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Preface

This standard was prepared by the Braking Systems – Part 4: Infrastructure Maintenance Rolling Stock Development Group, overseen by the ARISO Rolling Stock Standing Committee.

Objective

The objective of this Standard is to provide safety benefits in that proper braking performance contributes to the prevention of collisions or derailments of railway rolling stock by providing controls for known hazards.

This Standard describes minimum standards for brake performance, features and compatibility for the braking systems of infrastructure maintenance rolling stock.

This Standard is intended to complement the rolling stock compliance certification process outlined in AS 7501 including new and/or modified infrastructure maintenance rolling stock.

Changes Summary

This standard has been updated to be consistent with the changes introduced to AS 7510.2:2024.

Compliance

There are four types of provisions contained within Australian Standards developed by ARISO:

(a) Requirements.

(b) Recommendations.

(c) Permissions.

(d) Constraints.

Requirements – it is mandatory to follow all requirements to claim full compliance with the Standard. Requirements are identified within the text by the term ‘shall’.

Recommendations – do not mention or exclude other possibilities but do offer the one that is preferred. Recommendations are identified within the text by the term ‘should’.

Recommendations recognize that there could be limitations to the universal application of the control, i.e. the identified control is not able to be applied, or other controls are more appropriate or better.

For compliance purposes, where a recommended control is not applied as written in the standard it could be incumbent on the adopter of the standard to demonstrate their actual method of controlling the risk as part of their WHS or Rail Safety National Law obligations. Similarly, it could also be incumbent on an adopter of the standard to demonstrate their method of controlling the risk to contracting entities or interfacing organisations where the risk may be shared.

Permissions – conveys consent by providing an allowable option. Permissions are identified within the text by the term ‘may’.

Constraints – provided by an external source such as legislation. Constraints are identified within the text by the term ‘must’.

ARISO Standards identify known hazards relevant to the railway industry. Appendix A provides a non-exhaustive list of hazards relevant to the scope of this Standard.

Appendices in ARISO Standards may be designated either “normative” or “informative”. A "normative" appendix is an integral part of a Standard and compliance with it is a requirement, whereas an "informative" appendix is only for information and guidance.

Commentary

Commentary *C Preface*

This Standard includes a commentary on some of the clauses. The commentary directly follows the relevant clause, is designated by 'C' preceding the clause number and is printed in italics in a box. The commentary is for information and guidance and does not form part of the Standard.

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Section 1 Scope and general

1.1 Scope

This Standard applies to infrastructure maintenance rolling stock that is:

(a) new;

(b) modified affecting braking system compliance; and/or

(c) is to operate in a network in which it has not previously operated.

NOTE:

It is recognized that across the ANZ rail industry, existing infrastructure maintenance rolling stock can have braking system requirements different to this Standard due to the age of the fleets and the previous organizational structures (e.g., fully integrated state government owned and operated railways). These differences can be a result of braking system requirements designed to earlier standards such as previous versions of AS 7510.4, the Railways of Australia manual or legacy standards from prior organizational structures.

It is also recognized that modifications conducted on existing infrastructure maintenance rolling stock affecting braking system compliance defined in this Standard, could only affect certain requirements and the RSO can deem full compliance with the requirements of this Standard not practical to achieve.

An example of these types of modifications can be a change of end cock, installation of a different handbrake or replacement of a legacy brake valve with an updated/modern version.

For guidance on assessing the compliance requirements for modifications conducted on infrastructure maintenance rolling stock, the derogation process as defined in AS 7501 is a recommended method of assessing non-conformances to mandatory requirements where it is deemed not practicable to change the design to comply with the requirements.

This Standard covers the design, construction and maintenance of braking systems fitted to infrastructure maintenance rolling stock.

This includes, but is not limited to:

(d) tampers;

(e) ballast regulators;

(f) ballast cleaners;

(g) rail grinders;

(h) dynamic track stabilisers;

(i) overhead wiring vehicles; and

(j) light on-track equipment (e.g., trolleys, trailers, section cars and similar devices).

Infrastructure maintenance rolling stock is used to carry out various work on or around track and rail infrastructure. Major types include track maintenance machines and light on-track equipment such as trolleys, trailers, section cars and support frames.

The Standard does not cover:

(k) the operation of rolling stock, including network safeworking rules and route standards;

(l) infrastructure maintenance rolling stock used on light rail or cane railway networks, although provisions of this Standard can be applied to such systems as deemed appropriate by the relevant Rolling Stock Operator (RSO) and/or Rail Infrastructure Manager (RIM);

(m) freight wagons used to carry track materials, which are covered under AS 7510.2; and

(n) road rail vehicles which are covered under AS 7502.

1.2 Infrastructure maintenance rolling stock types and applicability

Infrastructure maintenance rolling stock are categorised as follows:

(a) Infrastructure maintenance rolling stock including:

(i) required to be hauled in train formation (automatic air brake);

(ii) required to operate coupled with other vehicles where inter-vehicle braking is controlled using an automatic brake; and

(iii) required to operate as a standalone vehicle.

(b) Equipment that operates solely on rail and can be readily removed from the track (i.e. trolleys, motorized trolleys, trailers, section cars).

Where a vehicle is not fitted with a particular brake system type, only the requirements relevant to the fitted systems and intended interfaces apply.

Table 1 Minimum Braking Equipment by Infrastructure Maintenance Rolling Stock Category

Braking function	Coupled infrastructure maintenance rolling stock in train formation (network operation)	Coupled infrastructure maintenance rolling stock (Worksite operation only)	Standalone vehicle (not hauled)	Trailer (incl. non-RRV hauled trailers)	Trolley/support frame & motorized trolley[2]	Section Car[2]
Automatic air brake (AS 7510.1 & AS 7510.2)	x	(o)				
Automatic brake (fail safe)		x				
Service brake	x	x	x	x	x	x
Park brake	x	x	x[1]	x[1]	x[1]	x[1]

Legend: x = required; (o) = optional; blank = not required/not applicable

NOTE 1:

Where a non-automatic brake is fitted, it needs to be backed by a fail-safe brake system (e.g., automatic air brake or spring-applied park brake).

NOTE 2:

For trolleys, support frames and section cars, the fail-safe brake system provides both service and parking functions and applies automatically when operator control is released.

1.3 Normative references

The following documents are referred to in the text in such a way that *some* or all of their content constitutes requirements of this document:

- AS 1210:2010, *Pressure vessels*
- AS 2671:2021, *Hydraulic fluid power — General rules and safety requirements for systems and their components*
- AS 2971:2007, *Serially produced pressure vessels*
- AS 4024.1604:2019, *Safety of machinery – Design of controls, interlocks and guarding – Emergency stop principles*
- AS 7495:2024, *Rolling stock communications equipment*
- AS 7451:2023, *Train integrity*
- AS 7502:2025, *Road Rail Vehicles*
- AS 7503:2023, *Rail vehicle identification and markings*
- AS 7504.1:2026, *Brake Components – Part 1: Brake Blocks*
- AS 7504.2:2023, *Brake components – Part 2: Brake discs and pads*
- AS 7510.1:2026, *Braking systems — Part 1: Locomotive rolling stock*
- AS 7510.2:2024, *Braking systems — Part 2: Hauled rolling stock*
- AS 7510.6:2014, *Railway rolling stock - Braking systems - Part 6: Train*
- AS 7519 (Amdt 1):2024 , *Bogie Structural Requirements*
- AS 7520.4:2023, *Body Structural Requirement - Part 4: Infrastructure Maintenance*
- AS 61508:2011, *Functional safety of electrical/electronic/programmable electronic safety-related systems*
- EN 50128:2012, *Railway applications – Communication, signalling and processing systems – Software for railway control and protection systems*

NOTE:

Documents for informative purposes are listed in a Bibliography at the back of the Standard.

