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B-737-700

Operational Data

Manual

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Revision Date: September 23, 2016

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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-737-700 OPERATIONAL DATA MANUAL

Date: 23 Sep 16

Revision Number: 30

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REMOVE	INSERT	REMARKS
TABLE OF CONTENTS	TABLE OF CONTENTS	Date updated to reflect revision.
COVER PAGE	COVER PAGE	Cover page updated to reflect revision.
LIST OF EFFECTIVE PAGES Page <i>i</i>	LIST OF EFFECTIVE PAGES Page <i>i</i>	List of Effective Pages updated to reflect revision.
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.*

This list is effective with ODM Revision #30

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END

737-700 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	
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	30 to 29	13 – 18
Medium to Poor	Braking deceleration OR directional control is between Medium and Poor.	Greater than 1/8" depth of: - Water - Slush	2	21 to 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.

737-700 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
155,000	11,000	9,800	7,600	5,500	4,400	7,600	6,300	6,000
150,000	10,700	9,500	7,400	5,400	4,400	7,500	6,200	5,900
145,000	10,400	9,300	7,300	5,300	4,300	7,300	6,100	5,800
140,000	10,100	9,100	7,100	5,200	4,200	7,100	5,900	5,600
135,000	9,800	8,800	7,000	5,100	4,100	7,000	5,800	5,500
130,000	9,500	8,600	6,800	5,000	4,000	6,800	5,700	5,400
129,200	9,500	8,600	6,800	5,000	4,000	6,800	5,700	5,400
125,000	9,200	8,300	6,600	4,900	3,900	6,600	5,600	5,300
120,000	8,900	8,100	6,500	4,800	3,800	6,500	5,400	5,100
115,000	8,600	7,800	6,300	4,700	3,800	6,300	5,300	5,000
110,000	8,300	7,600	6,100	4,600	3,700	6,100	5,200	4,900
105,000	8,000	7,300	5,900	4,500	3,600	5,900	5,000	4,800
100,000	7,700	7,100	5,800	4,400	3,500	5,800	4,900	4,600
95,000	7,400	6,800	5,600	4,300	3,400	5,600	4,800	4,500

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Speed at Touchdown = 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	-600	-500	-300	-200	-100	-300	-300	-200
2,000	0	0	0	0	0	0	0	0
4,000	600	500	300	200	100	300	300	200
6,000	1,100	900	600	400	300	600	500	500
8,000	1,700	1,400	1,000	600	400	1,000	800	700
10,000	2,500	2,000	1,400	900	600	1,400	1,100	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	350	400	350	200	100	350	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	-100	0	0	-50	0	-100	-100
PER 1% DOWN SLOPE	200	50	0	0	50	0	100	100
1 REVERSER INOP	700	100	0	0	100	0	300	200
2 REVERSERS INOP	800	100	0	0	100	100	600	600
MANUAL SPOILERS	200	200	200	200	200	200	200	200

Note: Do not operate when Braking Action is Nil.

737-700 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
155,000	8,500	8,300	8,200	10,800	10,800	10,800
150,000	8,300	8,100	8,000	10,500	10,500	10,500
145,000	8,100	7,900	7,800	10,200	10,200	10,200
140,000	7,900	7,700	7,600	10,000	10,000	10,000
135,000	7,700	7,500	7,400	9,700	9,700	9,700
130,000	7,500	7,300	7,200	9,400	9,400	9,400
129,200	7,500	7,300	7,200	9,300	9,300	9,300
125,000	7,300	7,100	7,000	9,100	9,100	9,100
120,000	7,100	6,900	6,800	8,800	8,800	8,800
115,000	6,900	6,700	6,700	8,500	8,500	8,500
110,000	6,700	6,500	6,500	8,200	8,200	8,200
105,000	6,500	6,300	6,300	8,000	8,000	8,000
100,000	6,300	6,100	6,100	7,700	7,700	7,700
95,000	6,100	5,900	5,900	7,400	7,400	7,400

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Speed at Touchdown = 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	-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	700	1,100	1,100	1,100
8,000	1,200	1,200	1,100	1,700	1,700	1,700
10,000	1,800	1,800	1,700	2,500	2,500	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	250	300	300	300
PER 10°C ABOVE ISA	150	150	150	200	200	200
PER 10°C BELOW ISA	-150	-150	-150	-250	-250	-250
PER 1% UP SLOPE	-150	-200	-200	-450	-450	-450
PER 1% DOWN SLOPE	200	250	300	700	700	700
1 REVERSER INOP	600	700	700	1,500	1,500	1,500
2 REVERSERS INOP	1,600	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.

737-700 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
155,000	10,300	9,200	7,200	5,300	4,300	7,200	6,100	5,800
150,000	10,000	9,000	7,100	5,200	4,200	7,100	6,000	5,700
145,000	9,800	8,700	6,900	5,100	4,200	6,900	5,900	5,600
140,000	9,500	8,500	6,800	5,000	4,100	6,800	5,800	5,500
135,000	9,200	8,300	6,600	4,900	4,000	6,600	5,600	5,400
130,000	9,000	8,100	6,500	4,800	3,900	6,500	5,500	5,300
129,200	8,900	8,100	6,400	4,800	3,900	6,500	5,500	5,200
125,000	8,700	7,900	6,300	4,700	3,800	6,300	5,400	5,100
120,000	8,400	7,600	6,100	4,600	3,800	6,200	5,300	5,000
115,000	8,100	7,400	6,000	4,500	3,700	6,000	5,100	4,900
110,000	7,900	7,200	5,800	4,400	3,600	5,800	5,000	4,800
105,000	7,600	6,900	5,700	4,300	3,600	5,700	4,900	4,700
100,000	7,300	6,700	5,500	4,200	3,500	5,500	4,800	4,500
95,000	7,000	6,500	5,300	4,100	3,400	5,400	4,600	4,400

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Speed at Touchdown = 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	-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	800	600	400	300	600	500	500
8,000	1,500	1,200	900	600	400	900	700	700
10,000	2,200	1,800	1,300	900	600	1,300	1,000	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	350	350	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	-200	-100	0	0	-50	0	-100	-100
PER 1% DOWN SLOPE	200	50	0	0	50	0	100	100
1 REVERSER INOP	600	100	0	0	100	0	200	200
2 REVERSERS INOP	700	100	0	0	100	100	600	500
MANUAL SPOILERS	200	200	200	200	200	200	200	200

Note: Do not operate when Braking Action is Nil.

737-700 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
155,000	8,100	7,900	7,900	10,300	10,200	10,200
150,000	7,900	7,800	7,700	10,000	10,000	10,000
145,000	7,800	7,600	7,500	9,700	9,700	9,700
140,000	7,600	7,400	7,300	9,500	9,400	9,400
135,000	7,400	7,200	7,100	9,200	9,200	9,200
130,000	7,200	7,000	6,900	8,900	8,900	8,900
129,200	7,200	7,000	6,900	8,900	8,900	8,900
125,000	7,000	6,800	6,800	8,700	8,600	8,600
120,000	6,800	6,600	6,600	8,400	8,400	8,400
115,000	6,600	6,400	6,400	8,100	8,100	8,100
110,000	6,400	6,300	6,200	7,900	7,800	7,800
105,000	6,300	6,100	6,000	7,600	7,600	7,600
100,000	6,100	5,900	5,800	7,300	7,300	7,300
95,000	5,900	5,700	5,700	7,100	7,100	7,000

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Speed at Touchdown = 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	-300	-500	-500	-500
2,000	0	0	0	0	0	0
4,000	400	400	300	500	500	500
6,000	700	700	700	1,000	1,000	1,000
8,000	1,100	1,100	1,000	1,500	1,500	1,500
10,000	1,600	1,600	1,500	2,200	2,200	2,200

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	300	250	250	300	300	300
PER 10°C ABOVE ISA	150	150	150	200	200	200
PER 10°C BELOW ISA	-150	-150	-150	-200	-200	-200
PER 1% UP SLOPE	-150	-200	-200	-400	-450	-450
PER 1% DOWN SLOPE	200	250	300	650	650	650
1 REVERSER INOP	500	600	600	1,300	1,300	1,300
2 REVERSERS INOP	1,400	1,500	1,500	3,600	3,600	3,600
MANUAL SPOILERS	200	200	200	200	200	200

Note: Do not operate when Braking Action is Nil.

737-700 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
155,000	10,000	8,900	7,000	5,100	4,300	7,000	6,100	5,800
150,000	9,700	8,700	6,900	5,000	4,200	6,900	5,900	5,700
145,000	9,500	8,500	6,700	5,000	4,100	6,700	5,800	5,500
140,000	9,200	8,300	6,600	4,900	4,000	6,600	5,700	5,400
135,000	9,000	8,100	6,400	4,800	3,900	6,400	5,600	5,300
130,000	8,700	7,900	6,300	4,700	3,900	6,300	5,500	5,200
129,200	8,700	7,800	6,300	4,700	3,900	6,300	5,400	5,200
125,000	8,500	7,600	6,100	4,600	3,800	6,200	5,300	5,100
120,000	8,200	7,400	6,000	4,500	3,700	6,000	5,200	5,000
115,000	7,900	7,200	5,800	4,400	3,700	5,800	5,100	4,900
110,000	7,700	7,000	5,700	4,300	3,600	5,700	4,900	4,700
105,000	7,400	6,700	5,500	4,200	3,500	5,500	4,800	4,600
100,000	7,100	6,500	5,400	4,100	3,500	5,400	4,700	4,500
95,000	6,900	6,300	5,200	4,000	3,400	5,200	4,600	4,400

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Speed at Touchdown = 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	-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	800	600	400	300	600	500	500
8,000	1,500	1,200	900	600	400	900	700	700
10,000	2,200	1,800	1,300	900	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	350	300	200	150	300	200	150
PER 10°C ABOVE ISA	200	200	150	100	50	150	100	100
PER 10°C BELOW ISA	-200	-200	-150	-100	-50	-150	-100	-100
PER 1% UP SLOPE	-200	-100	0	0	-50	0	-100	-100
PER 1% DOWN SLOPE	150	50	0	0	50	50	100	100
1 REVERSER INOP	500	100	0	0	0	0	200	200
2 REVERSERS INOP	700	100	0	0	100	100	500	500
MANUAL SPOILERS	200	200	200	200	200	200	200	200

Note: Do not operate when Braking Action is Nil.

737-700 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
155,000	8,000	7,800	7,700	10,100	10,000	10,000
150,000	7,800	7,700	7,500	9,800	9,800	9,700
145,000	7,600	7,500	7,400	9,500	9,500	9,500
140,000	7,400	7,300	7,200	9,300	9,200	9,200
135,000	7,200	7,100	7,000	9,000	9,000	8,900
130,000	7,100	6,900	6,800	8,700	8,700	8,700
129,200	7,000	6,900	6,800	8,700	8,700	8,600
125,000	6,900	6,700	6,700	8,500	8,500	8,400
120,000	6,700	6,500	6,500	8,200	8,200	8,200
115,000	6,500	6,400	6,300	8,000	8,000	7,900
110,000	6,300	6,200	6,100	7,700	7,700	7,700
105,000	6,100	6,000	5,900	7,500	7,500	7,400
100,000	5,900	5,800	5,800	7,200	7,200	7,200
95,000	5,800	5,600	5,600	7,000	7,000	6,900

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Speed at Touchdown = 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	-300	-500	-500	-500
2,000	0	0	0	0	0	0
4,000	400	400	300	500	500	500
6,000	700	700	700	1,000	1,000	1,000
8,000	1,100	1,100	1,000	1,500	1,500	1,400
10,000	1,600	1,600	1,500	2,200	2,200	2,100

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	300	250	250	300	300	250
PER 10°C ABOVE ISA	150	150	150	200	200	200
PER 10°C BELOW ISA	-150	-150	-150	-200	-200	-200
PER 1% UP SLOPE	-150	-200	-200	-400	-450	-450
PER 1% DOWN SLOPE	250	250	300	650	650	650
1 REVERSER INOP	500	600	600	1,300	1,300	1,300
2 REVERSERS INOP	1,400	1,400	1,400	3,300	3,300	3,300
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.

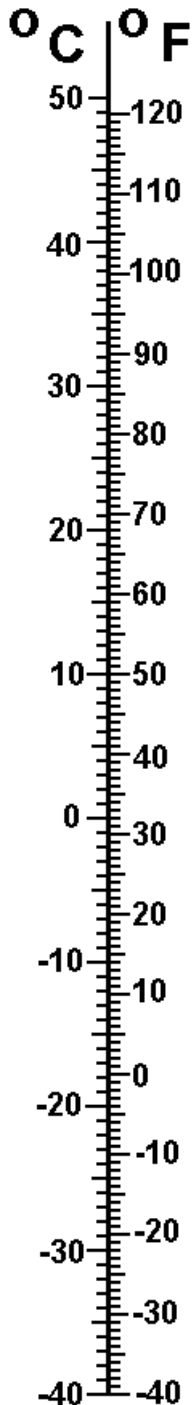
STATIC AIR TEMPERATURE (SAT) - The ambient still air temperature outside of the aircraft. Sometimes known as the Outside Air Temperature (OAT).

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: ALT	DOUBLE ALT	SUBTRACT 15	CHANGE SIGN
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.

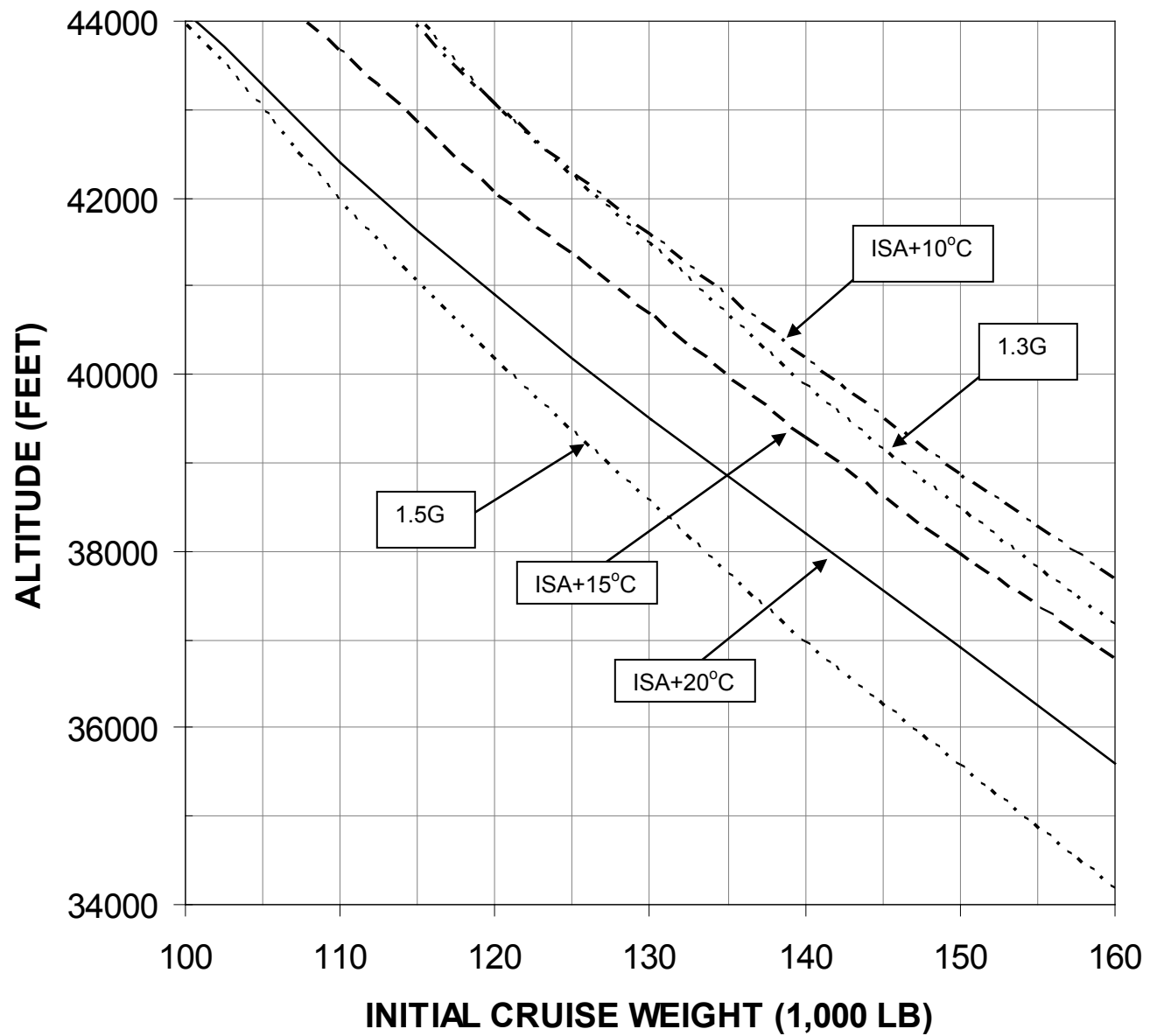
EXAMPLE:

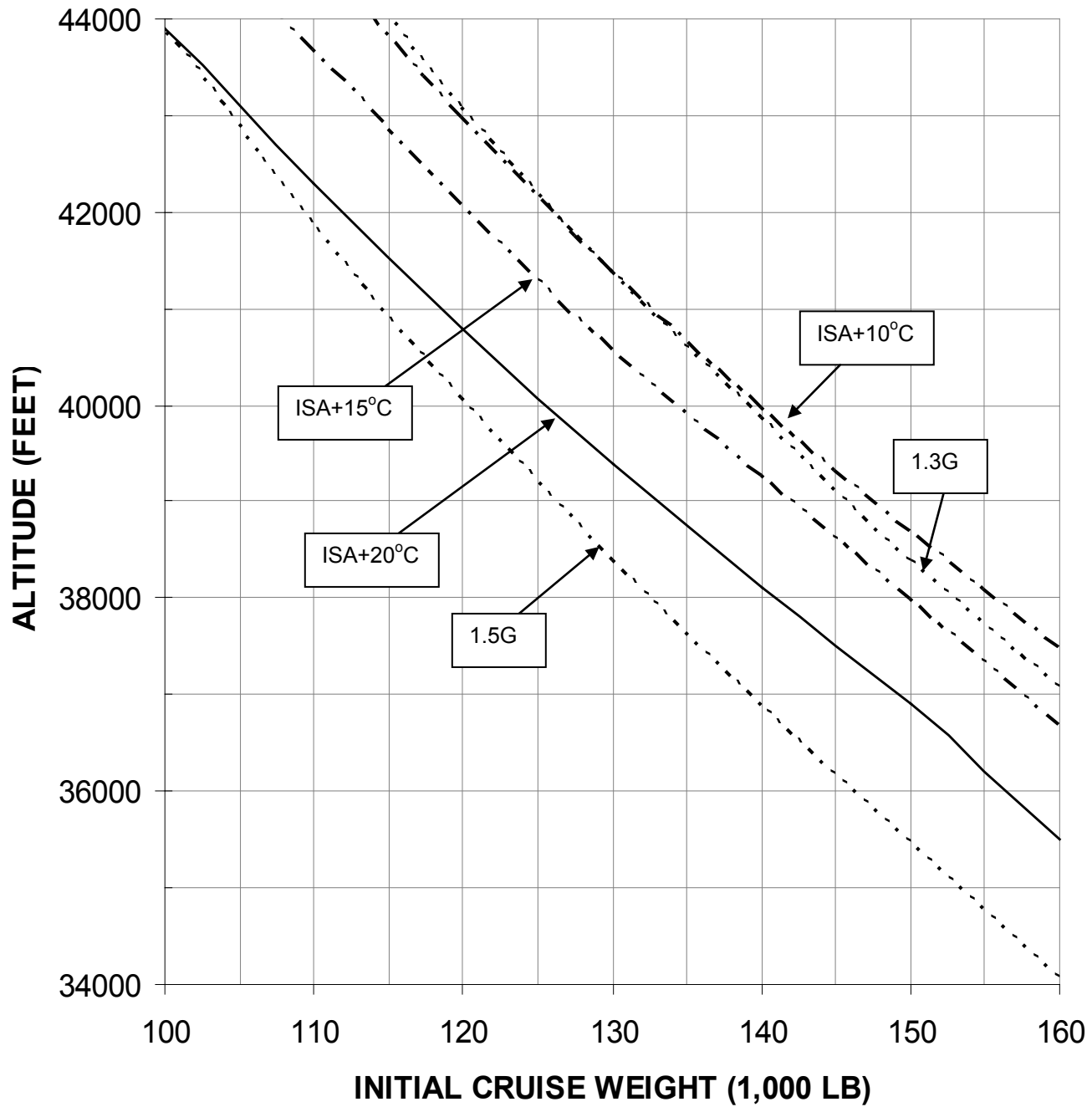
Fuel Type = Jet A (adjusted freeze point -37°C).

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	160,000	.76 224	204	241+				
	140,000		186	241+				
	120,000		167	241+				
	100,000		147	241+				
	80,000		128	241+				
390	160,000	.76 233	201	254+	218	254+		
	140,000		182	254+	201	254+		
	120,000		162	254+	177	254+		
	100,000		144	254+	156	254+		
	80,000		124	254+	136	254+		
370	160,000	.76 245	197	266+	215	266+		
	140,000		178	266+	197	266+		
	120,000		160	266+	173	266+		
	100,000		141	266+	153	266+		
	80,000		122	266+	133	266+		
350	160,000	.76 258	192	279+	211	279+	258	279+
	140,000		174	279+	192	279+	230	279+
	120,000		157	279+	170	279+	206	279+
	100,000		139	279+	150	279+	195	279+
	80,000		119	279+	131	279+	157	279+
330	160,000	.76 269	188	290+	207	290+	247	290+
	140,000		171	290+	188	290+	226	290+
	120,000		154	290+	167	290+	202	290+
	100,000		137	290+	148	290+	191	290+
	80,000		117	290+	128	290+	154	290+
310	160,000	.76 280	184	305+	202	305+	243	305+
	140,000		168	305+	184	305+	222	305+
	120,000		151	305+	164	305+	197	305+
	100,000		135	305+	146	305+	188	305+
	80,000		115	305+	125	305+	151	305+
290	160,000	.73 280	181	317+	198	317+	238	317+
	140,000		165	317+	181	317+	218	317+
	120,000		149	317+	161	317+	192	317+
	100,000		133	317+	144	317+	184	317+
	80,000		113	317+	122	317+	148	317+

+ 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 / 1

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
155,000	10,000	150 / 151 / 153	B148 / 153 / 154	B141 / 154 / 155	B141 / 154 / 155	B141 / 154 / 155
	8,000	148 / 149 / 152	150 / 150 / 152	B151 / 152 / 153	B151 / 152 / 153	B151 / 152 / 153
	6,000	147 / 147 / 151	147 / 148 / 151	149 / 150 / 152	151 / 151 / 152	151 / 151 / 152
	4,000	146 / 146 / 150	145 / 146 / 150	147 / 148 / 151	149 / 149 / 151	149 / 149 / 151
	2,000	145 / 145 / 149	145 / 145 / 149	145 / 146 / 149	148 / 148 / 150	150 / 150 / 151
	0	143 / 144 / 149	143 / 144 / 149	143 / 144 / 149	146 / 146 / 149	147 / 147 / 149
150,000	10,000	147 / 148 / 150	149 / 149 / 151	B146 / 151 / 152	B146 / 151 / 152	B146 / 151 / 152
	8,000	145 / 146 / 149	147 / 147 / 149	149 / 149 / 150	149 / 149 / 150	149 / 149 / 150
	6,000	144 / 145 / 148	144 / 145 / 148	146 / 147 / 149	148 / 148 / 149	148 / 148 / 149
	4,000	143 / 144 / 148	143 / 144 / 148	145 / 145 / 148	146 / 146 / 148	146 / 146 / 148
	2,000	142 / 143 / 147	142 / 143 / 147	143 / 143 / 147	145 / 145 / 147	147 / 147 / 148
	0	141 / 141 / 146	141 / 141 / 146	141 / 142 / 146	143 / 143 / 146	144 / 144 / 147
145,000	10,000	144 / 145 / 147	146 / 146 / 148	148 / 148 / 149	148 / 148 / 149	148 / 148 / 149
	8,000	143 / 143 / 146	144 / 144 / 147	146 / 146 / 147	146 / 146 / 147	146 / 146 / 147
	6,000	141 / 142 / 146	142 / 142 / 146	143 / 144 / 146	145 / 145 / 146	145 / 145 / 146
	4,000	140 / 141 / 145	140 / 141 / 145	142 / 142 / 145	143 / 143 / 145	143 / 143 / 145
	2,000	139 / 140 / 145	139 / 140 / 145	140 / 141 / 145	142 / 142 / 145	143 / 143 / 145
	0	138 / 139 / 144	138 / 139 / 144	138 / 139 / 144	140 / 141 / 144	142 / 142 / 144
140,000	10,000	141 / 142 / 144	143 / 143 / 145	144 / 144 / 145	144 / 144 / 145	144 / 144 / 145
	8,000	140 / 140 / 144	141 / 141 / 144	142 / 142 / 144	142 / 142 / 144	142 / 142 / 144
	6,000	138 / 139 / 143	139 / 139 / 143	140 / 141 / 143	142 / 142 / 143	142 / 142 / 143
	4,000	137 / 138 / 142	137 / 138 / 142	139 / 139 / 142	140 / 140 / 143	140 / 140 / 143
	2,000	136 / 137 / 142	136 / 137 / 142	137 / 137 / 142	139 / 139 / 142	140 / 140 / 142
	0	135 / 136 / 141	135 / 136 / 141	135 / 136 / 141	137 / 138 / 141	139 / 139 / 141
135,000	10,000	138 / 138 / 141	139 / 140 / 142	141 / 141 / 142	141 / 141 / 142	141 / 141 / 142
	8,000	136 / 137 / 141	138 / 138 / 141	139 / 139 / 141	139 / 139 / 141	139 / 139 / 141
	6,000	135 / 136 / 140	135 / 136 / 140	137 / 137 / 140	139 / 139 / 140	139 / 139 / 140
	4,000	133 / 135 / 140	133 / 135 / 140	135 / 136 / 140	137 / 137 / 140	137 / 137 / 140
	2,000	132 / 133 / 139	132 / 134 / 139	133 / 134 / 139	136 / 136 / 139	137 / 137 / 139
	0	131 / 132 / 139	131 / 132 / 139	131 / 133 / 139	134 / 134 / 139	136 / 136 / 139
130,000	10,000	134 / 135 / 138	136 / 136 / 138	138 / 138 / 139	138 / 138 / 139	138 / 138 / 139
	8,000	133 / 134 / 138	135 / 135 / 138	136 / 136 / 138	136 / 136 / 138	136 / 136 / 138
	6,000	131 / 133 / 137	132 / 133 / 137	134 / 134 / 137	136 / 136 / 137	136 / 136 / 137
	4,000	130 / 131 / 137	130 / 131 / 137	132 / 133 / 137	134 / 134 / 137	134 / 134 / 137
	2,000	129 / 130 / 136	129 / 130 / 136	130 / 131 / 136	133 / 133 / 136	134 / 134 / 136
	0	128 / 129 / 136	128 / 129 / 136	128 / 129 / 136	131 / 131 / 136	133 / 133 / 136
125,000	10,000	131 / 132 / 135	133 / 133 / 135	134 / 134 / 136	134 / 134 / 136	134 / 134 / 136
	8,000	129 / 131 / 135	131 / 132 / 135	133 / 133 / 135	133 / 133 / 135	133 / 133 / 135
	6,000	128 / 129 / 134	128 / 130 / 134	131 / 131 / 134	132 / 132 / 134	132 / 132 / 134
	4,000	127 / 128 / 134	127 / 128 / 134	129 / 129 / 134	131 / 131 / 134	131 / 131 / 134
	2,000	126 / 127 / 134	126 / 127 / 134	127 / 128 / 134	129 / 129 / 134	131 / 131 / 134
	0	125 / 126 / 133	125 / 126 / 133	125 / 126 / 133	128 / 128 / 133	130 / 130 / 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 / 1**

