

# ATPL Workbook

## Candidate Training Copy

Subject 48:

- ATPL Advanced Aerodynamics, Performance and Systems Knowledge (Aeroplane)

- **This version of the workbook is for training purposes only.**
- **An examination version will be provided at the examination centre at the time of your exam sitting.**

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## Use of Performance Data

Unless otherwise stated, the specification aircraft referred to in the examination questions is the Boeing 777-300ER, and the following weights apply:

Maximum ramp weight	352,441 kg
Maximum take-off weight	351,534 kg
Maximum landing weight	251,290 kg
Maximum zero fuel weight	237,682 kg
Maximum taxi weight	352,441 kg
Prepared for service weight	174,600 kg
Basic weight	170,000 kg
Maximum fuel load	145,500 kg
Taxi fuel	510 kg

- Notes:
- 1) Take-off weight is the same as the Brake Release Weight (BRW).
  - 2) Prepared for service weight is the same as operating empty weight.
  - 3) Basic weight is the same as empty weight.
  - 4) For all HKG, LAX and LHR departures standard taxi fuel will be 720 kg.

## B777-300ER Take-off Speeds

5	200	220	240	260	280	300	320	340	360
V1	140	145	151	156	162	168	173	179	184
VR	149	154	160	164	170	176	180	186	191
V2	156	161	166	171	176	181	186	191	196

15	200	220	240	260	280	300	320	340	360
V1	130	133	136	140	144	147	151	155	159
VR	133	139	144	149	155	160	165	171	177
V2	148	153	157	162	166	170	175	179	183

20	200	220	240	260	280	300	320	340	360
V1	126	129	132	136	140	143	147	151	154
VR	129	134	139	144	150	156	161	167	172
V2	144	148	153	157	161	166	170	174	178

## Take-off and Go-around % N1

### Take-off and Go-around % N1

To find the Take-off and Go-Around % N1 based on normal engine bleed for packs on and anti-ice off, enter the Take-off and Go-Around N1 table with airport pressure altitude and reported OAT or TAT and read N1. N1 adjustments are shown for engine bleeds for various conditions.

Based on engine bleed for packs on and anti-ice off.

REPORTED OAT		TAT (degC)	AIRPORT PRESSURE ALTITUDE (1,000ft)												
deg C	deg F		-2	-1	0	1	2	3	4	5	6	7	8	9	10
66	150	70	93.7	93.8	94.1	93.9	93.8	93.7	95.6	93.4	93.3	92.6	91.5	90.5	89.6
56	133	60	96.5	96.6	96.9	96.7	96.6	96.5	96.4	96.2	96.1	95.4	94.3	93.4	92.5
51	124	55	97.8	98.0	98.3	98.1	97.9	97.9	97.7	97.6	97.4	96.7	95.7	94.7	93.9
46	115	50	99.1	99.3	99.6	99.4	99.3	99.2	99.1	98.9	98.7	98.0	97.0	96.1	95.2
41	106	45	100.2	100.7	101.1	101.0	100.9	100.7	100.5	100.4	100.0	99.3	98.3	97.3	96.5
36	97	40	101.3	102.4	103.2	103.2	102.8	102.6	102.3	102.0	101.4	100.5	99.5	98.6	97.8
31	88	35	101.2	103.9	105.8	105.4	105.1	104.7	104.3	103.8	102.7	101.7	100.6	99.7	98.9
26	79	30	100.4	103.1	105.9	106.8	107.3	106.8	106.6	106.4	105.0	103.4	101.9	10.8	100.0
21	70	25	99.3	102.2	105.0	105.9	106.5	107.0	107.4	107.4	106.8	105.7	104.0	102.3	101.3
16	61	20	98.7	101.4	104.1	105.0	105.6	106.1	106.5	107.0	106.8	106.3	105.2	104.2	103.3
11	53	15	97.9	100.5	103.2	104.1	104.7	105.2	105.6	106.1	105.9	105.5	104.9	104.4	104.0
7	44	10	97.0	99.6	102.3	103.2	103.8	104.3	104.7	105.1	105.0	104.6	104.0	103.5	103.4
2	35	5	96.1	98.7	101.4	102.3	102.9	103.4	105.8	104.2	104.1	103.7	103.1	102.6	102.5
-3	26	0	95.3	97.8	100.5	101.4	102.0	102.4	102.8	103.3	103.1	102.7	102.2	101.7	101.6
-13	8	-10	93.3	96.0	98.6	99.5	100.1	100.5	100.9	101.4	101.2	100.8	100.3	99.8	99.7
-23	-10	-20	91.7	94.2	96.7	97.6	98.2	98.6	99.0	99.4	99.3	98.9	98.3	97.9	97.8
-33	-27	-30	89.9	92.3	94.8	95.6	96.2	96.6	97.0	97.4	97.3	96.9	96.4	95.9	95.8
-43	-45	-40	88.0	90.4	92.8	93.6	94.2	94.6	95.0	95.4	95.3	94.9	94.4	93.9	93.9
-53	-63	-50	86.1	88.4	90.8	91.6	92.2	92.6	93.0	93.3	93.2	92.9	92.3	91.9	91.8

