



## Physical Properties Test Report

**Link Test Report:** 230368-01  
**Test Description:** SAE J661-2012  
**Purpose of Test:** To Evaluate the Characteristics of Brake Materials  
**Material Identification:** RZZW ZWA  
**Test Date:** 07/13/2023 - 07/14/2023

### Requested By

**Rizhao Zhongwei Automobile Part Co., Ltd.  
Han Songhua**

### Tested By

**Testing Coordination and Facility**  
**Link Transportation Testing Technology (Shanghai) Co., Ltd**  
**Building No.2, 778 Zhao Xian Road, Jiading District, Shanghai**  
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### SAE J661-2012

#### Test Information

Customer Name	Rizhao Zhongwei Automobile Part Co., Ltd.
Requestor	Han Songhua
Program Number	J661noinsp.chp
Test Coordinator	Bunny Lu
Test Equipment	Chase Machine
Test Dates	07/13/2023 - 07/14/2023
Datalogger	v1.0.23
Template Version	1.79

#### Setup Details

Sample Material	RZZW ZWA
Sample Size	1 inch x 1 inch
Sample Manufacturer	Rizhao Zhongwei Automobile Part Co., Ltd.
Test Pressure	150.0 psi

#### Sample Test Summary

Normal Friction Coefficient	0.387	Pass
Normal Friction Class	F	
Hot Friction Coefficient	0.345	Pass
Hot Friction Class	E	
Minimum Bold Coefficient	0.332	Pass
Max Variation Below Average for Bold Readings	0.0264	Pass
Max % Variation for Bold Readings	7.37%	Pass

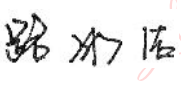
**Pass / Fail**

**Pass**

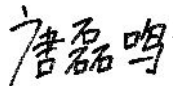
#### Comments:

N/A

**Created by:** Bunny Lu

**Signature:**  2023.07.17 14:32:38 +08'00' **Date** **7/17/2023**

**Reviewed by:** Duel Tang

**Signature:**  2023.07.18 16:36:07 +08'00' **Date** **7/17/2023**

Issue Date: 07/17/2023



**Test Number**

Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
230368-01-A	230368-01-B	230368-01-C	230368-01-D	230368-01-E

Manufacturer:  
**Rizhao Zhongwei  
Automobile Part Co., Ltd.**  
Material:  
**RZZW ZWA**

**Initial Baseline**

Application	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
1	0.283	0.250	0.250	0.233	0.288
20	0.331	0.293	0.275	0.293	0.339

Normal      **0.387**      **F**

**First Fade**

Temp (°F)	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
200.0	0.315	0.285	0.270	0.285	0.317
550.0	0.344	0.335	0.268	0.292	0.345

(or Temp @ 10min)

Hot      **0.345**      **E**

**First Recovery**

Temp (°F)	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Average
500.0	0.310	0.334	0.274	0.293	0.323	0.307
400.0	0.312	0.325	0.281	0.291	0.310	0.304
300.0	0.325	0.337	0.290	0.301	0.311	0.313
200.0	0.327	0.343	0.287	0.294	0.328	0.316

Norm/Hot

Hot

Hot

**Wear**

Application	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
1	0.346	0.353	0.312	0.304	0.334
100	0.403	0.394	0.360	0.382	0.406

**Second Fade**

Temp (°F)	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Average	Max Var. < Average	Norm/Hot	% Var
200.0	0.360	0.370	0.332	0.362	0.368	0.358	0.026	Normal	7%
250.0	0.390	0.395	0.367	0.407	0.403	0.392	0.025	Normal	6%
300.0	0.405	0.402	0.393	0.399	0.417	0.403	0.010	Normal	3%
350.0	0.416	0.402	0.389	0.402	0.406	0.403	0.014	-	3%
400.0	0.412	0.390	0.379	0.399	0.397	0.395	0.016	Normal	4%
450.0	0.394	0.386	0.360	0.372	0.392	0.381	0.021	Hot	5%
500.0	0.368	0.368	0.357	0.366	0.379	0.368	0.011	Hot	3%
550.0	0.370	0.361	0.345	0.370	0.372	0.364	0.019	Hot	5%
600.0	0.328	0.364	0.332	0.336	0.350	0.342	0.014	Hot	4%
650.0	0.329	0.348	0.315	0.307	0.342	0.328	0.021	Hot	6%

(or Temp @ 10min)

**Second Recovery**

Temp (°F)	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Average	Max Var. < Average	Norm/Hot	% Var
600.0	0.323	0.335	0.317	0.317	0.314	0.321	0.007	-	2%
500.0	0.340	0.348	0.339	0.338	0.329	0.339	0.010	Hot	3%
400.0	0.349	0.353	0.346	0.355	0.351	0.351	0.005	Hot	1%
300.0	0.353	0.372	0.341	0.368	0.355	0.358	0.017	Hot	5%
200.0	0.363	0.376	0.346	0.388	0.357	0.366	0.020	-	5%