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
120,000	10,000	127 / 128 / 132	130 / 130 / 132	131 / 131 / 133	131 / 131 / 133	131 / 131 / 133
	8,000	126 / 127 / 132	128 / 128 / 132	130 / 130 / 132	130 / 130 / 132	130 / 130 / 132
	6,000	125 / 126 / 131	125 / 126 / 131	127 / 128 / 131	129 / 129 / 131	129 / 129 / 131
	4,000	123 / 125 / 131	123 / 125 / 131	125 / 126 / 131	128 / 128 / 131	128 / 128 / 131
	2,000	122 / 124 / 131	122 / 124 / 131	123 / 124 / 131	126 / 126 / 131	128 / 128 / 131
	0	122 / 123 / 131	121 / 123 / 131	121 / 123 / 131	124 / 125 / 131	127 / 127 / 131
115,000	10,000	124 / 125 / 129	126 / 127 / 129	128 / 128 / 129	128 / 128 / 129	128 / 128 / 129
	8,000	122 / 124 / 129	124 / 125 / 129	126 / 126 / 129	126 / 126 / 129	126 / 126 / 129
	6,000	121 / 122 / 128	121 / 123 / 128	124 / 124 / 128	126 / 126 / 128	126 / 126 / 128
	4,000	120 / 121 / 128	120 / 121 / 128	122 / 122 / 128	124 / 124 / 128	124 / 124 / 128
	2,000	119 / 120 / 128	119 / 120 / 128	120 / 121 / 128	122 / 123 / 128	124 / 124 / 128
	0	118 / 119 / 128	118 / 119 / 128	118 / 119 / 128	121 / 121 / 128	123 / 123 / 128
110,000	10,000	120 / 121 / 126	123 / 123 / 126	124 / 124 / 126	124 / 124 / 126	124 / 124 / 126
	8,000	119 / 120 / 126	120 / 121 / 126	123 / 123 / 126	123 / 123 / 126	123 / 123 / 126
	6,000	118 / 119 / 125	118 / 119 / 125	120 / 121 / 125	122 / 122 / 125	122 / 122 / 125
	4,000	116 / 117 / 125	116 / 117 / 125	118 / 119 / 125	121 / 121 / 125	121 / 121 / 125
	2,000	116 / 117 / 125	116 / 117 / 125	116 / 117 / 125	119 / 119 / 125	121 / 121 / 125
	0	115 / 116 / 125	115 / 116 / 125	115 / 116 / 125	117 / 118 / 125	120 / 120 / 125
105,000	10,000	116 / 118 / 123	119 / 119 / 123	121 / 121 / 123	121 / 121 / 123	121 / 121 / 123
	8,000	115 / 116 / 123	117 / 118 / 123	119 / 119 / 123	119 / 119 / 123	119 / 119 / 123
	6,000	114 / 115 / 122	114 / 116 / 122	117 / 117 / 122	119 / 119 / 122	119 / 119 / 122
	4,000	113 / 114 / 122	113 / 114 / 122	115 / 115 / 122	117 / 117 / 122	117 / 117 / 122
	2,000	112 / 114 / 123	112 / 114 / 123	113 / 114 / 122	115 / 116 / 122	118 / 118 / 122
	0	112 / 113 / 123	112 / 113 / 123	112 / 113 / 123	114 / 115 / 122	116 / 116 / 122
100,000	10,000	113 / 114 / 120	115 / 116 / 120	117 / 117 / 120	117 / 117 / 120	117 / 117 / 120
	8,000	111 / 113 / 120	113 / 114 / 120	115 / 115 / 120	115 / 115 / 120	115 / 115 / 120
	6,000	110 / 112 / 119	110 / 112 / 119	113 / 114 / 119	115 / 115 / 119	115 / 115 / 119
	4,000	109 / 111 / 120	109 / 111 / 120	111 / 112 / 119	113 / 114 / 119	113 / 114 / 119
	2,000	109 / 110 / 120	109 / 110 / 120	110 / 111 / 120	112 / 112 / 119	114 / 114 / 119
	0	109 / 110 / 120	109 / 110 / 120	108 / 110 / 120	110 / 111 / 119	113 / 113 / 119
95,000	10,000	109 / 110 / 117	111 / 112 / 117	113 / 113 / 117	113 / 113 / 117	113 / 113 / 117
	8,000	107 / 109 / 116	109 / 110 / 116	111 / 112 / 116	111 / 112 / 116	111 / 112 / 116
	6,000	107 / 108 / 117	107 / 108 / 117	109 / 110 / 116	111 / 112 / 116	111 / 112 / 116
	4,000	106 / 107 / 117	106 / 108 / 117	107 / 109 / 117	109 / 110 / 116	109 / 110 / 116
	2,000	106 / 107 / 117	106 / 107 / 117	106 / 108 / 117	108 / 109 / 116	110 / 111 / 116
	0	*107 / 107 / 118	*107 / 107 / 118	*106 / 106 / 118	107 / 108 / 117	109 / 109 / 116
90,000	10,000	105 / 106 / 113	107 / 108 / 113	109 / 109 / 113	109 / 109 / 113	109 / 109 / 113
	8,000	104 / 105 / 114	105 / 106 / 113	107 / 108 / 113	107 / 108 / 113	107 / 108 / 113
	6,000	103 / 105 / 114	103 / 105 / 114	105 / 106 / 113	107 / 108 / 113	107 / 108 / 113
	4,000	*103 / 104 / 114	*103 / 104 / 114	104 / 105 / 114	106 / 106 / 113	106 / 106 / 113
	2,000	*105 / 105 / 115	*105 / 105 / 116	*103 / 104 / 114	104 / 105 / 114	106 / 107 / 113
	0	*107 / 107 / 118	*107 / 107 / 117	*107 / 107 / 118	103 / 104 / 114	105 / 106 / 113

Speeds marked with an asterisk (*) are limited by V_{mcg}.

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.

 $V_1 / V_R / V_2$

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TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
155,000	10,000	147 / 148 / 149	B148 / 149 / 150	B139 / 154 / 155	B139 / 154 / 155	B139 / 154 / 155
	8,000	145 / 147 / 148	147 / 148 / 149	B150 / 151 / 152	B150 / 151 / 152	B150 / 151 / 152
	6,000	144 / 145 / 148	144 / 145 / 148	147 / 148 / 149	150 / 151 / 152	150 / 151 / 152
	4,000	142 / 143 / 146	142 / 143 / 146	145 / 146 / 147	148 / 148 / 149	148 / 148 / 149
	2,000	141 / 142 / 146	141 / 142 / 146	142 / 143 / 146	145 / 146 / 147	148 / 148 / 149
	0	140 / 141 / 146	140 / 141 / 146	140 / 141 / 146	143 / 144 / 146	146 / 146 / 147
150,000	10,000	144 / 145 / 146	145 / 146 / 147	B144 / 151 / 152	B144 / 151 / 152	B144 / 151 / 152
	8,000	142 / 143 / 146	144 / 145 / 146	147 / 148 / 149	147 / 148 / 149	147 / 148 / 149
	6,000	141 / 142 / 145	141 / 142 / 145	144 / 145 / 146	147 / 147 / 148	147 / 147 / 148
	4,000	139 / 141 / 144	139 / 141 / 144	141 / 142 / 145	144 / 145 / 146	144 / 145 / 146
	2,000	138 / 140 / 144	138 / 140 / 144	139 / 140 / 144	142 / 143 / 144	145 / 145 / 146
	0	137 / 139 / 143	137 / 139 / 143	137 / 139 / 143	140 / 141 / 144	143 / 143 / 144
145,000	10,000	140 / 142 / 143	142 / 143 / 144	147 / 147 / 148	147 / 147 / 148	147 / 147 / 148
	8,000	139 / 140 / 143	141 / 142 / 143	144 / 144 / 145	144 / 144 / 145	144 / 144 / 145
	6,000	138 / 139 / 142	138 / 139 / 142	141 / 141 / 143	144 / 144 / 145	144 / 144 / 145
	4,000	136 / 138 / 142	136 / 138 / 142	138 / 139 / 142	141 / 142 / 143	141 / 142 / 143
	2,000	135 / 137 / 141	135 / 137 / 141	136 / 138 / 141	139 / 140 / 141	142 / 142 / 143
	0	135 / 136 / 141	134 / 136 / 141	134 / 136 / 141	137 / 138 / 141	140 / 140 / 141
140,000	10,000	137 / 139 / 141	139 / 140 / 141	143 / 143 / 144	143 / 143 / 144	143 / 143 / 144
	8,000	136 / 137 / 140	137 / 138 / 140	140 / 141 / 142	140 / 141 / 142	140 / 141 / 142
	6,000	135 / 136 / 140	135 / 136 / 140	137 / 138 / 140	140 / 140 / 141	140 / 140 / 141
	4,000	133 / 135 / 139	133 / 135 / 139	135 / 136 / 139	138 / 138 / 139	138 / 138 / 139
	2,000	132 / 134 / 139	132 / 134 / 139	133 / 135 / 139	136 / 136 / 139	138 / 138 / 139
	0	132 / 133 / 138	131 / 133 / 138	131 / 133 / 138	134 / 135 / 138	137 / 137 / 139
135,000	10,000	134 / 135 / 138	136 / 136 / 138	140 / 140 / 141	140 / 140 / 141	140 / 140 / 141
	8,000	133 / 134 / 137	134 / 135 / 137	137 / 137 / 138	137 / 137 / 138	137 / 137 / 138
	6,000	132 / 133 / 137	132 / 133 / 137	134 / 135 / 137	137 / 137 / 138	137 / 137 / 138
	4,000	130 / 132 / 137	130 / 132 / 137	132 / 133 / 137	134 / 135 / 137	134 / 135 / 137
	2,000	129 / 131 / 136	129 / 131 / 136	130 / 132 / 136	133 / 133 / 136	135 / 135 / 136
	0	128 / 130 / 136	128 / 130 / 136	128 / 130 / 136	131 / 132 / 136	133 / 134 / 136
130,000	10,000	131 / 132 / 135	133 / 133 / 135	136 / 136 / 137	136 / 136 / 137	136 / 136 / 137
	8,000	130 / 131 / 135	131 / 132 / 135	134 / 134 / 135	134 / 134 / 135	134 / 134 / 135
	6,000	128 / 130 / 134	129 / 130 / 134	131 / 132 / 134	133 / 134 / 135	133 / 134 / 135
	4,000	127 / 129 / 134	127 / 129 / 134	129 / 130 / 134	131 / 132 / 134	131 / 132 / 134
	2,000	126 / 128 / 134	126 / 128 / 134	127 / 128 / 134	129 / 130 / 134	132 / 132 / 134
	0	125 / 127 / 133	125 / 127 / 133	125 / 127 / 133	128 / 129 / 133	130 / 130 / 133
125,000	10,000	128 / 129 / 132	130 / 130 / 132	132 / 133 / 134	132 / 133 / 134	132 / 133 / 134
	8,000	126 / 128 / 132	128 / 129 / 132	130 / 131 / 132	130 / 131 / 132	130 / 131 / 132
	6,000	125 / 127 / 131	125 / 127 / 131	128 / 128 / 131	130 / 130 / 131	130 / 130 / 131
	4,000	124 / 125 / 131	124 / 125 / 131	126 / 127 / 131	128 / 128 / 131	128 / 128 / 131
	2,000	123 / 125 / 131	123 / 125 / 131	124 / 125 / 131	126 / 127 / 131	129 / 129 / 131
	0	122 / 124 / 131	122 / 124 / 131	122 / 124 / 131	125 / 126 / 131	127 / 127 / 131

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 / 5**

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

Speeds marked with an asterisk (*) are limited by V_{mcg}.

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

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TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
155,000	10,000					
	8,000	137 / 137 / 138	137 / 137 / 138			
	6,000	136 / 136 / 138	136 / 136 / 138	137 / 137 / 138	138 / 138 / 138	139 / 139 / 139
	4,000	135 / 135 / 139	135 / 135 / 139	136 / 136 / 138	137 / 137 / 138	138 / 138 / 138
	2,000	134 / 135 / 139	134 / 135 / 139	135 / 135 / 139	136 / 136 / 138	138 / 138 / 138
	0	134 / 134 / 139	134 / 134 / 139	134 / 134 / 139	135 / 135 / 138	137 / 137 / 138
150,000	10,000					
	8,000	134 / 135 / 136	134 / 135 / 136	136 / 136 / 136		
	6,000	133 / 134 / 136	133 / 134 / 136	134 / 135 / 136	136 / 136 / 136	137 / 137 / 137
	4,000	132 / 133 / 137	132 / 133 / 137	133 / 134 / 136	135 / 135 / 136	136 / 136 / 136
	2,000	131 / 133 / 137	131 / 133 / 137	132 / 133 / 137	134 / 134 / 136	135 / 136 / 136
	0	131 / 132 / 137	131 / 132 / 137	131 / 132 / 137	133 / 133 / 136	134 / 135 / 136
145,000	10,000	133 / 134 / 134	134 / 134 / 134			
	8,000	132 / 133 / 134	132 / 133 / 134	134 / 134 / 134	135 / 135 / 135	136 / 136 / 136
	6,000	131 / 132 / 134	131 / 132 / 134	132 / 133 / 134	134 / 134 / 134	135 / 135 / 135
	4,000	130 / 131 / 135	130 / 131 / 135	131 / 132 / 134	133 / 133 / 134	134 / 134 / 134
	2,000	129 / 131 / 135	129 / 131 / 135	130 / 131 / 135	132 / 132 / 134	133 / 134 / 134
	0	129 / 130 / 135	129 / 130 / 135	129 / 130 / 135	131 / 131 / 134	132 / 133 / 134
140,000	10,000	130 / 131 / 131	131 / 131 / 131	132 / 132 / 132		
	8,000	129 / 130 / 132	129 / 130 / 132	131 / 131 / 131	132 / 132 / 132	133 / 133 / 133
	6,000	128 / 129 / 132	128 / 129 / 132	129 / 130 / 132	131 / 131 / 131	132 / 132 / 132
	4,000	127 / 128 / 133	127 / 128 / 133	128 / 129 / 132	130 / 130 / 132	131 / 131 / 131
	2,000	126 / 128 / 133	126 / 128 / 133	127 / 128 / 133	129 / 129 / 132	130 / 131 / 131
	0	126 / 127 / 133	126 / 127 / 133	126 / 127 / 133	128 / 128 / 132	129 / 130 / 132
135,000	10,000	128 / 129 / 129	129 / 129 / 129	130 / 130 / 130	131 / 131 / 131	132 / 132 / 132
	8,000	127 / 128 / 130	127 / 128 / 130	129 / 129 / 129	130 / 130 / 130	131 / 131 / 131
	6,000	126 / 127 / 130	126 / 127 / 130	127 / 128 / 130	129 / 129 / 129	130 / 130 / 130
	4,000	125 / 126 / 131	125 / 126 / 131	126 / 127 / 130	128 / 128 / 130	129 / 129 / 129
	2,000	124 / 126 / 131	124 / 126 / 131	125 / 126 / 131	127 / 127 / 130	128 / 129 / 129
	0	124 / 125 / 131	124 / 125 / 131	124 / 125 / 131	126 / 126 / 130	127 / 128 / 130
130,000	10,000	125 / 126 / 126	126 / 126 / 126	127 / 127 / 127	128 / 128 / 128	129 / 129 / 129
	8,000	124 / 125 / 127	124 / 125 / 127	126 / 126 / 126	127 / 127 / 127	128 / 128 / 128
	6,000	123 / 124 / 127	123 / 124 / 127	124 / 125 / 127	126 / 126 / 126	127 / 127 / 127
	4,000	122 / 123 / 128	122 / 123 / 128	123 / 124 / 127	125 / 125 / 127	126 / 126 / 126
	2,000	121 / 123 / 128	121 / 123 / 128	122 / 123 / 128	124 / 124 / 127	125 / 126 / 126
	0	121 / 122 / 128	121 / 122 / 128	121 / 122 / 128	123 / 123 / 127	124 / 125 / 127
125,000	10,000	122 / 123 / 124	123 / 123 / 124	124 / 124 / 124	125 / 125 / 125	126 / 126 / 126
	8,000	121 / 122 / 125	121 / 122 / 125	123 / 123 / 124	124 / 124 / 124	125 / 125 / 125
	6,000	120 / 121 / 125	120 / 121 / 125	121 / 122 / 125	123 / 123 / 124	124 / 124 / 124
	4,000	119 / 120 / 126	119 / 120 / 126	120 / 121 / 125	122 / 122 / 125	123 / 123 / 124
	2,000	118 / 120 / 126	118 / 120 / 126	119 / 120 / 126	121 / 121 / 125	122 / 123 / 124
	0	118 / 119 / 126	118 / 119 / 126	118 / 119 / 126	120 / 120 / 125	121 / 122 / 125

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 / 10**

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

Speeds marked with an asterisk (*) are limited by V_{mcg}.

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 / 15

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
155,000	10,000					
	8,000	134 / 134 / 135	134 / 134 / 135			
	6,000	133 / 133 / 135	133 / 133 / 135	134 / 134 / 135	135 / 135 / 135	136 / 136 / 136
	4,000	132 / 132 / 136	132 / 132 / 136	133 / 133 / 135	134 / 134 / 135	135 / 135 / 135
	2,000	131 / 132 / 136	131 / 132 / 136	132 / 132 / 136	133 / 133 / 135	135 / 135 / 135
	0	131 / 131 / 136	131 / 131 / 136	131 / 131 / 136	132 / 132 / 135	134 / 134 / 135
150,000	10,000					
	8,000	132 / 132 / 133	132 / 132 / 133	133 / 133 / 133		
	6,000	131 / 131 / 133	131 / 131 / 133	132 / 132 / 133	133 / 133 / 133	134 / 134 / 134
	4,000	130 / 130 / 134	130 / 130 / 134	131 / 131 / 133	132 / 132 / 133	133 / 133 / 133
	2,000	129 / 130 / 134	129 / 130 / 134	130 / 130 / 134	131 / 131 / 133	133 / 133 / 133
	0	129 / 129 / 134	129 / 129 / 134	129 / 129 / 134	130 / 130 / 133	132 / 132 / 133
145,000	10,000	131 / 131 / 131	131 / 131 / 131			
	8,000	130 / 130 / 131	130 / 130 / 131	131 / 131 / 131	132 / 132 / 132	133 / 133 / 133
	6,000	129 / 129 / 131	129 / 129 / 131	130 / 130 / 131	131 / 131 / 131	132 / 132 / 132
	4,000	128 / 128 / 132	128 / 128 / 132	129 / 129 / 131	130 / 130 / 131	131 / 131 / 131
	2,000	127 / 128 / 132	127 / 128 / 132	128 / 128 / 132	129 / 129 / 131	131 / 131 / 131
	0	127 / 127 / 132	127 / 127 / 132	127 / 127 / 132	128 / 128 / 131	130 / 130 / 131
140,000	10,000	128 / 128 / 128	128 / 128 / 128	129 / 129 / 129		
	8,000	127 / 127 / 129	127 / 127 / 129	128 / 128 / 128	129 / 129 / 129	130 / 130 / 130
	6,000	126 / 126 / 129	126 / 126 / 129	127 / 127 / 129	128 / 128 / 128	129 / 129 / 129
	4,000	125 / 125 / 130	125 / 125 / 130	126 / 126 / 129	127 / 127 / 129	128 / 128 / 128
	2,000	124 / 125 / 130	124 / 125 / 130	125 / 125 / 130	126 / 126 / 129	128 / 128 / 128
	0	124 / 124 / 130	124 / 124 / 130	124 / 124 / 130	125 / 125 / 129	127 / 127 / 129
135,000	10,000	126 / 126 / 126	126 / 126 / 126	127 / 127 / 127	128 / 128 / 128	129 / 129 / 129
	8,000	125 / 125 / 127	125 / 125 / 127	126 / 126 / 126	127 / 127 / 127	128 / 128 / 128
	6,000	124 / 124 / 127	124 / 124 / 127	125 / 125 / 127	126 / 126 / 126	127 / 127 / 127
	4,000	123 / 123 / 128	123 / 123 / 128	124 / 124 / 127	125 / 125 / 127	126 / 126 / 126
	2,000	122 / 123 / 128	122 / 123 / 128	123 / 123 / 128	124 / 124 / 127	126 / 126 / 126
	0	122 / 122 / 128	122 / 122 / 128	122 / 122 / 128	123 / 123 / 127	125 / 125 / 127
130,000	10,000	123 / 123 / 124	123 / 123 / 124	124 / 124 / 124	125 / 125 / 125	126 / 126 / 126
	8,000	122 / 122 / 125	122 / 122 / 125	123 / 123 / 124	124 / 124 / 124	125 / 125 / 125
	6,000	121 / 121 / 125	121 / 121 / 125	122 / 122 / 125	123 / 123 / 124	124 / 124 / 124
	4,000	120 / 120 / 126	120 / 120 / 126	121 / 121 / 125	122 / 122 / 125	123 / 123 / 124
	2,000	119 / 120 / 126	119 / 120 / 126	120 / 120 / 126	121 / 121 / 125	123 / 123 / 124
	0	119 / 119 / 126	119 / 119 / 126	119 / 119 / 126	120 / 120 / 125	122 / 122 / 125
125,000	10,000	120 / 121 / 122	121 / 121 / 122	122 / 122 / 122	123 / 123 / 123	124 / 124 / 124
	8,000	119 / 120 / 123	119 / 120 / 123	121 / 121 / 122	122 / 122 / 122	123 / 123 / 123
	6,000	118 / 119 / 123	118 / 119 / 123	119 / 120 / 123	121 / 121 / 122	122 / 122 / 122
	4,000	117 / 118 / 124	117 / 118 / 124	118 / 119 / 123	120 / 120 / 123	121 / 121 / 122
	2,000	116 / 118 / 124	116 / 118 / 124	117 / 118 / 124	119 / 119 / 123	120 / 121 / 122
	0	116 / 117 / 124	116 / 117 / 124	116 / 117 / 124	118 / 118 / 123	119 / 120 / 123

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 / 15**

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

Speeds marked with an asterisk (*) are limited by V_{mcg}.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

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V₁ / V_R / V₂

TO2 / 25

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
155,000	10,000					
	8,000	132 / 132 / 134	132 / 132 / 134			
	6,000	131 / 131 / 134	131 / 131 / 134	132 / 132 / 134	133 / 133 / 133	134 / 134 / 134
	4,000	130 / 130 / 135	130 / 130 / 135	131 / 131 / 134	132 / 132 / 134	133 / 133 / 133
	2,000	129 / 130 / 135	129 / 130 / 135	130 / 130 / 135	131 / 131 / 134	133 / 133 / 133
	0	129 / 129 / 135	129 / 129 / 135	129 / 129 / 135	130 / 130 / 134	132 / 132 / 134
150,000	10,000					
	8,000	130 / 130 / 132	130 / 130 / 132	131 / 131 / 131		
	6,000	129 / 129 / 132	129 / 129 / 132	130 / 130 / 132	131 / 131 / 131	132 / 132 / 132
	4,000	128 / 128 / 133	128 / 128 / 133	129 / 129 / 132	130 / 130 / 132	131 / 131 / 131
	2,000	127 / 128 / 133	127 / 128 / 133	128 / 128 / 133	129 / 129 / 132	131 / 131 / 131
	0	127 / 127 / 133	127 / 127 / 133	127 / 127 / 133	128 / 128 / 132	130 / 130 / 132
145,000	10,000	129 / 129 / 129	129 / 129 / 129			
	8,000	128 / 128 / 130	128 / 128 / 130	129 / 129 / 129	130 / 130 / 130	131 / 131 / 131
	6,000	127 / 127 / 130	127 / 127 / 130	128 / 128 / 130	129 / 129 / 129	130 / 130 / 130
	4,000	126 / 126 / 131	126 / 126 / 131	127 / 127 / 130	128 / 128 / 130	129 / 129 / 129
	2,000	125 / 126 / 131	125 / 126 / 131	126 / 126 / 131	127 / 127 / 130	129 / 129 / 129
	0	125 / 125 / 131	125 / 125 / 131	125 / 125 / 131	126 / 126 / 130	128 / 128 / 130
140,000	10,000	127 / 127 / 127	127 / 127 / 127	128 / 128 / 128		
	8,000	126 / 126 / 128	126 / 126 / 128	127 / 127 / 127	128 / 128 / 128	129 / 129 / 129
	6,000	125 / 125 / 128	125 / 125 / 128	126 / 126 / 128	127 / 127 / 127	128 / 128 / 128
	4,000	124 / 124 / 129	124 / 124 / 129	125 / 125 / 128	126 / 126 / 128	127 / 127 / 127
	2,000	123 / 124 / 129	123 / 124 / 129	124 / 124 / 129	125 / 125 / 128	127 / 127 / 127
	0	123 / 123 / 129	123 / 123 / 129	123 / 123 / 129	124 / 124 / 128	126 / 126 / 128
135,000	10,000	124 / 125 / 125	125 / 125 / 125	126 / 126 / 126	127 / 127 / 127	128 / 128 / 128
	8,000	123 / 124 / 126	123 / 124 / 126	125 / 125 / 125	126 / 126 / 126	127 / 127 / 127
	6,000	122 / 123 / 126	122 / 123 / 126	123 / 124 / 126	125 / 125 / 125	126 / 126 / 126
	4,000	121 / 122 / 127	121 / 122 / 127	122 / 123 / 126	124 / 124 / 126	125 / 125 / 125
	2,000	120 / 122 / 127	120 / 122 / 127	121 / 122 / 127	123 / 123 / 126	124 / 125 / 125
	0	120 / 121 / 127	120 / 121 / 127	120 / 121 / 127	122 / 122 / 126	123 / 124 / 126
130,000	10,000	121 / 122 / 123	122 / 122 / 123	123 / 123 / 123	124 / 124 / 124	125 / 125 / 125
	8,000	120 / 121 / 124	120 / 121 / 124	122 / 122 / 123	123 / 123 / 123	124 / 124 / 124
	6,000	119 / 120 / 124	119 / 120 / 124	120 / 121 / 124	122 / 122 / 123	123 / 123 / 123
	4,000	118 / 119 / 125	118 / 119 / 125	119 / 120 / 124	121 / 121 / 124	122 / 122 / 123
	2,000	117 / 119 / 125	117 / 119 / 125	118 / 119 / 125	120 / 120 / 124	121 / 122 / 123
	0	117 / 118 / 125	117 / 118 / 125	117 / 118 / 125	119 / 119 / 124	120 / 121 / 124
125,000	10,000	119 / 119 / 121	119 / 119 / 121	120 / 120 / 121	121 / 121 / 121	122 / 122 / 122
	8,000	118 / 118 / 122	118 / 118 / 122	119 / 119 / 121	120 / 120 / 121	121 / 121 / 121
	6,000	117 / 117 / 122	117 / 117 / 122	118 / 118 / 122	119 / 119 / 121	120 / 120 / 120
	4,000	116 / 116 / 123	116 / 116 / 123	117 / 117 / 122	118 / 118 / 122	119 / 119 / 121
	2,000	115 / 116 / 123	115 / 116 / 123	116 / 116 / 123	117 / 117 / 122	119 / 119 / 121
	0	115 / 115 / 123	115 / 115 / 123	115 / 115 / 123	116 / 116 / 122	118 / 118 / 122

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 / 25**

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

Speeds marked with an asterisk (*) are limited by V_{mcg}.

