

## **Inertia Dynamometer Friction Behaviour Assessment for Automotive Brake Systems**

Test Req #: N/A  
Nucap Test #: NU-10K-E1138-1  
Customer Reference: 14K BRAKE  
Control Program: W030905

Prepared for :

**BILL GLIDEWELL  
KODIAK TRAILER**



---

**NUCAP R&D CENTER**  
115 Ridgetop Road  
Toronto, Canada. M1P 4W9  
Tel. 416-494-1444  
Fax. 416-321-3691  
[www.nucap.com](http://www.nucap.com)

|            |     |   |           |           |
|------------|-----|---|-----------|-----------|
| Test Req # | N/A | <b>NUCAP R&amp;D CENTER</b><br><b>Brake Dynamometer Testing</b> | Cust Ref: | 14K BRAKE |
|------------|-----|---|-----------|-----------|

**Test Description**  
FRICTION BEHAVIOR ASSESSMENT

**Test Information**

|                          |                  |
|--------------------------|------------------|
| Test Requestor:          | KODIAK TRAILER   |
| Requested By:            | BILL GLIDEWELL   |
| Test Procedure:          | SAE J2681        |
| Control Program:         | W030905          |
| Dynamometer:             | 3239             |
| Fixture ID:              | KODIAK AXLE 2250 |
| Test Coordinator:        | JACOB            |
| Test Technician:         | N/A              |
| Date Started:            | 11/16/10         |
| Date Completed:          | 11/16/10         |
| Date Parts Received:     | 15/11/2010       |
| Datalog, Report Version: | 2.72, 1.01       |

**Dynamometer Information**

|                      |                            |                         |
|----------------------|----------------------------|-------------------------|
| Rolling Radius:      | 16.5 inch                  | 419.5 mm                |
| Required Wheel Load: | 7000 lb                    | 3175 kg                 |
| Actual Wheel Load:   | 2397 lb                    | 1087 Kg                 |
| Gross Axle Wt:       | 14000 lb                   | 6350 Kg                 |
| Required Inertia:    | 295.0 slug-ft <sup>2</sup> | 400.0 Kg-m <sup>2</sup> |
| Actual Inertia:      | 141.2 slug-ft <sup>2</sup> | 191.4 Kg-m <sup>2</sup> |
| Piston Diameter:     | 2.50 inch                  | 63.50 mm                |
| Effective Radius:    | 6.75 inch                  | 171.45 mm               |
| Number of Pistons:   | 2                          |                         |

**Brake Information**

|                         |                |
|-------------------------|----------------|
| Brake Name/Type:        | KODIAK 2250    |
| Brake Size:             | 381*40.05      |
| Rotor/Drum ID:          | KODIAK TRAILER |
| Pri/Lead/Inner Lining:  | N/A            |
| Sec/Trail/Outer Lining: | N/A            |
| Drum/Rotor Type:        | VENTED         |
| Brake Orientation:      | Right          |

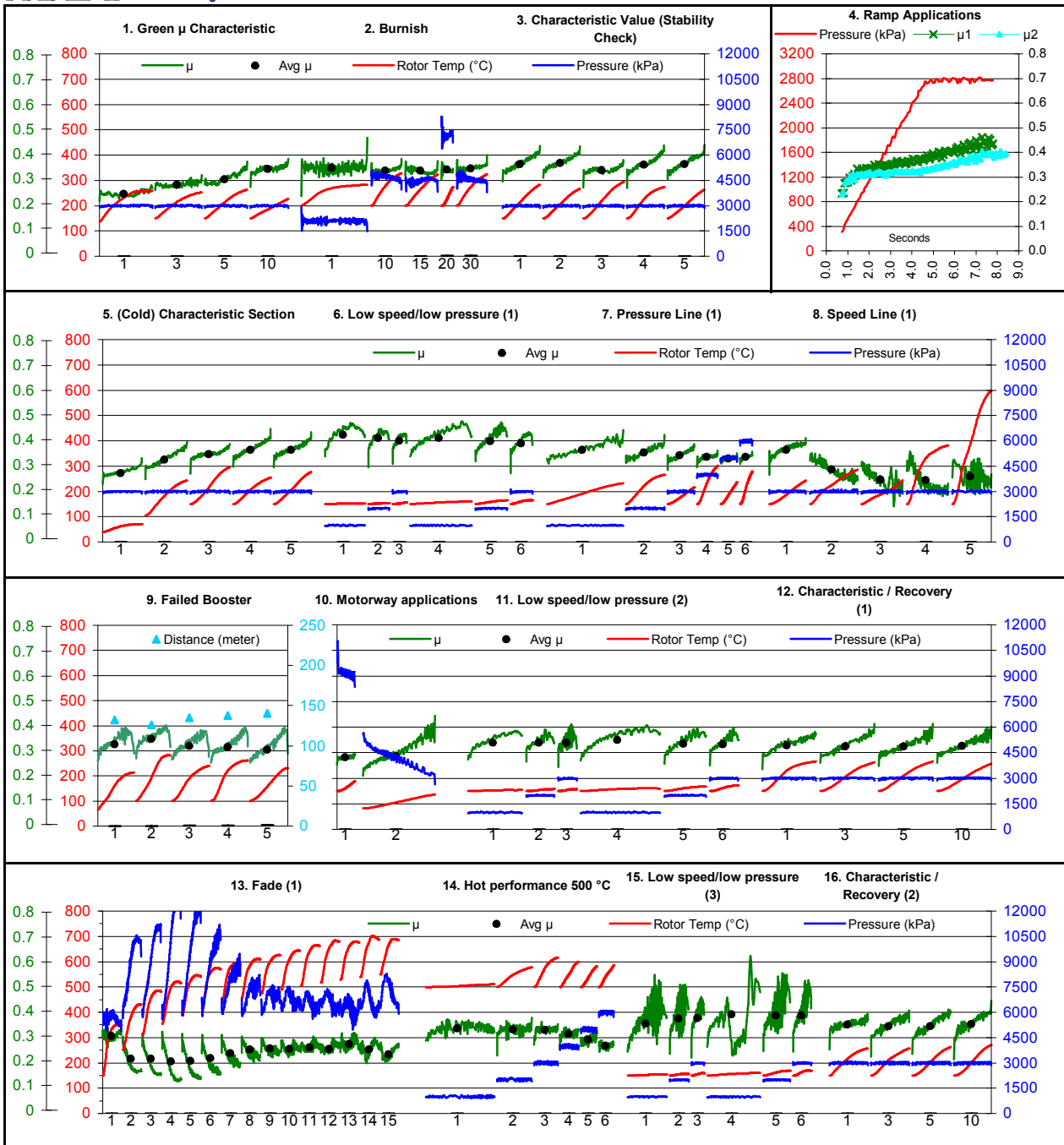
**Final Comments:**  
INITIAL LRO IS 001"  
USED KODIAK ROTOR AND PADS  
FRICTION BEHAVIOR ASSESSMENT ON D87.  
NOTICED ABNORMAL WORN OUT.

