

Standardized Technical Specification

PRIIA 305 Next-Generation Equipment Committee
Bi-Level Passenger Rail Cars

Chapter 7

Brakes

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7.0 Brakes

7.1 Overview

This chapter describes the design and functionality of the pneumatic and mechanical braking systems that shall be provided on each passenger rail car. The braking systems shall include a conventional pneumatic system for service and emergency brake applications for all cars in the train, control equipment to be installed on the cab/baggage car to provide braking control for the train brakes and a pneumatic parking brake for the cab/baggage car, a wheel slide control system and a mechanical hand brake.

7.2 General Requirements

A conventional pneumatic brake system shall be provided on all cars unless specified otherwise by the Customer.

All air brake equipment shall be completely compatible with 26C/26L air brake equipment, currently in use in intercity rail passenger service. The air brake system shall be capable of running in conventional service in graduated release or direct release mode.

Nominal air pressures in the air brake system shall be:

Main Reservoir:	140 psig
Brake Pipe:	110 psig
Brake Cylinder:	100 psig maximum

All cars shall be equipped with provision for an electrically controlled pneumatic (ECP) brake system. This provision shall consist of a discrete conduit and wiring per AAR Standard S-4200, and particularly AAR Standard S-4210, for redundant implementation of ECP cable-based system in this Specification. The installation shall include a terminal box at each end of the car (for installation of the inter-car jumper cables), a terminal box at the brake manifold, conduit connecting them, as well as, armored cable wiring. The Contractor shall provide appropriate clearance on brake manifolds and adjacent structure to permit installation, servicing and removal of ECP modules. The Contractor shall provide a wiring diagram showing connections of brake controls with the two car end junction boxes to implement ECP braking.

7.3 Performance

The system shall be designed for operation at all speeds up to 125 mph in train consists of up to 24 cars with any combination of intercity rail passenger locomotives and bi-level cars as specified.

The air brake system shall be designed for operation and maintenance in conformance with all applicable Amtrak air brake rules.

A train consisting of five bi-level cars built to this specification (in any combination of car types) and one F59 locomotive (or equivalent) shall have a minimum full service braking rate of 1.35 miles per hour per second (mphps) at 125 mph increasing to and maintaining an average of 2.00 mphps at speeds of 70 mph or less. The instantaneous full service deceleration rate shall not exceed 2.75 mphps nor be less than 1.25 mphps. The emergency brake rate shall not be less than 2.50 mphps at speeds below 70 mph. The cars shall be loaded to AW2 condition. The Contractor shall verify that the brakes are fully functional under all operating and environmental conditions found in PRIIA Specification 305-912. Locomotive dynamic braking shall not be used to determine compliance with specified brake rates.

The maximum jerk rate (the change in the rate of deceleration) during initial service brake application shall be limited to 1.5 miles per hour per second per second (mphpsps) under all normal conditions. There shall be no jerk limit for emergency brake applications.

The Contractor shall determine the brake system delay/dead time, build-up time, response time and equivalent deceleration rates for all speeds from maximum speed to full stop. This information shall be provided to the Customer during the brake system design review. The Contractor shall use *Mass Transit Brake System- Performance Requirements* per DIN EN Standard 13452-1 as the method to measure dead time response time and deceleration rate where applicable.

7.4 Design Review

Preliminary design review shall address the following subjects, describing Engineer's actions and indications and also providing detailed technical design and performance analysis for the following subjects:

Concept:

- Concept and operation of friction brake system
- Thermal capacity of brake system
- Calculations showing that the system's performance requirements will be met
- Graduated release setting of control valve
- Direct release setting of control valve
- Graduated release mode of automatic brake valve operation
- Direct release mode of automatic brake valve operation
- Lead/trail (cut-in/cut-out of automatic brake valve)
- Feed valve setting
- Safety control interface [cab signal, overspeed, alerter, Positive Train Control (PTC)]
- Forewarn pending restriction – positive and accurate interlock with suppression
- Penalty application
- Recovery from penalty
- Compliance with Amtrak daily and periodic test requirements
- Power knockdown: brakes and traction
- Penalty

- Emergency
- Wheel slide control
- Parking brake interface with brake system, both before and after parking brake application/release, penalty application and automatic brake application

Operating:

- Push-pull operation with locomotive in either leading or trailing position
- Stopping on a grade
- Starting on a grade
- Penalty brake application
- Engineer-initiated emergency brake application
- Conductor- or passenger-initiated emergency brake application
- Train separation (break-in-two)
- Operation of short trains (three cars or less)
- Operation of long trains [six to 24 cars including the locomotive(s)]
- Dead engine movement (with and without Main Reservoir (MR) to cab car)

Design and performance analysis will be evaluated during design review, First Article Inspection (FAI) and proof of design testing.

