



Brake Dynamometer Test Report

Link Test Report #: 103972-1
Test Description: SAEJ2784 FMVSS 135 2007 TOYOTA COROLLA FRONT
Customer Reference: D923
Program #: SAEV09057B0
Platform: 2007 TOYOTA COROLLA FRONT
Lining Material: D923
Test Date: 09/20/10

Requested By:

Hardex Brakes Ltd.
Boback Ras
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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2007 TOYOTA COROLLA FRONT SAE\J2784 FMVSS 135

Test Information

Customer Name	Hardex Brakes Tld.
Requestor	Boback Ras
Test Procedure	SAE\J2784 FMVSS 135
Program Number	SAE\V09057B0
Test Coordinator	KLEM, KELLY
Technician	
Dynamometer	19 - Model 2471
Parts received, start and end dates	N/A, 09/20/10 - 09/21/10
Datalog, Template version	2.82, 1.30

Setup Details

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

Dynamometer Information

Rolling Radius	307.5 mm	
Gross Axle Weight	850.5 kg	
Required Wheel Load	707.6 kg	
Actual Wheel Load	707.6 kg	
Required Inertia	66.9 kg-m ²	[GVWR]
Actual Inertia	66.9 kg-m ²	[Inertia values vary by section per SAE J2784]

Brake Information

Brake Platform	2007 TOYOTA COROLLA FRONT
Brake Type	Disc
Brake Size	N/A
Brake ID Number	43512-02111
Drum/Rotor Type	VENTED
Drum/Rotor Finish	NEW
Pri/Lead/Inner Lining	D923
Sec/Trail/Outer Lining	D923
Orientation	LEFT
Effective Radius	108.5 mm
Number of Pistons/Cyls	1
Coefficient Multiplier	0.0201
Piston Diameter	54.0 mm

Comments:

Processed by: Kelly Klem (313) 933-4900	Title Test Engineer	Date 9/21/2010
Reviewed by: Kelly Klem (313) 933-4900	Title Test Engineer	Date 9/21/2010



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	# of Stops/ Snubs
		[Equation from Table 1]					[g]	
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	4
							front-to-rear split	
		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	4
							front-to-rear split	
		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 = 55 °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				1
210	7.17 Final Inspection	Perform final inspection and measurements						



EFFECTIVENESS SUMMARY

μ (average by distance)

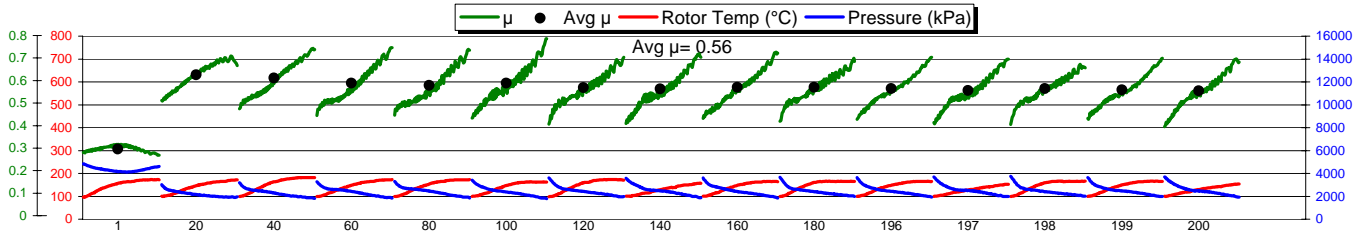
Section	μ (average by distance)			% of Section 7.5 GVWR
	minimum	average	maximum	
7.5 Cold Effectiveness at GVWR	0.45	0.45	0.46	100%
7.6 High Speed Effectiveness at GVWR	0.26	0.28	0.31	63%
7.5 Cold Effectiveness at LLVW	0.42	0.44	0.45	97%
7.6 High Speed Effectiveness at LLVW	0.25	0.28	0.30	62%
7.10 Hydraulic Circuit Failure at LLVW Diagonal Split	0.31	0.33	0.34	73%
7.10 Hydraulic Circuit Failure at GVWR Diagonal Split	0.26	0.27	0.27	59%
7.11 Failed Power-Brake Unit at GVWR	0.39	0.45	0.48	99%
7.13 Heating Snubs at GVWR	0.22	0.27	0.38	60%
7.14-1 First Hot Stop at GVWR		0.20		43%
7.14-2 Second Hot Stop at GVWR		0.20		44%
7.16 Recovery Performance at GVWR	0.34	0.37	0.41	83%

DECELERATION SUMMARY

Section	Setpoint (g/kPa)	Highest Level attained (g)	Pressure @ Highest Level (kPa)	Pressure Limit (kPa)
7.6 High Speed Effectiveness at GVWR	0.80	0.80	9,611	10,600
7.5 Cold Effectiveness at LLVW	0.90	0.96	7,567	10,600
7.6 High Speed Effectiveness at LLVW	0.80	0.80	9,312	10,600
7.10 Hydraulic Circuit Failure at LLVW Diagonal Split	0.45	0.45	9,611	10,600
7.10 Hydraulic Circuit Failure at GVWR Diagonal Split	0.40	0.33	10,514	10,600
7.11 Failed Power-Brake Unit at GVWR	3,300	0.39	3,240	3,300
7.13 Heating Snubs at GVWR	0.31	0.31	3,553	10,600
7.14-1 First Hot Stop at GVWR	7,551	0.38	7,491	7,551
7.14-2 Second Hot Stop at GVWR	0.90	0.54	10,496	10,600
7.16 Recovery Performance at GVWR	7,551	0.92	7,451	10,600



