



Brake Dynamometer Test Report

Link Test Report #: 103077-2
Test Description: SAEJ2784 DEC 2007 FMVSS 135 2002 CAMRY FRONT
Customer Reference: D908
Program #: SAEV09057C1
Platform: 2002 CAMRY FRONT
Lining Material:
Test Date: 08/18/10

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
13840 Elmira Ave.
Detroit, MI 48227
www.linkeng.com
Phone: (313) 933-4900
Fax: (313) 933-0710



2002 CAMRY FRONT SAEJ2784 DEC 2007 FMVSS 135

Test Information

Customer Name	HARDEX BRAKES LTD.
Requestor	
Test Procedure	SAEJ2784 DEC 2007 FMVSS 135
Program Number	SAEV09057C1
Test Coordinator	KLEM, KELLY
Technician	R.COX
Dynamometer	269 - Model 1900
Parts received, start and end dates	N/A, 08/18/10 - 08/19/10
Datalog, Template version	2.75, 1.30

Setup Details

Fixture Identification	02T122
Fixture Design	KNUCKLE
Drive adapter method	N/A

Dynamometer Information

Rolling Radius	320.6 mm	
Gross Axle Weight	937 kg	
Required Wheel Load	0.0 kg	
Actual Wheel Load	0.0 kg	
Required Inertia	75.6 kg·m ²	[GVWR]
Actual Inertia	75.6 kg·m ²	[Inertia values vary by section per SAE J2784]

Brake Information

Brake Platform	2002 CAMRY FRONT
Brake Type	Disc
Brake Size	N/A
Brake ID Number	43512-06040
Drum/Rotor Type	
Drum/Rotor Finish	NEW
Pri/Lead/Inner Lining	
Sec/Trail/Outer Lining	
Orientation	LEFT
Effective Radius	111.5 mm
Number of Pistons/Cyls	1
Coefficient Multiplier	0.0159
Piston Diameter	60.0 mm

Comments:

Processed by: Kelly Klem (313) 933-4900	Title Test Engineer	Date 2010-9-1
Reviewed by: Kelly Klem (313) 933-4900	Title Test Engineer	Date 2010-9-1

