



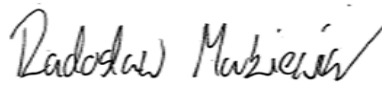
Physical Properties Test Report

Link Test Report: 105146-1-1
Test Description: SAE J661 Rev Feb 1997 Brake Lining Quality Test
Purpose of Test: To Evaluate the Characteristics of Brake Materials
Material Identification: D1194
Test Date: 12/18/2020 to 12/18/2020

Requested By:

ROYAL BRAKES CANADA
HARRY DIBADJ
1500-701 WEST GEORGIA STREET
VANCOUVER, B.C. V7Y 1C6
CANADA

Report Approved By:



Supervising Engineer, M.Sc.

Date: 12/21/20



LINK Engineering Company
Dearborn Technical Center
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Dearborn, MI 48120
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Phone: (313) 625-4000



Test Number
105146-1-1

Customer Reference
D1194

SAE J661 Rev Feb 1997 Brake Lining Quality Test

Test Information

| | |
|------------------|--------------------------|
| Customer Name | Royal Brakes Canada |
| Requestor | Harry Dibadj |
| Test Procedure | SAE J661 |
| Program Number | J661noinsp.chp |
| Test Coordinator | E. DEJULES |
| Test Equipment | Chase Machine 12 |
| Test Dates | 12/18/2020 to 12/18/2020 |
| Datalogger | v1.0.10 |
| Template Version | 2.06 |

Setup Details

| | |
|---------------------|---------------------|
| Sample Material | D1194 |
| Sample Size | 1" X 1" |
| Sample Manufacturer | Royal Brakes Canada |
| Test Pressure | 150 psi |

Sample Test Summary

| | | |
|---|-------|------|
| Normal Friction Coefficient | 0.418 | Pass |
| Normal Friction Class | F | |
| Hot Friction Coefficient | 0.485 | Pass |
| Hot Friction Class | G | |
| Minimum Bold Coefficient | 0.323 | Pass |
| Max Variation Below Avg for Bold readings | 0.000 | Pass |
| Max % Variation for Bold Readings | 0% | Pass |

Pass / Fail

Pass

Comments:

| | | | | | |
|--------------------|----------------------------------|--------------|---------------|-------------|------------|
| Created by: | Chris Arquette (313) 625-4000 | Title | Test Engineer | Date | 12/21/2020 |
|--------------------|----------------------------------|--------------|---------------|-------------|------------|

| | | | | | |
|---------------------|---------------------------------------|--------------|----------------------|-------------|------------|
| Reviewed by: | Radoslaw Markiewicz (313) 625-4000 | Title | Supervising Engineer | Date | 12/21/2020 |
|---------------------|---------------------------------------|--------------|----------------------|-------------|------------|

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.



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| | | Test Number | | | | | | | | |
|-------------------|--|------------------|----------|----------|----------|----------|---------------------|--------------|---------------|-----------|
| | | Sample 1 | Sample 2 | Sample 3 | Sample 4 | Sample 5 | Manufacturer | | | |
| | | 105146-1-2 | | | | | Royal Brakes Canada | | | |
| | | Initial Baseline | | | | | Material | | | |
| Application | | Sample 1 | Sample 2 | Sample 3 | Sample 4 | Sample 5 | D1194 | | | |
| 1 | | 0.377 | | | | | Normal | | | |
| 20 | | 0.415 | | | | | 0.418 F | | | |
| | | First Fade | | | | | Hot | | | |
| Temp (°F) | | Sample 1 | Sample 2 | Sample 3 | Sample 4 | Sample 5 | 0.485 G | | | |
| 200.0 | | 0.461 | | | | | | | | |
| 500.0 | | 0.463 | | | | | | | | |
| (or Temp @ 10min) | | | | | | | | | | |
| | | First Recovery | | | | | | | | |
| Temp (°F) | | Sample 1 | Sample 2 | Sample 3 | Sample 4 | Sample 5 | Average | Norm/Hot | | |
| 500.0 | | 0.487 | | | | | 0.487 | | | |
| 400.0 | | 0.505 | | | | | 0.505 | Hot | | |
| 300.0 | | 0.478 | | | | | 0.478 | Hot | | |
| 200.0 | | 0.427 | | | | | 0.427 | | | |
| | | Wear | | | | | | | | |
| Application | | Sample 1 | Sample 2 | Sample 3 | Sample 4 | Sample 5 | | | | |
| 1 | | 0.473 | | | | | | | | |
| 100 | | 0.471 | | | | | | | | |
| | | Second Fade | | | | | Max Var. | | | |
| Temp (°F) | | Sample 1 | Sample 2 | Sample 3 | Sample 4 | Sample 5 | Average | < Average | Norm/Hot | % Var |
| 200.0 | | 0.323 | | | | | 0.323 | 0.000 | Normal | 0% |
| 250.0 | | 0.394 | | | | | 0.394 | 0.000 | Normal | 0% |
| 300.0 | | 0.452 | | | | | 0.452 | 0.000 | Normal | 0% |
| 350.0 | | 0.473 | | | | | 0.473 | 0.000 | - | 0% |
| 400.0 | | 0.504 | | | | | 0.504 | 0.000 | Normal | 0% |
| 450.0 | | 0.547 | | | | | 0.547 | 0.000 | Hot | 0% |
| 500.0 | | 0.521 | | | | | 0.521 | 0.000 | Hot | 0% |
| 550.0 | | 0.504 | | | | | 0.504 | 0.000 | Hot | 0% |
| 600.0 | | 0.501 | | | | | 0.501 | 0.000 | Hot | 0% |
| 650.0 | | 0.473 | | | | | 0.473 | 0.000 | Hot | 0% |
| (or Temp @ 10min) | | | | | | | | | | |
| | | Second Recovery | | | | | Max Var. | | | |
| Temp (°F) | | Sample 1 | Sample 2 | Sample 3 | Sample 4 | Sample 5 | Average | < Average | Norm/Hot | % Var |
| 600.0 | | 0.486 | | | | | 0.486 | 0.000 | - | |
| 500.0 | | 0.472 | | | | | 0.472 | 0.000 | Hot | |
| 400.0 | | 0.446 | | | | | 0.446 | 0.000 | Hot | |
| 300.0 | | 0.405 | | | | | 0.405 | 0.000 | Hot | |
| 200.0 | | 0.363 | | | | | 0.363 | 0.000 | - | |
| | | Final Baseline | | | | | | | | |
| Application | | Sample 1 | Sample 2 | Sample 3 | Sample 4 | Sample 5 | | | | |
| 1 | | 0.354 | | | | | | | | |
| 20 | | 0.458 | | | | | | | | |