7.5 Car Body Components

7.5.1 Piping and Fittings

The inside diameter of the trainline MR pipe shall be 1.00 in. Iron Pipe Size (IPS). The Brake Pipe (BP) shall be 1.25 in. IPS. All pipes and fittings in both lines shall be extra-heavy steel pipe in accordance with ASTM Standard A-53.

Brake pipe trainline must pass AAR Standard S-471.

Piping practices shall conform to AAR Standard S-400.

AAR type branch pipe tees shall be provided and shall be orientated at a 45 degree slope upwards or higher to prevent moisture from being drawn into the branch pipes. The trainline MR branch pipe shall be routed to the main reservoir tanks before being routed to the brake manifold. As much as possible, piping shall be routed to avoid traps and avoid draining moisture toward brake valves.

Unless the main reservoir pipe is not routed below the lower level of the car, the low point of the MR pipe shall be equipped with a heated drain valve, to rid the pipe of moisture buildup; moisture drain shall be in response to either brake release cycle or timed cycle. The air supply system shall conform to APTA Standard SS-M-011-99 for compressed air quality for passenger locomotive and car equipment.

7.5.2 Angle and Cut-out Cocks

Locking, ball type, cut-out cocks shall be provided in the MR Pipe and the BP at each end of the car. The MR pipe cutout cock shall be vented toward the hose end, oriented below horizontal.

A locking vented ball-type cut-out cock shall be provided in the brake cylinder line to each truck for venting brake cylinder pressure. The cutout cock shall be a 3-way type, vented down stream. The vent port of the cut-out cock shall be tapped for 0.25 in. National Pipe Thread (NPT).

All cut-out cock handles, except end of car BP angle cocks, shall be arranged so that the handles are parallel to the air pipe in the closed position. Closed "end of car" BP cut-out angle cock handle shall be perpendicular to the air pipe.

All valves and cocks shall be identified including the cut-in and cut-out positions. A "flow bar" cast or stamped into cock handles shall be acceptable for cut-in/cut-out position labeling. All air brake angle cocks and cutout cocks are to be clearly labeled using engraved and color-coded stainless steel, aluminum or plastic tags.

7.5.3 Hoses and Couplings

All connecting hoses, except BP trainline hoses, shall be AAR Standard M-618 double wire braid reinforced hose. Brake Pipe trainline hoses shall be AAR Standard M-601 braided hose. All hose material, when installed on the car, shall be less than one year old from date of manufacture. Trainline hose connections shall be in accordance with APTA Standard SS-M-001. MR and BP hoses shall be supported near the glad hand end from the coupler using rubber suspenders. Trainline hose locations shall be in conformance with APTA Recommended Practice RP-M-001-97.

Two dummy couplings, one "F" type and one "E&L" non-insert vented type, shall be provided at each end of the car. The dummy coupling shall be secured to the car with chains in a manner which will prevent the trainline hoses at the ends of the car from dragging when the couplings are connected to the hoses.

7.5.4 Emergency (Conductor) Brake, Application and Vent Valves

Manually operated conductor's valves, Wabtec B-3-B emergency brake valve p/n 88566 shall be provided as follows:

- On both ends of the car in the upper level, just inside the body end door, right side of the door facing outward (except the F-end of cab/baggage cars).
- On the upper level F-end of the cab/baggage car, on the passenger side of the bulkhead separating the cab from the passenger area, to the right of the door when facing the cab area.
- In the lower level B-end side entrance vestibule, on the electric locker wall.

These emergency brake valves, when used in conjunction with a Wabtec E-3 brake valve p/n 505405 shall cause an emergency brake application when activated.

The valves shall be located in a conspicuous location for ease of operation. The operating handles shall be red and shall be clearly labeled, in accordance with PRIIA Specification 305-909.

A Wabtec emergency brake valve p/n 535026 shall be located in the cab on the Assistant's console.

