

Superseded

Technical Specification

**Transport and Main Roads Specifications
MRTS82A Finger Type Bridge Deck Expansion Joints**

August 2014

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1 Introduction

1.1 General

This technical specification applies to the design, fabrication, testing, supply and installation of finger type bridge deck expansion joints such as Fingerplate or Saw Tooth expansion joints.

This technical specification shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements* and other technical specifications as appropriate.

This technical specification forms part of the Transport and Main Roads Specifications Manual.

1.2 Statement of intent

The Finger type joints shall be designed, fabricated, inspected, tested and installed in accordance with the provisions of this specification.

Expansion joints require higher serviceability and maintenance costs. It is the intention of the system set up by the department that only expansion joints that will be serviceable and minimise maintenance costs be used and that they be installed to the highest standards.

It is the intention of this Specification that the supplier is responsible for supply of the joint and certification that the installation of the joint has been carried out in accordance with the supplier's joint installation procedure registered with the department.

1.3 Registered proprietary products

The supply and installation of Finger type bridge deck expansion joints shall use suppliers and joints that are registered by Transport and Main Roads in accordance with the Manual for "Registration of Expansion Joints". Registered joints and suppliers are listed in Clause 1 of the Annexure MRTS82A.1.

Finger type joints and associated products shall comply with the details of the Registration Certificate for the joint. Table 1.3 lists items requiring use of Transport and Main Roads registered suppliers and products in manufacture and installation of Finger type expansion joints.

Table 1.3 – Items requiring use of registered suppliers and products

Clause	Category of work
1.3	Finger type bridge deck expansion joints and associated proprietary products
10.3	Cast-In Ferrules
10.3	Mineral Grease
10.4	Joint Sealant

For information regarding registration of Finger type expansion joints and products and suppliers for the above items refer to the Approved products and registered suppliers page on the department's website.

An expansion joint other than the one nominated on the Drawings shall not be used without the prior authorisation of the Principal.

1.4 Installation

Installation of the joint shall be strictly in accordance with the Supplier's joint installation procedure registered with Transport and Main Roads.

2 Definition of terms

The terms used in this specification shall be as defined in Clause 2 of MRTS01 *Introduction to Technical Specifications*. Further definitions are as defined in Table 2.

Table 2 – Definition of terms

Term	Definition
Drainage seal	A flange inserted below the joint to capture dirt and water that falls through the joint
Registration Certificate for a joints	Formal letter of approval signed by Transport and Main Roads, Director (Bridge and Marine Engineering) to the Suppliers on successful completion of the evaluation of a joint registration application. This may include the specific requirements that the Supplier of the joint shall meet to supply the joint for Transport and Main Roads structures

3 Referenced documents

Table 3 lists documents referenced in this technical specification.

Table 3 – Referenced documents

Reference	Title
ASTMB26/B26M	Standard Specification for Aluminum-Alloy Sand Castings
ASTM D412	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers — Tension
ISO 868	Plastics and ebonite-Determination of indentation hardness by means of a durometer (Shore Hardness)
AS/NZS 1252	High strength steel bolts with associated nuts and washers for structural engineering
AS/NZS 1594	Hot-rolled steel flat products
AS 1683.11	Methods of Test for Elastomers – Tension Testing of Vulcanised or Thermoplastic Rubber.
AS 1683.15.1	Method of Test for Elastomers – International Rubber Hardness
AS/NSZ 1734	Aluminium and aluminium alloys-Flat sheets, coiled sheets and plate
AS 1874	Aluminium and aluminium alloys-Ingots and castings
AS/NZS 3678	Structural steel—Hot-rolled plates, floorplates and slabs
AS/NZS 4680	Hot-dip galvanised coatings (zinc) on fabricated ferrous articles
AS 5100.4	Bridge design: Part 4 : Bearings and deck joints
Manual	Material Testing Manual; Queensland Department of Transport and Main Roads
Position Paper	Design of Fingerplate Joints - Position Paper issued by the Bridge Policy, Specifications and Durability section of Roads & Maritime Services (RMS), NSW, Revision 4, May 2012

4 Quality system requirements

4.1 Hold Points, Witness Points and Milestones

General requirements for Hold Points, Witness Points and Milestones are specified in Clause 5.2 of MRTS01 *Introduction to Technical Specifications*.