|            |   |               |                   |
|------------|---|---------------|-------------------|
| Signature: |  | Title:        | Date:             |
|            |   | Test Engineer | November 22, 2010 |

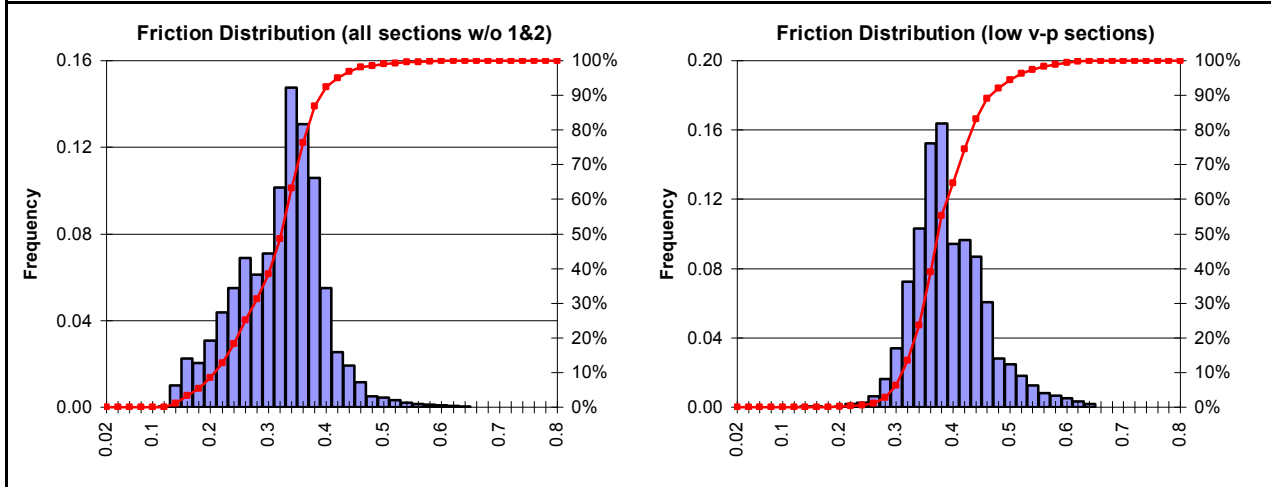
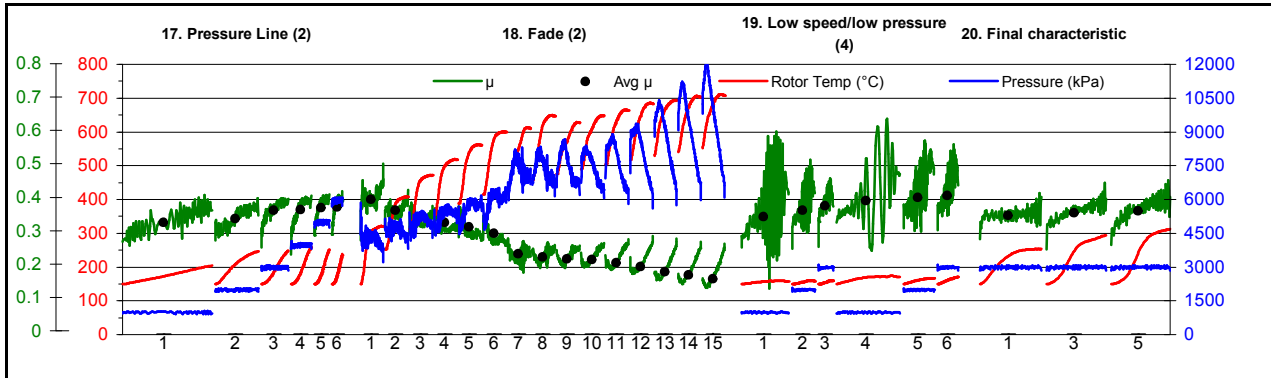
Data applicable to the materials tested. Valid if signed by the test engineer. Report can be copied in full.  
Bilateral uncertainty of measurements 0.63% of FS. Coverage factor of 2. Confidence of 95%. Details available upon request.

