DEPARTMENT *of* INFRASTRUCTURE, ENERGY *and* RESOURCES, TASMANIA

BRIDGEWORKS SPECIFICATION

B30 - ELASTOMERIC BEARINGS

July 2004

Includes requirements of previous Specifications B30, B31 and B32

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B30.1 SCOPE

This specification sets out the requirements for manufacture supply and installation of elastomeric bridge bearings

Bearings shall be manufactured from natural rubber together with other materials so compounded and cured as to give the properties specified. Plain *bearings* shall be vulcanised in a mould under pressure. *Laminated bearing* layers shall be bonded to steel plates during vulcanisation in a mould under pressure.

Bearings shall comply with the rated load capacity, dimensional and shear and compressive stiffness requirements specified.

Bearings shall comply with the requirements of AS *5100.4* "*Bridge Design -* Bearings *and Deck Joints* " except where modified by this Specification.

B30.2 REFERENCES

A.S. *5100.4*	*Bridge Design - Bearings and Deck Joints*
A.S. 1554	Structural steel welding
A.S. 1683	Methods of test for *rubber*
A.S. 3679	Structural steel
ISO 13000-1	*PTFE moulded sheet*
ISO 1827	*Rubber, Determination of modulus in shear, quadruple shear method*
ISO 4661	*Rubber, Preparation of samples and test pieces*
ISO 4661.1	*Physical tests*
ISO 815	*Rubber, Determination of compression set at ambient, elevated or low temperatures*
ASTM D 240A	*Stainless steel*
ASTM D 945	

B30.3 MATERIALS

B30.3.1 Elastomer

The elastomer to be used in the manufacture of the bearings shall be tested *using Category 1 tests of the AS 5100.4 Appendix B* These tests shall be at the Contractor's expense and shall be done at a NATA or AALA registered laboratory.

Material which does not comply with the requirements *specified* shall not be used in the manufacture of bearings.

Plain Bearings shall be formed using Type 60H rubber and Laminated and pot bearings from Type 53H rubber.

B32.4.2 PTFE (Polytetrafluoroethylene)

The PTFE sliding pad shall consist of unfilled PTFE sheet complying with *ISO 13000-1*.

The resin used in the manufacture of PTFE sliding pads shall be 100% virgin material with a relative density of 2.13 to 2.19 and durometer hardness of 50 - 65.

B32.4.3 Steel other than Stainless Steel

The steel, other than stainless steel, used in the manufacture of the bearings shall conform to AS 3679 and any welding shall conform to AS 1554.

B32.4.4 Stainless Steel

The stainless steel used in the manufacture of the sliding surface shall conform to *ASTMD-240A*, and the sliding surface shall be further polished to a mirror finish with a surface roughness of not greater than 0.4 um C.L.A.

B30.4 DIMENSIONS

B30.4.1 *Plain Bearings*

Plain Bearings shall be manufactured to the dimensions stated on the Drawings within the tolerances set out in AS *5100.4* and Table B30.*1*.

TABLE *B30.1* TOLERANCES ON DIMENSIONS, *PLAIN BEARINGS*

DIMENSION	TOLERANCE (mm)
Holes: diameter & location	± 2.0 / ± 2.0

B30.4.2 *Laminated* Bearings

Bearings shall be manufactured to the dimensions stated on the Drawings or the relevant AS Part No. shown on the Drawings ~~.~~within the tolerances given in AS *5100.4 Appendix A*.

B30.5 POT BEARINGS

Each bearing shall consist of a disc of elastomer confined in a steel pot.

Horizontal movement, if required, shall be provided by means of a polytetrafluoroethylene (PTFE) pad sliding against a smooth, truly plane stainless steel mating surface.

B30.5.1 Pot and Elastomer

Each bearing shall be *designed in accordance with AS 5100.4*.

B30.5.2 Expansion Bearings

For expansion bearings, the PTFE pad shall have a *nominal* thickness of 4.5 mm and be restrained by recessing it into the backing material to a depth of half its thickness and also bonding it to the backing material with an adhesive.

The *sliding* surface shall consist of a stainless steel sheet.

The backing materials to the PTFE and *sliding* surface shall be sufficiently rigid to ensure that the PTFE layer is uniformly loaded.

B30.6 TESTING

B30.6.1 General

All bearing *tests* shall be at the Contractor's expense at a NATA or AALA registered laboratory. *Testing of bearings shall be as specified in AS 5100.4.*

Plain bearings with holes shall be tested with holes plugged temporarily with elastomeric plugs having similar properties to the *bearings*.

B30.6.2 Stiffness in Compression, *Plain Bearings*

Compressive stiffness of *plain* bearing*s* ~~pads~~ shall be calculated following testing in accordance with AS *5100.4* Appendix *C using the properties listed in Table B30.2*.

