

AS 1085.19:2023



Railway track material: Part 19: Resilient fastening assemblies



Infrastructure Standard



This Australian Standard® AS 1085.19 Railway track material: Part 19: Resilient fastening assemblies was prepared by a Rail Industry Safety and Standards Board (RISSB) Development Group consisting of representatives from the following organisations:

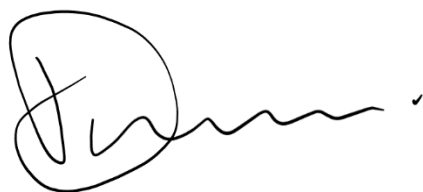
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The Standard was approved by the Development Group and the Infrastructure Standing Committee on February, 2023. On February 13, 2023, the RISSB Board approved the Standard for release.

This standard was issued for public consultation and was independently reviewed before being approved.

Development of the Standard was undertaken in accordance with RISSB's accredited process. As part of the approval process, the Standing Committee verified that proper process was followed in developing the Standard.

RISSB wishes to acknowledge the positive contribution of subject matter experts in the development of this Standard. Their efforts ranged from membership of the Development Group through to individuals providing comments on a draft of the Standard during the open review.



Damien White
Chief Executive Officer
Rail Industry Safety and Standards Board

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Railway track material: Part 19: Resilient fastening assemblies

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This Standard was prepared by the Rail Industry Safety and Standards Board (RISSB) Development Group AS 1085.19 Railway track material: Part 19: Resilient fastening assemblies. Membership of this Development Group consisted of representatives from the organisations listed on the inside cover of this document.

Objective

The objective of this Standard is to provide manufacturers and purchasers with performance requirements for resilient fastening assemblies for use with steel rails, sleepers, and other support structures in railway tracks.

It has been produced in order to clarify the separation of requirements for fasteners from those for sleepers.

Compliance

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

1. Requirements.
2. Recommendations.
3. Permissions.
4. 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 recognise 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.

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'.

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.

The terms 'normative' and 'informative' have been used in this Standard to define the application of the appendix to which they apply. A 'normative' appendix is an integral part of a Standard, whereas an 'informative' appendix is only for information and guidance.

Notes to the text contain information and guidance and are not considered to be an integral part of the Standard.

RISSB Standards address known hazards within the railway industry. Hazards, and clauses within this Standard that address those hazards, are listed in Appendix K.

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1 Scope and general

1.1 Purpose

The purpose of this Standard is to set out the performance parameters for ensuring that the resilient fastening assemblies are safe and fit for purpose.

It provides manufacturers and purchasers with performance requirements, test methods and in-field monitoring methods for ensuring a fit for purpose resilient fastening assembly.

This Standard clarifies the separation of requirements for fastening assemblies from those for individual fastening components (clips, insulators, rail pads, spacers, shoulders and pins, and base plates), sleepers and other support structures. There are more requirements for fastening components than covered in this standard, and these should be sought from standards specific to that component, e.g. rail base plates.

1.2 Scope

This Standard specifies performance requirements and test methods for resilient fastening assemblies for use in conjunction with steel rails and sleepers or other support structures for railway tracks for insulated and non-insulated applications.

NOTES:

1. Purchasing and usage guidelines are given in Appendix A, including information to be supplied by purchasers and suppliers, typical fastening evaluation data sheets, and a method for evaluation in track. Also included is a set of typical test loads for various track situations.
2. Guidance on demonstrating compliance with this Standard is given in Appendix B.

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 1085.3 Railway track material Part 3: Sleeper plates.
- AS 1085.13 Railway track material Part 13: Spring spikes.
- AS 1085.14 Railway track material Part 14: Concrete sleepers.
- AS 1085.17 Railway track material Part 17: Steel sleepers.
- AS 1085.18 Railway track material Part 18: Screw spikes.
- AS 1085.22 Railway track material Part 22: Alternative material sleepers.
- AS 1199 Sampling procedures and tables for inspection by attributes.
- AS 1399 Guide to AS 1199 – Sampling procedures and tables for inspection by attributes.
- AS 1444 Wrought alloy steels – Standard, hardenability (H) series and hardened and tempered to designated mechanical properties.
- AS 1447 Hot-rolled spring steel.
- AS 1683.23 Methods for test rubber Part 23: Rubber – vulcanized – determination of resistance to liquids.