**Final Baseline**

Application	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
1	0.358	0.384	0.366	0.388	0.369
20	0.418	0.409	0.408	0.414	0.403

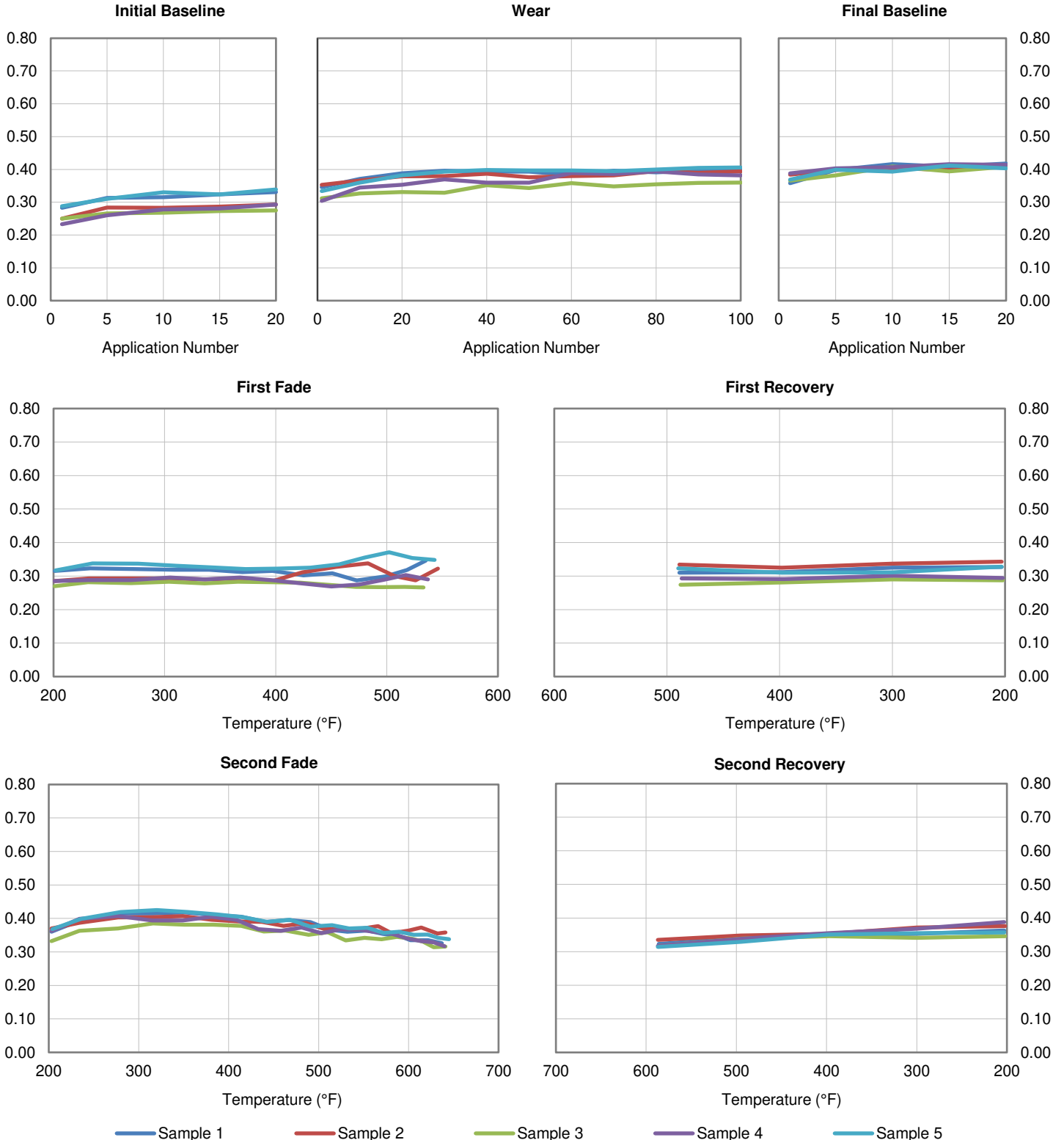


Manufacturer: Rizhao Zhongwei Automobile Part Co., Ltd.  
Material: RZZW ZWA  
Test Pressure: 150.0 psi

Test Dates: 07/13/2023 - 07/14/2023

**Summary of 5 Samples**

**Coefficient of Friction**





Normal **0.392**  
Hot **0.347**

**F**  
**E**

7/13/2023  
230368-01-A  
Sample 1 of 5

**Wear**

	Initial	Final	Loss	Loss / %
Weight (gr)	10.010	9.860	0.150	1.50
Thickness (inch)	0.239	0.236	0.003	1.26

