



Brake Dynamometer Test Report

Link Test Report #: 103077-3
Test Description: SAEJ2784 DEC 2007 FMVSS 135 2005 NISSAN
ALTIMA FRONT
Customer Reference: D815
Program #: SAEV09057C2
Platform: 2005 NISSAN ALTIMA FRONT
Lining Material: N/A
Test Date: 08/21/10

Requested By:

HARDEX BRAKES LTD.

1500-701, W GEORGIA ST
VANCOUVER, BC
V7Y 1C6 CANADA

Tested By:

Testing Coordination and Facility
North America Laboratory Test Operations
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2005 NISSAN ALTIMA FRONT SAEJ2784 DEC 2007 FMVSS 135

Test Information

Customer Name	HARDEX BRAKES LTD.
Requestor	
Test Procedure	SAEJ2784 DEC 2007 FMVSS 135
Program Number	SAEV09057C2
Test Coordinator	KLEM, KELLY
Technician	GEORGE YOUNIS
Dynamometer	269 - Model 1900
Parts received, start and end dates	N/A, 08/21/10 - 08/23/10
Datalog, Template version	2.75, 1.30

Setup Details

Fixture Identification	080233-1
Fixture Design	KNUCKLE
Drive adapter method	N/A

Dynamometer Information

Rolling Radius	324.6 mm	
Gross Axle Weight	1084 kg	
Required Wheel Load	711.9 kg	
Actual Wheel Load	711.9 kg	
Required Inertia	78.0 kg·m ²	[GVWR]
Actual Inertia	78.0 kg·m ²	[Inertia values vary by section per SAE J2784]

Brake Information

Brake Platform	2005 NISSAN ALTIMA FRONT
Brake Type	Disc
Brake Size	N/A
Brake ID Number	40206-3Z700
Drum/Rotor Type	N/A
Drum/Rotor Finish	NEW
Pri/Lead/Inner Lining	N/A
Sec/Trail/Outer Lining	N/A
Orientation	LEFT
Effective Radius	121.8 mm
Number of Pistons/Cyls	1
Coefficient Multiplier	0.0160
Piston Diameter	57.1 mm

Comments:

Processed by: Kelly Klem (313) 933-4900	Title Test Engineer	Date 2010-8-25
Reviewed by: Kelly Klem (313) 933-4900	Title Test Engineer	Date 2010-8-25

Data applicable to the materials tested. Report can be copied in full.
Bilateral uncertainty of measurements 0.63% of FS. Coverage factor of 2. Confidence of 95%. Details available upon request.



Table 2 - Service brakes test procedure

Section Number	FMVSS 135 Reference	Inertia Level	Braking Speed [km/h]	Brake Application Control (IBT, Cycle Time, or Distance)	Pressure Apply Rate [kPa/sec]	Pressure Limit [kPa]	Decel Level [g]	# of Stops/ Snubs
		[Equation from Table 1]						
10	7.1 Burnish at GVWR	Eq. 4 or 5	80	IBT = 100 °C	20 000	p _{500N} operational	0.31	200
20	7.4 (1) 3 500 kPa Adhesion Utilization Ramps at GVWR	Eq. 4 or 5	50	IBT = 65 °C first, then 100 °C	700-2000	3500 kPa	—	3
30	7.4 (2) 12 000 kPa Adhesion Utilization Ramps at GVWR	Eq. 4 or 5	100	IBT = 65 °C first, then 100 °C	5000	12 000 kPa	—	3
40	7.5 Cold Effectiveness at GVWR	Eq. 4 or 5	100	IBT = 100 °C	20 000	p _{500N} operational	0.9	6
50	7.6 High Speed Effectiveness at GVWR	Eq. 4 or 5	160 (80% V _{max} for V _{max} < 200 km/h)	IBT = 100 °C	20 000	p _{500N} operational	0.8	6
60	7.5 Cold Effectiveness at LLVW	Eq. 6 or 7	100	IBT = 100 °C	20 000	p _{500N} operational	0.9	6
70	7.6 High Speed Effectiveness at LLVW	Eq. 6 or 7	160 (80% V _{max} for V _{max} < 200 km/h)	IBT = 100 °C	20 000	p _{500N} operational	0.8	6
80	7.8 Failed Antilock System at LLVW	Eq. 6 or 7	100	IBT = 100 °C	20 000	p _{500N} operational	0.6	6
90.a	7.10 Hydraulic Circuit Failure at LLVW for front brakes	Eq. 9 for front-to-rear split	100	IBT = 100 °C	20 000	p _{500N} operational	0.7 front-to-rear split	4
		Eq. 12 or 13 for diagonal split					0.45 diagonal split	
90.b	7.10 Hydraulic Circuit Failure at LLVW for rear brakes	Eq. 9 for front-to-rear split	100	IBT = 100 °C	20 000	p _{500N} operational	0.35 front-to-rear split	4
		Eq. 12 or 13 for diagonal split					0.45 diagonal split	
100.a	7.10 Hydraulic Circuit Failure at GVWR for front brakes	Eq. 8 for front-to-rear split	100	IBT = 100 °C	20 000	p _{500N} operational	0.60 front-to-rear split	4
		Eq. 10 or 11 for diagonal split					0.40 diagonal split	
100.b	7.10 Hydraulic Circuit Failure at GVWR for rear brakes	Eq. 8 for front-to-rear split	100	IBT = 100 °C	20 000	p _{500N} operational	0.40 front-to-rear split	4
		Eq. 10 or 11 for diagonal split					0.40 diagonal split	
110	7.8 Failed Antilock System at GVWR	Eq. 4 or 5	100	IBT = 100 °C	20 000	p _{500N} operational	0.6	6
120	Cool Down at GVWR	Eq. 4 or 5	5	Until 5 °C above cooling air temp	—	—	—	—
130	Warm Up at GVWR	Eq. 4 or 5	50	Until 65° at 60 seconds cycle time	20 000	p _{500N} operational	0.31	As needed
140	7.11 Failed Power-Brake Unit at GVWR	Eq. 4 or 5	100	IBT = 65 °C first, then 100 °C	20 000	p _{500N} depleted	—	6
150	7.12 Parking Brake forward	—	Reserved for rear brakes; See appendix A					
155	7.12 Parking Brake reverse	—	Reserved for rear brakes; See appendix A					
160	7.13 Heating Snubs at GVWR	Eq. 4 or 5	120-60	IBT = 65 °C first, then cycle time of 45 seconds	20 000	p _{500N} operational	0.31	15
170	7.14-1 First Hot Stop at GVWR	Eq. 4 or 5	100	20 seconds after the end of the last snub from section 160	20 000	p _{best cold effect}	—	1
180	7.14-2 Second Hot Stop at GVWR	Eq. 4 or 5	100	20 seconds after the end of section 170	20 000	p _{500N} operational	0.9	1
190	7.15 Brake Cooling Stops at GVWR	Eq. 4 or 5	50	Cycle distance = 1.5 km after the end of section 180	20 000	p _{500N} operational	0.31	4
200	7.16 Recovery Performance at GVWR	Eq. 4 or 5	100	Cycle distance = 1.5 km after the start last stop of section 190	20 000	p _{best cold effect}	—	1
				20 seconds after the end of stop 1 of this section				
210	7.17 Final Inspection	Perform final inspection and measurements						



