

Recommended Practice for Transit Bus Foundation Brake Lining Classification

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Abstract: This recommended practice provides guidelines for selecting brake lining for replacement installation.

Keywords: brake lining, brake lining classification, brake lining replacement, bus brake, foundation brake lining replacement, transit bus, transit bus foundation

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Introduction

(This introduction is not a part of APTA BT-002-03, *Recommended Practice for Transit Bus Foundation Brake Lining Classification*)

This Recommended Practice for Transit Bus Foundation Brake Lining Classification reflects the consensus of the APTA Bus Standards Program members on the items, methods, and procedures that have provided the best performance record based on the experiences of those present and participating in meetings of the Program Task Forces and Working Groups. Recommended practices are voluntary, industry-developed, and consensus-based practices that assist equipment suppliers, vehicle and component manufacturers, and maintenance personnel in the construction, assembly, operation, and maintenance of transit bus vehicles. Recommended practices may include test methodologies and informational documents. Recommended practices are non-exclusive and voluntary; they are intended to neither endorse nor discourage the use of any product or procedure. All areas and items included therein are subject to manufacturers' supplemental or superceding recommendations. APTA recognizes that for certain applications, the practices, as implemented by operating agencies, may be either more or less restrictive than those given in this document.

This recommended practice provides guidelines for transit bus foundation brake lining classification. APTA recommends the use of this recommended practice by:

- Individuals or organizations that inspect and maintain transit buses
- Individuals or organizations that contract with others for the inspection and maintenance of transit buses
- Individuals or organizations that influence how transit buses are inspected and maintained

Participants

The American Public Transportation Association (APTA) greatly appreciates the contributions of the Bus Transit Standards Brake System Working Group, who provided the primary effort in the drafting of the *Recommended Practice for Transit Bus Foundation Brake Lining Classification*.

Contents

1. Overview.....	1
1.1 Scope	1
1.2 Purpose	1
2. References.....	1
3. Definitions, abbreviations, and acronyms.....	1
3.1 Definitions	1
3.2 Abbreviations and acronyms	2
4. Testing procedure.....	2
5. Classification.....	3

Recommended Practice for Transit Bus Foundation Brake Lining Classification

1. Overview

This recommended practice provides transit bus maintenance departments with typical test performance data to assist in the selection of replacement foundation brake linings. Individual operating agencies should modify these guidelines to accommodate their specific equipment and mode of operation.

1.1 Scope

This recommended practice provides guidelines for only “S-cam” type brakes and only at the parameters listed in the table in Section 4.1. The testing procedure and data collected does not cover brake lining wear, noise, or other areas of overall transit bus foundation brake system performance or operation.

1.2 Purpose

The purpose of this recommended practice is to provide guidance to operating agencies in selecting transit bus replacement brake lining.

Basic frictional properties of various brake blocks can be compared with other lining that have been FMVSS 121 dynamometer-tested using the referenced test conditions following SAE review of the test data. The torque values can only be used to determine the relative friction characteristics of the various lining under the stated test conditions.

2. References

This recommended practice should be used in conjunction with the following publications:

49 CFR 571.121, Code of Federal Regulations, Title 49: Volume 5, Part 571, “Federal Motor Vehicle Safety Standards, Section 121, “Air Brake Systems,” 2002.

SAE PRI, Society of Automotive Engineers, Peer Review Institute, Brake Lining Review Committee evaluation of FMVSS121 dynamometer test results.

3. Definitions, abbreviations, and acronyms

For the purposes of this recommended practice, the following terms, definitions, abbreviations, and acronyms apply.

3.1 Definitions

3.1.1 fade rating: The highest maximum fade pressure minus the lowest maximum fade pressure.

3.1.2 highest maximum fade pressure: The highest “maximum fade pressure” of the ten stops.

3.1.3 lowest maximum fade pressure: the lowest “maximum fade pressure” of the ten stops

3.1.4 maximum fade pressure: The Code of Federal Regulations: Title 49, part 571, section 121 paragraph S5.4.2 requires 10 snubs from 50 to 15 mph to be made for the “brake power” (sometimes referred to as fade) portion of the test. Each of these 10 applications will have a maximum fade pressure.

