

# Structures

## Master Specification

### ST-BF-C2 Deck Expansion Joints

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## ST-BF-C2 Deck Expansion Joints

### 1 General

- 1.1 This Part specifies the requirements for the supply and installation of the following types of bridge deck expansion joints:
- a) bonded metal-elastomer joints – comprising metal-reinforced elastomeric pad units rigidly attached to anchorages;
  - b) elastomeric strip joints – comprising preformed elastomeric strips retained by metal seal anchorages; and
  - c) compression seal joints – comprising a preformed open-cell elastomeric compression seal with multiple webs, installed with an adhesive lubricant.
- 1.2 Unless specified otherwise, all design and / or documentation must comply with the most recent revisions (including published amendments) of the following design standards and / or specifications:
- a) AS 1683.11 Methods of Test for Elastomers - Tension Testing of Vulcanized or Thermoplastic Rubber AS.
  - b) 1683.13 Methods of Test for Elastomers - Compression Set of Vulcanized Rubber Under Constant Deflection.
  - c) AS 1683.15.1 Methods of Test for Elastomers - International Rubber Hardness.
  - d) AS 1683.23 Methods of Test for Elastomers - Rubber - Vulcanized - Determination of Resistance to Liquids.
  - e) AS 1683.24 Methods of Test for Rubber - Determination of the Resistance of Vulcanized or Thermoplastic Rubbers to Ozone Cracking - Static Strain Test.
  - f) AS 1683.26 Methods of Test for Elastomers - Rubber, Vulcanized or Thermoplastic - Accelerated Ageing and Heat Resistance Tests.
  - g) AS 3679.1 Structural Steel – Hot Rolled Bars and Sections.
  - h) AS 4680 Hot Dip Galvanized (Zinc) Coatings on Fabricated Ferrous Articles.

### 2 Quality Requirements

- 2.1 The Contractor's Quality Plan shall include procedures and instructions for the installation of the joint system. Where appropriate to the type of joint, procedures for the following shall be included at a minimum:
- a) deck preparation, including blockout reinforcement, dimensions and tolerances required;
  - b) anchor locations and pre-setting required to suit the bridge deck temperature at the time of joint installation;
  - c) preparation of the blockout base to ensure a true and even surface on which to bed the joint units;
  - d) methods of sealing joint units at kerbs, gutters and horizontal directional changes in the bridge deck profile;
  - e) sequence of installation of the units;
  - f) method of achieving a watertight seal at the interfaces between the concrete blockout and the joint units;
  - g) method of joining adjacent joint units to ensure a watertight seal;
  - h) torque requirements for anchors and the method of sealing bolt hole cavities;
  - i) filling for the gap between the edges of the unit and the adjacent road surfaces;
  - j) time after completion of installation when traffic is allowed on the road; and

- k) method for testing of the installed joint for watertightness.
- 2.2 If not provided beforehand, the procedures shall be provided within 4 weeks of the Date of Acceptance of Tender.
- 2.3 Provision of the information listed in this clause shall constitute a **Hold Point**.

### 3 Design

- 3.1 Any design carried out by the Contractor shall comply with the Department's Design Standard – Structural, available from: [https://www.dpti.sa.gov.au/standards/major\\_structures\\_documents](https://www.dpti.sa.gov.au/standards/major_structures_documents).
- 3.2 The design and supporting documentation shall be submitted at least 28 days prior to installation.
- 3.3 Provision of this documentation shall constitute a **Hold Point**.

### 4 Materials

#### Elastomer

- 4.1 The elastomeric material in the joint shall be uniform, homogeneous and free of imperfections, surface splits or indentations.
- 4.2 The elastomeric components of the joint shall be made from vulcanized compound having polymerised chloroprene as the only base polymer and comply with the requirements specified in Table ST-BF-C2 4-1 and Table ST-BF-C2 4-2 as appropriate.

**Table ST-BF-C2 4-1 Elastomer Material Requirements for Bonded Metal-Elastomer Joints**

Property	Test Method	Acceptance Limits
General:		
• Tensile Strength	AS 1683.11 (Dumb-bell test pieces)	12.0 MPa minimum
• Elongation at Break	AS 1683.11 (Dumb-bell test pieces)	350% minimum
• Hardness	AS 1683.15.1	IRHD 59 +5
Accelerated Ageing:		
• Tensile Strength Change	AS 1683.26 (Method A for 72 hours at 100°C): AS 1683.11 (Dumb-bell test pieces)	-15% to +15%
• Elongation at Break Change	AS 1683.11 (Dumb-bell test pieces)	-40% to 0%
• Hardness Change	AS 1683.51.1	IRHD -15 to +15
Resistance to Ozone:	AS 1683.26 (Ozone concentration 50 pphm in air, 20% strain, 72 hours at 40°C)	No visible cracking
Change in Volume in Oil	AS 1683.23 (using Oil No.3, after 72 hours at 100°C)	+30% maximum
Compression Set	AS 1683.13 (72 hours at 100°C)	40% maximum
Brittleness	ASTM D746 (B) (at -30°C)	Not brittle

**Table ST-BF-C2 4-2 Elastomer Material Requirements for Bonded Metal-Elastomer Joints & Compression Seal Joints**

Property	Test Method	Acceptance Limits
General:		
• Tensile Strength	AS 1683.11 (Dumb-bell test pieces)	12.0 MPa minimum
• Elongation at Break	AS 1683.11 (Dumb-bell test pieces)	250% minimum
• Hardness	AS 1683.15.1	IRHD 59 ±5

