# U.S. DOT/NHTSA LABORATORY TEST PROCEDURE FOR FMVSS 121D
# AIR BRAKE SYSTEMS - DYNAMOMETER
# TP-121D-01 (09 MAY 1990)

**Client** Fritec S.A. de C.V.

**Brake** Meritor 'Q'

**Lining Code** BN3-4515

**Test No.** M02-108-10

**Date** 17 Junio 2002

**Signature**

Charles W. Greening, Jr., President
for Greening Testing Laboratories, Inc.

**Address of Client**

Fritec S.A. de C.V.
V Carranza M6L93
Sta Maria, Aztahuacan 09500
Mexico

Customer ID: FRIT01

**U.S. DEPARTMENT OF TRANSPORTATION**
**NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION**
**LABORATORY TEST PROCEDURE FOR FMVSS 121D**
**AIR BRAKE SYSTEMS - DYNAMOMETER**
**TP-121D-01 (09 MAY 1990)**

| | |
|---|---|
| Test No. | M02-108-10 |
| Brake | Meritor 'Q' |
| Lining Code | BN3-4515 |
| Brake Configuration | 'S' cam |
| FMSI No. | 4515 |
| Size | 16.5 x 7 inches |
| Effective Radius | 8.25 inches, nominal |
| Air Chamber | Type 30 |
| Slack Adjuster Length | 5.5 inches |
| Adjustment | automatic |
| Drum Part No. | Webb 66893F |
| Drum Mass | 48.0 kg (nominal) |
| Axle Load (GAWR) | 23000 lb |
| Static Loaded Radius | 19.6 inches |
| Test Inertia | 953 slug·ft² |
| Simulated Wheel Load | 11503 lb |
| Wheel Rotation | with cam |
| Test Fixture | 7601.134 |
| Control Thermocouple | Leading shoe, recessed 0.040" below surface |
| Date Test Parts Received | 03 Junio 2002 |
| Test Date(s) | 14 - 17 June 2002 |
| Reference | Mr. Bernardo Ramis |

**DATA NOTES**

1. All average and sustained pressure, torque, and deceleration values shown in this report are calculated with respect to **DISTANCE.**

2. The data presented in this report has been gathered as follows:
   START Threshold, Torque Controlled Stops = 50 lbf·ft torque(during brake apply)
   START Threshold, Pressure Controlled Stops = 95% of control level
   INITIAL Data values are taken at the point where the control level is achieved.
   SUSTAINED Data Interval = Time interval from which the control level is achieved through to the STOP threshold.
   END Data values are taken at the point where the STOP threshold is achieved back (minus) 0.1 seconds.
   STOP Threshold = 5 r/min, or 15 mi/h (for Brake Power Sequence)

   AVERAGE values are reported over the interval between START and STOP Threshold levels. MINIMUM values are only reported during the SUSTAINED Data Interval.

3. Brake Apply Control = Pressure, $\frac{250\ lbf/in^2}{s}$

4. Cooling Air Temperature = 80°F

5. Cooling Air Velocity = 25 mi/h

6. For all stops which show "zero" (0) or negative values for some of the computed pressure or torque values:

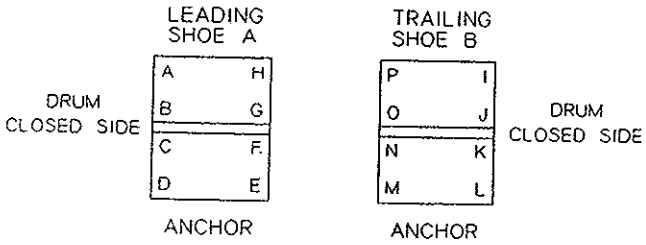
   These stops achieved zero speed but did not achieve the torque level required for the particular stop. Since the START data and STOP data thresholds were satisfied, deceleration rate, distance, time to stop, etc., are accurate values, and can be used for data comparison purposes.

   The presence of "zero" values generally is caused by lack of brake performance, resulting in a "clamp" condition. "Clamp" condition is defined by the brake calling for the maximum pressure the test section allows ("clamp" pressure) and the brake being unable to attain the deceleration rate required in the test section at that pressure.

## BRAKE SHOE THICKNESS

inches

Shoe Thickness Measurement Locations




| | Pre Test | Post Test | Loss |
|---|---|---|---|
| A | 0.819 | 0.815 | 0.004 |
| B | 0.898 | 0.883 | 0.015 |
| C | 0.846 | 0.827 | 0.019 |
| D | 0.643 | 0.637 | 0.006 |
| E | 0.647 | 0.638 | 0.009 |
| F | 0.845 | 0.830 | 0.015 |
| G | 0.899 | 0.885 | 0.014 |
| H | 0.824 | 0.814 | 0.010 |
| Average Thickness Loss | | | 0.012 |
| I | 0.817 | 0.801 | 0.016 |
| J | 0.899 | 0.892 | 0.007 |
| K | 0.839 | 0.838 | 0.001 |
| L | 0.636 | 0.634 | 0.002 |
| M | 0.635 | 0.636 | (0.001) |
| N | 0.842 | 0.844 | (0.002) |
| O | 0.899 | 0.892 | 0.007 |
| P | 0.818 | 0.796 | 0.022 |
| Average Thickness Loss | | | 0.006 |
| Total Average Loss | | | **0.018** |

## BRAKE SHOE MASS

kg

| | | | |
|---|---|---|---|
| Shoe A, Leading | 7.912 | 7.839 | 0.073 |
| Shoe B, Trailing | 7.936 | 7.897 | 0.039 |
| Total Loss | | | **0.112** |

NOTE: Values in parentheses indicate an increase in thickness or mass.

## DRUM DIAMETER
inches

| | OPEN | CENTER | CLOSED |
|---|---|---|---|
| Pre Test | | | |
| Point W to Point Y | 16.489 | 16.489 | 16.491 |
| Point X to Point Z | 16.500 | 16.497 | 16.495 |
| Post Test | | | |
| Point W to Point Y | 16.493 | 16.493 | 16.493 |
| Point X to Point Z | 16.498 | 16.496 | 16.496 |
| Change in Diameter W-Y | **(0.004)** | **(0.004)** | **(0.002)** |
| Change in Diameter X-Z | **0.002** | **0.001** | **(0.001)** |

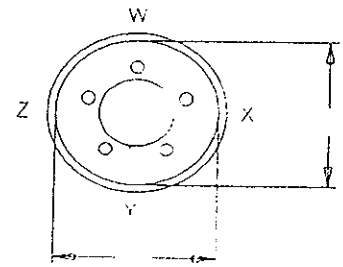
## DRUM MASS
kg

Pre Test 48.057 Post Test 47.997 Loss **0.060**

NOTE: Values in parentheses indicate an increase in thickness or mass

| | Pre Test | Post Test |
|---|---|---|
| **DRUM SURFACE FINISH,** µinches ($R_a$) (adjacent to W position) | 224 | 138 |
| **DRUM BRINELL HARDNESS** (adjacent to W position) | 217 | 212 |
| **DRUM TIR,** inches | 0.010 | 0.020 |