7.1 Burnish at GVWR at 66.9 kg-m²

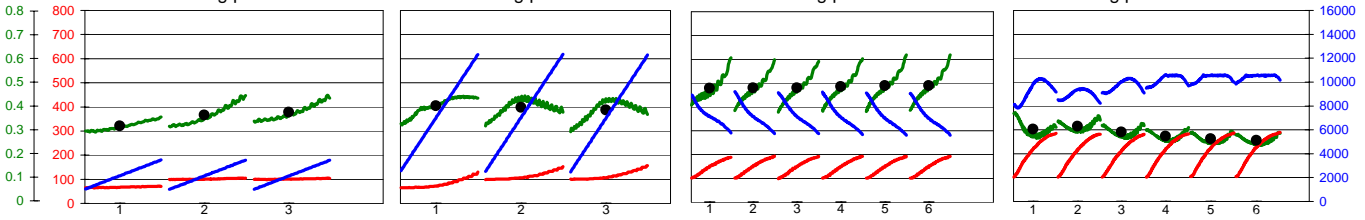


7.4 (1) 3 500 kPa Adhesion Utilization Ramps at GVWR at 67.4 kg-m²
Avg μ = 0.36

7.4 (2) 12 000 kPa Adhesion Utilization Ramps at GVWR at 67.0 kg-m²
Avg μ = 0.40

7.5 Cold Effectiveness at GVWR at 54.8 kg-m²
Avg μ = 0.48

7.6 High Speed Effectiveness at GVWR at 54.7 kg-m²
Avg μ = 0.28

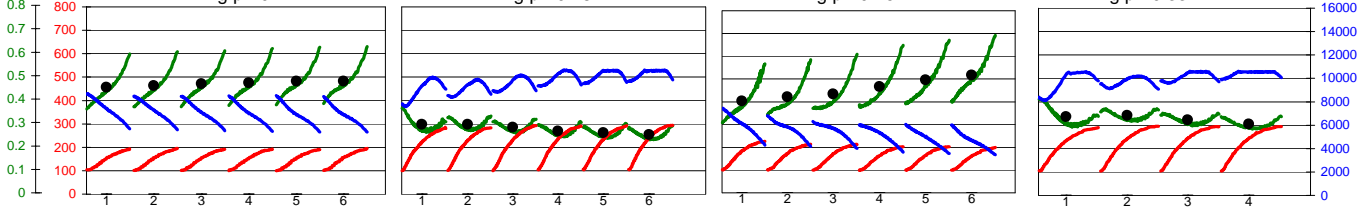


7.5 Cold Effectiveness at LLVW at 52.2 kg-m²
Avg μ = 0.47

7.6 High Speed Effectiveness at LLVW at 52.1 kg-m²
Avg μ = 0.28

7.8 Failed Anti-Lock System at LLVW at 56.8 kg-m²
Avg μ = 0.46

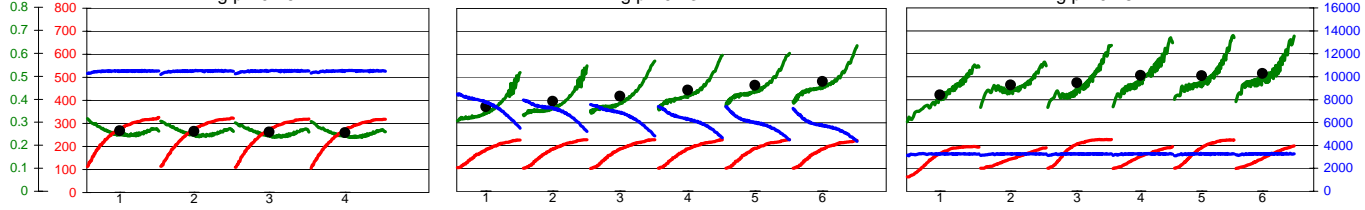
7.10 Hydraulic Circuit Failure at LLVW Diagonal Split at 112.4 kg-m²
Avg μ = 0.33



7.10 Hydraulic Circuit Failure at GVWR Diagonal Split at 132.3 kg-m²
Avg μ = 0.26

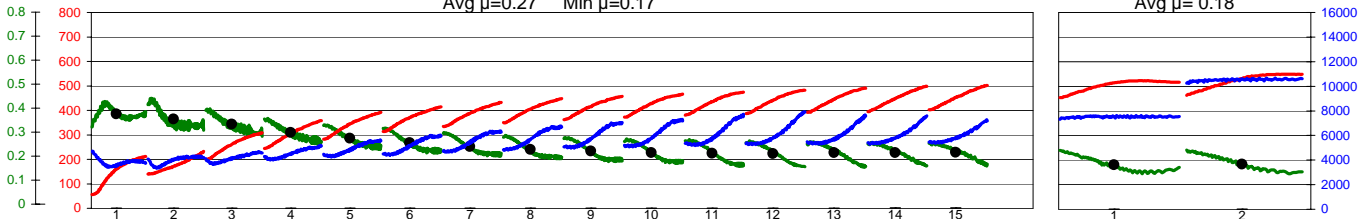
7.8 Failed Anti-Lock System at GVWR at 66.9 kg-m²
Avg μ = 0.43