### %N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (1,000ft)													
	-2	-1	0	1	2	3	4	5	6	7	8	9	10	
PACKS OFF	0.2	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3
1 PACK ON	-0.2	-0.2	-0.3	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3	-0.3
WING ANTI-ICE ON	-0.2	-0.3	-0.4	-0.5	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4

## Maximum Continuous Thrust

10,000 FT PRESS ALT		TAT (°C)											
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40
360	0.65	94.2	95.2	96.1	96.9	97.8	98.7	99.6	100.4	101.3	101.5	100.2	99.1
320	0.58	96.1	97.1	98.0	98.9	99.8	100.7	101.6	102.4	102.6	101.0	99.7	98.6
280	0.51	98.5	99.4	100.4	101.3	102.2	103.1	104.0	104.6	102.3	100.5	99.4	98.4
240	0.43	95.6	96.6	97.5	98.4	99.3	100.2	101.0	101.1	100.3	99.1	97.8	96.9
200	0.36	96.6	97.5	98.4	99.3	100.2	101.1	101.6	101.2	100.1	98.5	97.5	96.6
5,000 FT PRESS ALT		TAT (°C)											
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
360	0.59	92.6	93.5	94.3	95.2	96.0	96.9	97.7	98.5	99.4	100.2	99.3	98.5
320	0.53	94.0	94.9	95.8	96.7	97.5	98.4	99.2	100.1	100.9	100.1	99.1	98.2
280	0.46	95.0	95.9	96.8	97.6	98.5	99.4	100.2	101.1	100.9	99.8	98.8	97.8
240	0.40	95.7	96.6	97.5	98.4	99.3	100.2	101.0	101.6	100.5	99.4	98.3	97.4
200	0.33	97.0	97.9	98.8	99.7	100.6	101.5	102.4	101.7	100.3	99.1	98.1	97.3
0 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
360	0.55	90.7	91.6	92.5	93.4	94.2	95.1	96.0	96.8	97.6	98.4	98.3	97.4
320	0.49	91.9	92.8	93.7	94.6	95.5	96.3	97.2	95.3	98.9	99.7	99.5	98.5
280	0.42	93.1	94.0	94.9	95.8	96.7	97.5	98.3	99.2	100.0	99.5	99.3	98.1
240	0.36	93.9	94.8	95.7	96.6	97.5	98.3	99.4	99.7	99.4	98.8	98.4	97.0
200	0.30	95.3	96.2	97.1	98.0	98.9	99.7	100.9	101	99.1	98.4	97.9	96.5

## %N1 Adjustment for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1,000 FT)					
	0	2	4	6	8	10
ENG A/I ON	-0.6	-0.5	-0.5	-0.5	-0.5	-0.5
WING A/I ON – PACKS ON	-0.9	-0.9	-0.8	-0.8	-0.7	-0.7
WING A/I ON – PACKS OFF	-1.4	-1.3	-1.2	-1.1	-1.0	-0.9

## Max Climb %N1

Based on engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1,000 FT) / SPEED (KIAS OR MACH)									
	0	5	10	15	20	25	30	35	40	43
	310	310	310	310	310	310	310	0.84	0.84	0.84
60	88.3	88.1	90.3	91.0	93.1	96.7	99.6	101.7	101.8	101.3
50	90.6	90.4	90.2	89.6	91.7	95.3	98.0	100.1	100.2	99.7
40	92.5	92.4	92.4	92.2	90.5	93.8	96.5	98.6	98.7	98.2
30	91.6	94.1	94.2	94.0	93.1	94.2	95.2	97.0	97.1	96.6
20	90.1	92.5	95.1	95.8	95.9	95.9	96.9	95.9	95.5	95.0
15	89.3	91.7	94.3	96.9	96.9	96.9	97.8	96.6	95.8	95.4
10	88.6	90.9	93.5	96.1	98.4	98.1	98.8	97.2	96.5	96.0
5	87.8	90.1	92.7	95.2	98.1	99.6	100.1	98.1	97.2	96.8
0	87.0	89.3	91.8	94.4	97.3	99.9	101.5	99.3	98.1	97.6
-5	86.2	88.5	91.0	93.5	96.4	99.0	101.9	100.5	99.5	98.8
-10	85.4	87.7	90.1	92.6	95.5	98.1	100.9	101.3	100.5	100.0
-15	84.6	86.8	89.3	91.7	94.5	97.1	100.0	101.0	100.9	100.5
-20	83.7	86.0	88.4	90.8	93.6	96.2	99.0	100.1	99.9	99.5
-25	82.9	85.1	87.5	89.9	92.7	95.2	98.0	99.1	98.9	98.5
-30	82.1	84.3	86.7	89.0	91.8	94.3	97.0	98.1	97.9	97.5
-35	81.2	83.4	85.8	88.1	90.8	93.3	96.0	97.0	96.9	96.5
-40	80.4	82.5	84.9	87.2	89.8	92.3	95.0	96.0	95.9	95.5