The Hold Points, Witness Points and Milestones applicable to this Specification are summarised in Table 4.1.

Table 4.1 – Hold points, Witness Points and Milestones

Clause	Hold Point	Witness Point	Milestone
5.5	1. Design documentation		Submission of the documentation (14 days)
10.1	2. Installation of joint		<ul style="list-style-type: none"> • Submission of the Installer accreditation (14 days) • Submission of procedure for joint installation including water tightness test for seals (14 days)
10.3		Re-tightening of the holding down bolts (after 1 year of service)	
12			Submission of records (28 days)

4.2 Procedures

The Contractor shall prepare documented procedures incorporating the supplier's installation requirements for all construction processes in accordance with the quality system requirements of the Contract. The procedures stated below shall be submitted to the Administrator:

- a) transport, handling and storage, including measures to prevent damage to the joint and its protective coating
- b) installation of the joint including installation, field jointing and testing for watertightness of the seals
- c) repair procedures.

4.3 Quality records

For all joints incorporated in the Works, at least the documents listed below shall be included in the quality records:

- a) maintenance manual provided by the Supplier
- b) installation procedures provided by the Supplier
- c) NATA or NATA Mutual Recognition Arrangement(MRA) network laboratory certificates-of-conformance
- d) certification and testing of materials
- e) weld Non Destructive Examination (NDE) and inspection reports
- f) assembly documentation
- g) Written confirmation from Supplier that the fabricated joint conforms to the design
- h) procedures and results of testing the joint for watertightness
- i) "As-constructed" drawings.

5 Design requirements

5.1 General

Selection of expansion joints shall comply with the limitations on the use of the joint stated in the Registration Certificate for the joint. All details and installation shall conform to the Registration Certificate of the registered joint.

5.2 Design life

Design life for expansion joint systems including associated components and the corrosion protection system shall be 40 years. However, any components permanently buried into concrete such as cast-in anchors or ferrules, sleeves etc. shall have 100 year design life.

5.3 Design method

Finger type joints shall be designed according to the design method specified in the latest version of Position Paper for "*Design of Fingerplate Joints*" issued by Bridge Policy, Specifications and Durability Section, Roads and Maritime Services (RMS), NSW.

The joint shall be tested as per the RMS position paper, Clause 5.7.3: "*Acceptance by Testing*".

A copy of this position paper can be obtained from mr.techdocs@tmr.qld.gov.au.

5.4 Design loads

The joint shall be designed to withstand the following loads:

- a) a vertical live load from an A160 individual axle in accordance with AS 5100.2 and
- b) a concurrent longitudinal live load that is a minimum of 35% of the vertical load acting at road level parallel to the direction of traffic.

Design loads are to be applied at any location on the deck joint to give the worst loading case.

The design action for traffic loads is equal to $(1+\alpha)$ x the load factor x the action under consideration. Where α is the dynamic load allowance for traffic loads equal to 0.6.

The load factor for traffic loads shall be taken as 1.8 for ultimate limit state effects, 1.0 for serviceability limit state effects and 0.6 for fatigue limit state.

5.5 Design documentation

At least 14 days prior to the commencement of fabrication of the joint, the Contractor shall submit the following documents to the Administrator: **Milestone**

- a) a letter of confirmation signed by the Supplier stating that the Joint has been designed in accordance with design requirements stated in this specification
- b) the results of testing by a NATA registered laboratory or NATA Mutual Recognition Arrangement (MRA) network laboratory which demonstrates that the materials forming the component parts of the joint meet the requirements of this specification
- c) copy of the letter of "Registration Certificate for the Joint" for the particular joint supplied
- d) general arrangement drawings showing the details of the joint.