7.11 Failed Power-Brake Unit at GVWR at 66.7 kg-m²
Avg μ = 0.48



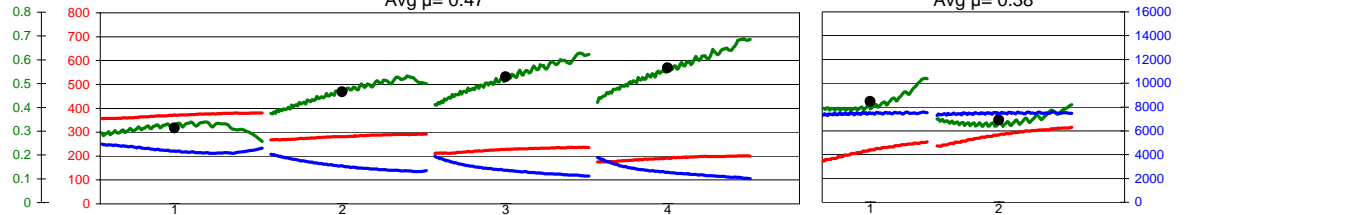
7.13 Heating Snubs at GVWR at 66.9 kg-m²
Avg μ = 0.27 Min μ = 0.17

7.14 GVW Hot Performance Stops #1 and #2
Avg μ = 0.18



7.15 Brake Cooling Stops at GVWR at 66.8 kg-m²
Avg μ = 0.47

7.16 Recovery Performance at GVWR at 54.8 kg-m²
Avg μ = 0.38



Test Description 2007 TOYOTA COROLLA FRONT SAEJ2784 FMVSS 135	Rotor	43512-02111	Effective Radius	108.5 mm
	Primary Lining		Piston Diameter	1 x 54.0 mm
	Secondary Lining		D923 Actual Inertia	66.9 kg-m ²
			D923 Actual Wheel Load	707.6 kg
			Rolling Radius	307.5 mm

