Engineering Specification
Track

SPC 221

INSULATED JOINT ASSEMBLIES

Version 3.2

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Engineering Specification

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NSW Transport RailCorp

Document control

Version	Date	Summary of change
1.0	October, 2006	First issue as a RailCorp document. Includes content from C 3363
2.0	April, 2007	Revision of production test requirements
3.0	October, 2007	Clarification of the location of labels; addition of requirement to mark the manufactured length on joint
3.1	December, 2009	All Sections - Change of format for front page, change history and table of contents, Format change to all pages. Section 6.3 - Deletion of superfluous wording
3.2	June, 2012	Changes detailed in Summary table below

Summary of changes from previous version

Summary of change	Section
Control Changes	Document Control
Reformatted to new template	All

1 Scope and Application

This Specification sets out requirements for pre-assembled insulated joint assemblies, including requirements for type-testing and approval of prototype bonded insulated joints and first articles from a new supplier.

The specification is applicable to both single and double bonded insulated Joints, as defined within the body of the specification.

2 References

2.1 Australian and International Standards

AS 1085.1 – Steel rails

AS 1085.2 – Fishplates

AS 1085.12 – Insulated Joint Assemblies

AS 1252 – High strength steel bolts with associated nuts and washers for structural engineering

AS 1100.401 – Engineering survey and engineering survey design drawing

AS 1816.1 – Metallic materials—Brinell hardness test - Test method

2.2 RailCorp Documents

ESC 220 – Rail and Rail Joints

2.3 Other References

Nil

3 General Description and Requirements

3.1 Single Insulated Joint Assembly

Insulated joint assemblies join two rails together, with an insulating end-post between them, in order to provide electrical isolation for signalling purposes between two lengths of rail in a railway track.

Insulated joint assemblies shall comply with the general requirements of AS 1085.12 and with the particular requirements of this specification.

3.1.1 Scope of Supply

This specification applies to the manufacture of Bonded insulated joint assemblies in 53kg/m and 60kg/m Head Hardened rail and 47kg/m Standard Carbon rail.

Each joint assembly shall consist of two lengths of rail rigidly joined by a pair of fishplates, insulating material, an insulating end post separating the two rails, six high strength fasteners and other hardware, such as washers, bushes etc.

3.1.2 Dimensional Requirements

3.1.2.1 Length of Single Insulated Joint Assembly

Overall length of the joint shall be either 3.43 or 4.57 metres or as specified otherwise. The tolerance allowed on manufacture shall be ± 50mm.

3.1.2.2 Curvature

The joints may be straight, or curved to a nominated versine equivalent to a radius of not less than 240 metres.

The designated curved joints shall be as stated in Table 1 and Table 2.

3.43 metre Long Bonded Insulated Joint Curvature Tolerances		
Designated Mid Ordinate	**Versine Measured in Full Mid Ordinate**	**Versine Half Mid Ordinates**
6	4.5 to 7.5mm	1.5 to 2.5mm
3	1.5 to 4.5mm	0.5 to 1.5mm
0	Section 5 - Joint Straightness Test	Section 5- Joint Straightness Test

Table 1 – 3.43 metre Long Bonded Insulated Joint Curvature Tolerances

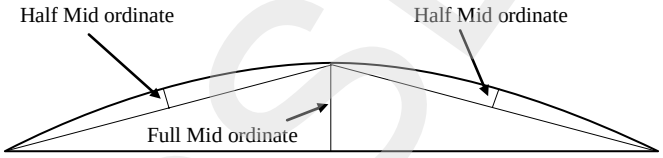

Figure 1 – Definition of terms

4.57 metre Long Bonded Insulated Joint Curvature Tolerances		
Designated Mid Ordinate	**Versine Measured in Full Mid Ordinate**	**Versine Half Mid Ordinates**
10	8.0 to 12.0m	2.5 to 4.00mm
5	3.0 to 7.0mm	1.0 to 2.5mm
0	Section 5 - Joint Straightness Test	Section 5 - Joint Straightness Test

Table 2 – 4.57 metre long Bonded Insulated Joint curvature tolerances

3.1.2.3 End Post Angle

Bonded Insulated Joint assemblies shall be manufactured with the rail ends at the insulating post cut at 150 to the right angle of the longitudinal axis (see Figure 2).

