TS 01759:1.0

IC-QA-B292, IC-DC-B292, IC-QA-B293, IC-DC-B293

Specification

Supply of Spherical Bearings

(ATS 5540-23, Ed 1.0 MOD)

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Preface

This document is the first issue as TS 01759 and supersedes TS 01759.1 (IC-QA-B292) *Spherical Bearings – Structural Steel – QA*, TS 01759.2 (IC-DC-B292) *Spherical Bearings – Structural Steel – DC*, TS 01760.1 (IC-QA-B293) *Spherical Bearings – Stainless Steel – QA* and TS 01760.2 (IC-DC-B293) *Spherical Bearings – Stainless Steel – DC*.

This document adopts and modifies Austroads Technical Specification ATS 5540-23 and sets out the requirements for the design, supply and installation of spherical bearings.

For the purposes of this document, where TfNSW has identically adopted, or adopted and modified, an ATS document as a Transport Standard, the corresponding Transport Standard should be applied.

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1. Scope

1.1 This Specification sets out the requirements for the supply of spherical approved sliding material (ASM) bearings and associated attachment plates, including their design and fabrication. It applies to bearings with both structural (i.e., carbon) and stainless steel components.

1.2 For bearing installation requirements, refer to TS 01758.

2. Referenced documents

2.1 The following documents are referenced in this Specification:

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	Structural steel welding – Welding stainless steels for structural purposes
AS 1627.1	Metal finishing – Preparation and pretreatment of surfaces – Part 1: Removal of oil, grease and related contamination
AS 1627.4	Metal finishing – Preparation and pretreatment of surfaces – Part 4: Abrasive blast cleaning of steel
AS 2312.1	Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings – Part 1: Paint coatings
AS/NZS 2312.2	Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings – 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 2331.3.9	Method s of test for metallic and related coatings – Method 3.9: Corrosion and related property tests – Metallic coatings – Porosity tests – Ferroxyl test
AS 2453	Electroplated coatings – Chromium for engineering applications
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 3894.3	Site testing of protective coatings – Method 3: Determination of dry film thickness
AS 3894.5	Site testing of protective coatings – Method 5: Determination of surface profile
AS/NZS 4680	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
AS 5100.2	Bridge design – Part 2: Design loads
AS 5100.4	Bridge design – Part 4: Bearings and deck joints
AS/NZS 5100.6	Bridge design – Part 6: Steel and composite construction

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AS/NZS ISO 9001	Quality management systems – Requirements

ASTM International

ASTM A276	Standard Specification for Stainless Steel Bars and Shapes
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

International standards

EN 1337	Structural bearings
EN 1337-2	Structural bearings – Part 2: Sliding elements
ISO 752	Zinc ingots
ISO 3274	Geometrical Product Specifications (GPS) – Surface texture: Profile method – Nominal characteristics of contact (stylus) instruments
ISO 4287	Geometrical Product Specifications (GPS) – Surface texture: Profile method – Terms, definitions and surface texture parameters
BS EN 60893-2	Insulating materials. Industrial rigid laminated sheets based on thermosetting resins for electrical purposes. Part 2. Methods of test

Australian Paint Approval Scheme

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

TfNSW standards

TS 00033	Supply of Bolts, Nuts and Washers (ATS 5420-20, Ed 1.0 MOD)
TS 00171	Fabrication of Stainless Steel Components (ATS 5540-22, Ed 1.0 MOD)
TS 01621	TfNSW Proprietary Components and Systems Register for Bridgeworks
TS 01744	Steel Fabrication (ATS 5410-23, Ed 1.1 MOD)
TS 01758	Installation of Bridge Bearings (ATS 5570-24, Ed 1.0 MOD)
TS 02033 (BTD 2018/01)	Bridge Bearings

