



## Sample Lab Test Report

Link Test Report: 153500-1  
Test Description: SAE J661 Rev Feb 1997 Brake Lining Quality  
Purpose of Test: To Evaluate the Characteristics of Brake  
Materials  
Program: J661noinsp.chp  
Lining Material: HDX88805D GG  
Test Date(s): 8/5/2015 to 8/7/2015

## Requested By

**HARDEX BRAKES CORP.**  
ALI AHMADI  
907-1030 W GEORGIA STREET  
VANCOUVER, BC, V6E 2Y3  
CANADA

## Tested By:

**Testing Coordination and Facility**  
Dearborn Technical Center  
401 Southfield Road  
Dearborn, MI 48120  
[www.linkeng.com](http://www.linkeng.com)  
Phone: (313) 625-4000



Test Number  
153500-1

Customer Reference  
HDX88805D GG

## SAE J661 Rev Feb 1997 Brake Lining Quality Test

### Test Information

Customer Name	HARDEX BRAKES CORP.
Requestor	Ali Ahmadi
Test Procedure	SAE J661
Program Number	J661noinsp.chp
Test Coordinator	Radoslaw Markiewicz
Test Equipment	Chase Machine 12
Test Dates	8/5/2015 to 8/7/2015
Datalogger	v1.0.10
Template Version	2.06

### Setup Details

Sample Material	HDX88805D GG
Sample Size	25.4mm x 25.4mm
Sample Manufacturer	HARDEX BRAKES CORP.
Test Pressure	1034.21 kPa

### Sample Test Summary

Normal Friction Coefficient	0.529	Pass
Normal Friction Class	G	
Hot Friction Coefficient	0.505	Pass
Hot Friction Class	G	
Minimum Bold Coefficient	0.463	Pass
Max Variation Below Avg for Bold readings	0.040	Pass
Max % Variation for Bold Readings	8%	Pass

**Pass / Fail**

**Pass**

### Comments:

<b>Created by:</b>	Tessa Maynard (313) 625-4000	<b>Title</b>	Lead Technician	<b>Date</b>	9/14/2015
<b>Reviewed by:</b>	Tessa Maynard (313) 625-4000	<b>Title</b>	Lead Technician	<b>Date</b>	9/14/2015

Data applicable to the materials tested. **Valid if signed by the test engineer.** 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.



Test Number  
153500-1

Customer Reference  
HDX88805D GG

Test Number				
Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
153500-A1	153500-A2	153500-A3	153500-A4	153500-A5

Manufacturer  
**HARDEX BRAKES CORP.**

Initial Baseline					
Application	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
1	0.413	0.434	0.437	0.459	0.410
20	0.434	0.531	0.412	0.473	0.423

Material  
**HDX88805D GG**

Normal **0.529** **G**

First Fade					
Temp (°C)	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
93.3	0.426	0.515	0.414	0.448	0.415
260.0	0.539	0.565	0.540	0.556	0.546

(or Temp @ 10min)

Hot **0.505** **G**

First Recovery							Norm/Hot
Temp (°C)	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Average	
260.0	0.559	0.540	0.552	0.586	0.559	0.559	
204.4	0.580	0.555	0.568	0.583	0.565	0.570	Hot
148.9	0.544	0.529	0.534	0.559	0.534	0.540	Hot
93.3	0.504	0.508	0.510	0.530	0.511	0.513	

Wear					
Application	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
1	0.531	0.532	0.532	0.545	0.543
100	0.449	0.541	0.482	0.490	0.570

Second Fade							Max Var.		
Temp (°C)	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Average	< Average	Norm/Hot	% Var
93.3	<b>0.495</b>	<b>0.489</b>	<b>0.503</b>	<b>0.497</b>	<b>0.489</b>	<b>0.495</b>	<b>0.006</b>	<b>Normal</b>	<b>1%</b>
121.1	<b>0.549</b>	<b>0.545</b>	<b>0.550</b>	<b>0.554</b>	<b>0.570</b>	<b>0.554</b>	<b>0.009</b>	<b>Normal</b>	<b>2%</b>
148.9	<b>0.534</b>	<b>0.526</b>	<b>0.552</b>	<b>0.581</b>	<b>0.546</b>	<b>0.548</b>	<b>0.022</b>	<b>Normal</b>	<b>4%</b>
176.7	<b>0.522</b>	<b>0.526</b>	<b>0.551</b>	<b>0.550</b>	<b>0.541</b>	<b>0.538</b>	<b>0.016</b>	-	<b>3%</b>
204.4	<b>0.508</b>	<b>0.523</b>	<b>0.509</b>	<b>0.509</b>	<b>0.559</b>	<b>0.522</b>	<b>0.014</b>	<b>Normal</b>	<b>3%</b>
232.2	<b>0.498</b>	<b>0.524</b>	<b>0.536</b>	<b>0.473</b>	<b>0.534</b>	<b>0.513</b>	<b>0.040</b>	<b>Hot</b>	<b>8%</b>
260.0	<b>0.482</b>	<b>0.510</b>	<b>0.511</b>	<b>0.503</b>	<b>0.519</b>	<b>0.505</b>	<b>0.023</b>	<b>Hot</b>	<b>5%</b>
287.8	<b>0.479</b>	<b>0.482</b>	<b>0.496</b>	<b>0.471</b>	<b>0.506</b>	<b>0.487</b>	<b>0.016</b>	<b>Hot</b>	<b>3%</b>
315.6	0.478	0.494	0.493	0.477	0.512	0.491	0.014	Hot	3%
343.3	0.474	0.468	0.457	0.479	0.429	0.461	0.032	Hot	7%

(or Temp @ 10min)

Second Recovery							Max Var.		
Temp (°C)	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Average	< Average	Norm/Hot	% Var
315.6	0.491	0.454	0.470	0.464	0.469	0.470	0.016	-	
260.0	0.512	0.500	0.488	0.476	0.498	0.495	0.019	Hot	
204.4	0.481	0.513	0.481	0.481	0.485	0.488	0.007	Hot	
148.9	<b>0.463</b>	<b>0.552</b>	<b>0.505</b>	<b>0.482</b>	<b>0.491</b>	<b>0.499</b>	<b>0.036</b>	<b>Hot</b>	
93.3	<b>0.503</b>	<b>0.522</b>	<b>0.500</b>	<b>0.509</b>	<b>0.474</b>	<b>0.502</b>	<b>0.028</b>	-	