Drum Diameter Measurement Locations



**FMVSS 121 DYNAMOMETER REQUIREMENTS FOR BRAKES PRODUCED AFTER 13 OCTOBER 1978**

| CATEGORY | AVERAGE RETARDATION FORCE RATIO minimum | BRAKE POWER 9 ft/s² 100 psig maximum | BRAKE RECOVERY 12 ft/s² 85 psig maximum | |
|---|---|---|---|---|
| | | | ANTI-LOCK 12 psig minimum | NON ANTI-LOCK 20 psig minimum |
| Truck-Tractor, front | | X | | |
| Truck-Tractor, rear | | X | * | X |
| Truck, front | | X | * | X |
| Truck, rear | | X | * | X |
| Trailered Vehicle, psig | X | | * | X |
| 20 | 0.05 | | | |
| 30 | 0.12 | | | |
| 40 | 0.18 | | | |
| 50 | 0.25 | | | |
| 60 | 0.31 | | | |
| 70 | 0.37 | | | |
| 80 | 0.41 | | | |
| Bus, Commercial, front | | X | * | X |
| Bus, Commercial, rear | | X | * | X |
| Bus, School, front | | X | * | X |
| Bus, School, rear | | X | * | X |

* This requirement applies to all assemblies that have an Anti-Lock system provided.

**TEST BRAKE NOISE GLOSSARY**

"Peeps" or "Squeaks" - medium to high-pitched noises of very short duration.

"Squeals" - high-pitched noises of rather long duration and very loud.

"Chatter" - low frequency but rather high intensity stuttering of the brake. On some chatters the dynamometer shakes a bit, may be any length.

"Howl" - noise of rather long duration and very loud, medium pitch.

"Squawks" - medium low-pitched noises of very short duration.

"Groans" - medium low-pitched noises of long duration.

"Moans" - very low-pitched noises of long duration.

NOTE: All brake noise will be footnoted at the bottom of the data sheets. If excessive noise was observed, a separate note will be included. If no noise is observed, there will be no comments shown.

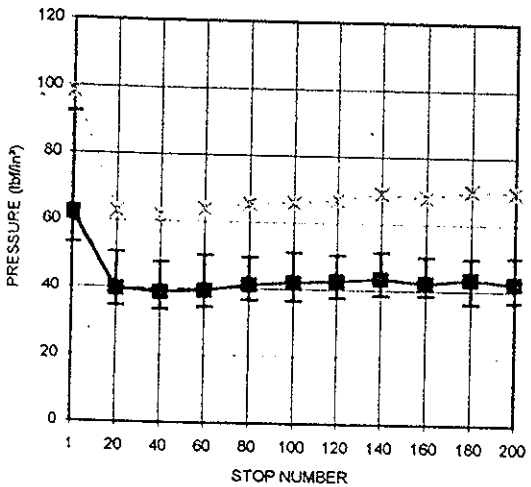
# U.S. DOT/NHTSA LABORATORY TEST PROCEDURE FOR FMVSS 121D
## AIR BRAKE SYSTEMS - DYNAMOMETER
## TP-121D-01 (09 MAY 1990)
## TEST SYNOPSIS

| Cycle | Initial Temp °F | Time Cycle s | Brake Speed mi/h | Cooling Speed mi/h | Press lbf/in² | Press Unit lbf/in² | Max Press Allowed | Decel ft/s² | Number of Stops |
|---|---|---|---|---|---|---|---|---|---|
| Burnish | 350 | -- | 40 | 30 | -- | -- | 105 | 10.0 | 200 |
| Burnish | 500 | -- | 40 | 30 | -- | -- | 105 | 10.0 | 200 |
| Brake Retardation | 160 | -- | 50 | 30 | -- | -- | -- | -- | 7 |
| Brake Power | 175 | 72 | 50-15 | 30 | 20-80 | 10 | 100 | 9.0 | 10 |
| | 175°F Initial Temperature for the first snub only | | | | | | | | |
| Hot Stop | -- | 60 | 20 | 30 | -- | -- | 120 | 14.0 | 1 |
| | Hot Stop begins 60 seconds after the end of the 10th Brake Power snub | | | | | | | | |
| Recovery | -- | 60 | 30 | 30 | -- | -- | 85 | 12.0 | 20 |
| | First stop begins 120 seconds after the end of the Hot Stop | | | | | | | | |
| 'nd of Test | -- | -- | -- | -- | -- | -- | -- | -- | -- |

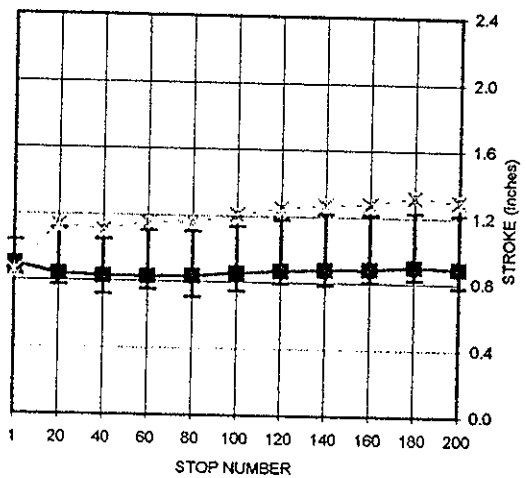
# U.S. DOT/NHTSA LABORATORY TEST PROCEDURE FOR FMVSS 121D (TP-121D-01)

TEST: M02-108-10 REPORT: 027491-1 LINING: BN3-4515

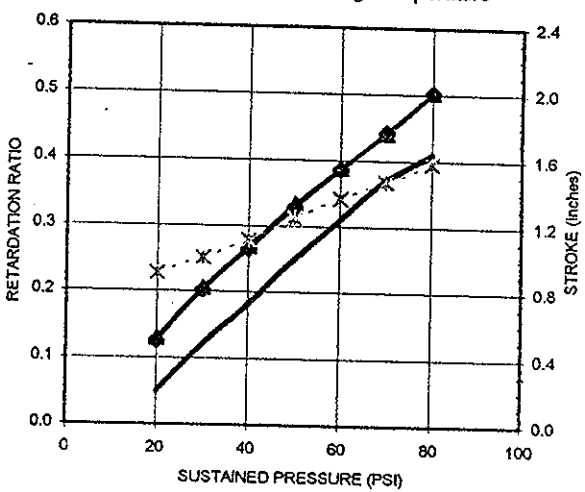
350°F BURNISH
40 mi/h - 10 ft/s² Deceleration