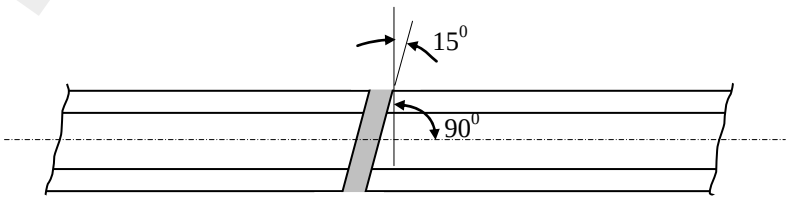

Figure 2 – Rail end angle

3.1.2.4 End Post Thickness

The end post thickness shall be 6.0mm + 1mm - 0.

3.1.3 Material and Manufacturing Requirements

3.1.3.1 Bolts and Swage Fasteners

Bonded Insulated Joint assemblies shall be manufactured with 6 hole bar type fishplates and six (6) fishbolts or swage fasteners.

3.1.3.2 Materials

All materials used, including rails, fishplates, insulating liners, ferrules, end posts, bolts, nuts, washers and swage fasteners, shall be free from defects and conform with the relevant Australian Standards as specified in AS 1085.12.

3.1.3.3 Marking of Joints

Each joint shall be marked with the information specified in AS 1085.12, Clause 8.2 such that it will remain readable during the life of the joint.

The following particular requirements apply:

- Mark the joint with a label attached to the web of the rail near the fishplate.
- Mark the curvature by including the versine (See Table 1 and Table 2).
- Mark the length (either 3.43 or 4.57)

3.1.3.4 Certificates of Conformance

All material certificates and mechanical test certificates required by relevant Australian Standards covering all components used in the joint shall be maintained by the manufacturer.

3.2 Double Bonded Insulated Joint

A Double Bonded Insulated joint shall consist of 2 bonded insulated joints 2.325m apart as detailed in Figure 3. The length of the double bonded insulated joint is 5.765 m and is composed of three lengths of rail (1.720m, 2.325m and 1.720m) rigidly joined by a pair of fishplates at each joint, adhesive insulating material and high strength bolts with nuts and washers.

In all other respects the requirements for single Bonded Insulated joints apply to double Bonded Insulated joints.

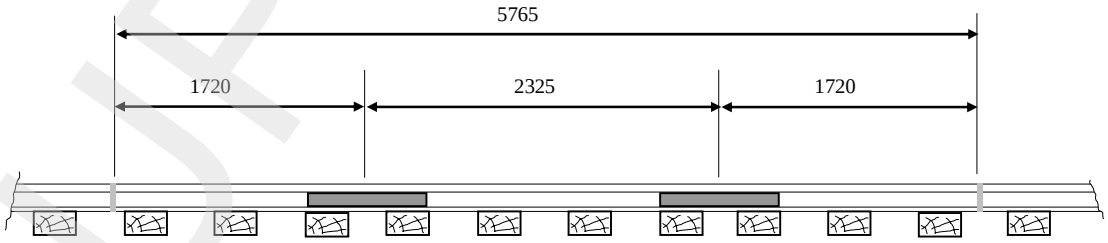

Figure 3 – Double Bonded Insulated Joint

4 Performance Requirements

4.1 Design Loads

Bonded insulated joint general arrangements and components shall conform to the requirements of RailCorp standard ESC 220 – "Rail and Rail Joints" for the rail size specified.

Insulated joint assemblies shall be designed to meet the design loads listed in Table 3 below.