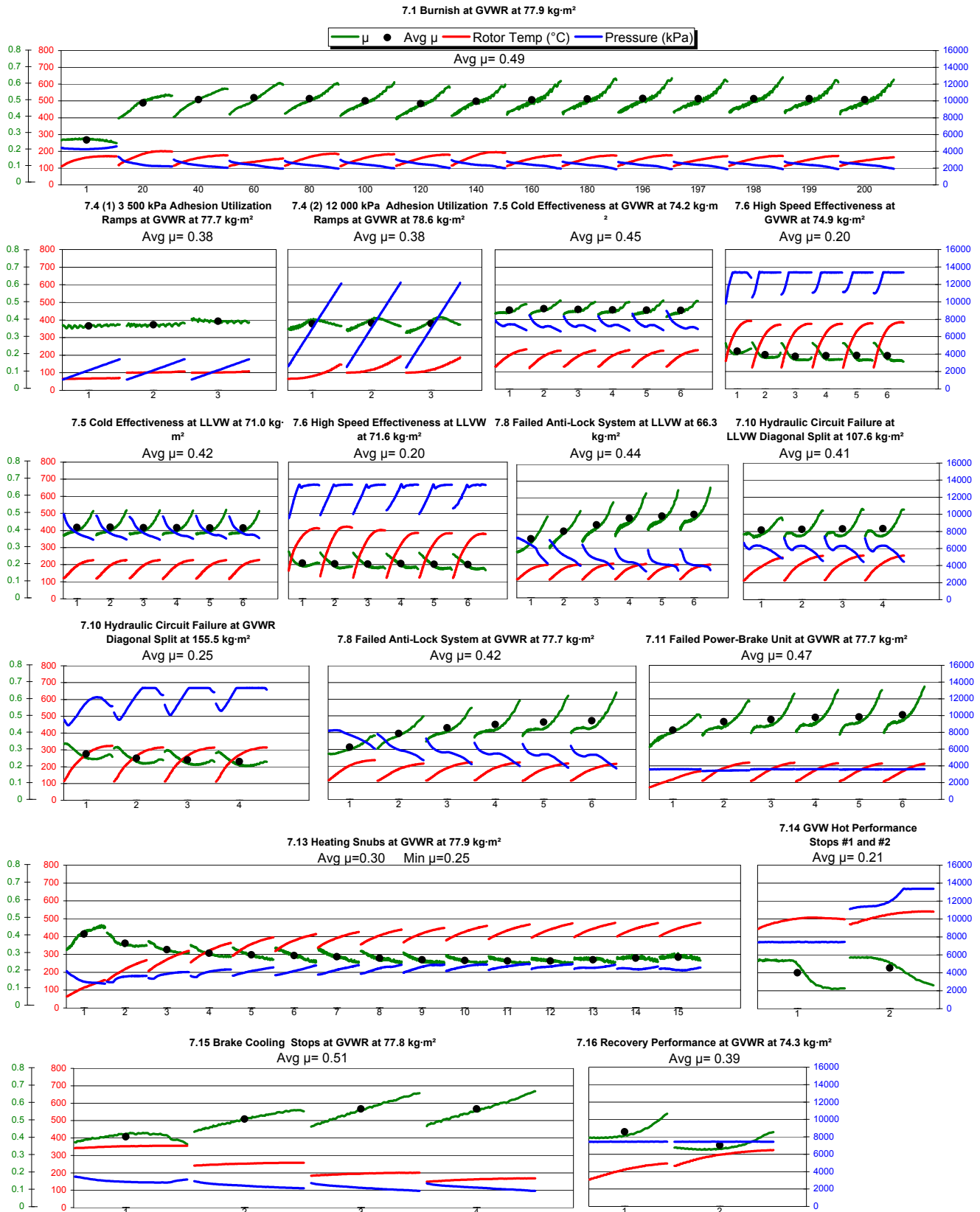
EFFECTIVENESS SUMMARY

μ (average by distance)

Section	minimum	average	maximum	% of Section 7.5 GVWR
7.5 Cold Effectiveness at GVWR	0.44	0.45	0.45	100%
7.6 High Speed Effectiveness at GVWR	0.20	0.21	0.22	46%
7.5 Cold Effectiveness at LLVW	0.40	0.40	0.40	90%
7.6 High Speed Effectiveness at LLVW	0.21	0.21	0.22	48%
7.10 Hydraulic Circuit Failure at LLVW Diagonal Split	0.39	0.39	0.40	88%
7.10 Hydraulic Circuit Failure at GVWR Diagonal Split	0.24	0.26	0.28	58%
7.11 Failed Power-Brake Unit at GVWR	0.39	0.44	0.47	100%
7.13 Heating Snubs at GVWR	0.26	0.30	0.40	67%
7.14-1 First Hot Stop at GVWR		0.24		54%
7.14-2 Second Hot Stop at GVWR		0.25		57%
7.16 Recovery Performance at GVWR	0.34	0.38	0.41	85%

DECELERATION SUMMARY

Section	Setpoint (g/kPa)	Highest Level attained (g)	Pressure @ Highest Level (kPa)	Pressure Limit (kPa)
7.5 Cold Effectiveness at GVWR	0.90	0.91	7,525	13,408
7.6 High Speed Effectiveness at GVWR	0.80	0.76	12,605	13,408
7.5 Cold Effectiveness at LLVW	0.90	0.94	8,150	13,408
7.6 High Speed Effectiveness at LLVW	0.80	0.75	12,196	13,408
7.10 Hydraulic Circuit Failure at LLVW Diagonal Split	0.45	0.45	6,102	13,408
7.10 Hydraulic Circuit Failure at GVWR Diagonal Split	0.40	0.39	10,560	13,408
7.11 Failed Power-Brake Unit at GVWR	3,460	0.48	3,586	3,460
7.13 Heating Snubs at GVWR	0.31	0.31	2,953	13,408
7.14-1 First Hot Stop at GVWR	7,387	0.40	7,427	7,387
7.14-2 Second Hot Stop at GVWR	0.90	0.73	11,897	13,408
7.16 Recovery Performance at GVWR	7,387	0.89	7,434	13,408



Test Description	Rotor	40206-3Z700	Effective Radius	121.8 mm
2005 NISSAN ALTIMA FRONT SAEJ2784	Primary Lining	N/A	Piston Diameter	1 x 57.1 mm
DEC 2007 FMVSS 135	Secondary Lining	N/A	Actual Inertia	78.0 kg-m²
			Actual Wheel Load	711.9 kg
			Rolling Radius	324.6 mm



