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POT BEARINGS – STRUCTURAL STEEL

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IC-DC-B282
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FOREWORD

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BASE SPECIFICATION

This document is based on Specification RMS B282 Edition 5 Revision 2.
1 GENERAL

1.1 SCOPE

This Specification sets out the requirements for the supply of structural steel pot bearings and associated attachment plates, including their design and fabrication.

For requirements on installation of bearings, refer to Specification RMS D&C B284.

1.2 STRUCTURE OF THE SPECIFICATION

This Specification includes a series of annexures that detail additional requirements.

1.2.1 Project Specific Requirements

Project specific details of work are shown in Annexure B282/A.

1.2.2 (Not Used)

1.2.3 Schedules of HOLD POINTS and Identified Records

The schedules in Annexure B282/C list the HOLD POINTS that must be observed. Refer to Specification RMS D&C Q6 for the definition of HOLD POINTS.

The records listed in Annexure B282/C are Identified Records for the purposes of RMS D&C Q6 Annexure Q/E.

1.2.4 Planning Documents

The PROJECT QUALITY PLAN must include each of the documents and requirements listed in Annexure B282/D and must be implemented.

1.2.5 Frequency of Testing

The Inspection and Test Plan must nominate the proposed frequency of testing to verify conformity of the item, which must not be less than the frequency specified in Annexure B282/L. Where a minimum frequency is not specified, nominate an appropriate frequency. Frequency of testing must conform to the requirements of RMS D&C Q6.

You may propose to the RMS Representative a reduced minimum frequency of testing. The proposal must be supported by a statistical analysis verifying consistent process capability and product characteristics. The RMS Representative may vary or restore the specified minimum frequency of testing, either provisionally or permanently, at any time.
1.2.6 Referenced Documents

Standards, specifications and test methods are referred to in abbreviated form (e.g. AS 1234). For convenience, the full titles are given in Annexure B282/M.

1.3 Definitions

The terms “you” and “your” mean “the Contractor” and “the Contractor’s” respectively.

The following definitions apply to this Specification:

- **Bearing internal surfaces**: The internal surfaces of the pot, the face of the piston in contact with the elastomeric disc, the rim of the piston and the areas covered by the stainless steel plates and the sliding pads and strips.

- **Bearing group**: Bearings of the same type, with the same pot and piston geometry and with similar load capacity, for the purpose of testing. Bearings within a group may have different translational movement ranges.

- **Bearing type**: Fixed, free sliding or guided sliding bearing.

- **Elastomer**: A macromolecular material that rapidly regains its approximate original dimensions after release of a weak stress that has caused its substantial deformation.

- **Elastomeric disc**: A disc of rubber fitted with internal seals around its perimeter that allows relative rotation of the top and bottom parts of the bearing.

- **External seal**: The component used to seal the gap between the piston and the pot.

- **Internal seal**: The sealing ring(s) recessed into the face of the elastomeric disc and being in contact with the piston that prevents the disc from extruding from the pot.

- **Nominal dimension**: The distance between any two points.

- **Pot bearing**: A high-load multi-rotational bearing comprising a steel pot and a close fitting steel piston separated by an elastomeric disc, together with a sliding plate where applicable.

- **Sliding plate**: A steel plate in a sliding bearing fitted with a sliding surface to allow relative movement between the plate and the bearing.

- **Structural Engineer**: A Professional Engineer who is a Chartered Member of Engineers Australia (or equivalent) practising in the field of structural engineering. An equivalent to membership of Engineers Australia would be an Engineer registered on the National Engineering Register (NER) in the general area of practice of Structural Engineering.

- **Surface roughness parameter ($R_a$)**: Measurement of roughness of a surface as specified in ISO 3274.
1.4 QUALITY MANAGEMENT SYSTEM

The manufacturer/supplier of the bearings under this Specification must have in place quality management systems independently certified as fully complying with AS/NZS ISO 9001, by an organisation accredited by JAS-ANZ or an affiliated international certification organisation. Provide evidence of the certification.

The RMS Representative may conduct audits and inspections of the suppliers’ procedures and processes during the course of the Contract.

1.5 APPROVED BRIDGE COMPONENTS AND SYSTEMS

Unless otherwise approved by the RMS Representative, use only pot bearing types that have been approved by RMS. The list of RMS approved bridge proprietary products can be found at: http://www.rms.nsw.gov.au/business-industry/partners-suppliers/documents/tenders-contracts/listofapprovedbridgecomponentssystems.pdf

2 DESIGN

2.1 GENERAL

2.1.1 Codes and Standards

Design bearings to comply with the requirements of AS 5100.4, EN 1337 and RMS Bridge Technical Directions, unless otherwise specified. The requirements of AS 5100.4 take precedence over those of EN 1337 where there is a conflict between the two.