Vent valves shall be provided along the BP in accordance with air brake system design requirements.

Ready access shall be provided to all valves to facilitate inspection, replacement and maintenance.

The valves shall meet the requirements of APTA Standard SS-M-007-98.

7.5.5 Air Reservoirs

Reservoirs of sufficient capacity for a minimum of three full-service brake applications without recharging shall be provided. ASME-certified main and auxiliary (brake cylinder) supply reservoirs shall be drilled as described in FRA 49CFR Part 229 to eliminate the need for hammer and hydro-static testing. When installed, they shall be sloped toward one end, where a manual purge valve with locking handle shall be provided to drain accumulated moisture. Main reservoirs and air supply reservoirs used for water raising shall be coated internally with a suitable paint to prevent corrosion. All reservoirs shall comply with the ASME Boiler and Pressure Vessel Code as applicable.

7.5.6 Control Manifold and Valves

The control valve shall be a Wabco 26C service portion and pipe bracket (Wabtec p/n 587904). Control valves shall use stainless steel springs and spool valves where appropriate. The control valve shall include the control reservoir charging cable.

The air brake control valve and cab control manifolds shall be located inside the carbody, above the level of brake pipe. Branches will leave the brake pipe at a 45-degree slope upwards or higher, and shall utilize an AAR "branch pipe tee". The Air Brake Control Valve manifold shall include test fittings for main reservoir, brake pipe, brake cylinder and #16 air pipes. In addition, the relay valve exhaust and #10 air pipe exhaust shall have a threaded exhaust outlet to permit mounting a gauge.

Full-face gaskets or o-ring gaskets shall be used for valve portion interface sealing. All stud mounted components shall be designed to allow installation or removal with standard socket wrenches.

Electronic modules, pneumatic modules, cutouts, test points and electrical connections shall be front-plate mounted on the manifold. Front-plate mounting is not required if the manifold is oriented so that access is provided to both sides. All power, input and output connections, external to the manifold, shall be provided with multiple pin connectors or a screw-type terminal block. Individual spade-type or threaded connectors are not permitted. Ring terminals shall be used if connected to a screw-type terminal block.

All valves on the manifold, as well as the manifold itself, shall be easily removable for servicing. All valves shall be individually replaceable with the manifold installed on the car without removing any additional valves or components.

Valves shall be acoustically isolated from the car interior areas to minimize exposure of passengers and crew to noise generated by the air brake components. Exhausted air shall be piped to the underside of the car. All valves that have an exhaust port shall be equipped with a wasp excluder.

Brake cylinder pressure shall be supplied and maintained by a relay valve with a nominal 1:1 ratio.

All devices shall be clearly and permanently labeled on the manifold body, including cut-in and cut-out positions of all valves and cocks. Etching or silk screen printing during the machining process is acceptable for labeling manifold items. Stamped aluminum tags may be used on valve handles.

7.5.7 P-2-A Application Valve

A Wabco P-2-A application valve portion and pipe bracket (Wabtec p/n 561925) shall be used to initiate a full service brake application when actuated by the alerter, overspeed or PTC.

7.5.8 Auxiliary Air Equipment

MR air will be used for air-operated auxiliary devices. BP air shall not be used. Auxiliary functions shall be isolated from air brake functions and shall be disabled when MR pressure falls below 80 psig. Auxiliary valves shall regulate air pressure for MR-supplied functions such as water raising and toilets. Air for the horn and bell on the cab/baggage car shall be supplied from the first main reservoir.

The water raising air valves shall be mounted above the water level of the water storage tank to prevent backflow of water into the air system during normal operation or when the air system is depressurized. The valves shall be readily accessible for maintenance and replacement.

7.6 Truck Components

The car shall be equipped with a combination disc and tread brake equipment. The actuators for both the disc brakes and the tread brakes shall operate at the same air pressure from the same air source. Brake effort contributions from disc and tread brakes shall be specified to avoid wheel thermal cracking and brake disc damage. Under all circumstances the brake rates defined in this chapter and in this Specification shall be achieved.

The truck-mounted components as specified have been identified for the purposes of interchangeability with other intercity bi-level cars. The Contractor may propose alternate components for Customer approval if the components as specified cannot achieve the specified braking rates, or if superior braking performance can be achieved through the use of other brake system components.