**Baseline**

Event	Initial		Final	
	Force (lb)	$\mu$	Force (lb)	$\mu$
1	42.2	0.283	54.4	0.358
5	47.5	0.313	60.5	0.398
10	48.2	0.315	62.3	0.416
15	48.9	0.324	61.3	0.408
20	50.2	0.331	63.3	0.418

**Wear**

Event	Force (lb)	$\mu$
1	52.2	0.346
10	55.7	0.371
20	58.3	0.388
30	60.0	0.396
40	58.9	0.393
50	58.9	0.393
60	58.3	0.383
70	59.9	0.396
80	58.9	0.391
90	59.3	0.396
100	60.4	0.403

**First Fade**

Time (sec)	Force (lb)	$\mu$	Temp (°F)
0.0	48.1	0.315	201
30.0	48.4	0.323	233
60.0	48.3	0.321	273
90.0	47.7	0.319	309
120.0	47.8	0.319	340
150.0	46.8	0.312	370
180.0	47.2	0.315	397
210.0	45.2	0.302	425
240.0	45.8	0.308	451
270.0	43.6	0.287	473
300.0	45.3	0.299	499
330.0	48.2	0.318	518
360.0	51.0	0.346	535

**Second Fade**

Time (sec)	Force (lb)	$\mu$	Temp (°F)
0.0	54.2	0.360	203
30.0	59.0	0.393	234
60.0	61.8	0.415	277
90.0	62.1	0.415	316
120.0	63.1	0.418	351
150.0	62.1	0.410	384
180.0	61.0	0.405	414
210.0	58.4	0.390	441
240.0	58.6	0.395	467
270.0	59.5	0.389	491
300.0	56.7	0.366	513
330.0	52.7	0.360	532
360.0	53.3	0.364	554
390.0	54.2	0.354	571
420.0	51.0	0.346	591
450.0	50.3	0.335	602
480.0	51.3	0.335	622
510.0	48.7	0.326	637

**First Recovery**

Event	Force (lb)	$\mu$	Temp (°F)
1	46.8	0.310	489
2	46.8	0.312	397
3	49.0	0.325	300
4	49.9	0.327	203