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 / 1

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
155,000	10,000	150 / 151 / 153	B148 / 153 / 154	B141 / 154 / 155	B141 / 154 / 155	B141 / 154 / 155
	8,000	148 / 149 / 152	150 / 150 / 152	B151 / 152 / 153	B151 / 152 / 153	B151 / 152 / 153
	6,000	147 / 147 / 151	147 / 148 / 151	149 / 150 / 152	151 / 151 / 152	151 / 151 / 152
	4,000	146 / 146 / 150	145 / 146 / 150	147 / 148 / 151	149 / 149 / 151	149 / 149 / 151
	2,000	145 / 145 / 149	145 / 145 / 149	145 / 146 / 149	148 / 148 / 150	150 / 150 / 151
	0	143 / 144 / 149	143 / 144 / 149	143 / 144 / 149	146 / 146 / 149	147 / 147 / 149
150,000	10,000	147 / 148 / 150	149 / 149 / 151	B146 / 151 / 152	B146 / 151 / 152	B146 / 151 / 152
	8,000	145 / 146 / 149	147 / 147 / 149	149 / 149 / 150	149 / 149 / 150	149 / 149 / 150
	6,000	144 / 145 / 148	144 / 145 / 148	146 / 147 / 149	148 / 148 / 149	148 / 148 / 149
	4,000	143 / 144 / 148	143 / 144 / 148	145 / 145 / 148	146 / 146 / 148	146 / 146 / 148
	2,000	142 / 143 / 147	142 / 143 / 147	143 / 143 / 147	145 / 145 / 147	147 / 147 / 148
	0	141 / 141 / 146	141 / 141 / 146	141 / 142 / 146	143 / 143 / 146	144 / 144 / 147
145,000	10,000	144 / 145 / 147	146 / 146 / 148	148 / 148 / 149	148 / 148 / 149	148 / 148 / 149
	8,000	143 / 143 / 146	144 / 144 / 147	146 / 146 / 147	146 / 146 / 147	146 / 146 / 147
	6,000	141 / 142 / 146	142 / 142 / 146	143 / 144 / 146	145 / 145 / 146	145 / 145 / 146
	4,000	140 / 141 / 145	140 / 141 / 145	142 / 142 / 145	143 / 143 / 145	143 / 143 / 145
	2,000	139 / 140 / 145	139 / 140 / 145	140 / 141 / 145	142 / 142 / 145	143 / 143 / 145
	0	138 / 139 / 144	138 / 139 / 144	138 / 139 / 144	140 / 141 / 144	142 / 142 / 144
140,000	10,000	141 / 142 / 144	143 / 143 / 145	144 / 144 / 145	144 / 144 / 145	144 / 144 / 145
	8,000	140 / 140 / 144	141 / 141 / 144	142 / 142 / 144	142 / 142 / 144	142 / 142 / 144
	6,000	138 / 139 / 143	139 / 139 / 143	140 / 141 / 143	142 / 142 / 143	142 / 142 / 143
	4,000	137 / 138 / 142	137 / 138 / 142	139 / 139 / 142	140 / 140 / 143	140 / 140 / 143
	2,000	136 / 137 / 142	136 / 137 / 142	137 / 137 / 142	139 / 139 / 142	140 / 140 / 142
	0	135 / 136 / 141	135 / 136 / 141	135 / 136 / 141	137 / 138 / 141	139 / 139 / 141
135,000	10,000	138 / 138 / 141	139 / 140 / 142	141 / 141 / 142	141 / 141 / 142	141 / 141 / 142
	8,000	136 / 137 / 141	138 / 138 / 141	139 / 139 / 141	139 / 139 / 141	139 / 139 / 141
	6,000	135 / 136 / 140	135 / 136 / 140	137 / 137 / 140	139 / 139 / 140	139 / 139 / 140
	4,000	133 / 135 / 140	133 / 135 / 140	135 / 136 / 140	137 / 137 / 140	137 / 137 / 140
	2,000	132 / 133 / 139	132 / 134 / 139	133 / 134 / 139	136 / 136 / 139	137 / 137 / 139
	0	131 / 132 / 139	131 / 132 / 139	131 / 133 / 139	134 / 134 / 139	136 / 136 / 139
130,000	10,000	134 / 135 / 138	136 / 136 / 138	138 / 138 / 139	138 / 138 / 139	138 / 138 / 139
	8,000	133 / 134 / 138	135 / 135 / 138	136 / 136 / 138	136 / 136 / 138	136 / 136 / 138
	6,000	131 / 133 / 137	132 / 133 / 137	134 / 134 / 137	136 / 136 / 137	136 / 136 / 137
	4,000	130 / 131 / 137	130 / 131 / 137	132 / 133 / 137	134 / 134 / 137	134 / 134 / 137
	2,000	129 / 130 / 136	129 / 130 / 136	130 / 131 / 136	133 / 133 / 136	134 / 134 / 136
	0	128 / 129 / 136	128 / 129 / 136	128 / 129 / 136	131 / 131 / 136	133 / 133 / 136
125,000	10,000	131 / 132 / 135	133 / 133 / 135	134 / 134 / 136	134 / 134 / 136	134 / 134 / 136
	8,000	129 / 131 / 135	131 / 132 / 135	133 / 133 / 135	133 / 133 / 135	133 / 133 / 135
	6,000	128 / 129 / 134	128 / 130 / 134	131 / 131 / 134	132 / 132 / 134	132 / 132 / 134
	4,000	127 / 128 / 134	127 / 128 / 134	129 / 129 / 134	131 / 131 / 134	131 / 131 / 134
	2,000	126 / 127 / 134	126 / 127 / 134	127 / 128 / 134	129 / 129 / 134	131 / 131 / 134
	0	125 / 126 / 133	125 / 126 / 133	125 / 126 / 133	128 / 128 / 133	130 / 130 / 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
TO1 / 1**

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
120,000	10,000	127 / 128 / 132	130 / 130 / 132	131 / 131 / 133	131 / 131 / 133	131 / 131 / 133
	8,000	126 / 127 / 132	128 / 128 / 132	130 / 130 / 132	130 / 130 / 132	130 / 130 / 132
	6,000	125 / 126 / 131	125 / 126 / 131	127 / 128 / 131	129 / 129 / 131	129 / 129 / 131
	4,000	123 / 125 / 131	123 / 125 / 131	125 / 126 / 131	128 / 128 / 131	128 / 128 / 131
	2,000	122 / 124 / 131	122 / 124 / 131	123 / 124 / 131	126 / 126 / 131	128 / 128 / 131
	0	122 / 123 / 131	121 / 123 / 131	121 / 123 / 131	124 / 125 / 131	127 / 127 / 131
115,000	10,000	124 / 125 / 129	126 / 127 / 129	128 / 128 / 129	128 / 128 / 129	128 / 128 / 129
	8,000	122 / 124 / 129	124 / 125 / 129	126 / 126 / 129	126 / 126 / 129	126 / 126 / 129
	6,000	121 / 122 / 128	121 / 123 / 128	124 / 124 / 128	126 / 126 / 128	126 / 126 / 128
	4,000	120 / 121 / 128	120 / 121 / 128	122 / 122 / 128	124 / 124 / 128	124 / 124 / 128
	2,000	119 / 120 / 128	119 / 120 / 128	120 / 121 / 128	122 / 123 / 128	124 / 124 / 128
	0	118 / 119 / 128	118 / 119 / 128	118 / 119 / 128	121 / 121 / 128	123 / 123 / 128
110,000	10,000	120 / 121 / 126	123 / 123 / 126	124 / 124 / 126	124 / 124 / 126	124 / 124 / 126
	8,000	119 / 120 / 126	120 / 121 / 126	123 / 123 / 126	123 / 123 / 126	123 / 123 / 126
	6,000	118 / 119 / 125	118 / 119 / 125	120 / 121 / 125	122 / 122 / 125	122 / 122 / 125
	4,000	116 / 117 / 125	116 / 117 / 125	118 / 119 / 125	121 / 121 / 125	121 / 121 / 125
	2,000	116 / 117 / 125	116 / 117 / 125	116 / 117 / 125	119 / 119 / 125	121 / 121 / 125
	0	115 / 116 / 125	115 / 116 / 125	115 / 116 / 125	117 / 118 / 125	120 / 120 / 125
105,000	10,000	116 / 118 / 123	119 / 119 / 123	121 / 121 / 123	121 / 121 / 123	121 / 121 / 123
	8,000	115 / 116 / 123	117 / 118 / 123	119 / 119 / 123	119 / 119 / 123	119 / 119 / 123
	6,000	114 / 115 / 122	114 / 116 / 122	117 / 117 / 122	119 / 119 / 122	119 / 119 / 122
	4,000	113 / 114 / 122	113 / 114 / 122	115 / 115 / 122	117 / 117 / 122	117 / 117 / 122
	2,000	112 / 114 / 123	112 / 114 / 123	113 / 114 / 122	115 / 116 / 122	118 / 118 / 122
	0	112 / 113 / 123	112 / 113 / 123	112 / 113 / 123	114 / 115 / 122	116 / 116 / 122
100,000	10,000	113 / 114 / 120	115 / 116 / 120	117 / 117 / 120	117 / 117 / 120	117 / 117 / 120
	8,000	111 / 113 / 120	113 / 114 / 120	115 / 115 / 120	115 / 115 / 120	115 / 115 / 120
	6,000	110 / 112 / 119	110 / 112 / 119	113 / 114 / 119	115 / 115 / 119	115 / 115 / 119
	4,000	109 / 111 / 120	109 / 111 / 120	111 / 112 / 119	113 / 114 / 119	113 / 114 / 119
	2,000	109 / 110 / 120	109 / 110 / 120	110 / 111 / 120	112 / 112 / 119	114 / 114 / 119
	0	109 / 110 / 120	109 / 110 / 120	108 / 110 / 120	110 / 111 / 119	113 / 113 / 119
95,000	10,000	109 / 110 / 117	111 / 112 / 117	113 / 113 / 117	113 / 113 / 117	113 / 113 / 117
	8,000	107 / 109 / 116	109 / 110 / 116	111 / 112 / 116	111 / 112 / 116	111 / 112 / 116
	6,000	107 / 108 / 117	107 / 108 / 117	109 / 110 / 116	111 / 112 / 116	111 / 112 / 116
	4,000	106 / 107 / 117	106 / 108 / 117	107 / 109 / 117	109 / 110 / 116	109 / 110 / 116
	2,000	106 / 107 / 117	106 / 107 / 117	106 / 108 / 117	108 / 109 / 116	110 / 111 / 116
	0	*107 / 107 / 118	*107 / 107 / 118	*106 / 106 / 118	107 / 108 / 117	109 / 109 / 116
90,000	10,000	105 / 106 / 113	107 / 108 / 113	109 / 109 / 113	109 / 109 / 113	109 / 109 / 113
	8,000	104 / 105 / 114	105 / 106 / 113	107 / 108 / 113	107 / 108 / 113	107 / 108 / 113
	6,000	103 / 105 / 114	103 / 105 / 114	105 / 106 / 113	107 / 108 / 113	107 / 108 / 113
	4,000	*103 / 104 / 114	*103 / 104 / 114	104 / 105 / 114	106 / 106 / 113	106 / 106 / 113
	2,000	*105 / 105 / 115	*105 / 105 / 116	*103 / 104 / 114	104 / 105 / 114	106 / 107 / 113
	0	*107 / 107 / 118	*107 / 107 / 117	*107 / 107 / 118	103 / 104 / 114	105 / 106 / 113

Speeds marked with an asterisk (*) are limited by V_{mcg}.

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 / 5

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
155,000	10,000	145 / 146 / 149	147 / 148 / 149	B143 / 152 / 153	B143 / 152 / 153	B143 / 152 / 153
	8,000	143 / 145 / 148	144 / 146 / 148	147 / 148 / 149	147 / 148 / 149	147 / 148 / 149
	6,000	142 / 143 / 147	142 / 144 / 147	145 / 147 / 148	149 / 149 / 150	149 / 149 / 150
	4,000	141 / 142 / 146	141 / 142 / 146	142 / 144 / 146	146 / 147 / 148	146 / 147 / 148
	2,000	139 / 141 / 146	139 / 141 / 146	140 / 142 / 146	143 / 144 / 147	146 / 147 / 148
	0	138 / 140 / 146	138 / 140 / 146	138 / 140 / 146	141 / 142 / 145	144 / 144 / 146
150,000	10,000	142 / 143 / 146	144 / 145 / 146	B148 / 148 / 149	B148 / 148 / 149	B148 / 148 / 149
	8,000	141 / 142 / 145	142 / 143 / 146	144 / 145 / 146	144 / 145 / 146	144 / 145 / 146
	6,000	139 / 141 / 145	140 / 141 / 145	142 / 143 / 145	145 / 146 / 147	145 / 146 / 147
	4,000	138 / 140 / 144	138 / 140 / 144	140 / 141 / 144	143 / 143 / 145	143 / 143 / 145
	2,000	137 / 139 / 144	137 / 139 / 144	138 / 139 / 144	140 / 141 / 144	143 / 143 / 144
	0	135 / 137 / 143	135 / 137 / 143	135 / 138 / 143	138 / 139 / 143	141 / 141 / 144
145,000	10,000	139 / 141 / 143	141 / 142 / 144	144 / 145 / 146	144 / 145 / 146	144 / 145 / 146
	8,000	138 / 139 / 143	139 / 140 / 143	141 / 142 / 143	141 / 142 / 143	141 / 142 / 143
	6,000	136 / 138 / 142	137 / 138 / 142	139 / 140 / 142	142 / 143 / 144	142 / 143 / 144
	4,000	135 / 137 / 142	135 / 137 / 142	137 / 138 / 142	139 / 140 / 142	139 / 140 / 142
	2,000	134 / 136 / 141	134 / 136 / 141	135 / 137 / 141	137 / 138 / 141	140 / 140 / 142
	0	133 / 135 / 141	133 / 135 / 141	133 / 135 / 141	135 / 136 / 141	138 / 138 / 141
140,000	10,000	136 / 138 / 141	138 / 139 / 141	141 / 142 / 143	141 / 142 / 143	141 / 142 / 143
	8,000	135 / 136 / 140	136 / 137 / 140	138 / 139 / 140	138 / 139 / 140	138 / 139 / 140
	6,000	133 / 135 / 140	134 / 135 / 140	136 / 137 / 140	139 / 139 / 140	139 / 139 / 140
	4,000	132 / 134 / 139	132 / 134 / 139	134 / 135 / 139	136 / 137 / 139	136 / 137 / 139
	2,000	131 / 133 / 139	131 / 133 / 139	132 / 134 / 139	134 / 135 / 139	137 / 137 / 139
	0	130 / 132 / 138	130 / 132 / 138	130 / 132 / 138	132 / 134 / 138	135 / 135 / 138
135,000	10,000	133 / 135 / 138	135 / 136 / 138	137 / 138 / 139	137 / 138 / 139	137 / 138 / 139
	8,000	131 / 133 / 137	133 / 134 / 137	135 / 136 / 137	135 / 136 / 137	135 / 136 / 137
	6,000	130 / 132 / 137	131 / 132 / 137	133 / 134 / 137	135 / 136 / 137	135 / 136 / 137
	4,000	129 / 131 / 137	129 / 131 / 137	131 / 132 / 137	133 / 134 / 137	133 / 134 / 137
	2,000	128 / 130 / 136	128 / 130 / 136	129 / 131 / 136	131 / 132 / 136	133 / 134 / 136
	0	127 / 129 / 136	126 / 129 / 136	126 / 129 / 136	129 / 131 / 136	131 / 132 / 136
130,000	10,000	130 / 131 / 135	131 / 133 / 135	134 / 135 / 136	134 / 135 / 136	134 / 135 / 136
	8,000	128 / 130 / 135	129 / 131 / 135	132 / 132 / 135	132 / 132 / 135	132 / 132 / 135
	6,000	127 / 129 / 134	127 / 129 / 134	130 / 131 / 134	132 / 133 / 134	132 / 133 / 134
	4,000	126 / 128 / 134	126 / 128 / 134	128 / 129 / 134	130 / 131 / 134	130 / 131 / 134
	2,000	125 / 127 / 134	124 / 127 / 134	125 / 127 / 134	128 / 129 / 134	130 / 131 / 134
	0	123 / 126 / 133	123 / 126 / 133	123 / 126 / 133	126 / 128 / 133	128 / 129 / 133
125,000	10,000	126 / 128 / 132	128 / 129 / 132	131 / 131 / 132	131 / 131 / 132	131 / 131 / 132
	8,000	125 / 127 / 132	126 / 128 / 132	128 / 129 / 132	128 / 129 / 132	128 / 129 / 132
	6,000	124 / 126 / 131	124 / 126 / 131	126 / 128 / 131	129 / 129 / 131	129 / 129 / 131
	4,000	122 / 125 / 131	122 / 125 / 131	124 / 126 / 131	127 / 127 / 131	127 / 127 / 131
	2,000	121 / 124 / 131	121 / 124 / 131	122 / 124 / 131	125 / 126 / 131	127 / 128 / 131
	0	120 / 122 / 131	120 / 123 / 131	120 / 123 / 131	123 / 124 / 131	125 / 126 / 131

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 / 5**

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

Speeds marked with an asterisk (*) are limited by V_{mcg}.

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 / 10

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
155,000	10,000					
	8,000	136 / 136 / 138				
	6,000	135 / 135 / 138	135 / 135 / 138	136 / 136 / 138	137 / 137 / 137	138 / 138 / 138
	4,000	134 / 134 / 139	134 / 134 / 139	135 / 135 / 138	136 / 136 / 138	137 / 137 / 137
	2,000	134 / 134 / 139	134 / 134 / 139	134 / 134 / 139	135 / 135 / 138	136 / 136 / 137
	0	133 / 133 / 139	133 / 133 / 139	133 / 133 / 139	134 / 134 / 139	136 / 136 / 138
150,000	10,000					
	8,000	133 / 134 / 136	133 / 134 / 136	135 / 135 / 135		
	6,000	132 / 133 / 136	132 / 133 / 136	133 / 134 / 136	135 / 135 / 135	136 / 136 / 136
	4,000	131 / 132 / 137	131 / 132 / 137	132 / 133 / 136	134 / 134 / 136	135 / 135 / 135
	2,000	131 / 132 / 137	131 / 132 / 137	131 / 132 / 137	132 / 133 / 136	134 / 134 / 135
	0	130 / 131 / 137	130 / 131 / 137	130 / 131 / 137	131 / 132 / 137	133 / 134 / 136
145,000	10,000	133 / 133 / 134				
	8,000	131 / 132 / 134	131 / 132 / 134	133 / 133 / 133	134 / 134 / 134	
	6,000	130 / 131 / 134	130 / 131 / 134	131 / 132 / 134	133 / 133 / 133	134 / 134 / 134
	4,000	129 / 130 / 135	129 / 130 / 135	130 / 131 / 134	132 / 132 / 134	133 / 133 / 133
	2,000	129 / 130 / 135	129 / 130 / 135	129 / 130 / 135	130 / 131 / 134	132 / 132 / 133
	0	128 / 129 / 135	128 / 129 / 135	128 / 129 / 135	129 / 130 / 135	131 / 132 / 134
140,000	10,000	130 / 130 / 132	130 / 130 / 132	131 / 131 / 131		
	8,000	128 / 129 / 132	128 / 129 / 132	130 / 130 / 131	131 / 131 / 131	132 / 132 / 132
	6,000	127 / 128 / 132	127 / 128 / 132	128 / 129 / 132	130 / 130 / 131	131 / 131 / 131
	4,000	126 / 127 / 133	126 / 127 / 133	127 / 128 / 132	129 / 129 / 132	130 / 130 / 131
	2,000	126 / 127 / 133	126 / 127 / 133	126 / 127 / 133	127 / 128 / 132	129 / 129 / 131
	0	125 / 126 / 133	125 / 126 / 133	125 / 126 / 133	126 / 127 / 133	128 / 129 / 132
135,000	10,000	127 / 128 / 130	127 / 128 / 130	128 / 129 / 129	129 / 130 / 130	
	8,000	125 / 127 / 130	125 / 127 / 130	127 / 128 / 129	128 / 129 / 129	130 / 130 / 130
	6,000	124 / 126 / 130	124 / 126 / 130	125 / 127 / 130	127 / 128 / 129	129 / 129 / 129
	4,000	123 / 125 / 131	123 / 125 / 131	124 / 126 / 130	126 / 127 / 130	127 / 128 / 129
	2,000	123 / 125 / 131	123 / 125 / 131	123 / 125 / 131	124 / 126 / 130	126 / 127 / 129
	0	122 / 124 / 131	122 / 124 / 131	122 / 124 / 131	123 / 125 / 131	125 / 127 / 130
130,000	10,000	124 / 125 / 128	124 / 125 / 128	125 / 126 / 127	126 / 127 / 127	128 / 128 / 128
	8,000	122 / 124 / 128	122 / 124 / 128	124 / 125 / 127	125 / 126 / 127	127 / 127 / 127
	6,000	121 / 123 / 128	121 / 123 / 128	122 / 124 / 128	124 / 125 / 127	126 / 126 / 126
	4,000	120 / 122 / 129	120 / 122 / 129	121 / 123 / 128	123 / 124 / 128	124 / 125 / 127
	2,000	120 / 122 / 129	120 / 122 / 129	120 / 122 / 129	121 / 123 / 128	123 / 124 / 127
	0	119 / 121 / 129	119 / 121 / 129	119 / 121 / 129	120 / 122 / 129	122 / 124 / 128
125,000	10,000	121 / 122 / 126	121 / 122 / 126	122 / 123 / 125	123 / 124 / 124	125 / 125 / 125
	8,000	119 / 121 / 126	119 / 121 / 126	121 / 122 / 125	122 / 123 / 125	124 / 124 / 124
	6,000	118 / 120 / 126	118 / 120 / 126	119 / 121 / 126	121 / 122 / 125	123 / 123 / 124
	4,000	117 / 119 / 127	117 / 119 / 127	118 / 120 / 126	120 / 121 / 126	121 / 122 / 125
	2,000	117 / 119 / 127	117 / 119 / 127	117 / 119 / 127	118 / 120 / 126	120 / 121 / 125
	0	116 / 118 / 127	116 / 118 / 127	116 / 118 / 127	117 / 119 / 127	119 / 121 / 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
TO1 / 10**

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

Speeds marked with an asterisk (*) are limited by V_{mcg}.

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 / 15

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
155,000	10,000					
	8,000	133 / 133 / 136				
	6,000	132 / 132 / 136	132 / 132 / 136	133 / 133 / 136	134 / 134 / 135	135 / 135 / 135
	4,000	131 / 131 / 137	131 / 131 / 137	132 / 132 / 136	133 / 133 / 136	134 / 134 / 135
	2,000	131 / 131 / 137	131 / 131 / 137	131 / 131 / 137	132 / 132 / 136	133 / 133 / 135
	0	130 / 130 / 137	130 / 130 / 137	130 / 130 / 137	131 / 131 / 137	133 / 133 / 136
150,000	10,000					
	8,000	131 / 131 / 134	131 / 131 / 134	132 / 132 / 133		
	6,000	130 / 130 / 134	130 / 130 / 134	131 / 131 / 134	132 / 132 / 133	133 / 133 / 133
	4,000	129 / 129 / 135	129 / 129 / 135	130 / 130 / 134	131 / 131 / 134	132 / 132 / 133
	2,000	129 / 129 / 135	129 / 129 / 135	129 / 129 / 135	130 / 130 / 134	131 / 131 / 133
	0	128 / 128 / 135	128 / 128 / 135	128 / 128 / 135	129 / 129 / 135	131 / 131 / 134
145,000	10,000	130 / 130 / 132				
	8,000	129 / 129 / 132	129 / 129 / 132	130 / 130 / 131	131 / 131 / 131	
	6,000	128 / 128 / 132	128 / 128 / 132	129 / 129 / 132	130 / 130 / 131	131 / 131 / 131
	4,000	127 / 127 / 133	127 / 127 / 133	128 / 128 / 132	129 / 129 / 132	130 / 130 / 131
	2,000	127 / 127 / 133	127 / 127 / 133	127 / 127 / 133	128 / 128 / 132	129 / 129 / 131
	0	126 / 126 / 133	126 / 126 / 133	126 / 126 / 133	127 / 127 / 133	129 / 129 / 132
140,000	10,000	127 / 127 / 130	127 / 127 / 130	128 / 128 / 129		
	8,000	126 / 126 / 130	126 / 126 / 130	127 / 127 / 129	128 / 128 / 129	129 / 129 / 129
	6,000	125 / 125 / 130	125 / 125 / 130	126 / 126 / 130	127 / 127 / 129	128 / 128 / 128
	4,000	124 / 124 / 131	124 / 124 / 131	125 / 125 / 130	126 / 126 / 130	127 / 127 / 129
	2,000	124 / 124 / 131	124 / 124 / 131	124 / 124 / 131	125 / 125 / 130	126 / 126 / 129
	0	123 / 123 / 131	123 / 123 / 131	123 / 123 / 131	124 / 124 / 131	126 / 126 / 130
135,000	10,000	125 / 125 / 128	125 / 125 / 128	126 / 126 / 127	127 / 127 / 127	
	8,000	124 / 124 / 128	124 / 124 / 128	125 / 125 / 127	126 / 126 / 127	127 / 127 / 127
	6,000	123 / 123 / 128	123 / 123 / 128	124 / 124 / 128	125 / 125 / 127	126 / 126 / 126
	4,000	122 / 122 / 129	122 / 122 / 129	123 / 123 / 128	124 / 124 / 128	125 / 125 / 127
	2,000	122 / 122 / 129	122 / 122 / 129	122 / 122 / 129	123 / 123 / 128	124 / 124 / 127
	0	121 / 121 / 129	121 / 121 / 129	121 / 121 / 129	122 / 122 / 129	124 / 124 / 128
130,000	10,000	122 / 122 / 126	122 / 122 / 126	123 / 123 / 125	124 / 124 / 124	125 / 125 / 125
	8,000	121 / 121 / 126	121 / 121 / 126	122 / 122 / 125	123 / 123 / 125	124 / 124 / 124
	6,000	120 / 120 / 126	120 / 120 / 126	121 / 121 / 126	122 / 122 / 125	123 / 123 / 124
	4,000	119 / 119 / 127	119 / 119 / 127	120 / 120 / 126	121 / 121 / 126	122 / 122 / 125
	2,000	119 / 119 / 127	119 / 119 / 127	119 / 119 / 127	120 / 120 / 126	121 / 121 / 125
	0	118 / 118 / 127	118 / 118 / 127	118 / 118 / 127	119 / 119 / 127	121 / 121 / 126
125,000	10,000	120 / 120 / 124	120 / 120 / 124	121 / 121 / 123	122 / 122 / 122	123 / 123 / 123
	8,000	118 / 119 / 124	118 / 119 / 124	120 / 120 / 123	121 / 121 / 123	122 / 122 / 122
	6,000	117 / 118 / 124	117 / 118 / 124	118 / 119 / 124	120 / 120 / 123	121 / 121 / 122
	4,000	116 / 117 / 125	116 / 117 / 125	117 / 118 / 124	119 / 119 / 124	120 / 120 / 123
	2,000	116 / 117 / 125	116 / 117 / 125	116 / 117 / 125	117 / 118 / 124	119 / 119 / 123
	0	115 / 116 / 125	115 / 116 / 125	115 / 116 / 125	116 / 117 / 125	118 / 119 / 124

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 / 15**

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

Speeds marked with an asterisk (*) are limited by V_{mcg}.

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 / 25

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
155,000	10,000					
	8,000	131 / 131 / 134				
	6,000	130 / 130 / 134	130 / 130 / 134	131 / 131 / 134	132 / 132 / 133	133 / 133 / 133
	4,000	129 / 129 / 135	129 / 129 / 135	130 / 130 / 134	131 / 131 / 134	132 / 132 / 133
	2,000	129 / 129 / 135	129 / 129 / 135	129 / 129 / 135	130 / 130 / 134	131 / 131 / 133
	0	128 / 128 / 135	128 / 128 / 135	128 / 128 / 135	129 / 129 / 135	131 / 131 / 134
150,000	10,000					
	8,000	129 / 129 / 132	129 / 129 / 132	130 / 130 / 131		
	6,000	128 / 128 / 132	128 / 128 / 132	129 / 129 / 132	130 / 130 / 131	131 / 131 / 131
	4,000	127 / 127 / 133	127 / 127 / 133	128 / 128 / 132	129 / 129 / 132	130 / 130 / 131
	2,000	127 / 127 / 133	127 / 127 / 133	127 / 127 / 133	128 / 128 / 132	129 / 129 / 131
	0	126 / 126 / 133	126 / 126 / 133	126 / 126 / 133	127 / 127 / 133	129 / 129 / 132
145,000	10,000	128 / 128 / 130				
	8,000	127 / 127 / 130	127 / 127 / 130	128 / 128 / 129	129 / 129 / 129	
	6,000	126 / 126 / 130	126 / 126 / 130	127 / 127 / 130	128 / 128 / 129	129 / 129 / 129
	4,000	125 / 125 / 131	125 / 125 / 131	126 / 126 / 130	127 / 127 / 130	128 / 128 / 129
	2,000	125 / 125 / 131	125 / 125 / 131	125 / 125 / 131	126 / 126 / 130	127 / 127 / 129
	0	124 / 124 / 131	124 / 124 / 131	124 / 124 / 131	125 / 125 / 131	127 / 127 / 130
140,000	10,000	126 / 126 / 128	126 / 126 / 128	127 / 127 / 127		
	8,000	125 / 125 / 128	125 / 125 / 128	126 / 126 / 127	127 / 127 / 127	128 / 128 / 128
	6,000	124 / 124 / 128	124 / 124 / 128	125 / 125 / 128	126 / 126 / 127	127 / 127 / 127
	4,000	123 / 123 / 129	123 / 123 / 129	124 / 124 / 128	125 / 125 / 128	126 / 126 / 127
	2,000	123 / 123 / 129	123 / 123 / 129	123 / 123 / 129	124 / 124 / 128	125 / 125 / 127
	0	122 / 122 / 129	122 / 122 / 129	122 / 122 / 129	123 / 123 / 129	125 / 125 / 128
135,000	10,000	124 / 124 / 126	124 / 124 / 126	125 / 125 / 125	126 / 126 / 126	
	8,000	122 / 123 / 126	122 / 123 / 126	124 / 124 / 125	125 / 125 / 125	126 / 126 / 126
	6,000	121 / 122 / 126	121 / 122 / 126	122 / 123 / 126	124 / 124 / 125	125 / 125 / 125
	4,000	120 / 121 / 127	120 / 121 / 127	121 / 122 / 126	123 / 123 / 126	124 / 124 / 125
	2,000	120 / 121 / 127	120 / 121 / 127	120 / 121 / 127	121 / 122 / 126	123 / 123 / 125
	0	119 / 120 / 127	119 / 120 / 127	119 / 120 / 127	120 / 121 / 127	122 / 123 / 126
130,000	10,000	121 / 121 / 124	121 / 121 / 124	122 / 122 / 123	123 / 123 / 123	124 / 124 / 124
	8,000	119 / 120 / 124	119 / 120 / 124	121 / 121 / 123	122 / 122 / 123	123 / 123 / 123
	6,000	118 / 119 / 124	118 / 119 / 124	119 / 120 / 124	121 / 121 / 123	122 / 122 / 122
	4,000	117 / 118 / 125	117 / 118 / 125	118 / 119 / 124	120 / 120 / 124	121 / 121 / 123
	2,000	117 / 118 / 125	117 / 118 / 125	117 / 118 / 125	118 / 119 / 124	120 / 120 / 123
	0	116 / 117 / 125	116 / 117 / 125	116 / 117 / 125	117 / 118 / 125	119 / 120 / 124
125,000	10,000	118 / 118 / 122	118 / 118 / 122	119 / 119 / 121	120 / 120 / 120	121 / 121 / 121
	8,000	117 / 117 / 122	117 / 117 / 122	118 / 118 / 121	119 / 119 / 121	120 / 120 / 120
	6,000	116 / 116 / 122	116 / 116 / 122	117 / 117 / 122	118 / 118 / 121	119 / 119 / 120
	4,000	115 / 115 / 123	115 / 115 / 123	116 / 116 / 122	117 / 117 / 122	118 / 118 / 121
	2,000	115 / 115 / 123	115 / 115 / 123	115 / 115 / 123	116 / 116 / 122	117 / 117 / 121
	0	114 / 114 / 123	114 / 114 / 123	114 / 114 / 123	115 / 115 / 123	117 / 117 / 122

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 / 25**

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

Speeds marked with an asterisk (*) are limited by V_{mcg}.