Test Request #:
103972-1



Customer Ref.:
D923

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 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 66.9 kg-m²																				
1	79.9	3.5	11.7	0.31	603	664	723	4068	4388	5381	0.28	0.31	0.28	0.00	93	173	25	25	27	26
5	79.9	3.5	149.8	0.31	599	668	775	2584	2864	4045	0.42	0.48	0.42	0.00	101	182	26	25	26	26
10	80.0	3.5	151.5	0.31	616	670	780	2007	2307	3588	0.50	0.60	0.56	0.00	100	184	25	25	25	26
15	79.9	3.5	154.8	0.31	622	671	808	1884	2264	3608	0.52	0.61	0.65	0.00	100	188	25	25	26	26
20	79.9	3.5	158.8	0.31	620	671	801	1888	2310	3653	0.52	0.60	0.66	0.00	101	171	24	25	26	25
25	79.9	3.5	160.1	0.31	619	673	797	1852	2319	3642	0.50	0.60	0.70	0.00	101	186	25	25	25	25
30	79.9	3.5	157.1	0.31	632	672	771	1798	2354	3587	0.49	0.59	0.72	0.00	99	165	25	25	25	25
35	79.9	3.5	157.0	0.31	627	675	784	1796	2385	3727	0.47	0.58	0.74	0.00	99	182	26	25	25	25
40	79.9	3.5	156.8	0.31	620	673	803	1791	2420	3778	0.48	0.57	0.73	0.00	100	181	26	26	25	27
45	79.9	3.5	156.9	0.31	628	674	798	1787	2460	3804	0.48	0.56	0.73	0.00	100	174	25	25	25	26
50	80.0	3.5	156.8	0.31	632	675	754	1791	2493	3705	0.45	0.55	0.76	0.00	100	184	25	26	25	26
55	79.9	3.5	156.3	0.31	621	673	772	1852	2509	3777	0.48	0.55	0.73	0.00	100	185	26	25	25	25
60	79.9	3.5	157.4	0.31	608	673	762	1798	2519	3725	0.46	0.55	0.73	0.00	100	171	25	25	25	26
65	79.9	3.5	157.5	0.31	627	675	784	1757	2569	3849	0.44	0.54	0.76	0.00	100	172	25	26	25	25
70	79.9	3.5	160.9	0.31	618	675	769	1819	2537	3810	0.45	0.54	0.75	0.00	98	177	25	25	26	25
75	80.0	3.5	160.0	0.31	619	675	746	1793	2561	3795	0.44	0.54	0.74	0.00	101	182	25	25	25	26
80	80.0	3.5	161.1	0.31	621	673	777	1812	2557	3817	0.46	0.54	0.72	0.00	100	173	25	25	25	24
85	80.0	3.5	159.2	0.32	629	677	779	1755	2572	3906	0.44	0.54	0.77	0.00	100	162	25	25	25	25
90	79.9	3.5	159.8	0.31	630	675	787	1771	2564	3943	0.47	0.54	0.73	0.00	100	163	25	25	25	25
95	79.9	3.5	158.6	0.31	616	676	774	1798	2562	3953	0.45	0.54	0.75	0.00	100	169	24	24	24	25
100	80.0	3.5	160.3	0.32	629	677	797	1705	2559	4038	0.44	0.54	0.79	0.00	100	164	24	24	24	25
105	79.9	3.5	160.1	0.31	619	678	769	1803	2568	3961	0.45	0.54	0.72	0.00	100	162	24	25	24	25
110	80.0	3.5	162.1	0.32	609	677	771	1821	2607	3980	0.43	0.53	0.75	0.00	100	160	24	24	25	25
115	80.0	3.5	162.8	0.32	626	678	794	1831	2581	4119	0.44	0.54	0.76	0.00	101	162	25	24	25	25
120	80.0	3.5	163.1	0.32	626	680	775	1907	2608	4078	0.41	0.53	0.74	0.00	99	173	24	25	25	25
125	79.9	3.5	164.3	0.32	629	678	775	1832	2631	4090	0.43	0.53	0.72	0.00	101	156	25	24	25	25
130	79.9	3.5	163.6	0.31	621	677	786	1943	2598	4068	0.44	0.53	0.71	0.00	99	161	24	24	25	25
135	80.0	3.5	162.6	0.32	622	680	780	1966	2609	4170	0.42	0.53	0.70	0.00	100	168	24	24	25	25
140	79.9	3.5	162.4	0.32	620	678	764	1846	2668	4151	0.42	0.52	0.72	0.00	101	159	24	24	25	25
145	80.0	3.5	161.8	0.32	630	678	792	1834	2594	4116	0.44	0.53	0.75	0.00	99	162	24	24	24	26
150	79.9	3.5	163.3	0.32	626	681	779	1895	2597	4235	0.43	0.54	0.69	0.00	100	163	25	25	25	25
155	79.9	3.5	161.9	0.32	616	678	789	1897	2679	4101	0.41	0.52	0.73	0.00	101	157	24	24	25	25
160	79.9	3.5	162.6	0.32	631	679	789	1831	2632	4166	0.44	0.53	0.72	0.00	100	165	25	25	25	26
165	80.0	3.5	164.5	0.32	628	681	775	1965	2639	4183	0.41	0.53	0.71	0.00	101	166	25	25	25	25
170	80.0	3.5	164.9	0.32	625	680	786	1855	2650	4182	0.42	0.52	0.74	0.00	100	157	25	25	25	25
175	80.0	3.5	164.0	0.32	631	679	795	1890	2603	4145	0.44	0.53	0.72	0.00	100	165	25	26	26	26
180	79.9	3.5	163.3	0.32	633	681	792	1924	2592	4235	0.43	0.54	0.68	0.00	101	165	26	25	25	25
185	80.0	3.5	164.2	0.32	628	680	764	1871	2698	4165	0.41	0.52	0.70	0.00	99	156	26	25	26	26
190	80.0	3.5	164.3	0.32	636	680	788	1941	2625	4170	0.44	0.53	0.71	0.00	98	166	26	26	26	26
195	79.9	3.5	162.7	0.32	630	683	791	1942	2611	4279	0.42	0.53	0.68	0.00	101	165	25	25	25	25
196	79.9	3.5	162.9	0.32	635	680	784	1849	2635	4292	0.44	0.53	0.70	0.00	100	166	25	25	25	26
197	79.9	3.5	164.8	0.32	629	681	780	1904	2695	4233	0.42	0.52	0.72	0.00	101	153	25	24	26	25
198	80.0	3.5	163.6	0.32	634	683	790	1948	2620	4285	0.41	0.53	0.66	0.00	101	166	25	26	25	26
199	79.9	3.5	163.2	0.32	637	680	794	1918	2658	4235	0.44	0.52	0.70	0.00	99	166	26	25	26	26
200	79.9	3.5	164.7	0.32	619	680	759	1907	2716	4234	0.40	0.51	0.71	0.00	100	155	26	26	27	26



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 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
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7.4 (1) 3 500 kPa Adhesion Utilization Ramps at GVWR at 67.4 kg-m²

1	50.0	37.7	339.1	0.19	220	408	641	1556	2552	3617	0.30	0.32	0.36	0.00	64	71	25	24	26	25
2	49.8	35.9	46.2	0.23	239	469	785	1554	2531	3588	0.32	0.37	0.44	0.00	100	105	25	25	25	26
3	50.0	35.8	38.6	0.23	257	477	782	1566	2518	3582	0.34	0.38	0.43	0.00	100	103	26	25	26	25