| Test Req #:                                       |      | N/A             |                   | NUCAP R&D CENTER<br>Brake Dynamometer Testing |                |               |              |               |                |                |                |                       |       | Cust Ref: |       | 14K BRAKE                  |               |                |                |                 |
|---|------|-----------------|-------------------|---|----------------|---------------|--------------|---------------|----------------|----------------|----------------|-----------------------|-------|-----------|-------|----------------------------|---------------|----------------|----------------|-----------------|
| Section   | Stop | Brake Speed kph | Release Speed kph | Stop Distance meter                           | Decel Torque g | Press Min kPa | Pres Avg kPa | Press Max kPa | Torque Min N-m | Torque Avg N-m | Torque Max N-m | MFDD m/s <sup>2</sup> | μ Min | μ Avg     | μ Max | Fluid Disp cm <sup>3</sup> | Rotor Init °C | Rotor Final °C | Lining Init °C | Lining Final °C |
| <b>100 Green μ Characteristic</b>                 |      |                 |                   |   |                |               |              |               |                |                |                |                       |       |           |       |                            |               |                |                |                 |
| 100   | 1    | 80.3            | 30.0              |   | 0.17           | 2882          | 2998         | 3069          | 1449           | 1606           | 1875           | 1.69                  | 0.218 | 0.247     | 0.283 | 6.27                       | 138           | 258            | 142            | 232             |
| 100   | 3    | 80.2            | 30.0              |   | 0.20           | 2872          | 2995         | 3080          | 1642           | 1849           | 2068           | 1.94                  | 0.257 | 0.282     | 0.319 | 7.56                       | 150           | 252            | 120            | 206             |
| 100   | 5    | 80.0            | 30.0              |   | 0.22           | 2897          | 2997         | 3058          | 1799           | 2059           | 2342           | 2.16                  | 0.269 | 0.305     | 0.369 | 7.60                       | 150           | 262            | 119            | 197             |
| 100   | 10   | 80.2            | 30.0              |   | 0.24           | 2901          | 2997         | 3063          | 2109           | 2281           | 2465           | 2.39                  | 0.274 | 0.344     | 0.385 | 7.72                       | 150           | 227            | 115            | 228             |
| <b>200 Burnish</b>                                |      |                 |                   |   |                |               |              |               |                |                |                |                       |       |           |       |                            |               |                |                |                 |
| 200   | 1    | 80.0            | 30.0              |   | 0.17           | 1788          | 2086         | 2360          | 1268           | 1580           | 1911           | 1.66                  | 0.237 | 0.349     | 0.480 | 6.95                       | 200           | 283            | 156            | 232             |
| 200   | 5    | 80.2            | 30.0              |   | 0.25           | 2870          | 3124         | 3305          | 2125           | 2332           | 2545           | 2.44                  | 0.278 | 0.344     | 0.404 | 8.08                       | 200           | 320            | 148            | 222             |
| 200   | 10   | 80.0            | 30.0              |   | 0.37           | 4303          | 4675         | 4957          | 3245           | 3455           | 3653           | 3.52                  | 0.313 | 0.338     | 0.380 | 9.32                       | 200           | 328            | 149            | 198             |
| 200   | 15   | 80.0            | 30.0              |   | 0.35           | 4181          | 4504         | 4724          | 3066           | 3263           | 3457           | 3.34                  | 0.315 | 0.338     | 0.378 | 9.02                       | 200           | 323            | 150            | 255             |
| 200   | 20   | 80.0            | 44.4              |   | 0.57           | 6886          | 7191         | 7467          | 5110           | 5307           | 5498           | 6.83                  | 0.304 | 0.343     | 0.374 | 10.54                      | 200           | 273            | 143            | 184             |
| 200   | 25   | 80.0            | 30.0              |   | 0.17           | 1478          | 1794         | 2042          | 1399           | 1581           | 1768           | 1.66                  | 0.230 | 0.388     | 0.535 | 6.74                       | 200           | 284            | 146            | 203             |
| 200   | 30   | 80.0            | 30.0              |   | 0.37           | 4321          | 4530         | 4831          | 3260           | 3454           | 3651           | 3.52                  | 0.304 | 0.346     | 0.400 | 8.89                       | 200           | 324            | 150            | 270             |
| 200   | 32   | 80.0            | 30.0              |   | 0.20           | 1869          | 2249         | 2659          | 1649           | 1866           | 2132           | 1.96                  | 0.261 | 0.371     | 0.492 | 7.28                       | 200           | 299            | 149            | 261             |
| <b>300 Characteristic Value (Stability Check)</b> |      |                 |                   |   |                |               |              |               |                |                |                |                       |       |           |       |                            |               |                |                |                 |
| 300   | 1    | 80.0            | 30.0              |   | 0.26           | 2926          | 2997         | 3067          | 2229           | 2477           | 2762           | 2.60                  | 0.296 | 0.364     | 0.433 | 7.76                       | 150           | 283            | 112            | 214             |
| 300   | 2    | 80.0            | 30.0              |   | 0.26           | 2931          | 2996         | 3067          | 2250           | 2469           | 2764           | 2.58                  | 0.309 | 0.367     | 0.429 | 7.72                       | 150           | 267            | 111            | 212             |
| 300   | 3    | 80.2            | 30.0              |   | 0.24           | 2924          | 2996         | 3065          | 2059           | 2220           | 2460           | 2.32                  | 0.272 | 0.339     | 0.374 | 7.69                       | 150           | 293            | 110            | 387             |
| 300   | 4    | 80.0            | 30.0              |   | 0.26           | 2930          | 2996         | 3067          | 2266           | 2451           | 2783           | 2.57                  | 0.269 | 0.362     | 0.434 | 7.64                       | 150           | 273            | 109            | 162             |
| 300   | 5    | 80.0            | 30.0              |   | 0.26           | 2930          | 2997         | 3065          | 2259           | 2485           | 2727           | 2.60                  | 0.302 | 0.364     | 0.432 | 7.66                       | 150           | 263            | 109            | 271             |
| <b>400 Ramp Applications</b>                      |      |                 |                   |   |                |               |              |               |                |                |                |                       |       |           |       |                            |               |                |                |                 |
| 400   | 1    | 50.1            | 3.0               |   | 0.23           |               |              | 2815          |                |                | 2879           | 2.33                  | 0.363 | 0.400     | 0.476 | 7.90                       | 100           | 132            | 73             | 94              |
| 400   | 2    | 50.1            | 3.0               |   | 0.21           |               |              | 2817          |                |                | 2481           | 2.10                  | 0.316 | 0.354     | 0.410 | 7.14                       | 100           | 153            | 77             | 108             |
| <b>500 (Cold) Characteristic Section</b>          |      |                 |                   |   |                |               |              |               |                |                |                |                       |       |           |       |                            |               |                |                |                 |
| 500   | 1    | 40.0            | 3.0               |   | 0.19           | 2942          | 2992         | 3023          | 1706           | 1799           | 1938           | 1.88                  | 0.230 | 0.273     | 0.331 | 7.60                       | 40            | 70             | 32             | 55              |
| 500   | 2    | 80.2            | 30.0              |   | 0.23           | 2925          | 2995         | 3089          | 1979           | 2225           | 2522           | 2.34                  | 0.249 | 0.324     | 0.394 | 6.36                       | 105           | 243            | 75             | 396             |
| 500   | 3    | 80.0            | 30.0              |   | 0.24           | 2916          | 2994         | 3057          | 2171           | 2298           | 2511           | 2.41                  | 0.269 | 0.346     | 0.386 | 6.72                       | 150           | 295            | 100            | 152             |
| 500   | 4    | 80.0            | 30.0              |   | 0.26           | 2921          | 2994         | 3058          | 2260           | 2472           | 2768           | 2.59                  | 0.297 | 0.364     | 0.447 | 7.18                       | 150           | 254            | 106            | 188             |
| 500   | 5    | 80.0            | 30.0              |   | 0.26           | 2921          | 2995         | 3061          | 2258           | 2456           | 2735           | 2.57                  | 0.296 | 0.364     | 0.434 | 7.35                       | 150           | 277            | 107            | 299             |
| <b>600 Low speed/low pressure (1)</b>             |      |                 |                   |   |                |               |              |               |                |                |                |                       |       |           |       |                            |               |                |                |                 |
| 600   | 1    | 20.1            | 0.5               |   | 0.10           | 951           | 986          | 1030          | 888            | 951            | 1033           | 1.01                  | 0.337 | 0.424     | 0.471 | 5.68                       | 150           | 153            | 110            | 117             |
| 600   | 2    | 20.1            | 3.0               |   | 0.19           | 1958          | 1989         | 2020          | 1727           | 1837           | 1941           | 1.94                  | 0.295 | 0.410     | 0.448 | 6.18                       | 150           | 154            | 112            | 125             |
| 600   | 3    | 20.1            | 3.0               |   | 0.29           | 2935          | 2976         | 3017          | 2425           | 2654           | 2794           | 2.85                  | 0.309 | 0.399     | 0.429 | 6.94                       | 150           | 155            | 113            | 130             |
| 600   | 4    | 30.0            | 3.0               |   | 0.10           | 955           | 985          | 1028          | 827            | 921            | 1039           | 0.97                  | 0.334 | 0.411     | 0.479 | 5.05                       | 150           | 160            | 114            | 126             |