500°F BURNISH
40 mi/h - 10 ft/s² Deceleration



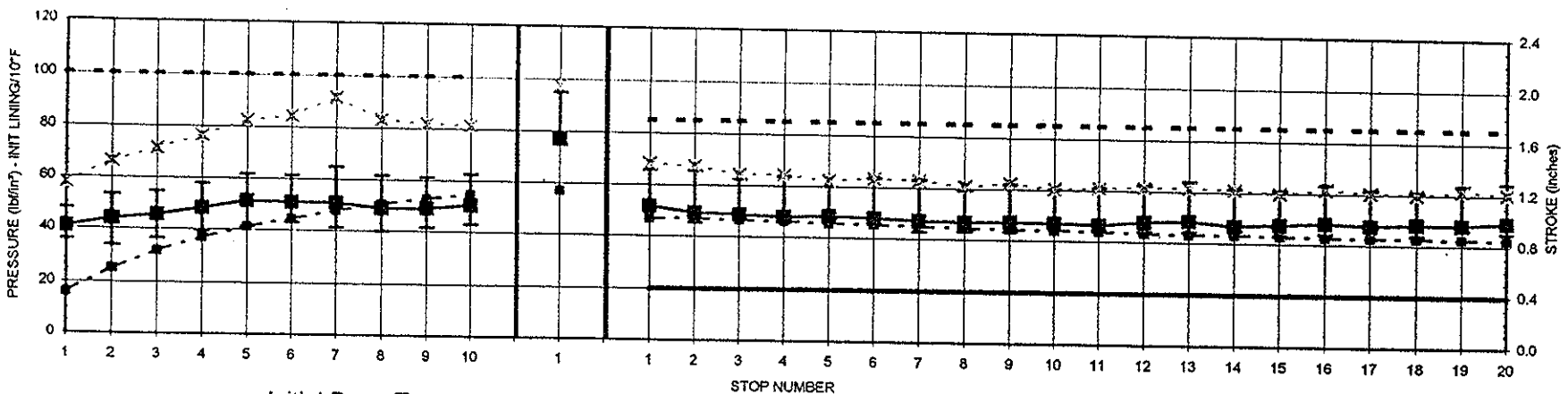

RETARDATION
50 mi/h - 160°F Initial Lining Temperature




BRAKE POWER

HOT STOP

RECOVERY




- Initial Drum Temperature
- Maximum Limit
- Retardation By Distance
- Maximum Stroke
- Minimum Limit
- Maximum, Average, Minimum Pressure
- Retardation By Time

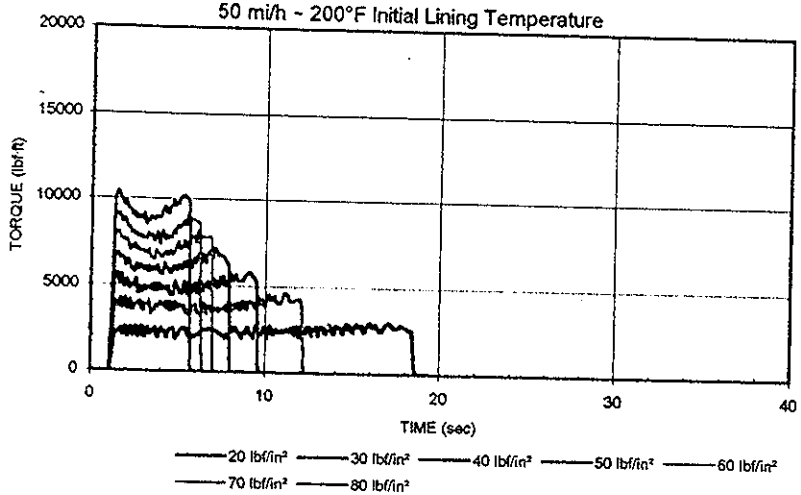
# U.S. DOT/NHTSA LABORATORY TEST PROCEDURE FOR FMVSS 121D (TP-121D-01)