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						



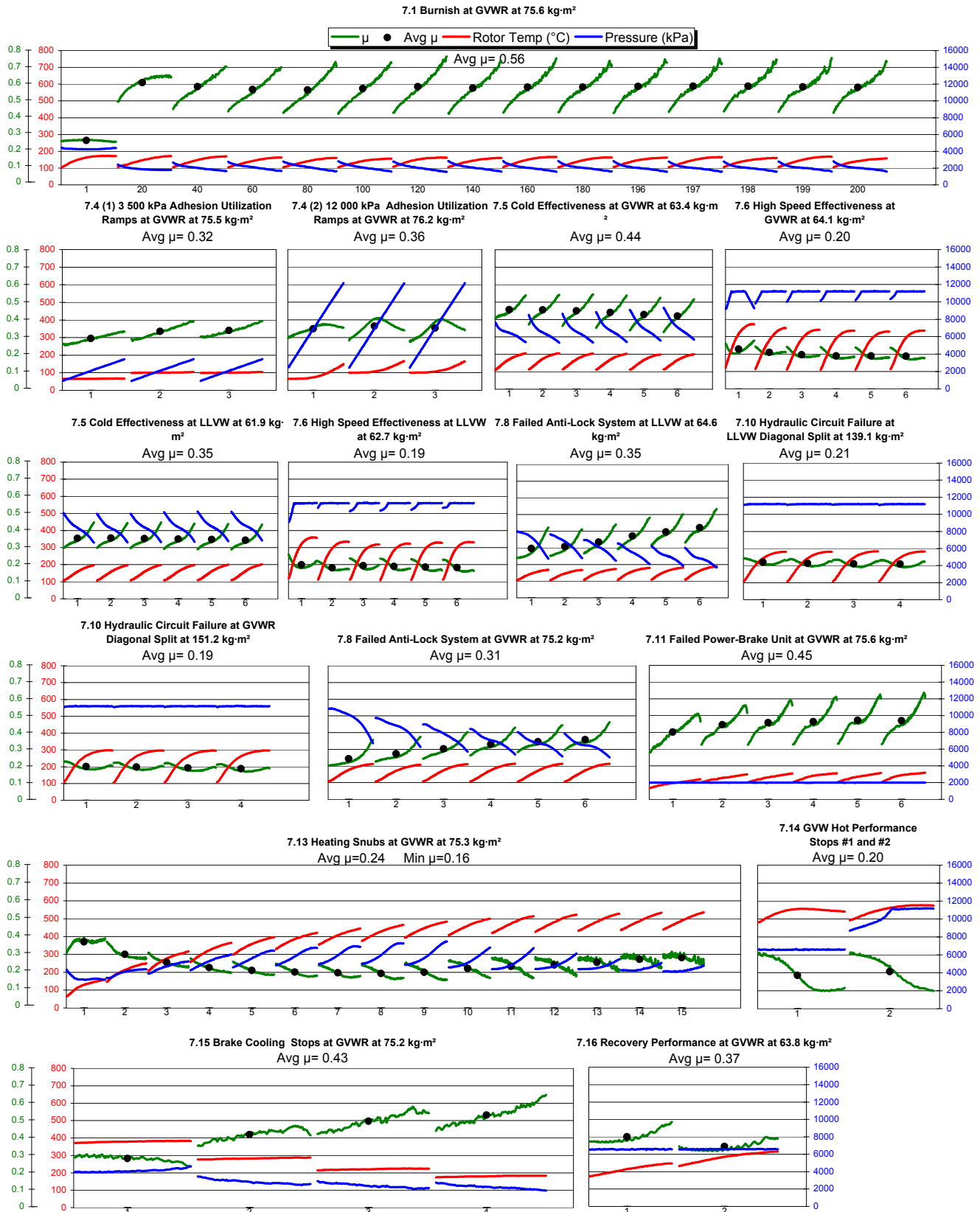
EFFECTIVENESS SUMMARY

μ (average by distance)

Section	minimum	average	maximum	% of Section 7.5 GVWR
7.5 Cold Effectiveness at GVWR	0.39	0.41	0.44	100%
7.6 High Speed Effectiveness at GVWR	0.20	0.20	0.22	49%
7.5 Cold Effectiveness at LLVW	0.32	0.33	0.34	80%
7.6 High Speed Effectiveness at LLVW	0.19	0.20	0.20	48%
7.10 Hydraulic Circuit Failure at LLVW Diagonal Split	0.21	0.22	0.22	52%
7.10 Hydraulic Circuit Failure at GVWR Diagonal Split	0.19	0.20	0.20	48%
7.11 Failed Power-Brake Unit at GVWR	0.37	0.42	0.44	100%
7.13 Heating Snubs at GVWR	0.19	0.24	0.37	59%
7.14-1 First Hot Stop at GVWR		0.23		57%
7.14-2 Second Hot Stop at GVWR		0.25		59%
7.16 Recovery Performance at GVWR	0.34	0.36	0.39	87%

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	0.94	7,607	11,238
7.6 High Speed Effectiveness at GVWR	0.80	0.78	10,677	11,238
7.5 Cold Effectiveness at LLVW	0.90	0.94	8,788	11,238
7.6 High Speed Effectiveness at LLVW	0.80	0.71	10,741	11,238
7.10 Hydraulic Circuit Failure at LLVW Diagonal Split	0.45	0.36	11,180	11,238
7.10 Hydraulic Circuit Failure at GVWR Diagonal Split	0.40	0.30	11,181	11,238
7.11 Failed Power-Brake Unit at GVWR	2,044	0.25	1,997	2,044
7.13 Heating Snubs at GVWR	0.31	0.31	3,155	11,238
7.14-1 First Hot Stop at GVWR	6,619	0.38	6,573	6,619
7.14-2 Second Hot Stop at GVWR	0.90	0.65	9,880	11,238
7.16 Recovery Performance at GVWR	6,619	0.85	6,562	11,238



Test Description 2002 CAMRY FRONT SAEJ2784 DEC 2007 FMVSS 135	Rotor 43512-06040	Effective Radius 111.5 mm
	Primary Lining	Piston Diameter 1 x 60.0 mm
	Secondary Lining	Actual Inertia 75.6 kg-m ²
		Actual Wheel Load 0.0 kg
		Rolling Radius 320.6 mm