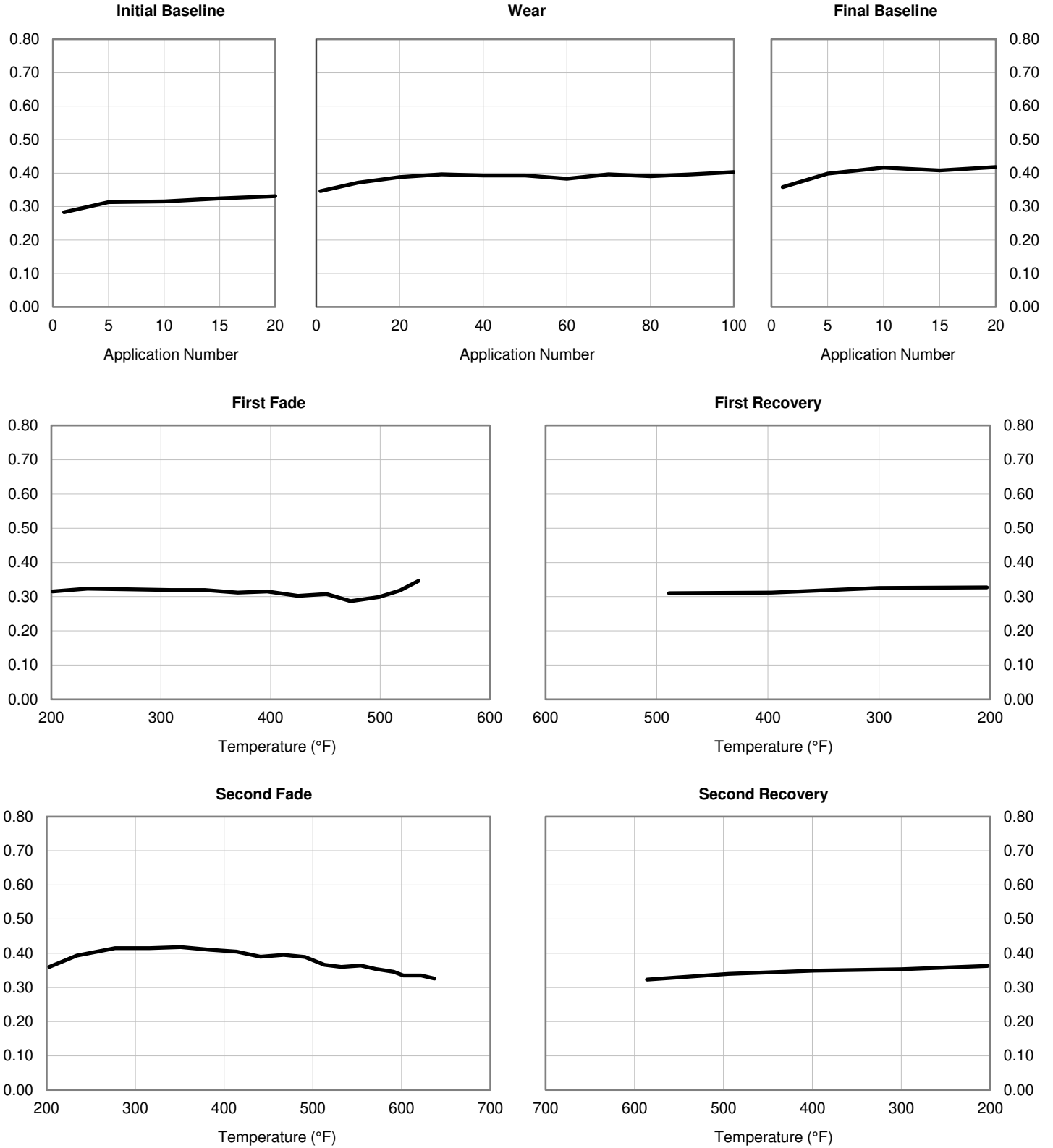
**Second Recovery**

Event	Force (lb)	$\mu$	Temp (°F)
1	48.8	0.323	586
2	51.3	0.340	494
3	52.1	0.349	398
4	52.7	0.353	300
5	54.0	0.363	203



7/13/2023  
230368-01-A  
Sample 1 of 5

### Coefficient of Friction





Normal 0.389

**F**

Hot 0.356

**F**

7/13/2023  
230368-01-B  
Sample 2 of 5

**Wear**

	Initial	Final	Loss	Loss / %
Weight (gr)	10.010	9.880	0.130	1.30
Thickness (inch)	0.237	0.235	0.002	0.85

**Baseline**

Event	Initial		Final	
	Force (lb)	μ	Force (lb)	μ
1	37.6	0.250	57.9	0.384
5	43.3	0.284	60.3	0.398
10	43.0	0.283	61.0	0.404
15	43.7	0.287	60.6	0.398
20	44.5	0.293	62.2	0.409

**Wear**

Event	Force (lb)	μ
1	53.2	0.353
10	55.1	0.366
20	57.1	0.379
30	56.9	0.380
40	58.3	0.387
50	56.8	0.376
60	57.5	0.380
70	57.2	0.382
80	59.4	0.395
90	58.3	0.390
100	59.0	0.394

**First Fade**

Time (sec)	Force (lb)	μ	Temp (°F)
0.0	43.3	0.285	201
30.0	44.5	0.293	232
60.0	44.1	0.293	270
90.0	43.6	0.293	305
120.0	44.2	0.290	337
150.0	44.9	0.293	367
180.0	43.6	0.283	395
210.0	46.1	0.311	424
240.0	49.5	0.327	454
270.0	49.9	0.338	483
300.0	45.3	0.300	507
330.0	43.2	0.287	526
360.0	48.7	0.322	546

**Second Fade**

Time (sec)	Force (lb)	μ	Temp (°F)
0.0	56.0	0.370	203
30.0	58.2	0.387	234
60.0	60.2	0.403	277
90.0	60.3	0.404	315
120.0	61.2	0.407	349
150.0	59.9	0.396	381
180.0	58.8	0.391	410
210.0	58.7	0.390	437
240.0	56.6	0.378	461
270.0	57.9	0.386	486
300.0	55.7	0.368	507
330.0	55.4	0.369	527
360.0	54.8	0.370	549
390.0	55.9	0.377	566
420.0	54.2	0.356	581
450.0	55.2	0.364	600
480.0	54.2	0.373	614
510.0	51.1	0.355	632
540.0	54.3	0.358	641

**First Recovery**

Event	Force (lb)	μ	Temp (°F)
1	50.5	0.334	489
2	49.0	0.325	398
3	51.0	0.337	300
4	52.0	0.343	203

