

Engineering Services

**Technical Standard
TS 16**

**Protection of Steelwork in
Atmospheric Environments**

**Revision: 1.0
Date: 13 November 2015**

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Significant/Major Changes Incorporated in This Edition

This is the first issue of this Technical Standard, it is a compilation of: TS 12, TS 24, TS 82 and TS 136 and supersedes these documents.

The following technical changes have been made:

1. Generalisation of standards to cover all repair coatings for steel pipes and structures.
2. Expansion of TS 136 to include ZINGA as an alternative product for the repair coating of steel pipes and structures.



Document Controls

Revision History

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Approvers

Role	Signature and Date
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1 Introduction

SA Water owns and operates an extensive amount of infrastructure of which steelwork forms a significant component.

This Technical Standard has been developed to assist SA Water to maintain, manage and protect steelwork in atmospheric environments.

This Standard shall be read in conjunction with the manufacturer's technical data sheets and specifications. Where details are not included in this standard products shall be applied in accordance with the manufacturer's written instructions.

1.1 Purpose

The purpose of this standard is to detail minimum requirements to ensure that assets covered by the scope of this standard are suitably protected and attain their required life.

1.2 Glossary

The following glossary items are used in this document:

Term	Description
ACA	Australasian Corrosion Association
APAS	Australian Paint Approvals Scheme
DFT	Dry film thickness
NACE	National Association of Corrosion Engineers
PCCP	Painting Contractor Certification Program
SA Water	South Australian Water Corporation
TG	SA Water Technical Guideline
TS	SA Water Technical Standard

1.3 References

1.3.1 Australian and International

The following table identifies Australian and International standards and other similar documents referenced in this document:

Number	Title
AS 1627	Metal finishing - Preparation and pretreatment of surfaces
Part 1	Cleaning using liquid solvent and alkaline solutions
Part 2	Removal of oil, grease and related contamination
Part 4	Abrasive Blast Cleaning
Part 7	Hand tool cleaning of metal surfaces
AS 3894	Site testing of protective coatings
Part 3	Determination of dry film thickness
Part 5	Determination of surface profile
Part 6	Determination of residual contaminants
Part 10	Inspection Report – Daily surface and ambient conditions
Part 11	Equipment Report
Part 12	Inspection report – Coating
AS/NZS 4680	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
AS 3750	Paints for steel structures
Part 15	Inorganic zinc silicate paint
AS 4312	Atmospheric corrosivity zones in Australia
APAS D – 184	Guidelines to Specification, Supply and Quality Assurance (www.apas.gov.au)
	APAS 2908
	APAS 2911
	APAS 2916
	APAS 2919
	APAS 2973
	APAS 2971
	APAS 0290/1

1.3.2 SA Water Documents

The following table identifies the SA Water standards and other similar documents referenced in this document:

Number	Title
TS 15	Protection of Steelwork in Immersed Environments
TS 18	Protection of Steel Pipework in Buried Conditions

1.4 Definitions

The following definitions are applicable to this document:

Term	Description
SA Water's Representative	The SA Water representative with delegated authority under a Contract or engagement, including (as applicable): <ul style="list-style-type: none">• Superintendent's Representative (e.g. AS 4300 & AS 2124 etc.)• SA Water Project Manager• SA Water nominated contact person
Responsible Discipline Lead	The engineering discipline expert responsible for TS 16 defined on page 3 (via SA Water's Representative)

2 Scope

This Technical Standard (TS) covers the surface preparation for application of and repair of steel pipes and structures using the following protection systems:

1. Jotun Jotamastic 87 Aluminium two-pack epoxy mastic,
2. ZINGA liquid galvanising zinc-based one-pack,
3. Inorganic zinc silicate,
4. Zinc / Epoxy primer, 2-pack Micaceous Iron Oxide, 2-pack gloss Polyurethane / Acrylic topcoat,
5. Inorganic zinc silicate and acrylic latex gloss and
6. Zinc Phosphate and Alkyd Gloss Enamel.

