



Brake Dynamometer Test Report

Link Test Report #: 103077-4
Test Description: SAEJ2784 DEC 2007 FMVSS 135 2007 TOYOTA
COROLLA FRONT - D923

Customer Reference: D923
Program #: SAEV09057C0
Platform: 2007 TOYOTA COROLLA FRONT - D923
Lining Material: D923
Test Date: 08/23/10

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

2007 TOYOTA COROLLA FRONT - D923 SAE\J2784 DEC 2007 FMVSS 135

Test Information

Customer Name	HARDEX BRAKES LTD.
Requestor	
Test Procedure	SAE\J2784 DEC 2007 FMVSS 135
Program Number	SAEV09057C0
Test Coordinator	KLEM, KELLY
Technician	JAK
Dynamometer	269 - Model 1900
Parts received, start and end dates	N/A, 08/23/10 - 08/24/10
Datalog, Template version	2.75, 1.30

Setup Details

Fixture Identification	083767-1
Fixture Design	L1 - KNUCKLE
Drive adapter method	N/A

Dynamometer Information

Rolling Radius	363.3 mm	
Gross Axle Weight	1322 kg	
Required Wheel Load	0.0 kg	
Actual Wheel Load	0.0 kg	
Required Inertia	122.7 kg-m ²	[GVWR]
Actual Inertia	122.7 kg-m ²	[Inertia values vary by section per SAE J2784]

Brake Information

Brake Platform	2007 TOYOTA COROLLA FRONT - D923
Brake Type	Disc
Brake Size	N/A
Brake ID Number	N/A
Drum/Rotor Type	N/A
Drum/Rotor Finish	NEW
Pri/Lead/Inner Lining	D923
Sec/Trail/Outer Lining	D923
Orientation	LEFT
Effective Radius	133.7 mm
Number of Pistons/Cyls	1
Coefficient Multiplier	0.0231
Piston Diameter	45.4 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						



