



Sample Lab Test Report

Link Test Report: 143947-3
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: ECX888Y0341
Test Date(s): 9/11/2014 to 9/12/2014

Requested By

HARDEX BRAKES LTD
DELLA DIBADJ
200-1311 HOWE STREET
VANCOUVER, BC V6Z 2P3
CANADA

Tested By:

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



Test Number
143947-3

Customer Reference
ECX888Y0341

SAE J661 Rev Feb 1997 Brake Lining Quality Test

Test Information

Customer Name	Hardex Brakes Ltd
Requestor	Della Dibadj
Test Procedure	SAE J661
Program Number	J661noinsp.chp
Test Coordinator	Timothy Coleman
Test Equipment	Chase Machine 12
Test Dates	9/11/2014 to 9/12/2014
Datalogger	v1.0.10
Template Version	2.06

Setup Details

Sample Material	ECX888Y0341
Sample Size	25.4mm x 25.4mm
Sample Manufacturer	Hardex Brakes Ltd
Test Pressure	1034.21 kPa

Sample Test Summary

Normal Friction Coefficient	0.427	Pass
Normal Friction Class	F	
Hot Friction Coefficient	0.386	Pass
Hot Friction Class	F	
Minimum Bold Coefficient	0.320	Pass
Max Variation Below Avg for Bold readings	0.044	Pass
Max % Variation for Bold Readings	7%	Pass

Pass / Fail

Pass

Comments:

Created by: Timothy Coleman **Title** Lead Technician **Date** 9/17/2014
(313) 625-4000

Reviewed by: Timothy Coleman **Title** Lead Technician **Date** 9/17/2014
(313) 625-4000

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
143947-3

Customer Reference
ECX888Y0341

Test Number				
Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
143947-C1	143947-C2	143947-C3	143947-C4	143947-C5

Manufacturer
HARDEX BRAKES

Initial Baseline					
Application	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
1	0.329	0.354	0.367	0.335	0.364
20	0.335	0.367	0.394	0.352	0.376

Material
ECX888Y0341

Normal **0.427** **F**

First Fade					
Temp (°C)	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
93.3	0.328	0.360	0.368	0.347	0.348
260.0	0.426	0.441	0.439	0.451	0.444

(or Temp @ 10min)

Hot **0.386** **F**

First Recovery							Norm/Hot
Temp (°C)	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Average	
260.0	0.425	0.409	0.468	0.454	0.401	0.431	
204.4	0.440	0.455	0.480	0.478	0.451	0.461	Hot
148.9	0.440	0.447	0.475	0.470	0.436	0.454	Hot
93.3	0.411	0.413	0.441	0.436	0.416	0.423	

Wear					
Application	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
1	0.444	0.446	0.458	0.456	0.471
100	0.404	0.424	0.432	0.445	0.421

Second Fade							Max Var.		
Temp (°C)	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Average	< Average	Norm/Hot	% Var
93.3	0.408	0.395	0.385	0.393	0.388	0.394	0.009	Normal	2%
121.1	0.436	0.451	0.437	0.460	0.435	0.444	0.009	Normal	2%
148.9	0.438	0.427	0.435	0.456	0.434	0.438	0.011	Normal	3%
176.7	0.443	0.428	0.435	0.443	0.419	0.434	0.015	-	3%
204.4	0.443	0.404	0.421	0.449	0.446	0.433	0.029	Normal	7%
232.2	0.410	0.431	0.432	0.439	0.425	0.427	0.017	Hot	4%
260.0	0.411	0.415	0.421	0.440	0.390	0.415	0.025	Hot	6%
287.8	0.369	0.361	0.406	0.408	0.369	0.383	0.022	Hot	6%
315.6	0.339	0.341	0.342	0.350	0.310	0.336	0.026	Hot	8%
343.3	0.313	0.306	0.319	0.332	0.312	0.316	0.010	Hot	3%

(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	0.320	0.283	0.299	0.354	0.316	0.314	0.031	-	
260.0	0.325	0.330	0.333	0.407	0.335	0.346	0.021	Hot	
204.4	0.326	0.347	0.334	0.424	0.336	0.353	0.027	Hot	
148.9	0.338	0.378	0.358	0.440	0.327	0.368	0.041	Hot	
93.3	0.325	0.388	0.365	0.424	0.320	0.364	0.044	-	

Final Baseline					
Application	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
1	0.317	0.375	0.361	0.404	0.329
20	0.358	0.364	0.408	0.446	0.292