3 Product Selection

Unless the coating material is explicitly specified in the project specification, Table 1 shall be used to determine the required coating. All materials listed in this document are suitable for use in atmospheric conditions, and shall not be used for pipework submerged in either soil or water. For steelwork in submerged conditions refer to TS 15. For steelwork in atmospheric and buried conditions refer to TS 16 and TS 18 respectively.

Table 1: Selection of Protective Material Coatings

	Jotun Jotamastic 87	ZINGA	Inorganic zinc silicate coating	Zinc epoxy, micaceous iron oxide, acrylic gloss	Zinc silicate and acrylic latex coating	Zinc Phosphate and Alkyd Gloss Enamel
Can be applied to bare steel	✓	✓	✓	✓	✓	✓
Can be applied to galvanised steel	x	✓	x	✓	✓	x
Can be used for repairs	✓	✓ ¹	✓	✓	✓	✓
Can be used on new pipes	✓	✓	✓	✓	✓	✓
Harshest environmental conditions which material is suitable	Severe atmospheric conditions; sewage treatment works, constant damp and humid environments.	Mild atmospheric conditions	Mild atmospheric conditions	Severe atmospheric conditions; sewage treatment works, constant damp and humid environments.	Mild atmospheric conditions	Dry indoor atmospheric conditions
Corrosivity Category ²	C5	C2	C2	C5	C2	C1

¹ Zinga shall only be used to repair existing Zinga coatings; it shall not be used to repair steelwork with other coatings unless written permission is given by the Responsible Discipline Lead.

² Corrosivity Category shall be in accordance with AS 4312.

4 Coating Contractor & Quality Assurance

The Contractor shall be certified under the PCCP for the appropriate class of work or an equivalent approved by the Materials Science Unit. The Contractor shall submit to SA Water's Representative documentation in accordance with their Quality Assurance Plan. However, the minimum requirement for Quality Assurance shall be completion of AS 3894.10, AS 3894.11 and AS 3894.12. All quality control records shall be available for inspection by SA Water's Representative.

5 Supply of Materials

When available the Australian Paint Approvals Scheme (APAS) 'APAS Record of Supply' shall be requested and obtained when the product is purchased.

A 'Certificate of Test' can then be obtained by SA Water's Representative if problems in the application of the coating subsequently occur. Information and procedures concerning Records of Supply and Certificate of Test are detailed in APAS Document D-184.

Returns, as required by APAS Document D-184, shall be completed by the manufacturer and submitted to SA Water's Representative by the Contractor for forwarding to Engineering Services, Materials Science.

6 Surface Preparation

The following clauses detail the required surface preparation for the different coating materials. Table 2 shall be followed for the surface preparation required for each coating system.

Table 2: Surface Preparation for Coating Systems

	Jotun Jotamastic	ZINGA	Inorganic zinc silicate coating	Zinc epoxy, micaceous iron oxide, acrylic gloss	Zinc silicate and acrylic latex coating	Zinc Phosphate and Alkyd Gloss Enamel
Welding Treatments	The fabricator shall ensure that all joints are fully welded and sealed, sharp edges and corners are ground off to a radius not less than 2 millimetres and all weld spatter and irregularities are removed.					
Surface contamination and oil removal	Steel surfaces shall be free from mill-scale, rust, weld-spatter, oil, grease, soil, moisture and any other matter likely to impair the adhesion of the coating. Oil and grease shall be removed from all steelwork using an alkali degreasing process or solvent washing as approved by accordance with AS 1627.1					
Surface Preparation Bare Steel	Hand or power tool cleaned (6.3)	Grit or slurry blasted (6.4)	Abrasive blast clean (6.1 and 6.2)	Abrasive blast clean (6.1 and 6.2)	Abrasive blast clean (6.1 and 6.2)	Hand, power tool or abrasive blast clean (6.1, 6.2 and 6.3)
Surface preparation Galvanised Steel	N/A	Worn coating: steam and blast clean. New coating: Steam clean and sweep blast. No visible oxidation	N/A	Abrasive blast clean No visible oxidation	Abrasive blast clean No visible oxidation	N/A
Steel condition after surface preparation	Bare steel: ST 2	Bare steel: Sa 2 ½ Galvanised Steel: No visible oxidation or surface contamination	Bare Steel: Sa 3	Bare steel: Sa 3 Galvanised Steel: No visible oxidation or surface contamination	Bare steel: Sa 3 Galvanised steel: No visible oxidation or surface contamination	Bare steel: ST 2