7.4 (2) 12 000 kPa Adhesion Utilization Ramps at GVWR at 67.0 kg-m²

1	99.9	47.3	206.1	0.86	966	1739	2673	5040	8305	12353	0.39	0.41	0.44	0.00	65	130	26	25	24	25
2	99.9	48.7	133.3	0.83	968	1699	2407	5086	8339	12389	0.39	0.40	0.38	0.00	100	154	25	26	25	26
3	99.9	50.2	204.7	0.81	892	1671	2337	5037	8301	12306	0.36	0.39	0.37	0.00	99	156	25	26	26	26

7.5 Cold Effectiveness at GVWR at 54.8 kg-m²

1	99.9	3.5	210.3	0.97	1572	1703	1857	5422	7567	9861	0.40	0.45	0.59	0.00	97	191	25	25	26	25
2	99.9	3.5	217.0	0.98	1596	1715	1821	5387	7676	9842	0.39	0.45	0.60	0.00	99	197	27	26	26	26
3	100.0	3.5	213.4	0.97	1607	1708	1788	5449	7667	9682	0.38	0.45	0.60	0.00	97	195	26	25	26	26
4	99.9	3.5	219.3	0.97	1591	1714	1810	5360	7620	9724	0.38	0.45	0.61	0.00	98	197	25	25	25	26
5	99.9	3.5	220.9	0.98	1579	1715	1818	5271	7559	9623	0.38	0.46	0.62	0.00	98	196	25	25	25	26
6	99.9	3.5	219.1	0.98	1588	1714	1808	5272	7551	9628	0.39	0.46	0.62	0.00	97	195	25	26	26	25

7.6 High Speed Effectiveness at GVWR at 54.7 kg-m²

1	143.9	3.5	197.4	0.79	1228	1359	1514	7805	8992	10329	0.37	0.31	0.30	0.00	102	287	26	26	28	28
2	143.9	3.5	356.5	0.80	1227	1374	1525	8212	8930	9502	0.34	0.31	0.30	0.00	98	282	26	26	26	27
3	143.9	3.5	341.9	0.80	1228	1379	1539	9014	9611	10348	0.32	0.29	0.27	0.00	101	283	26	26	27	27
4	143.9	3.5	339.3	0.79	1220	1363	1536	9463	10086	10640	0.30	0.27	0.26	0.00	100	286	27	26	27	28
5	143.9	3.5	329.3	0.77	1227	1336	1510	9702	10299	10623	0.29	0.26	0.25	0.00	100	288	26	26	28	28
6	143.9	3.5	334.2	0.76	1188	1313	1493	9817	10398	10614	0.28	0.26	0.24	0.00	101	289	27	26	27	28

7.5 Cold Effectiveness at LLVW at 52.2 kg-m²

1	99.9	3.5	231.3	0.96	1531	1587	1652	5169	7567	9114	0.36	0.42	0.60	0.00	99	197	27	27	28	28
2	99.9	3.5	215.3	0.96	1528	1581	1673	5094	7407	8969	0.38	0.43	0.61	0.00	101	198	28	27	28	27
3	99.9	3.5	223.5	0.96	1532	1588	1653	5058	7301	8921	0.37	0.44	0.62	0.00	100	199	27	28	27	28
4	99.9	3.5	221.3	0.96	1518	1592	1656	5006	7237	8995	0.38	0.44	0.62	0.00	101	196	28	27	27	27
5	100.0	3.5	216.7	0.96	1531	1598	1667	4976	7165	9046	0.38	0.45	0.63	0.00	99	195	27	28	28	27
6	99.9	3.5	215.5	0.96	1530	1595	1669	4946	7113	8913	0.39	0.45	0.63	0.00	100	197	28	28	27	27



