SA Water

Engineering

Technical Standard

TS 0711.5 – Concrete Remedial Works: Surface Protection and Lining of Concrete

Version: 1.0
Date: 16 September 2022
Status: Final

Document ID: SAWS-ENG-0711.5

Government of South Australia

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Application & Interpretation of this Document

It is the responsibility of the users of this Standard to ensure that the application of information is appropriate and that any designs based on this Standard are fit for SA Water's purposes and comply with all relevant Australian Standards, Acts and regulations.

Users of this Standard accept sole responsibility for interpretation and use of the information contained in this Standard. Users should independently verify the accuracy, fitness for purpose and application of information contained in this Standard.

Only the current revision of this Standard should be used which is available for download from the SA Water website.

Significant/Major Changes Incorporated in This Edition

This is the first issue of this Technical Standard. However, it supersedes the following SA Water documents:

- SAW-ENG-STR-TEM-TSB-004 Technical Specification Concrete Repair Works: Protective Coatings
- TS137 – Rehabilitation of Concrete Wastewater Manholes

Document Controls

Revision History

Revision	Date	Author	Comments
1.0	16/9/2022	H Habib	First issue

Template: Technical Standard Version 6.00, 10/05/2016

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1 Introduction

1.1 Purpose

The purpose of this section of the Concrete Remedial Works Technical Standard is to detail SA Water's minimum technical requirements the supply of materials, surface preparation, material application, inspection and testing for surface protection and lining of reinforced concrete water and wastewater assets.

It is intended that repairs completed in accordance with this Technical Standard are of consistent high quality and attain the specified durability and service life.

This Technical Standard does not include application of adhered or torch-on Bitumastic membrane for roof or external waterproofing.

1.2 Concrete Remedial Works Technical Standard Suite

This Technical Standard is one part of the SAWS-ENG-0711 Concrete Remedial Works Technical Standard suite, which comprises:

- TS 0711.0: General requirements
- TS 0711.1: Concrete repair
- TS 0711.2: Joint sealant replacement
- TS 0711.3: Concrete crack repair
- TS 0711.4: Structural bonding and strengthening
- **TS 0711.5: Surface protection and lining of concrete (This Document).**

Read TS 0711.5 in conjunction with TS 0711.0: General Requirements.

1.3 General Requirements

Refer to TS 0711.0 for details of the general project requirements:

1. Introduction: Purpose, references
2. Scope: Types of structure and repair methods, exclusions and technical dispensation
3. Using the technical standard
4. General project requirements
5. Quality requirements
6. Health and safety requirements
7. Environmental requirements
8. Construction requirements.

Appendix A : Schedules of hold points, witness points and identified records.

1.4 Concrete Surface Protection and Lining Requirements

Carry out all remediation of concrete in accordance with the requirements as specified in TS 0711.0, the project contract documents, the requirements specified in this Technical Standard and the material manufacturer's instructions.

Request written advice from SA Water's Representative to resolve any conflict between this Technical Standard and any manufacturer's instructions.

Make no deviation from this Technical Standard without written approval from SA Water's Representative.

The technical requirements of this Technical Standard include:

1. Application of penetrating concrete surface treatments
2. Application of film forming protective coatings
3. Application of cementitious protective materials
4. Application of liquid applied waterproof membranes
5. Application of adhered and loose sheet membrane liners.

Undertake additional remedial works if required (concrete repair, crack injection, joint sealant, structural bonding or strengthening) in accordance with TS 0711.1 to TS 0711.4.

Use WSA 201 version 2.1 and AS/NZS 2312.1 for selection and application of protective coatings to structural steelwork or other metal components that form part of the works.

1.5 Abbreviations

Abbreviations used in this document are defined in TS 0711.0 Clause 1.2.

1.6 References

Australian and International Standards, SA Water Standards, Industry Technical Guidelines and other documents referenced in this Technical Standard are defined in TS 0711.0 Clause 1.3.

1.7 Definitions

The terminology and technical definitions applicable to this Technical Standard are defined in TS 0711.0 Clause 1.4.

A selection of key technical terms relevant to this Technical Standard are defined in Table 1.

Table 1: Definitions of Terms Used in this Technical Standard

Term	Definition
Anti-carbonation coating	Coating applied to concrete and other cement-based substrates to retard their carbonation by atmospheric carbon dioxide (CO_2).
Carbonation	The reaction of atmospheric CO_2 with alkaline materials such as concrete, and cement which lowers the alkalinity (pH) and thus protection to steel reinforcement.
Coat	A continuous layer of a coating material resulting from a single application.
Coating system	Can be either protective or decorative coating system
Coating(s)	An interchangeable term, meaning either the actual process of covering the concrete surface with a layer(s) of paint, or representing a protective or decorative coating
Decorative coating system(s)	These can be either film-forming coatings, surface treatments or combinations of these which can improve the aesthetic appearance of a concrete surface.

Term	Definition
Dry film thickness (DFT)	The dry film thickness of a coating remaining on the surface and above the peaks of the surface profile when the coating or system has hardened and cured
Dry surface	Concrete residual moisture after surface preparation does not exceed the limits for successful coating application, bonding and curing in ASTM D4263, ASTM F1869 or ASTM F2170. Refer Clause 11.8.
Film-forming coating(s)	Viscous materials which form a pinhole - free film on the concrete surface to improve its aesthetic appearance or provide protection by acting as a barrier to the ingress of aggressive agents. Coatings are generally applied in two or more layers. Thin coatings have a dry film thickness (DFT) of 100-300 micron, high build coatings generally exceed 1 mm, whereas cementitious coatings are generally thick applications ranging from 1 to 20 mm thick.
Fugitive dye	An impermanent pigment that lightens, darkens, or otherwise changes in appearance or physicality over time when exposed to environmental conditions.
Maximum dry film thickness	The highest acceptable dry film thickness for each coating layer or for the whole coating system above which the performance of the coating layer or system could be impaired
Minimum dry film thickness	The minimum acceptable dry film thickness for each coating layer or for the whole coating system
Moist surface	Concrete surface has a matt moist appearance with no shiny water film, the pores are not water saturated, indicated by a drop of water being readily absorbed, restoring the surface to a matt appearance.
Nominal dry film thickness (NDFT)	The dry film thickness specified for each coating layer or for the whole coating system
Pore-lining penetrant(s) (Hydrophobic Impregnation(s)	These are low viscosity fluids (i.e., silane, silane/siloxane, siloxane, solid silane or silane cream) which react with the available hydroxyl group of the silicate structure of the concrete substrate in the presence of moisture, thus depositing water-repellent silicone resins chemically bonded to the walls of the concrete pore structure. These hydrophobic products can penetrate the concrete by several millimetres and work by repelling water and waterborne chloride ions.
Primer	The first coat of a coating system applied to an uncoated concrete substrate designed to enhance adhesion of the coating system onto the surface and/or impart a surface binding and toughening effect on the substrate.
Protective coating system	Either film-forming coatings, surface treatments or combinations of these which can impart protective qualities to the concrete surface against the ingress of aggressive agents.
Saturated surface dry (SSD)	The concrete substrate pores are saturated with water to a depth of several millimetres, the concrete surface may have a wet sheen, but there is no dripping/ ponded/free water on the surface, as if it had been dried with a cloth.
Sealer	These are viscous fluids which are intermediate between pore-lining penetrants and film-forming coatings. They can penetrate and block the pores of the concrete substrate and also form a thin film on its surface.
Surface treatment(s)	Viscous materials such as pore-lining penetrants (hydrophobic impregnations) and sealers which can penetrate the concrete or block the pores of the concrete to improve its aesthetic or protective qualities.
Undercoat	Highly pigmented coating which can serve as a first coat or intermediate coat before the finish coating to provide hiding power and improved adhesion of a top coat to the substrate.
Wet film thickness (WFT)	The thickness of the wet coating immediately after application.
Wet surface	The concrete surface has dripping or standing water.

2 Surface Protection and Lining System Selection

This Technical Standard provides requirements for surface protection and lining systems for water and wastewater concrete structures.

Coating system recommendations in this Technical Standard are based on WSA 201 version 2.1, Section 5 Selection of Coatings.

Provide coatings for application to concrete that meet the requirements of this Technical Standard and are resistant to the anticipated effects of chemical, mechanical and thermal stresses for the coatings intended purpose.

Select the most onerous set of exposure conditions to determine the required coating system taking into account its chemical and mechanical properties, structure geometry and operational requirements.

2.1 Exposure Class

Determine the concrete components exposure class based on the environmental conditions in accordance with Table 2, which is based on WSA 201-2017-2.1, Table 5.1.

Table 3 sets out the exposure classes by structure type and micro-environment and includes corresponding AS 3735 Table 4.1 exposure classifications. Wastewater structure exposure environments are shown in Figure 1.

Use the exposure class to select the type of coating required.

Table 2: Concrete Exposure Class

WSA 201 Exposure Class	Reinforced concrete	Concrete Repair Type[1]
Extreme	Continually subjected to corrosive and acidic chemicals	5A, 4D
	Continually subjected to non/partially ventilated septic sewage atmosphere (Biogenic H_2S exposure)	5B, 4D, 2C
	Buried in aggressive soils e.g., acid sulphate soils, high sulphate, contaminated sites and salinity hazard areas	5A, 4A
	Exposure category D as per AS 3735	5A, 5B, 2C
High	Subjected to chemicals containing salts (not acidic)	5A, 4A
	Continually subjected to fully ventilated septic sewage atmosphere (H_2S gas exposure)	5B, 2C
	Marine and coastal environments i.e., subjected to salt spray	5A
	High wear, abrasion, erosion	5D
Moderate	Continually exposed to normal atmosphere	5C, 5E, 4B
	Continually exposed to raw water, or fresh sewage (soft water exposure)	5E, 4C, 2B
	Continually exposed to potable water (soft water exposure)	5E, 4C, 2A
Low	Benign indoor building environment e.g., dry or air conditioned areas	1B
	Adequate concrete cover depth/quality and concrete grade to resist ambient conditions and absence of corrosive chemical exposure from ground or liquids for required service life	1B

Note: 1) Definitions in TS 0711.1 Table 2

Table 3: Exposure Classes by Structure Type and Micro-Environment

Structure Type	Exposure Environment	WSA 201 Exposure Class	AS 3735 Table 4.1 Exposure Condition
Raw Water Storage/ Transmission Assets	Submerged/splash	Moderate	B2
	Atmospheric - internal	Moderate	B1
	Atmospheric - external	Moderate	B1-C
Treated Water Assets	Submerged/splash	Moderate	B2
	Atmospheric - internal	Moderate	B1
	Atmospheric - external	Moderate	B1-C
	Chemical exposure (Refer Table 6)	High / Extreme	B2-D
Waste Water (Sewage) Assets	Continuously Submerged > 0.5 m below min. level, < 4m/s velocity	Moderate	B2
	Continuously Submerged > 0.5 m below min. level, > 4m/s velocity	High	B2
	All internal areas above (0.5 m below min. sewage level) - open to air, fresh sewage	Moderate	B2
	All internal areas above (0.5 m below min. sewage level) - open to air, stale sewage	High	D
	All internal areas above (0.5 m below min. sewage level) - enclosed, fresh sewage	High	D
	All internal areas above (0.5 m below min. sewage level) - enclosed, stale sewage	Extreme	D
	Atmospheric - external	Moderate	B1-C
	Chemical exposure (Refer Table 6)	High / Extreme	B2-D
	Emergency Storage Tank	Moderate	B2
General Environments	Internal/external marine - aerosol and splash	High	C
	Buried	Low to Extreme	B1-D

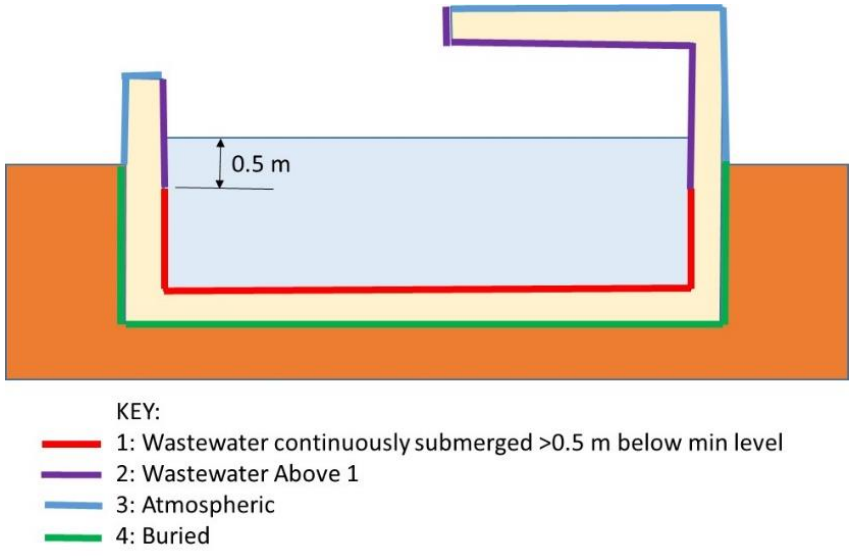

Figure 1: Wastewater Structure Exposure Environments

2.2 Coating Systems

Generic coating and liner systems are adapted from WSA 201- version 2.1, Tables 5.3, 5.6, 5.5 and 5.8.

Coating system type descriptions and maximum allowable exposure class are listed in Table 4.

Allowable coating and liner material types by exposure class are set out in Table 5.

Table 4: Generic Protective Coatings and Liners

Type	Material	Exposure Class	Type Description
B1	Silane and Siloxane Coatings	Moderate	Penetrating sealer for masonry and cementitious surfaces, to impede the passage of soluble salts and moisture, to provide long-term protection to concrete against water penetration and salt induced steel reinforcement corrosion of concrete structures.
B2	Colloidal Silica	Moderate	Penetrating waterproofing/anti-microbial treatment for cementitious surfaces, to impede the passage of soluble salts and moisture, to provide long-term protection to concrete against water penetration and biogenic corrosion of concrete structures.
B3	Elastomeric Anti-Carbonation Coating	Moderate	Elastomeric coating that impedes carbonation of concrete and has moderate crack bridging ability for atmospherically exposed concrete.
B4	Acrylic Latex	Decorative	Water based acrylic- paint for decorative painting.
B5	Polyurethane or Polysiloxane Systems	Moderate	A three-coat epoxy and polyurethane-based or polysiloxane-based coating system, for aesthetics, durability, and atmospheric corrosion protections. Polysiloxane top coats provides anti-graffiti properties.
B6	Water Based Epoxy	Moderate	A water based epoxy system for protecting concrete surfaces against light chemical and abrasion attack. Primarily decorative with surfaces that are easy to clean e.g., garage workshops and stores. It is typically odourless, making it suitable for interior applications. Can be made non-skid by adding suitable aggregates.
B7	Epoxy Mastic	Moderate	A two-coat surface tolerant epoxy system primarily for spot repairs and full overcoating of existing interior coating systems. Can be made non-skid by adding suitable aggregates.
B8	Epoxy High Build, Solvent Based/Solvent Free for Immersion Service	Moderate	A high-performance immersion-grade epoxy coating system for water reservoir internals. For immersion and vapour space exposure.
B9	Ultra-High Build Epoxy	High, Extreme	Ultra-high build solvent-free epoxy primarily intended for underground, immersion, areas of high abrasion. Suitable for coating of liquid retaining concrete

Type	Material	Exposure Class	Type Description
			structures with high exposure to H_2S gas acids found in wet wells, maintenance holes, and inlet works.
B10	Epoxy Novolac	High, Extreme	High build novolac epoxy system for concrete exposed to corrosive chemicals e.g., chemical bunds and septic sewer structures. Interior, high duty exposure including ponding, immersion or corrosive vapours.
B11	Vinyl Ester	Extreme	Vinyl ester coating system for steel and concrete to provide superior abrasion and chemical resistance.
B12	Waterproof Slurry Coating or Render	Moderate	Waterproof slurry coating incorporating crystalline technology applied to water retaining structures to seal widespread fine static cracking up to 0.4 mm wide, or higher durability thick render.
B13	Calcium Aluminate Cement	High, Extreme	Calcium aluminate cement is designed for refurbishment concrete structures in sewer environment and for lining of cast iron and steel pipes and fittings used for conveying sewage.
B14	Elastomeric Polyurethane/Poly-urea Membrane	High, Extreme	Elastomeric Polyurethane/Polyurea system to waterproof "tank" the internal floor and walls of tanks, bunds and sewerage elements.
B15	HDPE/PVC Anchored Corrosion Protection Liner	High, Extreme	Concrete protective liner typically made from high grade HDPE or PVC. High resistant to most chemicals which has anchors or ribs that are embedded into concrete substrate. Not suitable for long-term UV exposure.
B16	PVC Sheet Co-Polymer-Adhered	High, Extreme	Concrete protective liner typically made from high grade PVC. High resistant to most chemicals. Adhered to concrete surface using co-polymer adhesive. Not suitable for long-term UV exposure.
B17	Elastomeric Boot Seal	High, Extreme	Elastomeric Polyurethane/Polyurea system to stop water ingress of water between steel tanks and the concrete ring beam.

Table 5: Coating and Liner Types by Exposure Class

Moderate	High	Extreme	Lining
Silane/siloxane	Calcium Aluminate Cement	HDPE or PVC anchored lining	HDPE or PVC anchored lining
Colloidal silica	Epoxy Novolac	PVC with co-polymer adhesive	Adhered PVC Sheet
Elastomeric anti-carbonation	Ultra-High Build Epoxy	Calcium Aluminate Cement	Drop-in / Loose sheet HDPE/PVC membrane
Water based epoxy	High Build Epoxy	Elastomeric Polyurethane/ Polyurea	Elastomeric Polyurethane/ Polyurea

Moderate	High	Extreme	Lining
Epoxy Mastic	Silane/siloxane	Ultra-High Build Epoxy	Waterproof render
High Build Epoxy		Vinyl Ester	
Waterproof render		Epoxy Novolac	

2.3 Chemical Exposure

Guidance for selection of protective coatings for concrete containment bunds occasionally exposed to typical chemicals used in the water industry is based on WSA 201 version 2.1, Table 5.7, as set out in Table 6.

Confirm the chemical, concentration, exposure conditions, exposure temperature and duration of exposure to coating supplier for its recommended coating system's suitability for use.

Consult the coating manufacturer for confirmation of a suitable protective coating product for structures or equipment that will be exposed continuously to a specific chemical.

Table 6: Protective Coatings for Chemical Exposure

Chemical	Concentration (%)	Reinforced concrete bunds
Acetic acid	75	Epoxy Novolac,
		Vinyl Ester
Acidified Alum. PAC23	23	Epoxy Mastic
		Elastomeric Polyurethane/ Polyurea
Aluminium sulphate	45-50	Epoxy Mastic
		Elastomeric Polyurethane/ Polyurea
Ammonium hydroxide (ammonia)	25	Not required
Calcium hydroxide (hydrated lime)	-	Not required
Calcium nitrate	55	Not required
Cationic polymer	30	Not required
Citric acid	50	Epoxy Novolac
		Vinyl Ester
Diammonium Sulphate	40	Epoxy Novolac
		Vinyl Ester
Ethanol	>96	Not required
Ferric chloride	41-43	Epoxy Mastic
		Elastomeric Polyurethane/ Polyurea
Ferrous chloride (pickle liquor)	25-35	Epoxy Mastic
		Elastomeric Polyurethane/ Polyurea
Ferric sulphate	32-36	Epoxy Mastic
		Elastomeric Polyurethane/ Polyurea
Hydrofluorosilicic acid	20	Epoxy Novolac
		Vinyl Ester,
Hydrochloric acid	32-34	Epoxy Novolac
		Vinyl Ester
Magnesium hydroxide	60	Not required

Chemical	Concentration (%)	Reinforced concrete bunds
Methanol	>98	Not required
Non-ionic polymer	-	Not required
Potassium permanganate	-	Not required
Powdered Activated Carbon slurry	5 -10	Epoxy Mastic
		Elastomeric Polyurethane/ Polyurea
Sodium bisulphite	31	Epoxy Mastic
		Elastomeric Polyurethane/ Polyurea
Sodium hydroxide (caustic soda)	45-50	Not required
Sodium hypochlorite	0.8 - 13	Silane/siloxane,
		Epoxy Mastic
		Elastomeric Polyurethane/ Polyurea
Sulphuric acid	70-95	Epoxy Novolac
		Vinyl Ester

2.4 Concrete Joint Design

Design new and repaired concrete components that are to be coated without movement joints as the coating system cannot generally bridge movement joints permanently.

Special constructions such as connections, penetrations, coating endings and transitions are required if movement joints cannot be avoided.

Example transition details are provided in Appendix D.

2.5 Coatings to Treat Cracks

Coatings to treat cracks as defined in TS 0711.3 Table 3 are listed in Table 7.

Table 7: Coatings to Coat over Cracks in Concrete

Crack Type	Coating Types	Detail	TS 0711.5 Clause
Inactive cracking **HAIRLINE width in atmospheric**	B1	All coatings	-
Active cracking FINE width in normal atmospheric exposure	B3	Elastomeric anti-carbonation coating	7
Inactive FINE cracking width in water retaining structures	B12	Waterproof cement slurry coating	8
		All coatings after crack repair	-
Active cracking **Multiple ALL widths in water retaining structures**	B14, B15	Liquid applied or sheet membrane liners, positive pressure side	7, 9

3 Materials

3.1 General Requirements

Comply with general materials requirements detailed in TS 0711.0 Clause 8.4 and 8.5:

1. General
2. Repair systems
3. Proprietary items
4. Manufacturer's recommendations
5. Product Supplier
6. Compliance with AS/NZS 4020
7. Materials submissions
8. Storage of materials
9. Trials.

3.2 Approved Materials

Products not having prior documented SA Water approval shall not be used until approval has been obtained from SA Water's Representative.

HOLD POINT

3.3 Materials Testing

Undertake materials testing in accordance with TS 0711.0 Clause 5.9.

List all tests proposed to be undertaken to demonstrate compliance with the Technical Standard in the ITP.

Provide manufacturer's documented evidence including copies of original test certificates that demonstrate that as a minimum the product exceeds each of the minimum performance requirements.