1.4 Defined terms and abbreviations

For the purposes of this document, the following terms and definitions apply:

1.4.1
abrasive brake block
trim block
brake block that can be used to remove minor wheel and tread irregularities

1.4.2
automatic air brake
brake that automatically applies throughout a train when the brake pipe pressure is reduced and releases when the brake pipe pressure is restored

1.4.3
automatic brake
continuous brake system for trains or sets that will self-apply in the event of loss of continuity including train separation

1.4.4
automatic slack adjuster
device in the brake rigging that automatically takes up or lets out slack to compensate for friction element wear, maintaining brake cylinder travel and friction element clearances within specified limits

1.4.5
brake disc
rotor having one or more co-planar annular friction faces for the engagement of brake pads and means of transmitting rotational forces between itself and the associated axle or drive shaft element

1.4.6
brake pad
friction pad that interfaces with the brake disc via a brake calliper to slow the rolling stock down by the use of friction when the brakes are applied

1.4.7
brake system
braking equipment of a vehicle or a train

1.4.8
braking surface
equipment surface at which vehicle braking can be developed by friction

1.4.9
coefficient of adhesion
ratio of maximum tangential force (traction/braking) to the normal force (weight) between a wheel and a surface before slipping occurs

1.4.10
coefficient of friction
ratio of the resultant retarding force produced to the applied brake pad or brake block force (normal to the friction material)

1.4.11
composite brake block
brake block containing non-metallic friction material

1.4.12
continuity
continuous connection and the operability of the brake system of a train on all vehicles from the front of the train to its rear

1.4.13
continuous brake
brake system that is effective continuously along the length of the train

1.4.14
control pipe
conduit of the air brake system of a locomotive that conveys the control signal for the locomotive independent brake and for the straight air brakes of connected hauled vehicles

1.4.15
control valve
alternatively triple valve
distributor valve
control element of the automatic air brake of a vehicle

Note 1 to entry: For infrastructure maintenance rolling stock, the control valve can be mechanical, pneumatic, electro-pneumatic or electronic, provided it performs the same control function within an automatic air-brake system.

1.4.16
dummy volume
automatic air brake reservoir on a vehicle which provides the reference volume for the pilot signal for a relayed brake system

1.4.17
friction element
consumable pad or block that is forced onto a braking surface to develop a braking force by friction

1.4.18
function check
brake checking in the field performed for the purpose of confirming the serviceability of the brake system of a vehicle or vehicles

1.4.19
independent brake
direct brakes
straight air brake that is for the primary purpose of holding one or more vehicles stationary and that is operated via the control valve sometimes called direct brakes.

1.4.20
main reservoir
one or more interconnected compressed air reservoirs supplied directly by one or more air compressors as a primary source of compressed air for a vehicle air brake system and often for additional purposes

1.4.21
powered park brake
park brake unit where the brake force is applied via an external power source

Note 1 to entry: An example is a spring with pneumatic release.

1.4.22
quadricycle
section car
small, self-propelled vehicle used for conveying personnel, tools, or equipment along the track

1.4.23
retention test
in-service static brake test to ensure that the automatic air brake of each of the last three trailing vehicles of a train will remain applied for a specified time with the brake pipe vented to atmosphere

1.4.24
service application
application of the stopping brake that is propagated within a train at a normal rate that is pre-determined and that results in a normal rate of retardation according to driver demand

1.4.25
service braking
normal manipulation of the direct brake during train running

1.4.26
single-car test
brake testing performed to confirm the correct operation of the brake system of a single vehicle

Note 1 to entry: This includes a single-car air test (SCAT).

1.4.27
spring park brake
park brake that is applied by spring force and released by compressed air or hydraulic force

1.4.28
standard brake pipe pressure
network specified maximum brake pipe pressure to which an automatic air brake is to be initially charged for normal train operation

Note 1 to entry: A standard brake pipe pressure of 500 kPa is typically adopted for DIRN locomotive-hauled operations.

1.4.29
stopping brake
braking equipment used for stopping a train in running

1.4.30
trailer
non-powered vehicle, rail-bound or adapted for rail operation, designed to be hauled by a rail or road rail vehicle

Note 1 to entry: A trailer is typically used for transporting equipment, tools or materials. It can include road trailers fitted with rail guidance systems for dual rail/road operation.

1.4.31
transfer mode
mode of operation where infrastructure maintenance rolling stock is hauled within a locomotive-hauled train consist

1.4.32
travel mode
mode of operation where infrastructure maintenance rolling stock is operating on track and is not performing infrastructure work activities

1.4.33
trolley
small, non-powered rail-bound vehicle pushed by workers, designed for conveying tools and equipment along the track and fitted with an automatic braking function when the operator control, is released

Note 1 to entry: This includes but is not limited to support frames, laser trolleys, flat-top trolleys and measuring trolleys.

1.4.34
trolley (motorized)
small, powered vehicles with operator walking, used for conveying tools and equipment

Note 1 to entry: Release of the operator control automatically applies a brake capable of holding the vehicle stationary.

1.4.35
work mode
mode of operation where infrastructure maintenance rolling stock is performing infrastructure inspection, maintenance, construction, or associated work activities

General rail industry terms and definitions are maintained in the ARISO Glossary. Refer to:
https://www.ariso.org.au/glossary/

Section 2 Brake system

2.1 General

This Standard contains requirements for multiple braking systems. Where a vehicle does not incorporate a particular system or feature, only the requirements relevant to the systems fitted and the intended operating mode shall apply.

Infrastructure maintenance rolling stock shall be equipped with a fail-safe braking system.

Braking systems on infrastructure maintenance rolling stock shall be designed and constructed such that, for the intended operation, the vehicle can be stopped and secured safely under all intended operating conditions.

Self-propelled infrastructure maintenance rolling stock brake systems shall have at least two separate brake systems. Typical examples of commonly used brake system arrangements include:

(a) direct brake (straight air brake or electrically controlled straight air brake) and spring park brake;

(b) automatic air brake and spring park brake or handbrake; or

(c) hydraulic motor braking and spring park brake.

Commentary *C2.1-1*

Some infrastructure maintenance rolling stock can operate coupled together with the straight air brakes controlled from the leading vehicle and would normally have spring park brakes which can operate automatically.

Commentary *C2.1-2*

Some smaller infrastructure maintenance rolling stock have service and secondary brake functionality provided by a single fail-safe brake system, incorporating separate brake actuators acting on more than one axle.

Commentary *C2.1-3*

Some infrastructure maintenance rolling stock have automatic air brake and can be attached to a train, with the automatic air brakes operated from the train brake pipe.

Commentary *C2.1-4*

Where hydraulic motor braking is proposed as the second brake system, it is only permissible where:

a) the vehicle has RIM/RSO-accepted operating limits;

b) testing demonstrates compliant service and emergency performance without wheel skid on clean, dry, level track; and

c) loss of the hydraulic system cannot degrade the remaining brake system(s).

The brake system shall be designed such that brake application causes traction effort to be removed, reduced, or commanded to a non-powering state so that propulsion does not oppose braking.