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
7.1 Burnish at GVWR at 75.6 kg-m²																				
1	79.9	3.6	9.1	0.31	692	707	765	4214	4288	4744	0.26	0.26	0.25	2.20	91	171	39	51	59	91
5	80.0	3.6	114.3	0.31	681	710	794	2446	2591	3411	0.41	0.44	0.40	1.96	100	192	84	89	91	118
10	80.0	3.6	117.6	0.31	683	712	880	1899	2076	3512	0.49	0.56	0.52	2.13	100	189	85	91	93	129
15	80.0	3.6	115.1	0.31	688	713	899	1779	1953	3468	0.51	0.59	0.58	2.20	100	183	88	93	93	128
20	80.0	3.6	115.0	0.31	689	714	893	1751	1982	3538	0.49	0.58	0.62	2.26	99	171	87	95	94	133
25	80.0	3.6	114.8	0.31	689	716	863	1742	2006	3483	0.48	0.58	0.64	2.29	100	171	88	97	94	119
30	80.0	3.6	115.9	0.31	691	717	846	1696	2082	3621	0.46	0.56	0.66	2.32	100	172	88	99	94	129
35	80.0	3.6	115.7	0.31	692	717	810	1663	2097	3507	0.45	0.55	0.67	2.31	100	167	87	99	94	129
40	80.0	3.6	115.2	0.31	697	717	795	1625	2134	3498	0.45	0.54	0.69	2.31	100	169	88	101	94	128
45	80.0	3.6	115.7	0.31	695	718	766	1652	2190	3282	0.44	0.53	0.68	2.25	100	170	90	102	93	129
50	80.0	3.6	115.2	0.31	690	717	871	1612	2197	3920	0.44	0.53	0.69	2.42	100	167	89	102	94	131
55	80.0	3.6	116.2	0.31	685	717	764	1614	2192	3368	0.44	0.53	0.67	2.27	101	166	90	105	94	125
60	80.0	3.6	114.4	0.31	695	717	850	1626	2214	3866	0.44	0.52	0.70	2.39	101	164	90	105	93	130
65	80.0	3.6	115.3	0.31	697	717	861	1613	2204	3937	0.43	0.53	0.70	2.42	100	164	88	106	93	128
70	80.0	3.6	115.1	0.31	694	718	841	1585	2202	3892	0.43	0.53	0.71	2.40	101	166	89	107	93	124
75	80.0	3.6	116.2	0.31	696	718	832	1578	2228	3864	0.43	0.52	0.72	2.42	100	165	90	107	93	127
80	80.0	3.6	113.9	0.31	689	717	826	1580	2252	3824	0.43	0.52	0.70	2.39	101	160	89	107	94	132
85	80.0	3.6	113.8	0.31	693	718	843	1560	2241	3917	0.43	0.52	0.71	2.39	101	164	89	110	92	136
90	80.0	3.6	113.4	0.31	685	719	832	1578	2245	3942	0.42	0.52	0.68	2.41	100	165	90	111	93	124
95	80.0	3.6	113.6	0.31	685	719	806	1530	2226	3795	0.42	0.52	0.72	2.41	100	166	89	111	93	129
100	80.0	3.6	116.6	0.31	690	719	812	1562	2226	3871	0.42	0.52	0.72	2.41	101	157	89	112	94	133
105	80.0	3.6	116.4	0.31	698	718	830	1520	2192	3936	0.43	0.53	0.76	2.44	100	163	90	111	92	130
110	80.0	3.6	116.3	0.31	695	718	772	1588	2235	3413	0.42	0.52	0.72	2.35	100	159	89	112	93	130
115	80.0	3.6	116.8	0.31	692	718	802	1479	2201	3861	0.43	0.53	0.75	2.42	100	163	89	113	92	138
120	80.0	3.6	115.6	0.31	696	719	831	1509	2194	3966	0.43	0.53	0.76	2.42	101	163	89	114	92	130
125	80.0	3.6	116.7	0.31	695	719	811	1527	2192	3892	0.43	0.53	0.75	2.42	100	165	90	113	93	119
130	80.0	3.6	117.0	0.31	694	720	807	1549	2209	3880	0.42	0.53	0.74	2.42	100	160	90	114	92	135
135	80.0	3.6	116.3	0.31	690	718	791	1568	2224	3868	0.42	0.52	0.72	2.41	101	165	89	116	93	126
140	80.0	3.6	116.0	0.31	696	719	815	1538	2207	3914	0.43	0.53	0.75	2.42	100	160	90	115	94	136
145	80.0	3.6	115.7	0.31	690	719	806	1545	2175	3885	0.44	0.53	0.74	2.42	99	162	89	116	92	133
150	80.0	3.6	116.0	0.31	685	720	836	1515	2226	3990	0.42	0.52	0.76	2.45	100	166	90	115	92	126
155	80.0	3.6	116.0	0.31	689	719	867	1566	2171	4056	0.43	0.54	0.73	2.46	100	159	90	115	92	133
160	80.0	3.6	116.7	0.31	694	719	820	1504	2183	3933	0.43	0.53	0.76	2.43	99	165	89	118	92	130
165	80.0	3.6	115.0	0.31	683	719	816	1592	2185	3928	0.43	0.53	0.69	2.44	100	160	89	117	93	120
170	80.0	3.6	115.8	0.31	691	719	872	1520	2160	4082	0.43	0.54	0.76	2.48	100	161	90	117	93	125
175	80.0	3.6	116.1	0.31	692	720	829	1541	2155	3957	0.43	0.54	0.74	2.44	100	160	89	117	92	128
180	80.0	3.6	116.2	0.31	681	720	770	1564	2178	3392	0.43	0.53	0.71	2.35	100	164	89	118	92	123
185	80.0	3.6	116.5	0.31	685	720	878	1488	2145	4065	0.43	0.54	0.77	2.46	100	166	89	119	93	129
190	80.0	3.6	115.1	0.31	687	719	767	1560	2172	3313	0.43	0.54	0.73	2.33	100	161	89	118	93	135
195	80.0	3.6	115.8	0.31	677	719	771	1567	2174	3450	0.42	0.53	0.71	2.35	100	162	89	119	92	130
196	80.0	3.6	115.3	0.31	684	720	769	1540	2166	3520	0.42	0.54	0.74	2.37	100	162	89	119	93	135
197	80.0	3.6	115.1	0.31	682	719	773	1533	2154	3495	0.43	0.54	0.72	2.38	100	165	90	119	92	131
198	80.0	3.6	115.5	0.31	686	719	876	1538	2153	4035	0.43	0.54	0.75	2.49	100	160	88	119	94	136
199	80.0	3.6	114.9	0.31	675	719	844	1536	2158	3954	0.43	0.54	0.70	2.44	100	167	89	119	92	126
200	80.0	3.6	116.3	0.31	677	719	847	1580	2165	3966	0.43	0.54	0.67	2.44	100	157	89	119	93	136