- AS 1683.24 Methods for test rubber Part 24: Determination of the resistance of vulcanized or thermoplastic rubbers to ozone cracking – static strain test.
- AS 1831 Ductile cast iron.
- AS 2271 Plywood and blockboard for exterior use.
- HB 18.28 Guide 28 - General rules for a model third-party certification scheme for products
- BS EN 13146-1 Railway applications – Track – Test methods for fastening systems Part 1: Determination of longitudinal rail restraint
- BS EN 13146-3 Railway applications – Track – Test methods for fastening systems Part 3: Determination of attenuation of impact loads
- BS EN 13146-4 Railway applications – Track – Test methods for fastening systems Part 4: Effect of repeated loading
- BS EN 13146-5 Railway applications – Track – Test methods for fastening systems Part 5: Determination of electrical resistance
- BS EN 13146-7 Railway applications – Track – Test methods for fastening systems Part 7: Determination of clamping force
- BS EN 13146-8 Railway applications – Track – Test methods for fastening systems Part 8: In service testing
- ASTM D 2240 Standard test method for rubber property – Durometer hardness.

NOTE: There are no informative references in this document.

1.4 Terms and definitions

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

1.4.1

assembly clamping force

total force perpendicular to the rail seat (clamping force) is exerted by a resilient fastening assembly on the foot of the rail

1.4.2

fastening clip

flexible steel restraint that clamps the rail in position

1.4.3

insulator

part of the fastening assembly that fits between the fastening clip or shoulder and the rail foot to provide electrical isolation

1.4.4

pin

bar or rod placed through the sleeper to which the fastening clip is attached

1.4.5

rail base plate

plate placed between the foot of the rail and the sleeper, which incorporates a shoulder

1.4.6

rail pad

part of the fastening that fits between the rail and the sleeper and acts to absorb impact, isolate electrically or protect components against abrasion

1.4.7

resilient fastening assembly

assembly of several parts that hold the rail in position on the sleeper through a flexible clamp that acts on the rail foot

1.4.8

shoulder

part of the fastening assembly that provides lateral restraint of the rail

1.4.9

spacer

piece inserted into a fastening to enable different rail profiles to be used

1.4.10

toe load

downward force exerted by a single fastening clip on the foot of the rail

General rail industry terms and definitions are maintained in the RISSB Glossary:

<https://www.rissb.com.au/products/glossary/>

1.5

Notation

a	attenuation of test pad expressed as percent reduction in sleeper strain compared with that using a reference pad
a_t	attenuation at the top of the sleeper, in percent
a_b	attenuation at the bottom of the sleeper, in percent
C	conductivity of the water used, in millisiemens per metre
d_1	maximum longitudinal displacement of rail during the test, in millimetres
d_2	residual longitudinal displacement of rail after removal of load, in millimetres
d_3	calculated elastic longitudinal displacement of rail prior to slip, in millimetres
d_a	thickness of aluminium plate used with rail pad, in millimetres
d_t	thickness of rail pad for which assembly is designed, in millimetres
d_{rot}	rail rotation under lateral load restraint test
d_{tran}	rail translation under lateral load restraint test
d	mean vertical displacement of rail during determination of vertical stiffness, in millimetres vertical displacement during the uplift test
F_c	assembly clamping force (specified value) in kilonewtons
$F_{c,m}$	assembly clamping force (measured value) in kilonewtons
F_l	test load for lateral repeated load test defined in AS 1085.18 (specified for the application) in kilonewtons
F_{tr}	longitudinal rail restraint (maximum axial load on the rail without non- elastic displacement occurring) in kilonewtons