Final Baseline					
Application	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
1	0.506	0.519	0.492	0.496	0.491
20	0.479	0.449	0.445	0.464	0.464



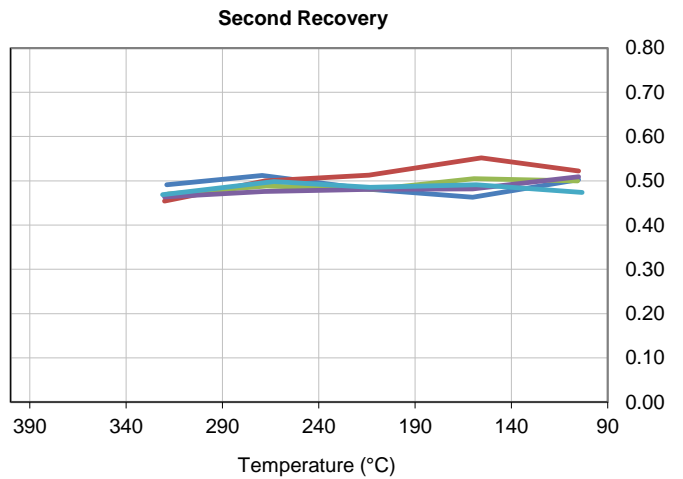
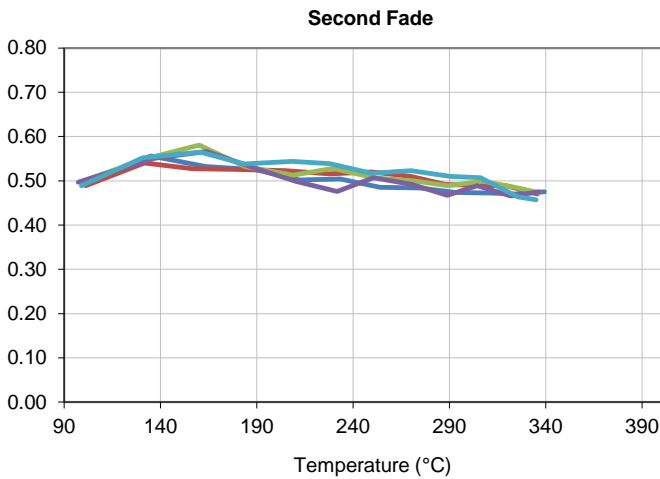
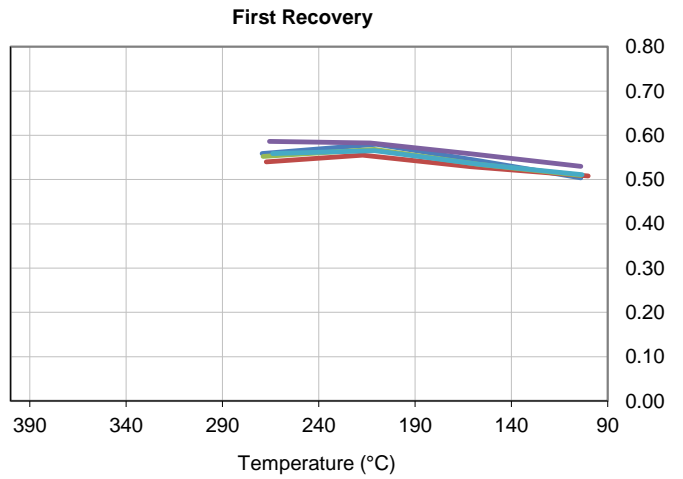
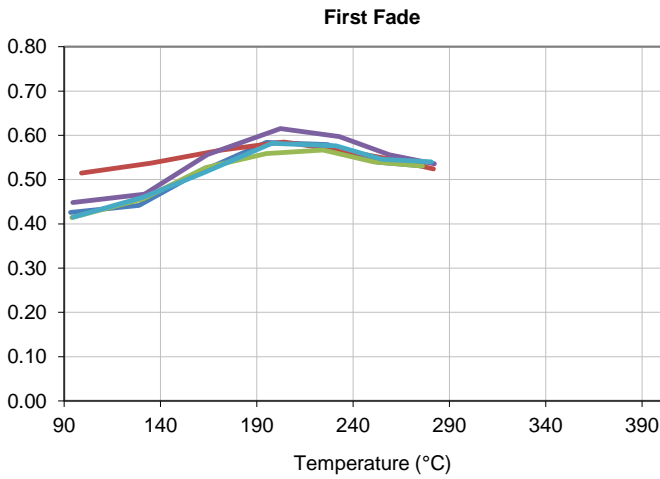
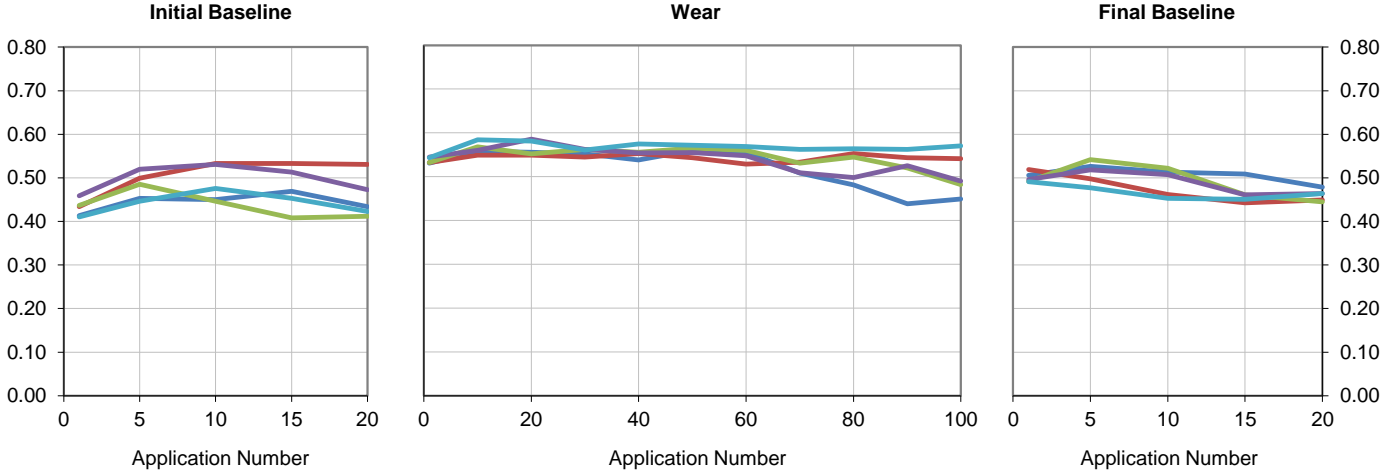
Test Number  
153500-1