HOLD POINT

3.4 Coatings and Lining General Requirements

3.4.1 Finished Colour

Colour is to be in accordance with AS 2700, or as specified by SA Water's Representative.

All colours need the approval of SA Water's Representative.

The colour of the coating shall be an approximate match to the specified colour as defined by AS 1580 Method 601.1.

Where a primer, undercoat or sealer is required as an integral part of the coating system (i.e., primer coat plus at least two coats of the protective or decorative part of the system), the primer, undercoat or sealer shall be a different colour to that of the final nominated colour.

3.4.2 Adhesive Bond Strength

The minimum coating or adhered lining material pull-off adhesive bond strength to concrete substrate at least 7 days after application and curing shall exceed the value in Table 8 unless noted otherwise.

Table 8: Minimum Substrate Bond Strength

Substrate compressive strength	**MPa**	**>50**	**30 to 50**	**15 to 30**
Min. substrate adhesive bond strength	MPa	2.0	1.5	0.8

3.5 Penetrating Concrete Surface Treatment

3.5.1 Silane

Use pore-lining penetrating materials in the form of a liquid or a cream to prevent contamination by preventing water containing salts and other deleterious substances from entering the concrete in atmospheric exposure, but being vapour permeable, pore-lining penetrants have a low resistance to carbon dioxide and they are not considered effective against carbonation.

Do not use silane materials for concrete subject to submerged or semi-submerged conditions.

Silane/siloxane materials may be used as primers for some anti-carbonation coatings.

Use opened silane materials within two days of opening.

Silane treatments shall have the following properties:

1. Water based pore-lining penetrating hydrophobic (water repellent) treatment to provide protection against moisture ingress
2. Silane: at least 95% active ingredients
3. Solid silane or thixotropic silane cream: at least 80% active ingredients
4. Incorporate a fugitive type dye to enable visibility once applied
5. Minimum penetration depth: 4 mm, when tested in accordance with Clause 11.13
6. Compatible with subsequently applied film forming protective coatings if used.

3.5.2 Colloidal Silica Liquid

Use a penetrative concrete sealer for concrete waterproofing and surface hardening.

The concrete sealer shall have the following properties:

1. Be a water borne colloidal silica type concrete treatment that is 100% VOC free
2. Be suitable for low pressure spray application
3. For chloride related repairs, be capable of inhibiting reinforcement corrosion
4. Be proven to penetrate >75 mm when topically applied into concrete pores to form a Calcium Silica Hydrate (CSH) gel
5. Decrease water sorptivity by minimum 40% when measured by a standard water sorptivity test method that does not damage the gel material compared to a control concrete
6. Not wash out of concrete, on the basis that it complies with and is certified to AS/NZS 4020.

In addition, colloidal silica material applied to wastewater assets shall include a biocide that is certified to kill the following bacteria on contact for 5 years (kill rate log10cfu/mL, 99.99% kill rate) at the manufacturer's recommended dosage:

1. Staphylococcus aureus (NCTC 6571 – Golden Staph)
2. Escherichia coli (NCTC 9001- E.coli)
3. Listeria monocytogenes (ACM 98 Listeria)
4. Salmonella salford

3.6 Film Forming Coatings and Linings

3.6.1 General Requirements

The concrete coating and lining systems is to meet the following general requirements:

1. Firmly bond with the concrete substrate and in the case of multi-layered systems to itself
2. Non-elastomeric coatings to bridge discontinuous cracks of less than 0.1 mm wide
3. Be compatibility to an alkaline surface, withstand the expected alkaline load by the cemented substrate and not chemically attack it
4. Be resistant to the expected chemical exposures and fluid loads and frequency, including the effect of the vapour phase and of abrasive media (e.g., suspensions) in cleaning agents
5. Be resistant to the expected steady state and temperature change load caused by exposure to the medium, operating conditions or cleaning processes (thermal shock) or other sources of heat or cooling
6. Be resistant to regularly expected mechanical loads. Extraordinary loads such as dragging forks on forklift trucks, direct contact by vehicles with steel wheels (steel rollers) are not covered by these requirements
7. When used outdoors, be resistant to ageing processes caused by heat including weather-related temperature change loads and by ultra violet light
8. Be resistant to expected cleaning and neutralisation processes (pH change). The selection of the cleaning procedure should be agreed between the Manufacturer and SA Water's Representative
9. Be resistant to the effect of micro-organisms.

3.6.2 Substrate Primer

1. The primer applied to the porous alkaline concrete substrate for film forming coatings and membranes shall achieve the following:
   a. Fill small gaps or voids, and provide a smooth, uniform surface
   b. Act as a bonding agent between the concrete and the coating, assuring proper adhesion to both surfaces
   c. To penetrate into the concrete, sealing it and protecting it from damage.
2. The preferred primer for concrete coatings and membranes is a low viscosity 100% volume solids penetrating epoxy primer to seal the concrete surface and assist in preventing out degassing
3. Some manufacturers recommend the dilution of the first coat of their coating system by 10% to 20% to act as a penetrating primer.

3.6.3 Floor Coating Non-Slip Properties

Finish all floor coatings to produce acceptable slip resistance for the expected use and to comply with the guidance outlined in HB 198 2014.

If required, consult the coating manufacturer on the type, quantity, and coverage rates of any non-slip additive required or finishing methodology required to achieve the slip resistance ratings specified in this document.

Match the colour of the non-slip additive to the coating colour.

3.6.4 Anti-Carbonation Coating

The anti-carbonation concrete protective coating system shall have a silane/siloxane primer, have the ability to bridge dynamic cracks up to 0.3 mm wide and have the properties listed in Table 9.

Table 9: Anti-Carbonation Coating Properties

Property	Criterion	Standard
Equivalent Air Layer Thickness	R >150 m	AS/NZS 4548.5 Appendix D
Equivalent Thickness of Concrete	Sc >450 mm	AS/NZS 4548.5 Appendix D
CO_2 Diffusion Co-efficient	D <2 x 10^{-7} cm^2/s	AS/NZS 4548.5 Appendix D
Water Vapour Equivalent Air Layer Thickness	Sd <4 m	AS/NZS 4548.5 Appendix C
Minimum Dry film thickness/coat	DFT <150 µm	AS 1580.108.2

3.7 Cementitious Materials

Cementitious coating and lining material properties are defined in TS 0711.1 Table 6 relevant to their use and where applied in TS 0711.1 Table 4.

3.7.1 Waterproof Cement Slurry Coating

Use a cementitious slurry waterproofing material that meets the requirements for Repair Type 3E or 5B(b).

The material shall be a single component blend of powders to which clean potable water shall be the only permitted site addition.

Coating Tensile Bond Strength to AS 3894.9 > 0.8 MPa.

3.7.2 Waterproof Cement Render Coating

Use a cementitious mortar/render waterproofing material that meets the requirements for Repair Type 3E or 5B(b).

The materials shall be a single component blend of powders to which clean potable water shall be the only permitted site addition.

3.7.3 Calcium Aluminate Cement Render

Use a calcium aluminate cement (CAC) mortar/render material that meets the requirements for Repair Type 5B (a) and complies with BS EN 14647.

The materials shall be a single component blend of powders to which clean potable water shall be the only permitted site addition.

Use an admixed accelerator such as lithium carbonate in order to allow sprayed CAC reinstatement mortar to be completed and sufficiently set to resist normal operations prior to the required 'return to service' time. The 'return to service' time is the time when the asset resumes normal operations. Agree the required set and cure times with the SA Water's Representative pending the outcomes of a trial.

Glass fibres may be used for strength and shrinkage control.

No Portland cement shall be mixed with the CAC material for any purpose.

Submit details of all proposed admixtures as part of the trial mix.

3.7.4 Geopolymer/Inorganic Polymer Render

Use a proprietary geopolymer or inorganic polymer mortar/render material that meets the requirements for Repair Type 5B (c).

3.7.5 Fairing Coat

Cementitious fairing coat materials shall comply with the requirements of TS 0711.1 Clause 3.8.7.

Epoxy resin fairing coat materials shall comply with the requirements of Clause 3.8.

3.8 Epoxy Resin Patching Mortar

Epoxy Resin patching mortar/fairing coat shall be a two-component thixotropic solvent-free epoxy resin material that complies with the requirements of TS 0711.1 Clause 3.9.

3.9 Sheet Membrane Lining

3.9.1 General Requirements

Sheet membrane lining systems shall exhibit the following minimum technical requirements:

1. Provide a waterproof solution for retaining water in the storage based on a flexible polymer sheet lining material
2. Be suitable for contact with potable water (AS/NZS 4020)
3. Not contain any substances that when dissolved in water, would exceed established applicable water quality standard and/or contribute to decreased water quality as per the Australian Drinking Water Guidelines
4. Be suitable for the operating conditions of the tank or component (temperature, water pressure, thermal expansion/contraction etc.)
5. Be resistant to environmental stress cracking
6. Be free of holes and pinholes, as well as bubbles, blisters, excessive contamination by foreign matter, and nicks and cuts on roll edges
7. Have an established past performance record and case history
8. Maintain its functional properties over the stated minimum service life
9. Exhibit chemical, abrasion, puncture, slip and chlorinated water resistance
10. Have sufficient strength and flexibility to tolerate concrete/substrate cracking, and movement
11. Be easily repairable if damage occurs
12. Service life at least 30 years maintenance free, without leaking
13. HDPE/PVC sheet liner and welding rod is to be manufactured from the same resins.

3.9.2 Drop–in/Loose Liner

The drop-in lining system shall exhibit the following minimum technical requirements:

1. Lie flat against tank walls and around buttresses and corners, as well as cover all areas
2. Reinforced Polyvinyl Chloride (PVC) or HDPE
3. Tensile breaking stress > 15 MPa to ASTM D6693 Type IV
4. Hardness Shore > 50
5. Elongation at break > 200% to ASTM D6693 Type IV
6. Minimise the requirement for field seaming as much as reasonably practicable.
7. Pre-fabricate complex elements
8. Minimum 2 mm thick.

The end of service life for the drop-in liner occurs when deterioration progresses to a level that makes the drop-in liner unserviceable and the level of maintenance necessary to maintain the functionality of the drop-in liner becomes uneconomical.

Supply an agreed quantity of additional lining material for future use by SA Water.

The additional lining material must be of the same make/model as that used to reline the storage and should be provided free from any damage or defects.

3.9.3 Anchor-Knob Liner

The anchor-knob liner system shall exhibit the following minimum technical requirements:

1. Hexene grade of HDPE in accordance with GRI-GM13 standards
2. Tensile breaking stress > 20 MPa to ASTM D6693 Type IV
3. Elongation at break >400% to ASTM D6693 Type IV
4. Minimum 1200 studs/m^2
5. Hardness Shore > 50
6. The embedment quality of the HDPE liner anchors should be tested at frequency such that statistical confidence is provided in achieving a pull-out resistance of 200 kPa
7. Minimum 2 mm thick.

3.9.4 Adhered PVC Sheet Liner

The Adhered PVC Sheet Lining System is a unique proprietary lining system that comprises the following components:

1. Primer: two component, 100% solids hybrid epoxy
2. Thixotropic structural polymer/adhesive
3. Chemical activator
4. Rigid PVC Liner Panel/Sheet
5. Seam material

3.10 Other Materials

Provide details of any material types proposed to be used that are not listed in this Specification in accordance with TS 0711.0 Clause 4.3.

3.11 Applicator Submissions

3.11.1 General

Comply with all parts of TS 0711.0: Clause 8.4.7 Submissions and the following specific requirements.

The following information is to be provided by the Applicator:

1. Details if any proposed protective screening, masking or containment to isolate the work area from any adjacent facilities or equipment
2. The minimum time intervals after installation of the coating or lining system before allowing:
   a. Foot traffic (Floor Coatings)
   b. Vehicular traffic (Coatings s for trafficable areas)
   c. Water or chemical exposure
3. Protection necessary for the protective coating system or lining system between installation and final handover
4. Maintenance and cleaning instructions for the installed protective coating system lining system.

3.11.2 Fabricated Liner

Submit fabricator shop drawings that include details of the following before fabrication of the liner:

1. Technical details of the liner
2. Verified site dimensions
3. Proposed layout of all panels
4. Factory and field seam locations, as well as the seaming method
5. Details of terminations of the panels at the perimeter of lined areas
6. Details of lining seals at all penetrations
7. Details and methods of sealing around penetrations and fixings
8. Method and placement of top anchor detail
9. Details of overlays, seam overlaps, and tolerance

3.12 Water

Use potable quality water, drawn from the metropolitan reticulated supply, conforming to AS 1379 for cleaning and surface preparation.

4 Workmanship - General

4.1 Standards and Codes

Comply with the standards, codes and guidelines referenced in this document and as defined in TS 0711.0: Clause 1.3.

4.2 Constructor Competency

4.2.1 General

Comply with all parts of TS 0711.0: Clause 4.1.

4.2.2 Coating & Lining Applicator: Specific Competency

SAW is reliant on the skill and experience of the Constructor's protective coating or lining system's applicator and the competence and experience of its personnel.

The specified coating or lining system shall be applied by a specialised Constructor familiar with the products to be used and an approved applicator of the coating or lining system Manufacturer.

By undertaking the work in accordance with this Technical Standard, the Constructor accepts its suitability for its intended purpose.

Preference shall be given to surface preparation, painting and lining applicators that:

1. Use a quality assurance system in accordance with ISO 9001
2. Use application personnel that are certified to www.training.gov.au "MSM30216 Certificate III in Surface Preparation and Coating Application"
3. Have a current valid accreditation to a nationally recognised coatings application certification scheme that is acceptable to SA Water
4. Show through trial applications that all coating system applicators can achieve the specified quality level at each work stage and can achieve the requirements of AS 2312.1, Section 7.8 Standard of Workmanship
5. All welding and seaming shall be carried out by welders/seamers who are suitably trained in each welding process to be used on the project. Competent welders shall have installed a minimum of 10 projects and seamed a minimum total of 500 metres length of weld. Where personnel do not meet this requirement, they shall be supervised by a competent person at all times.

HOLD POINT

4.3 Quality Assurance

Comply with all parts of TS 0711.0: Clause 5 Quality and the quality control testing requirements in Clause 11.

All work may be subject to partial or full inspection by SA Water's Representative or his representative.

4.3.1 Coating Inspector

Provide coating inspection personnel qualified in accordance with TS 0711.0: Clause 4.1 for daily site QC purposes in accordance with TS 0711.0: Clause 5.11.

Nominate the coating inspection personnel to SA Water's Representative prior to commencement of work.

4.3.2 Hold and Witness Points

Comply with all mandatory quality control and audit hold and witness points listed in Appendix A.

Advise SA Water's Representative when hold points are reached and ready for inspection.

4.3.3 Inspection and Test Plans

Comply with ITP requirements in TS 0711.0 Clause 5.6.

Show the type, sequence and number of tests to be undertaken in each area and how the pass, rework or reject criteria will be determined on the ITP.

An example ITP is provided in Appendix C.

4.3.4 Pre Start Meeting

Hold a pre-start meeting in accordance with TS 0711.0 Clause 8.6.

HOLD POINT

4.3.5 Daily Records

Comply with requirements in TS 0711.0 Clause 5.11 Site Records.

Maintain records of the work on a daily basis to enable traceability of workmanship and materials.

Report QA records in a format similar to AS 3894 Parts 10 to 14.

Provide the following minimum daily records:

1. Job Identification
2. Surface preparation method and equipment used
3. Coating equipment used
4. Coating material used, batch number, colour and thinner and areas coated with each batch and the date and time each item or area was coated
5. Application details including coat number, wet film thickness and dry film thickness
6. Any unusual events or behaviour associated with the coating work or materials or both
7. Weather conditions, ambient temperature, surface temperature, relative humidity, dew point and any other weather or site conditions such as dust, dirt, debris, etc. that may affect the specified finish at the start of each day's work then at a maximum of every 4 hours, or each change in weather conditions
8. Recording of any containment monitoring regime to confirm that abrasive blasting material or paint overspray has been contained within the works site boundary.

4.4 Health and Safety Requirements

Comply with health and safety requirements in TS 0711.0 Clause 6:

Clause 6.1 General

Clause 6.2 Works on existing sewers

Clause 6.3 Lighting

Clause 6.4 Concrete removal

Clause 6.5 Diving

Clause 6.6 Traffic management

Clause 6.7 Barriers and signs

Clause 6.8 Equipment

Clause 6.9 Hazardous materials

4.5 Environmental Requirements

Comply with health and safety requirements in TS 0711.0 Clause 7:

Clause 7.1 Noise emissions

Clause 7.2 Compressor silencing

Clause 7.3 Hand tools

Clause 7.4 Waste management/Disposal of contaminants

Clause 7.5 General cleaning and disposal of refuse

Clause 7.6 Dust and water

Clause 7.7 Existing flora.

4.6 Construction Requirements

Comply with the construction requirements in TS 0711.0 Clause 8:

Clause 8.1 Existing structures

Clause 8.2 Temporary works

Clause 8.3 Extent of works identification

Clause 8.4 Materials requirements

Clause 8.5 Trials

Clause 8.6 Pre-start meeting

Clause 8.7 Commissioning and water quality monitoring.

4.7 Temporary Works

Provide temporary works including propping, access systems and plant isolations in accordance with TS 0711.0 Clause 8.2.

4.8 Pre-Work Survey

Undertake the pre-work survey requirements of TS 0711.0 Clause 8:

1. Clause 8.1.1: Verify existing structures and the location of all services located outside or embedded within the concrete structure components
2. Clause 8.3 : Extent of works identification:
   a. Mark up plan showing extent of work
   b. Undertake and record pre-repair survey
   c. Undertake further testing if required
   d. Mark out all defect areas for repair.

HOLD POINT

4.9 Materials Handling and Mixing

4.9.1 General

Comply with TS 0711.0 Clause 8.4.8 and TS 0711.1 Clause 4.8 for materials storage, mixing, transport and weather precautions and specific requirements in the relevant Clauses of this Technical Standard.

4.9.2 Sheet Membrane Liner

Store rolls of materials vertically and in accordance with the manufacturer's recommendations.

Protect the lining materials by ensuring there are no stones, debris or other items underneath the membrane that could potentially cause damage.

Use appropriate lifting equipment and/or skilled manual labour to transport and move the liner whilst on site.

Do not use equipment on top of the installed liner unless absolutely necessary, in such case the equipment should have smooth rubber tyres.

Wear smooth rubber soled shoes or boots if walking on the lining material.

If the liner is in a situation where it may be damaged, inspect the liner for scratches and repair or reject it.

Ensure liner is not creased or severely folded as this causes local stresses and thinning of the liner.

If the liner is creased, scored or folded, cut out and patch these sections to ensure long-term performance and durability of the liner.

4.10 Trials

Undertake trial repairs for all types of specified repair in accordance with TS 0711.0 Clause 8.5.

Trial locations shall be as agreed with, or instructed by, SA Water's Representative.

HOLD POINT

4.10.1 Applied Protective Coatings Reference Area

At the commencement of the protective coatings project apply the full coating system to a trial / reference area. This will be assessed by SA Water's Representative.

The reference area is to establish a minimum acceptable standard for the work, to check that data provided by a Manufacturer or Constructor is correct, and to enable the performance of the coating system to be assessed at any time after completion.

Prepare the reference area at a location in which the corrosive stresses are typical for the rehabilitated structure.

Carry out all surface preparation and coating application work on the reference areas in the presence of representatives of all parties concerned, who shall give their agreement in writing when the reference areas are applied in accordance with the Technical Standard.

All reference areas shall be accurately documented, photographed and permanently marked on the structure.

The reference area size shall be in reasonable proportion, both practically and economically, to the area of the whole treated structure, with a minimum area of 2 m^2.

4.11 Equipment

Comply with TS 0711.0 Clause 6.8 Equipment.

4.12 Dehumidification

The use of dehumidification and temperature control during surface preparation and coating/lining application can be beneficial in providing air dew points below the surface temperature and reducing the relative humidity (%RH) at the surface thus retarding rust bloom.

Guidance on the use of dehumidification is given in SSPC-TR 3/NACE 6A192.

The minimum dew point/surface temperature differential for holding a blast over an extended period of time is 9°C to 14°C with a relative humidity not to exceed 40% to 55%.

When used, maintain dehumidification continually 24 hours a day during surface preparation, coating application and cure (if recommended by the Manufacturer).

Determine the required air change rate for maintaining these parameters (may be between one to six or more per hour), taking into account the use of ancillary exhaust and/or dust collection systems that can affect the air change rate.

Provide air change rates sufficient to maintain safe Lower Explosive Limits during coating applications.

Only use electric, indirect gas fired or steam coil auxiliary heating.

Do not use direct fired space heaters.

4.13 Generic Product Application Requirements

Generic product application requirements for coating and lining systems listed in Table 4 are provided in Appendix B.

Submit proposed coating systems endorsed by the Manufacturer for the chemical exposure it will be subject to, to SA Water's Representative for approval.

5 Concrete Surface Preparation

5.1 Pre-Application Tasks

Before commencing application of coatings and linings and surface treatments to concrete surfaces:

1. Complete all concrete repair works in accordance with TS 0711.1
2. Allow sufficient time for all cementitious grouts, mortars, fillers and fairing coat repair materials to cure material in accordance with TS 0711.1 Clause 8.4, nominally a minimum 28 days for new concrete or as specified by the material Manufacturer if the material is part of its concrete repair system prior to commencement of preparations for application of a protective surface coating or surface adhered liner
3. Obtain hold point releases and permission to proceed from SA Water's Representative
4. Protect the area surrounding the work from potential damage caused by the concrete substrate preparation works.

5.2 Concrete Substrate Preparation Methods

Perform all concrete surface preparation for protective coatings and renders application in accordance with:

1. SSPC-SP 13/NACE No. 6
2. SSPC-PA 7
3. ASTM D 4258
4. ICRI Guideline No 310.2R-2013.

Comply with the concrete removal health and safety requirements in TS 0711.0 Clause 6.4.

Ensure that the prepared concrete substrate is suitable for application of the coating or lining material, with voids opened up and irregularities smoothed out.

Approved surface preparation methods for concrete are:

1. Abrasive blast cleaning (Wet and Dry)
2. Grinding
3. Scarifying
4. Scabbling
5. High and ultra-high pressure water jetting.

