
B-737-800 Operational Data Manual (ODM)

Table of Contents

Cover Page	
Revision Highlights	
List of Effective Pages.....	i
Quick Reference	
Flight Planning.....	1-1
Takeoff.....	2-1
Approach / Landing.....	3-1
Abnormal.....	4-1
Ferry.....	5-1

THIS PAGE INTENTIONALLY BLANK



B-737-800 Operational Data Manual

Revision Number: 55
Revision Date: September 23, 2016

Issued by
Performance Engineering - Dept 088 ATG
© 2016: Delta Air Lines, Inc.

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.

Distribution of this manual is the responsibility of the Dept. 188, ATG, LibSvc.ATL188@delta.com.

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.

MANUAL RIGHTS

This Operational Data Manual has been prepared for use by properly trained Flight Operations and Operations Control personnel while operating or dispatching aircraft under the auspices of Delta Air Lines, Inc.

Neither this manual or any portion thereof may be reproduced, distributed, or used by any firm or person without the prior written consent of the Vice President – Operations Reliability and Control.



Revision Notification

Publication: B-737-800 OPERATIONAL DATA MANUAL

Date: 23 Sep 16

Revision Number: 55

Page: 1 of 1

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 #55

TOC / COVER PAGE		TAKEOFF (cont.)		ABNORMAL (cont.)	
Page	Date	Page	Date	Page	Date
	23 Sep 16	2-34	07 May 15	4-39	15 Jan 15
MANUAL RIGHTS		2-35	07 May 15	4-40	15 Jan 15
Page	Date	2-36	07 May 15	4-41	15 Jan 15
	NO DATE	APPROACH/LANDING		4-42	15 Jan 15
LIST OF EFFECTIVE PAGES		Page	Date	4-43	15 Jan 15
Page	Date	3-1	31 Dec 13	4-44	15 Jan 15
<i>i</i>	23 Sep 16	3-2	22 Apr 14	4-45	15 Jan 15
QUICK REFERENCE		3-3	22 Apr 14	4-46	BLANK
Page	Date	3-4	22 Apr 14	4-47	15 Jan 15
OPERATIONAL		3-5	16 Jul 13	4-48	15 Jan 15
LAND DIST	23 Sep 16	3-6	16 Jul 13	4-49	15 Jan 15
FLIGHT PLANNING		3-7	16 Jul 13	4-50	15 Jan 15
Page	Date	3-8	BLANK	4-51	15 Jan 15
1-1	26 Mar 13	3-9	31 Dec 13	4-52	15 Jan 15
1-2	21 Jul 11	3-10	31 Dec 13	4-53	15 Jan 15
1-3	21 Jul 11	3-11	31 Dec 13	4-54	15 Jan 15
1-4	21 Jul 11	3-12	02 Jul 15	4-55	15 Jan 15
1-5	26 Mar 13	3-13	02 Jul 15	4-56	15 Jan 15
1-6	26 Mar 13	3-14	02 Jul 15	4-57	15 Jan 15
1-7	26 Mar 13	3-15	02 Jul 15	FERRY	
1-8	26 Mar 13	3-16	02 Jul 15	Page	Date
1-9	26 Mar 13	3-17	02 Jul 15	5-1	31 Dec 13
TAKEOFF		ABNORMAL		5-2	BLANK
Page	Date	Page	Date	5-3	31 Mar 11
2-1	07 May 15	4-1	21 Jul 11	5-4	31 Mar 11
2-2	07 May 15	4-2	15 Jan 15	5-5	12 Aug 14
2-3	BLANK	4-3	05 Nov 13	5-6	31 Mar 11
2-4	07 May 15	4-4	21 Jul 11	5-7	31 Mar 11
2-5	07 May 15	4-5	21 Jul 11	END	
2-6	07 May 15	4-6	21 Jul 11		
2-7	07 May 15	4-7	21 Jul 11		
2-8	07 May 15	4-8	21 Jul 11		
2-9	07 May 15	4-9	21 Jul 11		
2-10	07 May 15	4-10	21 Jul 11		
2-11	07 May 15	4-11	02 Dec 14		
2-12	07 May 15	4-12	21 Jul 11		
2-13	07 May 15	4-13	21 Jul 11		
2-14	07 May 15	4-14	31 Mar 11		
2-15	07 May 15	4-15	31 Mar 11		
2-16	07 May 15	4-16	31 Mar 11		
2-17	07 May 15	4-17	31 Mar 11		
2-18	07 May 15	4-18	21 Jul 11		
2-19	07 May 15	4-19	31 Mar 11		
2-20	07 May 15	4-20	21 Jul 11		
2-21	07 May 15	4-21	BLANK		
2-22	07 May 15	4-22	02 Dec 14		
2-23	07 May 15	4-23	11 Oct 12		
2-24	07 May 15	4-24	11 Oct 12		
2-25	07 May 15	4-25	11 Oct 12		
2-26	07 May 15	4-26	11 Oct 12		
2-27	07 May 15	4-27	11 Oct 12		
2-28	07 May 15	4-28	11 Oct 12		
2-29	07 May 15	4-29	11 Oct 12		
2-30	07 May 15	4-30	11 Oct 12		
2-31	07 May 15	4-31	11 Oct 12		
2-32	07 May 15	4-32	02 Jul 15		
2-33	07 May 15	4-33	02 Jul 15		
		4-34	02 Jul 15		
		4-35	02 Jul 15		
		4-36	02 Jul 15		
		4-37	02 Jul 15		
		4-38	15 Jan 15		

737-800 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 39	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 29	
Poor	Braking deceleration is significantly reduced for the wheel braking effort applied OR directional control is significantly reduced.	• Ice	1	20 or lower	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.

737-800 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
180,000	13,600	12,100	9,400	6,600	5,500	9,400	7,600	7,100
175,000	13,300	11,900	9,200	6,500	5,400	9,200	7,400	7,000
170,000	13,000	11,600	9,100	6,400	5,300	9,100	7,300	6,900
165,000	12,700	11,400	8,900	6,300	5,100	8,900	7,100	6,700
160,000	12,300	11,100	8,700	6,100	5,000	8,700	7,000	6,600
155,000	12,000	10,800	8,500	6,000	4,900	8,500	6,900	6,500
150,000	11,700	10,600	8,300	5,900	4,800	8,300	6,700	6,300
146,300	11,500	10,400	8,200	5,800	4,700	8,200	6,600	6,200
145,000	11,400	10,300	8,100	5,800	4,600	8,100	6,600	6,200
140,000	11,000	10,000	7,900	5,700	4,500	7,900	6,400	6,100
135,000	10,700	9,700	7,700	5,500	4,400	7,700	6,300	5,900
130,000	10,400	9,400	7,500	5,400	4,300	7,500	6,100	5,800
125,000	10,000	9,100	7,300	5,300	4,200	7,300	5,900	5,600
120,000	9,700	8,800	7,100	5,200	4,100	7,100	5,800	5,500
115,000	9,400	8,500	6,900	5,000	4,000	6,900	5,600	5,300
110,000	9,000	8,200	6,700	4,900	3,900	6,700	5,500	5,200

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

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

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

 Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	DRY (6)					GOOD (5)		
0	-700	-600	-400	-200	-200	-400	-300	-300
2,000	0	0	0	0	0	0	0	0
4,000	700	600	400	200	200	400	300	300
6,000	1,400	1,200	800	500	400	800	600	600
8,000	2,100	1,700	1,200	700	600	1,200	900	800
10,000	3,000	2,400	1,700	1,000	800	1,700	1,300	1,200

CORRECTIONS

	DRY (6)					GOOD (5)		
PER 1 KT HEADWIND	-50	-50	-50	0	0	-50	0	0
PER 1 KT TAILWIND	150	150	100	50	50	100	100	100
PER 5 KTS ADD'L SPD	350	400	400	250	150	400	200	200
PER 10°C ABOVE ISA	300	250	200	100	100	200	150	150
PER 10°C BELOW ISA	-300	-250	-200	-100	-100	-200	-150	-150
PER 1% UP SLOPE	-300	-150	0	0	-50	0	-100	-100
PER 1% DOWN SLOPE	250	100	0	0	50	0	100	150
1 REVERSER INOP	900	300	0	0	100	0	300	300
2 REVERSERS INOP	1,300	300	0	0	200	100	700	700
MANUAL SPOILERS	200	200	200	200	200	200	200	200

Note: Do not operate when Braking Action is Nil.

737-800 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
180,000	10,500	10,100	9,900	13,300	13,200	13,200
175,000	10,300	9,900	9,700	13,000	12,900	12,900
170,000	10,100	9,700	9,500	12,600	12,600	12,600
165,000	9,800	9,400	9,300	12,300	12,200	12,200
160,000	9,600	9,200	9,100	12,000	11,900	11,900
155,000	9,400	9,000	8,900	11,700	11,600	11,600
150,000	9,200	8,800	8,700	11,400	11,300	11,300
146,300	9,000	8,600	8,500	11,100	11,100	11,100
145,000	9,000	8,600	8,400	11,100	11,000	11,000
140,000	8,700	8,300	8,200	10,700	10,700	10,700
135,000	8,500	8,100	8,000	10,400	10,400	10,400
130,000	8,300	7,900	7,800	10,100	10,000	10,000
125,000	8,000	7,700	7,500	9,800	9,700	9,700
120,000	7,800	7,400	7,300	9,400	9,400	9,400
115,000	7,500	7,200	7,100	9,100	9,100	9,100
110,000	7,300	7,000	6,900	8,800	8,800	8,800

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

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

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



Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

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

CORRECTIONS	MEDIUM (3)			POOR (1)		
PER 1 KT HEADWIND	-50	-50	-50	-50	-50	-50
PER 1 KT TAILWIND	150	150	150	200	200	200
PER 5 KTS ADD'L SPD	400	300	250	350	300	300
PER 10°C ABOVE ISA	200	200	200	250	250	250
PER 10°C BELOW ISA	-250	-200	-200	-300	-300	-300
PER 1% UP SLOPE	-150	-250	-250	-500	-550	-550
PER 1% DOWN SLOPE	250	300	350	800	850	800
1 REVERSER INOP	600	800	800	1,800	1,700	1,700
2 REVERSERS INOP	1,700	2,000	2,000	4,700	4,700	4,700
MANUAL SPOILERS	200	200	200	200	200	200

Note: Do not operate when Braking Action is Nil.

737-800 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
180,000	12,400	11,100	8,700	6,200	5,100	8,700	7,200	6,800
175,000	12,100	10,900	8,500	6,100	5,000	8,500	7,100	6,700
170,000	11,900	10,600	8,400	6,000	4,900	8,400	6,900	6,600
165,000	11,600	10,400	8,200	5,900	4,800	8,200	6,800	6,500
160,000	11,300	10,200	8,000	5,800	4,700	8,000	6,700	6,300
155,000	11,000	9,900	7,900	5,700	4,600	7,900	6,500	6,200
150,000	10,700	9,700	7,700	5,500	4,500	7,700	6,400	6,100
146,300	10,500	9,500	7,600	5,500	4,500	7,600	6,300	6,000
145,000	10,400	9,500	7,500	5,400	4,400	7,500	6,300	5,900
140,000	10,100	9,200	7,300	5,300	4,400	7,400	6,100	5,800
135,000	9,800	9,000	7,100	5,200	4,300	7,200	6,000	5,700
130,000	9,500	8,700	7,000	5,100	4,200	7,000	5,900	5,600
125,000	9,200	8,400	6,800	5,000	4,100	6,800	5,700	5,400
120,000	8,900	8,200	6,600	4,900	4,000	6,600	5,600	5,300
115,000	8,600	7,900	6,400	4,800	3,900	6,400	5,400	5,200
110,000	8,300	7,700	6,200	4,600	3,800	6,200	5,300	5,000

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

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

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

 Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

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

CORRECTIONS

	DRY (6)					GOOD (5)		
PER 1 KT HEADWIND	-50	-50	-50	0	0	-50	0	0
PER 1 KT TAILWIND	150	150	100	50	50	100	100	100
PER 5 KTS ADD'L SPD	350	350	350	200	150	350	200	200
PER 10°C ABOVE ISA	300	250	200	100	100	200	150	150
PER 10°C BELOW ISA	-300	-250	-200	-100	-100	-200	-150	-150
PER 1% UP SLOPE	-300	-150	0	0	-50	0	-100	-100
PER 1% DOWN SLOPE	250	100	0	0	50	0	100	150
1 REVERSER INOP	700	200	0	0	100	0	300	300
2 REVERSERS INOP	1,100	200	0	0	200	100	600	600
MANUAL SPOILERS	200	200	200	200	200	200	200	200

Note: Do not operate when Braking Action is Nil.

737-800 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
180,000	9,800	9,500	9,300	12,300	12,300	12,200
175,000	9,600	9,300	9,100	12,100	12,000	11,900
170,000	9,400	9,100	8,900	11,800	11,700	11,700
165,000	9,200	8,900	8,700	11,500	11,400	11,400
160,000	9,000	8,700	8,500	11,200	11,100	11,100
155,000	8,800	8,500	8,400	10,900	10,800	10,800
150,000	8,600	8,300	8,200	10,600	10,600	10,500
146,300	8,500	8,200	8,000	10,400	10,300	10,300
145,000	8,400	8,100	8,000	10,300	10,300	10,300
140,000	8,200	7,900	7,800	10,000	10,000	10,000
135,000	8,000	7,700	7,500	9,700	9,700	9,700
130,000	7,700	7,500	7,300	9,500	9,400	9,400
125,000	7,500	7,300	7,100	9,200	9,100	9,100
120,000	7,300	7,000	6,900	8,900	8,800	8,800
115,000	7,100	6,800	6,700	8,600	8,500	8,500
110,000	6,900	6,600	6,500	8,300	8,300	8,200

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

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

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



Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

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

CORRECTIONS

	MEDIUM (3)			POOR (1)		
PER 1 KT HEADWIND	-50	-50	-50	-50	-50	-50
PER 1 KT TAILWIND	150	150	150	200	200	200
PER 5 KTS ADD'L SPD	350	300	250	350	300	300
PER 10°C ABOVE ISA	200	200	200	250	250	250
PER 10°C BELOW ISA	-200	-200	-200	-250	-250	-250
PER 1% UP SLOPE	-150	-250	-250	-500	-500	-500
PER 1% DOWN SLOPE	250	300	300	750	800	750
1 REVERSER INOP	500	700	700	1,500	1,500	1,500
2 REVERSERS INOP	1,500	1,700	1,700	4,000	4,000	3,900
MANUAL SPOILERS	200	200	200	200	200	200

Note: Do not operate when Braking Action is Nil.

737-800 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
180,000	11,600	10,300	8,000	5,800	4,900	8,100	6,900	6,500
175,000	11,300	10,100	7,900	5,700	4,800	7,900	6,800	6,400
170,000	11,100	9,900	7,700	5,600	4,700	7,800	6,700	6,300
165,000	10,800	9,700	7,600	5,500	4,600	7,600	6,500	6,200
160,000	10,600	9,500	7,400	5,400	4,500	7,500	6,400	6,100
155,000	10,300	9,200	7,300	5,300	4,400	7,300	6,300	5,900
150,000	10,000	9,000	7,100	5,200	4,400	7,200	6,200	5,800
146,300	9,900	8,900	7,000	5,100	4,300	7,100	6,100	5,700
145,000	9,800	8,800	7,000	5,100	4,300	7,000	6,000	5,700
140,000	9,500	8,600	6,800	5,000	4,200	6,900	5,900	5,600
135,000	9,200	8,300	6,700	4,900	4,100	6,700	5,800	5,500
130,000	8,900	8,100	6,500	4,800	4,000	6,500	5,600	5,300
125,000	8,700	7,900	6,300	4,700	3,900	6,300	5,500	5,200
120,000	8,400	7,600	6,100	4,600	3,800	6,200	5,300	5,100
115,000	8,100	7,400	6,000	4,500	3,700	6,000	5,200	4,900
110,000	7,800	7,100	5,800	4,400	3,700	5,800	5,100	4,800

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

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

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

 Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

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

CORRECTIONS

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

737-800 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
180,000	9,200	9,000	8,900	11,700	11,600	11,600
175,000	9,000	8,800	8,700	11,400	11,400	11,300
170,000	8,800	8,600	8,500	11,200	11,100	11,100
165,000	8,600	8,500	8,300	10,900	10,800	10,800
160,000	8,500	8,300	8,100	10,600	10,600	10,500
155,000	8,300	8,100	8,000	10,400	10,300	10,300
150,000	8,100	7,900	7,800	10,100	10,000	10,000
146,300	7,900	7,700	7,600	9,900	9,800	9,800
145,000	7,900	7,700	7,600	9,800	9,800	9,700
140,000	7,700	7,500	7,400	9,500	9,500	9,500
135,000	7,500	7,300	7,200	9,300	9,200	9,200
130,000	7,300	7,100	7,000	9,000	8,900	8,900
125,000	7,100	6,900	6,800	8,700	8,700	8,700
120,000	6,800	6,700	6,600	8,400	8,400	8,400
115,000	6,600	6,500	6,400	8,200	8,100	8,100
110,000	6,400	6,300	6,200	7,900	7,800	7,800

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

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

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



Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	MEDIUM (3)			POOR (1)		
0	-400	-400	-400	-600	-600	-600
2,000	0	0	0	0	0	0
4,000	400	400	400	600	600	600
6,000	800	800	800	1,200	1,100	1,100
8,000	1,200	1,200	1,200	1,700	1,700	1,700
10,000	1,800	1,700	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	150	150	100	200	200	200
PER 5 KTS ADD'L SPD	350	300	250	300	300	300
PER 10°C ABOVE ISA	200	150	150	250	250	250
PER 10°C BELOW ISA	-200	-200	-200	-250	-250	-250
PER 1% UP SLOPE	-150	-250	-250	-450	-500	-500
PER 1% DOWN SLOPE	250	300	300	750	750	750
1 REVERSER INOP	600	600	600	1,400	1,400	1,400
2 REVERSERS INOP	1,500	1,500	1,500	3,500	3,500	3,500
MANUAL SPOILERS	200	200	200	200	200	200

Note: Do not operate when Braking Action is Nil.

CONTENTS

	Page
DEFINITIONS AND ASSUMPTIONS	1-2
TEMPERATURE CONVERSION AND STATIC AIR TEMPERATURE	1-3
TOTAL AIR TEMPERATURE VS STATIC AIR TEMPERATURE	1-4
NORMAL OPERATING SPEED LIMIT	1-5
EN ROUTE FUEL TEMPERATURE.....	1-6
MAXIMUM RECOMMENDED INITIAL CRUISE ALTITUDE	1-7
LRC	1-7
.79 MACH	1-8
BUFFET ONSET BOUNDARY SPEEDS	1-9

DEFINITIONS AND ASSUMPTIONS

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

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

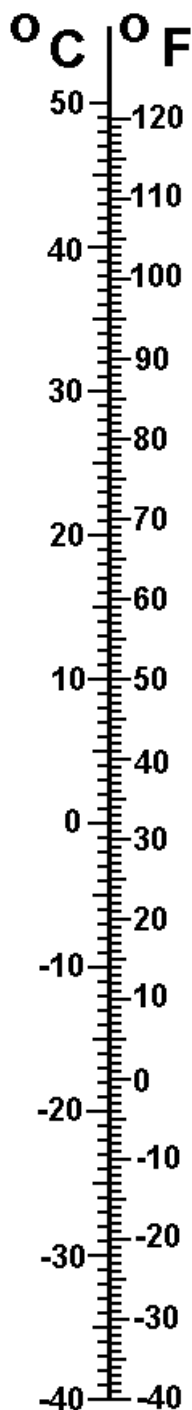
STATIC AIR TEMPERATURE (SAT) - The ambient still air temperature outside of the aircraft. Sometimes known as the Outside Air Temperature (OAT).

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

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

TEMPERATURE CONVERSION AND STATIC AIR TEMPERATURE

°C



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

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

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

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

TOTAL AIR TEMPERATURE vs STATIC AIR TEMPERATURE

°C

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

NORMAL OPERATING SPEED LIMIT

Vmo / Mmo

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

EN ROUTE FUEL TEMPERATURE

FOR DETERMINING DISPATCH CAPABILITY BASED ON FUEL FREEZE POINT.

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

INSTRUCTIONS:

1. Locate type of fuel being used.

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

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

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

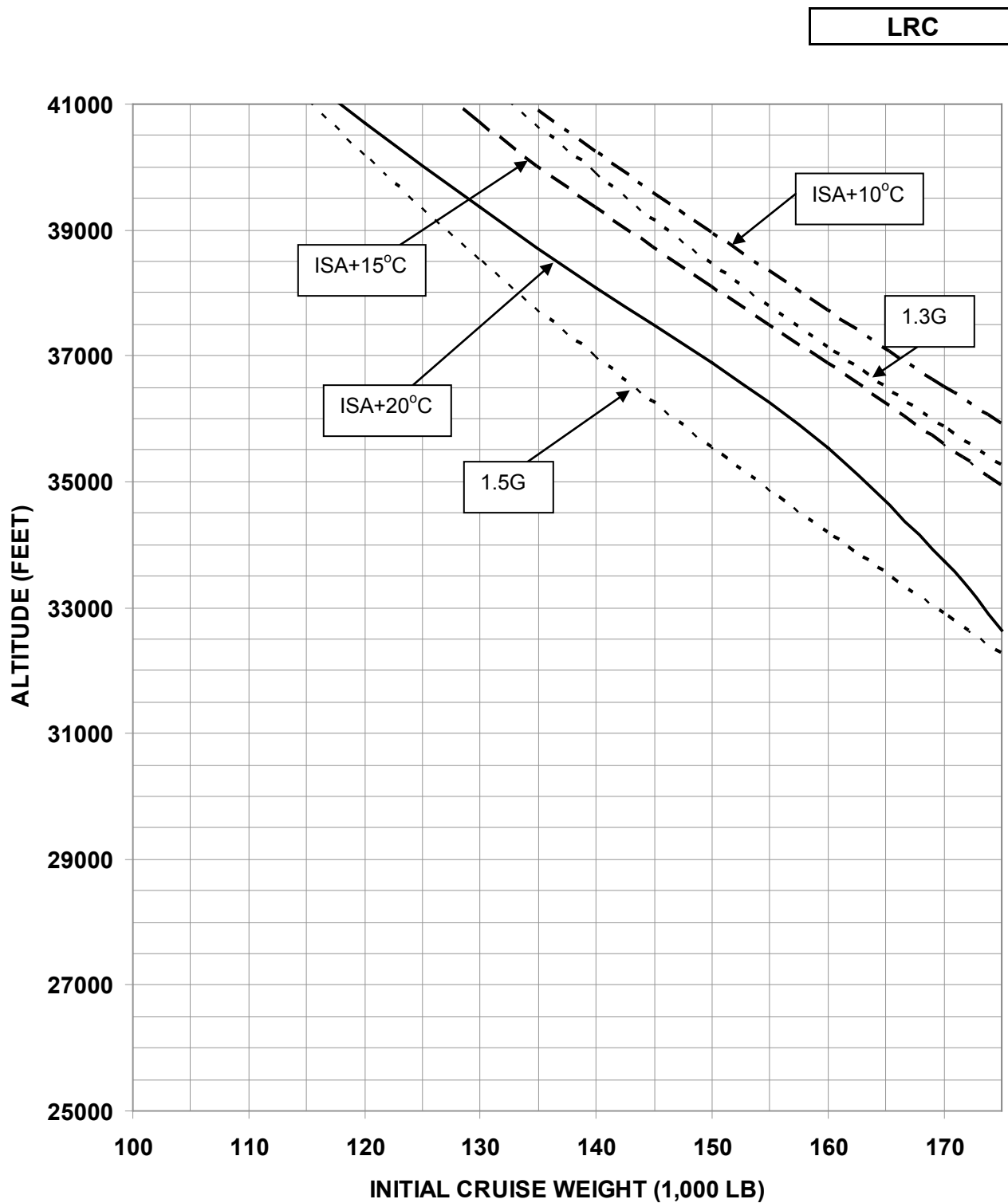
EXAMPLE:

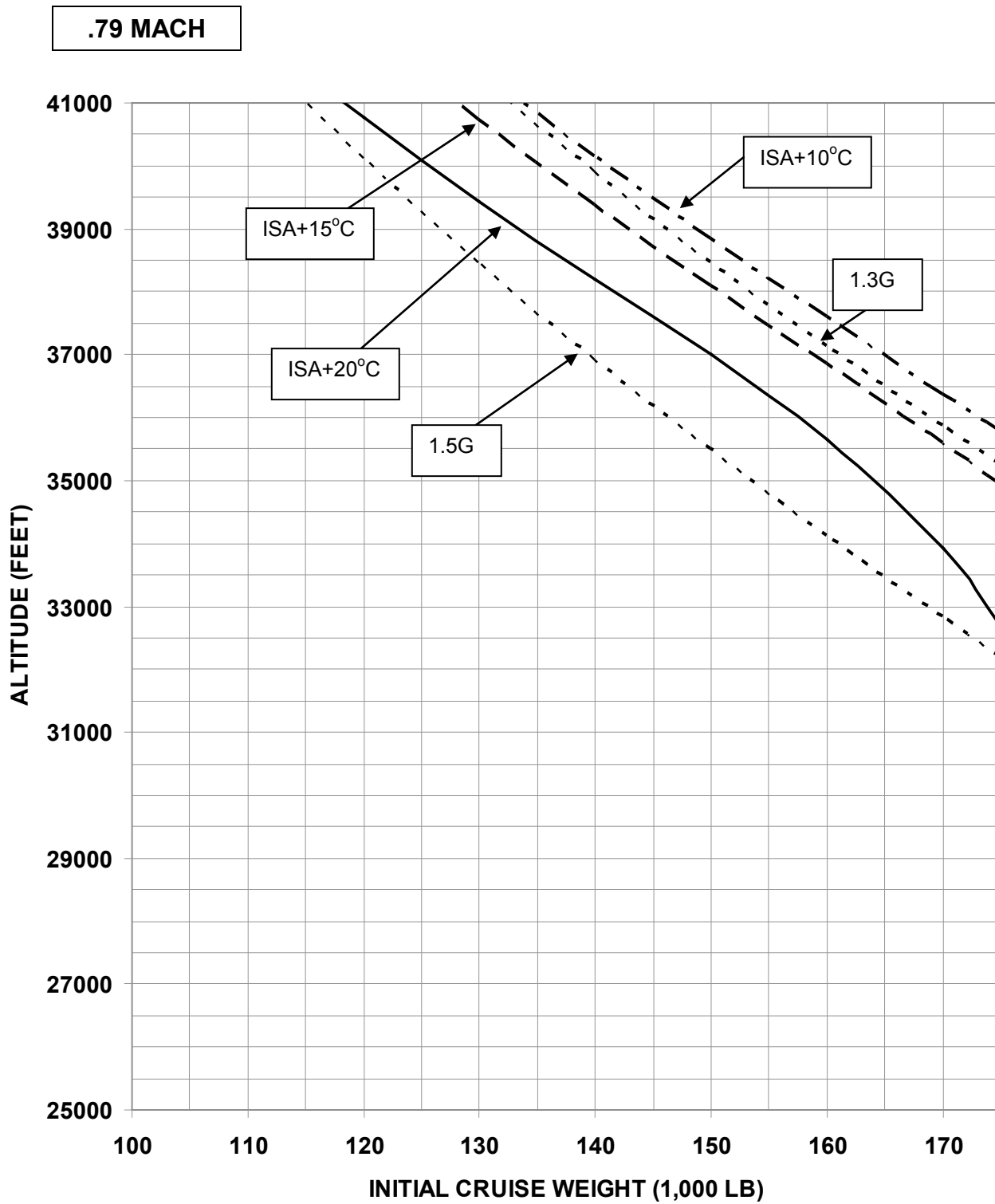
Fuel Type = Jet A (adjusted freeze point -37°C).

Expected Flight Level = 350.

Expected Mach Number = 0.81.

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

MAXIMUM RECOMMENDED INITIAL CRUISE ALTITUDE

MAXIMUM RECOMMENDED INITIAL CRUISE ALTITUDE

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	170,000	0.76 224	220	238				
	150,000		199	243+	223	235		
	130,000		181	243+	199	243+		
	110,000		160	243+	177	243+	215	240
	90,000		139	243+	155	243+	188	243+
390	170,000	0.76 233	211	254+	233	245		
	150,000		195	254+	213	254+		
	130,000		175	254+	195	254+	233	245
	110,000		157	254+	173	254+	210	254+
	90,000		134	254+	150	254+	183	254+
370	170,000	0.76 245	208	266+	230	274		
	150,000		191	266+	212	266+	250	266+
	130,000		173	266+	192	266+	230	266+
	110,000		154	266+	170	266+	205	266+
	90,000		132	266+	148	266+	180	266+
350	170,000	0.76 258	205	280+	225	280+		
	150,000		187	280+	209	280+	249	280+
	130,000		168	280+	188	280+	225	280+
	110,000		150	280+	167	280+	201	280+
	90,000		127	280+	145	280+	176	280+
330	170,000	0.76 269	201	292+	221	292+	270	285
	150,000		183	292+	204	292+	246	292+
	130,000		164	292+	184	292+	221	292+
	110,000		148	292+	163	292+	197	292+
	90,000		123	292+	142	292+	172	292+
310	170,000	0.76 280	195	305+	216	305+	263	305+
	150,000		178	305+	199	305+	242	305+
	130,000		158	305+	180	305+	216	305+
	110,000		143	305+	160	305+	193	305+
	90,000		120	305+	139	305+	169	305+
290	170,000	0.73 280	191	318+	212	318+	256	318+
	150,000		173	318+	195	318+	237	318+
	130,000		153	318+	177	318+	212	318+
	110,000		140	318+	157	318+	189	318+
	90,000		118	318+	136	318+	166	318+

+ 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

TABLE OF CONTENTS

	Page
DEFINITIONS AND ASSUMPTIONS	2-2
TAKEOFF SPEEDS	2-4
TO2 / 1	2-4
TO2 / 5	2-6
TO2 / 10	2-8
TO2 / 15	2-10
TO2 / 25	2-12
TO1 / 1	2-14
TO1 / 5	2-16
TO1 / 10	2-18
TO1 / 15	2-20
TO1 / 25	2-22
TO / 1	2-24
TO / 5	2-26
TO / 10	2-28
TO / 15	2-30
TO / 25	2-32
TAKEOFF STABILIZER SETTINGS	2-34
TO2	2-34
TO1	2-35
TO	2-36

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.

