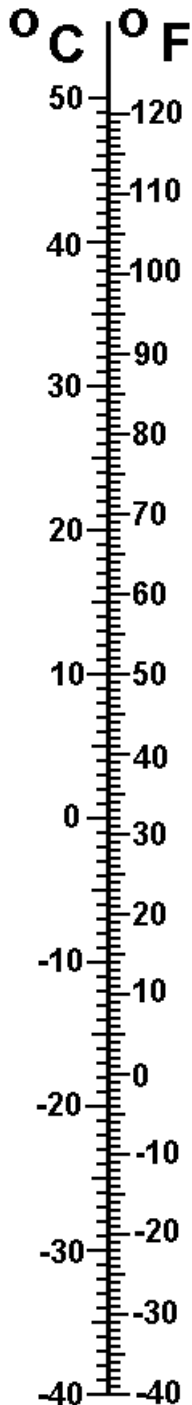
STATIC AIR TEMPERATURE (SAT) - The ambient still air temperature outside of the aircraft. Sometimes known as the Outside Air Temperature (OAT).

TOTAL AIR TEMPERATURE (TAT) - The total of the ambient air temperature (SAT) plus the increase in temperature due to compression heating.

V_{mo}/M_{mo} - Maximum allowable operating indicated airspeed or Mach number.

TEMPERATURE CONVERSION AND STATIC AIR TEMPERATURE

°C



ALTITUDE - FEET	ISA DEVIATION					
	ISA-20°C	ISA-10°C	ISA	ISA+10°C	ISA+20°C	ISA+30°C
36,000 & Higher	-76.5	-66.5	-56.5	-46.5	-36.5	-26.5
35,000	-74.2	-64.2	-54.2	-44.2	-34.2	-24.2
34,000	-72.3	-62.3	-52.3	-42.3	-32.3	-22.3
33,000	-70.3	-60.3	-50.3	-40.3	-30.3	-20.3
32,000	-68.3	-58.3	-48.3	-38.3	-28.3	-18.3
31,000	-66.3	-56.3	-46.3	-36.3	-26.3	-16.3
30,000	-64.3	-54.3	-44.3	-34.3	-24.3	-14.3
29,000	-62.4	-52.4	-42.4	-32.4	-22.4	-12.4
28,000	-60.4	-50.4	-40.4	-30.4	-20.4	-10.4
27,000	-58.4	-48.4	-38.4	-28.4	-18.4	-8.4
26,000	-56.5	-46.5	-36.5	-26.5	-16.5	-6.5
25,000	-54.5	-44.5	-34.5	-24.5	-14.5	-4.5
24,000	-52.5	-42.5	-32.5	-22.5	-12.5	-2.5
23,000	-50.5	-40.5	-30.5	-20.5	-10.5	-0.5
22,000	-48.5	-38.5	-28.5	-18.5	-8.5	+1.5
21,000	-46.6	-36.6	-26.6	-16.6	-6.6	+3.4
20,000	-44.6	-34.6	-24.6	-14.6	-4.6	+5.4
19,000	-42.6	-32.6	-22.6	-12.6	-2.6	+7.4
18,000	-40.6	-30.6	-20.6	-10.6	-0.6	+9.4
17,000	-38.7	-28.7	-18.7	-8.7	+1.3	+11.3
16,000	-36.7	-26.7	-16.7	-6.7	+3.3	+13.3
15,000	-34.7	-24.7	-14.7	-4.7	+5.3	+15.3
14,000	-32.7	-22.7	-12.7	-2.7	+7.3	+17.3
13,000	-30.7	-20.7	-10.7	-0.7	+9.3	+19.3
12,000	-28.8	-18.8	-8.8	+1.2	+11.2	+21.2
11,000	-26.8	-16.8	-6.8	+3.2	+13.2	+23.2
10,000	-24.8	-14.8	-4.8	+5.2	+15.2	+25.2
5000	-14.9	-4.9	+5.1	+15.1	+25.1	+35.1
0	-5.0	+5.0	+15.0	+25.0	+35.0	+45.0

RULE OF THUMB: For standard temperature (ISA) at or below 36,000 feet:

Double altitude (in thousands of feet), subtract 15, change sign.

EXAMPLES:	<u>ALT</u>	<u>DOUBLE ALT</u>	<u>SUBTRACT 15</u>	<u>CHANGE SIGN</u>
	0	0	-15	+15
	33	66	51	-51

TOTAL AIR TEMPERATURE vs STATIC AIR TEMPERATURE**°C**

TAT °C	INDICATED MACH NUMBER													
	.40	.50	.60	.70	.74	.75	.76	.77	.78	.80	.82	.84	.86	.88
75	64	58	52	44	41	40	39	38	37	35	34	32	30	28
70	59	54	47	39	36	35	34	33	33	31	29	28	26	24
65	55	49	42	35	32	31	30	29	28	27	25	23	21	20
60	50	44	38	30	27	26	25	24	24	22	21	19	17	15
55	45	39	33	26	23	22	21	20	19	18	16	14	13	11
50	40	35	28	21	18	17	16	15	14	13	12	10	8	7
45	35	30	24	17	14	13	12	11	10	9	7	6	4	2
40	30	25	19	12	9	8	7	6	6	4	3	1	0	-2
35	25	20	14	7	5	4	3	2	1	0	-1	-3	-5	-6
30	21	16	10	3	0	-1	-2	-3	-3	-4	-6	-7	-9	-11
25	16	11	5	-2	-4	-5	-6	-7	-7	-9	-10	-12	-13	-15
20	11	6	0	-6	-9	-10	-11	-12	-12	-13	-15	-16	-18	-19
15	6	1	-4	-11	-13	-14	-15	-16	-16	-18	-19	-21	-22	-24
10	1	-3	-9	-15	-18	-19	-20	-21	-21	-22	-23	-25	-27	-28
5	-4	-8	-14	-20	-22	-23	-24	-25	-25	-27	-28	-29	-31	-32
0	-8	-13	-18	-24	-27	-28	-29	-30	-30	-31	-32	-34	-35	-37
-5	-13	-18	-23	-29	-31	-32	-33	-34	-34	-35	-37	-38	-40	-41
-10	-18	-23	-28	-33	-36	-37	-38	-39	-39	-40	-41	-43	-44	-45
-15	-23	-27	-32	-38	-40	-41	-42	-43	-43	-44	-46	-47	-48	-50
-20	-28	-32	-37	-43	-45	-46	-47	-48	-48	-49	-50	-51	-53	-54
-25	-33	-37	-42	-47	-49	-50	-51	-52	-52	-53	-54	-56	-57	-58
-30	-38	-42	-46	-52	-54	-54	-55	-55	-56	-58	-59	-60	-61	-63
-35	-42	-46	-51	-56	-58	-59	-60	-61	-61	-62	-63	-64	-66	-67
-40	-47	-51	-56	-61	-63	-63	-64	-64	-65	-66	-68	-69	-70	-71
-45	-52	-56	-60	-65	-67	-68	-69	-70	-70	-71	-72	-73	-74	-76
-50	-57	-61	-65	-70	-72	-72	-73	-73	-74	-75	-76	-78	-79	-80
-55	-62	-65	-70	-74	-76	-77	-78	-79	-79	-80	-81	-82	-83	-84

NORMAL OPERATING SPEED LIMIT

Vmo / Mmo

PRESSURE ALTITUDE	INDICATED Vmo (KIAS)	MACH Mmo
0	340	0.514
5,000	340	0.560
10,000	340	0.612
15,000	340	0.669
17,000	340	0.694
19,000	340	0.720
21,000	340	0.747
23,000	340	0.775
25,000	340	0.805
27,000	333	0.820
29,000	319	0.820
31,000	306	0.820
33,000	293	0.820
35,000	280	0.820
37,000	267	0.820
39,000	255	0.820
41,000	244	0.820

EN ROUTE FUEL TEMPERATURE

FOR DETERMINING DISPATCH CAPABILITY BASED ON FUEL FREEZE POINT.

FUEL TYPE		ISA	JET A	JP-5	JET A1	Jet B	TS-1
ADJUSTED FUEL FREEZE TEMP.			-37°C	-43°C	-44°C	-47°C	-57°C
MACH	FLT LEVEL		MAXIMUM ISA DEVIATION - °C				
0.77	330	-50	-12	-17	-18	-21	-30
	350	-54	-8	-13	-14	-17	-26
	370 & HIGHER	-57	-6	-11	-12	-14	-23
0.78	330	-50	-12	-18	-18	-21	-30
	350	-54	-8	-14	-15	-17	-26
	370 & HIGHER	-57	-6	-11	-12	-15	-24
0.79	330	-50	-13	-18	-19	-22	-31
	350	-54	-9	-14	-15	-18	-27
	370 & HIGHER	-57	-7	-12	-13	-16	-24
0.80	330	-50	-13	-19	-20	-22	-31
	350	-54	-9	-15	-16	-18	-27
	370 & HIGHER	-57	-7	-13	-14	-16	-25
0.81	330	-50	-14	-19	-20	-23	-32
	350	-54	-10	-15	-16	-19	-28
	370 & HIGHER	-57	-8	-13	-14	-17	-26

INSTRUCTIONS:

1. Locate type of fuel being used.

NOTE: THE ADJUSTED FUEL FREEZING TEMPERATURE IS THE BASIC FUEL FREEZING TEMPERATURE + 3°C (PER THE APPROVED AIRCRAFT FLIGHT MANUAL).

2. Move down to the Mach number and Altitude expected en route and read the Maximum ISA Deviation.
3. Do not dispatch aircraft into en route temperatures colder than the Maximum ISA Deviation obtained in Step 2 above.

NOTE: The use of Fuel System Icing Inhibitor additives does not change the minimum fuel tank temperature limit.

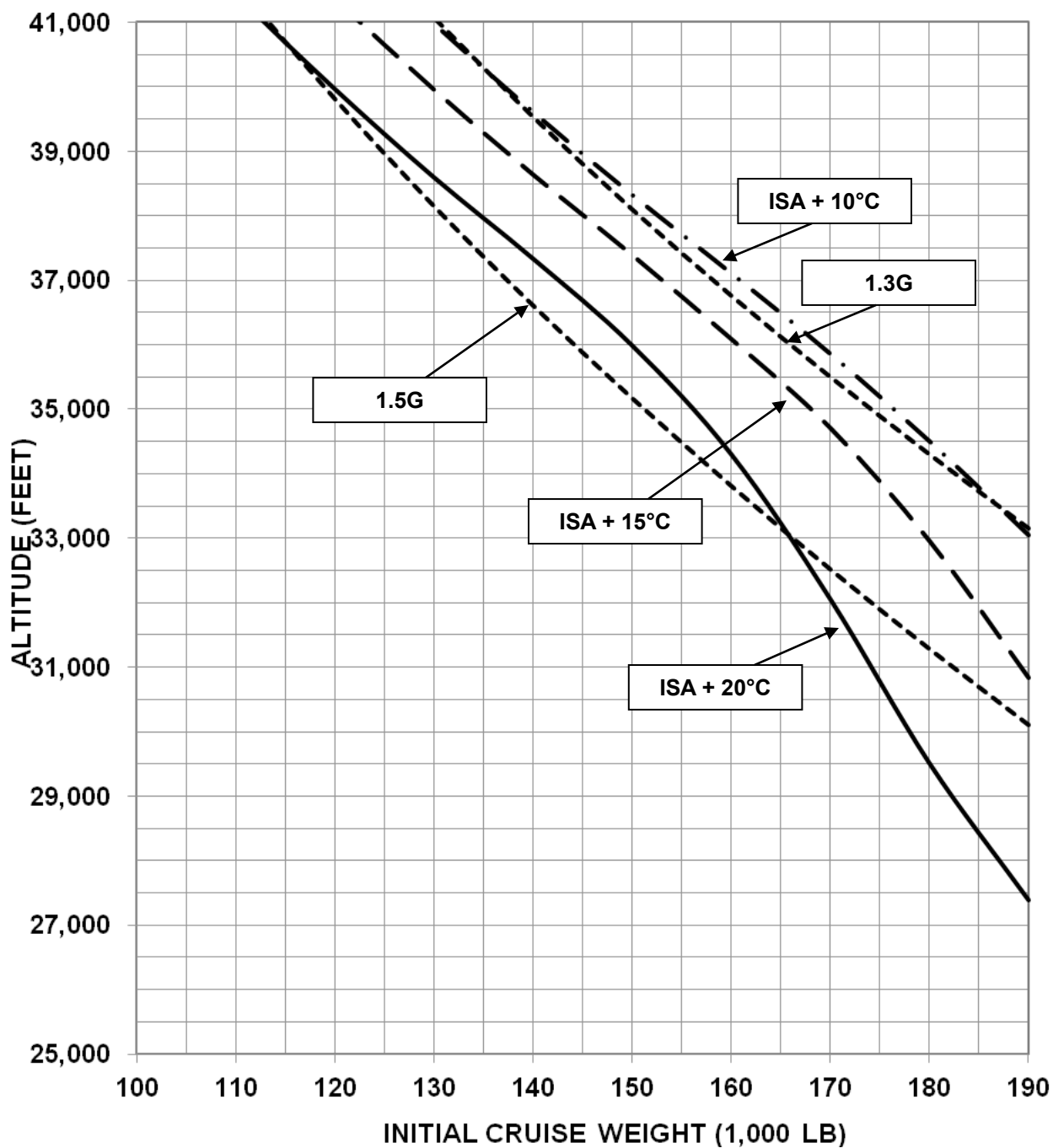
EXAMPLE:

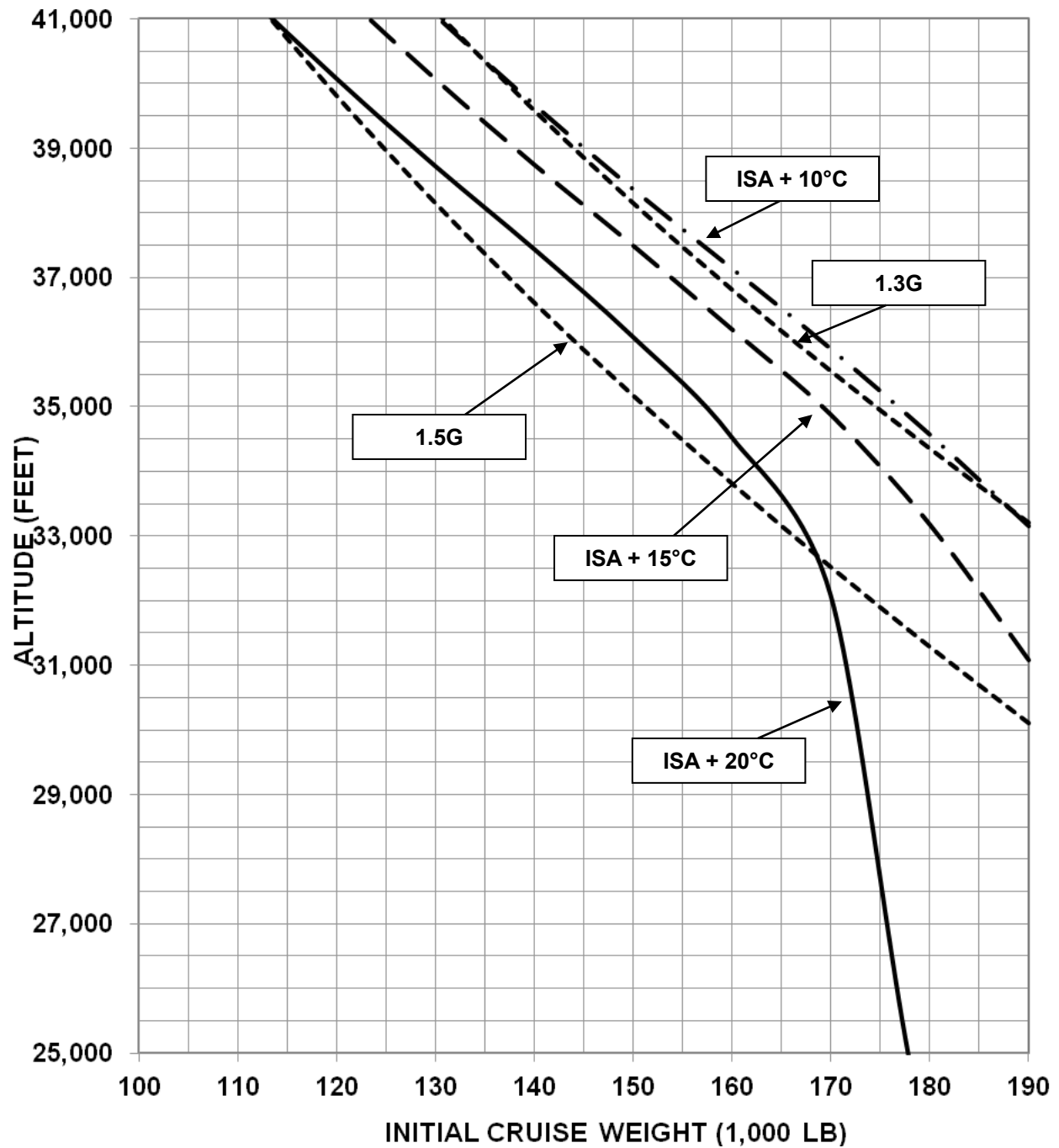
Fuel Type = Jet A (adjusted freeze point -37°C).

Expected Flight Level = 350.

Expected Mach Number = 0.81.

1. Enter the top of the Chart under JET A (Adjusted Fuel Freezing Temperature = -37°C).
2. Move down the chart to the flight conditions of Mach 0.81 and FL 350 and read the Maximum ISA Deviation (-10°C).
3. Do not dispatch aircraft into temperatures colder than ISA -10°C at FL 350.

MAXIMUM RECOMMENDED INITIAL CRUISE ALTITUDE**LRC**

MAXIMUM RECOMMENDED INITIAL CRUISE ALTITUDE**.79 MACH**

BUFFET ONSET BOUNDARY SPEEDS

KIAS

FLIGHT LEVEL	CRUISE WEIGHT - POUNDS	V _b - M KIAS	G / BANK ANGLE - DEGREES					
			1.0 / 0°		1.15 / 30°		1.5 / 48°	
			LOW	HIGH	LOW	HIGH	LOW	HIGH
410	180,000	0.76 224						
	160,000		216	239				
	140,000		196	244+	218	239		
	120,000		177	244+	194	244+		
	100,000		154	244+	170	244+	206	244+
390	180,000	0.76 233	229	255+				
	160,000		210	255+				
	140,000		192	255+	211	255+		
	120,000		171	255+	190	255+	230	248
	100,000		150	255+	166	255+	201	255+
370	180,000	0.76 245	223	267+				
	160,000		207	267+	228	267+		
	140,000		188	267+	207	267+		
	120,000		168	267+	185	267+	223	267+
	100,000		150	267+	162	267+	197	267+
350	180,000	0.76 258	219	280+	242	278		
	160,000		203	280+	224	280+		
	140,000		183	280+	203	280+	243	277
	120,000		163	280+	181	280+	219	280+
	100,000		150	280+	160	280+	193	280+
330	180,000	0.76 269	216	293+	237	293+		
	160,000		198	293+	220	293+	264	284
	140,000		180	293+	199	293+	239	293+
	120,000		163	293+	178	293+	215	293+
	100,000		150	293+	160	293+	188	293+
310	180,000	0.76 280	210	306+	234	306+		
	160,000		193	306+	215	306+	257	306+
	140,000		177	306+	194	306+	234	306+
	120,000		163	306+	174	306+	210	306+
	100,000		150	306+	160	306+	183	306+
290	180,000	0.73 280	206	319+	228	319+	273	319+
	160,000		190	319+	210	319+	252	319+
	140,000		176	319+	191	319+	230	319+
	120,000		163	319+	174	319+	206	319+
	100,000		150	319+	160	319+	181	319+

+ NOTE: Buffet Speeds shown with a **following + sign** are higher than the aircraft V_{mo}/M_{mo}.
The displayed speed is V_{mo}/M_{mo}.

 Aircraft is above buffet onset ceiling at this weight and altitude.

End of Section

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DEFINITIONS AND ASSUMPTIONS

- V₁ Takeoff Decision Speed** V₁ is the speed that determines the go or no-go decision in the event of an engine failure. No time is allowed after V₁ for reaction or decision. Action must be initiated at or before V₁. The Federal Aviation Regulations define V₁ as “the speed at which an engine failure has been recognized and action initiated to either continue or stop the takeoff”.
- V_R - Rotation Speed** V_R is the speed at which the pilot begins rotation of the aircraft to the takeoff pitch attitude. V_R is selected so that, with normal rate of rotation, the aircraft will lift off and attain a height of 35 feet at a speed of V₂.
- V₂ - Takeoff Safety Speed** V₂ is the speed used to achieve the required gradient during the second climb segment (landing gear retracted and flaps in the takeoff position).

NOTE: The takeoff speeds in this section may only be used with a manual weight data record based on ALM takeoff performance weight limits. These speeds may not be used with takeoff performance weight limits from AWABS. Optimum V₁ speeds are calculated in AWABS versus Balanced or Fixed V₁ speeds which are to be used for a manual WDR.

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TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

$V_1 / V_R / V_2$

TO2 / FLAPS 1

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
190,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
180,000	8,000					
	6,000					
	4,000					
	2,000					
	0	167 / 168 / 173				
170,000	8,000					
	6,000					
	4,000					
	2,000					
	0	162 / 164 / 168 162 / 163 / 168	162 / 164 / 168 162 / 163 / 168	161 / 164 / 167 162 / 163 / 168	159 / 166 / 167 163 / 164 / 167	163 / 166 / 167
160,000	8,000					
	6,000					
	4,000					
	2,000					
	0	158 / 159 / 163 157 / 158 / 164 156 / 158 / 164 156 / 157 / 164	157 / 159 / 163 157 / 158 / 164 156 / 158 / 164 156 / 157 / 164	155 / 160 / 163 158 / 159 / 163 157 / 158 / 163 156 / 157 / 164	159 / 161 / 162 158 / 160 / 163 157 / 158 / 163	160 / 161 / 162 159 / 160 / 163
150,000	8,000					
	6,000					
	4,000					
	2,000					
	0	154 / 155 / 159 153 / 154 / 159 152 / 153 / 160 151 / 153 / 160 151 / 152 / 160	154 / 155 / 159 153 / 154 / 159 152 / 153 / 160 151 / 153 / 160 151 / 152 / 160	154 / 157 / 158 154 / 155 / 159 153 / 154 / 159 152 / 153 / 159 151 / 152 / 160	155 / 157 / 158 154 / 156 / 158 153 / 155 / 159 152 / 153 / 159	156 / 158 / 158 156 / 157 / 158 155 / 156 / 158 154 / 155 / 159
140,000	8,000					
	6,000					
	4,000					
	2,000					
	0	148 / 149 / 154 147 / 148 / 154 146 / 147 / 155 145 / 147 / 155 145 / 146 / 155	148 / 149 / 154 147 / 148 / 154 146 / 147 / 155 145 / 147 / 155 145 / 146 / 155	149 / 151 / 153 148 / 149 / 154 147 / 148 / 154 146 / 147 / 154 145 / 146 / 155	150 / 152 / 153 149 / 151 / 153 148 / 150 / 153 147 / 149 / 154 146 / 147 / 154	151 / 153 / 153 151 / 152 / 153 150 / 151 / 153 149 / 150 / 153 148 / 149 / 154

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

V₁ / V_R / V₂
TO2 / FLAPS 1

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
130,000	8,000	142 / 143 / 149	142 / 143 / 149	143 / 145 / 148	144 / 146 / 148	145 / 147 / 147
	6,000	141 / 142 / 149	141 / 142 / 149	142 / 143 / 149	143 / 145 / 148	145 / 146 / 148
	4,000	140 / 141 / 150	140 / 141 / 150	141 / 142 / 149	142 / 144 / 148	144 / 145 / 148
	2,000	139 / 141 / 150	139 / 141 / 150	140 / 141 / 149	141 / 143 / 149	143 / 144 / 148
	0	139 / 140 / 150	139 / 140 / 150	139 / 140 / 150	140 / 141 / 149	142 / 143 / 149
120,000	8,000	135 / 136 / 143	135 / 136 / 143	136 / 138 / 142	137 / 139 / 142	138 / 140 / 141
	6,000	134 / 135 / 143	134 / 135 / 143	135 / 136 / 143	136 / 138 / 142	138 / 139 / 142
	4,000	133 / 134 / 144	133 / 134 / 144	134 / 135 / 143	135 / 137 / 142	137 / 138 / 142
	2,000	132 / 134 / 144	132 / 134 / 144	133 / 134 / 143	134 / 136 / 143	136 / 137 / 142
	0	132 / 133 / 144	132 / 133 / 144	132 / 133 / 144	133 / 134 / 143	135 / 136 / 143
110,000	8,000	128 / 129 / 137	128 / 129 / 137	129 / 131 / 136	130 / 132 / 136	131 / 133 / 135
	6,000	127 / 128 / 137	127 / 128 / 137	128 / 129 / 137	129 / 131 / 136	131 / 132 / 136
	4,000	126 / 127 / 138	126 / 127 / 138	127 / 128 / 137	128 / 130 / 136	130 / 131 / 136
	2,000	125 / 127 / 138	125 / 127 / 138	126 / 127 / 137	127 / 129 / 137	129 / 130 / 136
	0	125 / 126 / 138	125 / 126 / 138	125 / 126 / 138	126 / 127 / 137	128 / 129 / 137
100,000	8,000	121 / 122 / 132	121 / 122 / 132	122 / 124 / 131	123 / 125 / 131	124 / 126 / 130
	6,000	120 / 121 / 132	120 / 121 / 132	121 / 122 / 132	122 / 124 / 131	124 / 125 / 131
	4,000	119 / 120 / 133	119 / 120 / 133	120 / 121 / 132	121 / 123 / 131	123 / 124 / 131
	2,000	118 / 120 / 133	118 / 120 / 133	119 / 120 / 132	120 / 122 / 132	122 / 123 / 131
	0	118 / 119 / 133	118 / 119 / 133	118 / 119 / 133	119 / 120 / 132	121 / 122 / 132
90,000	8,000	114 / 114 / 126	114 / 114 / 126	115 / 116 / 125	116 / 117 / 125	117 / 118 / 124
	6,000	113 / 113 / 126	113 / 113 / 126	114 / 114 / 126	115 / 116 / 125	117 / 117 / 125
	4,000	112 / 112 / 127	112 / 112 / 127	113 / 113 / 126	114 / 115 / 125	116 / 116 / 125
	2,000	111 / 112 / 127	111 / 112 / 127	112 / 112 / 126	113 / 114 / 126	115 / 115 / 125
	0	111 / 111 / 127	111 / 111 / 127	111 / 111 / 127	112 / 112 / 126	114 / 114 / 126

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

$V_1 / V_R / V_2$

TO2 / FLAPS 5

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
190,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
180,000	8,000					
	6,000					
	4,000					
	2,000					
	0	159 / 160 / 165				
170,000	8,000					
	6,000					
	4,000					
	2,000					
	0	154 / 156 / 161 154 / 155 / 161	154 / 156 / 161 154 / 155 / 161	155 / 156 / 160 154 / 155 / 161	156 / 158 / 160 155 / 156 / 160	157 / 158 / 160
160,000	8,000					
	6,000					
	4,000	151 / 152 / 156	151 / 152 / 156	152 / 153 / 156	152 / 154 / 155	
	2,000	150 / 151 / 157	150 / 151 / 157	151 / 152 / 156	151 / 153 / 156	153 / 154 / 155
	0	149 / 151 / 157 149 / 150 / 157	149 / 151 / 157 149 / 150 / 157	150 / 151 / 156 149 / 150 / 157	150 / 151 / 156	152 / 153 / 156
150,000	8,000	147 / 148 / 152	147 / 148 / 152	148 / 150 / 151		
	6,000	146 / 147 / 152	146 / 147 / 152	147 / 148 / 152	148 / 150 / 151	150 / 151 / 151
	4,000	145 / 146 / 153	145 / 146 / 153	146 / 147 / 152	147 / 149 / 151	149 / 150 / 151
	2,000	144 / 146 / 153	144 / 146 / 153	145 / 146 / 152	146 / 148 / 152	148 / 149 / 151
	0	144 / 145 / 153	144 / 145 / 153	144 / 145 / 153	145 / 146 / 152	147 / 148 / 152
140,000	8,000	141 / 142 / 147	141 / 142 / 147	142 / 144 / 146	143 / 145 / 146	144 / 146 / 146
	6,000	140 / 141 / 147	140 / 141 / 147	141 / 142 / 147	142 / 144 / 146	144 / 145 / 146
	4,000	139 / 140 / 148	139 / 140 / 148	140 / 141 / 147	141 / 143 / 146	143 / 144 / 146
	2,000	138 / 140 / 148	138 / 140 / 148	139 / 140 / 147	140 / 142 / 147	142 / 143 / 146
	0	138 / 139 / 148	138 / 139 / 148	138 / 139 / 148	139 / 140 / 147	141 / 142 / 147

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

**V₁ / V_R / V₂
TO2 / FLAPS 5**

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
130,000	8,000	135 / 136 / 142	135 / 136 / 142	136 / 138 / 141	137 / 139 / 141	138 / 140 / 140
	6,000	134 / 135 / 142	134 / 135 / 142	135 / 136 / 142	136 / 138 / 141	138 / 139 / 141
	4,000	133 / 134 / 143	133 / 134 / 143	134 / 135 / 142	135 / 137 / 141	137 / 138 / 141
	2,000	132 / 134 / 143	132 / 134 / 143	133 / 134 / 142	134 / 136 / 142	136 / 137 / 141
	0	132 / 133 / 143	132 / 133 / 143	132 / 133 / 143	133 / 134 / 142	135 / 136 / 142
120,000	8,000	129 / 130 / 137	129 / 130 / 137	130 / 132 / 136	131 / 133 / 136	132 / 134 / 135
	6,000	128 / 129 / 137	128 / 129 / 137	129 / 130 / 137	130 / 132 / 136	132 / 133 / 136
	4,000	127 / 128 / 138	127 / 128 / 138	128 / 129 / 137	129 / 131 / 136	131 / 132 / 136
	2,000	126 / 128 / 138	126 / 128 / 138	127 / 128 / 137	128 / 130 / 137	130 / 131 / 136
	0	126 / 127 / 138	126 / 127 / 138	126 / 127 / 138	127 / 128 / 137	129 / 130 / 137
110,000	8,000	122 / 123 / 132	122 / 123 / 132	123 / 125 / 131	124 / 126 / 131	125 / 127 / 130
	6,000	121 / 122 / 132	121 / 122 / 132	122 / 123 / 132	123 / 125 / 131	125 / 126 / 131
	4,000	120 / 121 / 133	120 / 121 / 133	121 / 122 / 132	122 / 124 / 131	124 / 125 / 131
	2,000	119 / 121 / 133	119 / 121 / 133	120 / 121 / 132	121 / 123 / 132	123 / 124 / 131
	0	119 / 120 / 133	119 / 120 / 133	119 / 120 / 133	120 / 121 / 132	122 / 123 / 132
100,000	8,000	116 / 116 / 126	116 / 116 / 126	117 / 118 / 125	118 / 119 / 125	119 / 120 / 124
	6,000	115 / 115 / 126	115 / 115 / 126	116 / 116 / 126	117 / 118 / 125	119 / 119 / 125
	4,000	114 / 114 / 127	114 / 114 / 127	115 / 115 / 126	116 / 117 / 125	118 / 118 / 125
	2,000	113 / 114 / 127	113 / 114 / 127	114 / 114 / 126	115 / 116 / 126	117 / 117 / 125
	0	113 / 113 / 127	113 / 113 / 127	113 / 113 / 127	114 / 114 / 126	116 / 116 / 126
90,000	8,000	109 / 109 / 120	109 / 109 / 120	110 / 111 / 119	111 / 112 / 119	112 / 113 / 118
	6,000	108 / 108 / 120	108 / 108 / 120	109 / 109 / 120	110 / 111 / 119	112 / 112 / 119
	4,000	107 / 107 / 121	107 / 107 / 121	108 / 108 / 120	109 / 110 / 119	111 / 111 / 119
	2,000	106 / 107 / 121	106 / 107 / 121	107 / 107 / 120	108 / 109 / 120	110 / 110 / 119
	0	106 / 106 / 121	106 / 106 / 121	106 / 106 / 121	107 / 107 / 120	109 / 109 / 120

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

$V_1 / V_R / V_2$
TO2 / FLAPS 10

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
190,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
180,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
170,000	8,000					
	6,000					
	4,000					
	2,000	146 / 148 / 153	146 / 148 / 153	147 / 148 / 152	148 / 150 / 152	
	0	146 / 147 / 153	146 / 147 / 153	146 / 147 / 153	147 / 148 / 152	149 / 150 / 152
160,000	8,000					
	6,000	143 / 144 / 148	143 / 144 / 148	144 / 145 / 148		
	4,000	142 / 143 / 149	142 / 143 / 149	143 / 144 / 148	144 / 146 / 147	
	2,000	141 / 143 / 149	141 / 143 / 149	142 / 143 / 148	143 / 145 / 148	145 / 146 / 147
	0	141 / 142 / 149	141 / 142 / 149	141 / 142 / 149	142 / 143 / 148	144 / 145 / 148
150,000	8,000	139 / 140 / 143	139 / 140 / 143	140 / 142 / 142		
	6,000	138 / 139 / 143	138 / 139 / 143	139 / 140 / 143	140 / 142 / 142	142 / 143 / 143
	4,000	137 / 138 / 144	137 / 138 / 144	138 / 139 / 143	139 / 141 / 142	141 / 142 / 142
	2,000	136 / 138 / 144	136 / 138 / 144	137 / 138 / 143	138 / 140 / 143	140 / 141 / 142
	0	136 / 137 / 144	136 / 137 / 144	136 / 137 / 144	137 / 138 / 143	139 / 140 / 143
140,000	8,000	133 / 134 / 139	133 / 134 / 139	134 / 136 / 138	135 / 137 / 138	136 / 138 / 138
	6,000	132 / 133 / 139	132 / 133 / 139	133 / 134 / 139	134 / 136 / 138	136 / 137 / 138
	4,000	131 / 132 / 140	131 / 132 / 140	132 / 133 / 139	133 / 135 / 138	135 / 136 / 138
	2,000	130 / 132 / 140	130 / 132 / 140	131 / 132 / 139	132 / 134 / 139	134 / 135 / 138
	0	130 / 131 / 140	130 / 131 / 140	130 / 131 / 140	131 / 132 / 139	133 / 134 / 139

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

**V₁ / V_R / V₂
TO2 / FLAPS 10**

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
130,000	8,000	128 / 129 / 134	128 / 129 / 134	129 / 131 / 133	130 / 132 / 133	131 / 133 / 133
	6,000	127 / 128 / 134	127 / 128 / 134	128 / 129 / 134	129 / 131 / 133	131 / 132 / 133
	4,000	126 / 127 / 135	126 / 127 / 135	127 / 128 / 134	128 / 130 / 133	130 / 131 / 133
	2,000	125 / 127 / 135	125 / 127 / 135	126 / 127 / 134	127 / 129 / 134	129 / 130 / 133
	0	125 / 126 / 135	125 / 126 / 135	125 / 126 / 135	126 / 127 / 134	128 / 129 / 134
120,000	8,000	122 / 123 / 129	122 / 123 / 129	123 / 125 / 128	124 / 126 / 128	125 / 127 / 127
	6,000	121 / 122 / 129	121 / 122 / 129	122 / 123 / 129	123 / 125 / 128	125 / 126 / 128
	4,000	120 / 121 / 130	120 / 121 / 130	121 / 122 / 129	122 / 124 / 128	124 / 125 / 128
	2,000	119 / 121 / 130	119 / 121 / 130	120 / 121 / 129	121 / 123 / 129	123 / 124 / 128
	0	119 / 120 / 130	119 / 120 / 130	119 / 120 / 130	120 / 121 / 129	122 / 123 / 129
110,000	8,000	116 / 116 / 124	116 / 116 / 124	117 / 118 / 123	118 / 119 / 123	119 / 120 / 122
	6,000	115 / 115 / 124	115 / 115 / 124	116 / 116 / 124	117 / 118 / 123	119 / 119 / 123
	4,000	114 / 114 / 125	114 / 114 / 125	115 / 115 / 124	116 / 117 / 123	118 / 118 / 123
	2,000	113 / 114 / 125	113 / 114 / 125	114 / 114 / 124	115 / 116 / 124	117 / 117 / 123
	0	113 / 113 / 125	113 / 113 / 125	113 / 113 / 125	114 / 114 / 124	116 / 116 / 124
100,000	8,000	110 / 110 / 119	110 / 110 / 119	111 / 112 / 118	112 / 113 / 118	113 / 114 / 117
	6,000	109 / 109 / 119	109 / 109 / 119	110 / 110 / 119	111 / 112 / 118	113 / 113 / 118
	4,000	108 / 108 / 120	108 / 108 / 120	109 / 109 / 119	110 / 111 / 118	112 / 112 / 118
	2,000	107 / 108 / 120	107 / 108 / 120	108 / 108 / 119	109 / 110 / 119	111 / 111 / 118
	0	107 / 107 / 120	107 / 107 / 120	107 / 107 / 120	108 / 108 / 119	110 / 110 / 119
90,000	8,000	103 / 103 / 113	103 / 103 / 113	104 / 105 / 112	105 / 106 / 112	106 / 107 / 111
	6,000	102 / 102 / 113	102 / 102 / 113	103 / 103 / 113	104 / 105 / 112	106 / 106 / 112
	4,000	101 / 101 / 114	101 / 101 / 114	102 / 102 / 113	103 / 104 / 112	105 / 105 / 112
	2,000	100 / 101 / 114	100 / 101 / 114	101 / 101 / 113	102 / 103 / 113	104 / 104 / 112
	0	100 / 100 / 114	100 / 100 / 114	100 / 100 / 114	101 / 101 / 113	103 / 103 / 113

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

$V_1 / V_R / V_2$

TO2 / FLAPS 15

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
190,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
180,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
170,000	8,000					
	6,000					
	4,000					
	2,000	144 / 146 / 151	144 / 146 / 151	145 / 146 / 150	146 / 148 / 150	
	0	144 / 145 / 151	144 / 145 / 151	144 / 145 / 151	145 / 146 / 150	147 / 148 / 150
160,000	8,000					
	6,000	141 / 142 / 146	141 / 142 / 146	142 / 143 / 146		
	4,000	140 / 141 / 147	140 / 141 / 147	141 / 142 / 146	142 / 144 / 145	
	2,000	139 / 141 / 147	139 / 141 / 147	140 / 141 / 146	141 / 143 / 146	143 / 144 / 145
	0	139 / 140 / 147	139 / 140 / 147	139 / 140 / 147	140 / 141 / 146	142 / 143 / 146
150,000	8,000	137 / 138 / 142	137 / 138 / 142	138 / 140 / 141		
	6,000	136 / 137 / 142	136 / 137 / 142	137 / 138 / 142	138 / 140 / 141	140 / 141 / 141
	4,000	135 / 136 / 143	135 / 136 / 143	136 / 137 / 142	137 / 139 / 141	139 / 140 / 141
	2,000	134 / 136 / 143	134 / 136 / 143	135 / 136 / 142	136 / 138 / 142	138 / 139 / 141
	0	134 / 135 / 143	134 / 135 / 143	134 / 135 / 143	135 / 136 / 142	137 / 138 / 142
140,000	8,000	132 / 133 / 137	132 / 133 / 137	133 / 135 / 136	134 / 136 / 136	135 / 137 / 137
	6,000	131 / 132 / 137	131 / 132 / 137	132 / 133 / 137	133 / 135 / 136	135 / 136 / 136
	4,000	130 / 131 / 138	130 / 131 / 138	131 / 132 / 137	132 / 134 / 136	134 / 135 / 136
	2,000	129 / 131 / 138	129 / 131 / 138	130 / 131 / 137	131 / 133 / 137	133 / 134 / 136
	0	129 / 130 / 138	129 / 130 / 138	129 / 130 / 138	130 / 131 / 137	132 / 133 / 137

