

Resilient Fastenings for Concrete Sleepers

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Version 1.1	30 January 2022	TfNSW template applied
Version 2.0	30 January 2022	Internal revision only – no change
Version 3.0	30 January 2022	First full UGLRL release.

Table of contents

1.	Scope and application
2.	References
2.1.	Australian and International Standards5
2.2.	CRN Documents5
2.3.	Other References
3.	Design requirements
3.1.	General Information6
3.2.	Installation and Removal7
4.	Materials7
4.1.	Fastening7
4.2.	Corrosion protection7
4.3.	Insulation (for use with concrete sleepers)7
4.4.	Rail seat bearing pad (for use with concrete sleepers)8
4.5.	Cast-in Components
4.6.	Threaded Inserts
4.7.	Spacers
5.	Product Approval Requirements8

1. Scope and application

This specification details requirements for the design and type approval of resilient rail fastening assemblies for concrete sleepers.

Resilient fastening assemblies include all clips, bearing pads and insulators, "cast in" components and base plates.

It is applicable for fastening assemblies used on the CRN Network to meet the requirements of CRN Engineering Standard CRN CS 230 "Sleepers and Track Support".

2. References

2.1. Australian and International Standards

AS 1085.1	Rails
AS 1085.14	Prestressed Concrete Sleepers
AS 1085.18	Screwspikes and Threaded Inserts
AS 1085.19	Resilient Fastenings

Unless otherwise specified, all references relate to the latest standard versions, including amendments and relevant superseding standards.

2.2. CRN Documents

CRN CS 200	Track System
CRN CS 210	Track Geometry and Stability
CRN CS 230	Sleepers and Track Support
CRN CP 232	Concrete Sleepers

2.3. Other References

Nil

3. Design requirements

The design of resilient fastening assembly components shall be in accordance with AS 1085.19 unless otherwise specified in this document.

3.1. General Information

The following track details are supplied:

Criterion	Detail / Description
Support type	Resilient fastenings are required for use with concrete sleepers and bearers and with direct fixation.
Track gauge	1435mm gauge with installation tolerance ±4 mm (See CRN Engineering standard CRN CS 210 "Track Geometry and Stability")
Rail	AS 1085.1 - 53 kg/m rail, with the capacity to use 60 kg/m
Rail cant	All running rails slope towards the track centre-line at 1 in 20
Maximum Grade	1 in 33.
Curve Radius	Minimum Radius 200m
Signalling	Track circuited signalling
Climate	Temperate
Nominal distance between axles	1.7 metres 25 Tonne axle load 1.6 metres 23 Tonne axle load
Minimum Service life	50 years
Electrical Insulation	Rail fastening assemblies and sleepers / bearers shall ensure a minimum electrical resistance between the running rails of 10 Ohms per track kilometre.
Impact factor	The combined quasi-static and dynamic load factor for Medium Duty Concrete sleepers only is 2.04
Rail weight	Use 53 kg/m rail to calculate the wheel load distribution factor for Medium Duty sleepers.
Thermal expansion and contraction	Thermal expansion and contraction forces act on the continuously welded rails with a rail temperature range from -10°C to 75°C about a neutral rail temperature of 35°C.

Table 1 – Design Information

Maximum train speeds to be used are specified in CRN Engineering standard CRN CS 200 "Track System" and detailed in Table 2.

Table 2 – Maximum Train Speed

Axle Load / Traffic Classification	25TAL	23TAL	21TAL	19TAL
Max Super Deficiency	75 mm	75 mm	75 mm	110 mm
Maximum Speed on Tangent Track	80 km/h	110 km/h	115 km/h	160 km/h

Track configuration and operating requirements to be used are specified in CRN CS 200 and detailed in Table 3.

Parameter	Medium Duty Sleeper
Operating Class	Class 1
Nominal ballast depth	300 mm
Nominal track modulus	30 mPa
Nominal track condition index (TCI)	45 to 50
Axle Load	25 tonnes
Sleeper Centres	600 mm
Annual Tonnage	20 mgt

Table 3 – Track Structure Data (for use in conjunction with AS 1085.14)

3.2. Installation and Removal

The fastening shall be such as to require minimum labour for insertion and removal. Mechanical insertion and/or withdrawal should be practical and preference will be given to those fastenings for which a proven clip installation and removal machine is available.