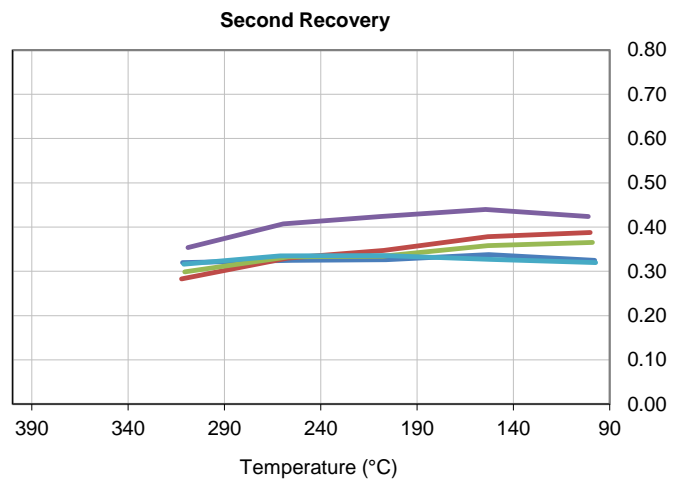
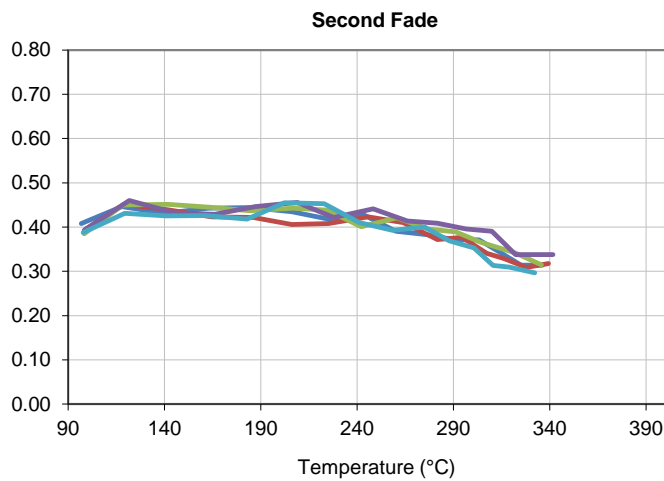
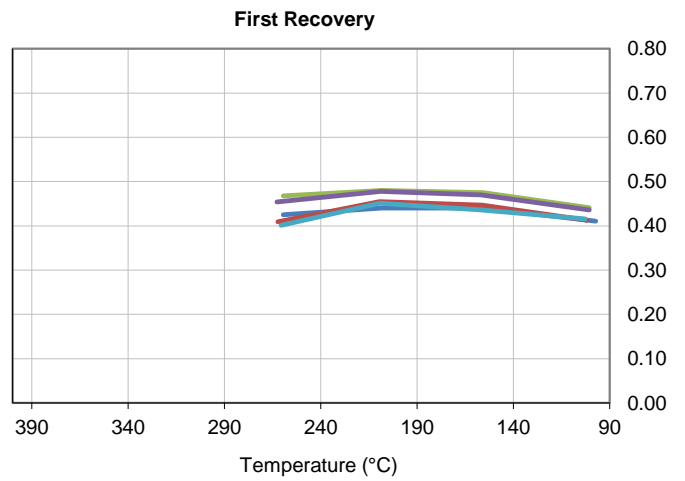
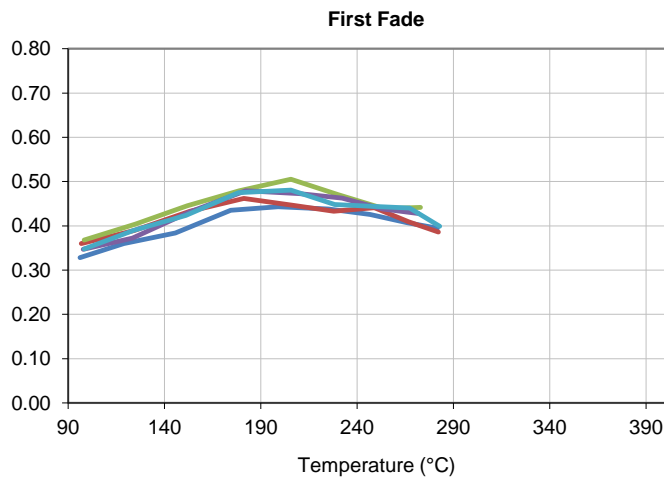
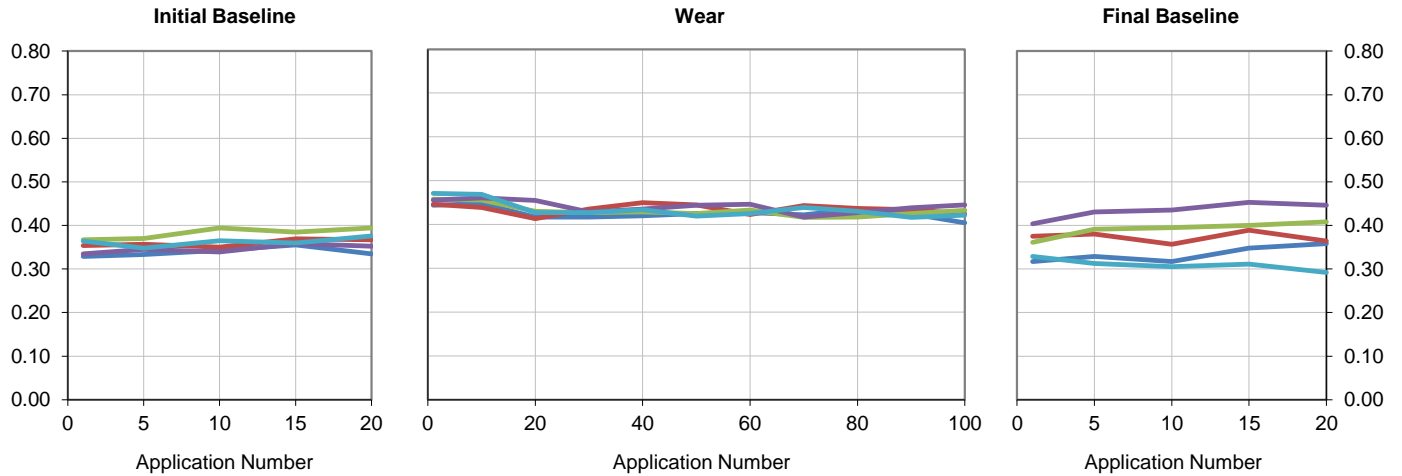
Test Number
143947-3

Customer Reference
ECX888Y0341

Manufacturer: HARDEX BRAKES LTD
Material: ECX888Y0341
Test Pressure: 1034.21 kPa

9/11/2014 to 9/12/2014
Summary of 5 Samples

Coefficient of Friction





Test Number
143947-3

Customer Reference
ECX888Y0341

Manufacturer: HARDEX BRAKES
Material: ECX888Y0341
Test Pressure: 1034.21 kPa

Normal **0.431** **F**
Hot **0.371** **F**

9/11/2014
143947-C1
Sample 1 of 5

Wear

	Initial	Final	Loss		Specific Wear	
Weight (gr)	7.945	7.515	0.43	5%	2.49E-01	gr/kWh
Thickness (cm)	0.627	0.594	0.033	5%	1.23E-01	cm ³ /kWh

Baseline

Event	Initial		Final	
	Force (N)	μ	Force (N)	μ
1	218	0.329	211	0.317
5	225	0.333	220	0.329
10	229	0.343	212	0.317
15	237	0.355	231	0.348
20	225	0.335	238	0.358