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

**V₁ / V_R / V₂
TO2 / FLAPS 15**

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
130,000	8,000	126 / 127 / 133	126 / 127 / 133	127 / 129 / 132	128 / 130 / 132	129 / 131 / 131
	6,000	125 / 126 / 133	125 / 126 / 133	126 / 127 / 133	127 / 129 / 132	129 / 130 / 132
	4,000	124 / 125 / 134	124 / 125 / 134	125 / 126 / 133	126 / 128 / 132	128 / 129 / 132
	2,000	123 / 125 / 134	123 / 125 / 134	124 / 125 / 133	125 / 127 / 133	127 / 128 / 132
	0	123 / 124 / 134	123 / 124 / 134	123 / 124 / 134	124 / 125 / 133	126 / 127 / 133
120,000	8,000	120 / 121 / 128	120 / 121 / 128	121 / 123 / 127	122 / 124 / 127	123 / 125 / 126
	6,000	119 / 120 / 128	119 / 120 / 128	120 / 121 / 128	121 / 123 / 127	123 / 124 / 127
	4,000	118 / 119 / 129	118 / 119 / 129	119 / 120 / 128	120 / 122 / 127	122 / 123 / 127
	2,000	117 / 119 / 129	117 / 119 / 129	118 / 119 / 128	119 / 121 / 128	121 / 122 / 127
	0	117 / 118 / 129	117 / 118 / 129	117 / 118 / 129	118 / 119 / 128	120 / 121 / 128
110,000	8,000	114 / 115 / 123	114 / 115 / 123	115 / 117 / 122	116 / 118 / 122	117 / 119 / 121
	6,000	113 / 114 / 123	113 / 114 / 123	114 / 115 / 123	115 / 117 / 122	117 / 118 / 122
	4,000	112 / 113 / 124	112 / 113 / 124	113 / 114 / 123	114 / 116 / 122	116 / 117 / 122
	2,000	111 / 113 / 124	111 / 113 / 124	112 / 113 / 123	113 / 115 / 123	115 / 116 / 122
	0	111 / 112 / 124	111 / 112 / 124	111 / 112 / 124	112 / 113 / 123	114 / 115 / 123
100,000	8,000	108 / 108 / 118	108 / 108 / 118	109 / 110 / 117	110 / 111 / 117	111 / 112 / 116
	6,000	107 / 107 / 118	107 / 107 / 118	108 / 108 / 118	109 / 110 / 117	111 / 111 / 117
	4,000	106 / 106 / 119	106 / 106 / 119	107 / 107 / 118	108 / 109 / 117	110 / 110 / 117
	2,000	105 / 106 / 119	105 / 106 / 119	106 / 106 / 118	107 / 108 / 118	109 / 109 / 117
	0	105 / 105 / 119	105 / 105 / 119	105 / 105 / 119	106 / 106 / 118	108 / 108 / 118
90,000	8,000	101 / 102 / 112	101 / 102 / 112	102 / 104 / 111	103 / 105 / 111	104 / 106 / 110
	6,000	100 / 101 / 112	100 / 101 / 112	101 / 102 / 112	102 / 104 / 111	104 / 105 / 111
	4,000	99 / 100 / 113	99 / 100 / 113	100 / 101 / 112	101 / 103 / 111	103 / 104 / 111
	2,000	98 / 100 / 113	98 / 100 / 113	99 / 100 / 112	100 / 102 / 112	102 / 103 / 111
	0	98 / 99 / 113	98 / 99 / 113	98 / 99 / 113	99 / 100 / 112	101 / 102 / 112

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

$V_1 / V_R / V_2$
TO2 / FLAPS 25

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
190,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
180,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
170,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
160,000	8,000					
	6,000	138 / 138 / 141	138 / 138 / 141	139 / 139 / 141		
	4,000	137 / 137 / 142	137 / 137 / 142	138 / 138 / 141	139 / 140 / 140	
	2,000	136 / 137 / 142	136 / 137 / 142	137 / 137 / 141	138 / 139 / 141	140 / 140 / 140
	0	136 / 136 / 142	136 / 136 / 142	136 / 136 / 142	137 / 137 / 141	139 / 139 / 141
150,000	8,000	134 / 134 / 138	134 / 134 / 138	135 / 136 / 137		
	6,000	133 / 133 / 138	133 / 133 / 138	134 / 134 / 138	135 / 136 / 137	137 / 137 / 137
	4,000	132 / 132 / 139	132 / 132 / 139	133 / 133 / 138	134 / 135 / 137	136 / 136 / 137
	2,000	131 / 132 / 139	131 / 132 / 139	132 / 132 / 138	133 / 134 / 138	135 / 135 / 137
	0	131 / 131 / 139	131 / 131 / 139	131 / 131 / 139	132 / 132 / 138	134 / 134 / 138
140,000	8,000	129 / 129 / 133	129 / 129 / 133	130 / 131 / 132	131 / 132 / 132	132 / 133 / 133
	6,000	128 / 128 / 133	128 / 128 / 133	129 / 129 / 133	130 / 131 / 132	132 / 132 / 132
	4,000	127 / 127 / 134	127 / 127 / 134	128 / 128 / 133	129 / 130 / 132	131 / 131 / 132
	2,000	126 / 127 / 134	126 / 127 / 134	127 / 127 / 133	128 / 129 / 133	130 / 130 / 132
	0	126 / 126 / 134	126 / 126 / 134	126 / 126 / 134	127 / 127 / 133	129 / 129 / 133

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

**V₁ / V_R / V₂
TO2 / FLAPS 25**

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
130,000	8,000	124 / 124 / 129	124 / 124 / 129	125 / 126 / 128	126 / 127 / 128	127 / 128 / 128
	6,000	123 / 123 / 129	123 / 123 / 129	124 / 124 / 129	125 / 126 / 128	127 / 127 / 128
	4,000	122 / 122 / 130	122 / 122 / 130	123 / 123 / 129	124 / 125 / 128	126 / 126 / 128
	2,000	121 / 122 / 130	121 / 122 / 130	122 / 122 / 129	123 / 124 / 129	125 / 125 / 128
	0	121 / 121 / 130	121 / 121 / 130	121 / 121 / 130	122 / 122 / 129	124 / 124 / 129
120,000	8,000	118 / 118 / 124	118 / 118 / 124	119 / 120 / 123	120 / 121 / 123	121 / 122 / 122
	6,000	117 / 117 / 124	117 / 117 / 124	118 / 118 / 124	119 / 120 / 123	121 / 121 / 123
	4,000	116 / 116 / 125	116 / 116 / 125	117 / 117 / 124	118 / 119 / 123	120 / 120 / 123
	2,000	115 / 116 / 125	115 / 116 / 125	116 / 116 / 124	117 / 118 / 124	119 / 119 / 123
	0	115 / 115 / 125	115 / 115 / 125	115 / 115 / 125	116 / 116 / 124	118 / 118 / 124
110,000	8,000	112 / 112 / 119	112 / 112 / 119	113 / 114 / 118	114 / 115 / 118	115 / 116 / 117
	6,000	111 / 111 / 119	111 / 111 / 119	112 / 112 / 119	113 / 114 / 118	115 / 115 / 118
	4,000	110 / 110 / 120	110 / 110 / 120	111 / 111 / 119	112 / 113 / 118	114 / 114 / 118
	2,000	109 / 110 / 120	109 / 110 / 120	110 / 110 / 119	111 / 112 / 119	113 / 113 / 118
	0	109 / 109 / 120	109 / 109 / 120	109 / 109 / 120	110 / 110 / 119	112 / 112 / 119
100,000	8,000	105 / 106 / 114	105 / 106 / 114	106 / 108 / 113	107 / 109 / 113	108 / 110 / 112
	6,000	104 / 105 / 114	104 / 105 / 114	105 / 106 / 114	106 / 108 / 113	108 / 109 / 113
	4,000	103 / 104 / 115	103 / 104 / 115	104 / 105 / 114	105 / 107 / 113	107 / 108 / 113
	2,000	102 / 104 / 115	102 / 104 / 115	103 / 104 / 114	104 / 106 / 114	106 / 107 / 113
	0	102 / 103 / 115	102 / 103 / 115	102 / 103 / 115	103 / 104 / 114	105 / 106 / 114
90,000	8,000	98 / 99 / 109	98 / 99 / 109	99 / 101 / 108	100 / 102 / 108	101 / 103 / 107
	6,000	97 / 98 / 109	97 / 98 / 109	98 / 99 / 109	99 / 101 / 108	101 / 102 / 108
	4,000	96 / 97 / 110	96 / 97 / 110	97 / 98 / 109	98 / 100 / 108	100 / 101 / 108
	2,000	95 / 97 / 110	95 / 97 / 110	96 / 97 / 109	97 / 99 / 109	99 / 100 / 108
	0	97* / 97 / 111	97* / 97 / 111	97* / 97 / 111	96 / 97 / 109	98 / 99 / 109

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

NOTE: Speeds denoted by an asterisk (*) are VMCG limited. DO NOT APPLY NEGATIVE CORRECTIONS.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

V₁ / V_R / V₂
TO1 / FLAPS 1

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
190,000	8,000					
	6,000					
	4,000					
	2,000					
	0	161 / 172 / 178				
180,000	8,000					
	6,000					
	4,000					
	2,000	161 / 168 / 173				
	0	164 / 167 / 173	163 / 167 / 173	160 / 167 / 173		
170,000	8,000					
	6,000					
	4,000	160 / 164 / 168				
	2,000	160 / 163 / 169	160 / 163 / 169	160 / 163 / 168		
	0	159 / 162 / 169	159 / 162 / 169	159 / 162 / 169	160 / 163 / 168	162 / 165 / 168
160,000	8,000					
	6,000					
	4,000	156 / 158 / 164	156 / 158 / 164			
	2,000	155 / 157 / 165	155 / 157 / 165	155 / 157 / 164	156 / 158 / 164	158 / 160 / 163
	0	154 / 156 / 165	154 / 156 / 165	154 / 156 / 165	155 / 157 / 164	157 / 159 / 164
150,000	8,000					
	6,000	152 / 153 / 159	152 / 153 / 159			
	4,000	151 / 152 / 159	151 / 152 / 159	151 / 152 / 159	152 / 153 / 159	154 / 155 / 158
	2,000	150 / 151 / 160	150 / 151 / 160	150 / 151 / 159	151 / 152 / 159	153 / 154 / 158
	0	149 / 150 / 160	149 / 150 / 160	149 / 150 / 160	150 / 151 / 159	152 / 153 / 159
140,000	8,000	147 / 149 / 153	147 / 149 / 153			
	6,000	146 / 148 / 154	146 / 148 / 154	146 / 149 / 154	147 / 149 / 153	149 / 151 / 153
	4,000	145 / 147 / 154	145 / 147 / 154	145 / 147 / 154	146 / 148 / 154	148 / 150 / 153
	2,000	144 / 146 / 155	144 / 146 / 155	144 / 146 / 154	145 / 147 / 154	147 / 149 / 153
	0	143 / 145 / 155	143 / 145 / 155	143 / 145 / 155	144 / 146 / 154	146 / 148 / 154

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

**V₁ / V_R / V₂
TO1 / FLAPS 1**

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
130,000	8,000	141 / 142 / 148	141 / 142 / 148	142 / 143 / 148	142 / 144 / 148	144 / 145 / 147
	6,000	140 / 141 / 149	140 / 141 / 149	140 / 142 / 149	141 / 142 / 148	143 / 144 / 148
	4,000	139 / 140 / 149	139 / 140 / 149	139 / 140 / 149	140 / 141 / 149	142 / 143 / 148
	2,000	138 / 139 / 150	138 / 139 / 150	138 / 139 / 149	139 / 140 / 149	141 / 142 / 148
	0	137 / 138 / 150	137 / 138 / 150	137 / 138 / 150	138 / 139 / 149	140 / 141 / 149
120,000	8,000	135 / 135 / 143	135 / 135 / 143	136 / 136 / 143	136 / 137 / 143	138 / 138 / 142
	6,000	134 / 134 / 144	134 / 134 / 144	134 / 135 / 144	135 / 135 / 143	137 / 137 / 143
	4,000	133 / 133 / 144	133 / 133 / 144	133 / 133 / 144	134 / 134 / 144	136 / 136 / 143
	2,000	132 / 132 / 145	132 / 132 / 145	132 / 132 / 144	133 / 133 / 144	135 / 135 / 143
	0	131 / 131 / 145	131 / 131 / 145	131 / 131 / 145	132 / 132 / 144	134 / 134 / 144
110,000	8,000	128 / 128 / 137	128 / 128 / 137	129 / 129 / 137	129 / 130 / 137	131 / 131 / 136
	6,000	127 / 127 / 138	127 / 127 / 138	127 / 128 / 138	128 / 128 / 137	130 / 130 / 137
	4,000	126 / 126 / 138	126 / 126 / 138	126 / 126 / 138	127 / 127 / 138	129 / 129 / 137
	2,000	125 / 125 / 139	125 / 125 / 139	125 / 125 / 138	126 / 126 / 138	128 / 128 / 137
	0	124 / 124 / 139	124 / 124 / 139	124 / 124 / 139	125 / 125 / 138	127 / 127 / 138
100,000	8,000	121 / 121 / 131	121 / 121 / 131	122 / 122 / 131	122 / 123 / 131	124 / 124 / 130
	6,000	120 / 120 / 132	120 / 120 / 132	120 / 121 / 132	121 / 121 / 131	123 / 123 / 131
	4,000	119 / 119 / 132	119 / 119 / 132	119 / 119 / 132	120 / 120 / 132	122 / 122 / 131
	2,000	118 / 118 / 133	118 / 118 / 133	118 / 118 / 132	119 / 119 / 132	121 / 121 / 131
	0	117 / 117 / 133	117 / 117 / 133	117 / 117 / 133	118 / 118 / 132	120 / 120 / 132
90,000	8,000	113 / 113 / 125	113 / 113 / 125	114 / 114 / 125	114 / 115 / 125	116 / 116 / 124
	6,000	112 / 112 / 126	112 / 112 / 126	112 / 113 / 126	113 / 113 / 125	115 / 115 / 125
	4,000	111 / 111 / 126	111 / 111 / 126	111 / 111 / 126	112 / 112 / 126	114 / 114 / 125
	2,000	110 / 110 / 127	110 / 110 / 127	110 / 110 / 126	111 / 111 / 126	113 / 113 / 125
	0	109 / 109 / 127	109 / 109 / 127	109 / 109 / 127	110 / 110 / 126	112 / 112 / 126

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

$V_1 / V_R / V_2$

TO1 / FLAPS 5

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
190,000	8,000					
	6,000					
	4,000					
	2,000					
	0	161 / 164 / 170				
180,000	8,000					
	6,000					
	4,000					
	2,000	158 / 160 / 166				
	0	157 / 159 / 166	157 / 159 / 166	157 / 159 / 166		
170,000	8,000					
	6,000					
	4,000	154 / 156 / 161				
	2,000	153 / 155 / 162	153 / 155 / 162	153 / 155 / 161		
	0	152 / 154 / 162	152 / 154 / 162	152 / 154 / 162	153 / 155 / 161	155 / 157 / 161
160,000	8,000					
	6,000					
	4,000	149 / 151 / 157	149 / 151 / 157			
	2,000	148 / 150 / 158	148 / 150 / 158	148 / 150 / 157	149 / 151 / 157	151 / 153 / 156
	0	147 / 149 / 158	147 / 149 / 158	147 / 149 / 158	148 / 150 / 157	150 / 152 / 157
150,000	8,000					
	6,000	145 / 146 / 152	145 / 146 / 152			
	4,000	144 / 145 / 152	144 / 145 / 152	144 / 145 / 152	145 / 146 / 152	147 / 148 / 151
	2,000	143 / 144 / 153	143 / 144 / 153	143 / 144 / 152	144 / 145 / 152	146 / 147 / 151
	0	142 / 143 / 153	142 / 143 / 153	142 / 143 / 153	143 / 144 / 152	145 / 146 / 152
140,000	8,000	140 / 142 / 147	140 / 142 / 147			
	6,000	139 / 141 / 148	139 / 141 / 148	139 / 142 / 148	140 / 142 / 147	142 / 144 / 147
	4,000	138 / 140 / 148	138 / 140 / 148	138 / 140 / 148	139 / 141 / 148	141 / 143 / 147
	2,000	137 / 139 / 149	137 / 139 / 149	137 / 139 / 148	138 / 140 / 148	140 / 142 / 147
	0	136 / 138 / 149	136 / 138 / 149	136 / 138 / 149	137 / 139 / 148	139 / 141 / 148

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

V₁ / V_R / V₂
TO1 / FLAPS 5

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
130,000	8,000	134 / 135 / 142	134 / 135 / 142	135 / 136 / 142	135 / 137 / 142	137 / 138 / 141
	6,000	133 / 134 / 143	133 / 134 / 143	133 / 135 / 143	134 / 135 / 142	136 / 137 / 142
	4,000	132 / 133 / 143	132 / 133 / 143	132 / 133 / 143	133 / 134 / 143	135 / 136 / 142
	2,000	131 / 132 / 144	131 / 132 / 144	131 / 132 / 143	132 / 133 / 143	134 / 135 / 142
	0	130 / 131 / 144	130 / 131 / 144	130 / 131 / 144	131 / 132 / 143	133 / 134 / 143
120,000	8,000	128 / 129 / 137	128 / 129 / 137	129 / 130 / 137	129 / 131 / 137	131 / 132 / 136
	6,000	127 / 128 / 138	127 / 128 / 138	127 / 129 / 138	128 / 129 / 137	130 / 131 / 137
	4,000	126 / 127 / 138	126 / 127 / 138	126 / 127 / 138	127 / 128 / 138	129 / 130 / 137
	2,000	125 / 126 / 139	125 / 126 / 139	125 / 126 / 138	126 / 127 / 138	128 / 129 / 137
	0	124 / 125 / 139	124 / 125 / 139	124 / 125 / 139	125 / 126 / 138	127 / 128 / 138
110,000	8,000	122 / 122 / 131	122 / 122 / 131	123 / 123 / 131	123 / 124 / 131	125 / 125 / 130
	6,000	121 / 121 / 132	121 / 121 / 132	121 / 122 / 132	122 / 122 / 131	124 / 124 / 131
	4,000	120 / 120 / 132	120 / 120 / 132	120 / 120 / 132	121 / 121 / 132	123 / 123 / 131
	2,000	119 / 119 / 133	119 / 119 / 133	119 / 119 / 132	120 / 120 / 132	122 / 122 / 131
	0	118 / 118 / 133	118 / 118 / 133	118 / 118 / 133	119 / 119 / 132	121 / 121 / 132
100,000	8,000	115 / 115 / 126	115 / 115 / 126	116 / 116 / 126	116 / 117 / 126	118 / 118 / 125
	6,000	114 / 114 / 127	114 / 114 / 127	114 / 115 / 127	115 / 115 / 126	117 / 117 / 126
	4,000	113 / 113 / 127	113 / 113 / 127	113 / 113 / 127	114 / 114 / 127	116 / 116 / 126
	2,000	112 / 112 / 128	112 / 112 / 128	112 / 112 / 127	113 / 113 / 127	115 / 115 / 126
	0	111 / 111 / 128	111 / 111 / 128	111 / 111 / 128	112 / 112 / 127	114 / 114 / 127
90,000	8,000	108 / 108 / 120	108 / 108 / 120	109 / 109 / 120	109 / 110 / 120	111 / 111 / 119
	6,000	107 / 107 / 121	107 / 107 / 121	107 / 108 / 121	108 / 108 / 120	110 / 110 / 120
	4,000	106 / 106 / 121	106 / 106 / 121	106 / 106 / 121	107 / 107 / 121	109 / 109 / 120
	2,000	105 / 105 / 122	105 / 105 / 122	105 / 105 / 121	106 / 106 / 121	108 / 108 / 120
	0	104 / 104 / 122	104 / 104 / 122	104 / 104 / 122	105 / 105 / 121	107 / 107 / 121

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

V₁ / V_R / V₂
TO1 / FLAPS 10

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
190,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
180,000	8,000					
	6,000					
	4,000					
	2,000	149 / 151 / 157	148 / 150 / 157	148 / 150 / 157		
	0	148 / 150 / 157	148 / 150 / 157	148 / 150 / 157		
170,000	8,000					
	6,000					
	4,000	146 / 148 / 152				
	2,000	145 / 147 / 153	145 / 147 / 153	145 / 147 / 152		
	0	144 / 146 / 153	144 / 146 / 153	144 / 146 / 153	145 / 147 / 152	147 / 149 / 152
160,000	8,000					
	6,000					
	4,000	141 / 143 / 148	141 / 143 / 148			
	2,000	140 / 142 / 149	140 / 142 / 149	140 / 142 / 148	141 / 143 / 148	143 / 145 / 147
	0	139 / 141 / 149	139 / 141 / 149	139 / 141 / 149	140 / 142 / 148	142 / 144 / 148
150,000	8,000					
	6,000	137 / 138 / 144	137 / 138 / 144			
	4,000	136 / 137 / 144	136 / 137 / 144	136 / 137 / 144	137 / 138 / 144	139 / 140 / 143
	2,000	135 / 136 / 145	135 / 136 / 145	135 / 136 / 144	136 / 137 / 144	138 / 139 / 143
	0	134 / 135 / 145	134 / 135 / 145	134 / 135 / 145	135 / 136 / 144	137 / 138 / 144
140,000	8,000	133 / 134 / 139	133 / 134 / 139			
	6,000	132 / 133 / 140	132 / 133 / 140	132 / 134 / 140	133 / 134 / 139	135 / 136 / 139
	4,000	131 / 132 / 140	131 / 132 / 140	131 / 132 / 140	132 / 133 / 140	134 / 135 / 139
	2,000	130 / 131 / 141	130 / 131 / 141	130 / 131 / 140	131 / 132 / 140	133 / 134 / 139
	0	129 / 130 / 141	129 / 130 / 141	129 / 130 / 141	130 / 131 / 140	132 / 133 / 140

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

**V₁ / V_R / V₂
TO1 / FLAPS 10**

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
130,000	8,000	127 / 128 / 134	127 / 128 / 134	128 / 129 / 134	128 / 130 / 134	130 / 131 / 133
	6,000	126 / 127 / 135	126 / 127 / 135	126 / 128 / 135	127 / 128 / 134	129 / 130 / 134
	4,000	125 / 126 / 135	125 / 126 / 135	125 / 126 / 135	126 / 127 / 135	128 / 129 / 134
	2,000	124 / 125 / 136	124 / 125 / 136	124 / 125 / 135	125 / 126 / 135	127 / 128 / 134
	0	123 / 124 / 136	123 / 124 / 136	123 / 124 / 136	124 / 125 / 135	126 / 127 / 135
120,000	8,000	121 / 122 / 129	121 / 122 / 129	122 / 123 / 129	122 / 124 / 129	124 / 125 / 128
	6,000	120 / 121 / 130	120 / 121 / 130	120 / 122 / 130	121 / 122 / 129	123 / 124 / 129
	4,000	119 / 120 / 130	119 / 120 / 130	119 / 120 / 130	120 / 121 / 130	122 / 123 / 129
	2,000	118 / 119 / 131	118 / 119 / 131	118 / 119 / 130	119 / 120 / 130	121 / 122 / 129
	0	117 / 118 / 131	117 / 118 / 131	117 / 118 / 131	118 / 119 / 130	120 / 121 / 130
110,000	8,000	115 / 116 / 124	115 / 116 / 124	116 / 117 / 124	116 / 118 / 124	118 / 119 / 123
	6,000	114 / 115 / 125	114 / 115 / 125	114 / 116 / 125	115 / 116 / 124	117 / 118 / 124
	4,000	113 / 114 / 125	113 / 114 / 125	113 / 114 / 125	114 / 115 / 125	116 / 117 / 124
	2,000	112 / 113 / 126	112 / 113 / 126	112 / 113 / 125	113 / 114 / 125	115 / 116 / 124
	0	111 / 112 / 126	111 / 112 / 126	111 / 112 / 126	112 / 113 / 125	114 / 115 / 125
100,000	8,000	109 / 109 / 119	109 / 109 / 119	110 / 110 / 119	110 / 111 / 119	112 / 112 / 118
	6,000	108 / 108 / 120	108 / 108 / 120	108 / 109 / 120	109 / 109 / 119	111 / 111 / 119
	4,000	107 / 107 / 120	107 / 107 / 120	107 / 107 / 120	108 / 108 / 120	110 / 110 / 119
	2,000	106 / 106 / 121	106 / 106 / 121	106 / 106 / 120	107 / 107 / 120	109 / 109 / 119
	0	105 / 105 / 121	105 / 105 / 121	105 / 105 / 121	106 / 106 / 120	108 / 108 / 120
90,000	8,000	103 / 103 / 113	103 / 103 / 113	104 / 104 / 113	104 / 105 / 113	106 / 106 / 112
	6,000	102 / 102 / 114	102 / 102 / 114	102 / 103 / 114	103 / 103 / 113	105 / 105 / 113
	4,000	101 / 101 / 114	101 / 101 / 114	101 / 101 / 114	102 / 102 / 114	104 / 104 / 113
	2,000	100 / 100 / 115	100 / 100 / 115	100 / 100 / 114	101 / 101 / 114	103 / 103 / 113
	0	102* / 102 / 118	102* / 102 / 118	101* / 101 / 117	100 / 100 / 114	102 / 102 / 114

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

NOTE: Speeds denoted by an asterisk (*) are VMCG limited. DO NOT APPLY NEGATIVE CORRECTIONS.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

$V_1 / V_R / V_2$

TO1 / FLAPS 15

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
190,000	8,000					
	6,000					
180,000	4,000					
	2,000	147 / 149 / 155				
170,000	0	146 / 148 / 155	146 / 148 / 155	146 / 148 / 155		
	8,000					
160,000	6,000					
	4,000	144 / 146 / 150				
150,000	2,000	143 / 145 / 151	143 / 145 / 151	143 / 145 / 150		
	0	142 / 144 / 151	142 / 144 / 151	142 / 144 / 151	143 / 145 / 150	145 / 147 / 150
140,000	8,000					
	6,000					
130,000	4,000	139 / 141 / 146	139 / 141 / 146			
	2,000	138 / 140 / 147	138 / 140 / 147	138 / 140 / 146	139 / 141 / 146	141 / 143 / 145
120,000	0	137 / 139 / 147	137 / 139 / 147	137 / 139 / 147	138 / 140 / 146	140 / 142 / 146
	8,000					
110,000	6,000	135 / 137 / 142	135 / 137 / 142			
	4,000	134 / 136 / 142	134 / 136 / 142	134 / 136 / 142	135 / 137 / 142	137 / 139 / 141
100,000	2,000	133 / 135 / 143	133 / 135 / 143	133 / 135 / 142	134 / 136 / 142	136 / 138 / 141
	0	132 / 134 / 143	132 / 134 / 143	132 / 134 / 143	133 / 135 / 142	135 / 137 / 142
90,000	8,000	131 / 132 / 137	131 / 132 / 137			
	6,000	130 / 131 / 138	130 / 131 / 138	130 / 132 / 138	131 / 132 / 137	133 / 134 / 137
80,000	4,000	129 / 130 / 138	129 / 130 / 138	129 / 130 / 138	130 / 131 / 138	132 / 133 / 137
	2,000	128 / 129 / 139	128 / 129 / 139	128 / 129 / 138	129 / 130 / 138	131 / 132 / 137
70,000	0	127 / 128 / 139	127 / 128 / 139	127 / 128 / 139	128 / 129 / 138	130 / 131 / 138

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

**V₁ / V_R / V₂
TO1 / FLAPS 15**

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
130,000	8,000	125 / 127 / 132	125 / 127 / 132	126 / 128 / 132	126 / 129 / 132	128 / 130 / 131
	6,000	124 / 126 / 133	124 / 126 / 133	124 / 127 / 133	125 / 127 / 132	127 / 129 / 132
	4,000	123 / 125 / 133	123 / 125 / 133	123 / 125 / 133	124 / 126 / 133	126 / 128 / 132
	2,000	122 / 124 / 134	122 / 124 / 134	122 / 124 / 133	123 / 125 / 133	125 / 127 / 132
	0	121 / 123 / 134	121 / 123 / 134	121 / 123 / 134	122 / 124 / 133	124 / 126 / 133
120,000	8,000	120 / 121 / 127	120 / 121 / 127	121 / 122 / 127	121 / 123 / 127	123 / 124 / 126
	6,000	119 / 120 / 128	119 / 120 / 128	119 / 121 / 128	120 / 121 / 127	122 / 123 / 127
	4,000	118 / 119 / 128	118 / 119 / 128	118 / 119 / 128	119 / 120 / 128	121 / 122 / 127
	2,000	117 / 118 / 129	117 / 118 / 129	117 / 118 / 128	118 / 119 / 128	120 / 121 / 127
	0	116 / 117 / 129	116 / 117 / 129	116 / 117 / 129	117 / 118 / 128	119 / 120 / 128
110,000	8,000	114 / 114 / 122	114 / 114 / 122	115 / 115 / 122	115 / 116 / 122	117 / 117 / 121
	6,000	113 / 113 / 123	113 / 113 / 123	113 / 114 / 123	114 / 114 / 122	116 / 116 / 122
	4,000	112 / 112 / 123	112 / 112 / 123	112 / 112 / 123	113 / 113 / 123	115 / 115 / 122
	2,000	111 / 111 / 124	111 / 111 / 124	111 / 111 / 123	112 / 112 / 123	114 / 114 / 122
	0	110 / 110 / 124	110 / 110 / 124	110 / 110 / 124	111 / 111 / 123	113 / 113 / 123
100,000	8,000	108 / 108 / 117	108 / 108 / 117	109 / 109 / 117	109 / 110 / 117	111 / 111 / 116
	6,000	107 / 107 / 118	107 / 107 / 118	107 / 108 / 118	108 / 108 / 117	110 / 110 / 117
	4,000	106 / 106 / 118	106 / 106 / 118	106 / 106 / 118	107 / 107 / 118	109 / 109 / 117
	2,000	105 / 105 / 119	105 / 105 / 119	105 / 105 / 118	106 / 106 / 118	108 / 108 / 117
	0	104 / 104 / 119	104 / 104 / 119	104 / 104 / 119	105 / 105 / 118	107 / 107 / 118
90,000	8,000	101 / 101 / 112	101 / 101 / 112	102 / 102 / 112	102 / 103 / 112	104 / 104 / 111
	6,000	100 / 100 / 113	100 / 100 / 113	100 / 101 / 113	101 / 101 / 112	103 / 103 / 112
	4,000	99 / 99 / 113	99 / 99 / 113	99 / 99 / 113	100 / 100 / 113	102 / 102 / 112
	2,000	99* / 99 / 115	99* / 99 / 115	98 / 98 / 113	99 / 99 / 113	101 / 101 / 112
	0	102* / 102 / 119	102* / 102 / 119	101* / 101 / 118	98 / 98 / 113	100 / 100 / 113

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

NOTE: Speeds denoted by an asterisk (*) are VMCG limited. DO NOT APPLY NEGATIVE CORRECTIONS.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

$V_1 / V_R / V_2$
TO1 / FLAPS 25

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
190,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
180,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
170,000	8,000					
	6,000					
	4,000	141 / 142 / 146				
	2,000	140 / 141 / 147	140 / 141 / 147	140 / 141 / 146		
	0	139 / 140 / 147	139 / 140 / 147	139 / 140 / 147	140 / 141 / 146	142 / 143 / 146
160,000	8,000					
	6,000					
	4,000	136 / 137 / 142	136 / 137 / 142			
	2,000	135 / 136 / 143	135 / 136 / 143	135 / 136 / 142	136 / 137 / 142	138 / 139 / 141
	0	134 / 135 / 143	134 / 135 / 143	134 / 135 / 143	135 / 136 / 142	137 / 138 / 142
150,000	8,000					
	6,000	132 / 133 / 138	132 / 133 / 138			
	4,000	131 / 132 / 138	131 / 132 / 138	131 / 132 / 138	132 / 133 / 138	134 / 135 / 137
	2,000	130 / 131 / 139	130 / 131 / 139	130 / 131 / 138	131 / 132 / 138	133 / 134 / 137
	0	129 / 130 / 139	129 / 130 / 139	129 / 130 / 139	130 / 131 / 138	132 / 133 / 138
140,000	8,000	128 / 129 / 133	128 / 129 / 133			
	6,000	127 / 128 / 134	127 / 128 / 134	127 / 129 / 134	128 / 129 / 133	130 / 131 / 133
	4,000	126 / 127 / 134	126 / 127 / 134	126 / 127 / 134	127 / 128 / 134	129 / 130 / 133
	2,000	125 / 126 / 135	125 / 126 / 135	125 / 126 / 134	126 / 127 / 134	128 / 129 / 133
	0	124 / 125 / 135	124 / 125 / 135	124 / 125 / 135	125 / 126 / 134	127 / 128 / 134

 Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

**V₁ / V_R / V₂
TO1 / FLAPS 25**

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
130,000	8,000	123 / 123 / 129	123 / 123 / 129	124 / 124 / 129	124 / 125 / 129	126 / 126 / 128
	6,000	122 / 122 / 130	122 / 122 / 130	122 / 123 / 130	123 / 123 / 129	125 / 125 / 129
	4,000	121 / 121 / 130	121 / 121 / 130	121 / 121 / 130	122 / 122 / 130	124 / 124 / 129
	2,000	120 / 120 / 131	120 / 120 / 131	120 / 120 / 130	121 / 121 / 130	123 / 123 / 129
	0	119 / 119 / 131	119 / 119 / 131	119 / 119 / 131	120 / 120 / 130	122 / 122 / 130
120,000	8,000	117 / 117 / 124	117 / 117 / 124	118 / 118 / 124	118 / 119 / 124	120 / 120 / 123
	6,000	116 / 116 / 125	116 / 116 / 125	116 / 117 / 125	117 / 117 / 124	119 / 119 / 124
	4,000	115 / 115 / 125	115 / 115 / 125	115 / 115 / 125	116 / 116 / 125	118 / 118 / 124
	2,000	114 / 114 / 126	114 / 114 / 126	114 / 114 / 125	115 / 115 / 125	117 / 117 / 124
	0	113 / 113 / 126	113 / 113 / 126	113 / 113 / 126	114 / 114 / 125	116 / 116 / 125
110,000	8,000	111 / 111 / 119	111 / 111 / 119	112 / 112 / 119	112 / 113 / 119	114 / 114 / 118
	6,000	110 / 110 / 120	110 / 110 / 120	110 / 111 / 120	111 / 111 / 119	113 / 113 / 119
	4,000	109 / 109 / 120	109 / 109 / 120	109 / 109 / 120	110 / 110 / 120	112 / 112 / 119
	2,000	108 / 108 / 121	108 / 108 / 121	108 / 108 / 120	109 / 109 / 120	111 / 111 / 119
	0	107 / 107 / 121	107 / 107 / 121	107 / 107 / 121	108 / 108 / 120	110 / 110 / 120
100,000	8,000	105 / 105 / 114	105 / 105 / 114	106 / 106 / 114	106 / 107 / 114	108 / 108 / 113
	6,000	104 / 104 / 115	104 / 104 / 115	104 / 105 / 115	105 / 105 / 114	107 / 107 / 114
	4,000	103 / 103 / 115	103 / 103 / 115	103 / 103 / 115	104 / 104 / 115	106 / 106 / 114
	2,000	102 / 102 / 116	102 / 102 / 116	102 / 102 / 115	103 / 103 / 115	105 / 105 / 114
	0	102* / 102 / 117	102* / 102 / 117	101 / 101 / 116	102 / 102 / 115	104 / 104 / 115
90,000	8,000	98 / 98 / 109	98 / 98 / 109	99 / 99 / 109	99 / 100 / 109	101 / 101 / 108
	6,000	97 / 97 / 110	97 / 97 / 110	97 / 98 / 110	98 / 98 / 109	100 / 100 / 109
	4,000	96 / 96 / 110	96 / 96 / 110	96 / 96 / 110	97 / 97 / 110	99 / 99 / 109
	2,000	99* / 99 / 115	99* / 99 / 115	98* / 98 / 113	96 / 96 / 110	98 / 98 / 109
	0	102* / 102 / 119	102* / 102 / 119	101* / 101 / 118	97* / 97 / 112	97 / 97 / 110

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

NOTE: Speeds denoted by an asterisk (*) are VMCG limited. DO NOT APPLY NEGATIVE CORRECTIONS.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

V₁ / V_R / V₂
TO / FLAPS 1

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
190,000	8,000	140 / 176 / 176				
	6,000	146 / 175 / 176	143 / 175 / 176	141 / 175 / 176		
	4,000	151 / 174 / 177	148 / 174 / 177	145 / 174 / 176	143 / 175 / 176	142 / 176 / 176
	2,000	156 / 172 / 177	153 / 172 / 177	151 / 173 / 177	149 / 174 / 176	147 / 175 / 176
	0	162 / 171 / 178	158 / 171 / 178	156 / 172 / 177	153 / 173 / 177	152 / 174 / 176
180,000	8,000	143 / 171 / 172	141 / 171 / 172			
	6,000	149 / 170 / 172	147 / 170 / 172	144 / 170 / 172	142 / 171 / 172	141 / 172 / 172
	4,000	155 / 169 / 173	152 / 169 / 173	149 / 169 / 172	148 / 170 / 172	146 / 171 / 171
	2,000	160 / 167 / 173	157 / 167 / 173	155 / 168 / 173	153 / 169 / 172	152 / 170 / 172
	0	162 / 166 / 174	162 / 166 / 174	160 / 167 / 173	158 / 168 / 173	157 / 169 / 172
170,000	8,000	148 / 165 / 168	145 / 165 / 168	143 / 166 / 167	141 / 166 / 167	
	6,000	153 / 164 / 168	151 / 164 / 168	148 / 164 / 168	146 / 165 / 168	145 / 166 / 167
	4,000	159 / 163 / 169	157 / 163 / 169	153 / 163 / 168	152 / 164 / 168	150 / 165 / 167
	2,000	158 / 161 / 169	158 / 161 / 169	159 / 162 / 169	157 / 163 / 168	156 / 164 / 168
	0	157 / 160 / 170	157 / 160 / 170	158 / 161 / 169	159 / 162 / 169	160 / 163 / 168
160,000	8,000	153 / 160 / 163	150 / 160 / 163	148 / 161 / 162	146 / 161 / 162	144 / 162 / 162
	6,000	155 / 159 / 163	155 / 159 / 163	153 / 159 / 163	151 / 160 / 163	149 / 161 / 162
	4,000	154 / 158 / 164	154 / 158 / 164	155 / 158 / 163	156 / 159 / 163	155 / 160 / 162
	2,000	153 / 156 / 164	153 / 156 / 164	154 / 157 / 164	155 / 158 / 163	156 / 159 / 163
	0	152 / 155 / 165	152 / 155 / 165	153 / 156 / 164	154 / 157 / 164	155 / 158 / 163
150,000	8,000	152 / 154 / 159	152 / 154 / 159	152 / 155 / 158	151 / 155 / 158	149 / 156 / 157
	6,000	150 / 153 / 159	150 / 153 / 159	151 / 153 / 159	152 / 154 / 159	153 / 155 / 158
	4,000	149 / 152 / 160	149 / 152 / 160	150 / 152 / 159	151 / 153 / 159	152 / 154 / 158
	2,000	148 / 150 / 160	148 / 150 / 160	149 / 151 / 160	150 / 152 / 159	151 / 153 / 159
	0	147 / 149 / 161	147 / 149 / 161	148 / 150 / 160	149 / 151 / 160	150 / 152 / 159
140,000	8,000	147 / 148 / 154	147 / 148 / 154	147 / 149 / 153	148 / 149 / 153	149 / 150 / 152
	6,000	145 / 147 / 154	145 / 147 / 154	146 / 147 / 154	147 / 148 / 154	148 / 149 / 153
	4,000	144 / 146 / 155	144 / 146 / 155	145 / 146 / 154	146 / 147 / 154	147 / 148 / 153
	2,000	143 / 144 / 155	143 / 144 / 155	144 / 145 / 155	145 / 146 / 154	146 / 147 / 154
	0	142 / 143 / 156	142 / 143 / 156	143 / 144 / 155	144 / 145 / 155	145 / 146 / 154