Design bolts to AS 5100.6.

Design steel components to AS 5100.6 or another bearing design standard approved by the RMS Representative. Regardless of the design standard used, the relevant capacity reduction factors in AS 5100.6 must apply.

2.1.2 Design Loads and Movements

Design pot bearings for Ultimate Limit State (ULS) effects. For rehabilitation work where the ULS loads have not been specified, obtain the relevant design loads by multiplying the relevant Serviceability Limit State (SLS) loads by 1.5.

Design and dimension all associated sliding surfaces to accommodate the ULS movements plus an additional movement of ± 25 mm.

Design the guide bars to withstand the lateral forces shown on the Design Documentation drawings, and dimension them such that the bearing movement remain guided throughout the specified limits of translation and rotation.

2.1.3 Other Requirements

Allow for construction tolerances in the design and fabrication of the bearings and attachment plates, where required for the construction method adopted.
Design the bearings such that the fasteners connecting the bearings to the attachment plates can be replaced without lifting the bridge superstructure.

Design the bearings to allow their removal at a maximum jacking lift of 10 mm unless specified otherwise on the Design Documentation drawings.

The bearing attachment plates and anchor bolts must not obstruct the movement and rotation of the bearing and must allow its removal and replacement.

Provide for mechanical lifting and handling of the bearings where required.

### 2.2 Design Calculations and Certifications

Submit the following for each bearing group:

(a) Confirmation of all load cases (axial and shear loads, and rotation and movement in each direction, as applicable).

(b) Drawings of the assembled bearing and attachment plates to scale with overall dimensions, including pot and piston dimensions.

(c) Design calculations of the bearing including elastomer pressure, elastomer thickness, PTFE mean and peak pressures, maximum bearing stress on substructure and superstructure giving method of calculation, forces on bolts and dowels with required sizes and grades, and stress checks on pot and piston components.

(d) Verification of the external seal closing the gap between piston and cylinder, accounting for all rotations calculated.

(e) Any variations from the details of the bridge proprietary bearing as approved by RMS (refer to Clause 1.5).

(f) A certificate from a Structural Engineer (refer Clause 1.3 for definition of “Structural Engineer”) experienced in the structural design of bearings verifying that all bearings and attachments comply with the requirements of the Design Documentation drawings and this Specification.

### 3 Materials

#### 3.1 Ferrous Materials

##### 3.1.1 Pot, Piston, Sliding Plate, Guide Bars and Attachment Plates

Pot, piston, sliding plate, guide bars and all attachment plates must be made from structural steel conforming to AS/NZS 3678 and/or AS/NZS 3679.1 or approved equivalent.

##### 3.1.2 Sliding Surfaces

Sliding surfaces must be made from stainless steel sheets conforming to ASTM A240M Grade 316 L or equivalent. The minimum thickness of stainless steel sheets must be 1.5 mm for sheets with their larger dimension being less than 800 mm, and 2.5 mm for larger sheets.
The sliding surface of the stainless steel sheet must be 2B surface finish, mechanically polished to a mirror finish with maximum surface roughness $R_a$ of 0.4 $\mu$m.

3.1.3 Bolts, Nuts, Screws and Washers

All bolts, nuts, screws and washers used must comply with Specification RMS D&C B240.

3.2 SLIDING PADS AND STRIPS

3.2.1 General

Polytetrafluoroethylene (PTFE) sheets for sliding pads and guide sliding strips must be made from 100% virgin PTFE conforming to ISO 13000-1 Grade 1, and etched on the side which is bonded to the steel.

The minimum thickness of PTFE must be 4.5 mm for pads or strips with no dimension exceeding 650 mm, or 6 mm for pads or strips with larger dimensions.

3.2.2 Sliding Pads

Sliding pads must be made from unfilled PTFE dimensionally stabilised moulded sheet, and must be dimpled and lubricated in accordance with AS 5100.4 on the face in contact with the sliding surface.

3.2.3 Guide Sliding Strips

Guide sliding strips must be made from durable filled PTFE, with the fillers being either milled glass fibre (25% maximum) or carbon fibre (25% maximum).

Alternatively, guide sliding strips may be a multilayered composite material, e.g. a three layer composite comprising a bronze backing strip, a sintered interlocking porous impregnated matrix, and an overlay of PTFE/lead, graphite/lead or similar mixture.

Guide sliding strips do not need to be dimpled.

3.3 ELASTOMERIC DISC

The elastomer used in the elastomeric disc must be 100% virgin natural rubber (polyisoprene). The elastomer must be plain, not laminated or fibre reinforced, and cured to satisfy the properties specified in Appendix B of AS 5100.4 for Type 50H.