Wear

Event	Force (N)	μ
1	296	0.444
10	301	0.448
20	278	0.417
30	279	0.417
40	282	0.420
50	283	0.425
60	286	0.427
70	282	0.422
80	291	0.435
90	283	0.424
100	270	0.404

First Fade

Time (sec)	Force (N)	μ	Temp (°C)
0	219	0.328	96
30	239	0.360	119
60	258	0.384	146
90	291	0.435	174
120	296	0.443	199
150	295	0.438	225
180	286	0.426	247
210	270	0.407	266
240	263	0.395	282
270			
300			
330			
360			
390			
420			
450			
480			
510			
540			
570			
600			

Second Fade

Time (sec)	Force (N)	μ	Temp (°C)
0	271	0.408	97
30	297	0.446	118
60	288	0.431	140
90	296	0.443	163
120	299	0.444	184
150	291	0.435	206
180	278	0.418	225
210	286	0.429	243
240	260	0.391	260
270	256	0.383	277
300	246	0.371	291
330	247	0.371	303
360	226	0.339	316
390	209	0.314	325
420	210	0.314	336
450			
480			
510			
540			
570			
600			

First Recovery

Event	Force (N)	μ	Temp (°C)
1	283	0.425	259
2	293	0.440	208
3	295	0.440	156
4	272	0.411	97

Second Recovery

Event	Force (N)	μ	Temp (°C)
1	213	0.320	312
2	217	0.325	255
3	216	0.326	206
4	226	0.338	153
5	216	0.325	98



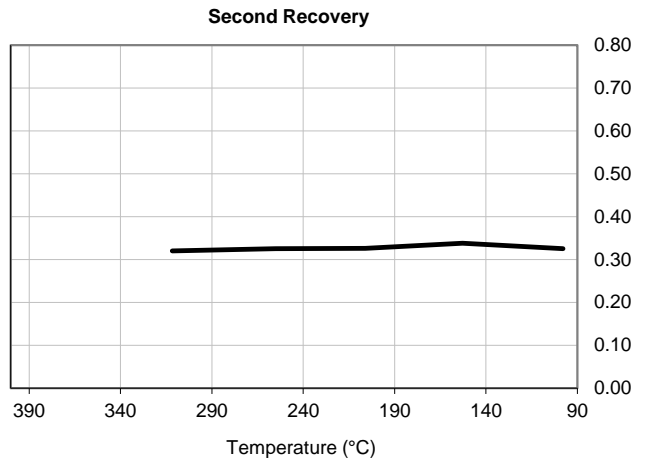
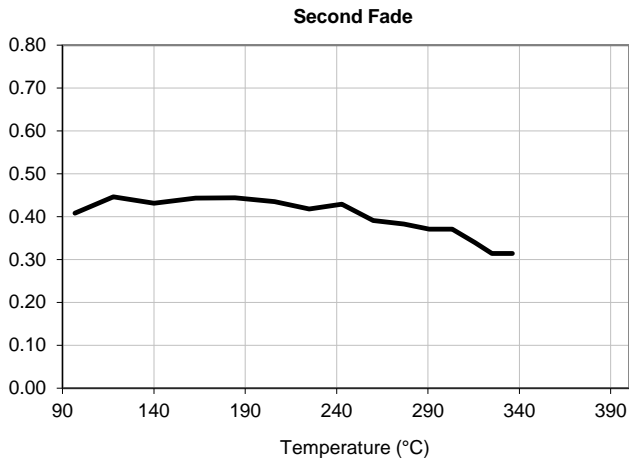
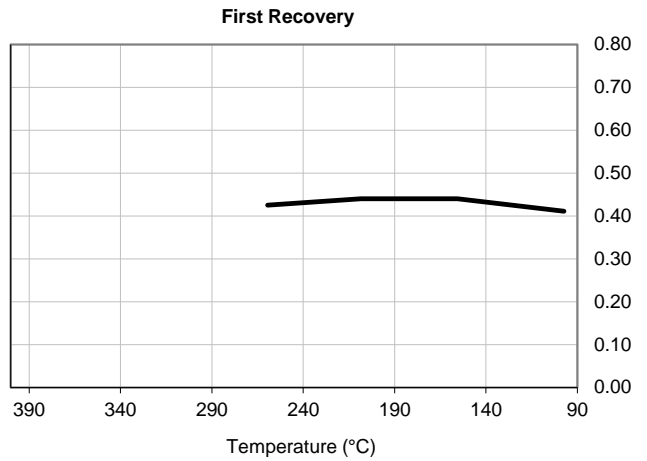
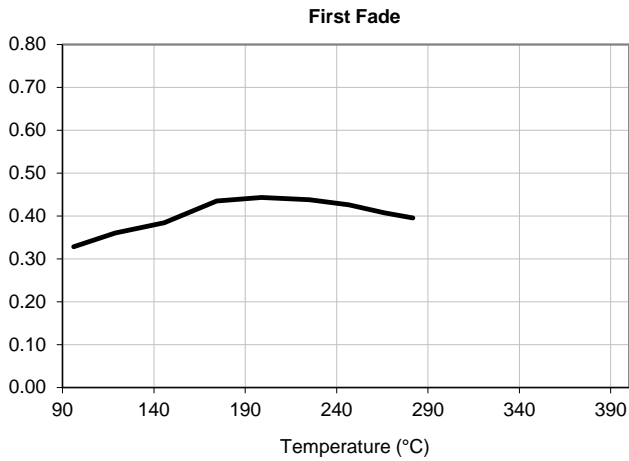
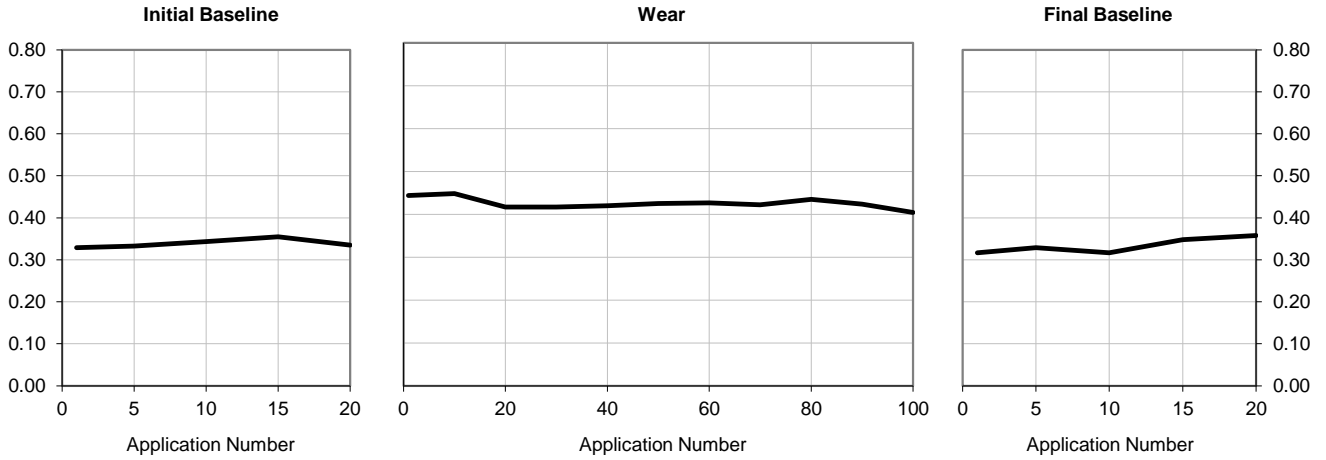
Test Number
143947-3