Brakes designed for static applications shall not be used in dynamic applications, unless validated as suitable for that function.

Where low wheel/rail adhesion conditions are foreseeable (e.g., contamination, moisture, leaf film), measures shall be applied to ensure the required stopping performance is achieved.

Commentary *C2.1*-5

Measures can include reduction in operating speed, railhead conditioning, sanding, or braking systems that do not rely solely on wheel/rail adhesion.

Where self-propelled infrastructure maintenance rolling stock has selectable brake or drive operating modes, the selected mode shall be appropriate for the intended operating configuration.

Selectable brake or drive operating mode devices shall be protected against inadvertent operation or unauthorized tampering where incorrect selection could adversely affect braking performance.

Brake cylinder travel should be regulated by an automatic slack adjuster to maintain the specified travel and friction element clearances, irrespective of friction element wear.

For new vehicles not equipped with a slack adjuster, there shall be a visual indicator representing the acceptable brake cylinder travel limits.

Infrastructure maintenance rolling stock shall be fitted with a brake applied or released indicator observable from the driver's position.

The brake system shall be able to operate effectively as intended under the full range of environmental conditions that can be expected in the route/area of operation.

Commentary *C2.1-6*

The ambient temperatures of the Australian natural environment for the operation of trains can range from -10° C to +55° C. The Australian climate can produce conditions including relative humidity of 100% at 25°C, heavy rain, hail, frost, dew and fine dust.

Load compensation devices (or equivalent brake force compensation strategies) shall be provided where the tare-to-gross mass ratio exceeds 1:3, unless it can be demonstrated that:

(a) the vehicle will not overbrake in tare condition; and

(b) the braking system complies with the stopping performance requirements across the loading range without load compensation.

Colour coding, labelling and marking of brake equipment—including handles, lettering, and release devices—shall comply with the requirements of AS 7503:2023.

Externally mounted park brake wheels and levers shall be in a contrasting colour to their surroundings (e.g., white).

Design load cases, including mountings for brake system body-mounted equipment, shall be in accordance with AS 7520.4:2023.

Design load cases, including mountings for bogie-mounted brake system equipment, shall be in accordance with AS 7519:2024.

2.2 Air brake system

The requirements in this section apply to infrastructure maintenance rolling stock fitted with pneumatic braking systems, including direct brake systems. Section 3 contains additional requirements specific to automatic air brake systems.

The accuracy of air pressure displays to the operator that are required to control the air brakes shall be corrected if found to be in error by ±15 kPa.

Air pressures nominated in this standard which do not include a tolerance or are described as nominal shall have a tolerance of ±21 kPa.

Commentary *C2.2-1*

Some RSOs and RIMs could require a more accurate tolerance than defined above for air pressure displays and/or standard tolerance for air pressures.

Infrastructure maintenance rolling stock fitted with compressed air reservoirs shall:

(a) comply with applicable pressure vessel legislation;

(b) comply with AS 1210:2010, AS 2971:2007 or equivalent recognized pressure vessel standards;

(c) incorporate means for draining accumulated water; and

(d) provide suitable access for maintenance and inspection.

The pneumatic energy required for brake operation on each vehicle shall be stored on the vehicle.

Infrastructure maintenance rolling stock can be fitted with an air compressor.

The capacity of the air compressor shall meet the requirements of the vehicle and, where relevant, any coupled vehicles.

The air compressor capacity and associated reservoir capacity should be matched to the expected duty cycle, with control systems set to minimize cold starts and short cycling which can decrease service life.

Commentary *C2.2-2*

Factors that can influence the selection of air compressor capacity and associated reservoir capacity include:
(a) brake system operating pressure;
(b) brake application frequency;
(c) expected duty cycle;
(d) brake leakage rates;
(e) reservoir recharge time;
(f) auxiliary pneumatic loads;
(g) operation of any connected vehicles where applicable; and
(h) environmental operating conditions.

The brake system shall be protected from any auxiliary system that interfaces with the compressed air system so that the brake system efficiency and safe operation are not adversely affected.

Infrastructure maintenance rolling stock fitted with an air brake shall have brake system pipework that:

(e) is orientated, secured and supported to minimize rubbing, chafing, twisting and water traps;

(f) minimizes the accumulation of water within pneumatic equipment; and

(g) has operating pressure capability exceeding the maximum pressure expected in service.

Infrastructure maintenance rolling stock brake rigging shall:

(h) minimize the risk of fouling or exceeding the rolling stock outline following component failure;

(i) incorporate suitable retention of body and bogie mounted brake equipment; and

(j) prevent loss of components due to single pin failures.

2.3 Hydraulic brake systems

Where fitted, hydraulic brake systems, including hydraulic actuation of friction brakes, hydrostatic/hydrodynamic retarder functions, or hydraulic release of spring-applied brakes, the hydraulic brake system shall:

(a) comply with AS 2671:2021 or an equivalent standard accepted by the RIM/RSO; and

(b) be designed such that loss of hydraulic pressure results in a safe state appropriate to the intended function or be supplemented by an independent fail-safe brake system capable of achieving the required braking performance.

Where hydraulic pressure is used to maintain a brake in the released position, loss of hydraulic pressure shall result in brake application.

The driver's cab shall include an indication of hydraulic brake system pressure and, where fitted, accumulator pressure or charge state, sufficient to confirm brake availability for the intended operation.

The accuracy of hydraulic brake system pressure displays to the driver, including accumulator pressure displays where fitted, that are required to confirm brake availability shall be ±2% of the display full-scale span.

Hydraulic piping and flexible hoses shall be designed and installed such that failure, leakage or rupture does not result in an unsafe loss of braking functionality.

Hoses should be protected from abrasion, heat and mechanical damage, and should be arranged to minimize the risk of unintended disconnection.

Hydraulic brake systems shall be designed to minimize the risk of contamination, debris or filter blockage causing loss, degradation or suppression of braking functionality.

Hydraulic brake system components requiring periodic inspection, cleaning or filter replacement shall be accessible for maintenance.

Hydraulic braking systems that rely on stored hydraulic energy shall incorporate one or more accumulators capable of maintaining sufficient hydraulic pressure to achieve the required braking performance under normal and emergency operating conditions.

The accumulator system shall:

(c) be designed and certified in accordance with AS 1210:2010 or recognized equivalent pressure-vessel standards;

(d) include means to monitor pre-charge and system pressure;

(e) be sized to provide at least one full-service brake application after loss of the power source;

(f) prioritize the brake circuit when a common hydraulic supply serves multiple systems; and

(g) incorporate pressure-relief and isolation devices to permit safe maintenance.

NOTE:

Where hydraulic brake couplings are provided between vehicles, the requirements of Clause 2.6 apply.

2.4 Dynamic brake system

Infrastructure maintenance rolling stock fitted with dynamic brake systems (including hydrodynamic or hydrostatic braking) that can provide additional retardation to control vehicle speed shall:

(a) be independent of the friction braking system and not be relied upon to meet the minimum stopping-brake performance requirements of Section 7; and

(b) have a design that manages the combined braking effort to avoid wheel slide and wheel skid where designed to operate concurrently with a friction braking system.

NOTE:

This can be achieved by dynamic-brake cut-out/knock-out logic, blending control limits and/or wheel slide protection.

2.5 Emergency cock/button

2.5.1 General

Self-propelled infrastructure maintenance rolling stock shall be fitted with one or more emergency brake controls (cock, button, or equivalent) that operate the fail-safe brake.