3.4 INTERNAL SEALS

Internal seals must be made of polyoxymethylene (POM) or carbon filled PTFE complying with EN 1337-5 or equivalent. Provide evidence demonstrating faultless field performance of the seal type proposed.

Alternatively, internal seals may be made from rectangular brass sections conforming to AS/NZS 1567 (half-hard). Where the zinc content in the brass is greater than 15%, the brass must be inhibited against dezincification. Brass seals made of grade CuZn37 to EN 12163 or grade CuZn39Pb3 to EN 12164 are acceptable.
3.5 LUBRICANT

Lubricant for filling the dimples in the PTFE sliding pad and lubricating the top and bottom surfaces of the elastomeric disc must be made of silicone compounds. The lubricant must comply with Table B282.1.

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Requirements</th>
</tr>
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<tbody>
<tr>
<td>Worked penetration</td>
<td>ASTM D217</td>
<td>&lt; 260 (1, 2)</td>
</tr>
<tr>
<td>Evaporation after 22 hr at 150°C</td>
<td>ASTM D972</td>
<td>&lt; 2%</td>
</tr>
</tbody>
</table>

Notes:

(1) Unit of measurement is one tenth of a millimetre.
(2) Penetration results up to 295 may be accepted for lubricants complying with the requirements of EN 1337-2 and EN 1337-5.

The lubricant must retain its room temperature consistency over a temperature range of −40°C to +200°C and be compatible with all the components in contact with it.

3.6 MATERIAL CONFORMITY

Provide documentary evidence including certificates of compliance to verify conformity of all materials to the requirements of this Specification.

Testing of materials must be carried out in laboratories accredited by NATA for the test, or in laboratories accredited for that test by an organisation with Mutual Recognition Agreement (MRA) with NATA. If no such facilities are available for a test, the test must be carried out in a laboratory accepted by the RMS Representative with the results reported in a format acceptable to the RMS Representative.

4 FABRICATION

4.1 GENERAL

**HOLD POINT**

Process Held: Fabrication of bearings.

Submission Details: All documents stated in Annexure B282/D, at least 10 working days before the proposed commencement of fabrication of the bearings.

Release of Hold Point: The Nominated Authority will consider the submitted documents for compliance with this Specification, prior to authorising the release of the Hold Point.

All fabricated items of the bearings must be free from defects including weld spatter.

Round all sharp edges, corners and weld crests to a minimum radius of 1.5 mm. Chamfer the edges of drilled holes.
4.2 FLATNESS OF SURFACES

4.2.1 Bearing Internal Surfaces

The flatness of all bearing internal surfaces (refer Clause 1.3 for definition of “bearing internal surface”) of the bearing must not exceed 0.005 times the nominal dimension.

4.2.2 Plane Sliding Surfaces

The flatness of all plane sliding surfaces must not exceed 0.0003 times the sliding material’s larger dimension or 0.2 mm, whichever is greater.

4.2.3 Contact Surfaces of Pots/Pistons with Attachment Plates

The flatness of the steel surfaces of pots and attachment plates where the two are in contact with each other, must not exceed 0.0003 times the nominal dimension or 0.2 mm, whichever is greater.

The same applies to the flatness of the steel surfaces of pistons and attachment plates where the two are in contact with each other.

4.2.4 Guide Bars

The flatness of contact surfaces of guide bars must not exceed 0.001 times the nominal dimension.

4.2.5 Attachment Plates

Notwithstanding the requirement of Clause 4.2.3, the flatness of attachment plate surfaces other than those in contact with pots and pistons must conform to the requirements of Specification RMS D&C B201.

4.3 POT AND PISTON

4.3.1 General

The pot internal diameter must not exceed the piston rim diameter by more than 1.0 mm for bearings with metallic or POM internal seals, or 0.8 mm for bearings with PTFE seals.

Where required, machine the internal surfaces of the bearing to the flatness specified in Clause 4.2.1 and to a maximum surface roughness $R_a$ of 6.3 µm.

4.3.2 Pot

Fabricate the cylinder and base plate of the pot from one piece of steel.

Welding of a separate base plate to the cylinder may be accepted if supporting design calculations and/or experimental evidence are submitted showing that the strength of the welded component is equivalent to that made from a single piece of steel.

The welding must be Category SP or better conforming to the relevant part of AS/NZS 1554.

For bearings which will be subjected to uplift loading at ULS, carry out inspection of the welding (if any) of ancillary elements of the bearings designed to carry the uplift loading, as follows:

(a) magnetic particle inspection on 100% of the weld;
(b) ultrasonic testing on at least 20% of the weld of each element.

4.3.3 Piston

Machine the piston from a single piece of steel.

Bevel or curve the contact rim face of the piston, which bears against the pot wall, where the thickness of the rim exceeds 15 mm or the bearing ULS rotation exceeds 0.025 radians.