| 600   | 5    | 30.0            | 3.0               |   | 0.19           | 1953          | 1992         | 2018          | 1635           | 1797           | 2068           | 1.89                  | 0.320 | 0.398     | 0.476 | 6.14                       | 150           | 163            | 113            | 140             |
| 600   | 6    | 30.0            | 3.0               |   | 0.28           | 2926          | 2984         | 3019          | 2440           | 2616           | 2821           | 2.75                  | 0.272 | 0.389     | 0.434 | 6.93                       | 150           | 166            | 113            | 141             |
| <b>700 Pressure Line (1)</b>                      |      |                 |                   |   |                |               |              |               |                |                |                |                       |       |           |       |                            |               |                |                |                 |
| 700   | 1    | 80.2            | 40.0              |   | 0.08           | 948           | 983          | 1038          | 726            | 818            | 1014           | 0.86                  | 0.303 | 0.363     | 0.467 | 5.09                       | 150           | 233            | 114            | 209             |
| 700   | 2    | 80.0            | 40.0              |   | 0.17           | 1916          | 1995         | 2061          | 1453           | 1608           | 1843           | 1.68                  | 0.313 | 0.354     | 0.422 | 6.44                       | 150           | 265            | 113            | 365             |
| 700   | 3    | 80.0            | 40.0              |   | 0.24           | 2920          | 2994         | 3073          | 2130           | 2304           | 2533           | 2.41                  | 0.284 | 0.342     | 0.387 | 7.38                       | 150           | 216            | 112            | 449             |
| 700   | 4    | 80.0            | 40.0              |   | 0.31           | 3897          | 3982         | 4065          | 2858           | 2949           | 3063           | 3.04                  | 0.295 | 0.335     | 0.358 | 8.14                       | 150           | 301            | 110            | 238             |
| 700   | 5    | 80.0            | 40.0              |   | 0.38           | 4905          | 5000         | 5095          | 3499           | 3616           | 3768           | 3.68                  | 0.308 | 0.330     | 0.350 | 8.81                       | 150           | 236            | 110            | 488             |
| 700   | 6    | 80.0            | 40.0              |   | 0.47           | 5884          | 5986         | 6095          | 4324           | 4429           | 4553           | 5.05                  | 0.307 | 0.336     | 0.357 | 9.46                       | 150           | 278            | 108            | 220             |
| <b>800 Speed Line (1)</b>                         |      |                 |                   |   |                |               |              |               |                |                |                |                       |       |           |       |                            |               |                |                |                 |
| 800   | 1    | 80.0            | 40.0              |   | 0.26           | 2835          | 2985         | 3103          | 1649           | 2354           | 2662           | 2.57                  | 0.266 | 0.363     | 0.409 | 7.30                       | 150           | 243            | 109            | 430             |
| 800   | 2    | 120.2           | 80.0              |   | 0.19           | 2850          | 2988         | 3117          | 1399           | 1860           | 2699           | 1.76                  | 0.220 | 0.287     | 0.404 | 7.24                       | 150           | 285            | 116            | 470             |
| 800   | 3    | 160.0           | 130.0             |   | 0.17           | 2850          | 2988         | 3073          | 890            | 1595           | 2301           | 1.67                  | 0.138 | 0.246     | 0.351 | 7.85                       | 150           | 243            | 112            | 497             |
| 800   | 4    | 180.1           | 150.1             |   | 0.17           | 2845          | 2988         | 3079          | 1150           | 1588           | 2497           | 1.65                  | 0.177 | 0.245     | 0.383 | 8.02                       | 150           | 382            | 112            | 504             |
| 800   | 5    | 200.2           | 170.0             |   | 0.18           | 2850          | 2988         | 3077          | 1170           | 1678           | 2234           | 1.76                  | 0.182 | 0.259     | 0.347 | 8.58                       | 150           | 598            | 77             | 344             |
| <b>900 Failed Booster</b>                         |      |                 |                   |   |                |               |              |               |                |                |                |                       |       |           |       |                            |               |                |                |                 |
| 900   | 1    | 100.1           | 0.5               | 132.0   | 0.32           | 3943          | 4081         | 4154          | 2681           | 3025           | 3701           | 3.17                  | 0.258 | 0.326     | 0.416 | 9.48                       | 66            | 214            | 31             | 216             |
| 900   | 2    | 100.1           | 3.0               | 126.3   | 0.34           | 3944          | 4083         | 4164          | 2796           | 3188           | 3600           | 3.32                  | 0.268 | 0.347     | 0.404 | 8.85                       | 101           | 282            | 61             | 246             |
| 900   | 3    | 100.1           | 3.0               | 134.7   | 0.32           | 3947          | 4083         | 4178          | 2581           | 2970           | 3458           | 3.10                  | 0.261 | 0.320     | 0.392 | 9.24                       | 101           | 239            | 56             | 254             |
| 900   | 4    | 100.1           | 3.0               | 137.8   | 0.31           | 3936          | 4085         | 4177          | 2539           | 2893           | 3487           | 3.03                  | 0.253 | 0.314     | 0.395 | 9.26                       | 101           | 262            | 62             | 349             |
| 900   | 5    | 100.1           | 3.0               | 140.1   | 0.31           | 3940          | 4086         | 4186          | 2395           | 2832           | 3492           | 2.97                  | 0.251 | 0.303     | 0.394 | 9.45                       | 101           | 231            | 57             | 349             |
| 900   | 6    | 100.1           | 3.0               | 142.8   | 0.30           | 3957          | 4089         | 4180          | 2427           | 2777           | 3401           | 2.91                  | 0.258 | 0.302     | 0.386 | 9.28                       | 101           | 281            | 45             | 343             |
| <b>1000 Motorway applications</b>                 |      |                 |                   |   |                |               |              |               |                |                |                |                       |       |           |       |                            |               |                |                |                 |
| 1000  | 1    | 100.1           | 69.1              |   | 0.60           | 8366          | 9271         | 11087         | 5319           | 5651           | 6631           | 7.74                  | 0.252 | 0.281     | 0.297 | 12.94                      | 151           | 189            | 89             | 425             |
| 1000  | 2    | 99.9            | 5.1               |   | 0.60           | 2644          | 4415         | 5845          | 2336           | 2692           | 2996           | 6.03                  | 0.210 | 0.285     | 0.468 | 9.67                       | 82            | 136            | 48             | 187             |
| <b>1100 Low speed/low pressure (2)</b>            |      |                 |                   |   |                |               |              |               |                |                |                |                       |       |           |       |                            |               |                |                |                 |
| 1100  | 1    | 20.1            | 0.5               |   | 0.08           | 953           | 995          | 1036          | 699            | 768            | 847            | 0.81                  | 0.272 | 0.338     | 0.388 | 6.19                       | 150           | 154            | 94             | 99              |
| 1100  | 2    | 20.1            | 3.0               |   | 0.16           | 1963          | 1997         | 2043          | 1396           | 1519           | 1712           | 1.62                  | 0.264 | 0.339     | 0.394 | 6.49                       | 150           | 157            | 98             | 103             |
| 1100  | 3    | 20.1            | 3.0               |   | 0.24           | 2961          | 2988         | 3031          | 1957           | 2262           | 2717           | 2.41                  | 0.244 | 0.338     | 0.414 | 7.35                       | 150           | 158            | 99             | 105             |
| 1100  | 4    | 30.0            | 3.0               |   | 0.08           | 952           | 993          | 1045          | 714            | 801            | 890            | 0.84                  | 0.267 | 0.350     | 0.411 | 5.24                       | 150           | 160            | 102            | 107             |
| 1100  | 5    | 30.2            | 3.0               |   | 0.16           | 1958          | 2002         | 2037          | 1318           | 1523           | 1747           | 1.61                  | 0.257 | 0.334     | 0.403 | 6.46                       | 150           | 167            | 102            | 112             |
| 1100  | 6    | 30.0            | 3.0               |   | 0.24           | 2949          | 2995         | 3024          | 2049           | 2241           | 2610           | 2.35                  | 0.249 | 0.333     | 0.398 | 7.29                       | 150           | 171            | 103            | 114             |
| <b>1200 Characteristic /Recovery (1)</b>          |      |                 |                   |   |                |               |              |               |                |                |                |                       |       |           |       |                            |               |                |                |                 |
| 1200  | 1    | 80.0            | 30.0              |   | 0.23           | 2896          | 3002         | 3061          | 1989           | 2257           | 2524           | 2.36                  | 0.235 | 0.328     | 0.386 | 7.32                       | 150           | 265            | 104            | 158             |
| 1200  | 3    | 80.2            | 30.0              |   | 0.23           | 2913          | 3003         | 3060          | 1966           | 2252           | 2582           | 2.36                  | 0.259 | 0.325     | 0.409 | 7.91                       | 150           | 262            | 101            | 362             |
| 1200  | 5    | 80.0            | 30.0              |   | 0.23           | 2916          | 3005         | 3061          | 1941           | 2237           | 2678           | 2.35                  | 0.248 | 0.325     | 0.410 | 7.84                       | 150           | 265            | 101            | 374             |
| 1200  | 10   | 80.2            | 30.0              |   | 0.23           | 2919          | 3003         | 3063          | 1958           | 2233           | 2719           | 2.34                  | 0.260 | 0.325     | 0.412 | 7.80                       | 150           | 256            | 100            | 453             |