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

**V₁ / V_R / V₂
TO / FLAPS 1**

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
130,000	8,000	141 / 142 / 149	141 / 142 / 149	141 / 143 / 148	142 / 143 / 148	143 / 144 / 147
	6,000	139 / 141 / 149	139 / 141 / 149	140 / 141 / 149	141 / 142 / 149	142 / 143 / 148
	4,000	138 / 140 / 150	138 / 140 / 150	139 / 140 / 149	140 / 141 / 149	141 / 142 / 148
	2,000	137 / 138 / 150	137 / 138 / 150	138 / 139 / 150	139 / 140 / 149	140 / 141 / 149
	0	136 / 137 / 151	136 / 137 / 151	137 / 138 / 150	138 / 139 / 150	139 / 140 / 149
120,000	8,000	134 / 135 / 144	134 / 135 / 144	134 / 136 / 143	135 / 136 / 143	136 / 137 / 142
	6,000	132 / 134 / 144	132 / 134 / 144	133 / 134 / 144	134 / 135 / 144	135 / 136 / 143
	4,000	131 / 133 / 145	131 / 133 / 145	132 / 133 / 144	133 / 134 / 144	134 / 135 / 143
	2,000	130 / 131 / 145	130 / 131 / 145	131 / 132 / 145	132 / 133 / 144	133 / 134 / 144
	0	129 / 130 / 146	129 / 130 / 146	130 / 131 / 145	131 / 132 / 145	132 / 133 / 144
110,000	8,000	128 / 128 / 138	128 / 128 / 138	128 / 129 / 137	129 / 129 / 137	130 / 130 / 136
	6,000	126 / 127 / 138	126 / 127 / 138	127 / 127 / 138	128 / 128 / 138	129 / 129 / 137
	4,000	125 / 126 / 139	125 / 126 / 139	126 / 126 / 138	127 / 127 / 138	128 / 128 / 137
	2,000	124 / 124 / 139	124 / 124 / 139	125 / 125 / 139	126 / 126 / 138	127 / 127 / 138
	0	123 / 123 / 140	123 / 123 / 140	124 / 124 / 139	125 / 125 / 139	126 / 126 / 138
100,000	8,000	121 / 121 / 132	121 / 121 / 132	121 / 122 / 131	122 / 122 / 131	123 / 123 / 130
	6,000	119 / 120 / 132	119 / 120 / 132	120 / 120 / 132	121 / 121 / 132	122 / 122 / 131
	4,000	118 / 119 / 133	118 / 119 / 133	119 / 119 / 132	120 / 120 / 132	121 / 121 / 131
	2,000	117 / 117 / 133	117 / 117 / 133	118 / 118 / 133	119 / 119 / 132	120 / 120 / 132
	0	116 / 116 / 134	116 / 116 / 134	117 / 117 / 133	118 / 118 / 133	119 / 119 / 132
90,000	8,000	113 / 113 / 126	113 / 113 / 126	113 / 114 / 125	114 / 114 / 125	115 / 115 / 124
	6,000	111 / 112 / 126	111 / 112 / 126	112 / 112 / 126	113 / 113 / 126	114 / 114 / 125
	4,000	110 / 111 / 127	110 / 111 / 127	111 / 111 / 126	112 / 112 / 126	113 / 113 / 125
	2,000	109 / 109 / 127	109 / 109 / 127	110 / 110 / 127	111 / 111 / 126	112 / 112 / 126
	0	108 / 108 / 128	108 / 108 / 128	109 / 109 / 127	110 / 110 / 127	111 / 111 / 126

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

V₁ / V_R / V₂
TO / FLAPS 5

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
190,000	8,000	140 / 168 / 168				
	6,000	146 / 167 / 168	143 / 167 / 168	141 / 167 / 168		
	4,000	151 / 166 / 169	148 / 166 / 169	145 / 166 / 168	143 / 167 / 168	142 / 168 / 168
	2,000	156 / 164 / 169	153 / 164 / 169	151 / 165 / 169	149 / 166 / 168	147 / 167 / 168
	0	159 / 163 / 170	158 / 163 / 170	156 / 164 / 169	153 / 165 / 169	152 / 166 / 168
180,000	8,000	143 / 163 / 165	141 / 163 / 165			
	6,000	149 / 162 / 165	147 / 162 / 165	144 / 162 / 165	142 / 163 / 165	141 / 164 / 164
	4,000	155 / 161 / 166	152 / 161 / 166	149 / 161 / 165	148 / 162 / 165	146 / 163 / 164
	2,000	156 / 159 / 166	156 / 159 / 166	155 / 160 / 166	153 / 161 / 165	152 / 162 / 165
	0	155 / 158 / 167	155 / 158 / 167	156 / 159 / 166	157 / 160 / 166	157 / 161 / 165
170,000	8,000	148 / 158 / 161	145 / 158 / 161	143 / 159 / 160	141 / 159 / 160	
	6,000	153 / 157 / 161	151 / 157 / 161	148 / 157 / 161	146 / 158 / 161	145 / 159 / 160
	4,000	152 / 156 / 162	152 / 156 / 162	153 / 156 / 161	152 / 157 / 161	150 / 158 / 160
	2,000	151 / 154 / 162	151 / 154 / 162	152 / 155 / 162	153 / 156 / 161	154 / 157 / 161
	0	150 / 153 / 163	150 / 153 / 163	151 / 154 / 162	152 / 155 / 162	153 / 156 / 161
160,000	8,000	150 / 153 / 156	150 / 153 / 156	148 / 154 / 155	146 / 154 / 155	144 / 155 / 155
	6,000	148 / 152 / 156	148 / 152 / 156	149 / 152 / 156	150 / 153 / 156	149 / 154 / 155
	4,000	147 / 151 / 157	147 / 151 / 157	148 / 151 / 156	149 / 152 / 156	150 / 153 / 155
	2,000	146 / 149 / 157	146 / 149 / 157	147 / 150 / 157	148 / 151 / 156	149 / 152 / 156
	0	145 / 148 / 158	145 / 148 / 158	146 / 149 / 157	147 / 150 / 157	148 / 151 / 156
150,000	8,000	145 / 147 / 152	145 / 147 / 152	145 / 148 / 151	146 / 148 / 151	147 / 149 / 150
	6,000	143 / 146 / 152	143 / 146 / 152	144 / 146 / 152	145 / 147 / 152	146 / 148 / 151
	4,000	142 / 145 / 153	142 / 145 / 153	143 / 145 / 152	144 / 146 / 152	145 / 147 / 151
	2,000	141 / 143 / 153	141 / 143 / 153	142 / 144 / 153	143 / 145 / 152	144 / 146 / 152
	0	140 / 142 / 154	140 / 142 / 154	141 / 143 / 153	142 / 144 / 153	143 / 145 / 152
140,000	8,000	140 / 141 / 148	140 / 141 / 148	140 / 142 / 147	141 / 142 / 147	142 / 143 / 146
	6,000	138 / 140 / 148	138 / 140 / 148	139 / 140 / 148	140 / 141 / 148	141 / 142 / 147
	4,000	137 / 139 / 149	137 / 139 / 149	138 / 139 / 148	139 / 140 / 148	140 / 141 / 147
	2,000	136 / 137 / 149	136 / 137 / 149	137 / 138 / 149	138 / 139 / 148	139 / 140 / 148
	0	135 / 136 / 150	135 / 136 / 150	136 / 137 / 149	137 / 138 / 149	138 / 139 / 148

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

**V₁ / V_R / V₂
TO / FLAPS 5**

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
130,000	8,000	134 / 135 / 143	134 / 135 / 143	134 / 136 / 142	135 / 136 / 142	136 / 137 / 141
	6,000	132 / 134 / 143	132 / 134 / 143	133 / 134 / 143	134 / 135 / 143	135 / 136 / 142
	4,000	131 / 133 / 144	131 / 133 / 144	132 / 133 / 143	133 / 134 / 143	134 / 135 / 142
	2,000	130 / 131 / 144	130 / 131 / 144	131 / 132 / 144	132 / 133 / 143	133 / 134 / 143
	0	129 / 130 / 145	129 / 130 / 145	130 / 131 / 144	131 / 132 / 144	132 / 133 / 143
120,000	8,000	128 / 129 / 137	128 / 129 / 137	128 / 130 / 136	129 / 130 / 136	130 / 131 / 135
	6,000	126 / 128 / 137	126 / 128 / 137	127 / 128 / 137	128 / 129 / 137	129 / 130 / 136
	4,000	125 / 127 / 138	125 / 127 / 138	126 / 127 / 137	127 / 128 / 137	128 / 129 / 136
	2,000	124 / 125 / 138	124 / 125 / 138	125 / 126 / 138	126 / 127 / 137	127 / 128 / 137
	0	123 / 124 / 139	123 / 124 / 139	124 / 125 / 138	125 / 126 / 138	126 / 127 / 137
110,000	8,000	122 / 122 / 132	122 / 122 / 132	122 / 123 / 131	123 / 123 / 131	124 / 124 / 130
	6,000	120 / 121 / 132	120 / 121 / 132	121 / 121 / 132	122 / 122 / 132	123 / 123 / 131
	4,000	119 / 120 / 133	119 / 120 / 133	120 / 120 / 132	121 / 121 / 132	122 / 122 / 131
	2,000	118 / 118 / 133	118 / 118 / 133	119 / 119 / 133	120 / 120 / 132	121 / 121 / 132
	0	117 / 117 / 134	117 / 117 / 134	118 / 118 / 133	119 / 119 / 133	120 / 120 / 132
100,000	8,000	115 / 115 / 126	115 / 115 / 126	115 / 116 / 125	116 / 116 / 125	117 / 117 / 124
	6,000	113 / 114 / 126	113 / 114 / 126	114 / 114 / 126	115 / 115 / 126	116 / 116 / 125
	4,000	112 / 113 / 127	112 / 113 / 127	113 / 113 / 126	114 / 114 / 126	115 / 115 / 125
	2,000	111 / 111 / 127	111 / 111 / 127	112 / 112 / 127	113 / 113 / 126	114 / 114 / 126
	0	110 / 110 / 128	110 / 110 / 128	111 / 111 / 127	112 / 112 / 127	113 / 113 / 126
90,000	8,000	108 / 108 / 121	108 / 108 / 121	108 / 109 / 120	109 / 109 / 120	110 / 110 / 119
	6,000	106 / 107 / 121	106 / 107 / 121	107 / 107 / 121	108 / 108 / 121	109 / 109 / 120
	4,000	105 / 106 / 122	105 / 106 / 122	106 / 106 / 121	107 / 107 / 121	108 / 108 / 120
	2,000	104 / 104 / 122	104 / 104 / 122	105 / 105 / 122	106 / 106 / 121	107 / 107 / 121
	0	105* / 105 / 125	104* / 104 / 124	104 / 104 / 122	105 / 105 / 122	106 / 106 / 121

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

NOTE: Speeds denoted by an asterisk (*) are VMCG limited. DO NOT APPLY NEGATIVE CORRECTIONS.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

V₁ / V_R / V₂
TO / FLAPS 10

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
190,000	8,000	140 / 159 / 159				
	6,000	146 / 158 / 159	143 / 158 / 159	141 / 158 / 159		
	4,000	151 / 157 / 160	148 / 157 / 160	145 / 157 / 159	143 / 158 / 159	142 / 159 / 159
	2,000	152 / 155 / 160	152 / 155 / 160	151 / 156 / 160	149 / 157 / 159	147 / 158 / 159
	0	151 / 154 / 161	151 / 154 / 161	152 / 155 / 160	153 / 156 / 160	152 / 157 / 159
180,000	8,000	143 / 154 / 156	141 / 154 / 156			
	6,000	149 / 153 / 156	147 / 153 / 156	144 / 153 / 156	142 / 154 / 156	141 / 155 / 155
	4,000	148 / 152 / 157	148 / 152 / 157	149 / 152 / 156	148 / 153 / 156	146 / 154 / 155
	2,000	147 / 150 / 157	147 / 150 / 157	148 / 151 / 157	149 / 152 / 156	150 / 153 / 156
	0	146 / 149 / 158	146 / 149 / 158	147 / 150 / 157	148 / 151 / 157	149 / 152 / 156
170,000	8,000	147 / 149 / 152	145 / 149 / 152	143 / 150 / 151	141 / 150 / 151	
	6,000	145 / 148 / 152	145 / 148 / 152	146 / 148 / 152	146 / 149 / 152	145 / 150 / 151
	4,000	144 / 147 / 153	144 / 147 / 153	145 / 147 / 152	146 / 148 / 152	147 / 149 / 151
	2,000	143 / 145 / 153	143 / 145 / 153	144 / 146 / 153	145 / 147 / 152	146 / 148 / 152
	0	142 / 144 / 154	142 / 144 / 154	143 / 145 / 153	144 / 146 / 153	145 / 147 / 152
160,000	8,000	142 / 144 / 148	142 / 144 / 148	142 / 145 / 147	143 / 145 / 147	144 / 146 / 146
	6,000	140 / 143 / 148	140 / 143 / 148	141 / 143 / 148	142 / 144 / 148	143 / 145 / 147
	4,000	139 / 142 / 149	139 / 142 / 149	140 / 142 / 148	141 / 143 / 148	142 / 144 / 147
	2,000	138 / 140 / 149	138 / 140 / 149	139 / 141 / 149	140 / 142 / 148	141 / 143 / 148
	0	137 / 139 / 150	137 / 139 / 150	138 / 140 / 149	139 / 141 / 149	140 / 142 / 148
150,000	8,000	138 / 139 / 144	138 / 139 / 144	138 / 140 / 143	139 / 140 / 143	140 / 141 / 142
	6,000	136 / 138 / 144	136 / 138 / 144	137 / 138 / 144	138 / 139 / 144	139 / 140 / 143
	4,000	135 / 137 / 145	135 / 137 / 145	136 / 137 / 144	137 / 138 / 144	138 / 139 / 143
	2,000	134 / 135 / 145	134 / 135 / 145	135 / 136 / 145	136 / 137 / 144	137 / 138 / 144
	0	133 / 134 / 146	133 / 134 / 146	134 / 135 / 145	135 / 136 / 145	136 / 137 / 144
140,000	8,000	132 / 134 / 140	132 / 134 / 140	132 / 135 / 139	133 / 135 / 139	134 / 136 / 138
	6,000	130 / 133 / 140	130 / 133 / 140	131 / 133 / 140	132 / 134 / 140	133 / 135 / 139
	4,000	129 / 132 / 141	129 / 132 / 141	130 / 132 / 140	131 / 133 / 140	132 / 134 / 139
	2,000	128 / 130 / 141	128 / 130 / 141	129 / 131 / 141	130 / 132 / 140	131 / 133 / 140
	0	127 / 129 / 142	127 / 129 / 142	128 / 130 / 141	129 / 131 / 141	130 / 132 / 140

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

V₁ / V_R / V₂
TO / FLAPS 10

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
130,000	8,000	127 / 128 / 135	127 / 128 / 135	127 / 129 / 134	128 / 129 / 134	129 / 130 / 133
	6,000	125 / 127 / 135	125 / 127 / 135	126 / 127 / 135	127 / 128 / 135	128 / 129 / 134
	4,000	124 / 126 / 136	124 / 126 / 136	125 / 126 / 135	126 / 127 / 135	127 / 128 / 134
	2,000	123 / 124 / 136	123 / 124 / 136	124 / 125 / 136	125 / 126 / 135	126 / 127 / 135
	0	122 / 123 / 137	122 / 123 / 137	123 / 124 / 136	124 / 125 / 136	125 / 126 / 135
120,000	8,000	121 / 122 / 130	121 / 122 / 130	121 / 123 / 129	122 / 123 / 129	123 / 124 / 128
	6,000	119 / 121 / 130	119 / 121 / 130	120 / 121 / 130	121 / 122 / 130	122 / 123 / 129
	4,000	118 / 120 / 131	118 / 120 / 131	119 / 120 / 130	120 / 121 / 130	121 / 122 / 129
	2,000	117 / 118 / 131	117 / 118 / 131	118 / 119 / 131	119 / 120 / 130	120 / 121 / 130
	0	116 / 117 / 132	116 / 117 / 132	117 / 118 / 131	118 / 119 / 131	119 / 120 / 130
110,000	8,000	115 / 116 / 125	115 / 116 / 125	115 / 117 / 124	116 / 117 / 124	117 / 118 / 123
	6,000	113 / 115 / 125	113 / 115 / 125	114 / 115 / 125	115 / 116 / 125	116 / 117 / 124
	4,000	112 / 114 / 126	112 / 114 / 126	113 / 114 / 125	114 / 115 / 125	115 / 116 / 124
	2,000	111 / 112 / 126	111 / 112 / 126	112 / 113 / 126	113 / 114 / 125	114 / 115 / 125
	0	110 / 111 / 127	110 / 111 / 127	111 / 112 / 126	112 / 113 / 126	113 / 114 / 125
100,000	8,000	109 / 109 / 120	109 / 109 / 120	109 / 110 / 119	110 / 110 / 119	111 / 111 / 118
	6,000	107 / 108 / 120	107 / 108 / 120	108 / 108 / 120	109 / 109 / 120	110 / 110 / 119
	4,000	106 / 107 / 121	106 / 107 / 121	107 / 107 / 120	108 / 108 / 120	109 / 109 / 119
	2,000	105 / 105 / 121	105 / 105 / 121	106 / 106 / 121	107 / 107 / 120	108 / 108 / 120
	0	105* / 105 / 123	104 / 104 / 122	105 / 105 / 121	106 / 106 / 121	107 / 107 / 120
90,000	8,000	102 / 102 / 114	102 / 102 / 114	102 / 103 / 113	103 / 103 / 113	104 / 104 / 112
	6,000	100 / 101 / 114	100 / 101 / 114	101 / 101 / 114	102 / 102 / 114	103 / 103 / 113
	4,000	99 / 100 / 115	99 / 100 / 115	100 / 100 / 114	101 / 101 / 114	102 / 102 / 113
	2,000	102* / 102 / 119	101* / 101 / 118	99 / 99 / 115	100 / 100 / 114	101 / 101 / 114
	0	105* / 105 / 124	104* / 104 / 123	103* / 103 / 120	100* / 100 / 116	100 / 100 / 114

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

NOTE: Speeds denoted by an asterisk (*) are VMCG limited. DO NOT APPLY NEGATIVE CORRECTIONS.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

$V_1 / V_R / V_2$

TO / FLAPS 15

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
190,000	8,000	140 / 157 / 157				
	6,000	146 / 156 / 157	143 / 156 / 157	141 / 156 / 157		
	4,000	151 / 155 / 158	148 / 155 / 158	145 / 155 / 157	143 / 156 / 157	142 / 157 / 157
	2,000	150 / 153 / 158	150 / 153 / 158	151 / 154 / 158	149 / 155 / 157	147 / 156 / 157
	0	149 / 152 / 159	149 / 152 / 159	150 / 153 / 158	151 / 154 / 158	152 / 155 / 157
180,000	8,000	143 / 152 / 153	141 / 152 / 153			
	6,000	147 / 151 / 153	147 / 151 / 153	144 / 151 / 153	142 / 152 / 153	141 / 153 / 153
	4,000	146 / 150 / 154	146 / 150 / 154	147 / 150 / 153	148 / 151 / 153	146 / 152 / 152
	2,000	145 / 148 / 154	145 / 148 / 154	146 / 149 / 154	147 / 150 / 153	148 / 151 / 153
	0	144 / 147 / 155	144 / 147 / 155	145 / 148 / 154	146 / 149 / 154	147 / 150 / 153
170,000	8,000	145 / 148 / 150	145 / 148 / 150	143 / 149 / 149	141 / 149 / 149	
	6,000	143 / 147 / 150	143 / 147 / 150	144 / 147 / 150	145 / 148 / 150	145 / 149 / 149
	4,000	142 / 146 / 151	142 / 146 / 151	143 / 146 / 150	144 / 147 / 150	145 / 148 / 149
	2,000	141 / 144 / 151	141 / 144 / 151	142 / 145 / 151	143 / 146 / 150	144 / 147 / 150
	0	140 / 143 / 152	140 / 143 / 152	141 / 144 / 151	142 / 145 / 151	143 / 146 / 150
160,000	8,000	140 / 143 / 146	140 / 143 / 146	140 / 144 / 145	141 / 144 / 145	142 / 145 / 145
	6,000	138 / 142 / 146	138 / 142 / 146	139 / 142 / 146	140 / 143 / 146	141 / 144 / 145
	4,000	137 / 141 / 147	137 / 141 / 147	138 / 141 / 146	139 / 142 / 146	140 / 143 / 145
	2,000	136 / 139 / 147	136 / 139 / 147	137 / 140 / 147	138 / 141 / 146	139 / 142 / 146
	0	135 / 138 / 148	135 / 138 / 148	136 / 139 / 147	137 / 140 / 147	138 / 141 / 146
150,000	8,000	136 / 138 / 142	136 / 138 / 142	136 / 139 / 141	137 / 139 / 141	138 / 140 / 140
	6,000	134 / 137 / 142	134 / 137 / 142	135 / 137 / 142	136 / 138 / 142	137 / 139 / 141
	4,000	133 / 136 / 143	133 / 136 / 143	134 / 136 / 142	135 / 137 / 142	136 / 138 / 141
	2,000	132 / 134 / 143	132 / 134 / 143	133 / 135 / 143	134 / 136 / 142	135 / 137 / 142
	0	131 / 133 / 144	131 / 133 / 144	132 / 134 / 143	133 / 135 / 143	134 / 136 / 142
140,000	8,000	131 / 132 / 138	131 / 132 / 138	131 / 133 / 137	132 / 133 / 137	133 / 134 / 136
	6,000	129 / 131 / 138	129 / 131 / 138	130 / 131 / 138	131 / 132 / 138	132 / 133 / 137
	4,000	128 / 130 / 139	128 / 130 / 139	129 / 130 / 138	130 / 131 / 138	131 / 132 / 137
	2,000	127 / 128 / 139	127 / 128 / 139	128 / 129 / 139	129 / 130 / 138	130 / 131 / 138
	0	126 / 127 / 140	126 / 127 / 140	127 / 128 / 139	128 / 129 / 139	129 / 130 / 138

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

**V₁ / V_R / V₂
TO / FLAPS 15**

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
130,000	8,000	125 / 126 / 133	125 / 126 / 133	125 / 127 / 132	126 / 127 / 132	127 / 128 / 131
	6,000	123 / 125 / 133	123 / 125 / 133	124 / 125 / 133	125 / 126 / 133	126 / 127 / 132
	4,000	122 / 124 / 134	122 / 124 / 134	123 / 124 / 133	124 / 125 / 133	125 / 126 / 132
	2,000	121 / 122 / 134	121 / 122 / 134	122 / 123 / 134	123 / 124 / 133	124 / 125 / 133
	0	120 / 121 / 135	120 / 121 / 135	121 / 122 / 134	122 / 123 / 134	123 / 124 / 133
120,000	8,000	120 / 121 / 128	120 / 121 / 128	120 / 122 / 127	121 / 122 / 127	122 / 123 / 126
	6,000	118 / 120 / 128	118 / 120 / 128	119 / 120 / 128	120 / 121 / 128	121 / 122 / 127
	4,000	117 / 119 / 129	117 / 119 / 129	118 / 119 / 128	119 / 120 / 128	120 / 121 / 127
	2,000	116 / 117 / 129	116 / 117 / 129	117 / 118 / 129	118 / 119 / 128	119 / 120 / 128
	0	115 / 116 / 130	115 / 116 / 130	116 / 117 / 129	117 / 118 / 129	118 / 119 / 128
110,000	8,000	114 / 114 / 123	114 / 114 / 123	114 / 115 / 122	115 / 115 / 122	116 / 116 / 121
	6,000	112 / 113 / 123	112 / 113 / 123	113 / 113 / 123	114 / 114 / 123	115 / 115 / 122
	4,000	111 / 112 / 124	111 / 112 / 124	112 / 112 / 123	113 / 113 / 123	114 / 114 / 122
	2,000	110 / 110 / 124	110 / 110 / 124	111 / 111 / 124	112 / 112 / 123	113 / 113 / 123
	0	109 / 109 / 125	109 / 109 / 125	110 / 110 / 124	111 / 111 / 124	112 / 112 / 123
100,000	8,000	107 / 108 / 118	107 / 108 / 118	107 / 109 / 117	108 / 109 / 117	109 / 110 / 116
	6,000	105 / 107 / 118	105 / 107 / 118	106 / 107 / 118	107 / 108 / 118	108 / 109 / 117
	4,000	104 / 106 / 119	104 / 106 / 119	105 / 106 / 118	106 / 107 / 118	107 / 108 / 117
	2,000	103 / 104 / 119	103 / 104 / 119	104 / 105 / 119	105 / 106 / 118	106 / 107 / 118
	0	105* / 105 / 122	104* / 104 / 121	103 / 104 / 119	104 / 105 / 119	105 / 106 / 118
90,000	8,000	101 / 101 / 113	101 / 101 / 113	101 / 102 / 112	102 / 102 / 112	103 / 103 / 111
	6,000	99 / 100 / 113	99 / 100 / 113	100 / 100 / 113	101 / 101 / 113	102 / 102 / 112
	4,000	98 / 99 / 114	98 / 99 / 114	99 / 99 / 113	100 / 100 / 113	101 / 101 / 112
	2,000	102* / 102 / 119	101* / 101 / 118	99* / 99 / 115	99 / 99 / 113	100 / 100 / 113
	0	105* / 105 / 124	104* / 104 / 123	103* / 103 / 120	100* / 100 / 116	99 / 99 / 113

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

NOTE: Speeds denoted by an asterisk (*) are VMCG limited. DO NOT APPLY NEGATIVE CORRECTIONS.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

$V_1 / V_R / V_2$

TO / FLAPS 25

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
190,000	8,000	140 / 153 / 153				
	6,000	146 / 152 / 152	143 / 152 / 152	141 / 152 / 152		
	4,000	148 / 151 / 153	148 / 151 / 153	145 / 151 / 152	143 / 152 / 152	142 / 153 / 153
	2,000	147 / 149 / 153	147 / 149 / 153	148 / 150 / 153	149 / 151 / 152	147 / 152 / 152
	0	146 / 148 / 154	146 / 148 / 154	147 / 149 / 153	148 / 150 / 153	149 / 151 / 152
180,000	8,000	143 / 148 / 149	141 / 148 / 149			
	6,000	145 / 147 / 149	145 / 147 / 149	144 / 147 / 149	142 / 148 / 149	141 / 149 / 149
	4,000	144 / 146 / 150	144 / 146 / 150	145 / 146 / 149	146 / 147 / 149	146 / 148 / 148
	2,000	143 / 144 / 150	143 / 144 / 150	144 / 145 / 150	145 / 146 / 149	146 / 147 / 149
	0	142 / 143 / 151	142 / 143 / 151	143 / 144 / 150	144 / 145 / 150	145 / 146 / 149
170,000	8,000	143 / 144 / 145	143 / 144 / 145	143 / 145 / 145	141 / 145 / 145	
	6,000	141 / 143 / 145	141 / 143 / 145	142 / 143 / 145	143 / 144 / 145	144 / 145 / 145
	4,000	140 / 142 / 146	140 / 142 / 146	141 / 142 / 145	142 / 143 / 145	143 / 144 / 144
	2,000	139 / 140 / 146	139 / 140 / 146	140 / 141 / 146	141 / 142 / 145	142 / 143 / 145
	0	138 / 139 / 147	138 / 139 / 147	139 / 140 / 146	140 / 141 / 146	141 / 142 / 145
160,000	8,000	138 / 139 / 142	138 / 139 / 142	138 / 140 / 141	139 / 140 / 141	140 / 141 / 141
	6,000	136 / 138 / 142	136 / 138 / 142	137 / 138 / 142	138 / 139 / 142	139 / 140 / 141
	4,000	135 / 137 / 143	135 / 137 / 143	136 / 137 / 142	137 / 138 / 142	138 / 139 / 141
	2,000	134 / 135 / 143	134 / 135 / 143	135 / 136 / 143	136 / 137 / 142	137 / 138 / 142
	0	133 / 134 / 144	133 / 134 / 144	134 / 135 / 143	135 / 136 / 143	136 / 137 / 142
150,000	8,000	132 / 134 / 138	132 / 134 / 138	132 / 135 / 137	133 / 135 / 137	134 / 136 / 136
	6,000	130 / 133 / 138	130 / 133 / 138	131 / 133 / 138	132 / 134 / 138	133 / 135 / 137
	4,000	129 / 132 / 139	129 / 132 / 139	130 / 132 / 138	131 / 133 / 138	132 / 134 / 137
	2,000	128 / 130 / 139	128 / 130 / 139	129 / 131 / 139	130 / 132 / 138	131 / 133 / 138
	0	127 / 129 / 140	127 / 129 / 140	128 / 130 / 139	129 / 131 / 139	130 / 132 / 138
140,000	8,000	127 / 129 / 134	127 / 129 / 134	127 / 130 / 133	128 / 130 / 133	129 / 131 / 132
	6,000	125 / 128 / 134	125 / 128 / 134	126 / 128 / 134	127 / 129 / 134	128 / 130 / 133
	4,000	124 / 127 / 135	124 / 127 / 135	125 / 127 / 134	126 / 128 / 134	127 / 129 / 133
	2,000	123 / 125 / 135	123 / 125 / 135	124 / 126 / 135	125 / 127 / 134	126 / 128 / 134
	0	122 / 124 / 136	122 / 124 / 136	123 / 125 / 135	124 / 126 / 135	125 / 127 / 134

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

V₁ / V_R / V₂
TO / FLAPS 25

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
130,000	8,000	122 / 123 / 129	122 / 123 / 129	122 / 124 / 128	123 / 124 / 128	124 / 125 / 127
	6,000	120 / 122 / 129	120 / 122 / 129	121 / 122 / 129	122 / 123 / 129	123 / 124 / 128
	4,000	119 / 121 / 130	119 / 121 / 130	120 / 121 / 129	121 / 122 / 129	122 / 123 / 128
	2,000	118 / 119 / 130	118 / 119 / 130	119 / 120 / 130	120 / 121 / 129	121 / 122 / 129
	0	117 / 118 / 131	117 / 118 / 131	118 / 119 / 130	119 / 120 / 130	120 / 121 / 129
120,000	8,000	117 / 117 / 125	117 / 117 / 125	117 / 118 / 124	118 / 118 / 124	119 / 119 / 123
	6,000	115 / 116 / 125	115 / 116 / 125	116 / 116 / 125	117 / 117 / 125	118 / 118 / 124
	4,000	114 / 115 / 126	114 / 115 / 126	115 / 115 / 125	116 / 116 / 125	117 / 117 / 124
	2,000	113 / 113 / 126	113 / 113 / 126	114 / 114 / 126	115 / 115 / 125	116 / 116 / 125
	0	112 / 112 / 127	112 / 112 / 127	113 / 113 / 126	114 / 114 / 126	115 / 115 / 125
110,000	8,000	111 / 111 / 120	111 / 111 / 120	111 / 112 / 119	112 / 112 / 119	113 / 113 / 118
	6,000	109 / 110 / 120	109 / 110 / 120	110 / 110 / 120	111 / 111 / 120	112 / 112 / 119
	4,000	108 / 109 / 121	108 / 109 / 121	109 / 109 / 120	110 / 110 / 120	111 / 111 / 119
	2,000	107 / 107 / 121	107 / 107 / 121	108 / 108 / 121	109 / 109 / 120	110 / 110 / 120
	0	106 / 106 / 122	106 / 106 / 122	107 / 107 / 121	108 / 108 / 121	109 / 109 / 120
100,000	8,000	105 / 105 / 115	105 / 105 / 115	105 / 106 / 114	106 / 106 / 114	107 / 107 / 113
	6,000	103 / 104 / 115	103 / 104 / 115	104 / 104 / 115	105 / 105 / 115	106 / 106 / 114
	4,000	102 / 103 / 116	102 / 103 / 116	103 / 103 / 115	104 / 104 / 115	105 / 105 / 114
	2,000	102* / 102 / 117	101 / 101 / 116	102 / 102 / 116	103 / 103 / 115	104 / 104 / 115
	0	105* / 105 / 122	104* / 104 / 121	103* / 103 / 118	102 / 102 / 116	103 / 103 / 115
90,000	8,000	98 / 98 / 110	98 / 98 / 110	98 / 99 / 109	99 / 99 / 109	100 / 100 / 108
	6,000	96 / 97 / 110	96 / 97 / 110	97 / 97 / 110	98 / 98 / 110	99 / 99 / 109
	4,000	98* / 98 / 113	97* / 97 / 112	96 / 96 / 110	97 / 97 / 110	98 / 98 / 109
	2,000	102* / 102 / 119	101* / 101 / 118	99* / 99 / 115	96 / 96 / 110	97 / 97 / 110
	0	105* / 105 / 124	104* / 104 / 123	103* / 103 / 120	100* / 100 / 116	96 / 96 / 110

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

NOTE: Speeds denoted by an asterisk (*) are VMCG limited. DO NOT APPLY NEGATIVE CORRECTIONS.

TAKEOFF STABILIZER SETTINGS

UNITS AIRPLANE NOSE UP

TO2

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

FLAPS 1 AND 5

GROSS WEIGHT - POUNDS	CENTER OF GRAVITY PERCENT M.A.C.										
	6	8	9	20	25	26	28	30	32	34	36
190,000	8.50	8.50	8.25	6.50	5.75	5.75	5.25	5.00	4.75	4.25	4.00
180,000	8.50	8.50	8.25	6.50	5.75	5.50	5.25	4.75	4.50	4.25	4.00
160,000	8.25	8.00	7.75	6.00	5.25	5.25	5.00	4.50	4.25	4.00	3.75
140,000	7.75	7.50	7.25	5.75	5.00	4.74	4.50	4.25	4.00	3.75	3.50
120,000	7.00	6.75	6.75	5.25	4.50	4.50	4.25	4.00	3.75	3.25	3.00
90,000 – 100,000	6.50	6.25	6.00	4.75	4.00	3.75	3.50	3.25	3.00	2.75	2.75

FLAPS 10, 15, AND 25

GROSS WEIGHT - POUNDS	CENTER OF GRAVITY PERCENT M.A.C.										
	6	8	9	20	25	26	28	30	32	34	36
190,000	8.50	8.25	8.00	6.00	5.00	5.00	4.50	4.25	3.75	3.50	3.25
180,000	8.50	8.25	8.00	5.75	5.00	4.75	4.50	4.00	3.75	3.25	3.00
160,000	8.00	7.75	7.50	5.50	4.50	4.25	4.00	3.75	3.25	3.00	2.75
140,000	7.50	7.00	7.00	5.00	4.00	4.00	3.50	3.25	3.00	2.75	2.75
120,000	7.00	6.50	6.25	4.50	3.50	3.50	3.50	2.75	2.75	2.75	2.75
90,000 – 100,000	6.25	6.00	5.75	4.00	3.25	3.00	2.75	2.75	2.75	2.75	2.75

TAKEOFF STABILIZER SETTINGS

UNITS AIRPLANE NOSE UP

TO1

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

FLAPS 1 AND 5

GROSS WEIGHT - POUNDS	CENTER OF GRAVITY PERCENT M.A.C.										
	6	8	9	20	25	26	28	30	32	34	36
190,000	8.50	8.25	8.25	6.50	5.75	5.75	5.25	5.00	4.75	4.50	4.25
180,000	8.50	8.25	8.00	6.50	5.75	5.50	5.25	5.00	4.50	4.25	4.00
160,000	8.00	7.75	7.50	6.00	5.25	5.00	4.75	4.50	4.25	4.00	3.50
140,000	7.50	7.00	7.00	5.50	4.75	4.50	4.25	4.00	3.75	3.50	3.25
120,000	6.75	6.50	6.50	5.00	4.25	4.25	4.00	3.75	3.50	3.00	2.75
90,000 – 100,000	6.00	5.75	5.75	4.25	3.75	3.50	3.25	3.00	2.75	2.75	2.75

FLAPS 10, 15, AND 25

GROSS WEIGHT - POUNDS	CENTER OF GRAVITY PERCENT M.A.C.										
	6	8	9	20	25	26	28	30	32	34	36
190,000	8.50	8.50	8.25	5.75	4.75	4.75	4.25	4.00	3.50	3.25	2.75
180,000	8.50	8.25	8.00	5.50	4.75	4.50	4.00	3.75	3.25	3.00	2.75
160,000	8.00	7.75	7.50	5.25	4.25	4.00	3.75	3.25	3.00	2.75	2.75
140,000	7.50	7.00	6.75	4.75	3.75	3.75	3.25	3.00	2.75	2.75	2.75
120,000	7.00	6.50	6.25	4.25	3.25	3.25	2.75	2.75	2.75	2.75	2.75
90,000 – 100,000	6.25	5.75	5.50	3.75	3.00	2.75	2.75	2.75	2.75	2.75	2.75

TAKEOFF STABILIZER SETTINGS

UNITS AIRPLANE NOSE UP

TO

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

FLAPS 1 AND 5

GROSS WEIGHT - POUNDS	CENTER OF GRAVITY PERCENT M.A.C.										
	6	8	9	20	25	26	28	30	32	34	36
190,000	8.50	8.25	8.00	6.25	5.50	5.25	5.00	4.75	4.50	4.00	3.75
180,000	8.25	8.00	7.75	6.00	5.25	5.25	4.75	4.50	4.25	4.00	3.50
160,000	7.75	7.50	7.25	5.75	5.00	4.75	4.50	4.25	4.00	3.50	3.25
140,000	7.25	7.00	6.75	5.25	4.50	4.25	4.00	3.75	3.50	3.25	3.00
120,000	6.50	6.25	6.25	4.75	4.00	4.00	3.75	3.50	3.00	2.75	2.75
90,000 – 100,000	5.75	5.50	5.50	4.00	3.50	3.25	3.00	2.75	2.75	2.75	2.75

FLAPS 10, 15, AND 25

GROSS WEIGHT - POUNDS	CENTER OF GRAVITY PERCENT M.A.C.										
	6	8	9	20	25	26	28	30	32	34	36
190,000	8.50	8.00	7.75	5.50	4.50	4.50	4.00	3.75	3.25	3.00	2.75
180,000	8.25	7.75	7.75	5.25	4.50	4.25	3.75	3.50	3.25	2.75	2.75
160,000	7.75	7.25	7.25	5.00	4.00	3.75	3.50	3.25	2.75	2.75	2.75
140,000	7.25	7.00	6.75	4.50	3.75	3.50	3.25	2.75	2.75	2.75	2.75
120,000	6.50	6.25	6.00	4.00	3.25	3.00	2.75	2.75	2.75	2.75	2.75
90,000 – 100,000	6.00	5.50	5.25	3.50	2.75	2.75	2.75	2.75	2.75	2.75	2.75

End of Section

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DEFINITIONS AND ASSUMPTIONS

ACTUAL LANDING DISTANCE	The actual distance required to land starting at 50 feet above the runway (usually at the threshold) to a complete stop on the runway. This distance is based on a V_{REF} speed at 50 feet and assumes maximum braking and NO reverse thrust.
APPROACH CLIMB LIMIT WEIGHT	Approach Climb Limit Weight is defined in FAR 25.121 as the maximum weight at which a missed approach climb meets the FAR prescribed climb gradient (2.1% for a two engine aircraft). This gradient is determined with the critical engine inoperative, remaining engine at takeoff thrust, landing gear retracted, and approach flap setting (as defined in the FAA Approved Flight Manual). This weight takes into account an air conditioning pack ON and operated from engine bleed air.
F.A.R. LANDING FIELD LENGTH	This is the landing field length as defined in the Federal Air Regulations Part 121, and is the actual landing distance plus an additional safety margin of 67%. Dispatch is based on F.A.R. Landing Field Length at the destination airport.
GO-AROUND THRUST	Maximum thrust setting available for use during a missed approach.
LANDING CLIMB LIMIT WEIGHT	Landing Climb Limit Weight is defined in FAR 25.119 as the maximum weight at which the aircraft meets the FAR prescribed climb gradient (3.2%). This gradient is determined with all engines operating, landing gear extended, and landing flap setting.
V_S	Indicated stall speed for the aircraft weight and configuration. $1.3 V_S$ is 1.3 times the stall speed, or an increase of 30% above stall speed.