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3. Definitions

3.1 The following definitions apply to this Specification:

Approved sliding material (ASM):	A generic term adopted by AS 5100.4 for a new sliding material (not PTFE) based on a modified ultra-high molecular weight polyethylene and which has high compressive strength, low friction and high wear-resistance.
Bearing concave and convex plates:	Steel plates with curved (spherical) surfaces to accommodate bearing rotation.
Bearing internal surfaces:	The internal surfaces of bearing covered by sliding materials.
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.
Effective bearing temperature:	The maximum shade air temperature to AS 5100.2 minus 4°C. This term is used in the design of ASM pads.
Principal's Registration Scheme:	Any scheme for the prequalification, registration or approval of products, manufacturers, suppliers and/or Professional Engineers in operation in the jurisdiction where the bearing is to be installed.
Sliding plate:	A steel plate in a sliding bearing fitted with a sliding surface to allow relative movement between the plate and the bearing.
Stainless steel bearing:	A spherical bearing with its main steel components manufactured from stainless steel.
Structural steel bearing:	A spherical bearing with its main steel components manufactured from structural (carbon) steel, except for the stainless steel sliding surfaces.
Professional Engineer:	A person who: a) is registered on any scheme of registration of engineers prescribed by legislation in the applicable jurisdiction; b) is appropriately registered or prequalified, if the Principal has implemented an applicable registration or prequalification scheme; and c) satisfies at least one of the following requirements: i) is a Chartered Professional Engineer; or ii) holds a 4 year civil engineering degree from a university that is accredited under the Washington Accord and is registered in a relevant area of practice on the National Engineering Register (in Australia).
Surface roughness parameter (Ra):	Measurement of roughness of a surface as specified in ISO 3274.

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Surface roughness parameter (Ry5i)	Measurement of roughness of a surface as specified in ISO 4287

4. Quality System Requirements

4.1 The Contractor must prepare and implement a Quality Plan that includes the documentation in Table 4.1.

Table 4.1: Quality Plan

Clause	Description of document
4.2	Evidence of AS/NZS ISO 9001 certification
5.9	Design Documentation and Certification
7.5	Details of built up sections proposed for concave and convex plates, where applicable
7.13	Procedures for welding of stainless steel sheet.
7.24	Procedure for lubricating the ASM pad.
8 or 9	Procedure for protective treatment.
9.4	Procedure for insulation details, where applicable
10	Procedure for dismantling and reassembly of test bearings.

HOLD POINT 1	
Process Held	Fabrication of bearings.
Submission Details	The Quality Plan and evidence of certification to AS/NZS ISO 9001 must be provided at least 15 working days prior to the supply of the bearings.

4.2 The manufacturer / supplier of the bearings must have a quality management system in place which is certified as compliant AS/NZS ISO 9001, by an organisation accredited by JAS-ANZ or an affiliated international certification organisation.

4.3 The bearings must be an approved product included in TS 01621.

5. Design

General

5.1 Bearings must be designed in accordance with:

a. TS 02033 and be an approved product included in TS 01621;

b. AS 5100.4; and

c. EN 1337 and relevant European Technical Approvals.

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The above order of precedence applies in the event of an inconsistency.

5.2 Bolts must be designed in accordance with AS/NZS 5100.6.

5.3 Steel components must be designed in accordance with to AS/NZS 5100.6. The relevant capacity reduction factors must not be less than those specified in AS/NZS 5100.6, even if the Principal approves an alternative design standard.

5.4 All components of bearing must be designed in accordance with AS 5100.4 and to bearing performance requirements specified on the Drawings.

5.5 All associated plane sliding surfaces must be designed to accommodate the ULS movements plus an additional movement of ± 25 mm. All associated spherical sliding surfaces must be designed to accommodate the ULS rotation plus an additional rotation of 0.01 radians, without exposing the smaller sliding surface. Unintended metal to metal contact must not occur at the ULS movements or rotations.

5.6 The guide bars must be designed to withstand the lateral forces shown on the Drawings and dimensioned such that the bearing movement is guided throughout the specified limits of translation and rotation.

ASM Pad Design – Temperature

5.7 For design of the ASM pad, the operating bearing temperature must be the higher of 40°C or the Effective Bearing Temperature for the location where the bearings will be installed.