7.6.1 Disc Brake Actuator

An air actuated caliper mounted on the truck frame shall be used in conjunction with each disc to develop braking effort. Automatic slack adjusters shall maintain a 0.03 in. to 0.06 in. clearance between the pad and the disc when brakes are released.

The disc brake system shall use Wabtec composition disc pads p/n V2601 (right) and p/n V2602 (left), or if the Customer requests a different pad that is compliant with PRIIA Specification 305-900. Performance of brake disc friction material shall be suitable for the speeds, route brake duty cycle and overall train braking performance and shall not induce temperatures that may result in long or short term thermal damage as to disc friction ring as defined by brake disc manufacturer.

Pad holders and disc pads shall be equipped with a locking device. The slack adjuster shall have sufficient capacity to maintain nominal shoe clearance and piston travel through the full range of new to worn discs and brake pads.

The disc brake actuators shall be Wabtec p/n 694954-0001 (left) and p/n 694954-0002 (right). The disc actuator shall be capable of handling pressure up to 140 psig without damaging the actuator, disc, brake rigging or any other system or component on the vehicle.

7.6.2 Brake Discs

Two self-ventilated 28 in. maximum, 27.5 in. nominal diameter ductile iron "monoblock" brake discs shall be provided per axle. Brake discs must meet all Amtrak requirements for design, heat dissipation, resonant frequency and mechanical stability. The fatigue life of the connection between the hub and friction ring must take into account cyclic loading from thermal and shock environments encountered in normal service. The strains resulting from shock loading is a function disc response in the form of "bending out plane" vibrational mode from the shock environment developed at the wheel/rail interaction at normal revenue speeds. The natural resonance frequency of the disc, for this bending mode, shall not be less than 350 hz. The fatigue life of the connection between the hub and spoke, taken at the highest stress point for combined strains from thermal and shock load, shall be equal or greater than the projected service life of the friction ring or 1,000,000 miles, whichever is greater.

7.6.3 Tread Brake Units

A truck mounted air actuated tread brake unit, with integral single acting slack adjuster, Wabtec p/n 693187-1313 (left) or p/n 693187-1424 (right), shall be applied at each wheel. The tread brake unit shall operate in conjunction with the adjacent disc brake caliper from the same air source.

Composition brake shoes 2 in. thick and of a size and type in general use by Amtrak shall be provided, Wabtec p/n V-185. Performance of brake shoe friction material shall be suitable for the speeds, route brake duty cycle and overall train braking performance and shall not induce temperatures at the wheel tread that may result in long or short term thermal damage, as defined in 49CFR Part 238. A brake key shall secure the brake shoe to the brake heads, and shall not require the use of specific tools for installation or removal.

The design of the tread brake shall accommodate a new wheel with a diameter 0.625 in. greater than nominal wheel diameter.

The slack adjuster shall have sufficient capacity to maintain nominal shoe clearance and piston travel through the full range of new to worn wheels and brake shoes, and shall provide sufficient clearance to install a 2.0 in. brake shoe against a new wheel.

One tread brake unit on each axle of the B-end truck shall be equipped with hand brake linkage [Wabtec p/n 693188-1313 (left) and p/n 693188-1424 (right)]. Tread brake units shall be provided with spring applied parking brakes, integral to the tread brake unit which is compatible with APTA Standard SS-M-006-98, if specified by Customer.

7.7 Wheelslide Control System

The wheel slide control system shall modulate the application of the pneumatic brakes to prevent sliding of the wheels through the use of a microprocessor design. The system for each car shall include:

- System unit/controller with pre-wired connector plugs
- Modulation type dump valves (two per car)
- Molded T-harness cable, or equivalent protected cable type (two per car)
- Speed sensors (one per axle)
- Download any diagnostic software for a Portable Test Unit (PTU) (test unit itself is not required)
- Adapter cable to connect a PTU to the wheelslide control unit

The system shall continuously measure the speed of each axle and take corrective action should a sliding wheel be detected. The wheel slide system shall operate under all braking conditions and shall not permit the jerk limit to be exceeded on reapplication of brakes following a slide correction. The system shall be designed to prevent permanent thermal damage to the wheel tread as evidenced by spalling, under all adhesion conditions.

The wheelslide system components, including controller and dump valves shall be equipped with an identification plate or tag which includes:

- Vendor
- Vendor part number
- Date of manufacture
- Serial number
- Car type

7.7.1 Control Unit

The control unit shall be mounted in the electric locker.