	Jotun Jotamastic	ZINGA	Inorganic zinc silicate coating	Zinc epoxy, micaceous iron oxide, acrylic gloss	Zinc silicate and acrylic latex coating	Zinc Phosphate and Alkyd Gloss Enamel
Bare steel Surface Roughness Grade³	None	Medium: 45-70 µm	Fine: < 44µm	Medium: 45-70 µm	Medium: 45-70 µm	None
Special Requirements	Coating must be completed on the same day as surface preparation	Coating must be applied within 4 hours of surface preparation	Coating must be completed on the same day as surface preparation	Coating must be completed on the same day as surface preparation	Coating must be completed on the same day as surface preparation	Coating must be completed on the same day as surface preparation

³ The surface grade profile shall be determined in accordance with Table 1 of AS 3894.5.

6.1 Abrasive Blast Cleaning – Bare Steel

Wet or dry blasting shall be in accordance with AS 1627.4 to the finish class listed in Table 2. Abrasive materials used shall be in accordance with AS 1627.4. Additionally, abrasive materials shall:

1. Be free from contamination, and
2. Contain less than 100 milligrams per kilogram of sodium chloride and contain less than 30 milligrams per kilogram of copper.

Water used during the cleaning process shall be potable and shall not contain more than 500 milligrams per litre of total dissolved salts.

6.2 Abrasive Blast Cleaning – Galvanised Steel

If the steelwork is galvanised then it shall be hot dip galvanised in accordance with AS/NZS 4680. Excessive localised lumps or pools of zinc and all dross shall be removed. For galvanised steel abrasive blast cleaning is intended a) to remove oxide film and surface contamination and b) lightly profile the surface. The galvanised surfaces shall be lightly 'whip' or 'brush' blasted to provide a fine surface profile. Abrasive material shall be garnet or other silica free mineral and shall be in accordance with AS 1627.4. Additionally, abrasive materials shall be free from contamination, contain less than 100 milligrams per kilogram sodium chloride and contain no metallic copper.

The abrasive blast cleaning procedure shall be in accordance with AS 1627.4 and Appendix I of AS/NZS 4680. Abrasive blast cleaning shall not reduce the galvanised layer by more than 10 micrometres.

6.3 Hand and Power Tool Cleaning – Bare Steel

Surfaces shall be hand or power tool cleaned in accordance with AS 1627.2 and AS 1627.7 to a ST 2 finish. Areas of the pipe where the current coating is sound do not need to be removed, but shall be lightly abraded to enable adhesion of the Jotun Jotamastic coating. Loose material and rust shall be removed from all surfaces via disc or hand sanding. Some scratching and polishing of the exposed bare metal shall be undertaken to leave the steelwork with a dull silvery finish. Finally surfaces shall be dusted and cleaned.

6.4 Grit and Slurry Blasted – Bare Steel

Shot-blasting (with spherical particles) shall not be permitted. Following blasting the surface shall be de-dusted with non-contaminated compressed air in accordance with AS 1627.4.

For ZINGA that will not be immersed, ZINGA can be applied on mild flash rust (occurring after wet blasting in the allowed time limit), but this is not recommended for optimal results. For application where ZINGA will be immersed, it shall be prepared to a Sa 2 ½ standard in accordance with NACE No5/SSPC SP-12 level SC1.

On small areas or on non-critical applications, ZINGA can be applied on a surface that is manually prepared to degree ST 3 according to ISO 8501-1.

After surface preparation the steel surface shall have a roughness grade of medium (45-70 µm) in accordance with AS 3894.5.

7 Application of Coating System

This clause details the application of the coating material. The first coat shall be applied as soon as the surface preparation has been approved by SA Water's Representative.