THIS PAGE INTENTIONALLY BLANK

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
175,000	8,000	147 / 165 / 165	145 / 165 / 165	143 / 167 / 167	142 / 168 / 168	140 / 169 / 169
	6,000	153 / 164 / 164	150 / 164 / 164	148 / 165 / 165	147 / 167 / 167	145 / 168 / 168
	4,000	159 / 163 / 164	156 / 163 / 164	154 / 164 / 164	152 / 166 / 166	150 / 167 / 167
	2,000	162 / 163 / 165	162 / 163 / 165	159 / 163 / 164	158 / 165 / 165	156 / 166 / 166
	0	162 / 162 / 165	162 / 162 / 165	162 / 162 / 165	163 / 164 / 164	161 / 165 / 165
170,000	8,000	149 / 162 / 162	147 / 162 / 162	145 / 164 / 164	144 / 165 / 165	142 / 166 / 166
	6,000	155 / 161 / 162	152 / 161 / 162	150 / 162 / 162	149 / 164 / 164	147 / 165 / 165
	4,000	160 / 160 / 162	158 / 160 / 162	156 / 161 / 162	154 / 163 / 163	152 / 164 / 164
	2,000	159 / 160 / 163	159 / 160 / 163	160 / 160 / 162	160 / 162 / 162	158 / 163 / 163
	0	159 / 159 / 163	159 / 159 / 163	159 / 159 / 163	161 / 161 / 162	162 / 162 / 162
165,000	8,000	152 / 160 / 160	150 / 160 / 160	148 / 162 / 162	146 / 163 / 163	144 / 164 / 164
	6,000	158 / 159 / 160	155 / 159 / 160	153 / 160 / 160	151 / 162 / 162	150 / 163 / 163
	4,000	158 / 158 / 160	158 / 158 / 160	159 / 159 / 160	157 / 161 / 161	155 / 162 / 162
	2,000	157 / 158 / 161	157 / 158 / 161	158 / 158 / 160	160 / 160 / 160	161 / 161 / 161
	0	157 / 157 / 161	157 / 157 / 161	157 / 157 / 161	159 / 159 / 160	160 / 160 / 160
160,000	8,000	154 / 157 / 157	152 / 157 / 157	150 / 159 / 159	148 / 160 / 160	146 / 161 / 161
	6,000	156 / 156 / 158	156 / 156 / 158	155 / 157 / 157	153 / 159 / 159	152 / 160 / 160
	4,000	155 / 155 / 158	155 / 155 / 158	156 / 156 / 158	158 / 158 / 158	157 / 159 / 159
	2,000	154 / 155 / 159	154 / 155 / 159	155 / 155 / 158	157 / 157 / 158	158 / 158 / 158
	0	154 / 154 / 159	154 / 154 / 159	154 / 154 / 159	156 / 156 / 158	157 / 157 / 157
155,000	8,000	154 / 155 / 155	154 / 155 / 155	153 / 157 / 157	151 / 158 / 158	149 / 159 / 159
	6,000	153 / 154 / 156	153 / 154 / 156	154 / 155 / 155	156 / 157 / 157	155 / 158 / 158
	4,000	152 / 153 / 156	152 / 153 / 156	153 / 154 / 156	155 / 156 / 156	156 / 157 / 157
	2,000	151 / 153 / 157	151 / 153 / 157	152 / 153 / 156	154 / 155 / 156	155 / 156 / 156
	0	151 / 152 / 157	151 / 152 / 157	151 / 152 / 157	153 / 154 / 156	154 / 155 / 155
150,000	8,000	151 / 152 / 153	151 / 152 / 153	153 / 154 / 154	153 / 155 / 155	151 / 156 / 156
	6,000	150 / 151 / 154	150 / 151 / 154	151 / 152 / 153	153 / 154 / 154	154 / 155 / 155
	4,000	149 / 150 / 154	149 / 150 / 154	150 / 151 / 154	152 / 153 / 153	153 / 154 / 154
	2,000	148 / 150 / 155	148 / 150 / 155	149 / 150 / 154	151 / 152 / 154	152 / 153 / 153
	0	148 / 149 / 155	148 / 149 / 155	148 / 149 / 155	150 / 151 / 154	151 / 152 / 153
145,000	8,000	149 / 149 / 151	149 / 149 / 151	151 / 151 / 151	152 / 152 / 152	153 / 153 / 153
	6,000	148 / 148 / 152	148 / 148 / 152	149 / 149 / 151	151 / 151 / 151	152 / 152 / 152
	4,000	147 / 147 / 152	147 / 147 / 152	148 / 148 / 152	150 / 150 / 151	151 / 151 / 151
	2,000	146 / 147 / 153	146 / 147 / 153	147 / 147 / 152	149 / 149 / 152	150 / 150 / 151
	0	146 / 146 / 153	146 / 146 / 153	146 / 146 / 153	148 / 148 / 152	149 / 149 / 151
140,000	8,000	146 / 146 / 148	146 / 146 / 148	148 / 148 / 148	149 / 149 / 149	150 / 150 / 150
	6,000	145 / 145 / 149	145 / 145 / 149	146 / 146 / 148	148 / 148 / 148	149 / 149 / 149
	4,000	144 / 144 / 149	144 / 144 / 149	145 / 145 / 149	147 / 147 / 148	148 / 148 / 148
	2,000	143 / 144 / 150	143 / 144 / 150	144 / 144 / 149	146 / 146 / 149	147 / 147 / 148
	0	143 / 143 / 150	143 / 143 / 150	143 / 143 / 150	145 / 145 / 149	146 / 146 / 148

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

TAKEOFF SPEEDS

DRY RUNWAY KIAS

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

V₁ / V_R / V₂
TO2 / 1

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
135,000	8,000	143 / 143 / 146	143 / 143 / 146	145 / 145 / 145	146 / 146 / 146	147 / 147 / 147
	6,000	142 / 142 / 147	142 / 142 / 147	143 / 143 / 146	145 / 145 / 145	146 / 146 / 146
	4,000	141 / 141 / 147	141 / 141 / 147	142 / 142 / 147	144 / 144 / 146	145 / 145 / 145
	2,000	140 / 141 / 148	140 / 141 / 148	141 / 141 / 147	143 / 143 / 147	144 / 144 / 146
	0	140 / 140 / 148	140 / 140 / 148	140 / 140 / 148	142 / 142 / 147	143 / 143 / 146
130,000	8,000	140 / 140 / 143	140 / 140 / 143	142 / 142 / 142	143 / 143 / 143	144 / 144 / 144
	6,000	139 / 139 / 144	139 / 139 / 144	140 / 140 / 143	142 / 142 / 142	143 / 143 / 143
	4,000	138 / 138 / 144	138 / 138 / 144	139 / 139 / 144	141 / 141 / 143	142 / 142 / 142
	2,000	137 / 138 / 145	137 / 138 / 145	138 / 138 / 144	140 / 140 / 144	141 / 141 / 143
	0	137 / 137 / 145	137 / 137 / 145	137 / 137 / 145	139 / 139 / 144	140 / 140 / 143
125,000	8,000	137 / 137 / 141	137 / 137 / 141	139 / 139 / 140	140 / 140 / 140	141 / 141 / 141
	6,000	136 / 136 / 142	136 / 136 / 142	137 / 137 / 141	139 / 139 / 140	140 / 140 / 140
	4,000	135 / 135 / 142	135 / 135 / 142	136 / 136 / 142	138 / 138 / 141	139 / 139 / 140
	2,000	134 / 135 / 143	134 / 135 / 143	135 / 135 / 142	137 / 137 / 142	138 / 138 / 141
	0	134 / 134 / 143	134 / 134 / 143	134 / 134 / 143	136 / 136 / 142	137 / 137 / 141
120,000	8,000	133 / 134 / 138	133 / 134 / 138	135 / 136 / 137	136 / 137 / 137	137 / 138 / 138
	6,000	132 / 133 / 139	132 / 133 / 139	133 / 134 / 138	135 / 136 / 137	136 / 137 / 137
	4,000	131 / 132 / 139	131 / 132 / 139	132 / 133 / 139	134 / 135 / 138	135 / 136 / 137
	2,000	130 / 132 / 140	130 / 132 / 140	131 / 132 / 139	133 / 134 / 139	134 / 135 / 138
	0	130 / 131 / 140	130 / 131 / 140	130 / 131 / 140	132 / 133 / 139	133 / 134 / 138
115,000	8,000	130 / 131 / 136	130 / 131 / 136	132 / 133 / 135	133 / 134 / 135	134 / 135 / 135
	6,000	129 / 130 / 137	129 / 130 / 137	130 / 131 / 136	132 / 133 / 135	133 / 134 / 135
	4,000	128 / 129 / 137	128 / 129 / 137	129 / 130 / 137	131 / 132 / 136	132 / 133 / 135
	2,000	127 / 129 / 138	127 / 129 / 138	128 / 129 / 137	130 / 131 / 137	131 / 132 / 136
	0	127 / 128 / 138	127 / 128 / 138	127 / 128 / 138	129 / 130 / 137	130 / 131 / 136
110,000	8,000	127 / 127 / 133	127 / 127 / 133	129 / 129 / 132	130 / 130 / 132	131 / 131 / 131
	6,000	126 / 126 / 134	126 / 126 / 134	127 / 127 / 133	129 / 129 / 132	130 / 130 / 132
	4,000	125 / 125 / 134	125 / 125 / 134	126 / 126 / 134	128 / 128 / 133	129 / 129 / 132
	2,000	124 / 125 / 135	124 / 125 / 135	125 / 125 / 134	127 / 127 / 134	128 / 128 / 133
	0	124 / 124 / 135	124 / 124 / 135	124 / 124 / 135	126 / 126 / 134	127 / 127 / 133
105,000	8,000	124 / 124 / 131	124 / 124 / 131	126 / 126 / 130	127 / 127 / 130	128 / 128 / 129
	6,000	123 / 123 / 132	123 / 123 / 132	124 / 124 / 131	126 / 126 / 130	127 / 127 / 130
	4,000	122 / 122 / 132	122 / 122 / 132	123 / 123 / 132	125 / 125 / 131	126 / 126 / 130
	2,000	121 / 122 / 133	121 / 122 / 133	122 / 122 / 132	124 / 124 / 132	125 / 125 / 131
	0	121 / 121 / 133	121 / 121 / 133	121 / 121 / 133	123 / 123 / 132	124 / 124 / 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
175,000	8,000	147 / 159 / 159	145 / 159 / 159	143 / 161 / 161	142 / 162 / 162	140 / 163 / 163
	6,000	153 / 158 / 158	150 / 158 / 158	148 / 159 / 159	147 / 161 / 161	145 / 162 / 162
	4,000	156 / 157 / 158	156 / 157 / 158	154 / 158 / 158	152 / 160 / 160	150 / 161 / 161
	2,000	155 / 157 / 159	155 / 157 / 159	156 / 157 / 158	158 / 159 / 159	156 / 160 / 160
	0	155 / 156 / 159	155 / 156 / 159	155 / 156 / 159	157 / 158 / 158	158 / 159 / 159
170,000	8,000	149 / 156 / 156	147 / 156 / 156	145 / 158 / 158	144 / 159 / 159	142 / 160 / 160
	6,000	155 / 155 / 156	152 / 155 / 156	150 / 156 / 156	149 / 158 / 158	147 / 159 / 159
	4,000	154 / 154 / 156	154 / 154 / 156	155 / 155 / 156	154 / 157 / 157	152 / 158 / 158
	2,000	153 / 154 / 157	153 / 154 / 157	154 / 154 / 156	156 / 156 / 156	157 / 157 / 157
	0	153 / 153 / 157	153 / 153 / 157	153 / 153 / 157	155 / 155 / 156	156 / 156 / 156
165,000	8,000	152 / 154 / 154	150 / 154 / 154	148 / 156 / 156	146 / 157 / 157	144 / 158 / 158
	6,000	153 / 153 / 154	153 / 153 / 154	153 / 154 / 154	151 / 156 / 156	150 / 157 / 157
	4,000	152 / 152 / 154	152 / 152 / 154	153 / 153 / 154	155 / 155 / 155	155 / 156 / 156
	2,000	151 / 152 / 155	151 / 152 / 155	152 / 152 / 154	154 / 154 / 154	155 / 155 / 155
	0	151 / 151 / 155	151 / 151 / 155	151 / 151 / 155	153 / 153 / 154	154 / 154 / 154
160,000	8,000	151 / 151 / 151	151 / 151 / 151	150 / 153 / 153	148 / 154 / 154	146 / 155 / 155
	6,000	150 / 150 / 152	150 / 150 / 152	151 / 151 / 151	153 / 153 / 153	152 / 154 / 154
	4,000	149 / 149 / 152	149 / 149 / 152	150 / 150 / 152	152 / 152 / 152	153 / 153 / 153
	2,000	148 / 149 / 153	148 / 149 / 153	149 / 149 / 152	151 / 151 / 152	152 / 152 / 152
	0	148 / 148 / 153	148 / 148 / 153	148 / 148 / 153	150 / 150 / 152	151 / 151 / 151
155,000	8,000	148 / 149 / 149	148 / 149 / 149	150 / 151 / 151	151 / 152 / 152	149 / 153 / 153
	6,000	147 / 148 / 150	147 / 148 / 150	148 / 149 / 149	150 / 151 / 151	151 / 152 / 152
	4,000	146 / 147 / 150	146 / 147 / 150	147 / 148 / 150	149 / 150 / 150	150 / 151 / 151
	2,000	145 / 147 / 151	145 / 147 / 151	146 / 147 / 150	148 / 149 / 150	149 / 150 / 150
	0	145 / 146 / 151	145 / 146 / 151	145 / 146 / 151	147 / 148 / 150	148 / 149 / 149
150,000	8,000	145 / 146 / 147	145 / 146 / 147	147 / 148 / 148	148 / 149 / 149	149 / 150 / 150
	6,000	144 / 145 / 148	144 / 145 / 148	145 / 146 / 147	147 / 148 / 148	148 / 149 / 149
	4,000	143 / 144 / 148	143 / 144 / 148	144 / 145 / 148	146 / 147 / 147	147 / 148 / 148
	2,000	142 / 144 / 149	142 / 144 / 149	143 / 144 / 148	145 / 146 / 148	146 / 147 / 147
	0	142 / 143 / 149	142 / 143 / 149	142 / 143 / 149	144 / 145 / 148	145 / 146 / 147
145,000	8,000	143 / 144 / 145	143 / 144 / 145	145 / 146 / 146	146 / 147 / 147	147 / 148 / 148
	6,000	142 / 143 / 146	142 / 143 / 146	143 / 144 / 145	145 / 146 / 146	146 / 147 / 147
	4,000	141 / 142 / 146	141 / 142 / 146	142 / 143 / 146	144 / 145 / 145	145 / 146 / 146
	2,000	140 / 142 / 147	140 / 142 / 147	141 / 142 / 146	143 / 144 / 146	144 / 145 / 145
	0	140 / 141 / 147	140 / 141 / 147	140 / 141 / 147	142 / 143 / 146	143 / 144 / 145
140,000	8,000	140 / 141 / 142	140 / 141 / 142	142 / 143 / 143	143 / 144 / 144	144 / 145 / 145
	6,000	139 / 140 / 143	139 / 140 / 143	140 / 141 / 142	142 / 143 / 143	143 / 144 / 144
	4,000	138 / 139 / 143	138 / 139 / 143	139 / 140 / 143	141 / 142 / 142	142 / 143 / 143
	2,000	137 / 139 / 144	137 / 139 / 144	138 / 139 / 143	140 / 141 / 143	141 / 142 / 142
	0	137 / 138 / 144	137 / 138 / 144	137 / 138 / 144	139 / 140 / 143	140 / 141 / 142

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
135,000	8,000	137 / 138 / 140	137 / 138 / 140	139 / 140 / 140	140 / 141 / 141	141 / 142 / 142
	6,000	136 / 137 / 141	136 / 137 / 141	137 / 138 / 140	139 / 140 / 140	140 / 141 / 141
	4,000	135 / 136 / 141	135 / 136 / 141	136 / 137 / 141	138 / 139 / 140	139 / 140 / 140
	2,000	134 / 136 / 142	134 / 136 / 142	135 / 136 / 141	137 / 138 / 141	138 / 139 / 140
	0	134 / 135 / 142	134 / 135 / 142	134 / 135 / 142	136 / 137 / 141	137 / 138 / 140
130,000	8,000	134 / 135 / 138	134 / 135 / 138	136 / 137 / 137	137 / 138 / 138	138 / 139 / 139
	6,000	133 / 134 / 139	133 / 134 / 139	134 / 135 / 138	136 / 137 / 137	137 / 138 / 138
	4,000	132 / 133 / 139	132 / 133 / 139	133 / 134 / 139	135 / 136 / 138	136 / 137 / 137
	2,000	131 / 133 / 140	131 / 133 / 140	132 / 133 / 139	134 / 135 / 139	135 / 136 / 138
	0	131 / 132 / 140	131 / 132 / 140	131 / 132 / 140	133 / 134 / 139	134 / 135 / 138
125,000	8,000	131 / 132 / 136	131 / 132 / 136	133 / 134 / 135	134 / 135 / 135	135 / 136 / 136
	6,000	130 / 131 / 137	130 / 131 / 137	131 / 132 / 136	133 / 134 / 135	134 / 135 / 135
	4,000	129 / 130 / 137	129 / 130 / 137	130 / 131 / 137	132 / 133 / 136	133 / 134 / 135
	2,000	128 / 130 / 138	128 / 130 / 138	129 / 130 / 137	131 / 132 / 137	132 / 133 / 136
	0	128 / 129 / 138	128 / 129 / 138	128 / 129 / 138	130 / 131 / 137	131 / 132 / 136
120,000	8,000	128 / 129 / 133	128 / 129 / 133	130 / 131 / 132	131 / 132 / 132	132 / 133 / 133
	6,000	127 / 128 / 134	127 / 128 / 134	128 / 129 / 133	130 / 131 / 132	131 / 132 / 132
	4,000	126 / 127 / 134	126 / 127 / 134	127 / 128 / 134	129 / 130 / 133	130 / 131 / 132
	2,000	125 / 127 / 135	125 / 127 / 135	126 / 127 / 134	128 / 129 / 134	129 / 130 / 133
	0	125 / 126 / 135	125 / 126 / 135	125 / 126 / 135	127 / 128 / 134	128 / 129 / 133
115,000	8,000	125 / 126 / 131	125 / 126 / 131	127 / 128 / 130	128 / 129 / 130	129 / 130 / 130
	6,000	124 / 125 / 132	124 / 125 / 132	125 / 126 / 131	127 / 128 / 130	128 / 129 / 130
	4,000	123 / 124 / 132	123 / 124 / 132	124 / 125 / 132	126 / 127 / 131	127 / 128 / 130
	2,000	122 / 124 / 133	122 / 124 / 133	123 / 124 / 132	125 / 126 / 132	126 / 127 / 131
	0	122 / 123 / 133	122 / 123 / 133	122 / 123 / 133	124 / 125 / 132	125 / 126 / 131
110,000	8,000	122 / 122 / 128	122 / 122 / 128	124 / 124 / 127	125 / 125 / 127	126 / 126 / 126
	6,000	121 / 121 / 129	121 / 121 / 129	122 / 122 / 128	124 / 124 / 127	125 / 125 / 127
	4,000	120 / 120 / 129	120 / 120 / 129	121 / 121 / 129	123 / 123 / 128	124 / 124 / 127
	2,000	119 / 120 / 130	119 / 120 / 130	120 / 120 / 129	122 / 122 / 129	123 / 123 / 128
	0	119 / 119 / 130	119 / 119 / 130	119 / 119 / 130	121 / 121 / 129	122 / 122 / 128
105,000	8,000	119 / 119 / 126	119 / 119 / 126	121 / 121 / 125	122 / 122 / 125	123 / 123 / 124
	6,000	118 / 118 / 127	118 / 118 / 127	119 / 119 / 126	121 / 121 / 125	122 / 122 / 125
	4,000	117 / 117 / 127	117 / 117 / 127	118 / 118 / 127	120 / 120 / 126	121 / 121 / 125
	2,000	116 / 117 / 128	116 / 117 / 128	117 / 117 / 127	119 / 119 / 127	120 / 120 / 126
	0	116 / 116 / 128	116 / 116 / 128	116 / 116 / 128	118 / 118 / 127	119 / 119 / 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
TO2 / 10

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
175,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
170,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
165,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
160,000	8,000	149 / 149 / 149	149 / 149 / 149	150 / 151 / 151	148 / 152 / 152	146 / 153 / 153
	6,000	148 / 148 / 149	148 / 148 / 149	149 / 149 / 149	151 / 151 / 151	152 / 152 / 152
	4,000	147 / 147 / 149	147 / 147 / 149	148 / 148 / 149	150 / 150 / 150	151 / 151 / 151
	2,000	146 / 147 / 150	146 / 147 / 150	147 / 147 / 149	149 / 149 / 149	150 / 150 / 150
	0	146 / 146 / 150	146 / 146 / 150	146 / 146 / 150	148 / 148 / 149	149 / 149 / 149
155,000	8,000	147 / 147 / 147	147 / 147 / 147	149 / 149 / 149	150 / 150 / 150	149 / 151 / 151
	6,000	146 / 146 / 148	146 / 146 / 148	147 / 147 / 147	149 / 149 / 149	150 / 150 / 150
	4,000	145 / 145 / 148	145 / 145 / 148	146 / 146 / 148	148 / 148 / 148	149 / 149 / 149
	2,000	144 / 145 / 149	144 / 145 / 149	145 / 145 / 148	147 / 147 / 148	148 / 148 / 148
	0	144 / 144 / 149	144 / 144 / 149	144 / 144 / 149	146 / 146 / 148	147 / 147 / 147
150,000	8,000	144 / 145 / 145	144 / 145 / 145	146 / 147 / 147	147 / 148 / 148	148 / 149 / 149
	6,000	143 / 144 / 146	143 / 144 / 146	144 / 145 / 145	146 / 147 / 147	147 / 148 / 148
	4,000	142 / 143 / 146	142 / 143 / 146	143 / 144 / 146	145 / 146 / 146	146 / 147 / 147
	2,000	141 / 143 / 147	141 / 143 / 147	142 / 143 / 146	144 / 145 / 146	145 / 146 / 146
	0	141 / 142 / 147	141 / 142 / 147	141 / 142 / 147	143 / 144 / 146	144 / 145 / 145
145,000	8,000	142 / 142 / 143	142 / 142 / 143	144 / 144 / 144	145 / 145 / 145	146 / 146 / 146
	6,000	141 / 141 / 144	141 / 141 / 144	142 / 142 / 143	144 / 144 / 144	145 / 145 / 145
	4,000	140 / 140 / 144	140 / 140 / 144	141 / 141 / 144	143 / 143 / 143	144 / 144 / 144
	2,000	139 / 140 / 145	139 / 140 / 145	140 / 140 / 144	142 / 142 / 144	143 / 143 / 143
	0	139 / 139 / 145	139 / 139 / 145	139 / 139 / 145	141 / 141 / 144	142 / 142 / 143
140,000	8,000	139 / 139 / 141	139 / 139 / 141	141 / 141 / 141	142 / 142 / 142	143 / 143 / 143
	6,000	138 / 138 / 142	138 / 138 / 142	139 / 139 / 141	141 / 141 / 141	142 / 142 / 142
	4,000	137 / 137 / 142	137 / 137 / 142	138 / 138 / 142	140 / 140 / 141	141 / 141 / 141
	2,000	136 / 137 / 143	136 / 137 / 143	137 / 137 / 142	139 / 139 / 142	140 / 140 / 141
	0	136 / 136 / 143	136 / 136 / 143	136 / 136 / 143	138 / 138 / 142	139 / 139 / 141

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

TAKEOFF SPEEDS

DRY RUNWAY KIAS

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

**$V_1 / V_R / V_2$
TO2 / 10**

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
135,000	8,000	136 / 136 / 139	136 / 136 / 139	138 / 138 / 138	139 / 139 / 139	140 / 140 / 140
	6,000	135 / 135 / 140	135 / 135 / 140	136 / 136 / 139	138 / 138 / 138	139 / 139 / 139
	4,000	134 / 134 / 140	134 / 134 / 140	135 / 135 / 140	137 / 137 / 139	138 / 138 / 138
	2,000	133 / 134 / 141	133 / 134 / 141	134 / 134 / 140	136 / 136 / 140	137 / 137 / 139
	0	133 / 133 / 141	133 / 133 / 141	133 / 133 / 141	135 / 135 / 140	136 / 136 / 139
130,000	8,000	133 / 133 / 136	133 / 133 / 136	135 / 135 / 135	136 / 136 / 136	137 / 137 / 137
	6,000	132 / 132 / 137	132 / 132 / 137	133 / 133 / 136	135 / 135 / 135	136 / 136 / 136
	4,000	131 / 131 / 137	131 / 131 / 137	132 / 132 / 137	134 / 134 / 136	135 / 135 / 135
	2,000	130 / 131 / 138	130 / 131 / 138	131 / 131 / 137	133 / 133 / 137	134 / 134 / 136
	0	130 / 130 / 138	130 / 130 / 138	130 / 130 / 138	132 / 132 / 137	133 / 133 / 136
125,000	8,000	130 / 130 / 134	130 / 130 / 134	132 / 132 / 133	133 / 133 / 133	134 / 134 / 134
	6,000	129 / 129 / 135	129 / 129 / 135	130 / 130 / 134	132 / 132 / 133	133 / 133 / 133
	4,000	128 / 128 / 135	128 / 128 / 135	129 / 129 / 135	131 / 131 / 134	132 / 132 / 133
	2,000	127 / 128 / 136	127 / 128 / 136	128 / 128 / 135	130 / 130 / 135	131 / 131 / 134
	0	127 / 127 / 136	127 / 127 / 136	127 / 127 / 136	129 / 129 / 135	130 / 130 / 134
120,000	8,000	127 / 127 / 131	127 / 127 / 131	129 / 129 / 130	130 / 130 / 130	131 / 131 / 131
	6,000	126 / 126 / 132	126 / 126 / 132	127 / 127 / 131	129 / 129 / 130	130 / 130 / 130
	4,000	125 / 125 / 132	125 / 125 / 132	126 / 126 / 132	128 / 128 / 131	129 / 129 / 130
	2,000	124 / 125 / 133	124 / 125 / 133	125 / 125 / 132	127 / 127 / 132	128 / 128 / 131
	0	124 / 124 / 133	124 / 124 / 133	124 / 124 / 133	126 / 126 / 132	127 / 127 / 131
115,000	8,000	124 / 124 / 129	124 / 124 / 129	126 / 126 / 128	127 / 127 / 128	128 / 128 / 128
	6,000	123 / 123 / 130	123 / 123 / 130	124 / 124 / 129	126 / 126 / 128	127 / 127 / 128
	4,000	122 / 122 / 130	122 / 122 / 130	123 / 123 / 130	125 / 125 / 129	126 / 126 / 128
	2,000	121 / 122 / 131	121 / 122 / 131	122 / 122 / 130	124 / 124 / 130	125 / 125 / 129
	0	121 / 121 / 131	121 / 121 / 131	121 / 121 / 131	123 / 123 / 130	124 / 124 / 129
110,000	8,000	121 / 121 / 126	121 / 121 / 126	123 / 123 / 125	124 / 124 / 125	125 / 125 / 125
	6,000	120 / 120 / 127	120 / 120 / 127	121 / 121 / 126	123 / 123 / 125	124 / 124 / 125
	4,000	119 / 119 / 127	119 / 119 / 127	120 / 120 / 127	122 / 122 / 126	123 / 123 / 125
	2,000	118 / 119 / 128	118 / 119 / 128	119 / 119 / 127	121 / 121 / 127	122 / 122 / 126
	0	118 / 118 / 128	118 / 118 / 128	118 / 118 / 128	120 / 120 / 127	121 / 121 / 126
105,000	8,000	118 / 118 / 124	118 / 118 / 124	120 / 120 / 123	121 / 121 / 123	122 / 122 / 122
	6,000	117 / 117 / 125	117 / 117 / 125	118 / 118 / 124	120 / 120 / 123	121 / 121 / 123
	4,000	116 / 116 / 125	116 / 116 / 125	117 / 117 / 125	119 / 119 / 124	120 / 120 / 123
	2,000	115 / 116 / 126	115 / 116 / 126	116 / 116 / 125	118 / 118 / 125	119 / 119 / 124
	0	115 / 115 / 126	115 / 115 / 126	115 / 115 / 126	117 / 117 / 125	118 / 118 / 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.

 $V_1 / V_R / V_2$

TO2 / 15

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
175,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
170,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
165,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
160,000	8,000	146 / 146 / 146	146 / 146 / 146	148 / 148 / 148	148 / 149 / 149	146 / 150 / 150
	6,000	145 / 145 / 147	145 / 145 / 147	146 / 146 / 146	148 / 148 / 148	149 / 149 / 149
	4,000	144 / 144 / 147	144 / 144 / 147	145 / 145 / 147	147 / 147 / 147	148 / 148 / 148
	2,000	143 / 144 / 148	143 / 144 / 148	144 / 144 / 147	146 / 146 / 147	147 / 147 / 147
	0	143 / 143 / 148	143 / 143 / 148	143 / 143 / 148	145 / 145 / 147	146 / 146 / 146
155,000	8,000	144 / 144 / 144	144 / 144 / 144	146 / 146 / 146	147 / 147 / 147	148 / 148 / 148
	6,000	143 / 143 / 145	143 / 143 / 145	144 / 144 / 144	146 / 146 / 146	147 / 147 / 147
	4,000	142 / 142 / 145	142 / 142 / 145	143 / 143 / 145	145 / 145 / 145	146 / 146 / 146
	2,000	141 / 142 / 146	141 / 142 / 146	142 / 142 / 145	144 / 144 / 145	145 / 145 / 145
	0	141 / 141 / 146	141 / 141 / 146	141 / 141 / 146	143 / 143 / 145	144 / 144 / 144
150,000	8,000	141 / 141 / 142	141 / 141 / 142	143 / 143 / 143	144 / 144 / 144	145 / 145 / 145
	6,000	140 / 140 / 143	140 / 140 / 143	141 / 141 / 142	143 / 143 / 143	144 / 144 / 144
	4,000	139 / 139 / 143	139 / 139 / 143	140 / 140 / 143	142 / 142 / 142	143 / 143 / 143
	2,000	138 / 139 / 144	138 / 139 / 144	139 / 139 / 143	141 / 141 / 143	142 / 142 / 142
	0	138 / 138 / 144	138 / 138 / 144	138 / 138 / 144	140 / 140 / 143	141 / 141 / 142
145,000	8,000	139 / 139 / 140	139 / 139 / 140	141 / 141 / 141	142 / 142 / 142	143 / 143 / 143
	6,000	138 / 138 / 141	138 / 138 / 141	139 / 139 / 140	141 / 141 / 141	142 / 142 / 142
	4,000	137 / 137 / 141	137 / 137 / 141	138 / 138 / 141	140 / 140 / 140	141 / 141 / 141
	2,000	136 / 137 / 142	136 / 137 / 142	137 / 137 / 141	139 / 139 / 141	140 / 140 / 140
	0	136 / 136 / 142	136 / 136 / 142	136 / 136 / 142	138 / 138 / 141	139 / 139 / 140
140,000	8,000	136 / 136 / 138	136 / 136 / 138	138 / 138 / 138	139 / 139 / 139	140 / 140 / 140
	6,000	135 / 135 / 139	135 / 135 / 139	136 / 136 / 138	138 / 138 / 138	139 / 139 / 139
	4,000	134 / 134 / 139	134 / 134 / 139	135 / 135 / 139	137 / 137 / 138	138 / 138 / 138
	2,000	133 / 134 / 140	133 / 134 / 140	134 / 134 / 139	136 / 136 / 139	137 / 137 / 138
	0	133 / 133 / 140	133 / 133 / 140	133 / 133 / 140	135 / 135 / 139	136 / 136 / 138

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

TAKEOFF SPEEDS

DRY RUNWAY KIAS

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

V₁ / V_R / V₂
TO2 / 15

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

 $V_1 / V_R / V_2$

TO2 / 25

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
175,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
170,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
165,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
160,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
155,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
150,000	8,000	139 / 139 / 140	139 / 139 / 140	141 / 141 / 141	142 / 142 / 142	143 / 143 / 143
	6,000	138 / 138 / 141	138 / 138 / 141	139 / 139 / 140	141 / 141 / 141	142 / 142 / 142
	4,000	137 / 137 / 141	137 / 137 / 141	138 / 138 / 141	140 / 140 / 140	141 / 141 / 141
	2,000	136 / 137 / 142	136 / 137 / 142	137 / 137 / 141	139 / 139 / 141	140 / 140 / 140
	0	136 / 136 / 142	136 / 136 / 142	136 / 136 / 142	138 / 138 / 141	139 / 139 / 140
145,000	8,000	136 / 137 / 138	136 / 137 / 138	138 / 139 / 139	139 / 140 / 140	140 / 141 / 141
	6,000	135 / 136 / 139	135 / 136 / 139	136 / 137 / 138	138 / 139 / 139	139 / 140 / 140
	4,000	134 / 135 / 139	134 / 135 / 139	135 / 136 / 139	137 / 138 / 138	138 / 139 / 139
	2,000	133 / 135 / 140	133 / 135 / 140	134 / 135 / 139	136 / 137 / 139	137 / 138 / 138
	0	133 / 134 / 140	133 / 134 / 140	133 / 134 / 140	135 / 136 / 139	136 / 137 / 138
140,000	8,000	133 / 134 / 136	133 / 134 / 136	135 / 136 / 136	136 / 137 / 137	137 / 138 / 138
	6,000	132 / 133 / 137	132 / 133 / 137	133 / 134 / 136	135 / 136 / 136	136 / 137 / 137
	4,000	131 / 132 / 137	131 / 132 / 137	132 / 133 / 137	134 / 135 / 136	135 / 136 / 136
	2,000	130 / 132 / 138	130 / 132 / 138	131 / 132 / 137	133 / 134 / 137	134 / 135 / 136
	0	130 / 131 / 138	130 / 131 / 138	130 / 131 / 138	132 / 133 / 137	133 / 134 / 136

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
135,000	8,000	131 / 131 / 134	131 / 131 / 134	133 / 133 / 133	134 / 134 / 134	135 / 135 / 135
	6,000	130 / 130 / 135	130 / 130 / 135	131 / 131 / 134	133 / 133 / 133	134 / 134 / 134
	4,000	129 / 129 / 135	129 / 129 / 135	130 / 130 / 135	132 / 132 / 134	133 / 133 / 133
	2,000	128 / 129 / 136	128 / 129 / 136	129 / 129 / 135	131 / 131 / 135	132 / 132 / 134
	0	128 / 128 / 136	128 / 128 / 136	128 / 128 / 136	130 / 130 / 135	131 / 131 / 134
130,000	8,000	128 / 128 / 131	128 / 128 / 131	130 / 130 / 130	131 / 131 / 131	132 / 132 / 132
	6,000	127 / 127 / 132	127 / 127 / 132	128 / 128 / 131	130 / 130 / 130	131 / 131 / 131
	4,000	126 / 126 / 132	126 / 126 / 132	127 / 127 / 132	129 / 129 / 131	130 / 130 / 130
	2,000	125 / 126 / 133	125 / 126 / 133	126 / 126 / 132	128 / 128 / 132	129 / 129 / 131
	0	125 / 125 / 133	125 / 125 / 133	125 / 125 / 133	127 / 127 / 132	128 / 128 / 131
125,000	8,000	125 / 125 / 129	125 / 125 / 129	127 / 127 / 128	128 / 128 / 128	129 / 129 / 129
	6,000	124 / 124 / 130	124 / 124 / 130	125 / 125 / 129	127 / 127 / 128	128 / 128 / 128
	4,000	123 / 123 / 130	123 / 123 / 130	124 / 124 / 130	126 / 126 / 129	127 / 127 / 128
	2,000	122 / 123 / 131	122 / 123 / 131	123 / 123 / 130	125 / 125 / 130	126 / 126 / 129
	0	122 / 122 / 131	122 / 122 / 131	122 / 122 / 131	124 / 124 / 130	125 / 125 / 129
120,000	8,000	122 / 122 / 127	122 / 122 / 127	124 / 124 / 126	125 / 125 / 126	126 / 126 / 126
	6,000	121 / 121 / 128	121 / 121 / 128	122 / 122 / 127	124 / 124 / 126	125 / 125 / 126
	4,000	120 / 120 / 128	120 / 120 / 128	121 / 121 / 128	123 / 123 / 127	124 / 124 / 126
	2,000	119 / 120 / 129	119 / 120 / 129	120 / 120 / 128	122 / 122 / 128	123 / 123 / 127
	0	119 / 119 / 129	119 / 119 / 129	119 / 119 / 129	121 / 121 / 128	122 / 122 / 127
115,000	8,000	119 / 119 / 125	119 / 119 / 125	121 / 121 / 124	122 / 122 / 124	123 / 123 / 123
	6,000	118 / 118 / 126	118 / 118 / 126	119 / 119 / 125	121 / 121 / 124	122 / 122 / 124
	4,000	117 / 117 / 126	117 / 117 / 126	118 / 118 / 126	120 / 120 / 125	121 / 121 / 124
	2,000	116 / 117 / 127	116 / 117 / 127	117 / 117 / 126	119 / 119 / 126	120 / 120 / 125
	0	116 / 116 / 127	116 / 116 / 127	116 / 116 / 127	118 / 118 / 126	119 / 119 / 125
110,000	8,000	116 / 116 / 122	116 / 116 / 122	118 / 118 / 121	119 / 119 / 121	120 / 120 / 120
	6,000	115 / 115 / 123	115 / 115 / 123	116 / 116 / 122	118 / 118 / 121	119 / 119 / 121
	4,000	114 / 114 / 123	114 / 114 / 123	115 / 115 / 123	117 / 117 / 122	118 / 118 / 121
	2,000	113 / 114 / 124	113 / 114 / 124	114 / 114 / 123	116 / 116 / 123	117 / 117 / 122
	0	113 / 113 / 124	113 / 113 / 124	113 / 113 / 124	115 / 115 / 123	116 / 116 / 122
105,000	8,000	113 / 113 / 120	113 / 113 / 120	115 / 115 / 119	116 / 116 / 119	117 / 117 / 118
	6,000	112 / 112 / 121	112 / 112 / 121	113 / 113 / 120	115 / 115 / 119	116 / 116 / 119
	4,000	111 / 111 / 121	111 / 111 / 121	112 / 112 / 121	114 / 114 / 120	115 / 115 / 119
	2,000	110 / 111 / 122	110 / 111 / 122	111 / 111 / 121	113 / 113 / 121	114 / 114 / 120
	0	110 / 110 / 122	110 / 110 / 122	110 / 110 / 122	112 / 112 / 121	113 / 113 / 120