TABLE *B30.2* PROPERTIES OF *PLAIN BEARINGS*

PLAIN BEARINGS (holes, if any, plugged)	**SIZE (mm)**	
	380 x 100 x 20	600 x 125 x 25
Shape Factor	1.98	2.07
Hardness	60 ± 5	60 ± 5
Nominal design compressive load	70kN	140kN
Nominal design shear deflection	10.0mm	12.5mm

B30.6.3 Stiffness in Compression, *Laminated* Bearings

Each bearing shall be tested in accordance with the method set out in Appendix *C* of AS *5100.4*. (For non-standard bearings the rated load at zero shear is given on the Drawings).

Bearings which exceed the relevant tolerance given in Table B30.3 (or given on the Drawings in the case of a non-standard bearing) shall be rejected.

TABLE *B30.3* TOLERANCES ON COMPRESSIVE STIFFNESS

*** COMPRESSIVE DEFLECTION (mm)**	**LAYER THICKNESS (mm)**	**TOLERANCE (%)**
< 0.75	6 9, 12, 15, 18	30 25
0.75 to 1.25	6 9, 12, 15, 18	25 20
1.25 to 2.5	6 9, 12, 15, 18	25 25
2.5 to 4.0	6 9, 12, 15, 18	20 15
> 4.0	6 9, 12, 15, 18	na 15

Note: The tolerance for compressive stiffness is based on allowances for variations in properties of elastomer, layer and overall bearing thicknesses and measurement of compressive deflection.

* As measured from 0.1 to 1.1 times the rated compressive load at zero shear.

B30.6.4 Stiffness in Shear, *Plain Bearings*

After completion of the tests of stiffness in compression, *plain bearings* shall be tested in shear *in accordance with AS 5100.4 Appendix C using the nominal design compressive load and shear deflection given in Table B30.2*.

B30.6.5 Stiffness in Shear, *Laminated* Bearings

After completion of the tests on stiffness in compression, *laminated* bearings shall be tested in shear in accordance with the method set out in Appendix *C* of AS *5100.4*. (For non-standard bearings the rated load at maximum shear and shear deflection capacity are given on the Drawings).

The effective shear stiffness at zero shear is given in AS *5100.4*. Bearings which exceed a tolerance of ± 20% on the shear stiffness *specified* shall be rejected.

B30.6.6 Visual Faults

During the tests for compression~~,~~ *and* shear stiffness close observation of the bearing shall be maintained so as to detect any fault or variation due to lack of elastomer to steel bond, misplaced plates or inadequately cured elastomer etc.

Should any bearing exhibit any signs of failure such as:

(a) splitting or permanent deformation of the elastomer,

(b) tearing, cracking or permanent deformation of the PTFE sliding surface, or

(c) significantly irregular or unsymmetrical surface bulging,

(d) cracking or permanent deformation of the sealing ring or other part of the bearing,

(e) abrasive *damage* indicating abnormal contact between the metal surfaces of the bearing plates or piston, and the pot,

then, such bearings shall be rejected.

B30.6.7 Test with Applied Rotation - *Laminated* Bearings

One representative bearing, selected by the Contractor from every twenty bearings, or part thereof, of each size of bearing shall be tested. Bearings to be tested shall be subject to an angular rotation equivalent to the rotational capacity at rated load at zero shear determined from AS ~~1523~~*5100.4* rounded to the nearest 0.005 radians (or given on the Drawings in the case of non-standard bearings). The angular rotation shall be applied at right angles to the long axis of the bearing while applying the rated load at zero shear.

On completion of the rotation test the bearings shall again be loaded in compression in accordance with *AS 5100.4 Appendix C* and its compressive stiffness determined. Should this stiffness differ from that previously determined by more than 10%, the bearing, and those bearings represented by it, shall be rejected.

B30.7 TESTING OF POT BEARINGS

B30.7.1 Test Loads

Bearings shall be *tested in accordance with AS 5100.4.*

B30.7.2 Test for Coefficient of Friction

In addition to testing to the requirements for vertical and lateral forces, the coefficient of friction of sliding surfaces of expansion bearings shall be determined. The value of the coefficient of friction shall be taken as the average result of five tests and shall be determined for both maximum and minimum vertical loads. . The sliding surfaces shall not be lubricated before doing the tests but the bearings may be given two preliminary sliding runs under load prior to taken the test readings.

The friction coefficient of the sliding surfaces shall not exceed the values given in Table B30.~~5~~ *4* for the relevant stresses on the PTFE surface. Values shall be interpolated for intermediate bearing pressures.