Customer Reference  
HDX88805D GG

Manufacturer: HARDEX BRAKES CORP.  
Material: HDX88805D GG  
Test Pressure: 1034.21 kPa

8/5/2015 to 8/7/2015  
**Summary of 5 Samples**

### Coefficient of Friction





Test Number  
153500-1

Customer Reference  
HDX88805D GG

Manufacturer: HARDEX BRAKES CORP.  
Material: HDX88805D GG  
Test Pressure: 1034.21 kPa

Normal **0.522** **G**  
Hot **0.499** **G**

8/5/2015  
153500-A1  
Sample 1 of 5

**Wear**

	Initial	Final	Loss	Loss / %	Specific Wear	
Weight (gr)	9.084	8.357	0.727	8%	3.48E-01	gr/kWh
Thickness (cm)	0.615	0.561	0.054	9%	1.67E-01	cm <sup>3</sup> /kWh

**Baseline**

Event	Initial		Final	
	Force (N)	$\mu$	Force (N)	$\mu$
1	276	0.413	337	0.506
5	304	0.453	351	0.526
10	302	0.450	345	0.513
15	313	0.469	340	0.509
20	289	0.434	322	0.479

**Wear**

Event	Force (N)	$\mu$
1	354	0.531
10	371	0.558
20	371	0.556
30	367	0.552
40	359	0.538
50	375	0.560
60	371	0.556
70	337	0.508
80	322	0.481
90	290	0.438
100	299	0.449

**First Fade**

Time (sec)	Force (N)	$\mu$	Temp (°C)
0	283	0.426	93
30	295	0.442	129
60	343	0.514	159
90	390	0.584	195
120	386	0.579	227
150	359	0.539	253
180	355	0.531	277
210			
240			
270			
300			
330			
360			
390			
420			
450			
480			
510			
540			
570			
600			

**Second Fade**

Time (sec)	Force (N)	$\mu$	Temp (°C)
0	330	0.495	102
30	372	0.556	135
60	357	0.532	163
90	352	0.525	189
120	336	0.502	212
150	335	0.504	233
180	324	0.485	254
210	321	0.484	274
240	318	0.474	293
270	315	0.472	312
300	312	0.470	324
330	317	0.475	339
360			
390			
420			
450			
480			
510			
540			
570			
600			

**First Recovery**

Event	Force (N)	$\mu$	Temp (°C)
1	373	0.559	269
2	386	0.580	210
3	364	0.544	158
4	334	0.504	104

**Second Recovery**

Event	Force (N)	$\mu$	Temp (°C)
1	327	0.491	319
2	342	0.512	269
3	322	0.481	214
4	304	0.463	160
5	334	0.503	105



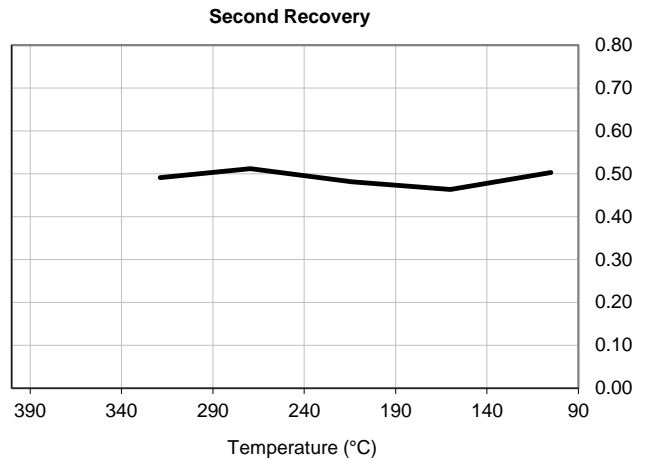
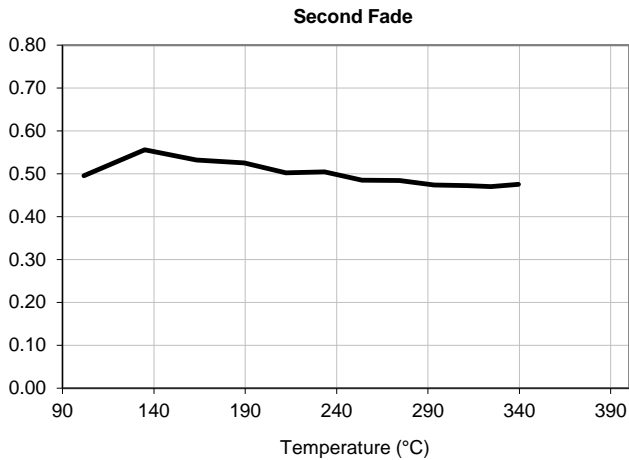
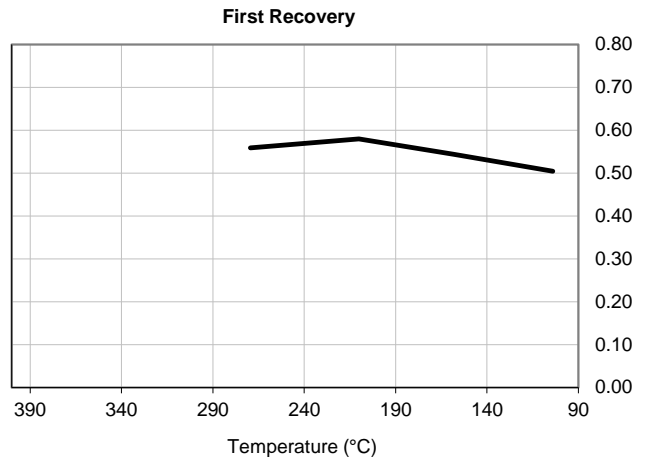
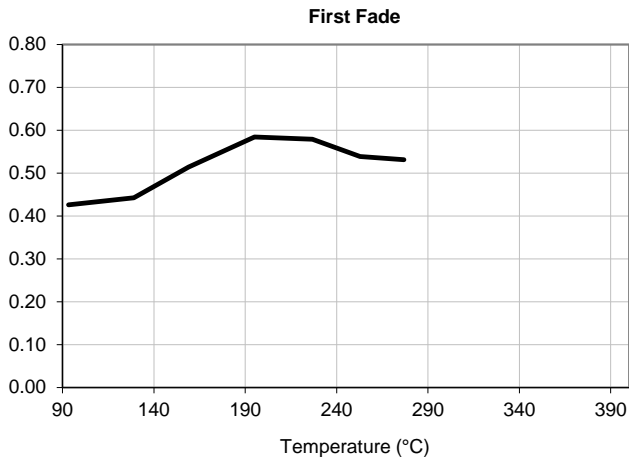
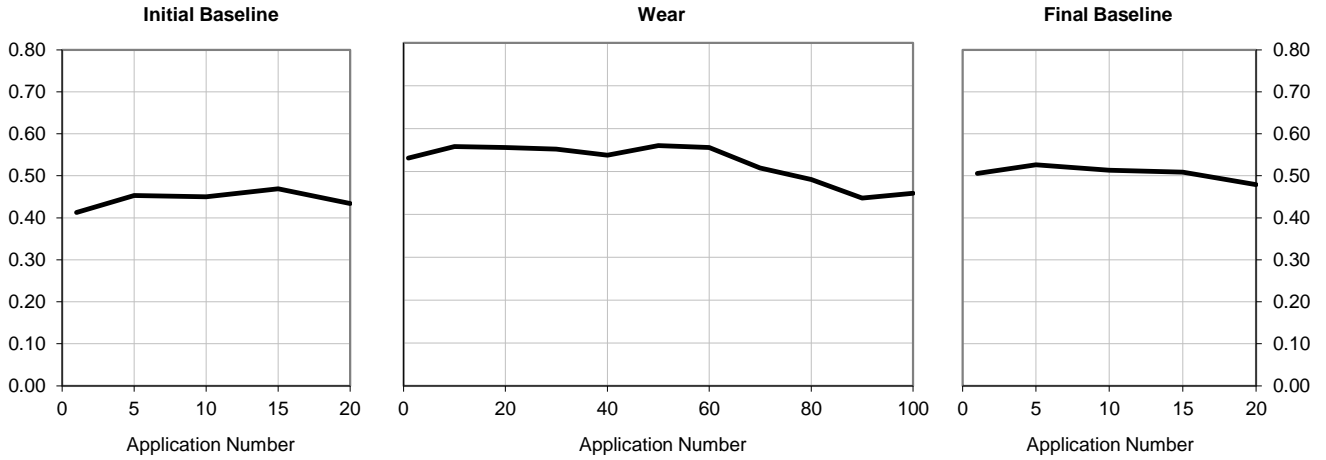
Test Number  
153500-1