Other Requirements

5.8 The design of the bearing must:

a. allow for construction tolerances in the design and fabrication of the bearings and attachment plates, where required for the construction method adopted;

b. enable the fasteners connecting the bearings to the attachment plates can be replaced without lifting the bridge superstructure;

c. allow their removal at a maximum jacking lift of 10 mm (unless specified otherwise on the Drawings);

d. ensure that the bearing attachment plate bolts / screws and anchor bolts do not obstruct the movement and rotation of the bearing and allow its removal and replacement; and

e. provide for mechanical lifting and handling of the bearings where required.

Design Documentation and Certification

5.9 The Quality Plan must include the following documentation for each bearing group:

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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 bearing concave and convex plates dimensions;

c. design calculations of the bearing including sliding pad 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 steel structural components;

d. where an approved bearing is proposed, any variations from the details of the bridge proprietary bearing as approved by the road agency; and

e. a certificate from a Professional Engineer, with at least 5 years of experience in structural engineering which is relevant to bridge bearings, verifying that all bearings and attachments comply with the requirements of the Drawings and this Specification.

Approved Sliding Material

5.10 Details of the proposed ASM must be submitted to the Principal to demonstrate proven performance as a sliding material and its suitability for the allowable maximum pressure on the ASM used in the design of the bearings, and for the coefficient of friction and wear rates of the ASM.

6. Materials

General

6.1 Testing must be carried out at laboratories meeting the requirements specified in Clause 10.1.

Mating Sliding Surfaces

6.2 Materials for sliding surfaces under this Specification include ASM, polytetrafluoroethylene (PTFE), composite materials, stainless steel sheets, stainless steel plates and chromium plated steel surfaces.

6.3 The Material combinations for mating sliding surfaces must be one of the combinations listed in Table 6.3.

Table 6.3: Combinations of Materials for Sliding Surfaces

Type	Acceptable Sliding Surface Combinations
Curved surface	ASM on stainless steel; or ASM on hard chromium plated steel (1)

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Type	Acceptable Sliding Surface Combinations
Plane surface	ASM on stainless steel
Guides	ASM on stainless steel; PTFE on stainless steel; or Composite material on stainless steel

Note:

1 Not permitted if stainless steel bearings are specified.

6.4 The backing plates to the sliding surfaces must be adequately rigid when calculated using the method specified in EN 1337-2, to ensure uniform loading and avoid unacceptable deformation.

Ferrous Materials

6.5 Ferrous Materials must comply with Table 6.5.

Table 6.5: Ferrous Materials

Application	Requirement
Concave and convex bearing plates, plane sliding plates, guide bars and attachment plates for Structural Steel Bearings:	Structural steel conforming to AS/NZS 3678 and/or AS/NZS 3679.1 or approved equivalent. Curved bearing plates that are hard chromium plated (refer Clause 7.17) must be Grade 350 or higher.
For welded components:	Austenitic stainless steel conforming to ASTM A240M (1) Grade 316 L (2) or approved equivalent
For components not to be welded:	Austenitic stainless steel conforming to ASTM A240M (1) Grade 316 L (2) / Grade 316 (2) or approved equivalent.
Structural steel attachment plates in Stainless Steel Bearings (e.g., top attachment plates to steel girders),	Structural steel conforming to AS/NZS 3678 and/or AS/NZS 3679.1. All structural steel conforming to AS/NZS 3678 and/or AS/NZS 3679.1 must be certified by ACRS.
Sliding surfaces made from stainless steel sheets	ASTM A240M Grade 316 L or equivalent. The minimum thickness of stainless steel sheets is 2.5 mm. The sliding surface of the stainless steel sheet must be 2B surface finish, mechanically polished to mirror finish with a maximum surface roughness Ra of 0.4 µm, or roughness Ry5i of 1 µm.