Rail Size	60kg/m	53kg/m	50kg/m
Axle Load	30 T	25 T	22 T
Average Dynamic Wheel Load	170 kN	155 kN	150 kN
Estimated Number of Load Cycles Per Annum	1 Million	0.5 Million	0.25 Million

Table 3 – Operating Environment

The joint will also be subjected to tensile or compressive forces up to 115 tonne whilst under vertical load from traffic. The axial forces are caused by thermal rail expansion over the range of -10oC to +60oC.

The joint shall not bend or fail under vertical or lateral wheel loads and shall not deteriorate during its service life in such a way that signal failure may occur as a result of electrical conduction across the joint.

The joint shall also resist longitudinal slippage under thermal expansion and contraction effects of the rail so that the insulated joint will not allow one rail to move relative to the other rail within the joint by more than 0.1mm.

4.2 Electrical Characteristics

The joints shall provide a minimum electrical resistance of 1 megohm rail to rail and rail to fishplate at an operating voltage of 500V DC.

5 Production Testing

The manufacturer shall undertake testing of assembled joints at frequencies nominated in the manufacturer's own procedures. Methods of test shall meet the requirements of AS 1085.12. The manufacture and test procedures shall be approved by the Chief Engineer Track as part of the Type Approval process (see Section 6.)

In addition to tests detailed in AS 1085.12 conduct curvature tests using the following procedures:

- Measure curvature of the joint assembly by stretching a stringline between each end 16mm below the top of the rail. Measure the mid-ordinate.
- Measure the half mid-ordinate of the joint assembly by stretching a stringline between each end and the centre of the insulating end post, 16mm below the top of the rail. Measure the mid-ordinate.

The joint must meet the tolerances nominated in Table 1 and Table 2.

6 Type Approval Requirements

The following type approval requirements apply to new types of joints and to new manufacturers producing joints of an existing design.

6.1 General

When submitting a new type of bonded insulated joint for approval, or when a new manufacturer proposes to produce a joint of an existing design, the joint assembly shall either conform fully to the requirements of AS 1085.12 and as set out in Sections 3.1.2 and 3.1.3 of this specification, or be tested in accordance with the following requirements.

6.2 Performance Demonstrations

The manufacturer shall submit independent tests and case histories to demonstrate that the nominated joint is capable of:

- Withstanding all the service conditions and loading (see Performance requirements - Section 4).
- Performing as well or better than other approved joints.

The tests shall comprise the following:

- Electrical test in accordance with AS 1085.12 Appendix C.

The joint has failed this test if the electrical resistance is less than 1 megohm.

- Pull Apart Test/Non-Destructive Test in accordance with AS 1085.12 Appendix D.
- Load Deflection Test/Slow Bend Test in accordance with AS 1085.12 Appendix E.
- Repeated Load Fatigue Test in accordance with AS 1085.12 Appendix F.
- Joint Straightness Test in accordance with AS 1085.12 Appendix G.

The joint must meet the performance requirements nominated in AS 1085.12 Table 1 and Table E1.

6.3 Information to be Provided

- Documentation complying with AS 1100.401 shall be provided as part of the design process. This will include:
- Rail section.
- Detailed assembly drawing of the joint.
- Detailed drawing of all components used in the joint. If no Australian Standard exists for any components, general requirements of AS 1085 shall be adhered to.
- Material and Component Specifications.
- Details of the system for marking joint assemblies for traceability.
- Chart listing each operation or process and the applicable tolerances.
- Specifications for the method of rail hardening for 47kg/m insulated joint assemblies.
- Procedures for the manufacture of bonded insulated joints to meet the requirements of this specification.
- Production inspection and test procedures and frequencies to meet the requirements of AS 1085.12.
- RailCorp shall review the procedures as part of the type approval process
- Test report meeting the requirements of AS 1085.12, including:
  - Date of testing.
  - Applied test loads.
  - The load versus deflection graphs.
  - Number of cycles when first crack appeared and when total failure occurred.
  - Permanent longitudinal movement between the rails and the fishplates at the neutral axis.
  - Testing procedures and processes.