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 / 1

Minimum takeoff weight for TO power is 125,000 lbs.

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
155,000	10,000	148 / 149 / 152	149 / 150 / 153	B149 / 151 / 153	B149 / 151 / 153	B149 / 151 / 153
	8,000	146 / 147 / 151	146 / 148 / 151	147 / 148 / 151	147 / 148 / 151	147 / 148 / 151
	6,000	144 / 146 / 151	144 / 146 / 151	145 / 147 / 151	146 / 148 / 151	146 / 148 / 151
	4,000	142 / 144 / 150	142 / 144 / 150	143 / 145 / 150	145 / 146 / 150	145 / 146 / 150
	2,000	140 / 142 / 149	140 / 142 / 149	140 / 143 / 149	142 / 144 / 149	145 / 146 / 149
	0	138 / 141 / 149	138 / 141 / 149	138 / 141 / 149	140 / 142 / 149	143 / 144 / 149
150,000	10,000	145 / 146 / 149	146 / 147 / 150	147 / 148 / 150	147 / 148 / 150	147 / 148 / 150
	8,000	143 / 145 / 149	144 / 145 / 149	144 / 146 / 149	144 / 146 / 149	144 / 146 / 149
	6,000	141 / 143 / 148	141 / 143 / 148	142 / 144 / 148	144 / 145 / 148	144 / 145 / 148
	4,000	139 / 141 / 148	139 / 141 / 148	140 / 142 / 148	142 / 143 / 148	142 / 143 / 148
	2,000	137 / 139 / 147	137 / 140 / 147	137 / 140 / 147	140 / 141 / 147	142 / 143 / 147
	0	135 / 138 / 146	135 / 138 / 146	135 / 138 / 146	138 / 140 / 146	140 / 141 / 146
145,000	10,000	142 / 144 / 147	143 / 144 / 147	144 / 145 / 147	144 / 145 / 147	144 / 145 / 147
	8,000	140 / 142 / 146	141 / 142 / 146	142 / 143 / 146	142 / 143 / 146	142 / 143 / 146
	6,000	138 / 140 / 146	138 / 140 / 146	139 / 141 / 146	141 / 142 / 146	141 / 142 / 146
	4,000	136 / 138 / 145	136 / 138 / 145	137 / 139 / 145	139 / 140 / 145	139 / 140 / 145
	2,000	134 / 137 / 145	134 / 137 / 145	134 / 137 / 145	137 / 139 / 145	139 / 140 / 145
	0	132 / 135 / 144	132 / 135 / 144	132 / 135 / 144	135 / 137 / 144	137 / 139 / 144
140,000	10,000	139 / 141 / 144	140 / 141 / 144	140 / 141 / 144	140 / 141 / 144	140 / 141 / 144
	8,000	137 / 139 / 144	137 / 139 / 144	139 / 140 / 144	139 / 140 / 144	139 / 140 / 144
	6,000	135 / 137 / 143	135 / 137 / 143	136 / 138 / 143	138 / 139 / 143	138 / 139 / 143
	4,000	133 / 135 / 142	133 / 135 / 142	134 / 136 / 142	136 / 137 / 142	136 / 137 / 142
	2,000	131 / 133 / 142	131 / 133 / 142	131 / 134 / 142	134 / 136 / 142	136 / 137 / 142
	0	129 / 132 / 141	129 / 132 / 141	129 / 132 / 141	131 / 134 / 141	134 / 136 / 141
135,000	10,000	136 / 137 / 141	136 / 138 / 141	137 / 138 / 141	137 / 138 / 141	137 / 138 / 141
	8,000	134 / 135 / 141	134 / 136 / 141	135 / 137 / 141	135 / 137 / 141	135 / 137 / 141
	6,000	132 / 134 / 140	132 / 134 / 140	133 / 135 / 140	135 / 136 / 140	135 / 136 / 140
	4,000	130 / 132 / 140	129 / 132 / 140	130 / 133 / 140	132 / 134 / 140	132 / 134 / 140
	2,000	127 / 130 / 139	127 / 130 / 139	128 / 131 / 139	130 / 132 / 139	133 / 134 / 139
	0	126 / 129 / 139	126 / 129 / 139	126 / 129 / 139	128 / 130 / 139	131 / 132 / 139
130,000	10,000	132 / 134 / 138	133 / 134 / 138	134 / 135 / 138	134 / 135 / 138	134 / 135 / 138
	8,000	130 / 132 / 138	131 / 132 / 138	132 / 133 / 138	132 / 133 / 138	132 / 133 / 138
	6,000	128 / 130 / 137	128 / 131 / 137	129 / 131 / 137	131 / 133 / 137	131 / 133 / 137
	4,000	126 / 129 / 137	126 / 129 / 137	127 / 129 / 137	129 / 131 / 137	129 / 131 / 137
	2,000	124 / 127 / 136	124 / 127 / 136	125 / 127 / 136	127 / 129 / 136	129 / 131 / 136
	0	123 / 126 / 136	123 / 126 / 136	123 / 126 / 136	125 / 127 / 136	128 / 129 / 136
125,000	10,000	129 / 130 / 135	129 / 131 / 135	131 / 132 / 135	131 / 132 / 135	131 / 132 / 135
	8,000	127 / 129 / 135	127 / 129 / 135	128 / 130 / 135	128 / 130 / 135	128 / 130 / 135
	6,000	125 / 127 / 134	125 / 127 / 134	126 / 128 / 134	128 / 129 / 134	128 / 129 / 134
	4,000	123 / 125 / 134	123 / 125 / 134	123 / 126 / 134	126 / 127 / 134	126 / 127 / 134
	2,000	121 / 123 / 134	121 / 124 / 134	121 / 124 / 134	124 / 126 / 134	126 / 128 / 134
	0	*121 / 123 / 134	*121 / 123 / 134	*120 / 123 / 134	122 / 124 / 133	124 / 126 / 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.

Minimum takeoff weight for TO power is 125,000 lbs.

V₁ / V_R / V₂
TO / 5

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
155,000	10,000	144 / 146 / 149	145 / 146 / 149	146 / 148 / 149	146 / 148 / 149	146 / 148 / 149
	8,000	142 / 144 / 147	142 / 144 / 147	144 / 146 / 148	144 / 146 / 148	144 / 146 / 148
	6,000	140 / 142 / 147	140 / 143 / 147	141 / 143 / 147	144 / 145 / 148	144 / 145 / 148
	4,000	138 / 141 / 146	138 / 141 / 146	139 / 141 / 146	141 / 143 / 146	141 / 143 / 146
	2,000	136 / 139 / 146	136 / 139 / 146	137 / 140 / 146	139 / 141 / 146	141 / 143 / 146
	0	135 / 138 / 146	135 / 138 / 146	135 / 138 / 146	137 / 140 / 146	139 / 141 / 145
150,000	10,000	141 / 143 / 146	142 / 143 / 146	143 / 145 / 146	143 / 145 / 146	143 / 145 / 146
	8,000	139 / 141 / 145	140 / 142 / 145	141 / 143 / 145	141 / 143 / 145	141 / 143 / 145
	6,000	137 / 140 / 145	138 / 140 / 145	138 / 140 / 145	141 / 142 / 145	141 / 142 / 145
	4,000	136 / 138 / 144	135 / 138 / 144	136 / 139 / 144	138 / 140 / 144	138 / 140 / 144
	2,000	134 / 137 / 144	133 / 137 / 144	134 / 137 / 144	136 / 138 / 144	139 / 140 / 144
	0	132 / 135 / 143	132 / 135 / 143	132 / 135 / 143	134 / 137 / 143	137 / 138 / 143
145,000	10,000	138 / 140 / 143	139 / 141 / 143	140 / 142 / 143	140 / 142 / 143	140 / 142 / 143
	8,000	136 / 139 / 143	137 / 139 / 143	138 / 140 / 143	138 / 140 / 143	138 / 140 / 143
	6,000	135 / 137 / 142	135 / 137 / 142	136 / 138 / 142	138 / 139 / 142	138 / 139 / 142
	4,000	133 / 135 / 142	133 / 135 / 142	133 / 136 / 142	135 / 137 / 142	135 / 137 / 142
	2,000	131 / 134 / 141	131 / 134 / 141	131 / 134 / 141	133 / 136 / 141	136 / 137 / 141
	0	129 / 132 / 141	129 / 132 / 141	129 / 133 / 141	131 / 134 / 141	134 / 136 / 141
140,000	10,000	135 / 137 / 141	136 / 138 / 141	137 / 138 / 141	137 / 138 / 141	137 / 138 / 141
	8,000	133 / 136 / 140	134 / 136 / 140	135 / 137 / 140	135 / 137 / 140	135 / 137 / 140
	6,000	132 / 134 / 140	132 / 134 / 140	133 / 135 / 140	134 / 136 / 140	134 / 136 / 140
	4,000	130 / 132 / 139	130 / 132 / 139	130 / 133 / 139	132 / 134 / 139	132 / 134 / 139
	2,000	128 / 131 / 139	128 / 131 / 139	128 / 131 / 139	130 / 133 / 139	133 / 134 / 139
	0	126 / 129 / 138	126 / 129 / 138	126 / 130 / 138	128 / 131 / 138	131 / 133 / 138
135,000	10,000	132 / 134 / 138	133 / 135 / 138	134 / 135 / 138	134 / 135 / 138	134 / 135 / 138
	8,000	130 / 132 / 137	131 / 133 / 137	132 / 134 / 137	132 / 134 / 137	132 / 134 / 137
	6,000	128 / 131 / 137	128 / 131 / 137	129 / 132 / 137	131 / 133 / 137	131 / 133 / 137
	4,000	126 / 129 / 137	126 / 129 / 137	127 / 130 / 137	129 / 131 / 137	129 / 131 / 137
	2,000	124 / 128 / 136	124 / 128 / 136	125 / 128 / 136	127 / 130 / 136	130 / 131 / 136
	0	123 / 126 / 136	123 / 126 / 136	123 / 126 / 136	125 / 128 / 136	128 / 130 / 136
130,000	10,000	129 / 131 / 135	129 / 131 / 135	131 / 132 / 135	131 / 132 / 135	131 / 132 / 135
	8,000	127 / 129 / 135	127 / 130 / 135	129 / 130 / 135	129 / 130 / 135	129 / 130 / 135
	6,000	125 / 128 / 134	125 / 128 / 134	126 / 129 / 134	128 / 130 / 134	128 / 130 / 134
	4,000	123 / 126 / 134	123 / 126 / 134	124 / 127 / 134	126 / 128 / 134	126 / 128 / 134
	2,000	121 / 125 / 134	121 / 125 / 134	122 / 125 / 134	124 / 127 / 134	126 / 128 / 134
	0	*121 / 123 / 133	*120 / 123 / 133	*120 / 123 / 133	122 / 125 / 133	125 / 127 / 133
125,000	10,000	126 / 128 / 132	126 / 128 / 132	127 / 129 / 132	127 / 129 / 132	127 / 129 / 132
	8,000	124 / 126 / 132	124 / 126 / 132	125 / 127 / 132	125 / 127 / 132	125 / 127 / 132
	6,000	122 / 125 / 131	122 / 125 / 131	123 / 125 / 131	125 / 127 / 131	125 / 127 / 131
	4,000	120 / 123 / 131	120 / 123 / 131	121 / 124 / 131	123 / 125 / 131	123 / 125 / 131
	2,000	*118 / 121 / 131	*118 / 121 / 131	118 / 122 / 131	121 / 123 / 131	123 / 125 / 131
	0	*121 / 121 / 131	*121 / 121 / 131	*120 / 121 / 131	119 / 122 / 131	122 / 124 / 131

Speeds marked with an asterisk (*) are limited by Vmcg.

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 / 10

Minimum takeoff weight for TO power is 125,000 lbs.

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
155,000	10,000	136 / 137 / 138	136 / 137 / 138	136 / 138 / 138	138 / 138 / 138	139 / 139 / 139
	8,000	135 / 136 / 139	135 / 136 / 139	135 / 137 / 138	136 / 137 / 137	138 / 138 / 138
	6,000	133 / 135 / 139	133 / 135 / 139	134 / 136 / 139	135 / 136 / 138	136 / 137 / 137
	4,000	132 / 134 / 139	132 / 134 / 139	133 / 134 / 139	134 / 135 / 139	135 / 136 / 138
	2,000	131 / 133 / 140	131 / 133 / 140	131 / 133 / 140	133 / 134 / 139	134 / 135 / 138
	0	130 / 132 / 140	130 / 132 / 140	130 / 132 / 140	131 / 133 / 139	133 / 135 / 138
150,000	10,000	133 / 135 / 136	133 / 135 / 136	133 / 136 / 136	135 / 136 / 136	137 / 137 / 137
	8,000	132 / 134 / 137	132 / 134 / 137	132 / 135 / 136	133 / 135 / 135	135 / 136 / 136
	6,000	130 / 133 / 137	130 / 133 / 137	131 / 134 / 137	132 / 134 / 136	133 / 135 / 135
	4,000	129 / 132 / 137	129 / 132 / 137	130 / 132 / 137	131 / 133 / 137	132 / 134 / 136
	2,000	128 / 131 / 138	128 / 131 / 138	128 / 131 / 138	130 / 132 / 137	131 / 133 / 136
	0	127 / 130 / 138	127 / 130 / 138	127 / 130 / 138	128 / 131 / 137	130 / 133 / 136
145,000	10,000	131 / 133 / 134	131 / 133 / 134	131 / 134 / 134	133 / 134 / 134	135 / 135 / 135
	8,000	130 / 132 / 135	130 / 132 / 135	130 / 133 / 134	131 / 133 / 133	133 / 134 / 134
	6,000	128 / 131 / 135	128 / 131 / 135	129 / 132 / 135	130 / 132 / 134	131 / 133 / 133
	4,000	127 / 130 / 135	127 / 130 / 135	128 / 130 / 135	129 / 131 / 135	130 / 132 / 134
	2,000	126 / 129 / 136	126 / 129 / 136	126 / 129 / 136	128 / 130 / 135	129 / 131 / 134
	0	125 / 128 / 136	125 / 128 / 136	125 / 128 / 136	126 / 129 / 135	128 / 131 / 134
140,000	10,000	128 / 130 / 132	128 / 130 / 132	128 / 131 / 131	130 / 131 / 131	132 / 132 / 132
	8,000	127 / 129 / 133	127 / 129 / 133	127 / 130 / 132	128 / 130 / 131	130 / 131 / 131
	6,000	125 / 128 / 133	125 / 128 / 133	126 / 129 / 133	127 / 129 / 132	128 / 130 / 131
	4,000	124 / 127 / 133	124 / 127 / 133	125 / 127 / 133	126 / 128 / 133	127 / 129 / 132
	2,000	123 / 126 / 134	123 / 126 / 134	123 / 126 / 134	125 / 127 / 133	126 / 128 / 132
	0	123* / 125 / 134	122 / 125 / 134	122 / 125 / 134	123 / 126 / 133	125 / 128 / 132
135,000	10,000	126 / 127 / 130	126 / 127 / 130	126 / 128 / 129	128 / 128 / 129	129 / 129 / 129
	8,000	125 / 126 / 131	125 / 126 / 131	125 / 127 / 130	126 / 127 / 129	128 / 128 / 129
	6,000	123 / 125 / 131	123 / 125 / 131	124 / 126 / 131	125 / 126 / 130	126 / 127 / 129
	4,000	122 / 124 / 131	122 / 124 / 131	123 / 124 / 131	124 / 125 / 131	125 / 126 / 130
	2,000	121 / 123 / 132	121 / 123 / 132	121 / 123 / 132	123 / 124 / 131	124 / 125 / 130
	0	123* / 123 / 133	122* / 122 / 132	122* / 122 / 132	121 / 123 / 131	123 / 125 / 130
130,000	10,000	123 / 124 / 128	123 / 124 / 128	123 / 125 / 127	125 / 125 / 127	126 / 126 / 126
	8,000	122 / 123 / 129	122 / 123 / 129	122 / 124 / 128	123 / 124 / 127	125 / 125 / 127
	6,000	120 / 122 / 129	120 / 122 / 129	121 / 123 / 129	122 / 123 / 128	123 / 124 / 127
	4,000	119 / 121 / 129	119 / 121 / 129	120 / 121 / 129	121 / 122 / 129	122 / 123 / 128
	2,000	119* / 120 / 130	119* / 120 / 130	118 / 120 / 130	120 / 121 / 129	121 / 122 / 128
	0	123* / 123 / 134	122* / 122 / 133	122* / 122 / 133	118 / 120 / 129	120 / 122 / 128
125,000	10,000	120 / 122 / 126	120 / 122 / 126	120 / 123 / 125	122 / 123 / 125	124 / 124 / 124
	8,000	119 / 121 / 127	119 / 121 / 127	119 / 122 / 126	120 / 122 / 125	122 / 123 / 125
	6,000	117 / 120 / 127	117 / 120 / 127	118 / 121 / 127	119 / 121 / 126	120 / 122 / 125
	4,000	116 / 119 / 127	116 / 119 / 127	117 / 119 / 127	118 / 120 / 127	119 / 121 / 126
	2,000	119* / 119 / 129	119* / 119 / 129	118* / 118 / 128	117 / 119 / 127	118 / 120 / 126
	0	123* / 123 / 134	122* / 122 / 133	122* / 122 / 133	117* / 118 / 127	117 / 120 / 126

Speeds marked with an asterisk (*) are limited by V_{mcg}.

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.

Minimum takeoff weight for TO power is 125,000 lbs.

V₁ / V_R / V₂
TO / 15

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
155,000	10,000	134 / 134 / 135	134 / 134 / 135	135 / 135 / 135	135 / 135 / 135	136 / 136 / 136
	8,000	133 / 133 / 136	133 / 133 / 136	134 / 134 / 135	134 / 134 / 134	135 / 135 / 135
	6,000	132 / 132 / 136	132 / 132 / 136	133 / 133 / 136	133 / 133 / 135	134 / 134 / 134
	4,000	131 / 131 / 136	131 / 131 / 136	131 / 131 / 136	132 / 132 / 136	133 / 133 / 135
	2,000	130 / 130 / 137	130 / 130 / 137	130 / 130 / 137	131 / 131 / 136	132 / 132 / 135
	0	129 / 129 / 137	129 / 129 / 137	129 / 129 / 137	130 / 130 / 136	132 / 132 / 135
150,000	10,000	132 / 132 / 133	132 / 132 / 133	132 / 133 / 133	133 / 133 / 133	134 / 134 / 134
	8,000	131 / 131 / 134	131 / 131 / 134	131 / 132 / 133	132 / 132 / 132	133 / 133 / 133
	6,000	129 / 130 / 134	129 / 130 / 134	130 / 131 / 134	131 / 131 / 133	132 / 132 / 132
	4,000	128 / 129 / 134	128 / 129 / 134	129 / 129 / 134	130 / 130 / 134	131 / 131 / 133
	2,000	127 / 128 / 135	127 / 128 / 135	127 / 128 / 135	129 / 129 / 134	130 / 130 / 133
	0	126 / 127 / 135	126 / 127 / 135	126 / 127 / 135	127 / 128 / 134	129 / 130 / 133
145,000	10,000	130 / 130 / 131	130 / 130 / 131	130 / 131 / 131	131 / 131 / 131	132 / 132 / 132
	8,000	129 / 129 / 132	129 / 129 / 132	129 / 130 / 131	130 / 130 / 130	131 / 131 / 131
	6,000	127 / 128 / 132	127 / 128 / 132	128 / 129 / 132	129 / 129 / 131	130 / 130 / 130
	4,000	126 / 127 / 132	126 / 127 / 132	127 / 127 / 132	128 / 128 / 132	129 / 129 / 131
	2,000	125 / 126 / 133	125 / 126 / 133	125 / 126 / 133	127 / 127 / 132	128 / 128 / 131
	0	124 / 125 / 133	124 / 125 / 133	124 / 125 / 133	125 / 126 / 132	127 / 128 / 131
140,000	10,000	127 / 127 / 129	127 / 127 / 129	127 / 128 / 128	128 / 128 / 128	129 / 129 / 129
	8,000	126 / 126 / 130	126 / 126 / 130	126 / 127 / 129	127 / 127 / 128	128 / 128 / 128
	6,000	124 / 125 / 130	124 / 125 / 130	125 / 126 / 130	126 / 126 / 129	127 / 127 / 128
	4,000	123 / 124 / 130	123 / 124 / 130	124 / 124 / 130	125 / 125 / 130	126 / 126 / 129
	2,000	122 / 123 / 131	122 / 123 / 131	122 / 123 / 131	124 / 124 / 130	125 / 125 / 129
	0	123* / 123 / 132	122* / 122 / 131	122* / 122 / 131	122 / 123 / 130	124 / 125 / 129
135,000	10,000	124 / 125 / 127	124 / 125 / 127	124 / 126 / 126	126 / 126 / 126	127 / 127 / 127
	8,000	123 / 124 / 128	123 / 124 / 128	123 / 125 / 127	124 / 125 / 126	126 / 126 / 126
	6,000	121 / 123 / 128	121 / 123 / 128	122 / 124 / 128	123 / 124 / 127	124 / 125 / 126
	4,000	120 / 122 / 128	120 / 122 / 128	121 / 122 / 128	122 / 123 / 128	123 / 124 / 127
	2,000	119 / 121 / 129	119 / 121 / 129	119 / 121 / 129	121 / 122 / 128	122 / 123 / 127
	0	123* / 123 / 132	122* / 122 / 131	122* / 122 / 131	119 / 121 / 128	121 / 123 / 127
130,000	10,000	121 / 122 / 125	121 / 122 / 125	121 / 123 / 124	123 / 123 / 124	124 / 124 / 124
	8,000	120 / 121 / 126	120 / 121 / 126	120 / 122 / 125	121 / 122 / 124	123 / 123 / 124
	6,000	118 / 120 / 126	118 / 120 / 126	119 / 121 / 126	120 / 121 / 125	121 / 122 / 124
	4,000	117 / 119 / 126	117 / 119 / 126	118 / 119 / 126	119 / 120 / 126	120 / 121 / 125
	2,000	119* / 119 / 128	119* / 119 / 128	118* / 118 / 127	118 / 119 / 126	119 / 120 / 125
	0	123* / 123 / 133	122* / 122 / 132	122* / 122 / 132	117* / 118 / 126	118 / 120 / 125
125,000	10,000	119 / 120 / 123	119 / 120 / 123	119 / 121 / 122	121 / 121 / 122	122 / 122 / 122
	8,000	118 / 119 / 124	118 / 119 / 124	118 / 120 / 123	119 / 120 / 122	121 / 121 / 122
	6,000	116 / 118 / 124	116 / 118 / 124	117 / 119 / 124	118 / 119 / 123	119 / 120 / 122
	4,000	115 / 117 / 124	115 / 117 / 124	116 / 117 / 124	117 / 118 / 124	118 / 119 / 123
	2,000	119* / 119 / 128	119* / 119 / 128	118* / 118 / 127	116 / 117 / 124	117 / 118 / 123
	0	123* / 123 / 133	122* / 122 / 132	122* / 122 / 132	117* / 117 / 125	116 / 118 / 123

Speeds marked with an asterisk (*) are limited by Vmcg.

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 / 25

Minimum takeoff weight for TO power is 125,000 lbs.

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
155,000	10,000	132 / 132 / 134	132 / 132 / 134	133 / 133 / 133	133 / 133 / 133	134 / 134 / 134
	8,000	131 / 131 / 135	131 / 131 / 135	132 / 132 / 134	132 / 132 / 133	133 / 133 / 133
	6,000	130 / 130 / 135	130 / 130 / 135	131 / 131 / 135	131 / 131 / 134	132 / 132 / 133
	4,000	129 / 129 / 135	129 / 129 / 135	129 / 129 / 135	130 / 130 / 135	131 / 131 / 134
	2,000	128 / 128 / 136	128 / 128 / 136	128 / 128 / 136	129 / 129 / 135	130 / 130 / 134
	0	127 / 127 / 136	127 / 127 / 136	127 / 127 / 136	128 / 128 / 135	130 / 130 / 134
150,000	10,000	130 / 130 / 132	130 / 130 / 132	131 / 131 / 131	131 / 131 / 131	132 / 132 / 132
	8,000	129 / 129 / 133	129 / 129 / 133	130 / 130 / 132	130 / 130 / 131	131 / 131 / 131
	6,000	128 / 128 / 133	128 / 128 / 133	129 / 129 / 133	129 / 129 / 132	130 / 130 / 131
	4,000	127 / 127 / 133	127 / 127 / 133	127 / 127 / 133	128 / 128 / 133	129 / 129 / 132
	2,000	126 / 126 / 134	126 / 126 / 134	126 / 126 / 134	127 / 127 / 133	128 / 128 / 132
	0	125 / 125 / 134	125 / 125 / 134	125 / 125 / 134	126 / 126 / 133	128 / 128 / 132
145,000	10,000	128 / 128 / 130	128 / 128 / 130	129 / 129 / 129	129 / 129 / 129	130 / 130 / 130
	8,000	127 / 127 / 131	127 / 127 / 131	128 / 128 / 130	128 / 128 / 129	129 / 129 / 129
	6,000	126 / 126 / 131	126 / 126 / 131	127 / 127 / 131	127 / 127 / 130	128 / 128 / 129
	4,000	125 / 125 / 131	125 / 125 / 131	125 / 125 / 131	126 / 126 / 131	127 / 127 / 130
	2,000	124 / 124 / 132	124 / 124 / 132	124 / 124 / 132	125 / 125 / 131	126 / 126 / 130
	0	123 / 123 / 132	123 / 123 / 132	123 / 123 / 132	124 / 124 / 131	126 / 126 / 130
140,000	10,000	126 / 126 / 128	126 / 126 / 128	126 / 127 / 127	127 / 127 / 127	128 / 128 / 128
	8,000	125 / 125 / 129	125 / 125 / 129	125 / 126 / 128	126 / 126 / 127	127 / 127 / 127
	6,000	123 / 124 / 129	123 / 124 / 129	124 / 125 / 129	125 / 125 / 128	126 / 126 / 127
	4,000	122 / 123 / 129	122 / 123 / 129	123 / 123 / 129	124 / 124 / 129	125 / 125 / 128
	2,000	121 / 122 / 130	121 / 122 / 130	121 / 122 / 130	123 / 123 / 129	124 / 124 / 128
	0	123* / 123 / 132	122* / 122 / 131	122* / 122 / 131	121 / 122 / 129	123 / 124 / 128
135,000	10,000	123 / 123 / 126	123 / 123 / 126	123 / 124 / 125	124 / 124 / 125	125 / 125 / 125
	8,000	122 / 122 / 127	122 / 122 / 127	122 / 123 / 126	123 / 123 / 125	124 / 124 / 125
	6,000	120 / 121 / 127	120 / 121 / 127	121 / 122 / 127	122 / 122 / 126	123 / 123 / 125
	4,000	119 / 120 / 127	119 / 120 / 127	120 / 120 / 127	121 / 121 / 127	122 / 122 / 126
	2,000	119* / 119 / 128	119* / 119 / 128	118 / 119 / 128	120 / 120 / 127	121 / 121 / 126
	0	123* / 123 / 133	122* / 122 / 132	122* / 122 / 132	118 / 119 / 127	120 / 121 / 126
130,000	10,000	120 / 120 / 124	120 / 120 / 124	120 / 121 / 123	121 / 121 / 123	122 / 122 / 122
	8,000	119 / 119 / 125	119 / 119 / 125	119 / 120 / 124	120 / 120 / 123	121 / 121 / 123
	6,000	117 / 118 / 125	117 / 118 / 125	118 / 119 / 125	119 / 119 / 124	120 / 120 / 123
	4,000	116 / 117 / 125	116 / 117 / 125	117 / 117 / 125	118 / 118 / 125	119 / 119 / 124
	2,000	119* / 119 / 129	119* / 119 / 129	118* / 118 / 128	117 / 117 / 125	118 / 118 / 124
	0	123* / 123 / 134	122* / 122 / 133	122* / 122 / 133	117* / 117 / 126	117 / 118 / 124
125,000	10,000	118 / 118 / 122	118 / 118 / 122	118 / 119 / 121	119 / 119 / 121	120 / 120 / 120
	8,000	117 / 117 / 123	117 / 117 / 123	117 / 118 / 122	118 / 118 / 121	119 / 119 / 121
	6,000	115 / 116 / 123	115 / 116 / 123	116 / 117 / 123	117 / 117 / 122	118 / 118 / 121
	4,000	115* / 115 / 123	115* / 115 / 123	115 / 115 / 123	116 / 116 / 123	117 / 117 / 122
	2,000	119* / 119 / 129	119* / 119 / 129	118* / 118 / 128	115 / 115 / 123	116 / 116 / 122
	0	123* / 123 / 134	122* / 122 / 133	122* / 122 / 133	117* / 117 / 126	115 / 116 / 122

Speeds marked with an asterisk (*) are limited by V_{mcg}.