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 75.5 kg-m²																				
1	50.0	37.6	329.4	0.21	239	467	737	1488	2481	3550	0.26	0.30	0.33	2.39	64	67	64	68	65	68
2	50.0	35.8	66.6	0.24	271	535	869	1492	2484	3556	0.30	0.34	0.39	2.23	100	105	82	84	86	90
3	50.0	35.8	40.2	0.24	286	539	877	1514	2482	3573	0.32	0.34	0.39	2.20	100	105	83	88	89	92
7.4 (2) 12 000 kPa Adhesion Utilization Ramps at GVWR at 76.2 kg-m²																				
1	99.9	48.5	227.1	0.84	1004	1849	2716	4905	8177	12176	0.33	0.35	0.36	4.13	65	150	63	70	67	77
2	99.9	47.0	126.7	0.87	1081	1944	2598	4950	8168	12150	0.35	0.37	0.34	3.77	100	166	89	95	93	107
3	99.9	47.6	194.0	0.87	1013	1923	2614	4995	8203	12150	0.33	0.36	0.34	3.83	101	165	93	101	97	109
7.5 Cold Effectiveness at GVWR at 63.4 kg-m²																				
1	99.9	3.5	197.0	0.92	1668	1820	2044	5252	6619	9856	0.40	0.44	0.51	3.44	100	206	92	112	95	129
2	100.1	3.5	202.7	0.93	1667	1855	1986	5184	6884	9767	0.37	0.43	0.51	3.33	101	208	92	111	95	124
3	99.9	3.5	201.8	0.94	1683	1858	1970	5186	6996	9791	0.36	0.42	0.52	3.36	100	207	91	111	95	126
4	100.1	3.5	202.0	0.94	1680	1860	1961	5261	7159	10274	0.35	0.41	0.51	3.47	100	205	91	111	95	124
5	99.9	3.5	201.4	0.94	1696	1864	1946	5359	7420	10161	0.34	0.40	0.50	3.45	100	204	91	111	94	122
6	99.9	3.5	202.4	0.94	1702	1869	1943	5484	7607	10235	0.33	0.39	0.50	3.46	100	203	93	112	95	123
7.6 High Speed Effectiveness at GVWR at 64.1 kg-m²																				
1	160.0	3.6	196.8	0.78	1405	1483	1646	9065	10677	11262	0.26	0.22	0.28	3.75	101	369	102	166	102	198
2	160.0	3.6	341.9	0.74	1377	1453	1593	9804	10910	11282	0.24	0.21	0.22	4.05	101	351	106	174	98	196
3	160.0	3.6	358.4	0.69	1274	1385	1579	9980	10986	11279	0.24	0.20	0.20	3.99	100	339	106	174	99	200
4	160.0	3.6	361.4	0.67	1225	1359	1623	10111	11001	11272	0.24	0.20	0.18	4.00	99	332	107	172	101	203
5	160.0	3.6	359.1	0.67	1209	1362	1591	10154	11013	11259	0.24	0.20	0.18	4.02	100	329	106	171	102	204
6	160.0	3.6	358.4	0.66	1178	1357	1621	10298	11013	11296	0.24	0.20	0.17	4.01	101	332	107	171	103	202
7.5 Cold Effectiveness at LLVW at 61.9 kg-m²																				
1	100.1	3.5	205.5	0.94	1666	1812	1871	6248	8625	10742	0.30	0.33	0.43	3.81	99	200	91	111	95	133
2	99.9	3.5	204.2	0.94	1666	1810	1890	6271	8559	10670	0.30	0.34	0.42	3.73	100	199	92	111	95	133
3	100.1	3.5	200.6	0.94	1665	1808	1870	6266	8635	10716	0.30	0.33	0.42	3.75	100	201	92	112	94	133
4	100.1	3.5	202.0	0.94	1676	1812	1874	6295	8725	10675	0.29	0.33	0.43	3.75	100	202	90	111	95	134
5	99.9	3.5	199.0	0.94	1698	1812	1875	6347	8788	10811	0.29	0.33	0.43	3.77	100	203	92	112	94	133
6	100.1	3.5	201.0	0.94	1689	1809	1871	6403	8859	10738	0.29	0.32	0.42	3.76	99	205	91	111	95	134



