6. APTA PR-M-S-006-98, Rev. 2
Standard for Parking Brakes for New Passenger Locomotives and Cars

Originally Approved June 15, 1998
Revision 1 Approved May 5, 2003
Revision 2 May 18, 2007
APTA PRESS Task Force

Originally Authorized March 17, 1999
Revision 1 Authorized September 28, 2003
Revision 2 Authorized June 2, 2007
APTA Commuter Rail Executive Committee

Abstract: This document provides standards for parking brake systems that are manually operated, spring applied-air released operated or hydraulically operated.

Key words: Handbrake, grade holding
Participants

The American Public Transportation Association greatly appreciates the contributions of the following individual(s), who provided the primary effort in the drafting of the Standard for Parking Brakes for New Passenger Locomotives and Cars:

Rich Walz
John Casale
Chuck Florian
Andrew Mulhall
Greg Gagarin
Craig Prudian
Ken Hesser
Kevin Simms
Paul Jamieson
Christian Stuckart

At the time that this standard was completed, the PRESS Mechanical Committee included the following members:

Dave Carter, Chair

Asuman Alp
Gordon Bachinsky
Gilbert Bailey
R. Bailey
Walter Beard
George Binns
B.A. Black
Chris Brockhoff
Dave Brooks
Mark Campbell
Gary Carr
David Carter
John Casale
Al Cheren
George A. Chipko
Roger Collen
Richard Conway
Jack Coughlin
Tim Cumbie
Richard Curtis
Greg Dvorchak
Ed Deitt
Terry Duffy
James D. Dwyer
Magdy El-Sibaie
John Elkins
Rod Engelbrecht
Ronald L. Farrell
Andrew F. Farilla
Benoit Filion
Chuck Florian
Matt Franc
Greg Gagarin
John Goliber
Jeff Gordon
Thomas Grant
Harry Haber
Francois Henri
Ken Hesser
Chris Holliday
Cornelius Jackson
Paul Jamieson
James Jewell
Joe Kalousek
Bob Kells
Kevin Kesler
Paul Kezmersky
Sunil Kondapalli
John Kopke
Frank Lami
Bob Lauby
Rick Laue
John Leary
H. B. Lewin
Jason Lipscomb
Ben Lue
William Lydon
Frank Maldari
George Manessis
Valerie Marchi
James Martin
Tom McCabe
Thomas McDermott
Lloyd McSparran
Cornelius Mullaney
Ed Murphy
Dak Murthy
Larry Niemond
Frank Orioles
James Parry
George Payne
Tom Peacock
John Pearson, Jr.
Ian Pirie
Richard Polley
John Posterino
Chuck Prehm
Alfred Pucci
John Punwani
Jim Rees
Jack Reidy
Al Roman
John Rutkowski
Tom Ruskin
Radovan Sarunac
Fred Schaer
Dave Schanous
Pete Schumacher
Kevin Simms
Tom Simpson
Mark Stewart
James Stoetzel
Philip M. Strong
Chris Studeart
Ali Tajaddini
Joe Talafous
Richard Trail
Mike Trosino
Ron Truitt
Tom Tsai
Richard Vadnal
David H. VanHise
John Wagner
Rich Walz
David Warner
Douglas Warner
Herbert Weinstock
Charles Whalen
Brian Whitten
James Wilson
Bruce Wigod
Werner Wodtko
Steve Zuiderveen
Clifford Woodbury, 3rd
Eric Wolf
Alan Zarembski
John Zolock
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1. Overview

This document gives standards for the design of parking brake systems for new passenger locomotives and cars for the passenger railroad industry.

1.1 Scope

This document provides standards for parking brake systems that are manually operated or spring applied-air released operated or hydraulically operated to promote safe, efficient and reliable systems and operations.

Specific areas addressed are:

- Grade-holding requirements
- Prevention of equipment damage
- Human force for parking brake operation as well as miscellaneous safety issues

2. References

APTA SS-M-016-07 Standard for Safety Appliances for Rail Passenger Cars

3. Definitions, abbreviations and acronyms

3.1 Definitions

3.1.1 parking brake: A system that is applied to prevent a stationary locomotive or passenger car from rolling due to gravity. This shall include systems referred to as handbrakes.

3.1.2 static coefficient of friction: The ratio of the magnitude of the maximum force of static friction to the magnitude of the normal force.

4. Manually operated

For the purposes of this document, manually operated shall mean independently activated or deactivated by hand.