**Second Recovery**

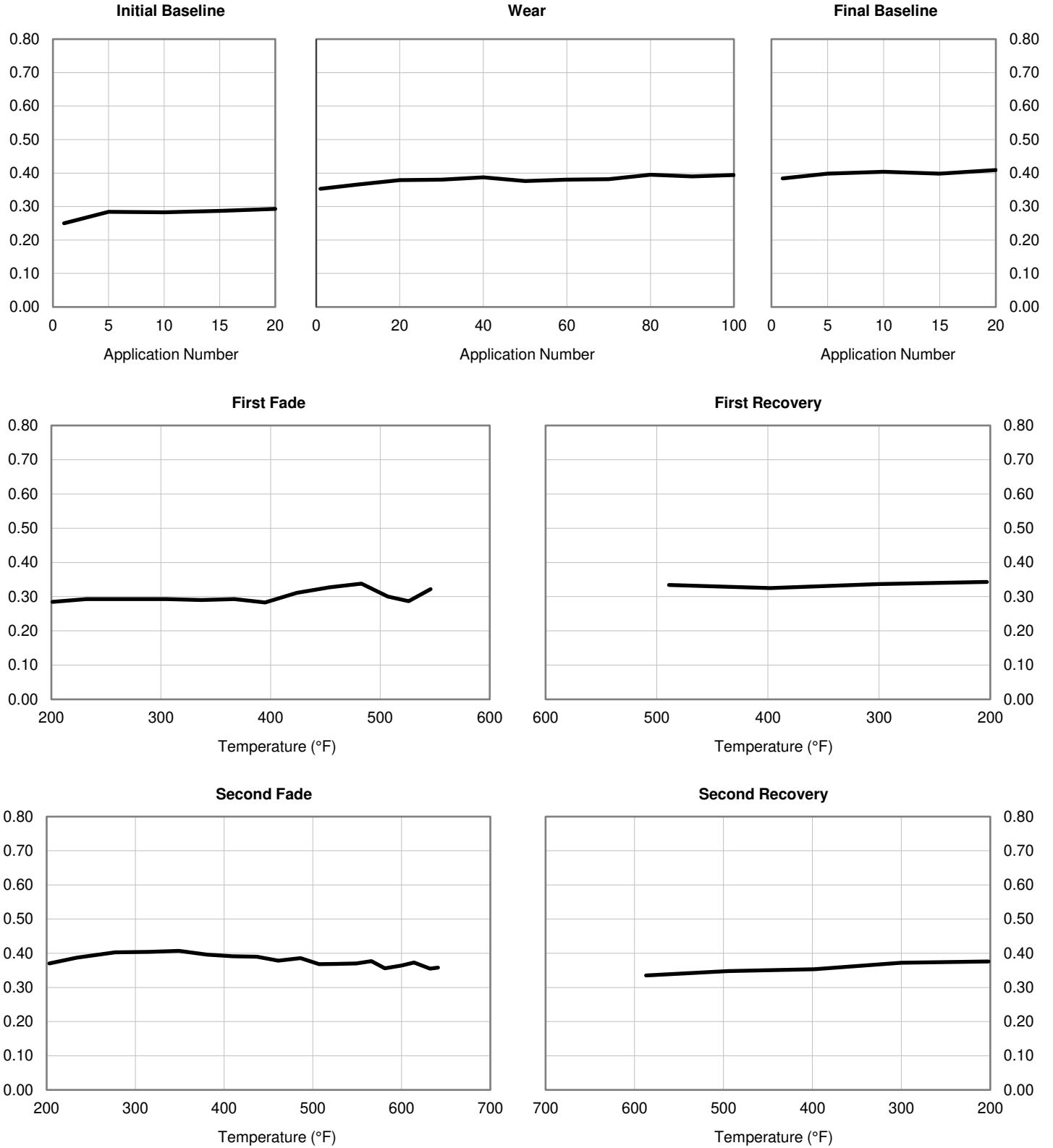
Event	Force (lb)	μ	Temp (°F)
1	50.4	0.335	587
2	52.9	0.348	495
3	53.2	0.353	398
4	55.3	0.372	300
5	56.2	0.376	202





7/13/2023  
230368-01-B  
Sample 2 of 5

### Coefficient of Friction





Normal **0.368**

**F**

7/14/2023  
230368-01-C

Hot **0.331**

**E**

**Sample 3 of 5**

**Wear**

	Initial	Final	Loss	Loss / %
Weight (gr)	9.990	9.880	0.110	1.10
Thickness (inch)	0.237	0.236	0.001	0.42

**Baseline**

Event	Initial		Final	
	Force (lb)	$\mu$	Force (lb)	$\mu$
1	37.2	0.250	55.5	0.366
5	39.9	0.266	56.8	0.382
10	40.5	0.268	61.3	0.409
15	41.2	0.273	59.7	0.394
20	41.6	0.275	60.9	0.408

**Wear**

Event	Force (lb)	$\mu$
1	47.4	0.312
10	49.3	0.327
20	49.5	0.331
30	50.2	0.329
40	52.6	0.352
50	51.6	0.343
60	54.0	0.358
70	52.4	0.348
80	53.6	0.355
90	54.4	0.359
100	54.1	0.360

**First Fade**

Time (sec)	Force (lb)	$\mu$	Temp (°F)
0.0	41.1	0.270	201
30.0	42.4	0.282	231
60.0	41.9	0.279	270
90.0	42.4	0.283	304
120.0	42.0	0.278	336
150.0	42.4	0.283	366
180.0	42.0	0.282	395
210.0	41.7	0.280	422
240.0	41.2	0.274	447
270.0	40.3	0.268	472
300.0	40.3	0.267	495
330.0	39.7	0.268	516
360.0	39.6	0.266	533