TEST: M02-108-10 REPORT: 027491-1 LINING: BN3-4515

TORQUE PROFILE vs TIME & DISTANCE

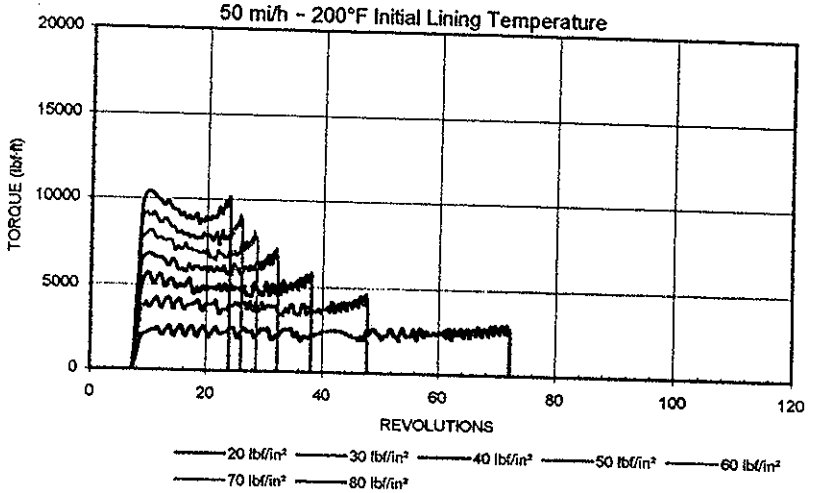
BRAKE RETARDATION

50 mi/h - 200°F Initial Lining Temperature




BRAKE RETARDATION

50 mi/h - 200°F Initial Lining Temperature

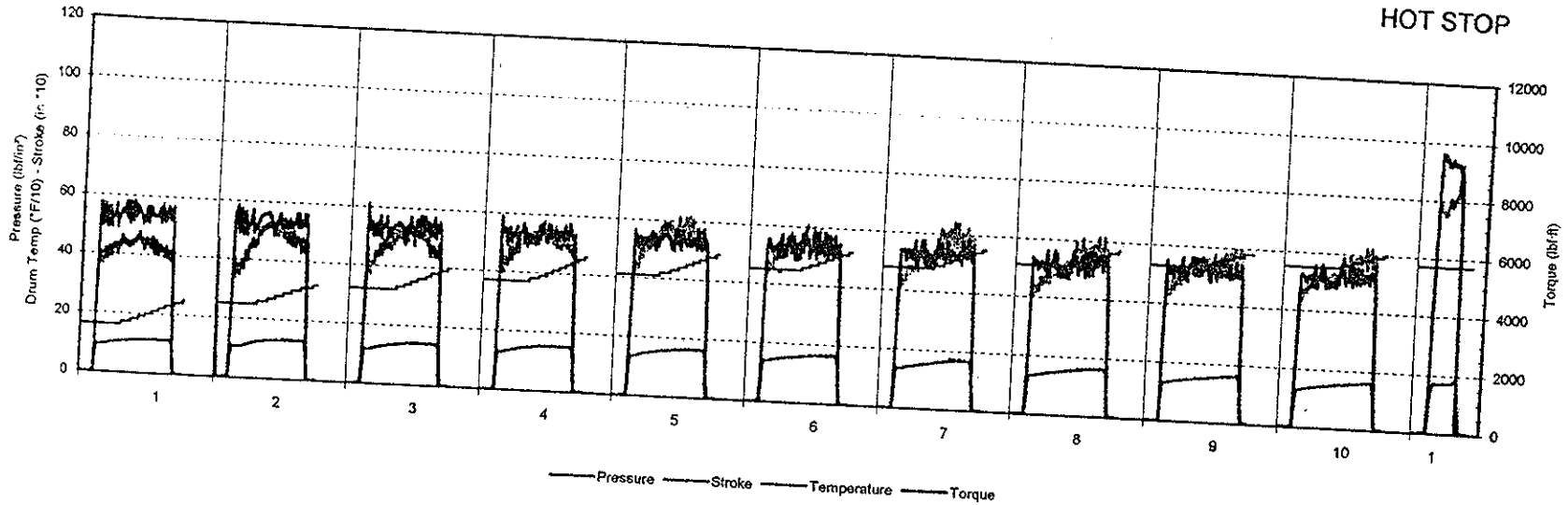


# U.S. DOT/NHTSA LABORATORY TEST PROCEDURE FOR FMVSS 121D (TP-121D-01)

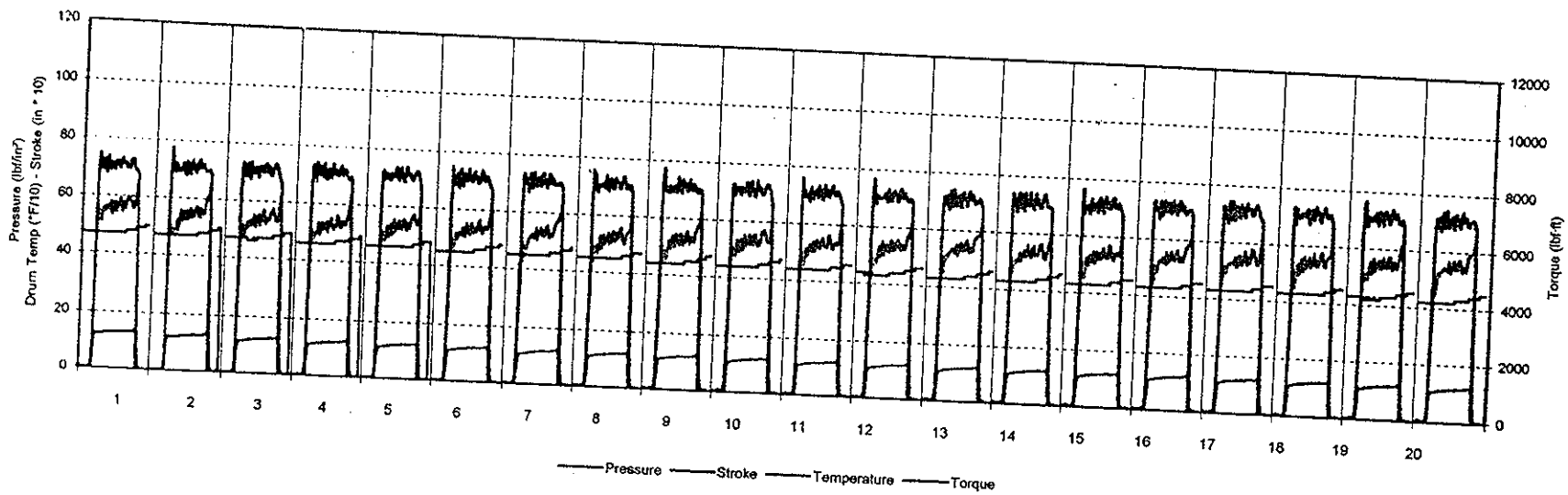
TEST: M02-108-10 REPORT: 027491-1 LINING: BN3-4515

BRAKE POWER

HOT STOP




RECOVERY



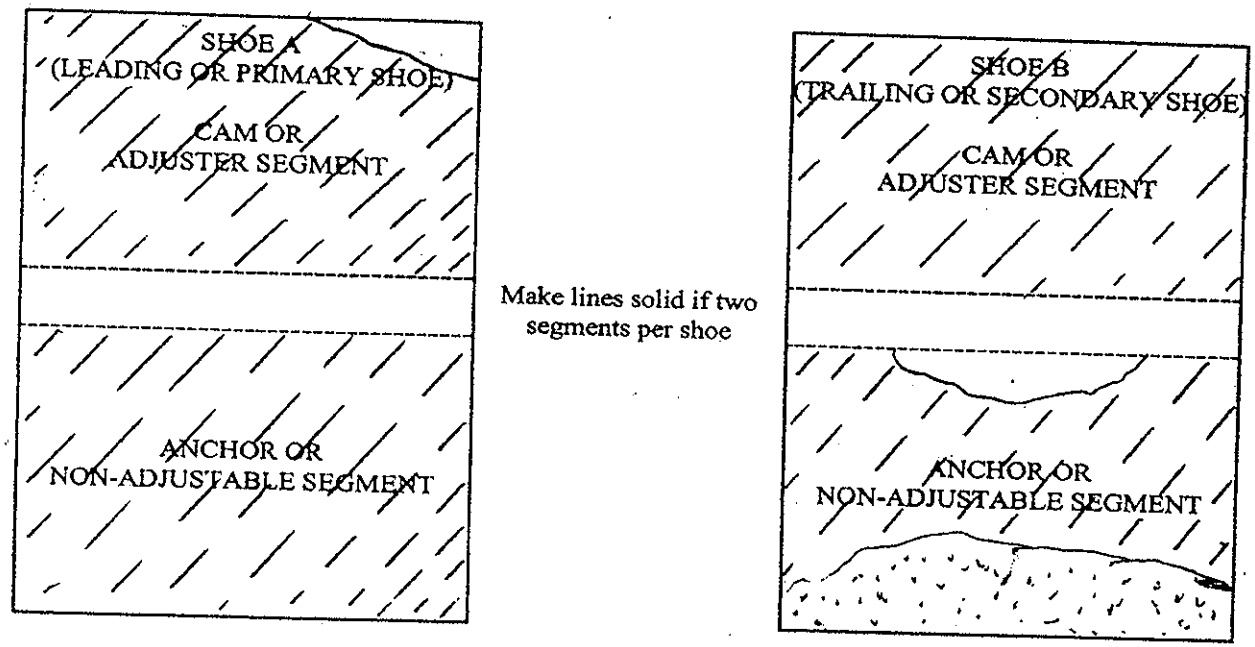
# PRE BURNISH BRAKE ADJUSTMENT CHECK

1. 1.4 inches stroke at 80 lbf/in².