Customer Reference  
HDX88805D GG

Manufacturer: HARDEX BRAKES CORP.  
Material: HDX88805D GG  
Test Pressure: 1034.21 kPa

8/5/2015  
153500-A1  
Sample 1 of 5

### Coefficient of Friction





Test Number  
153500-1

Customer Reference  
HDX88805D GG

Manufacturer: HARDEX BRAKES CORP.  
Material: HDX88805D GG  
Test Pressure: 1034.21 kPa

Normal **0.521** **G**  
Hot **0.513** **G**

8/6/2015  
153500-A2  
Sample 2 of 5

**Wear**

	Initial	Final	Loss	Loss / %	Specific Wear	
Weight (gr)	9.079	8.304	0.775	9%	3.57E-01	gr/kWh
Thickness (cm)	0.612	0.559	0.053	9%	1.57E-01	cm <sup>3</sup> /kWh

**Baseline**

Event	Initial		Final	
	Force (N)	$\mu$	Force (N)	$\mu$
1	289	0.434	348	0.519
5	332	0.499	333	0.498
10	353	0.533	309	0.462
15	356	0.533	296	0.443
20	355	0.531	299	0.449

**Wear**

Event	Force (N)	$\mu$
1	356	0.532
10	368	0.549
20	365	0.549
30	365	0.545
40	367	0.553
50	364	0.543
60	354	0.529
70	355	0.533
80	370	0.553
90	363	0.543
100	359	0.541

**First Fade**

Time (sec)	Force (N)	$\mu$	Temp (°C)
0	346	0.515	99
30	356	0.537	135
60	381	0.567	172
90	391	0.585	204
120	378	0.565	235
150	364	0.545	261
180	353	0.524	282
210			
240			
270			
300			
330			
360			
390			
420			
450			
480			
510			
540			
570			
600			

**Second Fade**

Time (sec)	Force (N)	$\mu$	Temp (°C)
0	325	0.489	101
30	359	0.540	132
60	352	0.527	157
90	351	0.526	179
120	347	0.523	205
150	344	0.516	228
180	347	0.520	249
210	343	0.510	270
240	327	0.492	288
270	326	0.490	304
300	326	0.489	319
330	315	0.470	336
360			
390			
420			
450			
480			
510			
540			
570			
600			

**First Recovery**

Event	Force (N)	$\mu$	Temp (°C)
1	361	0.540	267
2	370	0.555	217
3	353	0.529	161
4	339	0.508	100

**Second Recovery**

Event	Force (N)	$\mu$	Temp (°C)
1	304	0.454	320
2	331	0.500	268
3	343	0.513	214
4	368	0.552	156
5	348	0.522	105