Customer Reference
ECX888Y0341

Manufacturer: HARDEX BRAKES
Material: ECX888Y0341
Test Pressure: 1034.21 kPa

9/11/2014
143947-C1
Sample 1 of 5

Coefficient of Friction





Test Number
143947-3

Customer Reference
ECX888Y0341

Manufacturer: HARDEX BRAKES
Material: ECX888Y0341
Test Pressure: 1034.21 kPa

Normal **0.419** **F**
Hot **0.381** **F**

9/12/2014
143947-C2
Sample 2 of 5

Wear

	Initial	Final	Loss		Specific Wear	
Weight (gr)	8.127	7.69	0.437	5%	2.48E-01	gr/kWh
Thickness (cm)	0.632	0.597	0.035	6%	1.28E-01	cm ³ /kWh

Baseline

Event	Initial		Final	
	Force (N)	μ	Force (N)	μ
1	236	0.354	250	0.375
5	238	0.357	255	0.380
10	233	0.350	237	0.357
15	245	0.369	258	0.389
20	244	0.367	243	0.364

Wear

Event	Force (N)	μ
1	298	0.446
10	295	0.439
20	275	0.413
30	289	0.435
40	300	0.450
50	298	0.445
60	281	0.423
70	297	0.443
80	295	0.437
90	291	0.434
100	283	0.424

First Fade

Time (sec)	Force (N)	μ	Temp (°C)
0	239	0.360	97
30	261	0.390	124
60	288	0.433	153
90	307	0.462	181
120	297	0.447	206
150	291	0.433	228
180	294	0.441	249
210	274	0.409	267
240	258	0.386	282
270			
300			
330			
360			
390			
420			
450			
480			
510			
540			
570			
600			

Second Fade

Time (sec)	Force (N)	μ	Temp (°C)
0	263	0.395	99
30	302	0.451	119
60	292	0.439	142
90	282	0.423	164
120	282	0.422	186
150	271	0.406	206
180	273	0.408	225
210	281	0.423	246
240	274	0.410	264
270	249	0.372	282
300	253	0.377	294
330	228	0.341	307
360	219	0.329	316
390	206	0.309	328
420	214	0.318	339
450			
480			
510			
540			
570			
600			

First Recovery

Event	Force (N)	μ	Temp (°C)
1	273	0.409	262
2	304	0.455	209
3	298	0.447	156
4	277	0.413	102

Second Recovery

Event	Force (N)	μ	Temp (°C)
1	191	0.283	312
2	221	0.330	257
3	231	0.347	207
4	251	0.378	153
5	257	0.388	100