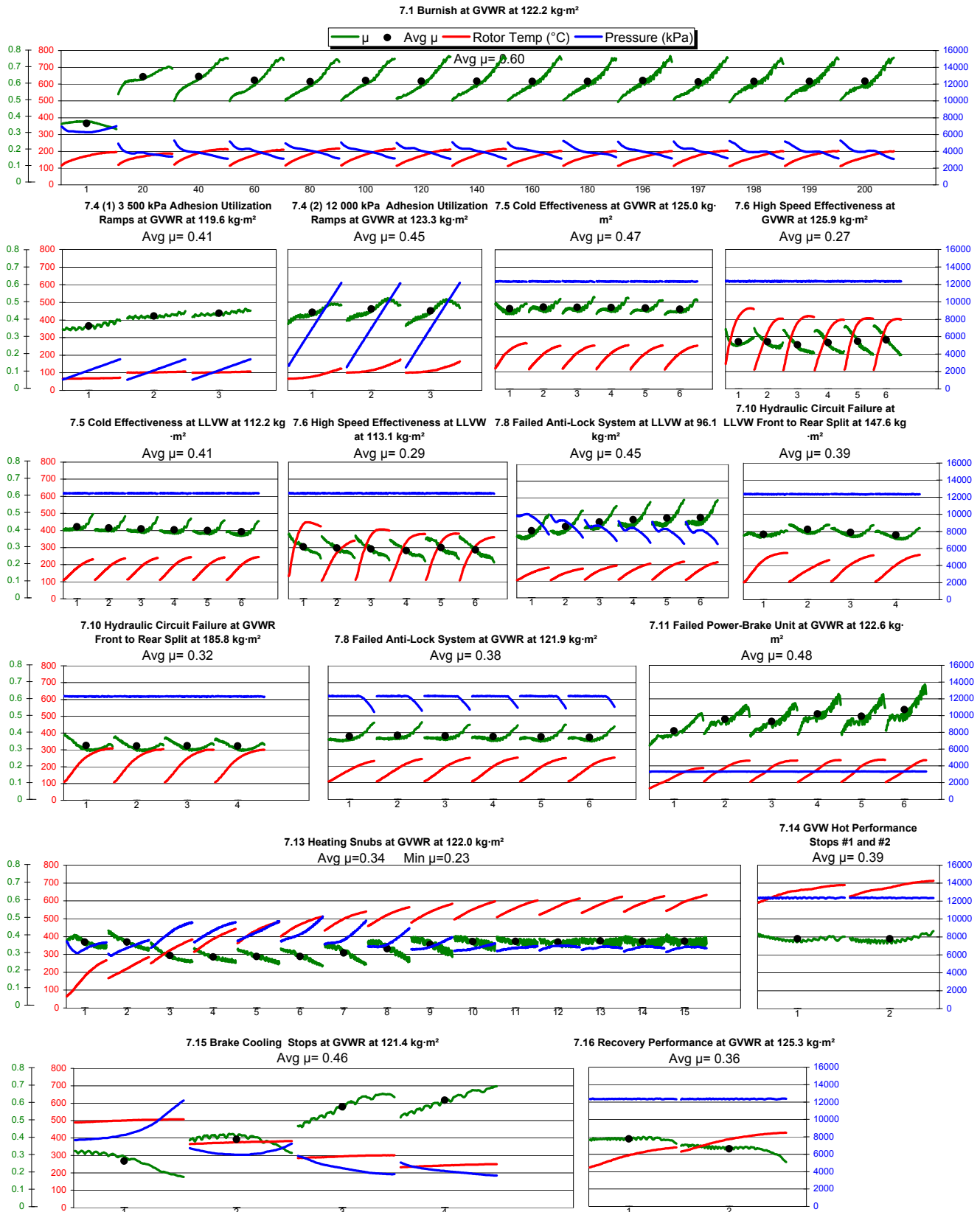
EFFECTIVENESS SUMMARY

μ (average by distance)

Section	minimum	average	maximum	% of Section 7.5 GVWR
7.5 Cold Effectiveness at GVWR	0.45	0.46	0.47	100%
7.6 High Speed Effectiveness at GVWR	0.27	0.29	0.31	63%
7.5 Cold Effectiveness at LLVW	0.39	0.40	0.41	87%
7.6 High Speed Effectiveness at LLVW	0.30	0.31	0.32	68%
7.10 Hydraulic Circuit Failure at LLVW Diagonal Split	0.38	0.39	0.41	85%
7.10 Hydraulic Circuit Failure at GVWR Diagonal Split	0.33	0.33	0.33	72%
7.11 Failed Power-Brake Unit at GVWR	0.38	0.46	0.50	100%
7.13 Heating Snubs at GVWR	0.29	0.34	0.38	75%
7.14-1 First Hot Stop at GVWR		0.39		85%
7.14-2 Second Hot Stop at GVWR		0.38		83%
7.16 Recovery Performance at GVWR	0.34	0.36	0.39	79%

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	0.74	12,360	12,398
7.6 High Speed Effectiveness at GVWR	0.80	0.44	12,352	12,398
7.5 Cold Effectiveness at LLVW	0.90	0.74	12,352	12,398
7.6 High Speed Effectiveness at LLVW	0.80	0.53	12,352	12,398
7.10 Hydraulic Circuit Failure at LLVW Diagonal Split	0.70	0.55	12,357	12,398
7.10 Hydraulic Circuit Failure at GVWR Diagonal Split	0.60	0.35	12,353	12,398
7.11 Failed Power-Brake Unit at GVWR	3,148	0.23	3,324	3,148
7.13 Heating Snubs at GVWR	0.31	0.31	6,316	12,398
7.14-1 First Hot Stop at GVWR	12,357	0.61	12,353	12,357
7.14-2 Second Hot Stop at GVWR	0.90	0.61	12,357	12,398
7.16 Recovery Performance at GVWR	12,357	0.60	12,351	12,398