| Test Req #:                              |      | N/A             |                   | NUCAP R&D CENTER<br>Brake Dynamometer Testing |                |               |              |               |                |                |                |                       |       |       | Cust Ref: |                            | 14K BRAKE     |                |                |                 |
|--|------|-----------------|-------------------|---|----------------|---------------|--------------|---------------|----------------|----------------|----------------|-----------------------|-------|-------|-----------|----------------------------|---------------|----------------|----------------|-----------------|
| Section                                  | Stop | Brake Speed kph | Release Speed kph | Stop Distance meter                           | Decel Torque g | Press Min kPa | Pres Avg kPa | Press Max kPa | Torque Min N-m | Torque Avg N-m | Torque Max N-m | MFDD m/s <sup>2</sup> | μ Min | μ Avg | μ Max     | Fluid Disp cm <sup>3</sup> | Rotor Init °C | Rotor Final °C | Lining Init °C | Lining Final °C |
| <b>1300 Fade (1)</b>                     |      |                 |                   |   |                |               |              |               |                |                |                |                       |       |       |           |                            |               |                |                |                 |
| 1300                                     | 1    | 100.1           | 5.1               |   | 0.40           | 4813          | 5660         | 6282          | 2846           | 3729           | 4454           | 3.83                  | 0.255 | 0.306 | 0.345     | 10.42                      | 151           | 348            | 96             | 402             |
| 1300                                     | 2    | 100.1           | 5.1               |   | 0.40           | 6657          | 8972         | 10569         | 3267           | 3708           | 4024           | 3.81                  | 0.160 | 0.217 | 0.311     | 13.23                      | 253           | 429            | 179            | 463             |
| 1300                                     | 3    | 100.1           | 5.1               |   | 0.40           | 6984          | 9100         | 11241         | 3415           | 3706           | 3908           | 3.81                  | 0.151 | 0.216 | 0.318     | 15.15                      | 313           | 481            | 210            | 508             |
| 1300                                     | 4    | 100.1           | 5.1               |   | 0.40           | 7099          | 10125        | 13315         | 3385           | 3696           | 3926           | 3.80                  | 0.126 | 0.206 | 0.325     | 17.61                      | 355           | 514            | 252            | 558             |
| 1300                                     | 5    | 100.1           | 5.1               |   | 0.40           | 7317          | 9721         | 12520         | 3308           | 3702           | 4093           | 3.81                  | 0.134 | 0.207 | 0.319     | 18.30                      | 388           | 540            | 286            | 601             |
| 1300                                     | 6    | 100.1           | 5.1               |   | 0.40           | 7113          | 8852         | 11227         | 3172           | 3710           | 4410           | 3.81                  | 0.148 | 0.218 | 0.316     | 18.05                      | 415           | 569            | 310            | 619             |
| 1300                                     | 7    | 100.1           | 5.1               |   | 0.40           | 6610          | 7817         | 9462          | 3119           | 3716           | 4399           | 3.82                  | 0.180 | 0.238 | 0.310     | 17.14                      | 437           | 590            | 330            | 627             |
| 1300                                     | 8    | 100.1           | 5.1               |   | 0.40           | 6131          | 7225         | 8226          | 3009           | 3720           | 4537           | 3.82                  | 0.196 | 0.252 | 0.313     | 16.25                      | 457           | 609            | 343            | 648             |
| 1300                                     | 9    | 100.1           | 5.1               |   | 0.40           | 6196          | 6975         | 7613          | 3021           | 3723           | 4451           | 3.83                  | 0.214 | 0.257 | 0.306     | 15.96                      | 475           | 625            | 356            | 684             |
| 1300                                     | 10   | 100.1           | 5.1               |   | 0.40           | 5879          | 6941         | 7555          | 3098           | 3727           | 4459           | 3.84                  | 0.214 | 0.255 | 0.294     | 16.19                      | 490           | 642            | 353            | 628             |
| 1300                                     | 11   | 100.1           | 5.1               |   | 0.40           | 5456          | 6692         | 7297          | 3020           | 3729           | 4457           | 3.84                  | 0.228 | 0.261 | 0.309     | 16.06                      | 504           | 661            | 340            | 594             |
| 1300                                     | 12   | 100.3           | 5.1               |   | 0.40           | 5661          | 6788         | 7408          | 3142           | 3730           | 4437           | 3.85                  | 0.223 | 0.255 | 0.297     | 16.26                      | 518           | 679            | 340            | 590             |
| 1300                                     | 13   | 100.1           | 5.1               |   | 0.40           | 4988          | 6357         | 7148          | 2826           | 3728           | 4539           | 3.84                  | 0.229 | 0.273 | 0.330     | 16.39                      | 529           | 675            | 309            | 550             |
| 1300                                     | 14   | 100.1           | 5.1               |   | 0.40           | 5635          | 7008         | 7932          | 3237           | 3729           | 4260           | 3.85                  | 0.194 | 0.252 | 0.305     | 17.12                      | 540           | 686            | 333            | 558             |
| 1300                                     | 15   | 100.1           | 5.1               |   | 0.40           | 6172          | 7610         | 8336          | 3158           | 3732           | 4299           | 3.85                  | 0.195 | 0.233 | 0.285     | 17.10                      | 550           | 684            | 359            | 565             |
| <b>1400 Hot performance 500 °C</b>       |      |                 |                   |   |                |               |              |               |                |                |                |                       |       |       |           |                            |               |                |                |                 |
| 1400                                     | 1    | 80.2            | 40.0              |   | 0.08           | 901           | 992          | 1107          | 618            | 739            | 887            | 0.78                  | 0.265 | 0.335 | 0.389     | 9.35                       | 500           | 511            | 309            | 372             |
| 1400                                     | 2    | 80.2            | 40.0              |   | 0.15           | 1888          | 2002         | 2108          | 1238           | 1453           | 1643           | 1.52                  | 0.229 | 0.331 | 0.390     | 9.72                       | 500           | 578            | 352            | 483             |
| 1400                                     | 3    | 80.2            | 40.0              |   | 0.23           | 2860          | 3001         | 3120          | 1962           | 2154           | 2304           | 2.25                  | 0.272 | 0.329 | 0.362     | 11.36                      | 500           | 616            | 349            | 472             |
| 1400                                     | 4    | 80.2            | 40.0              |   | 0.29           | 3817          | 3988         | 4111          | 2531           | 2736           | 2936           | 2.84                  | 0.251 | 0.315 | 0.345     | 11.94                      | 500           | 598            | 367            | 477             |
| 1400                                     | 5    | 80.2            | 40.0              |   | 0.34           | 4815          | 5010         | 5135          | 2881           | 3213           | 3501           | 3.32                  | 0.262 | 0.291 | 0.325     | 13.30                      | 500           | 581            | 378            | 461             |
| 1400                                     | 6    | 80.2            | 40.0              |   | 0.37           | 5804          | 5999         | 6090          | 3146           | 3461           | 3738           | 3.54                  | 0.239 | 0.267 | 0.297     | 14.61                      | 500           | 585            | 382            | 458             |
| <b>1500 Low speed/low pressure (3)</b>   |      |                 |                   |   |                |               |              |               |                |                |                |                       |       |       |           |                            |               |                |                |                 |
| 1500                                     | 1    | 20.1            | 3.0               |   | 0.09           | 941           | 991          | 1030          | 534            | 828            | 1217           | 0.87                  | 0.243 | 0.354 | 0.561     | 7.67                       | 150           | 153            | 119            | 121             |
| 1500                                     | 2    | 20.1            | 3.0               |   | 0.18           | 1959          | 1994         | 2021          | 1256           | 1708           | 2262           | 1.82                  | 0.236 | 0.373 | 0.519     | 7.51                       | 150           | 157            | 121            | 126             |
| 1500                                     | 3    | 20.1            | 3.0               |   | 0.28           | 2941          | 2983         | 3021          | 2287           | 2579           | 3052           | 2.78                  | 0.221 | 0.377 | 0.467     | 8.38                       | 150           | 160            | 122            | 129             |
| 1500                                     | 4    | 30.0            | 3.0               |   | 0.10           | 930           | 988          | 1027          | 423            | 900            | 1438           | 0.95                  | 0.213 | 0.391 | 0.657     | 6.03                       | 150           | 160            | 123            | 127             |
| 1500                                     | 5    | 30.0            | 3.0               |   | 0.19           | 1951          | 1996         | 2034          | 1215           | 1795           | 2539           | 1.90                  | 0.247 | 0.388 | 0.583     | 7.31                       | 150           | 170            | 120            | 137             |
| 1500                                     | 6    | 30.0            | 3.0               |   | 0.29           | 2936          | 2990         | 3035          | 2271           | 2676           | 3454           | 2.84                  | 0.244 | 0.387 | 0.530     | 8.03                       | 150           | 170            | 118            | 139             |
| <b>1600 Characteristic /Recovery (2)</b> |      |                 |                   |   |                |               |              |               |                |                |                |                       |       |       |           |                            |               |                |                |                 |
| 1600                                     | 1    | 80.0            | 30.0              |   | 0.25           | 2908          | 2997         | 3092          | 2142           | 2332           | 2627           | 2.44                  | 0.252 | 0.351 | 0.395     | 8.05                       | 150           | 258            | 119            | 254             |
| 1600                                     | 3    | 80.0            | 30.0              |   | 0.25           | 2896          | 2997         | 3075          | 2043           | 2359           | 2821           | 2.47                  | 0.225 | 0.345 | 0.423     | 8.26                       | 150           | 257            | 108            | 223             |