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 - 1,000 POUNDS	CENTER OF GRAVITY PERCENT M.A.C.									
	9	11	13	16	20	24	28	30	32	33
160	8.50	8.50	8.50	7.75	7.00	6.25	5.50	5.00	4.75	4.50
140	8.50	8.50	8.00	7.25	6.50	5.75	5.00	4.50	4.25	4.00
120	8.50	8.00	7.50	6.75	6.00	5.25	4.50	4.25	4.00	4.00
100 AND BELOW	7.00	6.75	6.50	6.00	5.25	4.50	4.00	4.00	4.00	4.00

FLAPS 10, 15, AND 25

GROSS WEIGHT - 1,000 POUNDS	CENTER OF GRAVITY PERCENT M.A.C.									
	9	11	13	16	20	24	28	30	32	33
160	8.50	8.50	8.50	7.50	6.75	5.75	5.00	4.50	4.25	4.25
140	8.50	8.50	8.00	7.00	6.25	5.25	4.50	4.25	4.25	4.25
120	8.50	8.00	7.25	6.50	5.50	4.75	4.25	4.25	4.25	4.25
100 AND BELOW	6.75	6.25	6.00	5.50	4.75	4.25	4.25	4.25	4.25	4.25

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 - 1,000 POUNDS	CENTER OF GRAVITY PERCENT M.A.C.									
	9	11	13	16	20	24	26	28	30	33
160	8.50	8.50	8.50	7.75	6.75	6.00	5.50	5.25	4.75	4.25
140	8.50	8.50	8.00	7.25	6.25	5.50	5.25	4.75	4.50	4.00
120	8.50	8.00	7.50	6.50	5.75	5.00	4.75	4.25	4.00	4.00
100 AND BELOW	6.75	6.50	6.00	5.50	5.00	4.25	4.00	4.00	4.00	4.00

FLAPS 10, 15, AND 25

GROSS WEIGHT - 1,000 POUNDS	CENTER OF GRAVITY PERCENT M.A.C.									
	9	11	13	16	20	23	27	30	32	33
160	8.50	8.50	8.25	7.25	6.50	5.75	5.00	4.25	4.25	4.25
140	8.50	8.50	7.75	6.75	6.00	5.25	4.50	4.25	4.25	4.25
120	8.50	7.75	7.25	6.00	5.25	4.75	4.25	4.25	4.25	4.25
100 AND BELOW	6.25	6.00	5.50	5.00	4.50	4.25	4.25	4.25	4.25	4.25

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 - 1,000 POUNDS	CENTER OF GRAVITY PERCENT M.A.C.									
	9	11	13	16	20	23	26	28	31	33
160	8.50	8.50	8.50	7.25	6.50	6.00	5.50	5.00	4.50	4.00
140	8.50	8.50	7.75	6.75	6.00	5.50	4.75	4.50	4.00	4.00
120	8.50	7.75	7.25	6.25	5.50	4.75	4.25	4.00	4.00	4.00
100 AND BELOW	6.25	6.00	5.50	5.00	4.25	4.00	4.00	4.00	4.00	4.00

FLAPS 10, 15, AND 25

GROSS WEIGHT - 1,000 POUNDS	CENTER OF GRAVITY PERCENT M.A.C.									
	9	11	12	14	18	23	26	28	31	33
160	8.50	8.50	8.50	8.00	6.50	5.25	4.50	4.25	4.25	4.25
140	8.50	8.50	7.75	6.50	5.75	4.50	4.25	4.25	4.25	4.25
120	8.50	7.00	6.00	5.75	4.75	4.25	4.25	4.25	4.25	4.25
100 AND BELOW	5.50	5.00	5.00	4.50	4.25	4.25	4.25	4.25	4.25	4.25

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.
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 FULL EXT			SLATS FULL EXT		
		FLAPS 0	FLAPS 1	FLAPS 5	FLAPS 10	FLAPS 15	FLAPS 25	FLAPS 15	FLAPS 30	FLAPS 40
		V _{Ref} + 70	V _{Ref} + 50	V _{Ref} + 30	V _{Ref} + 30	V _{Ref} + 20	V _{Ref} + 10	V _{Ref15}	V _{Ref30}	V _{Ref40}
154,500	144	214	194	174	174	164	154	152	146	144
150,000	142	212	192	172	172	162	152	150	144	142
145,000	140	210	190	170	170	160	150	148	142	140
140,000	137	207	187	167	167	157	147	145	140	137
135,000	135	205	185	165	165	155	145	142	137	135
130,000	132	202	182	162	162	152	142	139	134	132
125,000	129	199	179	159	159	149	139	136	132	129
120,000	126	196	176	156	156	146	136	133	129	126
115,000	123	193	173	153	153	143	133	130	126	123
110,000	120	190	170	150	150	140	130	127	123	120
105,000	117	187	167	147	147	137	127	124	120	117
100,000	114	184	164	144	144	134	124	121	117	114
95,000	111	181	161	141	141	131	121	118	114	111
90,000	108	178	158	138	138	128	118	115	111	108

NOTE: When the flap lever is in positions 1 or 5, the inboard L.E. flaps fully extend while the outboard L.E. slats extend half way. When the flap lever is in position 10 or higher, both L.E. flaps and slats are fully extended.

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 FULL EXT	FLAPS 15 SLATS FULL EXT	FLAPS 25 SLATS FULL EXT	FLAPS 15 SLATS FULL EXT	FLAPS 30 SLATS FULL EXT	FLAPS 40 SLATS FULL EXT
160,000	169	136	133	127	124	123	126	121	119
155,000	167	134	131	125	122	121	124	119	117
150,000	164	132	128	123	120	118	122	117	115
145,000	161	129	126	120	118	116	119	115	113
140,000	158	127	124	118	116	114	117	113	111
135,000	155	124	121	116	114	112	115	111	108
130,000	152	122	119	114	111	110	113	109	106
125,000	149	119	116	112	109	108	111	107	104
120,000	146	116	114	109	107	106	108	104	102
115,000	143	114	111	107	105	104	106	102	100
110,000	140	111	109	105	103	101	104	100	98
105,000	136	109	106	102	100	99	101	98	96
100,000	133	106	104	100	98	97	99	95	93
95,000	130	103	102	97	95	94	97	93	91
90,000	126	101	98	94	93	92	94	90	88
85,000	123	98	96	92	90	89	92	88	86

NOTE: When the flap lever is in positions 1 or 5, the inboard L.E. flaps fully extend while the outboard L.E. slats extend half way. When the flap lever is in position 10 or higher, both L.E. flaps and slats are fully extended.

F.A.R. DRY LANDING FIELD LENGTH

FEET

CFM56-7B26

FLAPS 15

AIRCRAFT WEIGHT LBS	AIRPORT PRESSURE ALTITUDE – FEET										
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
154,500	5,781	5,923	6,070	6,223	6,382	6,546	6,719	6,897	7,081	7,274	7,474
150,000	5,641	5,779	5,920	6,068	6,221	6,381	6,548	6,721	6,900	7,087	7,281
145,000	5,485	5,617	5,753	5,894	6,042	6,196	6,358	6,525	6,697	6,878	7,066
140,000	5,317	5,443	5,572	5,707	5,849	5,998	6,153	6,314	6,480	6,654	6,835
135,000	5,144	5,265	5,388	5,517	5,652	5,795	5,944	6,098	6,258	6,425	6,599
130,000	4,972	5,086	5,204	5,326	5,456	5,592	5,735	5,883	6,036	6,196	6,363
125,000	4,801	4,911	5,024	5,141	5,265	5,394	5,530	5,670	5,815	5,967	6,127
120,000	4,629	4,735	4,844	4,956	5,074	5,196	5,324	5,457	5,594	5,739	5,892
115,000	4,458	4,559	4,663	4,771	4,882	4,998	5,119	5,244	5,373	5,511	5,657
110,000	4,293	4,390	4,490	4,593	4,699	4,808	4,923	5,041	5,162	5,294	5,432
105,000	4,149	4,243	4,339	4,438	4,540	4,645	4,755	4,868	4,985	5,110	5,242
100,000	4,004	4,094	4,186	4,282	4,379	4,480	4,586	4,695	4,807	4,926	5,051
95,000	3,859	3,945	4,033	4,125	4,218	4,314	4,416	4,520	4,627	4,741	4,859
90,000	3,712	3,794	3,879	3,966	4,056	4,148	4,244	4,344	4,447	4,554	4,666

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	- 44 ft. per knot
Tailwind	+ 70 ft. per knot
Manual Spoilers	See ODM Abnormal section
Anti-Skid Inoperative	See ODM Abnormal section
Wet runway and/or Low Minima	increase distance by 15%
VREF ICE	increase distance by 12%

F.A.R. DRY LANDING FIELD LENGTH**FEET****CFM56-7B26****FLAPS 30**

AIRCRAFT WEIGHT LBS	AIRPORT PRESSURE ALTITUDE – FEET										
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
154,500	5,537	5,673	5,813	5,958	6,109	6,266	6,429	6,598	6,773	6,957	7,147
150,000	5,404	5,534	5,669	5,810	5,956	6,108	6,267	6,431	6,601	6,778	6,963
145,000	5,254	5,380	5,509	5,644	5,785	5,931	6,085	6,244	6,408	6,580	6,758
140,000	5,093	5,213	5,337	5,466	5,600	5,742	5,890	6,042	6,200	6,365	6,537
135,000	4,928	5,043	5,161	5,283	5,412	5,548	5,690	5,836	5,988	6,147	6,312
130,000	4,763	4,872	4,984	5,101	5,224	5,354	5,491	5,631	5,776	5,929	6,087
125,000	4,599	4,704	4,812	4,924	5,042	5,165	5,294	5,427	5,565	5,710	5,862
120,000	4,434	4,535	4,639	4,747	4,858	4,975	5,097	5,224	5,354	5,492	5,637
115,000	4,291	4,388	4,488	4,592	4,699	4,810	4,926	5,046	5,170	5,303	5,442
110,000	4,153	4,247	4,343	4,443	4,545	4,651	4,762	4,876	4,994	5,120	5,254
105,000	4,014	4,104	4,197	4,293	4,392	4,493	4,600	4,709	4,823	4,944	5,071
100,000	3,874	3,961	4,050	4,143	4,237	4,334	4,437	4,542	4,651	4,766	4,886
95,000	3,733	3,817	3,902	3,991	4,081	4,174	4,272	4,373	4,477	4,587	4,701
90,000	3,591	3,671	3,753	3,838	3,924	4,013	4,107	4,204	4,303	4,407	4,515

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	- 44 ft. per knot
Tailwind	+ 70 ft. per knot
Manual Spoilers	See ODM Abnormal section
Anti-Skid Inoperative	See ODM Abnormal section
Wet runway and/or Low Minima	increase distance by 15%

F.A.R. DRY LANDING FIELD LENGTH**FEET****CFM56-7B26****FLAPS 40**

AIRCRAFT WEIGHT LBS	AIRPORT PRESSURE ALTITUDE – FEET										
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
154,500	5,420	5,557	5,698	5,844	5,998	6,158	6,325	6,498	6,678	6,866	7,063
150,000	5,288	5,419	5,554	5,695	5,843	5,998	6,160	6,328	6,501	6,684	6,875
145,000	5,140	5,265	5,394	5,528	5,670	5,819	5,976	6,138	6,305	6,482	6,665
140,000	4,981	5,100	5,222	5,350	5,485	5,628	5,779	5,934	6,094	6,264	6,440
135,000	4,818	4,931	5,047	5,168	5,297	5,434	5,578	5,726	5,880	6,042	6,211
130,000	4,655	4,762	4,872	4,986	5,109	5,240	5,377	5,519	5,666	5,821	5,983
125,000	4,496	4,598	4,704	4,814	4,930	5,053	5,183	5,316	5,454	5,602	5,756
120,000	4,361	4,460	4,563	4,669	4,780	4,896	5,019	5,145	5,276	5,417	5,565
115,000	4,226	4,322	4,420	4,523	4,629	4,739	4,855	4,974	5,098	5,232	5,375
110,000	4,090	4,182	4,278	4,376	4,477	4,581	4,691	4,803	4,919	5,047	5,184
105,000	3,953	4,042	4,134	4,229	4,326	4,426	4,531	4,639	4,751	4,872	5,001
100,000	3,815	3,901	3,989	4,080	4,173	4,269	4,370	4,474	4,581	4,696	4,817
95,000	3,677	3,759	3,843	3,931	4,020	4,112	4,208	4,308	4,411	4,519	4,633
90,000	3,537	3,616	3,697	3,780	3,865	3,953	4,046	4,141	4,239	4,342	4,448

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	- 44 ft. per knot
Tailwind	+ 70 ft. per knot
Manual Spoilers	See ODM Abnormal section
Anti-Skid Inoperative	See ODM Abnormal section
Wet runway* and/or Low Minima	increase distance by 15%

* Same as dry for skid resistant runways only.

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APPROACH AND LANDING CLIMB LIMITS

POUNDS

CFM56-7B26
**APPROACH FLAPS 1
LANDING FLAPS 15**

OAT °C	AIRPORT PRESSURE ALTITUDE – FEET										
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
50	157,900	152,100	146,300								
45	165,900	159,800	153,800	147,900	142,250	138,100					
40	174,000	167,700	161,300	155,100	149,300	143,400	137,700	132,300			
35	180,000	175,900	169,350	162,850	156,600	150,450	144,450	138,750	133,250	127,900	
32	180,000	180,000	174,000	167,500	161,000	154,900	148,600	142,600	136,900	131,400	126,100
30	180,000	180,000	177,100	170,600	164,100	157,800	151,600	145,300	139,400	133,800	128,400
28	180,000	180,000	180,000	173,800	167,300	160,700	154,600	148,300	142,100	136,300	130,800
26	180,000	180,000	180,000	176,959	170,500	163,700	157,300	151,300	144,900	138,900	133,200
24	180,000	180,000	180,000	180,000	173,500	163,700	160,100	154,000	147,900	141,700	135,800
22	180,000	180,000	180,000	180,000	176,500	163,700	163,200	156,700	150,600	144,500	138,500
20	180,000	180,000	180,000	180,000	176,600	163,700	166,500	159,800	153,200	147,400	141,200
18	180,000	180,000	180,000	180,000	176,700	163,700	169,500	162,900	156,200	150,100	144,000
≤16	180,000	180,000	180,000	180,000	176,800	163,700	169,600	165,800	159,300	152,900	146,700

NOTES:

- AFM Maximum Structural Landing Weight must not be exceeded.
- Reduce Limit Weight by 17,700 pounds when operating in icing conditions during any part of the flight when the forecast landing temperature is below 10 degrees C.

CORRECTIONS:

ENGINE ANTI-ICE ON	-600
ENGINE & WING ANTI-ICE ON	-3,500

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

CFM56-7B26

APPROACH FLAPS 15
LANDING FLAPS 30

OAT °C	AIRPORT PRESSURE ALTITUDE – FEET										
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
50	134,700	129,900	125,000								
45	141,500	136,300	131,250	126,300	121,550						
40	148,300	142,900	137,600	132,400	127,500	122,500	117,600	113,000			
35	155,500	149,850	144,200	138,800	133,550	128,450	123,400	118,450	113,700	109,200	
32	159,800	154,000	148,300	142,700	137,300	132,100	126,900	121,800	116,900	112,200	107,700
30	162,900	157,000	151,100	145,400	139,900	134,600	129,400	124,100	119,100	114,300	109,700
28	163,100	159,900	154,000	148,200	142,500	137,100	131,900	126,600	121,500	116,500	111,800
26	163,200	160,100	156,900	151,000	145,300	139,600	134,300	129,100	123,800	118,800	113,900
24	163,400	160,200	157,000	153,800	148,000	142,400	136,600	131,500	126,300	121,200	116,100
22	163,500	160,300	157,200	153,900	150,700	145,200	139,300	133,900	128,700	123,600	118,500
20	163,600	160,400	157,300	154,000	150,800	147,800	142,100	136,500	131,100	126,100	120,800
18	163,800	160,600	157,400	154,100	150,900	147,900	144,600	139,200	133,500	128,300	123,200
≤16	163,900	160,700	157,500	154,200	151,000	148,000	144,700	141,500	136,100	130,700	125,500

NOTES:

- AFM Maximum Structural Landing Weight must not be exceeded.
- Reduce Limit Weight by 14,700 pounds when operating in icing conditions during any part of the flight when the forecast landing temperature is below 10 degrees C.

CORRECTIONS:

PACKS OFF	+3,300
ENGINE ANTI-ICE ON	-600
ENGINE & WING ANTI-ICE ON	-3,000

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****CFM56-7B26****APPROACH FLAPS 15
LANDING FLAPS 40**

OAT °C	AIRPORT PRESSURE ALTITUDE – FEET										
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
50	134,100	129,200	124,300								
45	140,800	135,600	130,550	125,700	121,000						
40	147,700	142,200	136,900	131,800	126,900	121,900	117,100	112,500			
35	154,500	148,900	143,250	138,000	132,800	127,700	122,700	117,800	113,100	108,600	
32	158,800	153,000	147,300	141,700	136,500	131,200	126,100	121,100	116,300	111,600	107,100
30	161,800	155,800	150,100	144,400	139,000	133,700	128,500	123,400	118,500	113,700	109,200
28	162,000	158,700	152,800	147,100	141,500	136,100	130,900	125,700	120,700	115,900	111,200
26	162,100	158,800	155,600	149,800	144,100	138,500	133,200	128,000	122,900	118,000	113,300
24	162,300	159,000	155,700	152,500	146,800	141,200	135,500	130,400	125,200	120,300	115,400
22	162,400	159,100	155,800	152,600	149,400	143,900	138,100	132,800	127,600	122,500	117,600
20	162,500	159,200	155,900	152,700	149,400	146,300	140,700	135,200	129,800	124,900	119,800
18	162,700	159,300	156,000	152,800	149,500	146,400	143,000	137,700	132,200	127,100	122,000
≤16	162,800	159,400	156,100	152,900	149,600	146,500	143,100	139,900	134,600	129,300	124,100

NOTES:

- AFM Maximum Structural Landing Weight must not be exceeded.
- Reduce Limit Weight by 15,300 pounds when operating in icing conditions during any part of the flight when the forecast landing temperature is below 10 degrees C.

CORRECTIONS:

PACKS OFF	+2,700
ENGINE ANTI-ICE ON	-600
ENGINE & WING ANTI-ICE ON	-1,700

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.

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
155,000	11,000	9,800	7,600	5,500	4,400	7,600	6,300	6,000
150,000	10,700	9,500	7,400	5,400	4,400	7,500	6,200	5,900
145,000	10,400	9,300	7,300	5,300	4,300	7,300	6,100	5,800
140,000	10,100	9,100	7,100	5,200	4,200	7,100	5,900	5,600
135,000	9,800	8,800	7,000	5,100	4,100	7,000	5,800	5,500
130,000	9,500	8,600	6,800	5,000	4,000	6,800	5,700	5,400
129,200	9,500	8,600	6,800	5,000	4,000	6,800	5,700	5,400
125,000	9,200	8,300	6,600	4,900	3,900	6,600	5,600	5,300
120,000	8,900	8,100	6,500	4,800	3,800	6,500	5,400	5,100
115,000	8,600	7,800	6,300	4,700	3,800	6,300	5,300	5,000
110,000	8,300	7,600	6,100	4,600	3,700	6,100	5,200	4,900
105,000	8,000	7,300	5,900	4,500	3,600	5,900	5,000	4,800
100,000	7,700	7,100	5,800	4,400	3,500	5,800	4,900	4,600
95,000	7,400	6,800	5,600	4,300	3,400	5,600	4,800	4,500

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Speed at Touchdown = 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	-600	-500	-300	-200	-100	-300	-300	-200
2,000	0	0	0	0	0	0	0	0
4,000	600	500	300	200	100	300	300	200
6,000	1,100	900	600	400	300	600	500	500
8,000	1,700	1,400	1,000	600	400	1,000	800	700
10,000	2,500	2,000	1,400	900	600	1,400	1,100	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	350	400	350	200	100	350	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	-100	0	0	-50	0	-100	-100
PER 1% DOWN SLOPE	200	50	0	0	50	0	100	100
1 REVERSER INOP	700	100	0	0	100	0	300	200
2 REVERSERS INOP	800	100	0	0	100	100	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
155,000	8,500	8,300	8,200	10,800	10,800	10,800
150,000	8,300	8,100	8,000	10,500	10,500	10,500
145,000	8,100	7,900	7,800	10,200	10,200	10,200
140,000	7,900	7,700	7,600	10,000	10,000	10,000
135,000	7,700	7,500	7,400	9,700	9,700	9,700
130,000	7,500	7,300	7,200	9,400	9,400	9,400
129,200	7,500	7,300	7,200	9,300	9,300	9,300
125,000	7,300	7,100	7,000	9,100	9,100	9,100
120,000	7,100	6,900	6,800	8,800	8,800	8,800
115,000	6,900	6,700	6,700	8,500	8,500	8,500
110,000	6,700	6,500	6,500	8,200	8,200	8,200
105,000	6,500	6,300	6,300	8,000	8,000	8,000
100,000	6,300	6,100	6,100	7,700	7,700	7,700
95,000	6,100	5,900	5,900	7,400	7,400	7,400

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Speed at Touchdown = 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	-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	700	1,100	1,100	1,100
8,000	1,200	1,200	1,100	1,700	1,700	1,700
10,000	1,800	1,800	1,700	2,500	2,500	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	250	300	300	300
PER 10°C ABOVE ISA	150	150	150	200	200	200
PER 10°C BELOW ISA	-150	-150	-150	-250	-250	-250
PER 1% UP SLOPE	-150	-200	-200	-450	-450	-450
PER 1% DOWN SLOPE	200	250	300	700	700	700
1 REVERSER INOP	600	700	700	1,500	1,500	1,500
2 REVERSERS INOP	1,600	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
155,000	10,300	9,200	7,200	5,300	4,300	7,200	6,100	5,800
150,000	10,000	9,000	7,100	5,200	4,200	7,100	6,000	5,700
145,000	9,800	8,700	6,900	5,100	4,200	6,900	5,900	5,600
140,000	9,500	8,500	6,800	5,000	4,100	6,800	5,800	5,500
135,000	9,200	8,300	6,600	4,900	4,000	6,600	5,600	5,400
130,000	9,000	8,100	6,500	4,800	3,900	6,500	5,500	5,300
129,200	8,900	8,100	6,400	4,800	3,900	6,500	5,500	5,200
125,000	8,700	7,900	6,300	4,700	3,800	6,300	5,400	5,100
120,000	8,400	7,600	6,100	4,600	3,800	6,200	5,300	5,000
115,000	8,100	7,400	6,000	4,500	3,700	6,000	5,100	4,900
110,000	7,900	7,200	5,800	4,400	3,600	5,800	5,000	4,800
105,000	7,600	6,900	5,700	4,300	3,600	5,700	4,900	4,700
100,000	7,300	6,700	5,500	4,200	3,500	5,500	4,800	4,500
95,000	7,000	6,500	5,300	4,100	3,400	5,400	4,600	4,400

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Speed at Touchdown = 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	-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	800	600	400	300	600	500	500
8,000	1,500	1,200	900	600	400	900	700	700
10,000	2,200	1,800	1,300	900	600	1,300	1,000	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	350	350	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	-200	-100	0	0	-50	0	-100	-100
PER 1% DOWN SLOPE	200	50	0	0	50	0	100	100
1 REVERSER INOP	600	100	0	0	100	0	200	200
2 REVERSERS INOP	700	100	0	0	100	100	600	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
155,000	8,100	7,900	7,900	10,300	10,200	10,200
150,000	7,900	7,800	7,700	10,000	10,000	10,000
145,000	7,800	7,600	7,500	9,700	9,700	9,700
140,000	7,600	7,400	7,300	9,500	9,400	9,400
135,000	7,400	7,200	7,100	9,200	9,200	9,200
130,000	7,200	7,000	6,900	8,900	8,900	8,900
129,200	7,200	7,000	6,900	8,900	8,900	8,900
125,000	7,000	6,800	6,800	8,700	8,600	8,600
120,000	6,800	6,600	6,600	8,400	8,400	8,400
115,000	6,600	6,400	6,400	8,100	8,100	8,100
110,000	6,400	6,300	6,200	7,900	7,800	7,800
105,000	6,300	6,100	6,000	7,600	7,600	7,600
100,000	6,100	5,900	5,800	7,300	7,300	7,300
95,000	5,900	5,700	5,700	7,100	7,100	7,000

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Speed at Touchdown = 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	-300	-500	-500	-500
2,000	0	0	0	0	0	0
4,000	400	400	300	500	500	500
6,000	700	700	700	1,000	1,000	1,000
8,000	1,100	1,100	1,000	1,500	1,500	1,500
10,000	1,600	1,600	1,500	2,200	2,200	2,200

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	300	250	250	300	300	300
PER 10°C ABOVE ISA	150	150	150	200	200	200
PER 10°C BELOW ISA	-150	-150	-150	-200	-200	-200
PER 1% UP SLOPE	-150	-200	-200	-400	-450	-450
PER 1% DOWN SLOPE	200	250	300	650	650	650
1 REVERSER INOP	500	600	600	1,300	1,300	1,300
2 REVERSERS INOP	1,400	1,500	1,500	3,600	3,600	3,600
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
155,000	10,000	8,900	7,000	5,100	4,300	7,000	6,100	5,800
150,000	9,700	8,700	6,900	5,000	4,200	6,900	5,900	5,700
145,000	9,500	8,500	6,700	5,000	4,100	6,700	5,800	5,500
140,000	9,200	8,300	6,600	4,900	4,000	6,600	5,700	5,400
135,000	9,000	8,100	6,400	4,800	3,900	6,400	5,600	5,300
130,000	8,700	7,900	6,300	4,700	3,900	6,300	5,500	5,200
129,200	8,700	7,800	6,300	4,700	3,900	6,300	5,400	5,200
125,000	8,500	7,600	6,100	4,600	3,800	6,200	5,300	5,100
120,000	8,200	7,400	6,000	4,500	3,700	6,000	5,200	5,000
115,000	7,900	7,200	5,800	4,400	3,700	5,800	5,100	4,900
110,000	7,700	7,000	5,700	4,300	3,600	5,700	4,900	4,700
105,000	7,400	6,700	5,500	4,200	3,500	5,500	4,800	4,600
100,000	7,100	6,500	5,400	4,100	3,500	5,400	4,700	4,500
95,000	6,900	6,300	5,200	4,000	3,400	5,200	4,600	4,400

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Speed at Touchdown = 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	-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	800	600	400	300	600	500	500
8,000	1,500	1,200	900	600	400	900	700	700
10,000	2,200	1,800	1,300	900	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	350	300	200	150	300	200	150
PER 10°C ABOVE ISA	200	200	150	100	50	150	100	100
PER 10°C BELOW ISA	-200	-200	-150	-100	-50	-150	-100	-100
PER 1% UP SLOPE	-200	-100	0	0	-50	0	-100	-100
PER 1% DOWN SLOPE	150	50	0	0	50	50	100	100
1 REVERSER INOP	500	100	0	0	0	0	200	200
2 REVERSERS INOP	700	100	0	0	100	100	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 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
155,000	8,000	7,800	7,700	10,100	10,000	10,000
150,000	7,800	7,700	7,500	9,800	9,800	9,700
145,000	7,600	7,500	7,400	9,500	9,500	9,500
140,000	7,400	7,300	7,200	9,300	9,200	9,200
135,000	7,200	7,100	7,000	9,000	9,000	8,900
130,000	7,100	6,900	6,800	8,700	8,700	8,700
129,200	7,000	6,900	6,800	8,700	8,700	8,600
125,000	6,900	6,700	6,700	8,500	8,500	8,400
120,000	6,700	6,500	6,500	8,200	8,200	8,200
115,000	6,500	6,400	6,300	8,000	8,000	7,900
110,000	6,300	6,200	6,100	7,700	7,700	7,700
105,000	6,100	6,000	5,900	7,500	7,500	7,400
100,000	5,900	5,800	5,800	7,200	7,200	7,200
95,000	5,800	5,600	5,600	7,000	7,000	6,900

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Speed at Touchdown = 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	-300	-500	-500	-500
2,000	0	0	0	0	0	0
4,000	400	400	300	500	500	500
6,000	700	700	700	1,000	1,000	1,000
8,000	1,100	1,100	1,000	1,500	1,500	1,400
10,000	1,600	1,600	1,500	2,200	2,200	2,100

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	300	250	250	300	300	250
PER 10°C ABOVE ISA	150	150	150	200	200	200
PER 10°C BELOW ISA	-150	-150	-150	-200	-200	-200
PER 1% UP SLOPE	-150	-200	-200	-400	-450	-450
PER 1% DOWN SLOPE	250	250	300	650	650	650
1 REVERSER INOP	500	600	600	1,300	1,300	1,300
2 REVERSERS INOP	1,400	1,400	1,400	3,300	3,300	3,300
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
CFM56-7B26

 0 TO 60 KNOTS
 BASED ON NORMAL* BLEED

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
-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
-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
-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
-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
-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 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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*TO Power is based on the FULL CFM56-7B26 26K engine rating with:

-Packs ON

-Engine Anti-ice on or off

-Wing anti-ice off

Pressure Altitude / Field Elevation Correction:

Subtract/Add 100ft to elevation for every 0.11 inch barometric setting above/below 29.92 inches.