These methods are detailed in ICRI Guideline No 310.2R-2013.

Be aware that aggressive methods may damage the concrete surface and require repair.

Acid etching is **NOT** an approved method to remove cement paste from the surface and surface pores of concrete. Do not use acid etching under any circumstances.

Do not use chemical stripping materials.

5.3 Preliminary Cleaning

Undertake preliminary cleaning to remove surface contamination including dirt, oil, grease, and chemicals prior to surface preparation of the concrete for coating application in accordance with ASTM D 4258 and ICRI 310.2R.

Typical practices include compressed air, water cleaning, scrubbing, sweeping, or vacuuming, detergent cleaning, low pressure water cleaning, and steam cleaning.

Remove cleaning agents used to remove oil and grease spots by a freshwater rinse.

These methods are not intended for use in achieving a concrete surfaces profile.

5.4 Preparation of Concrete Substrate

Use a method in Clause 5.2 at the water or blasting pressure, or mechanical effort, required to achieve the required surface profile specified in the Generic Product Application Requirements in Appendix B for the specified system.

Remove the following from the concrete substrate:

1. All existing incompatible coating materials including grout, sealers, polymeric coatings, adhesives and mastics
2. Dust, laitance, grease, curing compounds, impregnations, waxes, chemicals, fungi, bacteria, foreign particles, disintegrated materials and other bond inhibiting materials
3. Degraded/weak concrete
4. Protrusions such as form lines, fins sharp edges and splatter.

Use sharp tools for mechanical breaking out to avoid unnecessary vibration and damage to the structure.

If scabbling is used to remove surface concrete, inspect the prepared surface for defects and surface bruising (micro-cracked and fractured layer 3 mm to 10 deep). Remove any such weakened material that will reduce bond strength using abrasive blasting or hydro-demolition methods.

Vacuum or hose down the concrete surfaces after surface preparation to ensure complete removal of all spent abrasive medium and loose dust/debris material.

5.5 Heavily Contaminated Concrete

Remove concrete contaminated or degraded to a significant depth by acids, alkali solutions, oils or other deteriorating substances to a sound substrate as indicated by tests listed in Clause 5.10 and reinstate with fresh cementitious material in accordance with TS 0711.1.

Take appropriate measures to neutralize any residues in order to prevent any subsequent deterioration of the concrete or coating.

Where recommended by the manufacturer, scrub the surface with a soda wash solution to achieve the required substrate pH.

Thoroughly rinse the treated surface with clean water is required to ensure no residue remains.

In extreme cases of concrete damage, degradation, or deep penetration by contaminants, it may be necessary to completely remove and replace the concrete prior to application of a protective coating.

5.6 Surface Repairs

Inspect the prepared surface for surface defects and irregularities.

Fill unwanted minor surface voids up to 3 mm in depth, cracks, tie-holes, blowholes, pinholes and excess porosity using a cementitious or epoxy resin based patching material/fairing coat compatible with the coating or lining material and allow to cure and dry.

Cementitious fairing coat material shall comply with Clause 3.7.5.

Avoid rapid drying out of the cementitious fairing coat due to high temperatures, direct sun or strong wind that might affect its bond strength.

Use an epoxy patching/fairing coat material for organic coating systems that complies with Clause 3.8, or as recommended by the coating manufacturer.

Patch defects such as honeycombing, scaling and spalling that become apparent in accordance with TS 0711.1.

Seal cracks that will affect long term durability of the coating or structure in accordance with TS 0711.3.

Repeat surface preparation in accordance with Clause 5.4.

5.7 Masonry

Treat masonry surfaces and joints (if any) the same as specified for a concrete surface and remove the brick glaze if present.

Repoint loose brickwork and voids in the mortar joints and replace missing bricks, using materials in accordance with AS 3700.

Seal all active hydrostatic leaks in accordance with TS 0711.3 prior to protective coating application.

5.8 Cracks and Minor Defects

Repair cracks in accordance with TS 0711.3.

Repair minor surface defects (e.g., Blow holes or uneven surface defects) with an epoxy resin repair mortar in accordance with TS 0711.1 Clause 16.

5.9 Concrete Surface Moisture Condition

Concrete is considered "DRY" for application of a surface coating or adhered liner when the concrete residual moisture after surface preparation does not exceed the limits for successful coating application, bonding and curing in Table 10.

Table 10: Concrete Moisture Test Criteria for “Dry” Concrete

Moisture Test	Criterion for "Dry" Concrete
ASTM D4263 Plastic sheet method	No visible moisture
ASTM F1869 Calcium chloride test	≤ 15 g/24 hr/m^2
ASTM F2170 Relative humidity	≤ 80%

The concrete surface moisture condition immediately before application of the coating material or primer shall be nominally as listed in Table 11, however shall meet the material manufacturer's specific requirements.

Do not apply any coating or liner material to a wet surface, remove any excess water immediately prior to material application.

If required allow the prepared concrete surface to dry prior to application of surface coating.

Do not use direct heat or artificial drying to achieve the required surface moisture condition.

Table 11: Required Concrete Surface Moisture Condition

Repair Material Type	Surface Moisture Condition
Moisture intolerant epoxy based primers, coatings and mortars	Dry / Slightly Moist
Moisture tolerant epoxy based primers, coatings and mortars Certain cement based coatings, acrylic bonding agents	Moist
Cement based materials (grouts, mortars, fillers, fairing coats, slurry priming coats) that do not have a primer or bonding agent	SSD

5.10 Substrate Inspection and Testing

Before applying protective coatings and lining systems conduct inspection and testing in accordance with this Clause to verify the substrate preparation meets the specified requirements.

HOLD POINT

5.10.1 Concrete Surface Profile

Prepare the concrete surface to achieve the ICRI Guideline No 310.2R concrete surface profile range as specified for the application in accordance with Clause 11.4.

Verify using the ICRI replica profiles.

5.10.2 Oil and Grease

Test for oil and grease contamination in accordance with Clauses 11.5 and 11.6.

5.10.3 Cracks

Inspect cracks to ensure that they are fully sealed and not leaking in accordance with Clause 11.7.

5.10.4 Concrete Moisture Level

Test the degree of concrete residual moisture in accordance with Clause 11.8 and ensure that the acceptance criteria in Clause 11.8.2 and the Manufacturer's specified substrate moisture limit values are complied with.

Conduct this test after application of any cementitious rendering material.

Take due attention of moisture content along concrete surface due to, for example, dew fall.

5.10.5 Concrete pH

Measure the pH of the prepared concrete substrate in accordance with Clause 11.9.

5.10.6 Substrate Soundness/Flatness

For heavily contaminated concrete, test indicative concrete strength using a rebound hammer to confirm sound concrete in accordance with Clause 11.10.

Following repair, check the surface flatness in accordance with Clause 11.11.

5.10.7 Bond Strength of the Prepared Substrate

Conduct substrate bond strength testing to all prepared surfaces in accordance with Clause 11.12.

5.11 Concrete CPF Formwork Liner

Use a controlled permeability formwork (CPF) liner to reinstate large areas of critical surfaces of concrete structures such as external or internal walls of a concrete treatment tank that are to be coated.

CPF liners shall be Type III, multiple use, self-adhesive CPF liner in accordance with WSA 201, Clause 6.2.5.2.

Inspect the CPF panels before installation and rectify any defects such as ripples in the filter fabric before the formwork is fully erected and the concrete cast.

The concrete cast against the CPF liner shall have a uniformly textured matt finish free of blowholes and other surface blemishes.

5.12 Equipment Grouting Repairs

Inspect and identify defects in grout under baseplates supporting equipment or support columns, or encasing pipework.

Remove damaged or contaminated grout from under equipment and conveyor support columns.

Prepare and re-coat steel work damaged by grout removal or corroded locally in accordance with Clause 5.13.

Reinstate the grout using a non-shrink cementitious grout or synthetic resin mortar mix in accordance with TS 0711.1.

Install the coating system over the grout and extend a minimum of 300 mm up the support or equipment base where practicable.

5.13 Steel Components

Prepare corroded or damaged steel components such as columns and baseplates by abrasive blast cleaning to AS 1627.4 Class 2½ or by bristle blaster to AS 1627.2, Class St 3.

Use a coating compatible or equivalent to coating Types B8, B9, B10 or B11.

Prime the prepared steel surfaces promptly (< 4 hrs).

Apply the specified topcoats to obtain the specified dry film thickness.

5.14 High Build Coatings - Edge Detailing

5.14.1 Anchorage Grooves

Avoid feather edging of high build coatings.

For coating systems over 2 mm thick, form anchorage grooves (chases) into the concrete substrate along all termination points and 100 mm in from the perimeter.

Cut chases at all penetrations, bay joints, drains, doorways, around columns and at regular centres across floor slabs (typically 6 m centres unless specified in writing by the Manufacturer).

Provide a toe-in joint (example in Figure 2, Appendix D) for coatings, greater than 2 mm thick, at level joints with existing uncoated surfaces, or around the outside perimeter of the area. Coatings less than 2 mm thick may not require a special edge detail.

It is essential that anchorage grooves are correctly placed to aid in the distribution of mechanical stress in coatings from temperature changes and shrinkage.

Cut anchorage grooves using a diamond cutting wheel, or cut chase with a concrete saw, break out with a percussion hammer and grind the chase base smooth.

Cast an anchorage groove when placing the fresh concrete.

Undertake concrete cutting and grinding in accordance with TS 0711.0 Clause 6.4.

5.14.2 Groove Geometry

Confirm anchorage grove requirements with the coating manufacturer.

Example anchorage grove details are provided in Figure 5 to Figure 10 in Appendix D.

Heavy Traffic/High Stress

The chase shall be equal to twice the thickness of the coating in depth and the thickness of the coating in width, subject to a minimum chase cross-section 5 mm wide x 10 mm deep.

Light Traffic/Low Stress

Provide a single concrete saw cut 5 mm wide x 5 mm deep into which the coating will flow and terminate at the edge.

5.14.3 Coving

Form a coved fillet at all horizontal and vertical joins using a slump resistant synthetic resin mortar mix as shown in Figure 3.

Apply the protective coating to form a continuous smooth transition from horizontal to vertical with a typical 50 mm radius and extended 100 mm up the walls with a toe-in joint or chase at each end of the cove.

5.14.4 Drains, Channels and Gullies

Assess the chemical and physical exposure of Drains, Channels and Gullies, that might be more onerous than for the general area and use a higher durability material compatible with the general area coating if required subject to SA Water's Representative approval.

Provide a monolithic coating to avoid joints in vulnerable areas.

Provide anchorage grooves 100 mm in from the edge of the drain.

Install a 10 mm cove in the bottom corners of drains.

5.14.5 Falls

Where applicable for floors provide falls in the substrate with a minimum slope of 1 in 80 to produce a free-draining floor.

5.15 Floor Joints/Joint Sealants

5.15.1 General

The types of joints to consider are:

- Construction (cold) joints
- Expansion (horizontal and vertical) joints
- Construction (control) joints
- Isolation (treat as expansion) joints
- Cracks (unplanned joints and cracks).

All existing floor joints are to be expressed within the new resin floor system.

Use a purpose suitable joint sealant to address the issues of the joint movement, traffic type and frequency, in accordance with TS 0711.2.

Carry all movement joints in the concrete slab through the concrete coating system.

In certain circumstances, where the concrete structure is mature and stable and subject to approval by the coating Manufacturer and SA Water's Representative, the concrete coating system may be laid over any joint where further movement is no longer anticipated.

In all instances agree the necessity for joints and their type and positioning between all parties concerned prior to commencement of the project.

5.15.2 Design

Apply sealant in joints between 8 mm and 50 mm wide.

Design all moving joints to an optimal width to depth ratio of 2:1, with a minimum joint size of 8 mm sealant depth for non-porous surfaces and 20 mm minimum depth in applications where the sealant is subject to a hydrostatic pressure or traffic.

An example method for forming a floor slab joint for high build coatings is shown in Figure 4 in Appendix D.

5.15.3 Application

The joint surfaces must be thoroughly dry and clean and prepared in accordance with TS 0711.2 Clause 5.2.

Extend the concrete coating system (minus topcoat) inside the joint to a minimum of 5 mm beyond the depth of the sealant.

Apply sealant in accordance with TS 0711.2 Clause 5.4.

Once cured apply the concrete coating system topcoat if required using a bond breaker tape, fibre reinforcement or elastomeric membrane to the recommendations of the coating Manufacturer and SA Water's Representative approval.

5.16 Repairs to Damaged Applied Coatings and Substrates

Repair the concrete substrate if damaged, and test core holes, using the same materials and method used in any prior repair work and in general accordance with TS 0711.1.

Remove the damaged area plus 50 mm of sound coating around the perimeter of the defect.

Cut a chase around edge of perimeter and bevel the internal edge.

Lightly abrade the surface of adjacent coating to overlap the systems topcoat.

Reinstate the coating system.

6 Application of Penetrating Concrete Surface Treatments

6.1 Application of Silane Type Materials

6.1.1 Surface Preparation

Wait at least two weeks after completion of any concrete repairs before application of silane pore-lining penetrant material.

Complete concrete surface preparation as per Clause 5 to provide a dry sound absorbent substrate free of any contaminates or previous coatings that would prevent penetration of the silane material.

Mask off bearings, painted steel surfaces, plastic and joint sealants adjacent to members to be impregnated with silane before application.

Protect areas to be treated from adverse weather conditions and process liquids splash or aerosols before, during and after application.

The concrete surface shall be dry for a minimum 24 hours before application commences.

HOLD POINT

6.1.2 Application Method

Monitor atmospheric conditions in accordance with Clause 11.3.

Handle and apply the material in accordance with the Manufacturer's recommendations.

Manage environmental risks associated with overspray during handling and application.

Liquid Silane

Apply liquid silane material as follows:

1. Application rate shall be two flood applications at a minimum application rate of 0.3 litres/m^2 with a minimum interval between coats of at least 6 hours
2. Use an airless spray system with an operating pressure in the range 35 to 70 kPa to minimise atomization or misting of the material
3. Do not apply by brush
4. Use a continuous spray technique giving saturation flooding, working from the lowest level and proceeding upward toward higher levels
5. The treated area shall have a 'wet look' for a few seconds after the application.

Silane Cream

Apply water-dispersed silane cream as follows:

1. Application rate shall be one thick application at an application rate of 0.25 to 0.45 litres/m^2 depending on substrate porosity
2. Apply a second coat if required to meet the application rate
3. Use an airless pump system with an operating pressure not exceeding 70 kPa to ensure that no atomization or misting of the material occurs
4. Use brushes, rollers or trowels for small areas
5. Use a wet film gauge to check the application thickness in accordance with Clause 11.16
6. Immediately cease work and protect the treated surface if suddenly exposed to process liquids, aerosols or rain
7. Allow adequate time for the silane cream to become fully absorbed.

Record the total solution volume applied for each area treated.

Remove silane material from tools immediately after use.

Treated slabs should be trafficable once the silane has fully penetrated the surface and is surface dry. This is typically achievable several hours after application.

Core sample and test for silane penetration depth in accordance with Clause 11.13.

WITNESS POINT

6.1.3 Silane Application Trial

Undertake a trial area application of the silane treatment to a minimum 4 m^2 area in accordance with the method in Clause 6.1.2.

Obtain a minimum 2 no. cores from the trial area and test the cores for silane penetration depth in accordance with Clause 11.13.

6.2 Application of Colloidal Silica Material

6.2.1 Surface Preparation

Complete concrete surface preparation as per Clause 5 to provide a sound absorbent substrate free of any contaminates or previous coatings that would prevent penetration of the colloidal silica solution.

The concrete surface shall be SSD without standing water.

HOLD POINT

6.2.2 Application Method

Monitor atmospheric conditions in accordance with Clause 11.3.

Handle and apply the material in accordance with the Manufacturer's recommendations.

Mange environmental risks associated with run off of excess liquid containing biocide during handling and application.

Apply colloidal silica solution at a typical coverage rate of 1.6 m^2/l on normal porosity/permeability concrete to the point of concrete saturation (where run-off is about to occur) in back to back light spray passes.

Apply the colloidal silica solution using a low pressure airless sprayer.

Apply at least two applications, allowing the first application to be fully absorbed into the surface (loss of surface sheen but not dry) before applying a subsequent application.

If required dampen the surface with water prior to re-applying.

Saturate the area but do not allow the colloidal silica solution to puddle on the surface, disperse puddled areas by broom 15-30 minutes after application.

Begin application at the lowest point. Apply to vertical surfaces from the bottom up.

Overlap fan spray patterns 25 to 30% to ensure complete coverage.

Note that application of the colloidal silica solution may cause contaminants such as oil and grease to be purged from the concrete.

Wait at least 12 hours after completion of the application then remove any surface salts. Flush the surface thoroughly with water and allow to completely dry before coating.

Reinspect and if necessary, repeat removal expunged salts and washing of the surface.

Core sample and test for colloidal silica solution penetration depth in accordance with Clause 11.14.

Core sample and test for concrete sorptivity in accordance Clause 11.15.

WITNESS POINT

Allow a minimum 48 hours before applying coatings or as per the Manufacturer's recommendation. Inspect the treated concrete surfaces and remove any expressed salts.

Treated slabs should be trafficable once the colloidal silica solution has penetrated the surface and is surface dry. This is typically achievable one hour after application.

6.2.3 Colloidal Silica Application Trial

Undertake a trial area application of the colloidal silica solution treatment to minimum 4 m^2 area in accordance with the method in Clause 0.

Obtain minimum 3 no. cores from the trial area and 3 no. cores from an untreated area in accordance with Clause 11.14.

Test the cores on site for depth of colloidal silica solution penetration depth in accordance with Clause 11.14.

Test the cores for sorptivity in accordance with Clause 11.15.

In consultation with SA Water's Representative, establish compliance criteria for the full application.

HOLD POINT

7 Application of Film Forming Coatings and Membranes

7.1 Compliance Requirements

Apply materials in accordance with the following:

1. Liquid applied film forming protective coatings to SSPC-PA 7
2. Liquid applied waterproof membranes to SSPC-TU 2/NACE 6G197
3. Manufacturer's product Technical Data sheets and recommendations
4. The approval of SA Water's Representative.

This includes, but is not limited to:

1. Pre-cleaning, abrasive blast cleaning, application of protective coatings using trowel, brush, roller or spray methods and onsite repairs
2. Thinning, elapsed time between coats, substrate temperature and surface coating temperature
3. Effect of ambient temperature conditions on:
    a. The mixed liquid pot life
    b. Recoat intervals.

Approval by the SA Water's Representative is required for spray painting on site.

Where spray painting is approved, ensure protective measures are taken so that plant and painted surfaces in the vicinity are not affected. The Constructor is not relieved of his responsibility for the safety of personnel and damage to other plant and equipment caused by overspray etc.

7.2 General Application Requirements

Apply surface coatings to the substrate as soon as practicable after surface preparation operations.

Keep painted surfaces free of any contamination between subsequent coats.

Wear appropriate gloves when handling painted surfaces between coating applications.

Mix multi-component surface coating systems prior to application to produce a homogeneous product. Apply these products within the Manufacturer's stated 'pot-life' for that material.

Apply additional finishing coats on surfaces where adequate "cover" or "hiding power" has not been achieved by the application of the scheduled paint system until a satisfactory "cover" has been achieved.

Apply successive surface coatings between the specified minimum and maximum recoat times, and where possible use a different shade or colour to the preceding coat.

When there is contravention of the Manufacturer's specified recoat intervals, or the uncured coating has been affected by contamination, heavy dew, rainfall or heat, repair the affected area in accordance with the system specified as recommended by the Manufacturer and to the approval of SA Water's Representative.

Blend any patch painting in with the original painting with respect to color and finish. Pay particular attention to the painting of corners, surface irregularities and edges.

7.3 Mixing of Liquid Materials

7.3.1 General

Do not use subdivided packs of pre-batched components, or blend in any other additional materials such as diluents or aggregates.

Thoroughly mix together the liquid components before blending in the fillers and aggregates, unless the Manufacturer specifies otherwise.

Use the coating manufacturer's literature to determine an accurate indication of the usable (pot) life of the properly mixed product at one or more temperatures.

Limit the quantity of product that is mixed at any one time such that it can be applied within its usable working life without generating excessive heat.

Do not mix or apply resin products outside of the temperature range 10°C to 25°C without the Manufacturers written approval unless the product has been designed to be used for a wider temperature range.

Mix batches of the product at a rate that allows sufficient time for the mixed material to be transferred to the area where the material is being applied and also gives sufficient working time to apply the product on the concrete surface.

7.3.2 Mixing Unfilled Liquid Systems

Thoroughly blend together components parts of unfilled liquid system such as primers, seals or coatings using a mechanical mixer to form a homogeneous mix.

Ensure that any material adhering to the sides and bottom of the mixing vessel is thoroughly mixed in.

Mix the two components using a slow speed (200 rpm to 500 rpm) drill fitted with a mixing paddle designed to minimize air entrainment.

Where one or both of the components has a low flashpoint, use a mixing drill with a flameproof motor or a pneumatically powered drill.

7.3.3 Mixing Filled Liquid Systems

Mechanically mix all filled liquid products following the procedures recommended by the Manufacturer.

Use forced action mixers of the rotating pan, paddle or trough type for all flow-applied and trowel-applied screeds.

Do not use free fall mixers.

Certain flow-applied flooring products may be mixed using a heavy duty slow speed drill (200 rpm to 500 rpm) fitted with a mixing paddle in line with the Manufacturer's recommendations.

Thoroughly mix together the liquid components and then gradually add the fillers and/or aggregates whilst continuing the mixing action.

When all the fillers and/or aggregates have been added, continue mixing (for typically 3 to 4 minutes) to ensure thorough "wetting" out of the fillers and/or aggregates by the resin.

Avoid unduly extended or vigorous mixing in order to minimize undesirable air entrainment.

Ensure that any material adhering to the sides, bottom and corners of the mixer is thoroughly blended in.

7.4 Environmental Conditions

Apply coatings only when atmospheric and surface temperatures and humidity are in accordance with the coating Manufacturer's Technical Data Sheet requirements.

Monitor atmospheric conditions in accordance with Clause 11.3.