PATTERN AND APPROACH SPEEDS

KIAS

NORMAL CONFIGURATION

GROSS WEIGHT -POUNDS	V _{Ref}	APPROACH – GEAR UP						LANDING – GEAR DOWN		
		SLATS RET	SLATS EXT					SLATS EXT	SLATS FULL EXT	
		FLAPS 0	FLAPS 1	FLAPS 5	FLAPS 10	FLAPS 15	FLAPS 25	FLAPS 15	FLAPS 30	FLAPS 40
		V _{Ref40} + 70	V _{Ref40} + 50	V _{Ref40} + 30	V _{Ref40} + 30	V _{Ref40} + 20	V _{Ref40} + 10	V _{Ref15}	V _{Ref30}	V _{Ref40}
190,000	159	229	209	189	189	179	169	172	162	159
180,000	155	225	205	185	185	175	165	167	158	155
170,000	150	220	200	180	180	170	160	162	154	150
160,000	145	215	195	175	175	165	155	158	150	145
150,000	141	211	191	171	171	161	151	152	145	141
140,000	136	206	186	166	166	156	146	147	140	136
130,000	130	200	180	160	160	150	140	142	135	130
120,000	124	194	174	154	154	144	134	136	130	124
110,000	119	189	169	149	149	139	129	130	124	119
100,000	112	182	162	142	142	132	122	124	118	112
90,000	106	176	156	136	136	126	116	117	112	106

NOTE: When the flap lever is in positions 1 – 25, the inboard L.E. flaps move to the FULL EXT (sealed) position while the outboard L.E. slats move to the EXT (sealed) position. When the flap lever is in position 30 or higher, the L.E. flaps remain sealed and slats are fully extended (gapped).

STALL SPEEDS - V_s **KIAS**

GROSS WEIGHT – POUNDS	GEAR UP						GEAR DOWN		
	FLAPS 0 SLATS RET	FLAPS 1 SLATS EXT	FLAPS 5 SLATS EXT	FLAPS 10 SLATS EXT	FLAPS 15 SLATS EXT	FLAPS 25 SLATS EXT	FLAPS 15 SLATS EXT	FLAPS 30 SLATS FULL EXT	FLAPS 40 SLATS FULL EXT
190,000	184	147	145	139	137	136	138	130	128
185,000	181	145	143	137	135	134	137	128	126
180,000	179	143	141	135	133	132	135	126	124
175,000	176	141	139	133	131	130	133	125	123
170,000	174	139	136	131	129	128	131	123	121
165,000	171	137	134	129	127	126	129	121	119
160,000	168	135	132	127	125	124	127	119	117
155,000	166	133	130	124	123	122	125	118	115
150,000	163	130	128	122	121	120	123	116	113
145,000	160	128	126	120	120	118	121	114	112
140,000	158	126	124	118	118	116	119	112	110
135,000	155	124	121	116	115	114	117	110	108
130,000	152	121	119	114	113	111	115	108	105
125,000	149	119	116	112	111	109	113	106	103
120,000	146	116	114	110	109	107	110	104	101
115,000	143	114	112	108	107	105	108	102	99
110,000	140	111	109	105	104	102	106	99	97
105,000	137	109	107	103	102	100	103	97	95
100,000	133	106	104	100	99	98	101	95	92
95,000	130	103	101	98	97	95	98	92	90
90,000	126	101	99	95	94	93	96	90	88

NOTE: When the flap lever is in positions 1 – 25, the inboard L.E. flaps move to the FULL EXT (sealed) position while the outboard L.E. slats move to the EXT (sealed) position. When the flap lever is in position 30 or higher, the L.E. flaps remain sealed and slats are fully extended (gapped).

F.A.R. DRY LANDING FIELD LENGTH**FEET****CFM56-7B27B1****FLAPS 15**

AIRCRAFT WEIGHT – POUNDS	AIRPORT PRESSURE ALTITUDE – FEET									
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	8,400
190,000	7,550	7,740	7,940	8,200	8,610	9,050	9,540	10,070	10,660	10,920
185,000	7,280	7,460	7,650	7,840	8,060	8,430	8,860	9,330	9,850	10,070
180,000	7,010	7,180	7,360	7,550	7,760	7,970	8,240	8,660	9,110	9,300
175,000	6,750	6,910	7,080	7,260	7,460	7,660	7,870	8,090	8,430	8,600
170,000	6,490	6,650	6,810	6,980	7,170	7,360	7,560	7,760	7,980	8,060
165,000	6,240	6,390	6,540	6,710	6,880	7,060	7,250	7,440	7,640	7,730
160,000	6,020	6,160	6,310	6,470	6,640	6,810	6,990	7,170	7,360	7,440
155,000	5,850	5,990	6,130	6,280	6,450	6,610	6,780	6,950	7,130	7,210
150,000	5,670	5,810	5,950	6,100	6,250	6,410	6,570	6,740	6,910	6,990
145,000	5,500	5,630	5,770	5,910	6,060	6,210	6,370	6,530	6,700	6,770
140,000	5,340	5,450	5,580	5,720	5,870	6,010	6,160	6,320	6,480	6,550
135,000	5,170	5,280	5,390	5,520	5,660	5,800	5,950	6,100	6,250	6,320
130,000	5,010	5,110	5,220	5,320	5,460	5,590	5,730	5,870	6,020	6,080
125,000	4,850	4,950	5,050	5,150	5,260	5,380	5,510	5,650	5,800	5,850
120,000	4,690	4,780	4,880	4,970	5,080	5,180	5,300	5,430	5,570	5,620
115,000	4,530	4,620	4,710	4,800	4,900	5,000	5,100	5,210	5,340	5,390
110,000	4,370	4,460	4,540	4,630	4,720	4,810	4,910	5,020	5,120	5,170
105,000	4,220	4,290	4,370	4,460	4,540	4,630	4,720	4,820	4,920	4,960
100,000	4,090	4,170	4,240	4,320	4,410	4,490	4,580	4,670	4,770	4,810
95,000	3,970	4,040	4,120	4,190	4,270	4,350	4,440	4,530	4,620	4,660
90,000	3,850	3,910	3,990	4,060	4,140	4,220	4,300	4,380	4,470	4,510

NOTE:

Actual Landing Distance is:

- 60 percent of the F.A.R. Landing Field Lengths above.
- The distance to a complete stop from 50 feet above the runway threshold at V_{Ref} .
- Based on Maximum Braking, Speed Brakes Extended and No Thrust Reverse.

CORRECTIONS:

CONDITION	CORRECTION
Headwind	- 20 ft. per knot
Tailwind	+ 330 ft. per knot
Wet runway and/or Low Minima	Increase distance by 15%
Manual Spoilers	See Abnormal section
Anti-skid Inoperative	See Abnormal section

F.A.R. DRY LANDING FIELD LENGTH**FEET****CFM56-7B27B1****FLAPS 30**

AIRCRAFT WEIGHT – POUNDS	AIRPORT PRESSURE ALTITUDE – FEET									
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	8,400
190,000	6,870	7,040	7,220	7,410	7,600	7,790	8,000	8,310	8,710	8,870
185,000	6,630	6,800	6,970	7,140	7,330	7,520	7,710	7,910	8,140	8,290
180,000	6,400	6,550	6,710	6,880	7,060	7,240	7,430	7,620	7,820	7,900
175,000	6,160	6,310	6,470	6,630	6,800	6,970	7,150	7,330	7,530	7,610
170,000	5,940	6,080	6,230	6,380	6,550	6,710	6,880	7,060	7,240	7,320
165,000	5,780	5,910	6,060	6,210	6,370	6,530	6,690	6,870	7,040	7,120
160,000	5,620	5,750	5,890	6,040	6,190	6,340	6,500	6,670	6,840	6,910
155,000	5,460	5,580	5,720	5,860	6,010	6,160	6,310	6,480	6,640	6,710
150,000	5,320	5,430	5,550	5,690	5,830	5,980	6,130	6,280	6,440	6,510
145,000	5,180	5,280	5,390	5,510	5,650	5,790	5,940	6,090	6,240	6,310
140,000	5,030	5,140	5,240	5,350	5,470	5,610	5,750	5,890	6,040	6,100
135,000	4,890	4,980	5,080	5,190	5,300	5,410	5,550	5,690	5,830	5,890
130,000	4,740	4,830	4,920	5,020	5,130	5,240	5,350	5,480	5,620	5,670
125,000	4,590	4,680	4,770	4,860	4,960	5,060	5,170	5,280	5,410	5,460
120,000	4,440	4,520	4,610	4,700	4,800	4,890	4,990	5,100	5,210	5,250
115,000	4,290	4,370	4,450	4,540	4,630	4,720	4,820	4,920	5,020	5,060
110,000	4,140	4,220	4,300	4,380	4,470	4,550	4,640	4,740	4,840	4,880
105,000	4,030	4,100	4,180	4,260	4,340	4,430	4,510	4,600	4,700	4,730
100,000	3,920	3,990	4,060	4,140	4,220	4,300	4,380	4,470	4,560	4,590
95,000	3,800	3,870	3,940	4,010	4,090	4,170	4,250	4,330	4,410	4,450
90,000	3,690	3,750	3,820	3,890	3,960	4,030	4,110	4,190	4,270	4,310

NOTE:

Actual Landing Distance is:

- 60 percent of the F.A.R. Landing Field Lengths above.
- The distance to a complete stop from 50 feet above the runway threshold at V_{Ref} .
- Based on Maximum Braking, Speed Brakes Extended and No Thrust Reverse.

CORRECTIONS:

CONDITION	CORRECTION
Headwind	- 20 ft. per knot
Tailwind	+ 240 ft. per knot
Wet runway and/or Low Minima	Increase distance by 15%
Manual Spoilers	See Abnormal section
Anti-skid Inoperative	See Abnormal section

F.A.R. DRY LANDING FIELD LENGTH**FEET****CFM56-7B27B1****FLAPS 40**

AIRCRAFT WEIGHT – POUNDS	AIRPORT PRESSURE ALTITUDE – FEET									
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	8,400
190,000	6,580	6,740	6,910	7,090	7,270	7,460	7,650	7,860	8,070	8,220
185,000	6,330	6,480	6,640	6,810	6,990	7,170	7,360	7,550	7,760	7,840
180,000	6,060	6,210	6,360	6,520	6,690	6,870	7,060	7,250	7,450	7,530
175,000	5,840	5,980	6,130	6,280	6,450	6,630	6,810	7,000	7,200	7,280
170,000	5,660	5,800	5,940	6,100	6,260	6,430	6,610	6,800	6,990	7,070
165,000	5,500	5,620	5,760	5,910	6,080	6,240	6,420	6,600	6,790	6,860
160,000	5,350	5,470	5,590	5,730	5,890	6,050	6,220	6,400	6,580	6,650
155,000	5,200	5,320	5,440	5,560	5,710	5,870	6,030	6,200	6,370	6,450
150,000	5,060	5,170	5,290	5,410	5,540	5,680	5,840	6,000	6,170	6,240
145,000	4,930	5,030	5,140	5,260	5,380	5,500	5,650	5,810	5,970	6,030
140,000	4,780	4,880	4,990	5,100	5,220	5,340	5,460	5,610	5,760	5,820
135,000	4,640	4,740	4,830	4,940	5,050	5,160	5,280	5,410	5,550	5,610
130,000	4,500	4,590	4,680	4,780	4,880	4,990	5,110	5,220	5,350	5,400
125,000	4,350	4,440	4,530	4,620	4,720	4,820	4,930	5,040	5,160	5,210
120,000	4,210	4,290	4,380	4,460	4,560	4,650	4,760	4,860	4,970	5,020
115,000	4,070	4,150	4,230	4,310	4,400	4,490	4,590	4,690	4,790	4,830
110,000	3,970	4,040	4,110	4,190	4,280	4,360	4,450	4,550	4,650	4,690
105,000	3,860	3,930	4,000	4,070	4,160	4,240	4,330	4,410	4,510	4,550
100,000	3,750	3,820	3,890	3,960	4,030	4,110	4,200	4,280	4,370	4,400
95,000	3,640	3,710	3,770	3,840	3,920	3,990	4,070	4,150	4,230	4,270
90,000	3,540	3,600	3,660	3,720	3,800	3,860	3,940	4,010	4,090	4,130

NOTE:

Actual Landing Distance is:

- 60 percent of the F.A.R. Landing Field Lengths above.
- The distance to a complete stop from 50 feet above the runway threshold at V_{Ref} .
- Based on Maximum Braking, Speed Brakes Extended and No Thrust Reverse.

CORRECTIONS:

CONDITION	CORRECTION
Headwind	- 20 ft. per knot
Tailwind	+ 220 ft. per knot
Wet runway and/or Low Minima	Increase distance by 15%
Manual Spoilers	See Abnormal section
Anti-skid Inoperative	See Abnormal section

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APPROACH AND LANDING CLIMB LIMITS

POUNDS

CFM56-7B27B1

APPROACH FLAPS 1
LANDING FLAPS 15

PACKS ON OR OFF, ANTI-ICE OFF

OAT °C	AIRPORT PRESSURE ALTITUDE – FEET									
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	8,400
50	170,250	163,750	157,500	OUTSIDE ENVIRONMENTAL ENVELOPE						
45	178,000	172,500	166,750	161,000	154,500					
40	185,750	180,000	174,000	168,250	162,500	157,250	150,000	143,250		
35	190,000	187,000	181,750	175,750	170,000	164,000	157,500	150,250	143,250	141,000
32	190,000	188,500	184,500	180,000	174,000	168,000	161,000	154,000	147,250	144,500
30	190,000	189,000	185,250	181,500	176,000	170,250	163,750	156,500	149,500	147,000
28	190,000	189,750	186,000	182,000	178,250	172,000	166,000	159,000	152,000	149,500
26	190,000	190,000	186,500	182,750	178,750	173,500	167,250	161,250	154,500	152,000
24	190,000	190,000	187,250	183,500	179,500	174,750	168,500	162,500	156,500	154,000
22	190,000	190,000	188,000	184,000	180,250	176,250	170,000	163,500	157,500	155,250
20	190,000	190,000	188,750	185,000	181,000	177,000	171,000	164,750	158,500	156,000
18	190,000	190,000	189,500	185,500	181,500	177,750	172,250	166,000	159,500	157,250
≤ 16	190,000	190,000	190,000	186,250	182,250	177,750	172,250	167,000	160,750	157,750

NOTES:

- AFM Maximum Structural Landing Weight Limit must still be observed.
- Reduce Gross Weight by 19,800 lbs. when operating in icing conditions during any part of the flight when the forecast landing temperature is below 10°C.

CORRECTIONS:

CONFIGURATION	CORRECTION – POUNDS
Engine Anti-Ice OFF	0
Engine Anti-Ice ON	-600
Engine & Wing Anti-Ice ON	- 3,600

BASIS:

The limit weights shown are the more restrictive of:

Approach

- One engine inoperative.
- Flaps at approach setting.
- Landing gear retracted.

Landing

- All engines operating.
- Flaps at landing setting.
- Landing gear extended.

APPROACH AND LANDING CLIMB LIMITS

POUNDS

CFM56-7B27B1

APPROACH FLAPS 15
LANDING FLAPS 30

PACKS ON, ANTI-ICE OFF

OAT – °C	AIRPORT PRESSURE ALTITUDE – FEET									
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	8,400
50	153,250	147,500	141,500	OUTSIDE ENVIRONMENTAL ENVELOPE						
45	160,500	155,500	150,250	144,500	138,500					
40	167,750	162,250	156,750	151,250	146,000	141,000	134,750	128,500		
35	175,000	169,750	163,750	158,500	153,000	147,500	141,500	135,000	128,750	126,500
32	179,750	173,750	168,000	162,000	156,750	151,000	145,000	138,500	132,000	129,500
30	182,750	176,250	170,500	164,250	158,500	153,000	147,000	140,500	134,250	132,000
28	183,000	178,750	172,500	166,000	160,500	154,500	149,000	142,500	136,500	134,000
26	183,000	179,000	174,500	168,000	162,000	156,000	150,250	144,500	138,500	136,000
24	183,250	179,000	174,750	169,500	163,250	157,000	151,250	145,500	140,250	138,000
22	183,500	179,250	175,000	169,500	164,500	158,250	152,500	146,500	141,000	139,000
20	183,500	179,250	175,000	169,750	164,500	159,500	153,500	147,750	142,000	140,000
18	183,500	179,500	175,250	169,750	164,500	159,500	154,500	148,500	143,000	140,500
≤ 16	183,750	179,500	175,250	170,000	164,750	159,500	154,500	149,500	144,000	142,000

NOTES:

- AFM Maximum Structural Landing Weight Limit must still be observed.
- Reduce Gross Weight by 19,300 lbs. when operating in icing conditions during any part of the flight when the forecast landing temperature is below 10°C.

CORRECTIONS:

CONFIGURATION	CORRECTION – POUNDS
Packs OFF	+3,000
Engine Anti-Ice OFF	0
Engine Anti-Ice ON	-600
Engine & Wing Anti-Ice ON	- 3,200

BASIS:

The limit weights shown are the more restrictive of:

Approach

- One engine inoperative.
- Flaps at approach setting.
- Landing gear retracted.

Landing

- All engines operating.
- Flaps at landing setting.
- Landing gear extended.

APPROACH AND LANDING CLIMB LIMITS

POUNDS

CFM56-7B27B1

**APPROACH FLAPS 15
LANDING FLAPS 40**

PACKS ON, ANTI-ICE OFF

OAT – °C	AIRPORT PRESSURE ALTITUDE – FEET									
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	8,400
50	147,750	142,000	136,500	OUTSIDE ENVIRONMENTAL ENVELOPE						
45	154,500	149,750	144,500	139,250	133,500					
40	161,500	156,250	151,000	146,000	141,000	136,250	130,000	124,000		
35	168,750	163,500	157,750	152,500	147,250	142,250	136,500	130,250	124,000	122,000
32	173,500	168,500	162,000	156,000	151,000	145,500	139,750	133,750	127,500	125,000
30	176,500	170,000	164,500	158,500	153,000	147,750	141,750	135,750	129,750	128,000
28	176,500	172,500	166,500	160,250	154,500	149,000	143,750	137,750	131,750	130,000
26	177,000	172,500	168,500	162,000	156,250	150,500	144,750	139,500	133,500	131,500
24	177,000	172,750	168,500	163,500	157,250	151,500	146,000	140,500	135,250	133,000
22	177,000	173,000	168,500	163,500	158,500	152,750	147,000	141,500	136,250	134,000
20	177,250	173,000	168,750	163,500	158,500	153,750	148,000	142,500	137,000	135,000
18	177,500	173,000	169,000	163,500	158,500	153,750	149,000	143,250	138,000	136,000
≤ 16	177,500	173,250	169,000	163,750	158,750	153,750	149,000	144,000	138,750	137,000

NOTES:

- AFM Maximum Structural Landing Weight Limit must still be observed.
- Reduce Gross Weight by 16,100 lbs. when operating in icing conditions during any part of the flight when the forecast landing temperature is below 10°C.

CORRECTIONS:

CONFIGURATION	CORRECTION – POUNDS
Packs OFF	+2,700
Engine Anti-Ice OFF	0
Engine Anti-Ice ON	-500
Engine & Wing Anti-Ice ON	- 3,100

BASIS:

The limit weights shown are the more restrictive of:

- | | |
|--|--|
| <u>Approach</u> <ul style="list-style-type: none"> • One engine inoperative. • Flaps at approach setting. • Landing gear retracted. | <u>Landing</u> <ul style="list-style-type: none"> • All engines operating. • Flaps at landing setting. • Landing gear extended. |
|--|--|

OPERATIONAL LANDING DISTANCES FEET

FLAPS 15

Landing Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).							
	DRY (6)					GOOD (5)		
	AB 1	AB 2	AB 3	Max AB	Max Manual	AB 3	Max AB	Max Manual
190,000	13,300	11,800	9,200	6,500	5,600	9,200	7,500	7,000
185,000	13,000	11,600	9,000	6,400	5,500	9,000	7,300	6,800
180,000	12,700	11,400	8,900	6,300	5,300	8,900	7,200	6,700
175,000	12,400	11,100	8,700	6,200	5,200	8,700	7,100	6,600
170,000	12,100	10,900	8,500	6,100	5,000	8,500	6,900	6,500
165,000	11,800	10,600	8,400	6,000	4,900	8,400	6,800	6,400
160,000	11,600	10,400	8,200	5,900	4,800	8,200	6,700	6,200
157,300	11,400	10,300	8,100	5,800	4,700	8,100	6,600	6,200
155,000	11,300	10,100	8,000	5,700	4,600	8,000	6,500	6,100
150,000	11,000	9,900	7,800	5,600	4,500	7,900	6,400	6,000
145,000	10,700	9,600	7,700	5,500	4,400	7,700	6,200	5,900
140,000	10,300	9,400	7,500	5,400	4,300	7,500	6,100	5,700
135,000	10,000	9,100	7,300	5,300	4,200	7,300	6,000	5,600
130,000	9,700	8,900	7,100	5,200	4,100	7,100	5,800	5,500
125,000	9,400	8,600	6,900	5,100	4,000	7,000	5,700	5,400
120,000	9,100	8,300	6,800	5,000	3,900	6,800	5,600	5,200
115,000	8,800	8,100	6,600	4,900	3,800	6,600	5,400	5,100
110,000	8,500	7,800	6,400	4,800	3,700	6,400	5,300	5,000
105,000	8,200	7,600	6,200	4,600	3,600	6,200	5,100	4,900
100,000	7,900	7,300	6,100	4,500	3,600	6,100	5,000	4,700

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Touchdown Speed = VREF15 - 5 •

Data is advisory and includes 15% safety margin and 1,500 ft. air distance from threshold to touchdown.

REFERENCE DISTANCES BASED UPON PRESSURE ALTITUDE OF 2,000 FEET AND ARE CONSERVATIVE FOR ALL LOWER ALTITUDES.

Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	DRY (6)					GOOD (5)		
0	-700	-600	-400	-200	-200	-400	-300	-300
2,000	0	0	0	0	0	0	0	0
4,000	700	600	400	200	200	400	300	300
6,000	1,300	1,100	800	500	400	800	600	600
8,000	2,000	1,700	1,200	700	600	1,200	900	800
10,000	2,900	2,500	1,800	1,000	900	1,800	1,300	1,200

CORRECTIONS

	DRY (6)					GOOD (5)		
PER 1 KT HEADWIND	-50	-50	-50	0	0	-50	0	0
PER 1 KT TAILWIND	150	150	100	50	50	100	100	100
PER 5 KTS ADD'L SPD	350	400	400	200	150	400	200	200
PER 10°C ABOVE ISA	300	250	200	100	100	200	150	150
PER 10°C BELOW ISA	-300	-250	-200	-100	-100	-200	-150	-150
PER 1% UP SLOPE	-300	-150	0	0	-50	0	-100	-100
PER 1% DOWN SLOPE	250	100	0	0	50	0	100	150
1 REVERSER INOP	800	200	0	0	100	0	300	300
2 REVERSERS INOP	1,100	200	0	0	200	0	600	600
MANUAL SPOILERS	200	200	200	200	200	200	200	200

Note: Do not operate when Braking Action is Nil.

OPERATIONAL LANDING DISTANCES FEET

FLAPS 15

Landing Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).					
	MEDIUM (3)			POOR (1)		
	AB 3	Max AB	Max Manual	AB 3	Max AB	Max Manual
190,000	10,400	9,900	9,700	13,100	13,000	13,000
185,000	10,100	9,700	9,500	12,800	12,700	12,700
180,000	9,900	9,500	9,300	12,500	12,400	12,400
175,000	9,700	9,300	9,100	12,200	12,100	12,100
170,000	9,500	9,100	9,000	11,900	11,800	11,800
165,000	9,300	8,900	8,800	11,600	11,500	11,500
160,000	9,100	8,700	8,600	11,300	11,200	11,200
157,300	9,000	8,600	8,500	11,200	11,100	11,100
155,000	8,900	8,500	8,400	11,000	11,000	10,900
150,000	8,700	8,300	8,200	10,800	10,700	10,700
145,000	8,500	8,100	8,000	10,500	10,400	10,400
140,000	8,300	7,900	7,800	10,200	10,100	10,100
135,000	8,100	7,700	7,600	9,900	9,800	9,800
130,000	7,800	7,500	7,400	9,600	9,500	9,500
125,000	7,600	7,300	7,200	9,300	9,200	9,200
120,000	7,400	7,100	7,000	9,000	8,900	8,900
115,000	7,200	6,900	6,800	8,700	8,700	8,600
110,000	7,000	6,700	6,600	8,400	8,400	8,400
105,000	6,800	6,400	6,400	8,100	8,100	8,100
100,000	6,600	6,200	6,200	7,800	7,800	7,800

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Touchdown Speed = VREF15 - 5 •

Data is advisory and includes 15% safety margin and 1,500 ft. air distance from threshold to touchdown.

REFERENCE DISTANCES BASED UPON PRESSURE ALTITUDE OF 2,000 FEET AND ARE CONSERVATIVE FOR ALL LOWER ALTITUDES.



Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	MEDIUM (3)			POOR (1)		
0	-500	-500	-500	-700	-700	-700
2,000	0	0	0	0	0	0
4,000	500	500	500	700	700	700
6,000	1,000	900	900	1,400	1,300	1,300
8,000	1,400	1,400	1,400	2,100	2,000	2,000
10,000	2,100	2,100	2,000	3,100	3,000	3,000

CORRECTIONS	MEDIUM (3)			POOR (1)		
PER 1 KT HEADWIND	-50	-50	-50	-50	-50	-50
PER 1 KT TAILWIND	150	150	150	200	200	200
PER 5 KTS ADD'L SPD	400	300	250	350	300	300
PER 10°C ABOVE ISA	200	200	200	300	300	300
PER 10°C BELOW ISA	-250	-200	-200	-300	-300	-300
PER 1% UP SLOPE	-150	-250	-250	-500	-550	-550
PER 1% DOWN SLOPE	250	300	350	800	850	850
1 REVERSER INOP	500	700	700	1,600	1,600	1,600
2 REVERSERS INOP	1,500	1,700	1,700	4,200	4,200	4,200
MANUAL SPOILERS	200	200	200	200	200	200

Note: Do not operate when Braking Action is Nil.

OPERATIONAL LANDING DISTANCES FEET

FLAPS 30

Landing Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).							
	DRY (6)					GOOD (5)		
	AB 1	AB 2	AB 3	Max AB	Max Manual	AB 3	Max AB	Max Manual
190,000	12,200	10,900	8,600	6,100	5,200	8,600	7,100	6,600
185,000	11,900	10,700	8,400	6,000	5,100	8,400	6,900	6,500
180,000	11,600	10,500	8,200	5,900	5,000	8,300	6,800	6,400
175,000	11,400	10,300	8,100	5,800	4,900	8,100	6,700	6,300
170,000	11,100	10,000	7,900	5,700	4,800	7,900	6,600	6,200
165,000	10,900	9,800	7,800	5,600	4,600	7,800	6,500	6,100
160,000	10,600	9,600	7,600	5,500	4,500	7,600	6,300	5,900
157,300	10,500	9,500	7,500	5,500	4,500	7,600	6,300	5,900
155,000	10,300	9,400	7,500	5,400	4,400	7,500	6,200	5,800
150,000	10,100	9,100	7,300	5,300	4,300	7,300	6,100	5,700
145,000	9,800	8,900	7,100	5,200	4,200	7,100	6,000	5,600
140,000	9,500	8,700	7,000	5,100	4,200	7,000	5,800	5,500
135,000	9,300	8,500	6,800	5,000	4,100	6,800	5,700	5,400
130,000	9,000	8,200	6,600	4,900	4,000	6,600	5,600	5,200
125,000	8,700	8,000	6,500	4,800	3,900	6,500	5,500	5,100
120,000	8,500	7,800	6,300	4,700	3,800	6,300	5,300	5,000
115,000	8,200	7,500	6,100	4,600	3,700	6,100	5,200	4,900
110,000	7,900	7,300	6,000	4,500	3,600	6,000	5,100	4,800
105,000	7,600	7,100	5,800	4,400	3,600	5,800	4,900	4,700
100,000	7,400	6,800	5,600	4,300	3,500	5,600	4,800	4,600

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Touchdown Speed = VREF30 - 5 •

Data is advisory and includes 15% safety margin and 1,500 ft. air distance from threshold to touchdown.

REFERENCE DISTANCES BASED UPON PRESSURE ALTITUDE OF 2,000 FEET AND ARE CONSERVATIVE FOR ALL LOWER ALTITUDES.

Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	DRY (6)					GOOD (5)		
0	-600	-500	-300	-200	-200	-300	-300	-300
2,000	0	0	0	0	0	0	0	0
4,000	600	500	300	200	200	300	300	300
6,000	1,200	1,000	700	400	300	700	600	500
8,000	1,800	1,500	1,000	600	500	1,000	800	800
10,000	2,600	2,100	1,500	900	700	1,500	1,200	1,100

CORRECTIONS

	DRY (6)					GOOD (5)		
PER 1 KT HEADWIND	-50	-50	-50	0	0	-50	0	0
PER 1 KT TAILWIND	150	150	100	50	50	100	100	100
PER 5 KTS ADD'L SPD	300	350	350	200	150	350	200	200
PER 10°C ABOVE ISA	250	250	200	100	100	200	150	150
PER 10°C BELOW ISA	-250	-250	-200	-100	-100	-200	-150	-150
PER 1% UP SLOPE	-300	-150	0	0	-50	0	-100	-100
PER 1% DOWN SLOPE	250	100	0	0	50	0	100	100
1 REVERSER INOP	600	200	0	0	100	0	200	200
2 REVERSERS INOP	1,000	200	0	0	100	0	500	500
MANUAL SPOILERS	200	200	200	200	200	200	200	200

Note: Do not operate when Braking Action is Nil.

OPERATIONAL LANDING DISTANCES FEET

FLAPS 30

Landing Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).					
	MEDIUM (3)			POOR (1)		
	AB 3	Max AB	Max Manual	AB 3	Max AB	Max Manual
190,000	9,700	9,300	9,100	12,100	12,100	12,000
185,000	9,500	9,100	8,900	11,900	11,800	11,700
180,000	9,300	9,000	8,700	11,600	11,500	11,500
175,000	9,100	8,800	8,600	11,400	11,300	11,200
170,000	8,900	8,600	8,400	11,100	11,000	10,900
165,000	8,700	8,400	8,200	10,800	10,700	10,700
160,000	8,500	8,200	8,000	10,600	10,500	10,400
157,300	8,400	8,100	7,900	10,400	10,300	10,300
155,000	8,300	8,000	7,800	10,300	10,200	10,200
150,000	8,100	7,800	7,700	10,000	9,900	9,900
145,000	8,000	7,700	7,500	9,800	9,700	9,600
140,000	7,800	7,500	7,300	9,500	9,400	9,400
135,000	7,600	7,300	7,100	9,200	9,200	9,100
130,000	7,400	7,100	6,900	9,000	8,900	8,900
125,000	7,200	6,900	6,700	8,700	8,700	8,600
120,000	7,000	6,700	6,600	8,400	8,400	8,300
115,000	6,800	6,500	6,400	8,200	8,100	8,100
110,000	6,600	6,300	6,200	7,900	7,900	7,800
105,000	6,400	6,100	6,000	7,700	7,600	7,600
100,000	6,200	5,900	5,800	7,400	7,400	7,300

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Touchdown Speed = VREF30 - 5 •

Data is advisory and includes 15% safety margin and 1,500 ft. air distance from threshold to touchdown.

REFERENCE DISTANCES BASED UPON PRESSURE ALTITUDE OF 2,000 FEET AND ARE CONSERVATIVE FOR ALL LOWER ALTITUDES.



Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	MEDIUM (3)			POOR (1)		
0	-400	-400	-400	-600	-600	-600
2,000	0	0	0	0	0	0
4,000	400	400	400	600	600	600
6,000	900	900	800	1,200	1,200	1,200
8,000	1,300	1,300	1,200	1,900	1,900	1,800
10,000	1,900	1,900	1,800	2,800	2,800	2,600

CORRECTIONS	MEDIUM (3)			POOR (1)		
PER 1 KT HEADWIND	-50	-50	-50	-50	-50	-50
PER 1 KT TAILWIND	150	150	150	200	200	200
PER 5 KTS ADD'L SPD	350	300	250	300	300	300
PER 10°C ABOVE ISA	200	200	200	250	250	250
PER 10°C BELOW ISA	-200	-200	-200	-300	-300	-300
PER 1% UP SLOPE	-200	-250	-250	-500	-500	-500
PER 1% DOWN SLOPE	250	300	300	750	800	750
1 REVERSER INOP	500	600	600	1,400	1,300	1,300
2 REVERSERS INOP	1,300	1,500	1,500	3,500	3,500	3,500
MANUAL SPOILERS	200	200	200	200	200	200

Note: Do not operate when Braking Action is Nil.

OPERATIONAL LANDING DISTANCES FEET

FLAPS 40

Landing Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).							
	DRY (6)					GOOD (5)		
	AB 1	AB 2	AB 3	Max AB	Max Manual	AB 3	Max AB	Max Manual
190,000	11,800	10,600	8,300	5,900	5,000	8,400	7,000	6,600
185,000	11,500	10,300	8,100	5,800	4,900	8,200	6,900	6,400
180,000	11,200	10,100	8,000	5,700	4,800	8,000	6,700	6,300
175,000	11,000	9,800	7,800	5,600	4,700	7,800	6,600	6,200
170,000	10,700	9,600	7,600	5,500	4,600	7,600	6,400	6,000
165,000	10,400	9,400	7,400	5,400	4,500	7,400	6,300	5,900
160,000	10,100	9,100	7,200	5,300	4,400	7,200	6,200	5,800
157,300	10,000	9,000	7,100	5,200	4,300	7,100	6,100	5,700
155,000	9,800	8,900	7,000	5,100	4,300	7,100	6,000	5,700
150,000	9,600	8,600	6,900	5,100	4,200	6,900	5,900	5,500
145,000	9,300	8,400	6,700	5,000	4,100	6,800	5,800	5,400
140,000	9,100	8,200	6,600	4,900	4,000	6,600	5,700	5,300
135,000	8,800	8,000	6,400	4,800	3,900	6,400	5,500	5,200
130,000	8,600	7,800	6,300	4,700	3,800	6,300	5,400	5,100
125,000	8,300	7,500	6,100	4,600	3,800	6,100	5,300	5,000
120,000	8,100	7,300	6,000	4,500	3,700	6,000	5,200	4,800
115,000	7,800	7,100	5,800	4,400	3,600	5,800	5,100	4,700
110,000	7,500	6,900	5,600	4,300	3,500	5,700	4,900	4,600
105,000	7,300	6,700	5,500	4,200	3,400	5,500	4,800	4,500
100,000	7,000	6,500	5,300	4,100	3,300	5,400	4,700	4,400

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Touchdown Speed = VREF40 - 5 •

Data is advisory and includes 15% safety margin and 1,500 ft. air distance from threshold to touchdown.

REFERENCE DISTANCES BASED UPON PRESSURE ALTITUDE OF 2,000 FEET AND ARE CONSERVATIVE FOR ALL LOWER ALTITUDES.

Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	DRY (6)					GOOD (5)		
0	-600	-500	-400	-200	-200	-400	-300	-300
2,000	0	0	0	0	0	0	0	0
4,000	600	500	400	200	200	400	300	300
6,000	1,200	1,000	700	400	300	700	600	600
8,000	1,700	1,500	1,100	600	500	1,100	900	800
10,000	2,500	2,200	1,600	900	700	1,600	1,300	1,200

CORRECTIONS

	DRY (6)					GOOD (5)		
PER 1 KT HEADWIND	-50	-50	-50	0	0	-50	0	0
PER 1 KT TAILWIND	150	100	100	50	50	100	100	50
PER 5 KTS ADD'L SPD	350	350	350	200	150	350	200	200
PER 10°C ABOVE ISA	300	250	200	100	100	200	150	150
PER 10°C BELOW ISA	-300	-250	-200	-100	-100	-200	-150	-150
PER 1% UP SLOPE	-250	-150	0	0	-50	0	-100	-100
PER 1% DOWN SLOPE	200	50	0	0	50	50	100	100
1 REVERSER INOP	500	100	0	0	100	0	200	200
2 REVERSERS INOP	800	100	0	0	100	0	500	400
MANUAL SPOILERS	200	200	200	200	200	200	200	200

Note: Do not operate when Braking Action is Nil.

OPERATIONAL LANDING DISTANCES FEET

FLAPS 40

Landing Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).					
	MEDIUM (3)			POOR (1)		
	AB 3	Max AB	Max Manual	AB 3	Max AB	Max Manual
190,000	9,500	9,200	9,000	12,000	11,800	11,800
185,000	9,200	9,000	8,800	11,700	11,600	11,500
180,000	9,000	8,800	8,600	11,400	11,300	11,200
175,000	8,800	8,600	8,400	11,100	11,000	10,900
170,000	8,600	8,400	8,200	10,800	10,700	10,700
165,000	8,400	8,100	8,000	10,500	10,400	10,400
160,000	8,100	7,900	7,800	10,200	10,100	10,100
157,300	8,000	7,800	7,700	10,000	10,000	9,900
155,000	7,900	7,700	7,600	9,900	9,800	9,800
150,000	7,700	7,500	7,400	9,600	9,600	9,500
145,000	7,600	7,400	7,200	9,400	9,300	9,300
140,000	7,400	7,200	7,000	9,100	9,100	9,000
135,000	7,200	7,000	6,900	8,900	8,800	8,800
130,000	7,000	6,800	6,700	8,600	8,600	8,500
125,000	6,800	6,600	6,500	8,400	8,300	8,300
120,000	6,600	6,400	6,300	8,100	8,100	8,000
115,000	6,500	6,200	6,100	7,800	7,800	7,800
110,000	6,300	6,100	6,000	7,600	7,600	7,500
105,000	6,100	5,900	5,800	7,300	7,300	7,300
100,000	5,900	5,700	5,600	7,100	7,100	7,000

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Touchdown Speed = VREF40 - 5 •

Data is advisory and includes 15% safety margin and 1,500 ft. air distance from threshold to touchdown.