The emergency brake control shall be provided at each driver or operator position and at any secondary driving or operating position if applicable, including any remote-control operator station where fitted.

The brake system shall permit an emergency brake application (or equivalent safe-state braking response) of the stopping brake at any time when running.

Operation of an emergency brake control shall result in traction power, propulsion effort or equivalent driving force being removed or inhibited where fitted.

Self-propelled infrastructure maintenance rolling stock equipped with an automatic air brake shall have an emergency cock provided near each driving position.

When opened, the emergency cock shall directly vent the brake pipe.

2.5.2 Emergency stop

At least one externally accessible emergency-stop device shall be provided on each side of the vehicle to enable personnel outside the vehicle to activate the fail-safe brake from track level.

A risk assessment shall be undertaken to determine the location(s) and quantity emergency-stop devices (and/or equivalent actuation means) required for the intended operating and work modes.

Emergency-stop devices shall be:

(a) clearly marked and protected against inadvertent operation;

(b) accessible from ground level; and

(c) designed and located to remain functional when remote-control or automated operation modes are in use;

(d) designed considering the applicable emergency-stop design principles of AS/NZS 4024.1604:2019;

(e) manually reset at the location where the emergency-stop actuation was initiated; and

(f) override all other operating commands associated with vehicle movement.

Where the alternative emergency-stop actuation means is implemented using remote-control equipment, the remote-control system shall comply with AS 7495:2024.

The remote-control system shall fail-safe such that loss of communications, loss of power, or detected fault results in a safe-state response, including traction isolation (where fitted) and application of braking consistent with the fail-safe brake.

Resetting an externally accessible emergency-stop device equivalent actuation means, or restoring remote-control communications, shall not of itself cause the fail-safe brake to release.

Resetting an emergency-stop device (or equivalent actuation means) shall not, of itself, release the fail-safe brake.

Commentary *C2.5.2-1*

Exterior emergency-stop actuation provides an immediate means for track workers and responders to stop unintended vehicle movement. In some rail operations contexts, direct access to vehicle-mounted devices could be prohibited or introduce additional hazards; in these cases, an equivalent external emergency-stop actuation arrangement can be used, provided it achieves the same safety outcome and is fail-safe.

2.6 Couplings between vehicles

Infrastructure maintenance rolling stock fitted with an automatic brake system shall have a brake pipe coupling at each end of the vehicle in accordance with Clause 2.6 of AS 7510.2:2024.

Infrastructure maintenance rolling stock that has a brake system that is not compatible with any existing brake system should have inter-vehicle brake system couplings that are unique to the brake system and prevent the coupling of incompatible brake systems.

Infrastructure maintenance rolling stock fitted with couplings that could be connected to incompatible equipment shall have permanent metal signage fitted to the coupling and headstock to warn of incompatible vehicles and/or classes.

Where straight air brake coupling cocks and associated hoses are used between infrastructure maintenance rolling stock vehicles in a towing configuration, a breakaway feature shall be provided to minimize damage to coupling cocks, hoses and adjacent fittings in the event of unintended separation.

Commentary *C2.6-1*

Breakaway couplings can be used to reduce damage to straight air brake coupling cocks, hoses and adjacent fittings if a towing connection parts unexpectedly. One industry approach is to provide a deliberate weak link using a breakaway 12 mm Type-B coupling located approximately 300 mm on each side of the towing pin. The coupling and hose arrangement is configured to minimize hose kinking and support safe disconnection.

Hydraulic hose brake couplings between infrastructure maintenance rolling stock vehicles shall be able to break away without damage to the hydraulic hose.

Where hydraulic hose brake couplings between infrastructure maintenance rolling stock vehicles break away, the service brake or emergency brake (or other equivalent fail-safe brake function) shall apply on both vehicles.

Commentary *C2.6-2*

For hydraulic brake systems, particularly systems where hydraulic pressure maintains the release of spring-applied brakes, the breakaway characteristics of hydraulic hose couplings are critical. A sealing/self-sealing breakaway coupling can trap pressure on the detached side and prevent brake application; fail-safe arrangements rely on the detached side losing brake-release pressure on separation, while also preventing uncontrolled hydraulic fluid loss from the towing vehicle (e.g., by an upstream isolation/shut-off function). If the separation response is provided by a brake mechanism normally used for parking, its dynamic stopping suitability needs specific validation, noting that a park brake is defined as equipment arranged to secure a vehicle at rest without reliance on the stopping brake.

2.7 Coupled operation braking systems

Where infrastructure maintenance rolling stock is operated as a coupled consist, the lead driver/operator shall have control over the application of the braking system for the consist.

The brake control arrangement for a coupled consist shall cause brake application on each vehicle required to contribute to stopping performance.

The coupled consist brake control arrangement shall be compatible with the intended operating mode and the brake systems fitted to the vehicles in the consist.

Where brake control is transmitted between vehicles, the inter-vehicle brake control connection shall be arranged so that a loss of connection or unintended separation results in a safe-state braking response appropriate to the intended operation.

Commentary *C2.7-1*

Verification of coupled consist braking performance can include dynamic stopping tests, deceleration measurements, brake propagation assessments, simulation or other methods accepted by the RIM/RSO for the intended operation. Guidance relating to train braking performance assessment can also be found in AS 7510.6.

2.8 Trolleys, trailers, motorized trolleys and section cars

2.8.1 General

Trolleys, motorized trolleys, trailers and section cars shall be provided with braking and securing arrangements appropriate to the intended operation, such that uncontrolled movement is prevented under all operating conditions.

Commentary *C2.8.1*

Trolleys and trailers are any type of track maintenance vehicle that operates solely on the track but can be readily removed from the track.

Trolleys and trailers have restrictions in operation on the network as per RIM requirements.

2.8.2 Trolleys

All trolleys shall be fitted with a fail-safe brake system that provides a park brake and service brake functions.

The brake system shall require a positive action to release and hold the brake in the released position. After this positive action is released, the brake shall reapply.

The design of the brake system shall consider appropriate preventative measures such that the load on the trolley cannot interfere with the release of the positive action.

The braking system shall be regularly inspected, tested and maintained in a fully operative condition.

The park brake system shall be designed to hold the trolley indefinitely on a 1-in-30 grade when loaded to the maximum capacity, or as otherwise specified by the RIM.

The trolley loaded at maximum capacity shall be able to stop from 5 km/h (walking pace) on a track with a 1-in-30 gradient, or as otherwise defined by the RIM, within 5 m.

If the brakes are applied on a motorized trolley, tractive power shall be cut.

Commentary *C2.8.2*

The braking requirements specified for trolleys are intended for low-speed operation under worksite arrangements and are not intended to comply with the braking performance requirements in Section 7 applicable to rolling stock operating within train consists on the rail network.

2.8.3 Trailers

All trailers shall be equipped with a fail-safe braking system that proportionally applies the trailer brakes as the brakes on the hauling vehicle are applied, and releases the trailer brakes as the brakes on the hauling vehicle are released.

The brake system shall provide a service brake function and a park brake function

The braking performance of the hauling vehicle and trailer combination shall comply with the requirements of Section 7.

Where the trailer is intended to operate with a road-rail vehicle, the braking performance requirements shall also comply with AS 7502:2025, where applicable.

All trailers shall be fitted with a park brake capable of holding the fully loaded trailer, with and without the hauling vehicle attached, indefinitely on a 1-in-30 grade, or the maximum grade specified by the RIM for the intended network.