## %N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1,000 FT)									
	0	5	10	15	20	25	30	35	40	43
2 PACKS ON - 1 BLEED SOURCE	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4	-0.4	-0.5
1 PACK ON - 1 OR 2 BLEED SOURCES	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4	-0.4	-0.5
ENGINE ANTI-ICE ON	-0.3	-0.5	-0.4	-0.3	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2
ENGINE & WING ANTI-ICE ON*	-0.6	-0.8	-0.7	-0.5	-0.2	-0.3	-0.3	-0.4	-0.4	-0.4
ENGINE & WING ANTI-ICE ON**	-1.1	-0.9	-0.9	-0.6	-0.3	-0.4	-0.5	-0.5	-0.6	-0.6

\*Packs on or off with 2 bleed sources

\*\*Packs off with 1 bleed source

## Severe Turbulence

The turbulent air penetration speed (in severe turbulence) is defined as:

- 270 KIAS below 25,000 FT
- 280 KIAS/0.82 Mach (whichever is lower) at and above 25,000 FT. Maintain a minimum speed of 15 KTS above the minimum manoeuvring speed when below 0.82 Mach.

The turbulent air penetration speed provides ample protection from stall and high-speed buffet, while also providing protection from exceeding the structural limit.

## Cost Index 50 Maximum Operating Altitude

This table provides the maximum operating and optimum altitudes a given cruise weight in the same manner as the FMC. Maximum altitudes are shown for a given manoeuvre capability.

Your airline has selected a 1.3g margin for determination of its Maximum Operating Altitude, therefore in the specimen aircraft (Boeing 777-300ER) use the 1.30'G' column. Note that the optimum altitudes shown in the table results in buffet-related manoeuvre margins of at least 1.3g (39° bank capability). The altitudes shown in the table are limited to the maximum certified altitude of 43,100 FT.

### Max Climb (MCL) Thrust; valid for ISA +25°C and below

WEIGHT (TONNE)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
360	27,900	3	30,400	28,800	27,200
350	28,500	2	31,000	29,400	27,900
340	29,200	0	31,700	30,000	28,500
330	29,800	-1	32,200	30,500	29,000
320	30,500	-3	32,700	31,100	29,600
310	31,200	-4	33,200	31,600	30,100
300	31,900	-6	33,800	32,200	30,700
290	32,600	-7	34,300	32,800	31,300
280	33,400	-9	34,900	33,400	31,900
270	34,100	-11	35,500	34,000	32,500
260	34,900	-12	36,200	34,600	33,200
250	35,800	-14	36,800	35,300	33,900
240	36,600	-15	37,500	36,000	34,600
230	37,500	-15	38,300	36,700	35,300
220	38,400	-15	39,000	37,500	36,100
210	39,400	-15	39,800	38,300	37,000
200	40,400	-15	40,700	39,200	37,800
190	41,500	-15	41,600	40,100	38,800
180	42,600	-15	42,600	41,100	39,800
170	43,100	-15	43,100	42,300	40,900
160	43,100	-15	43,100	43,100	42,200

## Cost Index 50 Control

These tables provide target %N1, Cost Index 50 Cruise Mach number, IAS and standard day fuel flow per engine for the airplane weight and pressure altitude. As indicated by the shaded area, at optimum altitude, .83 Mach approximates the Cost Index 50 Cruise Mach schedule.