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
7.6 High Speed Effectiveness at LLVW at 62.7 kg-m²																				
1	160.0	3.6	194.1	0.71	1245	1350	1605	8915	10741	11265	0.26	0.20	0.23	3.87	100	356	100	159	104	211
2	160.0	3.6	343.7	0.66	1149	1314	1584	10625	11142	11289	0.22	0.19	0.16	4.15	100	332	102	183	104	214
3	160.0	3.6	353.9	0.70	1195	1374	1564	10224	10930	11272	0.24	0.20	0.19	4.05	100	316	104	172	106	205
4	160.0	3.6	351.7	0.68	1165	1369	1568	10282	10920	11253	0.23	0.20	0.17	4.12	101	321	104	178	106	206
5	159.9	3.6	353.1	0.67	1105	1350	1560	10379	10990	11272	0.23	0.20	0.16	4.09	101	326	104	181	105	208
6	160.0	3.6	351.5	0.66	1046	1346	1541	10613	11032	11241	0.23	0.19	0.15	4.16	100	329	104	181	106	208
7.8 Failed Anti-Lock System at LLVW at 64.6 kg-m²																				
1	99.9	3.6	356.5	0.62	1138	1219	1286	4558	7279	8522	0.24	0.27	0.40	3.60	100	169	97	143	99	137
2	99.9	3.6	207.6	0.61	1148	1217	1272	4655	6870	8182	0.25	0.28	0.39	3.33	101	168	94	140	98	142
3	99.9	3.6	203.8	0.61	1134	1213	1261	4354	6274	7185	0.27	0.31	0.42	3.12	100	174	94	136	97	149
4	99.9	3.6	202.3	0.61	1141	1217	1257	3950	5694	7025	0.29	0.34	0.46	3.09	100	180	94	134	97	152
5	99.9	3.6	204.4	0.61	1140	1216	1262	3797	5285	7000	0.32	0.37	0.48	3.03	100	183	94	135	96	156
6	99.9	3.6	203.9	0.61	1148	1219	1272	3561	4984	6990	0.33	0.39	0.52	3.03	100	188	94	135	97	155
7.10 Hydraulic Circuit Failure at LLVW Diagonal Split at 139.1 kg-m²																				
1	99.9	3.6	370.7	0.36	1422	1565	1705	11085	11180	11253	0.24	0.22	0.21	4.17	100	280	102	177	102	200
2	99.9	3.6	330.9	0.35	1357	1520	1679	11068	11178	11267	0.23	0.22	0.21	4.12	100	281	100	173	100	203
3	99.9	3.6	327.4	0.34	1330	1502	1658	11093	11181	11231	0.23	0.21	0.21	4.20	101	282	98	174	102	202
4	100.1	3.6	331.7	0.34	1320	1481	1631	11063	11178	11250	0.23	0.21	0.21	4.21	100	282	99	173	101	203
7.10 Hydraulic Circuit Failure at GVWR Diagonal Split at 151.2 kg-m²																				
1	99.9	3.6	363.7	0.30	1267	1436	1634	11061	11181	11272	0.23	0.20	0.19	4.18	99	296	99	180	103	212
2	99.9	3.6	347.4	0.30	1251	1415	1596	11060	11181	11261	0.22	0.20	0.19	4.22	100	294	99	180	101	212
3	99.9	3.6	346.7	0.29	1209	1376	1564	11061	11182	11246	0.22	0.20	0.18	4.23	100	293	99	183	101	214
4	99.9	3.6	346.8	0.28	1183	1348	1532	11078	11183	11270	0.21	0.19	0.18	4.26	101	293	99	184	102	211
7.8 Failed Anti-Lock System at GVWR at 75.2 kg-m²																				
1	99.9	3.6	1129.9	0.62	1357	1421	1552	6379	10154	10924	0.20	0.22	0.34	4.27	101	212	99	141	105	148
2	99.9	3.6	258.3	0.62	1347	1420	1508	6034	8945	10137	0.23	0.25	0.36	3.86	100	208	101	144	101	152
3	99.9	3.6	250.8	0.62	1353	1422	1484	5551	8099	9029	0.24	0.28	0.39	3.67	101	212	99	137	100	152
4	99.9	3.6	244.3	0.62	1342	1423	1471	5217	7388	8760	0.26	0.31	0.41	3.52	101	215	99	135	101	154
5	99.9	3.6	243.1	0.62	1338	1422	1471	5007	6993	8610	0.28	0.32	0.43	3.51	100	212	99	137	100	154
6	99.9	3.6	239.9	0.61	1340	1422	1473	4863	6733	8437	0.29	0.34	0.44	3.45	99	214	98	137	101	155
7.11 Failed Power-Brake Unit at GVWR at 75.6 kg-m²																				
1	100.1	1.2	49.1	0.21	330	453	637	1959	2000	2055	0.27	0.37	0.42	1.66	65	120	60	147	61	149
2	99.9	1.2	166.4	0.24	400	508	695	1943	2000	2055	0.32	0.41	0.43	1.66	100	151	92	176	94	182
3	100.1	1.2	231.7	0.24	403	523	730	1953	1999	2103	0.33	0.43	0.46	1.69	100	154	94	179	99	188
4	99.9	1.2	235.5	0.25	397	526	758	1939	2002	2082	0.33	0.43	0.49	1.74	100	157	95	182	99	180
5	99.9	1.2	235.4	0.25	403	537	772	1955	1997	2098	0.34	0.44	0.50	1.73	100	159	96	182	99	190
6	100.1	1.2	235.4	0.25	401	530	789	1943	2001	2069	0.33	0.43	0.51	1.76	100	160	96	183	99	176