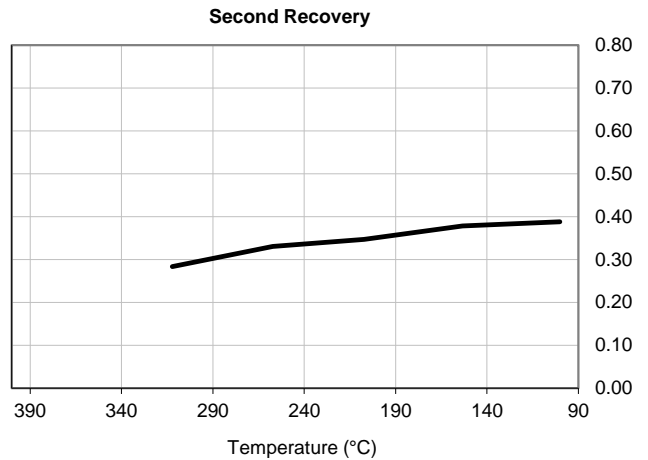
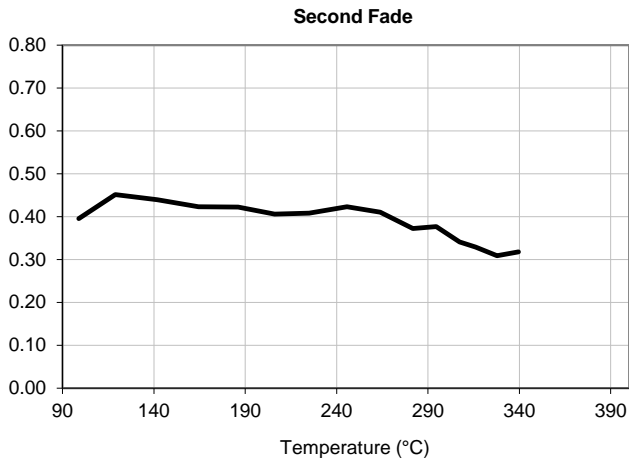
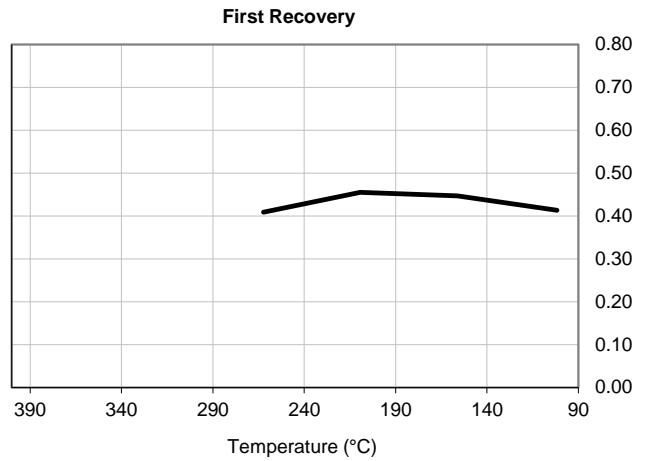
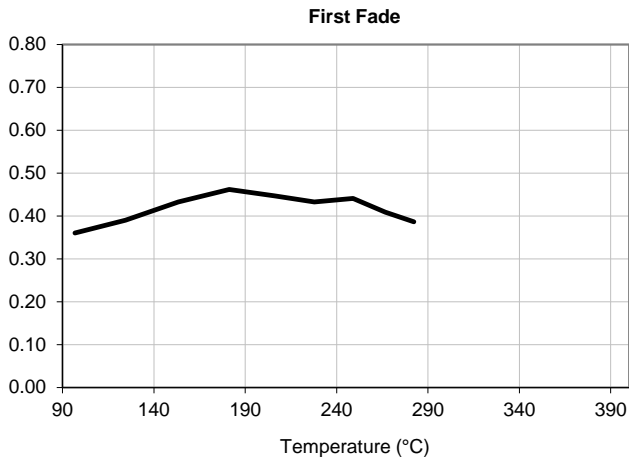
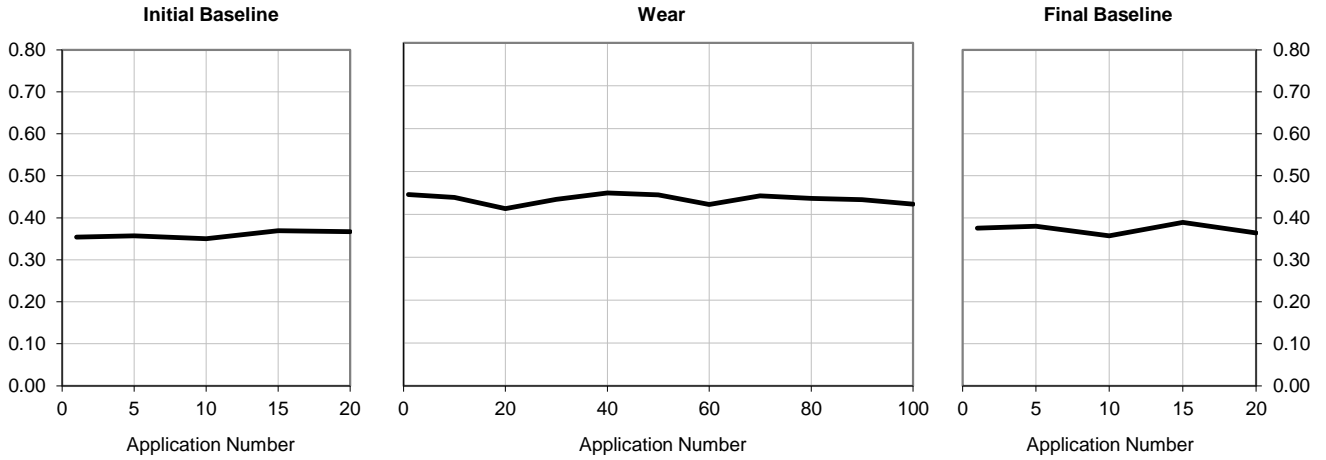
Test Number
143947-3

Customer Reference
ECX888Y0341

Manufacturer: HARDEX BRAKES
Material: ECX888Y0341
Test Pressure: 1034.21 kPa

9/12/2014
143947-C2
Sample 2 of 5

Coefficient of Friction





Test Number
143947-3

Customer Reference
ECX888Y0341

Manufacturer: HARDEX BRAKES
Material: ECX888Y0341
Test Pressure: 1034.21 kPa

Normal **0.420** **F**
Hot **0.390** **F**

9/12/2014
143947-C3
Sample 3 of 5

Wear

	Initial	Final	Loss		Specific Wear	
Weight (gr)	7.964	7.519	0.445	6%	2.50E-01	gr/kWh
Thickness (cm)	0.625	0.589	0.036	6%	1.30E-01	cm ³ /kWh

Baseline

Event	Initial		Final	
	Force (N)	μ	Force (N)	μ
1	245	0.367	241	0.361
5	247	0.370	262	0.391
10	263	0.394	265	0.395
15	258	0.385	266	0.400
20	263	0.394	272	0.408

Wear

Event	Force (N)	μ
1	308	0.458
10	304	0.456
20	288	0.430
30	285	0.427
40	285	0.429
50	284	0.425
60	291	0.433
70	278	0.416
80	277	0.417
90	284	0.425
100	289	0.432

First Fade

Time (sec)	Force (N)	μ	Temp (°C)
0	244	0.368	98
30	270	0.404	125
60	297	0.445	152
90	321	0.479	179
120	338	0.505	206
150	315	0.471	230
180	293	0.439	254
210	295	0.442	273
240			
270			
300			
330			
360			
390			
420			
450			
480			
510			
540			
570			
600			