Commentary *C2.8.3*

Certain hydraulic couplings and fittings can suppress brake application following separation or hose failure and are therefore not suitable for fail-safe trailer brake systems. This includes dry break, quick connect or similar couplings that seal when hydraulic pressure is lost.

The fail-safe operation of spring-applied hydraulic-release brake systems relies on hydraulic pressure venting from disconnected or severed hoses, fittings, or couplings to permit automatic brake application.

Trailer brake performance testing shall include, as a minimum:

(a) hauling vehicle without trailer attached;

(b) hauling vehicle with empty trailer attached; and

(c) hauling vehicle with fully loaded trailer attached.

2.8.4 Section cars

Section cars shall be fitted with a fail-safe brake system that provides service and park brake functionality. The brake system shall require a positive action from an operator to enable the handle to release and hold the brake in the released position. After this positive action is released, the brake shall reapply.

Commentary *C2.8.4*

Section cars in some jurisdictions are also call quadricycles.

The brake system shall meet the performance requirements as detailed in Section 7 of this standard for both the service brake and the park brake.

When the brake is applied, traction power shall be removed.

Section 3 Automatic air brake

Infrastructure maintenance rolling stock required to be hauled by locomotives or as haul wagons in a train formation shall be fitted with an automatic air brake compliant with the applicable clauses in Section 3 of AS 7510.2:2024.

Infrastructure maintenance rolling stock intended to operate as a self-propelled train formation shall be fitted with an automatic air brake system compliant with Section 3 requirements of AS 7510.1:2014.

Infrastructure maintenance rolling stock fitted with an automatic air brake controlled by the driver/operator shall be fitted with a brake pipe pressure gauge or indicator observable from each driver/operator position.

The automatic air brake control system shall permit an emergency application of the stopping brake at any time when in running.

Where fitted with an automatic air brake system, provision shall be made to isolate the brake system on an individual vehicle without interfering with continuity of the through brake pipe.

The automatic air brake shall be sized to provide at least two successive full-service applications.

Commentary *C3*

AS 7510.2 contains the principal requirements for automatic air brake systems used on hauled rolling stock operating within a locomotive-hauled train formation.

AS 7510.1 could apply where infrastructure maintenance rolling stock operates as a self-propelled train formation or multiple unit consist.

Examples of infrastructure maintenance rolling stock that could require compliance with AS 7510.2 include trailers, wagons, ballast hoppers, rail handling consists or other non-self-propelled vehicles intended to operate within a locomotive-hauled consist.

Section 4 Non-automatic brake

Infrastructure maintenance rolling stock may be fitted with a non-automatic brake (e.g., straight air brake).

All non-automatic brakes shall be backed up by a fail-safe brake system.

The fail-safe brake system may be either an automatic air brake or a spring-applied park brake.

Commentary C4-1

Non-automatic brakes can include systems such as straight air brakes, direct hydraulic brakes, hydrostatic or hydraulic drive transmission holding functions, retarder systems or dynamic braking systems. Where non-automatic brakes are used for operational braking, a separate fail-safe brake system is required to maintain braking capability following loss of power, pressure, control signal or traction system functionality. Brakes designed for static applications are not intended for routine operational stopping or speed control. Examples can include park brake friction elements, mechanical transmission locks, or hydraulic drive transmission holding functions. This does not preclude the use of spring-applied park brakes as a fail-safe brake function following a fault, loss of power, or emergency condition.

Section 5 Park brake

5.1 General

Infrastructure maintenance rolling stock shall have park brakes.

Infrastructure maintenance rolling stock should be fitted with spring park brakes.

Each vehicle, articulated vehicle or multi-unit vehicle shall be equipped with at least one park brake that complies with the requirements of this section.

Infrastructure maintenance rolling stock fitted with manually applied park brakes shall be fitted with automatic air brakes.

Spring park brakes fitted to infrastructure maintenance rolling stock shall be able to be applied by the operator from any driving position.

The spring parking brake status (brake applied or released) shall be observable by from each driver/operator position.

Where an anti-compounding arrangement is provided, it shall be configured so that transitions between stopping brake and park brake do not result in the simultaneous release of the stopping brake and the park brake.

Commentary *C5.1-1*

Compounding can occur where the powered park brake and stopping brake act on the same friction elements and are capable of overlapping application. Anti-compounding measures are commonly used to prevent excessive brake forces and component overload. The anti-compounding design needs particular care to avoid unintended loss of braking capability, especially during transitions between braking modes.

Hydraulic motors or hydrostatic transmission systems shall not be relied upon to provide the park brake holding function.

Commentary *C5.1-2*

Hydraulic motor braking systems can experience internal leakage or case leakage over time and are generally not suitable as the sole means of maintaining long-term stationary brake holding performance.

5.2 Manual park brake

A manually applied park brake fitted to infrastructure maintenance rolling stock shall be designed to be applied and released with a maximum manual force of 420 N.

The manual force shall be either applied tangentially to the rim of the handbrake wheel or the end of the operating lever.

The park brake holding force shall be measured when the applied manual force has been removed from the manual application point.

When a manual park brake is fitted, human factors should be considered in the design of the operating control and mechanism.

Commentary *C5.2*

The 420 N limit controls peak manual force but does not, on its own, control overall operator workload. Some manually applied park brakes can meet the force limit yet still require excessive winding or repeated lever strokes to reach full application due to take-up travel, mechanism ratio, adjustment state or poor access. Excessive repetitions increase task time and fatigue and can contribute to incomplete application (particularly when operators are wearing gloves, working in wet/contaminated conditions, or operating from constrained positions).

A human factors study could consider:

(a) appropriate mechanism ratio and take-up arrangement so the required holding force can be achieved without unnecessary repetitions;

(b) operating control can be used with a safe posture and without over-reach, while avoiding pinch points through the full range of motion;

(c) grip features suitable for gloved operation and foreseeable environmental conditions;

(d) sufficient clearance around the operating lever/handwheel and associated parts, and clear indication/marking of apply and release direction; and

(e) providing positive feedback (e.g., detent/lock/stop) that supports the operator in recognizing full application.

5.3 Powered park brake

The force to apply a powered park brake is normally via a spring (with pneumatic release) but other methods of providing a braking force may be used (e.g., electro/hydraulic or electro/mechanical).

The application of a powered park brake should not cause the designed brake force of a vehicle to be exceeded at any time, including during any overlap between stopping brake and park brake application.

Spring park brakes shall be maintained in the released position by pneumatic or hydraulic (e.g., main reservoir, brake pipe) pressure onboard the vehicle.

A powered park brake shall be able to be released by manual means.

A powered park brake shall apply a constant park brake force without requiring human effort to determine the application force.

Vehicles incorporating park brakes that are power operated but not automatic shall be treated as if fitted with manual park brakes with regard to brake retention testing.

5.4 Automatic park brake

Where automatic park brakes (APB) are fitted, the APB system and its operation shall comply with the applicable requirements of AS 7510.2:2024.

Section 6 Brake force application

6.1 General

Friction elements on infrastructure maintenance rolling stock shall transmit stopping brake forces to the tread of each wheel or to brake discs securely connected to each wheelset.

Brake blocks shall comply with AS 7504.1:2026.

Brake discs and pads shall comply with AS 7504.2:2023.

During any normal braking, temperatures reached by a friction element and the associated wheel or disc shall not affect the structural integrity of the braking surfaces of either.

The mechanism that applies the brake force shall be capable of sustaining all loadings that can arise during normal vehicle operations whilst providing the freedom necessary to accommodate relative movement between brake gear and running gear.