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

TAKEOFF SPEEDS

DRY RUNWAY KIAS

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

V₁ / V_R / V₂
TO1 / 1

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

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
135,000	8,000	142 / 143 / 147	142 / 143 / 147	143 / 144 / 146	144 / 145 / 145	145 / 146 / 146
	6,000	140 / 141 / 148	140 / 141 / 148	142 / 143 / 147	143 / 144 / 146	144 / 145 / 145
	4,000	139 / 140 / 148	139 / 140 / 148	141 / 141 / 148	142 / 143 / 147	143 / 144 / 146
	2,000	139 / 140 / 149	139 / 140 / 149	139 / 140 / 148	141 / 142 / 147	142 / 143 / 146
	0	138 / 139 / 149	138 / 139 / 149	138 / 139 / 149	140 / 141 / 148	141 / 142 / 147
130,000	8,000	139 / 140 / 144	139 / 140 / 144	140 / 141 / 143	141 / 142 / 142	142 / 143 / 143
	6,000	137 / 138 / 145	137 / 138 / 145	139 / 140 / 144	140 / 141 / 143	141 / 142 / 142
	4,000	136 / 137 / 145	136 / 137 / 145	138 / 138 / 145	139 / 140 / 144	140 / 141 / 143
	2,000	136 / 137 / 146	136 / 137 / 146	136 / 137 / 145	138 / 139 / 144	139 / 140 / 143
	0	135 / 136 / 146	135 / 136 / 146	135 / 136 / 146	137 / 138 / 145	138 / 139 / 144
125,000	8,000	136 / 137 / 142	136 / 137 / 142	137 / 138 / 141	138 / 139 / 140	139 / 140 / 140
	6,000	134 / 135 / 143	134 / 135 / 143	136 / 137 / 142	137 / 138 / 141	138 / 139 / 140
	4,000	133 / 134 / 143	133 / 134 / 143	135 / 135 / 143	136 / 137 / 142	137 / 138 / 141
	2,000	133 / 134 / 144	133 / 134 / 144	133 / 134 / 143	135 / 136 / 142	136 / 137 / 141
	0	132 / 133 / 144	132 / 133 / 144	132 / 133 / 144	134 / 135 / 143	135 / 136 / 142
120,000	8,000	133 / 134 / 139	133 / 134 / 139	134 / 135 / 138	135 / 136 / 137	136 / 137 / 137
	6,000	131 / 132 / 140	131 / 132 / 140	133 / 134 / 139	134 / 135 / 138	135 / 136 / 137
	4,000	130 / 131 / 140	130 / 131 / 140	132 / 132 / 140	133 / 134 / 139	134 / 135 / 138
	2,000	130 / 131 / 141	130 / 131 / 141	130 / 131 / 140	132 / 133 / 139	133 / 134 / 138
	0	129 / 130 / 141	129 / 130 / 141	129 / 130 / 141	131 / 132 / 140	132 / 133 / 139
115,000	8,000	130 / 131 / 137	130 / 131 / 137	131 / 132 / 136	132 / 133 / 135	133 / 134 / 135
	6,000	128 / 129 / 138	128 / 129 / 138	130 / 131 / 137	131 / 132 / 136	132 / 133 / 135
	4,000	127 / 128 / 138	127 / 128 / 138	129 / 129 / 138	130 / 131 / 137	131 / 132 / 136
	2,000	127 / 128 / 139	127 / 128 / 139	127 / 128 / 138	129 / 130 / 137	130 / 131 / 136
	0	126 / 127 / 139	126 / 127 / 139	126 / 127 / 139	128 / 129 / 138	129 / 130 / 137
110,000	8,000	126 / 127 / 134	126 / 127 / 134	127 / 128 / 133	128 / 129 / 132	129 / 130 / 132
	6,000	124 / 125 / 135	124 / 125 / 135	126 / 127 / 134	127 / 128 / 133	128 / 129 / 132
	4,000	123 / 124 / 135	123 / 124 / 135	125 / 125 / 135	126 / 127 / 134	127 / 128 / 133
	2,000	123 / 124 / 136	123 / 124 / 136	123 / 124 / 135	125 / 126 / 134	126 / 127 / 133
	0	122 / 123 / 136	122 / 123 / 136	122 / 123 / 136	124 / 125 / 135	125 / 126 / 134
105,000	8,000	123 / 124 / 131	123 / 124 / 131	124 / 125 / 130	125 / 126 / 129	126 / 127 / 129
	6,000	121 / 122 / 132	121 / 122 / 132	123 / 124 / 131	124 / 125 / 130	125 / 126 / 129
	4,000	120 / 121 / 132	120 / 121 / 132	122 / 122 / 132	123 / 124 / 131	124 / 125 / 130
	2,000	120 / 121 / 133	120 / 121 / 133	120 / 121 / 132	122 / 123 / 131	123 / 124 / 130
	0	119 / 120 / 133	119 / 120 / 133	119 / 120 / 133	121 / 122 / 132	122 / 123 / 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.

 $V_1 / V_R / V_2$

TO1 / 5

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
175,000	8,000	147 / 159 / 159	145 / 159 / 159	143 / 160 / 160	141 / 161 / 161	140 / 162 / 162
	6,000	152 / 157 / 158	150 / 157 / 158	148 / 159 / 159	146 / 160 / 160	145 / 161 / 161
	4,000	154 / 156 / 158	154 / 156 / 158	153 / 157 / 158	152 / 159 / 159	150 / 160 / 160
	2,000	154 / 156 / 159	154 / 156 / 159	154 / 156 / 158	156 / 158 / 158	155 / 159 / 159
	0	153 / 155 / 159	153 / 155 / 159	153 / 155 / 159	155 / 157 / 158	156 / 158 / 158
170,000	8,000	149 / 156 / 156	147 / 156 / 156	145 / 157 / 157	143 / 158 / 158	142 / 159 / 159
	6,000	153 / 154 / 156	152 / 154 / 156	150 / 156 / 156	148 / 157 / 157	147 / 158 / 158
	4,000	152 / 153 / 156	152 / 153 / 156	154 / 154 / 156	154 / 156 / 156	152 / 157 / 157
	2,000	152 / 153 / 157	152 / 153 / 157	152 / 153 / 156	154 / 155 / 155	155 / 156 / 156
	0	151 / 152 / 157	151 / 152 / 157	151 / 152 / 157	153 / 154 / 156	154 / 155 / 155
165,000	8,000	152 / 154 / 154	149 / 154 / 154	148 / 155 / 155	146 / 156 / 156	144 / 157 / 157
	6,000	151 / 152 / 154	151 / 152 / 154	153 / 154 / 154	151 / 155 / 155	149 / 156 / 156
	4,000	150 / 151 / 154	150 / 151 / 154	152 / 152 / 154	153 / 154 / 154	154 / 155 / 155
	2,000	150 / 151 / 155	150 / 151 / 155	150 / 151 / 154	152 / 153 / 153	153 / 154 / 154
	0	149 / 150 / 155	149 / 150 / 155	149 / 150 / 155	151 / 152 / 154	152 / 153 / 153
160,000	8,000	150 / 151 / 151	150 / 151 / 151	150 / 152 / 152	148 / 153 / 153	146 / 154 / 154
	6,000	148 / 149 / 152	148 / 149 / 152	150 / 151 / 151	151 / 152 / 152	151 / 153 / 153
	4,000	147 / 148 / 152	147 / 148 / 152	149 / 149 / 152	150 / 151 / 151	151 / 152 / 152
	2,000	147 / 148 / 153	147 / 148 / 153	147 / 148 / 152	149 / 150 / 151	150 / 151 / 151
	0	146 / 147 / 153	146 / 147 / 153	146 / 147 / 153	148 / 149 / 152	149 / 150 / 151
155,000	8,000	148 / 149 / 149	148 / 149 / 149	149 / 150 / 150	150 / 151 / 151	149 / 152 / 152
	6,000	146 / 147 / 150	146 / 147 / 150	148 / 149 / 149	149 / 150 / 150	150 / 151 / 151
	4,000	145 / 146 / 150	145 / 146 / 150	147 / 147 / 150	148 / 149 / 149	149 / 150 / 150
	2,000	145 / 146 / 151	145 / 146 / 151	145 / 146 / 150	147 / 148 / 149	148 / 149 / 149
	0	144 / 145 / 151	144 / 145 / 151	144 / 145 / 151	146 / 147 / 150	147 / 148 / 149
150,000	8,000	145 / 146 / 147	145 / 146 / 147	146 / 147 / 147	147 / 148 / 148	148 / 149 / 149
	6,000	143 / 144 / 148	143 / 144 / 148	145 / 146 / 147	146 / 147 / 147	147 / 148 / 148
	4,000	142 / 143 / 148	142 / 143 / 148	144 / 144 / 148	145 / 146 / 147	146 / 147 / 147
	2,000	142 / 143 / 149	142 / 143 / 149	142 / 143 / 148	144 / 145 / 147	145 / 146 / 146
	0	141 / 142 / 149	141 / 142 / 149	141 / 142 / 149	143 / 144 / 148	144 / 145 / 147
145,000	8,000	143 / 144 / 145	143 / 144 / 145	144 / 145 / 145	145 / 146 / 146	146 / 147 / 147
	6,000	141 / 142 / 146	141 / 142 / 146	143 / 144 / 145	144 / 145 / 145	145 / 146 / 146
	4,000	140 / 141 / 146	140 / 141 / 146	142 / 142 / 146	143 / 144 / 145	144 / 145 / 145
	2,000	140 / 141 / 147	140 / 141 / 147	140 / 141 / 146	142 / 143 / 145	143 / 144 / 144
	0	139 / 140 / 147	139 / 140 / 147	139 / 140 / 147	141 / 142 / 146	142 / 143 / 145
140,000	8,000	140 / 141 / 143	140 / 141 / 143	141 / 142 / 142	142 / 143 / 143	143 / 144 / 144
	6,000	138 / 139 / 144	138 / 139 / 144	140 / 141 / 143	141 / 142 / 142	142 / 143 / 143
	4,000	137 / 138 / 144	137 / 138 / 144	139 / 139 / 144	140 / 141 / 143	141 / 142 / 142
	2,000	137 / 138 / 145	137 / 138 / 145	137 / 138 / 144	139 / 140 / 143	140 / 141 / 142
	0	136 / 137 / 145	136 / 137 / 145	136 / 137 / 145	138 / 139 / 144	139 / 140 / 143

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
135,000	8,000	137 / 138 / 141	137 / 138 / 141	138 / 139 / 140	139 / 140 / 140	140 / 141 / 141
	6,000	135 / 136 / 142	135 / 136 / 142	137 / 138 / 141	138 / 139 / 140	139 / 140 / 140
	4,000	134 / 135 / 142	134 / 135 / 142	136 / 136 / 142	137 / 138 / 141	138 / 139 / 140
	2,000	134 / 135 / 143	134 / 135 / 143	134 / 135 / 142	136 / 137 / 141	137 / 138 / 140
	0	133 / 134 / 143	133 / 134 / 143	133 / 134 / 143	135 / 136 / 142	136 / 137 / 141
130,000	8,000	134 / 135 / 138	134 / 135 / 138	135 / 136 / 137	136 / 137 / 137	137 / 138 / 138
	6,000	132 / 133 / 139	132 / 133 / 139	134 / 135 / 138	135 / 136 / 137	136 / 137 / 137
	4,000	131 / 132 / 139	131 / 132 / 139	133 / 133 / 139	134 / 135 / 138	135 / 136 / 137
	2,000	131 / 132 / 140	131 / 132 / 140	131 / 132 / 139	133 / 134 / 138	134 / 135 / 137
	0	130 / 131 / 140	130 / 131 / 140	130 / 131 / 140	132 / 133 / 139	133 / 134 / 138
125,000	8,000	131 / 132 / 136	131 / 132 / 136	132 / 133 / 135	133 / 134 / 134	134 / 135 / 135
	6,000	129 / 130 / 137	129 / 130 / 137	131 / 132 / 136	132 / 133 / 135	133 / 134 / 134
	4,000	128 / 129 / 137	128 / 129 / 137	130 / 130 / 137	131 / 132 / 136	132 / 133 / 135
	2,000	128 / 129 / 138	128 / 129 / 138	128 / 129 / 137	130 / 131 / 136	131 / 132 / 135
	0	127 / 128 / 138	127 / 128 / 138	127 / 128 / 138	129 / 130 / 137	130 / 131 / 136
120,000	8,000	128 / 129 / 134	128 / 129 / 134	129 / 130 / 133	130 / 131 / 132	131 / 132 / 132
	6,000	126 / 127 / 135	126 / 127 / 135	128 / 129 / 134	129 / 130 / 133	130 / 131 / 132
	4,000	125 / 126 / 135	125 / 126 / 135	127 / 127 / 135	128 / 129 / 134	129 / 130 / 133
	2,000	125 / 126 / 136	125 / 126 / 136	125 / 126 / 135	127 / 128 / 134	128 / 129 / 133
	0	124 / 125 / 136	124 / 125 / 136	124 / 125 / 136	126 / 127 / 135	127 / 128 / 134
115,000	8,000	125 / 126 / 132	125 / 126 / 132	126 / 127 / 131	127 / 128 / 130	128 / 129 / 130
	6,000	123 / 124 / 133	123 / 124 / 133	125 / 126 / 132	126 / 127 / 131	127 / 128 / 130
	4,000	122 / 123 / 133	122 / 123 / 133	124 / 124 / 133	125 / 126 / 132	126 / 127 / 131
	2,000	122 / 123 / 134	122 / 123 / 134	122 / 123 / 133	124 / 125 / 132	125 / 126 / 131
	0	121 / 122 / 134	121 / 122 / 134	121 / 122 / 134	123 / 124 / 133	124 / 125 / 132
110,000	8,000	121 / 122 / 129	121 / 122 / 129	122 / 123 / 128	123 / 124 / 127	124 / 125 / 127
	6,000	119 / 120 / 130	119 / 120 / 130	121 / 122 / 129	122 / 123 / 128	123 / 124 / 127
	4,000	118 / 119 / 130	118 / 119 / 130	120 / 120 / 130	121 / 122 / 129	122 / 123 / 128
	2,000	118 / 119 / 131	118 / 119 / 131	118 / 119 / 130	120 / 121 / 129	121 / 122 / 128
	0	117 / 118 / 131	117 / 118 / 131	117 / 118 / 131	119 / 120 / 130	120 / 121 / 129
105,000	8,000	118 / 119 / 127	118 / 119 / 127	119 / 120 / 126	120 / 121 / 125	121 / 122 / 125
	6,000	116 / 117 / 128	116 / 117 / 128	118 / 119 / 127	119 / 120 / 126	120 / 121 / 125
	4,000	115 / 116 / 128	115 / 116 / 128	117 / 117 / 128	118 / 119 / 127	119 / 120 / 126
	2,000	115 / 116 / 129	115 / 116 / 129	115 / 116 / 128	117 / 118 / 127	118 / 119 / 126
	0	114 / 115 / 129	114 / 115 / 129	114 / 115 / 129	116 / 117 / 128	117 / 118 / 127

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

TAKEOFF SPEEDS

DRY RUNWAY KIAS

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

$V_1 / V_R / V_2$
TO1 / 10

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
175,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
170,000	8,000	149 / 154 / 154	147 / 154 / 154	145 / 155 / 155	143 / 156 / 156	142 / 157 / 157
	6,000	152 / 152 / 154	152 / 152 / 154	150 / 154 / 154	148 / 155 / 155	147 / 156 / 156
	4,000	151 / 151 / 154	151 / 151 / 154	152 / 152 / 154	154 / 154 / 154	152 / 155 / 155
	2,000	151 / 151 / 155	151 / 151 / 155	151 / 151 / 154	153 / 153 / 153	154 / 154 / 154
	0	150 / 150 / 155	150 / 150 / 155	150 / 150 / 155	152 / 152 / 154	153 / 153 / 153
165,000	8,000	152 / 152 / 152	149 / 152 / 152	148 / 153 / 153	146 / 154 / 154	144 / 155 / 155
	6,000	150 / 150 / 152	150 / 150 / 152	152 / 152 / 152	151 / 153 / 153	149 / 154 / 154
	4,000	149 / 149 / 152	149 / 149 / 152	150 / 150 / 152	152 / 152 / 152	153 / 153 / 153
	2,000	149 / 149 / 153	149 / 149 / 153	149 / 149 / 152	151 / 151 / 151	152 / 152 / 152
	0	148 / 148 / 153	148 / 148 / 153	148 / 148 / 153	150 / 150 / 152	151 / 151 / 151
160,000	8,000	149 / 150 / 150	149 / 150 / 150	150 / 151 / 151	148 / 152 / 152	146 / 153 / 153
	6,000	147 / 148 / 150	147 / 148 / 150	149 / 150 / 150	150 / 151 / 151	151 / 152 / 152
	4,000	146 / 147 / 150	146 / 147 / 150	148 / 148 / 150	149 / 150 / 150	150 / 151 / 151
	2,000	146 / 147 / 151	146 / 147 / 151	146 / 147 / 150	148 / 149 / 149	149 / 150 / 150
	0	145 / 146 / 151	145 / 146 / 151	145 / 146 / 151	147 / 148 / 150	148 / 149 / 149
155,000	8,000	147 / 148 / 148	147 / 148 / 148	148 / 149 / 149	149 / 150 / 150	149 / 151 / 151
	6,000	145 / 146 / 148	145 / 146 / 148	147 / 148 / 148	148 / 149 / 149	149 / 150 / 150
	4,000	144 / 145 / 148	144 / 145 / 148	146 / 146 / 148	147 / 148 / 148	148 / 149 / 149
	2,000	144 / 145 / 149	144 / 145 / 149	144 / 145 / 148	146 / 147 / 147	147 / 148 / 148
	0	143 / 144 / 149	143 / 144 / 149	143 / 144 / 149	145 / 146 / 148	146 / 147 / 147
150,000	8,000	144 / 145 / 145	144 / 145 / 145	145 / 146 / 146	146 / 147 / 147	147 / 148 / 148
	6,000	142 / 143 / 146	142 / 143 / 146	144 / 145 / 145	145 / 146 / 146	146 / 147 / 147
	4,000	141 / 142 / 146	141 / 142 / 146	143 / 143 / 146	144 / 145 / 145	145 / 146 / 146
	2,000	141 / 142 / 147	141 / 142 / 147	141 / 142 / 146	143 / 144 / 145	144 / 145 / 145
	0	140 / 141 / 147	140 / 141 / 147	140 / 141 / 147	142 / 143 / 146	143 / 144 / 145
145,000	8,000	142 / 142 / 143	142 / 142 / 143	143 / 143 / 143	144 / 144 / 144	145 / 145 / 145
	6,000	140 / 140 / 144	140 / 140 / 144	142 / 142 / 143	143 / 143 / 143	144 / 144 / 144
	4,000	139 / 139 / 144	139 / 139 / 144	140 / 140 / 144	142 / 142 / 143	143 / 143 / 143
	2,000	139 / 139 / 145	139 / 139 / 145	139 / 139 / 144	141 / 141 / 143	142 / 142 / 142
	0	138 / 138 / 145	138 / 138 / 145	138 / 138 / 145	140 / 140 / 144	141 / 141 / 143
140,000	8,000	139 / 139 / 141	139 / 139 / 141	140 / 140 / 140	141 / 141 / 141	142 / 142 / 142
	6,000	137 / 137 / 142	137 / 137 / 142	139 / 139 / 141	140 / 140 / 140	141 / 141 / 141
	4,000	136 / 136 / 142	136 / 136 / 142	137 / 137 / 142	139 / 139 / 141	140 / 140 / 140
	2,000	136 / 136 / 143	136 / 136 / 143	136 / 136 / 142	138 / 138 / 141	139 / 139 / 140
	0	135 / 135 / 143	135 / 135 / 143	135 / 135 / 143	137 / 137 / 142	138 / 138 / 141

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

TAKEOFF SPEEDS

DRY RUNWAY KIAS

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

$V_1 / V_R / V_2$
TO1 / 10

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
135,000	8,000	136 / 137 / 139	136 / 137 / 139	137 / 138 / 138	138 / 139 / 139	139 / 140 / 140
	6,000	134 / 135 / 140	134 / 135 / 140	136 / 137 / 139	137 / 138 / 138	138 / 139 / 139
	4,000	133 / 134 / 140	133 / 134 / 140	135 / 135 / 140	136 / 137 / 139	137 / 138 / 138
	2,000	133 / 134 / 141	133 / 134 / 141	133 / 134 / 140	135 / 136 / 139	136 / 137 / 138
	0	132 / 133 / 141	132 / 133 / 141	132 / 133 / 141	134 / 135 / 140	135 / 136 / 139
130,000	8,000	133 / 134 / 137	133 / 134 / 137	134 / 135 / 136	135 / 136 / 136	136 / 137 / 137
	6,000	131 / 132 / 138	131 / 132 / 138	133 / 134 / 137	134 / 135 / 136	135 / 136 / 136
	4,000	130 / 131 / 138	130 / 131 / 138	132 / 132 / 138	133 / 134 / 137	134 / 135 / 136
	2,000	130 / 131 / 139	130 / 131 / 139	130 / 131 / 138	132 / 133 / 137	133 / 134 / 136
	0	129 / 130 / 139	129 / 130 / 139	129 / 130 / 139	131 / 132 / 138	132 / 133 / 137
125,000	8,000	130 / 131 / 135	130 / 131 / 135	131 / 132 / 134	132 / 133 / 133	133 / 134 / 134
	6,000	128 / 129 / 136	128 / 129 / 136	130 / 131 / 135	131 / 132 / 134	132 / 133 / 133
	4,000	127 / 128 / 136	127 / 128 / 136	129 / 129 / 136	130 / 131 / 135	131 / 132 / 134
	2,000	127 / 128 / 137	127 / 128 / 137	127 / 128 / 136	129 / 130 / 135	130 / 131 / 134
	0	126 / 127 / 137	126 / 127 / 137	126 / 127 / 137	128 / 129 / 136	129 / 130 / 135
120,000	8,000	127 / 127 / 132	127 / 127 / 132	128 / 128 / 131	129 / 129 / 130	130 / 130 / 130
	6,000	125 / 125 / 133	125 / 125 / 133	127 / 127 / 132	128 / 128 / 131	129 / 129 / 130
	4,000	124 / 124 / 133	124 / 124 / 133	125 / 125 / 133	127 / 127 / 132	128 / 128 / 131
	2,000	124 / 124 / 134	124 / 124 / 134	124 / 124 / 133	126 / 126 / 132	127 / 127 / 131
	0	123 / 123 / 134	123 / 123 / 134	123 / 123 / 134	125 / 125 / 133	126 / 126 / 132
115,000	8,000	124 / 124 / 130	124 / 124 / 130	125 / 125 / 129	126 / 126 / 128	127 / 127 / 128
	6,000	122 / 122 / 131	122 / 122 / 131	124 / 124 / 130	125 / 125 / 129	126 / 126 / 128
	4,000	121 / 121 / 131	121 / 121 / 131	122 / 122 / 131	124 / 124 / 130	125 / 125 / 129
	2,000	121 / 121 / 132	121 / 121 / 132	121 / 121 / 131	123 / 123 / 130	124 / 124 / 129
	0	120 / 120 / 132	120 / 120 / 132	120 / 120 / 132	122 / 122 / 131	123 / 123 / 130
110,000	8,000	120 / 121 / 127	120 / 121 / 127	121 / 122 / 126	122 / 123 / 125	123 / 124 / 125
	6,000	118 / 119 / 128	118 / 119 / 128	120 / 121 / 127	121 / 122 / 126	122 / 123 / 125
	4,000	117 / 118 / 128	117 / 118 / 128	119 / 119 / 128	120 / 121 / 127	121 / 122 / 126
	2,000	117 / 118 / 129	117 / 118 / 129	117 / 118 / 128	119 / 120 / 127	120 / 121 / 126
	0	116 / 117 / 129	116 / 117 / 129	116 / 117 / 129	118 / 119 / 128	119 / 120 / 127
105,000	8,000	117 / 118 / 125	117 / 118 / 125	118 / 119 / 124	119 / 120 / 123	120 / 121 / 123
	6,000	115 / 116 / 126	115 / 116 / 126	117 / 118 / 125	118 / 119 / 124	119 / 120 / 123
	4,000	114 / 115 / 126	114 / 115 / 126	116 / 116 / 126	117 / 118 / 125	118 / 119 / 124
	2,000	114 / 115 / 127	114 / 115 / 127	114 / 115 / 126	116 / 117 / 125	117 / 118 / 124
	0	113 / 114 / 127	113 / 114 / 127	113 / 114 / 127	115 / 116 / 126	116 / 117 / 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.

 $V_1 / V_R / V_2$

TO1 / 15

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
175,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
170,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
165,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
160,000	8,000	146 / 146 / 146	146 / 146 / 146	147 / 147 / 147	148 / 148 / 148	146 / 149 / 149
	6,000	144 / 144 / 147	144 / 144 / 147	146 / 146 / 146	147 / 147 / 147	148 / 148 / 148
	4,000	143 / 143 / 147	143 / 143 / 147	144 / 144 / 147	146 / 146 / 146	147 / 147 / 147
	2,000	143 / 143 / 148	143 / 143 / 148	143 / 143 / 147	145 / 145 / 146	146 / 146 / 146
	0	142 / 142 / 148	142 / 142 / 148	142 / 142 / 148	144 / 144 / 147	145 / 145 / 146
155,000	8,000	144 / 144 / 145	144 / 144 / 145	145 / 145 / 145	146 / 146 / 146	147 / 147 / 147
	6,000	142 / 142 / 146	142 / 142 / 146	144 / 144 / 145	145 / 145 / 145	146 / 146 / 146
	4,000	141 / 141 / 146	141 / 141 / 146	142 / 142 / 146	144 / 144 / 145	145 / 145 / 145
	2,000	141 / 141 / 147	141 / 141 / 147	141 / 141 / 146	143 / 143 / 145	144 / 144 / 144
	0	140 / 140 / 147	140 / 140 / 147	140 / 140 / 147	142 / 142 / 146	143 / 143 / 145
150,000	8,000	141 / 142 / 143	141 / 142 / 143	142 / 143 / 143	143 / 144 / 144	144 / 145 / 145
	6,000	139 / 140 / 144	139 / 140 / 144	141 / 142 / 143	142 / 143 / 143	143 / 144 / 144
	4,000	138 / 139 / 144	138 / 139 / 144	140 / 140 / 144	141 / 142 / 143	142 / 143 / 143
	2,000	138 / 139 / 145	138 / 139 / 145	138 / 139 / 144	140 / 141 / 143	141 / 142 / 142
	0	137 / 138 / 145	137 / 138 / 145	137 / 138 / 145	139 / 140 / 144	140 / 141 / 143
145,000	8,000	139 / 139 / 141	139 / 139 / 141	140 / 140 / 140	141 / 141 / 141	142 / 142 / 142
	6,000	137 / 137 / 142	137 / 137 / 142	139 / 139 / 141	140 / 140 / 140	141 / 141 / 141
	4,000	136 / 136 / 142	136 / 136 / 142	137 / 137 / 142	139 / 139 / 141	140 / 140 / 140
	2,000	136 / 136 / 143	136 / 136 / 143	136 / 136 / 142	138 / 138 / 141	139 / 139 / 140
	0	135 / 135 / 143	135 / 135 / 143	135 / 135 / 143	137 / 137 / 142	138 / 138 / 141
140,000	8,000	136 / 136 / 138	136 / 136 / 138	137 / 137 / 137	138 / 138 / 138	139 / 139 / 139
	6,000	134 / 134 / 139	134 / 134 / 139	136 / 136 / 138	137 / 137 / 137	138 / 138 / 138
	4,000	133 / 133 / 139	133 / 133 / 139	134 / 134 / 139	136 / 136 / 138	137 / 137 / 137
	2,000	133 / 133 / 140	133 / 133 / 140	133 / 133 / 139	135 / 135 / 138	136 / 136 / 137
	0	132 / 132 / 140	132 / 132 / 140	132 / 132 / 140	134 / 134 / 139	135 / 135 / 138

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

TAKEOFF SPEEDS

DRY RUNWAY KIAS

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

V₁ / V_R / V₂
TO1 / 15

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

 $V_1 / V_R / V_2$

TO1 / 25

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
175,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
170,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
165,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
160,000	8,000	143 / 143 / 144	143 / 143 / 144	144 / 144 / 144	145 / 145 / 145	146 / 146 / 146
	6,000	141 / 141 / 145	141 / 141 / 145	143 / 143 / 144	144 / 144 / 144	145 / 145 / 145
	4,000	140 / 140 / 145	140 / 140 / 145	141 / 141 / 145	143 / 143 / 144	144 / 144 / 144
	2,000	140 / 140 / 146	140 / 140 / 146	140 / 140 / 145	142 / 142 / 144	143 / 143 / 143
	0	139 / 139 / 146	139 / 139 / 146	139 / 139 / 146	141 / 141 / 145	142 / 142 / 144
155,000	8,000	141 / 141 / 142	141 / 141 / 142	142 / 142 / 142	143 / 143 / 143	144 / 144 / 144
	6,000	139 / 139 / 143	139 / 139 / 143	141 / 141 / 142	142 / 142 / 142	143 / 143 / 143
	4,000	138 / 138 / 143	138 / 138 / 143	139 / 139 / 143	141 / 141 / 142	142 / 142 / 142
	2,000	138 / 138 / 144	138 / 138 / 144	138 / 138 / 143	140 / 140 / 142	141 / 141 / 141
	0	137 / 137 / 144	137 / 137 / 144	137 / 137 / 144	139 / 139 / 143	140 / 140 / 142
150,000	8,000	138 / 139 / 140	138 / 139 / 140	139 / 140 / 140	140 / 141 / 141	141 / 142 / 142
	6,000	136 / 137 / 141	136 / 137 / 141	138 / 139 / 140	139 / 140 / 140	140 / 141 / 141
	4,000	135 / 136 / 141	135 / 136 / 141	137 / 137 / 141	138 / 139 / 140	139 / 140 / 140
	2,000	135 / 136 / 142	135 / 136 / 142	135 / 136 / 141	137 / 138 / 140	138 / 139 / 139
	0	134 / 135 / 142	134 / 135 / 142	134 / 135 / 142	136 / 137 / 141	137 / 138 / 140
145,000	8,000	136 / 137 / 138	136 / 137 / 138	137 / 138 / 138	138 / 139 / 139	139 / 140 / 140
	6,000	134 / 135 / 139	134 / 135 / 139	136 / 137 / 138	137 / 138 / 138	138 / 139 / 139
	4,000	133 / 134 / 139	133 / 134 / 139	135 / 135 / 139	136 / 137 / 138	137 / 138 / 138
	2,000	133 / 134 / 140	133 / 134 / 140	133 / 134 / 139	135 / 136 / 138	136 / 137 / 137
	0	132 / 133 / 140	132 / 133 / 140	132 / 133 / 140	134 / 135 / 139	135 / 136 / 138
140,000	8,000	133 / 134 / 136	133 / 134 / 136	134 / 135 / 135	135 / 136 / 136	136 / 137 / 137
	6,000	131 / 132 / 137	131 / 132 / 137	133 / 134 / 136	134 / 135 / 135	135 / 136 / 136
	4,000	130 / 131 / 137	130 / 131 / 137	132 / 132 / 137	133 / 134 / 136	134 / 135 / 135
	2,000	130 / 131 / 138	130 / 131 / 138	130 / 131 / 137	132 / 133 / 136	133 / 134 / 135
	0	129 / 130 / 138	129 / 130 / 138	129 / 130 / 138	131 / 132 / 137	132 / 133 / 136

