

6. APTA PR-E-RP-006-99 Recommended Practice for Diesel Electric Passenger Locomotive Dynamic Brake Control

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Abstract: This recommended practice provides a common design basis for the control and configuration of dynamic brake systems for diesel-electric passenger locomotives.

Keywords: dynamic brake, dynamic brake control, straight dynamic brake

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APTA PR-E-RP-006-99

Recommended Practice for Diesel Electric Passenger Locomotive Dynamic Brake Control

1. Overview

1.1 Scope

This recommended practice, adapted from the Association of American Railroads S-518, A Dynamic Brake Control, applies to Diesel-Electric passenger locomotive units that are designed for multiple unit operation with straight dynamic braking. Blended dynamic/air brake systems are not covered by this recommended practice.

The passenger rail industry phased this recommended practice into practice over the six-month period from July 1 to December 31, 1999. The recommended practice took effect January 1, 2000.

1.2 Purpose

The purpose of this recommended practice is to provide a common design basis for the control and configuration of dynamic brake systems, as well as to promote standardization.

2. References

This standard shall be used in conjunction with the following publications. When the following standards are superseded by an approved revision, the revision shall apply.

APTA PR-E-RP-017-99 Recommended Practice for 27-Point Control and Communication Trainline for Locomotives and Locomotive-Hauled Equipment

3. Definitions, abbreviations and acronyms

3.1 Definitions

For the purpose of this recommended practice the following definitions apply.

3.1.1 blended brake: The coordinated combination of two or more modes of braking (e.g. dynamic brake and friction brake) to produce the desired total retarding effort.

3.1.2 dynamic brake: A mode of operation of the propulsion system in which retarding is provided through the use of the traction motors as generators, converting the kinetic energy of the vehicle or train into electrical energy.

3.1.3 Silicon-controlled-rectifier (SCR): a three-lead thyristor.

3.1.4 straight dynamic brake: A dynamic brake which functions entirely on its own, without an interface to any other retarding or braking system (e.g. friction brakes).

4. Trainlines

The control function should be trainlined between units. When using the 27-point plug, cable, and receptacle, connect as specified in *APTA PR-E-RP-017-99 Recommended Practice for 27-Point Locomotive Communication and Control Trainline*¹. All wire number references included herein apply specifically to 27-point plug applications.

5. Set-up

Dynamic brake switching set-up should be accomplished by energizing wire No. 17, not including closing of the excitation circuit. The control equipment should include a delay device that will delay the setting up of the dynamic braking circuits for not less than five seconds after the opening of the generator field contactor.

Closing of the excitation circuit will be accomplished by energizing wire No. 21.

Manual regulation of dynamic braking effort will be accomplished by suitable devices that supply a variable voltage in response to control handle position. This variable voltage should be applied to wire No. 24, and the maximum potential applied (for full dynamic braking) should be the control circuit voltage, nominally 74 volts. The rate of increase of braking effort will be limited so that a minimum of ten seconds is required to reach maximum braking.

Annunciation of excessive dynamic braking current, as determined by the control equipment, shall be accomplished by energizing wire No. 20. When this wire is energized, a visual warning indication shall be activated in each control cab.

6. Dynamic brake control techniques

The response of the dynamic braking excitation and power circuits should be such as to provide a braking grid current that is related to control potential (wire 24) as shown by the following characteristic curve (Figure 1). The relationship will be independent of speed within the design range of the dynamic brake and the grid current should not be greater than the ampacity rating of the braking grids at any speed.

As information, the following drawings are of simplified dynamic brake control devices developed to effect compatibility of different types of dynamic brake controls.

Figure 2 describes the SCR-type dynamic brake controller used primarily on units with field current control (field loop) system. The SCR does not require a regohm regulator, as the circuitry has a current limiting feature.

On units already equipped with grid current (potential) control and a regohm-type regulator, compatibility may be obtained as shown in Figure 3.