Stop	Brake Speed kph	Release Speed kph	Cycle Time sec	Decel Torque g	Min Torque N*m	Avg Torque N*m	Max Torque N*m	Min Press kPa	Avg Pres Dist kPa	Max Press kPa	Init μ	Avg μ Dist	Final μ	Max Fluid Disp cm ³	Init Rotor °C	Final Rotor °C	Init InPad °C	Final InPad °C	Init OutPad °C	Final OutPad °C
7.1 Burnish at GVWR at 77.9 kg-m²																				
1	79.9	3.7	9.1	0.30	696	717	815	4215	4310	5001	0.27	0.27	0.24	1.69	87	169	33	39	51	74
5	80.0	3.7	266.3	0.31	684	730	825	2755	3110	4177	0.34	0.38	0.37	1.61	100	189	89	95	98	119
10	79.9	3.7	104.5	0.30	679	723	853	2491	2873	4072	0.38	0.41	0.43	1.52	101	200	77	80	95	118
15	80.0	3.7	103.8	0.31	685	723	861	2310	2675	4077	0.39	0.44	0.48	1.52	100	195	76	80	94	119
20	80.0	3.7	104.0	0.31	692	730	881	2170	2582	4076	0.40	0.46	0.52	1.52	100	195	76	82	93	118
25	79.9	3.7	104.1	0.31	698	728	882	2123	2490	4059	0.40	0.48	0.53	1.51	100	200	78	82	93	117
30	80.0	3.7	106.3	0.31	693	729	867	2136	2497	4010	0.42	0.48	0.53	1.49	100	183	78	84	93	116
35	79.9	3.7	106.9	0.31	689	725	943	2100	2504	4346	0.41	0.47	0.53	1.55	101	162	78	84	93	117
40	79.9	3.7	106.7	0.31	697	726	974	2023	2480	4488	0.40	0.48	0.56	1.57	100	176	79	86	93	119
45	80.0	3.7	106.3	0.31	707	727	993	1931	2401	4534	0.42	0.49	0.60	1.59	101	185	81	87	93	119
50	80.0	3.7	107.6	0.31	703	725	979	1975	2358	4472	0.43	0.50	0.58	1.60	100	181	81	88	93	113
55	80.0	3.7	107.1	0.31	702	724	912	1954	2436	4191	0.42	0.49	0.59	1.55	100	162	81	89	93	115
60	79.9	3.7	107.2	0.31	693	724	978	1916	2439	4387	0.42	0.49	0.59	1.57	100	158	81	88	93	119
65	80.0	3.7	106.6	0.31	692	726	963	1904	2441	4375	0.41	0.49	0.59	1.59	100	177	81	89	93	119
70	79.9	3.7	106.6	0.31	700	725	972	1990	2435	4362	0.42	0.49	0.58	1.57	101	183	81	90	91	118
75	79.9	3.7	107.1	0.31	698	725	982	1906	2468	4358	0.42	0.48	0.60	1.60	100	159	81	90	91	119
80	79.9	3.7	107.6	0.31	683	724	894	1926	2444	4101	0.42	0.48	0.58	1.53	100	184	80	90	92	119
85	79.9	3.7	107.2	0.31	697	725	991	1921	2475	4443	0.42	0.48	0.59	1.61	100	171	81	91	92	118
90	80.0	3.7	107.1	0.31	692	726	963	1888	2500	4351	0.41	0.47	0.60	1.61	100	171	81	91	92	119
95	80.0	3.7	106.9	0.31	692	725	972	1892	2490	4391	0.42	0.48	0.60	1.60	100	183	81	91	91	118
100	79.9	3.7	107.8	0.31	707	725	861	1944	2512	3920	0.41	0.47	0.60	1.51	100	182	82	93	92	119