7.1 Prior to Coating

Before beginning coating checking shall be undertaken to ensure that:

1. Surface temperature of steel is a minimum of 3 °C above dew point.
2. All steel surfaces shall be between 10 °C and 55 °C during the cure period. (The product curing profile shall be obtained from the supplier prior to coating application.)
3. Application of coating shall not commence until the surface preparation has been inspected and approved by the SA Water Representative.
4. If rust-producing salts, chlorides or any other surface contamination are detected, surfaces shall be further prepared. Surfaces shall be reinspected by the SA Water Representative. This process is repeated until satisfaction from the Representative is achieved.
5. SA Water's Representative may conduct testing for contamination material at their discretion. This testing shall be done in accordance with AS 3894.6. The maximum permissible level of chlorides shall be 50 milligrams per square metre (8.3 micrograms per square centimetre). The test areas shall be re-prepared as outlined in clause 6.
6. Commencement of work on the coating shall indicate unconditional acceptance of the surface to be coated.

7.2 Storage and Preparation of Coating Material

Coating materials shall be mixed and applied in accordance with the manufacturer's written instructions. Proportioning and mixing of part cans is not permitted without the approval of SA Water's Representative. Strict attention shall be paid to the coating manufacturer's recommendations, including shelf life and onsite storage conditions.

Safety and application shall be strictly in accordance with the manufacturer's written instructions.

The colour of coating used shall be as specified or as directed by SA Water's Representative.

7.3 Coating Application

Table 3 shall be followed for steelwork coating. Minimum over coating times, as detailed in the manufacturer’s data sheet, shall be observed. The top coat finish shall be generally smooth and free from protuberances and dry spray. **Table 3: Coating Specifications**

	Jotun Jotamastic	ZINGA	Inorganic zinc silicate coating	Zinc epoxy, micaceous iron oxide, acrylic gloss	Zinc silicate and acrylic latex coating	Zinc Phosphate and Alkyd Gloss Enamel
Additional Conditions that shall be met prior to coating	N/A	Ambient temperature shall be greater than - 15 °C and less than 40 °C and the relative humidity less than 95%. Steel surface temperature shall be less than 60 °C Zinga shall remain between 15 and 25 °C during application.	Type 4 primer coats shall not be applied if the relative humidity is less than 50 % or is likely to fall below 50 % during curing.	If the coating has been allowed to cure beyond the recommended limits the area shall be whip blasted with fine silica free grit before the application of subsequent coats.	N/A	N/A
Bare Steel Primer Coat Primer Shall not be applied to galvanised steel.	N/A	N/A	Inorganic Zinc silicate	Two part (liquid and zinc dust) inorganic zinc silicate coating in accordance with APAS 2908 or; 2-pack epoxy coating approved in accordance with APAS 2973 or; Organic zinc rich coating approved in accordance with APAS 2916.	International 215 inorganic zinc silicate grey or; Interzinc 225 or; Wattyl Galvit ES510 or; Wattyl Galvit ES600 or; PPG D9 SB Zinc silicate grey.	International Interprime 198 or; International Interprime 164 or; Solver Line 4120 Zinc phosphate Metal Primer or; Wattyl P162 ZP Primer or; Superprime ZP Primer or; Jotun Jotaprime 200 or; Jontun Jotaprime 250.
Application of	N/A	N/A	Spray	Conventional spray	Conventional Spray	See manufacturer’s