Do not carry out application of film forming coatings (unless dehumidification is used) if:

1. The concrete substrate surface moisture content does not meet the manufacturer's recommendation
2. The ambient or concrete substrate temperature is outside the range ≥10°C to ≤35°C
3. The concrete substrate surface temperature is ≤3°C above the dew point
4. Ambient relative humidity ≥85%.

7.5 Out Gassing

Out-gassing must always be considered a possibility during application of a film forming coating to any concrete substrate.

Out-gassing can be reduced by:

1. Apply coatings during times when the surface temperature of the concrete is stable or decreasing
2. Out-gassing can be minimized by spray applying a "mist coat" of primer and allowing the concrete to out-gas for several minutes. Then back rolling immediately followed by spraying the full coat of primer or rolling a coat of primer with the recommended roller cover.

7.6 Stripe Coating

Stripe coating is a means to ensure that an adequate dry film thickness is achieved on edges, corners, pitted and uneven surfaces, and other irregular surfaces.

Apply the stripe coat by stiff brush. Ensure the stripe coat is worked into crevices and into pits using the tip of the brush.

Allow the stripe coat to reach "touch dry" before the application of the full coat. Schedule all work to maintain the cleanness of the substrate.

The dry film thickness of the stripe coat is to be sufficient to ensure the total coating DFT meets the specification requirements.

7.7 Non-Skid Finish

Provide a non-skid finish in designated floor areas or walkways traffic areas, as directed by SA Water's Representative, if required, in accordance with the coating Manufacturer's recommendations.

Broadcast a 1 mm aluminium oxide aggregate onto the surface of the wet topcoat until refusal occurs then allow the coating to cure.

Sweep up and remove excess aluminium oxide aggregate.

Apply a final topcoat to fully seal the surface.

Test the applied non-skid finish in accordance with Clause 11.21.

7.8 Film Forming Coating Application

Apply the liquid applied coating system in accordance with in accordance with SSPC-PA 7 and the Manufacturers recommendations including the following requirements:

1. Apply in accordance with the relevant generic application requirements for the coating type in Appendix B and the requirements in this Clause 7
2. Prepare the substrate in accordance with Clause 5, and undertake Tests listed in Clause 5.10
3. Roller apply the primer, working in to voids cracks and depressions with a stiff brush where necessary
4. Apply subsequent coats in a smooth and even film, free from defects and presenting a sound and long lasting finish
5. Check coverage rates by ensuring the correct volume of coating is applied to a given area. Record the volume of coating used over a surface area at the end of each day of application
6. Monitor the wet film thickness (WFT) during application of the protective coating system in accordance with Clause 11.16. Where the minimum WFT is less than that specified, apply additional coats to achieve the specified thickness
7. Ensure that edges are clean with a sharp cut off. Remove any marking material applied beyond the defined edges of the marking
8. Undertake testing and inspections following full curing
   a. Clause 11.17 -Visual inspection of applied coating
   b. Clause 11.18 - Dry Film Thickness
   c. Clause 0 - Coating adhesion

   HOLD POINT
9. Repair or correct all deficiencies and defects revealed by the above inspection and test methods. Zero defects required unless otherwise approved by SA Water's Representative.

7.9 Film Forming Coatings and Membranes for Concrete

Apply coatings and liquid applied film forming membranes for concrete immersion service, bunding and secondary containment in accordance with SSPC-TU 2/NACE 6G197 and the Manufacturers recommendations, including the following requirements:

1. Apply in accordance with the relevant generic application requirements for the coating type in Appendix B and the requirements in this Clause 7
2. Prepare the substrate in accordance with Clause 5, other than application of filler/fairing coat, and undertake Tests listed in Clause 5.10
3. Apply a conductive primer where practical
4. Roller apply the primer, working in to voids cracks and depressions with a stiff brush where necessary
5. Apply by trowel a filler/fairing coat to fill voids, depressions and blow holes
6. Apply subsequent coats in a smooth and even film, free from defects and presenting a sound and long lasting finish
7. Check coverage rates by ensuring the correct volume of coating is applied to a given area. Record the volume of coating used over a surface area at the end of each day of application
8. Monitor the wet film thickness (WFT) during application of the protective coating system in accordance with Clause 11.16. Where the minimum WFT is less than that specified, apply additional coats to achieve the specified thickness
9. Ensure that edges are clean with a sharp cut off. Remove any marking material applied beyond the defined edges of the marking
10. Undertake testing and inspections following full curing of the coating or membrane:
    a. Clause 11.17 - Visual inspection of applied coating
    b. Clause 11.18 - Dry Film Thickness
    c. Clause 0 - Coating adhesion
    d. Clause 11.20 - Continuity test

    HOLD POINT
11. Repair or correct all deficiencies and defects revealed by the above inspection and test methods. Zero defects required unless otherwise approved by SA Water's Representative.

The final continuity test shall be a hold point in the Constructor's ITP and may be performed or witnessed by SA Water's Representative.

7.10 Tank Boot Seal

Apply an Elastomeric Polyurethane/Polyurea system to stop water ingress between a steel tank and its concrete ring beam (Coating System B17 in Appendix B).

Apply in accordance with the relevant generic application requirements for the coating type in Appendix B and the requirements in this Clause 7.

1. Prepare the substrate in accordance with Clause 5, other than application of filler/fairing coat, and undertake Tests listed in Clause 5.10
2. Prepare the steel surfaces of the Steel tank and steel annulus ring by abrasive blast clean to AS 1627.4 Class Sa 2½ with a surface profile of 50 µm to 75 µm. Apply an approved protective coating system
3. Roller apply the primer to the concrete ring beam, working in to voids cracks and depressions with a stiff brush where necessary
4. Apply by trowel a filler/fairing coat to fill voids, depressions and blow holes
5. Install an approved sealant between the underside of the steel annulus ring and the top of the concrete ring beam. Taper at approximately 45° to support the geotextile
6. Apply bands of geotextile glued onto the concrete primer and steel tank. (Refer Figure 11)
7. Use an approved 100% volume solids epoxy recommended by the Manufacturer as the adhesive
8. Apply Elastomeric Polyurethane/Polyurea system approved by SA Water's Representative prior to use approximately 100 mm up the walls of the tank and 100 mm below the top of the concrete ring beam
9. Apply subsequent coats in a smooth and even film, free from defects and presenting a sound and long lasting finish
10. Check coverage rates by ensuring the correct volume of coating is applied to a given area. Record the volume of coating used over a surface area at the end of each day of application
11. Monitor the wet film thickness (WFT) during application of the protective coating system in accordance with Clause 11.16. Where the minimum WFT is less than that specified, apply additional coats to achieve the specified thickness
12. Ensure that edges are clean with a sharp cut off. Remove any marking material applied beyond the defined edges of the marking
13. Undertake testing and inspections following full curing of the coating or membrane:
    a. Clause 11.17 - Visual inspection of applied coating
    b. Clause 11.18 - Dry Film Thickness
    c. Clause 11.19 - Coating adhesion
14. Repair or correct all deficiencies and defects revealed by the above inspection and test methods. Zero defects required unless otherwise approved by SA Water's Representative.

HOLD POINT

7.11 Liquid Applied Coatings - Compliance Criteria

Under the following circumstances, the applied coating shall be deemed to fail to comply with the Technical Standard:

1. Sagging of the coating
2. Coating contains any for the following defects: dirt or inclusions, pinholes, orange peel, overspray, blisters
3. Maximum interval between successive coats has been exceeded
4. The minimum coating dry film thickness is less than that specified
5. The DFT exceeds 150% of the specified thickness. (SA Water's Representative reserves the right to reject the coated item)
6. The bond to the substrate is less than that specified
7. The bond between any two coating layers is less than that specified
8. The finished colour is not as agreed with SA Water's Representative

Under these circumstances, remove all traces of the defective coating.

7.12 Coating or Membrane Rectification

Submit the procedure for identification of and removal of the defective coating to SA Water's Representative for approval.

Re-apply the coating or membrane to this Technical Standard.

Repair all deficiencies and defects revealed by testing in accordance with this Technical Standard and retest.

Treat the unsatisfactory areas by isolating the area concerned by saw cutting, followed by removing and re-laying the affected protective coating system, or by resin injection in accordance with TS 0711.3.

When removing an area of the protective coating system, take care to minimize any disturbance to the bonding of the adjacent parts of the coating or membrane.

8 Application of Cementitious Protective Materials

8.1 Waterproof Cement Render or Slurry Coating

8.1.1 General

Before application of the waterproof cement render mortar lining or slurry coating materials:

1. If required, undertake concrete patch repairs at active water leakage areas with waterproof mortar in accordance with TS 0711.1 Clause 13
2. If required, treat any leaking cracks by routing and filling with waterproof mortar in accordance with TS 0711.3 Clause 8
3. Monitor atmospheric conditions in accordance with Clause 11.3
4. Handle and apply the material in accordance with the Manufacturer's recommendations, including application rate and thickness
5. Mix waterproof cementitious repair material components at the water to powder ratios recommended by the system Manufacturer
6. When spraying slurry, hold the nozzle close enough that slurry is forced into cracks and pores
7. Do not apply the slurry waterproofing material under rainy conditions or when the ambient temperature is below 4°C or above 30°C
8. Do not feather edge the coating or render
9. Cut cold joints straight and flush to achieve a neat finish between panels after final set
10. Accurately measure the consumption of cementitious slurry waterproofing applied. The applied coverage rate per m^2 shall not be less than the cementitious slurry waterproofing Manufacturer's recommended coverage rate.

8.1.2 Surface Preparation

Complete concrete surface preparation as per Clause 5 to provide a sound absorbent substrate free of any contaminates or previous coatings, with a CSP-3 to 5 profile for slurry coating and CSP 5-10 for render.

The concrete surface shall be SSD without standing water.

If required by the manufacturer, apply a priming agent to the concrete substrate to accelerate the crystalline process.

HOLD POINT

8.1.3 Waterproof Slurry Coating Application

Provide waterproof slurry coating material suited to the intended type of repair and performance requirements when placed by hand or spray methods in accordance with Clause 3.7.1.

Treat an area that extends at least 75 mm past the extent of the finely cracked area.

Provide and apply by brush or specialised spray equipment to the substrate a slurry mix of "concentrated" hydrophilic crystalline cementitious material to a minimum 1.25 mm DFT thickness per coat.

Work the slurry bonding agent into the concrete substrate, including fine cracks, using a short bristle brush or broom to enhance the bond at the repair interface, taking into account environmental constraints.

Apply a second coating of the cementitious waterproofing coating material after the first coat has reached an initial setting time and while it is still "green", typically within 24-30 hours. Lightly pre-water prior to the second coat application if rapid drying conditions are encountered.

Apply a third coating of the cementitious waterproofing coating material after the second coat has reached an initial setting time and while it is still "green", typically within 24-30 hours. Lightly pre-water prior to the third coat application if rapid drying conditions are encountered.

Undertake testing and inspections following full curing:

1. Clause 11.17 -Visual inspection of applied coating
2. Clause 0 - Coating adhesion.

HOLD POINT

8.1.4 Waterproof Render Mortar Application

Provide waterproof render mortar material suited to the intended type of repair and performance requirements when placed by hand or spray methods in accordance with Clause 3.7.2.

Provide and apply by brush to the substrate a bonding agent scrub coat/slurry mix of the waterproof render mortar material immediately prior to application of waterproof render mortar. Work the slurry into the concrete substrate, using a short bristle brush to enhance the bond at the repair interface, taking into account environmental constraints. Ensure that the bonding agent does not dry out prior to the application of the waterproof render mortar material.

Remove and replace all concrete repair material that has not bonded properly due to the incorrect application or drying out of the bonding agent.

SA Water may inspect the application of the bonding agent.

WITNESS POINT

Mix and transport repair mortar in accordance with Clause 4.9.

Place the waterproof patch repair mortar to reinstate the concrete by hand (in accordance with TS 0711.1 Clause 9.2) or spray methods (in accordance with the requirements of TS 0711.1 Clause 10), and in strict accordance with the manufacturer's written application instructions.

The applied material shall have no voids, be properly compacted and not sag.

Build up to the original surface profile in layers not exceeding the repair material manufacturer's recommendations and in accordance with the approved Work Method Statement, nominally ion the range 10 mm to 50 mm thick.

Monitor the render thickness during application using a wet film comb or other gauge in accordance with Clause 11.16. Where the minimum thickness is less than that specified, apply additional coats to achieve the specified thickness.

If required roughen each previous layer to provide a mechanical key for the next layer. Cure each layer for a period recommended by the repair material manufacturer before subsequent layers are applied.

If required apply an additional layer of cementitious waterproof slurry after the prior coat or layer has reached an initial setting time and while it is still "green", typically within 24-30 hours.

If required following three days moist curing, brush apply a slurry mix of "concentrated" hydrophilic crystalline cementitious material to coat the SSD repair area and the area 50 mm outside the repair area to minimum 1.25 mm thickness.

Undertake testing and inspections following full curing to TS 0711.1 Clauses 18.3, 18.4, 18.8, 18.10.

HOLD POINT

8.1.5 Curing

Following initial set, cure the material using a fine mist spray three times daily for a minimum three days or apply the manufacturer's nominated curing agent in accordance with its recommendations.

During curing, protect the material from damage, adverse climatic conditions and other external environments. Do not lay plastic sheeting directly on the waterproof material as air contact is required for proper curing.

Allow a minimum 14 days curing time before the waterproof material is trafficked.

If the area is required to be trafficable prior to 14 days, provide suitable protection as recommended by the Manufacturer.

8.2 CAC Render

8.2.1 General

Before application of the CAC mortar lining material:

1. If required, undertake concrete repairs in accordance with TS 0711.1, although in some cases concrete reinstatement and surface protection may be using the same CAC material
2. If required, undertake concrete patch repairs at active water leakage areas with waterproof mortar in accordance with TS 0711.1 Clause 13
3. If required, treat any leaking cracks by routing and filling with waterproof mortar in accordance with TS 0711.3 Clause 8
4. Monitor atmospheric conditions in accordance with Clause 11.3
5. Handle and apply the material in accordance with the Manufacturer's recommendations, including application rate and thickness
6. Mix CAC repair material components at the water to powder ratios recommended by the system Manufacturer
7. Do not apply the CAC material under rainy conditions or when the ambient temperature is below 4°C or above 30°C
8. Do not feather edge the render
9. Cut cold joints straight and flush to achieve a neat finish between panels after final set
10. Accurately measure the consumption of cementitious slurry waterproofing applied. The applied coverage rate per m^2 shall not be less than the cementitious slurry waterproofing Manufacturer's recommended coverage rate.

8.2.2 Surface Preparation

Complete concrete surface preparation as per Clause 5 to provide a sound absorbent substrate free of any contaminates or previous coatings, with a CSP-5 to 10 profile.

The concrete surface shall be SSD without standing water.

HOLD POINT

8.2.3 CAC Render Application

Provide CAC render mortar material suited to the intended type of repair and performance requirements when placed by hand or spray methods in accordance with Clause 3.7.3.

Apply CAC render using sprayed concrete method to a nominal thickness in the range 25 to 50 mm in accordance with TS 0711.1 Clause 10.

In manholes, spraying may be undertaken using spinning head equipment and trowel-finished. Submit propose details to SA Water's Representative.

WITNESS POINT

8.2.4 Inspection and Testing

Accurately measure the consumption of CAC material applied.

The applied coverage rate per m^2 shall not be less than the CAC material Manufacturer's recommended coverage rate.

Undertake testing and inspections following full curing to TS 0711.1 Clauses 18.3, 18.4, 18.8, 18.10.

WITNESS POINT

8.3 Sprayed Geopolymer / Inorganic Polymer Render

Sprayed Geopolymer/Inorganic Polymer Renders are a novel proprietary materials with a limited track record.

Supply and apply the material in broad accordance with Clause 0, subject to a trial application to verify the method and achieved material properties to the satisfaction of SA Water's Representative.

9 Application of Sheet Membrane Liner Systems

9.1 General Requirements

Installation of sheet membrane liner systems shall include the following general steps, however, carry out the method to the manufacturer's recommendations:

1. Take care at all stages of storage, handling, fabrication, transportation, deployment, as well as during and after installation to prevent damage of the liner
2. Cut floor and wall panels
3. Fabricate the lining for internal features, including buttresses, inlet, ladder, etc.
4. Test welding equipment, and examine trial seams using destructive (peel test) and non-destructive methods including mechanical stress, air lance, air pressure and vacuum box testing
5. Clean, weld and test seams
6. Repair any defects
7. Pack liner for transportation.

9.2 Internal Storage Tank Features

Internal penetrating structures and features of the storage tank may include:

1. Inlet pipework
2. Scour valve/pits/sumps
3. Caged outlet
4. Overflow pipework
5. Buttresses (along walls)
6. Access ladder or platforms.

Accommodate all penetrating structures in the liner using extrusion fillet welding or physical fixing.

Panels around appurtenances, such as sumps and buttresses, shall be cut with rounded corners to minimise stress concentrators.

Fabricate all boots and shrouds from the same material and thickness as that specified for the work and fit snugly without wrinkling and remain in contact with the subsurface.

Use special fittings such as reglets and clamps fabricated in grade 316 stainless steel to achieve water tightness.

9.3 Environmental Conditions

Apply materials only when atmospheric and surface temperatures and humidity are in accordance with the coating Manufacturer's Technical Data Sheet requirements.

Monitor atmospheric conditions in accordance with Clause 11.3.

Do not carry out application of liners if:

1. The concrete substrate surface moisture content does not meet the manufacturer's recommendation
2. The ambient or concrete substrate temperature is outside the range ≥10°C to ≤30°C
3. The concrete substrate surface temperature is ≤3°C above the dew point
4. Ambient relative humidity ≥85%.

9.4 Welding of HDPE/PVC Liners

9.4.1 Wetness of Work Area

Ensure that the areas to be welded are kept dry prior to and during liner welding operations.

9.4.2 Pre-Weld Inspection

Inspect the internal surface of each lining to check for defects or irregularities.

9.4.3 Field Welds

Welding techniques shall be as appropriate to the lining material and may include wedge welding, hot air fusion welding and extrusion.

Thoroughly clean all lining surfaces to remove any dirt, dust, moisture or oily deposits.

All field welds shall be uniform in width and properties.

Liner panels shall have a minimum overlap of 75 mm for extrusion welding, refer to typical detail in Figure 12.

Upslope panels shall overlap downslope to provide a shingle effect for drainage.

Remove the oxidised surface layer prior to welding by scraping or grinding the weld area.

Chamfer the upper sheet to ensure the full welded width.

Use fillet extrusion welding for repairs, T-seams, and detail work.

Environmental conditions for seam welding shall be:

1. Sheets are dry
2. Ambient sheet temperature is in the range 8°C to 27°C.

Undertake trial welds to prove compliance with the conditions set out in clauses 11.24 and 11.25.

9.4.4 Initial Trial Welds

Each welding technician is required to prove their ability to consistently produce successful welds before commencing production-welding operations.

Each welding technician is to prepare three test strips as per the procedure for daily trial welds outlined herein using the equipment intended for the works. These are to be tested in accordance with Clause 11.24.

9.4.5 Daily Trial Welds

Perform trial welds before starting production welds each day.

Conduct all trial welds under the same conditions as will be encountered during actual welding in accordance with Clause 11.24.

Once qualified by passing a trial weld, welding technicians must not change equipment parameters without performing an additional trial.

9.4.6 Non-Destructive Tests

Use the following non-destructive tests to monitor and confirm the integrity of all field joints/seams completed on the installation:

1. Vacuum box test (Clause 11.25)
2. Spark testing (Clause 0)

9.5 Drop-in/Loose Liner Installation

9.5.1 General

Install the drop-in liner in accordance with the drawings and instructions to be provided by the Fabricator as described in Clause 3.11.2.

Notify any changes to the SA Water's Representative before they are made.

Avoid defects during installation such as waves, wrinkles, sagging, slack, as well as holes and tears.

9.5.2 Drop-in Liner Concrete Substrate Preparation

Inspect the floor and walls of the storage structure prior to the installation of the liner.

Prepare all surfaces that are to be lined must be prepared so that they are:

1. Clean and dry
2. Smooth
3. Free of rocks and stones
4. Free of plant vegetation and debris.

Undertake repair to the concrete surface if required in accordance with TS 0711.1.

Provide a geotextile underlay for added protection from surface irregularities, movement, rocks and tree roots.

HOLD POINT

9.5.3 Seams

Undertake welding of seams in accordance with Clause 9.2 and to the manufacturers' instructions.

Test all equipment and seaming prior to the commencement of welding each day, when conditions change, after identification of a defective weld, or following a power failure.

Carry out destructive and non-destructive inspection and testing as detailed in Section 9.2.

9.5.4 Attachment to Substrate

Attach the liner to walls using stainless steel batten strips with neoprene gaskets along the top of the walls.

Use a geotextile fabric to protect the liner and only use materials that will be durable and resistant to corrosion. An anchor trench may also be used if appropriate.

During installation, use adequate temporary anchorages at the top of the internal wall, as well as the floor to avoid movement of the liner.

9.5.5 Inspection

Test site welds in accordance with Clauses 11.24, 11.25 and 0 and the Inspection and Test Plan.

WITNESS POINT

9.6 Anchor Knob Liner Installation

9.6.1 General

Apply in accordance with the relevant generic application requirements for the liner type in Appendix B and the requirements in this Clause.

Apply HDPE anchor knob liners to vertical and soffit surfaces first, followed by horizontal or sloped surfaces.

Deploy liner rolls using a spreader bar assembly attached to a front-end loader bucket or by other methods approved by the liner manufacturer.

Pre-fabricate complex details. The anchor knobs act as spacers between the liner and substrate, the void being filled by a fine grout.

9.6.2 Concrete Surface Preparation

Prepare the concrete substrate in accordance with Clause 5, and undertake tests listed in Clause 5.10.

9.6.3 HDPE Liner Placement – Vertical and Soffit Surfaces

Clean formwork before placing the liner.

Loosely lay the liner over the formwork with sufficient slack (about 2 percent) to accommodate thermal expansion and contraction encountered during construction.

Provide formwork and temporary propping to securely hold the HDPE in place in accordance with the design drawings by methods that do not damage the liner.