PRESS ALT (1,000 FT) (STD TAT)		GROSS WEIGHT (TONNE)										
		160	180	200	220	240	260	280	300	320	340	360
43 (-26)	%N1	82.9	84.9	88.2	93.6							
	MACH	.832	.834	.833	.831							
	KIAS	236	237	236	236							
	FF/ENG	2394	2619	2997	3566							
41 (-27)	%N1	81.0	83.0	85.0	88.0	96.2						
	MACH	.822	.832	.834	.833	.831						
	KIAS	244	247	248	247	247						
	FF/ENG	2441	2653	2889	3274	3819						
39 (-27)	%N1	79.0	81.1	83.0	84.8	87.5	91.3					
	MACH	.805	.823	.832	.834	.832	.831					
	KIAS	250	256	259	260	259	259					
	FF/ENG	2455	2688	2901	3140	3518	4023					
37 (-27)	%N1	76.7	79.1	81.0	82.7	84.3	86.8	89.8	95.0			
	MACH	.783	.806	.822	.831	.833	.832	.831	.830			
	KIAS	254	262	268	271	272	271	271	271			
	FF/ENG	2460	2703	2936	3149	3382	3744	4203	4891			
35 (-25)	%N1	75.0	77.2	79.4	81.1	82.8	84.2	86.3	88.9	92.4		
	MACH	.761	.784	.805	.820	.829	.833	.832	.831	.830		
	KIAS	257	266	274	280	283	284	284	284	283		
	FF/ENG	2488	2728	2974	3209	3426	3651	3988	4407	4965		
33 (-21)	%N1	73.7	75.7	77.8	79.9	81.4	83.1	84.4	86.1	88.3	91.0	94.9
	MACH	.738	.760	.783	.802	.818	.827	.832	.832	.831	.830	.829
	KIAS	260	269	278	285	291	295	297	297	297	296	296
	FF/ENG	2525	2758	3008	3260	3500	3724	3943	4240	4631	5110	5781
31 (-18)	%N1	72.4	74.4	76.3	78.3	80.2	81.7	83.3	84.6	85.9	87.8	90.0
	MACH	.715	.737	.759	.780	.799	.814	.824	.830	.832	.832	.831
	KIAS	263	272	281	289	297	303	307	310	311	310	310
	FF/ENG	2550	2783	3029	3289	3547	3795	4027	4243	4495	4859	5287
29 (-14)	%N1	71.1	73.0	74.9	76.8	78.6	80.4	82.0	83.3	84.7	85.8	87.3
	MACH	.692	.713	.734	.755	.776	.794	.810	.821	.828	.831	.832
	KIAS	265	274	283	292	300	308	315	319	322	324	324
	FF/ENG	2572	2801	3046	3304	3576	3844	4101	4345	4566	4794	5096
27 (-11)	%N1	69.6	71.6	73.5	75.3	77.1	78.8	80.6	82.1	83.4	84.6	85.8
	MACH	.667	.688	.709	.730	.751	.771	.789	.805	.816	.825	.829
	KIAS	266	275	284	293	302	311	319	326	331	335	337
	FF/ENG	2600	2820	3059	3313	3582	3866	4149	4421	4676	4912	5128
25 (-9)	%N1	68.2	70.1	72.0	73.9	75.6	77.3	78.9	80.6	82.2	83.4	(Too
	MACH	.644	.664	.684	.705	.725	.745	.764	.782	.798	.811	Fast)
	KIAS	268	276	285	294	304	313	321	330	337	343	
	FF/ENG	2633	2846	3075	3321	3582	3857	4151	4449	4736	5005	

Shaded area approximates optimum altitude.



## Long Range Cruise Control

These tables provide target %N1, Long Range Cruise Mach number, IAS and standard day fuel flow per engine for the airplane weight and pressure altitude. As indicated by the shaded area, at optimum altitude, .84 Mach approximates the Long Range Cruise Mach schedule.