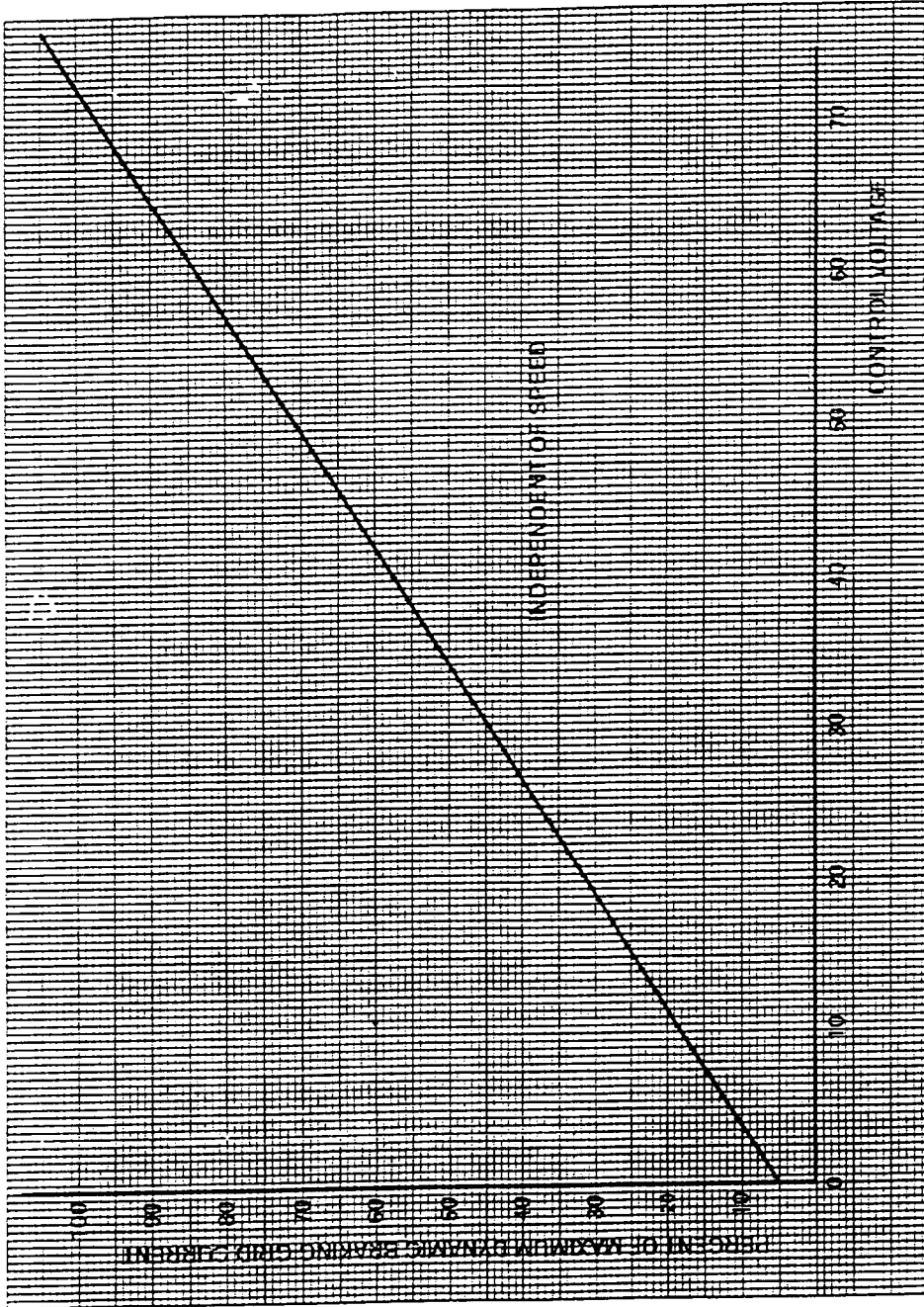
¹ For references in Italics, see Section 2.

Figure 4 represents d.c. traction speed-braking effort curves typical to field current and grid current control systems. Figure 5 represents a typical a.c. traction speed-braking effort curve.