| 1600                                     | 5    | 80.0            | 30.0              |   | 0.25           | 2896          | 2996         | 3073          | 1981           | 2383           | 2759           | 2.50                  | 0.236 | 0.345 | 0.416     | 8.06                       | 150           | 263            | 104            | 217             |
| 1600                                     | 10   | 80.0            | 30.0              |   | 0.25           | 2899          | 2995         | 3070          | 2031           | 2420           | 2767           | 2.54                  | 0.215 | 0.352 | 0.438     | 7.83                       | 150           | 270            | 101            | 226             |
| <b>1700 Pressure Line (2)</b>            |      |                 |                   |   |                |               |              |               |                |                |                |                       |       |       |           |                            |               |                |                |                 |
| 1700                                     | 1    | 80.0            | 40.0              |   | 0.08           | 899           | 984          | 1042          | 572            | 758            | 975            | 0.80                  | 0.237 | 0.332 | 0.434     | 5.99                       | 150           | 204            | 104            | 174             |
| 1700                                     | 2    | 80.0            | 40.0              |   | 0.16           | 1902          | 1994         | 2065          | 1320           | 1584           | 1806           | 1.66                  | 0.280 | 0.344 | 0.404     | 7.22                       | 150           | 247            | 102            | 232             |
| 1700                                     | 3    | 80.0            | 40.0              |   | 0.26           | 2895          | 2995         | 3069          | 2220           | 2522           | 2734           | 2.63                  | 0.258 | 0.368 | 0.413     | 8.03                       | 150           | 248            | 101            | 223             |
| 1700                                     | 4    | 80.0            | 40.0              |   | 0.35           | 3868          | 3984         | 4056          | 3068           | 3394           | 3619           | 3.50                  | 0.238 | 0.369 | 0.412     | 8.52                       | 150           | 259            | 106            | 206             |
| 1700                                     | 5    | 80.0            | 40.0              |   | 0.45           | 4851          | 4999         | 5086          | 3937           | 4321           | 4590           | 4.80                  | 0.289 | 0.375 | 0.417     | 9.20                       | 150           | 251            | 105            | 193             |
| 1700                                     | 6    | 80.0            | 42.7              |   | 0.54           | 5828          | 5983         | 6102          | 4847           | 5187           | 5451           | 6.75                  | 0.291 | 0.378 | 0.423     | 9.83                       | 150           | 234            | 102            | 169             |
| <b>1800 Fade (2)</b>                     |      |                 |                   |   |                |               |              |               |                |                |                |                       |       |       |           |                            |               |                |                |                 |
| 1800                                     | 1    | 100.1           | 5.1               |   | 0.40           | 3649          | 4297         | 4968          | 3016           | 3725           | 4446           | 3.84                  | 0.279 | 0.400 | 0.505     | 9.14                       | 150           | 321            | 108            | 326             |
| 1800                                     | 2    | 100.1           | 5.1               |   | 0.40           | 4082          | 4695         | 5245          | 3224           | 3726           | 4425           | 3.83                  | 0.318 | 0.367 | 0.426     | 10.08                      | 253           | 408            | 170            | 383             |
| 1800                                     | 3    | 100.1           | 5.1               |   | 0.40           | 4293          | 5117         | 5551          | 3089           | 3724           | 4470           | 3.83                  | 0.301 | 0.346 | 0.408     | 11.00                      | 313           | 471            | 219            | 434             |
| 1800                                     | 4    | 100.1           | 5.1               |   | 0.40           | 4497          | 5380         | 5794          | 3112           | 3721           | 4393           | 3.83                  | 0.295 | 0.332 | 0.394     | 11.87                      | 355           | 518            | 249            | 456             |
| 1800                                     | 5    | 100.1           | 5.1               |   | 0.40           | 4850          | 5675         | 6177          | 3227           | 3725           | 4252           | 3.83                  | 0.277 | 0.318 | 0.390     | 12.83                      | 388           | 560            | 273            | 512             |
| 1800                                     | 6    | 100.1           | 5.1               |   | 0.40           | 5099          | 6070         | 6638          | 3143           | 3722           | 4255           | 3.83                  | 0.255 | 0.300 | 0.359     | 13.70                      | 415           | 599            | 299            | 575             |
| 1800                                     | 7    | 100.4           | 5.1               |   | 0.40           | 6204          | 7480         | 8322          | 2515           | 3728           | 4935           | 3.86                  | 0.179 | 0.238 | 0.295     | 16.80                      | 437           | 609            | 345            | 616             |
| 1800                                     | 8    | 100.1           | 5.1               |   | 0.40           | 6285          | 7597         | 8446          | 2750           | 3734           | 4649           | 3.85                  | 0.194 | 0.230 | 0.275     | 15.63                      | 457           | 646            | 363            | 603             |
| 1800                                     | 9    | 100.1           | 5.1               |   | 0.40           | 6422          | 7775         | 8722          | 3206           | 3735           | 4262           | 3.84                  | 0.188 | 0.223 | 0.269     | 14.90                      | 475           | 626            | 369            | 613             |
| 1800                                     | 10   | 100.1           | 5.1               |   | 0.40           | 6304          | 7629         | 8419          | 3366           | 3735           | 4073           | 3.84                  | 0.192 | 0.222 | 0.273     | 13.82                      | 490           | 646            | 377            | 604             |
| 1800                                     | 11   | 100.1           | 5.1               |   | 0.40           | 6282          | 7996         | 8928          | 3476           | 3736           | 4001           | 3.84                  | 0.188 | 0.213 | 0.283     | 14.51                      | 504           | 664            | 387            | 607             |
| 1800                                     | 12   | 100.1           | 5.1               |   | 0.40           | 6263          | 8423         | 9407          | 3450           | 3736           | 4061           | 3.84                  | 0.172 | 0.202 | 0.293     | 14.98                      | 517           | 683            | 397            | 613             |
| 1800                                     | 13   | 100.1           | 5.1               |   | 0.40           | 6287          | 9152         | 10478         | 3479           | 3742           | 3992           | 3.86                  | 0.157 | 0.186 | 0.284     | 16.01                      | 529           | 693            | 404            | 599             |
| 1800                                     | 14   | 100.1           | 5.1               |   | 0.40           | 6663          | 9543         | 11294         | 3531           | 3746           | 4037           | 3.86                  | 0.145 | 0.176 | 0.276     | 16.47                      | 540           | 703            | 409            | 597             |
| 1800                                     | 15   | 100.3           | 5.1               |   | 0.40           | 6622          | 10209        | 12154         | 3393           | 3750           | 4060           | 3.87                  | 0.137 | 0.166 | 0.269     | 17.52                      | 550           | 707            | 418            | 606             |
| <b>1900 Low speed/low pressure (4)</b>   |      |                 |                   |   |                |               |              |               |                |                |                |                       |       |       |           |                            |               |                |                |                 |
| 1900                                     | 1    | 20.1            | 3.0               |   | 0.08           | 931           | 987          | 1031          | 212            | 798            | 1508           | 0.84                  | 0.121 | 0.349 | 0.685     | 6.79                       | 150           | 159            | 118            | 123             |
| 1900                                     | 2    | 20.1            | 3.0               |   | 0.18           | 1942          | 1990         | 2020          | 1205           | 1659           | 2295           | 1.75                  | 0.254 | 0.368 | 0.523     | 6.20                       | 150           | 159            | 121            | 133             |
| 1900                                     | 3    | 20.1            | 3.0               |   | 0.28           | 2920          | 2974         | 3021          | 2288           | 2550           | 3026           | 2.71                  | 0.259 | 0.381 | 0.466     | 6.97                       | 150           | 160            | 123            | 135             |
| 1900                                     | 4    | 30.0            | 3.0               |   | 0.10           | 924           | 985          | 1045          | 447            | 893            | 1495           | 0.94                  | 0.219 | 0.396 | 0.654     | 4.82                       | 150           | 172            | 124            | 136             |
| 1900                                     | 5    | 30.0            | 3.0               |   | 0.20           | 1932          | 1992         | 2032          | 1234           | 1834           | 2669           | 1.93                  | 0.290 | 0.405 | 0.608     | 5.93                       | 150           | 166            | 123            | 140             |
| 1900                                     | 6    | 30.0            | 3.0               |   | 0.30           | 2916          | 2985         | 3038          | 2202           | 2785           | 3697           | 2.94                  | 0.308 | 0.411 | 0.570     | 6.76                       | 150           | 169            | 123            | 141             |
| <b>2000 Final characteristic</b>         |      |                 |                   |   |                |               |              |               |                |                |                |                       |       |       |           |                            |               |                |                |                 |
| 2000                                     | 1    | 80.0            | 30.0              |   | 0.25           | 2881          | 2993         | 3078          | 1904           | 2315           | 2861           | 2.42                  | 0.282 | 0.353 | 0.443     | 6.87                       | 150           | 253            | 122            | 246             |
| 2000                                     | 3    | 80.0            | 30.0              |   | 0.26           | 2888          | 2995         | 3081          | 2156           | 2440           | 3044           | 2.55                  | 0.251 | 0.360 | 0.459     | 7.02                       | 150           | 293            | 111            | 257             |
| 2000                                     | 5    | 80.0            | 30.0              |   | 0.26           | 2894          | 2996         | 3085          | 2156           | 2511           | 3095           | 2.63                  | 0.266 | 0.366 | 0.469     | 7.02                       | 150           | 311            | 112            | 259             |