4.3.4 External Seal

Seal the gap between the pot and the piston against dust and moisture using either a small compression seal conforming to Specification RMS D&C B310 or a neutral cure silicone sealant or approved equivalent.

The seal must be able to accommodate the maximum ULS movements without being damaged.

4.4 ELASTOMERIC DISC

Manufacture each elastomeric disc from an individually moulded rubber slab.

Lubricate the disc using a lubricant complying with Clause 3.5 of this Specification.

In the unloaded condition, the lateral clearance between the pot and the elastomeric disc must not exceed 0.2% of the diameter of the elastomeric disc or 0.5 mm, whichever is greater.

4.5 INTERNAL SEAL

4.5.1 POM or Carbon Filled PTFE Seals

POM seal rings, where applicable, must be made from individual interlocking elements and moulded as an integral part of the elastomeric disc during the vulcanisation process.

Carbon filled PTFE seal rings, where applicable, must be completely recessed into the elastomeric disc.

4.5.2 Brass Seals

Brass seals must consist of a number of split rings formed to fit snugly in recesses in the elastomeric disc and within the inside wall surface of the pot. Each ring must contain one vertical cut, made at 45° to the tangent, with a maximum gap of 1 mm. Install the rings such that the cuts of the individual rings are staggered equally or by a minimum of 90° relative to one another when the rings are fitted to the elastomeric disc.

The minimum number of rings must be two. Use three rings where the outside diameter of the ring is greater than 700 mm or the specified rotational capacity is greater than 0.025 radians.

The minimum thickness of each ring must be 1.5 mm. The minimum width of rings must be 6 mm for ring diameters not exceeding 300 mm, and 10 mm for rings with larger diameters.

The rings must have a maximum surface roughness $R_a$ of 6.3 µm.
4.6 STAINLESS STEEL SLIDING SURFACE

4.6.1 General

The stainless steel sheet in the assembled bearing must be wider than the PTFE pad, extending beyond the edges of the PTFE pad, to accommodate the limits of translation specified in Clause 2.1.2.

Attach the stainless steel sheet to the backing plate by continuous welds along the edges. The backing plate must extend beyond the stainless steel sheet to accommodate the welds. The welded perimeter of the stainless sheet must not come in contact with the PTFE.

4.6.2 Welding

Welding must conform to AS/NZS 1554.6 Category 2B, surface condition II. Use prequalified welding consumables in accordance with AS/NZS 1554.6 for the combination of materials involved. The weld size must not exceed the thickness of the stainless steel sheet.

Submit welding procedures in accordance with AS/NZS 1554.6 prior to welding. The welding procedures must detail the welding sequence necessary to eliminate distortion and to ensure flatness of the sheet and its full contact with the backing plate.

After welding, the flatness of the sliding sheet must conform to that specified in Clause 4.2.2.

4.6.3 Passivation and Repolishing

Passivate all welds and heat affected zones of the stainless steel sheet and repolish the sheet to a maximum surface roughness $R_a$ of 0.4 μm.

4.7 GUIDE BARS

4.7.1 General

Manufacture each guide bar from one piece of steel. Where connected by screws, recess the guide bars into the sliding plates, pistons or pots as applicable. Alternatively, the guide bar and the sliding plate, piston or pot as applicable, may be manufactured from one piece of steel by machining, or by welding to form a single piece.

The two contact surfaces of the guide bar(s) must be parallel to each other, with a flatness conforming to that specified in Clause 4.2.3.

The maximum gap between a guide and its corresponding sliding surface must not exceed 3 mm when the other side is in full contact.

4.7.2 Sliding Surfaces

For each pair of mating sliding surfaces, use a combination of stainless steel strip/sheet welded as specified in Clause 4.6.1 to one surface, and a sliding strip in accordance with Clause 3.2.3 for the corresponding sliding surface. The sliding strip must be restrained by adhesive bonding and recessing and/or mechanical fixing.
4.8 **PTFE SLIDING PADS AND STRIPS**

Restrain the PTFE by adhesive bonding and recessing it into the backing material to a depth conforming to AS 5100.4 to prevent its extrusion, with the protrusion being not less than that specified in EN 1337-2. The average adhesion-in-peel strength of the adhesive compound must not be less than 30 N when tested under standard conditions to ASTM C794.

The backing material to the PTFE and the mating surface must be flat and rigid so that the PTFE layer will be uniformly loaded. The flatness of the PTFE surface must conform to that specified in Clause 4.2.2.

The shoulder of the recess into the backing material must be sharp and square to resist extrusion of the PTFE. Do not leave any gap between the inner face of the recess and the PTFE.

Permanently lubricate the PTFE pad and strips in accordance with AS 5100.4.