TABLE B30.*4* FRICTION COEFFICIENT OF SLIDING SURFACES

Bearing Pressure	5 MPa	15 MPa	20 MPa
Friction Coefficient	0.08	0.05	0.04

B30.7.3 Test for Rotation - Pot Bearings

One bearing of each type shall be tested in rotation to the value for rotation shown on the Drawings rounded upwards to the nearest 0.005 radians while being loaded in compression to the maximum vertical load *specified*. Bearings that are required to resist lateral forces shall also have the specified lateral load applied during this test.

B30.7.4 Failure to Meet Requirements

If a bearing is rejected, two additional bearings from the batch it represents shall be tested. If both bearings meet the requirements of this Specification the remaining bearings in the batch shall be accepted. Otherwise each remaining bearing in the batch shall be tested to determine its compliance with the Specification.

B30.8 TEST CERTIFICATES

Prior to delivery of the bearings, copies of the test certificates shall be submitted to the Superintendent for his acceptance.

The test certificate for the elastomer shall show the elastomer properties as detailed in *AS 5100.4 Appendix B*.

The test certificate for the bearings shall show the hardness and stiffness in compression and shear and note whether any tolerances have been exceeded or whether any faults have been observed.

B30.9 PROTECTIVE TREATMENT

The protective treatment for exposed parts of metal bearings shall consist of abrasive blast cleaning and the application of an inorganic zinc rich *coating* as specified in Specification B24. All holding down bolts shall be either stainless steel or hot dipped galvanised.

Stainless steel sliding surfaces of expansion bearings shall receive no protective treatment and care shall be taken to protect these surfaces from being damaged or coated during the application of the protective treatment.

Any damage to the protective treatment shall be made good at the Contractor's expense.

B30.10 SHOP ASSEMBLY

The bearings, including all parts as shown on the Drawings, shall be fully shop assembled at the manufacturer's works to ensure proper fitting of all parts.

B30.11 MARKING AND DELIVERY OF BEARINGS ♦

All bearings shall have a permanent label affixed detailing the manufacturer, design loads, movements and rotation and date of manufacture.

All bearings shall *also* be suitably marked to identify their location in the bridge.

Mating parts of bearings shall also be suitably and permanently marked and shall be supplied in sets held together to prevent misalignment and damage of the components during transport and erection. The transit clips and/or bolts shall not be removed until final installation in the bridge.

The bearings shall be packed carefully to avoid damage during transporting to site. When stored, bearings shall remain in their packing.

B30.12 INSTALLATION ♦

Any modifications to other bridge components needed to accommodate *bearings that vary from those specified on the Drawings* shall be made at the Contractor's cost.

The surface on which elastomeric bearings are to be placed shall be a flat in the design plane, clean, wood floated surface, free of bumps and depressions greater than 1.0 mm.

No adhesive or other material shall be introduced between the bearing and bearing surface. The bearing shall be placed in exactly the orientation and position specified on the Drawings.

The Contractor shall submit a detailed installation procedure in the Contract Management Plan. The procedure shall ensure that uniform bearing contact is obtained on all bearing surfaces.

B30.13 PAYMENT ♦

The rate in the Bill of Quantities for the supply and installation of *plain* elastomeric bearing*s* shall include full payment for providing labour, materials, tools, equipment and any other work incidental to the testing and completion of the *plain* elastomeric bearing*s* and their subsequent installation as specified.

The rates in the Bill of Quantities for the supply and installation of *laminated* elastomeric bearings shall include full payment for providing labour, materials, tools, equipment and any other work incidental to the testing and completion of the *laminated* elastomeric bearings and their subsequent installation as specified.

The rates in the Bill of Quantities for the supply and installation of pot-type confined elastomer bearings shall include full payment for providing labour, materials, tools, equipment and any other work incidental to the testing and completion of the bearings and their subsequent installation as specified.

Payment for these items shall include patterns, steel plates, testing, marking, handling, packing, delivery, storage and placing in their final position and no separate allowance will be made for any of these.

All materials, tools and equipment supplied by the Contractor which do not form part of the completed works shall remain the property of the Contractor unless specified otherwise.

B30.14 HOLDPOINTS

The following Holdpoints have been identified in this Specification.

- Acceptance of test certificate data by the Superintendent prior to delivery to site. (B30.8)

B30.15 CONTRACT MANAGEMENT PLAN

The following details have been identified as relevant to the Contract Management Plan.

- overall height of bearing, (B30.2)
- rated load and movement capacities, (B30.2)
- name of manufacturer, (B30.3)
- diameter and thickness of elastomeric disc, (B30.5.1)
- dimensions and thickness of PTFE sliding pad for expansion bearings, (B30.5.1)
- any modifications to other bridge components needed to accommodate bearing (B30.12)
- a detailed installation procedure (B30.12)