5. General requirements

The parking brake may employ a system that utilizes stored energy (spring), hydraulics, electrical energy, mechanical ratchets, screw mechanisms, chains, cables, lever and linkages, or any combination thereof.
A power assist may be utilized when power is available, but the parking brake design shall allow the parking brake to be initially applied or released manually, without power assist.

An effective parking brake shall be provided on each locomotive or passenger car and be located where it can be safely operated by the railroad employee.

Parking brake shall be a manually operated mechanical brake and shall be independent of, but operate in harmony with, the power brake.

Internal components of package disc or tread brake units shall be capable of transmitting loads from an applied parking brake superimposed on maximum brake cylinder pressure (usually emergency) without any damage to the components.

Expected truck alignment conditions shall neither render a parking brake less than 100% effective nor cause an unintended release.

The parking brake design shall be capable of maintaining the minimum specified output force without auxiliary power (electrical, hydraulic, etc.) for an unlimited time period.

**Note -** A parking brake status indication may be specified by the operating authority if required by their “system safety plan”.

### 6. Grade holding capability calculations

The parking brake shall have the capability of holding a fully-fueled locomotive or fully loaded (fully seated plus number of standees and baggage defined by the railroad) car used in passenger service on the steepest operating grade as specified by the operator, but in no case shall the holding capability be less than that required for a 3% grade.

For passenger cars, the grade encountered in yards or sidings may be steeper than those of the operating grade. If the passenger car is left on these grades, the car weight shall be assumed to be the empty car mass.

For passenger cars, the operating or yard/siding grade requiring the highest holding force shall be utilized in the calculation.

Calculations shall utilize the minimum static coefficient of friction as specified by the friction material supplier.

The assumed mechanical efficiency of the tread brake unit and disc brake actuator/calipers shall not exceed 95 percent.

The assumed mechanical efficiency of the mechanical operated parking brake cables/chains and wheel/lever shall not exceed 90 percent.

The wheel to rail adhesion shall not exceed 15 percent.

**Note:** For existing passenger cars when more stringent grade holding requirements or a reduction in the brake material coefficient of friction occurs, the parking brake calculation shall be re-calculated to confirm that the holding force is adequate.
7. Spring applied/air release parking brake

A spring applied parking brake application shall occur when parking brake air pressure is depleted from the parking brake air chamber of the tread brake unit or disc brake actuator.

A spring applied-air release parking brake shall incorporate a manual mechanical release feature. When this feature is activated, it shall fully release the parking brake force. Following activation of a manual mechanical release, the parking brake shall not reapply until it is reset. Operation of the manual mechanical release feature shall not require more than 50 pounds force (222 N) in the pulling direction.

If anti-compounding protection features are employed, the parking brake shall apply prior to the depletion of the brake cylinder pressures required to meet the requirements of section 6.0. Anti-compounding protection feature prevents addition of parking brake and service/emergency brake forces that may cause damage due to overload of the brake components or their mountings.

8. Manually operated mechanical parking brake

The input force required, as applied 3 inches (7.6 cm) in from the end of a lever or on the rim of a handwheel, to fully apply the mechanical parking brake shall be 125 pounds force (556 Newton). Full application shall be defined as that force that meets the grade holding capability determined by the calculations required by section 6.0.

With the brake in the release position, there shall be no excess slack in the mechanical parking brake chain/cable or other connections. Where a chain winds on a drum, provisions shall be made in the design for winding the chain uniformly on the drum without overlapping.

Installation clearances for mechanical parking brake levers/wheels are defined in APTA SS-M-016-07 latest revision Standard for Safety Appliances for Rail Passenger Cars.

When a quick release feature is used, it shall be arranged to operate so that a parking brake wheel or lever will not move when the brake is released by this means.

A suitable means shall be provided at pulleys to prevent chains/cables from leaving the turning groove.

Provisions shall be made that, when piston travel is maintained within operational standards, normal wear shall not cause the hand brake to bind or bottom with less than full braking force.

The parking brake system excluding the power brake actuator to which it is connected shall be designed with a safety factor of 3.

9. Hydraulic parking brake

A hydraulic parking brake shall employ a mechanical locking mechanism to prevent an unintended release in the event of loss of hydraulic pressure.

10. Parking Brake Test

A parking brake test shall be conducted for each new passenger car/locomotive type. The
parking brake holding force can be determined by placing the car/locomotive on the maximum grade specified with the appropriate car loading condition or by pulling the passenger car/locomotive with a force measurement device located between the coupler and the force input mechanism.
Appendix A Bibliography (Informative)