Property	Test Method	Acceptance Limits
Accelerated Ageing:		
• Tensile Strength Change	AS 1683.26 (Method A for 72 hours at 100°C); AS 1683.11 (Dumb-bell test pieces)	-20% to 0%
• Elongation at Break Change	AS 1683.11 (Dumb-bell test pieces)	-20% to 0%
• Hardness Change	AS 1683.51.1	IRHD 0 to +10
Resistance to Ozone:	AS 1683.26 (Ozone concentration 100 pphm in air, 20% strain, 72 hours at 40°C)	No visible cracking
Change in Volume in Oil	AS 1683.23 (using Oil No.3, after 72 hours at 100°C)	+70% maximum
Compression Set	AS 1683.13 (72 hours at 100°C)	40% maximum
Brittleness	ASTM D746 (B) (at -30°C)	Not brittle
Low Temperature Stiffness (Hardness Change)	AS 1683.15.1 (After 7 days at -10°C)	IRHD 0 to +15

- 4.3 At least 2 weeks prior to the installation of the joint, the Contractor shall provide either:
- test results of the elastomer used in the joint from a laboratory with appropriate NATA registration; or
  - evidence that the elastomer has been manufactured under a third party certified quality system to AS 9001 with test certificates of the above properties from batches less than 6 months old.
- 4.4 Provision of the information listed in this Clause shall constitute a **Hold Point**.

## Steel

- 4.5 Steel shall comply with AS 3679.1 Grade 250 unless specified otherwise on the Drawings. Anchors shall be galvanized in accordance with AS 4680.

## Other Materials

- 4.6 Material other than steel and elastomer used in the manufacture or installation of joints shall be certified by the Manufacturer and documentation provided to support its suitability for use.
- 4.7 Provision of the certification shall constitute a **Hold Point**.

# 5 Joint Installation

## General

- 5.1 The expansion joint shall be installed in accordance with the Manufacturer's Instructions and shall make due allowance for retaining the deck reinforcement and any embedments. Where jointing is seated directly on concrete, any depressions or high spots shall be brought to the correct profile prior to installing the joint. Compression seals or membranes shall extend in one continuous length for the full width of the bridges.
- 5.2 Joints shall not be installed until at least 3 days after all deck concreting in the adjacent spans or abutments is completed.
- 5.3 The Contractor shall ensure that an appropriately experienced and qualified technician, who is employed directly or nominated by the joint manufacturer and is not an employee of the Contractor, is present to oversee the installation. The technician shall provide certification that the joint has been installed in accordance with the Manufacturer's Instructions.
- 5.4 Prior to casting deck concrete, the Contractor shall ensure that there is no conflict between the joint anchors and deck reinforcement, including any embedments.
- 5.5 For bridges, other than post-tensioned cast in place girders, concrete adjacent to the joint and extending to or above the finished concrete surface shall be cast monolithically with the underlying concrete. Holes for fixing bolts shall not be drilled within 7 days of concreting. Fixing bolts for post-

tensioned box girders and voided slabs shall not be fixed in position until at least 4 weeks after deck stressing. The levels of joints for these structures shall be adjusted for any variation of design hog.

- 5.6 Joints shall not have loads applied to them until they are capable of carrying loads without being damaged.
- 5.7 After installation, joints and seals shall be protected from damage due to construction activities.

## Installation Temperature

- 5.8 Deck joints shall be set in position with an appropriate gap adjusted to conform to the actual mean structure temperature at the time of installation.
- 5.9 In the absence of more accurate procedures, the installation temperature may be taken as the mean shade temperature at the underside of the deck or inside the cells of box girder bridges for:
- a) the two consecutive days prior to joint installation in concrete structures; and
  - b) the one day period prior to joint installation for steel and steel composite structures.
- 5.10 The Contractor shall record and submit details of setting of the joint including installation date and setting dimension.

## Tolerances

- 5.11 Unless specified otherwise on the drawings, joints shall be installed to within the tolerances in Table ST-BF-C2 5-1.

**Table ST-BF-C2 5-1 Tolerance Requirements**

Property	Acceptance Limit
Joint Gap	±3 mm of specified gap
Level of top surface joint	Within 5 mm of a 2.5 m straightedge
Deviation of joint from plan alignment	Less than 5 mm

- 5.12 The upper surfaces of the joint shall conform to the longitudinal grade and crossfalls of the completed deck surface with the top of the joint recessed 5 mm below the adjacent surface.
- 5.13 The Contractor shall:
- a) measure and record the above tolerances at 2 m intervals along the joints; and
  - b) supply written verification that the requirements of this Clause have been complied with, and supply the verification with the lot package.

## 6 Warranty

- 6.1 The Contractor shall supply a written warranty in the name of the Department for all expansion joints, covering workmanship, serviceability and materials for a minimum period of 5 years from the date of installation. Serviceability includes water leaking through the joint. The warranty shall cover the installation of a replacement joint in addition to supply of the replacement joint.

## 7 Hold Points

- 7.1 The following is a summary of Hold Points referenced in this Part:

Document Ref.	Hold Point	Response Time
2.3	Submission of procedures	7 days
3.3	Details and certification of any alternative joint	7 days
4.4	Elastomer data	7 days
4.7	Certification of other materials	7 days

## 8 Verification Requirements and Records

**Table ST-BF-C2 8-1 Verification Records**

Document Ref.	Record
5	Records of installation date, temperature and setting dimension
5	Certification that the joint has been installed in accordance with the manufacturer's instructions
5	Records of actual installation tolerances achieved
6	Warranty