PRESS ALT (1,000 FT) (STD TAT)		GROSS WEIGHT (TONNE)										
		160	180	200	220	240	260	280	300	320	340	360
43 (-26)	%N1	83.1	85.2									
	MACH	.838	.840									
	KIAS	238	239									
	FF/ENG	2423	2659									
41 (-26)	%N1	81.1	83.3	85.3	88.3							
	MACH	.826	.839	.840	.838							
	KIAS	245	250	250	249							
	FF/ENG	2457	2690	2935	3321							
39 (-27)	%N1	78.9	81.3	83.2	85.1	87.8						
	MACH	.801	.830	.839	.840	.838						
	KIAS	248	258	262	262	261						
	FF/ENG	2441	2721	2947	3192	3570						
37 (-27)	%N1	76.3	79.2	81.3	83.0	84.7	87.0					
	MACH	.770	.808	.831	.839	.840	.838					
	KIAS	249	262	271	274	274	274					
	FF/ENG	2404	2713	2983	3204	3442	3802					
35 (-25)	%N1	74.1	77.0	79.5	81.4	83.1	84.6	86.6	89.2			
	MACH	.737	.778	.810	.831	.839	.840	.839	.837			
	KIAS	248	264	276	284	287	287	287	286			
	FF/ENG	2382	2699	3003	3269	3490	3718	4052	4474			
33 (-21)	%N1	72.7	75.2	77.8	80.1	81.8	83.4	84.8	86.4	88.6	91.3	
	MACH	.712	.745	.782	.810	.830	.838	.840	.839	.838	.836	
	KIAS	250	263	277	289	296	300	300	300	299	299	
	FF/ENG	2399	2680	3003	3306	3576	3799	4019	4312	4709	5189	
31 (-17)	%N1	71.5	73.6	75.9	78.4	80.6	82.1	83.7	84.9	86.3	88.2	90.3
	MACH	.692	.718	.749	.783	.809	.828	.837	.840	.840	.839	.837
	KIAS	254	264	277	290	301	309	313	314	314	313	313
	FF/ENG	2432	2682	2976	3304	3608	3885	4115	4332	4581	4942	5376
29 (-14)	%N1	70.0	72.4	74.4	76.6	78.8	80.9	82.4	83.8	85.1	86.2	87.7
	MACH	.669	.698	.721	.750	.781	.806	.824	.835	.839	.840	.839
	KIAS	256	268	277	290	303	313	321	326	327	328	327
	FF/ENG	2460	2717	2971	3274	3608	3919	4205	4449	4667	4892	5185
27 (-11)	%N1	68.4	71.1	73.2	75.0	77.0	79.1	81.0	82.6	83.8	85.1	86.2
	MACH	.643	.677	.701	.723	.749	.778	.802	.820	.832	.838	.840
	KIAS	256	270	281	290	302	314	325	333	338	341	342
	FF/ENG	2483	2757	3011	3267	3573	3915	4238	4537	4799	5026	5242
25 (-9)	%N1	66.8	69.5	71.9	73.8	75.5	77.3	79.2	81.0	82.7	83.6	84.5
	MACH	.616	.652	.681	.703	.723	.747	.773	.796	.814	.819	.819
	KIAS	255	271	284	294	303	313	325	336	344	346	346
	FF/ENG	2490	2782	3057	3309	3566	3870	4216	4551	4864	5069	5246

Shaded area approximates optimum altitude.

# Indicated Airspeed for Low/High Speed Buffet

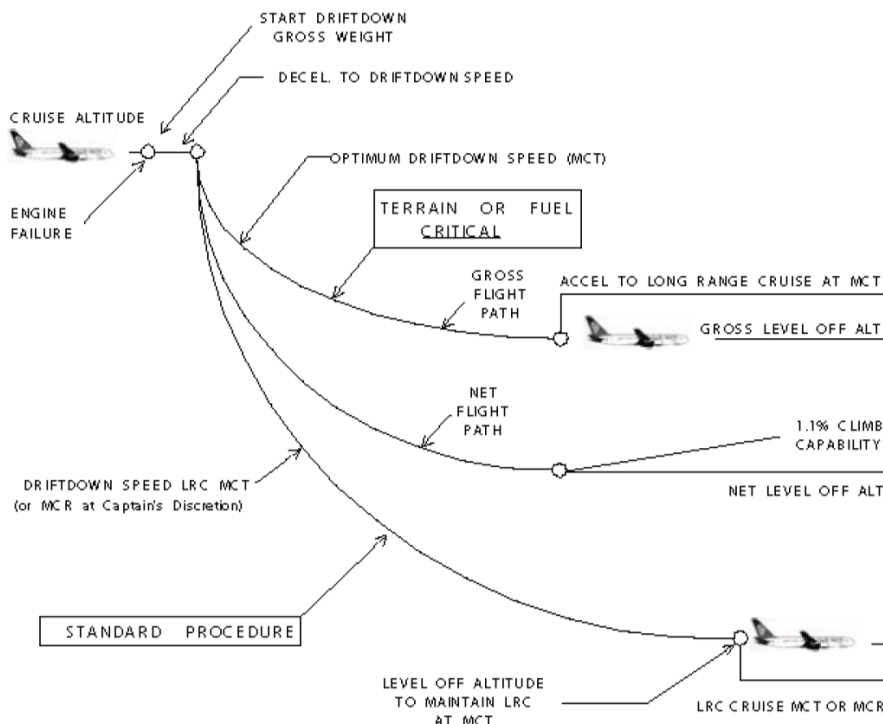
**INDICATED AIRSPEED (KIAS) FOR 1.3G LOW SPEED BUFFET**