3.1.5 Torque Value: The Code of Federal Regulations: Title 49, part 571, section 121 paragraph S5.4.1.1 requires 7 brake applications to be made from 50 mph to 0 for the "brake retardation", in 10 psi increments, beginning at 20 psi, ending at 80 psi, with each stop initiating at 200 F. Each application will have an average brake output torque value.

3.2 Abbreviations and acronyms

FMSI	Friction Material Standard Institute
FMVSS	Federal Motor Vehicle Safety Standards
OEM	original equipment manufacturer
PRI	Performance Review Institute
psi	pound per square inch
SAE	Society of Automotive Engineers
SLR	static loaded radius

4. Testing procedure

Performance of original equipment foundation brake linings is regulated by FMVSS 121. At the request of replacement lining manufacturers, the SAE PRI Brake Lining Performance Review Committee periodically reviews the results of FMVSS 121 dynamometer tests conducted by PRI-qualified dynamometers in accordance with specified test conditions as delineated below:

Table 1 - Brake configurations and test conditions

Description	Brake type	
Brake size (dia x width in.)	14 ½ x 10	16 ½ x 8 ⅝
Designation	FMSI #4592 AD	FMSI #4728 D
Type	Meritor W brake	Meritor Cast Plus brake
Gross axle weight rating	26000 lbs.	26000 lbs
Static loaded radius (SLR)	20.3 in.	18.5 in.
Air chamber	Type 30 standard stroke	Type 30 standard stroke
Slack adjuster length	7 in.	6 ½ in.
Drum weight	180 lbs. nominal	165 lbs. nominal
Surface finish	200 micro in.maximum	200 micro in.maximum

5. Classification

5.1 Basic frictional properties listed in Tables 2 and 3 of various brake linings can be compared with other linings that have been FMVSS 121 dynamometer-tested using the test conditions in Table 1 above following SAE PRI Brake Lining Review Committee evaluation of the test data. This evaluation compares the test results from three individual FMVSS 121 tests for each material. The average values from those tests are reported in Tables 2 and 3, below, as well as on both the APTA and the PRI websites.

5.1.1 The torque values can only be used to determine the relative friction characteristics of the various linings under the test conditions stated in Section 4. The 20 psi torque value represents typical brake application, the 40 psi torque value represents aggressive brake application, and the 80 psi torque value represents emergency brake application. The individual property should evaluate the importance of each value or combination of values to determine appropriate brake performance in their specific operating condition.

5.1.2 The fade rating can be used to compare brake lining reaction to temperature. The greater the rating number, the greater the reaction to increasing temperature, the greater the fade. Some fade is beneficial, excess fade is not, however, all listed materials meet the FMVSS 121 OE standard.

Table 2 – 14 ½ x 10 brake lining material listing

Company	Market brand name	Torque value (in. -lbs)			Fade rating	Review date	Expiration date
		20 psi	40 psi	80 psi			

Table 3 – 16 ½ x 8 5/8 brake lining material listing

Company	Market brand name	Torque value (in. lb.)			Fade rating	Review date	Expiration date
		20 psi	40 psi	80 psi			

Check www.apta.com or *PRI website* for recent updates of brake linings that meet these requirements.

Annex A

(Informative)

Understanding the Brake Lining Rating

The values in the Rating Table are taken from certain brake applications in the FMVSS 121 dynamometer test. These specific applications were selected to indicate lining performance under certain conditions.

The torque values provide information on “cold” effectiveness, at initial temperatures of 150 to 200°F. The results at different input pressures should be approximately linear, twice the pressure should provide twice the torque. This would be a brake lining that is not sensitive to changes in pressure. If a material is sensitive to different pressure levels, it could provide unstable, erratic, or unexpected braking forces.

The fade rating provides information about lining sensitivity to changes in brake temperature. A fade test sequence normally starts with temperatures in the 150 to 200°F, and ends with temperatures around 600 to 700°F. The rating value is the difference between the lowest peak air pressure, usually in the coldest stop, and the highest peak pressure, usually in the hottest stop. A larger fade number indicates greater fade, more sensitivity to brake temperature, than a smaller number. Fade ratings of 30 or less are expected, ratings up to 50 are acceptable, ratings over 50 indicate excessive fade. Differences of less than 20 between various lining materials should indicate approximately the same fade characteristics. Some fade is expected as drum – lining interface temperatures can reach 1500°F, but excessive fade should normally be avoided.