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 75.3 kg-m²																				
1	120.0	60.5	584.9	0.31	680	720	796	2954	3155	5049	0.31	0.37	0.38	2.67	55	162	56	105	56	157
2	120.0	60.5	45.0	0.30	664	694	829	3101	3704	4473	0.37	0.30	0.28	2.38	136	253	116	167	117	182
3	119.9	60.5	44.9	0.30	664	689	801	3589	4325	4935	0.31	0.26	0.23	2.44	200	318	163	200	168	223
4	120.0	60.5	45.0	0.30	667	686	768	3954	4861	5691	0.28	0.23	0.20	2.61	248	368	196	230	207	254
5	120.0	60.5	45.0	0.30	664	685	725	4252	5200	6060	0.26	0.21	0.19	2.74	288	399	221	250	236	277
6	120.0	60.5	44.9	0.30	661	684	763	4484	5429	6354	0.25	0.20	0.18	2.89	322	423	239	267	257	294
7	120.0	60.5	45.0	0.30	650	685	762	4591	5559	6514	0.24	0.20	0.18	2.97	348	447	250	278	275	306
8	120.0	60.5	45.0	0.30	644	681	798	4635	5655	6843	0.24	0.19	0.17	3.12	368	468	261	288	291	318
9	120.0	60.5	45.0	0.29	641	678	766	4501	5462	7064	0.25	0.20	0.16	3.21	384	485	276	300	304	330
10	120.0	60.5	44.9	0.29	647	682	762	4227	4964	6508	0.26	0.22	0.16	3.09	400	503	289	306	316	339
11	120.0	60.5	44.9	0.29	628	681	793	4060	4743	6472	0.28	0.23	0.16	3.11	412	516	298	318	325	350
12	120.0	60.5	44.9	0.30	627	687	818	4068	4575	5888	0.28	0.24	0.17	2.98	420	523	303	327	334	360
13	120.0	60.5	45.0	0.30	624	694	768	4014	4344	5280	0.27	0.26	0.21	2.80	427	529	309	334	341	367
14	120.0	60.5	44.9	0.30	634	697	775	3892	4129	4865	0.27	0.27	0.24	2.70	428	536	317	339	348	372
15	120.0	60.5	45.0	0.30	640	699	776	3777	3973	4557	0.31	0.28	0.27	2.62	433	540	322	345	354	378
7.14-1 First Hot Stop at GVWR at 64.3 kg-m²																				
1	99.9	3.5	26.7	0.38	395	958	1440	6505	6573	6661	0.30	0.23	0.12	3.27	467	541	338	351	378	401
7.14-2 Second Hot Stop at GVWR at 63.7 kg-m²																				
1	99.9	3.5	27.8	0.65	659	1517	1920	8689	9880	11270	0.31	0.25	0.09	4.51	484	573	343	356	408	439
7.15 Brake Cooling Stops at GVWR at 75.2 kg-m²																				
1	50.0	3.5	116.2	0.30	632	699	798	3760	3913	4678	0.30	0.29	0.22	2.75	371	383	299	306	333	344
2	49.9	3.5	116.4	0.31	617	722	752	2425	2880	3660	0.35	0.40	0.36	2.36	275	287	242	253	263	271
3	50.0	3.5	116.2	0.31	682	720	775	1983	2446	3663	0.42	0.47	0.55	2.32	212	224	194	211	208	220
4	50.0	3.5	115.8	0.31	681	722	796	1761	2305	3500	0.44	0.51	0.65	2.35	172	183	160	179	170	183
7.16 Recovery Performance at GVWR at 63.8 kg-m²																				
1	100.1	3.5	64.1	0.85	1505	1591	2012	6449	6562	6650	0.37	0.39	0.45	3.19	165	250	153	178	161	201
2	99.9	3.5	24.5	0.72	1306	1378	1646	6491	6573	6645	0.34	0.34	0.33	3.05	224	317	181	205	198	246