Second Fade

Time (sec)	Force (N)	μ	Temp (°C)
0	258	0.385	98
30	301	0.450	118
60	302	0.451	142
90	296	0.445	163
120	294	0.437	184
150	295	0.443	207
180	291	0.438	224
210	269	0.401	242
240	280	0.421	261
270	265	0.396	277
300	260	0.389	291
330	245	0.366	304
360	229	0.342	322
390	211	0.315	336
420			
450			
480			
510			
540			
570			
600			

First Recovery

Event	Force (N)	μ	Temp (°C)
1	313	0.468	259
2	319	0.480	208
3	317	0.475	156
4	294	0.441	101

Second Recovery

Event	Force (N)	μ	Temp (°C)
1	200	0.299	311
2	223	0.333	257
3	224	0.334	208
4	238	0.358	153
5	245	0.365	99



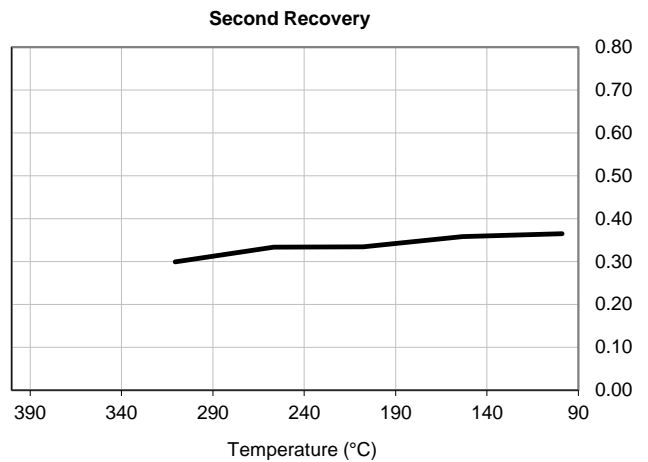
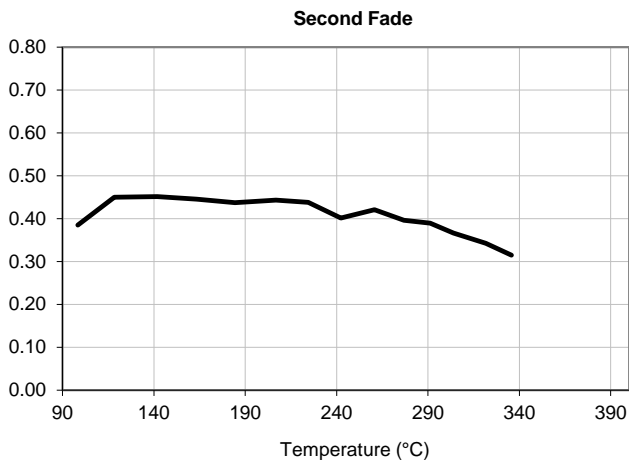
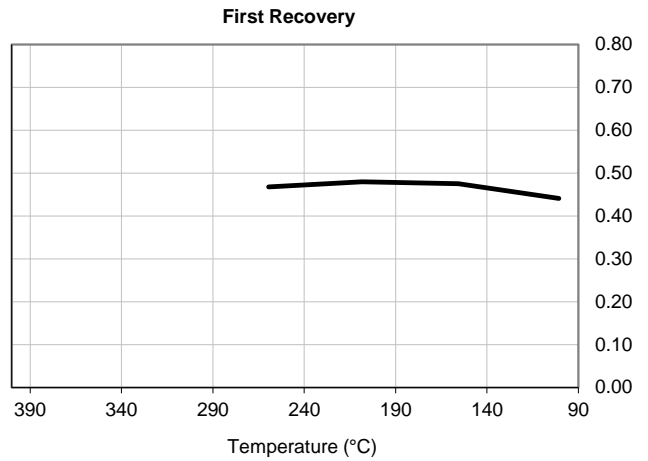
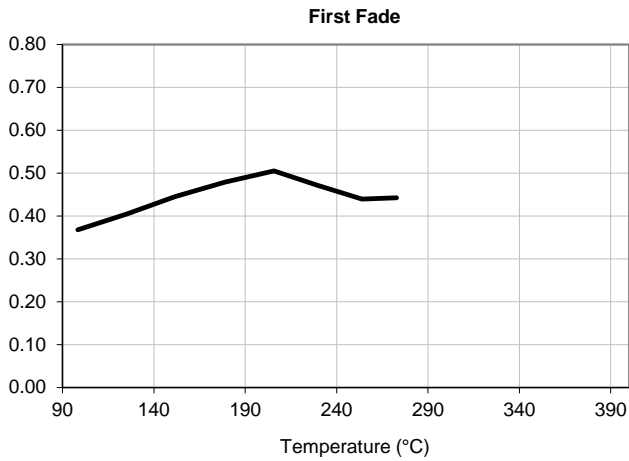
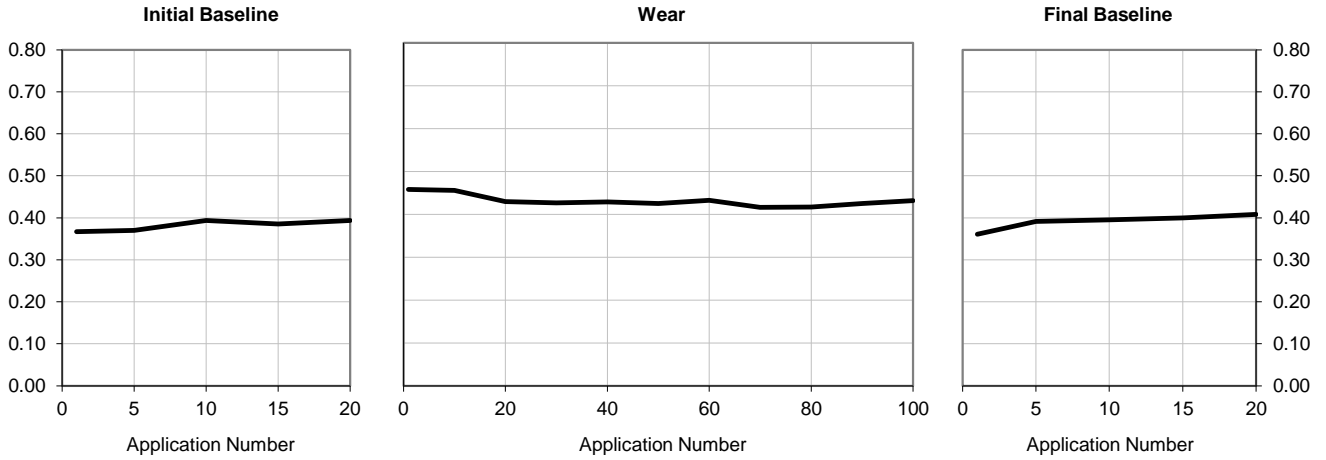
Test Number
143947-3