4.9 **ATTACHMENT PLATES**

Use separate steel attachment plates for above and below the pot bearings. The minimum mean thickness of the attachment plates must be 20 mm.

Attachment plates may be tapered to correct lack of parallelism caused by various effects including longitudinal grade, crossfall in the carriageway and hog or camber of the superstructure.

5 **PROTECTIVE TREATMENT**

5.1 **GENERAL**

5.1.1 **Standards**

Unless otherwise specified all work required for the protective treatment must comply with the requirements of AS/NZS 2312.1 or AS/NZS 2312.2, as relevant, and this Specification.

5.1.2 **Coating Systems**

Unless otherwise specified, the coating systems for the bearing and attachment plates must be in accordance with Table B282.2.

<table>
<thead>
<tr>
<th>Component</th>
<th>Bearing External Surfaces</th>
<th>Bearing Internal Surfaces</th>
<th>Attachment Plates</th>
<th>Fasteners</th>
<th>Stainless Steel Sheet</th>
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</thead>
<tbody>
<tr>
<td>System</td>
<td>ZP (1)</td>
<td>No treatment (3)</td>
<td>HDG (2) or ZP (1)</td>
<td>HDG (2)</td>
<td>No treatment (5)</td>
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</table>

**Notes:**

(1) ZP: Zinc metal spray and paint system as detailed in Annexure B282/E.

(2) HDG: Refer to Clause 5.4.

(3) Do not coat stainless steel sliding surfaces and bearing internal surfaces, and protect these surfaces from being coated or damaged during the application of the protective treatment to adjacent areas.
5.1.3 Application of Protective System

Apply the protective treatment under factory conditions prior to assembly of the bearings. Carry out repairs to damaged coatings in accordance with the paint manufacturer’s recommendations.

The protective treatment of the attachment plates where attached to steel girders, must be the same as that of the steel girders.

5.1.4 Paints

All paints must be from a single manufacturer and comply with the Australian Paint Approval Scheme (APAS) specifications stated in Annexure B282/E. Record details of paint used.

5.2 Surface Preparation

Clean steelwork surfaces which are to receive protective treatment, except those to be galvanized, by abrasive blasting in accordance with AS 1627.4 using crushed sharp angular metallic abrasive grit.

Before abrasive blasting, clean the areas contaminated with oil, grease, fingerprints, salt residues or other contaminants using alkaline solutions in accordance with AS 1627.1.

Prepare steelwork surfaces to be galvanized in accordance with AS/NZS 4680 and AS/NZS 1214 as appropriate.

5.3 Zinc Metal Spray

Apply the zinc metal using an electric arc spray method for melting the zinc wire. Apply the spray to dry, dust free and clean surfaces within 24 hours after abrasive blasting to avoid any discolouration or contamination of the surfaces.

The temperature of the steelwork must be at least 3°C above the dew point.

The specified coating thickness must be the minimum local thickness on the significant surface of a single component in the bearing. Seal the zinc metal coating with an appropriate sealer prior to application of top coat.

5.4 Hot-Dip Galvanizing

Carry out hot-dip galvanizing in accordance with AS/NZS 4680 for attachment plates and AS/NZS 1214 for fasteners.

Quench all galvanized items in a passivating chromate solution immediately after galvanizing.

5.5 Paint Application

Apply paint using airless or air-assisted airless spraying methods to zinc sprayed steelwork no later than 24 hours after the zinc spraying. Apply a stripe coat of paint to all edges of the surfaces to be painted prior to spraying. Brush shadowed areas before spraying.

Apply paint coats under the environmental conditions specified by the paint manufacturer. Cure finished paintwork for a minimum of three days before dispatch of bearings to site, unless otherwise recommended by the manufacturer.
6 TESTING OF BEARINGS

6.1 GENERAL

Test bearings in accordance with Clause 6 and at the frequency specified in Annexure B282/L. Carry out the vertical, lateral and rotation load tests on the same bearing.

Test bearings fully assembled, but without the external seal.

The direction of loads/rotations applied in all the tests must replicate the design conditions.

On completion of all load tests on each bearing tested, dismantle the bearing tested and inspect for the defects listed in Clause 6.4.

Re-lubricate all sliding surfaces and elastomeric discs and install the external seal for final assembly.

6.2 GEOMETRICAL VERIFICATION

Check bearing dimensions, flatness, surface roughness and clearances to verify compliance with the requirements of Clauses 3 and 4.

Measure flatness in all directions using a precision straight edge sliding on the surface and feeler gauges.

6.3 LOAD TESTS

6.3.1 General

Carry out the types of load tests in accordance with Table B282.3.