105	79.9	3.7	107.3	0.31	691	727	863	1949	2504	3922	0.41	0.47	0.58	1.54	100	165	81	92	92	119
110	80.0	3.7	108.7	0.31	698	724	934	1923	2557	4120	0.41	0.46	0.59	1.54	101	164	82	93	91	119
115	79.9	3.7	108.6	0.31	701	723	964	1984	2543	4250	0.42	0.46	0.58	1.60	100	177	82	93	91	118
120	80.0	3.7	108.7	0.31	686	725	967	1976	2608	4287	0.40	0.45	0.57	1.59	100	180	83	94	91	122
125	80.0	3.7	110.0	0.31	693	724	943	2028	2591	4023	0.40	0.46	0.58	1.54	100	162	83	95	92	119
130	80.0	3.7	109.5	0.31	694	724	891	1999	2561	3880	0.41	0.46	0.59	1.52	101	170	83	94	91	119
135	79.9	3.7	108.2	0.31	690	723	992	2048	2529	4233	0.42	0.47	0.58	1.60	100	168	84	95	92	117
140	79.9	3.7	107.1	0.31	695	725	961	1964	2519	4164	0.41	0.47	0.60	1.60	100	190	83	95	92	122
145	80.0	3.7	111.4	0.31	674	723	978	1985	2597	4271	0.41	0.45	0.55	1.62	101	157	83	95	91	119
150	79.9	3.7	111.2	0.31	693	725	840	1928	2524	3720	0.42	0.47	0.60	1.50	100	177	83	95	91	124
155	79.9	3.7	111.9	0.31	687	723	972	1901	2524	4166	0.42	0.47	0.59	1.60	100	171	83	95	91	119
160	80.0	3.7	111.1	0.31	692	723	922	1893	2472	3866	0.42	0.48	0.63	1.55	100	175	84	95	91	119
165	79.9	3.7	112.7	0.31	687	723	990	1840	2451	4182	0.43	0.48	0.61	1.63	100	182	83	95	91	120
170	80.0	3.7	111.5	0.31	692	722	1027	1884	2476	4235	0.43	0.48	0.60	1.65	100	167	83	96	91	125
175	79.9	3.7	113.1	0.31	695	723	1014	1836	2455	4243	0.43	0.48	0.62	1.61	100	177	83	95	91	120
180	79.9	3.7	112.9	0.31	686	723	1027	1829	2454	4255	0.43	0.48	0.62	1.63	100	175	83	96	91	120
185	80.0	3.7	112.7	0.31	699	723	1031	1822	2442	4270	0.43	0.48	0.64	1.63	100	177	83	96	91	121
190	80.0	3.7	112.5	0.31	698	723	942	1880	2448	3849	0.42	0.48	0.63	1.54	100	169	83	96	91	120
195	80.0	3.7	112.8	0.31	695	723	956	1857	2456	3923	0.42	0.48	0.64	1.58	100	165	83	96	91	120
196	80.0	3.7	113.0	0.31	696	723	1043	1855	2438	4221	0.43	0.48	0.63	1.62	100	176	83	95	91	121
197	79.9	3.7	112.8	0.31	694	723	987	1854	2442	4080	0.43	0.48	0.61	1.58	100	170	83	96	91	120
198	80.0	3.7	112.0	0.31	695	723	1014	1829	2440	4193	0.43	0.48	0.63	1.63	100	174	83	96	91	120
199	79.9	3.7	113.2	0.31	694	723	883	1868	2442	3737	0.44	0.48	0.61	1.52	100	172	83	96	91	120
200	80.0	3.7	112.7	0.31	695	723	1016	1870	2460	4147	0.42	0.48	0.63	1.61	100	164	83	97	91	121