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Application	Requirement
Hard chromium plating of sliding surfaces for curved sliding surfaces only	AS 2453 with minimum thickness of at least 100 µm. The chromium plated surface must have a surface roughness Ry5i of not more than 3 µm. Where necessary, polish the base material and/or hard chromium plating to achieve the specified roughness.
Bolts, nuts, screws and washers:	Compliance with TS 00033
Stainless steel dowels:	ASTM A276 Grade 316L or equivalent for welded components. Grade 316 otherwise.

Notes:

1 Rolled plates must be used in fabrication, per the referenced standard. The Principal must be notified immediately and directions sought if suitable rolled plate sizes cannot be sourced.

2 Stainless steel Grade 316 / Grade 316L may not provide adequate corrosion protection for the exposed surfaces of bearings located at high chloride environments. In such cases, the details of a superior material grade or / and additional surface protection must be submitted to the Principal for approval.

Non-Metallic Sliding Pads and Strips

6.6 The minimum thickness of ASM pads and strips is 8 mm.

6.7 Plane or curved sliding pads must be made of ASM and must be dimpled and filled with lubricant conforming to Clause 6.10.

6.8 Guide sliding strips must be either:

a. made from either ASM or PTFE. The PTFE for guide sliding strips must be durable filled PTFE, with the fillers being either milled glass fibre (25% maximum) or carbon fibre (25% maximum); or

b. 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.

6.9 Guide sliding strips do not need to be dimpled.

Lubricant

6.10 Lubricant for filling the dimples in the ASM sliding pad must be made of silicone compounds. The lubricant must comply with Table 6.10.

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Table 6.10: Properties of Lubricant

Property	Method of Test	Requirements
Worked penetration	ASTM D217	< 260 (1, 2)
Evaporation after 22 hr at 150°C	ASTM D972	< 2%

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.

6.11 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.

Material Conformity

6.12 The following must be provided to the Principal:

a. documentary evidence, including certificates of compliance, to verify that all materials conform to the requirements of this Specification; and

b. a certificate of compliance with each bearing supplied confirming that the ASM used is the same material as that approved for the particular bearing (refer to Clause 4.3).

6.13 Testing must be carried out at laboratories as specified in Clause 10.1.

7. Fabrication

General

7.1 The bearings must comply with AS 5100.4 and as amended by this Specification.

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

7.3 All sharp edges, corners and weld crests must be rounded to a minimum radius of 1.5 mm and the edges of drilled holes chamfered.

Flatness of Surfaces

7.4 The flatness along the profile of all sliding and contact surfaces must conform to the requirements of Table 7.4.

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Table 7.4: Flatness

Surface	Maximum deviation from the specified surface profile
Curved sliding surfaces	0.0003 times the larger dimension of the sliding material or 0.2 mm, whichever is greater.
Plane sliding surfaces	0.0003 times the larger dimension of the sliding material or 0.2 mm, whichever is greater.
Contact surfaces of bearing concave/convex plates, intermediate plates, tapered or otherwise, and attachment plates where they are in contact with each other	0.0003 times the nominal dimension or 0.2 mm, whichever is greater.
Contact surfaces of guide bars	0.001 times the nominal dimension
Attachment plate surfaces other than those in contact with bearing concave and convex plates	Conform to the requirements of Specification TS 01744 and TS 00171.

Bearing Concave and Convex Plates

7.5 The Quality Plan must include details of built up sections proposed for concave and convex plates, where applicable.

7.6 Each plate must be manufactured from one piece of steel.

7.7 The Principal may permit welded stainless steel plates in large bearings where plates with the required thickness are not commercially available. In such cases, the Contractor must submit to the Principal details of the proposed welding and associated testing and inspections demonstrating that welding will not compromise the plate performance.

7.8 Continuous welding of ancillary elements to allow fixing of the bearing to the attachment plates must be Category SP or better conforming to the relevant part of AS 1554.

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

a. magnetic particle (for carbon steel) or liquid penetrant (for stainless steel) on 100% of the weld; and

b. ultrasonic testing on at least 20 % of the weld of each element, unless directed otherwise by the Principal.