Fabrication shall not be commenced until the Administrator has reviewed the documentation and released the Hold Point. **Hold Point 1**

5.6 Length of seals

All seals shall extend the full width of the roadway, without the need for field joints except at sharp changes of the profile.

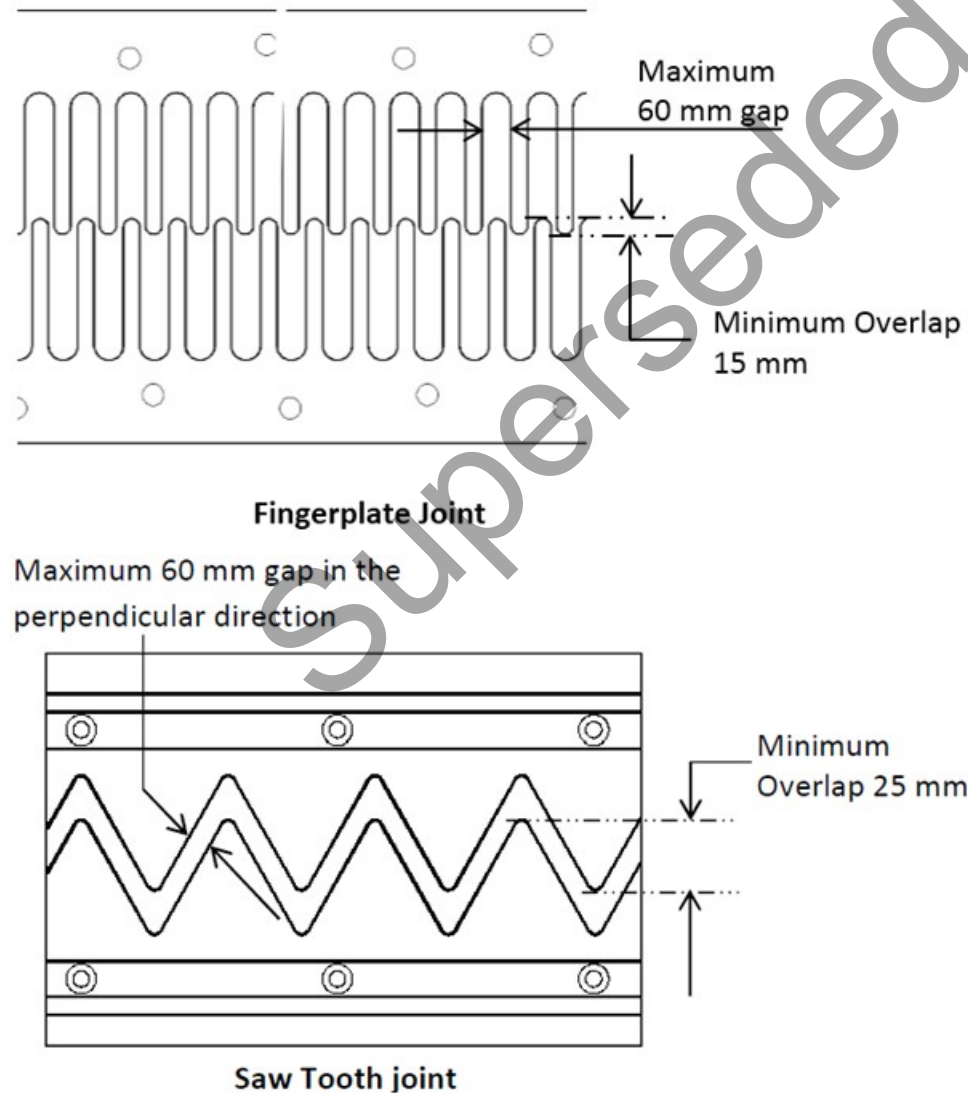
5.7 Gap width

For fingerplate joints, the gap width specified in AS5100.4 Clause 17.3.5 shall be amended as, the maximum opening between fingers between adjacent fingers on the same side of the joint shall be 60 mm and minimum overlap of the fingers on the opposite side of the joint shall be 15 mm.