Stop	Brake Speed kph	Release Speed kph	Cycle Time sec	Decel Torque g	Min Torque N*m	Avg Torque Dist N*m	Max Torque N*m	Min Press kPa	Avg Pres Dist kPa	Max Press kPa	Init μ	Avg μ Dist	Final μ	Max Fluid Disp cm ³	Init Rotor °C	Final Rotor °C	Init InPad °C	Final InPad °C	Init OutPad °C	Final OutPad °C
7.4 (1) 3 500 kPa Adhesion Utilization Ramps at GVWR at 77.7 kg-m²																				
1	50.1	35.5	363.4	0.25	355	572	814	1648	2548	3555	0.35	0.37	0.37	1.51	65	71	60	62	63	66
2	49.9	35.2	118.5	0.25	364	579	834	1642	2543	3543	0.37	0.37	0.38	1.46	100	107	79	80	85	86
3	50.1	34.4	39.7	0.26	394	609	844	1641	2548	3551	0.40	0.39	0.39	1.45	100	108	80	80	86	89
7.4 (2) 12 000 kPa Adhesion Utilization Ramps at GVWR at 78.6 kg-m²																				
1	100.0	47.8	260.3	0.87	1178	1973	2761	5153	8275	12146	0.38	0.38	0.37	2.79	65	146	61	64	61	68
2	100.0	46.7	131.3	0.89	1180	2008	2753	5119	8290	12196	0.37	0.38	0.36	2.66	100	193	81	85	89	95
3	100.0	46.9	194.7	0.89	1122	2010	2821	5078	8240	12170	0.36	0.38	0.37	2.66	100	188	87	90	95	102
7.5 Cold Effectiveness at GVWR at 74.2 kg-m²																				
1	100.0	3.5	202.4	0.90	1832	2039	2329	6674	7387	9720	0.44	0.45	0.44	2.35	99	228	86	96	94	114
2	100.0	3.4	225.3	0.91	1838	2071	2286	6457	7397	9508	0.42	0.45	0.46	2.36	98	224	85	96	95	113
3	100.0	3.4	225.0	0.91	1858	2061	2350	6545	7405	9651	0.43	0.45	0.46	2.37	98	223	85	96	97	117
4	100.0	3.4	229.7	0.91	1856	2061	2361	6537	7448	10248	0.43	0.45	0.46	2.44	99	224	86	97	96	114
5	100.0	3.4	237.3	0.91	1908	2068	2345	6535	7525	9929	0.42	0.44	0.47	2.44	98	223	85	97	95	114
6	100.0	3.4	237.1	0.91	1920	2073	2349	6716	7586	10120	0.42	0.44	0.46	2.42	98	226	86	97	96	115
7.6 High Speed Effectiveness at GVWR at 74.9 kg-m²																				
1	159.9	3.7	236.9	0.76	1565	1688	1860	9613	12605	13420	0.27	0.22	0.22	3.09	100	387	91	141	105	177
2	159.9	3.7	362.9	0.70	1475	1593	1909	10517	12652	13469	0.27	0.20	0.23	3.28	101	369	95	153	105	185
3	159.9	3.7	422.6	0.66	1365	1549	1844	10818	12695	13411	0.26	0.20	0.20	3.18	101	372	95	152	113	193
4	159.9	3.7	388.4	0.67	1370	1585	1829	11039	12580	13405	0.26	0.20	0.18	3.12	101	373	96	152	103	185
5	159.9	3.7	386.8	0.67	1347	1599	1852	11081	12502	13405	0.26	0.21	0.16	3.12	100	375	95	152	107	186
6	159.9	3.7	395.3	0.66	1297	1592	1896	10936	12489	13419	0.26	0.21	0.16	3.14	100	379	94	153	107	188
7.5 Cold Effectiveness at LLVW at 71.0 kg-m²																				
1	100.0	3.4	244.7	0.94	1873	2019	2361	6472	8141	11359	0.37	0.40	0.50	2.80	99	227	84	101	94	119
2	100.0	3.5	242.1	0.94	1879	2021	2315	6349	8113	10899	0.37	0.40	0.51	2.73	98	228	85	101	95	119
3	100.0	3.4	238.1	0.94	1877	2022	2296	6448	8150	10325	0.38	0.40	0.52	2.63	98	228	87	102	93	118
4	100.0	3.5	241.4	0.93	1860	1999	2319	6598	8045	10899	0.37	0.40	0.50	2.72	98	229	86	101	95	118
5	100.0	3.4	237.8	0.93	1858	2001	2343	6108	8075	10914	0.38	0.40	0.52	2.71	98	226	86	102	94	119
6	100.0	3.5	238.4	0.93	1853	2000	2315	6280	8079	10858	0.38	0.40	0.51	2.70	99	228	88	103	95	119