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Figure 1

DYNAMIC BRAKE CHARACTERISTIC CURVE



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EARLY DYNAMIC BRAKE CONTROL METHOD: FIELD CURRENT CONTROL

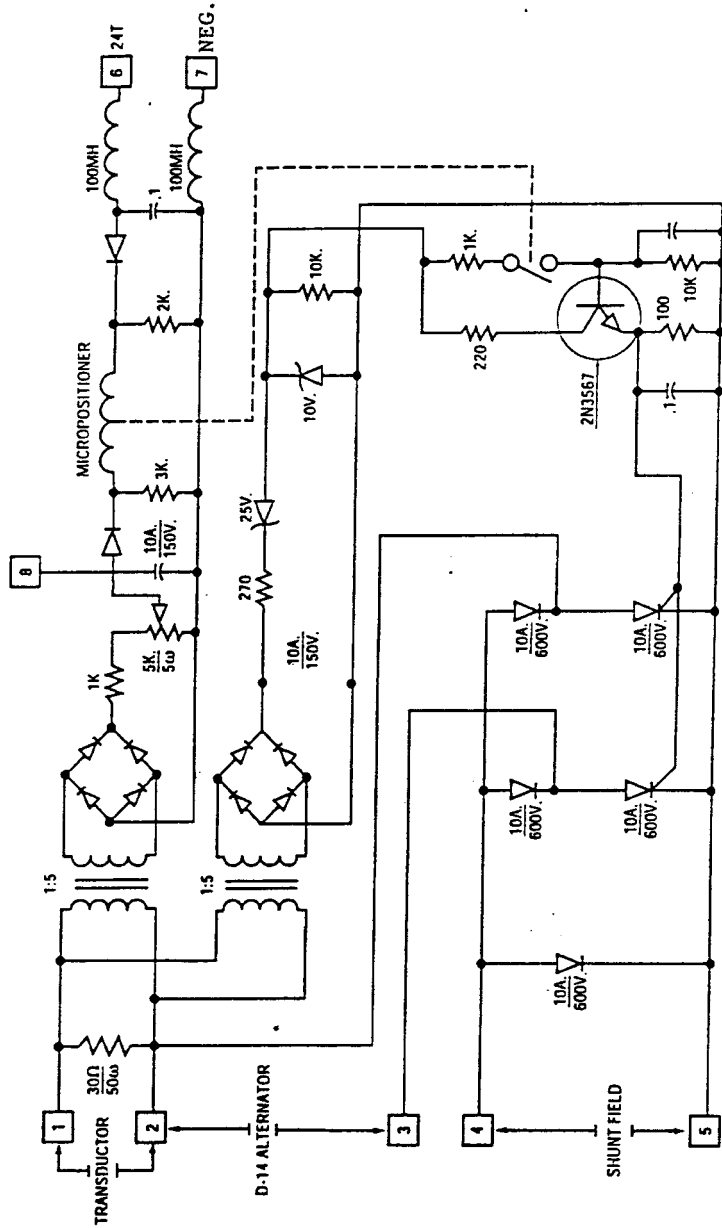


Figure 2

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NEWER, RECOMMENDED DYNAMIC BRAKE CONTROL METHOD:
 GRID CURRENT CONTROL