2. 4 lbf·ft (48 lbf·in) at 10 r/min.

| CYCLE NO. | SPEED INIT mi/h | SPEED FNL mi/h | TIME STOP s | DISTANCE STOP ft | DECEL AVERAGE TIME ft/s² | DECEL AVERAGE DIST ft/s² | PRESSURE INIT lbf/in² | PRESSURE SUSTAINED TIME lbf/in² | PRESSURE SUSTAINED DIST lbf/in² | PRESSURE END lbf/in² | PRESSURE MAX lbf/in² | PRESSURE MIN lbf/in² | TORQUE AVERAGE TIME lbf·ft | TORQUE AVERAGE DIST lbf·ft | TORQUE INIT lbf·ft | TORQUE SUSTAINED TIME lbf·ft | TORQUE SUSTAINED DIST lbf·ft | TORQUE END lbf·ft | TORQUE MAX lbf·ft | TORQUE MIN lbf·ft | TEMPERATURE DRUM INIT °F | TEMPERATURE DRUM FNL °F | TEMPERATURE LEADING INIT °F | TEMPERATURE LEADING FNL °F | TEMPERATURE TRAILING INIT °F | TEMPERATURE TRAILING FNL °F | STROKE MAX- in | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BURNISH** | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 40 mi/h - 10.0 ft/s² Deceleration Rate | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 350°F Initial Temperature measured 18 seconds before brake engagement. Initial Temperature shown is at brake engagement. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 40.0 | 0.6 | 5.82 | 175 | 9.92 | 9.82 | 67.4 | 62.4 | 58.7 | 68.6 | 65.1 | 86.7 | 92.5 | 53.4 | 5757 | 5678 | 6022 | 5881 | 5915 | 5714 | 6242 | 5564 | 380 | 414 | 325 | 403 | 191 | 207 | 1.97 | |
| 20 | 40.0 | 0.6 | 5.76 | 173 | 10.05 | 9.94 | 39.8 | 39.6 | 49.7 | 40.4 | 40.8 | 36.7 | 50.7 | 34.6 | 5808 | 5728 | 6387 | 5936 | 5974 | 5828 | 6735 | 5304 | 323 | 383 | 350 | 406 | 317 | 330 | 1.26 | |
| 40 | 40.0 | 0.6 | 5.74 | 173 | 10.06 | 9.96 | 38.6 | 38.6 | 47.2 | 39.2 | 39.8 | 35.8 | 47.9 | 33.6 | 5809 | 5735 | 6333 | 5937 | 5973 | 5639 | 6572 | 5477 | 323 | 383 | 350 | 418 | 320 | 335 | 1.24 | |
| 60 | 39.9 | 0.6 | 5.78 | 173 | 9.98 | 9.89 | 39.8 | 39.3 | 48.5 | 40.4 | 40.6 | 43.7 | 50.1 | 34.4 | 5799 | 5736 | 6168 | 5921 | 5969 | 5771 | 6660 | 5456 | 329 | 388 | 350 | 407 | 322 | 334 | 1.28 | |
| 80 | 40.0 | 0.6 | 5.76 | 173 | 10.03 | 9.96 | 41.7 | 41.2 | 47.0 | 42.3 | 42.5 | 43.2 | 49.6 | 36.6 | 5802 | 5737 | 6000 | 5920 | 5960 | 5560 | 6644 | 5469 | 328 | 383 | 350 | 420 | 322 | 336 | 1.31 | |
| 100 | 39.9 | 0.7 | 5.78 | 174 | 9.93 | 9.85 | 42.5 | 42.0 | 50.8 | 43.2 | 43.4 | 45.6 | 51.2 | 36.4 | 5796 | 5725 | 6258 | 5922 | 5965 | 5760 | 6466 | 5477 | 327 | 386 | 349 | 396 | 321 | 331 | 1.32 | |
| 120 | 40.0 | 0.7 | 5.78 | 174 | 9.98 | 9.90 | 43.2 | 42.7 | 49.6 | 43.8 | 44.0 | 43.9 | 50.6 | 37.6 | 5805 | 5736 | 6233 | 5926 | 5961 | 5602 | 6659 | 5473 | 331 | 392 | 350 | 416 | 323 | 338 | 1.34 | |
| 140 | 40.0 | 0.6 | 5.76 | 173 | 10.03 | 9.92 | 44.0 | 43.4 | 49.2 | 44.8 | 44.9 | 41.0 | 51.5 | 38.4 | 5797 | 5711 | 6069 | 5929 | 5956 | 5656 | 6664 | 5469 | 329 | 384 | 350 | 399 | 321 | 331 | 1.38 | |
| 160 | 40.0 | 0.7 | 5.76 | 173 | 10.02 | 9.94 | 43.1 | 42.4 | 49.4 | 43.9 | 43.8 | 39.7 | 50.3 | 38.5 | 5813 | 5733 | 6217 | 5931 | 5956 | 5917 | 6719 | 5475 | 332 | 393 | 350 | 393 | 324 | 334 | 1.36 | |
| 180 | 40.0 | 0.6 | 5.76 | 173 | 10.03 | 9.95 | 43.9 | 43.5 | 46.4 | 44.6 | 44.9 | 43.3 | 49.8 | 36.1 | 5804 | 5734 | 5977 | 5925 | 5960 | 5509 | 6446 | 5490 | 327 | 385 | 350 | 468 | 326 | 347 | 1.40 | |
| 200 | 39.9 | 0.6 | 5.74 | 173 | 10.03 | 9.91 | 42.8 | 42.3 | 49.0 | 43.5 | 43.6 | 39.1 | 50.3 | 36.6 | 5814 | 5741 | 6194 | 5932 | 5962 | 5691 | 6813 | 5439 | 334 | 406 | 350 | 419 | 326 | 341 | 1.39 | |
| 500°F Initial Temperature measured 18 seconds before brake engagement. Initial Temperature shown is at brake engagement. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 40.1 | 0.6 | 5.80 | 177 | 10.06 | 9.90 | 45.9 | 45.0 | 49.7 | 47.1 | 47.2 | 43.0 | 52.2 | 41.8 | 5740 | 5626 | 6054 | 5892 | 5915 | 5934 | 6407 | 5326 | 210 | 353 | 198 | 224 | 187 | 194 | 0.86 | |
| 20 | 40.0 | 0.5 | 5.76 | 172 | 10.08 | 9.98 | 44.4 | 42.0 | 46.7 | 45.0 | 43.3 | 54.0 | 56.1 | 38.6 | 5759 | 5708 | 6232 | 5862 | 5907 | 5709 | 6787 | 5199 | 442 | 528 | 500 | 549 | 446 | 453 | 1.14 | |
| 40 | 40.0 | 0.7 | 5.74 | 173 | 10.05 | 9.96 | 43.6 | 41.3 | 43.2 | 44.2 | 42.6 | 47.4 | 52.7 | 36.0 | 5760 | 5699 | 6054 | 5867 | 5897 | 5638 | 6744 | 5243 | 447 | 525 | 500 | 551 | 452 | 459 | 1.11 | |
| 60 | 40.0 | 0.6 | 5.76 | 173 | 10.03 | 9.93 | 44.0 | 41.3 | 44.6 | 44.5 | 42.6 | 52.2 | 55.6 | 37.5 | 5758 | 5706 | 5979 | 5863 | 5904 | 5779 | 6444 | 5323 | 455 | 529 | 500 | 556 | 458 | 465 | 1.16 | |
| 80 | 40.1 | 0.6 | 5.76 | 173 | 10.06 | 10.01 | 44.2 | 41.7 | 43.1 | 44.8 | 43.0 | 50.1 | 55.4 | 35.4 | 5756 | 5696 | 5943 | 5865 | 5896 | 5581 | 6780 | 5220 | 456 | 527 | 500 | 559 | 461 | 467 | 1.16 | |
| 100 | 40.0 | 0.6 | 5.74 | 172 | 10.06 | 9.98 | 45.5 | 42.7 | 46.1 | 46.2 | 44.1 | 53.8 | 56.9 | 37.3 | 5751 | 5692 | 6101 | 5861 | 5900 | 5786 | 6476 | 5352 | 463 | 534 | 500 | 560 | 463 | 470 | 1.21 | |
| 120 | 40.0 | 0.5 | 5.76 | 173 | 10.06 | 9.97 | 46.0 | 43.4 | 46.4 | 46.7 | 44.8 | 56.7 | 59.1 | 39.7 | 5752 | 5696 | 5927 | 5861 | 5907 | 5772 | 6516 | 5401 | 463 | 531 | 499 | 561 | 464 | 471 | 1.25 | |
| 140 | 39.9 | 0.6 | 5.78 | 173 | 9.96 | 9.89 | 46.8 | 43.9 | 46.9 | 47.4 | 45.4 | 56.8 | 60.9 | 39.2 | 5749 | 5690 | 5876 | 5860 | 5905 | 5748 | 6443 | 5417 | 464 | 533 | 500 | 566 | 465 | 472 | 1.27 | |
| 160 | 40.0 | 0.6 | 5.78 | 173 | 10.01 | 9.94 | 46.9 | 44.3 | 48.1 | 47.5 | 45.7 | 58.4 | 60.8 | 40.2 | 5758 | 5709 | 6086 | 5860 | 5905 | 5729 | 6738 | 5425 | 468 | 533 | 500 | 572 | 466 | 473 | 1.28 | |
| 180 | 40.1 | 0.6 | 5.78 | 173 | 10.02 | 9.98 | 47.9 | 45.1 | 48.2 | 48.5 | 46.5 | 59.0 | 61.5 | 41.0 | 5757 | 5701 | 6136 | 5859 | 5900 | 5769 | 6595 | 5426 | 468 | 536 | 500 | 575 | 467 | 475 | 1.32 | |
| 200 | 40.0 | 0.7 | 5.78 | 173 | 9.98 | 9.92 | 47.5 | 44.6 | 47.7 | 48.1 | 46.0 | 56.1 | 61.0 | 38.8 | 5760 | 5707 | 5951 | 5865 | 5904 | 5617 | 6607 | 5386 | 469 | 536 | 500 | 580 | 467 | 474 | 1.30 | |