**Second Fade**

Time (sec)	Force (lb)	$\mu$	Temp (°F)
0.0	50.3	0.332	203
30.0	54.7	0.363	234
60.0	55.4	0.370	277
90.0	57.7	0.385	316
120.0	57.6	0.381	351
150.0	57.3	0.381	383
180.0	56.9	0.378	414
210.0	54.0	0.361	439
240.0	53.9	0.364	463
270.0	53.3	0.351	489
300.0	52.1	0.359	510
330.0	52.1	0.334	530
360.0	50.4	0.342	551
390.0	51.1	0.338	570
420.0	50.7	0.345	587
450.0	51.7	0.340	603
480.0	49.8	0.331	616
510.0	47.9	0.314	628
540.0	47.0	0.316	641

**First Recovery**

Event	Force (lb)	$\mu$	Temp (°F)
1	41.2	0.274	488
2	42.1	0.281	397
3	43.5	0.290	300
4	42.6	0.287	202

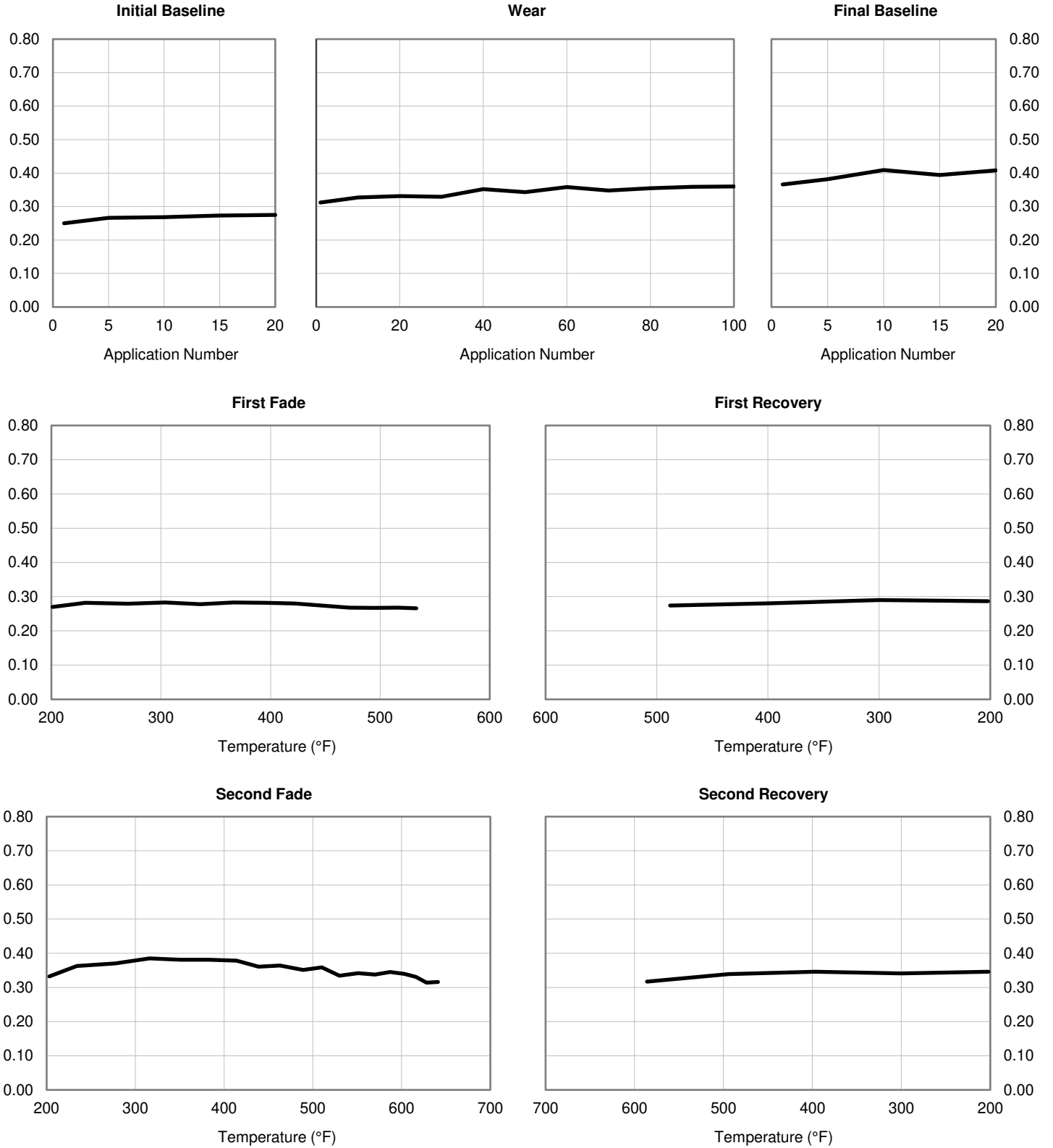
**Second Recovery**

Event	Force (lb)	$\mu$	Temp (°F)
1	47.2	0.317	586
2	50.4	0.339	494
3	52.1	0.346	397
4	51.4	0.341	300
5	51.5	0.346	202