4. Materials

4.1. Fastening

The fastening shall be an elastic resilient fastening of a type that is internationally proven under operating conditions on a major railway system, or alternatively has been proven under simulated railway conditions.

The fastenings should be designed to match the nominal service life of the sleepers.

4.2. Corrosion protection

Resilient fastenings shall be provided with 'temporary' corrosion protection with an effective life of 12 months when stored in an open environment.

Where specified for use in 'special environments' resilient fastenings shall be either 'sheradised' or galvanised.

4.3. Insulation (for use with concrete sleepers)

Insulation shall be used to prevent interference with the signalling system and deterioration of the fastening system and concrete sleeper through electrical leakage. This requirement necessitates full insulation between rail and sleeper.

The insulation or insulators shall have a minimum life of 10 years.

4.4. Rail seat bearing pad (for use with concrete sleepers)

The rail seat pad shall be manufactured from High Density Polyethylene, or other suitable material, and shall be so designed that it is self-locating on the sleeper. The pad shall be capable of transmitting the rail seat load to the sleeper and shall be designed to suit the concrete sleeper accepted for use.

The rail pad shall be capable of transmitting the rail seat load of 147 KN - 180 KN to the sleeper.

The minimum thickness bearing pad permitted shall be 5 mm.

The pad shall have a minimum life of 10 years.

4.5. Cast-in Components

Where cast in components are used, they shall be designed for the full life of the sleeper. They shall be resistant to corrosion and able to withstand the required repeated loads without fatigue failure. They shall also be maintenance free.

The cast-in component shall be bonded to the concrete sleeper to meet the requirements of See CRN Engineering specification CRN CP 232 "Concrete Sleepers".

4.6. Threaded Inserts

Where threaded inserts are used, they shall be designed for the full life of the sleeper. They shall be resistant to corrosion and able to withstand the required repeated loads without fatigue failure. They shall also be maintenance free.

4.7. Spacers

Spacers (where required) shall be of proven mechanical capacity and have been proven under service conditions similar to Section 4.1.

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

5. Product Approval Requirements

The following product approval requirements shall be met for new designs or when a new manufacturer is proposing to supply fastenings of an existing design.

The following data shall be provided by the supplier:

- Fully dimensioned drawings showing all the required manufacturing tolerances of assemblies in respect of every component of the assembly and cast in pieces.
- Details showing material compositions of all components.

• Method of identification of components parts.

The supplier will also be required to provide documentation of the following test results as stipulated in AS 1085.19:

- Electrical Impedance Test (Appendix C)
- Lateral load restraint test (Appendix D) with a vertical component of applied load, V_t, of 180kN, and horizontal component of applied load, L_t, of 115 kN. Rail translation d_{tran} is to be not greater than 1.5mm under the test load; Rail rotation d_{rot} is to be not greater than 1.0mm under half the test load.
- Fastening Longitudinal Restraint Test (Appendix E) with a maximum applied longitudinal load of 12 kN
- Fastening Uplift Test (Appendix F). The "Toe" load should not be less that 21 KN per rail seat.
- Fastening Repeated Load Test (Appendix G). with a maximum applied longitudinal load of 12 kN.

Consideration will be given to repeated load testing of the fastening/sleeper assembly under lateral and vertical loadings equivalent to those determined for design of the track structure. This testing may replace the fastening assembly repeated load test.

- Clip Spring Rate and Toe Load Test (Appendix H).
- Clip Fatigue Test (Appendix I).
- Impact Test for Rail Pad Attenuation for Concrete (Appendix J).
- Fastening insert pull out test (cast-in components).
- Fastening insert torque test (cast-in components).

The following additional information is to be included:

- Availability of small installation and removal tools.
- Magnitude of dimensional tolerances allowed.
- Sleeper Pad load Deflection Graph
- Rail Clip Load Deflection Graph
- The "Toe" load which the fastenings impose on the rail.
- Any other test results which may support approval.
- Production test requirements.