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Stainless Steel Sliding Surface

7.10 The stainless steel sheet in the assembled bearing must be larger than the ASM pad, extending beyond the edges of the ASM pad to accommodate the limits of translation specified in Clause 5.5.

7.11 The stainless steel sheet must be attached 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 steel sheet must not come in contact with the ASM.

7.12 Welding must conform to AS/NZS 1554.6 Category 2B, surface condition II. Prequalified welding consumables must be used 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.

7.13 The Quality Plan must include welding procedures in accordance with AS/NZS 1554.6. 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.

7.14 After welding, the flatness of the sliding sheet must conform to the requirements of Clause 7.4.

7.15 All welds and heat affected zones of the stainless steel sheet must be passivated and repolished to meet the requirements of Clause 6.5.

Hard Chromium Plated Surfaces

7.16 Hard chromium plated sliding surfaces must not be used in an environment where airborne particles of chlorides and fluorine are present in the environment, such as in industrial environment, unless special provisions are made to protect the surface.

7.17 The following applies where hard chromium plated steel is selected as one of the sliding surface combinations (refer Table 6.3):

a. the entire curved surface of the bearing convex plate must be hard chromium plated;

b. the hard chromium plating and its base surface must be free from surface porosity, shrinkage cracks and inclusions;

c. small surface defects may be repaired (e.g. by pinning) prior to hard chromium plating;

d. the hard chromium plated surface must be visually inspected for cracks and pores;

e. a non-destructive Ferroxyl test must be carried out in accordance with AS 2331.3.9 to detect any discontinuities (without being counted) in the hard chromium plated surface; and

f. any hard chromium plating where a discontinuity is detected must be rejected.

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Guide Bars

7.18 Each guide bar must be manufactured from one piece of steel. Where connected by screws, the guide bars must be recessed into the plane sliding plates, or the bearing convex or concave plates, as applicable.

7.19 Alternatively, the guide bar and the connecting sliding plate may be manufactured from one piece of steel by machining or by continuous welding to form a single piece.

7.20 The two contact surfaces of the guide bar(s) must be parallel to each other, with a flatness conforming to that specified in Table 7.4.

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

7.22 The combination of sliding surfaces of guided bars must conform to the requirements of Clause 6.3.

Non-Metallic Sliding Surfaces

7.23 The flatness of non-metallic sliding surfaces must conform to the requirements of Table 7.4.

7.24 ASM pads must:

a. be restrained by recessing it into the backing material to a depth conforming to AS 5100.4. The shoulder of the recess into the backing material must be sharp and square to resist extrusion of ASM. There must not be any gap between the inner face of the recess and ASM apart from intermittent gaps of not more than the larger of 0.001 times the diameter or 0.6 mm; and

b. be permanently lubricated in accordance with AS 5100.4.

7.25 Sliding strips must be restrained by recessing in addition to mechanical fixing and/or adhesive bonding. 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.

7.26 Composite material sliding strips must be restrained by mechanical fixing.

Attachment Plates

7.27 Separate structural steel attachment plates must be used above and below the bearings. The minimum mean thickness of the attachment plates is 20 mm.

7.28 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.

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8. Protective Treatment – Structural Steel Bearings

General

8.1 This Clause 8 only applies to Structural steel bearings.

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

8.3 Unless otherwise specified, the coating systems for the bearing and attachment plates must be in accordance with Table 8.3.

Table 8.3: Coating Systems for Bearings and Attachment Plates

Component	System
Bearing External Surfaces	Hot dip galvanised and painted to achieve a minimum of 50 years life to first maintenance; or ZP (1)
Bearing Internal Surfaces which are fully shielded from environmental effects	No treatment (4)
Attachment Plates	HDG (2) or ZP (1)
Fasteners	HDG (2)
Stainless Steel Sheet	No treatment (3)
Chromium Plated Surface	No treatment (3)

Notes:

1. ZP: Zinc metal spray and paint system as detailed in Annexure B.
2. Hot Dip Galvanising: Refer to Clause 8.13.
3. Do not coat stainless steel sliding surfaces and chromium plated surfaces, and protect these surfaces from being coated or damaged during the application of the protective treatment to adjacent areas.
4. Primer may be applied to the recess for ASM but do not apply any treatment below the stainless steel sheet on the backing plate to prevent interference with welding.