F_p	insert pull-out test load (specified value) in kilonewtons
F_t	fastening clip toe load (specified value) in kilonewtons
k_c	correction factor for the conductivity of the water used $k_c = 0.03 \text{ }^\circ\text{C}$
k	vertical stiffness of fastening assembly, in meganewtons/metre
L_t	lateral component of the test load, in kilonewtons
L/V	ratio of lateral and vertical rail seat loads $L_t/V_t = \tan a$
m_s	weight of unsupported sleeper (or part of sleeper) and fastening components
m_f	weight of unsupported loading frame bearing on the sleeper
P	load measured during the uplift test
P_s	load at which shims may be removed during uplift test
Q	maximum static axle load of vehicles using the track, in kilonewtons
R_c	measured minimum resistance, in Ohms
R_{33}	wet electrical resistance, corrected to $C = 33$ millisiemens per metre
V_t	vertical component of the test load, in kilonewtons
x	position of the line of application of L_t below the centre of curvature of the gauge corner of the rail head, as shown in Figure G1, in millimetres
T	torque, in kilonewton metres
a	angle between the load line and a line normal to the base of the sleeper, in degrees $a = \tan^{-1}(L_t/V_t)$
ϵ_t	first peak strain in the top of the sleeper using a test pad
ϵ_b	first peak strain in the bottom of the sleeper using a test pad
ϵ_{rt}	mean first peak strain in the top of the sleeper using a reference pad
ϵ_{rb}	mean first peak strain in the bottom of the sleeper using a reference pad
ϵ_{st}	strain in the top of the sleeper due to static pre-load in alternative test procedure
ϵ_{sb}	strain in the bottom of the sleeper due to static pre-load in alternative test procedure

2 Fastening assembly

2.1 General

Resilient fastening assemblies are used to fasten steel rails in the track. The resilient fastening provides a flexible restraint that holds the rail in position on the sleeper or other support structures by providing a spring force of known magnitude. The assembly, if required, can also provide load spreading, impact attenuation and electrical isolation.

Resilient fastening assemblies are placed on both sides of the rail and may require a rail base plate or have the shoulder built into the fastening or cast into the sleeper. They hold the rail onto the rail seat of the support structure.

The components specified for the fastening assembly shall be provided as follows:

- (a) Fastening clips in accordance with Section 3.
- (a) Insulators in accordance with Section 4.
- (b) Rail pads in accordance with Section 5.
- (c) Spacers in accordance with Section 6.
- (d) Shoulders and pins in accordance with Section 7.
- (e) Rail base plates in accordance with Section 8.

2.2 Installation and maintenance

Fastening assemblies shall:

- (a) provide for safe and easy installation and removal in existing track without sustaining damage;
- (b) allow for rails to be de-stressed or changed; and
- (c) allow for replacement of individual clips, pads and insulators where used.

NOTE: Special tools and machinery are often required to install and remove parts of the resilient fastening assembly (e.g. clips).

2.3 Marking

The components of the resilient fastening assembly shall be clearly and indelibly marked, where the performance is not affected, to indicate at least the following information:

- (a) The manufacturer.
- (b) The year of manufacture (month if relevant).
- (c) Identification markings.

Where the component is too small or marking will affect the performance of the component, the marking may be reduced or omitted.

2.4 Performance Criteria

2.4.1 General

The complete resilient fastening assembly, which includes clips, insulators, pads, spacers, shoulders, etc., shall be capable of passing the tests specified in the following clauses and in the appropriate section, in the configuration in which it is intended to be used.

The tests shall be carried out on a suitable base that approximates the in-service use as close as possible.

The requirements for fastening assemblies used in conjunction with concrete, steel and alternative material sleepers are given in AS 1085.14, AS 1085.17, and AS 1085.22, respectively.

The effect of environmental conditions on plastic, rubber and metal can reduce the service life of the components. This Standard does not provide tests to determine the performance of plastic and rubber components under environmental conditions. Appropriate tests should be selected to study the expected life of such components.

Unless specified otherwise, instruments chosen for measuring load and displacement shall maintain an accuracy of ± 0.5 kN (load) and ± 0.01 mm (displacement), respectively.

2.4.2 Resilient fastening assembly test

When tested in accordance with Appendix C, all the components shall fit together and disassemble without damage.

2.4.3 Assembly insulation test

When tested in accordance with Appendix C, the impedance shall not be less than $1\text{ M}\Omega$. This test applies to insulated fastening assemblies only.