Lay out and position each panel to minimize the number and length of the field joints and to be consistent with accepted installation practice. Ensure a maximum 3 mm gap width between panels.

Use methods to place panels that minimize wrinkles especially along field seams/joints.

Fix HDPE liner to formwork using adhesive strip, clamps, contact adhesive, tape nylon line or other suitable method.

Use “H” profile strips or flat extrusion butt welds, flat extrusion overlap welds, or corner welds to join panels in accordance with Clause 9.2. Remove or trim anchor knobs as required.

Do not nail the HDPE sheet or use ties that penetrate the lining.

Use timber battens, closed cell foam minimum 15 mm thick and sealant to make the formwork watertight.

Use a geosynthetic rub sheet if necessary, under the membrane to prevent damage when dragging or moving panels.

Securely fasten ducts, inlet and outlet pipes for placing grout at locations shown on the plans or on the approved Shop Drawings or as otherwise approved by SA Water’s Representative.

9.6.1 Grout Installation

The concrete surface immediately prior to grouting shall be SSD without standing water.

Use cementitious grout that complies with the material requirements in TS 0711.1 Clause 3.8.8.

Apply grout in general accordance with TS 0711.1 Clause 15, adapted to grouting the HDPE anchor knob liner material.

9.6.2 HDPE Liner Placement – Horizontal or Sloped Surfaces

Lay out and position each panel in accordance with the design drawings to minimize the number and length of the field joints and to be consistent with accepted installation practice. Ensure a maximum 3 mm gap width between panels.

Use "H" type profile strips or flat extrusion butt welds, flat extrusion overlap welds, or corner welds to join panels in accordance with Clause 9.2. Remove or trim anchor knobs as required.

Mix and place a thixotropic cementitious mortar or grout in accordance with TS 0711.1 Clause 9, including the use of bonding agent if required, modified as follows:

1. The repair material fluid consistency shall enable the mortar to be placed at a consistent thickness to suit the anchor knob dimensions to the required surface profile
2. Minimum adhesive bond strength 0.8 MPa.

Roll the pre-cut and welded liner material into the wet grout and ensure that no air is entrapped.

Weigh down the free edge to prevent any movement during laying.

Once laid into the grout material, evenly ballast 100% of the liner material surface until the grout has set.

9.6.3 Inspection

Test site welds in accordance with Clauses 11.24, 11.25 and 0 and the Inspection and Test Plan.

Check for voids in the grout behind the liner by light hammer tapping.

Test adhesive bond strength in accordance with Clause 11.12.

WITNESS POINT

9.6.4 Void Repairs

Drill two small diameter holes at end of any voids and inject one with a cementitious grout complying with Clause 9.6.1 until grout expels from the second hole.

Repair the holes in accordance with Clause 0.

9.7 Adhered PVC Sheet Lining System Application

9.7.1 General

Apply the Adhered PVC Sheet Lining system in accordance with the Manufacturer's recommendations and the requirements in this Clause.

9.7.2 Concrete Surface Preparation

Prepare the concrete substrate in accordance with Clause 5, to CSP 3 -6, and undertake tests listed in Clause 5.10.

9.7.3 Liner Placement

Pre-cut the PVC liner panel to the required sizes for the areas and configuration to be completed. Develop a numbered sequencing and layout plan to minimize waste and improve production rates.

Mix and apply the Primer A and B components at a one to one by volume ratio with a power mixer for one minute to be smooth and even in colour with no marbling or major colour fluctuations. Apply by roller or spray application uniformly ensuring complete substrate coverage at a rate of 5 m^2/l and recommended NDFT and allow to tack.

Apply chemical activator by roller to the PVC liner panel or seam material at a rate of 3 to 5 m^2/l and allow to touch dry.

Note: Once the activator has been applied, the sheets remain activated for an indefinite period.

Mix and apply by trowel or spray the structural polymer at the design thickness to the primed surface within 3 days of primer application at nominal WFT 25 mm.

Monitor the wet film thickness (WFT) during application of the protective coating system in accordance with Clause 11.16. Where the minimum WFT is less than that specified, apply additional coats to achieve the specified thickness.

Install detail strips and corner pieces.

Embed the rigid PVC panel into the structural polymer using rollers, ensuring that a bead of material is always pushed up in front of the panel at all times to prevent hollow areas forming.

Spray structural polymer onto the overlap area of a PVC panel before the next panel is installed.

Ensure all seams are fully embedded and overlapped at least 100 mm.

Mix and immediately apply a 25 mm bead of seam material to the edge of the overlap using tape or a seaming tool to produce a neat and clean edge.

Remove the tape as soon after the seam bead is applied to avoid pulling material away and forming sharp edges.

Check all surfaces to make certain PVC panel is smooth and fully embedded and seams are tight with no open areas or voids.

9.7.4 Inspection

Undertake testing and inspections following full curing of the coating or membrane:

1. Clause 11.17 - Visual inspection of applied coating
2. Check for voids in the applied liner by light hammer tapping.
3. Clause 11.12: Adhesive bond strength.

WITNESS POINT

9.8 Liner Repairs

9.8.1 General

Carry out repairs to any portion of the liner system or joints that have been damaged during installation or that fail testing by installation of a patch.

All patches shall be of the same liner material and extend a minimum of 150 mm beyond the edges of the defect area.

Carry out repair work in accordance with the the materials, procedures and test and inspection requirements outlined in this Clause, the Manufacturer's recommendations and to the satisfaction of SA Water's Representative.

Record the number and location of repairs for each area in the quality documentation.

Mark defective areas on the lining itself using a permanent marker compatible with the lining system.

Seal holes drilled through the liner for manholes, vent pipes etc. with a suitable sealant in accordance with TS 0711.2.

Retest the repair to ensure compliance with this Technical Standard.

9.8.2 HDPE

Lightly abrade adjacent liner sections so as to remove no more than 10% of the original material thickness no more than 15 minutes before welding.

All patches shall have rounded corners and shall be extrusion welded to the liner. Alternatively, place a bead of weld extrudate over all holes that are less than 6 mm in diameter.

Repair all failed seams by installing a cap strip over the entire length of the failed seam.

The cap strip shall be of the same liner material and shall extend the failed seam a minimum of 150 mm in all directions. Alternatively, extrusion weld the seam along the upper flap to the liner along the entire length of the failed seam.

9.8.3 PVC Panel

Repair delaminated panel by cutting out delaminated areas and repeating the full installation process, over lapping onto sound material.

9.9 Installation Records

Keep records of all liner manufacture, site inspection and testing activities.

The following are minimum reporting format requirements:

1. Installation Record:
    a. Date, panel/item identification, panel length and width and layout diagram
2. Trial Weld Report:
    a. Date, time, technician, machine no., ambient temp, extrudate temp, pre-heat temp, sample ID, test type, and pass/fail
3. Production Weld Report:
    a. Date, time, technician, machine no., seam/joint identification, test type, and pass/fail
    b. The installer will write the details of each non-destructive test on the actual liner
    c. When a test fails, the details of the appropriate repair will also be recorded on the material and in the Inspection and test report.
4. For vacuum testing this will include:
    a. The initials of the tester
    b. The date
    c. Pass or fail result.
5. For spark testing this will include:
    a. The initials of the tester
    b. The date
    c. Voltage setting
    d. Pass or fail result.

10 Water Storage Return to Service

Undertake cleaning and testing of water storage tanks that have had a liquid applied or sheet lining waterproof lining installed.

10.1 Cleaning and Flushing

Thoroughly clean the installed liner to remove all organic material, dirt, grease and residue resulting from construction activities. A cleaning program approved by the SA Water's Representative is required before commencing any works.

Activities comprising the overall cleaning process include but are not limited to:

1. Sweeping and/or vacuuming the floor of the storage to remove accumulated debris
2. Hosing the internal surfaces of the tanks with superchlorinated water (between 5-10 mg/L)
3. Disposal of waste material and water in accordance with TS 0711.0 Clause 7.4 and SA Water's requirements
4. Take all necessary precautions during the cleaning program to ensure the safety of workers particularly when working with disinfection solutions.

HOLD POINT

10.2 Hydrostatic Testing

Carry out the tank hydrostatic testing as follows:

1. Allow a period in accordance with the lining manufacturers' requirements to elapse before running water into the storage
2. Comply with TS0600 Watertightness Testing of Liquid Retaining Structures
3. Have all ITPs signed off, inclusive of tank flushing, and the final approval provided by the SA Water's Representative to begin disinfecting the storage. This shall include completion of a visual check of the tank in the presence of the SA Water's Representative looking for obvious omissions from the design drawings, welding defects and quality of joints

HOLD POINT

4. Give SA Water's Representative at least 48 hours' notice of the intention to fill the tank for testing. Liaise with SA Water's Representative for filling of storage and after filling of the storage has commenced, be available, if requested by the SA Water's Representative, to inspect the storage at any time during filling and testing
5. Arrange with the SA Water's Representative to fill the storage in stages to the top water level
6. Arrange with the SA Water's Representative to run water into the storage and steadily fill
7. Should any leaks or evidence of unsatisfactory performance develop, draw down the water level and carry out repairs to the satisfaction of the SA Water's Representative. Then raise the water level again to ensure that the repairs are satisfactory
8. When the storage is filled with water to the specified level, allow it to stand for a period of at least seven (7) days to ensure the detection of any leaks or other defects.

The storage is deemed to have passed the test if, after a period of seven (7) consecutive days, no leakage or other defect is evident.

10.3 Potable Water Storage - Disinfection and Sampling

Disinfection and sampling prior to the potable water storage going online shall be undertaken in accordance with Section 4.13 of TS0600.

HOLD POINT

11 Quality Control Testing

11.1 General

Comply with all Quality Control Testing requirements in TS 0711.0 Clause 5 and this Technical Standard.

Use a certified coating inspector or engineer (QC Engineer) to conduct all testing and quality control activities as required by this Technical Standard and the ITPs as the works proceed.

Allow for all samples, their production, retrieval and storage, testing and reporting required by the Contract.

Provide access, undertake sampling by coring (if requested by SA Water's Representative) and make good to reinstate to the profile of the surrounding surfaces using the approved repair materials and workmanship for any tests.

SA Water's Representative is at liberty to witness the carrying out of any test performed by the Constructor or its representative. The Constructor will be given one copy of any test result or report upon request.

Where testing is to be performed by a laboratory, supply one (1) copy of the laboratory report.

11.2 Coating and Liner - Quality Control Tests

The minimum testing requirements are listed in Table 12 as appropriate to the shape of the element and the test details follow.

Additional testing may be included in the submitted ITP.

Table 12: Coating and Liner Quality Control Tests and Frequency

Test Required	Performed By	Procedure	Minimum Frequency of Testing
Atmospheric Conditions	QC Engineer	Clause 11.3	Every 30 minutes. Digitally recorded
Concrete Surface Profile	QC Engineer	Clause 11.4	100% of coated concrete surface
Water-Break Test	QC Engineer	Clause 11.5	100% of coated concrete surface
Black Light Test	QC Engineer	Clause 11.6	100% of coated concrete surface
Visual Inspection of Sealed Cracks	QC Engineer	Clause 11.7	All sealed cracks
Concrete Moisture	QC Engineer	Clause 11.8	One test per 50 m^2 of coated concrete surface with a minimum of one test for each 10 m of vertical rise commencing within 300 mm of the floor
Concrete Substrate pH	QC Engineer	Clause 11.9	100% of coated concrete surface
Soundness of Highly Contaminated Concrete	QC Engineer	Clause 11.10	All highly contaminated concrete
Concrete Surface Flatness	QC Engineer	Clause 11.11	One test per 5 m^2 of coated concrete surface
Concrete Substrate Bond Strength	QC Engineer	Clause 11.12	As per the test plan in AS 3894.9
Depth of Silane Penetration	QC Engineer	Clause 11.13	Three cores per 50 m^2 of treated concrete surface
Depth of Colloidal Silica Penetration	QC Engineer	Clause 11.14	Three cores per 50 m^2 of treated concrete surface
Concrete Sorptivity	QC Engineer	Clause 11.15	Three cores test per 500 m^2 of treated concrete surface
Wet Film Thickness	Applicator	Clause 11.16	All coated areas, one test per 5 m^2 of coated concrete surface. Not recorded.
Visual Inspection of Applied Coating	QC Engineer	Clause 11.17	All coated areas
Dry Film Thickness	QC Engineer	Clause 11.18	As per the test plan in AS 3894.3
Coating Adhesion	QC Engineer	Clause 0	As per the test plan in AS 3894.9
Coating Continuity Testing	QC Engineer	Clause 11.20	100% of coated concrete surface

Slip Resistance	QC Engineer	Clause 11.21	One test per 50 m^2 of coated concrete surface
Visual Evaluation of Liner Welds	QC Engineer	Clause 0	All welds
Impact Testing of Liner Welds	QC Engineer	Clause 11.23	All welds
Peel and Shear Test of Liner Welds	QC Engineer	Clause 11.24	Daily weld test
Peel and Shear Test of Liner Welds	NATA Laboratory	Clause 11.24	10% of site tested welds
Vacuum Box Test of Liner Welds	QC Engineer	Clause 11.25	All weld, T intersections and weld repairs
Spark Test of Liner Welds	QC Engineer	Clause 0	All welds that cannot be Vacuum tested

11.3 Atmospheric Conditions

The atmospheric conditions are be measured at the site where the coating is to be applied during application and cure.

The ambient conditions are to be monitored each half hour from prior to commencement of application to 48 hours after completion of application.

The results shall be submitted with the daily Quality Assurance records as specified in this specification

11.3.1 Method

An electronic dew point meter with data logging capacity capable of measuring:

- Dew point
- Surface temperature
- Ambient temperature
- ΔT (The difference between the surface temperature and the dewpoint).

11.3.2 Acceptance Criteria

Unless otherwise specified by the coating manufacturer or on the product data sheet the following criteria apply:

- The relative humidity is less than 85%
- The surface temperature is greater than 3 °C above the dew point (ΔT), or
- The ambient temperature is between 10 °C or above 35 °C.

Note: some coating types can be applied at higher humilities or over wider temperatures provided the written advice of the coating manufacturer is provided.

11.4 Test Method - Surface Profile

11.4.1 Method

Assess the surface profile of each area at the completion of the final surface preparation and prior to coating application, according to ICRI Guideline No. 310.2.

Record on the relevant Quality Assurance documentation and confirm that it is suitable for the application of the specified coatings.

11.4.2 Acceptance Criteria

The concrete surface profile complies with the specified CSP range for the specified system in Generic Product Application Requirements in Appendix B, using ICRI Guideline No. 310.2 moulded replicas which are available in the range of CSP 1 to CSP 10.

11.5 Test Method - Water-Break Test (Oil & Grease Contamination)

11.5.1 Method

Conduct a water-break test in accordance with ASTM F22 as a screening test.

11.5.2 Acceptance Criteria

If water spreads out immediately instead of standing as droplets, the concrete surface is not likely to be contaminated with oil or grease.

Differences in drying rate may indicate minor levels of oil contamination or other conditions such as residual curing compound, penetrating sealers, and densified surfaces that affect porosity.

If the water remains in droplets, additional testing may be required.

11.6 Test Method - Black Light Test (Oil & Grease Contamination)

11.6.1 Method

Perform a black light test in accordance AS 3894.6, Section 7 Method B—Determination of Oil or Water Droplet Contamination for the presence of oil and grease.

11.6.2 Acceptance Criteria

No luminesce under black light.

11.7 Test Method - Visual Inspection of Sealed Cracks

11.7.1 Method

Inspect the entire crack length of sealed crack following cleaning off of adhesive.

Assess the extent of crack filling visually.

Assess for any ongoing water leakage.

11.7.2 Acceptance Criteria

Crack fully sealed and no sign of moisture before coating.

11.8 Test Method - Concrete Moisture Level

11.8.1 Method

Use ASTM D 4263 (Plastic sheet method) to determine if the concrete is sufficiently dry to apply the coating primer.

Test at the rate of every 50 m^2 of coated concrete surface, with a minimum of one test for each 10 m of vertical rise commencing within 300 mm of the floor.

The test area is to be left open to ambient conditions for a minimum of 24 h prior to the placement of the test kit.

Conduct the test after the application of any cementitious rendering material.

If required by SA Waters Representative:

1. Assess the concrete vapour emission rate to ASTM F 1869 (Calcium Chloride Test)
2. Assess the concrete's internal relative humidity to ASTM F 2170 (In situ RH% probe test).

11.8.2 Acceptance Criteria

ASTM D 4263 (Plastic sheer Method): No darkening of the concrete.

ASTM F 1869 (Calcium Chloride Test): Maximum result of 15 g/24 hr/m^2.

ASTM F 2170 (In situ RH% probe test): Maximum in situ relative humidity result of 80% or as otherwise specified by the coating Manufacturer.

Note: These limits apply in the absence of the coating Manufacturer's limits.

11.9 Test Method – Concrete Surface pH

11.9.1 Method

Assess the concrete surface pH using one of the following methods:

1. Spray freshly broken or prepared surface with phenolphthalein indicator solution
2. Press pH indicating strip moistened with distilled or deionised water onto the surface for 15 seconds or longer
3. Create a dam or small pond on horizontal surface (a 25 mm diameter form can be used), of distilled or deionised water. Determine the pH with the aid of a pH indicating strip after 1 minute.

11.9.2 Acceptance Criteria

Prepared concrete substrate shall be in the range pH 9.5 to 13.

11.10 Test Method – Soundness of Highly Contaminated Concrete

11.10.1 Method

Remove contaminated material from an area 500 mm x 500 mm (minimum).

Test indicative concrete strength at incremental depths using a rebound hammer to ASTM C 805 and averaging at least 12 readings per test location.

Repeat testing until a consistent mean reading is obtained and the substrate is considered sound based on visual inspection and through pH testing in Clause 11.9.

11.10.2 Acceptance Criteria

The consistent mean reading the pass/fail criterion for the rest of the concrete surfaces.

11.11 Test Method – Concrete Surface Flatness

11.11.1 Method

Check surface irregularity of the concrete substrate using a 2 m long straightedge laid in contact with the surface and resting under its own weight.

Measure the deviations of the concrete substrate from the underside of the straightedge, between the points which are in contact with the concrete substrate, by means of a slip gauge or other suitable accurate measuring device.

11.11.2 Acceptance Criteria

The acceptable out-of-flatness tolerance and surface irregularity are as follows:

Edges and surfaces in plan and level over 2 m distance: ± 3 mm.

11.12 Test Method – Concrete Substrate Bond Strength

11.12.1 Method

Test the adhesive bonding capacity of the prepared surface using a direct pull tensile test to ASTM C1583/C1583M, and ICRI Technical Guideline No 210.3, at a rate not less than 3 tests per 10 m^2 of repair area.

11.12.2 Acceptance Criteria

The prepared concrete surface tensile capacity shall be greater than the minimum bond strength value in Table 8.

11.13 Test Method - Depth of Silane Penetration

11.13.1 Sampling Method

A minimum of 7 days following the application of silane, cut two 50 mm nominal diameter cores 50 mm deep through the treated concrete, ensuring that the core is perpendicular to the concrete surface and does not damage the reinforcement.

Whenever possible, core using a vacuum-clamped coring machine.

Where metallic fixings are used, remove them subsequent to coring.

Repair fixing holes and core holes with an approved hand applied repair mortar (refer TS 0711.1) and re-treat the area.

Seal removed cores in individual plastic bags, label and send to an approved laboratory for testing.

11.13.2 Testing Method

Oven dry core for 24 hours at 40°C.

Split the core diametrically and treat the split face with an approved water-based dye solution. Solutions of 10% v/v food dye in water have been found to be suitable for this purpose.

The area not absorbing dye indicates the zone of silane treatment.

Record the minimum distance from the surface to the interface of the dyed concrete, such that penetration has not been halted by the presence of coarse aggregate particles.

This distance shall be deemed to be the depth of penetration of the applied treatment.

Should difficulty be encountered in distinguishing this interface, use a petrographic microscope.

Testing shall be completed at the same laboratory that tested the trial application cores.

11.13.3 Acceptance Criteria

Minimum penetration depth: 4 mm.

In any unit where the treated area falls below the control standard as established by the testing conducted on the trial areas, retreat that area.

If more than 30% of the tests fall below the control standards, retreat the entire structure.

11.14 Test Method - Depth of Colloidal Silica Penetration

11.14.1 Sampling Method

Trial Application:

A minimum of 48 hours following the application of colloidal silica solution, cut three 100 mm nominal diameter cores 70 mm deep through the treated concrete, ensuring that the core is perpendicular to the concrete surface and does not damage the reinforcement.

Use these cores for the sorptivity test in Clause 11.15.

Site Testing:

Cores for routine QC tests of colloidal silica penetration depth may be 50 mm diameter.

General

Whenever possible, core using a vacuum-clamped coring machine.

Where metallic fixings are used, remove them subsequent to coring.

Repair fixing holes and core holes with an approved hand applied repair mortar (refer TS 0711.1) and re-treat the area.

11.14.2 Testing Method

Clean the cores surfaces with water.

Allow the cores to dry for approximately 5 minutes.

The unpenetrated concrete will become surface dry, whilst the penetrated concrete will remain beaded with water.

Measure the depth of penetration using a tape measure.

11.14.3 Acceptance Criteria

Minimum penetration depth shall be 75 mm, or the value agreed during the trial with SA Water's Representative.

In any unit where the treated area falls below the control standard as established by the testing conducted on the trial areas, retreat that area.

If more than 30% of the tests fall below the control standards, retreat the entire structure.

11.15 Test Method – Concrete Water Sorptivity

11.15.1 Method

A minimum of 48 hours following the application of colloidal silica solution, cut three 100 mm nominal diameter cores 70 mm deep through the treated concrete, ensuring that the core is perpendicular to the concrete surface and does not damage the reinforcement.

Seal the three cores in individual plastic bags, label and send to an approved laboratory for water sorptivity testing to ASTM C1585.

Testing during site works shall be completed at the same laboratory that tested the trial application cores.

11.15.2 Acceptance Criteria

The treated concrete shall have a water sorptivity value not less than 40% of the control area established in the trial application, or the value agreed during the trial application with SA Water's Representative.

