Current Rating Systems for Replacement Brake Lining

Review for The Maintenance Council

American Trucking Associations

Adams Mark Hotel - Charlotte, NC

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Overview

- Current Methods
  - Passenger Vehicle and Heavy Truck
    - » North America
    - » Europe
- Laboratory to Vehicle Correlation
- What is Achievable?

Current North American Methods

- Brake Lining Only
  - SAE J661/J866 and VESC V-3 Edge Codes
- Passenger Car Brakes
  - SAE J1652/J2430
  - D³EA® Brake Lining Certification
- Heavy Vehicle Brakes
  - RP-628
  - FMVSS 121D
  - SAE J1801/1802
- Vehicles
  - FMVSS 100/105/121/135

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SAE J661/J866 and VESC V-3

- Brake Lining Quality Control Test
- What it Does
  - Empirical friction material sample test
    - » Small test sample (1 inch x 1 inch)
  - No vehicle relevant conditions such as speed, surface loading or cooling
  - Material "registration" (AMECA)
- What it Does Not
  - Objectively predict the suitability of a brake friction material for use in a specific vehicle

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Friction Materials Test Machine (Chase)

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SAE J866 Friction Coefficient Identification

1. Scope -

Note: it is emphasized that this document does not establish friction requirements for brake linings, nor does it designate significant characteristics of brake linings which must be considered in overall brake performance. Due to other factors that include brake system design and operating environment, the friction coefficients obtained from this document cannot reliably be used to predict brake system performance.

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SAE J1652/J2430

Friction Material Effectiveness Rating Test

- Single-ended Dynamometer Test
- What it Does
  - 'A' vs. 'B' comparisons
  - Reviewing changes in formulations
- What it Does Not
  - Objectively predict the suitability of a brake friction material for use in a specific vehicle
  - Does not preserve interactive conditioning between front and rear brakes
  - Does not use vehicle relevant brake cooling

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Single-ended Dynamometer

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Test Brake Set-up

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Sample Size Comparison

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Brake Lining Certification Program (1)

- Dual-ended Dynamometer Test
  - Front and rear brakes tested in tandem
- What it Does
  - Voluntary certification process based upon Federal braking standards for new motor vehicles
  - Vehicle platform specific test conditions
  - Objective performance criteria

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Brake Lining Certification Program (2)

- Correlation demonstrated with vehicle tests across a wide range of vehicles and friction materials
- NHTSA Participation
  - Regularly reviewed
  - Endorsed

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Dual-ended Brake Dynamometer

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Air Brakes

RP-628

- Brake Lining Rating Program
- What it Does
  - Friction material performance grading based upon FMVSS 121D Laboratory Test
  - Limited comparison to other materials
  - Limited number of test conditions provided
- What it Does Not
  - Objectively predict the suitability of a friction material for use in a specific vehicle
  - Does not provide evidence of compliance with FMVSS 121

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Air Brakes
FMVSS 121D

- Laboratory Brake Test
- What it Does
  - Test of one complete brake assembly
  - Grading based upon FMVSS 121D
- What it Does Not
  - Not a validation test, compliance only
  - " are not rules, regulations or NHTSA interpretations regarding the meaning of a FMVSS"
  - Objectively predict the suitability of a brake friction material for use in a specific vehicle

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SAE J1801/J1802
Brake Block Effectiveness Rating

- Dynamometer Brake Test
  - J1801 - criteria
  - J1802 - test procedure
- What is Does (was supposed to do)
  - Rate performance of friction materials for air-braked vehicles
- What it Does Not
  - Rate performance of friction materials for air-braked vehicles
  - Very few tests conducted beyond initial development testing

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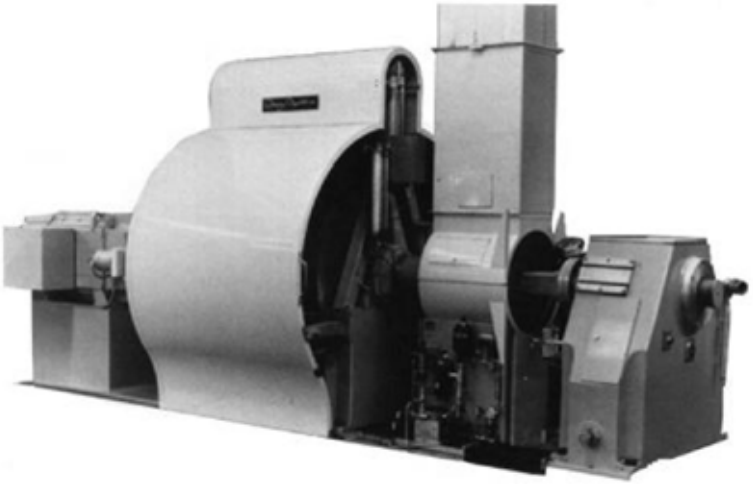
On-Highway Truck Brake Dynamometer



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European Replacement Brake Lining Rating Methods

- Combination of Vehicle and Lab tests
- Passenger Cars
  - ECE R90
    - » Vehicle test in accordance with ECE R13
    - » Dynamometer test for matching OE friction (+/- 15%)
    - » Every application must be tested
- Heavy Vehicles
  - ISO/DIS 11157

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North American Vehicle Tests
FMVSS 100/121/122/105/135

- Vehicle Brake System Performance Tests
- What They Do
  - Specific vehicle test protocol
  - Measure vehicle stopping distances under a variety of conditions
  - Provide objective criteria for pass/fail
- NHTSA enforced mandatory conformance

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Laboratory to Vehicle Correlation

- Why don't most lab tests correlate to vehicle tests?
  - Failure to properly simulate vehicle characteristics
    - » Weight distribution
    - » Brake actuation system
    - » Brake cooling
    - » Synergistic brake conditioning

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