# POST BURNISH INSPECTION SKETCH




BURNISHED  NO CONTACT  IN BETWEEN

Estimate of percentage contacted lining area is: Shoe A 98 % Shoe B 95 %

JMU
Technician

08:47
Time

17 JN02
Date

# POST BURNISH BRAKE ADJUSTMENT CHECK

1. 1.5 inches stroke at 80 lbf/in².

2. 21 lbf·ft (252 lbf·in) at 10 r/min.

## BRAKE RETARDATION

50 mi/h - 160°F Initial Temperature measured 18 seconds before brake engagement. Initial Temperature shown is at brake engagement.

| CYCLE NO. | SPEED INIT (mi/h) | SPEED FNL (mi/h) | TIME STOP (s) | DISTANCE STOP (ft) | DECEL AVERAGE TIME (ft/s²) | DECEL AVERAGE DIST (ft/s²) | PRESSURE AVERAGE TIME (lbf/in²) | PRESSURE AVERAGE DIST (lbf/in²) | PRESSURE SUSTAINED TIME (lbf/in²) | PRESSURE SUSTAINED DIST (lbf/in²) | PRESSURE MAX (lbf/in²) | PRESSURE MIN (lbf/in²) | TORQUE AVERAGE TIME (lbf·ft) | TORQUE AVERAGE DIST (lbf·ft) | TORQUE INIT (lbf·ft) | TORQUE SUSTAINED TIME (lbf·ft) | TORQUE SUSTAINED DIST (lbf·ft) | TORQUE END (lbf·ft) | TORQUE MAX (lbf·ft) | TORQUE MIN (lbf·ft) | TEMPERATURE DRUM INIT (°F) | TEMPERATURE DRUM FNL (°F) | TEMPERATURE LEADING INIT (°F) | TEMPERATURE LEADING FNL (°F) | TEMPERATURE TRAILING INIT (°F) | TEMPERATURE TRAILING FNL (°F) | STROKE MAX (in) | RETARDATION RATIO TIME | RETARDATION RATIO DIST |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 49.9 | 0.6 | 17.07 | 652 | 4.24 | 4.11 | 20.2 | 20.1 | 20.2 | 20.1 | 20.6 | 19.5 | 2431 | 2355 | 2049 | 2432 | 2358 | 2589 | 2975 | 1830 | 211 | 298 | 160 | 231 | 126 | 145 | 0.91 | 0.129 | 0.126 |
| 1 | 49.7 | 0.6 | 10.72 | 401 | 6.72 | 6.62 | 30.2 | 30.0 | 30.2 | 30.1 | 30.5 | 29.7 | 3861 | 3796 | 3614 | 3859 | 3798 | 4264 | 4661 | 3163 | 154 | 272 | 161 | 328 | 161 | 186 | 1.01 | 0.205 | 0.202 |
| 1 | 49.6 | 0.5 | 8.15 | 303 | 8.83 | 8.71 | 40.2 | 39.9 | 40.2 | 40.0 | 40.6 | 39.7 | 5065 | 5001 | 5276 | 5061 | 5002 | 5580 | 5841 | 4298 | 143 | 251 | 160 | 288 | 161 | 187 | 1.12 | 0.269 | 0.266 |
| 1 | 49.3 | 0.6 | 6.55 | 242 | 10.91 | 10.83 | 50.2 | 49.8 | 50.2 | 49.9 | 50.5 | 49.8 | 6285 | 6215 | 6660 | 6268 | 6177 | 6506 | 7214 | 5527 | 141 | 271 | 160 | 360 | 161 | 188 | 1.25 | 0.334 | 0.329 |
| 1 | 49.2 | 0.7 | 5.59 | 205 | 12.72 | 12.73 | 60.1 | 59.7 | 60.2 | 59.8 | 60.5 | 59.8 | 7305 | 7281 | 8091 | 7286 | 7259 | 7857 | 8263 | 6479 | 141 | 269 | 160 | 207 | 161 | 173 | 1.37 | 0.388 | 0.386 |
| 1 | 49.1 | 0.6 | 4.91 | 178 | 14.48 | 14.60 | 70.1 | 69.6 | 70.2 | 69.7 | 70.5 | 69.5 | 8306 | 8332 | 9452 | 8288 | 8310 | 8708 | 9452 | 7377 | 142 | 273 | 160 | 291 | 161 | 186 | 1.47 | 0.441 | 0.442 |
| 1 | 48.7 | 0.6 | 4.30 | 155 | 16.41 | 16.52 | 80.1 | 79.5 | 80.2 | 79.6 | 80.9 | 79.7 | 9468 | 9474 | 10324 | 9444 | 9444 | 10012 | 10628 | 8580 | 142 | 263 | 160 | 290 | 161 | 185 | 1.58 | 0.503 | 0.503 |