THRUST SETTINGS – ALL ENGINE

TAKEOFF %N1

TO1

0 TO 60 KNOTS
BASED ON NORMAL * BLEED

CFM56-7B26

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	95.7	96.7	97.6	98.5
-10	89.6	90.6	91.2	91.7	92.3	92.9	93.6	94.3	95.1	95.9	96.8	97.7
-20	88.8	89.8	90.4	90.9	91.5	92.1	92.8	93.5	94.3	95.1	96.1	97.0
-30	88.0	89.0	89.5	90.0	90.6	91.3	92.0	92.7	93.5	94.3	95.3	96.2
-40	87.1	88.2	88.7	89.2	89.8	90.5	91.2	91.9	92.6	93.5	94.5	95.4
-50	86.3	87.3	87.9	88.4	89.0	89.6	90.3	91.0	91.8	92.6	93.7	94.6

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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*TO1 Power is based on the CFM56-7B26 engine derated to thrust 24K rating with:

- Packs ON
- Engine Anti-ice on or off
- Wing anti-ice off

Pressure Altitude / Field Elevation Correction:

Subtract/Add 100ft to elevation for every 0.11 inch barometric setting above/below 29.92 inches.

THRUST SETTINGS – ALL ENGINE

TAKEOFF %N1

TO2
CFM56-7B26

 0 TO 60 KNOTS
 BASED ON NORMAL * BLEED

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	88.3	88.7	88.8	88.9	89.1	89.2	89.2	89.1	88.6	88.3	88.7	89.2
55	89.1	89.5	89.7	89.8	89.9	90.0	90.0	90.0	89.5	89.0	88.8	88.6
50	89.8	90.4	90.5	90.6	90.7	90.9	90.8	90.8	90.4	89.9	89.7	89.6
45	90.7	91.2	91.3	91.4	91.5	91.7	91.6	91.6	91.2	90.8	90.7	90.5
40	91.6	92.1	92.2	92.3	92.4	92.5	92.4	92.4	92.1	91.7	91.6	91.5
35	92.5	93.0	93.1	93.2	93.2	93.3	93.3	93.2	92.9	92.5	92.5	92.4
30	92.6	93.8	93.9	94.0	94.0	94.1	94.0	93.9	93.7	93.4	93.3	93.2
25	91.9	93.1	93.7	94.4	94.8	94.9	94.8	94.8	94.4	94.0	94.0	94.0
20	91.1	92.3	93.0	93.6	94.3	95.0	95.6	95.6	95.3	94.9	94.8	94.7
15	90.4	91.6	92.2	92.8	93.6	94.3	94.8	95.3	95.9	96.1	95.9	95.5
10	89.6	90.8	91.4	92.1	92.8	93.5	94.0	94.5	95.1	95.7	96.4	97.1
5	88.9	90.0	90.7	91.3	92.0	92.7	93.2	93.7	94.3	94.9	95.6	96.3
0	88.1	89.2	89.9	90.5	91.2	91.9	92.4	92.9	93.5	94.1	94.8	95.5
-10	86.5	87.6	88.3	88.9	89.6	90.3	90.8	91.3	91.9	92.5	93.2	93.9
-20	84.9	86.0	86.6	87.3	87.9	88.6	89.1	89.7	90.3	90.8	91.6	92.3
-30	83.3	84.4	85.0	85.6	86.3	86.9	87.4	88.0	88.6	89.2	89.9	90.6
-40	81.6	82.7	83.3	83.9	84.5	85.2	85.7	86.2	86.8	87.4	88.2	88.9
-50	79.9	80.9	81.5	82.1	82.8	83.4	83.9	84.5	85.1	85.7	86.4	87.2

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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*TO2 Power is based on the CFM56-7B26 engine derated to thrust 22K rating with:

- Packs ON
- Engine Anti-ice on or off
- Wing anti-ice off

Pressure Altitude / Field Elevation Correction:

Subtract/Add 100ft to elevation for every 0.11 inch barometric setting above/below 29.92 inches.

THRUST SETTINGS – ALL ENGINE

CLIMB %N1

CLB
CFM56-7B26

CLIMB SPEED SCHEDULE: 280 KIAS / 0.78M
NORMAL BLEED - PACKS ON OR OFF / ANTI-ICE OFF

TAT °C	PRESSURE ALTITUDE (FEET)									
	0	5,000	10,000	15,000	20,000	25,000	30,000	35,000	37,000	41,000
60	89.4	89.7	89.7	89.8	89.6	91.4	93.0	94.4	94.5	92.8
55	90.2	90.5	90.5	90.7	90.0	90.8	92.4	93.7	93.8	92.1
50	90.9	91.2	91.3	91.5	91.0	90.8	91.7	93.0	93.1	91.4
45	91.6	91.9	92.1	92.3	91.9	91.7	91.7	92.3	92.4	90.7
40	92.4	92.6	92.9	93.1	92.7	92.5	92.5	91.6	91.7	90.0
35	92.9	93.3	93.6	93.8	93.6	93.3	93.3	92.4	91.7	90.1
30	92.2	94.1	94.3	94.6	94.4	94.1	94.0	93.2	92.6	91.1
25	91.5	94.1	95.0	95.2	95.2	94.8	94.7	94.0	93.4	92.1
20	90.7	93.3	95.8	96.0	95.9	95.6	95.4	94.7	94.2	93.0
15	90.0	92.5	95.2	96.8	96.7	96.3	96.1	95.5	95.0	94.0
10	89.2	91.8	94.4	97.1	97.6	97.0	96.7	96.2	95.8	94.9
5	88.4	91.0	93.6	96.3	98.5	97.9	97.4	97.0	96.6	95.8
0	87.7	90.2	92.8	95.5	97.9	99.0	98.4	97.8	97.5	96.7
-5	86.9	89.4	92.0	94.7	97.2	98.9	99.4	98.6	98.3	97.7
-10	86.1	88.6	91.2	93.9	96.4	98.1	99.7	99.5	99.2	98.7
-15	85.3	87.8	90.3	93.1	95.6	97.4	98.9	100.5	100.1	99.7
-20	84.5	87.0	89.5	92.3	94.8	96.6	98.1	100.2	100.7	100.3
-25	83.7	86.1	88.7	91.4	94.1	95.8	97.3	99.3	99.9	99.5
-30	82.9	85.3	87.8	90.6	93.3	95.0	96.5	98.5	99.0	98.7
-35	82.0	84.5	87.0	89.8	92.4	94.1	95.6	97.6	98.2	97.8
-40	81.2	83.6	86.1	88.9	91.6	93.3	94.8	96.8	97.3	96.9

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
CLB - 1	Reduce N1 from table by 3.0 percent.					
CLB - 2	Reduce N1 from table by 6.0 percent.					

THRUST SETTINGS – ALL ENGINE

CRUISE %N1

CRZ
CFM56-7B26

TAT - °C	AIRPORT PRESSURE ALTITUDE - FEET										
	25,000	30,000	31,000	32,000	33,000	34,000	35,000	36,000	37,000	39,000	41,000
15	92.3	91.8	91.7								
10	92.8	92.3	92.2								
5	92.9	92.9	92.8	92.8	92.8	92.6	92.4	91.9	92.0	91.8	91.3
0	92.1	93.5	93.4	93.4	93.3	93.1	92.9	92.5	92.6	92.4	92.1
-5	91.2	94.1	94.2	94.1	94.1	93.8	93.6	93.1	93.2	93.0	92.8
-10	90.4	93.3	93.9	94.5	94.7	94.6	94.4	93.8	94.0	93.8	93.6
-15	89.5	92.4	93.0	93.6	94.3	94.8	95.0	94.6	94.7	94.6	94.4
-20	88.7	91.5	92.1	92.7	93.4	93.9	94.5	94.8	95.1	94.8	94.6
-25	87.8	90.6	91.2	91.8	92.5	93.0	93.6	93.9	94.2	94.0	93.8
-30	86.9	89.7	90.3	90.9	91.6	92.1	92.7	93.0	93.3	93.1	92.9
-35	86.0	88.8	89.4	90.0	90.7	91.2	91.9	92.1	92.4	92.2	92.0
-40	85.2	87.9	88.5	89.1	89.7	90.3	91.0	91.2	91.5	91.3	91.1
-45	84.2	87.0	87.6	88.2	88.8	89.3	90.0	90.3	90.6	90.4	90.2
-50				87.3	87.8	88.4	89.1	89.4	89.7	89.5	89.3

Engine Bleed Adjustments

Eng. A/I ON	-0.9
Eng. & Wing A/I ON	-3.3

THRUST SETTINGS – ALL ENGINE

GO-AROUND %N₁

NORMAL BLEED - PACKS ON / ANTI-ICE OFF

CFM56-7B26

OAT - °C	PRESSURE ALTITUDE - FEET								
	-1,000	0	1,000	2,000	3,000	4,000	6,000	8,000	10,000
54	96.0	96.5	96.1	OUTSIDE ENVIRONMENTAL ENVELOPE					
52	96.3	96.7	96.6						
50	96.6	97.1	97.1						
48	96.9	97.4	97.6						
46	97.3	97.8	97.9	98.0	97.9	97.8	98.1		
44	97.6	98.1	98.2	98.3	98.3	98.3			
42	97.9	98.4	98.5	98.6	98.7	98.8			
40	98.1	98.7	98.8	98.9	99.0	99.1			
38	98.4	99.0	99.1	99.2	99.3	99.4	99.3	98.7	99.2
36	98.6	99.3	99.4	99.5	99.5	99.7	99.6	99.0	99.3
34	98.8	99.6	99.7	99.8	99.8	100.0	99.9	99.3	99.4
32	99.0	99.9	100.0	100.1	100.1	100.3	100.2	99.6	99.5
30	98.8	99.7	100.0	100.3	100.3	100.4	100.3	99.9	99.7
28	98.5	99.6	100.1	100.5	100.5	100.5	100.4	100.2	100.0
26	98.3	99.4	100.0	100.5	100.6	100.7	100.6	100.4	100.2
24	98.1	99.3	99.9	100.4	100.6	100.8	100.7	100.7	100.5
22	97.9	99.1	99.7	100.3	100.6	100.9	100.9	100.9	100.8
20	97.5	98.8	99.4	100.0	100.3	100.6	100.9	101.0	100.9
18	97.2	98.5	99.1	99.7	100.0	100.3	100.9	101.1	101.0
16	96.9	98.2	98.8	99.3	99.7	100.0	100.7	101.1	101.0
14	96.6	97.9	98.5	99.0	99.4	99.7	100.4	101.0	101.1
12	96.3	97.6	98.2	98.7	99.1	99.4	100.1	100.9	101.2
10	96.0	97.3	97.9	98.4	98.8	99.1	99.8	100.6	101.1
8	95.7	97.0	97.6	98.1	98.5	98.8	99.5	100.3	101.0
6	95.3	96.6	97.2	97.8	98.2	98.5	99.3	100.0	100.8
4	95.0	96.3	96.9	97.5	97.9	98.2	99.0	99.7	100.5
2	94.7	96.0	96.6	97.2	97.6	97.9	98.7	99.4	100.2
0	94.4	95.7	96.3	96.9	97.3	97.6	98.4	99.1	99.9
-2	94.1	95.4	96.0	96.6	97.0	97.3	98.1	98.8	99.6
-4	93.7	95.0	95.6	96.2	96.6	97.0	97.8	98.5	99.2
-6	93.4	94.7	95.3	95.9	96.3	96.7	97.5	98.2	98.9
-8	93.1	94.4	95.0	95.6	96.0	96.4	97.2	97.9	98.6
-10	92.8	94.1	94.7	95.3	95.7	96.1	96.9	97.6	98.3
-15	91.9	93.2	93.8	94.4	94.8	95.2	96.0	96.8	97.5
-20	91.2	92.5	93.1	93.7	94.1	94.5	95.3	96.1	96.8
-25	90.1	91.5	92.1	92.7	93.1	93.5	94.3	95.1	95.8
-30	89.3	90.6	91.3	91.9	92.3	92.7	93.5	94.3	95.0

Engine Bleed Adjustments

Packs OFF	0.7	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.0
Packs HIGH	-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

BASED ON 250 KIAS / 310 KIAS / 0.79 MACH SPEED SCHEDULE

NORMAL BLEED - PACKS ON, ANTI-ICE OFF

CFM56-7B26

TAT °C	PRESSURE ALTITUDE – FEET									
	5,000	10,000	15,000	20,000	25,000	30,000	35,000	37,000	39,000	41,000
40	92.3	92.5	92.6	OUTSIDE ENVIRONMENTAL ENVELOPE						
35	93.0	93.3	93.3							
30	93.8	94.0	94.0							
25	94.3	94.7	94.6	OUTSIDE ENVIRONMENTAL ENVELOPE						
20	93.8	95.6	95.3							
15	93.0	95.5	95.9							
10	92.2	94.5	95.1	97.6	97.3	96.8	96.2	95.8	95.6	95.0
5	91.4	94.0	94.3	96.8	97.5	97.5	97.0	96.6	96.4	95.9
0	90.6	92.9	93.5	96.0	96.8	98.4	97.8	97.5	97.2	96.8
-5	89.8	92.1	92.6	95.2	96.0	98.9	98.6	98.3	98.1	97.8
-10	89.0	91.5	91.8	94.4	95.2	98.4	99.5	99.2	99.0	98.7
-15		90.5	90.9	93.6	94.4	97.6	100.4	100.1	99.9	99.7
-20		90.1	90.0	92.8	93.6	96.8	99.8	100.4	100.2	100.0
-25			89.2	92.0	92.8	96.0	99.0	99.6	99.4	99.2
-30	91.1		91.9	95.2	98.2	98.7	98.5	98.3		
-35	90.3		91.1	94.3	97.3	97.9	97.7	97.5		
-40			90.3	93.5	96.5	97.0	96.8	96.6		

Engine Bleed Adjustments

Engine Anti-Ice ON	-0.8	-0.8	-0.9	-0.9	-1.0	-0.9	-0.8	-0.8	-0.8	-0.8
Engine & Wing Anti-Ice ON	-3.1	-3.2	-3.4	-3.6	-3.9	-4.2	-4.7	-4.7	-4.8	-4.8

NOTE:

- Values shown in shaded areas are outside the environmental envelope.

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
160,000	249	251	253	256	257	253	231
150,000	241	243	245	247	248	251	231
140,000	233	234	236	238	239	242	231
130,000	224	225	227	229	230	232	231
120,000		216	218	219	220	222	225
110,000		206	208	210	210	212	214
100,000			198	199	200	201	203

ONE ENGINE INOPERATIVE

DRIFTDOWN SPEED AND GROSS LEVEL OFF ALTITUDE

ENGINE ANTI-ICE OFF

GROSS WEIGHT – POUNDS		APPROX GROSS LEVEL OFF ALTITUDE – FEET			
AT ENGINE FAILURE	AT LEVEL OFF (APPROX)	OPTIMUM DRIFTDOWN SPEED - KIAS	ISA + 10°C & COLDER	ISA + 15°C	ISA + 20°C
160,000	154,000	247	21,000	19,700	18,100
150,000	144,600	240	23,100	21,900	20,400
140,000	135,100	232	25,100	24,100	22,800
130,000	125,600	224	27,200	26,200	25,100
120,000	116,400	216	29,300	28,500	27,400
110,000	107,000	207	31,300	30,600	29,700
100,000	97,700	198	33,300	32,600	31,800

ENGINE ANTI-ICE ON

GROSS WEIGHT – POUNDS		APPROX GROSS LEVEL OFF ALTITUDE – FEET			
AT ENGINE FAILURE	AT LEVEL OFF (APPROX)	OPTIMUM DRIFTDOWN SPEED - KIAS	ISA + 10°C & COLDER	ISA + 15°C	ISA + 20°C
160,000	153,800	246	20,200	18,700	16,800
150,000	144,400	239	22,200	20,900	19,300
140,000	135,000	232	24,400	23,200	21,800
130,000	125,400	224	26,500	25,500	24,300
120,000	116,200	216	28,800	27,700	26,600
110,000	106,800	207	30,900	30,000	29,000
100,000	97,600	198	32,900	32,100	31,200

ENGINE & WING ANTI-ICE ON

GROSS WEIGHT – POUNDS		APPROX GROSS LEVEL OFF ALTITUDE – FEET			
AT ENGINE FAILURE	AT LEVEL OFF (APPROX)	OPTIMUM DRIFTDOWN SPEED - KIAS	ISA + 10°C & COLDER	ISA + 15°C	ISA + 20°C
160,000	153,300	245	17,200	15,300	13,100
150,000	144,000	238	19,500	17,700	15,700
140,000	134,700	230	21,800	20,100	18,100
130,000	125,300	223	24,200	22,800	20,800
120,000	115,900	215	26,400	25,400	23,900
110,000	106,500	206	28,700	27,700	26,500
100,000	97,100	197	30,900	30,000	29,000

BASIS:

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

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
170,000	16,100	13,100	9,700
160,000	18,400	15,900	12,900
150,000	20,700	18,600	15,900
140,000	22,900	21,200	18,700
130,000	25,200	23,600	21,600
120,000	27,500	26,200	24,400
110,000	29,800	28,800	27,200
100,000	32,000	31,100	29,900
90,000	34,100	33,300	32,200
80,000	36,400	35,600	34,600

CORRECTIONS:

CONFIGURATION	ALT. CORRECTION – FEET
Engine Anti-Ice ON	- 2,400
Engine and Wing Anti-Ice ON	- 7,400

BASIS:

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

ONE ENGINE INOPERATIVE

LONG RANGE CRUISE

FL (ISA)		GROSS WEIGHT – POUNDS								
		170,000	160,000	150,000	140,000	130,000	120,000	110,000	100,000	90,000
300 (-29)	%N ₁							96.1	92.1	88.8
	MAX TAT							-9	0	
	KIAS							230	222	215
	MACH							0.619	0.599	0.580
	FF/ENG							3856	3417	3075
290 (-26)	KTAS							365	353	342
	%N ₁						98.0	94.3	90.8	87.8
	MAX TAT						-13	-3		
	KIAS						239	231	224	216
	MACH						0.629	0.609	0.590	0.570
280 (-25)	FF/ENG						4281	3792	3407	3076
	KTAS						372	360	349	338
	%N ₁						96.2	92.7	89.7	86.9
	MAX TAT						-7	2		
	KIAS						240	233	226	217
270 (-23)	MACH						0.618	0.600	0.582	0.560
	FF/ENG						4190	3755	3407	3075
	KTAS						367	356	346	333
	%N ₁					97.9	94.5	91.4	88.7	86.1
	MAX TAT					-10	-2	6		
260 (-21)	KIAS					249	242	234	227	217
	MACH					0.626	0.608	0.591	0.574	0.550
	FF/ENG					4608	4127	3740	3411	3072
	KTAS					374	363	353	343	328
	%N ₁					96.1	93.1	90.3	87.9	85.3
250 (-20)	MAX TAT					-4	3	10		
	KIAS					250	243	236	228	217
	MACH					0.616	0.599	0.583	0.564	0.539
	FF/ENG					4516	4089	3738	3410	3069
	KTAS					369	359	350	338	323
250 (-20)	%N ₁					94.4	91.8	89.4	87.1	84.4
	MAX TAT					1	8			
	KIAS					251	244	238	228	218
	MACH					0.607	0.591	0.575	0.554	0.529
	FF/ENG					4457	4073	3746	3408	3068
250 (-20)	KTAS					365	356	346	333	318

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 (ISA)		GROSS WEIGHT – POUNDS								
		170,000	160,000	150,000	140,000	130,000	120,000	110,000	100,000	90,000
240 (-17)	%N1				95.8	93.2	90.8	88.6	86.2	83.6
	MAX TAT				-1	5	12			
	KIAS				259	253	246	239	229	218
	MACH				0.613	0.598	0.583	0.566	0.544	0.518
	FF/ENG				4837	4423	4076	3750	3409	3070
230 (-16)	KTAS				371	361	353	342	329	313
	%N1				94.4	92.1	89.9	87.8	85.4	82.7
	MAX TAT				4	10	16			
	KIAS				261	254	248	239	229	218
	MACH				0.604	0.590	0.576	0.556	0.533	0.508
220 (-14)	FF/ENG				4787	4416	4094	3756	3414	3072
	KTAS				367	358	349	337	324	308
	%N1			95.4	93.2	91.1	89.1	87.0	84.6	81.9
	MAX TAT			2	8	14				
	KIAS			269	262	256	249	240	229	218
210 (-12)	MACH			0.609	0.596	0.582	0.566	0.546	0.523	0.497
	FF/ENG			5159	4767	4430	4105	3763	3420	3075
	KTAS			371	366	355	345	333	319	303
	%N1			94.3	92.2	90.3	88.3	86.1	83.7	81.0
	MAX TAT			7	12	17				
200 (-10)	KIAS			270	264	258	249	240	229	217
	MACH			0.601	0.588	0.574	0.556	0.536	0.513	0.487
	FF/ENG			5126	4772	4455	4115	3770	3426	3078
	KTAS			368	360	351	340	328	314	298
	%N1		95.2	93.1	91.2	89.5	87.5	85.3	82.9	80.1
190 (-8)	MAX TAT		6	11	16	21				
	KIAS		278	272	266	259	250	240	229	217
	MACH		0.605	0.593	0.581	0.565	0.547	0.526	0.502	0.477
	FF/ENG		5492	5121	4796	4468	4123	3778	3432	3084
	KTAS		372	364	357	347	336	323	309	293
190 (-8)	%N1		94.0	92.2	90.5	88.7	86.7	84.5	82.0	79.3
	MAX TAT		10	15	20					
	KIAS		279	274	267	259	250	240	229	217
	MACH		0.597	0.585	0.572	0.556	0.536	0.515	0.492	0.468
	FF/ENG		5479	5138	4821	4478	4132	3785	3436	3093
190 (-8)	KTAS		368	361	353	343	331	318	304	289

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 (ISA)		GROSS WEIGHT – POUNDS								
		170,000	160,000	150,000	140,000	130,000	120,000	110,000	100,000	90,000
180 (-6)	%N1	94.8	93.0	91.4	89.8	87.9	85.8	83.6	81.1	78.5
	MAX TAT	9	14	18	23					
	KIAS	287	281	276	268	260	250	240	229	217
	MACH	0.601	0.589	0.578	0.563	0.546	0.526	0.505	0.482	0.459
	FF/ENG	5843	5489	5174	4836	4489	4142	3794	3442	3105
170 (-5)	KTAS	372	365	358	349	338	326	313	299	284
	%N1	93.8	92.2	90.7	89.0	87.1	85.0	82.8	80.3	77.7
	MAX TAT	13	17	22	27					
	KIAS	289	283	277	269	260	250	240	229	218
	MACH	0.593	0.582	0.569	0.554	0.536	0.516	0.495	0.473	0.451
160 (-3)	FF/ENG	5846	5518	5194	4849	4500	4152	3801	3452	3119
	KTAS	369	362	354	344	333	321	308	294	280
	%N1	92.9	91.5	89.9	88.1	86.3	84.2	81.9	79.5	76.9
	MAX TAT	16	21	26						
	KIAS	290	285	277	269	260	250	240	229	218
150 (-2)	MACH	0.585	0.575	0.560	0.544	0.536	0.507	0.486	0.464	0.442
	FF/ENG	5868	5552	5208	4860	4500	4161	3806	3463	3133
	KTAS	365	359	350	339	333	316	303	290	276
	%N1	92.2	90.7	89.1	87.3	85.4	83.4	81.1	78.7	76.1
	MAX TAT	20	24	29						
140 (0)	KIAS	293	286	278	269	260	250	239	229	218
	MACH	0.579	0.566	0.551	0.534	0.516	0.497	0.476	0.456	0.434
	FF/ENG	5905	5566	5218	4868	4518	4166	3812	3474	3149
	KTAS	363	354	345	335	323	311	298	285	272
	%N1	91.5	90.0	88.3	86.5	84.6	82.5	80.3	77.9	75.3
130 (2)	MAX TAT	23	28	33						
	KIAS	294	286	278	270	260	250	240	229	218
	MACH	0.570	0.556	0.541	0.524	0.506	0.487	0.467	0.447	0.427
	FF/ENG	5921	5574	5224	4874	4522	4166	3819	3485	3165
	KTAS	359	350	340	330	318	306	294	281	268
130 (2)	%N1	90.7	89.2	87.5	85.8	83.8	81.7	79.5	77.1	74.7
	MAX TAT	26	31							
	KIAS	294	287	278	270	260	250	240	229	219
	MACH	0.561	0.547	0.532	0.515	0.497	0.478	0.459	0.439	0.419
	FF/ENG	5927	5578	5227	4876	4522	4167	3826	3497	3182
130 (2)	KTAS	354	345	335	325	314	302	290	277	265

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 (ISA)		GROSS WEIGHT – POUNDS								
		170,000	160,000	150,000	140,000	130,000	120,000	110,000	100,000	90,000
120 (3)	%N1	89.9	88.4	86.7	84.9	83.0	80.9	78.7	76.4	74.0
	MAX TAT	30	35							
	KIAS	295	287	279	269	260	250	240	230	219
	MACH	0.552	0.538	0.522	0.505	0.487	0.469	0.451	0.432	0.412
	FF/ENG	5930	5579	5228	4876	4520	4171	3834	3510	3198
	KTAS	350	341	331	320	309	297	286	274	261
110 (5)	%N1	89.2	87.6	86.0	84.1	82.2	80.1	77.9	75.7	73.3
	MAX TAT	33	38							
	KIAS	295	287	279	269	260	250	240	230	220
	MACH	0.543	0.528	0.512	0.496	0.478	0.461	0.443	0.424	0.405
	FF/ENG	5932	5581	5229	4876	4520	4177	3845	3526	3215
	KTAS	345	336	326	315	304	293	282	270	258
100 (7)	%N1	88.4	86.9	85.2	83.3	81.4	79.4	77.2	75.0	72.6
	MAX TAT	36								
	KIAS	296	287	278	269	260	250	240	230	220
	MACH	0.533	0.519	0.503	0.486	0.469	0.452	0.435	0.417	0.399
	FF/ENG	5935	5584	5231	4874	4524	4185	3859	3542	3233
	KTAS	340	331	321	310	300	289	278	266	255
90 (8)	%N1	87.7	86.1	84.3	82.5	80.6	78.6	76.5	74.3	71.8
	MAX TAT	40								
	KIAS	296	287	278	269	260	250	241	231	221
	MACH	0.524	0.509	0.494	0.477	0.461	0.445	0.428	0.410	0.392
	FF/ENG	5940	5588	5232	4876	4531	4197	3875	3560	3253
	KTAS	336	326	316	306	295	285	274	263	251
80 (10)	%N1	86.9	85.3	83.5	81.8	79.8	77.8	75.8	73.6	71.1
	MAX TAT	43								
	KIAS	296	287	278	269	260	251	241	231	221
	MACH	0.515	0.500	0.484	0.469	0.453	0.437	0.420	0.404	0.386
	FF/ENG	5946	5591	5232	4881	4541	4212	3892	3579	3274
	KTAS	331	321	311	301	291	281	270	260	248
70 (12)	%N1	86.1	84.5	82.8	81.0	79.0	77.1	75.1	72.9	70.4
	MAX TAT									
	KIAS	296	287	278	269	260	251	241	232	222
	MACH	0.505	0.491	0.476	0.461	0.445	0.430	0.414	0.397	0.380
	FF/ENG	5951	5592	5235	4889	4553	4228	3911	3599	3297
	KTAS	326	317	307	297	287	277	267	256	246