The wheelslide control equipment is subject to the following conditions:

- The wheel slip function shall be automatically self-calibrating to continuously adjust for the difference in wheel circumference from nominal new wheel to fully worn wheel rim thickness.

- The system software shall be designed to account for the rotational inertia properties of the wheel set assembly.
- Wheel slide corrections shall not occur at normal deceleration rates on dry, level tangent track. System logic and criteria for detection and correction of wheel slip and instantaneous deceleration rate shall be submitted for review and approval.
- The system software/control electronics shall possess features to prevent inappropriate wheel slip correction function from transient signals arising from one damaged or missing gear tooth. This requirement includes provisions for intelligent interpretation of transient changes in signal amplitude at all speeds due to axle gear run-out, vibration of sensor mounting bracket or sensor/gear clearance settings.
- Wheel slide protection shall be retained on all remaining axles should the control unit fail to receive one or more axle speed signals. It is recognized the system performance for the axle with the defective sensor is compromised under these conditions.
- A safety timing function shall be provided to cancel wheel slide corrections exceeding a specified duration to be determined based on final system design. Protection shall be locked out on the affected truck until car is at zero speed.
- The system shall utilize software that is at the current revision at the time of installation.

7.7.1.1 Auxiliary Functions

The system shall supply two auxiliary zero speed signals, provided for door control, as described in Chapter 8, as follows:

- A zero-speed switching device shall close below 3 mph, and shall open above 3 mph.
- A 20 mph speed switching device shall close below 20 mph and shall open above 20 mph.
- Logic shall be fail-safe, such that zero-speed and 20 mph relay drop out in the event of any component failure or loss of power. Speed signal logic shall meet the requirements of EN 50126 SIL 2. The speed signal shall incorporate separate relays that break both the positive and negative components of the zero and 20 mph signals. Both the normally open and normally closed contacts shall be made external to the unit. Contact rating shall be 0.25A @ 80VDC. Contacts shall be high reliability to reduce the probability of welding.

7.7.1.2 Diagnostics

The wheelslide control unit shall include integral diagnostic indications (at a minimum) of the following system states with the vehicle moving:

- Open, shorted or grounded speed sensor circuit
- Open, shorted or grounded dump valve circuit
- Electronics fault identified at card level
- Power loss/low supply voltage during car deceleration
- Software logic fatal error or program lockup
- Time out of safety timer
- Weak/missing speed sensor signal

When the car is stationary with adequate power and air, it shall be possible to conduct a self-test that shall verify the following functions in addition to those above:

- Ability of magnet valves to release and apply brake cylinder pressure
- Ability to test magnet valve time-out
- Ability to exercise zero-speed relays

7.7.1.3 Faults

Faults detected shall be retained in the fault memory and displayed on the front of the controller using a numerical display that indicates proper system operation, or a fault code. The readout shall:

- Be able to identify defects down to printed circuit board, individual speed sensor or magnet valve level.
- Include transient faults detected while the car is in motion.
- Provide sufficient information to enable maintenance personnel to determine if the unit is working properly, and if not, whether the system can be repaired while on the car or must be removed for repairs.

A permanent label shall be fixed to or near the controller that identifies the numerical codes for faults represented by numerical display. It shall also provide instructions for initiation of self test program and the clearing of faults from memory. The chart shall be positioned so that it can be easily referenced in seated or standing position (as appropriate) while reading the display or manipulating button.

7.7.1.4 Circuit Boards

All circuit boards shall be identified with:

- Vendor name
- Vendor part number
- Date of manufacture
- Revision level
- Serial number

7.7.1.5 Test Equipment and Software

The Contractor shall provide five electronic copies of wheelslide system diagnostic software to be used on a PTU. Operating instructions for this software shall be included in the vehicle maintenance manuals.

The Contractor shall provide 10 cables to connect a PTU to the wheelslide control unit to allow on-car troubleshooting.