<table>
<thead>
<tr>
<th>Bearing Type</th>
<th>Vertical</th>
<th>Lateral</th>
<th>Friction</th>
<th>Rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Free sliding</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Guided sliding</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Tests must be carried out in laboratories accredited by NATA for the test or laboratories accredited for that test by an organisation with Mutual Recognition Agreement with NATA, unless accepted otherwise by the RMS Representative.

6.3.2 Vertical Load Test

Load the bearings in compression to the maximum ULS vertical load shown on the Design Documentation drawings, maintain this load for one minute, and then release the load. Reapply the load to the maximum ULS vertical load and maintain it for a minimum loading period of three minutes. (The loading period is the time the bearing sustains a test load of at least 95% of the initial load.)

Carry out a visual inspection of the bearing while under the second stage loading and report any sign of damage in accordance with Clause 6.4.
6.3.3 Lateral Load Test

Test bearings which are required to resist lateral forces by applying the following test loads:

(a) maximum ULS lateral load while loaded in compression to the concurrent minimum ULS vertical load shown on the Design Documentation drawings;

(b) maximum ULS lateral load while loaded in compression to the concurrent maximum ULS vertical load shown on the Design Documentation drawings.

In both cases, apply the vertical load first and then apply the lateral loads gradually. Maintain the test loads for a minimum loading period of three minutes.

Carry out a visual inspection of the bearing while under the applied loading and report any sign of damage in accordance with Clause 6.4.

6.3.4 Rotation Capacity Test

Load the bearings in compression to a test load of 0.7 times the maximum ULS vertical load shown on the Design Documentation drawings while at the design rotation specified in the Design Documentation drawings. Maintain this vertical load for a minimum loading period of three minutes.

Carry out a visual inspection of the bearing while under the applied loading and report any sign of damage in accordance with Clause 6.4.

6.3.5 Coefficient of Friction Test

Determine the coefficient of friction of sliding surfaces using vertical loads corresponding to vertical pressures on the PTFE pad of 5 and 20 MPa, unless shown otherwise on the Design Documentation drawings, at an ambient temperature between 5°C and 35°C.

The test displacement must be equal to the design displacement value but not exceeding 50 mm. Apply the vertical load and maintain it for three minutes before starting sliding. The test sliding speed must be in the range of 2.5 to 25 mm/minute.

Record the maximum horizontal force during sliding. Repeat the sliding and the horizontal force measurements to obtain the average of five measurements. Where bearings are tested in pairs, calculate the coefficient of friction of the bearings using the equation below:

\[
\text{Coefficient of friction} = \frac{\text{Average horizontal force}}{2 \times \text{vertical load}}
\]

The measured coefficient of friction must not exceed the values specified in Table B282.4 for the relevant pressure on the PTFE.

<table>
<thead>
<tr>
<th>PTFE pressure</th>
<th>5 MPa</th>
<th>15 MPa</th>
<th>20 MPa</th>
<th>≥ 30 MPa</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maximum coefficient of friction</strong></td>
<td>0.04</td>
<td>0.025</td>
<td>0.02</td>
<td>0.015</td>
</tr>
</tbody>
</table>

**Note:**
Interpolate friction values linearly for intermediate PTFE pressures.
6.4 CRITERIA FOR ACCEPTANCE

6.4.1 General

Reject any bearing that does not meet the requirements of the geometrical verification in Clause 6.2 or any of the load tests in Clause 6.3, or exhibits any signs of damage during or after the testing.

Such signs of damage include:

(a) splitting, extrusion or permanent deformation of the elastomer;
(b) tearing, cracking or permanent deformation of the PTFE sliding surfaces;
(c) cracking, indentation or permanent deformation of the internal seal or other part of the bearing;
(d) abrasive marks indicating abnormal contact between the metal surfaces of the bearing plates or piston, and the pot;
(e) failure or permanent deformations of guide bars.

6.4.2 Acceptance of Remainder

If a bearing is rejected, test two additional bearings from the group of bearing represented by the failed bearing. If both bearings meet the requirements of this Specification, the RMS Representative may accept the remaining bearings in the bearing group. Should one or both of the bearings not meet the requirements of this Specification, test each of the remaining bearings in the group for compliance.

6.5 BEARING REPORT

Provide a bearing report verifying that the bearings conform to the requirements of this Specification. The report must include the following:

(a) a summary of all test results with clear identification of the bearings tested;
(b) geometrical verification of all bearing dimensions;
(c) protective treatment certification.

7 IDENTIFICATION AND DELIVERY

7.1 IDENTIFICATION

Identify each bearing and fit a name plate to the bearing in accordance with AS 5100.4. Indicate the applicable installation locations of the bearings.