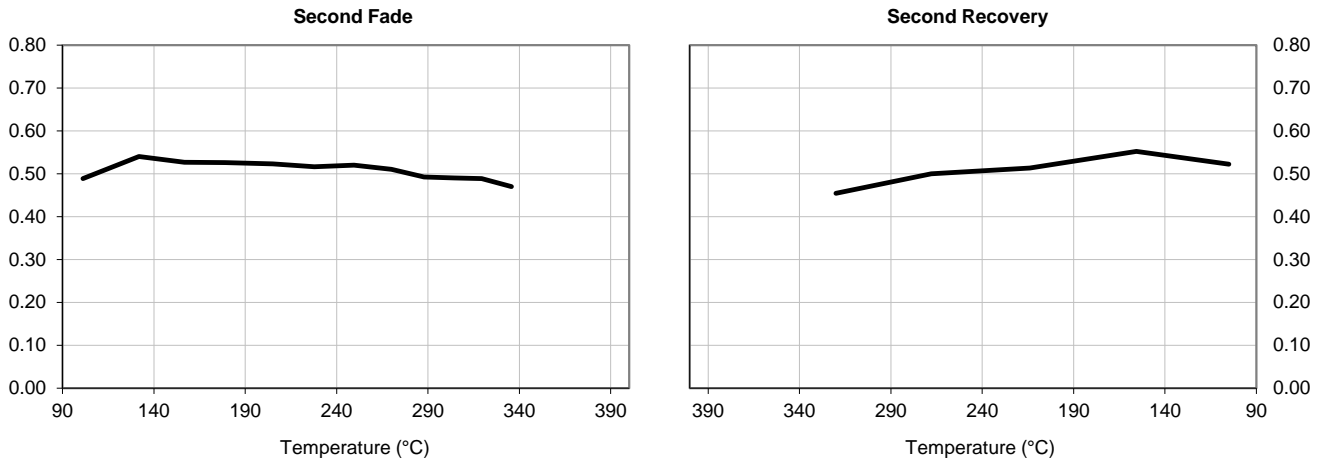
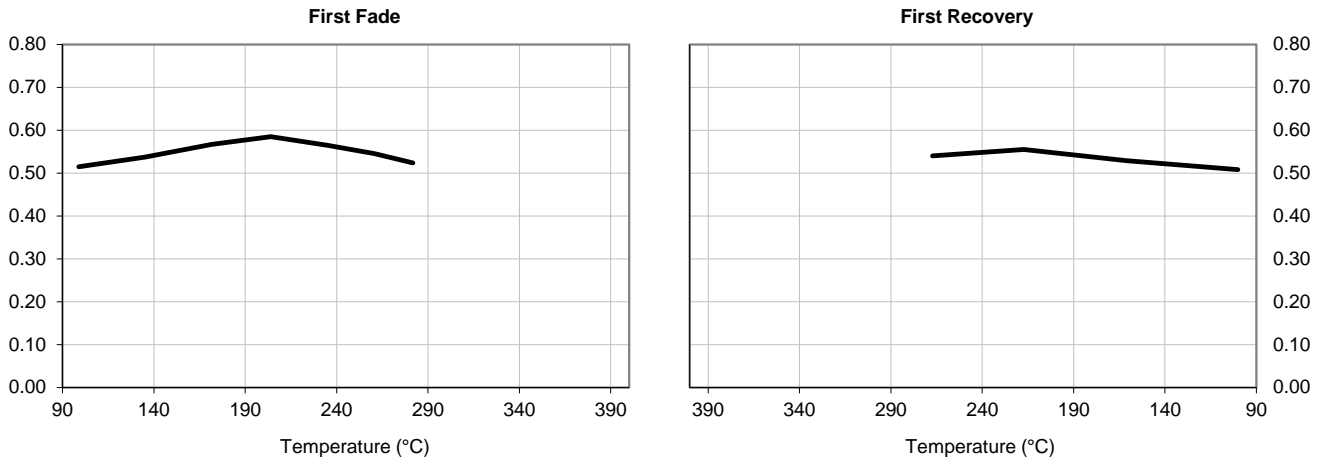
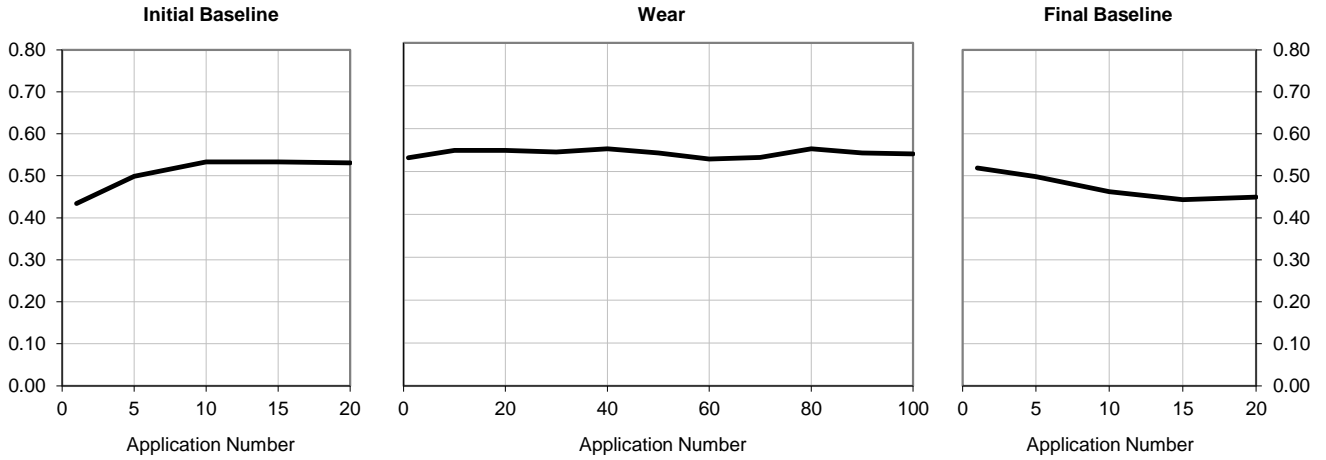
Test Number  
153500-1

Customer Reference  
HDX88805D GG

Manufacturer: HARDEX BRAKES CORP.  
Material: HDX88805D GG  
Test Pressure: 1034.21 kPa

8/6/2015  
153500-A2  
Sample 2 of 5

### Coefficient of Friction







Test Number  
153500-1

Customer Reference  
HDX88805D GG

Manufacturer: HARDEX BRAKES CORP.  
Material: HDX88805D GG  
Test Pressure: 1034.21 kPa

Normal **0.529** **G**  
Hot **0.507** **G**

8/6/2015  
153500-A3  
Sample 3 of 5

### Wear

	Initial	Final	Loss	Loss / %	Specific Wear	
Weight (gr)	8.881	8.150	0.731	8%	3.40E-01	gr/kWh
Thickness (cm)	0.620	0.564	0.056	9%	1.68E-01	cm <sup>3</sup> /kWh

### Baseline

Event	Initial		Final	
	Force (N)	$\mu$	Force (N)	$\mu$
1	291	0.437	328	0.492
5	324	0.485	361	0.542
10	299	0.446	347	0.522
15	274	0.408	308	0.461
20	277	0.412	297	0.445