| CYCLE NO. | SPEED INIT | SPEED FNL | TIME STOP | DISTANCE STOP | DECEL AVERAGE TIME | DECEL AVERAGE DIST | PRESSURE AVERAGE TIME | PRESSURE AVERAGE DIST | PRESSURE INIT | PRESSURE SUSTAINED TIME | PRESSURE SUSTAINED DIST | PRESSURE END | PRESSURE MAX | PRESSURE MIN | TORQUE AVERAGE TIME | TORQUE AVERAGE DIST | TORQUE INIT | TORQUE SUSTAINED TIME | TORQUE SUSTAINED DIST | TORQUE END | TORQUE MAX | TORQUE MIN | TEMPERATURE DRUM INIT | TEMPERATURE DRUM FNL | TEMPERATURE LEADING INIT | TEMPERATURE LEADING FNL | TEMPERATURE TRAILING INIT | TEMPERATURE TRAILING FNL | STROKE MAX |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mi/h | | s | ft | ft/s² | | | | | lbf/in² | | | | | | | | lbf·ft | | | | | °F | | | | | | in |
| **BRAKE POWER** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50 - 15 mi/h - 9.0 ft/s² Deceleration Rate - 72 Second Time Cycle - First Snub 175°F Initial Temperature measured 18 seconds before brake engagement. Initial Temperature shown is at brake engagement. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 50.0 | 15.3 | 5.55 | 267 | 9.19 | 9.14 | 41.7 | 40.9 | 44.2 | 42.4 | 41.9 | 39.6 | 47.9 | 36.1 | 5253 | 5223 | 5779 | 5354 | 5375 | 5110 | 5939 | 4879 | 159 | 272 | 178 | 307 | 179 | 195 | 1.16 |
| 2 | 50.1 | 15.3 | 5.55 | 267 | 9.22 | 9.19 | 45.4 | 43.9 | 40.1 | 46.2 | 45.1 | 43.9 | 53.4 | 33.9 | 5255 | 5227 | 5414 | 5345 | 5363 | 5702 | 6041 | 4783 | 252 | 335 | 237 | 482 | 211 | 241 | 1.33 |
| 3 | 50.1 | 15.4 | 5.55 | 268 | 9.19 | 9.15 | 46.8 | 45.6 | 45.2 | 47.5 | 46.7 | 44.3 | 54.7 | 36.6 | 5260 | 5235 | 5731 | 5348 | 5366 | 5252 | 6125 | 4828 | 318 | 422 | 286 | 328 | 243 | 254 | 1.43 |
| 4 | 50.1 | 15.3 | 5.57 | 269 | 9.19 | 9.13 | 49.6 | 48.4 | 46.7 | 50.6 | 49.7 | 45.7 | 58.0 | 39.7 | 5256 | 5228 | 5580 | 5350 | 5368 | 5345 | 6187 | 4842 | 369 | 487 | 304 | 342 | 265 | 274 | 1.53 |
| 5 | 50.0 | 15.3 | 5.57 | 269 | 9.16 | 9.07 | 52.3 | 50.8 | 51.1 | 53.3 | 52.3 | 52.3 | 61.4 | 43.1 | 5248 | 5217 | 5422 | 5342 | 5361 | 5193 | 5922 | 4879 | 412 | 517 | 322 | 362 | 286 | 296 | 1.65 |
| 6 | 50.1 | 15.3 | 5.59 | 270 | 9.16 | 9.10 | 53.0 | 50.8 | 48.1 | 53.9 | 52.2 | 54.7 | 65.0 | 41.3 | 5244 | 5212 | 5532 | 5349 | 5370 | 5588 | 6028 | 4803 | 446 | 550 | 350 | 398 | 313 | 324 | 1.69 |
| 7 | 50.1 | 15.3 | 5.74 | 277 | 8.90 | 8.86 | 50.9 | 48.8 | 48.4 | 51.8 | 50.2 | 53.2 | 61.7 | 40.0 | 5239 | 5211 | 5424 | 5338 | 5360 | 5260 | 6050 | 4805 | 478 | 577 | 383 | 455 | 341 | 354 | 1.83 |
| 8 | 50.0 | 15.3 | 5.76 | 278 | 8.84 | 8.79 | 51.0 | 49.1 | 46.9 | 51.8 | 50.4 | 57.6 | 61.1 | 41.7 | 5091 | 5062 | 5366 | 5190 | 5215 | 4977 | 6006 | 4662 | 507 | 592 | 421 | 529 | 370 | 387 | 1.67 |
| 9 | 50.0 | 15.3 | 5.76 | 279 | 8.86 | 8.76 | 52.4 | 50.5 | 48.4 | 53.4 | 51.9 | 58.8 | 62.6 | 43.1 | 5083 | 5057 | 5279 | 5184 | 5208 | 5031 | 5660 | 4746 | 529 | 607 | 457 | 587 | 399 | 418 | 1.64 |
| 10 | 50.0 | 15.3 | 5.76 | 279 | 8.86 | 8.76 | 52.4 | 50.5 | 48.4 | 53.4 | 51.9 | 58.8 | 62.6 | 43.1 | 5090 | 5060 | 5189 | 5188 | 5213 | 5033 | 5937 | 4771 | 547 | 621 | 488 | 589 | 426 | 442 | 1.63 |
| **HOT STOP** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 mi/h - 14.0 ft/s² Deceleration Rate - Stop begins 60 seconds after the end of the 10th Brake Power snub | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 19.9 | 0.6 | 1.93 | 31 | 14.67 | 13.65 | 73.5 | 65.7 | 84.2 | 79.7 | 77.1 | 89.9 | 95.0 | 74.9 | 8417 | 7831 | 9524 | 9340 | 9480 | 9078 | 9850 | 9018 | 570 | 579 | 514 | 553 | 451 | 455 | 1.95 |
| **BRAKE RECOVERY** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 30 mi/h - 12.0 ft/s² Deceleration Rate - First stop begins 120 seconds after the end of the Hot Stop 60 Second Time Cycle | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 30.0 | 0.6 | 3.60 | 82 | 11.99 | 11.74 | 54.7 | 51.6 | 57.7 | 56.4 | 55.0 | 62.8 | 65.8 | 50.9 | 6860 | 6678 | 7207 | 7138 | 7200 | 6872 | 7687 | 6812 | 469 | 517 | 484 | 539 | 447 | 452 | 1.37 |
| 2 | 30.0 | 0.6 | 3.59 | 82 | 12.02 | 11.79 | 52.8 | 49.2 | 57.8 | 54.2 | 52.0 | 62.7 | 65.5 | 45.5 | 6897 | 6756 | 7517 | 7130 | 7200 | 7058 | 7781 | 6731 | 470 | 513 | 489 | 539 | 449 | 455 | 1.35 |