7.7.2 Dump Valves

When a slide condition is detected by the controller, it shall be relieved on a per truck basis, by controlled reduction of brake cylinder pressure by an electro-pneumatic modulating type dump valve. Braking shall be reapplied after correction is made at a rate designed to take maximum advantage of prevailing adhesion but shall not exceed the jerk rate. Air consumption shall be minimized during slide correction. The dump valve porting and internal capacity shall be optimized for car dead and displacement brake cylinder volumes. All valve and relay coils, except anti-skid valves, shall be suppressed with passive electronic devices. The manufacturer must provide a pre-wired mating plug connector for each dump valve. The wire pigtail must be molded construction and sealed at the plug.

7.7.3 Speed Sensors and Wiring

Axle speed shall be determined from a passive magnetic speed sensor mounted on a journal bearing adapter and a 104-tooth gear mounted on the end of the axle. The sensor shall detect speeds of 2.5 mph or more. Nominal sensor gap shall be 0.020 in. to 0.035 in. The speed sensors shall connect to the wheelslide control unit through a T-harness, or equivalent protected cable system. The T-harness or equivalent protected cable system shall connect to the carbody wiring through a MIL standard circular connector, mounted to an electrical box on the carbody. Terminal and junction boxes shall not be mounted on the trucks.

The speed sensor cables and T-harness, or equivalent protected cable system, shall be attached to the truck frame using coated clamps that provide secure attachment while not abrading or pinching the cable. Each clamp shall secure no more than one cable. Clamps shall be attached to the truck frame using fasteners and lock washers in tapped holes. There shall be sufficient slack in the speed sensor wiring to allow the bearing adapter to move to the bottom of the pedestal opening without stressing the cable (such as when the truck is lifted with axles installed). Cables and harnesses shall be accessible for replacement while the car is in service.

7.8 Brake Indication Devices

7.8.1 Pneumatic Indicators

Pneumatically operated indicators, one on each side of the carbody at each truck, shall be connected to the brake cylinder air supply line between the brake cylinder cut-out cock and the brake cylinder. These indicators shall provide a positive visual status of the brake system to crewmembers, with the plunger extended away from the carbody when the brakes are applied, and retracted under the carbody when the brakes are released. The indicators shall be readily visible from station platforms as well as track level, and from both ends of each side of the car.

7.8.2 Pressure Switches and Brake Status Lights

A pressure switch shall be provided for each truck, monitoring the brake cylinder pressure downstream of the truck cutout cock. A test fitting shall be provided in each brake cylinder line to the trucks, downstream from cutout cock and dump valve. In addition, a test fitting shall be provided for each pressure switch to check calibration. These pressure switches operate the brake applied/released indicator lights, as well as provide a signal to the engineer's console in the locomotive or cab/baggage car (via pins 19 and 20 of the 27-point

communication trainline) to display brake system status (applied or released). Trainline function is as follows:

- Brake released: continuity when brake cylinder pressure on both trucks is less than one-half of a minimum service application, and handbrake is released.
- Brake applied: continuity when brake cylinder pressure on both trucks is applied at one-half of a minimum service application or greater or handbrake is applied.

The exterior of each car shall be equipped with two 3-lamp indicator assemblies, as specified in Chapter 11. Indicators shall display the following aspects:

Green: All brakes released and handbrake released

Yellow: Brakes applied and handbrake released

Flashing Yellow: Handbrake applied (with air brakes applied or released)

A weatherproof micro-switch shall be provided to indicate handbrake status to the car's exterior brake status lights, and to the locomotive and cab/baggage car via pin 20 of the 27-point communication trainline. The switch shall be weatherproof to prevent damage from environmental conditions.

7.9 Handbrake

7.9.1 Handbrake or Spring Brake Units

A handbrake with lever-type handle shall be provided at the B-end of each car accessible from the passageway between collision posts. Spring-applied parking brakes may be provided in lieu of a handbrake if requested by the Customer. The handbrake or spring brakes shall be compliant with APTA Standard SS-M-006-98.

7.9.2 Handbrake Linkage

The handbrake linkage shall connect the handbrake operator to one tread brake actuator on each axle on the B-end truck. All handbrake linkage, chain or cable guides, lever pivots and carriers shall be adequately designed to prevent wear or binding throughout the life of the vehicle, including due to corrosion, abrasion or close clearances. The handbrake system shall not rattle during car motion, and shall not inhibit proper operation of the brake cylinder slack adjusters. A return spring shall ensure that adequate slack is in the handbrake linkage when released, so that the tread brakes do not drag on the wheels when the handbrake is released. This section applies only if handbrakes are utilized.