8.4 The protective treatment must be applied under factory conditions prior to assembly of the bearings. Any repairs to damaged coatings must be carried out in accordance with the paint manufacturer's instructions.

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

8.6 All paints must be from a single manufacturer and comply with APAS 2911 or APAS 2972. Details of paint used must be recorded.

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Surface Preparation

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

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

8.9 Steelwork surfaces to be galvanized in accordance with AS/NZS 4680 and AS/NZS 1214 must be prepared as appropriate.

Zinc Metal Spray

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

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

8.12 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 the top coat.

Hot-Dip Galvanizing

8.13 Hot-dip galvanizing must be carried out in accordance with AS/NZS 4680 for applicable attachment plates and AS/NZS 1214 for fasteners.

8.14 All galvanized items must be quenched in a passivating chromate solution immediately after galvanizing.

Paint Application

8.15 Paint must be applied using airless or air-assisted airless spraying methods to zinc sprayed steelwork no later than 24 hours after the zinc spraying. A stripe coat of paint to all edges of the surfaces to be painted must be applied prior to spraying. Shadowed areas must be brushed before spraying.

8.16 Paint coats must be applied under the environmental conditions specified by the paint manufacturer. Finished paintwork must be cured for a minimum of three days before dispatch of bearings to site, unless otherwise recommended by the manufacturer.

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9. Protective Treatment – Stainless Steel Bearings

General

9.1 This Clause 9 only applies to Stainless steel bearings.

9.2 Unless approved otherwise, a protective treatment must not be applied to any stainless steel component.

9.3 Where attached to steel girders, the protective treatment of any structural steel attachment plates must be the same as that of the steel girders.

Insulation

9.4 The stainless steel bearing must be insulated from the structural steel attachment plates (where used) using suitable flat sheets, bushes and washers of at least 3 mm thickness, at the interface between the pot bearing and the attachment plates and around the bolts to the attachment plates.

9.5 The flat sheets, bushes and washers must be made of resin laminated sheets and tubes made from an electrical insulating material complying with the performance requirements of Table 9.5 must be used.

Table 9.5: Performance Requirements for Insulating Material

Property	Method of Test	Requirements
Insulating resistance after immersion in water	BS EN 60893-2	≥ 5 x 1010 Ω
Water absorption (3 mm)	BS EN 60893-2	≤ 50 mg
Impact strength, notched Charpy	BS EN 60893-2	≥ 10 kJ/m^2

9.6 Holes must be matched drilled through the insulating sheet to accommodate the fixing screws to the top attachment plate.

10. Testing

General

10.1 Unless approved otherwise by the Principal, testing must be performed by a laboratory which is accredited for the test by a body that is a signatory to the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement (ILAC MRA). The National Association of Testing Authorities (NATA) and International Accreditation New Zealand (IANZ) are signatories to ILAC MRA.

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10.2 Bearings must be tested in accordance with this Clause 10 at the frequency specified in Table 10.2. The vertical, lateral and rotation load tests must be carried out on the same bearing.

Table 10.2: Frequency of Testing

Method of Test	Bearings per Group ≤ 10	Bearings per Group > 10 and ≤ 25	Bearings per Group > 25
Geometrical verification	All	All	All
Vertical load test	1 per group	2 per group	3 per group
Lateral load test	1 per group	2 per group	3 per group
Rotation capacity test	1 per group	2 per group	3 per group
Coefficient of friction test	1 per stainless steel sheet batch and ASM batch combination (1)	1 per stainless steel sheet batch and ASM batch combination (1)	1 per stainless steel sheet batch and ASM batch combination (1)

Note:

1 The test results are only valid where the stainless steel batch and ASM 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 ASM and stainless steel batches may be accepted by the Principal

WITNESS POINT 1	
Process	Testing of bearings
Notification	At least 7 days prior to the commencement of testing.