| 3 | 30.0 | 0.6 | 3.59 | 82 | 12.02 | 11.78 | 51.7 | 48.7 | 53.8 | 53.3 | 51.8 | 57.9 | 62.4 | 47.5 | 6883 | 6718 | 7357 | 7136 | 7187 | 6828 | 7645 | 6745 | 466 | 509 | 489 | 541 | 450 | 455 | 1.29 |
| 4 | 30.0 | 0.6 | 3.60 | 82 | 11.99 | 11.81 | 51.1 | 48.0 | 50.7 | 52.6 | 50.9 | 61.3 | 63.9 | 46.8 | 6889 | 6740 | 7223 | 7127 | 7193 | 6979 | 7653 | 6754 | 463 | 503 | 489 | 541 | 451 | 456 | 1.29 |
| 5 | 30.0 | 0.7 | 3.58 | 82 | 12.01 | 11.84 | 51.5 | 48.5 | 54.0 | 53.1 | 51.6 | 55.0 | 60.1 | 47.6 | 6895 | 6735 | 7465 | 7140 | 7187 | 6973 | 7663 | 6784 | 457 | 500 | 488 | 538 | 450 | 455 | 1.25 |
| 6 | 30.0 | 0.7 | 3.61 | 82 | 11.91 | 11.71 | 51.0 | 47.9 | 50.2 | 52.5 | 50.9 | 58.3 | 63.7 | 45.6 | 6884 | 6728 | 7449 | 7122 | 7173 | 6798 | 7681 | 6721 | 454 | 495 | 485 | 538 | 450 | 455 | 1.27 |
| 7 | 29.9 | 0.6 | 3.59 | 82 | 11.98 | 11.72 | 50.9 | 47.3 | 50.7 | 52.3 | 50.3 | 59.2 | 63.1 | 42.9 | 6888 | 6741 | 7185 | 7121 | 7178 | 7010 | 7809 | 6727 | 450 | 492 | 482 | 531 | 449 | 454 | 1.26 |
| 8 | 29.9 | 0.6 | 3.60 | 82 | 11.94 | 11.62 | 50.0 | 46.9 | 50.2 | 51.5 | 49.8 | 55.4 | 59.6 | 43.3 | 6890 | 6730 | 7515 | 7124 | 7167 | 6981 | 7707 | 6694 | 447 | 489 | 480 | 533 | 448 | 452 | 1.22 |
| 9 | 30.0 | 0.6 | 3.59 | 82 | 12.02 | 11.82 | 50.7 | 47.3 | 53.3 | 52.2 | 50.2 | 59.9 | 62.0 | 43.4 | 6901 | 6758 | 7457 | 7127 | 7191 | 7066 | 7807 | 6700 | 443 | 484 | 479 | 526 | 446 | 452 | 1.25 |
| 10 | 30.0 | 0.6 | 3.65 | 84 | 11.79 | 11.48 | 50.4 | 47.0 | 51.5 | 52.6 | 51.2 | 54.6 | 60.3 | 47.1 | 6807 | 6566 | 7251 | 7141 | 7186 | 6918 | 7717 | 6732 | 441 | 482 | 477 | 525 | 446 | 450 | 1.21 |
| 11 | 30.0 | 0.5 | 3.65 | 84 | 11.84 | 11.45 | 50.1 | 46.6 | 50.4 | 52.2 | 50.7 | 56.7 | 61.2 | 44.1 | 6794 | 6551 | 7545 | 7128 | 7174 | 6879 | 7843 | 6672 | 439 | 478 | 476 | 526 | 443 | 448 | 1.22 |
| 12 | 30.0 | 0.6 | 3.60 | 82 | 11.99 | 11.81 | 51.3 | 47.9 | 51.0 | 52.7 | 50.8 | 59.6 | 62.4 | 44.1 | 6896 | 6751 | 7151 | 7123 | 7183 | 7019 | 7705 | 6716 | 435 | 475 | 472 | 520 | 442 | 447 | 1.23 |
| 13 | 30.0 | 0.6 | 3.62 | 82 | 11.92 | 11.71 | 52.0 | 48.5 | 53.1 | 53.7 | 51.7 | 59.6 | 64.1 | 44.4 | 6872 | 6702 | 7389 | 7124 | 7179 | 6981 | 7843 | 6692 | 433 | 475 | 470 | 518 | 440 | 445 | 1.23 |
| 14 | 30.1 | 0.7 | 3.64 | 84 | 11.83 | 11.53 | 50.5 | 46.9 | 51.0 | 52.7 | 51.1 | 57.6 | 61.3 | 45.1 | 6794 | 6553 | 7383 | 7122 | 7169 | 6978 | 7643 | 6733 | 432 | 473 | 469 | 522 | 439 | 443 | 1.22 |
| 15 | 30.0 | 0.6 | 3.62 | 83 | 11.92 | 11.58 | 50.9 | 47.6 | 50.7 | 52.6 | 51.0 | 56.6 | 61.0 | 43.3 | 6851 | 6656 | 7587 | 7123 | 7164 | 6893 | 7869 | 6605 | 430 | 470 | 468 | 520 | 437 | 441 | 1.20 |
| 16 | 30.1 | 0.6 | 3.60 | 82 | 12.04 | 11.85 | 51.8 | 48.3 | 53.2 | 53.3 | 51.3 | 59.9 | 63.6 | 44.1 | 6892 | 6742 | 7463 | 7123 | 7175 | 7021 | 7757 | 6721 | 428 | 470 | 466 | 512 | 436 | 441 | 1.23 |
| 17 | 30.0 | 0.8 | 3.63 | 84 | 11.76 | 11.50 | 51.2 | 47.6 | 51.6 | 53.4 | 52.0 | 58.0 | 61.5 | 47.0 | 6797 | 6558 | 7274 | 7129 | 7177 | 6856 | 7643 | 6704 | 428 | 470 | 465 | 515 | 435 | 439 | 1.21 |
| 18 | 30.0 | 0.8 | 3.61 | 83 | 11.86 | 11.66 | 51.7 | 48.4 | 50.7 | 53.6 | 51.9 | 57.0 | 61.0 | 43.9 | 6849 | 6649 | 7305 | 7125 | 7167 | 6993 | 7887 | 6593 | 427 | 468 | 464 | 512 | 433 | 437 | 1.20 |
| 19 | 30.1 | 0.5 | 3.64 | 84 | 11.92 | 11.61 | 51.9 | 48.1 | 53.7 | 54.2 | 52.6 | 60.8 | 63.7 | 46.1 | 6802 | 6575 | 7323 | 7127 | 7183 | 6976 | 7717 | 6733 | 426 | 467 | 462 | 510 | 432 | 437 | 1.23 |
| 20 | 30.1 | 0.7 | 3.61 | 82 | 11.96 | 11.81 | 52.9 | 49.3 | 53.4 | 54.7 | 52.8 | 60.4 | 64.7 | 45.0 | 6869 | 6698 | 7328 | 7124 | 7177 | 7017 | 7873 | 6664 | 424 | 467 | 461 | 507 | 431 | 436 | 1.21 |

## POST TEST INSPECTION

Shoe A, Leading: The lining has resin bleed, pitting and 97% contact. There is no flaking, grooving or surface cracking evident.

Shoe B, Trailing: The lining has resin bleed, pitting and 93% contact. There is no flaking, grooving or surface cracking evident.

Drum: The braking surface is lightly grooved and brown/grey in color. There is light lining transfer and pitting present. There are no heat checks or surface cracks evident.

All other test hardware appears in good condition.