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: $V_{Ref} + 55$ KIAS

Severe Turbulent Air Penetration: The conditions for severe turbulence penetration are unchanged except the recommended airspeed for flight is $V_{Ref} + 70$ 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
160,000	151,000	215	3,500	1,100	
150,000	142,000	211	6,500	4,300	1,900
140,000	133,000	206	9,400	7,500	5,400
130,000	124,000	201	12,100	10,600	8,700
120,000	114,000	196	14,800	13,800	12,100
110,000	105,000	190	17,300	16,400	15,200
100,000	96,000	184	19,900	18,800	17,700
90,000	86,000	178	22,500	21,500	20,400
80,000	77,000	172	25,100	24,300	23,300

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
140,000	3,300		
130,000	7,400	4,600	700
120,000	11,200	9,000	6,200
110,000	14,600	13,300	10,800
100,000	17,900	16,800	15,500
90,000	21,200	20,000	18,800
80,000	24,200	23,200	22,200

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 CRUISE SPEED - KIAS MACH NUMBER TARGET %N1 FUEL FLOW / ENGINE- LB/HR									
	5,000	7,000	9,000	11,000	13,000	15,000	17,000	19,000	21,000	23,000
140,000	225 0.372 91.8 7452									
130,000	218 0.361 89.5 6884	217 0.373 91.3 6882	217 0.385 93.0 6894							
120,000	211 0.349 87.3 6347	210 0.360 88.9 6320	209 0.372 90.6 6314	208 0.385 92.4 6329						
110,000	204 0.337 85.0 5834	203 0.348 86.5 5790	201 0.359 88.1 5760	200 0.371 89.8 5755	200 0.383 91.5 5772	199 0.397 94.0 5820				
100,000	197 0.325 82.6 5344	195 0.335 84.0 5284	194 0.345 85.5 5239	193 0.356 87.0 5209	192 0.368 88.7 5205	191 0.381 90.5 5211	190 0.395 92.9 5231	189 0.409 96.8 5368		
90,000	189 0.313 79.9 4882	188 0.322 81.3 4804	186 0.331 82.7 4742	184 0.341 84.2 4697	183 0.352 85.7 4669	182 0.364 87.4 4653	181 0.377 89.3 4643	181 0.391 91.5 4645	180 0.406 95.0 4750	
80,000	182 0.300 77.2 4433	180 0.309 78.5 4355	178 0.317 79.8 4275	176 0.326 81.2 4213	175 0.336 82.6 4167	173 0.347 84.2 4131	172 0.359 85.9 4099	172 0.373 87.9 4100	172 0.388 89.9 4116	172 0.404 93.4 4205

BASIS:

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

Note: Increase or decrease %N1 requires by 1% per 5°C above or below standard TAT

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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 - POUNDS						
	160,000	150,000	140,000	130,000	120,000	110,000	100,000
DRY	4,920	4,710	4,500	4,290	4,080	3,890	3,700
GOOD	6,630	6,365	6,100	5,835	5,570	5,295	5,020
MEDIUM	9,360	8,920	8,480	8,040	7,600	7,155	6,710
POOR	12,500	11,840	11,180	10,520	9,860	9,205	8,550
VREF40+55	202	197	192	187	181	175	169

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+85	+140	+230	+330
	Per 1,000 feet (above 8,000 ft.)	+115	+195	+315	+470
Wind	Per 1 kt. headwind	-12	-20	-33	-49
	Per 1 kt. tailwind	+41	+70	+116	+183
Slope	Per 1% downhill	+35	+105	+265	+595
	Per 1% uphill	-35	-95	-225	-455
Temperature	Per 1°C above ISA	+8	+13	+19	+26
	Per 1°C below ISA	-8	-13	-20	-28
Approach Speed	Per 10 kt. Above VREF*	+200	+280	+390	+485

ANTI-SKID INOPERATIVE (FLAPS 40)**

RWY COND. & APPCH SPEED	LANDING WEIGHT - POUNDS						
	160,000	150,000	140,000	130,000	120,000	110,000	100,000
DRY	6,120	5,850	5,580	5,310	5,040	4,770	4,500
GOOD	6,790	6,475	6,160	5,845	5,530	5,215	4,900
MEDIUM	8,590	8,145	7,700	7,255	6,810	6,380	5,950
POOR	11,360	10,720	10,080	9,440	8,800	8,185	7,570
VREF40	147	142	137	132	126	120	114

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+120	+140	+190	+260
	Per 1,000 feet (above 8,000 ft.)	+160	+190	+270	+400
Wind	Per 1 kt. headwind	-23	-27	-40	-66
	Per 1 kt. tailwind	+85	+104	+162	+300
Slope	Per 1% downhill	+135	+195	+435	+1530
	Per 1% uphill	-115	-160	-320	-725
Temperature	Per 1°C above ISA	+11	+12	+16	+19
	Per 1°C below ISA	-11	-12	-17	-23
Approach Speed	Per 10 kt. Above VREF*	+365	+395	+455	+505

***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 - POUNDS						
	160,000	150,000	140,000	130,000	120,000	110,000	100,000
DRY	4,080	3,915	3,750	3,585	3,420	3,275	3,130
GOOD	5,690	5,435	5,180	4,925	4,670	4,415	4,160
MEDIUM	7,770	7,365	6,960	6,555	6,150	5,755	5,360
POOR	10,110	9,530	8,950	8,370	7,790	7,235	6,680
VREF15	155	150	145	139	133	127	121

CORRECTIONS		DRY	Good	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+60	+110	+175	+250
	Per 1,000 feet (above 8,000 ft.)	+85	+155	+255	+370
Wind	Per 1 kt. headwind	-11	-19	-30	-45
	Per 1 kt. tailwind	+37	+66	+108	+170
Slope	Per 1% downhill	+35	+110	+260	+560
	Per 1% uphill	-35	-95	-215	-420
Temperature	Per 1°C above ISA	+6	+10	+14	+18
	Per 1°C below ISA	-6	-10	-15	-20
Approach Speed	Per 10 kt. Above VREF*	+260	+390	+505	+590

HYDRAULICS - LOSS OF SYSTEM A (FLAPS 30)

RWY COND. & APPCH SPEED	LANDING WEIGHT - POUNDS						
	160,000	150,000	140,000	130,000	120,000	110,000	100,000
DRY	3,960	3,810	3,660	3,510	3,360	3,220	3,080
GOOD	5,500	5,260	5,020	4,780	4,540	4,295	4,050
MEDIUM	7,420	7,040	6,660	6,280	5,900	5,530	5,160
POOR	9,570	9,030	8,490	7,950	7,410	6,890	6,370
VREF30	149	144	140	134	129	123	117

CORRECTIONS		DRY	Good	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+60	+105	+165	+230
	Per 1,000 feet (above 8,000 ft.)	+85	+150	+235	+340
Wind	Per 1 kt. headwind	-11	-19	-29	-44
	Per 1 kt. tailwind	+37	+65	+106	+166
Slope	Per 1% downhill	+35	+105	+250	+540
	Per 1% uphill	-35	-95	-210	-400
Temperature	Per 1°C above ISA	+6	+10	+14	+17
	Per 1°C below ISA	-6	-10	-14	-19
Approach Speed	Per 10 kt. Above VREF*	+275	+395	+495	+565

***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 - POUNDS						
	160,000	150,000	140,000	130,000	120,000	110,000	100,000
DRY	3,930	3,785	3,640	3,495	3,350	3,210	3,070
GOOD	5,450	5,210	4,970	4,730	4,490	4,250	4,010
MEDIUM	7,270	6,900	6,530	6,160	5,790	5,430	5,070
POOR	9,300	8,780	8,260	7,740	7,220	6,720	6,220
VREF40	147	142	137	132	126	120	114

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+60	+105	+160	+225
	Per 1,000 feet (above 8,000 ft.)	+90	+150	+235	+330
Wind	Per 1 kt. headwind	-11	-19	-29	-43
	Per 1 kt. tailwind	+37	+65	+106	+164
Slope	Per 1% downhill	+40	+110	+250	+530
	Per 1% uphill	-35	-95	-210	-390
Temperature	Per 1°C above ISA	+6	+9	+13	+17
	Per 1°C below ISA	-6	-10	-14	-18
Approach Speed	Per 10 kt. Above VREF*	+290	+405	+495	+555

HYDRAULICS - LOSS OF SYSTEM B (FLAPS 15)

RWY COND. & APPCH SPEED	LANDING WEIGHT - POUNDS						
	160,000	150,000	140,000	130,000	120,000	110,000	100,000
DRY	4,180	4,025	3,870	3,715	3,560	3,405	3,250
GOOD	5,240	5,015	4,790	4,565	4,340	4,115	3,890
MEDIUM	7,110	6,755	6,400	6,045	5,690	5,340	4,990
POOR	9,280	8,765	8,250	7,735	7,220	6,725	6,230
VREF15	155	150	145	139	133	127	121

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+65	+95	+155	+220
	Per 1,000 feet (above 8,000 ft.)	+95	+135	+220	+320
Wind	Per 1 kt. headwind	-12	-18	-28	-42
	Per 1 kt. tailwind	+42	+62	+102	+162
Slope	Per 1% downhill	+40	+85	+215	+485
	Per 1% uphill	-40	-80	-180	-365
Temperature	Per 1°C above ISA	+7	+9	+13	+17
	Per 1°C below ISA	-7	-9	-14	-18
Approach Speed	Per 10 kt. Above VREF*	+240	+310	+410	+490

***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 - POUNDS						
	160,000	150,000	140,000	130,000	120,000	110,000	100,000
DRY	5,310	5,105	4,900	4,695	4,490	4,280	4,070
GOOD	6,540	6,260	5,980	5,700	5,420	5,140	4,860
MEDIUM	9,050	8,605	8,160	7,715	7,270	6,835	6,400
POOR	11,760	11,120	10,480	9,840	9,200	8,590	7,980
VREF15	155	150	145	139	133	127	121

CORRECTIONS		DRY	Good	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+95	+125	+200	+280
	Per 1,000 feet (above 8,000 ft.)	+130	+180	+285	+415
Wind	Per 1 kt. headwind	-17	-22	-34	-50
	Per 1 kt. tailwind	+56	+75	+121	+186
Slope	Per 1% downhill	+90	+155	+340	+690
	Per 1% uphill	-85	-135	-290	-525
Temperature	Per 1°C above ISA	+9	+12	+17	+21
	Per 1°C below ISA	-9	-12	-18	-23
Approach Speed	Per 10 kt. Above VREF*	+430	+520	+645	+725

LEADING EDGE FLAPS TRANSIT

RWY COND. & APPCH SPEED	LANDING WEIGHT - POUNDS						
	160,000	150,000	140,000	130,000	120,000	110,000	100,000
DRY	4,180	4,010	3,840	3,670	3,500	3,355	3,210
GOOD	5,700	5,460	5,220	4,980	4,740	4,495	4,250
MEDIUM	7,790	7,405	7,020	6,635	6,250	5,870	5,490
POOR	10,140	9,585	9,030	8,475	7,920	7,380	6,840
VREF15+15	170	165	160	154	148	142	136

CORRECTIONS		DRY	Good	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+65	+110	+175	+250
	Per 1,000 feet (above 8,000 ft.)	+90	+155	+245	+360
Wind	Per 1 kt. headwind	-11	-19	-29	-44
	Per 1 kt. tailwind	+37	+65	+107	+167
Slope	Per 1% downhill	+30	+95	+230	+510
	Per 1% uphill	-30	-85	-195	-385
Temperature	Per 1°C above ISA	+6	+10	+15	+19
	Per 1°C below ISA	-7	-11	-15	-21
Approach Speed	Per 10 kt. Above VREF*	+210	+305	+400	+480

***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 - POUNDS						
	160,000	150,000	140,000	130,000	120,000	110,000	100,000
DRY	3,800	3,645	3,490	3,335	3,180	3,045	2,910
GOOD	5,250	5,025	4,800	4,575	4,350	4,125	3,900
MEDIUM	7,420	7,050	6,680	6,310	5,940	5,570	5,200
POOR	10,150	9,590	9,030	8,470	7,910	7,360	6,810
VREF15	155	150	145	139	133	127	121

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+55	+95	+160	+240
	Per 1,000 feet (above 8,000 ft.)	+75	+130	+220	+335
Wind	Per 1 kt. headwind	-10	-18	-30	-47
	Per 1 kt. tailwind	+35	+63	+108	+178
Slope	Per 1% downhill	+30	+95	+255	+640
	Per 1% uphill	-25	-85	-215	-465
Temperature	Per 1°C above ISA	+6	+9	+14	+20
	Per 1°C below ISA	-6	-9	-15	-21
Approach Speed	Per 10 kt. Above VREF*	+200	+305	+430	+540

STABILIZER TRIM INOPERATIVE

RWY COND. & APPCH SPEED	LANDING WEIGHT - POUNDS						
	160,000	150,000	140,000	130,000	120,000	110,000	100,000
DRY	3,760	3,610	3,460	3,310	3,160	3,030	2,900
GOOD	5,070	4,855	4,640	4,425	4,210	3,995	3,780
MEDIUM	6,870	6,530	6,190	5,850	5,510	5,180	4,850
POOR	8,910	8,425	7,940	7,455	6,970	6,500	6,030
VREF15	155	150	145	139	133	127	121

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+50	+90	+145	+210
	Per 1,000 feet (above 8,000 ft.)	+75	+130	+205	+300
Wind	Per 1 kt. headwind	-10	-17	-27	-41
	Per 1 kt. tailwind	+34	+60	+100	+158
Slope	Per 1% downhill	+25	+80	+200	+455
	Per 1% uphill	-25	-70	-170	-340
Temperature	Per 1°C above ISA	+5	+9	+12	+16
	Per 1°C below ISA	-5	-9	-13	-18
Approach Speed	Per 10 kt. Above VREF*	+190	+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 - POUNDS						
	160,000	150,000	140,000	130,000	120,000	110,000	100,000
DRY	3,760	3,610	3,460	3,310	3,160	3,030	2,900
GOOD	5,070	4,855	4,640	4,425	4,210	3,995	3,780
MEDIUM	6,870	6,530	6,190	5,850	5,510	5,180	4,850
POOR	8,910	8,425	7,940	7,455	6,970	6,500	6,030
VREF15	155	150	145	139	133	127	121

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+50	+90	+145	+210
	Per 1,000 feet (above 8,000 ft.)	+75	+130	+205	+300
Wind	Per 1 kt. headwind	-10	-17	-27	-41
	Per 1 kt. tailwind	+34	+60	+100	+158
Slope	Per 1% downhill	+25	+80	+200	+455
	Per 1% uphill	-25	-70	-170	-340
Temperature	Per 1°C above ISA	+5	+9	+12	+16
	Per 1°C below ISA	-5	-9	-13	-18
Approach Speed	Per 10 kt. Above VREF*	+190	+280	+375	+450

TRAILING EDGE FLAP ASYMMETRY (30 ≤ FLAPS < 40)

RWY COND. & APPCH SPEED	LANDING WEIGHT - POUNDS						
	160,000	150,000	140,000	130,000	120,000	110,000	100,000
DRY	3,670	3,525	3,380	3,235	3,090	2,970	2,850
GOOD	4,920	4,715	4,510	4,305	4,100	3,895	3,690
MEDIUM	6,580	6,260	5,940	5,620	5,300	4,985	4,670
POOR	8,470	8,015	7,560	7,105	6,650	6,210	5,770
VREF30	149	144	140	134	129	123	117

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+50	+90	+135	+195
	Per 1,000 feet (above 8,000 ft.)	+70	+120	+195	+280
Wind	Per 1 kt. headwind	-10	-17	-27	-40
	Per 1 kt. tailwind	+33	+60	+98	+155
Slope	Per 1% downhill	+25	+80	+195	+435
	Per 1% uphill	-25	-70	-165	-325
Temperature	Per 1°C above ISA	+5	+8	+12	+15
	Per 1°C below ISA	-5	-8	-12	-17
Approach Speed	Per 10 kt. Above VREF*	+195	+285	+370	+435

***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 - POUNDS						
	160,000	150,000	140,000	130,000	120,000	110,000	100,000
DRY	3,760	3,610	3,460	3,310	3,160	3,030	2,900
GOOD	5,070	4,855	4,640	4,425	4,210	3,995	3,780
MEDIUM	6,870	6,530	6,190	5,850	5,510	5,180	4,850
POOR	8,910	8,425	7,940	7,455	6,970	6,500	6,030
VREF15	155	150	145	139	133	127	121

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+50	+90	+145	+210
	Per 1,000 feet (above 8,000 ft.)	+75	+130	+205	+300
Wind	Per 1 kt. headwind	-10	-17	-27	-41
	Per 1 kt. tailwind	+34	+60	+100	+158
Slope	Per 1% downhill	+25	+80	+200	+455
	Per 1% uphill	-25	-70	-170	-340
Temperature	Per 1°C above ISA	+5	+9	+12	+16
	Per 1°C below ISA	-5	-9	-13	-18
Approach Speed	Per 10 kt. Above VREF*	+190	+280	+375	+450

TRAILING EDGE FLAP ASYMMETRY (1 ≤ FLAPS < 15)

RWY COND. & APPCH SPEED	LANDING WEIGHT - POUNDS						
	160,000	150,000	140,000	130,000	120,000	110,000	100,000
DRY	4,250	4,085	3,920	3,755	3,590	3,430	3,270
GOOD	5,760	5,530	5,300	5,070	4,840	4,605	4,370
MEDIUM	7,940	7,565	7,190	6,815	6,440	6,065	5,690
POOR	10,410	9,860	9,310	8,760	8,210	7,670	7,130
VREF40+30	177	172	167	162	156	150	144

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+65	+115	+185	+260
	Per 1,000 feet (above 8,000 ft.)	+95	+160	+260	+375
Wind	Per 1 kt. headwind	-11	-19	-30	-44
	Per 1 kt. tailwind	+38	+65	+107	+169
Slope	Per 1% downhill	+30	+90	+225	+510
	Per 1% uphill	-30	-80	-195	-385
Temperature	Per 1°C above ISA	+7	+11	+15	+20
	Per 1°C below ISA	-7	-11	-16	-22
Approach Speed	Per 10 kt. Above VREF*	+195	+280	+375	+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.

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 - POUNDS						
	160,000	150,000	140,000	130,000	120,000	110,000	100,000
DRY	3,670	3,525	3,380	3,235	3,090	2,970	2,850
GOOD	4,920	4,715	4,510	4,305	4,100	3,895	3,690
MEDIUM	6,580	6,260	5,940	5,620	5,300	4,985	4,670
POOR	8,470	8,015	7,560	7,105	6,650	6,210	5,770
VREF30	149	144	140	134	129	123	117

CORRECTIONS		DRY	Good	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+50	+90	+135	+195
	Per 1,000 feet (above 8,000 ft.)	+70	+120	+195	+280
Wind	Per 1 kt. headwind	-10	-17	-27	-40
	Per 1 kt. tailwind	+33	+60	+98	+155
Slope	Per 1% downhill	+25	+80	+195	+435
	Per 1% uphill	-25	-70	-165	-325
Temperature	Per 1°C above ISA	+5	+8	+12	+15
	Per 1°C below ISA	-5	-8	-12	-17
Approach Speed	Per 10 kt. Above VREF*	+195	+285	+370	+435

TRAILING EDGE FLAP DISAGREE (15 ≤ FLAPS < 30)

RWY COND. & APPCH SPEED	LANDING WEIGHT - POUNDS						
	160,000	150,000	140,000	130,000	120,000	110,000	100,000
DRY	3,760	3,610	3,460	3,310	3,160	3,030	2,900
GOOD	5,070	4,855	4,640	4,425	4,210	3,995	3,780
MEDIUM	6,870	6,530	6,190	5,850	5,510	5,180	4,850
POOR	8,910	8,425	7,940	7,455	6,970	6,500	6,030
VREF15	155	150	145	139	133	127	121

CORRECTIONS		DRY	Good	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+50	+90	+145	+210
	Per 1,000 feet (above 8,000 ft.)	+75	+130	+205	+300
Wind	Per 1 kt. headwind	-10	-17	-27	-41
	Per 1 kt. tailwind	+34	+60	+100	+158
Slope	Per 1% downhill	+25	+80	+200	+455
	Per 1% uphill	-25	-70	-170	-340
Temperature	Per 1°C above ISA	+5	+9	+12	+16
	Per 1°C below ISA	-5	-9	-13	-18
Approach Speed	Per 10 kt. Above VREF*	+190	+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 - POUNDS						
	160,000	150,000	140,000	130,000	120,000	110,000	100,000
DRY	4,250	4,085	3,920	3,755	3,590	3,430	3,270
GOOD	5,760	5,530	5,300	5,070	4,840	4,605	4,370
MEDIUM	7,940	7,565	7,190	6,815	6,440	6,065	5,690
POOR	10,410	9,860	9,310	8,760	8,210	7,670	7,130
VREF40+30	177	172	167	162	156	150	144

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+65	+115	+185	+260
	Per 1,000 feet (above 8,000 ft.)	+95	+160	+260	+375
Wind	Per 1 kt. headwind	-11	-19	-30	-44
	Per 1 kt. tailwind	+38	+65	+107	+169
Slope	Per 1% downhill	+30	+90	+225	+510
	Per 1% uphill	-30	-80	-195	-385
Temperature	Per 1°C above ISA	+7	+11	+15	+20
	Per 1°C below ISA	-7	-11	-16	-22
Approach Speed	Per 10 kt. Above VREF*	+195	+280	+375	+460

TRAILING EDGE FLAPS UP

RWY COND. & APPCH SPEED	LANDING WEIGHT - POUNDS						
	160,000	150,000	140,000	130,000	120,000	110,000	100,000
DRY	4,480	4,300	4,120	3,940	3,760	3,585	3,410
GOOD	6,040	5,800	5,560	5,320	5,080	4,830	4,580
MEDIUM	8,410	8,015	7,620	7,225	6,830	6,430	6,030
POOR	11,120	10,535	9,950	9,365	8,780	8,200	7,620
VREF40+40	187	182	177	172	166	160	154

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+70	+125	+195	+285
	Per 1,000 feet (above 8,000 ft.)	+100	+170	+275	+405
Wind	Per 1 kt. headwind	-11	-19	-31	-46
	Per 1 kt. tailwind	+39	+67	+110	+173
Slope	Per 1% downhill	+35	+95	+235	+535
	Per 1% uphill	-30	-85	-200	-410
Temperature	Per 1°C above ISA	+7	+11	+17	+22
	Per 1°C below ISA	-7	-12	-17	-24
Approach Speed	Per 10 kt. Above VREF*	+195	+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
155,000	9,600	8,500	6,600	4,800	3,900	6,600	5,500	5,200
150,000	9,300	8,300	6,500	4,700	3,800	6,500	5,400	5,100
145,000	9,100	8,100	6,300	4,600	3,700	6,300	5,300	5,000
140,000	8,800	7,900	6,200	4,500	3,600	6,200	5,200	4,900
135,000	8,600	7,700	6,100	4,400	3,600	6,100	5,100	4,800
130,000	8,300	7,500	5,900	4,300	3,500	5,900	4,900	4,700
129,200	8,300	7,400	5,900	4,300	3,500	5,900	4,900	4,700
125,000	8,000	7,300	5,800	4,300	3,400	5,800	4,800	4,600
120,000	7,800	7,000	5,600	4,200	3,300	5,600	4,700	4,500
115,000	7,500	6,800	5,500	4,100	3,300	5,500	4,600	4,400
110,000	7,200	6,600	5,300	4,000	3,200	5,300	4,500	4,300
105,000	7,000	6,400	5,200	3,900	3,100	5,200	4,400	4,100
100,000	6,700	6,200	5,000	3,800	3,100	5,000	4,300	4,000
95,000	6,500	5,900	4,900	3,700	3,000	4,900	4,100	3,900

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	-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	800	600	300	200	600	400	400
8,000	1,400	1,200	800	500	400	800	700	600
10,000	2,100	1,800	1,200	700	600	1,200	1,000	900

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	350	300	200	100	300	200	150
PER 10°C ABOVE ISA	200	200	150	100	50	150	100	100
PER 10°C BELOW ISA	-200	-200	-150	-100	-50	-150	-100	-100
PER 1% UP SLOPE	-200	-100	0	0	-50	0	-50	-100
PER 1% DOWN SLOPE	150	50	0	0	50	0	100	100
1 REVERSER INOP	600	100	0	0	100	0	200	200
2 REVERSERS INOP	700	100	0	0	100	100	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
155,000	7,400	7,200	7,100	9,400	9,400	9,400
150,000	7,200	7,000	7,000	9,200	9,200	9,200
145,000	7,100	6,900	6,800	8,900	8,900	8,900
140,000	6,900	6,700	6,600	8,700	8,700	8,700
135,000	6,700	6,500	6,500	8,400	8,400	8,400
130,000	6,500	6,300	6,300	8,200	8,200	8,200
129,200	6,500	6,300	6,300	8,100	8,100	8,100
125,000	6,400	6,200	6,100	7,900	7,900	7,900
120,000	6,200	6,000	6,000	7,700	7,700	7,700
115,000	6,000	5,800	5,800	7,400	7,400	7,400
110,000	5,800	5,600	5,600	7,200	7,200	7,200
105,000	5,700	5,500	5,400	6,900	6,900	6,900
100,000	5,500	5,300	5,300	6,700	6,700	6,700
95,000	5,300	5,100	5,100	6,400	6,400	6,400

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	-300	-300	-300	-500	-500	-500
2,000	0	0	0	0	0	0
4,000	300	300	300	500	500	500
6,000	700	700	600	1,000	1,000	1,000
8,000	1,000	1,000	1,000	1,400	1,400	1,400
10,000	1,500	1,500	1,500	2,100	2,100	2,100

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	150	150	150	200	200	200
PER 10°C BELOW ISA	-150	-150	-150	-200	-200	-200
PER 1% UP SLOPE	-100	-200	-200	-400	-400	-400
PER 1% DOWN SLOPE	200	250	250	600	600	600
1 REVERSER INOP	500	600	600	1,300	1,300	1,300
2 REVERSERS INOP	1,400	1,500	1,500	3,700	3,700	3,700
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
155,000	9,000	8,000	6,300	4,600	3,800	6,300	5,300	5,100
150,000	8,700	7,800	6,100	4,500	3,700	6,200	5,200	5,000
145,000	8,500	7,600	6,000	4,400	3,600	6,000	5,100	4,900
140,000	8,300	7,400	5,900	4,300	3,500	5,900	5,000	4,800
135,000	8,000	7,200	5,800	4,300	3,500	5,800	4,900	4,700
130,000	7,800	7,100	5,600	4,200	3,400	5,600	4,800	4,600
129,200	7,800	7,000	5,600	4,200	3,400	5,600	4,800	4,600
125,000	7,600	6,900	5,500	4,100	3,300	5,500	4,700	4,500
120,000	7,300	6,600	5,300	4,000	3,300	5,400	4,600	4,400
115,000	7,100	6,400	5,200	3,900	3,200	5,200	4,500	4,300
110,000	6,800	6,200	5,100	3,800	3,200	5,100	4,400	4,200
105,000	6,600	6,000	4,900	3,800	3,100	4,900	4,200	4,100
100,000	6,400	5,800	4,800	3,700	3,000	4,800	4,100	3,900
95,000	6,100	5,600	4,600	3,600	3,000	4,700	4,000	3,800

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	-400	-400	-300	-200	-100	-300	-200	-200
2,000	0	0	0	0	0	0	0	0
4,000	400	400	300	200	100	300	200	200
6,000	900	700	500	300	200	500	400	400
8,000	1,300	1,100	800	500	400	800	600	600
10,000	1,900	1,600	1,200	700	600	1,200	900	900