### Wear

Event	Force (N)	$\mu$
1	355	0.532
10	379	0.568
20	369	0.552
30	376	0.562
40	373	0.556
50	376	0.565
60	372	0.560
70	354	0.531
80	362	0.545
90	346	0.520
100	323	0.482

### First Fade

Time (sec)	Force (N)	$\mu$	Temp (°C)
0	276	0.414	94
30	306	0.457	131
60	355	0.527	163
90	376	0.559	195
120	378	0.567	224
150	361	0.540	251
180	352	0.531	276
210			
240			
270			
300			
330			
360			
390			
420			
450			
480			
510			
540			
570			
600			

### Second Fade

Time (sec)	Force (N)	$\mu$	Temp (°C)
0	334	0.503	102
30	367	0.550	132
60	387	0.581	160
90	357	0.532	184
120	341	0.513	209
150	354	0.528	229
180	338	0.506	252
210	332	0.500	272
240	328	0.489	289
270	335	0.499	307
300	326	0.485	324
330	315	0.473	337
360			
390			
420			
450			
480			
510			
540			
570			
600			

### First Recovery

Event	Force (N)	$\mu$	Temp (°C)
1	367	0.552	269
2	378	0.568	211
3	355	0.534	157
4	341	0.510	104

### Second Recovery

Event	Force (N)	$\mu$	Temp (°C)
1	315	0.470	318
2	325	0.488	267
3	323	0.481	211
4	338	0.505	159
5	333	0.500	106



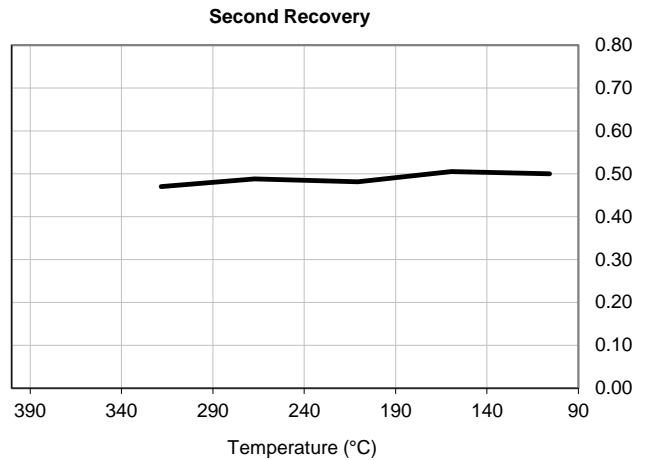
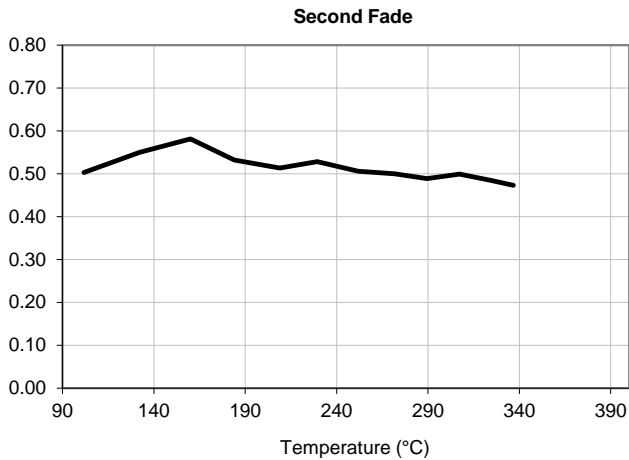
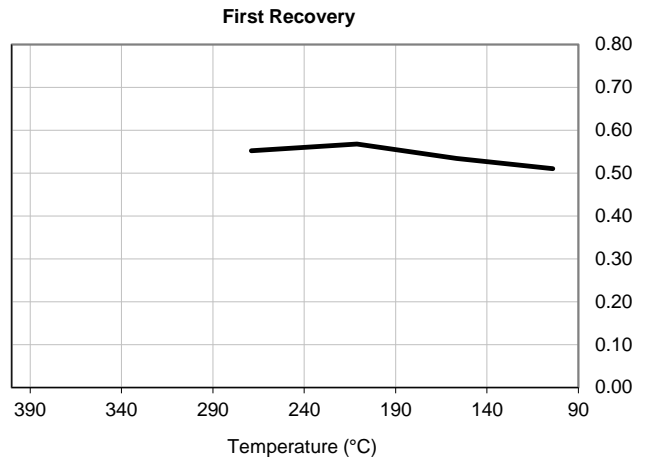
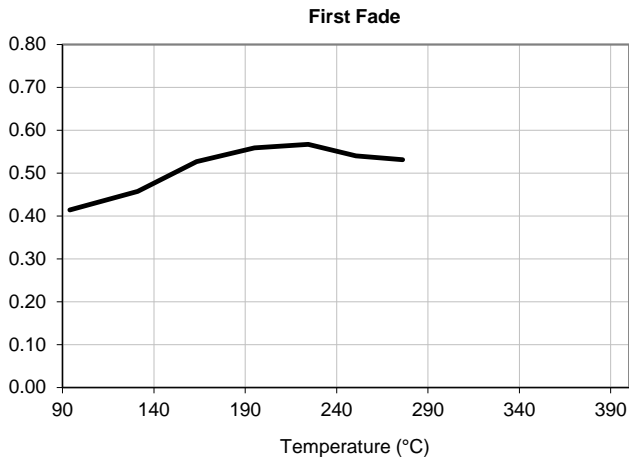
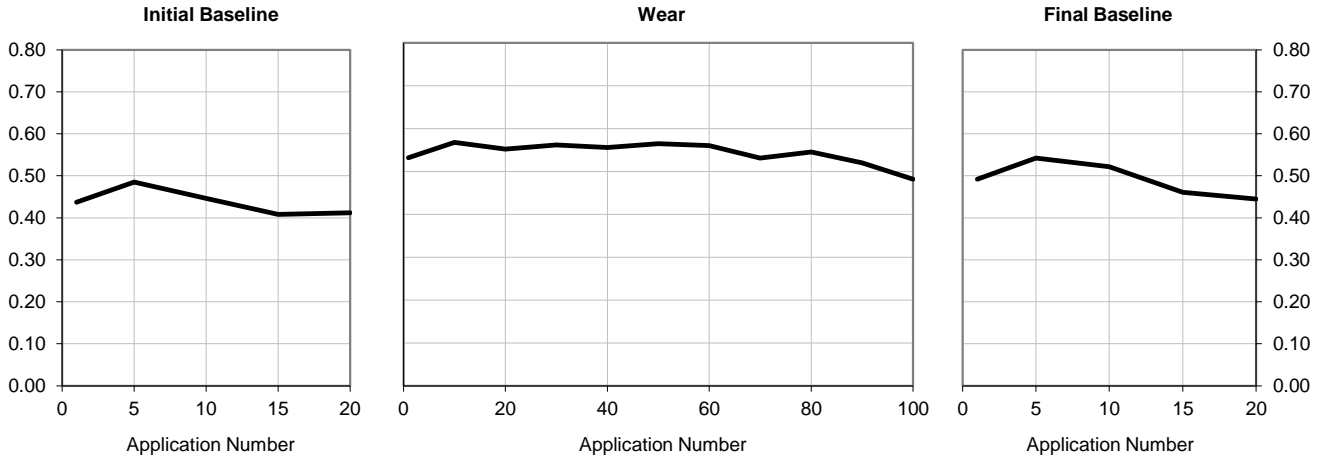
Test Number  
153500-1