WEIGHT (TONNE)	ALTITUDE (FEET)													
	31000		33000		35000		37000		39000		41000		43000	
	10% MAC	35% MAC	10% MAC	35% MAC	10% MAC	35% MAC	10% MAC	35% MAC	10% MAC	35% MAC	10% MAC	35% MAC	10% MAC	35% MAC
360	255	244	265	249	-	-	-	-	-	-	-	-	-	-
340	246	236	251	240	-	246	-	-	-	-	-	-	-	-
320	236	227	240	230	246	235	-	-	-	-	-	-	-	-
300	227	219	230	221	235	224	-	229	-	-	-	-	-	-
280	217	210	220	213	223	215	227	218	-	224	-	-	-	-
260	208	202	210	203	213	205	216	208	221	212	-	220	-	-
240	199	192	201	194	202	196	205	198	208	200	214	204	-	216
220	190	184	191	185	193	186	195	188	197	190	201	192	207	196

**INDICATED AIRSPEED (KIAS) FOR 1.3G HIGH SPEED BUFFET**

WEIGHT (TONNE)	ALTITUDE (FEET)													
	31000		33000		35000		37000		39000		41000		43000	
	10% MAC	35% MAC	10% MAC	35% MAC	10% MAC	35% MAC	10% MAC	35% MAC	10% MAC	35% MAC	10% MAC	35% MAC	10% MAC	35% MAC
360	310	315	285	294	-	-	-	-	-	-	-	-	-	-
340	315	318	293	299	-	276	-	-	-	-	-	-	-	-
320	318	321	299	303	276	283	-	256	-	-	-	-	-	-
300	321	322*	303	306	283	288	260	268	-	-	-	-	-	-
280	322*	322*	306	308*	289	292	269	274	-	253	-	-	-	-
260	322*	322*	308*	308*	292	294	275	277	255	259	-	237	-	-
240	322*	322*	308*	308*	295*	295*	278	280	261	264	241	246	-	222
220	322*	322*	308*	308*	295*	295*	282	282	265	267	248	252	228	235

## Diversion - One Engine Inoperative (OEI) Driftdown Profile



## OEI Long Range Cruise Altitude Capability

This table shows the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on LRC speed, Max Continuous Thrust, and 100 FT/MIN Residual Rate of Climb.

### Maximum Continuous Thrust; 100 FT/MIN Residual Rate of Climb

WEIGHT (TONNE)	PRESSURE ALTITUDE (ft)		
	ISA+10 Deg C & Below	ISA+15 Deg C	ISA+20 Deg C
360	15,000	13,600	12,000
350	15,500	14,200	12,600
340	16,400	14,900	13,100
330	17,200	15,700	13,900
320	18,100	16,600	14,900
310	19,000	17,500	15,800
300	19,900	18,400	16,700
290	20,600	19,400	17,800
280	21,200	20,200	18,800
270	21,900	20,900	19,900
260	22,800	21,600	20,600
250	23,800	22,500	21,400
240	24,900	23,700	22,100
230	26,200	24,900	23,400
220	27,600	26,300	24,600
210	29,100	27,700	26,000
200	30,400	29,100	27,600
190	31,400	30,500	29,100
180	32,400	31,700	30,600
170	33,400	33,000	32,000
160	34,600	34,400	33,500
With engine anti-ice on, no altitude capability adjustment is required.			
With engine and wing anti-ice on, decrease altitude capability by 300 ft.			

### Descent at .84/310/250 KIAS

Distance and time for descent are shown for a .84/310/250 descent speed schedule.

Enter the table with top of descent pressure altitude and read distance in nautical miles and time in minutes. Data is based on flight idle thrust descent in zero wind.

Allowances are included for straight-in approach with gear down and landing Flaps 30 at the outer marker.

PRESSURE ALT (1,000 FT)	25	27	29	31	33	35	37	39	41	43
DISTANCE (NM)	96	104	111	118	124	129	135	140	145	150
TIME (MINUTES)	20	21	22	23	24	24	25	26	26	27

## Landing Reference Speeds (VREF)

WEIGHT (1,000 KG)	FLAPS		
	30	25	20
360	184	186	199
340	180	183	196
320	173	177	190
300	164	172	184
280	158	166	178
260	152	160	172
240	146	154	165
220	140	148	158
200	134	141	151
180	126	133	143
160	119	125	134

## Normal Configuration Landing Distance – Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	220,000 KG LANDING WEIGHT	PER 5,000 KG ABV/BLW 220,000 KG	PER 1,000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/TAIL WIND	PER 1% DOWN/UP HILL	PER 10°C ABV/BLW ISA	PER 5 KTS ABOVE VREF30	ONE REV	TWO REV

## Dry Runway

MAX MANUAL	1,275	+14/-15	+23	-44/+153	+0/-0	+0/-0	+44	-	-
MAX AUTO	1,580	+21/-22	+40	-59/+201	+0/-0	+34/-34	+73	-	-
AUTOBRAKE 4	1,995	+30/-31	+58	-85/+288	+0/-0	+49/-49	+101	-	-
AUTOBRAKE 3	2,320	+38/-39	+72	-105/+357	+0/-0	+60/-60	+125	-	-
AUTOBRAKE 2	2,620	+43/-46	+84	-123/+420	+0/-0	+71/-71	+132	-	-
AUTOBRAKE 1	3,080	+54/-55	+104	-152/+520	+0/-0	+87/-87	+163	-	-