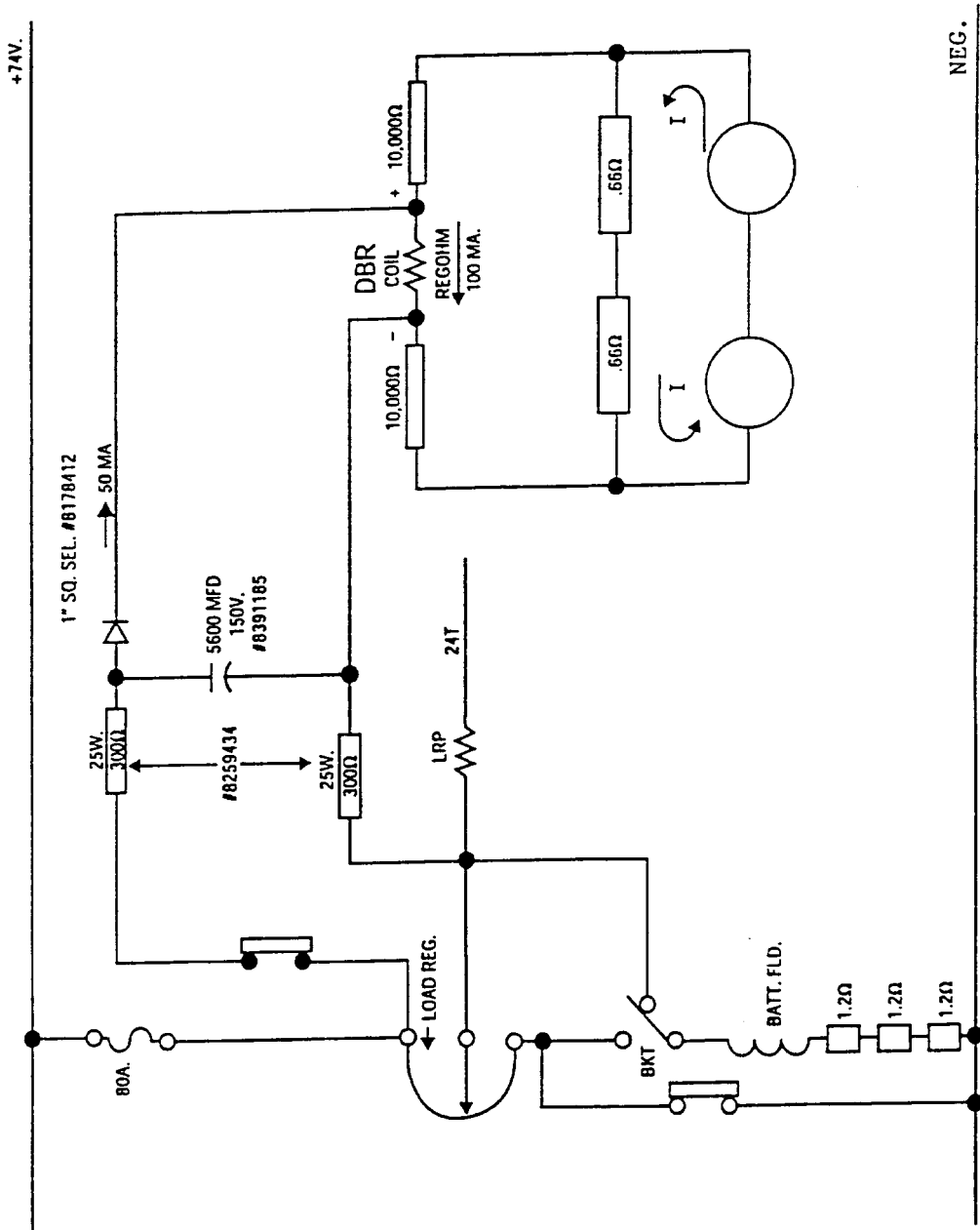


Figure 3

D.C.-Motored Locomotive Dynamic Brake Characteristics

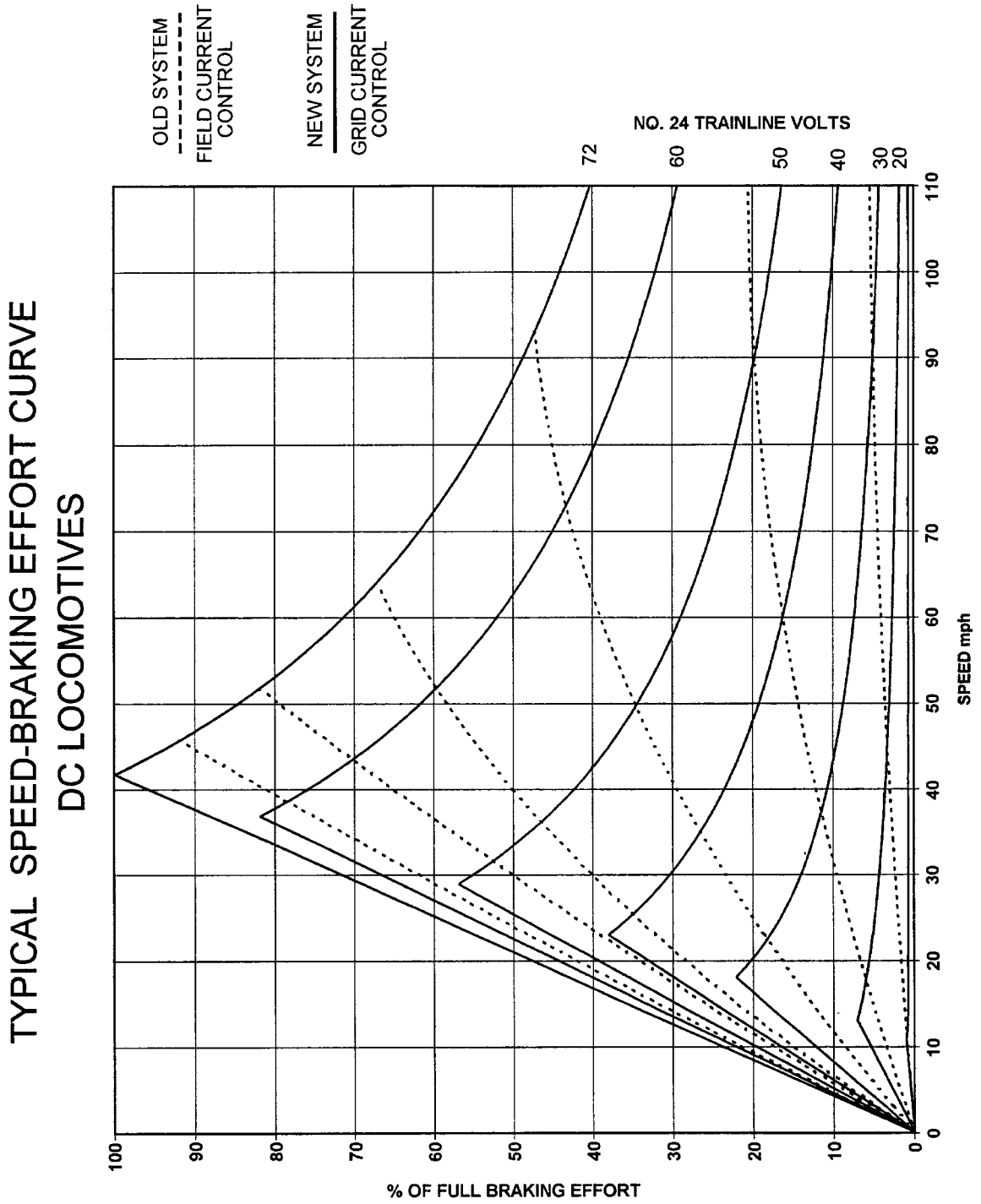


Figure 4