2.4.4 Wet electrical impedance test

When tested in accordance with Appendix C, the wet electrical impedance shall not be less than 4000Ω .

NOTES:

1. This test is relevant to signalling currents, not traction currents, and is applicable to complete insulated fastening assemblies.
2. Impedance is the measure of opposition to an alternating current (AC), while resistance usually refers to direct current (DC). Resistance is simple, while impedance will consider reactance in addition to resistance to determine it. Resistance is the pure ohmic impedance (absence phase shift).

2.4.5 Lateral load restraint test

When tested as per Appendix D with lateral and vertical rail seat loads L_t and V_t (see Appendix A), the deflections obtained shall be less than the following:

- (a) d_{tran} (rail translation) under the test load.
- (b) d_{rot} (rail rotation) under half the test load.

NOTES:

1. This test does not always reflect the in-track behaviour of rail fastening assemblies. In track, the torsional stiffness of the rail and the restraint resulting from adjacent fastening assemblies will affect the rotation and translation of the head. The degree of rail rotation and translation acceptable can vary

from the values given. Other test limits may be appropriate depending on the application (e.g., impact-attenuating pads and direct fixation systems).

2. Rail rotation is gauge-widening, less rail translation.

2.4.6 Longitudinal restraint test

When tested in accordance with Appendix E, using a test load of half the minimum clamping force specified by the purchaser ($0.5F_c$), the rail shall not move more than 5 mm during the initial 3 min period, and there shall be no more than 0.25 mm of further movement of the rail during the remainder of the test period.

The fastening shall be capable of meeting the requirements of the longitudinal restraint test in either direction. The specified maximum loading to be used in the testing shall reflect the track standard required.

2.4.7 Fastening uplift test

When tested in accordance with Appendix F, the recorded assembly clamping force ($F_{c,m}$), shall exceed the minimum value specified by the purchaser for clamping force.

The fastening system shall support a maximum test load of $1.5F_{c,m}$ (but not exceeding 45kN) without failure.

NOTE: Due to the inherent variability of this test 3 samples should be tested.

2.4.8 Fastening repeated load test

When tested using the below methods, with lateral and vertical rail seat loads L_t and V_t , no fatigue cracking of the fastening clip or loss of function of the other components shall occur.

- (a) Prestressed concrete sleepers - Appendix G, using the sleeper to be used in track.
- (b) Steel sleepers - the method given in AS 1085.17.
- (c) Alternative material sleepers - the method is given in AS 1085.22.
- (d) Other bases (including timber) - Appendix G, using a suitable base that approximates the in-service use as close as possible.

NOTES:

1. The alternative method given in paragraph G4, is included for information only and may be used if appropriate. The test load $((L_t^2 + V_t^2)^{0.5})$ is derived from the lateral and vertical rail seat loads, the angle α is given by $\tan^{-1}(L_t/V_t)$ and the value of x is to be supplied by the purchaser (see also Table A1).
2. The tests in Appendix G of this Standard may also be appropriate for development and testing of new fastening assemblies.

3 Fastening clips

3.1 General

This section specifies requirements for fastening clips for use in resilient fastening assemblies.

NOTE: The choice of fastening clip depends on the conditions in which it is to be used. Information supplied in the form of spring rate and fatigue performance will aid in the selection process.

3.2 Function

Fastening clips are used to secure steel rails in place in a track. The fastening clip provides a flexible restraint that holds the rail in position on the sleeper or other supporting structure by providing a spring force of known magnitude. They clamp the rail in place in the assembly to facilitate vertical, longitudinal and lateral restraint.

3.3 Material

Fastening clips shall be made from steel in accordance with AS 1444 or AS 1447 or as approved by the RIM.

3.4 Corrosion

Fastening clips shall be provided with a suitable short-term protective coating. Where additional corrosion protection is required, these shall be specified by the RIM.

3.5 Performance

3.5.1 Spring rate and toe load test

The spring rate and design toe load, including permanent set after excess deflection of the fastening clip, shall be determined in accordance with Appendix H. The toe load (F_t) after excess deflection shall not be less than the value specified by the purchaser.