Test Description	Rotor	Effective Radius	133.7 mm
2007 TOYOTA COROLLA FRONT - D923	Primary Lining	Piston Diameter	1 x 45.4 mm
SAEJ2784 DEC 2007 FMVSS 135	Secondary Lining	D923 Actual Inertia	122.7 kg-m ²
		D923 Actual Wheel Load	0.0 kg
		Rolling Radius	363.3 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 122.2 kg-m²																				
1	80.0	4.1	8.5	0.31	987	1023	1097	6245	6447	7482	0.36	0.37	0.33	1.97	99	194	39	52	59	97
5	80.0	4.1	147.3	0.31	956	1023	1145	3546	3827	5751	0.56	0.62	0.52	1.87	101	207	86	91	88	118
10	80.0	4.1	151.5	0.31	989	1021	1191	3341	3595	5716	0.60	0.66	0.64	1.87	100	196	88	95	87	118
15	80.0	4.1	152.9	0.31	991	1029	1150	3436	3771	5817	0.55	0.64	0.66	1.89	100	180	87	97	88	117
20	80.0	4.1	150.3	0.31	976	1031	1152	3354	3870	5879	0.54	0.62	0.68	1.91	100	187	87	99	88	123
25	80.0	4.1	153.7	0.31	974	1034	1160	3199	3978	6058	0.52	0.61	0.71	1.90	101	208	87	103	91	129
30	80.0	4.1	154.1	0.31	983	1033	1158	3229	3998	6150	0.52	0.60	0.71	1.92	101	201	87	102	92	128
35	80.0	4.1	153.7	0.31	979	1037	1153	3133	4000	6153	0.51	0.60	0.73	1.93	100	206	88	104	91	131
40	80.0	4.1	155.1	0.31	978	1039	1151	3101	4015	6186	0.50	0.60	0.74	1.95	100	209	87	103	90	131
45	80.0	4.1	156.0	0.31	968	1039	1114	3122	4083	6041	0.49	0.59	0.73	1.93	101	206	88	104	91	133
50	80.0	4.1	159.1	0.31	980	1041	1138	3115	4125	6083	0.49	0.59	0.73	1.95	101	208	88	102	91	131
55	80.0	4.1	160.0	0.31	976	1040	1148	3125	4103	6251	0.49	0.59	0.73	1.97	100	212	87	103	91	135
60	80.0	4.1	167.7	0.31	959	1038	1133	3099	4181	6034	0.50	0.58	0.72	1.93	100	206	87	102	91	131
65	80.0	4.1	164.6	0.31	954	1037	1119	3117	4229	5893	0.50	0.57	0.71	1.92	100	210	87	102	90	133
70	80.0	4.1	165.2	0.31	960	1034	1112	3163	4197	5750	0.50	0.57	0.71	1.90	100	210	87	103	91	136
75	80.0	4.1	166.0	0.31	970	1035	1141	3065	4197	5804	0.50	0.58	0.74	1.92	100	211	88	103	91	132
80	80.0	4.1	165.8	0.31	961	1033	1125	3130	4203	5816	0.50	0.57	0.72	1.94	100	212	88	104	91	134
85	80.0	4.1	166.8	0.31	969	1030	1168	3128	4140	6018	0.50	0.58	0.72	1.95	100	216	89	104	91	134
90	80.0	4.1	166.8	0.31	960	1034	1106	3157	4173	5811	0.50	0.58	0.71	1.92	100	212	89	106	91	135
95	80.0	4.1	168.0	0.31	972	1033	1150	3093	4132	5991	0.51	0.58	0.73	1.95	100	208	89	104	91	133
100	80.0	4.1	167.6	0.31	980	1032	1168	3122	4154	6165	0.50	0.58	0.73	1.97	100	214	90	106	91	135