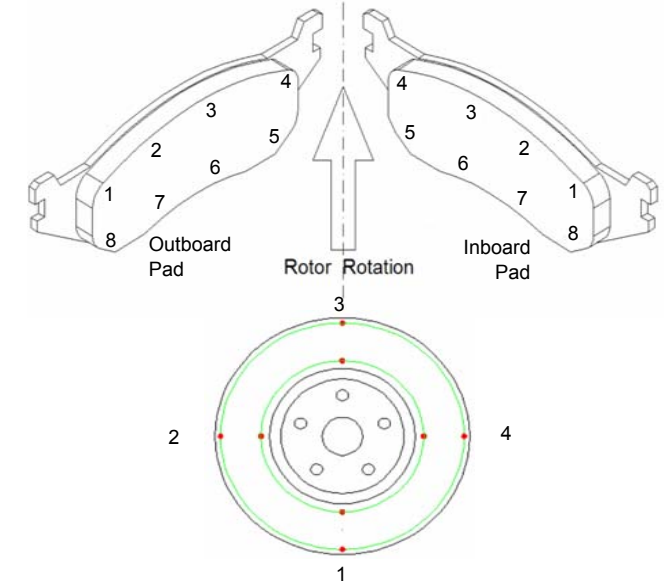
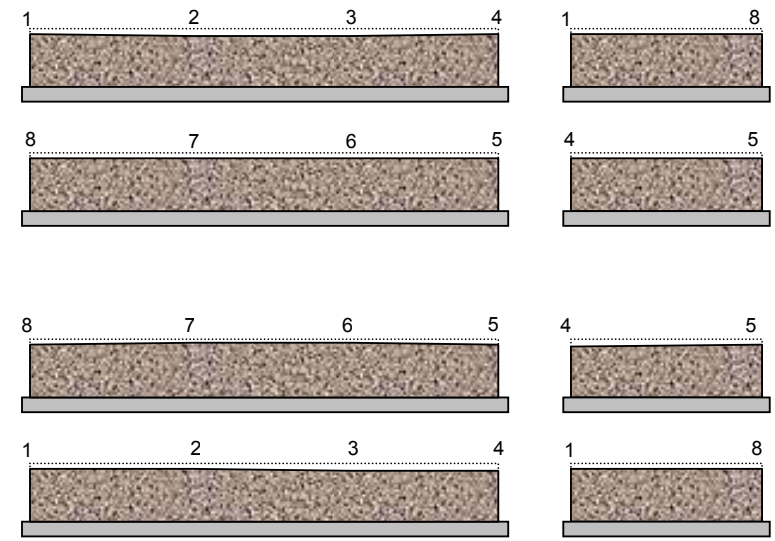
Inboard Pad Thickness (mm)										
	1	2	3	4	5	6	7	8	Average	Mass (gram)
Initial	16.98	17.04	17.01	16.95	17.01	17.05	17.04	16.96	17.01	356.3
Final	15.68	15.67	15.63	15.65	15.84	15.85	15.86	15.87	15.76	344.4
Loss	1.30	1.37	1.38	1.30	1.17	1.20	1.18	1.09	1.25	11.9
Tangential Wear		Radial Wear			Cup Wear			Structural Integrity		
-3.2%		13.3%			-5.3%					