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
135,000	8,000	130 / 131 / 134	130 / 131 / 134	131 / 132 / 133	132 / 133 / 133	133 / 134 / 134
	6,000	128 / 129 / 135	128 / 129 / 135	130 / 131 / 134	131 / 132 / 133	132 / 133 / 133
	4,000	127 / 128 / 135	127 / 128 / 135	129 / 129 / 135	130 / 131 / 134	131 / 132 / 133
	2,000	127 / 128 / 136	127 / 128 / 136	127 / 128 / 135	129 / 130 / 134	130 / 131 / 133
	0	126 / 127 / 136	126 / 127 / 136	126 / 127 / 136	128 / 129 / 135	129 / 130 / 134
130,000	8,000	127 / 128 / 132	127 / 128 / 132	128 / 129 / 131	129 / 130 / 130	130 / 131 / 131
	6,000	125 / 126 / 133	125 / 126 / 133	127 / 128 / 132	128 / 129 / 131	129 / 130 / 130
	4,000	124 / 125 / 133	124 / 125 / 133	126 / 126 / 133	127 / 128 / 132	128 / 129 / 131
	2,000	124 / 125 / 134	124 / 125 / 134	124 / 125 / 133	126 / 127 / 132	127 / 128 / 131
	0	123 / 124 / 134	123 / 124 / 134	123 / 124 / 134	125 / 126 / 133	126 / 127 / 132
125,000	8,000	125 / 125 / 130	125 / 125 / 130	126 / 126 / 129	127 / 127 / 128	128 / 128 / 128
	6,000	123 / 123 / 131	123 / 123 / 131	125 / 125 / 130	126 / 126 / 129	127 / 127 / 128
	4,000	122 / 122 / 131	122 / 122 / 131	123 / 123 / 131	125 / 125 / 130	126 / 126 / 129
	2,000	122 / 122 / 132	122 / 122 / 132	122 / 122 / 131	124 / 124 / 130	125 / 125 / 129
	0	121 / 121 / 132	121 / 121 / 132	121 / 121 / 132	123 / 123 / 131	124 / 124 / 130
120,000	8,000	122 / 122 / 127	122 / 122 / 127	123 / 123 / 126	124 / 124 / 125	125 / 125 / 125
	6,000	120 / 120 / 128	120 / 120 / 128	122 / 122 / 127	123 / 123 / 126	124 / 124 / 125
	4,000	119 / 119 / 128	119 / 119 / 128	120 / 120 / 128	122 / 122 / 127	123 / 123 / 126
	2,000	119 / 119 / 129	119 / 119 / 129	119 / 119 / 128	121 / 121 / 127	122 / 122 / 126
	0	118 / 118 / 129	118 / 118 / 129	118 / 118 / 129	120 / 120 / 128	121 / 121 / 127
115,000	8,000	119 / 119 / 125	119 / 119 / 125	120 / 120 / 124	121 / 121 / 123	122 / 122 / 123
	6,000	117 / 117 / 126	117 / 117 / 126	119 / 119 / 125	120 / 120 / 124	121 / 121 / 123
	4,000	116 / 116 / 126	116 / 116 / 126	117 / 117 / 126	119 / 119 / 125	120 / 120 / 124
	2,000	116 / 116 / 127	116 / 116 / 127	116 / 116 / 126	118 / 118 / 125	119 / 119 / 124
	0	115 / 115 / 127	115 / 115 / 127	115 / 115 / 127	117 / 117 / 126	118 / 118 / 125
110,000	8,000	116 / 116 / 123	116 / 116 / 123	117 / 117 / 122	118 / 118 / 121	119 / 119 / 121
	6,000	114 / 114 / 124	114 / 114 / 124	116 / 116 / 123	117 / 117 / 122	118 / 118 / 121
	4,000	113 / 113 / 124	113 / 113 / 124	114 / 114 / 124	116 / 116 / 123	117 / 117 / 122
	2,000	113 / 113 / 125	113 / 113 / 125	113 / 113 / 124	115 / 115 / 123	116 / 116 / 122
	0	112 / 112 / 125	112 / 112 / 125	112 / 112 / 125	114 / 114 / 124	115 / 115 / 123
105,000	8,000	113 / 113 / 121	113 / 113 / 121	114 / 114 / 120	115 / 115 / 119	116 / 116 / 119
	6,000	111 / 111 / 122	111 / 111 / 122	113 / 113 / 121	114 / 114 / 120	115 / 115 / 119
	4,000	110 / 110 / 122	110 / 110 / 122	111 / 111 / 122	113 / 113 / 121	114 / 114 / 120
	2,000	110 / 110 / 123	110 / 110 / 123	110 / 110 / 122	112 / 112 / 121	113 / 113 / 120
	0	109 / 109 / 123	109 / 109 / 123	109 / 109 / 123	111 / 111 / 122	112 / 112 / 121

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

TAKEOFF SPEEDS

DRY RUNWAY KIAS

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

V₁ / V_R / V₂
TO / 1

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
175,000	8,000	146 / 164 / 164	144 / 164 / 164	142 / 165 / 165	140 / 166 / 166	
	6,000	152 / 163 / 164	149 / 163 / 164	147 / 164 / 164	145 / 165 / 165	143 / 166 / 166
	4,000	157 / 162 / 165	154 / 162 / 165	152 / 163 / 164	150 / 164 / 164	148 / 165 / 165
	2,000	159 / 161 / 165	159 / 161 / 165	157 / 161 / 165	156 / 163 / 164	154 / 164 / 164
	0	158 / 160 / 166	158 / 160 / 166	158 / 160 / 166	159 / 161 / 165	159 / 163 / 164
170,000	8,000	148 / 161 / 161	145 / 161 / 161	143 / 162 / 162	142 / 163 / 163	140 / 164 / 164
	6,000	154 / 160 / 162	151 / 160 / 162	149 / 161 / 162	147 / 162 / 162	145 / 163 / 163
	4,000	157 / 159 / 163	156 / 159 / 163	154 / 160 / 162	152 / 161 / 162	150 / 162 / 162
	2,000	156 / 158 / 163	156 / 158 / 163	156 / 158 / 163	158 / 160 / 162	156 / 161 / 161
	0	155 / 157 / 164	155 / 157 / 164	155 / 157 / 164	156 / 158 / 163	158 / 160 / 162
165,000	8,000	151 / 159 / 159	148 / 159 / 159	146 / 160 / 160	144 / 161 / 161	142 / 162 / 162
	6,000	156 / 158 / 160	154 / 158 / 160	151 / 159 / 160	149 / 160 / 160	148 / 161 / 161
	4,000	155 / 157 / 161	155 / 157 / 161	155 / 158 / 160	155 / 159 / 160	153 / 160 / 160
	2,000	154 / 156 / 161	154 / 156 / 161	154 / 156 / 161	156 / 158 / 160	157 / 159 / 159
	0	153 / 155 / 162	153 / 155 / 162	153 / 155 / 162	154 / 156 / 161	156 / 158 / 160
160,000	8,000	153 / 156 / 157	150 / 156 / 157	148 / 157 / 157	146 / 158 / 158	144 / 159 / 159
	6,000	153 / 155 / 158	153 / 155 / 158	153 / 156 / 158	151 / 157 / 157	150 / 158 / 158
	4,000	152 / 154 / 159	152 / 154 / 159	152 / 155 / 158	154 / 156 / 158	155 / 157 / 157
	2,000	151 / 153 / 159	151 / 153 / 159	151 / 153 / 159	153 / 155 / 158	154 / 156 / 157
	0	150 / 152 / 160	150 / 152 / 160	150 / 152 / 160	151 / 153 / 159	153 / 155 / 158
155,000	8,000	152 / 154 / 155	152 / 154 / 155	151 / 155 / 155	149 / 156 / 156	147 / 157 / 157
	6,000	151 / 153 / 156	151 / 153 / 156	152 / 154 / 156	153 / 155 / 155	153 / 156 / 156
	4,000	150 / 152 / 157	150 / 152 / 157	150 / 153 / 156	152 / 154 / 156	153 / 155 / 155
	2,000	149 / 151 / 157	149 / 151 / 157	149 / 151 / 157	151 / 153 / 156	152 / 154 / 155
	0	148 / 150 / 158	148 / 150 / 158	148 / 150 / 158	149 / 151 / 157	151 / 153 / 156
150,000	8,000	149 / 151 / 153	149 / 151 / 153	150 / 152 / 153	151 / 153 / 153	150 / 154 / 154
	6,000	148 / 150 / 154	148 / 150 / 154	149 / 151 / 154	150 / 152 / 153	151 / 153 / 153
	4,000	147 / 149 / 155	147 / 149 / 155	147 / 150 / 154	149 / 151 / 154	150 / 152 / 153
	2,000	146 / 148 / 155	146 / 148 / 155	146 / 148 / 155	148 / 150 / 154	149 / 151 / 153
	0	145 / 147 / 156	145 / 147 / 156	145 / 147 / 156	146 / 148 / 155	148 / 150 / 154
145,000	8,000	146 / 148 / 151	146 / 148 / 151	147 / 149 / 151	148 / 150 / 150	149 / 151 / 151
	6,000	145 / 147 / 152	145 / 147 / 152	146 / 148 / 152	147 / 149 / 151	148 / 150 / 150
	4,000	144 / 146 / 153	144 / 146 / 153	144 / 147 / 152	146 / 148 / 152	147 / 149 / 151
	2,000	143 / 145 / 153	143 / 145 / 153	143 / 145 / 153	145 / 147 / 152	146 / 148 / 151
	0	142 / 144 / 154	142 / 144 / 154	142 / 144 / 154	143 / 145 / 153	145 / 147 / 152
140,000	8,000	143 / 145 / 148	143 / 145 / 148	144 / 146 / 148	145 / 147 / 147	146 / 148 / 148
	6,000	142 / 144 / 149	142 / 144 / 149	143 / 145 / 149	144 / 146 / 148	145 / 147 / 147
	4,000	141 / 143 / 150	141 / 143 / 150	141 / 144 / 149	143 / 145 / 149	144 / 146 / 148
	2,000	140 / 142 / 150	140 / 142 / 150	140 / 142 / 150	142 / 144 / 149	143 / 145 / 148
	0	139 / 141 / 151	139 / 141 / 151	139 / 141 / 151	140 / 142 / 150	142 / 144 / 149

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

TAKEOFF SPEEDS

DRY RUNWAY KIAS

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

**$V_1 / V_R / V_2$
TO / 1**

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
135,000	8,000	140 / 142 / 146	140 / 142 / 146	141 / 143 / 146	142 / 144 / 145	143 / 145 / 145
	6,000	139 / 141 / 147	139 / 141 / 147	140 / 142 / 147	141 / 143 / 146	142 / 144 / 145
	4,000	138 / 140 / 148	138 / 140 / 148	138 / 141 / 147	140 / 142 / 147	141 / 143 / 146
	2,000	137 / 139 / 148	137 / 139 / 148	137 / 139 / 148	139 / 141 / 147	140 / 142 / 146
	0	136 / 138 / 149	136 / 138 / 149	136 / 138 / 149	137 / 139 / 148	139 / 141 / 147
130,000	8,000	137 / 139 / 144	137 / 139 / 144	138 / 140 / 144	139 / 141 / 143	140 / 142 / 142
	6,000	136 / 138 / 145	136 / 138 / 145	137 / 139 / 145	138 / 140 / 144	139 / 141 / 143
	4,000	135 / 137 / 146	135 / 137 / 146	135 / 138 / 145	137 / 139 / 145	138 / 140 / 144
	2,000	134 / 136 / 146	134 / 136 / 146	134 / 136 / 146	136 / 138 / 145	137 / 139 / 144
	0	133 / 135 / 147	133 / 135 / 147	133 / 135 / 147	134 / 136 / 146	136 / 138 / 145
125,000	8,000	134 / 136 / 142	134 / 136 / 142	135 / 137 / 142	136 / 138 / 141	137 / 139 / 140
	6,000	133 / 135 / 143	133 / 135 / 143	134 / 136 / 143	135 / 137 / 142	136 / 138 / 141
	4,000	132 / 134 / 144	132 / 134 / 144	132 / 135 / 143	134 / 136 / 143	135 / 137 / 142
	2,000	131 / 133 / 144	131 / 133 / 144	131 / 133 / 144	133 / 135 / 143	134 / 136 / 142
	0	130 / 132 / 145	130 / 132 / 145	130 / 132 / 145	131 / 133 / 144	133 / 135 / 143
120,000	8,000	131 / 132 / 139	131 / 132 / 139	132 / 133 / 139	133 / 134 / 138	134 / 135 / 137
	6,000	130 / 131 / 140	130 / 131 / 140	131 / 132 / 140	132 / 133 / 139	133 / 134 / 138
	4,000	129 / 130 / 141	129 / 130 / 141	129 / 131 / 140	131 / 132 / 140	132 / 133 / 139
	2,000	128 / 129 / 141	128 / 129 / 141	128 / 129 / 141	130 / 131 / 140	131 / 132 / 139
	0	127 / 128 / 142	127 / 128 / 142	127 / 128 / 142	128 / 129 / 141	130 / 131 / 140
115,000	8,000	128 / 129 / 137	128 / 129 / 137	129 / 130 / 137	130 / 131 / 136	131 / 132 / 135
	6,000	127 / 128 / 138	127 / 128 / 138	128 / 129 / 138	129 / 130 / 137	130 / 131 / 136
	4,000	126 / 127 / 139	126 / 127 / 139	126 / 128 / 138	128 / 129 / 138	129 / 130 / 137
	2,000	125 / 126 / 139	125 / 126 / 139	125 / 126 / 139	127 / 128 / 138	128 / 129 / 137
	0	124 / 125 / 140	124 / 125 / 140	124 / 125 / 140	125 / 126 / 139	127 / 128 / 138
110,000	8,000	125 / 126 / 134	125 / 126 / 134	126 / 127 / 134	127 / 128 / 133	128 / 129 / 132
	6,000	124 / 125 / 135	124 / 125 / 135	125 / 126 / 135	126 / 127 / 134	127 / 128 / 133
	4,000	123 / 124 / 136	123 / 124 / 136	123 / 125 / 135	125 / 126 / 135	126 / 127 / 134
	2,000	122 / 123 / 136	122 / 123 / 136	122 / 123 / 136	124 / 125 / 135	125 / 126 / 134
	0	121 / 122 / 137	121 / 122 / 137	121 / 122 / 137	122 / 123 / 136	124 / 125 / 135
105,000	8,000	122 / 123 / 131	122 / 123 / 131	123 / 124 / 131	124 / 125 / 130	125 / 126 / 129
	6,000	121 / 122 / 132	121 / 122 / 132	122 / 123 / 132	123 / 124 / 131	124 / 125 / 130
	4,000	120 / 121 / 133	120 / 121 / 133	120 / 122 / 132	122 / 123 / 132	123 / 124 / 131
	2,000	119 / 120 / 133	119 / 120 / 133	119 / 120 / 133	121 / 122 / 132	122 / 123 / 131
	0	118 / 119 / 134	118 / 119 / 134	118 / 119 / 134	119 / 120 / 133	121 / 122 / 132

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

TAKEOFF SPEEDS

DRY RUNWAY KIAS

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

V₁ / V_R / V₂
TO / 5

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
175,000	8,000	146 / 158 / 158	144 / 158 / 158	142 / 159 / 159	140 / 160 / 160	
	6,000	152 / 157 / 158	149 / 157 / 158	147 / 158 / 158	145 / 159 / 159	143 / 160 / 160
	4,000	153 / 156 / 159	153 / 156 / 159	152 / 157 / 158	150 / 158 / 158	148 / 159 / 159
	2,000	152 / 155 / 159	152 / 155 / 159	152 / 155 / 159	154 / 157 / 158	154 / 158 / 158
	0	151 / 154 / 160	151 / 154 / 160	151 / 154 / 160	152 / 155 / 159	154 / 157 / 158
170,000	8,000	148 / 155 / 155	145 / 155 / 155	143 / 156 / 156	142 / 157 / 157	140 / 158 / 158
	6,000	152 / 154 / 156	151 / 154 / 156	149 / 155 / 156	147 / 156 / 156	145 / 157 / 157
	4,000	151 / 153 / 157	151 / 153 / 157	151 / 154 / 156	152 / 155 / 156	150 / 156 / 156
	2,000	150 / 152 / 157	150 / 152 / 157	150 / 152 / 157	152 / 154 / 156	153 / 155 / 155
	0	149 / 151 / 158	149 / 151 / 158	149 / 151 / 158	150 / 152 / 157	152 / 154 / 156
165,000	8,000	151 / 153 / 153	148 / 153 / 153	146 / 154 / 154	144 / 155 / 155	142 / 156 / 156
	6,000	150 / 152 / 154	150 / 152 / 154	151 / 153 / 154	149 / 154 / 154	148 / 155 / 155
	4,000	149 / 151 / 155	149 / 151 / 155	149 / 152 / 154	151 / 153 / 154	152 / 154 / 154
	2,000	148 / 150 / 155	148 / 150 / 155	148 / 150 / 155	150 / 152 / 154	151 / 153 / 153
	0	147 / 149 / 156	147 / 149 / 156	147 / 149 / 156	148 / 150 / 155	150 / 152 / 154
160,000	8,000	148 / 150 / 151	148 / 150 / 151	148 / 151 / 151	146 / 152 / 152	144 / 153 / 153
	6,000	147 / 149 / 152	147 / 149 / 152	148 / 150 / 152	149 / 151 / 151	150 / 152 / 152
	4,000	146 / 148 / 153	146 / 148 / 153	146 / 149 / 152	148 / 150 / 152	149 / 151 / 151
	2,000	145 / 147 / 153	145 / 147 / 153	145 / 147 / 153	147 / 149 / 152	148 / 150 / 151
	0	144 / 146 / 154	144 / 146 / 154	144 / 146 / 154	145 / 147 / 153	147 / 149 / 152
155,000	8,000	146 / 148 / 149	146 / 148 / 149	147 / 149 / 149	148 / 150 / 150	147 / 151 / 151
	6,000	145 / 147 / 150	145 / 147 / 150	146 / 148 / 150	147 / 149 / 149	148 / 150 / 150
	4,000	144 / 146 / 151	144 / 146 / 151	144 / 147 / 150	146 / 148 / 150	147 / 149 / 149
	2,000	143 / 145 / 151	143 / 145 / 151	143 / 145 / 151	145 / 147 / 150	146 / 148 / 149
	0	142 / 144 / 152	142 / 144 / 152	142 / 144 / 152	143 / 145 / 151	145 / 147 / 150
150,000	8,000	143 / 145 / 147	143 / 145 / 147	144 / 146 / 147	145 / 147 / 147	146 / 148 / 148
	6,000	142 / 144 / 148	142 / 144 / 148	143 / 145 / 148	144 / 146 / 147	145 / 147 / 147
	4,000	141 / 143 / 149	141 / 143 / 149	141 / 144 / 148	143 / 145 / 148	144 / 146 / 147
	2,000	140 / 142 / 149	140 / 142 / 149	140 / 142 / 149	142 / 144 / 148	143 / 145 / 147
	0	139 / 141 / 150	139 / 141 / 150	139 / 141 / 150	140 / 142 / 149	142 / 144 / 148
145,000	8,000	141 / 142 / 145	141 / 142 / 145	142 / 143 / 145	143 / 144 / 144	144 / 145 / 145
	6,000	140 / 141 / 146	140 / 141 / 146	141 / 142 / 146	142 / 143 / 145	143 / 144 / 144
	4,000	139 / 140 / 147	139 / 140 / 147	139 / 141 / 146	141 / 142 / 146	142 / 143 / 145
	2,000	138 / 139 / 147	138 / 139 / 147	138 / 139 / 147	140 / 141 / 146	141 / 142 / 145
	0	137 / 138 / 148	137 / 138 / 148	137 / 138 / 148	138 / 139 / 147	140 / 141 / 146
140,000	8,000	138 / 139 / 143	138 / 139 / 143	139 / 140 / 143	140 / 141 / 142	141 / 142 / 142
	6,000	137 / 138 / 144	137 / 138 / 144	138 / 139 / 144	139 / 140 / 143	140 / 141 / 142
	4,000	136 / 137 / 145	136 / 137 / 145	136 / 138 / 144	138 / 139 / 144	139 / 140 / 143
	2,000	135 / 136 / 145	135 / 136 / 145	135 / 136 / 145	137 / 138 / 144	138 / 139 / 143
	0	134 / 135 / 146	134 / 135 / 146	134 / 135 / 146	135 / 136 / 145	137 / 138 / 144

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

TAKEOFF SPEEDS

DRY RUNWAY KIAS

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

V₁ / V_R / V₂
TO / 5

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
135,000	8,000	135 / 136 / 141	135 / 136 / 141	136 / 137 / 141	137 / 138 / 140	138 / 139 / 139
	6,000	134 / 135 / 142	134 / 135 / 142	135 / 136 / 142	136 / 137 / 141	137 / 138 / 140
	4,000	133 / 134 / 143	133 / 134 / 143	133 / 135 / 142	135 / 136 / 142	136 / 137 / 141
	2,000	132 / 133 / 143	132 / 133 / 143	132 / 133 / 143	134 / 135 / 142	135 / 136 / 141
	0	131 / 132 / 144	131 / 132 / 144	131 / 132 / 144	132 / 133 / 143	134 / 135 / 142
130,000	8,000	132 / 133 / 138	132 / 133 / 138	133 / 134 / 138	134 / 135 / 137	135 / 136 / 136
	6,000	131 / 132 / 139	131 / 132 / 139	132 / 133 / 139	133 / 134 / 138	134 / 135 / 137
	4,000	130 / 131 / 140	130 / 131 / 140	130 / 132 / 139	132 / 133 / 139	133 / 134 / 138
	2,000	129 / 130 / 140	129 / 130 / 140	129 / 130 / 140	131 / 132 / 139	132 / 133 / 138
	0	128 / 129 / 141	128 / 129 / 141	128 / 129 / 141	129 / 130 / 140	131 / 132 / 139
125,000	8,000	129 / 130 / 136	129 / 130 / 136	130 / 131 / 136	131 / 132 / 135	132 / 133 / 134
	6,000	128 / 129 / 137	128 / 129 / 137	129 / 130 / 137	130 / 131 / 136	131 / 132 / 135
	4,000	127 / 128 / 138	127 / 128 / 138	127 / 129 / 137	129 / 130 / 137	130 / 131 / 136
	2,000	126 / 127 / 138	126 / 127 / 138	126 / 127 / 138	128 / 129 / 137	129 / 130 / 136
	0	125 / 126 / 139	125 / 126 / 139	125 / 126 / 139	126 / 127 / 138	128 / 129 / 137
120,000	8,000	126 / 127 / 134	126 / 127 / 134	127 / 128 / 134	128 / 129 / 133	129 / 130 / 132
	6,000	125 / 126 / 135	125 / 126 / 135	126 / 127 / 135	127 / 128 / 134	128 / 129 / 133
	4,000	124 / 125 / 136	124 / 125 / 136	124 / 126 / 135	126 / 127 / 135	127 / 128 / 134
	2,000	123 / 124 / 136	123 / 124 / 136	123 / 124 / 136	125 / 126 / 135	126 / 127 / 134
	0	122 / 123 / 137	122 / 123 / 137	122 / 123 / 137	123 / 124 / 136	125 / 126 / 135
115,000	8,000	123 / 124 / 132	123 / 124 / 132	124 / 125 / 132	125 / 126 / 131	126 / 127 / 130
	6,000	122 / 123 / 133	122 / 123 / 133	123 / 124 / 133	124 / 125 / 132	125 / 126 / 131
	4,000	121 / 122 / 134	121 / 122 / 134	121 / 123 / 133	123 / 124 / 133	124 / 125 / 132
	2,000	120 / 121 / 134	120 / 121 / 134	120 / 121 / 134	122 / 123 / 133	123 / 124 / 132
	0	119 / 120 / 135	119 / 120 / 135	119 / 120 / 135	120 / 121 / 134	122 / 123 / 133
110,000	8,000	120 / 121 / 129	120 / 121 / 129	121 / 122 / 129	122 / 123 / 128	123 / 124 / 127
	6,000	119 / 120 / 130	119 / 120 / 130	120 / 121 / 130	121 / 122 / 129	122 / 123 / 128
	4,000	118 / 119 / 131	118 / 119 / 131	118 / 120 / 130	120 / 121 / 130	121 / 122 / 129
	2,000	117 / 118 / 131	117 / 118 / 131	117 / 118 / 131	119 / 120 / 130	120 / 121 / 129
	0	116 / 117 / 132	116 / 117 / 132	116 / 117 / 132	117 / 118 / 131	119 / 120 / 130
105,000	8,000	117 / 118 / 127	117 / 118 / 127	118 / 119 / 127	119 / 120 / 126	120 / 121 / 125
	6,000	116 / 117 / 128	116 / 117 / 128	117 / 118 / 128	118 / 119 / 127	119 / 120 / 126
	4,000	115 / 116 / 129	115 / 116 / 129	115 / 117 / 128	117 / 118 / 128	118 / 119 / 127
	2,000	114 / 115 / 129	114 / 115 / 129	114 / 115 / 129	116 / 117 / 128	117 / 118 / 127
	0	113 / 114 / 130	113 / 114 / 130	113 / 114 / 130	114 / 115 / 129	116 / 117 / 128

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

TAKEOFF SPEEDS

DRY RUNWAY KIAS

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

V₁ / V_R / V₂
TO / 10

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
175,000	8,000	146 / 156 / 156	144 / 156 / 156	142 / 157 / 157	140 / 158 / 158	
	6,000	152 / 155 / 156	149 / 155 / 156	147 / 156 / 156	145 / 157 / 157	143 / 158 / 158
	4,000	153 / 154 / 157	153 / 154 / 157	152 / 155 / 156	150 / 156 / 156	148 / 157 / 157
	2,000	152 / 153 / 157	152 / 153 / 157	152 / 153 / 157	154 / 155 / 156	154 / 156 / 156
	0	151 / 152 / 158	151 / 152 / 158	151 / 152 / 158	152 / 153 / 157	154 / 155 / 156
170,000	8,000	148 / 153 / 153	145 / 153 / 153	143 / 154 / 154	142 / 155 / 155	140 / 156 / 156
	6,000	151 / 152 / 154	151 / 152 / 154	149 / 153 / 154	147 / 154 / 154	145 / 155 / 155
	4,000	150 / 151 / 155	150 / 151 / 155	150 / 152 / 154	152 / 153 / 154	150 / 154 / 154
	2,000	149 / 150 / 155	149 / 150 / 155	149 / 150 / 155	151 / 152 / 154	152 / 153 / 153
	0	148 / 149 / 156	148 / 149 / 156	148 / 149 / 156	149 / 150 / 155	151 / 152 / 154
165,000	8,000	150 / 151 / 151	148 / 151 / 151	146 / 152 / 152	144 / 153 / 153	142 / 154 / 154
	6,000	149 / 150 / 152	149 / 150 / 152	150 / 151 / 152	149 / 152 / 152	148 / 153 / 153
	4,000	148 / 149 / 153	148 / 149 / 153	148 / 150 / 152	150 / 151 / 152	151 / 152 / 152
	2,000	147 / 148 / 153	147 / 148 / 153	147 / 148 / 153	149 / 150 / 152	150 / 151 / 151
	0	146 / 147 / 154	146 / 147 / 154	146 / 147 / 154	147 / 148 / 153	149 / 150 / 152
160,000	8,000	147 / 148 / 149	147 / 148 / 149	148 / 149 / 149	146 / 150 / 150	144 / 151 / 151
	6,000	146 / 147 / 150	146 / 147 / 150	147 / 148 / 150	148 / 149 / 149	149 / 150 / 150
	4,000	145 / 146 / 151	145 / 146 / 151	145 / 147 / 150	147 / 148 / 150	148 / 149 / 149
	2,000	144 / 145 / 151	144 / 145 / 151	144 / 145 / 151	146 / 147 / 150	147 / 148 / 149
	0	143 / 144 / 152	143 / 144 / 152	143 / 144 / 152	144 / 145 / 151	146 / 147 / 150
155,000	8,000	145 / 146 / 147	145 / 146 / 147	146 / 147 / 147	147 / 148 / 148	147 / 149 / 149
	6,000	144 / 145 / 148	144 / 145 / 148	145 / 146 / 148	146 / 147 / 147	147 / 148 / 148
	4,000	143 / 144 / 149	143 / 144 / 149	143 / 145 / 148	145 / 146 / 148	146 / 147 / 147
	2,000	142 / 143 / 149	142 / 143 / 149	142 / 143 / 149	144 / 145 / 148	145 / 146 / 147
	0	141 / 142 / 150	141 / 142 / 150	141 / 142 / 150	142 / 143 / 149	144 / 145 / 148
150,000	8,000	142 / 143 / 145	142 / 143 / 145	143 / 144 / 145	144 / 145 / 145	145 / 146 / 146
	6,000	141 / 142 / 146	141 / 142 / 146	142 / 143 / 146	143 / 144 / 145	144 / 145 / 145
	4,000	140 / 141 / 147	140 / 141 / 147	140 / 142 / 146	142 / 143 / 146	143 / 144 / 145
	2,000	139 / 140 / 147	139 / 140 / 147	139 / 140 / 147	141 / 142 / 146	142 / 143 / 145
	0	138 / 139 / 148	138 / 139 / 148	138 / 139 / 148	139 / 140 / 147	141 / 142 / 146
145,000	8,000	140 / 141 / 143	140 / 141 / 143	141 / 142 / 143	142 / 143 / 143	143 / 144 / 144
	6,000	139 / 140 / 144	139 / 140 / 144	140 / 141 / 144	141 / 142 / 143	142 / 143 / 143
	4,000	138 / 139 / 145	138 / 139 / 145	138 / 140 / 144	140 / 141 / 144	141 / 142 / 143
	2,000	137 / 138 / 145	137 / 138 / 145	137 / 138 / 145	139 / 140 / 144	140 / 141 / 143
	0	136 / 137 / 146	136 / 137 / 146	136 / 137 / 146	137 / 138 / 145	139 / 140 / 144
140,000	8,000	137 / 138 / 141	137 / 138 / 141	138 / 139 / 141	139 / 140 / 140	140 / 141 / 141
	6,000	136 / 137 / 142	136 / 137 / 142	137 / 138 / 142	138 / 139 / 141	139 / 140 / 140
	4,000	135 / 136 / 143	135 / 136 / 143	135 / 137 / 142	137 / 138 / 142	138 / 139 / 141
	2,000	134 / 135 / 143	134 / 135 / 143	134 / 135 / 143	136 / 137 / 142	137 / 138 / 141
	0	133 / 134 / 144	133 / 134 / 144	133 / 134 / 144	134 / 135 / 143	136 / 137 / 142

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

TAKEOFF SPEEDS

DRY RUNWAY KIAS

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

**$V_1 / V_R / V_2$
TO / 10**

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
135,000	8,000	134 / 135 / 139	134 / 135 / 139	135 / 136 / 139	136 / 137 / 138	137 / 138 / 138
	6,000	133 / 134 / 140	133 / 134 / 140	134 / 135 / 140	135 / 136 / 139	136 / 137 / 138
	4,000	132 / 133 / 141	132 / 133 / 141	132 / 134 / 140	134 / 135 / 140	135 / 136 / 139
	2,000	131 / 132 / 141	131 / 132 / 141	131 / 132 / 141	133 / 134 / 140	134 / 135 / 139
	0	130 / 131 / 142	130 / 131 / 142	130 / 131 / 142	131 / 132 / 141	133 / 134 / 140
130,000	8,000	131 / 132 / 137	131 / 132 / 137	132 / 133 / 137	133 / 134 / 136	134 / 135 / 135
	6,000	130 / 131 / 138	130 / 131 / 138	131 / 132 / 138	132 / 133 / 137	133 / 134 / 136
	4,000	129 / 130 / 139	129 / 130 / 139	129 / 131 / 138	131 / 132 / 138	132 / 133 / 137
	2,000	128 / 129 / 139	128 / 129 / 139	128 / 129 / 139	130 / 131 / 138	131 / 132 / 137
	0	127 / 128 / 140	127 / 128 / 140	127 / 128 / 140	128 / 129 / 139	130 / 131 / 138
125,000	8,000	128 / 129 / 135	128 / 129 / 135	129 / 130 / 135	130 / 131 / 134	131 / 132 / 133
	6,000	127 / 128 / 136	127 / 128 / 136	128 / 129 / 136	129 / 130 / 135	130 / 131 / 134
	4,000	126 / 127 / 137	126 / 127 / 137	126 / 128 / 136	128 / 129 / 136	129 / 130 / 135
	2,000	125 / 126 / 137	125 / 126 / 137	125 / 126 / 137	127 / 128 / 136	128 / 129 / 135
	0	124 / 125 / 138	124 / 125 / 138	124 / 125 / 138	125 / 126 / 137	127 / 128 / 136
120,000	8,000	125 / 126 / 132	125 / 126 / 132	126 / 127 / 132	127 / 128 / 131	128 / 129 / 130
	6,000	124 / 125 / 133	124 / 125 / 133	125 / 126 / 133	126 / 127 / 132	127 / 128 / 131
	4,000	123 / 124 / 134	123 / 124 / 134	123 / 125 / 133	125 / 126 / 133	126 / 127 / 132
	2,000	122 / 123 / 134	122 / 123 / 134	122 / 123 / 134	124 / 125 / 133	125 / 126 / 132
	0	121 / 122 / 135	121 / 122 / 135	121 / 122 / 135	122 / 123 / 134	124 / 125 / 133
115,000	8,000	122 / 123 / 130	122 / 123 / 130	123 / 124 / 130	124 / 125 / 129	125 / 126 / 128
	6,000	121 / 122 / 131	121 / 122 / 131	122 / 123 / 131	123 / 124 / 130	124 / 125 / 129
	4,000	120 / 121 / 132	120 / 121 / 132	120 / 122 / 131	122 / 123 / 131	123 / 124 / 130
	2,000	119 / 120 / 132	119 / 120 / 132	119 / 120 / 132	121 / 122 / 131	122 / 123 / 130
	0	118 / 119 / 133	118 / 119 / 133	118 / 119 / 133	119 / 120 / 132	121 / 122 / 131
110,000	8,000	119 / 120 / 127	119 / 120 / 127	120 / 121 / 127	121 / 122 / 126	122 / 123 / 125
	6,000	118 / 119 / 128	118 / 119 / 128	119 / 120 / 128	120 / 121 / 127	121 / 122 / 126
	4,000	117 / 118 / 129	117 / 118 / 129	117 / 119 / 128	119 / 120 / 128	120 / 121 / 127
	2,000	116 / 117 / 129	116 / 117 / 129	116 / 117 / 129	118 / 119 / 128	119 / 120 / 127
	0	115 / 116 / 130	115 / 116 / 130	115 / 116 / 130	116 / 117 / 129	118 / 119 / 128
105,000	8,000	116 / 117 / 125	116 / 117 / 125	117 / 118 / 125	118 / 119 / 124	119 / 120 / 123
	6,000	115 / 116 / 126	115 / 116 / 126	116 / 117 / 126	117 / 118 / 125	118 / 119 / 124
	4,000	114 / 115 / 127	114 / 115 / 127	114 / 116 / 126	116 / 117 / 126	117 / 118 / 125
	2,000	113 / 114 / 127	113 / 114 / 127	113 / 114 / 127	115 / 116 / 126	116 / 117 / 125
	0	112 / 113 / 128	112 / 113 / 128	112 / 113 / 128	113 / 114 / 127	115 / 116 / 126