Ensure that the bearing orientation, the centreline and the direction(s) of movement as appropriate are readily identifiable to facilitate correct placement.
7.2 DELIVERY

**HOLD POINT**

<table>
<thead>
<tr>
<th>Process Held:</th>
<th>Delivery of bearings to site.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Submission Details:</td>
<td>Bearing report in accordance with Clause 6.5, at least 10 working days before the proposed date for delivery of bearings to site.</td>
</tr>
<tr>
<td>Release of Hold Point:</td>
<td>The Nominated Authority will consider the submitted documents for compliance with this Specification, prior to authorising the release of the Hold Point.</td>
</tr>
</tbody>
</table>

Provide temporary transit clips or equivalent, which must be easily removable, to hold the bearing components assembled during delivery. Do not remove the transit clips and/or bolts until after completion of installation in the bridge structure.

Supply mating parts of bearings in sets held together at the correct preset and skew with metal transit clips and/or bolts to prevent misalignment and/or damage of the components during transport and erection.

Do not remove the transit clips and/or bolts until after completion of installation in the bridge structure.

Protect bearings in dust and moisture resistant wrappings after assembly and during transportation to site.
ANNEXURE B282/A – PROJECT SPECIFIC REQUIREMENTS

Refer to Clause 1.2.1.

<table>
<thead>
<tr>
<th>Paint System</th>
<th>Colour of Paint Coat</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ANNEXURE B282/B – (NOT USED)
ANNEXURE B282/C – SCHEDULES OF HOLD POINTS AND IDENTIFIED RECORDS

Refer to Clause 1.2.3.

C1 SCHEDULE OF HOLD POINTS

<table>
<thead>
<tr>
<th>Clause</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Submission of planning documents</td>
</tr>
<tr>
<td>7.2</td>
<td>Submission of bearing report</td>
</tr>
</tbody>
</table>

C2 SCHEDULE OF IDENTIFIED RECORDS

The records listed below are Identified Records for the purposes of RMS D&C Q6 Annexure Q/E.

<table>
<thead>
<tr>
<th>Clause</th>
<th>Description of the Identified Record</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.2</td>
<td>Bearing design calculations, drawings and certification</td>
</tr>
<tr>
<td>2.2</td>
<td>Any variations from the previously approved bearing details</td>
</tr>
<tr>
<td>3.6</td>
<td>Documentary evidence of materials conformity</td>
</tr>
<tr>
<td>5.1</td>
<td>Protective treatment details</td>
</tr>
<tr>
<td>6.5</td>
<td>Bearing report</td>
</tr>
</tbody>
</table>

ANNEXURE B282/D – PLANNING DOCUMENTS

Refer to Clause 1.2.4.

The following documents are a summary of documents that must be included in the PROJECT QUALITY PLAN. Review the requirements of this Specification and other contract documents to determine any additional documentation requirements.

<table>
<thead>
<tr>
<th>Clause</th>
<th>Description of Document</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.6.2</td>
<td>Technical procedure for welding of stainless steel sheet</td>
</tr>
<tr>
<td>4.8</td>
<td>Technical procedure for bonding and lubricating the PTFE pad</td>
</tr>
<tr>
<td>5</td>
<td>Technical procedures for protective treatment</td>
</tr>
<tr>
<td>6.1</td>
<td>Technical procedure for dismantling and reassembly of test bearings</td>
</tr>
</tbody>
</table>
ANNEXURE B282/E – ZP COATING SYSTEM

E1 Coating System

Coating system consists of zinc coat, sealer and wet paint coating applied in their respective order.

E2 Surface Preparation

(a) Abrasive blast cleaned to Class 3 in accordance with AS 1627.4.
(b) Nominal surface profile of 75 \( \mu m \).
(c) Surface profile measured in accordance with Method A in AS 3894.5.

E3 Zinc Coat

(a) Zinc wire: Zn 99.99 conforming to ISO 752.
(b) Minimum local thickness of 150 \( \mu m \).
(b) Local coat thickness measured in accordance with AS 2331.1.3.

E4 Sealer

(a) Sealer: a proprietary low viscosity sealer compatible with the top coat.

E5 Wet Paint Coating Systems

(a) Wet paint coating systems must be either System A or System B in accordance with Table B282/E.1.

<table>
<thead>
<tr>
<th>Description</th>
<th>System A</th>
<th>System B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paint</td>
<td>MIO epoxy</td>
<td>HB polyurethane</td>
</tr>
<tr>
<td>Min DFT (( \mu m ))</td>
<td>125</td>
<td>125</td>
</tr>
<tr>
<td>Colour</td>
<td>RMS Bridge Grey to <em>Colours for Micaceous Iron Oxide Pigmented Paints</em>, produced by the NSW State Paint Group of the Government Paint Committee, June 1993</td>
<td>Colour N35 “Light Grey” to AS 2700</td>
</tr>
</tbody>
</table>

(b) System A is the default system.
(c) System B is only applied where so specified in Annexure B282/A as a job specific requirement.
(d) **MIO epoxy**: a two pack micaceous iron oxide pigmented polyamide cured epoxy coating conforming to APAS 2972.
(e) **HB polyurethane**: a full gloss two component, high build recoatable, acrylic modified polyurethane enamel, excluding two pack acrylic, included in a system conforming to APAS 2911.
(f) Minimum DFT is the minimum dry film thickness measured in accordance with Magnetic Induction Method B in AS 3894.3.