	Jotun Jotamastic	ZINGA	Inorganic zinc silicate coating	Zinc epoxy, micaceous iron oxide, acrylic gloss	Zinc silicate and acrylic latex coating	Zinc Phosphate and Alkyd Gloss Enamel
primer						technical datasheet
Agitation method of primer	N/A	N/A	Continuously mechanically stirred while spraying	Continuously mechanically stirred while spraying	Continuously mechanically stirred while spraying	See manufacturer's technical datasheet
Primer minimum DFT	N/A	N/A	≥75 µm	75-100 µm	75-100 µm	50 µm
Intermediate Coat	N/A	N/A	N/A	Epoxy high build, 2-pack-micaceous iron oxide approved in accordance with APAS 2973.	International Interzinc 52 MCR or; Wattyl Epiname PR 250	N/A
Application of intermediate coat	N/A	N/A	N/A	Spray	Spray	N/A
Intermediate coat DFT	N/A	N/A	N/A	≥200 µm	≥40 µm	N/A
Top Coat	Jotun Jotamastic 87 Aluminium	ZINGA liquid galvanising zinc-based one-pack	Inorganic zinc silicate product shall comply with AS/NZS 3750.15 as either a Type 1 or Type 6 waterborne or a Type 4 solvent based paint. Additionally the product shall be approved by the APAS 2908A.	2-pack solvent borne gloss polyurethane approved in accordance with APAS 2911 or; 2-pack solvent borne gloss catalysed acrylic approved in accordance with APAS 2919.	International Intercryl 853 white or; Wattyl Solagard gloss or; PPG Taubmans Sunproof MAX acrylic gloss.	Dulux Super Enamel or; Wattyl Agricultural Enamel (high gloss).
Application Method of top coat	Spray	Spray or brush	Spray	Spray	Applied in 2 coats by spray, roller or brush.	See manufacturer's technical datasheet
Agitation method of	Compressed air driven agitator	None	Compressed air driven agitator during	None	None	See manufacturer's technical datasheet

	Jotun Jotamastic	ZINGA	Inorganic zinc silicate coating	Zinc epoxy, micaceous iron oxide, acrylic gloss	Zinc silicate and acrylic latex coating	Zinc Phosphate and Alkyd Gloss Enamel
coating material	during coating		coating			
Top Coat minimum DFT thickness	250-300 µm	≥120 µm	≥100 µm	≥50 µm	≥50 µm	See manufacturer's technical datasheet
Minimum DFT of Coating System	≥250 µm		≥100 µm	≥325 µm	≥165 µm	See manufacturer's technical datasheet
Dry Film Thickness Measurement	The dry film thickness shall be measured in accordance with AS 3894.3. Calibration of instruments shall take account of surface profile height and shall be adjusted in accordance with this test method.					

Table 3: Coating Specifications

	Jotun Jotamastic	ZINGA	Inorganic zinc silicate coating	Zinc epoxy, micaceous iron oxide, acrylic gloss	Zinc silicate and acrylic latex coating	Zinc Phosphate and Alkyd Gloss Enamel
Additional Conditions that shall be met prior to coating	N/A	Ambient temperature shall be greater than - 15 °C and less than 40 °C and the relative humidity less than 95%. Steel surface temperature shall be less than 60 °C Zinga shall remain between 15 and 25 °C during application.	Type 4 primer coats shall not be applied if the relative humidity is less than 50 % or is likely to fall below 50 % during curing.	If the coating has been allowed to cure beyond the recommended limits the area shall be whip blasted with fine silica free grit before the application of subsequent coats.	N/A	N/A
Bare Steel Primer Coat Primer Shall not be applied to galvanised steel.	N/A	N/A	Inorganic Zinc silicate ⁴	Two part (liquid and zinc dust) inorganic zinc silicate coating in accordance with APAS 2908 or; 2-pack epoxy coating approved in accordance with APAS 2973 or; Organic zinc rich coating approved in accordance with APAS 2916.	International 215 inorganic zinc silicate grey or; Interzinc 225 or; Wattyl Galvit ES510 or; Wattyl Galvit ES600 or; PPG D9 SB Zinc silicate grey.	International Interprime 198 or; International Interprime 164 or; Solver Line 4120 Zinc phosphate Metal Primer or; Wattyl P162 ZP Primer or; Superprime ZP Primer or; Jotun Jotaprime 200 or; Jontun Jotaprime 250.
Application of	N/A	N/A	Spray	Conventional spray	Conventional Spray	See manufacturer's

⁴ Inorganic Zinc silicate can be used either as a primer or as a top coat.