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

TAKEOFF SPEEDS

DRY RUNWAY KIAS

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

V₁ / V_R / V₂
TO / 15

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
175,000	8,000	146 / 152 / 152	144 / 152 / 152	142 / 153 / 153	140 / 154 / 154	
	6,000	151 / 151 / 153	149 / 151 / 153	147 / 152 / 153	145 / 153 / 153	143 / 154 / 154
	4,000	150 / 150 / 154	150 / 150 / 154	150 / 151 / 153	150 / 152 / 153	148 / 153 / 153
	2,000	149 / 149 / 154	149 / 149 / 154	149 / 149 / 154	151 / 151 / 153	152 / 152 / 152
	0	148 / 148 / 155	148 / 148 / 155	148 / 148 / 155	149 / 149 / 154	151 / 151 / 153
170,000	8,000	148 / 150 / 150	145 / 150 / 150	143 / 151 / 151	142 / 152 / 152	140 / 153 / 153
	6,000	148 / 149 / 151	148 / 149 / 151	149 / 150 / 151	147 / 151 / 151	145 / 152 / 152
	4,000	147 / 148 / 152	147 / 148 / 152	147 / 149 / 151	149 / 150 / 151	150 / 151 / 151
	2,000	146 / 147 / 152	146 / 147 / 152	146 / 147 / 152	148 / 149 / 151	149 / 150 / 150
	0	145 / 146 / 153	145 / 146 / 153	145 / 146 / 153	146 / 147 / 152	148 / 149 / 151
165,000	8,000	147 / 148 / 148	147 / 148 / 148	146 / 149 / 149	144 / 150 / 150	142 / 151 / 151
	6,000	146 / 147 / 149	146 / 147 / 149	147 / 148 / 149	148 / 149 / 149	148 / 150 / 150
	4,000	145 / 146 / 150	145 / 146 / 150	145 / 147 / 149	147 / 148 / 149	148 / 149 / 149
	2,000	144 / 145 / 150	144 / 145 / 150	144 / 145 / 150	146 / 147 / 149	147 / 148 / 148
	0	143 / 144 / 151	143 / 144 / 151	143 / 144 / 151	144 / 145 / 150	146 / 147 / 149
160,000	8,000	144 / 145 / 146	144 / 145 / 146	145 / 146 / 146	146 / 147 / 147	144 / 148 / 148
	6,000	143 / 144 / 147	143 / 144 / 147	144 / 145 / 147	145 / 146 / 146	146 / 147 / 147
	4,000	142 / 143 / 148	142 / 143 / 148	142 / 144 / 147	144 / 145 / 147	145 / 146 / 146
	2,000	141 / 142 / 148	141 / 142 / 148	141 / 142 / 148	143 / 144 / 147	144 / 145 / 146
	0	140 / 141 / 149	140 / 141 / 149	140 / 141 / 149	141 / 142 / 148	143 / 144 / 147
155,000	8,000	142 / 143 / 144	142 / 143 / 144	143 / 144 / 144	144 / 145 / 145	145 / 146 / 146
	6,000	141 / 142 / 145	141 / 142 / 145	142 / 143 / 145	143 / 144 / 144	144 / 145 / 145
	4,000	140 / 141 / 146	140 / 141 / 146	140 / 142 / 145	142 / 143 / 145	143 / 144 / 144
	2,000	139 / 140 / 146	139 / 140 / 146	139 / 140 / 146	141 / 142 / 145	142 / 143 / 144
	0	138 / 139 / 147	138 / 139 / 147	138 / 139 / 147	139 / 140 / 146	141 / 142 / 145
150,000	8,000	139 / 140 / 142	139 / 140 / 142	140 / 141 / 142	141 / 142 / 142	142 / 143 / 143
	6,000	138 / 139 / 143	138 / 139 / 143	139 / 140 / 143	140 / 141 / 142	141 / 142 / 142
	4,000	137 / 138 / 144	137 / 138 / 144	137 / 139 / 143	139 / 140 / 143	140 / 141 / 142
	2,000	136 / 137 / 144	136 / 137 / 144	136 / 137 / 144	138 / 139 / 143	139 / 140 / 142
	0	135 / 136 / 145	135 / 136 / 145	135 / 136 / 145	136 / 137 / 144	138 / 139 / 143
145,000	8,000	137 / 138 / 140	137 / 138 / 140	138 / 139 / 140	139 / 140 / 140	140 / 141 / 141
	6,000	136 / 137 / 141	136 / 137 / 141	137 / 138 / 141	138 / 139 / 140	139 / 140 / 140
	4,000	135 / 136 / 142	135 / 136 / 142	135 / 137 / 141	137 / 138 / 141	138 / 139 / 140
	2,000	134 / 135 / 142	134 / 135 / 142	134 / 135 / 142	136 / 137 / 141	137 / 138 / 140
	0	133 / 134 / 143	133 / 134 / 143	133 / 134 / 143	134 / 135 / 142	136 / 137 / 141
140,000	8,000	134 / 135 / 138	134 / 135 / 138	135 / 136 / 138	136 / 137 / 137	137 / 138 / 138
	6,000	133 / 134 / 139	133 / 134 / 139	134 / 135 / 139	135 / 136 / 138	136 / 137 / 137
	4,000	132 / 133 / 140	132 / 133 / 140	132 / 134 / 139	134 / 135 / 139	135 / 136 / 138
	2,000	131 / 132 / 140	131 / 132 / 140	131 / 132 / 140	133 / 134 / 139	134 / 135 / 138
	0	130 / 131 / 141	130 / 131 / 141	130 / 131 / 141	131 / 132 / 140	133 / 134 / 139

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

TAKEOFF SPEEDS

DRY RUNWAY KIAS

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

V₁ / V_R / V₂
TO / 15

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
135,000	8,000	131 / 132 / 136	131 / 132 / 136	132 / 133 / 136	133 / 134 / 135	134 / 135 / 135
	6,000	130 / 131 / 137	130 / 131 / 137	131 / 132 / 137	132 / 133 / 136	133 / 134 / 135
	4,000	129 / 130 / 138	129 / 130 / 138	129 / 131 / 137	131 / 132 / 137	132 / 133 / 136
	2,000	128 / 129 / 138	128 / 129 / 138	128 / 129 / 138	130 / 131 / 137	131 / 132 / 136
	0	127 / 128 / 139	127 / 128 / 139	127 / 128 / 139	128 / 129 / 138	130 / 131 / 137
130,000	8,000	128 / 129 / 134	128 / 129 / 134	129 / 130 / 134	130 / 131 / 133	131 / 132 / 132
	6,000	127 / 128 / 135	127 / 128 / 135	128 / 129 / 135	129 / 130 / 134	130 / 131 / 133
	4,000	126 / 127 / 136	126 / 127 / 136	126 / 128 / 135	128 / 129 / 135	129 / 130 / 134
	2,000	125 / 126 / 136	125 / 126 / 136	125 / 126 / 136	127 / 128 / 135	128 / 129 / 134
	0	124 / 125 / 137	124 / 125 / 137	124 / 125 / 137	125 / 126 / 136	127 / 128 / 135
125,000	8,000	125 / 126 / 132	125 / 126 / 132	126 / 127 / 132	127 / 128 / 131	128 / 129 / 130
	6,000	124 / 125 / 133	124 / 125 / 133	125 / 126 / 133	126 / 127 / 132	127 / 128 / 131
	4,000	123 / 124 / 134	123 / 124 / 134	123 / 125 / 133	125 / 126 / 133	126 / 127 / 132
	2,000	122 / 123 / 134	122 / 123 / 134	122 / 123 / 134	124 / 125 / 133	125 / 126 / 132
	0	121 / 122 / 135	121 / 122 / 135	121 / 122 / 135	122 / 123 / 134	124 / 125 / 133
120,000	8,000	122 / 123 / 130	122 / 123 / 130	123 / 124 / 130	124 / 125 / 129	125 / 126 / 128
	6,000	121 / 122 / 131	121 / 122 / 131	122 / 123 / 131	123 / 124 / 130	124 / 125 / 129
	4,000	120 / 121 / 132	120 / 121 / 132	120 / 122 / 131	122 / 123 / 131	123 / 124 / 130
	2,000	119 / 120 / 132	119 / 120 / 132	119 / 120 / 132	121 / 122 / 131	122 / 123 / 130
	0	118 / 119 / 133	118 / 119 / 133	118 / 119 / 133	119 / 120 / 132	121 / 122 / 131
115,000	8,000	119 / 120 / 128	119 / 120 / 128	120 / 121 / 128	121 / 122 / 127	122 / 123 / 126
	6,000	118 / 119 / 129	118 / 119 / 129	119 / 120 / 129	120 / 121 / 128	121 / 122 / 127
	4,000	117 / 118 / 130	117 / 118 / 130	117 / 119 / 129	119 / 120 / 129	120 / 121 / 128
	2,000	116 / 117 / 130	116 / 117 / 130	116 / 117 / 130	118 / 119 / 129	119 / 120 / 128
	0	115 / 116 / 131	115 / 116 / 131	115 / 116 / 131	116 / 117 / 130	118 / 119 / 129
110,000	8,000	116 / 117 / 125	116 / 117 / 125	117 / 118 / 125	118 / 119 / 124	119 / 120 / 123
	6,000	115 / 116 / 126	115 / 116 / 126	116 / 117 / 126	117 / 118 / 125	118 / 119 / 124
	4,000	114 / 115 / 127	114 / 115 / 127	114 / 116 / 126	116 / 117 / 126	117 / 118 / 125
	2,000	113 / 114 / 127	113 / 114 / 127	113 / 114 / 127	115 / 116 / 126	116 / 117 / 125
	0	112 / 113 / 128	112 / 113 / 128	112 / 113 / 128	113 / 114 / 127	115 / 116 / 126
105,000	8,000	113 / 114 / 123	113 / 114 / 123	114 / 115 / 123	115 / 116 / 122	116 / 117 / 121
	6,000	112 / 113 / 124	112 / 113 / 124	113 / 114 / 124	114 / 115 / 123	115 / 116 / 122
	4,000	111 / 112 / 125	111 / 112 / 125	111 / 113 / 124	113 / 114 / 124	114 / 115 / 123
	2,000	110 / 111 / 125	110 / 111 / 125	110 / 111 / 125	112 / 113 / 124	113 / 114 / 123
	0	109 / 110 / 126	109 / 110 / 126	109 / 110 / 126	110 / 111 / 125	112 / 113 / 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
TO / 25

TAKEOFF WEIGHT LBS	AIRPORT PRESSURE ALTITUDE FT	AMBIENT TEMPERATURE – °C				
		10 & below	20	30	40	50
175,000	8,000					
	6,000					
	4,000					
	2,000					
	0					
170,000	8,000	146 / 147 / 147	145 / 147 / 147	143 / 148 / 148	142 / 149 / 149	140 / 150 / 150
	6,000	145 / 146 / 148	145 / 146 / 148	146 / 147 / 148	147 / 148 / 148	145 / 149 / 149
	4,000	144 / 145 / 149	144 / 145 / 149	144 / 146 / 148	146 / 147 / 148	147 / 148 / 148
	2,000	143 / 144 / 149	143 / 144 / 149	143 / 144 / 149	145 / 146 / 148	146 / 147 / 147
	0	142 / 143 / 150	142 / 143 / 150	142 / 143 / 150	143 / 144 / 149	145 / 146 / 148
165,000	8,000	144 / 145 / 146	144 / 145 / 146	145 / 146 / 146	144 / 147 / 147	142 / 148 / 148
	6,000	143 / 144 / 147	143 / 144 / 147	144 / 145 / 147	145 / 146 / 146	146 / 147 / 147
	4,000	142 / 143 / 148	142 / 143 / 148	142 / 144 / 147	144 / 145 / 147	145 / 146 / 146
	2,000	141 / 142 / 148	141 / 142 / 148	141 / 142 / 148	143 / 144 / 147	144 / 145 / 146
	0	140 / 141 / 149	140 / 141 / 149	140 / 141 / 149	141 / 142 / 148	143 / 144 / 147
160,000	8,000	141 / 142 / 144	141 / 142 / 144	142 / 143 / 144	143 / 144 / 144	144 / 145 / 145
	6,000	140 / 141 / 145	140 / 141 / 145	141 / 142 / 145	142 / 143 / 144	143 / 144 / 144
	4,000	139 / 140 / 146	139 / 140 / 146	139 / 141 / 145	141 / 142 / 145	142 / 143 / 144
	2,000	138 / 139 / 146	138 / 139 / 146	138 / 139 / 146	140 / 141 / 145	141 / 142 / 144
	0	137 / 138 / 147	137 / 138 / 147	137 / 138 / 147	138 / 139 / 146	140 / 141 / 145
155,000	8,000	139 / 140 / 142	139 / 140 / 142	140 / 141 / 142	141 / 142 / 142	142 / 143 / 143
	6,000	138 / 139 / 143	138 / 139 / 143	139 / 140 / 143	140 / 141 / 142	141 / 142 / 142
	4,000	137 / 138 / 144	137 / 138 / 144	137 / 139 / 143	139 / 140 / 143	140 / 141 / 142
	2,000	136 / 137 / 144	136 / 137 / 144	136 / 137 / 144	138 / 139 / 143	139 / 140 / 142
	0	135 / 136 / 145	135 / 136 / 145	135 / 136 / 145	136 / 137 / 144	138 / 139 / 143
150,000	8,000	136 / 138 / 140	136 / 138 / 140	137 / 139 / 140	138 / 140 / 140	139 / 141 / 141
	6,000	135 / 137 / 141	135 / 137 / 141	136 / 138 / 141	137 / 139 / 140	138 / 140 / 140
	4,000	134 / 136 / 142	134 / 136 / 142	134 / 137 / 141	136 / 138 / 141	137 / 139 / 140
	2,000	133 / 135 / 142	133 / 135 / 142	133 / 135 / 142	135 / 137 / 141	136 / 138 / 140
	0	132 / 134 / 143	132 / 134 / 143	132 / 134 / 143	133 / 135 / 142	135 / 137 / 141
145,000	8,000	134 / 135 / 138	134 / 135 / 138	135 / 136 / 138	136 / 137 / 137	137 / 138 / 138
	6,000	133 / 134 / 139	133 / 134 / 139	134 / 135 / 139	135 / 136 / 138	136 / 137 / 137
	4,000	132 / 133 / 140	132 / 133 / 140	132 / 134 / 139	134 / 135 / 139	135 / 136 / 138
	2,000	131 / 132 / 140	131 / 132 / 140	131 / 132 / 140	133 / 134 / 139	134 / 135 / 138
	0	130 / 131 / 141	130 / 131 / 141	130 / 131 / 141	131 / 132 / 140	133 / 134 / 139
140,000	8,000	131 / 132 / 136	131 / 132 / 136	132 / 133 / 136	133 / 134 / 135	134 / 135 / 135
	6,000	130 / 131 / 137	130 / 131 / 137	131 / 132 / 137	132 / 133 / 136	133 / 134 / 135
	4,000	129 / 130 / 138	129 / 130 / 138	129 / 131 / 137	131 / 132 / 137	132 / 133 / 136
	2,000	128 / 129 / 138	128 / 129 / 138	128 / 129 / 138	130 / 131 / 137	131 / 132 / 136
	0	127 / 128 / 139	127 / 128 / 139	127 / 128 / 139	128 / 129 / 138	130 / 131 / 137

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

TAKEOFF SPEEDS

DRY RUNWAY KIAS

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

V₁ / V_R / V₂
TO / 25

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

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

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.									
	6	9	11	14	18	21	24	28	32	36
180	8.50	8.50	8.50	8.00	7.25	6.75	6.50	5.75	5.25	4.50
160	8.50	8.50	8.25	7.75	7.00	6.50	6.00	5.25	4.75	4.00
140	8.50	8.00	7.75	7.25	6.50	6.00	5.50	4.75	4.25	3.50
120	7.75	7.25	7.00	6.50	6.00	5.50	5.00	4.50	3.75	3.00
100	6.75	6.25	6.00	5.75	5.25	4.75	4.25	3.75	3.25	2.75
80	6.75	6.25	6.00	5.75	5.25	4.75	4.25	3.75	3.25	2.75

FLAPS 10, 15, AND 25

GROSS WEIGHT - 1,000 POUNDS	CENTER OF GRAVITY PERCENT M.A.C.									
	6	8	9	10	16	26	27	31	34	36
180	8.50	8.50	8.50	8.50	7.25	5.00	4.75	4.00	3.50	3.00
160	8.50	8.50	8.25	8.00	6.50	4.50	4.50	3.50	3.00	2.75
140	8.00	7.75	7.50	7.25	6.00	4.25	4.00	3.25	2.75	2.75
120	7.00	6.75	6.50	6.25	5.25	3.50	3.25	2.75	2.75	2.75
100	6.00	5.75	5.50	5.50	4.50	2.75	2.75	2.75	2.75	2.75
80	6.00	5.75	5.50	5.50	4.50	2.75	2.75	2.75	2.75	2.75

TAKEOFF STABILIZER SETTINGS

UNITS AIRPLANE NOSE UP

TO1

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

FLAPS 1 AND 5

GROSS WEIGHT - 1,000 POUNDS	CENTER OF GRAVITY PERCENT M.A.C.									
	6	8	10	14	18	22	26	33	34	36
180	8.50	8.50	8.50	7.75	7.25	6.50	5.75	4.50	4.25	4.00
160	8.50	8.50	8.25	7.50	6.75	6.00	5.50	4.25	4.00	3.75
140	8.00	7.75	7.25	6.75	6.25	5.50	4.75	3.75	3.50	3.25
120	7.25	7.00	6.75	6.25	5.50	5.00	4.25	3.25	3.25	3.00
100	6.50	6.25	6.00	5.25	4.75	4.25	3.75	2.75	2.75	2.75
80	6.50	6.25	6.00	5.25	4.75	4.25	3.75	2.75	2.75	2.75

FLAPS 10, 15, AND 25

GROSS WEIGHT - 1,000 POUNDS	CENTER OF GRAVITY PERCENT M.A.C.									
	6	8	9	10	16	26	29	32	34	36
180	8.50	8.50	8.50	8.50	7.00	5.00	4.25	3.75	3.25	2.75
160	8.50	8.50	8.25	8.00	6.50	4.50	3.75	3.25	2.75	2.75
140	8.00	7.75	7.50	7.25	5.75	3.75	3.25	2.75	2.75	2.75
120	7.00	6.75	6.50	6.25	5.25	3.25	2.75	2.75	2.75	2.75
100	5.75	5.50	5.25	5.00	4.25	2.75	2.75	2.75	2.75	2.75
80	5.75	5.50	5.25	5.00	4.25	2.75	2.75	2.75	2.75	2.75

TAKEOFF STABILIZER SETTINGS

UNITS AIRPLANE NOSE UP

TO

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

FLAPS 1 AND 5

GROSS WEIGHT - 1,000 POUNDS	CENTER OF GRAVITY PERCENT M.A.C.									
	6	9	14	18	22	26	30	32	33	36
180	8.50	8.50	7.75	7.00	6.25	5.50	5.00	4.50	4.50	4.00
160	8.50	8.00	7.25	6.50	5.75	5.25	4.50	4.25	4.00	3.50
140	7.75	7.25	6.50	6.00	5.25	4.75	4.00	3.75	3.50	3.00
120	7.00	6.50	5.75	5.25	4.75	4.00	3.50	3.25	3.00	2.75
100	6.25	5.75	5.25	4.50	4.00	3.50	3.00	2.75	2.75	2.75
80	6.25	5.75	5.25	4.50	4.00	3.50	3.00	2.75	2.75	2.75

FLAPS 10, 15, AND 25

GROSS WEIGHT - 1,000 POUNDS	CENTER OF GRAVITY PERCENT M.A.C.									
	6	9	11	16	24	28	29	31	33	36
180	8.50	8.50	8.50	6.75	5.00	4.25	4.00	3.50	3.25	2.75
160	8.50	8.50	7.75	6.00	4.50	3.75	3.50	3.00	2.75	2.75
140	8.00	7.25	6.75	5.50	4.00	3.25	3.00	2.75	2.75	2.75
120	7.00	6.25	6.00	5.00	3.50	2.75	2.75	2.75	2.75	2.75
100	5.25	4.75	4.50	3.75	2.75	2.75	2.75	2.75	2.75	2.75
80	5.25	4.75	4.50	3.75	2.75	2.75	2.75	2.75	2.75	2.75

End of Section

CONTENTS

	Page
DEFINITIONS AND ASSUMPTIONS	3-2
PATTERN AND APPROACH SPEEDS	3-3
STALL SPEEDS - V_s.....	3-4
F.A.R. DRY LANDING FIELD LENGTH	3-5
FLAPS 15	3-5
FLAPS 30	3-6
FLAPS 40	3-7
APPROACH AND LANDING CLIMB LIMITS	3-9
APPROACH FLAPS 1 LANDING FLAPS 15	3-9
APPROACH FLAPS 15 LANDING FLAPS 30	3-10
APPROACH FLAPS 15 LANDING FLAPS 40	3-11
OPERATIONAL LANDING DISTANCES.....	3-12
FLAPS 15	3-12
FLAPS 30	3-14
FLAPS 40	3-16

DEFINITIONS AND ASSUMPTIONS

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

PATTERN AND APPROACH SPEEDS

KIAS

NORMAL CONFIGURATION

GROSS WEIGHT – POUNDS	V _{Ref}	APPROACH – GEAR UP						LANDING – GEAR DOWN		
		SLATS RET	SLATS EXT		SLATS 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}
175,000	155	225	205	185	185	175	165	172	163	155
170,000	153	223	203	183	183	173	163	169	160	153
165,000	150	220	200	180	180	170	160	166	158	150
160,000	148	218	198	178	178	168	158	164	156	148
155,000	146	216	196	176	176	166	156	161	153	146
150,000	144	214	194	174	174	164	154	159	151	144
145,000	141	211	191	171	171	161	151	156	148	141
140,000	139	209	189	169	169	159	149	154	146	139
135,000	136	206	186	166	166	156	146	151	143	136
130,000	133	203	183	163	163	153	143	148	141	133
125,000	130	200	180	160	160	150	140	145	138	130
120,000	128	198	178	158	158	148	138	142	135	128
115,000	125	195	175	155	155	145	135	138	132	125
110,000	122	192	172	152	152	142	132	135	129	122
105,000	119	189	169	149	149	139	129	132	126	119
100,000	116	186	166	146	146	136	126	129	123	116
95,000	112	182	162	142	142	132	122	125	119	112
90,000	109	179	159	139	139	129	119	122	116	109

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
175,000	178	142	139	133	130	128	132	126	124
170,000	175	140	136	130	128	126	129	124	122
165,000	172	138	134	128	126	124	127	122	120
160,000	169	136	132	126	124	122	125	120	118
155,000	166	133	130	124	122	120	123	118	116
150,000	163	131	128	122	120	118	121	116	114
145,000	159	128	126	120	118	116	119	114	112
140,000	156	126	124	118	116	114	116	112	110
135,000	153	124	121	116	113	112	114	110	108
130,000	150	122	118	114	111	110	112	108	106
125,000	147	119	116	111	109	108	110	106	104
120,000	144	116	114	109	106	105	108	104	102
115,000	141	114	111	106	104	103	106	102	100
110,000	138	111	108	104	102	101	104	100	98
105,000	135	108	106	101	100	98	101	98	96
100,000	132	106	104	99	98	96	99	96	93
95,000	129	104	101	96	95	94	96	93	90
90,000	125	100	98	94	92	91	94	90	88

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 – POUNDS	AIRPORT PRESSURE ALTITUDE – FEET									
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	8,400
175,000	7,500	7,690	7,880	8,070	8,280	8,550	8,940	9,360	9,830	10,020
170,000	7,220	7,400	7,580	7,770	7,970	8,160	8,370	8,700	9,100	9,280
165,000	6,950	7,110	7,290	7,470	7,650	7,840	8,040	8,250	8,460	8,600
160,000	6,730	6,890	7,060	7,230	7,410	7,590	7,790	7,990	8,190	8,280
155,000	6,540	6,690	6,860	7,020	7,200	7,380	7,560	7,750	7,950	8,040
150,000	6,350	6,500	6,650	6,820	6,990	7,160	7,340	7,520	7,720	7,800
145,000	6,160	6,300	6,450	6,610	6,770	6,940	7,110	7,290	7,480	7,550
140,000	5,950	6,090	6,240	6,390	6,540	6,700	6,870	7,040	7,220	7,290
135,000	5,740	5,880	6,010	6,160	6,310	6,460	6,620	6,790	6,960	7,030
130,000	5,530	5,660	5,790	5,930	6,080	6,220	6,380	6,530	6,700	6,770
125,000	5,320	5,450	5,570	5,710	5,840	5,980	6,130	6,280	6,440	6,500
120,000	5,120	5,230	5,360	5,480	5,610	5,750	5,890	6,030	6,180	6,240
115,000	4,910	5,020	5,140	5,260	5,380	5,510	5,640	5,780	5,920	5,980
110,000	4,700	4,810	4,920	5,030	5,150	5,270	5,400	5,530	5,670	5,720
105,000	4,500	4,600	4,710	4,820	4,930	5,040	5,170	5,290	5,420	5,470
100,000	4,340	4,440	4,540	4,640	4,750	4,860	4,970	5,090	5,220	5,270
95,000	4,170	4,270	4,360	4,460	4,570	4,670	4,780	4,900	5,020	5,060
90,000	4,010	4,100	4,190	4,280	4,380	4,480	4,590	4,700	4,810	4,860

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	- 15 ft. per knot
Tailwind	+ 80 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 30**

AIRCRAFT WEIGHT – POUNDS	AIRPORT PRESSURE ALTITUDE – FEET									
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	8,400
175,000	6,830	6,990	7,160	7,340	7,520	7,710	7,910	8,110	8,320	8,410
170,000	6,650	6,810	6,980	7,150	7,330	7,510	7,700	7,900	8,100	8,180
165,000	6,470	6,630	6,790	6,960	7,130	7,310	7,490	7,680	7,880	7,960
160,000	6,300	6,450	6,600	6,760	6,930	7,100	7,280	7,470	7,660	7,740
155,000	6,120	6,260	6,420	6,570	6,730	6,900	7,070	7,250	7,440	7,510
150,000	5,940	6,080	6,230	6,380	6,540	6,690	6,860	7,030	7,210	7,290
145,000	5,760	5,900	6,040	6,180	6,340	6,490	6,650	6,820	6,990	7,060
140,000	5,570	5,700	5,840	5,980	6,120	6,270	6,420	6,590	6,750	6,820
135,000	5,370	5,500	5,630	5,760	5,900	6,050	6,190	6,350	6,510	6,570
130,000	5,180	5,300	5,420	5,550	5,690	5,820	5,960	6,110	6,270	6,330
125,000	4,990	5,100	5,220	5,340	5,470	5,600	5,740	5,880	6,020	6,080
120,000	4,790	4,900	5,010	5,130	5,250	5,380	5,510	5,640	5,780	5,840
115,000	4,600	4,700	4,810	4,920	5,040	5,160	5,280	5,410	5,540	5,600
110,000	4,440	4,540	4,640	4,750	4,860	4,970	5,090	5,210	5,340	5,400
105,000	4,280	4,380	4,480	4,580	4,690	4,800	4,910	5,030	5,150	5,200
100,000	4,130	4,220	4,310	4,410	4,510	4,620	4,730	4,840	4,960	5,010
95,000	3,970	4,060	4,150	4,240	4,340	4,440	4,550	4,660	4,770	4,820
90,000	3,810	3,900	3,990	4,080	4,170	4,260	4,370	4,470	4,580	4,620

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	- 15 ft. per knot
Tailwind	+ 80 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 – POUNDS	AIRPORT PRESSURE ALTITUDE – FEET									
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	8,400
175,000	6,390	6,540	6,700	6,870	7,040	7,210	7,400	7,590	7,780	7,860
170,000	6,230	6,370	6,530	6,690	6,860	7,030	7,200	7,390	7,580	7,650
165,000	6,060	6,210	6,360	6,510	6,670	6,840	7,010	7,190	7,370	7,450
160,000	5,900	6,040	6,180	6,330	6,490	6,650	6,810	6,990	7,160	7,240
155,000	5,730	5,860	6,000	6,150	6,300	6,460	6,620	6,780	6,960	7,030
150,000	5,560	5,690	5,830	5,970	6,120	6,260	6,420	6,580	6,750	6,820
145,000	5,400	5,520	5,650	5,790	5,930	6,070	6,220	6,380	6,540	6,610
140,000	5,210	5,330	5,460	5,590	5,720	5,860	6,010	6,160	6,310	6,380
135,000	5,030	5,140	5,260	5,390	5,520	5,650	5,790	5,930	6,080	6,140
130,000	4,840	4,950	5,070	5,180	5,310	5,430	5,570	5,710	5,850	5,910
125,000	4,650	4,760	4,870	4,980	5,100	5,220	5,350	5,480	5,620	5,670
120,000	4,470	4,570	4,680	4,790	4,900	5,020	5,140	5,260	5,390	5,450
115,000	4,330	4,420	4,520	4,630	4,740	4,850	4,960	5,090	5,210	5,260
110,000	4,180	4,270	4,370	4,470	4,570	4,680	4,790	4,910	5,030	5,080
105,000	4,030	4,120	4,210	4,310	4,410	4,510	4,620	4,730	4,850	4,890
100,000	3,880	3,970	4,060	4,150	4,240	4,340	4,450	4,550	4,660	4,710
95,000	3,730	3,810	3,900	3,990	4,080	4,170	4,270	4,370	4,480	4,520
90,000	3,580	3,660	3,740	3,830	3,910	4,000	4,100	4,200	4,300	4,340

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	- 15 ft. per knot
Tailwind	+ 80 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%

THIS PAGE INTENTIONALLY BLANK

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	8,400
50	179,774	172,801	165,698	OUTSIDE ENVIRONMENTAL ENVELOPE						
45	188,109	181,957	175,830	169,306	162,277					
40	190,000	189,863	183,451	177,199	171,069	165,132	157,327	149,923		
35	190,000	190,000	190,000	185,037	178,622	172,302	165,136	157,425	149,954	147,458
32	190,000	190,000	190,000	189,557	183,224	176,650	169,341	161,679	154,097	151,481
30	190,000	190,000	190,000	190,000	185,528	179,257	171,948	164,283	156,811	154,174
28	190,000	190,000	190,000	190,000	187,749	180,838	174,368	166,742	159,299	156,686
26	190,000	190,000	190,000	190,000	189,590	182,413	175,701	169,078	161,628	158,847
24	190,000	190,000	190,000	190,000	190,000	184,035	176,969	170,304	163,785	160,940
22	190,000	190,000	190,000	190,000	190,000	185,696	178,593	171,492	164,929	162,377
20	190,000	190,000	190,000	190,000	190,000	187,266	180,513	173,286	166,072	163,568
18	190,000	190,000	190,000	190,000	190,000	187,364	182,254	175,412	167,914	164,903
≤ 16	190,000	190,000	190,000	190,000	190,000	187,462	182,349	177,327	170,299	167,300

NOTES:

- AFM Maximum Structural Landing Weight must not be exceeded.
- Reduce Gross Weight by 16,300 lbs. when operating in icing conditions during any part of the flight when the forecast landing temperature is below 10°C.

CORRECTIONS:

CONFIGURATION	CORRECTION – POUNDS	
	A/C PACKS OFF	A/C PACKS ON
Engine Anti-Ice OFF	0	0
Engine Anti-Ice ON	-600	- 600
Engine & Wing Anti-Ice ON	- 1,900	- 1,900

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	8,400
50	149,790	143,908	138,095	OUTSIDE ENVIRONMENTAL ENVELOPE						
45	156,760	151,645	146,506	141,099	135,357					
40	163,883	158,394	153,049	147,812	142,709	137,907	131,524	125,490		
35	171,117	165,726	159,986	154,620	149,265	143,987	138,141	131,776	125,617	123,645
32	175,924	169,934	164,339	158,339	153,085	147,468	141,488	135,293	129,088	127,001
30	178,859	172,526	166,757	160,616	154,967	149,613	143,570	137,396	131,311	129,187
28	179,049	174,997	168,920	162,577	156,787	150,987	145,563	139,424	133,371	131,223
26	179,232	175,162	171,004	164,342	158,372	152,355	146,758	141,338	135,335	133,049
24	179,387	175,303	171,127	165,934	159,671	153,646	147,862	142,386	137,119	134,792
22	179,529	175,437	171,243	166,035	160,842	154,865	148,967	143,361	138,068	135,943
20	179,671	175,564	171,356	166,135	160,929	156,004	150,114	144,387	138,984	136,863
18	179,799	175,692	171,466	166,233	161,016	156,079	151,123	145,396	139,885	137,726
≤ 16	179,926	175,802	171,575	166,326	161,101	156,153	151,194	146,289	140,775	138,590

NOTES:

- AFM Maximum Structural Landing Weight must not be exceeded.
- Reduce Gross Weight by 16,200 lbs. when operating in icing conditions during any part of the flight when the forecast landing temperature is below 10°C.