ANNEXURES B282/F TO B282/K – (NOT USED)
ANNEXURE B282/L – FREQUENCY OF TESTING

Refer to Clause 1.2.5.

Table B282/L.1 – Frequency of Testing

<table>
<thead>
<tr>
<th>Clause</th>
<th>Type of Test</th>
<th>Bearings per Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>≤ 10</td>
</tr>
<tr>
<td>6.2</td>
<td>Geometrical verification</td>
<td>All</td>
</tr>
<tr>
<td>6.3.2</td>
<td>Vertical load test</td>
<td></td>
</tr>
<tr>
<td>6.3.3</td>
<td>Lateral load test</td>
<td>1 per group</td>
</tr>
<tr>
<td>6.3.4</td>
<td>Rotation capacity test</td>
<td>2 per group</td>
</tr>
<tr>
<td>6.3.5</td>
<td>Coefficient of friction test</td>
<td>3 per group</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note:
(1) The test results are only valid where the stainless steel batch and PTFE batch combination tested is the same as that used for the bearings represented by the test sample. Past test results not more than two years old obtained for previous projects for the same PTFE and stainless steel batches may be accepted by the Project Verifier.
ANNEXURE B282/M – REFERENCED DOCUMENTS

Refer to Clause 1.2.6.

**RMS Specifications**

- RMS D&C Q6  Quality Management System (Type 6)
- RMS D&C B201  Steelwork for Bridges
- RMS D&C B240  Supply of Bolts, Nuts, Screws and Washers
- RMS D&C B284  Installation of Bridge Bearings
- RMS D&C B310  Compression Seal Expansion Joints

**Australian Standards**

- AS/NZS 1214  Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse thread series)
- AS/NZS 1554  Structural steel welding
- AS/NZS 1554.6  Part 6: Welding stainless steels for structural purposes
- AS/NZS 1567  Copper and copper alloys – Wrought rods, bars and sections
- AS 1627  Metal finishing – Preparation and pretreatment of surfaces
- AS 1627.1  Part 1: Removal of oil, grease and related contamination
- AS 1627.4  Part 4: Abrasive blast cleaning
- AS/NZS 2312  Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings
- AS/NZS 2312.1  Part 1: Paint coatings
- AS/NZS 2312.2  Part 2: Hot dip galvanizing
- AS 2331.1.3  Methods of test for metallic and related coatings
  - Method 1.3: Local thickness tests – Magnetic method
- AS 2700  Colour standards for general purposes
- AS/NZS 3678  Structural steel - Hot-rolled plates, floorplates and slabs
- AS/NZS 3679.1  Structural steel - Hot-rolled bars and sections
- AS 3894  Site testing of protective coating
- AS 3894.3  Part 3: Determination of dry film thickness
- AS 3894.5  Part 4: Determination of surface profile
- AS/NZS 4680  Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
- AS 5100  Bridge design
- AS 5100.4  Part 4: Bearings and deck joints
- AS 5100.6  Part 6: Steel and composite construction
- AS/NZS ISO 9001  Quality management systems – Requirements
Other Standards

ASTM A240M  Standard specification for chromium and chromium-nickel stainless steel plate, sheet, and strip for pressure vessels and for general applications
ASTM C794  Standard test method for adhesion-in-peel of elastomeric joint sealants
ASTM D217  Standard test methods for cone penetration of lubricating grease
ASTM D972  Standard test method for evaporation loss of lubricating greases and oils
EN 12163  Copper and copper alloys. Rod for general purposes
EN 12164  Copper and copper alloys. Rod for free machining purposes
EN 1337  Structural bearings
  EN 1337-2  Part 2: Sliding elements
  EN 1337-5  Part 5: Pot bearings
ISO 752  Zinc ingots
ISO 3274  Geometrical Product Specifications (GPS) – Surface texture: Profile method – Nominal characteristics of contact (stylus) instruments
ISO 13000-1  Plastics – Polytetrafluoroethylene (PTFE) semi-finished products
  Part 1: Requirements and designation

APAS Specifications

APAS 2911  Polyurethane coating for protection of steel
APAS 2972  Low build epoxy two-pack coating for the long term protection of steel in atmosphere