NOTE: The fastening clip design toe load will not necessarily be equivalent to the clamping force determined in Section 2.

3.5.2 Clip fatigue test

The fatigue performance (SN curve) of the fastening clip type shall be determined by testing in accordance with Appendix I.

NOTE: The SN curve resulting from this test can be used to verify the suitability of a clip for a particular application. Minor variations to clip shape would not necessarily invalidate an SN curve. The SN curve is relevant to the material, cross-section and basic geometry.

4 Insulators

4.1 General

This section specifies requirements for insulators for use in resilient fastening assemblies.

4.2 Function

The insulator provides electrical isolation, rail location, and physical separation between the rail and the support structure and transfers the clamping and restraining forces.

4.3 Performance

The insulator shall perform adequately under the assembly tests given in Section 2.

The material used shall be resistant to natural levels of ultraviolet radiation and ozone.

5 Rail pads

5.1 General

This section specifies requirements for rail pads for use in resilient fastening assemblies.

5.2 Function

The rail pads are used between the rail and the support structure.

Rail pads provide:

- (a) load distribution from the rail to the sleeper, rail base plate or support structure;
- (b) protection of components from abrasion and damage resulting from high localised loading or differential movement;
- (c) electrical isolation, if required; and
- (d) attenuation of dynamic loads and vibration (usually for concrete sleepers and slabs).

5.3 Performance

The rail pad shall perform adequately under the assembly tests given in Section 2.

Where the rail pad is required to absorb impact (from dynamic loads), the attenuation performance shall be measured in accordance with Appendix J.

The rail pad shall provide electrical separation to electrically isolate the rail where required.

Where rail pad attenuation is determined as per Appendix J test method, rail pad attenuation is described as follows:

- (a) ≤ 15 percent - low attenuation.
- (b) > 15 percent and ≤ 30 percent - medium attenuation.
- (c) > 30 percent - high attenuation.

Where rail pad stiffness is determined as per Appendix G test method, rail pad stiffness is described as follows:

- (a) < 80 MN/m - soft stiffness.
- (b) ≥ 80 MN/m and < 150 MN/m - medium stiffness.
- (c) ≥ 150 MN/m - high stiffness.

5.4 Materials

5.4.1 General

The material used shall be resistant to natural levels of ultraviolet radiation and ozone.

Generally, rail pads are manufactured from high-density polyethylene or elastomeric materials.

NOTE: Specifications for the properties of any other materials should be determined as needed.

5.4.2 Polyethylene rail pads

Polyethylene rail pads shall be high-density plastics. The hardness of polyethylene plastic moulding and extrusion materials shall be stable between 10 °C and 70 °C or as specified by the purchaser.

5.4.3 Elastomeric rail pads

Elastomeric rail pads, if used, shall be of weather-resistant materials. Materials shall comply with AS 1683.23 and AS 1683.24, as appropriate.

NOTE: Various fastening manufacturers have developed specific requirements for elastomeric pads in cooperation with railway organizations that have gained experience in their use (GRASSIE, S.L. *Measurement and attenuation of load in concrete sleepers*. Railway Engineering Conference, Institution of Engineers Australia. Perth: September 1987. pp.13-16).

6 Spacers

6.1 General

This section specifies requirements for spacers for use in resilient fastening assemblies.

6.2 Function

Spacers are used to enable different rail sizes to be used on the same rail seat. Spacers are placed on one or both sides of the rail to locate the rails at the required position and gauge. The spacers may be removed or changed to the opposite side of the rail to accomplish the rail position and gauge when changing to a different rail size.

Spacers can also perform the function of an electrical insulator.

6.3 Performance

Spacers shall perform adequately under the assembly tests given in Section 2.

Spacers shall be designed to remain in position when installed in track.

The material used shall be resistant to natural levels of ultraviolet radiation, ozone, and corrosion.

Where spacers also perform the function of an electrical insulator, they shall be designed to maintain electrical isolation and satisfy the requirements of Section 4.

NOTE: The addition of spacers to a fastening assembly can have a significant effect on the performance of the fastening assembly. Pass criteria and testing details need to be varied to reflect actual performance in track.