REFERENCE DISTANCES BASED UPON PRESSURE ALTITUDE OF 2,000 FEET AND ARE CONSERVATIVE FOR ALL LOWER ALTITUDES.



Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	MEDIUM (3)			POOR (1)		
0	-400	-400	-400	-600	-600	-600
2,000	0	0	0	0	0	0
4,000	400	400	400	600	600	600
6,000	900	900	800	1,200	1,200	1,200
8,000	1,300	1,300	1,200	1,900	1,900	1,800
10,000	1,900	1,900	1,800	2,800	2,800	2,700

CORRECTIONS

	MEDIUM (3)			POOR (1)		
PER 1 KT HEADWIND	-50	-50	-50	-50	-50	-50
PER 1 KT TAILWIND	150	150	100	200	200	200
PER 5 KTS ADD'L SPD	350	300	250	300	300	300
PER 10°C ABOVE ISA	200	200	200	300	300	300
PER 10°C BELOW ISA	-250	-200	-200	-300	-300	-300
PER 1% UP SLOPE	-150	-250	-250	-500	-500	-500
PER 1% DOWN SLOPE	250	300	300	750	750	750
1 REVERSER INOP	500	600	600	1,300	1,300	1,200
2 REVERSERS INOP	1,300	1,300	1,300	3,200	3,200	3,200
MANUAL SPOILERS	200	200	200	200	200	200

Note: Do not operate when Braking Action is Nil.

*** End of Section ***

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DEFINITIONS AND ASSUMPTIONS

GROSS LEVEL OFF ALTITUDE	Altitude at which the aircraft is expected to level off after the loss of one engine. No conservatism is built into this value. For use during flight, not for flight planning.
LONG RANGE CRUISE	The speed of the aircraft that will result in 99% of the maximum range of the aircraft in no wind conditions for a given weight and altitude.
MAXIMUM CONTINUOUS THRUST (MCT)	The maximum thrust level for which the engine is rated with no time constraint.
SPECIFIC AIR RANGE (SAR)	The gas mileage range an aircraft can fly per 1,000 lbs of fuel for a given weight, altitude, Mach number, and temperature. The SAR changes as the weight of the aircraft changes, all other parameters remaining constant. Fuel burn required for a given flight segment is the segment length divided by the average SAR for the leg.
STATIC AIR TEMPERATURE (SAT)	The static air temperature outside of the aircraft. Also referred to as the Outside Air Temperature or OAT.
TOTAL AIR TEMPERATURE (TAT)	The sum of both the ambient air temperature plus the total increase in temperature due to compression heating.

MEL RELATED PERFORMANCE ABBREVIATIONS DISPLAYED ON WDR

ASI	AWABS has automatically corrected the allowable weights and V1 speeds due to a completely inoperative anti-skid braking system.
GRD	AWABS has automatically corrected the allowable weights and V1 speeds due to gear down dispatch. Used when an MEL item requires delayed gear retraction or gear down flight.

THRUST SETTINGS – ALL ENGINE

TAKEOFF %N1

TO
CFM56-7B27B1

BASED ON ENGINE BLEEDS FOR PACKS ON
ENGINE AND WING ANTI-ICE ON OR OFF

OAT °C	AIRPORT PRESSURE ALTITUDE - FEET											
	-1,000	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
60	96.4	96.9	97.2	97.6	97.7	97.7	97.7	97.3	96.8	96.4	97.1	97.8
55	97.2	97.4	97.7	98.0	98.3	98.5	98.5	98.2	97.8	97.3	97.2	97.2
50	98.5	98.7	98.6	98.5	98.9	99.2	99.2	99.1	98.8	98.4	98.4	98.3
45	99.5	100.1	99.9	99.7	99.8	100.0	100.0	99.9	99.8	99.5	99.5	99.5
40	100.2	100.8	100.8	100.7	100.7	100.7	100.6	100.7	100.7	100.6	100.5	100.5
35	100.9	101.9	101.9	101.7	101.7	101.6	101.6	101.6	101.6	101.6	101.6	101.5
30	100.9	102.6	102.5	102.6	102.4	102.4	102.4	102.3	102.3	102.3	102.2	102.5
25	100.2	102.0	102.7	102.7	102.6	102.6	102.6	102.5	102.5	102.5	102.5	102.5
20	99.5	101.4	102.7	102.7	102.6	102.6	102.6	102.6	102.6	102.5	102.5	102.5
15	98.8	100.8	102.7	102.7	102.6	102.6	102.6	102.6	102.5	102.5	102.5	102.5
10	98.0	100.1	102.2	102.5	102.6	102.6	102.6	102.6	102.6	102.5	102.5	102.5
5	97.3	99.3	101.5	101.7	102.0	102.3	102.5	102.6	102.5	102.5	102.5	102.5
0	96.5	98.6	100.7	101.0	101.2	101.5	101.8	102.1	102.4	102.5	102.5	102.5
-5	95.7	97.8	99.9	100.2	100.4	100.7	101.0	101.3	101.6	101.9	102.2	102.5
-10	94.9	97.1	99.2	99.4	99.7	99.9	100.2	100.5	100.8	101.1	101.4	101.7
-15	94.1	96.3	98.4	98.6	98.9	99.1	99.4	99.7	100.0	100.3	100.6	100.8
-20	93.3	95.5	97.6	97.8	98.1	98.3	98.6	98.9	99.2	99.4	99.7	100.0
-25	92.5	94.7	96.8	97.0	97.3	97.5	97.8	98.1	98.3	98.6	98.9	99.2
-30	91.6	93.9	95.9	96.2	96.4	96.7	96.9	97.2	97.5	97.8	98.1	98.4
-35	90.8	93.1	95.1	95.4	95.6	95.8	96.1	96.4	96.7	96.9	97.2	97.5
-40	89.9	92.3	94.3	94.5	94.8	95.0	95.3	95.5	95.8	96.1	96.4	96.6
-45	89.1	91.4	93.4	93.7	93.9	94.1	94.4	94.7	95.0	95.2	95.5	95.8
-50	88.2	90.6	92.6	92.8	93.0	93.3	93.5	93.8	94.1	94.3	94.6	94.9

Engine Bleed Adjustment

Packs OFF	+0.8	+0.8	+0.9	+0.9	+0.9	+1.0	+1.0	+1.0	+1.0	+1.0	+1.0	+1.0
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THRUST SETTINGS – ALL ENGINE

TAKEOFF %N1

TO1

TO1 (26K) THRUST
 BASED ON ENGINE BLEEDS FOR PACKS ON
 ENGINE AND WING ANTI-ICE ON OR OFF

CFM56-7B27B1

OAT °C	AIRPORT PRESSURE ALTITUDE - FEET											
	-1,000	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
60	95.4	95.8	95.9	96.0	96.1	96.2	96.3	96.2	95.9	95.8	95.7	95.7
55	96.0	96.5	96.6	96.7	96.8	96.9	97.1	96.9	96.6	96.3	95.7	95.0
50	96.6	97.1	97.3	97.4	97.6	97.7	97.8	97.7	97.4	97.1	96.6	96.1
45	97.4	97.8	98.0	98.1	98.3	98.4	98.5	98.4	98.1	97.8	97.5	97.1
40	98.1	98.6	98.7	98.8	98.9	99.0	99.2	99.1	98.8	98.5	98.4	98.1
35	98.7	99.4	99.5	99.6	99.7	99.8	99.9	99.8	99.5	99.2	99.1	99.0
30	98.8	100.3	100.3	100.4	100.4	100.5	100.5	100.4	100.3	100.0	99.9	99.9
25	98.1	99.5	100.1	100.7	100.8	100.7	100.7	100.7	100.7	100.6	100.6	100.7
20	97.3	98.8	99.3	99.9	100.2	100.5	100.8	100.8	100.9	100.8	100.8	100.8
15	96.5	98.0	98.6	99.2	99.5	99.8	100.1	100.5	100.9	101.1	101.1	101.1
10	95.8	97.2	97.8	98.4	98.7	99.0	99.4	99.7	100.1	100.5	101.0	101.5
5	95.0	96.4	97.0	97.6	98.0	98.3	98.6	99.0	99.4	99.8	100.3	100.7
0	94.2	95.6	96.3	96.9	97.2	97.5	97.9	98.2	98.6	99.0	99.5	100.0
-5	93.4	94.8	95.5	96.1	96.4	96.7	97.1	97.5	97.9	98.3	98.7	99.2
-10	92.6	94.0	94.7	95.3	95.6	96.0	96.3	96.7	97.1	97.5	98.0	98.4
-15	91.7	93.2	93.9	94.5	94.8	95.2	95.6	95.9	96.3	96.7	97.2	97.6
-20	90.9	92.4	93.0	93.7	94.0	94.4	94.8	95.2	95.6	95.9	96.4	96.8
-25	90.1	91.6	92.2	92.9	93.2	93.6	94.0	94.4	94.8	95.2	95.6	96.0
-30	89.2	90.7	91.4	92.0	92.4	92.8	93.2	93.6	94.0	94.3	94.8	95.2
-35	88.4	89.9	90.5	91.2	91.6	91.9	92.4	92.8	93.1	93.5	94.0	94.4
-40	87.5	89.0	89.7	90.3	90.7	91.1	91.5	91.9	92.3	92.7	93.1	93.6
-45	86.6	88.2	88.8	89.5	89.9	90.3	90.7	91.1	91.5	91.9	92.3	92.7
-50	85.7	87.3	87.9	88.6	89.0	89.4	89.9	90.3	90.6	91.0	91.5	91.9

Engine Bleed Adjustments

Packs OFF	+0.8	+0.8	+0.9	+0.9	+0.9	+1.0	+1.0	+1.0	+1.0	+1.0	+1.0	+1.0
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THRUST SETTINGS – ALL ENGINE

TAKEOFF %N1

TO2
CFM56-7B27B1

TO2 (24K) THRUST
 BASED ON ENGINE BLEEDS FOR PACKS ON
 ENGINE AND WING ANTI-ICE ON OR OFF

OAT °C	AIRPORT PRESSURE ALTITUDE - FEET											
	-1,000	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
60	90.8	91.2	91.2	91.1	91.1	91.0	91.1	91.2	91.0	91.2	91.3	91.4
55	91.6	92.0	92.0	92.0	91.9	91.9	91.9	92.0	91.9	91.7	91.3	90.8
50	92.4	92.8	92.8	92.8	92.7	92.7	92.7	92.7	92.6	92.6	92.2	91.8
45	93.2	93.6	93.6	93.6	93.6	93.5	93.5	93.5	93.4	93.3	93.1	92.8
40	94.0	94.4	94.4	94.4	94.3	94.3	94.2	94.2	94.1	94.1	94.0	93.8
35	94.8	95.2	95.2	95.2	95.1	95.1	95.0	95.0	94.9	94.8	94.8	94.7
30	95.0	96.1	96.0	96.0	96.0	95.9	95.8	95.8	95.7	95.7	95.6	95.6
25	94.3	95.4	95.9	96.4	96.7	96.7	96.6	96.6	96.5	96.4	96.4	96.3
20	93.5	94.6	95.1	95.7	96.3	96.9	97.6	97.5	97.5	97.4	97.3	97.2
15	92.7	93.8	94.3	94.9	95.5	96.1	96.8	97.5	98.2	98.6	98.6	98.5
10	92.0	93.0	93.6	94.1	94.7	95.3	96.0	96.7	97.5	98.2	99.1	100.0
5	91.2	92.2	92.8	93.3	93.9	94.5	95.2	95.9	96.7	97.4	98.4	99.3
0	90.4	91.4	92.0	92.5	93.1	93.7	94.4	95.1	95.9	96.7	97.6	98.5
-5	89.6	90.6	91.2	91.7	92.3	92.9	93.6	94.3	95.1	95.9	96.8	97.7
-10	88.8	89.8	90.4	90.9	91.5	92.1	92.8	93.5	94.3	95.1	96.1	97.0
-15	88.0	89.0	89.5	90.0	90.6	91.3	92.0	92.7	93.5	94.3	95.3	96.2
-20	87.1	88.2	88.7	89.2	89.8	90.5	91.2	91.9	92.6	93.5	94.5	95.4
-25	86.3	87.3	87.9	88.4	89.0	89.6	90.3	91.0	91.8	92.6	93.7	94.6
-30	85.5	86.5	87.0	87.5	88.1	88.8	89.5	90.2	91.0	91.8	92.9	93.8
-35	84.6	85.6	86.2	86.6	87.3	87.9	88.6	89.3	90.1	91.0	92.1	93.0
-40	83.8	84.8	85.3	85.8	86.4	87.0	87.8	88.5	89.3	90.1	91.2	92.2
-45	82.9	83.9	84.4	84.9	85.5	86.2	86.9	87.6	88.4	89.3	90.4	91.4
-50	82.0	83.0	83.5	84.0	84.6	85.3	86.0	86.7	87.5	88.4	89.5	90.5

Engine Bleed Adjustments

Packs OFF	+0.7	+0.7	+0.7	+0.7	+0.7	+0.8	+0.8	+0.8	+0.8	+0.8	+0.9	+1.0
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THRUST SETTINGS – ALL ENGINE

CLIMB %N1

CLB

NORMAL BLEED - PACKS ON OR OFF / ANTI-ICE OFF

CFM56-7B27B1

TAT (°C)	PRESSURE ALTITUDE (FEET) / SPEED (KIAS/MACH)									
	0	5,000	10,000	15,000	20,000	25,000	30,000	35,000	37,000	41,000
	280	280	280	280	280	280	280	0.78	0.78	0.78
60	90.2	90.5	90.4	90.6	90.4	92.1	93.8	95.1	95.2	93.5
55	91.0	91.2	91.3	91.4	90.8	91.5	93.1	94.4	94.5	92.8
50	91.7	92.0	92.1	92.2	91.7	91.5	92.4	93.7	93.8	92.1
45	92.4	92.6	92.8	93.0	92.6	92.4	92.4	93.0	93.1	91.4
40	93.1	93.3	93.6	93.8	93.4	93.2	93.2	92.3	92.4	90.7
35	93.6	94.0	94.3	94.5	94.3	94.0	94.0	93.0	92.4	90.8
30	92.9	94.8	95.0	95.2	95.1	94.8	94.7	93.9	93.3	91.8
25	92.2	94.8	95.7	95.9	95.9	95.5	95.4	94.7	94.1	92.8
20	91.4	94.0	96.5	96.7	96.6	96.2	96.1	95.4	94.9	93.7
15	90.6	93.2	95.9	97.5	97.4	96.9	96.7	96.2	95.7	94.6
10	89.9	92.5	95.1	97.8	98.3	97.7	97.4	96.9	96.5	95.6
5	89.1	91.7	94.3	97.0	99.2	98.6	98.1	97.7	97.3	96.5
0	88.3	90.9	93.5	96.2	98.6	99.6	99.1	98.5	98.2	97.5
-5	87.6	90.1	92.7	95.4	97.8	99.6	100.0	99.2	99.0	98.4
-10	86.8	89.3	91.9	94.6	97.1	98.8	100.3	100.2	99.8	99.4
-15	86.0	88.5	91.0	93.8	96.3	98.0	99.6	101.1	100.8	100.4
-20	85.2	87.6	90.2	93.0	95.5	97.2	98.7	100.8	101.3	101.0
-25	84.3	86.8	89.4	92.2	94.7	96.4	97.9	100.0	100.5	100.1
-30	83.5	86.0	88.5	91.3	93.9	95.6	97.1	99.7	99.6	99.3
-35	82.7	85.1	87.7	90.5	93.1	94.8	96.3	98.3	98.8	98.4
-40	81.8	84.3	86.8	89.6	92.3	93.9	95.4	97.4	97.9	97.6

Engine Bleed Adjustments

	PRESSURE ALTITUDE (1000 FT)					
	0	10	20	30	35	41
Engine Anti- Ice ON	-0.6	-0.8	-0.9	-0.9	-0.8	-0.8
Engine and Wing Anti- Ice (Dual bleed sources)	-1.8	-2.1	-2.5	-2.7	-3.0	-3.0

THRUST SETTINGS – ALL ENGINE**CRUISE %N1****CRZ****CFM56-7B27B1**

TAT - °C	PRESSURE ALTITUDE – 1,000 FEET								
	25	27	29	31	33	35	37	39	41
15	91.4	91.0	90.8						
10	92.4	92.0	91.8						
5	93.2	92.8	92.6	92.0	91.0	90.3			
0	93.1	93.7	93.5	92.9	91.9	91.1	91.0	91.8	91.7
-5	92.2	92.9	93.7	93.8	92.8	92.0	91.9	92.6	92.6
-10	91.3	92.1	92.8	93.8	93.7	92.9	92.7	93.3	93.4
-15	90.5	91.2	91.9	92.9	94.2	93.6	93.5	93.9	94.0
-20	89.6	90.3	91.1	92.1	93.3	94.3	94.2	94.5	94.5
-25	88.7	89.4	90.2	91.2	92.4	93.5	94.1	93.9	93.6
-30	87.8	88.5	89.3	90.3	91.5	92.6	93.2	93.0	92.8
-35	87.0	87.6	88.4	89.4	90.6	91.7	92.3	92.1	91.9
-40	86.0	86.7	87.5	88.5	89.6	90.8	91.4	91.2	91.0
-45	85.1	85.8	86.5	87.6	88.7	89.9	90.5	90.3	90.1
-50	84.2	84.9	85.6	86.7	87.7	89.0	89.6	89.4	89.2
-55				85.8	86.7	88.1	88.7	88.5	88.2
-60				84.8	85.7	87.1	87.7	87.5	87.3
-65							86.8	86.6	86.3

Engine Bleed Adjustments

BLEED CONFIGURATION	PRESSURE ALTITUDE - 1,000 FEET								
	25	27	29	31	33	35	37	39	41
ENGINE ANTI-ICE ON	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.4	-1.4	-1.4
ENGINE & WING ANTI-ICE ON	-3.5	-3.5	-3.5	-3.8	-3.8	-3.8	-3.8	-3.8	-3.8

THRUST SETTINGS – ALL ENGINE

GO-AROUND %N₁

NORMAL BLEED - PACKS ON / ANTI-ICE OFF

CFM56-7B27B1

AIRPORT OAT -°C	TAT - °C	AIRPORT PRESSURE ALTITUDE - FEET								
		-2,000	0	1,000	2,000	3,000	4,000	6,000	8,000	10,000
57	60	95.0	96.2	96.8						
52	55	95.9	96.7	96.6	96.8	97.5				
47	50	96.6	97.6	97.8	97.8	97.7	97.5	98.8		
42	45	97.4	98.4	98.5	98.6	98.7	98.8	98.5	99.0	
37	40	98.0	99.1	99.2	99.3	99.4	99.5	99.5	98.9	99.1
32	35	98.1	99.9	100.0	100.1	100.1	100.3	100.2	99.6	99.5
27	30	97.3	99.8	100.4	100.7	100.7	100.7	100.7	100.4	100.3
22	25	96.6	99.1	99.7	100.2	100.6	100.9	100.9	100.9	100.8
17	20	95.8	98.3	98.9	99.5	99.8	100.2	100.9	101.1	101.0
12	15	95.0	97.5	98.1	98.7	99.1	99.4	100.1	100.9	101.2
7	10	94.2	96.8	97.4	98.0	98.3	98.7	99.4	100.2	100.9
2	5	93.4	96.0	96.6	97.2	97.6	97.9	98.7	99.4	100.2
-3	0	92.6	95.2	95.8	96.4	96.8	97.2	97.9	98.7	99.4
-8	-5	91.8	94.4	95.0	95.6	96.0	96.4	97.2	97.9	98.6
-13	-10	91.0	93.6	94.2	94.8	95.2	95.6	96.4	97.1	97.9
-17	-15	90.2	92.8	93.4	94.0	94.4	94.8	95.6	96.4	97.1
-22	-20	89.3	92.0	92.6	93.2	93.6	94.0	94.8	95.6	96.3
-27	-25	88.5	91.1	91.8	92.4	92.8	93.2	94.0	94.8	95.5
-32	-30	87.6	90.3	90.9	91.6	92.0	92.4	93.3	94.0	94.7
-37	-35	86.8	89.4	90.1	90.7	91.1	91.6	92.4	93.2	93.9
-42	-40	85.9	88.6	89.2	89.9	90.3	90.7	91.6	92.4	93.0
-47	-45	85.0	87.7	88.4	89.0	89.4	89.9	90.8	91.5	92.2
-52	-50	84.1	86.8	87.5	88.2	88.6	89.0	90.0	90.7	91.4

Engine Bleed Adjustments

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE - FEET									
	-2,000	0	1,000	2,000	3,000	4,000	6,000	8,000	10,000	
Packs OFF	+0.7	+0.8	+0.8	+0.8	+0.8	+0.9	0.9	+0.9	+0.9	+0.9
Packs HIGH	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1

NOTE: N₁ values shown in area outside environmental envelope are for interpolation purposes only.

ONE ENGINE INOPERATIVE

MAXIMUM CONTINUOUS THRUST N₁

CFM56-7B27B1

BASED ON 0.79 MACH
PACKS HIGH, ANTI-ICE OFF

TAT °C	PRESSURE ALTITUDE – 1,000 FEET								
	25	27	29	31	33	35	37	39	41
20	96.8	96.6	96.3	96.1	95.9	95.4	95.0	94.7	93.9
15	97.4	97.2	96.9	96.8	96.6	96.2	95.7	95.5	94.8
10	98.0	97.8	97.5	97.4	97.4	96.9	96.5	96.3	95.7
5	98.3	98.6	98.3	98.1	98.1	97.7	97.3	97.1	96.6
0	97.5	98.7	99.2	99.0	98.9	98.5	98.2	98.0	97.5
-5	96.7	98.0	99.1	99.8	99.7	99.3	98.9	98.7	98.4
-10	96.0	97.2	98.4	99.6	100.5	100.2	99.8	99.6	99.4
-15	95.2	96.4	97.6	98.8	100.1	101.0	100.8	100.6	100.3
-20	94.4	95.6	96.8	98.0	99.3	100.5	101.1	100.8	100.6
-25	93.6	94.9	96.0	97.2	98.5	99.7	100.2	100.0	99.8

Engine Bleed Adjustments

BLEED CONFIGURATION	PRESSURE ALTITUDE - 1,000 FEET								
	25	27	29	31	33	35	37	39	41
ENGINE ANTI-ICE ON	-1.2	-1.1	-1.0	-0.9	-0.8	-0.8	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-4.2	-4.4	-4.5	-4.7	-5.0	-4.8	-4.8	-4.8	-4.8

ONE ENGINE INOPERATIVE DRIFTDOWN PROCEDURES

IN THE EVENT OF AN ENGINE FAILURE OR SHUTDOWN DURING CRUISE:

1. Immediately set Maximum Continuous Thrust (MCT) from previous page.
2. Allow aircraft to decelerate in level flight to driftdown speed prior to initiating descent.
 - Aircraft will level off at or above altitudes shown in DRIFTDOWN GROSS LEVEL-OFF ALTITUDE chart.
 - Cross-check FMS engine-out level-off altitude if so equipped. Otherwise, cross-check with level-off altitude in ODM.
3. If driftdown terrain clearance is critical, consult Flight Plan Remarks to determine:
 - Recommended en route alternate airports, if required.
 - ISA temperature deviation at 18,000 feet.
4. If terrain clearance is a factor, select a suitable alternate airport as follows:
 - Terrain clearance is assured for flight to any flight plan alternate airport listed.
 - Comply with Unrestricted/Restricted Critical Terrain Procedures as described in Airway Manual – Section 6.
 - Use flight plan recommended en route alternate airport, or:
 - Determine aircraft position on appropriate Jeppesen Low Level or High/Low Level enroute chart and locations of other suitable alternates.
 - Check terrain clearance for flight via MEA / MOCA on airway or Grid MORA for a non-flight-plan suitable enroute alternate.
 - Maintain MCT / driftdown speed after level-off and allow aircraft to climb until at/above MEA / MOCA on airway or Grid MORA.
 - Maintain airway MEA / MOCA until established on the arrival to selected alternate airport.
5. Proceed to selected nearest suitable alternate.
6. Except as specified in Step 4, maintain Maximum Continuous Thrust (MCT) and allow aircraft to accelerate to engine-out Long Range Cruise speed at level-off altitude.

DRIFTDOWN SPEED SCHEDULE KIAS

GROSS WEIGHT– POUNDS	PRESSURE ALTITUDE – FEET						
	15,000 & below	20,000	25,000	29,000	31,000	35,000	39,000 & above
190,000	265	267	269	272	274	267	243
180,000	258	260	262	264	266	267	243
170,000	250	251	254	256	258	261	243
160,000		244	246	248	249	252	243
150,000		236	238	240	241	243	243
140,000		228	229	231	232	234	237
130,000			221	222	223	225	228
120,000			212	213	214	216	218
110,000				204	204	206	208
100,000				193	194	196	197

ONE ENGINE INOPERATIVE

DRIFTDOWN SPEED AND GROSS LEVEL OFF ALTITUDE

ENGINE ANTI-ICE OFF

GROSS WEIGHT – POUNDS		OPTIMUM DRIFTDOWN SPEED - KIAS	APPROX GROSS LEVEL OFF ALTITUDE – FEET		
AT ENGINE FAILURE	AT LEVEL OFF (APPROX)		ISA + 10°C & COLDER	ISA + 15°C	ISA + 20°C
190,000	182,900	267	16,900	15,800	14,600
180,000	173,500	267	18,600	17,400	16,300
170,000	164,300	261	20,200	19,100	17,900
160,000	154,800	252	21,600	20,700	19,600
150,000	145,100	243	23,100	22,200	21,300
140,000	135,300	234	24,700	23,900	22,900
130,000	125,500	225	26,700	25,700	24,800
120,000	116,300	216	28,800	27,900	26,900
110,000	106,800	206	30,800	30,100	29,100
100,000	97,500	196	32,800	32,100	31,300

ENGINE ANTI-ICE ON

GROSS WEIGHT – POUNDS		OPTIMUM DRIFTDOWN SPEED - KIAS	APPROX GROSS LEVEL OFF ALTITUDE – FEET		
AT ENGINE FAILURE	AT LEVEL OFF (APPROX)		ISA + 10°C & COLDER	ISA + 15°C	ISA + 20°C
190,000	182,800	267	16,200	15,000	13,600
180,000	173,300	267	17,800	16,700	15,500
170,000	163,900	261	19,500	18,400	17,100
160,000	154,600	252	21,000	20,100	18,900
150,000	145,000	243	22,500	21,600	20,600
140,000	135,300	234	24,100	23,200	22,300
130,000	125,400	225	26,000	25,000	24,100
120,000	116,100	216	28,200	27,200	26,200
110,000	106,800	206	30,300	29,400	28,500
100,000	97,400	196	32,400	31,600	30,800

ENGINE & WING ANTI-ICE ON

GROSS WEIGHT – POUNDS		OPTIMUM DRIFTDOWN SPEED - KIAS	APPROX GROSS LEVEL OFF ALTITUDE – FEET		
AT ENGINE FAILURE	AT LEVEL OFF (APPROX)		ISA + 10°C & COLDER	ISA + 15°C	ISA + 20°C
190,000	182,300	267	13,800	12,100	9,900
180,000	173,100	267	15,600	14,200	12,400
170,000	163,600	261	17,300	16,000	14,700
160,000	154,300	252	19,100	17,800	16,400
150,000	145,000	243	20,700	19,600	18,200
140,000	135,400	234	22,300	21,300	20,100
130,000	125,600	225	24,100	23,100	22,000
120,000	115,900	216	26,000	25,000	24,000
110,000	106,500	206	28,200	27,300	26,200
100,000	97,100	196	30,400	29,500	28,600

BASIS:

- APU operating
- Maximum Continuous Thrust Limits
- 35,000 ft initial altitude
- 100 ft/min residual rate of climb

ONE ENGINE INOPERATIVE

LONG RANGE CRUISE ALTITUDE CAPABILITY

FEET

GROSS WEIGHT – POUNDS	PRESSURE ALTITUDE – FEET		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
190,000	14,900	12,600	9,600
180,000	16,700	14,900	12,100
170,000	18,500	16,800	14,600
160,000	20,300	18,700	16,700
150,000	21,600	20,500	18,700
140,000	23,100	22,000	20,600
130,000	24,600	23,500	22,200
120,000	26,800	25,300	24,000
110,000	29,200	27,900	26,300
100,000	31,300	30,400	29,100
90,000	33,500	32,600	31,500

CORRECTIONS:

CONFIGURATION	ALT. CORRECTION – FEET
Engine Anti-Ice ON	-1,300
Engine and Wing Anti-Ice ON	-5,900

BASIS:

- Max continuous thrust.
- Long range cruise speed.
- 100 ft/min residual rate of climb

ONE ENGINE INOPERATIVE

LONG RANGE CRUISE

FL (STD TAT)		GROSS WEIGHT – 1,000 POUNDS									
		180	170	160	150	140	130	120	110	100	90
300 (-29)	%N ₁								97.1	93.4	89.7
	MAX TAT								-13	-4	
	KIAS								224	217	210
	MACH								0.603	0.585	0.567
	FF/ENG								3,949	3,494	3,144
290 (-27)	KTAS								355	345	334
	%N ₁								95.4	91.8	88.6
	MAX TAT								-7	1	
	KIAS								225	219	212
	MACH								0.594	0.577	0.560
280 (-25)	FF/ENG								3,882	3,476	3,148
	KTAS								352	341	331
	%N ₁							97.3	93.9	90.6	87.7
	MAX TAT							-11	-2		
	KIAS							234	227	221	213
270 (-23)	MACH							0.602	0.586	0.570	0.551
	FF/ENG							4,289	3,837	3,481	3,155
	KTAS							358	348	339	328
	%N ₁							95.6	92.4	89.6	87.0
	MAX TAT							-5	3		
260 (-21)	KIAS							235	229	222	214
	MACH							0.593	0.578	0.562	0.543
	FF/ENG							4,223	3,817	3,488	3,164
	KTAS							354	345	336	324
	%N ₁						97.2	94.1	91.2	88.6	86.2
250 (-19)	MAX TAT						-8	0	7		
	KIAS						243	237	231	224	215
	MACH						0.600	0.585	0.571	0.554	0.534
	FF/ENG						4,622	4,177	3,818	3,494	3,173
	KTAS						360	351	342	332	320
250 (-19)	%N ₁						95.6	92.8	90.2	87.9	85.5
	MAX TAT						-3	5	11		
	KIAS						245	239	233	225	216
	MACH						0.592	0.578	0.564	0.546	0.525
	FF/ENG						4,560	4,157	3,829	3,504	3,185
250 (-19)	KTAS						356	348	339	329	316

DEFINITIONS:**FL:** Flight level / altitude (feet).**ISA:** Standard Day temperature in °C.**MAX TAT:** Maximum Total Air Temperature in °C.**%N₁:** Target N₁ setting (percent).**FF/ENG:** Fuel Flow per Engine (lb per hr).**MACH:** Mach number.**KIAS:** Indicated airspeed in knots.**KTAS:** True airspeed in knots.**NOTE:** Shaded sections denote conditions that required thrust may exceed Maximum Continuous Thrust.**TEMPERATURE TRADE FACTORS:**

- %N₁ decreases 1.0% for every +5°C and increases 1.0% for every -5°C difference from ISA.
- FF/ENG increases 3% for every +10°C and decreases 3% for every -10°C difference from ISA.
- KTAS increases 1 knot per 1°C above ISA and decreases 1 knot per 1°C below ISA.

ONE ENGINE INOPERATIVE

LONG RANGE CRUISE

FL (STD TAT)		GROSS WEIGHT – 1,000 POUNDS									
		180	170	160	150	140	130	120	110	100	90
240 (-17)	%N ₁					97.0	94.2	91.7	89.3	87.2	84.7
	MAX TAT					-3	4	10			
	KIAS					253	247	241	234	226	217
	MACH					0.598	0.584	0.571	0.556	0.537	0.517
	FF/ENG					4,946	4,515	4,162	3,840	3,519	3,201
	KTAS					361	353	345	336	325	312
230 (-15)	%N ₁				98.2	95.4	93.0	90.7	88.6	86.4	84.0
	MAX TAT				-3	3	10				
	KIAS				260	254	248	243	235	227	218
	MACH				0.603	0.590	0.577	0.564	0.548	0.529	0.509
	FF/ENG				5,345	4,890	4,506	4,181	3,859	3,538	3,219
	KTAS				366	358	350	342	332	321	309
220 (-14)	%N ₁				96.6	94.1	91.9	89.9	87.9	85.7	83.3
	MAX TAT				4	10	16				
	KIAS				262	256	250	244	237	228	219
	MACH				0.594	0.582	0.570	0.556	0.539	0.521	0.500
	FF/ENG				5,269	4,861	4,521	4,202	3,880	3,559	3,239
	KTAS				362	355	347	339	329	317	305
210 (-12)	%N ₁			97.7	95.2	93.0	91.0	89.1	87.1	84.9	82.5
	MAX TAT			4	10	15					
	KIAS			269	264	258	252	245	238	229	220
	MACH			0.599	0.587	0.575	0.563	0.548	0.531	0.512	0.492
	FF/ENG			5,652	5,227	4,866	4,547	4,227	3,903	3,582	3,261
	KTAS			366	359	352	344	335	325	314	301
200 (-10)	%N ₁		98.6	96.1	94.0	92.0	90.2	88.4	86.4	84.2	81.8
	MAX TAT		5	10	16	21					
	KIAS		276	271	265	260	254	247	239	230	220
	MACH		0.602	0.591	0.579	0.568	0.555	0.540	0.523	0.504	0.484
	FF/ENG		6,042	5,602	5,219	4,891	4,574	4,250	3,927	3,605	3,284
	KTAS		370	363	356	349	341	332	321	310	297
190 (-8)	%N ₁		97.0	94.9	93.0	91.2	89.5	87.7	85.6	83.5	81.1
	MAX TAT		10	15	20						
	KIAS		278	273	267	262	255	248	240	231	221
	MACH		0.594	0.583	0.572	0.561	0.547	0.532	0.515	0.496	0.476
	FF/ENG		5,977	5,580	5,237	4,922	4,601	4,276	3,952	3,629	3,306
	KTAS		367	360	353	346	337	328	317	306	293

DEFINITIONS:

FL: Flight level / altitude (feet).

ISA: Standard Day temperature in °C.

MAX TAT: Maximum Total Air Temperature in °C.

%N₁: Target N₁ setting (percent).

FF/ENG: Fuel Flow per Engine (lb per hr).

MACH: Mach number.

KIAS: Indicated airspeed in knots.

KTAS: True airspeed in knots.

NOTE: Shaded sections denote conditions that required thrust may exceed Maximum Continuous Thrust.

TEMPERATURE TRADE FACTORS:

- %N₁ decreases 1.0% for every +5°C and increases 1.0% for every -5°C difference from ISA.
- FF/ENG increases 3% for every +10°C and decreases 3% for every -10°C difference from ISA.
- KTAS increases 1 knot per 1°C above ISA and decreases 1 knot per 1°C below ISA.

ONE ENGINE INOPERATIVE

LONG RANGE CRUISE

FL (STD TAT)		GROSS WEIGHT – 1,000 POUNDS									
		180	170	160	150	140	130	120	110	100	90
180 (-6)	%N ₁	97.8	95.7	93.8	92.1	90.5	88.8	86.9	84.9	82.8	80.4
	MAX TAT	10	15	19	24						
	KIAS	285	280	275	270	263	256	249	240	232	222
	MACH	0.597	0.587	0.576	0.566	0.553	0.539	0.524	0.507	0.488	0.468
	FF/ENG	6,358	5,950	5,592	5,275	4,954	4,628	4,303	3,978	3,656	3,329
	KTAS	370	363	357	351	343	334	324	314	302	290
170 (-4)	%N ₁	96.4	94.6	92.9	91.4	89.8	88.0	86.2	84.2	82.0	79.6
	MAX TAT	15	19	24							
	KIAS	287	282	277	271	265	258	250	241	232	222
	MACH	0.590	0.579	0.570	0.559	0.546	0.531	0.516	0.499	0.480	0.460
	FF/ENG	6,327	5,954	5,624	5,309	4,984	4,658	4,332	4,007	3,682	3,353
	KTAS	367	360	354	347	339	330	320	310	299	286
160 (-2)	%N ₁	95.2	93.6	92.1	90.7	89.1	87.3	85.5	83.5	81.3	78.9
	MAX TAT	19	23	28							
	KIAS	289	284	279	273	266	259	251	242	233	223
	MACH	0.582	0.573	0.563	0.551	0.538	0.523	0.508	0.491	0.472	0.452
	FF/ENG	6,319	5,978	5,665	5,340	5,013	4,687	4,360	4,035	3,707	3,378
	KTAS	363	357	351	344	336	327	317	306	295	282
150 (-1)	%N ₁	94.3	92.8	91.5	90.0	88.3	86.6	84.8	82.8	80.6	78.2
	MAX TAT	23	28								
	KIAS	291	286	280	274	267	260	252	243	234	223
	MACH	0.575	0.567	0.556	0.543	0.530	0.515	0.500	0.483	0.465	0.445
	FF/ENG	6,334	6,019	5,696	5,369	5,041	4,714	4,387	4,061	3,730	3,401
	KTAS	360	355	348	340	332	323	313	303	291	279
140 (1)	%N ₁	93.4	92.2	90.8	89.2	87.6	85.9	84.1	82.1	79.9	77.5
	MAX TAT	27	31								
	KIAS	293	288	282	275	268	261	252	244	234	224
	MACH	0.569	0.559	0.548	0.535	0.522	0.508	0.492	0.475	0.457	0.438
	FF/ENG	6,366	6,050	5,722	5,394	5,066	4,738	4,412	4,082	3,751	3,425
	KTAS	358	352	345	337	328	319	309	299	287	275
130 (3)	%N ₁	92.8	91.5	90.1	88.5	86.9	85.2	83.4	81.4	79.2	76.8
	MAX TAT	31	35								
	KIAS	295	289	283	276	269	261	253	244	235	225
	MACH	0.563	0.552	0.540	0.528	0.514	0.500	0.484	0.468	0.450	0.431
	FF/ENG	6,402	6,075	5,745	5,417	5,088	4,761	4,435	4,103	3,772	3,450
	KTAS	355	348	341	333	325	315	306	295	284	272

DEFINITIONS:

FL: Flight level / altitude (feet).

ISA: Standard Day temperature in °C.

MAX TAT: Maximum Total Air Temperature in °C.

%N₁: Target N₁ setting (percent).

FF/ENG: Fuel Flow per Engine (lb per hr).

MACH: Mach number.

KIAS: Indicated airspeed in knots.

KTAS: True airspeed in knots.

NOTE: Shaded sections denote conditions that required thrust may exceed Maximum Continuous Thrust.**TEMPERATURE TRADE FACTORS:**

- %N₁ decreases 1.0% for every +5°C and increases 1.0% for every -5°C difference from ISA.
- FF/ENG increases 3% for every +10°C and decreases 3% for every -10°C difference from ISA.
- KTAS increases 1 knot per 1°C above ISA and decreases 1 knot per 1°C below ISA.