The design of the braking system shall ensure brake blocks do not overhang the outer edge of the wheel rim.

For tread brake applications, the design of the braking system shall maximise the contact between the brake block and the wheel.

During the service life of the vehicle, a change to the specified friction element shall require a validation of the stopping performance as part of the type approval for the new friction material for the vehicle.

6.2 Composite brake blocks and brake disc pads

Composite brake blocks and brake disc pads should have performance characteristics as specified by the RIM, AS 7504:2018 or 7504.2:2023, respectively.

Commentary *C6.2*

It is recognized that composite brake blocks and brake disc pads that perform satisfactorily on a dynamometer could not necessarily perform satisfactorily in service.

6.3 Brake discs

The design of brake discs shall incorporate the braking forces, centrifugal forces, localised and bulk thermal inputs and inertial loads from track irregularities.

6.4 Cast iron brake blocks

New vehicle designs should not use cast iron brake blocks.

Section 7 Braking system performance

7.1 General

The performance of the stopping brake shall meet the network stopping requirements as given in this section or, for networks or vehicles not thus covered, as specified by the relevant RIM.

Braking performance shall be demonstrated for the vehicle configuration, loading condition, operating mode and maximum operating speed for which acceptance is sought.

Commentary *C7.1*

Network stopping distance requirements in general and additional data for several networks are given in AS 7510.6:2014.

7.2 Self-propelled & multiple unit operation

On level, dry rail, self-propelled infrastructure maintenance rolling stock vehicles, including self-propelled coupled consists, stopping from their maximum design speed under full braking shall:

(a) be capable of achieving a minimum equivalent deceleration of 0.9 m/s² without wheel slide in any condition of loading; and

(b) not exceed the stopping distances specified in Table 1.

Commentary *C7.2-1*
Equivalent deceleration does not include braking delay effects associated with driver reaction, system response, brake propagation, or brake cylinder filling/build-up time.

The equivalent deceleration shall be determined from a stopping distance measurement or a deceleration measurement method accepted by the RIM/RSO for the intended operation.

The total equivalent response time (t_e), should not exceed 3.5 s unless otherwise specified by the RIM for the intended operation.

By design, the maximum deceleration of a single vehicle shall not exceed 1.5 m/s², with or without a wheel slide protection system.

Table 1 Stopping Distance on Level Track

Speed (km/h)	Total brake distance (m)
15	16.5
20	26.4
30	52.7
40	87.6
50	131

60	183
70	243.6
80	312.8
90	390.5
100	476.8
110	571.7
115	622.4
NOTE: Using a_e equivalent deceleration 0.9 m/s^2 and t_e 3.5.	

Commentary C7.2-1

The stopping distance calculations in Table 1 determine braking distance using the following formula:

Equation 1 Stopping distance

$$s = v_0 t_e - \frac{1}{6} a_e t_e^2 + \frac{\left(v_0 - \frac{a_e}{2} t_e\right)^2}{2a_e}$$

Where:

s = total stopping distance, in m

v_0= initial speed, in m/s

t_e= equivalent brake build-up time, in s

a_e= equivalent deceleration, in m/s²

For the purposes of Table 1, t_e= 3.5 s and a_e= 0.9 m/s².

The above equation uses a two-phase braking model comprising a brake build-up phase followed by constant deceleration braking:

$$s = s_1 + s_2$$

s_1= distance travelled during brake build-up, in m

s_2= distance travelled during constant deceleration braking, in m

During the brake build-up phase:

$$s_1 = v_0 t_e - \frac{1}{6} a_e t_e^2$$

The speed at completion of brake build-up is :

$$v_r = v_0 - \frac{a_e}{2} t_e$$

v_r= speed at completion of brake build-up, in m/s

During the constant deceleration phase:

$$s_2 = \frac{{v_r}^2}{2a_e}$$

This approach models the ramp increase in brake deceleration during brake build-up and differs from simplified approaches such as EN 14531-1, which represent brake build-up using brake as a digital input.

Infrastructure maintenance rolling stock that operates solely within worksites shall be fitted with a braking system that brings the vehicle to a stand within 20 m from a speed of 15 km/h or from the maximum operating speed if the maximum speed is less than 15 km/h.

7.3 Self-propelled coupled consist operation

Where self-propelled vehicles are verified individually but are intended to operate as a coupled consist, the coupled configuration shall be verified where the coupling arrangement could affect braking performance.

Verification shall demonstrate that the coupled consist complies with the stopping performance requirements of Clause 7.2, particularly where:

(a) the method of brake control differs between vehicles;

(b) brake command, response or propagation characteristics differ between vehicles; or

(c) individual vehicle braking performance differs significantly.

Individual vehicle braking performance within a self-propelled coupled consist should be compatible to support consistent overall braking performance and minimize longitudinal forces due to under-braking or over-braking.

Guidance on train braking performance assessment can also be found in AS 7510.6.

7.4 Transfer mode operation within a locomotive-hauled train consist

Infrastructure maintenance rolling stock operating in transfer mode within a locomotive-hauled train consist on the open network shall comply with the stopping brake requirements of AS 7510.2:2024 for hauled rolling stock for the intended operating mode.

The braking system of an infrastructure maintenance vehicle operating in transfer mode shall be regulated to achieve a brake force at the rail corresponding to a coefficient of adhesion between the wheel and rail not in excess of 0.08, unless a wheel slip protection system is fitted .

Commentary *C7.4-1*

Transfer mode refers to the movement of infrastructure maintenance rolling stock between protected worksites or depots within a locomotive-hauled train consist on the open network. In transfer mode, braking performance requirements are consistent with network freight wagon and locomotive standards. The lower adhesion limit of 0.08 (compared with 0.11 in travel mode) reflects compatibility requirements with locomotive and wagon braking systems within a locomotive-hauled train consist.

Different braking performance, train handling and operational requirements apply when operating outside protected worksites and possessions. Additional guidance on train handling and consist operation can be found in AS 7510.6.

Where a vehicle has multiple operating modes (e.g., travel mode/work mode; direct/indirect brake settings), brake settings shall be managed so that the braking performance is appropriate for the active operating mode.

Commentary *C7.4-2*

Verification of consist braking performance can include dynamic stopping tests, deceleration measurements, brake propagation assessments, or other methods accepted by the RIM/RSO for the intended operation. Guidance relating to train braking performance assessment can also be found in AS 7510.6.

7.5 Park brake performance

The park brake shall hold the vehicle, articulated vehicle or multi-unit vehicle stationary on a 1-in-30 gradient, or as otherwise defined by the RIM, under all conditions of loading of the uncoupled vehicle, articulated vehicle or multi-unit vehicle.

Commentary *C7.5-1*

Where multi-unit vehicles and articulated vehicles have park brakes that do not apply force to all bogies, a reduced park brake holding capacity can result when unbraked bogies are loaded and braked bogies are unloaded.

A park brake should not be reliant upon the coefficient of adhesion exceeding 0.085 between the wheel and rail.

Commentary *C7.5-2*

A coefficient of adhesion of 0.085 allows park brakes to be applied to approximately 40% of the axles, assuming the axle loads are evenly distributed across the vehicle.

The park brake shall be able to maintain the required braking forces indefinitely.

Section 8 Calculation of braking system performance

8.1 Stopping brake calculation

Where braking performance is assessed using equivalent deceleration, the calculation method shall be based on a recognized method accepted by the RIM/RSO.