105	80.0	4.1	167.9	0.31	966	1031	1150	3160	4172	5957	0.51	0.58	0.71	1.96	100	214	89	106	91	137
110	80.0	4.1	167.0	0.31	947	1031	1152	3147	4178	5958	0.51	0.58	0.70	1.95	101	209	90	105	91	136
115	80.0	4.1	167.2	0.31	966	1034	1132	3123	4205	6016	0.50	0.57	0.72	1.97	100	213	90	107	91	134
120	80.0	4.1	166.1	0.31	989	1033	1119	3063	4205	5903	0.51	0.57	0.76	1.96	100	211	90	105	91	133
125	80.0	4.1	166.5	0.31	963	1034	1132	3166	4178	5957	0.51	0.58	0.71	1.95	100	210	89	106	90	134
130	80.0	4.1	166.7	0.31	987	1033	1126	3085	4197	5952	0.51	0.57	0.75	1.97	98	210	90	107	92	133
135	80.0	4.1	166.1	0.31	955	1034	1137	3063	4190	5869	0.50	0.58	0.74	1.96	100	209	89	107	91	133
140	80.0	4.1	167.2	0.31	983	1034	1125	3072	4192	5917	0.50	0.58	0.75	1.97	100	211	90	108	91	137
145	80.0	4.1	165.3	0.31	949	1035	1124	3071	4150	5749	0.50	0.58	0.72	1.94	100	206	90	107	90	134
150	80.0	4.1	164.8	0.31	980	1034	1128	3161	4149	5801	0.50	0.58	0.73	1.96	100	205	90	107	89	135
155	80.0	4.1	165.8	0.31	981	1036	1117	3091	4175	5891	0.49	0.58	0.74	1.97	100	202	89	107	89	133
160	80.0	4.1	163.0	0.31	963	1032	1171	3083	4183	6196	0.50	0.58	0.73	2.04	101	201	90	105	90	130
165	80.0	4.1	160.3	0.31	976	1033	1161	3085	4150	5975	0.50	0.58	0.75	2.00	100	210	89	109	91	141
170	80.0	4.1	159.6	0.32	949	1050	1148	3196	4267	5472	0.50	0.57	0.75	1.93	100	205	89	107	91	137
175	80.0	4.1	161.6	0.31	975	1034	1132	3096	4217	5753	0.49	0.57	0.74	1.97	100	204	89	108	90	135
180	80.0	4.1	159.5	0.32	963	1045	1145	3170	4230	6061	0.50	0.58	0.76	2.02	100	203	89	106	92	133
185	80.0	4.1	159.3	0.31	977	1048	1150	3079	4251	5970	0.49	0.58	0.74	2.01	100	198	89	110	92	135
190	80.0	4.1	158.8	0.32	972	1053	1121	3184	4291	5885	0.50	0.57	0.73	2.00	100	199	88	106	92	129
195	80.0	4.1	159.5	0.31	981	1033	1142	3057	4192	5644	0.51	0.58	0.77	1.95	101	209	90	111	91	137
196	80.0	4.1	160.4	0.31	954	1035	1152	3110	4157	6079	0.50	0.58	0.72	2.07	99	200	89	106	91	132
197	80.0	4.1	159.9	0.31	963	1034	1132	3115	4217	5614	0.51	0.57	0.72	1.97	100	203	88	109	91	139
198	80.0	4.1	159.0	0.31	944	1048	1140	3063	4237	5397	0.49	0.58	0.72	1.93	101	199	90	107	91	132
199	80.0	4.1	159.1	0.31	948	1047	1145	3082	4242	6061	0.50	0.58	0.75	2.03	100	203	88	108	91	138
200	80.0	4.1	158.3	0.31	950	1043	1160	3039	4205	5941	0.50	0.58	0.74	2.02	101	203	89	108	91	133