11.16 Test Method – Wet Film Thickness

11.16.1 Method

Monitor the wet film thickness during application of the coating system by use of a wet film thickness comb gauge as per AS 3894.3 Appendix C to ensure that when the coating is cured the specified DFT will be achieved.

Adopt an inspection plan to confirm that the coverage rates are adequate in accordance with AS 3894.3 Clause 7.3 and 7.4.

11.16.2 Acceptance Criteria

Where the minimum wet film thickness is less than that targeted, apply additional coats to achieve the specified thickness.

11.17 Test Method – Visual Inspection of Applied Coating

11.17.1 Method

Visually inspect 100% of coated areas under well-lit conditions in accordance with TS 0711.0 Clause 6.3.

11.17.2 Acceptance Criteria

The applied coating shall be uniform in thickness and appearance and shall be free of defects such as lumps, bubbles, ripples, runs, blisters, pinholes, holidays, overspray, inclusions and other film faults.

11.18 Test Method – Dry Film Thickness

11.18.1 Method

Regularly measure the DFT of the dried coating using an ultrasonic thickness tester specifically designed for the measurement of coating thickness on coated concrete substrates in accordance with ASTM D6132.

11.18.2 Acceptance Criteria

Where the minimum dry film thickness is less than that specified, apply additional coats to achieve the specified thickness.

11.19 Test Method – Coating Adhesion

11.19.1 Method

Test the adhesive bond strength of the applied concrete protective coating once it has achieved full cure in accordance with the manufacturer's recommendation using a suitable pull-off adhesion tester.

Where the base is solid, qualitatively assess the adhesion of the applied concrete coating by lightly tapping the surface, e.g., with a rod or a hammer, a hollow sound indicating lack of adhesion.

Test any areas of the applied concrete coating that are considered to be unsatisfactory in accordance with AS 3894.9 Method C and determine the reason for the lack of adhesion.

Undertake the minimum number of adhesion tests as per the test plan in AS 3894.9 Clause 4.2.

Record the type of failure.

Repair all core and test locations to the specified coating system in accordance with Clause 7.12.

11.19.2 Acceptance Criteria

Minimum coating adhesion bond strength shall be greater than the minimum bond strength value in Table 8.

A failure within the concrete is not considered an adhesion failure.

SA Water's Representative reserves the right to reject the coated item.

11.20 Test Method – Coating Continuity Testing

11.20.1 Method

Upon full curing of the coating, undertake continuity testing using an approved holiday detector (spark tester) to 100% of the coating system in accordance with AS 3894.1 and NACE SP0188 to detect holidays, pinholes, scratches and other coating discontinuities.

In cases where the high voltage continuity testing does not work over a conductive concrete substrate, subject to SA Water's Representative approval, conduct a 100% visual inspection of the surface.

Determine the test voltage as per AS 3894.1 High voltage (brush) method, Appendix D.

If this test is to be performed in some areas of an operational site, a hot work permit might be required.

Note: NACE SP0188 advises that a high-voltage spark tester may be used to determine discontinuities in coatings on conductive concrete substrates. The conductivity of concrete varies depending on moisture content, type, density, and location of reinforcement. Test conductivity by attaching a ground wire to the reinforcement or another metallic ground permanently embedded in the concrete and touching the electrode to the bare concrete. If the metallic ground is not visible, place the ground wire directly against the bare concrete surface weighted with a damp cloth or wet-sand-filled paper bag. If the test indicates that the concrete is not conductive, determining discontinuities with a high-voltage spark tester will be ineffective.

All defects are to be repaired and retested.

11.20.2 Acceptance Criteria

The pass criterion is zero defects after all repairs.

11.21 Test Method – Slip Resistance

11.21.1 Method

Undertake testing of slip resistance of installed floor and ramp non-skid coatings in traffic areas for pedestrians and equipment when wet in accordance with AS/NZS 4586, at the rate of every 50 m^2 of coated concrete surface.

11.21.2 Acceptance Criteria

The values in Table 3B of HB 198:2014, 'Wet pendulum test or oil-wet inclining platform classifications for applications where the NCC does not require slip resistance' apply when tested in accordance with AS/NZS 4586.

11.22 Test Method – Visual Evaluation of Liner Welds

11.22.1 Testing Method

Visually inspect all parts of all welds for the following properties:

1. excessive squeeze out
2. weld shape conformance
3. footprint/width
4. colour
5. evidence of air bubbles/change of surface texture
6. extensive heat deformation
7. folds
8. foreign matter
9. general appearance.

11.23 Test Method – Impact Testing of Liner Welds

11.23.1 Testing Method

Subject all parts of all welds to point stressing along the interface between the weld and the lining to ensure continuity of bond, using a blunt instrument such as a screwdriver.

The welding technician should complete this test progressively after each weld is complete, as the first step in ensuring weld integrity.

If the extrusion bead shows a tendency to peel, investigate the source of the problem.

Possible sources include:

1. insufficient grinding
2. inadequate preheating or extrudate
3. temperature
4. dirty or wet welding rod
5. dirt or oil at the joint.

11.23.2 Acceptance Criteria

No peeling.

Mark the area, and repair only after the source of the problem has been identified and rectified.

11.24 Test Method - Peel and Shear Test of Liner Welds

11.24.1 Testing Method

1. Make a trial weld by joining two (2) pieces of HDPE or PVC liner material, each piece at least 150 mm in width, approximately 1.5 m in length, with at least 100 mm seam overlap
2. Visually inspect the seam for squeeze out, footprint and general appearance (Clause 0)
3. Perform an impact test on the weld following completion (by picking at edge with a blunt object, Clause 11.23)
4. Cut four 25 mm wide x 150 mm long specimens, two from the middle of the seam and one each 300 mm from each end of the test seam using a 25 mm sample cutter. Any areas that look visually suspect should also be tested
5. Test two specimens each in peel and shear using a calibrated field tensiometer in accordance with ASTM D6392
6. Ensure that the calibrated site tensiometer is available on site at all times during the jointing activity.

Send the samples created from every tenth trial seem (10%) to a NATA accredited Laboratory for shear testing (2 samples) and peel testing (2 samples) to provide independent certification of the onsite testing.

11.24.2 Acceptance Criteria

The following values are applicable to anchor knob liner extrusion welds:

1. Shear - 70% minimum of liner strength
2. Peel – 50% minimum of liner strength.

The following values are applicable to smooth liner extrusion welds:

1. Shear - 90% minimum of liner strength
2. Peel – 60% minimum of liner strength.

All peel tests shall result in film tear bond (FTB) value. The FTB is defined as a failure of one of the bonded sheets before complete separation in the bonded area.

In the absence of a calibrated tensiometer, site tests can only be tested to the limit of the strength of the parent material on which the welds have been carried out.

In this case the test is considered a pass if the material fails in the parent material, not within the weld bead or between the bead and the surface of the liner.

Peel separation (or incursion) for extrusion welds cannot exceed 25% of the joint's bonded area.

If any samples fail, the trial seem should be repeated until two consecutive trial seams are achieved.

11.25 Test Method – Vacuum Box Test of Liner Welds

11.25.1 Testing Method

Undertake the Vacuum box tested in accordance with ASTM D 4437 and ASTM D 5641 to all extrusion welds, all T intersection welds and weld repairs, following the following general procedure:

1. Cover the length of welded seam to be tested with a soapy water solution
2. Place the vacuum box over the weld and press firmly onto the liner, and start the vacuum pump
3. With the bleed-valve closed, draw a partial vacuum to approximately minus 35 kPa gauge pressure (below atmospheric), ensuring a leak-tight seal is created
4. For a minimum of 10 seconds, examine the HDPE seam through the viewing window for the presence of bubbles (large bubbles or fine froth) within the soapy solution
5. If no bubbles appear during the observation period, release the vacuum by opening the bleed valve and switching off the pump
6. Move the vacuum box over to the next adjoining area with a minimum 50mm overlap and repeat the process until the entire length of weld has been tested.

Record the results on the ITP and actual results on the liner:

1. The initials of the tester
2. The date
3. Pass or fail result
4. Repair details.

11.25.2 Acceptance Criteria

Any area where soap bubbles appear (or a complete drop in vacuum is observed) shall be marked, recorded, repaired and retested until the result is satisfactory.

11.26 Test Method – Spark Test of Liner Welds

11.26.1 Testing Method

Spark test all welds that cannot be Vacuum tested.

Determine the test voltage as per AS 3894.1 High voltage (brush) method, Appendix D.

If this test is to be performed in some areas of an operational site, a hot work permit might be required.

Prior to the extrusion welding process, insert a fine copper wire into the joint at the termination point of the top sheet.

Prior to actual tests being carried out, make a trial calibration seam to confirm the minimum voltage required to discharge (spark) across a fissure in the seam between the brush electrode and the copper wire.

The test procedure is as follows:

1. The test area must be thoroughly cleaned and made dry
2. For DC spark testing equipment connect the negative (ground) electrode of the DC testing equipment to the exposed end of the copper wire. This is not required when using AC spark testing equipment
3. Determine the test voltage using a seam/joint with a known leak path
4. Connect the positive electrode to the wire brush or other type of search electrode.
5. Pass the search electrode over the surface of the weld at a rate of approximately 2-3 m/min, maintaining contact with the extruded bead and the liner at the edge of the bead
6. Monitor for audible and/or visible spark discharges that are indicative of a defect
7. Mark defects for repair.

Record the results in the test record, actual results on the liner and sign off the ITP:

1. The initials of the tester
2. The date
3. Voltage setting
4. Pass or fail result
5. Repair details.

11.26.2 Acceptance Criteria

No sparks indicating a defect.

All defects are to be repaired and retested.

11.27 Test Method - Pull-out Testing of HDPE Anchors

11.27.1 Method

Test the embedment quality of the HDPE concrete protection liner anchors using the method in Clause 0.

11.27.2 Acceptance Criteria

Pull-out resistance ≥ 0.2 MPa.

Appendix A : Schedules of Hold Points, Witness Points and Identified Records

A1 Schedule of Hold Points

Clause	Type	Description
3.2	Hold	Approved materials
3.3	Hold	Materials testing
4.2.2	Hold	Coating & lining applicator: specific competency
4.3.4	Hold	Pre-start meeting
0	Hold	Markup of areas to be repaired.
4.10, 6.2.3	Hold	Following trial application of coating systems
5.10, 6.1.1, 6.2.1, 8.1.2, 9.5.2, 9.6.2, 9.7.2	Hold	Substrate inspection and testing following surface preparation
7.8, 0, 0, 0, 8.1.4, 8.2.3	Hold	Following application and curing of primer/intermediate/final coat
10.1	Hold	Storage cleaning and flushing
10.2	Hold	Storage Hydrostatic testing
10.3	Hold	Storage Disinfection and sampling

A2 Schedule of Witness Points

Clause	Type	Description
6.1.2, 0, 8.1.4	Witness	Application of bonding agent
6.1.2, 0, 7.8, 0, 0, 0, 8.1.4, 0, 9.5.5, 9.6.3, 9.7.4, 10.2	Witness	Visual inspection and testing of repairs.

A3 Schedule of Identified Records

Clause	Description
4.2.2	Constructor competency verification
4.3	Constructor submission of WMS & ITP
4.10	Submission of Trial Repair Report, if trial repair is deemed necessary by SA Water.
4.3	Submission of the As-Repaired Report.

Appendix B : Generic Product Application Requirements

B1 Silane and Siloxane Coatings

Asset Area of use	Preliminary cleaning	Oil and grease removal	Surface Preparation	1st Coat	2nd Coat	3rd Coat
Penetrating sealer for masonry and cementitious surfaces, to impede the passage of soluble salts and moisture, to provide long-term protection to concrete against water penetration and salt induced steel reinforcement corrosion of concrete structures All coatings should be applied in accordance with the Manufacturer's recommendations. This specification forms part of the coating specification and should be read in its entirety.	**New concrete** Remove all surface contamination. **Aged Concrete:** Remove mud, dirt, chalk, algae, bird droppings and other loose contamination by brooming, vacuuming, air blasting, cleaning, high-pressure water cleaning, detergent water cleaning and steam cleaning. **Previously applied protection systems:** If the existing protective coating system is compatible with the new coating system, remove loose, delaminating, disbonded, chalked, or otherwise unsound areas.	Use detergent water cleaning and steam cleaning per ASTM D4258 to remove oils and grease from concrete. Do not use solvents.	Remove existing coatings, remove loose and weak materials and contaminants from the surface, repair the surface, and prepare surfaces by suitable means to achieve ICRI CSP 1 or as per the Manufacturer's recommended range. Repair blow holes and apply a cementitious fairing coat if required.	Silane or silane-siloxane penetrating sealer liquid to saturation "wet look" or Silane cream at nominated application rate	Silane or silane-siloxane penetrating sealer liquid to saturation "wet look" or Silane cream at nominated application rate if required as demonstrated by trial	Silane or silane-siloxane penetrating sealer liquid to saturation "wet look"
			Depth of penetration (Nominal)	Liquid: 2 mm Cream: 4 mm	Liquid: +1 mm	Liquid: +1 mm
	Total minimum depth of concrete surface penetration: 4.0 mm					

Quality Control Requirements (Minimum)	Surface temperature	AS 3894.7
	Dew point / Humidity	Whirling Psychrometer or Humidity Meter
	Concrete Surface Profile	ICRI Guideline No. 310.2
	Sorptivity	Dye Test 'Sorptivity' Testing in accordance with a method approved by SA Water's Representative for determination of the depth of silane impregnation.

Notes:

The quality of the concrete surface and the penetration of the protective coating system into the concrete can be highly variable. Multiple tests over representative surface areas may be necessary for the Constructor to satisfy themselves the substrate is suitable for the protective coating system.

Failure of the concrete surface preparation will likely result in areas NOT FULLY TREATED.

Do not use solvents to remove oil or grease as they can spread contaminants over a larger area or wash them deeper into the concrete

Remove all traces of the existing coating.

Open out blow holes and remove laitance.

Fill all blow holes with a compatible cementitious filler before applying silane/siloxane material using low pressure airless spray.

Concrete may require additional applications to achieve the depth of silane impregnation

Report QA records in a format similar to AS 3894 Parts 10 to 14, where applicable.

B2 Colloidal Silica

Asset Area of use	Preliminary cleaning	Oil and grease removal	Surface Preparation	1st Coat	2nd Coat	3rd Coat
Penetrating waterproofing/anti-microbial treatment for cementitious surfaces, to impede the passage of soluble salts and moisture, to provide long-term protection to concrete against water penetration and biogenic corrosion of concrete structures All coatings should be applied in accordance with the Manufacturer's recommendations. This specification forms part of the coating specification and should be read in its entirety.	**New concrete** Remove all surface contamination. **Aged Concrete:** Remove mud, dirt, chalk, algae, bird droppings and other loose contamination by brooming, vacuuming, air blasting, cleaning, high-pressure water cleaning, detergent water cleaning and steam cleaning. **Previously applied protection systems:** If the existing protective coating system is compatible with the new coating system, remove loose, delaminating, disbonded, chalked, or otherwise unsound areas.	Use detergent water cleaning and steam cleaning per ASTM D4258 to remove oils and grease from concrete. Do not use solvents.	Remove existing coatings, remove loose and weak materials and contaminants from the surface, repair the surface, and prepare surfaces by suitable means to achieve ICRI CSP 1 or as per the Manufacturer's recommended range.	Colloidal silica at nominated application rate	Colloidal silica at nominated application rate	If required as demonstrated by trial
			Depth of penetration (Nominal)	50 mm	+25 mm	
	Total minimum depth of concrete surface penetration: 75 mm					
Quality Control Requirements (Minimum)		Surface temperature	AS 3894.7			
		Dew point / Humidity	Whirling Psychrometer or Humidity Meter			
		Concrete Surface Profile	ICRI Guideline No. 310.2			
		Sorptivity	Water Penetration Test and Sorptivity Test in accordance with a method approved by SA Water's Representative for determination of the depth of colloidal silica impregnation.			

Notes:

The quality of the concrete surface and the penetration of the protective coating system into the concrete can be highly variable. Multiple tests over representative surface areas may be necessary for the Constructor to satisfy themselves the substrate is suitable for the protective coating system.

Failure of the concrete surface preparation will likely result in areas NOT FULLY TREATED.

Do not use solvents to remove oil or grease as they can spread contaminants over a larger area or wash them deeper into the concrete

Remove all traces of the existing coating.

Open out blow holes and remove laitance.

Do not fill blow holes or cracks etc before applying colloidal silica using low pressure airless spray.

Concrete may require additional applications to achieve the depth of colloidal silica impregnation

Report QA records in a format similar to AS 3894 Parts 10 to 14, where applicable.

B3 Elastomeric Anti-Carbonation Coating

Asset Area of use	Preliminary cleaning	Oil and grease removal	Surface Preparation	1st Coat (Primer)	2nd Coat	3rd Coat
Water based Elastomeric Anti-Carbonation Coating for decorative painting. All coatings should be applied in accordance with the Manufacturer's recommendations. This specification forms part of the coating specification and should be read in its entirety.	**New concrete** Remove all surface contamination. **Aged Concrete:** Remove mud, dirt, chalk, algae, bird droppings and other loose contamination by brooming, vacuuming, air blasting, cleaning, high-pressure water cleaning, detergent water cleaning and steam cleaning. **Previously applied protection systems:** If the existing protective coating system is compatible with the new coating system, remove loose, delaminating, disbonded, chalked, or otherwise unsound areas.	Use detergent water cleaning and steam cleaning per ASTM D4258 to remove oils and grease from concrete. Do not use solvents.	Remove existing coatings, remove loose and weak materials and contaminants from the surface, repair the surface, and prepare surfaces by suitable means to achieve ICRI CSP 1-3 or as per the Manufacturer's recommended range. Repair blow holes and apply a fairing coat if required. Prior to application of the coating system, pre-soak the surface using a bacterial and fungicide treatment recommended by the manufacturer. Leave overnight. High pressure wash.	Solvent borne primer/sealer APAS 0171 AS/NZS 3730.22 Apply to all prepared surfaces	**Latex -Membrane Coating** Water based acrylic membrane coating for AS/NZS 4548.2 systems APAS 0117/3	**Latex -Membrane Coating** Water based acrylic membrane coating for AS/NZS 4548.2 systems APAS 0117/3
			Dry Film Thickness (Nominal)	15 µm	400 µm	400 µm
	Total minimum DFT: 815 µm					

Quality Control Requirements (Minimum)	Surface temperature	AS 3894.7
	Dew point / Humidity	Whirling Psychrometer or Humidity Meter
	Surface preparation grade	ICRI Guideline No. 310.2
	Surface profile	ICRI Guideline No. 310.2
	WFT	AS 3894.3 Appendix C
	DFT	ASTM D6132

Notes:

The quality of the concrete surface and the adhesion of the protective coating system to the concrete can be highly variable. Multiple tests over representative surface areas may be necessary for the Constructor to satisfy themselves the substrate is suitable for the protective coating system.

Failure of the concrete surface preparation will likely result in unbonded or breached areas of the protective coating system.

Do not use solvents to remove oil or grease as they can spread contaminants over a larger area or wash them deeper into the concrete

If the original protective coating system is compatible with the new protection system it may be overcoated.

With many existing coating systems, all traces of the existing coating may have to be removed.

Products are to be approved by the superintendent prior to use.

Apply the coating system in accordance with the Manufacturer's recommendations.

Applicator to be recommended by the coating manufacturer.

Clean the surface thoroughly by water blasting or detergent cleaning, where a commercial cleaner is added to hot or cold water and surface is washed / scrubbed thoroughly with a stiff bristle broom and then rinsed clean with fresh water. This may need to be repeated on extremely dirty surfaces to ensure removal. Ensure that the surface is dry, clean and free from dust. Check for the presence of Release Agents and Bond Breakers by simply splashing water onto the substrate, if water beads on the surface, then total removal is mandatory.

Structural control or expansion joints, cracks and flaws should be filled in accordance with the manufacturer's recommendations.

Elastomeric Anti-Carbonation Coating systems may require additional film build and/or number of applications to achieve the required aesthetics.

Coverage of product is to be sufficient to achieve the minimum nominal DFT. Where DFT is difficult to measure, the coverage rate and consumption of product is to be documented.

Colour as specified by SA Water's Representative.

Report QA records in a format similar to AS 3894 Parts 10 to 14, where applicable.

For topcoat touch-ups, apply coating to an edge or a masked straight line for a neat finish.

B4 Acrylic Latex

Asset Area of use	Preliminary cleaning	Oil and grease removal	Surface Preparation	1st Coat (Primer)	2nd Coat	3rd Coat
Water based acrylic-paint for decorative painting. All coatings should be applied in accordance with the Manufacturer's recommendations. This specification forms part of the coating specification and should be read in its entirety.	**New concrete** Remove all surface contamination. **Aged Concrete:** Remove mud, dirt, chalk, algae, bird droppings and other loose contamination by brooming, vacuuming, air blasting, cleaning, high-pressure water cleaning, detergent water cleaning and steam cleaning. **Previously applied protection systems:** If the existing protective coating system is compatible with the new coating system, remove loose, delaminating, disbonded, chalked, or otherwise unsound areas.	Use detergent water cleaning and steam cleaning per ASTM D4258 to remove oils and grease from concrete. Do not use solvents.	Remove existing coatings, remove loose and weak materials and contaminants from the surface, repair the surface, and prepare surfaces by suitable means to achieve ICRI CSP 1-3 or as per the Manufacturer's recommended range. Repair blow holes and apply a fairing coat if required.	Solvent borne primer/sealer APAS 0171 AS/NZS 3730.22 Apply to all prepared surfaces	Waterborne acrylic APAS 0280 AS/NZS 3730.7 to .10 Gloss, semi-gloss or low gloss. Colour: to match topcoat (including MIO if specified)	Waterborne acrylic APAS 0280 AS/NZS 3730.7 to .10 Gloss, semi-gloss or low gloss. Colour: to match topcoat (including MIO if specified)
			Dry Film Thickness **(Nominal)**	40 µm	40 µm	40 µm
						Total minimum DFT: 95 µm

Quality Control Requirements **(Minimum)**	Surface temperature	AS 3894.7
	Dew point / Humidity	Whirling Psychrometer or Humidity Meter
	Surface preparation grade	ICRI Guideline No. 310.2
	Surface profile	ICRI Guideline No. 310.2
	WFT	AS 3894.3 Appendix C
	DFT	ASTM D6132

Notes:

The quality of the concrete surface and the adhesion of the protective coating system to the concrete can be highly variable. Multiple tests over representative surface areas may be necessary for the Constructor to satisfy themselves the substrate is suitable for the protective coating system.