TYPICAL SPEED-BRAKING EFFORT CURVE AC LOCOMOTIVES

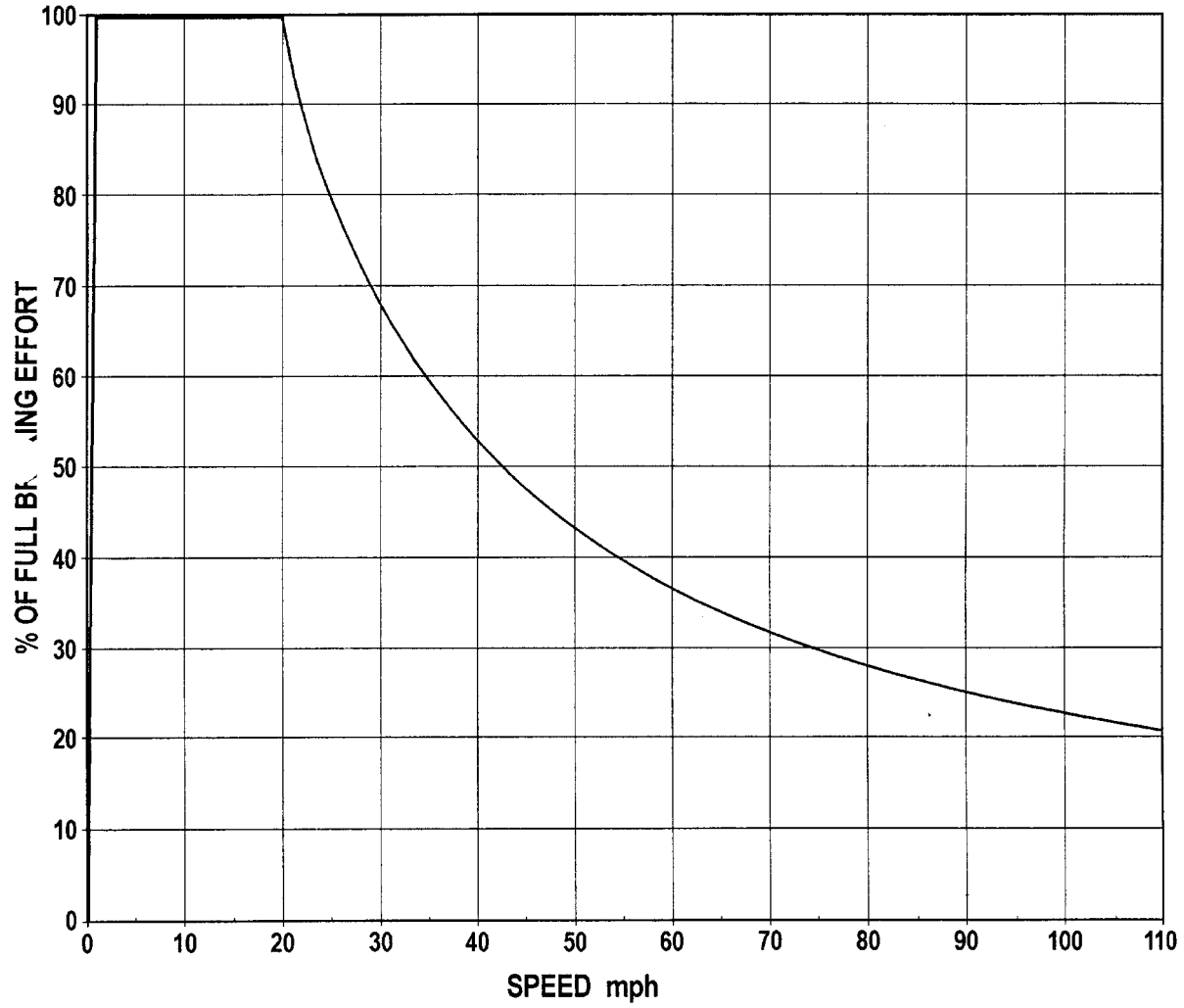


Figure 5

A.C.-Motored Locomotive Dynamic Brake Characteristic