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 119.6 kg-m²																				
1	50.0	42.7	462.3	0.12	242	403	604	1611	2558	3538	0.36	0.37	0.40	1.62	65	72	62	63	61	64
2	50.0	41.6	49.0	0.14	279	460	674	1612	2554	3544	0.41	0.42	0.45	1.61	100	107	82	82	82	86
3	50.0	41.4	42.7	0.15	287	480	687	1613	2557	3552	0.43	0.44	0.46	1.58	100	108	84	85	86	89
7.4 (2) 12 000 kPa Adhesion Utilization Ramps at GVWR at 123.3 kg-m²																				
1	100.0	69.3	279.3	0.52	913	1675	2555	5152	8470	12142	0.42	0.45	0.49	2.87	65	124	61	64	62	71
2	100.0	67.9	128.7	0.54	932	1752	2554	5138	8448	12153	0.42	0.47	0.48	2.89	101	175	86	88	85	93
3	100.0	68.1	227.5	0.54	887	1733	2515	5075	8455	12193	0.41	0.46	0.47	2.89	100	164	93	96	88	96
7.5 Cold Effectiveness at GVWR at 125.0 kg-m²																				
1	100.0	3.4	241.9	0.72	2271	2453	2655	12296	12357	12422	0.50	0.46	0.44	3.02	98	267	88	107	88	133
2	100.0	3.6	368.8	0.74	2345	2482	2760	12295	12360	12436	0.44	0.47	0.46	3.02	99	252	90	108	88	130
3	100.0	3.4	376.1	0.74	2310	2460	2816	12281	12358	12434	0.43	0.46	0.46	3.01	99	254	88	108	89	131
4	100.0	3.4	379.8	0.74	2305	2451	2802	12290	12359	12438	0.43	0.46	0.46	3.01	99	256	87	107	90	133
5	100.0	3.6	363.3	0.73	2302	2434	2724	12285	12358	12430	0.43	0.46	0.46	3.03	98	252	87	107	89	131
6	100.0	3.6	364.6	0.72	2277	2399	2750	12292	12359	12429	0.43	0.45	0.46	3.03	98	251	87	107	89	133
7.6 High Speed Effectiveness at GVWR at 125.9 kg-m²																				
1	160.0	4.1	425.8	0.42	1303	1446	1989	12270	12351	12425	0.35	0.27	0.29	2.99	100	457	93	201	95	260
2	160.0	4.1	577.9	0.42	1220	1517	1911	12267	12350	12450	0.35	0.29	0.28	3.17	101	403	96	217	91	227
3	160.0	4.1	641.5	0.39	1062	1466	1822	12269	12350	12446	0.34	0.28	0.22	3.19	101	412	94	209	91	242
4	160.0	4.1	645.6	0.41	1070	1549	1808	12288	12352	12436	0.33	0.29	0.22	3.21	100	396	93	195	90	224
5	160.0	4.1	633.6	0.42	1003	1614	1936	12275	12352	12421	0.35	0.30	0.19	3.26	100	401	98	186	91	235
6	160.0	4.1	634.7	0.44	1021	1662	1955	12284	12352	12422	0.36	0.31	0.20	3.34	101	398	99	176	91	229
7.5 Cold Effectiveness at LLVW at 112.2 kg-m²																				
1	100.0	3.4	386.0	0.74	2112	2199	2656	12275	12352	12415	0.40	0.41	0.46	3.50	99	233	85	111	88	133
2	100.0	3.4	363.7	0.73	2089	2167	2602	12299	12354	12450	0.40	0.41	0.44	3.39	100	238	85	114	89	137
3	100.0	3.4	362.1	0.72	2048	2141	2560	12279	12357	12410	0.40	0.40	0.44	3.39	100	240	86	115	89	139
4	100.0	3.4	369.2	0.71	2021	2111	2509	12273	12356	12412	0.40	0.40	0.43	3.42	99	245	85	116	88	141
5	100.0	3.4	355.1	0.70	2002	2090	2464	12285	12356	12415	0.40	0.39	0.43	3.44	99	244	85	116	87	138
6	100.0	3.4	354.0	0.69	1949	2058	2437	12292	12356	12410	0.39	0.39	0.43	3.41	99	246	85	117	88	142