CORRECTIONS:

CONFIGURATION	CORRECTION – POUNDS	
	A/C PACKS OFF	A/C PACKS ON
Engine Anti-Ice OFF	+ 2,800	0
Engine Anti-Ice ON	+ 2,200	- 600
Engine & Wing Anti-Ice ON	- 300	- 3,100

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	8,400
50	149,790	143,908	138,095	OUTSIDE ENVIRONMENTAL ENVELOPE						
45	156,760	151,645	146,506							
40	163,883	158,394	153,049	147,812	142,709	137,907	131,524	125,490		
35	171,117	165,726	159,986	154,620	149,265	143,987	138,141	131,776	125,617	123,645
32	175,924	169,934	164,339	158,339	153,085	147,468	141,488	135,293	129,088	127,001
30	178,859	172,526	166,757	160,616	154,967	149,613	143,570	137,396	131,311	129,187
28	179,049	174,997	168,920	162,577	156,787	150,987	145,563	139,424	133,371	131,223
26	179,232	175,162	171,004	164,342	158,372	152,355	146,758	141,338	135,335	133,049
24	179,387	175,303	171,127	165,934	159,671	153,646	147,862	142,386	137,119	134,792
22	179,529	175,437	171,243	166,035	160,842	154,865	148,967	143,361	138,068	135,943
20	179,671	175,564	171,356	166,135	160,929	156,004	150,114	144,387	138,984	136,863
18	179,799	175,692	171,466	166,233	161,016	156,079	151,123	145,396	139,885	137,726
≤ 16	179,926	175,802	171,575	166,326	161,101	156,153	151,194	146,289	140,775	138,590

NOTES:

- AFM Maximum Structural Landing Weight must not be exceeded.
- Reduce Gross Weight by 16,200 lbs. when operating in icing conditions during any part of the flight when the forecast landing temperature is below 10°C.

CORRECTIONS:

CONFIGURATION	CORRECTION – POUNDS	
	A/C PACKS OFF	A/C PACKS ON
Engine Anti-Ice OFF	+ 2,800	0
Engine Anti-Ice ON	+ 2,200	- 600
Engine & Wing Anti-Ice ON	- 300	- 3,100

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
180,000	13,600	12,100	9,400	6,600	5,500	9,400	7,600	7,100
175,000	13,300	11,900	9,200	6,500	5,400	9,200	7,400	7,000
170,000	13,000	11,600	9,100	6,400	5,300	9,100	7,300	6,900
165,000	12,700	11,400	8,900	6,300	5,100	8,900	7,100	6,700
160,000	12,300	11,100	8,700	6,100	5,000	8,700	7,000	6,600
155,000	12,000	10,800	8,500	6,000	4,900	8,500	6,900	6,500
150,000	11,700	10,600	8,300	5,900	4,800	8,300	6,700	6,300
146,300	11,500	10,400	8,200	5,800	4,700	8,200	6,600	6,200
145,000	11,400	10,300	8,100	5,800	4,600	8,100	6,600	6,200
140,000	11,000	10,000	7,900	5,700	4,500	7,900	6,400	6,100
135,000	10,700	9,700	7,700	5,500	4,400	7,700	6,300	5,900
130,000	10,400	9,400	7,500	5,400	4,300	7,500	6,100	5,800
125,000	10,000	9,100	7,300	5,300	4,200	7,300	5,900	5,600
120,000	9,700	8,800	7,100	5,200	4,100	7,100	5,800	5,500
115,000	9,400	8,500	6,900	5,000	4,000	6,900	5,600	5,300
110,000	9,000	8,200	6,700	4,900	3,900	6,700	5,500	5,200

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

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

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

 Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	DRY (6)					GOOD (5)		
0	-700	-600	-400	-200	-200	-400	-300	-300
2,000	0	0	0	0	0	0	0	0
4,000	700	600	400	200	200	400	300	300
6,000	1,400	1,200	800	500	400	800	600	600
8,000	2,100	1,700	1,200	700	600	1,200	900	800
10,000	3,000	2,400	1,700	1,000	800	1,700	1,300	1,200

CORRECTIONS	DRY (6)					GOOD (5)		
PER 1 KT HEADWIND	-50	-50	-50	0	0	-50	0	0
PER 1 KT TAILWIND	150	150	100	50	50	100	100	100
PER 5 KTS ADD'L SPD	350	400	400	250	150	400	200	200
PER 10°C ABOVE ISA	300	250	200	100	100	200	150	150
PER 10°C BELOW ISA	-300	-250	-200	-100	-100	-200	-150	-150
PER 1% UP SLOPE	-300	-150	0	0	-50	0	-100	-100
PER 1% DOWN SLOPE	250	100	0	0	50	0	100	150
1 REVERSER INOP	900	300	0	0	100	0	300	300
2 REVERSERS INOP	1,300	300	0	0	200	100	700	700
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
180,000	10,500	10,100	9,900	13,300	13,200	13,200
175,000	10,300	9,900	9,700	13,000	12,900	12,900
170,000	10,100	9,700	9,500	12,600	12,600	12,600
165,000	9,800	9,400	9,300	12,300	12,200	12,200
160,000	9,600	9,200	9,100	12,000	11,900	11,900
155,000	9,400	9,000	8,900	11,700	11,600	11,600
150,000	9,200	8,800	8,700	11,400	11,300	11,300
146,300	9,000	8,600	8,500	11,100	11,100	11,100
145,000	9,000	8,600	8,400	11,100	11,000	11,000
140,000	8,700	8,300	8,200	10,700	10,700	10,700
135,000	8,500	8,100	8,000	10,400	10,400	10,400
130,000	8,300	7,900	7,800	10,100	10,000	10,000
125,000	8,000	7,700	7,500	9,800	9,700	9,700
120,000	7,800	7,400	7,300	9,400	9,400	9,400
115,000	7,500	7,200	7,100	9,100	9,100	9,100
110,000	7,300	7,000	6,900	8,800	8,800	8,800

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

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

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



Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

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

CORRECTIONS	MEDIUM (3)			POOR (1)		
PER 1 KT HEADWIND	-50	-50	-50	-50	-50	-50
PER 1 KT TAILWIND	150	150	150	200	200	200
PER 5 KTS ADD'L SPD	400	300	250	350	300	300
PER 10°C ABOVE ISA	200	200	200	250	250	250
PER 10°C BELOW ISA	-250	-200	-200	-300	-300	-300
PER 1% UP SLOPE	-150	-250	-250	-500	-550	-550
PER 1% DOWN SLOPE	250	300	350	800	850	800
1 REVERSER INOP	600	800	800	1,800	1,700	1,700
2 REVERSERS INOP	1,700	2,000	2,000	4,700	4,700	4,700
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
180,000	12,400	11,100	8,700	6,200	5,100	8,700	7,200	6,800
175,000	12,100	10,900	8,500	6,100	5,000	8,500	7,100	6,700
170,000	11,900	10,600	8,400	6,000	4,900	8,400	6,900	6,600
165,000	11,600	10,400	8,200	5,900	4,800	8,200	6,800	6,500
160,000	11,300	10,200	8,000	5,800	4,700	8,000	6,700	6,300
155,000	11,000	9,900	7,900	5,700	4,600	7,900	6,500	6,200
150,000	10,700	9,700	7,700	5,500	4,500	7,700	6,400	6,100
146,300	10,500	9,500	7,600	5,500	4,500	7,600	6,300	6,000
145,000	10,400	9,500	7,500	5,400	4,400	7,500	6,300	5,900
140,000	10,100	9,200	7,300	5,300	4,400	7,400	6,100	5,800
135,000	9,800	9,000	7,100	5,200	4,300	7,200	6,000	5,700
130,000	9,500	8,700	7,000	5,100	4,200	7,000	5,900	5,600
125,000	9,200	8,400	6,800	5,000	4,100	6,800	5,700	5,400
120,000	8,900	8,200	6,600	4,900	4,000	6,600	5,600	5,300
115,000	8,600	7,900	6,400	4,800	3,900	6,400	5,400	5,200
110,000	8,300	7,700	6,200	4,600	3,800	6,200	5,300	5,000

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

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

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

Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

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

CORRECTIONS	DRY (6)					GOOD (5)		
PER 1 KT HEADWIND	-50	-50	-50	0	0	-50	0	0
PER 1 KT TAILWIND	150	150	100	50	50	100	100	100
PER 5 KTS ADD'L SPD	350	350	350	200	150	350	200	200
PER 10°C ABOVE ISA	300	250	200	100	100	200	150	150
PER 10°C BELOW ISA	-300	-250	-200	-100	-100	-200	-150	-150
PER 1% UP SLOPE	-300	-150	0	0	-50	0	-100	-100
PER 1% DOWN SLOPE	250	100	0	0	50	0	100	150
1 REVERSER INOP	700	200	0	0	100	0	300	300
2 REVERSERS INOP	1,100	200	0	0	200	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 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
180,000	9,800	9,500	9,300	12,300	12,300	12,200
175,000	9,600	9,300	9,100	12,100	12,000	11,900
170,000	9,400	9,100	8,900	11,800	11,700	11,700
165,000	9,200	8,900	8,700	11,500	11,400	11,400
160,000	9,000	8,700	8,500	11,200	11,100	11,100
155,000	8,800	8,500	8,400	10,900	10,800	10,800
150,000	8,600	8,300	8,200	10,600	10,600	10,500
146,300	8,500	8,200	8,000	10,400	10,300	10,300
145,000	8,400	8,100	8,000	10,300	10,300	10,300
140,000	8,200	7,900	7,800	10,000	10,000	10,000
135,000	8,000	7,700	7,500	9,700	9,700	9,700
130,000	7,700	7,500	7,300	9,500	9,400	9,400
125,000	7,500	7,300	7,100	9,200	9,100	9,100
120,000	7,300	7,000	6,900	8,900	8,800	8,800
115,000	7,100	6,800	6,700	8,600	8,500	8,500
110,000	6,900	6,600	6,500	8,300	8,300	8,200

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

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

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



Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

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

CORRECTIONS	MEDIUM (3)			POOR (1)		
PER 1 KT HEADWIND	-50	-50	-50	-50	-50	-50
PER 1 KT TAILWIND	150	150	150	200	200	200
PER 5 KTS ADD'L SPD	350	300	250	350	300	300
PER 10°C ABOVE ISA	200	200	200	250	250	250
PER 10°C BELOW ISA	-200	-200	-200	-250	-250	-250
PER 1% UP SLOPE	-150	-250	-250	-500	-500	-500
PER 1% DOWN SLOPE	250	300	300	750	800	750
1 REVERSER INOP	500	700	700	1,500	1,500	1,500
2 REVERSERS INOP	1,500	1,700	1,700	4,000	4,000	3,900
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
180,000	11,600	10,300	8,000	5,800	4,900	8,100	6,900	6,500
175,000	11,300	10,100	7,900	5,700	4,800	7,900	6,800	6,400
170,000	11,100	9,900	7,700	5,600	4,700	7,800	6,700	6,300
165,000	10,800	9,700	7,600	5,500	4,600	7,600	6,500	6,200
160,000	10,600	9,500	7,400	5,400	4,500	7,500	6,400	6,100
155,000	10,300	9,200	7,300	5,300	4,400	7,300	6,300	5,900
150,000	10,000	9,000	7,100	5,200	4,400	7,200	6,200	5,800
146,300	9,900	8,900	7,000	5,100	4,300	7,100	6,100	5,700
145,000	9,800	8,800	7,000	5,100	4,300	7,000	6,000	5,700
140,000	9,500	8,600	6,800	5,000	4,200	6,900	5,900	5,600
135,000	9,200	8,300	6,700	4,900	4,100	6,700	5,800	5,500
130,000	8,900	8,100	6,500	4,800	4,000	6,500	5,600	5,300
125,000	8,700	7,900	6,300	4,700	3,900	6,300	5,500	5,200
120,000	8,400	7,600	6,100	4,600	3,800	6,200	5,300	5,100
115,000	8,100	7,400	6,000	4,500	3,700	6,000	5,200	4,900
110,000	7,800	7,100	5,800	4,400	3,700	5,800	5,100	4,800

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

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

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

Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

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

CORRECTIONS	DRY (6)					GOOD (5)		
PER 1 KT HEADWIND	-50	-50	-50	0	0	-50	0	0
PER 1 KT TAILWIND	150	100	100	50	50	100	100	100
PER 5 KTS ADD'L SPD	300	350	350	200	150	350	200	200
PER 10°C ABOVE ISA	250	200	150	100	50	150	150	100
PER 10°C BELOW ISA	-250	-200	-150	-100	-50	-150	-150	-100
PER 1% UP SLOPE	-250	-150	0	0	-50	0	-100	-100
PER 1% DOWN SLOPE	200	50	0	0	50	50	100	150
1 REVERSER INOP	600	100	0	0	100	0	300	200
2 REVERSERS INOP	800	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 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
180,000	9,200	9,000	8,900	11,700	11,600	11,600
175,000	9,000	8,800	8,700	11,400	11,400	11,300
170,000	8,800	8,600	8,500	11,200	11,100	11,100
165,000	8,600	8,500	8,300	10,900	10,800	10,800
160,000	8,500	8,300	8,100	10,600	10,600	10,500
155,000	8,300	8,100	8,000	10,400	10,300	10,300
150,000	8,100	7,900	7,800	10,100	10,000	10,000
146,300	7,900	7,700	7,600	9,900	9,800	9,800
145,000	7,900	7,700	7,600	9,800	9,800	9,700
140,000	7,700	7,500	7,400	9,500	9,500	9,500
135,000	7,500	7,300	7,200	9,300	9,200	9,200
130,000	7,300	7,100	7,000	9,000	8,900	8,900
125,000	7,100	6,900	6,800	8,700	8,700	8,700
120,000	6,800	6,700	6,600	8,400	8,400	8,400
115,000	6,600	6,500	6,400	8,200	8,100	8,100
110,000	6,400	6,300	6,200	7,900	7,800	7,800

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

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

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

Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	MEDIUM (3)			POOR (1)		
0	-400	-400	-400	-600	-600	-600
2,000	0	0	0	0	0	0
4,000	400	400	400	600	600	600
6,000	800	800	800	1,200	1,100	1,100
8,000	1,200	1,200	1,200	1,700	1,700	1,700
10,000	1,800	1,700	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	150	150	100	200	200	200
PER 5 KTS ADD'L SPD	350	300	250	300	300	300
PER 10°C ABOVE ISA	200	150	150	250	250	250
PER 10°C BELOW ISA	-200	-200	-200	-250	-250	-250
PER 1% UP SLOPE	-150	-250	-250	-450	-500	-500
PER 1% DOWN SLOPE	250	300	300	750	750	750
1 REVERSER INOP	600	600	600	1,400	1,400	1,400
2 REVERSERS INOP	1,500	1,500	1,500	3,500	3,500	3,500
MANUAL SPOILERS	200	200	200	200	200	200

Note: Do not operate when Braking Action is Nil.

End of Section

CONTENTS

	Page
DEFINITIONS AND ASSUMPTIONS	4-3
THRUST SETTINGS – ALL ENGINE.....	4-4
TAKEOFF %N ₁	4-4
CLIMB %N ₁	4-7
CRUISE %N ₁	4-8
GO AROUND %N ₁	4-9
ONE ENGINE INOPERATIVE	4-10
MAXIMUM CONTINUOUS THRUST N ₁	4-10
DRIFTDOWN PROCEDURES	4-11
DRIFTDOWN SPEED AND GROSS LEVEL OFF ALTITUDE.....	4-12
LONG RANGE CRUISE ALTITUDE CAPABILITY.....	4-13
LONG RANGE CRUISE	4-14
LANDING GEAR EXTENDED REVENUE OPERATIONS.....	4-18
PROCEDURES	4-18
DRIFTDOWN PERFORMANCE	4-19
LONG RANGE CRUISE ALTITUDE CAPABILITY.....	4-19
LONG RANGE CRUISE – ONE ENGINE INOPERATIVE	4-20
ABNORMAL CONFIGURATION ACTUAL LANDING DISTANCES AND APPROACH SPEEDS.....	4-22
APPLICABILITY.....	4-22
ASSUMPTIONS.....	4-22
ALL FLAPS UP	4-23
ANTI-SKID INOPERATIVE (FLAPS 40)**	4-23
HYDRAULICS - LOSS OF SYSTEM A (FLAPS 15).....	4-24
HYDRAULICS - LOSS OF SYSTEM A (FLAPS 30).....	4-24
HYDRAULICS - LOSS OF SYSTEM A (FLAPS 40).....	4-25
HYDRAULICS - LOSS OF SYSTEM B (FLAPS 15).....	4-25
HYDRAULICS - MANUAL REVERSION (LOSS OF SYSTEM A & B)	4-26
LEADING EDGE FLAPS TRANSIT	4-26
ONE ENGINE INOPERATIVE (FLAPS 15)	4-27
STABILIZER TRIM INOPERATIVE	4-27
JAMMED/RESTRICTED FLIGHT CONTROLS	4-28
TRAILING EDGE FLAP ASYMMETRY (30 ≤ FLAPS < 40)	4-28
TRAILING EDGE FLAP ASYMMETRY (15 ≤ FLAPS < 30)	4-29
TRAILING EDGE FLAP ASYMMETRY (1 ≤ FLAPS < 15)	4-29
TRAILING EDGE FLAP DISAGREE (30 ≤ FLAPS < 40)	4-30
TRAILING EDGE FLAP DISAGREE (15 ≤ FLAPS < 30)	4-30
TRAILING EDGE FLAP DISAGREE (1 ≤ FLAPS < 15)	4-31
TRAILING EDGE FLAPS UP	4-31

CONTENTS (cont.)

	Page
EMERGENCY LANDING DISTANCES	4-32
FLAPS 15	4-32
FLAPS 30	4-34
FLAPS 40	4-36
OPERATION WITHOUT AIRSPEED INDICATION	4-38
CLIMB	4-38
CRUISE	4-38
DESCENT	4-39
HOLDING	4-39
TERMINAL AREA	4-39
FINAL APPROACH	4-40
BRAKE COOLING – CARBON BRAKES	4-41
BRAKE COOLING FOLLOWING LANDING	4-41
GOVERNING CONDITIONS	4-41
PROCEDURES	4-41
MAXIMUM QUICK TURN-AROUND LANDING WEIGHT	4-42
LANDING BRAKE COOLING TIMES	4-44
BRAKE COOLING FOLLOWING REJECTED TAKEOFF	4-45
BRAKE COOLING – STEEL BRAKES	4-47
BRAKE COOLING FOLLOWING LANDING	4-47
GOVERNING CONDITIONS	4-47
PROCEDURES	4-47
MAXIMUM QUICK TURN-AROUND LANDING WEIGHT	4-48
LANDING BRAKE COOLING TIMES	4-50
BRAKE COOLING FOLLOWING REJECTED TAKEOFF	4-51
MEL SUPPORT	4-52
V _{MCG} - MINIMUM CONTROL SPEED, GROUND	4-52
73-00-11: EEC NORMAL MODE INOPERATIVE	4-53
73-00-11: EEC ALTERNATE MODE TAKEOFF THRUST	4-54
FAR LANDING DISTANCES (FACTORED)	4-55
DEFINITION	4-55
APPLICABILITY	4-55
ASSUMPTIONS	4-55
ANTI-SKID INOP	4-56
MANUAL SPOILERS	4-57

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
-----------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

*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	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0
-----------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

*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	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9
-----------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

*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	90.2	90.5	90.4	90.6	90.4	92.1	93.8	95.1	95.2	93.5
55	91.0	91.2	91.3	91.4	90.8	91.5	93.1	94.4	94.5	92.8
50	91.7	92.0	92.1	92.2	91.7	91.5	92.4	93.7	93.8	92.1
45	92.4	92.6	92.8	93.0	92.6	92.4	92.4	93.0	93.1	91.4
40	93.1	93.3	93.6	93.8	93.4	93.2	93.2	92.3	92.4	90.7
35	93.6	94.0	94.3	94.5	94.3	94.0	94.0	93.0	92.4	90.8
30	92.9	94.8	95.0	95.2	95.1	94.8	94.7	93.9	93.3	91.8
25	92.2	94.8	95.7	95.9	95.9	95.5	95.4	94.7	94.1	92.8
20	91.4	94.0	96.5	96.7	96.6	96.2	96.1	95.4	94.9	93.7
15	90.6	93.2	95.9	97.5	97.4	96.9	96.7	96.2	95.7	94.6
10	89.9	92.5	95.1	97.8	98.3	97.7	97.4	96.9	96.5	95.6
5	89.1	91.7	94.3	97.0	99.2	98.6	98.1	97.7	97.3	96.5
0	88.3	90.9	93.5	96.2	98.6	99.6	99.1	98.5	98.2	97.5
-5	87.6	90.1	92.7	95.4	97.8	99.6	100.0	99.2	99.0	98.4
-10	86.8	89.3	91.9	94.6	97.1	98.8	100.3	100.2	99.8	99.4
-15	86.0	88.5	91.0	93.8	96.3	98.0	99.6	101.8	100.8	100.4
-20	85.2	87.6	90.2	93.0	95.5	97.2	98.7	100.8	101.3	101.0
-25	84.3	86.8	89.4	92.2	94.7	96.4	97.9	100.0	100.5	100.1
-30	83.5	86.0	88.5	91.3	93.9	95.6	97.1	99.1	99.6	99.3
-35	82.7	85.1	87.7	90.5	93.1	94.8	96.3	98.3	98.8	98.4
-40	81.8	84.3	86.8	89.6	92.3	93.9	95.4	97.4	97.9	97.6

Engine Bleed Adjustments

	PRESSURE ALTITUDE (1000 FT)					
	0	10	20	30	35	41
Engine Anti- Ice ON	-0.6	-0.8	-0.9	-0.9	-0.8	-0.8
Engine and Wing Anti- Ice (Dual bleed sources)	-1.8	-2.1	-2.5	-2.7	-3.0	-3.0
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	31.8	91.6								
10	92.8	92.3	92.2								
5	92.9	92.9	92.7	92.8	92.8	92.6	92.3	91.9	92.0	91.8	91.3
0	92.1	93.5	93.4	93.3	93.3	93.1	92.9	92.5	92.6	92.4	92.1
-5	91.2	94.1	94.2	94.1	94.0	93.8	93.6	93.1	93.2	93.0	92.8
-10	90.4	93.3	93.9	94.5	94.7	94.5	94.4	93.8	93.9	93.7	93.5
-15	89.5	92.4	93.0	93.6	94.3	94.7	95.0	94.6	94.7	94.6	94.4
-20	88.7	91.5	92.1	92.7	93.4	93.9	94.4	94.7	95.0	94.8	94.6
-25	87.8	90.6	91.3	91.8	92.5	93.0	93.6	93.9	94.2	94.0	93.7
-30	86.9	89.7	90.4	90.9	91.6	92.1	92.7	93.0	93.3	93.1	92.9
-35	86.0	88.8	89.5	90.0	90.6	91.1	91.8	92.1	92.4	92.2	92.0
-40	85.1	87.9	88.6	89.1	89.7	90.2	90.9	91.2	91.5	91.3	91.1
-45	84.2	87.0	87.7	88.2	88.7	89.3	90.0	90.3	90.6	90.4	90.2
-50				87.2	87.8	88.3	89.1	89.4	89.7	89.5	89.3

Engine Bleed Adjustments

Eng. A/I ON	-1.2
Eng. & Wing A/I ON	-3.4

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							96.8		
50	96.6	97.1	97.1							97.2	97.5	
48	96.9	97.4	97.6							97.6	97.7	97.3
46	97.3	97.8	97.9							98.0	97.9	97.8
44	97.6	98.1	98.2	98.3	98.3	98.3	98.1	98.7 99.2				
42	97.9	98.4	98.5	98.6	98.7	98.8	98.5					
40	98.1	98.7	98.8	98.9	99.0	99.1	98.9					
38	98.4	99.0	99.1	99.2	99.3	99.4	99.3					
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			

CORRECTIONS:

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

PERCENT

MCT

CFM56-7B26

BASED ON 250 KIAS / 310 KIAS / 0.79 MACH SPEED SCHEDULE
NORMAL BLEED - PACKS ON, ANTI-ICE OFF

TAT – °C	PRESSURE ALTITUDE – FEET								
	5,000	10,000	15,000	20,000	25,000	30,000	35,000	37,000	41,000
40	97.3								
35	98.0	97.8							
30	98.8	98.5							
25	99.3	99.3	99.3						
20	98.6	100.2	100.1	99.8	96.8	96.2	95.4	95.0	93.9
15	97.8	100.7	100.6	100.7	97.4	96.8	96.2	95.7	94.8
10	97.0	99.9	100.2	101.6	98.0	97.4	96.9	96.5	95.7
5	96.2	99.2	99.4	101.4	98.3	98.2	97.7	97.3	96.6
0	95.4	98.4	98.7	100.6	97.5	99.1	98.5	98.2	97.5
-5	94.6	97.7	97.9	99.9	96.7	99.4	99.3	98.9	98.4
-10	93.8	96.9	97.2	99.1	96.0	99.0	100.2	99.8	99.4
-15		96.1	96.4	98.3	95.2	98.2	101.0	100.8	100.3
-20		95.3	95.6	97.5	94.4	97.4	100.5	101.1	100.6
-25			94.8	96.7	93.6	96.6	99.7	100.2	99.8
-30				95.9	92.8	95.8	98.8	99.4	99.0
-35				95.1	92.0	95.0	98.0	98.5	98.1
-40					91.2	94.1	97.1	97.6	97.2

CORRECTIONS:

Engine Anti-Ice ON	-0.8	-0.8	-0.9	-0.9	-1.2	-1.0	-0.8	-0.8	-0.8
Engine & Wing Anti-Ice ON	-2.7	-3.2	-3.4	-3.6	-4.2	-4.6	-4.8	-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
180,000	265	267	270	272	274	253	231
170,000	257	259	262	264	265	253	231
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		225	227	229	230	232	231
120,000		216	218	219	220	222	225
110,000			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
180,000	174,900	263	19,100	17,900	16,600
170,000	165,600	256	20,600	19,600	18,300
160,000	155,800	249	22,000	21,100	20,000
150,000	146,000	241	23,500	22,600	21,600
140,000	136,100	233	25,100	24,200	23,300
130,000	126,400	225	27,200	26,200	25,100
120,000	117,000	217	29,300	28,500	27,400
110,000	107,500	208	31,300	30,600	29,700
100,000	97,900	199	33,300	32,700	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
180,000	174,700	262	18,300	17,100	15,800
170,000	165,500	256	20,000	18,800	17,500
160,000	155,900	248	21,400	20,400	19,300
150,000	145,900	241	22,800	22,000	20,900
140,000	136,100	233	24,500	23,600	22,600
130,000	126,300	224	26,500	25,500	24,400
120,000	116,900	216	28,800	27,700	26,700
110,000	107,400	208	30,900	30,000	29,000
100,000	97,800	198	32,900	32,200	31,300

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
180,000	174,300	261	15,900	14,500	12,600
170,000	164,900	254	17,700	16,300	14,900
160,000	155,500	247	19,500	18,100	16,700
150,000	145,900	240	21,000	19,900	18,400
140,000	136,200	232	22,600	21,600	20,300
130,000	126,400	224	24,400	23,400	22,200
120,000	116,600	215	26,400	25,400	24,200
110,000	107,100	207	28,700	27,700	26,500
100,000	97,600	198	30,900	30,000	29,000

BASIS:

- APU operating
- 100 ft/min residual rate of climb
- Maximum Continuous Thrust Limits
- 37,000 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
180,000	16,500	14,500	11,600
170,000	18,300	16,500	13,900
160,000	20,200	18,500	16,000
150,000	21,500	20,400	18,300
140,000	23,000	21,800	20,400
130,000	24,500	23,400	22,000
120,000	26,600	25,100	23,700
110,000	29,100	27,800	25,900
100,000	31,300	30,300	29,000
90,000	33,400	32,600	31,400

CORRECTIONS:

CONFIGURATION	ALT. CORRECTION – FEET
Engine Anti-Ice ON	- 2,000
Engine and Wing Anti-Ice ON	- 4,700

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 (-28)	%N ₁							97.3	93.6	90.1
	MAX TAT							-13	-4	
	KIAS							232	224	218
	MACH							0.623	0.602	0.586
	FF/ENG							4021	3551	3215
290 (-26)	KTAS							367	355	345
	%N ₁							95.6	92.1	89.0
	MAX TAT							-7	2	
	KIAS							233	226	218
	MACH							0.612	0.594	0.576
280 (-24)	FF/ENG							3943	3539	3205
	KTAS							362	352	341
	%N ₁						97.5	94.0	91.0	87.9
	MAX TAT						-11	-2	6	
	KIAS						242	234	228	219
270 (-22)	MACH						0.622	0.603	0.588	0.565
	FF/ENG						4366	3898	3554	3189
	KTAS						370	358	350	336
	%N ₁						95.7	92.7	89.9	87.0
	MAX TAT						-5	3		
260 (-20)	KIAS						243	236	230	219
	MACH						0.612	0.595	0.580	0.553
	FF/ENG						4287	3884	3558	3176
	KTAS						365	355	346	330
	%N ₁					97.4	94.2	91.6	88.8	86.1
250 (-19)	MAX TAT					-8	0	7		
	KIAS					252	244	238	230	218
	MACH					0.620	0.603	0.589	0.569	0.542
	FF/ENG					4701	4243	3896	3539	3163
	KTAS					372	361	353	341	325
250 (-19)	%N ₁					95.7	93.0	90.6	87.9	85.2
	MAX TAT					-2	4	11		
	KIAS					253	246	241	230	218
	MACH					0.610	0.595	0.582	0.558	0.530
	FF/ENG					4626	4229	3909	3526	3153
250 (-19)	KTAS					367	358	350	336	319

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						97.0	94.3	92.0	89.6
	MAX TAT						-3	4	10	
	KIAS						261	254	249	241
	MACH						0.617	0.601	0.589	0.571
	FF/ENG						5026	4586	4245	3893
	KTAS						373	364	356	345
230 (-15)	%N1						95.5	93.2	91.1	88.7
	MAX TAT						4	10	16	
	KIAS						262	256	251	241
	MACH						0.607	0.594	0.582	0.560
	FF/ENG						4962	4584	4268	3887
	KTAS						369	361	353	340
220 (-13)	%N1					96.7	94.3	92.3	90.1	87.8
	MAX TAT					4	10	15		
	KIAS					270	264	259	251	241
	MACH					0.613	0.599	0.588	0.571	0.549
	FF/ENG					5348	4938	4611	4260	3883
	KTAS					373	365	358	348	334
210 (-11)	%N1				97.7	95.3	93.3	91.3	89.2	86.9
	MAX TAT				5	10	15	21		
	KIAS				278	272	266	261	251	241
	MACH				0.618	0.604	0.593	0.581	0.560	0.538
	FF/ENG				5742	5305	4952	4636	4258	3881
	KTAS				378	370	363	355	343	329
200 (-9)	%N1			98.6	96.2	94.2	92.4	90.4	88.3	86.0
	MAX TAT			6	11	16	21			
	KIAS			286	279	274	269	261	251	240
	MACH			0.622	0.609	0.597	0.587	0.570	0.550	0.527
	FF/ENG			6143	5681	5303	4992	4634	4254	3878
	KTAS			382	374	367	361	350	338	324
190 (-7)	%N1			97	95.1	93.3	91.5	89.6	87.4	85.1
	MAX TAT			11	15	20				
	KIAS			287	281	276	270	261	251	240
	MACH			0.613	0.601	0.590	0.578	0.559	0.539	0.516
	FF/ENG			6065	5665	5333	5009	4631	4252	3876
	KTAS			378	370	364	357	345	332	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
180 (-5)	%N1		97.8	95.8	94.1	92.5	90.7	88.7	86.5	84.2
	MAX TAT		10	15	19	24				
	KIAS		295	289	283	279	271	261	251	240
	MACH		0.616	0.604	0.594	0.585	0.568	0.549	0.528	0.505
	FF/ENG		6455	6037	5685	5389	5011	4630	4252	3875
170 (-4)	KTAS		382	374	368	362	352	340	327	313
	%N1		96.5	94.7	93.2	91.6	89.8	87.8	85.7	83.3
	MAX TAT		15	19	24	29				
	KIAS		296	291	286	280	271	261	250	239
	MACH		0.607	0.597	0.588	0.575	0.557	0.538	0.517	0.494
160 (-2)	FF/ENG		6415	6047	5733	5391	5010	4630	4252	3875
	KTAS		378	371	366	357	346	334	321	307
	%N1	97.1	95.4	93.9	92.5	90.8	88.9	86.9	84.8	82.4
	MAX TAT	15	19	23	28					
	KIAS	303	298	293	288	280	271	261	250	239
150 (0)	MACH	0.610	0.600	0.591	0.581	0.565	0.547	0.527	0.506	0.484
	FF/ENG	6795	6413	6084	5771	5390	5008	4629	4251	3874
	KTAS	381	374	369	363	352	341	329	316	302
	%N1	95.9	94.5	93.2	91.6	89.9	88.1	86.1	83.9	81.6
	MAX TAT	19	23	27	32					
140 (1)	KIAS	305	300	296	288	280	270	260	250	238
	MACH	0.602	0.593	0.585	0.571	0.554	0.536	0.517	0.496	0.474
	FF/ENG	6780	6439	6144	5769	5385	5005	4625	4247	3880
	KTAS	377	372	367	358	347	336	324	311	297
	%N1	95.1	93.8	92.4	90.8	89.1	87.2	85.2	83.0	80.8
130 (3)	MAX TAT	23	27	31						
	KIAS	307	303	297	289	280	270	260	249	239
	MACH	0.595	0.588	0.576	0.560	0.544	0.526	0.506	0.485	0.466
	FF/ENG	6794	6488	6145	5760	5378	4998	4618	4241	3889
	KTAS	374	369	362	352	342	330	318	305	293
130 (3)	%N1	94.3	93.1	91.6	90.0	88.2	86.4	84.3	82.2	80.0
	MAX TAT	26	30	35						
	KIAS	310	305	297	288	279	270	259	249	239
	MACH	0.589	0.580	0.566	0.550	0.533	0.515	0.496	0.476	0.457
	FF/ENG	6835	6518	6133	5749	5368	4988	4610	4240	3899
130 (3)	KTAS	372	366	357	347	337	325	313	300	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
120 (5)	%N1	93.7	92.2	90.8	89.1	87.4	85.5	83.5	81.4	79.3
	MAX TAT	30	34							
	KIAS	313	305	297	288	279	269	259	249	239
	MACH	0.584	0.570	0.556	0.540	0.523	0.505	0.486	0.467	0.449
	FF/ENG	6890	6506	6119	5737	5356	4977	4600	4247	3910
110 (6)	KTAS	370	361	352	342	331	320	308	296	285
	%N1	92.9	91.5	89.9	88.3	86.6	84.7	82.7	80.7	78.5
	MAX TAT	34	38							
	KIAS	313	305	297	288	279	269	258	249	239
	MACH	0.574	0.560	0.545	0.529	0.513	0.495	0.476	0.459	0.441
100 (8)	FF/ENG	6878	6490	6106	5725	5345	4967	4598	4255	3924
	KTAS	365	356	347	337	326	315	303	292	281
	%N1	92.2	90.7	89.1	87.5	85.7	83.8	81.9	79.9	77.8
	MAX TAT	37	42							
	KIAS	313	305	297	288	278	268	259	249	240
90 (10)	MACH	0.564	0.550	0.535	0.519	0.502	0.485	0.468	0.451	0.434
	FF/ENG	6863	6478	6095	5714	5336	4959	4605	4267	3942
	KTAS	360	351	342	331	321	309	298	288	277
	%N1	91.3	89.8	88.3	86.7	84.9	83.0	81.1	79.1	77.1
	MAX TAT	41								
80 (11)	KIAS	313	305	296	287	278	268	259	249	240
	MACH	0.554	0.540	0.525	0.509	0.492	0.475	0.459	0.443	0.427
	FF/ENG	6852	6468	6086	5706	5328	4959	4615	4282	3963
	KTAS	355	346	336	326	315	305	294	284	273
	%N1	90.5	89.0	87.5	85.8	84.0	82.2	80.4	78.4	76.4
70 (13)	MAX TAT	45								
	KIAS	313	305	296	287	277	268	259	250	241
	MACH	0.544	0.530	0.515	0.499	0.482	0.467	0.451	0.436	0.420
	FF/ENG	6843	6460	6078	5699	5320	4968	4628	4301	3986
	KTAS	350	341	331	321	310	300	290	280	270
70 (13)	%N1	89.7	88.2	86.6	85.0	83.2	81.5	79.6	77.7	75.8
	MAX TAT									
	KIAS	313	304	295	286	277	268	259	250	241
	MACH	0.534	0.520	0.505	0.489	0.474	0.459	0.444	0.428	0.413
	FF/ENG	6835	6451	6070	5691	5324	4979	4644	4323	4012
	KTAS	345	336	326	316	306	296	286	277	266