Customer Reference
ECX888Y0341

Manufacturer: HARDEX BRAKES
Material: ECX888Y0341
Test Pressure: 1034.21 kPa

9/12/2014
143947-C3
Sample 3 of 5

Coefficient of Friction





Test Number
143947-3

Customer Reference
ECX888Y0341

Manufacturer: HARDEX BRAKES
Material: ECX888Y0341
Test Pressure: 1034.21 kPa

Normal **0.440** **F**
Hot **0.419** **F**

9/12/2014
143947-C4
Sample 4 of 5

Wear

	Initial	Final	Loss		Specific Wear	
Weight (gr)	7.958	7.471	0.487	6%	2.70E-01	gr/kWh
Thickness (cm)	0.635	0.592	0.043	7%	1.54E-01	cm ³ /kWh

Baseline

Event	Initial		Final	
	Force (N)	μ	Force (N)	μ
1	225	0.335	269	0.404
5	230	0.345	287	0.431
10	227	0.339	291	0.435
15	238	0.358	302	0.453
20	234	0.352	298	0.446

Wear

Event	Force (N)	μ
1	302	0.456
10	309	0.461
20	305	0.455
30	287	0.429
40	289	0.435
50	295	0.444
60	299	0.446
70	278	0.417
80	285	0.427
90	292	0.438
100	296	0.445

First Fade

Time (sec)	Force (N)	μ	Temp (°C)
0	231	0.347	98
30	248	0.372	123
60	287	0.431	153
90	320	0.479	182
120	317	0.473	210
150	307	0.463	232
180	293	0.438	253
210	285	0.428	272
240			
270			
300			
330			
360			
390			
420			
450			
480			
510			
540			
570			
600			

Second Fade

Time (sec)	Force (N)	μ	Temp (°C)
0	262	0.393	98
30	310	0.460	122
60	289	0.432	146
90	286	0.429	166
120	299	0.446	187
150	303	0.456	209
180	284	0.422	228
210	291	0.441	248
240	275	0.414	266
270	275	0.409	282
300	265	0.396	297
330	259	0.391	310
360	226	0.338	322
390	226	0.338	342
420			
450			
480			
510			
540			
570			
600			

First Recovery

Event	Force (N)	μ	Temp (°C)
1	303	0.454	263
2	318	0.478	209
3	313	0.470	157
4	293	0.436	101

Second Recovery

Event	Force (N)	μ	Temp (°C)
1	236	0.354	309
2	271	0.407	259
3	283	0.424	209
4	294	0.440	154
5	284	0.424	101