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 113.1 kg-m²																				
1	160.0	4.1	456.7	0.53	1221	1718	2051	12265	12352	12434	0.38	0.32	0.23	3.35	101	421	103	198	93	256
2	160.0	4.1	643.7	0.51	1213	1676	1974	12272	12352	12415	0.36	0.32	0.23	3.56	100	341	102	177	90	205
3	160.0	4.1	645.8	0.50	1128	1657	1998	12251	12353	12435	0.37	0.31	0.21	3.51	100	398	103	196	91	243
4	160.0	4.1	623.5	0.49	1102	1593	1929	12258	12352	12426	0.35	0.30	0.21	3.54	100	379	106	184	93	235
5	160.0	4.1	639.1	0.52	1111	1704	1932	12263	12352	12417	0.35	0.32	0.21	3.59	100	381	104	190	91	236
6	160.0	4.1	625.8	0.49	1049	1646	1977	12270	12352	12423	0.37	0.31	0.20	3.57	100	360	106	181	93	232
7.8 Failed Anti-Lock System at LLVW at 96.1 kg-m²																				
1	100.0	4.1	553.5	0.61	1497	1586	1717	7341	9646	10231	0.37	0.38	0.49	3.27	100	183	96	133	89	127
2	100.0	4.1	303.4	0.61	1484	1595	1754	6968	9064	10869	0.40	0.41	0.51	3.30	100	175	91	126	91	126
3	100.0	4.1	296.5	0.61	1490	1594	1728	6624	8494	10450	0.42	0.44	0.54	3.23	100	195	90	126	91	136
4	100.0	4.1	302.7	0.61	1468	1594	1777	6366	8219	10266	0.43	0.45	0.56	3.17	101	207	90	128	91	143
5	100.0	4.1	300.2	0.61	1468	1595	1784	6206	8089	10176	0.44	0.46	0.58	3.15	100	218	91	129	91	150
6	100.0	4.1	303.1	0.61	1475	1596	1788	6206	8012	10063	0.44	0.46	0.58	3.12	100	215	90	130	92	149
7.10 Hydraulic Circuit Failure at LLVW Front to Rear Split at 147.6 kg-m²																				
1	99.8	4.1	13.5	0.51	1931	2030	2164	12286	12357	12431	0.38	0.38	0.37	3.49	91	274	65	126	76	164
2	100.0	4.1	307.1	0.55	2041	2197	2377	12290	12357	12445	0.44	0.41	0.40	3.60	100	233	85	136	89	143
3	100.0	4.1	358.4	0.53	1943	2097	2324	12289	12357	12439	0.42	0.39	0.40	3.60	100	262	87	144	91	168
4	100.0	4.1	362.6	0.51	1863	2019	2241	12292	12357	12415	0.40	0.38	0.39	3.59	100	264	91	148	92	168
7.10 Hydraulic Circuit Failure at GVWR Front to Rear Split at 185.8 kg-m²																				
1	100.0	4.1	370.3	0.35	1554	1778	2093	12249	12353	12478	0.38	0.33	0.30	3.56	100	308	92	172	92	202
2	100.0	4.1	436.8	0.34	1549	1752	2039	12279	12353	12419	0.37	0.33	0.30	3.55	101	303	97	175	93	202
3	100.0	4.1	435.5	0.34	1567	1758	2009	12258	12353	12419	0.37	0.33	0.31	3.59	100	301	96	179	94	202
4	100.0	4.1	444.1	0.34	1555	1744	1974	12257	12354	12431	0.36	0.33	0.31	3.55	100	300	98	179	93	202
7.8 Failed Anti-Lock System at GVWR at 121.9 kg-m²																				
1	100.0	4.1	496.7	0.59	1836	1930	2134	10055	12272	12424	0.36	0.36	0.44	3.53	100	232	93	144	94	155
2	100.0	4.1	358.1	0.60	1897	1969	2129	10126	12273	12434	0.36	0.37	0.43	3.52	100	244	94	142	94	159
3	100.0	4.1	353.1	0.60	1873	1970	2124	10357	12290	12427	0.37	0.37	0.42	3.50	100	250	91	142	94	163
4	100.0	4.1	335.5	0.60	1846	1962	2111	10603	12308	12410	0.37	0.37	0.42	3.53	99	251	91	141	93	163
5	100.0	4.1	355.9	0.60	1830	1948	2151	10411	12313	12417	0.36	0.37	0.43	3.46	100	250	92	143	93	164
6	100.0	4.1	350.9	0.59	1832	1944	2137	10674	12325	12423	0.36	0.37	0.42	3.45	100	251	93	142	93	164
7.11 Failed Power-Brake Unit at GVWR at 122.6 kg-m²																				
1	99.8	1.4	14.2	0.17	427	542	727	3268	3311	3363	0.31	0.38	0.42	1.84	61	187	51	170	54	162
2	100.0	1.4	228.9	0.20	532	648	809	3267	3312	3353	0.39	0.46	0.43	1.86	100	231	85	192	91	205
3	100.0	1.4	314.3	0.20	517	623	819	3264	3317	3363	0.38	0.44	0.47	1.85	99	230	88	187	93	205
4	100.0	1.4	313.2	0.22	524	682	895	3266	3318	3360	0.38	0.48	0.48	1.84	100	234	88	187	93	202
5	100.0	1.4	305.3	0.21	533	668	891	3274	3322	3388	0.39	0.47	0.49	1.81	101	234	88	183	93	207
6	100.0	1.4	307.3	0.23	561	716	975	3278	3324	3366	0.42	0.50	0.54	1.83	99	234	88	174	94	189