The effect of wheelset rotational inertia should be included when assessing stopping performance.

The effect of rolling resistance shall not be included when assessing stopping performance.

Stopping performance assessments for braking systems incorporating disc brakes shall be based on new wheel diameters.

Where a stopping distance requirement does not specify whether the braking mode is service or emergency, then the assessment should be for service applications of the stopping brake.

Commentary *C8.1*

EN 14531-1 contains suggested methodologies for assessing stopping brake performance.

The use of measured characteristics for the actual friction elements should be used for braking calculations, given the sensitivity of stopping performance to friction element coefficient of friction.

Stopping brake shall be assessed in both loaded and unloaded conditions.

8.2 Park brake calculation

The effect of wind force shall not be included when assessing park brake performance.

The effect of rolling resistance shall not be included when assessing park brake performance.

Commentary *C8.2*

EN 14531-1 contains suggested methodologies for assessing park brake holding performance.

Park brake holding performance shall be assessed for rolling stock in both loaded and unloaded conditions.

Where a change in vehicle mass can reasonably occur while the vehicle is secured by the park brake (e.g., loading/unloading of materials or equipment, refuelling/watering, attachment/detachment of modules or trailers), the park brake holding performance shall be assessed for the transition from tare to gross with the park brake remaining applied.

The static friction values used in calculations shall include values under all conditions, including during elevated temperatures after operation.

8.3 Coefficient of friction

Friction characteristics shall be determined using a recognized method appropriate to the braking surface and duty.

For tread brake blocks, friction characteristics shall be determined in accordance with AS 7504.1:2026.

For brake discs and pads, friction characteristics shall be determined in accordance with AS 7504.2:2023.

Where an alternative recognized test method is used, it shall be technically justified as equivalent for the intended duty and agreed between the RIM/RSO and the manufacturer.

Section 9 Validation of braking function and performance

9.1 General

Infrastructure maintenance rolling stock brake system function and performance shall be validated by testing.

Testing shall confirm that the brake system functions as specified, that all brake system component parts meet their specifications, and that the braking performance specifications are met, including network specifications.

The results of brake system performance tests shall be recorded and the documentation retained for reference by the RSO.

The configuration of infrastructure maintenance rolling stock shall be reviewed to confirm that any type test, calculation or simulation used to demonstrate compliance is applicable to the vehicle configuration being accepted for service.

Brake system function and performance tests (static and/or dynamic, as applicable) should be conducted in any of the following circumstances:

(a) Introduction into service of a previously untested vehicle.

(b) A new type or build of vehicle is to be introduced to service.

(c) Modification of a vehicle that could affect braking performance.

(d) Modification of the brake system of a vehicle.

(e) A change to the rated load carrying capacity of a vehicle.

(f) An overhaul, replacement or reassembly of braking system components that could affect braking function or performance.

(g) An incident or abnormal event occurs where brake system function or performance can have contributed or can have been adversely affected.

Commentary *C9.1-1*

Infrastructure maintenance rolling stock can vary significantly in configuration between vehicles of the same nominal type or designation. Where type testing is used, the RSO is responsible for defining the bounds of applicability for the type test and verify that the vehicle configuration being accepted for

service remains within those bounds (e.g., vehicle mass, load condition, axle arrangement, brake equipment, wheel diameter, friction elements, braking modes, and consist configuration).

Commentary *C9.1-2*

A structured parameter change review (similar in concept to the assessment approach described in AS 7508, including the use of a parameter change matrix) can assist in determining whether additional testing, analysis, calculation, or simulation is required where the accepted vehicle configuration differs from the type-tested configuration.

9.2 Static brake type & routine tests

9.2.1 General requirements

Static brake tests shall verify correct operation of the brake system(s), including:

(a) integrity of pipework/circuits;

(b) correct charging;

(c) correct response to control inputs; and

(d) correct application and release of braking devices.

Corrective action followed by retesting shall be carried out if brake system function or static performance specifications are not met.

9.2.2 Static brake type tests

A static brake type test conducted on a vehicle shall establish whether its brake system will function and perform as specified when placed in service.

A static brake type test of a park brake shall confirm function and static performance.

9.2.3 Static routine type tests

Static brake type tests shall be carried out on one or more vehicles of a production run as specified by the RSO.

Static brake routine tests shall be carried out on all vehicles of a production run.

For vehicles fitted with automatic air brake systems capable of being attached to a train and operated from the train brake pipe, a single-car air test (SCAT) shall be performed in accordance with the applicable requirements of AS 7510.2:2024 (and network-specific SCAT requirements where mandated).

For vehicles fitted with hydraulic braking systems, an equivalent static test shall be defined. The static test shall verify system integrity, hydraulic pressure build-up and leak-down, stored-energy capacity (where applicable), and correct brake application and release response.

Where hydraulic pressure is used to maintain a spring-applied brake in the released position, the static test shall verify that loss of hydraulic pressure results in brake application.

9.2.4 Static air brake test content

The air brake system shall be tested by moving the brake controller to all positions and checking:

(a) the brakes apply and release (i.e. the brake blocks/brake disc pads are forced onto the wheels/discs and then released);

(b) the required braking force to achieve the required braking performance, in the loaded condition from measurements of actual braking forces with full service brake cylinder pressure;

(c) the required braking force to achieve the required braking performance, in the empty condition from measurements of actual braking forces with emergency brake cylinder pressure;

(d) the required braking force to achieve the required braking performance, when the independent brake (if fitted) is applied.

(e) that all air pressures are to specification for each brake application and release;

(f) that the brake application and release timings are to specification; and

(g) that all air leakage is within specification.

9.2.5 Static hydraulic brake test content

The hydraulic brake system shall be tested by operating the brake control through its full range (including all positions/detents where fitted) and checking:

(a) the brakes apply and release (i.e. the brake blocks/brake disc pads are forced onto the wheels/discs and then released);

(b) the required braking force to achieve the required braking performance, in the loaded condition from measurements of actual braking forces with full service brake cylinder pressure;

(c) the required braking force to achieve the required braking performance, in the empty condition from measurements of actual braking forces with emergency brake cylinder pressure;

(d) the required braking force to achieve the required braking performance, when the independent brake (if fitted) is applied;

(e) that all hydraulic pressures (and where fitted, accumulator pressure/charge state) are to specification for each brake application and release;

(f) that the brake application and release timings are to specification; and

(g) that all hydraulic leakage (external leakage and/or pressure decay, as applicable) is within specification.

9.3 Dynamic braking performance test

9.3.1 General

Prior to formally testing braking performance, brake blocks or brake pads should be bedded-in to stabilize friction performance, unless the friction elements are already bedded-in through prior controlled operation or manufacturer-approved conditioning.

Dynamic braking performance test on a prototype, developmental, new vehicle, vehicle previously operated on the network or substantially modified vehicle shall be performed to establish whether its brake system achieves the required performance in service, without wheel slide in any condition of loading.

Any modification to brake system components that could affect stopping performance, braking force, friction characteristics or brake actuation (including substitution of brake blocks or brake disc pads) shall require revalidation of braking performance

9.3.2 Dynamic braking performance test content

Dynamic braking performance test shall include stopping distance testing in accordance with network requirements, without wheel slide in any condition of loading.

Generally, this includes multiple brake stopping tests at speed steps of at least 20km/h up to the maximum design speed of the vehicle

A braking performance type test shall include a park brake holding test.