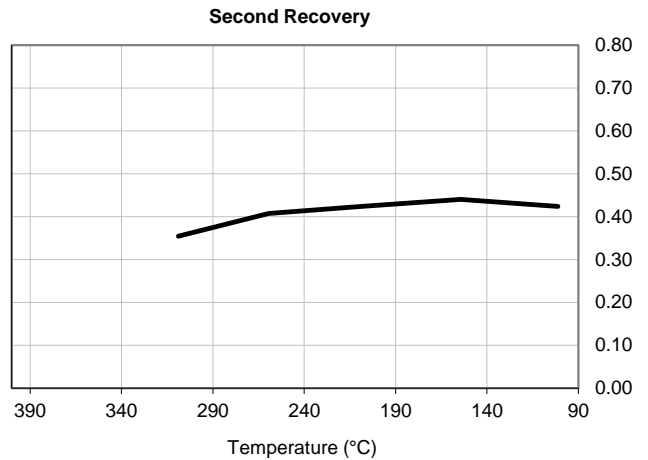
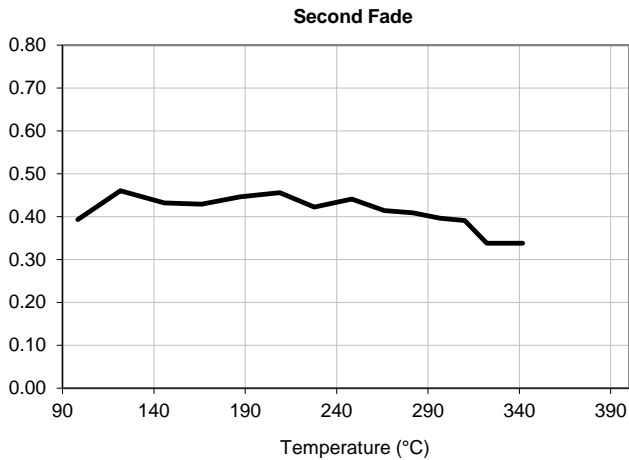
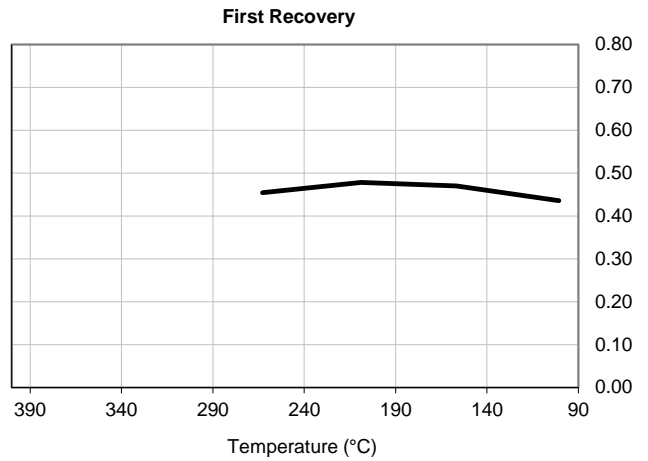
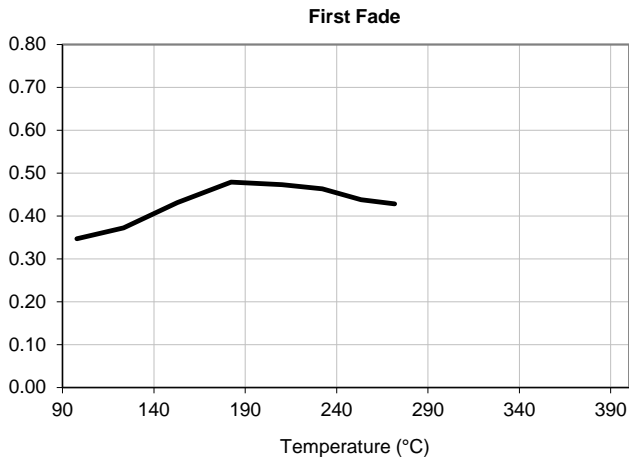
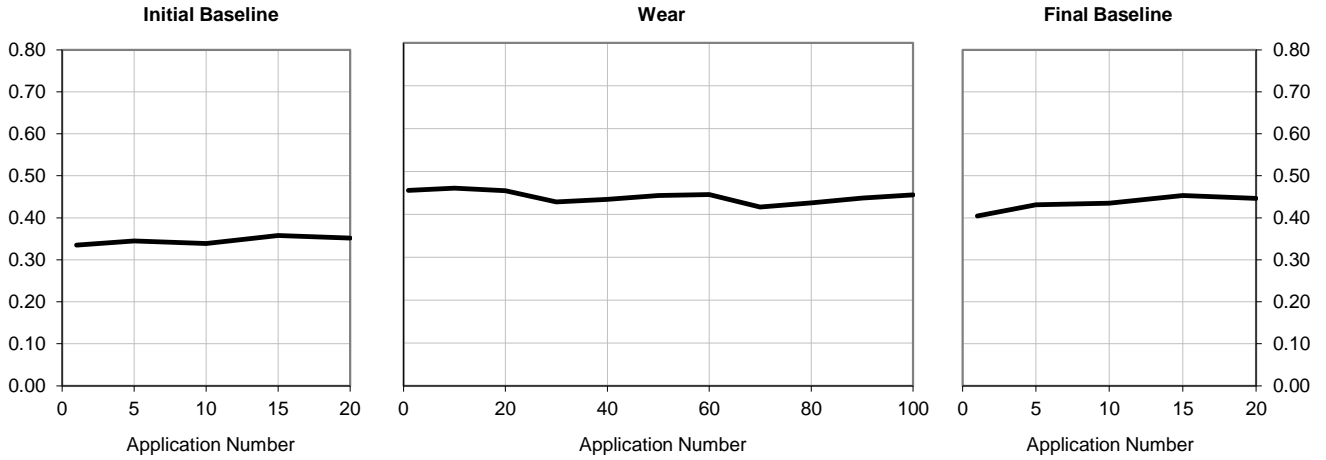
Test Number
143947-3

Customer Reference
ECX888Y0341

Manufacturer: HARDEX BRAKES
Material: ECX888Y0341
Test Pressure: 1034.21 kPa

9/12/2014
143947-C4
Sample 4 of 5

Coefficient of Friction





Test Number
143947-3

Customer Reference
ECX888Y0341

Manufacturer: HARDEX BRAKES
Material: ECX888Y0341
Test Pressure: 1034.21 kPa

Normal **0.426** **F**
Hot **0.369** **F**

9/12/2014
143947-C5
Sample 5 of 5

Wear

	Initial	Final	Loss	Specific Wear
Weight (gr)	7.963	7.511	0.452 6%	2.59E-01 gr/kWh
Thickness (cm)	0.63	0.594	0.036 6%	1.33E-01 cm ³ /kWh

Baseline

Event	Initial		Final	
	Force (N)	μ	Force (N)	μ
1	243	0.364	220	0.329
5	233	0.348	209	0.313
10	243	0.365	203	0.305
15	240	0.360	207	0.311
20	250	0.376	196	0.292

Wear

Event	Force (N)	μ
1	312	0.471
10	314	0.469
20	284	0.427
30	286	0.427
40	288	0.434
50	281	0.419
60	284	0.425
70	292	0.439
80	287	0.430
90	278	0.416
100	280	0.421

First Fade

Time (sec)	Force (N)	μ	Temp (°C)
0	233	0.348	98
30	259	0.390	124
60	283	0.424	151
90	315	0.475	178
120	325	0.481	206
150	300	0.448	228
180	294	0.444	249
210	293	0.440	267
240	267	0.399	283
270			
300			
330			
360			
390			
420			
450			
480			
510			
540			
570			
600			

Second Fade

Time (sec)	Force (N)	μ	Temp (°C)
0	258	0.388	98
30	287	0.431	119
60	282	0.425	141
90	285	0.426	161
120	279	0.418	183
150	305	0.455	202
180	301	0.453	223
210	275	0.410	241
240	262	0.393	258
270	267	0.400	275
300	248	0.369	288
330	236	0.353	301
360	208	0.313	311
390	206	0.310	319
420	200	0.297	332
450			
480			
510			
540			
570			
600			

First Recovery

Event	Force (N)	μ	Temp (°C)
1	268	0.401	261
2	303	0.451	209
3	290	0.436	157
4	279	0.416	103

Second Recovery

Event	Force (N)	μ	Temp (°C)
1	210	0.316	311
2	222	0.335	261
3	225	0.336	207
4	218	0.327	152
5	214	0.320	97



Test Number
143947-3

Customer Reference
ECX888Y0341

Manufacturer: HARDEX BRAKES
Material: ECX888Y0341
Test Pressure: 1034.21 kPa

9/12/2014
143947-C5
Sample 5 of 5

Coefficient of Friction