CORRECTIONS

	DRY (6)					GOOD (5)		
PER 1 KT HEADWIND	-50	-50	0	0	0	0	0	0
PER 1 KT TAILWIND	100	100	50	50	50	100	50	50
PER 5 KTS ADD'L SPD	300	300	300	150	100	300	200	150
PER 10°C ABOVE ISA	200	150	150	100	50	150	100	100
PER 10°C BELOW ISA	-200	-150	-150	-100	-50	-150	-100	-100
PER 1% UP SLOPE	-200	-100	0	0	-50	0	-50	-100
PER 1% DOWN SLOPE	150	50	0	0	50	0	100	100
1 REVERSER INOP	500	100	0	0	100	0	200	200
2 REVERSERS INOP	600	100	0	0	100	100	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
155,000	7,100	6,900	6,800	8,900	8,900	8,900
150,000	6,900	6,700	6,700	8,700	8,700	8,700
145,000	6,700	6,600	6,500	8,500	8,400	8,400
140,000	6,600	6,400	6,400	8,200	8,200	8,200
135,000	6,400	6,300	6,200	8,000	8,000	8,000
130,000	6,300	6,100	6,000	7,800	7,700	7,700
129,200	6,200	6,100	6,000	7,700	7,700	7,700
125,000	6,100	5,900	5,900	7,500	7,500	7,500
120,000	5,900	5,800	5,700	7,300	7,300	7,300
115,000	5,800	5,600	5,600	7,100	7,100	7,000
110,000	5,600	5,400	5,400	6,800	6,800	6,800
105,000	5,400	5,300	5,200	6,600	6,600	6,600
100,000	5,300	5,100	5,100	6,400	6,400	6,400
95,000	5,100	5,000	4,900	6,100	6,100	6,100

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	-300	-300	-300	-400	-400	-400
2,000	0	0	0	0	0	0
4,000	300	300	300	400	400	400
6,000	600	600	600	900	900	900
8,000	1,000	1,000	900	1,300	1,300	1,300
10,000	1,500	1,400	1,300	1,900	1,900	1,900

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	150	150	150	150	150	150
PER 10°C BELOW ISA	-150	-150	-150	-200	-200	-200
PER 1% UP SLOPE	-100	-150	-200	-350	-400	-350
PER 1% DOWN SLOPE	200	200	250	600	600	550
1 REVERSER INOP	500	500	500	1,200	1,200	1,200
2 REVERSERS INOP	1,300	1,300	1,300	3,100	3,100	3,100
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
155,000	8,700	7,700	6,100	4,500	3,700	6,100	5,300	5,000
150,000	8,500	7,600	6,000	4,400	3,600	6,000	5,200	4,900
145,000	8,200	7,400	5,800	4,300	3,600	5,900	5,100	4,800
140,000	8,000	7,200	5,700	4,200	3,500	5,700	5,000	4,700
135,000	7,800	7,000	5,600	4,200	3,400	5,600	4,900	4,600
130,000	7,600	6,800	5,500	4,100	3,400	5,500	4,700	4,500
129,200	7,600	6,800	5,400	4,100	3,400	5,500	4,700	4,500
125,000	7,400	6,700	5,300	4,000	3,300	5,400	4,600	4,400
120,000	7,100	6,500	5,200	3,900	3,200	5,200	4,500	4,300
115,000	6,900	6,300	5,100	3,800	3,200	5,100	4,400	4,200
110,000	6,700	6,100	4,900	3,700	3,100	4,900	4,300	4,100
105,000	6,400	5,900	4,800	3,700	3,100	4,800	4,200	4,000
100,000	6,200	5,700	4,700	3,600	3,000	4,700	4,100	3,900
95,000	6,000	5,500	4,500	3,500	2,900	4,500	4,000	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	-400	-400	-300	-200	-100	-300	-200	-200
2,000	0	0	0	0	0	0	0	0
4,000	400	400	300	200	100	300	200	200
6,000	900	700	500	300	200	500	400	400
8,000	1,300	1,100	800	500	400	800	600	600
10,000	1,900	1,600	1,200	700	600	1,200	900	900

CORRECTIONS

	DRY (6)					GOOD (5)		
PER 1 KT HEADWIND	-50	-50	0	0	0	0	0	0
PER 1 KT TAILWIND	100	100	50	50	50	50	50	50
PER 5 KTS ADD'L SPD	300	300	300	150	100	300	200	150
PER 10°C ABOVE ISA	200	150	100	50	50	100	100	100
PER 10°C BELOW ISA	-200	-150	-100	-50	-50	-100	-100	-100
PER 1% UP SLOPE	-200	-100	0	0	-50	0	-50	-100
PER 1% DOWN SLOPE	150	50	0	0	50	50	100	100
1 REVERSER INOP	500	100	0	0	0	0	200	200
2 REVERSERS INOP	600	100	0	0	100	100	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 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
155,000	6,900	6,800	6,700	8,800	8,700	8,700
150,000	6,800	6,700	6,600	8,500	8,500	8,500
145,000	6,600	6,500	6,400	8,300	8,300	8,200
140,000	6,500	6,300	6,300	8,100	8,000	8,000
135,000	6,300	6,200	6,100	7,800	7,800	7,800
130,000	6,100	6,000	5,900	7,600	7,600	7,600
129,200	6,100	6,000	5,900	7,600	7,600	7,500
125,000	6,000	5,900	5,800	7,400	7,400	7,300
120,000	5,800	5,700	5,600	7,200	7,200	7,100
115,000	5,700	5,500	5,500	6,900	6,900	6,900
110,000	5,500	5,400	5,300	6,700	6,700	6,700
105,000	5,300	5,200	5,200	6,500	6,500	6,500
100,000	5,200	5,100	5,000	6,300	6,300	6,200
95,000	5,000	4,900	4,900	6,100	6,100	6,000

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	-300	-300	-300	-400	-400	-400
2,000	0	0	0	0	0	0
4,000	300	300	300	400	400	400
6,000	600	600	600	900	900	800
8,000	1,000	1,000	900	1,300	1,300	1,300
10,000	1,500	1,500	1,300	1,900	1,900	1,900

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	150	150	150	150	150	150
PER 10°C BELOW ISA	-150	-150	-150	-200	-200	-200
PER 1% UP SLOPE	-150	-150	-200	-350	-400	-350
PER 1% DOWN SLOPE	200	250	250	550	600	550
1 REVERSER INOP	500	500	500	1,100	1,100	1,100
2 REVERSERS INOP	1,200	1,200	1,200	2,900	2,900	2,900
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				
		170,000	150,000	130,000	110,000	90,000
40,000	PITCH ATTITUDE RATE OF CLIMB (FT/MIN)			+4.5 700	+ 4.0 + 1,200	+ 4.0 + 1,700
30,000	PITCH ATTITUDE RATE OF CLIMB (FT/MIN)	+ 4.0 + 1,000	+ 4.0 + 1,200	+ 4.0 + 1,600	+ 4.0 + 2,000	4.0 + 2,500
20,000	PITCH ATTITUDE RATE OF CLIMB (FT/MIN)	+ 6.0 + 1,900	+ 6.0 + 2,300	+ 6.5 + 2,700	+ 6.5 + 3,300	+ 7.5 + 4,200
10,000	PITCH ATTITUDE RATE OF CLIMB (FT/MIN)	+ 8.0 + 2,700	+ 8.5 + 3,200	+ 9.0 + 3,700	+ 9.5 + 4,500	+ 11.0 + 5,600
0	PITCH ATTITUDE RATE OF CLIMB (FT/MIN)	+ 10.0 + 3,300	+ 10.5 + 3,800	+ 11.5 + 4,500	+ 12.5 + 5,400	+ 15.0 + 6,700

CRUISE						
SPEED: 0.76/280		THRUST: %N ₁ FOR LEVEL FLIGHT FLAPS: UP				
PRESSURE ALTITUDE FEET		GROSS WEIGHT - POUNDS				
		170,000	150,000	130,000	110,000	90,000
40,000	PITCH ATTITUDE %N ₁			+3.5 +88.4	+2.5 +84.9	+2.0 +82.5
35,000	PITCH ATTITUDE %N ₁	+3.5 +89.2	+3.0 +86.0	+2.5 +83.8	+2.0 +82.1	+1.5 +80.8
30,000	PITCH ATTITUDE %N ₁	+3.0 +85.1	+2.5 +83.4	+2.0 +82.1	+1.5 +81.0	+1.0 +80.3
25,000	PITCH ATTITUDE %N ₁	+3.0 +81.3	+2.5 +79.6	+2.0 +78.3	+1.5 +77.4	+1.0 +76.7
20,000	PITCH ATTITUDE %N ₁	+3.5 +77.4	+2.5 +75.8	+2.0 +74.7	+1.5 +73.8	+1.0 +73.1
15,000	PITCH ATTITUDE %N ₁	+3.5 +73.5	+3.0 +72.0	+2.0 +70.9	+1.5 +70.0	+1.0 +69.2

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				
		170,000	150,000	130,000	110,000	90,000
40,000	PITCH ATTITUDE	+1.5	+1.0	+0.5	-0.5	-1.5
	RATE OF CLIMB (FT/MIN)	-2700	-2500	-2400	-2500	-2700
30,000	PITCH ATTITUDE	+0.5	-0.5	-1.0	-2.0	-3.0
	RATE OF CLIMB (FT/MIN)	-2000	-2100	-2200	-2500	-3000
20,000	PITCH ATTITUDE	+0.5	0.0	-1.0	-2.0	-3.0
	RATE OF CLIMB (FT/MIN)	-1700	-1800	-2000	-2300	-2700
10,000	PITCH ATTITUDE	+0.5	0.0	-1.0	-2.0	-3.0
	RATE OF CLIMB (FT/MIN)	-1500	-1600	-1800	-2000	-2400
0	PITCH ATTITUDE	+0.5	0.0	-1.0	-2.0	-3.0
	RATE OF CLIMB (FT/MIN)	-1400	-1500	-1600	-1800	-2200

HOLDING						
SPEED: $V_{Ref40} + 70$			THRUST: %N ₁ FOR LEVEL FLIGHT FLAPS: UP			
PRESSURE ALTITUDE – FEET		GROSS WEIGHT – POUNDS				
		170,000	150,000	130,000	110,000	90,000
10,000	PITCH ATTITUDE	+5.0	+5.0	+5.0	+5.5	+5.0
	%N ₁	68.1	65.1	61.4	57.2	52.6
5,000	PITCH ATTITUDE	+5.0	+5.0	+5.5	+5.5	+5.5
	%N ₁	64.5	61.0	57.4	53.5	49.0

TERMINAL AREA							
SPEED: see below			THRUST: %N ₁ FOR LEVEL FLIGHT FLAPS: AS REQ'D				
PRESSURE ALTITUDE – FEET	FLAPS (GEAR) SPEED		GROSS WEIGHT – POUNDS				
			170,000	150,000	130,000	110,000	90,000
5,000	1 (UP) V _{Ref40} + 50	PITCH ATT % N ₁	+ 6.5 66	+6.0 63	+6.0 59	+5.5 56	+5.0 51
5,000	5 (UP) V _{Ref40} + 30	PITCH ATT % N ₁	+ 7.0 67	+6.5 64	+6.5 60	+6.0 56	+5.5 51
5,000	15 (DOWN) V _{Ref40} + 20	PITCH ATT % N ₁	+ 7.0 77	+6.5 73	+6.5 70	+6.0 65	+6.0 60

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 – POUNDS				
			170,000	150,000	130,000	110,000	90,000
1,500	15 (DOWN) V _{Ref15} + 10	PITCH ATT % N ₁	+4.0	+4.0	+3.5	+3.5	+3.5
			55	52	49	45	42
1,500	30 (DOWN) V _{Ref30} + 10	PITCH ATT % N ₁	+2.5	+2.0	+2.0	+2.0	+1.5
			61	58	54	50	46
1,500	40 (DOWN) V _{Ref40} + 10	PITCH ATT % N ₁	+0.5	+0.5	+0.5	+0.0	+0.0
			69	65	62	57	53

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 brakes on speed of 145kts 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 **62 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
-1000	180.0	180.0	180.0	180.0	178.5	175.6	172.8	170.0
0	180.0	180.0	180.0	178.3	175.3	172.4	169.5	166.6
1,000	180.0	180.0	178.0	175.0	172.0	169.0	166.0	163.2
2,000	180.0	177.9	174.7	171.7	168.5	165.5	162.6	159.8
3,000	177.8	174.5	171.4	168.1	165.0	162.0	159.3	----
4,000	174.4	171.2	167.8	164.6	161.5	158.7	156.0	----
5,000	171.0	167.5	164.2	161.1	158.2	155.4	152.8	----
6,000	167.4	163.9	160.7	157.7	154.8	152.1	149.5	----
7,000	163.8	160.4	157.3	154.4	151.6	148.9	146.4	----
8,000	160.2	157.0	154.0	151.1	148.4	145.8	----	----
9,000	156.8	153.6	150.7	147.9	145.2	142.7	----	----
10,000	153.4	150.3	147.4	144.7	142.1	139.8	----	----

FLAPS 30

AIRPORT PRESSURE ALTITUDE FEET	AMBIENT TEMPERATURE – °C							
	-20	-10	0	10	20	30	40	50
-1000	180.0	180.0	179.9	176.7	173.6	170.7	167.7	164.8
0	180.0	179.9	176.6	173.5	170.4	167.4	164.4	161.6
1,000	180.0	176.5	173.3	170.2	167.0	164.0	161.1	158.4
2,000	176.6	173.2	170.0	166.7	163.6	160.7	157.9	155.2
3,000	173.3	169.9	166.5	163.3	160.3	157.5	154.7	----
4,000	169.9	166.4	163.1	160.0	157.1	164.3	151.6	----
5,000	166.4	163.0	159.8	156.8	153.9	151.1	148.5	----
6,000	162.9	159.6	156.5	153.5	150.7	148.0	145.4	----
7,000	159.6	156.3	153.2	150.3	147.6	144.9	142.5	----
8,000	156.2	153.0	150.0	147.2	144.5	142.0	----	----
9,000	152.9	149.8	146.8	144.1	141.5	139.1	----	----
10,000	149.6	146.6	143.7	141.1	138.7	136.3	----	----

CONDITION		CORRECTION – POUNDS
Wind	per 1 kt. of headwind	+ 360
	per 1 kt. of tailwind	- 1,610
Runway slope	per 0.1% uphill slope	+ 150
	per 0.1% downhill slope	- 220

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	178.1	174.7	171.5	168.3	165.1	162.1	159.3	156.6
0	174.9	171.5	168.2	165.0	161.9	159.0	156.2	153.6
1,000	171.6	168.1	164.8	161.6	158.6	155.8	153.1	150.6
2,000	168.1	164.7	161.4	158.4	155.5	152.8	150.1	147.6
3,000	164.7	161.3	158.2	155.2	152.4	149.8	147.2	----
4,000	161.3	158.1	155.0	152.1	149.4	146.7	144.2	----
5,000	158.1	154.9	151.9	149.1	146.3	143.8	141.4	----
6,000	154.8	151.7	148.8	146.0	143.3	140.9	138.6	----
7,000	151.7	148.6	145.7	143.0	140.5	138.2	135.9	----
8,000	148.5	145.5	142.7	140.2	137.7	135.4	----	----
9,000	145.4	142.5	139.9	137.4	135.0	132.7	----	----
10,000	142.4	139.6	137.0	134.6	132.2	130.0	----	----

CONDITION		CORRECTION – POUNDS
Wind	per 1 kt. of headwind	+ 340
	per 1 kt. of tailwind	- 1,620
Runway slope	per 0.1% uphill slope	+ 130
	per 0.1% downhill slope	- 210

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
160	0:00 / 0:00	0:06 / 0:00	0:36 / 0:31	0:58C / 0:53C	1:16F / 1:11F	1:34F / 1:27F
150	0:00 / 0:00	0:00 / 0:00	0:31 / 0:26	0:53C / 0:49C	1:11F / 1:07C	1:28F / 1:22F
140	0:00 / 0:00	0:00 / 0:00	0:26 / 0:21	0:49C / 0:44	1:06C / 1:02C	1:23F / 1:17F
130	0:00 / 0:00	0:00 / 0:00	0:21 / 0:15	0:44 / 0:39	1:01C / 0:57C	1:17F / 1:12F
120	0:00 / 0:00	0:00 / 0:00	0:15 / 0:10	0:38 / 0:33	0:56C / 0:51C	1:11F / 1:07C
110	0:00 / 0:00	0:00 / 0:00	0:09 / 0:03	0:32 / 0:27	0:50C / 0:45	1:05C / 1:01C
100	0:00 / 0:00	0:00 / 0:00	0:00 / 0:00	0:26 / 0:20	0:44 / 0:39	0:59C / 0:54C
90	0:00 / 0:00	0:00 / 0:00	0:00 / 0:00	0:18 / 0:12	0:37 / 0:32	0:52C / 0:47

C - CAUTION ZONE (0:48 – 1:10) – 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, ≥ 1:11) – 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 1:11 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
MaxAuto	NW / NW	0:05 / NW	0:06 / 0:15	0:06 / 0:14	0:05 / 0:13	0:05 / 0:11
Auto 3	NW / NW	0:06 / NW	0:11 / NW	0:11 / 0:38	0:11 / 0:35	0:11 / 0:30
Auto 2	NW / NW	NW / NW	0:17 / NW	0:17 / NW	0:17 / NW	0:19 / 0:57
Auto 1	NW / NW	NW / NW	0:24 / NW	0:24 / NW	0:25 / NW	0:26 / 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
160	0:00	0:25	0:49C	1:09C	1:26F	1:45F
150	0:00	0:21	0:45	1:05C	1:22F	1:40F
140	0:00	0:17	0:41	1:01C	1:17F	1:34F
130	0:00	0:13	0:37	0:56C	1:12F	1:28F
120	0:00	0:08	0:32	0:51C	1:07C	1:22F
110	0:00	0:03	0:27	0:46	1:02C	1:16F
100	0:00	0:00	0:21	0:41	0:56C	1:10C
90	0:00	0:00	0:15	0:34	0:50C	1:03C

C - CAUTION ZONE (0:48 – 1:10) – 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, ≥ 1:11) – 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_{MCG} - MINIMUM CONTROL SPEED, GROUND

KIAS

CFM56-7B26

NO NOSEWHEEL STEERING

AIRPORT PRESSURE ALTITUDE - FEET	TEMPERATURE - °C						
	-60	20	30	40	50	60	70
-2,000	125	123	122	120	115	112	112
0	124	122	122	117	112	110	110
2,000	120	119	118	113	109	108	
4,000	116	115	114	110	107	107	
6,000	113	111	109	106	104		
8,000	109	107	105	102	101		
10,000	106	103	101	99	99		

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	+ 3
Wet V_1	+ 3
V_R	+ 2
V_2	0

MEL SUPPORT

73-00-11: EEC ALTERNATE MODE TAKEOFF THRUST

%N₁

CFM56-7B26

NORMAL BLEED - 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	93.2	93.6	93.7	93.8	93.9	94.0	94.1	94.0	93.7	93.6	93.5
55	93.8	94.3	94.4	94.5	94.6	94.7	94.9	94.7	94.4	94.1	93.5
50	94.4	94.9	95.1	95.2	95.4	95.5	95.6	95.5	95.2	94.9	94.4
45	95.2	95.6	95.8	95.9	96.1	96.2	96.3	96.2	95.9	95.6	95.3
40	95.9	96.4	96.5	96.6	96.7	96.8	97.0	96.9	96.6	96.3	96.2
35	96.5	97.2	97.3	97.4	97.5	97.6	97.7	97.6	97.3	97.0	96.9
30	96.6	98.1	98.1	98.2	98.2	98.3	98.3	98.2	98.1	97.8	97.7
25	95.9	97.3	97.9	98.5	98.6	98.5	98.5	98.5	98.5	98.4	98.4
20	95.1	96.6	97.1	97.7	98.0	98.3	98.6	98.6	98.7	98.6	98.6
15	94.3	95.8	96.4	97.0	97.3	97.6	97.9	98.3	98.7	98.9	98.9
10	93.6	95.0	95.6	96.2	96.5	96.8	97.2	97.5	97.9	98.3	98.8
5	92.8	94.2	94.8	95.4	95.8	96.1	96.4	96.8	97.2	97.6	98.1
0	92.0	93.4	94.1	94.7	95.0	95.3	95.7	96.0	96.4	96.8	97.3
-5	91.2	92.6	93.3	93.9	94.2	94.5	94.9	95.3	95.7	96.1	96.5
-10	90.4	91.8	92.5	93.1	93.4	93.8	94.1	94.5	94.9	95.3	95.8
-15	89.5	91.0	91.7	92.3	92.6	93.0	93.4	93.7	94.1	94.5	95.0
-20	88.7	90.2	90.8	91.5	91.8	92.2	92.6	93.0	93.4	93.7	94.2
-25	87.9	89.4	90.0	90.7	91.0	91.4	91.8	92.2	92.6	93.0	93.4
-30	87.0	88.5	89.2	89.8	90.2	90.6	91.0	91.4	91.8	92.1	92.6
-35	86.2	87.7	88.3	89.0	89.4	89.0	90.2	90.6	90.9	91.3	91.8
-40	85.3	86.8	87.5	88.1	88.5	88.9	89.3	89.7	90.1	90.5	90.9
-45	84.4	86.0	86.6	87.3	87.7	88.1	88.5	88.9	89.3	89.7	90.1
-50	83.5	85.1	85.7	86.4	86.8	87.2	87.7	88.1	88.4	88.8	89.3

Engine Bleed Adjustments:

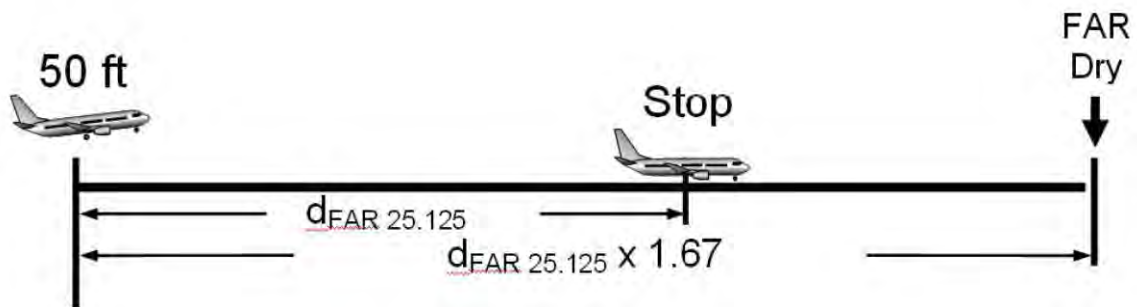
Bleed(s) OFF	+ 0.8	+ 0.8	+ 0.9	+ 0.9	+ 0.9	+ 1.0	+ 1.0	+ 1.0	+ 1.0	+ 1.0	+ 1.0
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MEL SUPPORT

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)

ANTI-SKID INOP – DRY RUNWAY *

FLAPS 40

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
150,000	10,190	10,450	10,720	11,010	11,310	11,650	11,980	12,330	12,700	13,070
140,000	9,670	9,900	10,160	10,420	10,700	11,020	11,330	11,660	11,990	12,350
130,000	9,120	9,320	9,550	9,790	10,050	10,350	10,640	10,940	11,250	11,580
120,000	8,560	8,750	8,970	9,190	9,430	9,700	9,970	10,240	10,530	10,820
110,000	8,000	8,180	8,380	8,580	8,810	9,060	9,300	9,540	9,800	10,060
100,000	7,440	7,600	7,780	7,970	8,190	8,420	8,640	8,860	9,100	9,350
90,000	6,870	7,020	7,190	7,360	7,560	7,770	7,970	8,180	8,400	8,620

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
150,000	11,720	12,010	12,330	12,660	13,010	13,400	13,780	14,180	14,600	15,030
140,000	11,120	11,390	11,680	11,980	12,300	12,670	13,030	13,400	13,790	14,200
130,000	10,480	10,720	10,990	11,260	11,560	11,900	12,230	12,580	12,940	13,320
120,000	9,840	10,060	10,310	10,570	10,850	11,160	11,460	11,780	12,100	12,440
110,000	9,200	9,400	9,630	9,870	10,130	10,420	10,690	10,970	11,270	11,570
100,000	8,550	8,740	8,950	9,170	9,410	9,680	9,930	10,190	10,460	10,750
90,000	7,900	8,070	8,260	8,460	8,690	8,940	9,170	9,410	9,660	9,910

CORRECTIONS:

Per 1 kt. Headwind	-50	-50	-50	-60	-60	-60	-60	-60	-60	-60
Per 1 kt. Tailwind	+ 240	+ 240	+ 250	+ 250	+ 250	+ 260	+ 260	+ 270	+ 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)

MANUAL SPOILERS – DRY RUNWAY

FLAPS 40

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
150,000	5,570	5,700	5,840	5,980	6,130	6,290	6,450	6,620	6,800	6,980
140,000	5,240	5,360	5,480	5,610	5,740	5,890	6,040	6,190	6,360	6,520
130,000	4,890	4,990	5,100	5,220	5,340	5,460	5,600	5,740	5,890	6,050
120,000	4,540	4,630	4,730	4,840	4,950	5,060	5,180	5,310	5,440	5,570
110,000	4,250	4,330	4,430	4,530	4,630	4,730	4,840	4,950	5,070	5,190
100,000	3,970	4,050	4,140	4,230	4,320	4,420	4,520	4,620	4,730	4,840
90,000	3,690	3,760	3,840	3,930	4,010	4,100	4,190	4,280	4,380	4,480

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
150,000	6,410	6,560	6,720	6,880	7,050	7,230	7,420	7,620	7,820	8,030
140,000	6,030	6,160	6,300	6,450	6,600	6,770	6,940	7,120	7,310	7,500
130,000	5,620	5,740	5,870	6,000	6,140	6,280	6,440	6,610	6,780	6,950
120,000	5,220	5,320	5,440	5,560	5,690	5,820	5,960	6,100	6,250	6,410
110,000	4,880	4,980	5,090	5,210	5,320	5,440	5,560	5,690	5,830	5,960
100,000	4,560	4,660	4,760	4,860	4,970	5,080	5,190	5,310	5,440	5,560
90,000	4,240	4,320	4,420	4,510	4,610	4,710	4,820	4,930	5,040	5,160

CORRECTIONS:

Per 1 kt. Headwind	-20	-20	-20	-20	-20	-20	-20	-20	-20	-20
Per 1 kt. Tailwind	+110	+110	+110	+110	+110	+110	+110	+110	+120	+120

End of Section

FERRY FLIGHT PLANNING AND OPERATION

AUTHORIZATION AND FLIGHT PLANNING 5-3

LANDING GEAR EXTENDED 5-4

WINGLET(S) REMOVED.....5-7

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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) unfilled 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 based on the values in the flight plan by multiplying the time and fuel values obtained in Step 1 by the factors listed under the ferry configuration. 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

Time and fuel factors (multiply by basic flight plan values – interpolate linearly):

RANGE – NAUTICAL MILES	RECOMMENDED ALTITUDE – FEET	TIME FACTOR	FUEL FACTOR
500	25,000	1.09	1.65
1,000	25,000	1.13	1.78
1,500	25,000	1.12	1.78
2,000	25,000	1.11	1.90

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 or 5 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
170,000	254 0.460 83.2 4804	251 0.560 92.6 4758								
160,000	247 0.447 81.5 4508	245 0.548 90.7 4464	243 0.565 92.9 4461							
150,000	240 0.434 79.8 4217	239 0.535 89.1 4183	237 0.552 90.8 4156	235 0.569 93.2 4178						
140,000	232 0.420 77.9 3934	232 0.518 87.2 3884	231 0.538 88.9 3877	229 0.555 90.8 3862	227 0.573 93.5 3905					
130,000	224 0.406 76.0 3654	223 0.500 85.1 3584	224 0.521 86.9 3582	223 0.541 88.6 3581	221 0.558 90.6 3582	218 0.576 93.7 3632				
120,000	216 0.391 74.0 3378	215 0.482 83.0 3290	215 0.501 84.7 3285	215 0.523 86.5 3290	214 0.543 88.2 3297	212 0.560 90.4 3303	210 0.579 93.6 3358			
110,000	207 0.375 71.6 3106	206 0.462 80.6 3001	206 0.481 82.4 2993	206 0.501 84.1 2997	206 0.523 85.9 3010	205 0.543 87.6 3016	203 0.561 90.0 3021	201 0.580 93.2 3081		
100,000	198 0.359 69.1 2844	197 0.442 78.1 2719	197 0.460 79.8 2705	197 0.479 81.6 2708	196 0.499 83.3 2721	197 0.521 85.1 2732	196 0.542 86.9 2735	194 0.560 89.3 2738	192 0.580 92.6 2797	
90,000	189 0.343 66.5 2593	187 0.421 75.3 2449	187 0.438 77.0 2424	187 0.456 78.8 2423	187 0.475 80.5 2437	187 0.496 82.3 2445	187 0.518 84.1 2451	186 0.540 85.9 2454	184 0.558 88.3 2457	182 0.578 92.0 2522
80,000	179 0.326 63.7 2346	177 0.398 72.4 2190	177 0.415 74.0 2158	176 0.432 75.7 2148	176 0.450 77.4 2160	176 0.469 79.2 2163	176 0.490 80.9 2168	176 0.512 82.8 2171	176 0.534 84.7 2174	174 0.554 87.3 2188

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
140,000	207 / 75.1	207 / 79.2
130,000	202 / 73.3	202 / 77.3
120,000	196 / 71.3	196 / 75.4

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 wingtip treatment on the other wing.
- 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