ONE ENGINE INOPERATIVE

LONG RANGE CRUISE

FL (STD TAT)		GROSS WEIGHT – 1,000 POUNDS									
		180	170	160	150	140	130	120	110	100	90
120 (4)	%N ₁	92.1	90.8	89.3	87.8	86.2	84.5	82.7	80.7	78.5	76.1
	MAX TAT	34									
	KIAS	297	291	284	278	270	262	254	245	235	225
	MACH	0.555	0.544	0.533	0.520	0.506	0.492	0.477	0.460	0.442	0.424
	FF/ENG	6,427	6,097	5,768	5,439	5,111	4,785	4,455	4,123	3,794	3,475
110 (6)	KTAS	352	345	337	329	321	312	302	291	280	269
	%N ₁	91.5	90.1	88.6	87.2	85.6	83.8	82.0	80.0	77.8	75.5
	MAX TAT	38									
	KIAS	298	292	286	279	271	263	255	246	236	226
	MACH	0.548	0.537	0.525	0.512	0.499	0.485	0.469	0.453	0.435	0.417
100 (8)	FF/ENG	6,450	6,120	5,791	5,462	5,135	4,808	4,476	4,144	3,819	3,501
	KTAS	348	341	334	326	317	308	298	288	277	265
	%N ₁	90.8	89.4	88.0	86.5	84.9	83.1	81.3	79.3	77.1	74.9
	MAX TAT	41									
	KIAS	300	293	287	279	272	264	255	246	237	227
90 (9)	MACH	0.540	0.529	0.517	0.505	0.491	0.477	0.462	0.446	0.429	0.411
	FF/ENG	6,475	6,145	5,815	5,487	5,161	4,831	4,497	4,167	3,845	3,529
	KTAS	345	338	330	322	314	304	295	284	274	262
	%N ₁	90.1	88.7	87.3	85.8	84.2	82.5	80.6	78.6	76.5	74.3
	MAX TAT										
80 (11)	KIAS	301	294	288	280	273	265	256	247	237	227
	MACH	0.533	0.522	0.510	0.497	0.484	0.470	0.454	0.439	0.422	0.404
	FF/ENG	6,503	6,173	5,843	5,516	5,188	4,854	4,521	4,193	3,873	3,557
	KTAS	341	334	327	319	310	301	291	281	270	259
	%N ₁	89.4	88.0	86.6	85.1	83.5	81.8	79.9	77.9	75.9	73.7
70 (13)	MAX TAT										
	KIAS	302	295	289	281	274	265	257	248	238	228
	MACH	0.525	0.514	0.502	0.490	0.476	0.462	0.447	0.432	0.415	0.398
	FF/ENG	6,533	6,202	5,873	5,546	5,214	4,878	4,546	4,221	3,902	3,585
	KTAS	338	331	323	315	306	297	288	278	267	256
	%N ₁	88.7	87.4	85.9	84.4	82.8	81.1	79.2	77.3	75.3	73.0
	MAX TAT										
	KIAS	303	296	289	282	274	266	257	248	239	229
	MACH	0.518	0.507	0.495	0.482	0.469	0.455	0.440	0.425	0.409	0.392
	FF/ENG	6,563	6,232	5,904	5,574	5,239	4,903	4,573	4,251	3,932	3,614
	KTAS	334	327	319	311	303	294	284	274	264	253

DEFINITIONS:

FL: Flight level / altitude (feet).

ISA: Standard Day temperature in °C.

MAX TAT: Maximum Total Air Temperature in °C.

%N₁: Target N₁ setting (percent).

FF/ENG: Fuel Flow per Engine (lb per hr).

MACH: Mach number.

KIAS: Indicated airspeed in knots.

KTAS: True airspeed in knots.

NOTE: Shaded sections denote conditions that required thrust may exceed Maximum Continuous Thrust.**TEMPERATURE TRADE FACTORS:**

- %N₁ decreases 1.0% for every +5°C and increases 1.0% for every -5°C difference from ISA.
- FF/ENG increases 3% for every +10°C and decreases 3% for every -10°C difference from ISA.
- KTAS increases 1 knot per 1°C above ISA and decreases 1 knot per 1°C below ISA.

LANDING GEAR EXTENDED REVENUE OPERATIONS

PROCEDURES

OPERATIONAL LIMITATIONS

The following are the FAA Airplane Flight Manual mandated limitations for gear down operations. Limitations are unchanged from normal except as listed below.

1. All components required for a landing gear extended operation must be functional in accordance with the appropriate maintenance manual.
2. The use of speed increase for improved climb performance in order to increase maximum takeoff weight is prohibited.
3. Dispatch into known icing conditions is prohibited.
4. The airplane is not eligible for extended over-water operations when landing gear down lock pins are installed. "Extended over-water operation" includes any operation over water at a horizontal distance of more than 50 nautical miles from the nearest shoreline.
5. Use of assumed temperature thrust settings for takeoff is prohibited.
6. Limitations relating to engine-out drift down are contained in the FLIGHT PLANNING and ABNORMAL sections of this Operational Data Manual (ODM).
7. V_{MO} and M_{MO} are reduced to 270 KIAS and .73M.
8. The airspeed indicator and Mach-airspeed warning switch must be reprogrammed for V_{MO} and M_{MO} .

PREPARATION OF AIRCRAFT

Maintenance will prepare the aircraft in accordance with the appropriate Maintenance Manual Procedures and make the appropriate log book entries.

EMERGENCY PROCEDURES

Procedures are unchanged for Emergency Procedures except as follows:

Emergency Descent: **Target speed is 270 KIAS / .73M.**

NORMAL PROCEDURES

Operating Procedures are unchanged except as follows:

The Flight Management Computer System (FMCS) does not contain special provisions for operation with landing gear extended. Enter only gross weight data on the PERF INIT page to render the VNAV function unavailable during flight. VNAV guidance, speed schedules, trip fuel, ETA predictions, optimum and maximum altitude data, step climb, top-of-descent prediction and VNAV descent guidance will be unavailable. Takeoff and approach speed schedules, flap maneuvering speeds and V_{Ref} speed bugs will be available. Except for VNAV, normal autopilot, autothrottle and LNAV modes will remain available for flight.

Company routes using cost index or cruise altitude information should not be used.

Final Climb Segment Speed: $V_{Ref40} + 55$ KIAS

Severe Turbulent Air Penetration: The conditions for severe turbulence penetration are unchanged except the recommended airspeed for flight is $V_{Ref40} + 70$ KIAS.

LANDING GEAR EXTENDED REVENUE OPERATIONS

DRIFTDOWN PERFORMANCE

PRESSURE ALTITUDE - FEET

GROSS WEIGHT – POUNDS		OPTIMUM DRIFT DOWN SPEED – KIAS	GROSS LEVEL OFF ALTITUDE – FEET		
AT ENGINE FAILURE	AT LEVEL OFF (APPROX)		ISA + 10°C & COLDER	ISA + 15°C	ISA + 20°C
180,000	171,000	224	2,800	1,000	
170,000	162,000	219	5,100	3,500	1,400
160,000	152,000	215	7,300	5,900	3,900
150,000	143,000	210	9,500	8,200	6,300
140,000	134,000	205	11,600	10,500	8,800
130,000	124,000	200	13,800	12,900	11,500
120,000	114,000	194	16,100	15,300	14,400
110,000	105,000	189	18,400	17,600	16,700
100,000	96,000	183	20,700	19,900	19,000
90,000	86,000	177	22,900	22,100	21,300

BASIS:

- One engine inoperative, APU operating
- Maximum Continuous Thrust Limits
- No Anti-ice, one pack on
- 100 ft/min residual rate of climb

LONG RANGE CRUISE ALTITUDE CAPABILITY

PRESSURE ALTITUDE - FEET

GROSS WEIGHT - POUNDS	ISA + 10°C & COLDER	ISA + 15°C	ISA + 20°C
160,000	2,600		
150,000	5,400	3,400	
140,000	8,200	6,500	4,000
130,000	10,900	9,600	7,300
120,000	13,400	12,400	10,700
110,000	16,100	15,300	14,300
100,000	18,900	17,900	17,100
90,000	21,700	20,800	19,800

BASIS:

- One engine inoperative, APU operating
- Maximum Continuous Thrust Limits
- 100 ft/min residual rate of climb

LANDING GEAR EXTENDED REVENUE OPERATIONS

LONG RANGE CRUISE – ONE ENGINE INOPERATIVE

GROSS WEIGHT - POUNDS	PRESSURE ALTITUDE - FEET								
	TARGET %N1 MACH NUMBER CRUISE SPEED - KIAS FUEL FLOW / ENGINE- LB/HR								
	5,000	7,000	9,000	11,000	13,000	15,000	17,000	19,000	21,000
150,000	94.2 0.384 232 8,126	96.3 0.397 232 8,164							
140,000	92.1 0.375 225 7,546	93.8 0.385 225 7,546	96.1 0.398 224 7,597						
130,000	90.0 0.361 218 6,988	91.6 0.373 217 6,970	93.4 0.385 217 6,969	95.7 0.399 216 7,032					
120,000	87.8 0.349 211 6,461	89.3 0.360 210 6,417	91.0 0.372 209 6,397	92.7 0.385 208 6,399	95.2 0.399 208 6,465				
110,000	85.6 0.337 204 5,963	87.0 0.348 203 5,897	88.5 0.359 201 5,851	90.2 0.371 200 5,833	91.9 0.383 200 5,838	94.4 0.397 199 5,886	98.3 0.412 198 6,060		
100,000	83.3 0.325 197 5,484	84.6 0.335 195 5,406	86.0 0.345 194 5,341	87.5 0.356 193 5,296	89.1 0.368 192 5,278	90.9 0.381 191 5,273	93.3 0.395 190 5,292	97.3 0.409 189 5,435	
90,000	80.8 0.313 189 5,027	82.1 0.322 188 4,936	83.4 0.331 186 4,859	84.8 0.341 184 4,796	86.2 0.352 183 4,752	87.9 0.364 183 4,724	89.7 0.377 181 4,702	91.9 0.391 181 4,700	95.4 0.406 180 4,813

BASIS:

- One engine inoperative, APU operating
- Maximum Continuous Thrust Limits
- 100 ft/min residual rate of climb

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ABNORMAL CONFIGURATION ACTUAL LANDING DISTANCES AND APPROACH SPEEDS

APPLICABILITY

The tables on the following pages provide landing distances and approach speeds to be used in the event of in-flight system failures. **The values in this section are not to be used for dispatch purposes.**

Refer to the “MEL Support” pages at the end of this section of the ODM for dispatch landing distances with the following MELs applied:

- Anti-skid Inoperative *
- Manual Spoilers

The landing distances provided in this section are classified by runway braking action. These classifications include “DRY,” “GOOD,” “MEDIUM,” or “POOR.” Refer to the Airway Manual – Section 4 (Weather) to find the relationship between these terms, the current environmental conditions, and runway friction values.

ASSUMPTIONS

The data within this section was generated based on a set of assumed conditions:

- Maximum manual braking (more aggressive than Max Autobrakes)*
- Includes distance from 50 feet above threshold to stop (1,500 feet of air distance)
- Based on demonstrated landing performance produced by the manufacturer during certification process
- Operating engines at maximum reverse thrust, except for hydraulic system failures

In addition, the data within this section were also calculated with certain baseline conditions. There are corrections provided for each abnormal configuration accounting for any variances from the following:

- Sea level altitude
- Standard Day Outside Air Temperature (OAT = ISA)
- No wind
- No slope
- Each abnormal configuration landing distance table is based on the approach speed stated within each table.

***NOTE:** With Anti-skid Inoperative, tire damage or blowouts can occur if moderate to heavy braking is used. Charts are based on Maximum Manual Braking.

ABNORMAL CONFIGURATION ACTUAL LANDING DISTANCES AND APPROACH SPEEDS

**FEET
KIAS**

NOTE: Data below assumes Max Manual Braking and does NOT include 15% safety margin. Refer to Page 4-22 for all assumed conditions.

ALL FLAPS UP

RWY COND. & APPCH SPEED	LANDING WEIGHT – 1,000 POUNDS									
	190	180	170	160	150	140	130	120	110	100
DRY	7,120	6,650	6,180	5,710	5,240	4,770	4,300	4,095	3,890	3,685
GOOD	7,250	6,985	6,720	6,455	6,190	5,925	5,660	5,395	5,130	4,865
MEDIUM	10,400	9,960	9,520	9,080	8,640	8,200	7,760	7,335	6,910	6,485
POOR	14,040	13,385	12,730	12,075	11,420	10,765	10,110	9,485	8,860	8,235
VREF40+55	214	210	205	200	196	191	185	179	174	167

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+95	+150	+245	+360
	Per 1,000 feet (above 8,000 ft.)	+210	+200	+330	+495
Wind	Per 1 kt. headwind	-13	-21	-33	-50
	Per 1 kt. tailwind	+45	+71	+118	+186
Slope	Per 1% downhill	+45	+105	+270	+615
	Per 1% uphill	-40	-95	-230	-475
Temperature	Per 1°C above ISA	+9	+14	+21	+29
	Per 1°C below ISA	-9	-14	-21	-30
Approach Speed	Per 10 kt. Above VREF*	+265	+275	+385	+485

ANTI-SKID INOPERATIVE (FLAPS 40)**

RWY COND. & APPCH SPEED	LANDING WEIGHT – 1,000 POUNDS									
	190	180	170	160	150	140	130	120	110	100
DRY	6,780	6,505	6,230	5,955	5,680	5,405	5,130	4,870	4,610	4,350
GOOD	7,610	7,285	6,960	6,635	6,310	5,985	5,660	5,360	5,060	4,760
MEDIUM	9,740	9,285	8,830	8,375	7,920	7,465	7,010	6,590	6,170	5,750
POOR	13,060	12,405	11,750	11,095	10,440	9,785	9,130	8,530	7,930	7,330
VREF40	159	155	150	145	141	136	130	124	119	112

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+130	+150	+215	+305
	Per 1,000 feet (above 8,000 ft.)	+175	+205	+300	+450
Wind	Per 1 kt. headwind	-23	-28	-41	-68
	Per 1 kt. tailwind	+84	+102	+159	+294
Slope	Per 1% downhill	+135	+195	+440	+1570
	Per 1% uphill	-115	-165	-330	-760
Temperature	Per 1°C above ISA	+11	+13	+17	+23
	Per 1°C below ISA	-12	-13	-18	-27
Approach Speed	Per 10 kt. Above VREF*	+360	+395	+460	+515

***NOTE:** Use the Approach Speed adjustment for every 10 knots VREF is increased above the values provided in the table. For example, VREF ICE in the QRH instructs crews to use VREF15 + 10 knots for certain conditions and configurations.

****NOTE:** Use this chart for **in-flight system failure** when referred by QRH, ANTI-SKID INOPERATIVE Non-Normal Procedure to determine actual landing distance. Charts are based on maximum manual braking. With anti-skid inoperative, tire damage or blowouts can occur if moderate to heavy braking is used. Use ANTI-SKID INOPERATIVE chart in ODM Abnormal, MEL SUPPORT section for **dispatch** with anti-skid inoperative. The MEL SUPPORT chart provides a factored landing distance which includes an additional 67% safety margin. In any case, plan Flaps 40 and use the longest available runway for landing.

ABNORMAL CONFIGURATION ACTUAL LANDING DISTANCES AND APPROACH SPEEDS

**FEET
KIAS**

NOTE: Data below assumes Max Manual Braking and does NOT include 15% safety margin. Refer to Page 4-22 for all assumed conditions.

HYDRAULICS - LOSS OF SYSTEM A (FLAPS 15)

RWY COND. & APPCH SPEED	LANDING WEIGHT – 1,000 POUNDS									
	190	180	170	160	150	140	130	120	110	100
DRY	4,910	4,710	4,510	4,310	4,110	3,910	3,710	3,555	3,400	3,245
GOOD	6,720	6,455	6,190	5,925	5,660	5,395	5,130	4,855	4,580	4,305
MEDIUM	9,340	8,915	8,490	8,065	7,640	7,215	6,790	6,370	5,950	5,530
POOR	12,230	11,625	11,020	10,415	9,810	9,205	8,600	8,015	7,430	6,845
VREF15	172	167	162	158	152	147	142	136	130	124

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+70	+130	+205	+300
	Per 1,000 feet (above 8,000 ft.)	+95	+175	+285	+420
Wind	Per 1 kt. headwind	-12	-21	-32	-48
	Per 1 kt. tailwind	+40	+71	+115	+179
Slope	Per 1% downhill	+40	+125	+295	+635
	Per 1% uphill	-40	-115	-250	-475
Temperature	Per 1°C above ISA	+7	+12	+18	+24
	Per 1°C below ISA	-7	-12	-18	-25
Approach Speed	Per 10 kt. Above VREF*	+290	+425	+540	+625

HYDRAULICS - LOSS OF SYSTEM A (FLAPS 30)

RWY COND. & APPCH SPEED	LANDING WEIGHT – 1,000 POUNDS									
	190	180	170	160	150	140	130	120	110	100
DRY	4,620	4,440	4,260	4,080	3,900	3,720	3,540	3,395	3,250	3,105
GOOD	6,270	6,030	5,790	5,550	5,310	5,070	4,830	4,580	4,330	4,080
MEDIUM	8,610	8,230	7,850	7,470	7,090	6,710	6,330	5,950	5,570	5,190
POOR	11,210	10,670	10,130	9,590	9,050	8,510	7,970	7,445	6,920	6,395
VREF30	162	158	154	150	145	140	135	130	124	118

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+65	+115	+185	+265
	Per 1,000 feet (above 8,000 ft.)	+85	+155	+250	+370
Wind	Per 1 kt. headwind	-11	-20	-31	-46
	Per 1 kt. tailwind	+38	+68	+111	+173
Slope	Per 1% downhill	+40	+115	+270	+585
	Per 1% uphill	-35	-105	-230	-435
Temperature	Per 1°C above ISA	+7	+11	+16	+21
	Per 1°C below ISA	-7	-11	-16	-23
Approach Speed	Per 10 kt. Above VREF*	+280	+405	+505	+580

***NOTE:** Use the Approach Speed adjustment for every 10 knots VREF is increased above the values provided in the table. For example, VREF ICE in the QRH instructs crews to use VREF15 + 10 knots for certain conditions and configurations.

ABNORMAL CONFIGURATION ACTUAL LANDING DISTANCES AND APPROACH SPEEDS

**FEET
KIAS**

NOTE: Data below assumes Max Manual Braking and does NOT include 15% safety margin. Refer to Page 4-22 for all assumed conditions.

HYDRAULICS - LOSS OF SYSTEM A (FLAPS 40)

RWY COND. & APPCH SPEED	LANDING WEIGHT – 1,000 POUNDS									
	190	180	170	160	150	140	130	120	110	100
DRY	4,490	4,310	4,130	3,950	3,770	3,590	3,410	3,275	3,140	3,005
GOOD	6,130	5,875	5,620	5,365	5,110	4,855	4,600	4,370	4,140	3,910
MEDIUM	8,340	7,950	7,560	7,170	6,780	6,390	6,000	5,650	5,300	4,950
POOR	10,810	10,265	9,720	9,175	8,630	8,085	7,540	7,050	6,560	6,070
VREF40	159	155	150	145	141	136	130	124	119	112

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+65	+115	+180	+255
	Per 1,000 feet (above 8,000 ft.)	+95	+165	+255	+365
Wind	Per 1 kt. headwind	-11	-19	-30	-44
	Per 1 kt. tailwind	+37	+66	+108	+169
Slope	Per 1% downhill	+40	+110	+260	+565
	Per 1% uphill	-35	-100	-220	-420
Temperature	Per 1°C above ISA	+6	+10	+15	+20
	Per 1°C below ISA	-6	-10	-15	-21
Approach Speed	Per 10 kt. Above VREF*	+285	+405	+500	+565

HYDRAULICS - LOSS OF SYSTEM B (FLAPS 15)

RWY COND. & APPCH SPEED	LANDING WEIGHT – 1,000 POUNDS									
	190	180	170	160	150	140	130	120	110	100
DRY	4,710	4,555	4,400	4,245	4,090	3,935	3,780	3,615	3,450	3,285
GOOD	6,030	5,800	5,570	5,340	5,110	4,880	4,650	4,415	4,180	3,945
MEDIUM	8,300	7,940	7,580	7,220	6,860	6,500	6,140	5,780	5,420	5,060
POOR	10,920	10,400	9,880	9,360	8,840	8,320	7,800	7,295	6,790	6,285
VREF15	172	167	162	158	152	147	142	136	130	124

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+75	+110	+175	+255
	Per 1,000 feet (above 8,000 ft.)	+100	+150	+240	+355
Wind	Per 1 kt. headwind	-13	-19	-29	-44
	Per 1 kt. tailwind	+44	+65	+107	+168
Slope	Per 1% downhill	+45	+95	+235	+525
	Per 1% uphill	-45	-85	-200	-395
Temperature	Per 1°C above ISA	+8	+10	+15	+21
	Per 1°C below ISA	-8	-11	-16	-22
Approach Speed	Per 10 kt. Above VREF*	+245	+315	+415	+495

***NOTE:** Use the Approach Speed adjustment for every 10 knots VREF is increased above the values provided in the table. For example, VREF ICE in the QRH instructs crews to use VREF15 + 10 knots for certain conditions and configurations.

ABNORMAL CONFIGURATION ACTUAL LANDING DISTANCES AND APPROACH SPEEDS

**FEET
KIAS**

NOTE: Data below assumes Max Manual Braking and does NOT include 15% safety margin. Refer to Page 4-22 for all assumed conditions.

HYDRAULICS - MANUAL REVERSION (LOSS OF SYSTEM A & B)

RWY COND. & APPCH SPEED	LANDING WEIGHT – 1,000 POUNDS									
	190	180	170	160	150	140	130	120	110	100
DRY	6,350	6,125	5,900	5,675	5,450	5,225	5,000	4,765	4,530	4,295
GOOD	7,850	7,550	7,250	6,950	6,650	6,350	6,050	5,740	5,430	5,120
MEDIUM	10,950	10,475	10,000	9,525	9,050	8,575	8,100	7,625	7,150	6,675
POOR	14,290	13,610	12,930	12,250	11,570	10,890	10,210	9,550	8,890	8,230
VREF15	172	167	162	158	152	147	142	136	130	124

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+110	+150	+235	+340
	Per 1,000 feet (above 8,000 ft.)	+150	+205	+330	+480
Wind	Per 1 kt. headwind	-18	-24	-37	-6
	Per 1 kt. tailwind	+60	+81	+129	+197
Slope	Per 1% downhill	+110	+185	+400	+790
	Per 1% uphill	-100	-165	-340	-600
Temperature	Per 1°C above ISA	+11	+14	+21	+27
	Per 1°C below ISA	-11	-15	-21	-28
Approach Speed	Per 10 kt. Above VREF*	+505	+595	+715	+790

LEADING EDGE FLAPS TRANSIT

RWY COND. & APPCH SPEED	LANDING WEIGHT – 1,000 POUNDS									
	190	180	170	160	150	140	130	120	110	100
DRY	5,010	4,800	4,590	4,380	4,170	3,960	3,750	3,580	3,410	3,240
GOOD	6,390	6,155	5,920	5,685	5,450	5,215	4,980	4,735	4,490	4,245
MEDIUM	8,770	8,400	8,030	7,660	7,290	6,920	6,550	6,175	5,800	5,425
POOR	11,440	10,910	10,380	9,850	9,320	8,790	8,260	7,735	7,210	6,685
VREF15+15	187	182	177	173	167	162	157	151	145	139

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+70	+120	+190	+270
	Per 1,000 feet (above 8,000 ft.)	+95	+160	+260	+375
Wind	Per 1 kt. headwind	-12	-19	-30	-45
	Per 1 kt. tailwind	+40	+67	+109	+170
Slope	Per 1% downhill	+35	+95	+235	+520
	Per 1% uphill	-35	-90	-200	-390
Temperature	Per 1°C above ISA	+7	+12	+17	+22
	Per 1°C below ISA	-7	-12	-17	-23
Approach Speed	Per 10 kt. Above VREF*	+215	+295	+385	+450

***NOTE:** Use the Approach Speed adjustment for every 10 knots VREF is increased above the values provided in the table. For example, VREF ICE in the QRH instructs crews to use VREF15 + 10 knots for certain conditions and configurations.

ABNORMAL CONFIGURATION ACTUAL LANDING DISTANCES AND APPROACH SPEEDS

**FEET
KIAS**

NOTE: Data below assumes Max Manual Braking and does NOT include 15% safety margin. Refer to Page 4-22 for all assumed conditions.

ONE ENGINE INOPERATIVE (FLAPS 15)

RWY COND. & APPCH SPEED	LANDING WEIGHT – 1,000 POUNDS									
	190	180	170	160	150	140	130	120	110	100
DRY	4,630	4,430	4,230	4,030	3,830	3,630	3,430	3,270	3,110	2,950
GOOD	5,970	5,745	5,520	5,295	5,070	4,845	4,620	4,390	4,160	3,930
MEDIUM	8,530	8,165	7,800	7,435	7,070	6,705	6,340	5,965	5,590	5,215
POOR	11,740	11,190	10,640	10,090	9,540	8,990	8,440	7,890	7,340	6,790
VREF15	172	167	162	158	152	147	142	136	130	124

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+60	+105	+175	+265
	Per 1,000 feet (above 8,000 ft.)	+80	+140	+235	+355
Wind	Per 1 kt. headwind	-11	-19	-31	-49
	Per 1 kt. tailwind	+38	+66	+112	+183
Slope	Per 1% downhill	+35	+100	+270	+670
	Per 1% uphill	-30	-90	-225	-490
Temperature	Per 1°C above ISA	+6	+10	+16	+24
	Per 1°C below ISA	-6	-11	-17	-24
Approach Speed	Per 10 kt. Above VREF*	+210	+305	+425	+530

STABILIZER TRIM INOPERATIVE

RWY COND. & APPCH SPEED	LANDING WEIGHT – 1,000 POUNDS									
	190	180	170	160	150	140	130	120	110	100
DRY	4,540	4,350	4,160	3,970	3,780	3,590	3,400	3,250	3,100	2,950
GOOD	5,760	5,545	5,330	5,115	4,900	4,685	4,470	4,250	4,030	3,810
MEDIUM	7,930	7,590	7,250	6,910	6,570	6,230	5,890	5,550	5,210	4,870
POOR	10,420	9,930	9,440	8,950	8,460	7,970	7,480	7,005	6,530	6,055
VREF15	172	167	162	158	152	147	142	136	130	124

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+60	+100	+165	+240
	Per 1,000 feet (above 8,000 ft.)	+80	+140	+225	+330
Wind	Per 1 kt. headwind	-11	-18	-28	-43
	Per 1 kt. tailwind	+37	+63	+103	+163
Slope	Per 1% downhill	+30	+85	+215	+485
	Per 1% uphill	-30	-75	-180	-365
Temperature	Per 1°C above ISA	+6	+10	+15	+20
	Per 1°C below ISA	-6	-10	-15	-21
Approach Speed	Per 10 kt. Above VREF*	+205	+280	+375	+450

***NOTE:** Use the Approach Speed adjustment for every 10 knots VREF is increased above the values provided in the table. For example, VREF ICE in the QRH instructs crews to use VREF15 + 10 knots for certain conditions and configurations.

ABNORMAL CONFIGURATION ACTUAL LANDING DISTANCES AND APPROACH SPEEDS

**FEET
KIAS**

NOTE: Data below assumes Max Manual Braking and does NOT include 15% safety margin. Refer to Page 4-22 for all assumed conditions.

JAMMED/RESTRICTED FLIGHT CONTROLS

RWY COND. & APPCH SPEED	LANDING WEIGHT – 1,000 POUNDS									
	190	180	170	160	150	140	130	120	110	100
DRY	4,540	4,350	4,160	3,970	3,780	3,590	3,400	3,250	3,100	2,950
GOOD	5,760	5,545	5,330	5,115	4,900	4,685	4,470	4,250	4,030	3,810
MEDIUM	7,930	7,590	7,250	6,910	6,570	6,230	5,890	5,550	5,210	4,870
POOR	10,420	9,930	9,440	8,950	8,460	7,970	7,480	7,005	6,530	6,055
VREF15	172	167	162	158	152	147	142	136	130	124

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+60	+100	+165	+240
	Per 1,000 feet (above 8,000 ft.)	+80	+140	+225	+330
Wind	Per 1 kt. headwind	-11	-18	-28	-43
	Per 1 kt. tailwind	+37	+63	+103	+163
Slope	Per 1% downhill	+30	+85	+215	+485
	Per 1% uphill	-30	-75	-180	-365
Temperature	Per 1°C above ISA	+6	+10	+15	+20
	Per 1°C below ISA	-6	-10	-15	-21
Approach Speed	Per 10 kt. Above VREF*	+205	+280	+375	+450

TRAILING EDGE FLAP ASYMMETRY (30 ≤ FLAPS < 40)

RWY COND. & APPCH SPEED	LANDING WEIGHT – 1,000 POUNDS									
	190	180	170	160	150	140	130	120	110	100
DRY	4,250	4,085	3,920	3,755	3,590	3,425	3,260	3,125	2,990	2,855
GOOD	5,440	5,245	5,050	4,855	4,660	4,465	4,270	4,070	3,870	3,670
MEDIUM	7,420	7,110	6,800	6,490	6,180	5,870	5,560	5,250	4,940	4,630
POOR	9,670	9,225	8,780	8,335	7,890	7,445	7,000	6,565	6,130	5,695
VREF30	162	158	154	150	145	140	135	130	124	118

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+55	+95	+150	+215
	Per 1,000 feet (above 8,000 ft.)	+75	+125	+200	+295
Wind	Per 1 kt. headwind	-10	-17	-27	-41
	Per 1 kt. tailwind	+36	+61	+100	+158
Slope	Per 1% downhill	+30	+80	+200	+455
	Per 1% uphill	-25	-75	-170	-340
Temperature	Per 1°C above ISA	+6	+9	+13	+18
	Per 1°C below ISA	-6	-9	-14	-19
Approach Speed	Per 10 kt. Above VREF*	+200	+280	+360	+425

***NOTE:** Use the Approach Speed adjustment for every 10 knots VREF is increased above the values provided in the table. For example, VREF ICE in the QRH instructs crews to use VREF15 + 10 knots for certain conditions and configurations.

ABNORMAL CONFIGURATION ACTUAL LANDING DISTANCES AND APPROACH SPEEDS

**FEET
KIAS**

NOTE: Data below assumes Max Manual Braking and does NOT include 15% safety margin. Refer to Page 4-22 for all assumed conditions.

TRAILING EDGE FLAP ASYMMETRY (15 ≤ FLAPS < 30)

RWY COND. & APPCH SPEED	LANDING WEIGHT – 1,000 POUNDS									
	190	180	170	160	150	140	130	120	110	100
DRY	4,540	4,350	4,160	3,970	3,780	3,590	3,400	3,250	3,100	2,950
GOOD	5,760	5,545	5,330	5,115	4,900	4,685	4,470	4,250	4,030	3,810
MEDIUM	7,930	7,590	7,250	6,910	6,570	6,230	5,890	5,550	5,210	4,870
POOR	10,420	9,930	9,440	8,950	8,460	7,970	7,480	7,005	6,530	6,055
VREF15	172	167	162	158	152	147	142	136	130	124

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+60	+100	+165	+240
	Per 1,000 feet (above 8,000 ft.)	+80	+140	+225	+330
Wind	Per 1 kt. headwind	-11	-18	-28	-43
	Per 1 kt. tailwind	+37	+63	+103	+163
Slope	Per 1% downhill	+30	+85	+215	+485
	Per 1% uphill	-30	-75	-180	-365
Temperature	Per 1°C above ISA	+6	+10	+15	+20
	Per 1°C below ISA	-6	-10	-15	-21
Approach Speed	Per 10 kt. Above VREF*	+205	+280	+375	+450

TRAILING EDGE FLAP ASYMMETRY (1 ≤ FLAPS < 15)

RWY COND. & APPCH SPEED	LANDING WEIGHT – 1,000 POUNDS									
	190	180	170	160	150	140	130	120	110	100
DRY	5,300	5,035	4,770	4,505	4,240	3,975	3,710	3,540	3,370	3,200
GOOD	6,250	6,020	5,790	5,560	5,330	5,100	4,870	4,645	4,420	4,195
MEDIUM	8,760	8,385	8,010	7,635	7,260	6,885	6,510	6,155	5,800	5,445
POOR	11,610	11,065	10,520	9,975	9,430	8,885	8,340	7,830	7,320	6,810
VREF40+30	189	185	180	175	171	166	160	154	149	142

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+75	+120	+195	+285
	Per 1,000 feet (above 8,000 ft.)	+100	+165	+265	+395
Wind	Per 1 kt. headwind	-12	-19	-30	-45
	Per 1 kt. tailwind	+40	+65	+108	+170
Slope	Per 1% downhill	+35	+90	+225	+515
	Per 1% uphill	-30	-80	-195	-390
Temperature	Per 1°C above ISA	+7	+11	+17	+23
	Per 1°C below ISA	-7	-11	-17	-24
Approach Speed	Per 10 kt. Above VREF*	+200	+265	+365	+445

***NOTE:** Use the Approach Speed adjustment for every 10 knots VREF is increased above the values provided in the table. For example, VREF ICE in the QRH instructs crews to use VREF15 + 10 knots for certain conditions and configurations.

ABNORMAL CONFIGURATION ACTUAL LANDING DISTANCES AND APPROACH SPEEDS

**FEET
KIAS**

NOTE: Data below assumes Max Manual Braking and does NOT include 15% safety margin. Refer to Page 4-22 for all assumed conditions.

TRAILING EDGE FLAP DISAGREE (30 ≤ FLAPS < 40)

RWY COND. & APPCH SPEED	LANDING WEIGHT – 1,000 POUNDS									
	190	180	170	160	150	140	130	120	110	100
DRY	4,250	4,085	3,920	3,755	3,590	3,425	3,260	3,125	2,990	2,855
GOOD	5,440	5,245	5,050	4,855	4,660	4,465	4,270	4,070	3,870	3,670
MEDIUM	7,420	7,110	6,800	6,490	6,180	5,870	5,560	5,250	4,940	4,630
POOR	9,670	9,225	8,780	8,335	7,890	7,445	7,000	6,565	6,130	5,695
VREF30	162	158	154	150	145	140	135	130	124	118

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+55	+95	+150	+215
	Per 1,000 feet (above 8,000 ft.)	+75	+125	+200	+295
Wind	Per 1 kt. headwind	-10	-17	-27	-41
	Per 1 kt. tailwind	+36	+61	+100	+158
Slope	Per 1% downhill	+30	+80	+200	+455
	Per 1% uphill	-25	-75	-170	-340
Temperature	Per 1°C above ISA	+6	+9	+13	+18
	Per 1°C below ISA	-6	-9	-14	-19
Approach Speed	Per 10 kt. Above VREF*	+200	+280	+360	+425

TRAILING EDGE FLAP DISAGREE (15 ≤ FLAPS < 30)

RWY COND. & APPCH SPEED	LANDING WEIGHT – 1,000 POUNDS									
	190	180	170	160	150	140	130	120	110	100
DRY	4,540	4,350	4,160	3,970	3,780	3,590	3,400	3,250	3,100	2,950
GOOD	5,760	5,545	5,330	5,115	4,900	4,685	4,470	4,250	4,030	3,810
MEDIUM	7,930	7,590	7,250	6,910	6,570	6,230	5,890	5,550	5,210	4,870
POOR	10,420	9,930	9,440	8,950	8,460	7,970	7,480	7,005	6,530	6,055
VREF15	172	167	162	158	152	147	142	136	130	124

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+60	+100	+165	+240
	Per 1,000 feet (above 8,000 ft.)	+80	+140	+225	+330
Wind	Per 1 kt. headwind	-11	-18	-28	-43
	Per 1 kt. tailwind	+37	+63	+103	+163
Slope	Per 1% downhill	+30	+85	+215	+485
	Per 1% uphill	-30	-75	-180	-365
Temperature	Per 1°C above ISA	+6	+10	+15	+20
	Per 1°C below ISA	-6	-10	-15	-21
Approach Speed	Per 10 kt. Above VREF*	+205	+280	+375	+450

***NOTE:** Use the Approach Speed adjustment for every 10 knots VREF is increased above the values provided in the table. For example, VREF ICE in the QRH instructs crews to use VREF15 + 10 knots for certain conditions and configurations.

ABNORMAL CONFIGURATION ACTUAL LANDING DISTANCES AND APPROACH SPEEDS

**FEET
KIAS**

NOTE: Data below assumes Max Manual Braking and does NOT include 15% safety margin. Refer to Page 4-22 for all assumed conditions.

TRAILING EDGE FLAP DISAGREE (1 ≤ FLAPS < 15)

RWY COND. & APPCH SPEED	LANDING WEIGHT – 1,000 POUNDS									
	190	180	170	160	150	140	130	120	110	100
DRY	5,300	5,035	4,770	4,505	4,240	3,975	3,710	3,540	3,370	3,200
GOOD	6,250	6,020	5,790	5,560	5,330	5,100	4,870	4,645	4,420	4,195
MEDIUM	8,760	8,385	8,010	7,635	7,260	6,885	6,510	6,155	5,800	5,445
POOR	11,610	11,065	10,520	9,975	9,430	8,885	8,340	7,830	7,320	6,810
VREF40+30	189	185	180	175	171	166	160	154	149	142

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+75	+120	+195	+285
	Per 1,000 feet (above 8,000 ft.)	+100	+165	+265	+395
Wind	Per 1 kt. headwind	-12	-19	-30	-5
	Per 1 kt. tailwind	+40	+65	+108	+170
Slope	Per 1% downhill	+35	+90	+225	+515
	Per 1% uphill	-30	-80	-195	-390
Temperature	Per 1°C above ISA	+7	+11	+17	+23
	Per 1°C below ISA	-7	-11	-17	-24
Approach Speed	Per 10 kt. Above VREF*	+200	+265	+365	+445

TRAILING EDGE FLAPS UP

RWY COND. & APPCH SPEED	LANDING WEIGHT – 1,000 POUNDS									
	190	180	170	160	150	140	130	120	110	100
DRY	5,840	5,520	5,200	4,880	4,560	4,240	3,920	3,735	3,550	3,365
GOOD	6,640	6,395	6,150	5,905	5,660	5,415	5,170	4,930	4,690	4,450
MEDIUM	9,390	8,990	8,590	8,190	7,790	7,390	6,990	6,605	6,220	5,835
POOR	12,550	11,965	11,380	10,795	10,210	9,625	9,040	8,485	7,930	7,375
VREF40+40	199	195	190	185	181	176	170	164	159	152

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+80	+130	+215	+310
	Per 1,000 feet (above 8,000 ft.)	+110	+175	+290	+430
Wind	Per 1 kt. headwind	-12	-19	-31	-47
	Per 1 kt. tailwind	+41	+67	+112	+177
Slope	Per 1% downhill	+35	+95	+245	+555
	Per 1% uphill	-35	-85	-210	-425
Temperature	Per 1°C above ISA	+8	+12	+18	+25
	Per 1°C below ISA	-8	-12	-19	-26
Approach Speed	Per 10 kt. Above VREF*	+205	+270	+370	+460

***NOTE:** Use the Approach Speed adjustment for every 10 knots VREF is increased above the values provided in the table. For example, VREF ICE in the QRH instructs crews to use VREF15 + 10 knots for certain conditions and configurations.

EMERGENCY LANDING DISTANCES FEET

NOTE: TO BE USED ONLY UNDER CAPTAIN'S EMERGENCY AUTHORITY. PROVIDES ACTUAL LANDING DISTANCES ON CONTAMINATED RUNWAYS.