|                         |                |                                     |          |
|-------------------------|----------------|-------------------------------------|----------|
| Test Req #:             | N/A            | Test Date:                          | 11/16/10 |
| Cust. Ref:              | KODIAK TRAILER | Program:                            | W030905  |
| Brake Name:             | KODIAK 2250    | Effective Radius (mm):              | 171.45   |
| Rotor/Drum ID:          | KODIAK TRAILER | Actual Wheel Load (kg):             | 1087     |
| Pri/Lead/Inner Lining:  | N/A            | Actual Inertia (kgm <sup>2</sup> ): | 191.4    |
| Sec/Trail/Outer Lining: | N/A            | SAE J2681 Report Version 1.01       |          |



| Description                                     | Value        | Description     | Value        |
|---|--------------|-----------------|--------------|
| <b>Nominal <math>\mu</math></b>                 | <b>0.344</b> |                 |              |
| <b>Minimum <math>\mu</math></b>                 | <b>0.166</b> | Test Duration   | 8 hrs        |
| <b>Maximum <math>\mu</math></b>                 | <b>0.424</b> |                 |              |
| Green effectiveness minimum $\mu$               | 0.247        |                 |              |
| Post - burnish average $\mu$ (Stability check)  | 0.359        |                 |              |
| Low v-p maximum $\mu$ (all low spd-low prs)     | 0.424        | <b>Wear</b>     | <b>Value</b> |
| Low v-p minimum $\mu$ (all low spd-low prs)     | 0.333        | Thickness loss: |              |
| Speed sensitivity (%) (160 vs. 80 km/h)         | -32          | Inner/Leading   | 8.283 mm     |
| High speed minimum $\mu$ (180 & 200 km/h)       | 0.245        | Outer/Trailing  | 7.160 mm     |
| Pre-fade pressure sensitivity (%)               | -5           | Rotor           | 1.9275 mm    |
| Post-fade pressure sensitivity (%)              | 10           | Weight loss:    |              |
| Fade (1) minimum $\mu$                          | 0.206        | Inner/Leading   | 184.46 gram  |
| Hot performance 500 °C minimum $\mu$            | 0.267        | Outer/Trailing  | 177.08 gram  |
| Fade (2) minimum $\mu$                          | 0.166        | Rotor           | 21 gram      |
| Post fades average $\mu$ , Final characteristic | 0.360        |                 |              |