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 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 52.1 kg-m²																				
1	143.9	3.5	202.9	0.79	1202	1288	1497	7469	8610	10017	0.36	0.30	0.28	0.00	101	281	28	28	28	28
2	143.9	3.5	339.3	0.80	1179	1309	1479	8248	8910	9834	0.33	0.30	0.28	0.00	101	284	28	29	30	29
3	143.9	3.5	332.6	0.80	1202	1312	1476	8684	9312	10186	0.31	0.29	0.28	0.00	100	294	28	28	28	28
4	143.9	3.5	336.7	0.80	1203	1309	1475	9149	9825	10626	0.29	0.27	0.27	0.00	99	292	28	28	28	28
5	143.9	3.5	345.8	0.79	1236	1297	1467	9291	10050	10627	0.29	0.26	0.27	0.00	100	293	28	28	29	29
6	144.0	3.5	335.4	0.78	1194	1281	1455	9575	10209	10627	0.29	0.25	0.26	0.00	99	295	28	28	28	29
7.8 Failed Anti-Lock System at LLVW at 56.8 kg-m²																				
1	99.9	3.5	355.9	0.64	1065	1146	1297	4007	6361	7923	0.31	0.36	0.56	0.00	101	228	29	29	29	29
2	99.9	3.5	233.5	0.63	1085	1133	1239	3848	5913	7437	0.35	0.39	0.59	0.00	100	213	29	29	29	29
3	99.9	3.5	234.8	0.63	1059	1120	1214	3710	5676	6836	0.37	0.40	0.60	0.00	100	213	29	29	29	29
4	99.9	3.5	234.4	0.63	1088	1124	1195	3457	5368	6577	0.38	0.42	0.65	0.00	100	202	29	29	29	29
5	99.9	3.5	232.6	0.63	1089	1134	1203	3314	5114	6612	0.39	0.45	0.67	0.00	100	203	29	29	29	28
6	99.9	3.5	231.1	0.63	1077	1140	1189	3221	4897	6622	0.40	0.47	0.70	0.00	100	201	29	29	29	28
7.10 Hydraulic Circuit Failure at LLVW Diagonal Split at 112.4 kg-m²																				
1	99.9	3.5	228.0	0.44	1478	1581	1757	8068	9307	10612	0.40	0.34	0.31	0.00	101	291	29	28	29	29
2	99.9	3.5	362.4	0.45	1504	1627	1745	9035	9611	10242	0.36	0.34	0.33	0.00	101	296	29	29	29	29
3	99.9	3.5	368.6	0.45	1499	1614	1743	9560	10062	10644	0.34	0.32	0.31	0.00	100	295	29	29	30	30
4	99.9	3.5	368.7	0.43	1463	1565	1716	9856	10363	10662	0.33	0.31	0.30	0.00	101	294	29	29	29	29
7.10 Hydraulic Circuit Failure at GVWR Diagonal Split at 132.3 kg-m²																				
1	99.9	3.5	374.3	0.33	1266	1419	1666	10270	10514	10668	0.32	0.27	0.24	0.00	100	323	29	29	29	29
2	99.9	3.5	403.2	0.32	1260	1406	1633	10252	10515	10670	0.31	0.27	0.24	0.00	100	322	29	29	31	29
3	99.9	3.5	407.1	0.32	1244	1382	1599	10246	10516	10686	0.30	0.27	0.24	0.00	99	320	28	29	29	29
4	99.9	3.5	410.2	0.32	1218	1372	1586	10260	10517	10656	0.31	0.26	0.24	0.00	100	317	29	29	29	29
7.8 Failed Anti-Lock System at GVWR at 66.9 kg-m²																				
1	99.9	3.5	407.7	0.63	1184	1322	1563	5203	7825	9047	0.31	0.34	0.52	0.00	100	226	29	28	28	29
2	99.9	3.5	266.7	0.63	1214	1320	1549	4924	7284	8581	0.33	0.37	0.54	0.00	99	228	29	29	28	29
3	99.9	3.5	268.7	0.62	1257	1319	1409	4638	6918	8030	0.36	0.39	0.57	0.00	100	226	29	29	29	29
4	99.9	3.5	272.6	0.62	1261	1326	1407	4450	6499	7934	0.37	0.41	0.58	0.00	101	226	29	29	30	29
5	99.9	3.5	271.6	0.62	1261	1334	1437	4340	6235	8153	0.37	0.43	0.60	0.00	100	225	29	28	29	28
6	99.9	3.5	272.7	0.62	1252	1335	1458	4151	6015	7703	0.39	0.45	0.63	0.00	101	225	29	29	30	29
7.11 Failed Power-Brake Unit at GVWR at 66.7 kg-m²																				
1	99.9	1.2	11.3	0.31	453	612	901	3063	3240	3364	0.31	0.39	0.49	0.00	64	191	28	28	27	29
2	99.9	1.2	164.7	0.35	550	705	904	3062	3237	3331	0.36	0.44	0.46	0.00	101	191	28	29	28	29
3	99.9	1.2	250.0	0.36	552	703	1025	3058	3239	3331	0.37	0.44	0.55	0.00	100	226	27	27	27	28
4	99.9	1.2	254.0	0.38	555	746	1085	3071	3239	3339	0.37	0.47	0.57	0.00	101	195	27	26	27	27
5	99.9	1.2	261.0	0.38	565	747	1102	3067	3239	3343	0.38	0.47	0.58	0.00	102	222	26	25	26	27
6	99.9	1.2	258.5	0.39	573	767	1093	3074	3240	3336	0.38	0.48	0.62	0.00	100	198	27	26	27	26