Customer Reference  
HDX88805D GG

Manufacturer: HARDEX BRAKES CORP.  
Material: HDX88805D GG  
Test Pressure: 1034.21 kPa

8/6/2015  
153500-A3  
Sample 3 of 5

### Coefficient of Friction





Test Number  
153500-1

Customer Reference  
HDX88805D GG

Manufacturer: HARDEX BRAKES CORP.  
Material: HDX88805D GG  
Test Pressure: 1034.21 kPa

Normal  
  
Hot

**0.535**  
  
**0.498**

**G**  
  
**G**

8/6/2015  
153500-A4  
Sample 4 of 5

**Wear**

	Initial	Final	Loss	Loss / %	Specific Wear	
Weight (gr)	9.310	8.633	0.677	7%	3.14E-01	gr/kWh
Thickness (cm)	0.615	0.569	0.046	7%	1.38E-01	cm <sup>3</sup> /kWh

**Baseline**

Event	Initial		Final	
	Force (N)	$\mu$	Force (N)	$\mu$
1	307	0.459	331	0.496
5	349	0.520	347	0.518
10	354	0.531	339	0.507
15	343	0.513	308	0.461
20	317	0.473	311	0.464

**Wear**

Event	Force (N)	$\mu$
1	363	0.545
10	375	0.560
20	391	0.586
30	373	0.562
40	367	0.554
50	371	0.555
60	366	0.548
70	338	0.509
80	333	0.498
90	350	0.525
100	327	0.490

**First Fade**

Time (sec)	Force (N)	$\mu$	Temp (°C)
0	300	0.448	94
30	311	0.467	132
60	371	0.557	164
90	413	0.615	202
120	401	0.597	233
150	371	0.556	259
180	358	0.536	282
210			
240			
270			
300			
330			
360			
390			
420			
450			
480			
510			
540			
570			
600			

**Second Fade**

Time (sec)	Force (N)	$\mu$	Temp (°C)
0	331	0.497	97
30	369	0.551	137
60	377	0.566	164
90	351	0.527	190
120	333	0.499	210
150	315	0.476	232
180	337	0.507	251
210	326	0.492	271
240	312	0.467	289
270	327	0.489	304
300	312	0.466	322
330	317	0.475	337
360			
390			
420			
450			
480			
510			
540			
570			
600			

**First Recovery**

Event	Force (N)	$\mu$	Temp (°C)
1	390	0.586	266
2	388	0.583	213
3	375	0.559	162
4	353	0.530	104

**Second Recovery**

Event	Force (N)	$\mu$	Temp (°C)
1	311	0.464	320
2	319	0.476	268
3	321	0.481	211
4	321	0.482	160
5	337	0.509	105