Failure of the concrete surface preparation will likely result in unbonded or breached areas of the protective coating system.

Do not use solvents to remove oil or grease as they can spread contaminants over a larger area or wash them deeper into the concrete

If the original protective coating system is compatible with the new protection system it may be overcoated.

With many existing coating systems, all traces of the existing coating may have to be removed.

Acrylic latex systems may require additional film build and/or number of applications to achieve the required aesthetics.

Coverage of product is to be sufficient to achieve the minimum nominal DFT. Where DFT is difficult to measure, the coverage rate and consumption of product is to be documented.

Colour as specified by SA Water's Representative.

Report QA records in a format similar to AS 3894 Parts 10 to 14, where applicable.

For topcoat touch-ups, apply coating to an edge or a masked straight line for a neat finish.

B5 Polyurethane or Polysiloxane Systems

Asset Area of use	Preliminary cleaning	Oil and grease removal	Surface Preparation	1st Coat (Primer)	2nd Coat	3rd Coat
A three-coat epoxy and polyurethane-based or polysiloxane-based coating system, aesthetics and durability, corrosion, The polysiloxane provides anti-graffiti properties Can be made non-skid by adding suitable aggregates. All coatings should be applied in accordance with the Manufacturer's recommendations. This specification forms part of the coating specification and should be read in its entirety.	**New concrete** Remove all surface contamination. **Aged Concrete:** Remove mud, dirt, chalk, algae, bird droppings and other loose contamination by brooming, vacuuming, air blasting, cleaning, high-pressure water cleaning, detergent water cleaning and steam cleaning. **Previously applied protection systems:** If the existing protective coating system is compatible with the new coating system, remove loose, delaminating, disbonded, chalked, or otherwise unsound areas.	Use detergent water cleaning and steam cleaning per ASTM D4258 to remove oils and grease from concrete. Do not use solvents.	Remove existing coatings, remove loose and weak materials and contaminants from the surface, repair the surface, and prepare surfaces by suitable means to achieve ICRI CSP 1-3 or as per the Manufacturer's recommended range. Repair blow holes and apply a fairing coat if required.	Apply an Epoxy Penetrating concrete primer/ sealer recommended by the Manufacturer to all prepared surfaces	High build epoxy APAS 0156 or 2977 AS/NZS 3750.1	2-pack Polyurethane APAS 2911 AS/NZS 3750.6 OR Ant graffiti: 2-pack Polysiloxane APAS 2920
			Dry Film Thickness **(Nominal)**	50 to 100 µm	200 µm	50 µm
						Total minimum DFT: 300 µm

Quality Control Requirements **(Minimum)**	Surface temperature	AS 3894.7
	Dew point / Humidity	Whirling Psychrometer or Humidity Meter
	Surface preparation grade	ICRI Guideline No. 310.2
	Surface profile	ICRI Guideline No. 310.2
	WFT	AS 3894.3 Appendix C
	DFT	ASTM D6132

Notes:

The quality of the concrete surface and the adhesion of the protective coating system to the concrete can be highly variable. Multiple tests over representative surface areas may be necessary for the Constructor to satisfy themselves the substrate is suitable for the protective coating system.

Failure of the concrete surface preparation will likely result in unbonded or breached areas of the protective coating system.

Do not use solvents to remove oil or grease as they can spread contaminants over a larger area or wash them deeper into the concrete

If the original protective coating system is compatible with the new protection system it may be overcoated.

With many existing coating systems, all traces of the existing coating may have to be removed.

Coverage of product is to be sufficient to achieve the minimum nominal DFT. Where DFT is difficult to measure, the coverage rate and consumption of product is to be documented.

Open out blow holes and remove laitance.

Fill all blow holes with a compatible epoxy filler before applying topcoat. The first high build epoxy coating application should be sprayed and immediately back-rolled whilst wet in multiple directions to ensure full wetting and penetration. Concrete may require extra film build and/or number of applications.

Colour as specified by SA Water's Representative.

Report QA records in a format similar to AS 3894 Parts 10 to 14, where applicable.

For topcoat touch-ups, apply coating to an edge or a masked straight line for a neat finish.

The coating manufacturer is to be consulted on the type, quantity, and coverage rates of non-slip additive required or finishing methodology required to achieve the slip resistance ratings specified in this document. If the colour of the non-slip additive can be chosen.

B6 Water Based Epoxy

Asset Area of use	Preliminary cleaning	Oil and grease removal	Surface Preparation	1st Coat (Primer)	2nd Coat	3rd Coat
A water based epoxy system for protecting concrete surfaces against light chemical and abrasion attack. Primarily decorative with surfaces that are easy to clean e.g., garage workshops and stores. It is odourless, making it suitable for interior applications Can be made non-skid by adding suitable aggregates. All coatings should be applied in accordance with the Manufacturer's recommendations. This specification forms part of the coating specification and should be read in its entirety.	**New concrete** Remove all surface contamination. **Aged Concrete:** Remove mud, dirt, chalk, algae, bird droppings and other loose contamination by brooming, vacuuming, air blasting, cleaning, high-pressure water cleaning, detergent water cleaning and steam cleaning. **Previously applied protection systems:** If the existing protective coating system is compatible with the new coating system, remove loose, delaminating, disbonded, chalked, or otherwise unsound areas.	Use detergent water cleaning and steam cleaning per ASTM D4258 to remove oils and grease from concrete. Do not use solvents.	Remove existing coatings, remove loose and weak materials and contaminants from the surface, repair the surface, and prepare surfaces by suitable means to achieve ICRI CSP 1 or as per the Manufacturer's recommended range. Repair blow holes and apply a fairing coat if required.	Water-based epoxy APAS 0167 Primer coat on concrete may be thinned down in accordance with the product data sheet to aid penetration to concrete as recommended by the Manufacturer. Apply to all prepared surfaces	Water-based epoxy APAS 0167	
			Dry Film Thickness **(Nominal)**	50 µm	50 µm	N/A
	Total minimum DFT: 100 µm					

Quality Control Requirements **(Minimum)**	Surface temperature	AS 3894.7
	Dew point / Humidity	Whirling Psychrometer or Humidity Meter
	Surface preparation grade	ICRI Guideline No. 310.2
	Surface profile	ICRI Guideline No. 310.2
	WFT	AS 3894.3 Appendix C
	DFT	ASTM D6132

Notes:

The quality of the concrete surface and the adhesion of the protective coating system to the concrete can be highly variable. Multiple tests over representative surface areas may be necessary for the Constructor to satisfy themselves the substrate is suitable for the protective coating system.

Failure of the concrete surface preparation will likely result in unbonded or breached areas of the protective coating system.

Do not use solvents to remove oil or grease as they can spread contaminants over a larger area or wash them deeper into the concrete

If the original protective coating system is compatible with the new protection system it may be overcoated.

With many existing coating systems, all traces of the existing coating may have to be removed.

Coverage of product is to be sufficient to achieve the minimum nominal DFT. Where DFT is difficult to measure, the coverage rate and consumption of product is to be documented.

When lining concrete open out blow holes and remove laitance. The first high build epoxy coating application should be sprayed and immediately back-rolled whilst wet in multiple directions to ensure full wetting and penetration. Concrete may require extra film build and/or number of applications.

If intended for immersion duty in drinking water system, use only drinking water-approved epoxy lining materials and the specified solvent(s).

Fill all blow holes with a compatible epoxy filler before applying topcoat. Each epoxy layer should be sprayed and immediately back-rolled whilst wet in multiple directions to ensure full wetting and penetration. Concrete may require extra film build and/or number of applications.

Colour as specified by SA Water's Representative.

Report QA records in a format similar to AS 3894 Parts 10 to 14, where applicable.

For topcoat touch-ups, apply coating to an edge or a masked straight line for a neat finish.

The coating manufacturer is to be consulted on the type, quantity, and coverage rates of non-slip additive required or finishing methodology required to achieve the slip resistance ratings specified in this document. If the colour of the non-slip additive can be chosen.

B7 Epoxy Mastic

Asset Area of use	Preliminary cleaning	Oil and grease removal	Surface Preparation	1st Coat (Primer)	2nd Coat	3rd Coat
A two-coat surface tolerant epoxy system primarily for spot repairs and full overcoating of existing interior coating systems. Can be made non-skid by adding suitable aggregates. All coatings should be applied in accordance with the Manufacturer's recommendations. This specification forms part of the coating specification and should be read in its entirety.	**New concrete** Remove all surface contamination. **Aged Concrete:** Remove mud, dirt, chalk, algae, bird droppings and other loose contamination by brooming, vacuuming, air blasting, cleaning, high-pressure water cleaning, detergent water cleaning and steam cleaning. **Previously applied protection systems:** If the existing protective coating system is compatible with the new coating system, remove loose, delaminating, disbonded, chalked, or otherwise unsound areas.	Use detergent water cleaning and steam cleaning per ASTM D4258 to remove oils and grease from concrete. Do not use solvents.	Remove existing coatings, remove loose and weak materials and contaminants from the surface, repair the surface, and prepare surfaces by suitable means to achieve ICRI CSP 1-3 or as per the Manufacturer's recommended range. Repair blow holes and apply a fairing coat if required.	Apply an Epoxy Penetrating concrete primer/ sealer recommended by the Manufacturer to all prepared surfaces	High build epoxy APAS 0156 or 2977 AS/NZS 3750.1	High build epoxy APAS 0156 or 2977 AS/NZS 3750.1
			Dry Film Thickness **(Nominal)**	50 to 100 µm	200 µm	200 µm
	Total minimum DFT: 300 µm					

Quality Control Requirements **(Minimum)**	Surface temperature	AS 3894.7
	Dew point / Humidity	Whirling Psychrometer or Humidity Meter
	Surface preparation grade	ICRI Guideline No. 310.2
	Surface profile	ICRI Guideline No. 310.2
	WFT	AS 3894.3 Appendix C
	DFT	ASTM D6132

Notes:

The quality of the concrete surface and the adhesion of the protective coating system to the concrete can be highly variable. Multiple tests over representative surface areas may be necessary for the Constructor to satisfy themselves the substrate is suitable for the protective coating system.

Failure of the concrete surface preparation will likely result in unbonded or breached areas of the protective coating system.

Do not use solvents to remove oil or grease as they can spread contaminants over a larger area or wash them deeper into the concrete

If the original protective coating system is compatible with the new protection system it may be overcoated.

With many existing coating systems, all traces of the existing coating may have to be removed.

Coverage of product is to be sufficient to achieve the minimum nominal DFT. Where DFT is difficult to measure, the coverage rate and consumption of product is to be documented.

When lining concrete open out blow holes and remove laitance. The first high build epoxy coating application should be sprayed and immediately back-rolled whilst wet in multiple directions to ensure full wetting and penetration. Concrete may require extra film build and/or number of applications.

If intended for immersion duty in drinking water system, use only drinking water-approved epoxy lining materials and the specified solvent(s).

Fill all blow holes with a compatible epoxy filler before applying topcoat. Each epoxy layer should be sprayed and immediately back-rolled whilst wet in multiple directions to ensure full wetting and penetration. Concrete may require extra film build and/or number of applications.

Colour as specified by SA Water's Representative.

Report QA records in a format similar to AS 3894 Parts 10 to 14, where applicable.

For topcoat touch-ups, apply coating to an edge or a masked straight line for a neat finish.

The coating manufacturer is to be consulted on the type, quantity, and coverage rates of non-slip additive required or finishing methodology required to achieve the slip resistance ratings specified in this document. If the colour of the non-slip additive can be chosen.

B8 Epoxy High Build, Solvent Based/Solvent Free for Immersion Service

Asset Area of use	Preliminary cleaning	Oil and grease removal	Surface Preparation	1st Coat (Primer)	2nd Coat	3rd Coat
A high-performance immersion-grade epoxy coating system for water reservoir internals. For immersion and vapour space exposure. All coatings should be applied in accordance with the Manufacturer's recommendations. This specification forms part of the coating specification and should be read in its entirety.	**New concrete** Remove all surface contamination. **Aged Concrete:** Remove mud, dirt, chalk, algae, bird droppings and other loose contamination by brooming, vacuuming, air blasting, cleaning, high-pressure water cleaning, detergent water cleaning and steam cleaning. **Previously applied protection systems:** If the existing protective coating system is compatible with the new coating system, remove loose, delaminating, disbonded, chalked, or otherwise unsound areas.	Use detergent water cleaning and steam cleaning per ASTM D4258 to remove oils and grease from concrete. Do not use solvents.	Remove existing coatings, remove loose and weak materials and contaminants from the surface, repair the surface, and prepare surfaces by suitable means to achieve ICRI CSP 1-3 or as per the Manufacturer's recommended range. Repair blow holes and apply a fairing coat if required.	Apply an Epoxy Penetrating concrete primer/ sealer recommended by the Manufacturer to all prepared surfaces	High build epoxy APAS 2973P or 2974P AS/NZS 3750.14 AS/NZS 4020 for use with potable water	High build epoxy APAS 2973P or 2974P AS/NZS 3750.14 AS/NZS 4020 for use with potable water
			Dry Film Thickness **(Nominal)**	50 to 100 µm	200 µm	200 µm
	Total minimum DFT: 360 µm					

Quality Control Requirements **(Minimum)**	Surface temperature	AS 3894.7
	Dew point / Humidity	Whirling Psychrometer or Humidity Meter
	Surface preparation grade	ICRI Guideline No. 310.2
	Surface profile	ICRI Guideline No. 310.2
	WFT	AS 3894.3 Appendix C
	DFT	ASTM D6132

Notes:

The quality of the concrete surface and the adhesion of the protective coating system to the concrete can be highly variable. Multiple tests over representative surface areas may be necessary for the Constructor to satisfy themselves the substrate is suitable for the protective coating system.

Failure of the concrete surface preparation will likely result in unbonded or breached areas of the protective coating system.

Do not use solvents to remove oil or grease as they can spread contaminants over a larger area or wash them deeper into the concrete

If the original protective coating system is compatible with the new protection system it may be overcoated.

With many existing coating systems, all traces of the existing coating may have to be removed.

Coverage of product is to be sufficient to achieve the minimum nominal DFT. Where DFT is difficult to measure, the coverage rate and consumption of product is to be documented.

When lining concrete open out blow holes and remove laitance. The first high build epoxy coating application should be sprayed and immediately back-rolled whilst wet in multiple directions to ensure full wetting and penetration. Concrete may require extra film build and/or number of applications.

If intended for immersion duty in drinking water system, use only drinking water-approved epoxy lining materials and the specified solvent(s).

Fill all blow holes with a compatible epoxy filler before applying topcoat. Each epoxy layer should be sprayed and immediately back-rolled whilst wet in multiple directions to ensure full wetting and penetration. Concrete may require extra film build and/or number of applications.

Colour as specified by SA Water's Representative.

Report QA records in a format similar to AS 3894 Parts 10 to 14, where applicable.

For topcoat touch-ups, apply coating to an edge or a masked straight line for a neat finish.

B9 Ultra-High Build Epoxy

Asset Area of use	Preliminary cleaning	Oil and grease removal	Surface Preparation	1st Coat (Primer)	2nd Coat	3rd Coat
Ultra-high build solvent-free epoxy primarily intended for underground, immersion, areas of high abrasion. Suitable for coating of liquid retaining concrete structures with high exposure to H_2S gas acids found in wet wells, maintenance holes, and inlet works. Ultra All coatings should be applied in accordance with the Manufacturer's recommendations. This specification forms part of the coating specification and should be read in its entirety.	**New concrete** Remove all surface contamination. **Aged Concrete:** Remove mud, dirt, chalk, algae, bird droppings and other loose contamination by brooming, vacuuming, air blasting, cleaning, high-pressure water cleaning, detergent water cleaning and steam cleaning. **Previously applied protection systems:** If the existing protective coating system is compatible with the new coating system, remove loose, delaminating, disbonded, chalked, or otherwise unsound areas.	Use detergent water cleaning and steam cleaning per ASTM D4258 to remove oils and grease from concrete. Do not use solvents.	Remove existing coatings, remove loose and weak materials and contaminants from the surface, repair the surface, and prepare surfaces by suitable means to achieve ICRI CSP 1-3 or as per the Manufacturer's recommended range. Repair blow holes and apply a fairing coat if required.	Apply an Epoxy Penetrating concrete primer/ sealer recommended by the Manufacturer to all prepared surfaces	Ultra-high build epoxy APAS 0156 or 2977 AS/NZS 3750.1	Ultra-high build epoxy APAS 0156 or 2977 AS/NZS 3750.1
			Dry Film Thickness **(Nominal)**	50 to 100 µm	1200 µm	1200 µm
	Total minimum DFT: 2000 µm					

Quality Control Requirements **(Minimum)**	Surface temperature	AS 3894.7
	Dew point / Humidity	Whirling Psychrometer or Humidity Meter
	Surface preparation grade	ICRI Guideline No. 310.2
	Surface profile	ICRI Guideline No. 310.2
	WFT	AS 3894.3 Appendix C
	DFT	ASTM D6132

Notes:

The quality of the concrete surface and the adhesion of the protective coating system to the concrete can be highly variable. Multiple tests over representative surface areas may be necessary for the Constructor to satisfy themselves the substrate is suitable for the protective coating system.

Failure of the concrete surface preparation will likely result in unbonded or breached areas of the protective coating system.

Do not use solvents to remove oil or grease as they can spread contaminants over a larger area or wash them deeper into the concrete

If the original protective coating system is compatible with the new protection system it may be overcoated.

With many existing coating systems, all traces of the existing coating may have to be removed.

Coverage of product is to be sufficient to achieve the minimum nominal DFT. Where DFT is difficult to measure, the coverage rate and consumption of product is to be documented.

When lining concrete open out blow holes and remove laitance. The first high build epoxy coating application should be sprayed and immediately back-rolled whilst wet in multiple directions to ensure full wetting and penetration. Concrete may require extra film build and/or number of applications.

If intended for immersion duty in drinking water system, use only drinking water-approved epoxy lining materials and the specified solvent(s).

Fill all blow holes with a compatible epoxy filler before applying topcoat. Each epoxy layer should be sprayed and immediately back-rolled whilst wet in multiple directions to ensure full wetting and penetration. Concrete may require extra film build and/or number of applications.

Colour as specified by SA Water's Representative.

Report QA records in a format similar to AS 3894 Parts 10 to 14, where applicable.

B10Epoxy Novolac

Asset Area of use	Preliminary cleaning	Oil and grease removal	Surface Preparation	1st Coat (Primer)	2nd Coat	3rd Coat	4th Coat
High build novolac epoxy system for concrete exposed to corrosive chemicals e.g., chemical bunds and septic sewer structures. Interior, high duty exposure including ponding, immersion or corrosive vapours. All coatings should be applied in accordance with the Manufacturer's recommendations. This specification forms part of the coating specification and should be read in its entirety.	**New concrete** Remove all surface contamination. **Aged Concrete:** Remove mud, dirt, chalk, algae, bird droppings and other loose contamination by brooming, vacuuming, air blasting, cleaning, high-pressure water cleaning, detergent water cleaning and steam cleaning. **Previously applied protection systems:** If the existing protective coating system is compatible with the new coating system, remove loose, delaminating, disbonded, chalked, or otherwise unsound areas.	Use detergent water cleaning and steam cleaning per ASTM D4258 to remove oils and grease from concrete. Do not use solvents.	Remove existing coatings, remove loose and weak materials and contaminants from the surface, repair the surface, and prepare surfaces by suitable means to achieve ICRI CSP 1-3 or as per the Manufacturer's recommended range. Repair blow holes and apply a fairing coat if required with a compatible epoxy filler.	Apply an Epoxy Penetrating concrete primer/ sealer recommended by the Manufacturer to all prepared surfaces	High build epoxy novolac	High build epoxy novolac	High build epoxy novolac
			Dry Film Thickness **(Nominal)**	50 to 100 µm	200 µm	200 µm	200 µm
	Total minimum DFT: 600 µm						

Quality Control Requirements **(Minimum)**	Surface temperature	AS 3894.7
	Dew point / Humidity	Whirling Psychrometer or Humidity Meter
	Surface preparation grade	ICRI Guideline No. 310.2
	Surface profile	ICRI Guideline No. 310.2
	WFT	AS 3894.3 Appendix C
	DFT	ASTM D6132

Notes:

The quality of the concrete surface and the adhesion of the protective coating system to the concrete can be highly variable. Multiple tests over representative surface areas may be necessary for the Constructor to satisfy themselves the substrate is suitable for the protective coating system.

Failure of the concrete surface preparation will likely result in unbonded or breached areas of the protective coating system.

Do not use solvents to remove oil or grease as they can spread contaminants over a larger area or wash them deeper into the concrete

If the original protective coating system is compatible with the new protection system it may be overcoated.

With many existing coating systems, all traces of the existing coating may have to be removed.

Coverage of product is to be sufficient to achieve the minimum nominal DFT. Where DFT is difficult to measure, the coverage rate and consumption of product is to be documented.

When lining concrete open out blow holes and remove laitance. The first high build epoxy coating application should be sprayed and immediately back-rolled whilst wet in multiple directions to ensure full wetting and penetration. Concrete may require extra film build and/or number of applications.

If intended for immersion duty in drinking water system, use only drinking water-approved epoxy lining materials and the specified solvent(s).

Fill all blow holes with a compatible epoxy filler before applying topcoat. Each epoxy layer should be sprayed and immediately back-rolled whilst wet in multiple directions to ensure full wetting and penetration. Concrete may require extra film build and/or number of applications.

Colour as specified by SA Water's Representative.

Report QA records in a format similar to AS 3894 Parts 10 to 14, where applicable.

If abrasion is an issue, use a vinyl ester.