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 122.0 kg-m²																				
1	120.0	60.5	633.2	0.31	935	1018	1189	5746	6380	7993	0.38	0.37	0.34	2.57	54	274	52	126	52	155
2	120.0	60.5	44.9	0.30	943	997	1134	5479	6280	7183	0.43	0.37	0.33	2.27	162	290	114	152	129	188
3	120.0	60.5	45.0	0.30	937	985	1094	6284	7795	9072	0.36	0.29	0.26	2.58	240	386	193	236	193	259
4	120.0	60.5	45.0	0.30	947	991	1066	6843	8055	9128	0.33	0.29	0.25	2.63	306	447	234	277	243	305
5	120.0	60.5	44.9	0.30	938	993	1058	6969	7992	9266	0.33	0.29	0.25	2.69	356	485	271	309	286	344
6	120.0	60.5	44.9	0.30	920	988	1083	6956	7953	9717	0.33	0.29	0.23	2.86	395	515	300	335	320	373
7	120.0	60.5	45.0	0.30	906	990	1090	6645	7464	9370	0.35	0.31	0.24	3.00	426	541	326	360	342	396
8	120.0	60.5	45.0	0.30	899	996	1070	6367	6956	8550	0.37	0.33	0.26	2.97	453	568	351	387	359	417
9	120.0	60.5	44.9	0.30	900	1002	1068	6104	6554	7589	0.40	0.36	0.31	2.82	473	587	371	409	382	442
10	120.0	60.5	44.9	0.30	904	1009	1080	5943	6282	6864	0.40	0.37	0.36	2.72	489	600	390	427	401	462
11	120.0	60.5	45.0	0.31	922	1011	1081	5924	6274	6549	0.40	0.38	0.37	2.65	504	607	407	447	415	476
12	120.0	60.5	44.9	0.31	923	1013	1119	5991	6411	6583	0.39	0.37	0.39	2.68	517	617	421	462	432	488
13	120.0	60.5	45.0	0.31	922	1014	1084	6060	6316	6493	0.36	0.37	0.40	2.65	528	627	434	476	444	503
14	120.0	60.5	44.9	0.31	913	1013	1089	5905	6297	6498	0.40	0.37	0.40	2.57	534	630	444	488	460	519
15	120.0	60.5	45.0	0.31	912	1012	1150	5839	6269	6463	0.41	0.38	0.39	2.62	539	636	451	504	468	530
7.14-1 First Hot Stop at GVWR at 125.6 kg-m²																				
1	100.0	3.4	26.6	0.61	1960	2078	2421	12220	12353	12450	0.42	0.39	0.39	3.88	585	689	479	515	508	562
7.14-2 Second Hot Stop at GVWR at 125.1 kg-m²																				
1	100.0	3.4	25.7	0.61	1917	2040	2309	12283	12357	12425	0.39	0.38	0.41	4.18	621	715	493	538	530	587
7.15 Brake Cooling Stops at GVWR at 121.4 kg-m²																				
1	50.0	3.4	118.1	0.29	850	973	1076	7266	7987	12069	0.33	0.28	0.17	4.19	488	506	415	427	422	444
2	50.0	3.6	117.5	0.30	889	1022	1108	5676	5966	7239	0.38	0.40	0.29	3.05	365	383	330	347	340	357
3	50.0	3.6	117.3	0.31	912	1058	1126	3576	4526	6242	0.47	0.54	0.57	2.77	284	300	263	289	268	291
4	50.0	3.6	116.6	0.31	993	1040	1152	3394	4104	5971	0.52	0.59	0.69	2.70	230	250	217	247	220	246
7.16 Recovery Performance at GVWR at 125.3 kg-m²																				
1	100.0	3.6	65.9	0.60	1656	2065	2136	12266	12351	12422	0.38	0.39	0.31	3.73	218	341	213	260	211	292
2	100.0	3.4	25.8	0.51	1148	1809	1992	12263	12351	12411	0.35	0.34	0.22	3.68	310	425	262	307	271	342