7/14/2023  
230368-01-C  
Sample 3 of 5

### Coefficient of Friction





Normal **0.392** **F**  
 Hot **0.340** **E**

7/14/2023  
 230368-01-D  
**Sample 4 of 5**

**Wear**

	Initial	Final	Loss	Loss / %
Weight (gr)	10.130	10.010	0.120	1.18
Thickness (inch)	0.239	0.238	0.002	0.63

**Baseline**

Event	Initial		Final	
	Force (lb)	$\mu$	Force (lb)	$\mu$
1	34.9	0.233	58.9	0.388
5	39.2	0.260	60.0	0.403
10	42.0	0.278	60.9	0.407
15	42.8	0.281	62.2	0.416
20	43.9	0.293	62.7	0.414

**Wear**

Event	Force (lb)	$\mu$
1	45.4	0.304
10	51.7	0.345
20	53.0	0.353
30	55.8	0.370
40	54.7	0.360
50	54.3	0.360
60	58.4	0.389
70	58.2	0.386
80	58.8	0.394
90	57.7	0.385
100	57.3	0.382

**First Fade**

Time (sec)	Force (lb)	$\mu$	Temp (°F)
0.0	43.9	0.285	201
30.0	43.5	0.288	231
60.0	43.5	0.288	270
90.0	43.9	0.296	305
120.0	44.6	0.290	336
150.0	42.7	0.296	368
180.0	41.9	0.287	398
210.0	42.5	0.279	421
240.0	39.8	0.269	450
270.0	42.1	0.275	475
300.0	43.4	0.289	497
330.0	45.1	0.303	517
360.0	44.5	0.290	537

**Second Fade**

Time (sec)	Force (lb)	$\mu$	Temp (°F)
0.0	55.1	0.362	203
30.0	59.5	0.399	234
60.0	60.9	0.407	277
90.0	59.6	0.394	315
120.0	59.5	0.394	349
150.0	60.6	0.405	381
180.0	59.0	0.395	409
210.0	55.1	0.368	433
240.0	54.8	0.363	458
270.0	56.1	0.373	481
300.0	53.5	0.356	503
330.0	55.3	0.367	524
360.0	54.5	0.366	547
390.0	53.6	0.361	559
420.0	51.6	0.355	580
450.0	49.1	0.340	599
480.0	48.9	0.332	614
510.0	49.8	0.329	628
540.0	47.0	0.317	640

**First Recovery**

Event	Force (lb)	$\mu$	Temp (°F)
1	43.6	0.293	487
2	43.8	0.291	396
3	44.9	0.301	299
4	44.1	0.294	202