FLAPS 15

DATA IS ADVISORY AND DOES NOT INCLUDE 15% SAFETY MARGIN.

Landing Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).							
	DRY (6)					GOOD (5)		
	AB 1	AB 2	AB 3	Max AB	Max Manual	AB 3	Max AB	Max Manual
190,000	11,600	10,300	8,000	5,700	4,900	8,000	6,500	6,100
185,000	11,300	10,100	7,800	5,600	4,700	7,900	6,400	6,000
180,000	11,100	9,900	7,700	5,500	4,600	7,700	6,300	5,900
175,000	10,800	9,700	7,600	5,400	4,500	7,600	6,100	5,700
170,000	10,600	9,500	7,400	5,300	4,400	7,400	6,000	5,600
165,000	10,300	9,200	7,300	5,200	4,300	7,300	5,900	5,500
160,000	10,100	9,000	7,100	5,100	4,100	7,100	5,800	5,400
157,300	9,900	8,900	7,000	5,000	4,100	7,100	5,700	5,400
155,000	9,800	8,800	7,000	5,000	4,000	7,000	5,700	5,300
150,000	9,500	8,600	6,800	4,900	3,900	6,800	5,600	5,200
145,000	9,300	8,400	6,700	4,800	3,900	6,700	5,400	5,100
140,000	9,000	8,200	6,500	4,700	3,800	6,500	5,300	5,000
135,000	8,700	7,900	6,400	4,600	3,700	6,400	5,200	4,900
130,000	8,500	7,700	6,200	4,500	3,600	6,200	5,100	4,800
125,000	8,200	7,500	6,000	4,400	3,500	6,100	5,000	4,700
120,000	7,900	7,300	5,900	4,300	3,400	5,900	4,800	4,600
115,000	7,700	7,000	5,700	4,200	3,300	5,700	4,700	4,400
110,000	7,400	6,800	5,600	4,100	3,300	5,600	4,600	4,300
105,000	7,100	6,600	5,400	4,000	3,200	5,400	4,500	4,200
100,000	6,900	6,400	5,300	4,000	3,100	5,300	4,400	4,100

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Speed at Touchdown = VREF15 - 5 •

Data is advisory and includes a 1,500 ft. air distance from threshold to touchdown.

REFERENCE DISTANCES BASED UPON PRESSURE ALTITUDE OF 2,000 FEET AND ARE CONSERVATIVE FOR ALL LOWER ALTITUDES.

 Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	DRY (6)					GOOD (5)		
0	-600	-500	-300	-200	-200	-300	-300	-200
2,000	0	0	0	0	0	0	0	0
4,000	600	500	300	200	200	300	300	200
6,000	1,200	1,000	700	400	300	700	500	500
8,000	1,700	1,400	1,000	600	500	1,000	800	700
10,000	2,500	2,100	1,500	900	700	1,500	1,200	1,000

CORRECTIONS	DRY (6)					GOOD (5)		
PER 1 KT HEADWIND	-50	-50	-50	0	0	-50	0	0
PER 1 KT TAILWIND	150	100	100	50	50	100	50	50
PER 5 KTS ADD'L SPD	300	350	350	200	100	350	200	150
PER 10°C ABOVE ISA	250	250	150	100	50	150	100	100
PER 10°C BELOW ISA	-250	-250	-150	-100	-50	-150	-100	-100
PER 1% UP SLOPE	-250	-150	0	0	-50	0	-100	-100
PER 1% DOWN SLOPE	200	100	0	0	50	0	100	100
1 REVERSER INOP	700	200	0	0	100	0	200	200
2 REVERSERS INOP	1,000	200	0	0	100	0	500	500
MANUAL SPOILERS	200	200	200	200	200	200	200	200

EMERGENCY LANDING DISTANCES FEET

NOTE: TO BE USED ONLY UNDER CAPTAIN'S EMERGENCY AUTHORITY. PROVIDES ACTUAL LANDING DISTANCES ON CONTAMINATED RUNWAYS.

DATA IS ADVISORY AND DOES NOT INCLUDE 15% SAFETY MARGIN.

FLAPS 15

Landing Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).					
	MEDIUM (3)			POOR (1)		
	AB 3	Max AB	Max Manual	AB 3	Max AB	Max Manual
190,000	9,000	8,600	8,500	11,400	11,300	11,300
185,000	8,800	8,500	8,300	11,100	11,000	11,000
180,000	8,600	8,300	8,100	10,900	10,800	10,800
175,000	8,500	8,100	8,000	10,600	10,500	10,500
170,000	8,300	7,900	7,800	10,400	10,300	10,300
165,000	8,100	7,800	7,600	10,100	10,000	10,000
160,000	7,900	7,600	7,400	9,900	9,800	9,800
157,300	7,800	7,500	7,400	9,700	9,600	9,600
155,000	7,700	7,400	7,300	9,600	9,500	9,500
150,000	7,600	7,200	7,100	9,400	9,300	9,300
145,000	7,400	7,000	6,900	9,100	9,000	9,000
140,000	7,200	6,900	6,800	8,800	8,800	8,800
135,000	7,000	6,700	6,600	8,600	8,500	8,500
130,000	6,800	6,500	6,400	8,300	8,300	8,300
125,000	6,600	6,300	6,200	8,100	8,000	8,000
120,000	6,500	6,100	6,100	7,800	7,800	7,800
115,000	6,300	6,000	5,900	7,600	7,500	7,500
110,000	6,100	5,800	5,700	7,300	7,300	7,300
105,000	5,900	5,600	5,500	7,100	7,000	7,000
100,000	5,700	5,400	5,400	6,800	6,800	6,800

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Speed at Touchdown = VREF15 - 5 •

Data is advisory and includes a 1,500 ft. air distance from threshold to touchdown.

REFERENCE DISTANCES BASED UPON PRESSURE ALTITUDE OF 2,000 FEET AND ARE CONSERVATIVE FOR ALL LOWER ALTITUDES.

Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	MEDIUM (3)			POOR (1)		
0	-400	-400	-400	-600	-600	-600
2,000	0	0	0	0	0	0
4,000	400	400	400	600	600	600
6,000	800	800	800	1,200	1,200	1,200
8,000	1,300	1,200	1,200	1,800	1,700	1,700
10,000	1,900	1,800	1,800	2,700	2,600	2,500

CORRECTIONS	MEDIUM (3)			POOR (1)		
PER 1 KT HEADWIND	-50	-50	-50	-50	-50	-50
PER 1 KT TAILWIND	100	100	100	200	200	200
PER 5 KTS ADD'L SPD	350	250	200	300	250	250
PER 10°C ABOVE ISA	200	200	200	250	250	250
PER 10°C BELOW ISA	-200	-200	-200	-250	-250	-250
PER 1% UP SLOPE	-150	-200	-250	-450	-450	-450
PER 1% DOWN SLOPE	200	250	300	700	750	700
1 REVERSER INOP	500	600	600	1,400	1,400	1,400
2 REVERSERS INOP	1,300	1,500	1,500	3,700	3,600	3,600
MANUAL SPOILERS	200	200	200	200	200	200

EMERGENCY LANDING DISTANCES FEET

NOTE: TO BE USED ONLY UNDER CAPTAIN'S EMERGENCY AUTHORITY. PROVIDES ACTUAL LANDING DISTANCES ON CONTAMINATED RUNWAYS.

FLAPS 30

DATA IS ADVISORY AND DOES NOT INCLUDE 15% SAFETY MARGIN.

Landing Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).							
	DRY (6)					GOOD (5)		
	AB 1	AB 2	AB 3	Max AB	Max Manual	AB 3	Max AB	Max Manual
190,000	10,600	9,500	7,400	5,300	4,500	7,500	6,100	5,800
185,000	10,300	9,300	7,300	5,200	4,400	7,300	6,000	5,700
180,000	10,100	9,100	7,200	5,100	4,300	7,200	5,900	5,600
175,000	9,900	8,900	7,000	5,100	4,200	7,000	5,800	5,500
170,000	9,700	8,700	6,900	5,000	4,100	6,900	5,700	5,400
165,000	9,400	8,500	6,800	4,900	4,000	6,800	5,600	5,300
160,000	9,200	8,300	6,600	4,800	3,900	6,600	5,500	5,200
157,300	9,100	8,200	6,600	4,800	3,900	6,600	5,500	5,100
155,000	9,000	8,200	6,500	4,700	3,800	6,500	5,400	5,100
150,000	8,800	8,000	6,400	4,600	3,800	6,400	5,300	5,000
145,000	8,500	7,800	6,200	4,500	3,700	6,200	5,200	4,900
140,000	8,300	7,600	6,100	4,500	3,600	6,100	5,100	4,800
135,000	8,100	7,400	5,900	4,400	3,500	5,900	5,000	4,700
130,000	7,800	7,200	5,800	4,300	3,500	5,800	4,900	4,600
125,000	7,600	7,000	5,600	4,200	3,400	5,600	4,700	4,500
120,000	7,400	6,800	5,500	4,100	3,300	5,500	4,600	4,400
115,000	7,100	6,600	5,300	4,000	3,200	5,300	4,500	4,300
110,000	6,900	6,400	5,200	4,000	3,200	5,200	4,400	4,200
105,000	6,600	6,200	5,000	3,900	3,100	5,100	4,300	4,100
100,000	6,400	6,000	4,900	3,800	3,000	4,900	4,200	4,000

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Speed at Touchdown = VREF30 - 5 •

Data is advisory and includes a 1,500 ft. air distance from threshold to touchdown.

REFERENCE DISTANCES BASED UPON PRESSURE ALTITUDE OF 2,000 FEET AND ARE CONSERVATIVE FOR ALL LOWER ALTITUDES.

Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	DRY (6)					GOOD (5)		
0	-500	-400	-300	-200	-100	-300	-200	-200
2,000	0	0	0	0	0	0	0	0
4,000	500	400	300	200	100	300	200	200
6,000	1,000	900	600	400	300	600	500	400
8,000	1,600	1,300	900	500	400	900	700	700
10,000	2,300	1,900	1,300	700	600	1,300	1,000	1,000

CORRECTIONS

	DRY (6)					GOOD (5)		
PER 1 KT HEADWIND	-50	-50	0	0	0	0	0	0
PER 1 KT TAILWIND	150	100	100	50	50	100	50	50
PER 5 KTS ADD'L SPD	300	300	300	200	100	300	200	150
PER 10°C ABOVE ISA	250	200	150	100	50	150	100	100
PER 10°C BELOW ISA	-250	-200	-150	-100	-50	-150	-100	-100
PER 1% UP SLOPE	-250	-150	0	0	-50	0	-100	-100
PER 1% DOWN SLOPE	200	100	0	0	50	0	100	100
1 REVERSER INOP	600	200	0	0	100	0	200	200
2 REVERSERS INOP	900	200	0	0	100	0	500	400
MANUAL SPOILERS	200	200	200	200	200	200	200	200

EMERGENCY LANDING DISTANCES FEET

NOTE: TO BE USED ONLY UNDER CAPTAIN'S EMERGENCY AUTHORITY. PROVIDES ACTUAL LANDING DISTANCES ON CONTAMINATED RUNWAYS.

DATA IS ADVISORY AND DOES NOT INCLUDE 15% SAFETY MARGIN.

FLAPS 30

Landing Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).					
	MEDIUM (3)			POOR (1)		
	AB 3	Max AB	Max Manual	AB 3	Max AB	Max Manual
190,000	8,400	8,100	7,900	10,600	10,500	10,400
185,000	8,200	7,900	7,800	10,300	10,300	10,200
180,000	8,100	7,800	7,600	10,100	10,000	10,000
175,000	7,900	7,600	7,400	9,900	9,800	9,700
170,000	7,800	7,500	7,300	9,600	9,600	9,500
165,000	7,600	7,300	7,100	9,400	9,300	9,300
160,000	7,400	7,100	7,000	9,200	9,100	9,100
157,300	7,300	7,100	6,900	9,100	9,000	8,900
155,000	7,300	7,000	6,800	9,000	8,900	8,800
150,000	7,100	6,800	6,700	8,700	8,700	8,600
145,000	6,900	6,700	6,500	8,500	8,400	8,400
140,000	6,700	6,500	6,300	8,300	8,200	8,200
135,000	6,600	6,300	6,200	8,000	8,000	7,900
130,000	6,400	6,200	6,000	7,800	7,800	7,700
125,000	6,200	6,000	5,900	7,600	7,500	7,500
120,000	6,100	5,800	5,700	7,300	7,300	7,300
115,000	5,900	5,700	5,500	7,100	7,100	7,000
110,000	5,700	5,500	5,400	6,900	6,900	6,800
105,000	5,600	5,300	5,200	6,700	6,600	6,600
100,000	5,400	5,200	5,100	6,400	6,400	6,400

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Speed at Touchdown = VREF30 - 5 •

Data is advisory and includes a 1,500 ft. air distance from threshold to touchdown.

REFERENCE DISTANCES BASED UPON PRESSURE ALTITUDE OF 2,000 FEET AND ARE CONSERVATIVE FOR ALL LOWER ALTITUDES.

Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	MEDIUM (3)			POOR (1)		
0	-400	-400	-400	-500	-500	-500
2,000	0	0	0	0	0	0
4,000	400	400	400	500	500	500
6,000	800	800	700	1,100	1,100	1,000
8,000	1,100	1,100	1,100	1,600	1,600	1,600
10,000	1,600	1,600	1,600	2,300	2,300	2,300

CORRECTIONS	MEDIUM (3)			POOR (1)		
PER 1 KT HEADWIND	-50	-50	-50	-50	-50	-50
PER 1 KT TAILWIND	100	100	100	200	150	150
PER 5 KTS ADD'L SPD	300	250	200	250	250	250
PER 10°C ABOVE ISA	200	150	150	200	200	200
PER 10°C BELOW ISA	-200	-150	-150	-250	-250	-250
PER 1% UP SLOPE	-150	-200	-200	-450	-450	-450
PER 1% DOWN SLOPE	200	250	250	650	700	650
1 REVERSER INOP	400	600	500	1,200	1,200	1,200
2 REVERSERS INOP	1,100	1,300	1,300	3,100	3,000	3,000
MANUAL SPOILERS	200	200	200	200	200	200

EMERGENCY LANDING DISTANCES FEET

NOTE: TO BE USED ONLY UNDER CAPTAIN'S EMERGENCY AUTHORITY. PROVIDES ACTUAL LANDING DISTANCES ON CONTAMINATED RUNWAYS.

FLAPS 40

DATA IS ADVISORY AND DOES NOT INCLUDE 15% SAFETY MARGIN.

Landing Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).							
	DRY (6)					GOOD (5)		
	AB 1	AB 2	AB 3	Max AB	Max Manual	AB 3	Max AB	Max Manual
190,000	10,300	9,200	7,200	5,200	4,400	7,300	6,100	5,700
185,000	10,000	9,000	7,100	5,100	4,300	7,100	6,000	5,600
180,000	9,800	8,800	6,900	5,000	4,200	6,900	5,900	5,500
175,000	9,500	8,600	6,800	4,900	4,100	6,800	5,700	5,400
170,000	9,300	8,400	6,600	4,800	4,000	6,600	5,600	5,300
165,000	9,000	8,100	6,400	4,700	3,900	6,500	5,500	5,100
160,000	8,800	7,900	6,300	4,600	3,800	6,300	5,400	5,000
157,300	8,700	7,800	6,200	4,500	3,800	6,200	5,300	5,000
155,000	8,500	7,700	6,100	4,500	3,700	6,100	5,200	4,900
150,000	8,300	7,500	6,000	4,400	3,600	6,000	5,100	4,800
145,000	8,100	7,300	5,900	4,300	3,600	5,900	5,000	4,700
140,000	7,900	7,100	5,700	4,200	3,500	5,700	4,900	4,600
135,000	7,700	6,900	5,600	4,200	3,400	5,600	4,800	4,500
130,000	7,400	6,800	5,500	4,100	3,300	5,500	4,700	4,400
125,000	7,200	6,600	5,300	4,000	3,300	5,300	4,600	4,300
120,000	7,000	6,400	5,200	3,900	3,200	5,200	4,500	4,200
115,000	6,800	6,200	5,000	3,800	3,100	5,100	4,400	4,100
110,000	6,600	6,000	4,900	3,800	3,000	4,900	4,300	4,000
105,000	6,300	5,800	4,800	3,700	3,000	4,800	4,200	3,900
100,000	6,100	5,600	4,600	3,600	2,900	4,700	4,100	3,800

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Speed at Touchdown = VREF40 - 5 •

Data is advisory and includes a 1,500 ft. air distance from threshold to touchdown.

REFERENCE DISTANCES BASED UPON PRESSURE ALTITUDE OF 2,000 FEET AND ARE CONSERVATIVE FOR ALL LOWER ALTITUDES.

 Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	DRY (6)					GOOD (5)		
0	-500	-400	-300	-200	-100	-300	-300	-200
2,000	0	0	0	0	0	0	0	0
4,000	500	400	300	200	100	300	300	200
6,000	1,000	900	600	400	300	600	500	500
8,000	1,500	1,300	1,000	500	400	1,000	800	700
10,000	2,200	1,900	1,400	800	600	1,400	1,100	1,000

CORRECTIONS	DRY (6)					GOOD (5)		
PER 1 KT HEADWIND	-50	-50	0	0	0	0	0	0
PER 1 KT TAILWIND	150	100	100	50	50	100	50	50
PER 5 KTS ADD'L SPD	300	300	300	200	100	300	200	150
PER 10°C ABOVE ISA	250	250	150	100	50	150	100	100
PER 10°C BELOW ISA	-250	-250	-150	-100	-50	-150	-100	-100
PER 1% UP SLOPE	-200	-100	0	0	-50	0	-100	-100
PER 1% DOWN SLOPE	200	50	0	0	50	50	100	100
1 REVERSER INOP	500	100	0	0	100	0	200	200
2 REVERSERS INOP	700	100	0	0	100	0	400	400
MANUAL SPOILERS	200	200	200	200	200	200	200	200

EMERGENCY LANDING DISTANCES FEET

NOTE: TO BE USED ONLY UNDER CAPTAIN'S EMERGENCY AUTHORITY. PROVIDES ACTUAL LANDING DISTANCES ON CONTAMINATED RUNWAYS.

DATA IS ADVISORY AND DOES NOT INCLUDE 15% SAFETY MARGIN.

FLAPS 40

Landing Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).					
	MEDIUM (3)			POOR (1)		
	AB 3	Max AB	Max Manual	AB 3	Max AB	Max Manual
190,000	8,200	8,000	7,800	10,400	10,300	10,300
185,000	8,000	7,800	7,600	10,100	10,100	10,000
180,000	7,800	7,600	7,500	9,900	9,800	9,800
175,000	7,700	7,500	7,300	9,600	9,600	9,500
170,000	7,500	7,300	7,100	9,400	9,300	9,300
165,000	7,300	7,100	6,900	9,100	9,100	9,000
160,000	7,100	6,900	6,800	8,900	8,800	8,800
157,300	7,000	6,800	6,700	8,700	8,700	8,600
155,000	6,900	6,700	6,600	8,600	8,600	8,500
150,000	6,700	6,600	6,400	8,400	8,300	8,300
145,000	6,600	6,400	6,300	8,200	8,100	8,100
140,000	6,400	6,200	6,100	7,900	7,900	7,900
135,000	6,300	6,100	6,000	7,700	7,700	7,600
130,000	6,100	5,900	5,800	7,500	7,500	7,400
125,000	5,900	5,800	5,700	7,300	7,200	7,200
120,000	5,800	5,600	5,500	7,000	7,000	7,000
115,000	5,600	5,400	5,300	6,800	6,800	6,800
110,000	5,500	5,300	5,200	6,600	6,600	6,500
105,000	5,300	5,100	5,000	6,400	6,400	6,300
100,000	5,100	5,000	4,900	6,100	6,100	6,100

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Speed at Touchdown = VREF40 - 5 •

Data is advisory and includes a 1,500 ft. air distance from threshold to touchdown.

REFERENCE DISTANCES BASED UPON PRESSURE ALTITUDE OF 2,000 FEET AND ARE CONSERVATIVE FOR ALL LOWER ALTITUDES.

Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	MEDIUM (3)			POOR (1)		
0	-400	-400	-400	-500	-500	-500
2,000	0	0	0	0	0	0
4,000	400	400	400	500	500	500
6,000	800	800	700	1,100	1,100	1,000
8,000	1,100	1,100	1,100	1,600	1,600	1,600
10,000	1,600	1,600	1,600	2,400	2,400	2,300

CORRECTIONS	MEDIUM (3)			POOR (1)		
PER 1 KT HEADWIND	-50	-50	-50	-50	-50	-50
PER 1 KT TAILWIND	100	100	100	150	150	150
PER 5 KTS ADD'L SPD	300	250	200	250	250	250
PER 10°C ABOVE ISA	200	200	200	250	250	250
PER 10°C BELOW ISA	-200	-200	-200	-250	-250	-250
PER 1% UP SLOPE	-150	-200	-200	-400	-450	-450
PER 1% DOWN SLOPE	200	250	250	650	650	650
1 REVERSER INOP	400	500	500	1,100	1,100	1,100
2 REVERSERS INOP	1,100	1,200	1,200	2,800	2,800	2,800
MANUAL SPOILERS	200	200	200	200	200	200

OPERATION WITHOUT AIRSPEED INDICATION

Use the following pitch attitude and thrust setting data to estimate airspeed and rate of climb/descent, if the airspeed system becomes unreliable or unusable enroute. ***If the damage to the airspeed indication system is detected during early stages of the flight (takeoff or initial climb), return to departure airport.***

CLIMB							
SPEED: 280/0.76				THRUST: MAX CLIMB FLAPS: UP			
PRESSURE ALTITUDE FEET		GROSS WEIGHT – POUNDS					
		180,000	160,000	140,000	120,000	100,000	80,000
40,000	PITCH ATTITUDE				4.0	4.0	4.0
	RATE OF CLIMB (FT/MIN)				800	1,300	2,000
30,000	PITCH ATTITUDE	4.0	4.0	4.0	4.0	4.0	4.5
	RATE OF CLIMB (FT/MIN)	700	1,000	1,300	1,700	2,100	2,800
20,000	PITCH ATTITUDE	6.0	6.0	6.0	6.5	6.5	7.5
	RATE OF CLIMB (FT/MIN)	1,600	2,000	2,400	2,900	3,600	4,600
10,000	PITCH ATTITUDE	8.0	8.0	8.5	9.0	10.0	11.5
	RATE OF CLIMB (FT/MIN)	2,400	2,800	3,300	4,000	4,900	6,200
0	PITCH ATTITUDE	9.5	10.0	10.5	11.5	13.0	15.5
	RATE OF CLIMB (FT/MIN)	3,000	3,500	4,100	4,800	5,900	7,400

CRUISE							
SPEED: 0.76/280				THRUST: %N ₁ FOR LEVEL FLIGHT FLAPS: UP			
PRESSURE ALTITUDE FEET		GROSS WEIGHT - POUNDS					
		180,000	160,000	140,000	120,000	100,000	80,000
40,000	PITCH ATTITUDE %N ₁			4.0 93	3.0 88	2.5 85	1.5 83
35,000	PITCH ATTITUDE %N ₁	4.0 94	3.5 88	2.5 86	2.0 84	1.5 82	1.0 81
30,000	PITCH ATTITUDE %N ₁	3.0 87	2.5 85	2.0 84	1.5 82	1.0 81	0.5 81
25,000	PITCH ATTITUDE %N ₁	3.5 83	3.0 81	2.5 80	2.0 79	1.5 78	0.5 77
20,000	PITCH ATTITUDE %N ₁	3.5 79	3.0 78	2.5 76	2.0 75	1.5 74	1.0 74
15,000	PITCH ATTITUDE %N ₁	3.5 75	3.0 74	2.5 72	2.0 71	1.5 70	1.0 70

OPERATION WITHOUT AIRSPEED INDICATION

Use the following pitch attitude and thrust setting data to estimate airspeed and rate of climb/descent, if the airspeed system becomes unreliable or unusable enroute. ***If the damage to the airspeed indication system is detected during early stages of the flight (takeoff or initial climb), return to departure airport.***

DESCENT							
SPEED: 0.76/280				THRUST: IDLE FLAPS: UP			
PRESSURE ALTITUDE – FEET		GROSS WEIGHT – POUNDS					
		180,000	160,000	140,000	120,000	100,000	80,000
40,000	PITCH ATTITUDE	1.5	1.0	0.5	0.0	-1.0	-2.0
	RATE OF CLIMB (FT/MIN)	-3,000	-2,700	-2,500	-2,400	-2,600	-2,900
30,000	PITCH ATTITUDE	0.5	0.0	-0.5	-1.5	-2.5	-4.0
	RATE OF CLIMB (FT/MIN)	-2,000	-2,100	-2,200	-2,500	-2,800	-3,400
20,000	PITCH ATTITUDE	1.0	0.0	-0.5	-1.5	-2.5	-4.0
	RATE OF CLIMB (FT/MIN)	-1,800	-1,900	-2,000	-2,200	-2,500	-3,100
10,000	PITCH ATTITUDE	1.0	0.0	-0.5	-1.5	-2.5	-4.0
	RATE OF CLIMB (FT/MIN)	-1,600	-1,700	-1,800	-2,000	-2,300	-2,800
0	PITCH ATTITUDE	0.5	0.0	-1.0	-2.0	-3.0	-4.5
	RATE OF CLIMB (FT/MIN)	-1,400	-1,500	-1,600	-1,800	-2,100	-2,600

HOLDING							
SPEED: $V_{\text{Ref40}} + 70$				THRUST: %N ₁ FOR LEVEL FLIGHT FLAPS: UP			
PRESSURE ALTITUDE – FEET		GROSS WEIGHT – POUNDS					
		180,000	160,000	140,000	120,000	100,000	80,000
10,000	PITCH ATTITUDE	5.0	5.0	5.0	5.5	5.5	5.0
	%N ₁	70	67	64	60	55	51
	KIAS	247	232	217	201	183	170
5,000	PITCH ATTITUDE	5.0	5.0	5.0	5.5	5.5	5.0
	%N ₁	66	63	60	56	52	47
	KIAS	246	232	216	200	182	170

TERMINAL AREA												
SPEED: see below			THRUST: %N ₁ FOR LEVEL FLIGHT FLAPS: AS REQ'D									
PRESSURE ALTITUDE – FEET	FLAPS (GEAR) SPEED		GROSS WEIGHT – 1,000 POUNDS									
			180	170	160	150	140	130	120	110	100	90
5,000	1 (UP) V _{Ref40} + 50	PITCH ATT	6.5	6.0	6.0	6.0	6.0	5.5	5.5	5.5	5.0	5.0
		% N ₁	68	67	66	64	62	60	58	56	54	52
5,000	5 (UP) V _{Ref40} + 30	PITCH ATT	7.0	7.0	6.5	6.5	6.5	6.5	6.5	6.0	6.0	6.0
		% N ₁	70	68	67	65	63	61	59	57	54	52
5,000	15 (DOWN) V _{Ref40} + 20	PITCH ATT	5.5	5.5	5.5	5.5	5.5	5.0	5.0	5.0	5.0	4.5
		% N ₁	78	76	75	73	71	69	67	64	62	59

OPERATION WITHOUT AIRSPEED INDICATION

Use the following pitch attitude and thrust setting data to estimate airspeed and rate of climb/descent, if the airspeed system becomes unreliable or unusable enroute. ***If the damage to the airspeed indication system is detected during early stages of the flight (takeoff or initial climb), return to departure airport.***

FINAL APPROACH												
SPEED: see below			THRUST: %N ₁ FOR 3° GLIDESLOPE FLAPS: AS REQ'D									
PRESSURE ALTITUDE – FEET	FLAPS (GEAR) SPEED		GROSS WEIGHT – 1,000 POUNDS									
			180	170	160	150	140	130	120	110	100	90
1,500	15 (DOWN) V _{Ref15} + 10	PITCH ATT % N ₁	2.0	2.0	2.0	2.0	1.5	1.5	1.5	1.5	1.5	1.5
			56	55	54	52	51	49	47	46	44	42
1,500	30 (DOWN) V _{Ref30} + 10	PITCH ATT % N ₁	1.5	1.5	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0
			63	62	60	59	57	55	54	52	50	47
1,500	40 (DOWN) V _{Ref40} + 10	PITCH ATT % N ₁	0.5	0.5	0.5	0.5	0.5	0.5	0.0	0.0	0.0	0.0
			69	67	66	64	62	60	58	56	54	51

BRAKE COOLING FOLLOWING LANDING

GOVERNING CONDITIONS

NOTE: Maximum Quick Turnaround Landing Weight (QTLW) is not limiting for most normal operations.

If any of the following conditions apply, accomplish the procedures below to determine QTLW and Brake Cooling requirements.

- “QTLW Warning Remark” appears on the WDR **or**
- Landing above MLW **or**
- Landing using Max Autobrake or higher **or**
- Landing with non-standard aircraft configurations (flaps inoperative, brake deactivated, etc.)

PROCEDURES

- A) Determine if the Maximum Quick Turn Landing Weight has been exceeded.
Note: MLW is significantly below all QTLW's and not anticipated to be exceeded under normal operations.
- B) Obtain a Landing Brake Cooling time.
- C) **Wait the longer of the two times** once the aircraft is parked at the gate or other designated area.

QUICK TURNAROUND LANDING WEIGHT

Determine the Maximum Quick Turnaround Landing Weight from Pages 4-42 and 4-43.

If Actual Landing Weight is greater than the Maximum Quick Turnaround Landing Weight then:

A **48 minute** ground cooling period is required.

NOTE: Check that wheel thermal plugs have not melted before executing a takeoff.

LANDING BRAKE COOLING

Determine the Cooling Time and associated action, if applicable, from the Brake Cooling Time and AutoBrake Adjustment tables from Page 4-44. Comply with the specified procedures for the Caution Zone and Fuse Plug Melt Zones.

BRAKE COOLING FOLLOWING LANDING

MAXIMUM QUICK TURN-AROUND LANDING WEIGHT

POUNDS

FLAPS 40

AIRPORT PRESSURE ALTITUDE FEET	AMBIENT TEMPERATURE – °C							
	-20	-10	0	10	20	30	40	50
-1,000	190,000	188,200	185,000	181,800	178,900	176,100	172,100	170,800
0	188,500	185,100	181,900	178,800	176,000	173,200	169,200	167,900
1,000	185,200	181,900	178,800	175,900	173,000	170,200	166,200	164,900
2,000	182,100	178,800	175,800	172,800	169,800	167,100	163,100	161,800
3,000	179,000	175,800	172,600	169,600	166,600	163,800	159,900	
4,000	175,800	172,400	169,200	166,200	163,200	160,500	156,500	
5,000	172,300	169,000	165,800	162,800	159,900	157,200		
6,000	168,800	165,500	162,400	159,500	156,600	154,000		
7,000	165,300	162,100	159,100	156,200	153,400	150,800		
8,000	161,900	158,700	155,700	152,900	150,200	147,600		
9,000	158,500	155,400	152,400	149,600	147,000	144,400		
10,000	155,100	152,000	149,200	146,400	143,800	141,300		

FLAPS 30

AIRPORT PRESSURE ALTITUDE FEET	AMBIENT TEMPERATURE – °C							
	-20	-10	0	10	20	30	40	50
-1,000	186,800	182,900	179,300	175,800	172,400	169,300	166,400	163,500
0	183,200	179,400	175,800	172,400	169,200	166,200	163,300	160,500
1,000	179,600	175,900	172,400	169,100	166,000	163,000	160,200	157,500
2,000	176,100	172,400	169,000	165,800	162,800	159,900	157,100	154,500
3,000	172,600	169,000	165,700	162,600	159,600	156,800	154,100	
4,000	169,100	165,600	162,400	159,300	156,400	153,600	151,000	
5,000	165,800	162,400	159,200	156,200	153,300	150,600	148,000	
6,000	162,500	159,200	156,000	153,100	150,300	147,600	145,000	
7,000	159,200	156,000	152,900	150,000	147,200	144,600	142,100	
8,000	156,000	152,800	149,800	147,000	144,200	141,700		
9,000	152,800	149,700	146,700	143,900	141,300	138,900		
10,000	149,700	146,600	143,700	141,000	138,500	136,100		

CONDITION		CORRECTION – POUNDS
Wind	per 1 kt. of headwind	+370
	per 1 kt. of tailwind	-1,840
Runway slope	per 0.1% uphill slope	+140
	per 0.1% downhill slope	-270

BRAKE COOLING FOLLOWING LANDING
MAXIMUM QUICK TURN-AROUND LANDING WEIGHT
POUNDS

FLAPS 15

AIRPORT PRESSURE ALTITUDE FEET	AMBIENT TEMPERATURE – °C							
	-20	-10	0	10	20	30	40	50
-1,000	175,700	172,000	168,600	165,400	162,300	159,400	156,600	153,900
0	172,300	168,700	165,400	162,200	159,300	156,500	153,700	151,100
1,000	168,900	165,500	162,200	159,200	156,300	153,500	150,800	148,200
2,000	165,600	162,300	159,100	156,100	153,200	150,500	147,900	145,400
3,000	162,400	159,100	156,000	153,000	150,200	147,600	145,000	
4,000	159,200	155,900	152,900	150,000	147,200	144,600	142,100	
5,000	156,000	152,900	149,900	147,000	144,300	141,700	139,400	
6,000	152,900	149,800	146,900	144,100	141,400	139,000	136,700	
7,000	149,900	146,800	143,900	141,200	138,700	136,300	134,000	
8,000	146,900	143,800	141,000	138,400	136,000	133,600		
9,000	143,800	140,900	138,200	135,700	133,300	131,000		
10,000	140,700	138,000	135,400	132,900	130,600	128,300		

CONDITION		CORRECTION – POUNDS
Wind	per 1 kt. of headwind	+330
	per 1 kt. of tailwind	-1,850
Runway slope	per 0.1% uphill slope	+130
	per 0.1% downhill slope	-270

BRAKE COOLING FOLLOWING LANDING

LANDING BRAKE COOLING

LANDING USING MAX MANUAL BRAKING:

Obtain a brake cooling time from the following table. A quick assessment can be made by using the next highest weight and speed. If the resulting wait time has the potential of causing a delay or is in the Caution or Fuse Plug Melt Zones, interpolation may be used to determine a more precise wait time with the associated zone action. Zones are indicated in the table for quicker identification. Refer to the time ranges for Caution and Fuse Plug Melt Zones below.

NOTE: Wait time begins once the aircraft is parked at the gate or other designated area.

BRAKE COOLING TIME (h:mm)

WEIGHT (1,000 lbs)	Brakes on Speed (Ground Speed KTS)					
	80	100	120	140	160	180
Reverse	0 Eng / 2 Eng	0 Eng / 2 Eng	0 Eng / 2 Eng	0 Eng / 2 Eng	0 Eng / 2 Eng	0 Eng / 2 Eng
190	0:00 / 0:00	0:25 / 0:22	0:54 / 0:48	1:19C / 1:13C	1:43F / 1:38F	F / F
180	0:00 / 0:00	0:20 / 0:16	0:50 / 0:45	1:14C / 1:08C	1:37F / 1:31F	2:00F / 1:53F
170	0:00 / 0:00	0:16 / 0:11	0:45 / 0:41	1:10C / 1:05C	1:32F / 1:26F	1:55F / 1:47F
160	0:00 / 0:00	0:12 / 0:07	0:41 / 0:36	1:04C / 0:59C	1:27F / 1:20C	1:48F / 1:41F
150	0:00 / 0:00	0:07 / 0:01	0:36 / 0:31	0:59C / 0:54	1:20C / 1:14C	1:42F / 1:37F
140	0:00 / 0:00	0:01 / 0:00	0:30 / 0:25	0:54 / 0:49	1:14C / 1:09C	1:37F / 1:29F
130	0:00 / 0:00	0:00 / 0:00	0:24 / 0:19	0:48 / 0:43	1:08C / 1:03C	1:27F / 1:20C
120	0:00 / 0:00	0:00 / 0:00	0:18 / 0:13	0:42 / 0:37	1:01C / 0:55C	1:19C / 1:13C
110	0:00 / 0:00	0:00 / 0:00	0:12 / 0:07	0:36 / 0:30	0:54 / 0:49	1:12C / 1:08C
100	0:00 / 0:00	0:00 / 0:00	0:05 / 0:00	0:27 / 0:22	0:47 / 0:42	1:03C / 0:59C

C - CAUTION ZONE (0:55 – 1:22) – Fuse plugs may melt. Wait the specified time. After the landing gear assembly has cooled, visually inspect for tire damage and seal leakage.

F - FUSE PLUG MELT ZONE (Shaded Region, ≥ 1:23) – Under these conditions, consider that the fuse plugs will likely melt and deflate the tires. Unless required, do not set parking brake. The possibility of tire, grease or hydraulic fluid fire should also be considered. Maintenance inspection of tires, wheels and brakes is recommended.

LANDING USING AUTOBRAKES:

- 1) Determine the time from the table above. This is the reference time.
- 2) Subtract the time in the adjustment table below from the reference time in the table above to get proper cooling time for the respective brake setting. **Any resulting wait time of 1:23 or above is in the Fuse Plug Melt Zone.**

AUTOBRAKE ADJUSTMENT

NW INDICATES NO WAITING REQUIRED

	Brakes on Speed (Ground Speed KTS)					
	80	100	120	140	160	180
Reverse	0 Eng / 2 Eng	0 Eng / 2 Eng	0 Eng / 2 Eng	0 Eng / 2 Eng	0 Eng / 2 Eng	0 Eng / 2 Eng
Max Auto	NW / NW	0:05 / 0:19	0:07 / 0:15	0:07 / 0:15	0:07 / 0:17	0:07 / 0:14
Auto 3	NW / NW	0:13 / NW	0:14 / 0:43	0:13 / 0:40	0:16 / 0:39	0:15 / 0:41
Auto 2	NW / NW	NW / NW	0:26 / NW	0:26 / NW	0:26 / 1:20	0:26 / 1:20
Auto 1	NW / NW	NW / NW	0:36 / NW	0:38 / NW	0:38 / NW	0:38 / NW

BRAKE COOLING FOLLOWING REJECTED TAKEOFF

REJECTED TAKEOFF BRAKE COOLING

PROCEDURES

Use the table below. A quick assessment can be made by using the next highest weight and speed. If the resulting wait time has the potential of causing a delay or is in the Caution or Fuse Plug Melt Zones, interpolation may be used to determine a more precise wait time with the associated zone action. Zones are indicated in the table for quicker identification. Refer to the time ranges for Caution and Fuse Plug Melt Zones below.

NOTE: Wait time begins once the aircraft is parked at the gate or other designated area.

BRAKE COOLING TIME (h:mm)

WEIGHT (1,000 lbs)	Brakes on Speed (Ground Speed KTS)					
	80	100	120	140	160	180
190	0:10	0:43	1:08C	F	F	F
180	0:06	0:39	1:04C	F	F	F
170	0:01	0:36	1:01C	F	F	F
160	0:00	0:31	0:57C	1:18C	F	F
150	0:00	0:26	0:52	1:13C	F	F
140	0:00	0:22	0:47	1:08C	F	F
130	0:00	0:17	0:42	1:03C	1:21C	F
120	0:00	0:12	0:37	0:57C	1:15C	F
110	0:00	0:07	0:31	0:51	1:08C	F
100	0:00	0:00	0:25	0:45	1:02C	1:18C

C - CAUTION ZONE (0:55 – 1:22) – Fuse plugs may melt. Wait the specified time. After the landing gear assembly has cooled, visually inspect for tire damage and seal leakage.