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
7.13 Heating Snubs at GVWR at 66.9 kg-m²																				
1	120.0	60.5	581.0	0.31	604	672	772	3101	3553	4940	0.33	0.38	0.39	0.00	57	211	25	27	26	26
2	119.9	60.5	44.9	0.31	567	653	819	3003	3628	4498	0.42	0.37	0.34	0.00	141	233	26	27	28	26
3	119.9	60.5	44.9	0.30	573	646	765	3338	3815	4392	0.40	0.35	0.30	0.00	200	313	28	28	29	28
4	119.9	60.5	44.9	0.30	590	641	751	3666	4190	4881	0.36	0.31	0.26	0.00	247	361	29	29	30	29
5	120.0	60.5	44.9	0.30	576	637	724	3903	4520	5349	0.34	0.29	0.25	0.00	280	393	29	30	31	31
6	119.9	60.5	44.9	0.30	585	633	742	4037	4776	5699	0.32	0.27	0.23	0.00	314	422	32	30	35	35
7	120.0	60.5	44.9	0.30	565	630	736	4274	5061	6062	0.31	0.25	0.22	0.00	336	434	35	35	35	36
8	119.9	60.5	44.9	0.29	565	627	716	4422	5302	6393	0.29	0.24	0.20	0.00	350	450	37	37	36	37
9	119.9	60.5	44.9	0.29	541	627	736	4594	5446	6698	0.29	0.23	0.20	0.00	365	460	37	37	36	36
10	119.9	60.5	44.9	0.29	541	625	715	4693	5557	6951	0.27	0.23	0.19	0.00	372	469	37	37	37	37
11	120.0	60.5	44.9	0.29	570	624	743	4785	5631	7299	0.28	0.23	0.19	0.00	383	478	37	37	37	38
12	119.9	60.5	44.9	0.29	570	621	701	4852	5662	7548	0.27	0.22	0.16	0.00	388	483	37	37	37	37
13	119.9	60.5	45.0	0.29	556	625	714	4891	5577	7348	0.26	0.23	0.17	0.00	394	492	39	38	38	38
14	119.9	60.5	44.9	0.29	557	625	712	4885	5581	7242	0.26	0.23	0.17	0.00	397	500	37	38	38	38
15	119.9	60.5	44.9	0.29	558	629	741	4962	5552	7038	0.27	0.23	0.17	0.00	403	504	38	38	38	38
7.14-1 First Hot Stop at GVWR at 54.9 kg-m²																				
1	99.9	3.5	27.2	0.38	516	719	940	7244	7491	7665	0.25	0.20	0.18	0.00	447	516	38	37	38	38
7.14-2 Second Hot Stop at GVWR at 55.1 kg-m²																				
1	99.9	3.5	28.3	0.54	733	1032	1293	10205	10496	10694	0.24	0.20	0.15	0.00	460	547	38	37	38	38
7.15 Brake Cooling Stops at GVWR at 66.8 kg-m²																				
1	49.8	3.5	116.7	0.31	523	668	737	3953	4317	5080	0.29	0.31	0.23	0.00	357	381	30	29	37	37
2	49.8	3.5	115.9	0.32	614	689	774	2514	3172	4422	0.38	0.44	0.48	0.00	269	291	28	29	32	32
3	50.0	3.5	115.9	0.32	642	694	777	2158	2857	4302	0.41	0.49	0.62	0.00	211	237	28	28	30	30
4	49.8	3.5	115.6	0.32	630	698	796	1956	2699	4287	0.43	0.53	0.70	0.00	176	200	26	26	29	29
7.16 Recovery Performance at GVWR at 54.8 kg-m²																				
1	99.9	3.5	62.4	0.92	1389	1508	1960	7266	7451	7584	0.40	0.41	0.49	0.00	166	255	28	28	29	30
2	99.8	3.5	24.5	0.74	1167	1248	1529	7254	7460	7620	0.35	0.34	0.35	0.00	228	315	28	28	31	29

Test Request #:
103972-1



Customer Ref.:
D923

Inboard Pad Thickness (mm)

	1	2	3	4	5	6	7	8	Average	Mass (gram)
Initial	16.94	16.97	16.96	16.89	16.84	16.86	16.87	16.84	16.90	363.0
Final	15.88	15.83	15.80	15.84	16.12	16.10	16.09	16.10	15.97	353.4
Loss	1.06	1.14	1.16	1.05	0.72	0.76	0.78	0.74	0.93	9.6

Tangential Wear 1.7% Radial Wear 32.0% Cup Wear -7.0% Structural Integrity

Outboard Pad Thickness (mm)

	1	2	3	4	5	6	7	8	Average	Mass (gram)
Initial	16.89	16.89	16.95	16.92	16.87	16.91	16.85	16.83	16.89	364.1
Final	16.01	16.03	16.09	16.12	16.36	16.35	16.31	16.24	16.19	355.8
Loss	0.88	0.86	0.86	0.80	0.51	0.56	0.54	0.59	0.70	8.3

Tangential Wear 10.9% Radial Wear 35.3% Cup Wear -1.4% Structural Integrity

Rotor Thickness (mm)

	Inner				Outer				Average	Mass (gram)
	1	2	3	4	1	2	3	4		
Initial	25.05	25.04	25.04	25.04	25.04	25.03	25.04	25.03	25.04	6,304.4
Final	25.01	25.00	25.01	25.00	24.99	24.99	25.00	24.99	25.00	6,294.0
Loss	0.04	0.04	0.03	0.04	0.05	0.04	0.04	0.04	0.04	10.4

Rotor Surface Finish, Ra (µm)

Initial	0.62	0.64	0.60	0.62	1.24	1.04	0.97	0.79
Final	0.75	0.92	1.22	0.73	2.20	1.84	1.99	2.20