Stop	Brake Speed kph	Release Speed kph	Cycle Time sec	Decel Torque g	Min Torque N*m	Avg Torque N*m	Max Torque N*m	Min Press kPa	Avg Pres Dist kPa	Max Press kPa	Init μ	Avg μ Dist	Final μ	Max Fluid Disp cm ³	Init Rotor °C	Final Rotor °C	Init InPad °C	Final InPad °C	Init OutPad °C	Final OutPad °C
7.6 High Speed Effectiveness at LLVW at 71.6 kg-m²																				
1	159.9	3.7	544.8	0.75	1536	1601	1808	9283	12196	13398	0.28	0.21	0.19	3.02	101	411	91	147	95	183
2	159.9	3.7	357.5	0.73	1468	1595	1792	9780	12085	13401	0.27	0.21	0.18	3.14	100	414	98	155	105	197
3	159.9	3.7	380.3	0.72	1339	1598	1816	9898	12121	13400	0.27	0.21	0.16	3.13	100	397	95	154	107	199
4	159.9	3.7	380.8	0.73	1344	1617	1799	10330	12047	13453	0.26	0.22	0.16	3.11	99	383	95	152	106	197
5	159.9	3.7	385.8	0.71	1237	1587	1785	9896	12008	13407	0.27	0.21	0.15	3.10	100	382	95	154	106	198
6	159.9	3.7	380.5	0.71	1209	1599	1796	10550	12150	13416	0.26	0.21	0.15	3.12	100	378	97	157	104	195
7.8 Failed Anti-Lock System at LLVW at 66.3 kg-m²																				
1	100.0	3.7	376.8	0.63	1149	1262	1348	3983	6424	8090	0.27	0.32	0.47	2.31	101	198	95	113	101	134
2	100.0	3.7	215.7	0.62	1178	1256	1331	3705	5564	7709	0.30	0.36	0.52	2.21	100	200	91	116	95	133
3	100.0	3.7	216.0	0.61	1180	1245	1363	3342	4988	6890	0.34	0.40	0.57	2.09	100	204	90	113	94	135
4	100.0	3.7	216.9	0.61	1157	1238	1428	2991	4522	6763	0.38	0.44	0.63	2.04	100	203	90	114	95	136
5	100.0	3.7	221.5	0.61	1129	1224	1541	2944	4285	7348	0.41	0.46	0.66	2.11	100	200	89	114	94	134
6	100.0	3.7	216.7	0.62	1127	1257	1536	2879	4330	6663	0.41	0.47	0.67	2.00	100	200	91	116	94	133
7.10 Hydraulic Circuit Failure at LLVW Diagonal Split at 107.6 kg-m²																				
1	100.0	3.7	237.9	0.45	1265	1468	1652	4819	6085	7881	0.38	0.39	0.40	2.24	100	247	89	137	91	152
2	100.0	3.7	255.0	0.45	1317	1479	1673	4437	6099	8110	0.36	0.39	0.48	2.30	100	258	91	132	96	164
3	100.0	3.7	268.1	0.45	1306	1483	1678	4351	6102	8124	0.36	0.39	0.48	2.30	100	258	91	136	96	163
4	100.0	3.7	277.6	0.45	1332	1479	1690	4356	6040	8211	0.37	0.40	0.49	2.29	100	258	92	136	97	164
7.10 Hydraulic Circuit Failure at GVWR Diagonal Split at 155.5 kg-m²																				
1	100.0	3.7	49.3	0.39	1676	1847	2010	8915	10560	12279	0.33	0.28	0.23	2.82	101	323	68	133	73	168
2	100.0	3.7	306.8	0.39	1734	1838	2010	9557	11454	13396	0.31	0.26	0.22	3.10	101	314	93	154	96	184
3	100.0	3.7	323.5	0.39	1704	1829	2036	10130	11928	13405	0.29	0.25	0.21	3.13	100	313	94	157	101	186
4	100.0	3.7	328.7	0.38	1674	1802	2010	10623	12263	13397	0.28	0.24	0.21	3.14	101	315	94	159	103	188
7.8 Failed Anti-Lock System at GVWR at 77.7 kg-m²																				
1	100.0	3.7	28.8	0.61	1326	1428	1513	5893	7831	8302	0.27	0.29	0.36	2.32	100	234	74	102	81	133
2	100.0	3.7	205.4	0.62	1335	1459	1531	4545	6433	8025	0.30	0.36	0.48	2.30	100	215	90	118	93	139
3	100.0	3.7	219.2	0.61	1324	1447	1584	4100	5834	8216	0.35	0.40	0.52	2.30	100	222	91	117	97	145
4	100.0	3.7	229.0	0.61	1350	1439	1645	3809	5535	8235	0.37	0.42	0.58	2.29	101	222	91	118	97	147
5	100.0	3.7	232.1	0.61	1344	1438	1642	3621	5390	7635	0.38	0.43	0.60	2.21	100	216	93	118	97	145
6	100.0	3.7	239.7	0.61	1346	1434	1661	3524	5266	7566	0.40	0.44	0.64	2.19	100	214	93	121	97	145
7.11 Failed Power-Brake Unit at GVWR at 77.7 kg-m²																				
1	100.0	1.2	1633.9	0.39	675	855	1124	3543	3594	3650	0.32	0.39	0.41	1.43	65	167	70	120	63	141
2	100.0	1.2	153.2	0.42	784	922	1262	3343	3425	3694	0.39	0.44	0.49	1.44	101	219	87	113	91	163
3	100.0	1.2	213.7	0.45	867	995	1399	3555	3592	3686	0.39	0.45	0.54	1.51	101	220	92	137	97	162
4	100.0	1.2	216.9	0.46	862	1018	1453	3555	3599	3856	0.41	0.46	0.56	1.51	101	216	93	122	97	160
5	100.0	1.2	222.3	0.46	828	1015	1435	3539	3571	3791	0.39	0.46	0.57	1.54	100	216	94	138	98	160
6	100.0	1.2	220.1	0.48	847	1042	1495	3548	3586	3758	0.39	0.47	0.60	1.51	100	213	91	120	98	158