10.3 Bearings must be tested fully assembled.

10.4 Where bearings are required to resist uplift forces, they must be subjected to appropriate testing to verify the adequacy of the design.

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

10.6 On completion of each load test, the bearing must be dismantled and inspected for the defects listed in Clause 10.18. All sliding surfaces must be re-lubricated for final assembly.

Geometrical Verification

10.7 Bearing dimensions, flatness, surface roughness and clearances must be checked to verify compliance with the requirements of Clauses 6 and 7.

Load Tests

10.8 The types of load tests specified in Table 10.8 must be carried out.

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Table 10.8: Types of Load Tests Required

Bearing Type	Vertical	Lateral	Friction	Rotation
Fixed	Yes	Yes	No	Yes
Free sliding	Yes	No	Yes	Yes
Guided sliding	Yes	Yes	Yes	Yes

10.9 The relevant load tests must be performed on the nominated bearing for testing.

Vertical Load Test

10.10 Vertical load testing of bearings must be carried out using the following procedure:

a. load the bearings in compression to the maximum ULS vertical load shown on the Drawings;

b. maintain this load for one minute;

c. release the load;

d. 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 intended test load); and

e. carry out a visual inspection of the bearing while under the second stage loading and report any sign of damage in accordance with Clause 10.18.

Lateral Load Test

10.11 Bearings which are required to resist lateral forces must be tested 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 Drawings;

b. maximum ULS lateral load while loaded in compression to the concurrent maximum ULS vertical load shown on the Drawings.

10.12 In both cases, the vertical load must be applied first and then the lateral loads applied gradually. The test loads must be maintained for a minimum loading period of three minutes.

10.13 A visual inspection of the bearing while under the applied loading must be carried out and any sign of damage in accordance with Clause 10.18 reported.

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Rotation Test

10.14 The bearings must be loaded in compression to a test load of 0.7 times the maximum ULS vertical load shown on the Drawings while at the design rotation specified in the Drawings. This vertical load must be maintained for a minimum loading period of three minutes.

10.15 A visual inspection of the bearing while under the applied loading must be carried out and any sign of damage reported in accordance with Clause 10.18.

Coefficient of Friction Test

10.16 Coefficient of friction testing of plane sliding surfaces of bearings must be carried out using the following procedure:

a. apply vertical loads corresponding to vertical pressures on the ASM pad of 15 and 60 MPa, unless shown otherwise on the Drawings, at an ambient temperature between 5°C and 35°C

b. the test displacement must be equal to the design displacement value but not exceeding 50 mm

c. apply the vertical load and maintain it for three minutes before starting sliding

d. the test sliding speed must be in the range of 2.5 to 25 mm/minute

e. record the maximum horizontal force during sliding

f. repeat the sliding and the horizontal force measurements to obtain the average of five measurements

g. where bearings are tested in pairs, calculate the coefficient of friction of the bearings using the equation: Coefficient of friction = Average horizontal force / (2 x vertical load)

10.17 The measured coefficient of friction must not exceed the values specified in Table 10.17 for the relevant pressure on the ASM.

Table 10.17: Coefficient of Friction for Lubricated Sliding Surfaces

Property	ASM pressure 15 MPa	ASM pressure 45 MPa	ASM pressure 60 MPa	ASM pressure ≥ 90 MPa
Maximum coefficient of friction	0.04	0.02	0.016	0.015

Note: Interpolate friction values linearly for intermediate ASM pressures.

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Criteria for Acceptance

10.18 Any bearing that does not meet the requirements specified in this Clause 10 or exhibits any signs of damage during or after the testing must be rejected. These signs of damage include:

a. tearing, cracking or excessive deformation of the sliding surfaces;

b. cracking, indentation or permanent deformation of any part of the bearing;

c. abrasive marks indicating abnormal contact between the metal surfaces of the bearing;

d. failure or permanent deformations of guide bars; and

e. damage to chromium plating where applicable.