	Jotun Jotamastic	ZINGA	Inorganic zinc silicate coating	Zinc epoxy, micaceous iron oxide, acrylic gloss	Zinc silicate and acrylic latex coating	Zinc Phosphate and Alkyd Gloss Enamel
primer						technical datasheet
Agitation method of primer	N/A	N/A	Continuously mechanically stirred while spraying	Continuously mechanically stirred while spraying	Continuously mechanically stirred while spraying	See manufacturer's technical datasheet
Primer minimum DFT	N/A	N/A	≥75 µm	75-100 µm	75-100 µm	50 µm
Intermediate Coat	N/A	N/A	N/A	Epoxy high build, 2-pack-micaceous iron oxide approved in accordance with APAS 2973.	International Interzinc 52 MCR or; Wattyl Epiname PR 250	N/A
Application of intermediate coat	N/A	N/A	N/A	Spray ⁵	Spray ⁶	N/A
Intermediate coat DFT	N/A	N/A	N/A	≥200 µm	≥40 µm	N/A
Top Coat	Jotun Jotamastic 87 Aluminium	ZINGA liquid galvanising zinc-based one-pack	Inorganic zinc silicate product shall comply with AS/NZS 3750.15 as either a Type 1 or Type 6 waterborne or a Type 4 ⁷ solvent based paint. Additionally the product shall be approved by the APAS 2908A.	2-pack solvent borne gloss polyurethane approved in accordance with APAS 2911 or; 2-pack solvent borne gloss catalysed acrylic approved in accordance with APAS 2919.	International Intercryl 853 white or; Wattyl Solagard gloss or; PPG Taubmans Sunproof MAX acrylic gloss.	Dulux Super Enamel or; Wattyl Agricultural Enamel (high gloss).

⁵ The coating may be applied in two coats over the inorganic zinc silicate primer. This coat shall be followed by a build coat.

⁶ The manufacturer may recommend thinning of the primer due to the porosity of the inorganic zinc silicate.

⁷ A Type 4, solvent based product may only be used as a primer coat with the epoxy topcoat.

	Jotun Jotamastic	ZINGA	Inorganic zinc silicate coating	Zinc epoxy, micaceous iron oxide, acrylic gloss	Zinc silicate and acrylic latex coating	Zinc Phosphate and Alkyd Gloss Enamel
Application Method of top coat⁸	Spray	Spray or brush ⁹	Spray	Spray	Applied in 2 coats by spray, roller or brush.	See manufacturer's technical datasheet
Agitation method of coating material	Compressed air driven agitator during coating	None	Compressed air driven agitator during coating	None	None	See manufacturer's technical datasheet
Top Coat minimum DFT thickness	250-300 µm	≥120 µm ¹⁰	≥100 µm	≥50 µm	≥50 µm	See manufacturer's technical datasheet
Minimum DFT of Coating System	≥250 µm		≥100 µm	≥325 µm	≥165 µm	See manufacturer's technical datasheet
Dry Film Thickness Measurement	The dry film thickness shall be measured in accordance with AS 3894.3. Calibration of instruments shall take account of surface profile height and shall be adjusted in accordance with this test method.					

⁸ Under special circumstances SA Water's Representative may approve brush application for small areas.

⁹ Subsequent layers of ZINGA may be applied by roller.

¹⁰ ZINGA shall be applied in 2 coats of equal thickness.

8 Inspection

8.1 General

The work shall be monitored and inspected by an accredited coating inspector from either:

1. The Australasian Corrosion Association, or
2. The National Association of Corrosion Engineering.

The inspector will be engaged by SA Water. The contractor shall give SA Water's Representative a minimum of two working days' notice prior to commencement of any surface preparation or coating of materials to allow SA Water to arrange such inspection.

Inspectors shall not be available outside of normal accepted industry working hours, unless specifically agreed to by SA Water.

8.2 Re-inspection

Should SA Water's Representative find the surface preparation or applied coating to be unsatisfactory and rework is required by the contractor, the additional costs (including additional inspection costs) may be charged to the Contractor. These costs may be deducted from any moneys due and payable to the Contractor.