|                         |                |                                     |          |
|-------------------------|----------------|-------------------------------------|----------|
| Test Req #:             | N/A            | Test Date:                          | 11/16/10 |
| Cust. Ref:              | KODIAK TRAILER | Program:                            | W030905  |
| Brake Name:             | KODIAK 2250    | Effective Radius (mm):              | 171.45   |
| Rotor/Drum ID:          | KODIAK TRAILER | Actual Wheel Load (kg):             | 1087     |
| Pri/Lead/Inner Lining:  | N/A            | Actual Inertia (kgm <sup>2</sup> ): | 191.4    |
| Sec/Trail/Outer Lining: | N/A            | SAE J2681 Report Version 1.01       |          |

|             |     |   |           |           |
|-------------|-----|---|-----------|-----------|
| Test Req #: | N/A | <b>NUCAP R&amp;D CENTER<br/>Brake Dynamometer Testing</b> | Cust Ref: | 14K BRAKE |
|-------------|-----|---|-----------|-----------|

### Pad and Rotor Wear

| <u>Inboard Pad Thickness (mm)</u> | Individual Positions |        |        |        |        |        |        |        | Avg          |
|-----------------------------------|----------------------|--------|--------|--------|--------|--------|--------|--------|--------------|
|                                   | 1                    | 2      | 3      | 4      | 5      | 6      | 7      | 8      |              |
| Initial                           | 15.616               | 15.664 | 15.691 | 15.602 | 15.631 | 15.633 | 15.654 | 15.640 | 15.641       |
| Final                             | 7.728                | 7.263  | 7.090  | 6.990  | 7.315  | 7.227  | 7.364  | 7.894  | 7.359        |
| Loss                              | 7.888                | 8.401  | 8.601  | 8.612  | 8.316  | 8.406  | 8.290  | 7.746  | <b>8.283</b> |

| <u>Outboard Pad Thickness (mm)</u> | Individual Positions |        |        |        |        |        |        |        | Avg          |
|------------------------------------|----------------------|--------|--------|--------|--------|--------|--------|--------|--------------|
|                                    | 1                    | 2      | 3      | 4      | 5      | 6      | 7      | 8      |              |
| Initial                            | 12.724               | 12.898 | 12.862 | 12.693 | 12.811 | 12.756 | 12.759 | 12.826 | 12.791       |
| Final                              | 5.191                | 5.469  | 5.684  | 6.059  | 6.040  | 5.607  | 5.573  | 5.430  | 5.632        |
| Loss                               | 7.533                | 7.429  | 7.178  | 6.634  | 6.771  | 7.149  | 7.186  | 7.396  | <b>7.160</b> |

| <u>Rotor Thickness (mm)</u> | POSITION 1 |        | POSITION 2 |        | POSITION 3 |        | POSITION 4 |        | Avg          |
|-----------------------------|------------|--------|------------|--------|------------|--------|------------|--------|--------------|
|                             | In         | Out    | In         | Out    | In         | Out    | In         | Out    |              |
|                             | Initial    | 40.010 | 40.050     | 40.000 | 40.040     | 40.010 | 40.040     | 40.020 |              |
| Final                       | 38.120     | 38.180 | 38.000     | 38.180 | 38.000     | 38.110 | 38.100     | 38.110 | 38.100       |
| Loss                        | 1.890      | 1.870  | 2.000      | 1.860  | 2.010      | 1.930  | 1.920      | 1.940  | <b>1.928</b> |

| <u>Pad &amp; Rotor Weight (gram)</u> | Inboard Pad | Outboard Pad | Rotor    |
|--------------------------------------|-------------|--------------|----------|
| Initial                              | 606.58      | 580.54       | 35381.00 |
| Final                                | 422.12      | 403.46       | 35360.00 |
| Loss                                 | 184.46      | 177.08       | 21.00    |

| <u>MicroFinish (micron)</u> | POSITION 1 |       | POSITION 2 |       | POSITION 3 |       | POSITION 4 |       |
|-----------------------------|------------|-------|------------|-------|------------|-------|------------|-------|
|                             | In         | Out   | In         | Out   | In         | Out   | In         | Out   |
|                             | Initial    | 1.17  | 1.36       | 1.16  | 1.43       | 1.17  | 1.42       | 1.18  |
| Final                       | 2.99       | 2.16  | 3.02       | 2.20  | 3.08       | 2.16  | 3.12       | 2.18  |
| Difference                  | -1.82      | -0.80 | -1.86      | -0.77 | -1.91      | -0.74 | -1.94      | -0.80 |