## Wet Runway - Good Reported Braking Action

MAX MANUAL	1,870	+26/-26	+53	-84/+295	+58/-49	+44/-44	+70	-134	-233
MAX AUTO	1,935	+27/-28	+55	-86/+302	+54/-45	+46/-46	+81	-142	-247
AUTOBRAKE 4	2,045	+31/-31	+60	-91/+315	+36/-20	+50/-50	+103	-35	-43
AUTOBRAKE 3	2,320	+38/-39	+72	-95/+357	+9/-1	+60/-60	+125	-0	-1
AUTOBRAKE 2	2,620	+43/-46	+84	-123/+420	+0/-15	+71/-71	+132	-0	-86
AUTOBRAKE 1	3,080	+54/-54	+104	-152/+520	+16/-19	+87/-87	+163	-71	-367

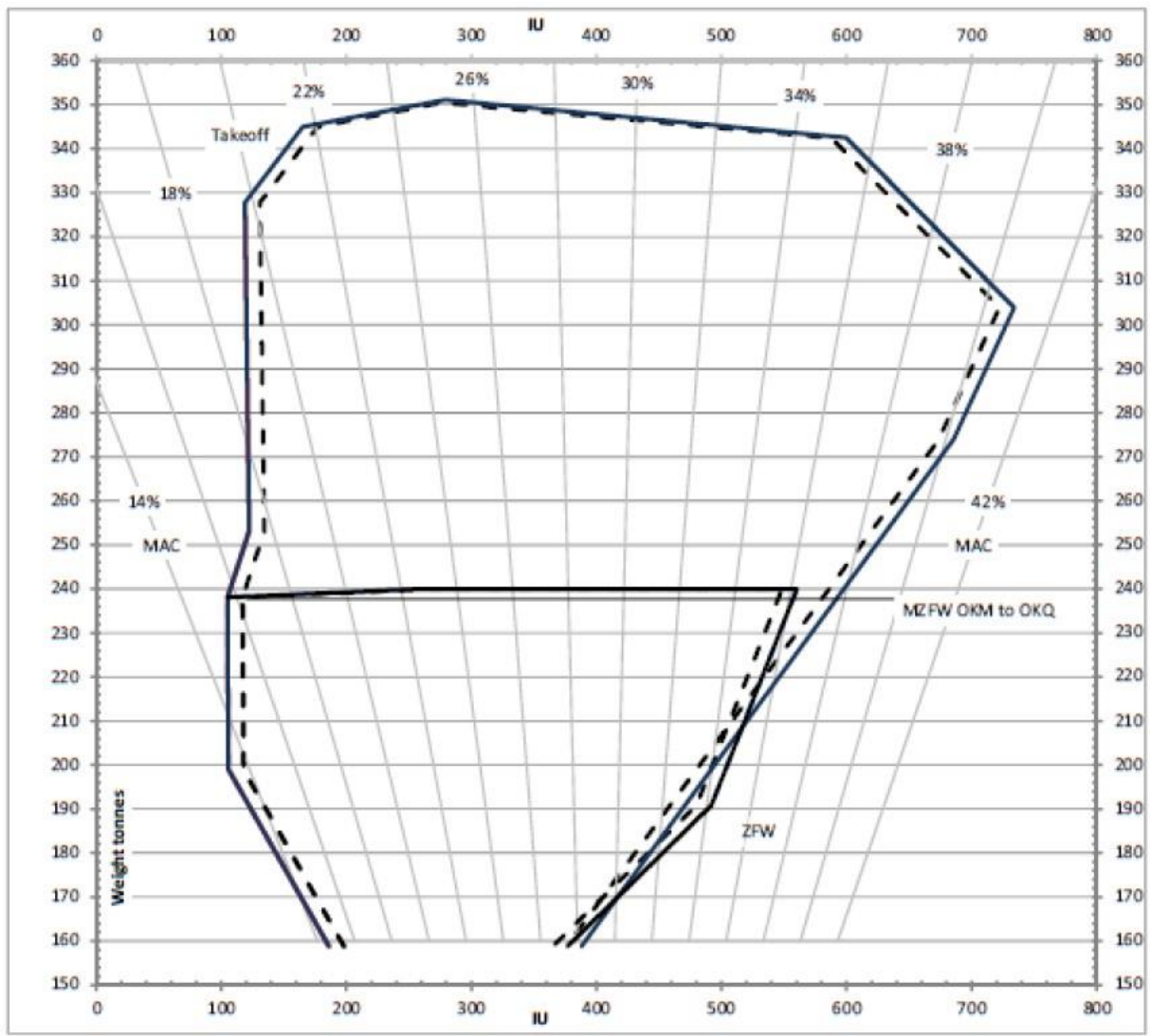
## ACN Tables

Aircraft Type	All-up Mass <sup>1</sup> (Maximum Apron Mass) (Operating Mass Empty)		Load on one main gear leg (%)	Standard Aircraft Tire Pressure			ACN relative to							
							Rigid Pavement Subgrades				Flexible Pavement Subgrades			
							High K = 150 MN/m <sup>3</sup>	Medium K = 80 MN/m <sup>3</sup>	Low K = 40 MN/m <sup>3</sup>	Ultralow K = 20 MN/m <sup>3</sup>	High CBR = 15%	Medium CBR = 10%	Low CBR = 6%	Very low CBR = 3%
	lbs	kgs	psi	kg/cm <sup>2</sup>	mPa	A	B	C	D	A	B	C	D	
B777-200ER	658000	298460	45.9	205	14.38	1.41	50	63	82	101	49	56	68	95
	313500	142200					22	22	26	33	19	20	23	30
B777-200LR	768000	348358	45.9	218	15.33	1.50	64	82	105	127	62	69	87	117
	320000	145150					23	23	27	34	20	21	24	31
B777-300	662000	300278	47.4	215	15.09	1.48	54	68	88	108	53	59	72	100
	350870	159150					26	27	33	41	23	25	28	38
B777-300ER	777000	352441	46.2	221	15.50	1.52	66	85	109	131	64	71	89	120
	370000	167829					27	28	34	43	24	25	29	40
B777-9	777000	352442	47.15	229	16.11	1.58	69	90	114	137	66	74	92	124
	350000	158757					24	27	33	41	23	24	28	37