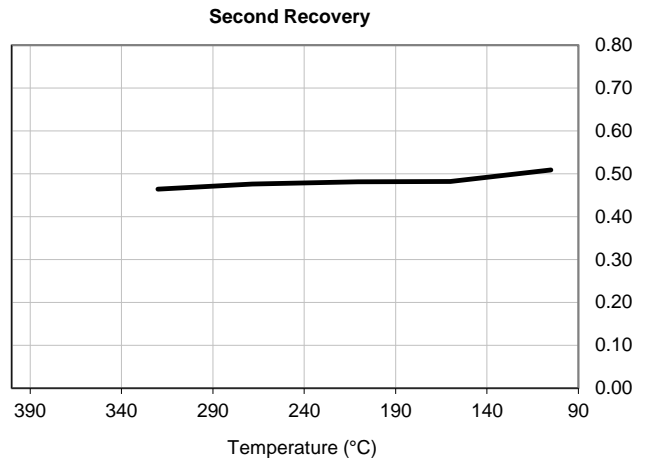
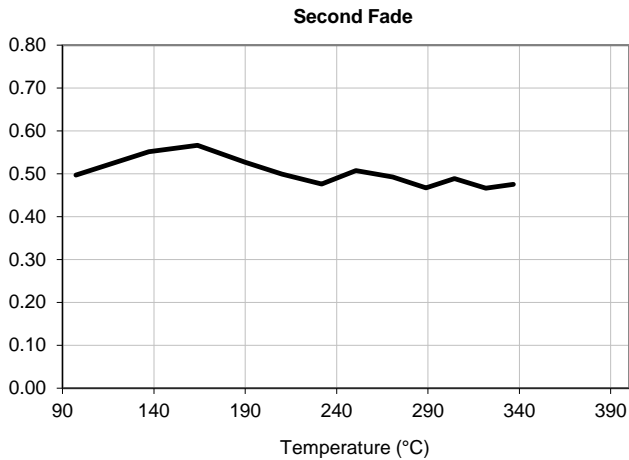
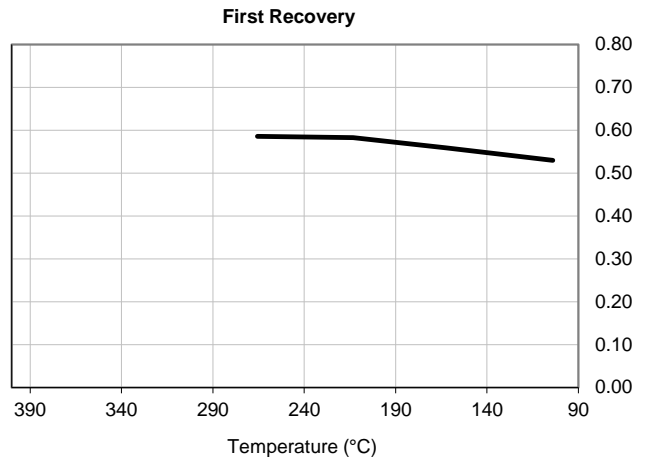
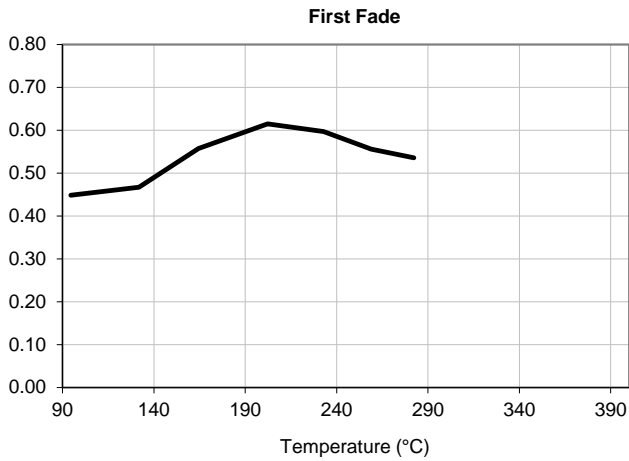
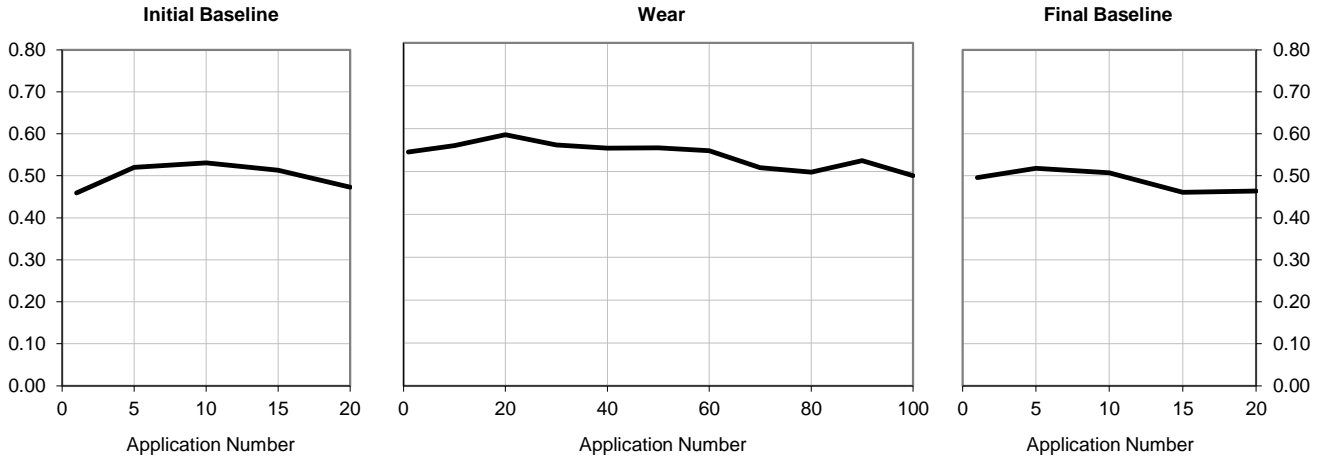
Test Number  
153500-1

Customer Reference  
HDX88805D GG

Manufacturer: HARDEX BRAKES CORP.  
Material: HDX88805D GG  
Test Pressure: 1034.21 kPa

8/6/2015  
153500-A4  
Sample 4 of 5

### Coefficient of Friction





Test Number  
153500-1

Customer Reference  
HDX88805D GG

Manufacturer: HARDEX BRAKES CORP.  
Material: HDX88805D GG  
Test Pressure: 1034.21 kPa

Normal **0.541** **G**  
Hot **0.507** **G**

8/7/2015  
153500-A5  
Sample 5 of 5

**Wear**

	Initial	Final	Loss	Loss / %	Specific Wear	
Weight (gr)	8.999	8.191	0.808	9%	3.65E-01	gr/kWh
Thickness (cm)	0.610	0.556	0.054	9%	1.57E-01	cm <sup>3</sup> /kWh

**Baseline**

Event	Initial		Final	
	Force (N)	$\mu$	Force (N)	$\mu$
1	272	0.410	327	0.491
5	299	0.446	320	0.477
10	317	0.476	303	0.453
15	302	0.453	301	0.451
20	283	0.423	310	0.464

**Wear**

Event	Force (N)	$\mu$
1	365	0.543
10	388	0.584
20	388	0.581
30	375	0.561
40	384	0.575
50	382	0.572
60	380	0.569
70	375	0.562
80	377	0.564
90	375	0.562
100	382	0.570

**First Fade**

Time (sec)	Force (N)	$\mu$	Temp (°C)
0	278	0.415	94
30	310	0.460	131
60	344	0.516	163
90	387	0.582	198
120	384	0.576	231
150	363	0.546	255
180	358	0.540	281
210			
240			
270			
300			
330			
360			
390			
420			
450			
480			
510			
540			
570			
600			

**Second Fade**

Time (sec)	Force (N)	$\mu$	Temp (°C)
0	327	0.489	99
30	368	0.552	131
60	377	0.565	161
90	357	0.538	183
120	363	0.544	208
150	359	0.539	228
180	345	0.517	249
210	350	0.523	270
240	340	0.510	291
270	338	0.507	306
300	308	0.464	326
330	306	0.457	335
360			
390			
420			
450			
480			
510			
540			
570			
600			

**First Recovery**

Event	Force (N)	$\mu$	Temp (°C)
1	371	0.559	264
2	376	0.565	211
3	358	0.534	156
4	342	0.511	103

**Second Recovery**

Event	Force (N)	$\mu$	Temp (°C)
1	312	0.469	321
2	331	0.498	263
3	322	0.485	213
4	329	0.491	158
5	318	0.474	103



Test Number  
153500-1

Customer Reference  
HDX88805D GG

Manufacturer: HARDEX BRAKES CORP.  
Material: HDX88805D GG  
Test Pressure: 1034.21 kPa

8/7/2015  
153500-A5  
Sample 5 of 5

### Coefficient of Friction