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
190,000	180,000	228	1,100		
180,000	170,000	224	3,200	1,500	
170,000	161,000	220	5,400	3,800	1,600
160,000	152,000	216	7,400	6,000	4,000
150,000	143,000	212	9,600	8,200	6,300
140,000	133,000	207	11,600	10,500	8,800
130,000	124,000	201	13,700	12,800	11,500
120,000	114,000	196	15,900	15,100	14,200
110,000	105,000	190	18,200	17,300	16,500
100,000	96,000	184	20,500	19,600	18,700
90,000	86,000	178	22,700	21,900	21,000

LONG RANGE CRUISE ALTITUDE CAPABILITY

PRESSURE ALTITUDE – FEET

GROSS WEIGHT - POUNDS	ISA + 10°C & COLDER	ISA + 15°C	ISA + 20°C
170,000	200		
160,000	2,900	600	
150,000	5,700	3,900	1,200
140,000	8,500	6,900	4,500
130,000	11,100	9,900	7,700
120,000	13,600	12,600	11,000
110,000	16,300	15,400	14,600
100,000	19,100	18,100	17,300
90,000	21,800	20,900	20,000

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

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
150,000	232 0.384 93.9 8062	232 0.397 96.1 8105							
140,000	225 0.372 91.9 7475	225 0.385 93.6 7487	224 0.398 95.9 7541						
130,000	218 0.361 89.7 6911	217 0.373 91.4 6904	217 0.385 93.1 6914	216 0.399 95.5 6979					
120,000	211 0.349 87.5 6382	210 0.360 89.0 6346	209 0.372 90.7 6336	208 0.385 92.5 6349	208 0.399 94.9 6416	207 0.413 98.7 6622			
110,000	204 0.337 85.2 5880	203 0.348 86.7 5824	201 0.359 88.2 5786	200 0.371 89.9 5777	200 0.383 91.6 5791	199 0.397 94.1 5841	198 0.412 98.0 6015		
100,000	197 0.325 82.9 5399	195 0.335 84.2 5329	194 0.345 85.6 5273	193 0.356 87.1 5235	192 0.368 88.8 5226	191 0.381 90.6 5230	190 0.395 93.0 5251	189 0.409 97.0 5393	
90,000	189 0.313 80.3 4943	188 0.322 81.6 4857	186 0.331 83.0 4787	184 0.341 84.4 4732	183 0.352 85.9 4695	182 0.364 87.6 4674	181 0.377 89.4 4661	181 0.391 91.6 4663	180 0.406 95.1 4774

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

THIS PAGE INTENTIONALLY BLANK

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
- Standard Day Outside Air Temperature (OAT = ISA)

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
- 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									
	180,000	170,000	160,000	150,000	140,000	130,000	120,000	110,000	100,000	90,000
DRY	6,910	6,410	5,910	5,410	4,910	4,410	4,200	3,990	3,780	3,570
GOOD	7,240	6,970	6,700	6,430	6,160	5,890	5,610	5,330	5,050	4,770
MEDIUM	10,270	9,830	9,390	8,950	8,510	8,070	7,610	7,150	6,690	6,230
POOR	13,790	13,130	12,470	11,810	11,150	10,490	9,830	9,170	8,510	7,850
V_{REF40}+55	212	208	203	199	194	188	183	177	171	164

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+150	+150	+250	+360
	Per 1,000 feet (above 8,000 ft.)	+150	+200	+330	+490
Wind	Per 1 kt. headwind	-14	-21	-33	-50
	Per 1 kt. tailwind	+67	+74	+123	+194
Slope	Per 1% downhill	+70	+110	+290	+650
	Per 1% uphill	-60	-100	-240	-490
Approach Speed	Per 10 kt. Above VREF*	+350	+290	+400	+500

ANTI-SKID INOPERATIVE (FLAPS 40)**

RWY COND. & APPCH SPEED	LANDING WEIGHT - POUNDS									
	180,000	170,000	160,000	150,000	140,000	130,000	120,000	110,000	100,000	90,000
DRY	6,810	6,530	6,250	5,970	5,690	5,410	5,130	4,850	4,570	4,290
GOOD	7,610	7,280	6,950	6,620	6,290	5,960	5,630	5,300	4,970	4,640
MEDIUM	9,680	9,220	8,760	8,300	7,840	7,380	6,930	6,480	6,030	5,580
POOR	12,930	12,260	11,590	10,920	10,250	9,580	8,940	8,300	7,660	7,020
V_{REF40}	157	153	148	144	139	133	128	122	116	109

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+130	+150	+210	+290
	Per 1,000 feet (above 8,000 ft.)	+180	+210	+290	+430
Wind	Per 1 kt. headwind	-24	-28	-42	-69
	Per 1 kt. tailwind	+89	+108	+169	+314
Slope	Per 1% downhill	+150	+220	+490	+1690
	Per 1% uphill	-130	-180	-350	-800
Approach Speed	Per 10 kt. Above VREF*	+380	+420	+480	+530

***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									
	180,000	170,000	160,000	150,000	140,000	130,000	120,000	110,000	100,000	90,000
DRY	4,920	4,700	4,480	4,260	4,040	3,820	3,650	3,480	3,310	3,140
GOOD	6,760	6,470	6,180	5,890	5,600	5,310	5,020	4,730	4,440	4,150
MEDIUM	9,350	8,890	8,430	7,970	7,510	7,050	6,600	6,150	5,700	5,250
POOR	12,200	11,550	10,900	10,250	9,600	8,950	8,330	7,710	7,090	6,470
V_{REF15}	174	169	164	159	154	148	142	135	129	122

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+80	+140	+210	+300
	Per 1,000 feet (above 8,000 ft.)	+100	+180	+300	+425
Wind	Per 1 kt. headwind	-12	-20	-32	-48
	Per 1 kt. tailwind	+42	+73	+120	+187
Slope	Per 1% downhill	+50	+130	+310	+670
	Per 1% uphill	-40	-110	-250	-490
Approach Speed	Per 10 kt. Above VREF*	+290	+420	+540	+630

HYDRAULICS - LOSS OF SYSTEM A (FLAPS 30)

RWY COND. & APPCH SPEED	LANDING WEIGHT - POUNDS									
	180,000	170,000	160,000	150,000	140,000	130,000	120,000	110,000	100,000	90,000
DRY	4,700	4,500	4,300	4,100	3,900	3,700	3,540	3,380	3,220	3,060
GOOD	6,420	6,150	5,880	5,610	5,340	5,070	4,800	4,530	4,260	3,990
MEDIUM	8,750	8,330	7,910	7,490	7,070	6,650	6,240	5,830	5,420	5,010
POOR	11,310	10,720	10,130	9,540	8,950	8,360	7,800	7,240	6,680	6,120
V_{REF30}	165	160	156	151	146	141	135	129	123	116

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+70	+130	+200	+270
	Per 1,000 feet (above 8,000 ft.)	+100	+170	+270	+385
Wind	Per 1 kt. headwind	-12	-20	-31	-46
	Per 1 kt. tailwind	+41	+72	+116	+182
Slope	Per 1% downhill	+50	+130	+300	+630
	Per 1% uphill	-40	-110	-240	-460
Approach Speed	Per 10 kt. Above VREF*	+300	+420	+520	+600

***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									
	180,000	170,000	160,000	150,000	140,000	130,000	120,000	110,000	100,000	90,000
DRY	4,470	4,290	4,110	3,930	3,750	3,570	3,420	3,270	3,120	2,970
GOOD	6,090	5,840	5,590	5,340	5,090	4,840	4,580	4,320	4,060	3,800
MEDIUM	8,250	7,860	7,470	7,080	6,690	6,300	5,920	5,540	5,160	4,780
POOR	10,580	10,040	9,500	8,960	8,420	7,880	7,360	6,840	6,320	5,800
V_{REF40}	157	153	148	144	139	133	128	122	116	109

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+70	+120	+180	+250
	Per 1,000 feet (above 8,000 ft.)	+90	+160	+250	+350
Wind	Per 1 kt. headwind	-11	-19	-30	-45
	Per 1 kt. tailwind	+40	+70	+114	+178
Slope	Per 1% downhill	+50	+130	+290	+610
	Per 1% uphill	-40	-110	-230	-440
Approach Speed	Per 10 kt. Above VREF*	+300	+430	+520	+580

HYDRAULICS - LOSS OF SYSTEM B (FLAPS 15)

RWY COND. & APPCH SPEED	LANDING WEIGHT - POUNDS									
	180,000	170,000	160,000	150,000	140,000	130,000	120,000	110,000	100,000	90,000
DRY	4,800	4,630	4,460	4,290	4,120	3,950	3,770	3,590	3,410	3,230
GOOD	6,120	5,870	5,620	5,370	5,120	4,870	4,620	4,370	4,120	3,870
MEDIUM	8,460	8,060	7,660	7,260	6,860	6,460	6,070	5,680	5,290	4,900
POOR	11,060	10,490	9,920	9,350	8,780	8,210	7,670	7,130	6,590	6,050
V_{REF15}	174	169	164	159	154	148	142	135	129	122

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+80	+120	+190	+260
	Per 1,000 feet (above 8,000 ft.)	+110	+160	+250	+370
Wind	Per 1 kt. headwind	-13	-19	-30	-45
	Per 1 kt. tailwind	+47	+68	+112	+178
Slope	Per 1% downhill	+50	+110	+260	+570
	Per 1% uphill	-40	-90	-210	-420
Approach Speed	Per 10 kt. Above VREF*	+250	+330	+430	+510

***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									
	180,000	170,000	160,000	150,000	140,000	130,000	120,000	110,000	100,000	90,000
DRY	6,320	6,080	5,840	5,600	5,360	5,120	4,870	4,620	4,370	4,120
GOOD	7,810	7,490	7,170	6,850	6,530	6,210	5,880	5,550	5,220	4,890
MEDIUM	10,850	10,350	9,850	9,350	8,850	8,350	7,850	7,350	6,850	6,350
POOR	14,150	13,430	12,710	11,990	11,270	10,550	9,860	9,170	8,480	7,790
V_{REF15}	174	169	164	159	154	148	142	135	129	122

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+110	+150	+240	+340
	Per 1,000 feet (above 8,000 ft.)	+150	+210	+330	+480
Wind	Per 1 kt. headwind	-18	-24	-37	-54
	Per 1 kt. tailwind	+61	+82	+130	+198
Slope	Per 1% downhill	+110	+190	+400	+800
	Per 1% uphill	-100	-160	-340	-600
Approach Speed	Per 10 kt. Above VREF*	+480	+570	+690	+770

LEADING EDGE FLAPS TRANSIT

RWY COND. & APPCH SPEED	LANDING WEIGHT - POUNDS									
	180,000	170,000	160,000	150,000	140,000	130,000	120,000	110,000	100,000	90,000
DRY	5,080	4,850	4,620	4,390	4,160	3,930	3,750	3,570	3,390	3,210
GOOD	6,630	6,360	6,090	5,820	5,550	5,280	5,010	4,740	4,470	4,200
MEDIUM	9,130	8,710	8,290	7,870	7,450	7,030	6,610	6,190	5,770	5,350
POOR	11,940	11,340	10,740	10,140	9,540	8,940	8,350	7,760	7,170	6,580
V_{REF15}+15	189	184	179	174	169	163	157	150	144	137

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+80	+130	+210	+290
	Per 1,000 feet (above 8,000 ft.)	+100	+180	+280	+410
Wind	Per 1 kt. headwind	-12	-20	-31	-46
	Per 1 kt. tailwind	+42	+71	+116	+183
Slope	Per 1% downhill	+40	+110	+270	+590
	Per 1% uphill	-40	-100	-220	-440
Approach Speed	Per 10 kt. Above VREF*	+230	+320	+420	+500

***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									
	180,000	170,000	160,000	150,000	140,000	130,000	120,000	110,000	100,000	90,000
DRY	4,680	4,460	4,240	4,020	3,800	3,580	3,420	3,260	3,100	2,940
GOOD	6,130	5,880	5,630	5,380	5,130	4,880	4,630	4,380	4,130	3,880
MEDIUM	8,790	8,380	7,970	7,560	7,150	6,740	6,330	5,920	5,510	5,100
POOR	12,050	11,440	10,830	10,220	9,610	9,000	8,400	7,800	7,200	6,600
V_{REF15}	174	169	164	159	154	148	142	135	129	122

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+70	+120	+190	+280
	Per 1,000 feet (above 8,000 ft.)	+90	+150	+250	+380
Wind	Per 1 kt. headwind	-11	-19	-32	-50
	Per 1 kt. tailwind	+40	+69	+119	+195
Slope	Per 1% downhill	+40	+110	+300	+740
	Per 1% uphill	-30	-90	-240	-530
Approach Speed	Per 10 kt. Above VREF*	+220	+320	+450	+560

STABILIZER TRIM INOPERATIVE

RWY COND. & APPCH SPEED	LANDING WEIGHT - POUNDS									
	180,000	170,000	160,000	150,000	140,000	130,000	120,000	110,000	100,000	90,000
DRY	4,600	4,390	4,180	3,970	3,760	3,550	3,390	3,230	3,070	2,910
GOOD	5,900	5,660	5,420	5,180	4,940	4,700	4,460	4,220	3,980	3,740
MEDIUM	8,070	7,700	7,330	6,960	6,590	6,220	5,850	5,480	5,110	4,740
POOR	10,600	10,060	9,520	8,980	8,440	7,900	7,390	6,880	6,370	5,860
V_{REF15}	174	169	164	159	154	148	142	135	129	122

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+70	+110	+170	+250
	Per 1,000 feet (above 8,000 ft.)	+90	+150	+240	+350
Wind	Per 1 kt. headwind	-11	-18	-29	-43
	Per 1 kt. tailwind	+39	+66	+109	+173
Slope	Per 1% downhill	+40	+100	+230	+530
	Per 1% uphill	+30	-80	-190	-390
Approach Speed	Per 10 kt. Above VREF*	+210	+300	+390	+470

***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									
	180,000	170,000	160,000	150,000	140,000	130,000	120,000	110,000	100,000	90,000
DRY	4,600	4,390	4,180	3,970	3,760	3,550	3,390	3,230	3,070	2,910
GOOD	5,900	5,660	5,420	5,180	4,940	4,700	4,460	4,220	3,980	3,740
MEDIUM	8,070	7,700	7,330	6,960	6,590	6,220	5,850	5,480	5,110	4,740
POOR	10,600	10,060	9,520	8,980	8,440	7,900	7,390	6,880	6,370	5,860
V_{REF15}	174	169	164	159	154	148	142	135	129	122

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+70	+110	+170	+250
	Per 1,000 feet (above 8,000 ft.)	+90	+150	+240	+350
Wind	Per 1 kt. headwind	-11	-18	-29	-43
	Per 1 kt. tailwind	+39	+66	+109	+173
Slope	Per 1% downhill	+40	+100	+230	+530
	Per 1% uphill	-30	-80	-190	-390
Approach Speed	Per 10 kt. Above VREF*	+210	+300	+390	+470

TRAILING EDGE FLAP ASYMMETRY (30 ≤ FLAPS < 40)

RWY COND. & APPCH SPEED	LANDING WEIGHT - POUNDS									
	180,000	170,000	160,000	150,000	140,000	130,000	120,000	110,000	100,000	90,000
DRY	4,320	4,140	3,960	3,780	3,600	3,420	3,270	3,120	2,970	2,820
GOOD	5,740	5,500	5,260	5,020	4,780	4,540	4,310	4,080	3,850	3,620
MEDIUM	7,830	7,460	7,090	6,720	6,350	5,980	5,630	5,280	4,930	4,580
POOR	10,180	9,660	9,140	8,620	8,100	7,580	7,090	6,600	6,110	5,620
V_{REF30}	165	160	156	151	146	141	135	129	123	116

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+60	+110	+160	+230
	Per 1,000 feet (above 8,000 ft.)	+80	+140	+220	+320
Wind	Per 1 kt. headwind	-10	-18	-29	-43
	Per 1 kt. tailwind	+37	+64	+105	+166
Slope	Per 1% downhill	+40	+100	+250	+590
	Per 1% uphill	-30	-80	-190	-380
Approach Speed	Per 10 kt. Above VREF*	+220	+310	+400	+470

***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									
	180,000	170,000	160,000	150,000	140,000	130,000	120,000	110,000	100,000	90,000
DRY	4,600	4,390	4,180	3,970	3,760	3,550	3,390	3,230	3,070	2,910
GOOD	5,900	5,660	5,420	5,180	4,940	4,700	4,460	4,220	3,980	3,740
MEDIUM	8,070	7,700	7,330	6,960	6,590	6,220	5,850	5,480	5,110	4,740
POOR	10,600	10,060	9,520	8,980	8,440	7,900	7,390	6,880	6,370	5,860
V_{REF15}	174	169	164	159	154	148	142	135	129	122

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+70	+110	+170	+250
	Per 1,000 feet (above 8,000 ft.)	+90	+150	+240	+350
Wind	Per 1 kt. headwind	-11	-18	-29	-43
	Per 1 kt. tailwind	+39	+66	+109	+173
Slope	Per 1% downhill	+40	+100	+230	+530
	Per 1% uphill	-30	-80	-190	-390
Approach Speed	Per 10 kt. Above VREF*	+210	+300	+390	+470

TRAILING EDGE FLAP ASYMMETRY (1 ≤ FLAPS < 15)

RWY COND. & APPCH SPEED	LANDING WEIGHT - POUNDS									
	180,000	170,000	160,000	150,000	140,000	130,000	120,000	110,000	100,000	90,000
DRY	5,130	4,880	4,630	4,380	4,130	3,880	3,700	3,520	3,340	3,160
GOOD	6,360	6,120	5,880	5,640	5,400	5,160	4,910	4,660	4,410	4,160
MEDIUM	8,870	8,480	8,090	7,700	7,310	6,920	6,530	6,140	5,750	5,360
POOR	11,730	11,160	10,590	10,020	9,450	8,880	8,320	7,760	7,200	6,640
V_{REF40}+30	187	183	178	174	169	163	158	152	146	139

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+80	+130	+200	+290
	Per 1,000 feet (above 8,000 ft.)	+100	+170	+270	+400
Wind	Per 1 kt. headwind	-12	-19	-31	-46
	Per 1 kt. tailwind	+43	+69	+115	+182
Slope	Per 1% downhill	+40	+100	+260	+580
	Per 1% uphill	-30	-90	-210	-430
Approach Speed	Per 10 kt. Above VREF*	+230	+290	+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.

TRAILING EDGE FLAP DISAGREE (30 ≤ FLAPS < 40)

RWY COND. & APPCH SPEED	LANDING WEIGHT - POUNDS									
	180,000	170,000	160,000	150,000	140,000	130,000	120,000	110,000	100,000	90,000
DRY	4,320	4,140	3,960	3,780	3,600	3,420	3,270	3,120	2,970	2,820
GOOD	5,740	5,500	5,260	5,020	4,780	4,540	4,310	4,080	3,850	3,620
MEDIUM	7,830	7,460	7,090	6,720	6,350	5,980	5,630	5,280	4,930	4,580
POOR	10,180	9,660	9,140	8,620	8,100	7,580	7,090	6,600	6,110	5,620
V_{REF30}	165	160	156	151	146	141	135	129	123	116

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+60	+110	+160	+230
	Per 1,000 feet (above 8,000 ft.)	+80	+140	+220	+320
Wind	Per 1 kt. headwind	-10	-18	-29	-43
	Per 1 kt. tailwind	+37	+64	+105	+166
Slope	Per 1% downhill	+40	+100	+250	+590
	Per 1% uphill	-30	-80	-190	-380
Approach Speed	Per 10 kt. Above VREF*	+220	+310	+400	+470

TRAILING EDGE FLAP DISAGREE (15 ≤ FLAPS < 30)

RWY COND. & APPCH SPEED	LANDING WEIGHT - POUNDS									
	180,000	170,000	160,000	150,000	140,000	130,000	120,000	110,000	100,000	90,000
DRY	4,600	4,390	4,180	3,970	3,760	3,550	3,390	3,230	3,070	2,910
GOOD	5,900	5,660	5,420	5,180	4,940	4,700	4,460	4,220	3,980	3,740
MEDIUM	8,070	7,700	7,330	6,960	6,590	6,220	5,850	5,480	5,110	4,740
POOR	10,600	10,060	9,520	8,980	8,440	7,900	7,390	6,880	6,370	5,860
V_{REF15}	174	169	164	159	154	148	142	135	129	122

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+70	+110	+170	+250
	Per 1,000 feet (above 8,000 ft.)	+90	+150	+240	+350
Wind	Per 1 kt. headwind	-11	-18	-29	-43
	Per 1 kt. tailwind	+39	+66	+109	+173
Slope	Per 1% downhill	+40	+100	+230	+530
	Per 1% uphill	-30	-80	-190	-390
Approach Speed	Per 10 kt. Above VREF*	+210	+300	+390	+470

***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									
	180,000	170,000	160,000	150,000	140,000	130,000	120,000	110,000	100,000	90,000
DRY	5,130	4,880	4,630	4,380	4,130	3,880	3,700	3,520	3,340	3,160
GOOD	6,360	6,120	5,880	5,640	5,400	5,160	4,910	4,660	4,410	4,160
MEDIUM	8,870	8,480	8,090	7,700	7,310	6,920	6,530	6,140	5,750	5,360
POOR	11,730	11,160	10,590	10,020	9,450	8,880	8,320	7,760	7,200	6,640
V_{REF40}+30	187	183	178	174	169	163	158	152	146	139

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+80	+130	+200	+290
	Per 1,000 feet (above 8,000 ft.)	+100	+170	+270	+400
Wind	Per 1 kt. headwind	-12	-19	-31	-46
	Per 1 kt. tailwind	+43	+69	+115	+182
Slope	Per 1% downhill	+40	+100	+260	+580
	Per 1% uphill	-30	-90	-210	-430
Approach Speed	Per 10 kt. Above VREF*	+230	+290	+400	+480

TRAILING EDGE FLAPS UP

RWY COND. & APPCH SPEED	LANDING WEIGHT - POUNDS									
	180,000	170,000	160,000	150,000	140,000	130,000	120,000	110,000	100,000	90,000
DRY	5,710	5,380	5,050	4,720	4,390	4,060	3,860	3,660	3,460	3,260
GOOD	6,650	6,400	6,150	5,900	5,650	5,400	5,140	4,880	4,620	4,360
MEDIUM	9,330	8,930	8,530	8,130	7,730	7,330	6,920	6,510	6,100	5,690
POOR	12,480	11,880	11,280	10,680	10,080	9,480	8,880	8,280	7,680	7,080
V_{REF40}+40	197	193	188	184	179	173	168	162	156	149

CORRECTIONS		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 feet (up to 8,000 ft.)	+110	+130	+220	+310
	Per 1,000 feet (above 8,000 ft.)	+110	+180	+285	+430
Wind	Per 1 kt. headwind	-12	-19	-32	-48
	Per 1 kt. tailwind	+55	+71	+118	+186
Slope	Per 1% downhill	+50	+110	+270	+610
	Per 1% uphill	-40	-90	-220	-450
Approach Speed	Per 10 kt. Above VREF*	+240	+280	+390	+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.

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
180,000	11,800	10,600	8,200	5,700	4,800	8,200	6,600	6,200
175,000	11,600	10,300	8,000	5,600	4,700	8,000	6,500	6,100
170,000	11,300	10,100	7,900	5,500	4,600	7,900	6,300	6,000
165,000	11,000	9,900	7,700	5,400	4,500	7,700	6,200	5,900
160,000	10,700	9,600	7,600	5,300	4,400	7,600	6,100	5,700
155,000	10,500	9,400	7,400	5,200	4,300	7,400	6,000	5,600
150,000	10,200	9,200	7,200	5,100	4,200	7,200	5,800	5,500
146,300	10,000	9,000	7,100	5,100	4,100	7,100	5,800	5,400
145,000	9,900	9,000	7,100	5,000	4,000	7,100	5,700	5,400
140,000	9,600	8,700	6,900	4,900	4,000	6,900	5,600	5,300
135,000	9,300	8,400	6,700	4,800	3,900	6,700	5,400	5,100
130,000	9,000	8,200	6,500	4,700	3,800	6,500	5,300	5,000
125,000	8,700	7,900	6,400	4,600	3,700	6,400	5,200	4,900
120,000	8,400	7,700	6,200	4,500	3,600	6,200	5,000	4,800
115,000	8,100	7,400	6,000	4,400	3,500	6,000	4,900	4,600
110,000	7,800	7,200	5,800	4,300	3,400	5,800	4,800	4,500

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Speed at Touchdown = VREF15 - 5 •
Data is advisory and includes a 1,500 ft. air distance from threshold to touchdown.

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

 Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	DRY (6)					GOOD (5)		
0	-600	-500	-300	-200	-200	-300	-300	-200
2,000	0	0	0	0	0	0	0	0
4,000	600	500	300	200	200	300	300	200
6,000	1,200	1,000	700	400	300	700	500	500
8,000	1,800	1,500	1,000	600	500	1,000	800	700
10,000	2,600	2,100	1,400	900	700	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	300	350	350	200	100	350	200	150
PER 10°C ABOVE ISA	250	250	150	100	50	150	100	100
PER 10°C BELOW ISA	-250	-250	-150	-100	-50	-150	-100	-100
PER 1% UP SLOPE	-250	-150	0	0	-50	0	-100	-100
PER 1% DOWN SLOPE	250	100	0	0	50	0	100	100
1 REVERSER INOP	800	200	0	0	100	0	300	300
2 REVERSERS INOP	1,100	200	0	0	200	100	600	600
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
180,000	9,100	8,800	8,600	11,500	11,500	11,500
175,000	8,900	8,600	8,500	11,300	11,200	11,200
170,000	8,700	8,400	8,300	11,000	10,900	10,900
165,000	8,600	8,200	8,100	10,700	10,600	10,600
160,000	8,400	8,000	7,900	10,400	10,400	10,400
155,000	8,200	7,800	7,700	10,200	10,100	10,100
150,000	8,000	7,600	7,500	9,900	9,800	9,800
146,300	7,800	7,500	7,400	9,700	9,600	9,600
145,000	7,800	7,500	7,300	9,600	9,600	9,600
140,000	7,600	7,300	7,200	9,300	9,300	9,300
135,000	7,400	7,100	7,000	9,100	9,000	9,000
130,000	7,200	6,900	6,800	8,800	8,700	8,700
125,000	7,000	6,700	6,600	8,500	8,500	8,500
120,000	6,800	6,500	6,400	8,200	8,200	8,200
115,000	6,600	6,300	6,200	7,900	7,900	7,900
110,000	6,400	6,100	6,000	7,700	7,600	7,600

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

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

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



Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	MEDIUM (3)			POOR (1)		
0	-400	-400	-400	-600	-600	-600
2,000	0	0	0	0	0	0
4,000	400	400	400	600	600	600
6,000	800	800	800	1,200	1,200	1,200
8,000	1,200	1,200	1,200	1,700	1,700	1,700
10,000	1,800	1,700	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	200	300	250	250
PER 10°C ABOVE ISA	200	200	150	250	250	250
PER 10°C BELOW ISA	-200	-200	-200	-250	-250	-250
PER 1% UP SLOPE	-150	-200	-250	-450	-450	-450
PER 1% DOWN SLOPE	200	250	300	700	700	700
1 REVERSER INOP	500	700	700	1,500	1,500	1,500
2 REVERSERS INOP	1,500	1,700	1,700	4,100	4,100	4,100
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 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
180,000	10,800	9,700	7,600	5,400	4,500	7,600	6,300	5,900
175,000	10,600	9,500	7,400	5,300	4,400	7,400	6,200	5,800
170,000	10,300	9,300	7,300	5,200	4,300	7,300	6,000	5,700
165,000	10,100	9,100	7,100	5,100	4,200	7,100	5,900	5,600
160,000	9,800	8,900	7,000	5,000	4,100	7,000	5,800	5,500
155,000	9,600	8,600	6,800	4,900	4,000	6,900	5,700	5,400
150,000	9,300	8,400	6,700	4,800	4,000	6,700	5,600	5,300
146,300	9,200	8,300	6,600	4,800	3,900	6,600	5,500	5,200
145,000	9,100	8,200	6,500	4,700	3,900	6,600	5,500	5,200
140,000	8,800	8,000	6,400	4,600	3,800	6,400	5,300	5,100
135,000	8,600	7,800	6,200	4,500	3,700	6,200	5,200	4,900
130,000	8,300	7,600	6,100	4,400	3,600	6,100	5,100	4,800
125,000	8,000	7,300	5,900	4,300	3,500	5,900	5,000	4,700
120,000	7,800	7,100	5,700	4,200	3,500	5,700	4,800	4,600
115,000	7,500	6,900	5,600	4,100	3,400	5,600	4,700	4,500
110,000	7,200	6,700	5,400	4,000	3,300	5,400	4,600	4,400

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Speed at Touchdown = VREF30 - 5 •
Data is advisory and includes a 1,500 ft. air distance from threshold to touchdown.

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

 Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

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

CORRECTIONS

	DRY (6)					GOOD (5)		
PER 1 KT HEADWIND	-50	-50	0	0	0	0	0	0
PER 1 KT TAILWIND	150	100	100	50	50	100	50	50
PER 5 KTS ADD'L SPD	300	300	300	200	100	300	200	150
PER 10°C ABOVE ISA	250	200	150	100	50	150	100	100
PER 10°C BELOW ISA	-250	-200	-150	-100	-50	-150	-100	-100
PER 1% UP SLOPE	-250	-150	0	0	-50	0	-100	-100
PER 1% DOWN SLOPE	200	100	0	0	50	0	100	100
1 REVERSER INOP	600	200	0	0	100	0	300	200
2 REVERSERS INOP	1,000	200	0	0	100	100	600	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 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
180,000	8,500	8,300	8,100	10,700	10,700	10,600
175,000	8,400	8,100	7,900	10,500	10,400	10,400
170,000	8,200	7,900	7,800	10,200	10,200	10,100
165,000	8,000	7,800	7,600	10,000	9,900	9,900
160,000	7,800	7,600	7,400	9,700	9,700	9,700
155,000	7,700	7,400	7,300	9,500	9,400	9,400
150,000	7,500	7,200	7,100	9,200	9,200	9,200
146,300	7,400	7,100	7,000	9,100	9,000	9,000
145,000	7,300	7,100	6,900	9,000	8,900	8,900
140,000	7,100	6,900	6,700	8,700	8,700	8,700
135,000	6,900	6,700	6,600	8,500	8,400	8,400
130,000	6,700	6,500	6,400	8,200	8,200	8,200
125,000	6,500	6,300	6,200	8,000	7,900	7,900
120,000	6,400	6,100	6,000	7,700	7,700	7,700
115,000	6,200	5,900	5,800	7,500	7,400	7,400
110,000	6,000	5,800	5,700	7,200	7,200	7,200

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

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

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



Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

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

CORRECTIONS	MEDIUM (3)			POOR (1)		
PER 1 KT HEADWIND	-50	-50	-50	-50	-50	-50
PER 1 KT TAILWIND	100	100	100	200	200	150
PER 5 KTS ADD'L SPD	300	250	200	300	250	250
PER 10°C ABOVE ISA	150	150	150	200	200	200
PER 10°C BELOW ISA	-200	-150	-150	-250	-250	-250
PER 1% UP SLOPE	-150	-200	-200	-400	-450	-450
PER 1% DOWN SLOPE	200	250	300	650	700	650
1 REVERSER INOP	500	600	600	1,300	1,300	1,300
2 REVERSERS INOP	1,300	1,500	1,500	3,500	3,400	3,400
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
180,000	10,100	9,000	7,000	5,000	4,300	7,000	6,000	5,700
175,000	9,900	8,800	6,900	4,900	4,200	6,900	5,900	5,600
170,000	9,600	8,600	6,700	4,900	4,100	6,800	5,800	5,500
165,000	9,400	8,400	6,600	4,800	4,000	6,600	5,700	5,400
160,000	9,200	8,200	6,500	4,700	3,900	6,500	5,600	5,300
155,000	9,000	8,000	6,300	4,600	3,900	6,400	5,500	5,200
150,000	8,700	7,900	6,200	4,500	3,800	6,200	5,400	5,100
146,300	8,600	7,700	6,100	4,500	3,700	6,200	5,300	5,000
145,000	8,500	7,700	6,100	4,500	3,700	6,100	5,200	5,000
140,000	8,300	7,500	5,900	4,400	3,600	6,000	5,100	4,900
135,000	8,000	7,300	5,800	4,300	3,600	5,800	5,000	4,700
130,000	7,800	7,000	5,600	4,200	3,500	5,700	4,900	4,600
125,000	7,500	6,800	5,500	4,100	3,400	5,500	4,800	4,500
120,000	7,300	6,600	5,300	4,000	3,300	5,400	4,600	4,400
115,000	7,000	6,400	5,200	3,900	3,300	5,200	4,500	4,300
110,000	6,800	6,200	5,000	3,800	3,200	5,100	4,400	4,200

BASIS: Zero wind • Two Engine Normal Reverse Thrust • Speed at Touchdown = VREF40 - 5 •
Data is advisory and includes a 1,500 ft. air distance from threshold to touchdown.