Test Number
105146-1-1

Customer Reference
D1194

Manufacturer: Royal Brakes Canada
Material: D1194
Test Pressure: 150 psi

Normal **0.418** **F**
Hot **0.485** **G**

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Sample 1 of 1

Wear

| | Initial | Final | Loss | Loss / % | Specific Wear | |
|------------------|---------|-------|-------|----------|---------------|------------------------|
| Weight (gr) | 9.217 | 8.618 | 0.599 | 6.50% | 2.32E-01 | gr/hp-hr |
| Thickness (inch) | 0.250 | 0.236 | 0.014 | 5.60% | 5.43E-03 | in ³ /hp-hr |

Baseline

| Event | Initial | | Final | |
|-------|------------|-------|------------|-------|
| | Force (lb) | μ | Force (lb) | μ |
| 1 | 57 | 0.377 | 54 | 0.354 |
| 5 | 64 | 0.426 | 60 | 0.397 |
| 10 | 63 | 0.417 | 65 | 0.432 |
| 15 | 63 | 0.422 | 67 | 0.441 |
| 20 | 63 | 0.415 | 69 | 0.458 |

Wear

| Event | Force (lb) | μ |
|-------|------------|-------|
| 1 | 71 | 0.473 |
| 10 | 78 | 0.518 |
| 20 | 80 | 0.532 |
| 30 | 75 | 0.505 |
| 40 | 76 | 0.500 |
| 50 | 69 | 0.461 |
| 60 | 71 | 0.463 |
| 70 | 66 | 0.438 |
| 80 | 67 | 0.443 |
| 90 | 66 | 0.441 |
| 100 | 71 | 0.471 |

First Fade

| Time (sec) | Force (lb) | μ | Temp (°F) |
|------------|------------|-------|-----------|
| 0 | 70 | 0.461 | 238 |
| 30 | 71 | 0.474 | 287 |
| 60 | 72 | 0.483 | 331 |
| 90 | 72 | 0.475 | 379 |
| 120 | 71 | 0.475 | 421 |
| 150 | 70 | 0.466 | 461 |
| 180 | 70 | 0.463 | 500 |
| 210 | 69 | 0.459 | 540 |
| 240 | | | |
| 270 | | | |
| 300 | | | |
| 330 | | | |
| 360 | | | |
| 390 | | | |
| 420 | | | |
| 450 | | | |
| 480 | | | |
| 510 | | | |
| 540 | | | |
| 570 | | | |
| 600 | | | |

Second Fade

| Time (sec) | Force (lb) | μ | Temp (°F) |
|------------|------------|-------|-----------|
| 0 | 60 | 0.402 | 230 |
| 30 | 67 | 0.445 | 273 |
| 60 | 72 | 0.475 | 327 |
| 90 | 80 | 0.531 | 380 |
| 120 | 78 | 0.525 | 431 |
| 150 | 81 | 0.533 | 479 |
| 180 | 76 | 0.503 | 526 |
| 210 | 77 | 0.519 | 571 |
| 240 | 71 | 0.478 | 607 |
| 270 | 68 | 0.451 | 639 |
| 300 | | | |
| 330 | | | |
| 360 | | | |
| 390 | | | |
| 420 | | | |
| 450 | | | |
| 480 | | | |
| 510 | | | |
| 540 | | | |
| 570 | | | |
| 600 | | | |

First Recovery

| Event | Force (lb) | μ | Temp (°F) |
|-------|------------|-------|-----------|
| 1 | 73 | 0.487 | 513 |
| 2 | 76 | 0.505 | 418 |
| 3 | 72 | 0.478 | 321 |
| 4 | 65 | 0.427 | 221 |

Second Recovery

| Event | Force (lb) | μ | Temp (°F) |
|-------|------------|-------|-----------|
| 1 | 73 | 0.486 | 602 |
| 2 | 71 | 0.472 | 512 |
| 3 | 67 | 0.446 | 416 |
| 4 | 61 | 0.405 | 316 |
| 5 | 55 | 0.363 | 217 |



Test Number
105146-1-1

Customer Reference
D1194

Manufacturer: Royal Brakes Canada
Material: D1194
Test Pressure: 150 psi

12/18/2020
105146-1-2
Sample 1 of 1

Coefficient of Friction