For saw tooth joints, the maximum perpendicular opening between adjacent saw teeth on the opposite side of the joint shall be 60 mm at the ultimate movement limit and the minimum overlap of the saw teeth on the opposite side of the joint shall be 25 mm.

Expansion gap widths are shown in Figure 5.7 below.

Figure 5.7: Fingerplate and Saw Tooth joint gap widths



6 Materials

6.1 General

Finger type joints comprise three main elements:

- a) metallic elements (steel or aluminium plates) to support the loads and provide the required surface for comfort and safety
- b) anchor bolts or loop anchors to securely anchor the plates
- c) drainage seal to prevent penetration of water and foreign objects.

Where a material is included in a Transport and Main Roads technical specification, the material shall comply with the technical specification.

All materials shall comply with the provisions of this Specification and the specific requirements included in the Registration Certificate for the joint issued to the supplier.

6.2 Finger plates and saw tooth plates

Steel plates for finger plates or saw tooth plates shall comply with AS/NZS 1594 or AS/NZS 3678 as appropriate.

Aluminium finger plates or saw tooth plates shall conform to MRTS79 and AS/NZS 1734. Cast aluminium plates shall conform to AS 1874. Aluminium Association Alloys (US) shall be in accordance with ASTM B26/B26M.

6.3 Anchor bolts

Anchor bolts, nuts and washers shall conform to the requirements of AS 1252. Anchor bolts shall have corrosion protection to Clause 7.8. Black bolts shall not be used. Anchorage for the bolt shall comply with the details of the Registration Certificate for the joint.

Anchorage to deck joints shall be to AS 5100.4. The following additional requirements shall apply to the design of anchors:

- a) bolts shall have a minimum diameter of 16 mm
- b) bars used as anchorage must form a loop of sufficient size to permit anchoring into the concrete with the contribution of the transverse and other reinforcement
- c) any welding of anchorage bars shall develop the full strength of the bar and accommodate an infinite number of fatigue cycles
- d) stud welded shear connectors used as anchors shall be at least 16 mm diameter and minimum of 150 mm in length and welded only by resistance welding using a welding gun. Welded steel stud shear connectors shall not be used with aluminium joints
- e) anchors are to be designed to allow easy replacement of the joint
- f) chemical anchors are not permitted as joint anchors. However, Chemical anchor inserts with sufficient anchor length are permitted to use for joint rehabilitation works

6.4 Drainage seals

Drainage seals shall be a part of the joint and manufactured from Ethylene Propylene Diene Monomer (EPDM) synthetic rubber elastomer or a soft versatile Thermoplastic Vulcanizate (TPV).

Documentary evidence shall be provided to verify that the elastomer used in the manufacture of the joint seals has been tested in a laboratory with appropriate NATA registration or in an overseas laboratory in NATA's Mutual Recognition Arrangement (MRA) Network and that it complies with the requirements stated in Table 6.4(a) or Table 6.4(b) as appropriate.

Table 6.4(a) – EPDM synthetic rubber elastomer material requirements

Property	Requirement	Test Method
Tensile Strength	7.0 MPa minimum	AS 1683.11 (Dumb-bell test pieces)
Elongation at Break	250% minimum	AS 1683.11 (Dumb-bell test pieces)
Hardness	IRHD (70-80) \pm 5	AS 1683.15.1

Table 6.4(b) – Thermoplastic Vulcanizate (TPV) material requirements

Property	Requirement	Test Method
Tensile Strength at break	7.0 MPa minimum	ASTM D412
Tear Strength	23.0 kN/m	ASTM D624
Elongation at Break	450% minimum	ASTM D412
Hardness	69	ISO 868

The material of each seal shall be uniform and homogeneous throughout. Any seal showing imperfections, shall be rejected.

The profile of the seal shall be appropriate for the joint opening and drainage requirements.