9.4 Park brake holding testing

Park brakes shall be tested by either:

(a) an incline test on track with a minimum 1-in-30 grade or the maximum grade for the network on which it will operate, whichever is greatest, and hold for at least 10 min or as otherwise specified by the RIM; or

(b) a pull test on level track using a force equivalent to 1.5 x GVM / grade, where the grade is 1-in-30 grade, or as otherwise defined by the RIM.

Where a change in vehicle mass can reasonably occur while the vehicle is secured by the park brake (e.g., loading/unloading of materials or equipment, refuelling/watering, attachment/detachment of modules or trailers), the park brake holding performance should be assessed for the transition from tare to gross with the park brake remaining applied.

9.5 Coupled consist braking validation

Where self-propelled infrastructure maintenance rolling stock vehicles are intended to operate as a coupled consist, validation shall confirm that the coupled configuration conforms to the stopping performance requirements of Clause 7.2 where required by Clause 7.3.

Validation shall identify the coupled configuration assessed, including vehicle types, brake control arrangement, brake connection arrangement, operating mode, loading condition, maximum operating speed and brake isolation status.

Validation shall confirm that brake command, response, build-up and propagation characteristics do not adversely affect stopping performance or longitudinal force management.

Validation shall confirm that traction effort is removed, reduced, or commanded to a non-powering state when braking is commanded from the lead driver/operator position.

9.6 Multiple vehicle operation

Multiple vehicles coupled together shall be classified as a train for inspection purposes.

An in-service static brake test according to AS 7510.6:2014 shall be carried out on the train prior to entering service.

RSOs shall have procedures to ensure all air hoses and cables pertaining to the brake system are correctly coupled prior to the vehicles entering service.

9.7 Single-car test

A single-car test shall be performed for vehicles with automatic air brake systems capable of being attached to a train and operated from the train brake pipe in accordance with AS 7510.2:2024.

Vehicles not fitted with an automatic air brake shall have a single-car test according to the vehicle or brake manufacturer's requirements.

9.7.1 Requirements

A single-car test conducted on a vehicle shall establish whether its brake system achieves the required performance.

A single-car test conducted on a vehicle shall confirm that:

(a) the vehicle brake system is sufficiently responsive as to operate correctly under service conditions; and

(b) the vehicle brake system maintenance condition is such that it can be expected to continue to perform as intended until the next maintenance service.

Commentary *C9.7.1*

A single-car test is typically performed on a vehicle:

- if the vehicle has not previously entered service;
- if required by the maintenance schedule;
- after replacement of any pneumatically operated control equipment on the vehicle; and/or
- if a brake system fault is suspected.

Section 10 Brake system software

Brake system software used in association with a brake system shall be designed, validated and tested to an appropriate safety integrity level (SIL) rating, in accordance with the requirements of AS 61508.1:2011, or in accordance with EN 50128:2012, or an alternative internationally recognized auditable standard that is specific to railway braking or to railway safety systems.

Section 11 Maintenance

11.1 General

Requirements for train inspection including qualifications for personnel shall be in accordance with AS 7451:2023.

RSOs shall specify the implementation of in-service brake system function and performance testing of vehicle brakes.

RSOs shall ensure the effective implementation of inspections, routine function checks, overhaul procedures and acceptance criteria to maintain specified brake system performance throughout the period between successive services.

The content and periodicity of the inspection, testing and maintenance of brake equipment should be based on the recommendations of the brake equipment manufacturer and data derived from in-service experience and testing.

RSOs shall ensure that personnel including contracted organisations engaged to overhaul and/or repair brake equipment are suitably qualified and trained in the necessary competencies to perform these tasks. Where applicable, these tasks shall include testing of equipment on a test rack to ensure correct operation.

11.2 Function checks – Serviceability

A vehicle brake system routine function check shall be undertaken to confirm serviceability when brake system components are replaced and reconnected on a vehicle following component repair, replacement or disconnection in the field.

The results of brake system function checks shall be recorded and the documentation retained for reference.

11.3 Abrasive brake blocks

Abrasive brake blocks (trim blocks) may be used to remove minor wheel and tread irregularities.

Abrasive brake blocks should have a thin coating of abrasive material over a conventional brake block material or an insert of abrasive material.

As the coefficient of friction of abrasive brake blocks is generally higher than that of the brake block that it will temporarily replace, the RSO should allow for the possible consequences of increased adhesion demand.

Appendix A Hazard Register (Informative)

Hazard Number	Hazard
5.1.1	Rolling Stock – Harm to the environment - Derailment or Collision, Human Error, Design Failure, Organisational SMS Failure, Security Breach, Loads not Secure and or Vandalism
5.2.1	Rolling Stock – Harm to infrastructure by rolling stock - Derailment or Collision, Human Error, Design Failure, Security Breach, Loads not Secure, and or Vandalism
5.3.1	Rolling Stock – Harm to persons - Derailment or Collision, Human Error, Track Failure, Design Failure, Health, Organisational SMS Failure, Security Breaches, Loads not Secure and or Vandalism
5.5,1	Rolling Stock – Harm to Rolling Stock Related Processes – Derailment or Collision, Human Error, Track Failure, Track Obstruction, Design Failure, Health Failure, Organisational SMS Failure, Security Breach, Load not Secure and or Vandalism
5.6.1	Rolling Stock – Out of Control Trains - Human Error, Design Failure, Health Failure, Organisational SMS Failure, Security Breach and or Vandalism
5.7.1	Rolling Stock – Path Infringement – Derailment or Collision, Human Error, Track Failure, Track Obstructions, Design, Health Failures, Environmental Impact, Security Breach, Load not Secure, Vandalism and or Threat
5.8.1	Rolling Stock – Collision – Derailment, Human Error, Track Failure, Track Obstructions, Design Failure, Health Failure, Organisational SMS Failure, Security Breach, Load not Secure and or Vandalism
5.9.1	Rolling Stock – Signal Passed at Danger – Human Error, Track Failure, Design Failure, Health Failure, Lack of Training and or Vandalism
5.10.1	Rolling Stock – Brakes being Inadequate when Moving - Derailment and Collision, Human Error, Design Failure, Organisational SMS Failure, Security Breach and or Vandalism
5.11.1	Rolling Stock – Brakes being Inadequate when Stationary – Human Error, Design Failure, Health Failure, Organisational SMS Failure, Security Breach and or Vandalism
5.12.1	Rolling Stock – Wheel Skidding – Derailment or Collision, Human Error, Track Obstruction, Design Failure, Security Breach and or Vandalism
5.18.1	Rolling Stock – Level crossing collision - Derailment, Human Error, Track Failure, Track Obstructions, Design Failure, Health Failure and or Vandalism
5.22.1	Rolling Stock – Overspeed - Design Failure, Health Failure, Organisational SMS Failure, Load not Secure, Vandalism and or Threat
5.30.1	Rolling Stock – Excessive dynamic longitudinal train forces - Derailment or Collision, Human Error, Track Failure, Design Failure, Health Failure, Load not Secure and or Vandalism

Hazard Number	Hazard
5.46.1	Rolling Stock – Excessive acceleration – Human Error, Design Failure, Health Failure, Organisational SMS Failure, Security Breach and or Vandalism
5.50.1	Rolling Stock – Uncommanded brake applications - Human Error, Design Failure, Health Failure, Security Breach and or Vandalism

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- *Field manual of the AAR interchange rules*
- *AAR Manual of Standards and Recommended Practices - Section E: Brakes and Brake Equipment*
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