Stop	Brake Speed kph	Release Speed kph	Cycle Time sec	Decel Torque g	Min Torque N*m	Avg Torque Dist N*m	Max Torque N*m	Min Press kPa	Avg Pres Dist kPa	Max Press kPa	Init μ	Avg μ Dist	Final μ	Max Fluid Disp cm ³	Init Rotor °C	Final Rotor °C	Init InPad °C	Final InPad °C	Init OutPad °C	Final OutPad °C
7.13 Heating Snubs at GVWR at 77.9 kg-m²																				
1	120.1	60.5	499.9	0.31	693	732	835	2531	2953	4957	0.33	0.40	0.45	1.75	55	163	54	99	58	114
2	119.9	60.5	45.0	0.30	649	704	920	2673	3159	4352	0.42	0.36	0.36	1.54	137	270	103	128	113	175
3	119.9	60.5	45.0	0.30	666	705	837	3049	3505	3799	0.38	0.33	0.31	1.45	197	323	140	170	158	211
4	119.9	60.5	45.0	0.30	664	704	901	3226	3721	4070	0.35	0.31	0.29	1.51	242	367	172	197	197	241
5	119.9	60.5	44.9	0.30	683	706	864	3375	3854	4286	0.34	0.30	0.27	1.54	278	398	198	222	228	269
6	120.1	60.5	45.0	0.30	677	705	850	3429	3897	4526	0.34	0.29	0.26	1.64	302	415	222	246	255	292
7	119.9	60.5	44.9	0.30	672	705	892	3479	3986	4558	0.34	0.29	0.25	1.66	326	427	241	265	273	305
8	119.9	60.5	45.0	0.30	671	705	937	3557	4097	4584	0.32	0.28	0.25	1.72	343	441	258	281	290	324
9	119.9	60.5	45.0	0.30	669	706	928	3670	4245	4580	0.31	0.27	0.26	1.79	357	448	273	296	302	336
10	120.1	60.5	45.0	0.30	674	709	832	3866	4310	4589	0.29	0.27	0.26	1.80	367	463	284	304	310	345
11	120.1	60.5	44.9	0.30	673	710	860	3947	4357	4638	0.29	0.26	0.26	1.83	375	470	295	317	319	354
12	119.9	60.5	44.9	0.30	674	711	775	4065	4375	4629	0.27	0.26	0.25	1.84	382	476	302	325	327	360
13	120.1	60.5	44.9	0.30	678	712	819	4094	4276	4589	0.27	0.27	0.25	1.83	386	478	309	332	332	366
14	119.9	60.5	44.9	0.30	675	714	775	4036	4156	4416	0.27	0.28	0.26	1.79	390	477	314	337	338	370
15	119.9	60.5	44.9	0.30	675	715	858	3938	4075	4337	0.29	0.28	0.26	1.79	393	479	319	341	342	374
7.14-1 First Hot Stop at GVWR at 74.9 kg-m²																				
1	100.0	3.5	26.7	0.40	500	1102	1470	7368	7427	7481	0.27	0.24	0.11	2.59	431	499	335	360	363	394
7.14-2 Second Hot Stop at GVWR at 74.3 kg-m²																				
1	100.0	3.5	27.7	0.73	934	1869	2096	11111	11897	13415	0.28	0.25	0.11	3.88	454	540	348	365	374	401
7.15 Brake Cooling Stops at GVWR at 77.8 kg-m²																				
1	49.9	3.5	116.0	0.30	643	726	839	2682	2930	3717	0.37	0.40	0.33	1.86	337	355	291	294	313	320
2	49.9	3.5	116.4	0.31	679	730	883	2070	2435	3613	0.43	0.49	0.53	1.70	238	258	224	229	238	247
3	49.9	3.5	116.2	0.31	701	731	913	1767	2228	3830	0.46	0.54	0.65	1.70	179	200	175	183	187	197
4	50.1	3.5	115.8	0.31	712	730	886	1739	2218	3782	0.47	0.54	0.68	1.60	145	169	144	152	152	164
7.16 Recovery Performance at GVWR at 74.3 kg-m²																				
1	100.0	3.4	64.1	0.89	1794	1909	2500	7402	7434	7487	0.40	0.41	0.50	2.29	140	250	142	164	145	172
2	100.0	3.5	24.3	0.72	1492	1570	1972	7379	7434	7528	0.34	0.34	0.37	2.28	212	325	170	194	186	208