F - FUSE PLUG MELT ZONE (Shaded Region, $\geq 1:23$) – Under these conditions, consider that the fuse plugs will likely melt and deflate the tires. Unless required, do not set parking brake. The possibility of tire, grease or hydraulic fluid fire should also be considered. Maintenance inspection of tires, wheels and brakes is recommended.

MEL SUPPORT**V_{MBE} – MAXIMUM BRAKE ENERGY SPEED LIMITS****KIAS****TO THRUST**

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
190,000	8,000	140	< 140	< 140	< 140	< 140
	6,000	145	143	141	< 140	< 140
	4,000	150	148	146	144	142
	2,000	156	153	151	149	147
	0	161	158	155	154	152
180,000	8,000	144	141	< 140	< 140	< 140
	6,000	149	146	144	142	141
	4,000	154	152	149	147	146
	2,000	160	157	155	153	151
	0	165	162	160	158	157
170,000	8,000	148	145	143	141	< 140
	6,000	154	151	148	146	145
	4,000	159	156	154	152	150
	2,000	165	162	159	158	156
	0	171	167	165	163	161
160,000	8,000	153	150	148	146	144
	6,000	159	156	153	151	149
	4,000	164	162	159	157	155
	2,000	171	168	165	163	161
	0	177	173	170	169	167
150,000	8,000	158	156	153	151	149
	6,000	164	162	159	157	155
	4,000	171	167	165	163	161
	2,000	177	174	171	169	167
	0	183	180	177	175	173
140,000	8,000	165	162	159	157	155
	6,000	171	168	165	163	161
	4,000	177	174	171	169	167
	2,000	184	181	178	175	174
	0	191	187	184	182	180

CORRECTIONS:

CONDITION	V _{MBE} CORRECTION
Runway Slope – per 1% uphill	+1 knot
Runway Slope – per 1% downhill	-4 knots
Headwind – per 10 knots	+3 knots
Tailwind – per 10 knots	-20 knots

MEL SUPPORT**V_{MBE} – MAXIMUM BRAKE ENERGY SPEED LIMITS****KIAS****TO THRUST**

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
130,000	8,000	171	168	165	163	161
	6,000	178	175	172	169	168
	4,000	185	182	179	176	174
	2,000	192	188	185	183	181
	0	199	195	192	190	188
120,000	8,000	180	176	173	171	169
	6,000	187	183	180	177	175
	4,000	193	190	187	184	182
	2,000	201	197	194	191	189
	0	208	204	201	198	197
110,000	8,000	189	186	183	180	178
	6,000	197	193	190	187	185
	4,000	204	200	197	194	192
	2,000	> 210	207	204	201	199
	0	> 210	> 210	> 210	209	207
100,000	8,000	200	197	193	191	188
	6,000	208	204	201	198	196
	4,000	> 210	> 210	208	206	203
	2,000	> 210	> 210	> 210	> 210	> 210
	0	> 210	> 210	> 210	> 210	> 210
90,000	8,000	> 210	210	206	203	201
	6,000	> 210	> 210	> 210	> 210	209
	4,000	> 210	> 210	> 210	> 210	> 210
	2,000	> 210	> 210	> 210	> 210	> 210
	0	> 210	> 210	> 210	> 210	> 210

CORRECTIONS:

CONDITION	V _{MBE} CORRECTION
Runway Slope – per 1% uphill	+1 knot
Runway Slope – per 1% downhill	-4 knots
Headwind – per 10 knots	+3 knots
Tailwind – per 10 knots	-20 knots

MEL SUPPORT**V_{MBE} – MAXIMUM BRAKE ENERGY SPEED LIMITS****KIAS****TO1 (26K) THRUST**

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
190,000	8,000	< 160	< 160	< 160	< 160	< 160
	6,000	< 160	< 160	< 160	< 160	< 160
	4,000	< 160	< 160	< 160	< 160	< 160
	2,000	< 160	< 160	< 160	< 160	< 160
	0	162	< 160	< 160	< 160	< 160
180,000	8,000	< 160	< 160	< 160	< 160	< 160
	6,000	< 160	< 160	< 160	< 160	< 160
	4,000	< 160	< 160	< 160	< 160	< 160
	2,000	161	< 160	< 160	< 160	< 160
	0	167	164	160	< 160	< 160
170,000	8,000	< 160	< 160	< 160	< 160	< 160
	6,000	< 160	< 160	< 160	< 160	< 160
	4,000	160	< 160	< 160	< 160	< 160
	2,000	166	163	160	< 160	< 160
	0	172	169	166	164	162
160,000	8,000	< 160	< 160	< 160	< 160	< 160
	6,000	< 160	< 160	< 160	< 160	< 160
	4,000	165	162	< 160	< 160	< 160
	2,000	172	168	165	163	161
	0	178	175	171	169	167
150,000	8,000	< 160	< 160	< 160	< 160	< 160
	6,000	165	162	< 160	< 160	< 160
	4,000	171	168	165	163	161
	2,000	178	174	171	169	167
	0	185	181	178	176	174
140,000	8,000	165	162	160	< 160	< 160
	6,000	171	168	165	163	161
	4,000	178	175	172	169	168
	2,000	185	181	178	176	174
	0	193	188	185	183	181

CORRECTIONS:

CONDITION	V _{MBE} CORRECTION
Runway Slope – per 1% uphill	+1 knot
Runway Slope – per 1% downhill	-4 knots
Headwind – per 10 knots	+3 knots
Tailwind – per 10 knots	-20 knots

MEL SUPPORT

V_{MBE} – MAXIMUM BRAKE ENERGY SPEED LIMITS

KIAS

TO1 (26K) THRUST

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
130,000	8,000	172	169	166	164	162
	6,000	179	175	173	170	168
	4,000	186	182	179	177	175
	2,000	193	189	186	184	182
	0	201	197	193	191	189
120,000	8,000	180	177	174	172	170
	6,000	187	184	181	178	176
	4,000	195	191	187	185	183
	2,000	202	198	195	192	190
	0	> 210	206	202	200	197
110,000	8,000	189	186	183	181	179
	6,000	197	193	190	188	185
	4,000	205	201	197	195	193
	2,000	> 210	209	205	202	200
	0	> 210	> 210	> 210	> 210	208
100,000	8,000	201	197	194	192	189
	6,000	209	205	201	199	196
	4,000	> 210	> 210	209	206	204
	2,000	> 210	> 210	> 210	> 210	> 210
	0	> 210	> 210	> 210	> 210	> 210
90,000	8,000	> 210	208	205	202	200
	6,000	> 210	> 210	> 210	> 210	207
	4,000	> 210	> 210	> 210	> 210	> 210
	2,000	> 210	> 210	> 210	> 210	> 210
	0	> 210	> 210	> 210	> 210	> 210

CORRECTIONS:

CONDITION	V _{MBE} CORRECTION
Runway Slope – per 1% uphill	+1 knot
Runway Slope – per 1% downhill	-4 knots
Headwind – per 10 knots	+3 knots
Tailwind – per 10 knots	-20 knots

MEL SUPPORT**V_{MBE} – MAXIMUM BRAKE ENERGY SPEED LIMITS****KIAS****TO2 (24K) THRUST**

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
190,000	8,000	< 160	< 160	< 160	< 160	< 160
	6,000	< 160	< 160	< 160	< 160	< 160
	4,000	< 160	< 160	< 160	< 160	< 160
	2,000	< 160	< 160	< 160	< 160	< 160
	0	163	160	< 160	< 160	< 160
180,000	8,000	< 160	< 160	< 160	< 160	< 160
	6,000	< 160	< 160	< 160	< 160	< 160
	4,000	< 160	< 160	< 160	< 160	< 160
	2,000	162	< 160	< 160	< 160	< 160
	0	168	165	162	160	< 160
170,000	8,000	< 160	< 160	< 160	< 160	< 160
	6,000	< 160	< 160	< 160	< 160	< 160
	4,000	161	< 160	< 160	< 160	< 160
	2,000	167	164	161	< 160	< 160
	0	174	170	167	165	163
160,000	8,000	< 160	< 160	< 160	< 160	< 160
	6,000	160	< 160	< 160	< 160	< 160
	4,000	166	163	161	< 160	< 160
	2,000	173	169	167	165	163
	0	180	176	173	171	169
150,000	8,000	< 160	< 160	< 160	< 160	< 160
	6,000	165	162	160	< 160	< 160
	4,000	172	169	166	164	162
	2,000	179	176	173	171	169
	0	187	183	179	177	175
140,000	8,000	165	163	161	< 160	< 160
	6,000	172	169	167	165	162
	4,000	179	176	173	171	169
	2,000	186	183	180	177	175
	0	194	190	187	184	182

CORRECTIONS:

CONDITION	V _{MBE} CORRECTION
Runway Slope – per 1% uphill	+1 knot
Runway Slope – per 1% downhill	-4 knots
Headwind – per 10 knots	+3 knots
Tailwind – per 10 knots	-20 knots

MEL SUPPORT**V_{MBE} – MAXIMUM BRAKE ENERGY SPEED LIMITS****KIAS****TO2 (24K) THRUST**

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
130,000	8,000	172	170	168	165	163
	6,000	180	176	174	172	170
	4,000	187	183	181	178	176
	2,000	195	191	188	185	183
	0	203	199	195	193	190
120,000	8,000	180	178	175	173	171
	6,000	188	184	182	180	177
	4,000	196	192	189	187	184
	2,000	204	200	196	194	192
	0	> 210	208	204	202	199
110,000	8,000	190	187	185	182	180
	6,000	198	194	192	189	187
	4,000	206	202	199	197	194
	2,000	> 210	> 210	206	204	202
	0	> 210	> 210	> 210	> 210	209
100,000	8,000	201	198	196	193	191
	6,000	210	206	203	201	198
	4,000	> 210	> 210	> 210	209	206
	2,000	> 210	> 210	> 210	> 210	> 210
	0	> 210	> 210	> 210	> 210	> 210
90,000	8,000	> 210	209	207	204	201
	6,000	> 210	> 210	> 210	> 210	209
	4,000	> 210	> 210	> 210	> 210	> 210
	2,000	> 210	> 210	> 210	> 210	> 210
	0	> 210	> 210	> 210	> 210	> 210

CORRECTIONS:

CONDITION	V _{MBE} CORRECTION
Runway Slope – per 1% uphill	+1 knot
Runway Slope – per 1% downhill	-4 knots
Headwind – per 10 knots	+3 knots
Tailwind – per 10 knots	-20 knots

MEL SUPPORT

V_{MCG} - MINIMUM CONTROL SPEED, GROUND

KIAS

CFM56-7B27B1

NO NOSEWHEEL STEERING

AIRPORT PRESSURE ALTITUDE - FEET	TEMPERATURE - °C						
	-60	20	30	40	50	60	70
-2,000	106	104	104	102	97	95	95
0	105	104	103	100	95	92	92
2,000	103	101	99	96	91	90	
4,000	99	97	95	92	89	89	
6,000	96	93	91	88	87		
8,000	92	89	88	85	85		
10,000	89	85	84	83	83		

NOTES:

- V_{MCG} is defined as the minimum control speed on the *ground*. It is the speed where the airplane can maintain directional control after a critical engine failure using the primary aerodynamic controls only. Credit for nose wheel steering is NOT taken.

MEL SUPPORT

73-00-11: EEC NORMAL MODE INOPERATIVE

RESTRICTIONS

The following restrictions apply to all MEL items presented on this page:

1. Set takeoff thrust manually. Use of Alternate Thrust for takeoff is NOT authorized.

73-00-11

EEC ALTERNATE
MODE

MEL 73-00-11 allows dispatch with the Electronic Engine Control inoperative, provided both engines are operated in the ALTERNATE mode. The following N_1 power setting must be used in lieu of the NORMAL thrust setting charts. Refer to the next page for the N_1 takeoff power setting chart for EEC ALT mode.

NOTE:

Maximum rated thrust may be reached at a reduced thrust lever position.

Procedures are unchanged except both EEC Mode switches must be in the ALTERNATE position.

V-SPEED CORRECTIONS

The takeoff speeds must be adjusted using the table below.

TAKEOFF SPEEDS	TAKEOFF SPEED ADJUSTMENT – KNOTS
Dry V_1	+ 1
Wet V_1	+ 2
V_R	+ 1
V_2	0

MEL SUPPORT**73-00-11: EEC ALTERNATE MODE TAKEOFF THRUST****%N₁****CFM56-7B27B1**

BASED ON ENGINE BLEEDS FOR PACKS ON
ENGINE AND WING ANTI-ICE ON OR OFF

OAT – °C	AIRPORT PRESSURE ALTITUDE – FEET										
	-1,000	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000
60	94.2	94.7	95.0	95.4	95.5	95.5	95.5	95.1	94.6	94.2	94.9
55	95.0	95.2	95.5	95.8	96.1	96.3	96.3	96.0	95.6	95.1	95.0
50	96.3	96.5	96.4	96.3	96.7	97.0	97.0	96.9	96.6	96.2	96.2
45	97.3	97.9	97.7	97.5	97.6	97.8	97.8	97.7	97.6	97.3	97.3
40	98.0	98.6	98.6	98.5	98.5	98.5	98.4	98.5	98.5	98.4	98.3
35	98.7	99.7	99.7	99.5	99.5	99.4	99.4	99.4	99.4	99.4	99.4
30	98.7	100.4	100.3	100.4	100.2	100.2	100.2	100.1	100.1	100.1	100.0
25	98.0	99.8	100.5	100.5	100.4	100.4	100.4	100.3	100.3	100.3	100.3
20	97.3	99.2	100.5	100.5	100.4	100.4	100.4	100.4	100.4	100.3	100.3
15	96.6	98.6	100.5	100.5	100.4	100.4	100.4	100.4	100.3	100.3	100.3
10	95.8	97.9	100.0	100.3	100.4	100.4	100.4	100.4	100.4	100.3	100.3
5	95.1	97.1	99.3	99.5	99.8	100.1	100.3	100.4	100.3	100.3	100.3
0	94.3	96.4	98.5	98.8	99.0	99.3	99.6	99.9	100.2	100.3	100.3
-5	93.5	95.6	97.7	98.0	98.2	98.5	98.8	99.1	99.4	99.7	100.0
-10	92.7	94.9	97.0	97.2	97.5	97.7	98.0	98.3	98.6	98.9	99.2
-15	91.9	94.1	96.2	96.4	96.7	96.9	97.2	97.5	97.8	98.1	98.4
-20	91.1	93.3	95.4	95.6	95.9	96.1	96.4	96.7	97.0	97.2	97.5
-25	90.3	92.5	94.6	94.8	95.1	95.3	95.6	95.9	96.1	96.4	96.7
-30	89.4	91.7	93.7	94.0	94.2	94.5	94.7	95.0	95.3	95.6	95.9
-35	88.6	90.9	92.9	93.2	93.4	93.6	93.9	94.2	94.5	94.7	95.0
-40	87.7	90.1	92.1	92.3	92.6	92.8	93.1	93.3	93.6	93.9	94.2
-45	86.9	89.2	91.2	91.5	91.7	91.9	92.2	92.5	92.8	93.0	93.3
-50	86.0	88.4	90.4	90.6	90.8	91.1	91.3	91.6	91.9	92.1	92.4

Engine Bleed Adjustments:

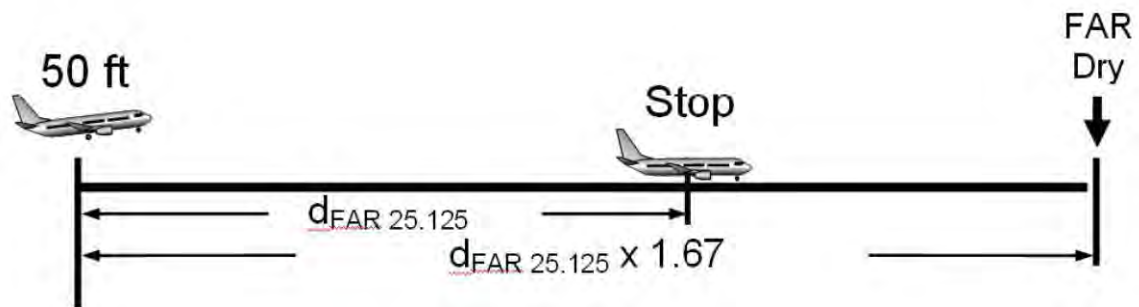
BLEED CONFIG	AIRPORT PRESSURE ALTITUDE – FEET										
	-1,000	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000
PACKS OFF	+0.8	+0.8	+0.9	+0.9	+0.9	+1.0	+1.0	+1.0	+1.0	+1.0	+1.0

MEL SUPPORT

FAR LANDING DISTANCES (FACTORED)

DEFINITION

All given distances in this section are FAR (Factored) Landing Distances. These distances represent the actual (or demonstrated) landing distances – designated as d_{FAR} in the diagram below – multiplied by a factor of 1.67.



FAR Landing Distance Diagram

This is in accordance with FAR 121.195, requiring the aircraft to be able to come to a complete stop within 60% of the effective length of the runway.

APPLICABILITY

The tables on the following pages provide landing distances and approach speeds to be used for dispatch with the given conditions and the associated MEL applied. For landing distances in the event of an in-flight system failure or abnormality not detected at or prior to dispatch, please refer to the “Abnormal Configuration Actual Landing Distances and Approach Speeds” pages in this section of the ODM.

ASSUMPTIONS

The data within this section was generated based on a set of assumed conditions:

- Standard day conditions
- No wind
- No slope
- No reverse thrust credit factored in FAR Landing Distances
- Maximum manual braking
- Includes distance from 50 feet above threshold to stop (1,000 feet of air distance)

MEL SUPPORT**FAR LANDING DISTANCES (FACTORED)****FLAPS 40****ANTI-SKID INOP – DRY RUNWAY ***

AIRCRAFT WEIGHT LBS	AIRPORT PRESSURE ALTITUDE - FEET									
	-1,000	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000
190,000	11,840	12,130	12,430	12,790	13,160	13,560	13,920	14,310	14,700	15,110
180,000	11,230	11,500	11,790	12,130	12,490	12,870	13,230	13,610	14,000	14,410
170,000	10,630	10,880	11,160	11,480	11,830	12,210	12,560	12,930	13,310	13,710
160,000	10,090	10,330	10,590	10,890	11,230	11,590	11,930	12,280	12,650	13,030
150,000	9,610	9,830	10,080	10,360	10,670	11,000	11,310	11,640	11,990	12,350
140,000	9,130	9,340	9,570	9,840	10,130	10,440	10,720	11,010	11,330	11,660
130,000	8,640	8,830	9,030	9,290	9,560	9,850	10,110	10,380	10,660	10,960
120,000	8,150	8,320	8,510	8,740	8,990	9,260	9,500	9,750	10,010	10,290
110,000	7,660	7,810	7,980	8,200	8,430	8,680	8,900	9,130	9,370	9,620
100,000	7,170	7,310	7,470	7,670	7,880	8,120	8,320	8,530	8,740	8,970
90,000	6,680	6,810	6,950	7,130	7,330	7,560	7,740	7,930	8,120	8,330

ANTI-SKID INOP – WET RUNWAY *

AIRCRAFT WEIGHT LBS	AIRPORT PRESSURE ALTITUDE - FEET									
	-1,000	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000
190,000	13,610	13,940	14,300	14,710	15,140	15,590	16,010	16,450	16,910	17,380
180,000	12,910	13,230	13,560	13,950	14,360	14,800	15,210	15,650	16,100	16,570
170,000	12,230	12,510	12,830	13,210	13,600	14,040	14,440	14,870	15,310	15,770
160,000	11,600	11,880	12,170	12,520	12,910	13,330	13,720	14,120	14,540	14,980
150,000	11,050	11,310	11,590	11,920	12,270	12,650	13,010	13,390	13,790	14,200
140,000	10,500	10,740	11,000	11,310	11,640	12,000	12,330	12,660	13,030	13,410
130,000	9,930	10,150	10,390	10,680	10,990	11,320	11,620	11,940	12,260	12,600
120,000	9,370	9,570	9,780	10,050	10,330	10,650	10,930	11,220	11,520	11,830
110,000	8,810	8,980	9,180	9,420	9,690	9,980	10,240	10,500	10,780	11,070
100,000	8,240	8,410	8,590	8,820	9,060	9,340	9,560	9,810	10,050	10,310
90,000	7,680	7,830	7,990	8,200	8,430	8,690	8,900	9,120	9,340	9,580

CORRECTIONS:

Per 1 kt. Headwind	-50	-50	-50	-50	-50	-50	-50	-50	-50	-50
Per 1 kt. Tailwind	+ 240	+ 240	+ 240	+ 250	+ 250	+ 260	+ 260	+ 260	+ 270	+ 270

***NOTE:** With Anti-skid Inoperative, tire damage or blowouts can occur if moderate to heavy braking is used. Actual Landing Distance charts are based on Maximum Manual Braking. The distances on this chart include an additional 67% factor to reduce braking requirements and the possibility of tire damage. When Anti-skid is inoperative use the longest available runway.

MEL SUPPORT

FAR LANDING DISTANCES (FACTORED)

FLAPS 40
MANUAL SPOILERS – DRY RUNWAY

AIRCRAFT WEIGHT LBS	AIRPORT PRESSURE ALTITUDE - FEET									
	-1,000	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000
190,000	6,740	6,890	7,060	7,230	7,410	7,600	7,790	7,980	8,190	8,400
180,000	6,220	6,360	6,510	6,670	6,830	7,010	7,190	7,380	7,580	7,780
170,000	5,840	5,960	6,100	6,250	6,410	6,580	6,760	6,940	7,130	7,330
160,000	5,530	5,640	5,760	5,890	6,040	6,200	6,370	6,540	6,720	6,910
150,000	5,250	5,350	5,470	5,590	5,710	5,840	5,990	6,150	6,320	6,490
140,000	4,970	5,070	5,170	5,280	5,390	5,520	5,640	5,770	5,910	6,070
130,000	4,680	4,770	4,870	4,960	5,070	5,180	5,290	5,400	5,530	5,650
120,000	4,400	4,480	4,560	4,650	4,740	4,840	4,940	5,050	5,150	5,270
110,000	4,160	4,230	4,300	4,380	4,460	4,550	4,640	4,730	4,830	4,940
100,000	3,940	4,000	4,070	4,140	4,220	4,300	4,380	4,460	4,550	4,640
90,000	3,710	3,770	3,840	3,900	3,970	4,040	4,120	4,190	4,270	4,360

MANUAL SPOILERS – WET RUNWAY

AIRCRAFT WEIGHT LBS	AIRPORT PRESSURE ALTITUDE - FEET									
	-1,000	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000
190,000	7,750	7,930	8,110	8,310	8,520	8,730	8,950	9,180	9,410	9,660
180,000	7,150	7,320	7,490	7,670	7,860	8,060	8,270	8,490	8,710	8,950
170,000	6,720	6,850	7,020	7,190	7,370	7,570	7,770	7,980	8,200	8,420
160,000	6,350	6,490	6,630	6,780	6,950	7,130	7,320	7,520	7,730	7,940
150,000	6,030	6,150	6,290	6,420	6,570	6,720	6,890	7,070	7,260	7,460
140,000	5,710	5,830	5,950	6,070	6,200	6,340	6,480	6,630	6,800	6,980
130,000	5,380	5,490	5,590	5,710	5,820	5,950	6,080	6,210	6,350	6,500
120,000	5,060	5,150	5,250	5,350	5,450	5,560	5,680	5,800	5,930	6,060
110,000	4,780	4,860	4,940	5,030	5,130	5,230	5,330	5,440	5,560	5,680
100,000	4,530	4,600	4,680	4,760	4,850	4,940	5,030	5,130	5,230	5,340
90,000	4,270	4,340	4,410	4,480	4,560	4,650	4,730	4,820	4,910	5,010

CORRECTIONS:

Per 1 kt. Headwind	-20	-20	-20	-20	-20	-20	-20	-20	-20	-20
Per 1 kt. Tailwind	+ 120	+ 120	+ 120	+ 120	+ 120	+ 130	+ 150	+ 170	+ 190	+ 220

End of Section

FERRY FLIGHT PLANNING AND OPERATION

AUTHORIZATION AND FLIGHT PLANNING	5-2
LANDING GEAR EXTENDED	5-3
WINGLET(S) REMOVED.....	5-6

AUTHORIZATION AND FLIGHT PLANNING

Authorization, procedures, and applicability of data for ferry operations is described in the Flight Operations Manual (Chapters 9 and 35) and the Technical Operations Policies and Procedures Manual (TOPP 40-60-05). Procedures outlined in these manuals must be strictly adhered to.

Ferry operational data is available for the following configurations:

- Landing Gear Extended
- Winglet(s) Removed

The following method should be used for ferry flight planning and certain revenue flight planning (as noted) and operations:

1. Obtain a normal aircraft configuration (computerized or manual) unfiled flight plan using Long Range Cruise (LRC) at the proposed cruise altitude. (The following FERRY page contains recommended cruise altitude under the FLIGHT PLANNING heading.)
2. Calculate the trip time and fuel load using the provided data under the FLIGHT PLANNING heading. Enter this data either in the Dispatcher Remarks section of the Computerized Flight Plan or on the Standby Flight Plan form (NS80172).
3. Add remarks containing the ferry speed, speed limit, altitude limit, total time, leg times if appropriate, and engine-out altitude capability.
Note: Suggested cruise altitudes are for reference, and reasonable adjustments may be made to accommodate ATC and direction of flight.
4. Assure adequate terrain clearance by referring to the Engine Out Altitude Limit table, if available. (See FERRY, ENROUTE heading)
5. Adjust the Runway Allowable and Climb Limit Takeoff Weights, and the Landing Climb Limit Weight as follows:
Subtract the weight decrements indicated under headings for TAKEOFF and LANDING from the NORMAL Thrust takeoff weight and the Landing Climb weight, respectively, obtained from the ARM (Airport Sections).

The following limitations should be applied to all ferry flights:

1. All ferry flight takeoffs will be made using full (NORMAL) thrust (TMC TO) and climb out will be made using Maximum Climb thrust (TMC CLB) unless otherwise specified on ferry configuration data page.
2. Observe additional limitations and restrictions as listed for each ferry configuration on the following data pages.

LANDING GEAR EXTENDED

Use the following conditions and factors for ferry flights with landing gear extended.

LIMITATIONS:

Refer to "Landing Gear Extended Revenue Operations" in the Abnormal section of the ODM for a list of operational limitations.

FLIGHT PLANNING

Fuel Required / Trip Time (1,000 lb / hours):

PRESSURE ALTITUDE – FEET	RANGE – NAUTICAL MILES				
	400	800	1,200	1,600	1,800
10,000	12.3 / 1.6	24.5 / 3.1	37.4 / 4.5	51.0 / 5.8	57.8 / 6.5
14,000	11.5 / 1.5	23.0 / 2.9	35.2 / 4.3	47.7 / 5.6	54.2 / 6.2
20,000	10.7 / 1.4	21.1 / 2.7	32.0 / 3.9	43.2 / 5.2	49.0 / 5.7
24,000	10.3 / 1.4	20.1 / 2.6	30.4 / 3.7		

NOTE: Based on Long Range Cruise, VREF40 + 70 climb and descent, zero winds, ISA conditions.

Assumes landing weight of 130,000 lb.

-Decrease fuel required by 3.5 percent for every 10,000 lb below 130,000 lb.

-Increase fuel required by 4 percent for every 10,000 above 130,000 lb.

TAKEOFF

RATOW & Takeoff climb limit weight:

Use GRD TPI in AWABS

Takeoff V Speeds:

Use GRD TPI in AWABS

Takeoff Thrust Settings:

Use NORMAL only, ALTERNATE thrust NOT approved.

Takeoff Flap Settings:

1, 5, or 15 degrees only.

Operation from Contaminated Runway:

Permitted, use GRD TPI.

LANDING GEAR EXTENDED (cont.)

ENROUTE

Long Range Cruise, All Engine

GROSS WEIGHT - POUNDS	PRESSURE ALTITUDE - 1,000 FEET CRUISE SPEED - KIAS MACH NUMBER TARGET %N1 FUEL FLOW / ENGINE - LB/HR									
	10	21	23	25	27	29	31	33	35	37
180,000	262 0.473 85.1 5,168									
170,000	254 0.460 83.5 4,868	251 0.560 93.0 4,822								
160,000	247 0.447 81.9 4,571	245 0.548 91.1 4,524	243 0.565 93.3 4,525							
150,000	240 0.434 80.1 4,280	239 0.535 89.4 4,241	237 0.552 91.2 4,214	235 0.569 93.7 4,243						
140,000	232 0.420 78.3 3,998	232 0.518 87.5 3,938	231 0.538 89.2 3,932	229 0.555 91.2 3,920	227 0.573 94.0 3,970					
130,000	224 0.406 76.4 3,719	223 0.500 85.4 3,633	224 0.521 87.3 3,633	223 0.541 89.0 3,634	221 0.558 91.1 3,637	218 0.576 94.2 3,696				
120,000	216 0.391 74.4 3,443	215 0.482 83.3 3,336	215 0.501 85.0 3,330	215 0.523 86.8 3,338	214 0.543 88.6 3,347	212 0.560 90.9 3,354	210 0.579 94.1 3,420			
110,000	207 0.375 72.2 3,172	206 0.462 81.0 3,046	206 0.481 82.7 3,037	206 0.501 84.4 3,039	206 0.523 86.2 3,055	205 0.543 88.0 3,063	203 0.561 90.5 3,069	201 0.580 93.8 3,140		
100,000	198 0.359 69.7 2,910	197 0.442 78.5 2,764	197 0.460 80.2 2,749	197 0.479 81.9 2,750	196 0.499 83.6 2,761	197 0.521 85.5 2,773	196 0.542 87.3 2,779	194 0.560 89.8 2,784	192 0.580 93.2 2,854	
90,000	189 0.343 67.1 2,659	187 0.421 75.7 2,493	187 0.438 77.4 2,468	187 0.456 79.1 2,464	187 0.475 80.8 2,476	187 0.496 82.6 2,482	187 0.518 84.4 2,489	186 0.540 86.4 2,495	184 0.558 88.8 2,500	182 0.578 92.6 2,575

Refer to "Landing Gear Extended Revenue Operations" in the Abnormal section of the ODM for driftdown performance and one engine inoperative Long Range Cruise speeds, N1 settings, and altitude capability.

LANDING GEAR EXTENDED (cont.)**LANDING**

Landing Speed restrictions:	No additional restrictions
Flap Setting Restrictions:	No additional restrictions
Approach & Landing climb limit weights:	Reduce by 23,000 lbs

HOLDING SPEED / THRUST (KIAS / %N1)

Weight - Pounds	Altitude - Feet	
	10,000	15,000
190,000	229 / 83.3	229 / 87.7
180,000	225 / 81.8	225 / 86.1
170,000	220 / 80.2	220 / 84.5
160,000	215 / 78.6	215 / 82.9
150,000	211 / 76.9	211 / 81.2
140,000	206 / 75.2	206 / 79.4
130,000	200 / 73.4	200 / 77.4
120,000	194 / 71.4	194 / 75.4
110,000	189 / 69.2	189 / 73.4
100,000	182 / 67.0	182 / 71.2
90,000	176 / 64.8	176 / 68.8

WINGLET(S) REMOVED

Use the following conditions and factors for one winglet or both winglets removed and with wing extensions either both installed or both removed.

LIMITATIONS:

Ferry flights are allowed with the following configurations:

- A winglet on one wing, and no winglet on the other wing.
- No wingtip treatment on either wing.

For aircraft with Split Scimitar Winglets, ferry flights are allowed with the following configurations:

- A winglet on one wing, and no wingtip treatment on the other wing. Both split scimitar winglet ventral strakes must be removed. Flight with only one split scimitar ventral strake installed is NOT authorized.
- No wingtip treatment on either wing.

Airplane must be flown during daytime hours since the position and anti-collision lights on the removed winglet(s) will be missing.

Avoid turbulence. Avoid abrupt control inputs.

Avoid flight in icing conditions.

Balance weight(s), if part of the winglet installation(s), shall remain in place.

NOTE: Balance weight(s) are installed in the wing leading edge(s). Disassembly of the wing leading edge(s) is not required for ferry flight without winglet(s).

Maximum Cruise Altitude: Normal

Maximum Speed: 300KIAS or 0.82 MACH. Whichever is lower.

C. G. Limitations No additional restrictions.

En Route Weather Restrictions: No additional restrictions.

FLIGHT PLANNING

Increase trip fuel by 15%

Reduce all climb performance limited weights, i.e., takeoff climb and obstacle clearance, enroute climb, approach climb, and landing climb weight limits by 15,000 pounds

TAKEOFF

Maximum crosswind: 15 knots.

RATOW & Climb limit weight: Reduce by 15,000 lbs

ENROUTE

Trim with rudder if/as required during cruise flight so the autopilot can be used.

Climb: Normal climb speeds and thrusts (TMC)

Cruise: Normal cruise speeds and thrusts (TMC)

Climb limit weight: Reduce by 15,000 lbs

LANDING

Cat. I landing approaches only.

Maximum crosswind: 15 knots.

Landing Speed restrictions: No additional restrictions

Flap Setting Restrictions: No additional restrictions

Adjustment to Landing Climb Limit Weights: None

Approach & Landing climb limit weights: Reduce by 15,000 lbs

End of Section

CONTENTS

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CRITICAL FUEL RESERVES	6-3
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ETOPS PERFORMANCE PROCEDURES

This section provides performance data for use in the event of an ETOPS enroute diversion and for flight planning to assure availability of engine-out terrain clearance and ETOPS fuel requirements. The performance levels in this section are based upon the following thrust setting and speed criteria:

1. Maximum Continuous Thrust.
2. Mach 0.79/290 KIAS driftdown speeds.
3. 290 KIAS engine-out cruise speed.

In the event of pressurization loss in addition to or independent of an engine shutdown, cruise at 290 KIAS (engine-out) or LRC (all-engines) following emergency descent to 10,000 feet or to 14,000 feet over terrain-critical areas of Greenland. Refer to the Airway Manual and QRH for driftdown and emergency descent procedures.

Refer to ABNORMAL Section for one engine operating LRC data.

FLIGHT PLANNING CONSIDERATIONS

Flight Planning data provided in ETOPS CRITICAL FUEL RESERVES reflects the analysis used by Flight Control to assure availability of required ETOPS fuel reserves. Critical Fuel Reserves are shown on the flight plan as "ETP Diversion Fuel" and are provided for both icing conditions and non-icing conditions. The ETOPS Critical Fuel Reserves are based upon the greater of engine-out or all-engines fuel consumption and reflect the following flight profile:

- Pressurization Inoperative
- Emergency descent to 10,000 feet
- Cruise at 10,000 feet/290 KIAS (engine-out) or LRC (all engines)
- 250 KIAS descent to 1,500 feet
- 15 minutes hold fuel at 1,500 feet
- Approach and land
- 5% fuel added for wind errors
- APU operating

- 5% fuel added for weather avoidance (180 minute ETOPS)

For icing conditions, seven percent additional fuel is added to account for both engine and wing anti-ice and ice accumulation on unheated surfaces. If forecast meteorology for the flight plan track indicates icing conditions, the flight planning system applies appropriate adjustment to these reserves to account for performance deterioration of each specific ship number. These adjustments are updated weekly based upon Delta's aircraft/engine trend monitoring system.

Use of these procedures and Critical Fuel Reserves allows the following ETOPS Area of Operation (still air operating radius):

120 minutes - 788 NM
180 minutes – 1,174 NM

CRITICAL FUEL RESERVES

FORECAST ICING CONDITIONS
ISA & BELOW

INITIAL GROSS WT (LB)	CRITICAL FUEL RESERVES - 1,000 LB									
	DISTANCE TO ALTERNATE - NAM									
	400	500	600	700	800	900	1,000	1,100	1,200	1,300
180,000	10.3	12.6	14.9	17.1	19.5	21.8	24.1	26.2	28.5	30.8
170,000	9.9	12.2	14.4	16.6	19.0	21.2	23.4	25.6	27.8	30.0
160,000	9.6	11.8	14.0	16.1	18.4	20.6	22.7	24.9	27.0	29.1
150,000	9.4	11.5	13.6	15.7	17.9	20.0	22.1	24.2	26.3	28.3
140,000	9.1	11.2	13.2	15.3	17.4	19.4	21.5	23.5	25.6	27.5
130,000	9.0	10.9	12.9	14.9	17.0	18.9	20.9	22.9	24.9	26.8
120,000	8.8	10.5	12.5	14.5	16.5	18.4	20.4	22.3	24.2	26.1
110,000	8.4	10.2	12.2	14.1	16.0	17.8	19.8	21.6	23.5	25.3
100,000	8.1	9.9	11.8	13.7	15.6	17.4	19.3	21.2	23.0	25.0

NOTES

- Based upon the greater of fuel burn for one-engine inoperative or for all-engines operating using the following flight profile:
 - Emergency descent to 10,000 ft.
 - Cruise @ 10,000 ft @ 290 KIAS.
 - 250 KIAS descent.
 - 15 minutes hold fuel at 1,500 feet.
 - Approach and land.
 - APU Operating.
- Includes the following fuel allowances:
 - 5% for wind forecast errors.
 - 5% for weather avoidance (180 minute ETOPS).**
 - 7% for Engine/Wing Anti-Ice ON and ice accumulation.
- This data reflects ETOPS data used by FLIGHT CONTROL for ETP Diversion Fuel analysis.
- The flight planning system adjusts Critical Fuel Reserve data to account for individual ship number performance deterioration
- For ambient temperatures above ISA, increase fuel required by 0.7% for each 10°C above ISA.

CRITICAL FUEL RESERVES

ANTI-ICE NOT REQUIRED
ISA & BELOW

INITIAL GROSS WT (LB)	CRITICAL FUEL RESERVES – 1,000 LB									
	DISTANCE TO ALTERNATE - NAM									
	400	500	600	700	800	900	1,000	1,100	1,200	1,300
180,000	9.2	11.3	13.3	15.3	17.5	19.5	21.6	23.5	25.6	27.6
170,000	8.9	11.0	13.0	14.9	17.0	19.0	21.0	22.9	24.9	26.9
160,000	8.6	10.6	12.6	14.5	16.5	18.5	20.4	22.4	24.3	26.1
150,000	8.4	10.3	12.2	14.1	16.1	18.0	19.8	21.7	23.6	25.4
140,000	8.2	10.1	11.9	13.8	15.6	17.4	19.3	21.1	23.0	24.7
130,000	8.0	9.8	11.6	13.4	15.2	17.0	18.8	20.6	22.4	24.0
120,000	7.9	9.5	11.2	13.0	14.8	16.5	18.3	20.1	21.7	23.4
110,000	7.6	9.2	10.9	12.7	14.4	16.0	17.7	19.4	21.1	22.7
100,000	7.2	8.9	10.6	12.3	14.0	15.6	17.3	19.0	20.7	22.5

NOTES:

1. Based upon the greater of fuel burn for one-engine inoperative or. all-engines operating using the following flight profile:
 - a. Emergency descent to 10,000 ft
 - b. Cruise @ 290 KIAS @ 10,000 ft.
 - c. 250 KIAS descent.
 - d. 15 minutes hold fuel at 1,500 feet.
 - e. Approach and land.
 - f. APU Operating .
2. Includes the following fuel allowances.
 - a. 5% for wind forecast errors.
3. This data reflects data used by FLIGHT CONTROL for ETP Diversion Fuel analysis.
4. The flight planning system adjusts this critical fuel data to account for individual ship number performance deterioration.
5. For ambient temperatures above ISA, increase fuel required by 0.7% for each 10 °C above ISA.

End of Section