The longitudinal profile of the seal, required to match the bridge cross section, may be obtained either by bending the seal to the required angle, or by joining straight lengths of seal by means of an adhesive recommended by the manufacturer of the seal. All joining of seal lengths shall be performed in the factory.

A certificate from the supplier of the seal verifying conformance of the seal with the requirements of the Drawings and this Specification shall be included in the quality records.

The method of installing the seals shall be in accordance with the recommendations of the seal manufacturer.

Alternative seals may be submitted by the Supplier to Director (Bridge and Marine Engineering) for prior approval. The Supplier shall submit full details including evidence of long term use and durability of the material demonstrating that it will achieve the required design life of the seal.

6.5 Material certificates

Test certificates for all materials shall be provided to the Administrator in accordance with this specification and specific requirements included in the Registration Certificate for the joint. Testing shall be conducted in a NATA certified testing laboratory in Australia or in an overseas laboratory in NATA's Mutual Recognition Arrangement (MRA) Network.

Material test certificates for bolts and steel plates shall describe the chemical composition and mechanical properties.

Where materials are supplied to other than Australian Standards, certified documents stating the material conforms to the equivalent grade in an Australian Standard shall be provided by the testing laboratory. Where there is no equivalent grade, the Supplier shall provide certified documents by the

testing laboratory providing evidence that the properties of the proposed material are acceptable to Transport and Main Roads for inclusion of the material in the Registration Certificate for the joint.

7 Fabrication

7.1 General

Fabrication of metallic elements shall be carried out in accordance with this specification and any other specific requirements included in the Registration Certificate for the joint.

7.2 Fabrication of steelwork

Where structural welding is required, fabrication of steelwork shall be carried out in accordance with the requirements of MTRS78 *Fabrication of Structural Steelwork*. Where structural welding is not required, material properties and cutting of steel shall comply with the requirements of MTRS78, however registration with the department for fabrication of structural steelwork is not required.

If a bearing plate is attached to the underside of the main fingerplate by welding, the main fingerplate shall be assessed for the fatigue strength in accordance with Section 13 of AS 5100.6.

7.3 Fabrication of aluminium components

Where structural welding is required, fabrication of aluminium works shall be carried out in accordance with the requirements of MRTS79 *Fabrication of Aluminium Components*.

7.4 Tolerances

Fabrication dimensions shall comply with the tolerances given on the Drawings. Where a tolerance is not specified it shall be ± 2 mm. Tolerances shall be such that all parts fit together within the stated tolerances.

7.5 Anti-Skid treatment

Anti-skid treatment shall be provided as per AS 5100.4 for plates exceeding 200 mm wide measured parallel to the traffic. The treatment shall extend for the full width and length of the plates, including fingers.

If weld patterns are used for anti-skid treatment, weld patterns shall be in accordance with the Clause 7.1.1 of the RMS position paper.

7.6 Identification marks

Each joint component shall be marked with durable identification marks and have its total mass clearly marked upon it.

7.7 Packing, storing and transporting

All parts shall be protected from damage in transit.

Special care shall be taken in the packing and methods of support and lifting during handling to prevent distortion or damage to the component and its protective coating.

All components, whether fabricated or not, shall be stored in such a manner that they are not bent or damaged and are adequately protected against corrosion. Generally, storage at least 200 mm above the ground on platforms, slabs, or other supports under cover will be satisfactory.

7.8 Durability

Steel plates, bolts, anchor bolts, ferrules, nuts and washers shall be hot-dip galvanised to MRTS78. Alternative corrosion protection treatments shall be as stated in the Registration Certificate for the joint. Junctions between dissimilar metals shall be insulated around the interface between the junction using suitable bushes and washers. These bushes and washers shall be made from an electrical insulating material. Anchor bolt recesses shall be properly sealed with joint sealant in accordance with Clause 10.4.

Surfaces exposed to traffic shall have a skid resistant embossed surface treatment and all such parts shall be resistant to attrition and vehicular impact.

8 Inspection of joint

Suitable facilities for the inspection of the fabricated components by the Administrator shall be provided. The facilities shall allow free access to all components of the joint so that a full compliance inspection to the requirements of this Specification can be carried out.