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

 Shaded region corresponds to Max Landing Weight (MLW)

ALTITUDE ADJUSTMENT

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

CORRECTIONS

	DRY (6)					GOOD (5)		
PER 1 KT HEADWIND	-50	-50	0	0	0	0	0	0
PER 1 KT TAILWIND	150	100	100	50	50	100	50	50
PER 5 KTS ADD'L SPD	300	300	300	200	100	300	200	150
PER 10°C ABOVE ISA	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	200	50	0	0	50	50	100	100
1 REVERSER INOP	500	100	0	0	100	0	200	200
2 REVERSERS INOP	700	100	0	0	100	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 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
180,000	8,000	7,900	7,700	10,200	10,100	10,100
175,000	7,800	7,700	7,600	10,000	9,900	9,800
170,000	7,700	7,500	7,400	9,700	9,600	9,600
165,000	7,500	7,400	7,200	9,500	9,400	9,400
160,000	7,400	7,200	7,100	9,300	9,200	9,200
155,000	7,200	7,000	6,900	9,000	9,000	8,900
150,000	7,000	6,900	6,800	8,800	8,700	8,700
146,300	6,900	6,700	6,700	8,600	8,600	8,500
145,000	6,900	6,700	6,600	8,500	8,500	8,500
140,000	6,700	6,500	6,400	8,300	8,300	8,200
135,000	6,500	6,300	6,300	8,100	8,000	8,000
130,000	6,300	6,200	6,100	7,800	7,800	7,800
125,000	6,100	6,000	5,900	7,600	7,500	7,500
120,000	6,000	5,800	5,800	7,300	7,300	7,300
115,000	5,800	5,600	5,600	7,100	7,100	7,100
110,000	5,600	5,500	5,400	6,900	6,800	6,800

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)	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	700	1,000	1,000	1,000
8,000	1,000	1,000	1,000	1,500	1,400	1,400
10,000	1,500	1,500	1,500	2,200	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	300	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	-150	-200	-200	-400	-450	-400
PER 1% DOWN SLOPE	250	250	250	650	650	650
1 REVERSER INOP	500	600	600	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

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					
		80,000	100,000	120,000	140,000	160,000	180,000
40,000	PITCH ATTITUDE	4.0	4.0	4.0	4.0		
	RATE OF CLIMB (FT/MIN)	2,000	1,400	900	400		
30,000	PITCH ATTITUDE	4.0	4.0	3.5	4.0	4.0	4.0
	RATE OF CLIMB (FT/MIN)	2,800	2,200	1,700	1,600	1,100	800
20,000	PITCH ATTITUDE	7.5	6.5	6.0	6.0	6.0	6.0
	RATE OF CLIMB (FT/MIN)	4,600	3,600	2,900	2,400	2,000	1,700
10,000	PITCH ATTITUDE	11.5	10.0	9.0	8.5	8.0	8.0
	RATE OF CLIMB (FT/MIN)	6,200	4,900	4,000	6,400	2,900	2,500
0	PITCH ATTITUDE	16.0	13.0	11.5	10.5	10.0	9.5
	RATE OF CLIMB (FT/MIN)	7,500	5,900	4,900	4,100	3,500	3,000

CRUISE							
SPEED: 0.76/280				THRUST: %N ₁ FOR LEVEL FLIGHT FLAPS: UP			
PRESSURE ALTITUDE – FEET		GROSS WEIGHT - POUNDS					
		80,000	100,000	120,000	140,000	160,000	180,000
40,000	PITCH ATTITUDE %N ₁	1.5 82	2.0 84	3.0 87	3.5 91		
35,000	PITCH ATTITUDE %N ₁	1.0 81	1.5 82	2.0 83	2.5 85	3.0 88	3.5 91
30,000	PITCH ATTITUDE %N ₁	0.5 81	1.0 81	1.5 82	2.0 83	2.5 85	3.0 87
25,000	PITCH ATTITUDE %N ₁	0.5 77	1.0 78	1.5 78	2.0 80	2.5 81	3.0 83
20,000	PITCH ATTITUDE %N ₁	0.5 73	1.0 74	2.0 75	2.5 76	3.0 77	3.5 79
15,000	PITCH ATTITUDE %N ₁	0.5 70	1.5 70	2 71	2.5 72	3 73	3.5 75

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					
		80,000	100,000	120,000	140,000	160,000	180,000
40,000	PITCH ATTITUDE	-2.0	-1.0	0.0	0.5	1.0	1.5
	RATE OF CLIMB (FT/MIN)	-2,900	-2,500	-2,300	-2,400	-2,600	-2,800
30,000	PITCH ATTITUDE	-4.0	-2.5	-1.5	-1.0	0.0	0.5
	RATE OF CLIMB (FT/MIN)	-3,400	-2,800	-2,400	-2,200	-2,000	-2,000
20,000	PITCH ATTITUDE	-4.0	-2.5	-1.5	-0.5	0.0	1.0
	RATE OF CLIMB (FT/MIN)	-3,100	-2,500	-2,200	-2,000	-1,800	-1,700
10,000	PITCH ATTITUDE	-4.0	-2.5	-1.5	-0.5	0.0	1.0
	RATE OF CLIMB (FT/MIN)	-2,800	-2,300	-2,000	-1,800	-1,600	-1,500
0	PITCH ATTITUDE	-4.5	-3.0	-2.0	-1.0	0.0	0.5
	RATE OF CLIMB (FT/MIN)	-2,500	-2,100	-1,800	-1,600	-1,500	-1,400

HOLDING							
SPEED: $V_{Ref40} + 70$				THRUST: %N ₁ FOR LEVEL FLIGHT FLAPS: UP			
PRESSURE ALTITUDE – FEET		GROSS WEIGHT – POUNDS					
		80,000	100,000	120,000	140,000	160,000	180,000
10,000	PITCH ATTITUDE	4.5	5.0	5.0	5.0	5.0	5.0
	%N ₁	51	55	60	64	67	70
5,000	PITCH ATTITUDE	4.5	5.0	5.5	5.0	5.0	5.0
	%N ₁	47	52	56	59	63	66

TERMINAL AREA								
SPEED: see below			THRUST: %N ₁ FOR LEVEL FLIGHT FLAPS: AS REQ'D					
PRESSURE ALTITUDE – FEET	FLAPS, SPEED		GROSS WEIGHT – POUNDS					
			80,000	100,000	120,000	140,000	160,000	180,000
5,000	FLAPS 1 (GEAR UP) V _{REF40} + 50	PITCH ATTITUDE	4.5	5.0	5.5	5.5	6.0	6.0
		%N ₁	49	54	58	62	65	68
5,000	FLAPS 5 (GEAR UP) V _{REF40} + 30	PITCH ATTITUDE	5.5	5.5	6.0	6.0	6.5	6.5
		%N ₁	49	54	59	63	66	69
5,000	FLAPS 15 (GEAR DOWN) V _{REF40} + 20	PITCH ATTITUDE	5.5	5.5	6.0	6.0	6.5	6.5
		%N ₁	57	63	68	72	76	79

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, SPEED		GROSS WEIGHT – POUNDS					
			80,000	100,000	120,000	140,000	160,000	180,000
1,500	FLAPS 15 V _{REF15} + 10	PITCH ATTITUDE %N ₁	2.0	2.5	2.5	2.5	2.5	2.5
			41	45	49	53	56	58
1,500	FLAPS 30 V _{REF30} + 10	PITCH ATTITUDE %N ₁	0.5	1.0	1.0	1.0	1.0	1.0
			45	50	54	58	61	64
1,500	FLAPS 40 V _{REF40} + 10	PITCH ATTITUDE %N ₁	-0.5	-0.5	0.0	0.0	0.0	0.0
			50	56	60	64	68	71

BRAKE COOLING – CARBON BRAKES

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.

- Landing within 3,500 lbs of MLW using Flaps 40 **or**
- Landing within 11,500 lbs of MLW using Flaps 30 **or**
- Landing using Flaps 15 at altitude of 1,000 ft or above **or**
- Landing above MLW with a brakes on speed of 140 kts (ground speed) 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.
- B) Obtain a Landing Brake Cooling time.
- C) **Wait the longer of the two times** once the aircraft is parked at the gate or other designated area.

QUICK TURNAROUND LANDING WEIGHT

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

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

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

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

LANDING BRAKE COOLING

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

BRAKE COOLING – CARBON BRAKES

MAXIMUM QUICK TURN-AROUND LANDING WEIGHT

POUNDS

FLAPS 40

AIRPORT PRESSURE ALTITUDE (FEET)	AMBIENT TEMPERATURE – °C					
	0	10	20	30	40	50
-1,000	182,000	178,500	175,200	172,100	169,100	166,200
0	178,600	175,200	172,000	168,900	166,000	163,100
1,000	175,200	171,900	168,700	165,700	162,800	160,000
2,000	171,800	168,500	165,400	162,500	159,700	157,000
3,000	168,500	165,200	162,200	159,300	156,600	---
4,000	165,100	162,000	159,000	156,200	153,500	---
5,000	161,900	158,800	155,900	153,100	150,500	---
6,000	158,700	155,700	152,800	150,000	147,400	---
7,000	155,500	152,500	149,700	147,000	144,500	---
8,000	152,300	149,400	146,700	144,000	---	---
8,400	151,060	148,200	145,500	142,920	---	---

FLAPS 30

AIRPORT PRESSURE ALTITUDE (FEET)	AMBIENT TEMPERATURE – °C					
	0	10	20	30	40	50
-1,000	171,500	168,200	165,100	162,200	159,300	156,600
0	168,300	165,100	162,100	159,200	156,400	153,700
1,000	165,100	162,000	159,000	156,200	153,400	150,800
2,000	161,900	158,800	155,900	153,100	150,500	148,000
3,000	158,700	155,700	152,900	150,200	147,600	---
4,000	155,600	152,700	149,900	147,200	144,700	---
5,000	152,600	149,700	146,900	144,300	141,900	---
6,000	149,600	146,700	144,000	141,600	139,200	---
7,000	146,600	143,800	141,300	138,900	136,600	---
8,000	143,600	141,000	138,500	136,200	---	---
8,400	142,480	139,920	137,420	135,120	---	---

NOTE: Weights in shaded area are above the maximum landing weight.

CORRECTIONS:

CONDITION		CORRECTION – POUNDS
Wind	per 1 kt. of headwind	+ 340
	per 1 kt. of tailwind	-1,840
Runway slope	per 0.1% uphill slope	+ 140
	per 0.1% downhill slope	-270

BRAKE COOLING – CARBON BRAKES

MAXIMUM QUICK TURN-AROUND LANDING WEIGHT POUNDS

FLAPS 15

AIRPORT PRESSURE ALTITUDE (FEET)	AMBIENT TEMPERATURE – °C					
	0	10	20	30	40	50
-1,000	160,500	157,500	154,600	151,800	149,200	146,700
0	157,600	154,600	151,800	149,100	146,500	144,000
1,000	154,600	151,700	148,900	146,200	143,700	141,400
2,000	151,600	148,700	146,000	143,400	141,100	138,900
3,000	148,700	145,800	143,200	140,800	138,500	---
4,000	145,700	143,000	140,500	138,200	135,900	---
5,000	143,000	140,400	138,000	135,700	133,400	---
6,000	140,300	137,800	135,400	133,100	130,900	---
7,000	137,600	135,200	132,800	130,600	128,400	---
8,000	135,000	132,600	130,300	128,100	---	---
8,400	133,960	131,560	129,260	127,100	---	---

NOTE: Weights in shaded area are above the maximum landing weight.

CORRECTIONS:

CONDITION		CORRECTION – POUNDS
Wind	per 1 kt. of headwind	+ 310
	per 1 kt. of tailwind	-1,780
Runway slope	per 0.1% uphill slope	+ 120
	per 0.1% downhill slope	-250

BRAKE COOLING – CARBON BRAKES

LANDING BRAKE COOLING TIMES

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
170	0:00 / 0:00	0:09 / 0:04	0:43 / 0:38	1:10C / 1:04C	F / F	F / F
160	0:00 / 0:00	0:04 / 0:00	0:39 / 0:34	1:05C / 0:59C	F / 1:19C	F / F
150	0:00 / 0:00	0:00 / 0:00	0:34 / 0:31	1:00C / 0:52	F / 1:14C	F / F
140	0:00 / 0:00	0:00 / 0:00	0:31 / 0:24	0:55C / 0:46	1:15C / 1:09C	F / F
130	0:00 / 0:00	0:00 / 0:00	0:24 / 0:18	0:47 / 0:41	1:09C / 1:04C	F / 1:19C
120	0:00 / 0:00	0:00 / 0:00	0:15 / 0:09	0:41 / 0:36	1:04C / 0:56C	1:20C / 1:13C
110	0:00 / 0:00	0:00 / 0:00	0:07 / 0:00	0:35 / 0:31	0:56C / 0:47	1:13C / 1:08C
100	0:00 / 0:00	0:00 / 0:00	0:00 / 0:00	0:29 / 0:23	0:46 / 0:41	1:06C / 1:00C
90	0:00 / 0:00	0:00 / 0:00	0:00 / 0:00	0:18 / 0:12	0:39 / 0:35	0:58C / 0:49

C - CAUTION ZONE (0:55 – 1:21) – 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, ≥ 1:22) – 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 1:22 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	0:00 / 0:00	0:02 / NW	0:02 / 0:12	0:01 / 0:12	0:01 / 0:12	0:02 / 0:08
Auto 3	0:00 / 0:00	0:12 / NW	0:11 / NW	0:12 / 0:46	0:12 / 0:42	0:12 / 0:42
Auto 2	0:00 / 0:00	NW / NW	0:22 / NW	0:26 / NW	0:26 / NW	0:26 / 1:20
Auto 1	0:00 / 0:00	NW / NW	NW / NW	0:35 / NW	0:32 / NW	0:36 / NW

BRAKE COOLING – CARBON BRAKES

BRAKE COOLING FOLLOWING REJECTED TAKEOFF

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
180	0:00	0:35	1:03C	F	F	F
170	0:00	0:32	0:59C	F	F	F
160	0:00	0:28	0:54	1:16C	F	F
150	0:00	0:23	0:47	1:12C	F	F
140	0:00	0:19	0:42	1:08C	F	F
130	0:00	0:12	0:40	1:03C	1:20C	F
120	0:00	0:07	0:39	0:56C	1:14C	F
110	0:00	0:00	0:30	0:49	1:09C	F
100	0:00	0:00	0:23	0:42	1:03C	1:16C
90	0:00	0:00	0:15	0:37	0:54	1:10C

C - CAUTION ZONE (0:55 – 1:21) – 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, ≥ 1:22) – 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.

THIS PAGE INTENTIONALLY BLANK

BRAKE COOLING – STEEL BRAKES

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.

- Landing above MLW using Flaps 40 **or**
- Landing within 500 lbs of MLW using Flaps 30 **or**
- Landing within 8,000 lbs of MLW using Flaps 15 at altitude of 5,000 ft or above **or**
- Landing above MLW with a brakes on speed of 140 kts (ground speed) or higher **or**
- Landing with non-standard aircraft configurations (flaps inoperative, brake deactivated, etc.)

PROCEDURES

- C) Determine if the Maximum Quick Turn Landing Weight has been exceeded.
- D) 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 4-48 and 4-49.

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

A **67 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 4-50. Comply with the specified procedures for the Caution Zone and Fuse Plug Melt Zones.

BRAKE COOLING – STEEL BRAKES

MAXIMUM QUICK TURN-AROUND LANDING WEIGHT

POUNDS

FLAPS 40

AIRPORT PRESSURE ALTITUDE (FEET)	AMBIENT TEMPERATURE – °C					
	0	10	20	30	40	50
-1,000	190,000	190,000	190,000	186,600	183,300	180,200
0	190,000	190,000	186,500	183,200	179,900	176,900
1,000	190,000	186,300	182,900	179,700	176,500	173,500
2,000	186,300	182,800	179,400	176,200	173,100	170,100
3,000	182,700	179,200	175,800	172,700	169,700	167,300
4,000	179,000	175,600	172,300	169,300	166,300	-----
5,000	175,500	172,100	169,000	165,900	163,000	-----
6,000	172,000	168,700	165,600	162,600	159,800	-----
7,000	168,500	165,300	162,200	159,300	156,600	-----
8,000	165,100	161,900	158,900	156,100	-----	-----
8,400	163,700	160,600	157,600	154,800	-----	-----

FLAPS 30

AIRPORT PRESSURE ALTITUDE (FEET)	AMBIENT TEMPERATURE – °C					
	0	10	20	30	40	50
-1,000	186,300	182,700	179,100	175,800	172,700	169,800
0	182,700	179,100	175,600	172,500	169,500	166,700
1,000	179,100	175,500	172,300	169,300	166,300	163,500
2,000	175,500	172,200	169,000	166,000	163,100	160,400
3,000	172,100	168,800	165,700	162,800	159,900	157,700
4,000	168,700	165,500	162,400	159,500	156,700	-----
5,000	165,400	162,200	159,200	156,400	153,700	-----
6,000	162,100	159,100	156,000	153,300	150,600	-----
7,000	158,800	155,800	152,900	150,200	147,600	-----
8,000	155,600	152,600	149,800	147,100	-----	-----
8,400	154,300	151,400	148,600	145,900	-----	-----

NOTE: Weights in shaded area are above the maximum landing weight.

CORRECTIONS:

CONDITION		CORRECTION – POUNDS
Wind	per 1 kt. of headwind	+ 380
	per 1 kt. of tailwind	- 1,700
Runway slope	per 0.1% uphill slope	+ 160
	per 0.1% downhill slope	- 260

BRAKE COOLING – STEEL BRAKES

MAXIMUM QUICK TURN-AROUND LANDING WEIGHT POUNDS

FLAPS 15

AIRPORT PRESSURE ALTITUDE (FEET)	AMBIENT TEMPERATURE – °C					
	0	10	20	30	40	50
-1,000	174,400	171,000	167,700	164,600	161,600	158,900
0	171,000	167,700	164,500	161,500	158,700	156,000
1,000	167,700	164,300	161,300	158,400	155,700	153,100
2,000	164,300	161,100	158,200	155,400	152,800	150,200
3,000	161,100	158,000	155,100	152,400	149,800	147,700
4,000	157,900	154,900	152,100	149,400	146,800	-----
5,000	154,900	151,900	149,100	146,500	143,900	-----
6,000	151,800	148,900	146,200	143,600	141,200	-----
7,000	148,700	145,900	143,300	140,800	138,500	-----
8,000	145,700	143,000	140,500	138,100	-----	-----
8,400	144,600	141,900	139,400	137,100	-----	-----

NOTE: Weights in shaded area are above the maximum landing weight.

CORRECTIONS:

CONDITION		CORRECTION – POUNDS
Wind	per 1 kt. of headwind	+ 330
	per 1 kt. of tailwind	- 1,170
Runway slope	per 0.1% uphill slope	+ 140
	per 0.1% downhill slope	- 260

BRAKE COOLING – STEEL BRAKES

LANDING BRAKE COOLING TIMES

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
170	0:00 / 0:00	0:12 / 0:07	0:45 / 0:38	1:10C / 1:04C	1:31C / 1:24C	1:52F / 1:44F
160	0:00 / 0:00	0:07 / 0:00	0:40 / 0:34	1:05C / 0:59	1:26C / 1:19C	1:45F / 1:38F
150	0:00 / 0:00	0:00 / 0:00	0:34 / 0:29	1:00 / 0:53	1:21C / 1:14C	1:39F / 1:32C
140	0:00 / 0:00	0:00 / 0:00	0:29 / 0:23	0:55 / 0:48	1:15C / 1:09C	1:32C / 1:26C
130	0:00 / 0:00	0:00 / 0:00	0:23 / 0:18	0:49 / 0:42	1:09C / 1:03C	1:26C / 1:19C
120	0:00 / 0:00	0:00 / 0:00	0:16 / 0:12	0:42 / 0:36	1:03C / 0:56	1:20C / 1:13C
110	0:00 / 0:00	0:00 / 0:00	0:10 / 0:02	0:35 / 0:29	0:56 / 0:49	1:13C / 1:07C
100	0:00 / 0:00	0:00 / 0:00	0:00 / 0:00	0:27 / 0:22	0:48 / 0:42	1:05C / 0:59
90	0:00 / 0:00	0:00 / 0:00	0:00 / 0:00	0:18 / 0:14	0:40 / 0:34	0:57 / 0:50

C - CAUTION ZONE (1:02 – 1:34) – Fuse plugs may melt. Wait the specified time. After the landing gear assembly has cooled, visually inspect for tire damage and seal leakage.

F - FUSE PLUG MELT ZONE (Shaded Region, $\geq$ 1:35) – 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:

- 3) Determine the time from the table above. This is the reference time.
- 4) 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 1:35 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	0:00 / 0:00	0:05 / NW	0:05 / 0:14	0:04 / 0:14	0:04 / 0:14	0:05 / 0:11
Auto 3	0:00 / 0:00	0:14 / NW	0:13 / NW	0:14 / 0:48	0:14 / 0:43	0:14 / 0:44
Auto 2	0:00 / 0:00	NW / NW	0:21 / NW	0:24 / NW	0:24 / 1:22	0:24 / 1:20
Auto 1	0:00 / 0:00	NW / NW	NW / NW	0:33 / NW	0:30 / NW	0:35 / NW

BRAKE COOLING – STEEL BRAKES

BRAKE COOLING FOLLOWING REJECTED TAKEOFF

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
180	0:00	0:34	1:02C	1:25C	F	F
170	0:00	0:30	0:58	1:21C	F	F
160	0:00	0:26	0:54	1:16C	F	F
150	0:00	0:22	0:49	1:12C	1:31C	F
140	0:00	0:18	0:44	1:07C	1:26C	F
130	0:00	0:14	0:40	1:02C	1:20C	F
120	0:00	0:10	0:34	0:56	1:14C	1:30C
110	0:00	0:02	0:28	0:50	1:08C	1:23C
100	0:00	0:00	0:22	0:43	1:02	1:16C
90	0:00	0:00	0:16	0:36	0:54	1:09C

C - CAUTION ZONE (1:02 – 1:34) – Fuse plugs may melt. Wait the specified time. After the landing gear assembly has cooled, visually inspect for tire damage and seal leakage.

F - FUSE PLUG MELT ZONE (Shaded Region, $\geq 1:35$) – 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	106	104	104	101	97	95	95
0	105	104	103	99	95	93	93
2,000	102	101	100	96	92	92	
4,000	99	98	96	93	90	90	
6,000	95	94	92	89	88		
8,000	92	90	88	86	86		
10,000	89	87	85	83	83		

NOTES:

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

MEL SUPPORT

73-00-11: EEC NORMAL MODE INOPERATIVE

RESTRICTIONS

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

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

73-00-11

EEC ALTERNATE
MODE

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

NOTE:

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

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

V-SPEED CORRECTIONS

The takeoff speeds must be adjusted using the table below.

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

MEL SUPPORT**73-00-11: EEC ALTERNATE MODE TAKEOFF THRUST****%N₁****CFM56-7B26**

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:

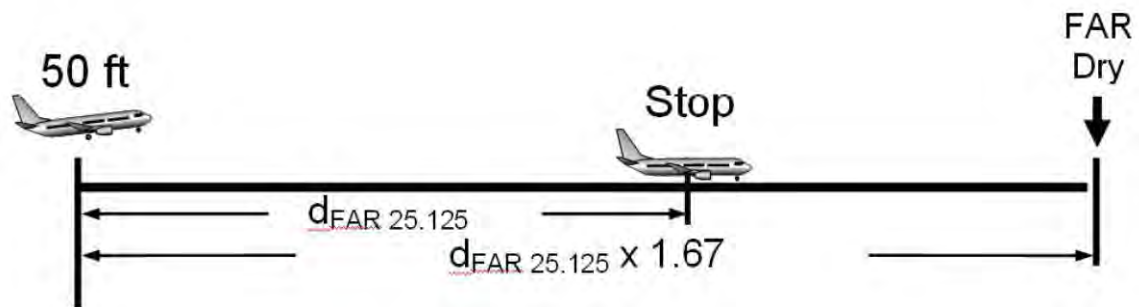
Bleed(s) OFF	+ 0.8	+ 0.8	+ 0.9	+ 0.9	+ 0.9	+ 1.0	+ 1.0	+ 1.0	+ 1.0	+ 1.0	+ 1.0
--------------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

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
180,000	12,110	12,400	12,720	13,070	13,450	13,850	14,220	14,610	15,010	15,430
170,000	11,590	11,870	12,170	12,500	12,870	13,250	13,600	13,970	14,360	14,750
160,000	11,060	11,320	11,610	11,930	12,280	12,650	12,980	13,340	13,700	14,080
150,000	10,530	10,780	11,050	11,350	11,680	12,040	12,360	12,690	13,040	13,400
140,000	9,960	10,190	10,450	10,740	11,060	11,390	11,690	12,010	12,330	12,670
130,000	9,350	9,570	9,810	10,080	10,380	10,700	10,980	11,270	11,580	11,900
120,000	8,750	8,950	9,170	9,420	9,700	10,000	10,270	10,540	10,830	11,120
110,000	8,140	8,330	8,530	8,770	9,030	9,320	9,560	9,810	10,080	10,350
100,000	7,540	7,710	7,890	8,120	8,360	8,630	8,850	9,090	9,330	9,590
90,000	6,940	7,090	7,260	7,470	7,700	7,950	8,150	8,370	8,590	8,820

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
180,000	13,930	14,260	14,630	15,020	15,460	15,930	16,350	16,800	17,260	17,740
170,000	13,330	13,650	13,990	14,370	14,790	15,240	15,640	16,070	16,510	16,970
160,000	12,720	13,020	13,350	13,720	14,120	14,540	14,930	15,340	15,750	16,190
150,000	12,110	12,390	12,700	13,050	13,440	13,840	14,210	14,590	14,990	15,410
140,000	11,460	11,720	12,010	12,350	12,710	13,100	13,450	13,810	14,180	14,570
130,000	10,760	11,000	11,270	11,590	11,930	12,300	12,620	12,960	13,320	13,680
120,000	10,060	10,290	10,540	10,830	11,160	11,500	11,810	12,120	12,450	12,790
110,000	9,360	9,570	9,810	10,080	10,390	10,710	10,990	11,290	11,590	11,910
100,000	8,670	8,860	9,070	9,330	9,620	9,920	10,180	10,450	10,730	11,020
90,000	7,980	8,150	8,340	8,580	8,850	9,140	9,370	9,620	9,880	10,150

CORRECTIONS:

Per 1 kt. Headwind	-50	-50	-50	-60	-60	-60	-60	-60	-60	-60
Per 1 kt. Tailwind	+ 240	+ 250	+ 250	+ 250	+ 260	+ 260	+ 270	+ 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
180,000	6,710	6,860	7,020	7,190	7,360	7,540	7,720	7,910	8,110	8,320
170,000	6,380	6,530	6,680	6,840	7,000	7,170	7,340	7,520	7,710	7,900
160,000	6,060	6,190	6,330	6,480	6,640	6,800	6,960	7,130	7,300	7,480
150,000	5,730	5,850	5,990	6,130	6,270	6,420	6,570	6,730	6,890	7,060
140,000	5,380	5,500	5,620	5,750	5,880	6,020	6,160	6,310	6,460	6,620
130,000	5,010	5,120	5,230	5,350	5,470	5,600	5,730	5,860	6,000	6,150
120,000	4,640	4,740	4,850	4,950	5,070	5,180	5,300	5,430	5,550	5,690
110,000	4,340	4,430	4,530	4,630	4,740	4,840	4,950	5,070	5,190	5,310
100,000	4,040	4,130	4,220	4,310	4,400	4,500	4,600	4,710	4,820	4,930
90,000	3,740	3,820	3,900	3,980	4,070	4,160	4,250	4,350	4,450	4,550

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
180,000	7,710	7,890	8,070	8,260	8,460	8,670	8,880	9,100	9,330	9,560
170,000	7,340	7,500	7,680	7,860	8,050	8,240	8,440	8,650	8,860	9,090
160,000	6,960	7,120	7,280	7,450	7,630	7,810	8,000	8,200	8,400	8,610
150,000	6,590	6,730	6,880	7,040	7,210	7,380	7,560	7,740	7,930	8,120
140,000	6,190	6,320	6,460	6,610	6,760	6,920	7,090	7,260	7,430	7,610
130,000	5,760	5,880	6,010	6,150	6,290	6,440	6,590	6,740	6,900	7,070
120,000	5,340	5,450	5,570	5,700	5,830	5,960	6,100	6,240	6,390	6,540
110,000	4,990	5,100	5,210	5,330	5,440	5,570	5,700	5,830	5,960	6,110
100,000	4,650	4,740	4,850	4,950	5,060	5,180	5,290	5,420	5,540	5,670
90,000	4,300	4,390	4,480	4,580	4,680	4,780	4,890	5,000	5,120	5,240

CORRECTIONS:

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

End of Section

FERRY FLIGHT PLANNING AND OPERATION

AUTHORIZATION AND FLIGHT PLANNING	5-3
WINGLET(S) REMOVED.....	5-4
LANDING GEAR EXTENDED	5-5

THIS PAGE INTENTIONALLY BLANK

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:

- Winglet(s) Removed
- Landing Gear Extended

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.

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 the 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/ODM)

Cruise: Normal cruise speeds and thrusts (TMC/ODM)

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

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	1.22	1.76
1,000	25,000	1.18	1.69
1,500	25,000	1.15	1.76
2,000	25,000	1.14	1.80

TAKEOFF

RATOW & Takeoff climb limit weight:	Use GRD TPI in AWABS
Takeoff V Speeds:	Use GRD TPI in AWABS
Takeoff Thrust Settings:	Use NORMAL only, ALTERNATE thrust NOT approved.
Takeoff Flap Settings:	1, 5, or 15 degrees only.
Operation from Contaminated Runway:	Permitted, use GRD TPI.

LANDING GEAR EXTENDED (cont.)

ENROUTE

Long Range Cruise, All Engine

GROSS WEIGHT - POUNDS	PRESSURE ALTITUDE - 1,000 FEET CRUISE SPEED - KIAS MACH NUMBER TARGET %N1 FUEL FLOW / ENGINE - LB/HR									
	10	21	23	25	27	29	31	33	35	37
190,000	268 0.485 86.3 5417									
180,000	262 0.473 84.8 5115									
170,000	254 0.460 83.2 4818	251 0.560 92.6 4773								
160,000	247 0.447 81.6 4523	245 0.548 90.7 4477	243 0.565 93.0 4478							
150,000	240 0.434 79.8 4234	239 0.535 89.1 4195	237 0.552 90.8 4170	235 0.569 93.3 4196						
140,000	232 0.420 78.0 3954	232 0.518 87.2 3897	231 0.538 88.9 3890	229 0.555 90.8 3878	227 0.573 93.6 3924					
130,000	224 0.406 76.1 3676	223 0.500 85.2 3597	224 0.521 87.0 3595	223 0.541 88.7 3595	221 0.558 90.7 3599	218 0.576 93.8 3652				
120,000	216 0.391 74.1 3402	215 0.482 83.0 3303	215 0.501 84.8 3297	215 0.523 86.6 3303	214 0.543 88.3 3311	212 0.560 90.5 3320	210 0.579 93.7 3379			
110,000	207 0.375 71.8 3133	206 0.462 80.7 3015	206 0.481 82.4 3006	206 0.501 84.2 3009	206 0.523 86.0 3023	205 0.543 87.7 3030	203 0.561 90.1 3038	201 0.580 93.4 3102		
100,000	198 0.359 69.3 2873	197 0.442 78.2 2735	197 0.460 79.9 2720	197 0.479 81.6 2722	196 0.499 83.4 2734	197 0.521 85.2 2745	196 0.542 87.0 2749	194 0.560 89.4 2755	192 0.580 92.8 2819	
90,000	189 0.343 66.7 2623	187 0.421 75.4 2467	187 0.438 77.1 2441	187 0.456 78.8 2439	187 0.475 80.6 2451	187 0.496 82.3 2458	187 0.518 84.2 2464	186 0.540 86.0 2468	184 0.558 88.4 2474	182 0.578 92.2 2544

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 23,500 lbs

HOLDING SPEED / THRUST (KIAS / %N1)

Weight - Pounds	Altitude - Feet	
	10,000	15,000
140,000	209 / 75.4	209 / 79.5
130,000	203 / 73.6	203 / 77.6
120,000	198 / 71.6	198 / 75.7

End of Section