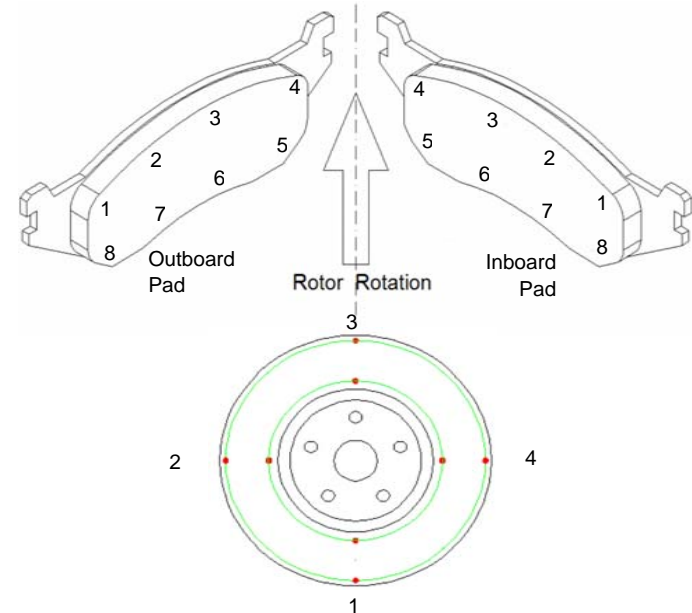
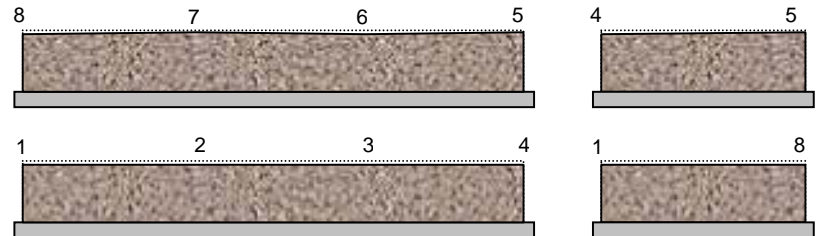
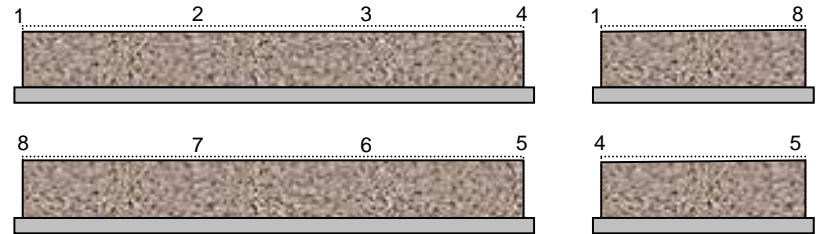
*Tangential Wear =Avg(1,8) - Avg(4,5)

*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

2007 TOYOTA COROLLA FRONT SAEJ2784
FMVSS 135

Rotor
Primary Lining
Secondary Lining

43512-02111
D923
D923

Effective Radius
Piston Diameter
Actual Inertia
Actual Wheel Load
Rolling Radius

108.5 mm
1 x 54.0 mm
66.9 kg·m²
707.6 kg
307.5 mm

Test Request #:
103972-1



Customer Ref.:
D923

Initial

Final

Initial

Final

Rotor

Inboard

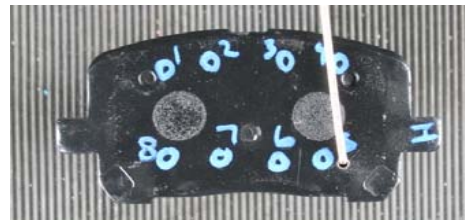
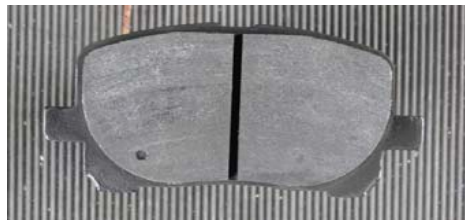
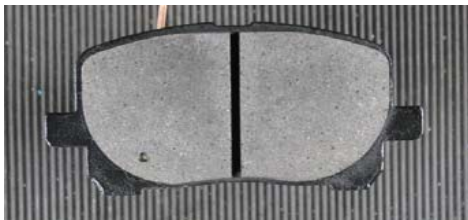
Outboard



Inner Pad

Friction

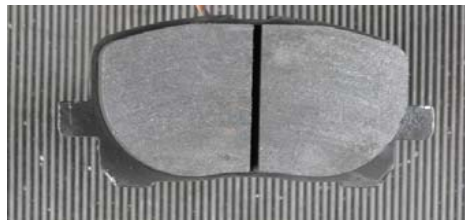
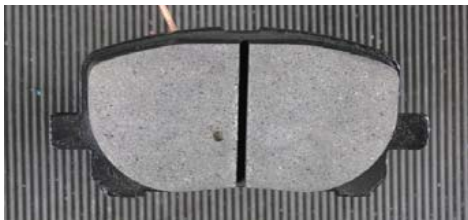
Backing Plate



Outer Pad

Friction

Backing Plate



Test Description:

2007 TOYOTA COROLLA FRONT
SAEJ2784 FMVSS 135

Rotor

Primary Lining:
Secondary Lining:

43512-02111
D923
D923

Effective Radius
Piston Diameter
Actual Inertia
Actual Wheel Load
Rolling Radius

108.5 mm
1 x 54.0 mm
66.9 kg-m²
707.6 kg
307.5 mm