9 Transport of joint

At all stages, joints shall be handled with care to prevent any damage to the joints or any of their parts or any damage to protective or decorative coatings.

Special lifting gear shall be provided by the Contractor for this purpose where necessary.

During transport, chains shall not be used to tie down components. Nylon strapping or similar shall be used during transport.

Loose parts shall be crated, tied or bolted in place to avoid loss or damage during transport. Temporary bolts and/or other material required to secure loose parts during transport shall be provided by the Contractor.

10 Installation of joint

10.1 General

Joints shall be installed by an installer who is accredited by the Supplier. When the Supplier has no approved installers, installation shall be by an employee of the Contractor who is trained and accredited for the installation of the joint by the Supplier. Evidence of accreditation by the Supplier shall be provided to the Administrator at least 14 days prior to the commencement of installation of the joint. **Milestone**

At least 14 days prior to the commencement of installation of the joint, the Contractor shall submit to the Administrator its procedure for the installation of the joint including field jointing if required for sharp changes of profile and testing for watertightness of the seals in accordance with the requirements of Clause 11. The installation procedure shall be in accordance with the installation procedure included in the Registration Certificate for the joint. **Milestone**

Installation of the joint shall be a Hold Point. Installation shall not commence until the Administrator has reviewed the procedure and released the Hold Point. **Hold Point 2**

The joint shall be installed in such a way that the deviation from a 3 metre long straight edge placed anywhere on the joint along the direction of the traffic in accordance with Test Method Q712 shall not

exceed 5 mm. Standard test methods shall be in accordance with Clause 4 of MRTS01 and the Materials Testing Manual.

10.2 Blockout reinforcement

Where a blockout is left in the concrete for installation of the joint at a later date, full details of the reinforcement in the blockout shall be recorded on 'As constructed' drawings after the reinforcement is placed and fully secured and before the concrete is placed.

10.3 Installation of anchor bolts

A critical element of a joint is the correct installation and tensioning of the anchor bolts. They shall be tensioned using a calibrated torque wrench. The applied torque shall comply with the Position Paper for "Design of Fingerplate Joints" by RMS and be as specified by the Joint Supplier. Anchor bolts shall be ferrule-anchored for easy replacement of the bolts. Cast-in ferrules shall be a registered product as listed in Clause 2 of the Annexure MRTS82A.1.

Prior to tightening, bolts are to be lubricated with a corrosion inhibiting mineral grease. Mineral Grease shall be a registered product as listed in Clause 3 of the Annexure MRTS82A.1. Alternative products may be submitted to the Administrator for approval.

Holding down bolts shall be re-tightened after one year of service by the Contractor. **Witness Point** This requirement shall be included into the maintenance manual of the installed joint referred to in Clause 4.3.

10.4 Anchor bolt recesses

After the bolts are tensioned, the socket recesses shall be filled with an approved polyurethane joint sealant. Joint sealant material shall be a registered product as listed in Clause 4 of the Annexure MRTS82A.1. Alternative products may be submitted to Administrator for approval.

10.5 Bedding

If concrete is poured in a block out with the plates in position, adequate vents shall be provided to prevent air pockets under the plates. For rehabilitating joints, after proper surface preparation by blast cleaning the existing concrete, the plates shall be set on approved epoxy bedding; the thickness and the extent of which shall be as shown on the design drawings.

11 Testing for watertightness

The joint shall be monitored for watertightness during the Defects Liability Period.

Any leakage detected shall require the joint to be repaired in accordance with specific repair measures recommended by the Joint Supplier.

As an alternative, the water tightness of the sealing system may be proved by pre-testing in the factory.

12 Records

Two copies of 'As-constructed' drawings for the assembly and installation of the joint shall be submitted to the Administrator not later than 28 days after the completion of installation. **Milestone**

Records shall also include a maintenance manual referred in Clause 4.3 which describes all activities necessary to ensure that the design life of the joint can be achieved.

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