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

Test Report

10.20 A report containing all details and the results of all load tests must be prepared and submitted to the Principal. The report must include:

a. the load used for the vertical load test;

b. the load used for the lateral load test;

c. the vertical load and the rotation used for the rotation test;

d. photographs of bearings during and at the end of each test;

e. photographs of any visible failure; and

f. any observations noted during the testing process;

Bearing Report

10.21 A bearing report must be prepared and submitted to the Principal. The report must include:

a. Certificate of Compliance, in accordance with Clause 6.12, that the materials comply with this Specification;

b. verification, in accordance with Clause 10.7, that the geometry of the bearing complies with this Specification;

c. a summary of all test results with clear identification of the bearings tested; and

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d. verification and certification that all bearings conform to the requirements of this Specification

11. Identification and Delivery

11.1 Each bearing must be identified and fitted a nameplate to the bearing in accordance with AS 5100.4 including the applicable installation locations of the bearings.

11.2 The bearing, orientation, the centreline and the direction(s) of movement as appropriate must be readily identifiable to facilitate correct placement.

HOLD POINT 2	
Process Held	Delivery of bearings to site
Submission Details	The laboratory report and bearing report, in accordance with Clause 10 must be submitted at least 10 working days before the proposed date for delivery of bearings to the Site.

11.3 Temporary transit clips or equivalent, which must be easily removable, must be provided to hold the bearing components assembled during delivery. The transit clips and/or bolts must not be removed until after completion of installation in the bridge structure unless approval is sought from and given by the Principal for operational reasons.

11.4 Bearings must be kept in dust and moisture resistant protective wrappings at all times prior to installation. Bearings must be kept secured in a horizontal condition.

11.5 Mating parts of bearings must be supplied 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.

11.6 The temporary constraints must be removed after installation to allow the bearings to function as intended.

11.7 For storage and handling of stainless steel spherical bearing refer to TS 00171.

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Annexure A Summary of Hold Points, Witness Points and Records

The following is a summary of the Witness Points/Hold Points that apply to this Specification and the Identified Records that the Contractor must submit to the Principal to demonstrate compliance with this Specification.

Clause	Hold point	Witness point	Identified records
4.1	1. Fabrication of bearings.		Quality Plan
5.9			Any variations from the previously approved bearing details
10.2		1. Testing of bearings	
10.20			Test Report
11.2	2. Delivery of bearings to site.		laboratory report and bearing report

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Annexure B ZP Coating System

This Annexure B only applies if the ZP Coating System has been specified.

Coating System

B.1 The coating system consists of zinc coat, sealer and wet paint coating applied in their respective order.

Surface Preparation

B.2 Abrasive blast cleaned to Class 3 in accordance with AS 1627.4.

B.3 Nominal surface profile of 75 µm.

B.4 Surface profile measured in accordance with Method A in AS 3894.5.

Zinc Coat

B.5 Zinc wire: Zn 99.99 conforming to ISO 752.

B.6 Minimum local thickness of 150 µm.

B.7 Local coat thickness measured in accordance with AS 2331.1.3.

Sealer

B.8 Sealer: a proprietary low viscosity sealer compatible with the top coat.

Wet Paint Coating Systems

B.9 The Wet paint coating systems must be either System A or System B in accordance with Table B5.

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Table B5: Wet Paint Coating Properties

Description	System A	System B
Paint	MIO epoxy	HB polyurethane
Description	A two pack micaceous iron oxide pigmented polyamide cured epoxy coating conforming to APAS 2972.	A full gloss two component, high build recoatable, acrylic modified polyurethane enamel, excluding two pack acrylic, included in a system conforming to APAS 2911.
Min DFT (µm)	125	125
Colour	Unless specified otherwise, colour ‘N44 Bridge Grey’ to AS 2700	Colour N35 “Light Grey” to AS 2700

Notes:

1. System A applies unless specified otherwise.

2. Minimum DFT is the minimum dry film thickness measured in accordance with Magnetic Induction Method B in AS 3894.3.

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