Inboard Pad Thickness (mm)

	1	2	3	4	5	6	7	8	Average	Mass (gram)
Initial	16.87	16.95	16.96	16.86	16.84	16.86	16.90	16.88	16.89	359.7
Final	15.35	15.25	15.22	15.26	15.51	15.52	15.54	15.61	15.41	342.8
Loss	1.52	1.70	1.74	1.60	1.33	1.34	1.36	1.27	1.48	16.9

Tangential Wear Radial Wear Cup Wear Structural Integrity
 -4.8% 19.2% -6.8%

Outboard Pad Thickness (mm)

	1	2	3	4	5	6	7	8	Average	Mass (gram)
Initial	16.84	16.85	16.86	16.84	16.86	16.89	16.89	16.87	16.86	364.5
Final	15.43	15.50	15.51	15.45	15.95	15.98	15.99	15.93	15.72	350.2
Loss	1.41	1.35	1.35	1.39	0.91	0.91	0.90	0.94	1.14	14.3

Tangential Wear Radial Wear Cup Wear Structural Integrity
 2.1% 33.5% 3.0%

Rotor Thickness (mm)

	Inner				Outer				Average	Mass (gram)
	1	2	3	4	1	2	3	4		
Initial	25.05	25.05	25.04	25.05	25.04	25.04	25.04	25.04	25.04	6,365.4
Final	25.01	25.01	25.01	25.01	25.01	25.01	25.01	25.01	25.01	6,350.8
Loss	0.04	0.04	0.03	0.04	0.03	0.03	0.03	0.03	0.03	14.6

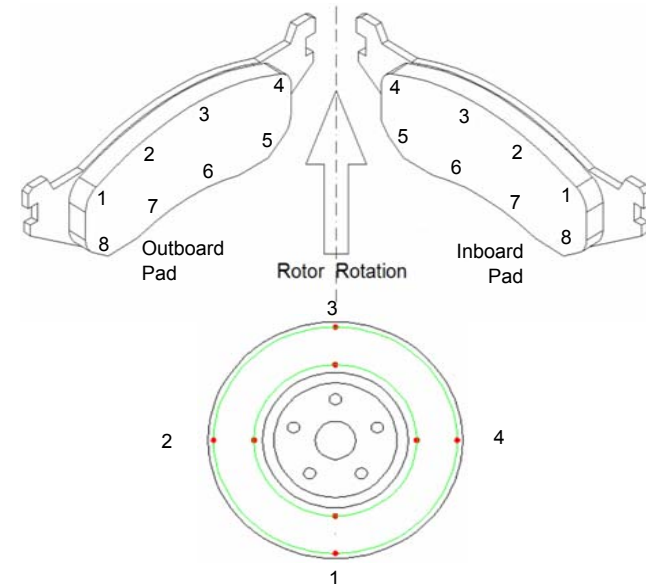
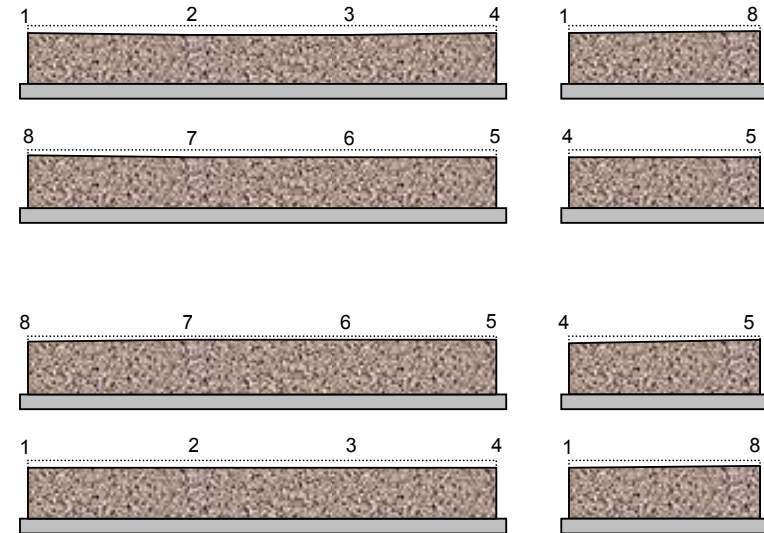
Rotor Surface Finish, Ra (µm)

Initial	0.41	0.41	0.54	0.44	0.79	0.60	0.87	0.58
Final	1.21	1.07	0.99	0.96	2.56	2.30	1.32	1.65

*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(2,3,7,8) ** scale factor of 1 used for pad wear diagrams



Test Description	SAEJ2784 DEC 2007 FMVSS 135 2007 TOYOTA COROLLA FRONT - D923	Rotor Primary Lining Secondary Lining	Effective Radius Piston Diameter Actual Inertia Actual Wheel Load Rolling Radius	133.7 mm 1 x 45.4 mm 122.7 kg·m ² 0.0 kg 363.3 mm
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