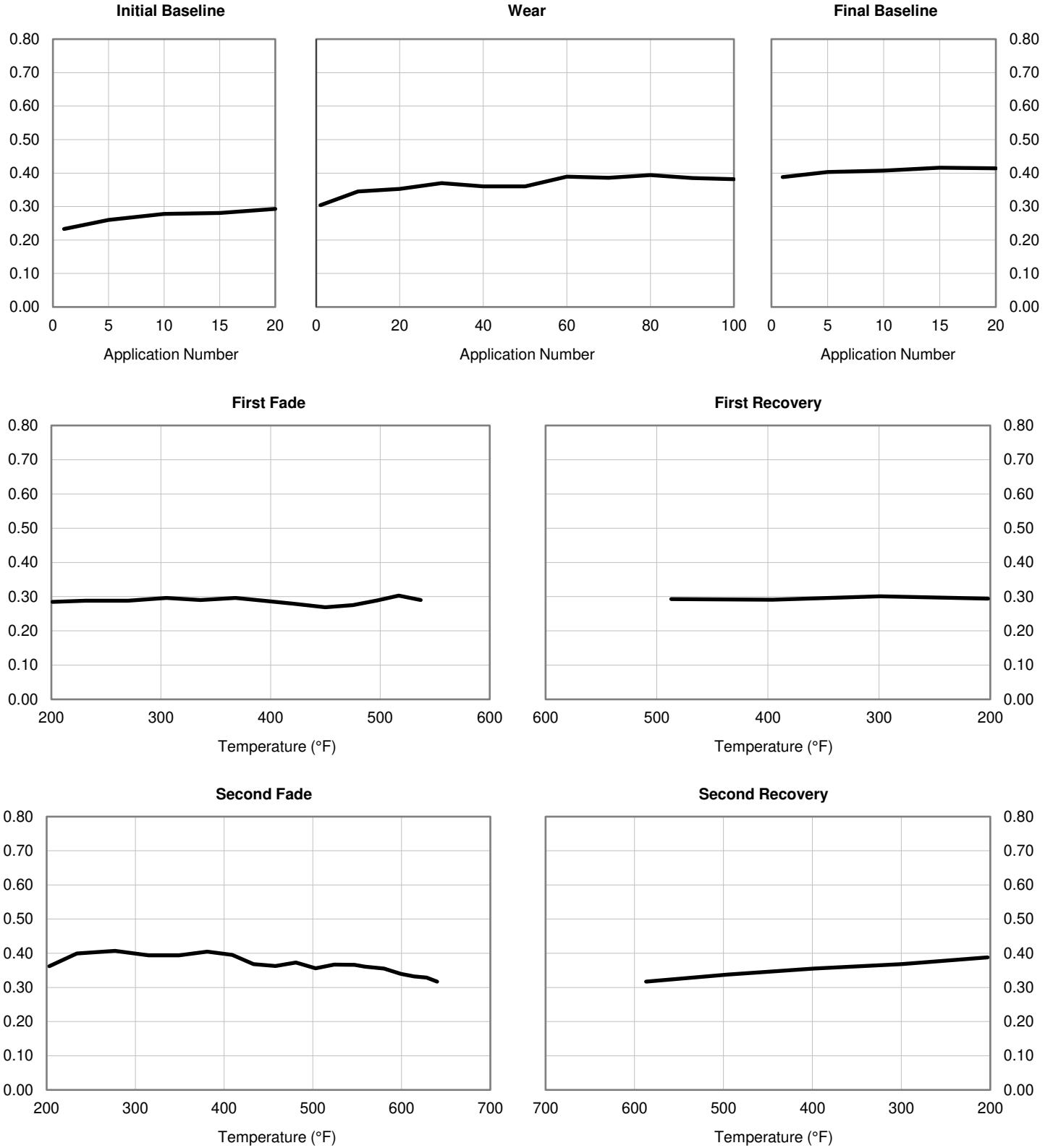
**Second Recovery**

Event	Force (lb)	$\mu$	Temp (°F)
1	47.5	0.317	587
2	50.2	0.338	495
3	53.1	0.355	398
4	54.8	0.368	300
5	57.7	0.388	203



7/14/2023  
230368-01-D  
Sample 4 of 5

### Coefficient of Friction





Normal **0.396**  
Hot **0.349**

**F**  
**E**

7/14/2023  
230368-01-E  
Sample 5 of 5

**Wear**

	Initial	Final	Loss	Loss / %
Weight (gr)	10.060	9.950	0.110	1.09
Thickness (inch)	0.239	0.236	0.004	1.46

**Baseline**

Event	Initial		Final	
	Force (lb)	$\mu$	Force (lb)	$\mu$
1	43.8	0.288	54.6	0.369
5	46.9	0.310	59.5	0.399
10	50.0	0.330	59.6	0.393
15	49.4	0.324	61.6	0.412
20	51.2	0.339	61.2	0.403

**Wear**

Event	Force (lb)	$\mu$
1	50.8	0.334
10	54.5	0.360
20	57.5	0.382
30	59.2	0.393
40	59.6	0.398
50	59.4	0.397
60	60.1	0.397
70	59.1	0.395
80	59.9	0.400
90	60.7	0.405
100	60.8	0.406

**First Fade**

Time (sec)	Force (lb)	$\mu$	Temp (°F)
0.0	48.4	0.317	202
30.0	50.9	0.338	235
60.0	50.5	0.337	276
90.0	49.4	0.331	311
120.0	48.7	0.326	343
150.0	48.0	0.321	373
180.0	48.7	0.322	402
210.0	48.8	0.325	431
240.0	49.6	0.335	457
270.0	53.3	0.355	480
300.0	55.7	0.371	502
330.0	54.4	0.354	523
360.0	52.6	0.348	543

**Second Fade**

Time (sec)	Force (lb)	$\mu$	Temp (°F)
0.0	56.0	0.368	204
30.0	60.7	0.399	236
60.0	62.2	0.419	280
90.0	65.0	0.425	320
120.0	64.3	0.419	355
150.0	62.1	0.412	387
180.0	60.3	0.404	416
210.0	60.0	0.390	443
240.0	58.1	0.396	468
270.0	57.7	0.376	491
300.0	56.2	0.380	515
330.0	56.4	0.370	534
360.0	54.8	0.372	554
390.0	54.5	0.357	572
420.0	53.5	0.360	589
450.0	53.0	0.351	606
480.0	52.1	0.352	621
510.0	52.2	0.342	633
540.0	50.5	0.338	645

**First Recovery**

Event	Force (lb)	$\mu$	Temp (°F)
1	48.5	0.323	490
2	46.7	0.310	398
3	47.0	0.311	300
4	48.8	0.328	203

**Second Recovery**

Event	Force (lb)	$\mu$	Temp (°F)
1	46.4	0.314	587
2	49.8	0.329	495
3	52.5	0.351	398
4	54.0	0.355	300
5	53.3	0.357	203



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### Coefficient of Friction

