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

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**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

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

## 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)*

[B1] AAR RP-023, Handbrake Specification Passenger Car Former location E119. Manual of Standards & Recommended Practices Section A Part 1 Issue 1984 of Operations & Maintenance Department Mechanical Division.