## PCN Tables

Airport	ICAO designator	Runway	Length (m)	Width (m)	Surface	PCN	Type	Pavement Subgrade	Max. Tyre Pressure	Evaluation Method
Adelaide	YPAD	05/23	3	45.1	ashpalt	072	flex	low	145	exp.
		12/30	1652	45.1	ashpalt	053	flex	low	145	exp.
Auckland	NZAA	23L/05R	3635	45.1	concrete	120	rigid	low	nil	tech.
Brisbane	YBBN	01/19	3560	45.7	ashpalt	097	flex	low	nil	exp.
		14/32	1760	30.5	ashpalt	015	flex	high	145	tech.
Christchurch	NZCH	02/20	3288	45.1	ashpalt	072	flex	medium	217	tech.
		11/29	1741	45.1	ashpalt	040	flex	high	217	tech.
Dunedin	NZDN	03/21	1900	45.7	ashpalt	060	flex	low	nil	tech.
Melbourne	YMML	09/27	2286	45.1	ashpalt	079	flex	low	217	exp.
		16/34	3657	45.1	ashpalt	079	flex	low	217	exp.
Sydney	YSSY	07/25	2530	45.7	ashpalt	067	flex	high	217	exp.
		16R/34L	3962	45.7	ashpalt	067	flex	high	217	exp.
		16L/34R	2438	45.7	ashpalt	067	flex	high	217	exp.
Wellington	NZWN	16/34	1936	45.1	ashpalt	057	flex	medium	217	exp.

# Operational Limits



# Take-off certificate/Loadsheet

## Take-off Certificate

ARPT	NZAA / AKL	TO 1(15%)	RTG
RWY	23L	Optimum	FLAP
INTX	FULL 23L	Auto	A/C
COND	Dry	Off	A/I
WIND	190/18 KT		
OAT	12°C		
QNH	1008.0 HPa		
Planned BRW:	318000 KG		
777-300 / GE90-115BL			
RTG	SEL TEMP	%N1	V1 173 KT
TO 1 (15%)	34°C	92.8	VR 181 KT
FLAP	ACCEL HT		V2 185 KT
5	1500ft AGL		
BRW	RWY / INTX	VREF30	
318000 KG	23L	172 KT	

## Loadsheet

<b>LOADSHEET X</b>	
LOADSHEET EDNO 03	
NZ0002 / 01APR15	
AKL LAX	ZKOKR 3/12
ZFW	233117 MAX 237682
TOF	108814
TOW	341931 MAX 351534
TIF	99226
LAW	242705 MAX 251290
UNDL	4565
PAX /298/ 8/ 3	TTL 309
LIZFW	378.2
LITOW	369.4
TOMAC	30.3
BW	169933 BI 264.0
DOW	174556 DOI 246.5
MIKE.BROWN 6543	