Inboard Pad Thickness (mm)

	1	2	3	4	5	6	7	8	Average	Mass (gram)
Initial	16.52	16.49	16.45	16.36	16.15	16.24	16.29	16.32	16.35	382.6
Final	15.69	15.65	15.61	15.56	15.44	15.46	15.51	15.58	15.56	375.6
Loss	0.83	0.84	0.84	0.80	0.71	0.78	0.78	0.74	0.79	7.0

Tangential Wear Radial Wear Cup Wear Structural Integrity
 3.8% 9.1% -4.9%

Outboard Pad Thickness (mm)

	1	2	3	4	5	6	7	8	Average	Mass (gram)
Initial	16.92	16.84	16.80	16.80	16.93	16.94	16.94	16.94	16.89	383.3
Final	15.78	15.71	15.68	15.67	16.03	16.10	16.12	16.10	15.90	374.2
Loss	1.14	1.13	1.12	1.13	0.90	0.84	0.82	0.84	0.99	9.1

Tangential Wear Radial Wear Cup Wear Structural Integrity
 -2.5% 24.8% 2.5%

Rotor Thickness (mm)

	Inner				Outer				Average	Mass (gram)
	1	2	3	4	1	2	3	4		
Initial	24.03	24.03	24.03	24.03	24.03	24.03	24.03	24.03	24.03	6,728.7
Final	24.00	24.00	24.00	24.00	24.00	24.01	24.00	24.01	24.00	6,719.3
Loss	0.03	0.03	0.03	0.03	0.03	0.02	0.03	0.02	0.03	9.4

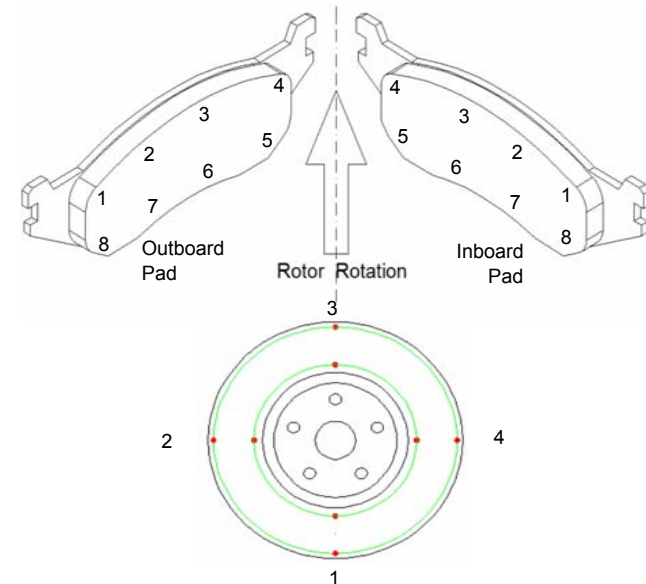
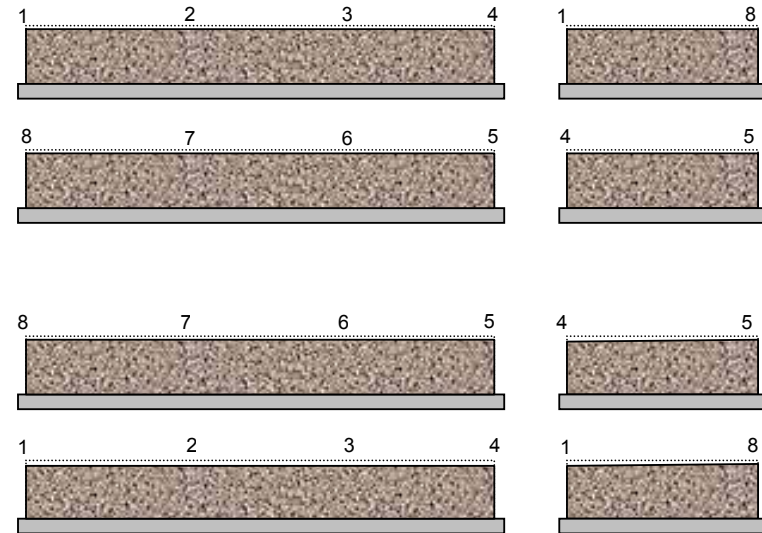
Rotor Surface Finish, Ra (µm)

Initial	0.72	0.60	0.68	0.69	0.94	0.77	0.98	0.77
Final	0.33	0.43	0.39	0.36	1.27	1.68	2.11	1.41

*Tangential Wear =Avg(1,8) - Avg(4,5)

*Radial Wear =Avg(1,2,3,4) - Avg(5,6,7,8) * reported as percentage of max

*Cup Wear =Avg(1,8,4,5) - Avg(2,3,7,6) ** scale factor of 1 used for pad wear diagrams



Test Description SAEJ2784 DEC 2007 FMVSS 135 2005 NISSAN ALTIMA FRONT	Rotor Primary Lining Secondary Lining	40206-3Z700	Effective Radius	121.8 mm
		N/A	Piston Diameter	1 x 57.1 mm
		N/A	Actual Inertia	78.0 kg·m ²
		N/A	Actual Wheel Load	711.9 kg
			Rolling Radius	324.6 mm