Outboard Pad Thickness (mm)										
	1	2	3	4	5	6	7	8	Average	Mass (gram)
Initial	16.90	16.99	17.01	16.95	16.99	17.02	17.03	16.97	16.98	355.7
Final	15.62	15.70	15.69	15.62	16.01	16.09	16.12	16.02	15.86	345.1
Loss	1.28	1.29	1.32	1.33	0.98	0.93	0.91	0.95	1.12	10.6
Tangential Wear		Radial Wear			Cup Wear			Structural Integrity		
-3.5%		27.8%			2.0%					

Rotor Thickness (mm)										
	Inner				Outer				Average	Mass (gram)
	1	2	3	4	1	2	3	4		
Initial	28.04	28.03	28.03	28.04	28.04	28.03	28.03	28.04	28.04	6,507.3
Final	27.99	28.00	27.99	28.00	28.00	28.00	28.00	27.99	28.00	6,496.1
Loss	0.05	0.03	0.04	0.04	0.04	0.03	0.03	0.05	0.04	11.2

Rotor Surface Finish, Ra (µm)								
	1	2	3	4	5	6	7	8
Initial	0.41	0.44	0.42	0.57	0.63	0.68	0.76	0.61
Final	1.44	1.25	1.34	1.09	2.14	1.63	1.60	1.68

*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 2002 CAMRY FRONT	Rotor Primary Lining Secondary Lining	43512-06040	Effective Radius	111.5 mm
			Piston Diameter	1 x 60.0 mm
			Actual Inertia	75.6 kg·m ²
			Actual Wheel Load	0.0 kg
			Rolling Radius	320.6 mm