B11 Vinyl Ester

Asset Area of use	Preliminary cleaning	Oil and grease removal	Surface Preparation	1st Coat (Primer)	2nd Coat	3rd Coat
Vinyl ester coating system for steel and concrete to provide superior abrasion and chemical resistance. All coatings should be applied in accordance with the Manufacturer's recommendations. This specification forms part of the coating specification and should be read in its entirety.	**New concrete** Remove all surface contamination. **Aged Concrete:** Remove mud, dirt, chalk, algae, bird droppings and other loose contamination by brooming, vacuuming, air blasting, cleaning, high-pressure water cleaning, detergent water cleaning and steam cleaning. **Previously applied protection systems:** If the existing protective coating system is compatible with the new coating system, remove loose, delaminating, disbonded, chalked, or otherwise unsound areas.	Use detergent water cleaning and steam cleaning per ASTM D4258 to remove oils and grease from concrete. Do not use solvents.	Remove existing coatings, remove loose and weak materials and contaminants from the surface, repair the surface, and prepare surfaces by suitable means to achieve ICRI CSP 1-3 or as per the Manufacturer's recommended range. Repair blow holes and apply a fairing coat if required.	Apply an Epoxy Penetrating concrete primer/ sealer recommended by the Manufacturer to all prepared surfaces	Vinyl ester APAS 2917	Vinyl ester APAS 2917
			Dry Film Thickness **(Nominal)**	50 to 100 µm	1500 µm	1500 µm
	Total minimum DFT: 3000 µm					

Quality Control Requirements **(Minimum)**	Surface temperature	AS 3894.7
	Dew point / Humidity	Whirling Psychrometer or Humidity Meter
	Surface preparation grade	ICRI Guideline No. 310.2
	Surface profile	ICRI Guideline No. 310.2
	WFT	AS 3894.3 Appendix C
	DFT	ASTM D6132

Notes:

The quality of the concrete surface and the adhesion of the protective coating system to the concrete can be highly variable. Multiple tests over representative surface areas may be necessary for the Constructor to satisfy themselves the substrate is suitable for the protective coating system.

Failure of the concrete surface preparation will likely result in unbonded or breached areas of the protective coating system.

Do not use solvents to remove oil or grease as they can spread contaminants over a larger area or wash them deeper into the concrete

If the original protective coating system is compatible with the new protection system it may be overcoated.

With many existing coating systems, all traces of the existing coating may have to be removed.

Coverage of product is to be sufficient to achieve the minimum nominal DFT. Where DFT is difficult to measure, the coverage rate and consumption of product is to be documented.

When lining concrete open out blow holes and remove laitance. The first high build epoxy coating application should be sprayed and immediately back-rolled whilst wet in multiple directions to ensure full wetting and penetration. Concrete may require extra film build and/or number of applications.

If intended for immersion duty in drinking water system, use only drinking water-approved epoxy lining materials and the specified solvent(s).

Fill all blow holes with a compatible epoxy filler before applying topcoat. The epoxy primer should be sprayed and immediately back-rolled whilst wet in multiple directions to ensure full wetting and penetration. Concrete may require extra film build and/or number of applications.

Colour as specified by SA Water's Representative.

Report QA records in a format similar to AS 3894 Parts 10 to 14, where applicable.

B12 Waterproof Slurry Coating or Render

Asset Area of use	Preliminary cleaning	Oil and grease removal	Surface Preparation	1st Coat (Primer)	2nd Coat Spray/Trowel Coat	3rd Coat
Waterproof slurry coating incorporating crystalline technology applied to water retaining structures to seal widespread fine static cracking up to 0.4 mm wide, or higher durability thick waterproof render. All materials should be applied in accordance with the Manufacturer's recommendations. This specification forms part of the coating specification and should be read in its entirety.	**New concrete** Remove all surface contamination. **Aged Concrete:** Remove mud, dirt, chalk, algae, bird droppings and other loose contamination by brooming, vacuuming, air blasting, cleaning, high-pressure water cleaning, detergent water cleaning and steam cleaning. Remove degraded concrete and other contamination **Previously applied protection systems:** Remove any existing protective coating system.	Use detergent water cleaning and steam cleaning per ASTM D4258 to remove oils and grease from concrete. Do not use solvents.	Remove existing coatings, remove loose and weak materials and contaminants from the surface Abrasive blast clean, grind, scarify, scrabble or high and ultra-high pressure water jetting to remove laitance, cement-rich fines, and to create the required surface profile/roughness to achieve ICRI CSP 3 -5 (Slurry) CSP 5 -10 (Render) or as per the Manufacturer's recommended range.	Ensure that substrate is fully saturated with water to achieve a Saturated Surface Dry (SSD) surface during application. Slurry Coat: "concentrated" hydrophilic crystalline cementitious material Render: Slurry mix of the waterproof render mortar	Waterproof Slurry Coat: Waterproof render mortar	Waterproof Slurry Coat:
			Dry Film Thickness **(Nominal)**	Slurry Coating: 1.25 mm Render: 1-2 mm	Slurry Coating: 1.25 mm Render: 10-50 mm	Slurry Coating: 1.25 mm
	Total minimum Slurry Coat DFT: 4 mm **Total minimum Render DFT:** 25 mm					

Quality Control Requirements **(Minimum)**	Surface temperature	AS 3894.7
	Dew point / Humidity	Whirling Psychrometer or Humidity Meter
	Surface preparation grade	ICRI Guideline No. 310.2
	Surface profile	ICRI Guideline No. 310.2
	WFT	AS 3894.3 Appendix C

Notes:

The quality of the concrete surface and the adhesion of the protective coating system to the concrete can be highly variable. Multiple tests over representative surface areas may be necessary for the Constructor to satisfy themselves the substrate is suitable for the protective coating system.

Failure of the concrete surface preparation will likely result in unbonded or breached areas of the protective coating system.

Do not use solvents to remove oil or grease as they can spread contaminants over a larger area or wash them deeper into the concrete

If the original protective render system is compatible with the new protection system it may be overcoated.

With many existing coating systems, all traces of the existing coating may have to be removed.

Apply by brush or specialised spray equipment.

Work primers in well with stiff brush or broom.

Apply subsequent layers of the cementitious waterproofing coating or render material after the first coat has reached an initial setting time and while it is still "green", typically within 24-30 hours. Lightly pre-water prior to the second coat application if rapid drying conditions are encountered.

Cut cold joints straight and flush to achieve a neat finish between panels after final set

Coverage of product is to be sufficient to achieve the minimum nominal coating thickness. Where thickness is difficult to measure, the coverage rate and consumption of product is to be documented.

Cure by fine mist spray minimum 3 days

Report QA records in a format similar to AS 3894 Parts 10 to 14, where applicable.

B13 Calcium Aluminate Cement Render

Asset Area of use	Preliminary cleaning	Oil and grease removal	Surface Preparation	1st Coat (Primer)	2nd Coat Spray/Trowel Coat	3rd Coat
Calcium aluminate cement is designed for refurbishment concrete structures in sewer environment and for lining of cast iron and steel pipes and fittings used for conveying sewage. All coatings should be applied in accordance with the Manufacturer's recommendations. This specification forms part of the coating specification and should be read in its entirety.	**New concrete** Remove all surface contamination. **Aged Concrete:** Remove mud, dirt, chalk, algae, bird droppings and other loose contamination by brooming, vacuuming, air blasting, cleaning, high-pressure water cleaning, detergent water cleaning and steam cleaning. Remove degraded concrete and other contamination **Previously applied protection systems:** Remove any existing protective coating system.	Use detergent water cleaning and steam cleaning per ASTM D4258 to remove oils and grease from concrete. Do not use solvents.	Remove existing coatings, remove loose and weak materials and contaminants from the surface Abrasive blast clean, grind, scarify, scrabble or high and ultra-high pressure water jetting to remove laitance, cement-rich fines, and to create the required surface profile/roughness to achieve ICRI CSP 5 -10 or as per the Manufacturer's recommended range.	Not generally required. Consult manufacturer. Ensure that substrate is fully saturated with water to achieve a Saturated Surface Dry (SSD) surface during application	Calcium aluminate cement EN 14647	-
			Dry Film Thickness (Nominal)	N/A	Min 25 mm	
	Total minimum DFT: 25 mm					

Quality Control Requirements (Minimum)		
	Surface temperature	AS 3894.7
	Dew point / Humidity	Whirling Psychrometer or Humidity Meter
	Surface preparation grade	ICRI Guideline No. 310.2
	Surface profile	ICRI Guideline No. 310.2
	WFT	AS 3894.3 Appendix C

Notes:

The quality of the concrete surface and the adhesion of the protective coating system to the concrete can be highly variable. Multiple tests over representative surface areas may be necessary for the Constructor to satisfy themselves the substrate is suitable for the protective coating system.

Failure of the concrete surface preparation will likely result in unbonded or breached areas of the protective coating system.

Do not use solvents to remove oil or grease as they can spread contaminants over a larger area or wash them deeper into the concrete

If the original protective render system is compatible with the new protection system it may be overcoated.

With many existing coating systems, all traces of the existing coating may have to be removed.

Coverage of product is to be sufficient to achieve the minimum nominal coating thickness. Where thickness is difficult to measure, the coverage rate and consumption of product is to be documented.

Report QA records in a format similar to AS 3894 Parts 10 to 14, where applicable.

B14 Elastomeric Polyurethane/Polyurea Membrane

Asset Area of use	Preliminary cleaning	Oil and grease removal	Surface Preparation	1st Coat (Primer)	2nd Coat	3rd Coat
Elastomeric Polyurethane/Polyurea system to waterproof "tank" the internal floor and walls of tanks, bunds and sewerage elements. All coatings should be applied in accordance with the Manufacturer's recommendations. This specification forms part of the coating specification and should be read in its entirety.	**New concrete** Remove all surface contamination. **Aged Concrete:** Remove mud, dirt, chalk, algae, bird droppings and other loose contamination by brooming, vacuuming, air blasting, cleaning, high-pressure water cleaning, detergent water cleaning and steam cleaning. **Previously applied protection systems:** If the existing protective coating system is compatible with the new coating system, remove loose, delaminating, disbonded, chalked, or otherwise unsound areas.	Use detergent water cleaning and steam cleaning per ASTM D4258 to remove oils and grease from concrete. Do not use solvents.	Remove existing coatings, remove loose and weak materials and contaminants from the surface, repair the surface, and prepare surfaces by suitable means to achieve ICRI CSP 1-3 or as per the Manufacturer's recommended range. Repair blow holes and apply a fairing coat if required.	Apply an Epoxy Penetrating concrete primer/ sealer recommended by the Manufacturer to all prepared surfaces Install an approved sealant system in joints	The preference is to apply the Elastomeric Polyurethane/Polyurea system directly to the primed concrete surface Only use approved geotextile in corners, over cracks and joints and coved edges. Glue approved geotextile onto the concrete primer Us an approved 100% volume solids epoxy as the adhesive recommended by the Manufacturer	Elastomeric Polyurethane/Polyurea system
			Dry Film Thickness **(Nominal)**	50 to 100 µm	N/A	3000 µm
	Total minimum DFT: 3000 µm					

Quality Control Requirements (Minimum)	
Surface temperature	AS 3894.7
Dew point / Humidity	Whirling Psychrometer or Humidity Meter
Surface preparation grade	ICRI Guideline No. 310.2
Surface profile	ICRI Guideline No. 310.2
WFT	AS 3894.3 Appendix C
DFT	ASTM D6132
Continuity Testing	AS 3894.1/NACE SP0188

Notes:

Do not install Elastomeric Polyurethane/Polyurea Membrane under pump intakes.

Background information on the technology is addressed in NACE Publication 6A198, Introduction to Thick-Film Polyurethanes, Polyureas and Blends and SSPC Paint 39, Two-Component Aliphatic Polyurea Topcoat Fast or Moderate Drying, Performance-Based.

The quality of the concrete surface and the adhesion of the protective coating system to the concrete can be highly variable. Multiple tests over representative surface areas may be necessary for the Constructor to satisfy themselves the substrate is suitable for the protective coating system.

Failure of the concrete surface preparation will likely result in unbonded or breached areas of the protective coating system.

Do not use solvents to remove oil or grease as they can spread contaminants over a larger area or wash them deeper into the concrete

If the original protective coating system is compatible with the new protection system it may be overcoated.

With many existing coating systems, all traces of the existing coating may have to be removed.

Install approved geotextile in corners, over cracks and joints and coved edges.

Grind parallel saw cuts around all terminations including at top of tank, pipe penetrations and all fittings/fixings. Locate saw cuts at 50 mm and 100 mm from the termination.

The minimum saw cuts dimensions are 6 mm width and 15 mm deep. Saw cuts shall be made in a straight line where practical. Trowel the Elastomeric Polyurethane or Polyurea into the saw cuts to lock the material to the concrete surface.

Colour as specified by SA Water's Representative.

Report QA records in a format similar to AS 3894 Parts 10 to 14, where applicable.

B15 HDPE/PVC Anchored Corrosion Protection Liner

Asset Area of use	Preliminary cleaning	Oil and grease removal	Surface Preparation	New Construction	Retro Fitting and Repairs
Concrete protective liner typically made from high grade HDPE or PVC. High resistant to most chemicals which has anchors or ribs that are embedded into concrete substrate. Not suitable for long-term UV exposure. All materials should be applied in accordance with the Manufacturer's recommendations. This specification forms part of the coating specification and should be read in its entirety.	**New Construction**: Remove all surface contamination. **Retro Fitting and Repairs:** Remove mud, dirt, chalk, algae, bird droppings and other loose contamination by brooming, vacuuming, air blasting, cleaning, high-pressure water cleaning, detergent water cleaning and steam cleaning.	Use detergent water cleaning and steam cleaning per ASTM D4258 to remove oils and grease from concrete. Do not use solvents.	Remove existing coatings, remove loose and weak materials and contaminants from the surface, repair the surface, and prepare surfaces by suitable means to achieve ICRI CSP 5-10 or as per the Manufacturer's recommended range.	Attach to formwork prior to concrete pour. High Density Polyethylene (HDPE) GRI-GM13	Attach to formwork and pressure grout into space between substrate and HDPE or PVC anchored membrane or Embed HDPE or PVC anchored membrane into thixotropic grout High Density Polyethylene (HDPE) GRI-GM13
			Membrane Thickness (Nominal)	2 mm	2 mm
	Minimum Liner Thickness: 2 mm				

Quality Control Requirements (Minimum)	Surface temperature	AS 3894.7
	Dew point / Humidity	Whirling Psychrometer or Humidity Meter
	Surface preparation grade	ICRI Guideline No. 310.2
	Continuity Testing	AS 3894.1/NACE SP0188
	Weld testing	Visual, impact, ASTM D6392, ASTM D 5641, AS 3894.1

Notes:

Failure of the concrete surface preparation will likely result in unbonded or delaminated areas of the protective coating system.

Do not use solvents to remove oil or grease as they can spread contaminants over a larger area or wash them deeper into the concrete

When lining concrete open out blow holes and remove laitance.

Light colours are preferred. Colour as specified by SA Water's Representative.

Report QA records in a format similar to AS 3894 Parts 10 to 14, where applicable.

B16 Adhered PVC Sheet Co-Polymer

Asset Area of use	Preliminary cleaning	Oil and grease removal	Surface Preparation	1st Coat (Primer)	2nd Coat Spray/Trowel Coat	3rd Coat
PVC Sheet Co-Polymer Adhered is designed for refurbishment concrete structures in sewer environment and for lining of cast iron and steel pipes and fittings used for conveying sewage. All coatings should be applied in accordance with the Manufacturer's recommendations. This specification forms part of the coating specification and should be read in its entirety.	**New concrete** Remove all surface contamination. **Aged Concrete:** Remove mud, dirt, chalk, algae, bird droppings and other loose contamination by brooming, vacuuming, air blasting, cleaning, high-pressure water cleaning, detergent water cleaning and steam cleaning. Remove degraded concrete and other contamination **Previously applied protection systems:** Remove any existing protective coating system.	Use detergent water cleaning and steam cleaning per ASTM D4258 to remove oils and grease from concrete. Do not use solvents.	Remove existing coatings, remove loose and weak materials and contaminants from the surface Abrasive blast clean, grind, scarify, scrabble or high and ultra-high pressure water jetting to remove laitance, cement-rich fines, and to create the required surface profile/roughness to achieve ICRI CSP 3 -6 or as per the Manufacturer's recommended range.	100% solids hybrid epoxy applied at rate of 0.2 litre/m^2. Allow to tack prior to application of the Structural Polymer. Consult manufacturer. Ensure that substrate is fully saturated with water to achieve a Saturated Surface Dry (SSD) surface during application	Structural Polymer Mastic	PVC sheet liner
			Dry Film Thickness **(Nominal)**	N/A	Min 25 mm	
	Total minimum DFT: 25 mm					

Quality Control Requirements **(Minimum)**	Surface temperature	AS 3894.7
	Dew point / Humidity	Whirling Psychrometer or Humidity Meter
	Surface preparation grade	ICRI Guideline No. 310.2
	Surface profile	ICRI Guideline No. 310.2
	WFT	AS 3894.3 Appendix C
	DFT	ASTM D6132

Notes:

The quality of the concrete surface and the adhesion of the protective coating system to the concrete can be highly variable. Multiple tests over representative surface areas may be necessary for the Constructor to satisfy themselves the substrate is suitable for the protective coating system.

Failure of the concrete surface preparation will likely result in unbonded or breached areas of the protective coating system.

Do not use solvents to remove oil or grease as they can spread contaminants over a larger area or wash them deeper into the concrete.

With many existing coating systems, all traces of the existing coating may have to be removed.

Develop a sequencing and layout plan to minimize waste and improve production rates.

Pre-cut the PVC liner for the areas and configuration to be completed according to the sequencing and layout plan.

Activate the PVC liner that will contact the Structural Polymer or the Seam Material to the Manufacturers requirements and allow to dry to the touch before installation.

Trowel or spray correctly mixed structural polymer to the primed surface as per the Manufacturer's recommendations.

Install detail strips and corners before laying up Rigid PVC Liner Panel.

Embed the rigid PVC panel using rollers, making certain that a wave of material is always pushed up in front of the sheet at all times. Air pockets will occur if the wave under the PVC sheer and the SP Mastic is not visually monitored.

Spray structural Polymer on the overlap area of a PVC sheet before the next sheet is installed.

Ensure all seams are fully embedded and overlapped at least 100 mm. Apply a 25 mm bead of seam material to the edge of the overlap using tape or a seaming tool to produce a neat and clean edge.

Visually monitor the wave of mastic under the PVC at all times to prevent hollow areas that will need repaired.

Apply seam material immediately after mixing while it is soft and easy to apply.

Check all surfaces to make certain PVC is smooth and fully embedded and seams are tight with no open areas or voids.

Test the total area for drumminess between the coating and the concrete surface.

Where drumminess is detected, undertake adhesion pull-off testing on these areas to determine the degree of coating adhesion.

Areas determined to be unsatisfactory are to be stripped, repaired and re-tested to confirm satisfactory results.

Colour as specified by SA Water's Representative.

Report QA records in a format similar to AS 3894 Parts 10 to 14, where applicable.

For topcoat touch-ups, apply coating to an edge or a masked straight line for a neat finish.

B17 Elastomeric Boot Seal

Asset Area of use	Preliminary cleaning	Oil and grease removal	Surface Preparation	1st Coat (Primer)	2nd Coat	3rd Coat
Elastomeric Polyurethane/Polyurea system to stop water ingress of water between steel tanks and the concrete ring beam All coatings should be applied in accordance with the Manufacturer's recommendations. This specification forms part of the coating specification and should be read in its entirety.	**New concrete** Remove all surface contamination. **Aged Concrete:** Remove mud, dirt, chalk, algae, bird droppings and other loose contamination by brooming, vacuuming, air blasting, cleaning, high-pressure water cleaning, detergent water cleaning and steam cleaning. **Previously applied protection systems:** If the existing protective coating system is compatible with the new coating system, remove loose, delaminating, disbonded, chalked, or otherwise unsound areas.	Use detergent water cleaning and steam cleaning per ASTM D4258 to remove oils and grease from concrete. Do not use solvents.	Remove existing coatings, remove loose and weak materials and contaminants from the surface, repair the surface, and prepare surfaces by suitable means to achieve ICRI CSP 1-3 or as per the Manufacturer's recommended range. Repair blow holes and apply a fairing coat if required. Steel tank and steel annulus ring. Abrasive blast clean corroded areas to AS 1627.4 Class Sa 2½ with a surface profile of 50 µm to 75 µm. apply approver protective coating system	Apply an Epoxy Penetrating concrete primer/ sealer recommended by the Manufacturer to all prepared surfaces	Apply bands of geotextile glued onto the concrete primer and steel tank. Us an approved 100% volume solids epoxy recommended by the Manufacturer as the adhesive	Elastomeric Polyurethane/Polyurea system
			Dry Film Thickness **(Nominal)**	50 to 100 µm	N/A	3000 µm
	Total minimum DFT: 3000 µm					

Quality Control Requirements **(Minimum)**		
	Surface temperature	AS 3894.7
	Dew point / Humidity	Whirling Psychrometer or Humidity Meter
	Surface preparation grade	ICRI Guideline No. 310.2
	Surface profile	ICRI Guideline No. 310.2
	WFT	AS 3894.3 Appendix C
	DFT	ASTM D6132

Notes:

The elastomeric topcoat is applied as per Repair Type B14 Elastomeric Polyurethane/Polyurea Membrane

The quality of the concrete surface and the adhesion of the protective coating system to the concrete can be highly variable. Multiple tests over representative surface areas may be necessary for the Constructor to satisfy themselves the substrate is suitable for the protective coating system.

Failure of the concrete surface preparation will likely result in unbonded or breached areas of the protective coating system.

Do not use solvents to remove oil or grease as they can spread contaminants over a larger area or wash them deeper into the concrete

If the original protective coating system is compatible with the new protection system it may be overcoated.

With many existing coating systems, all traces of the existing coating may have to be removed.

Elastomeric Polyurethane/Polyurea system to be approved by SA Water's Representative prior to use.

Colour as specified by SA Water's Representative.

Report QA records in a format similar to AS 3894 Parts 10 to 14, where applicable.

Appendix C : Example Inspection and Test Plans

C1 Example ITP for WWPS Wet-Well Lining with Ultra High Build Epoxy

LEGEND: X = Responsible for H = Hold point W = Witness (option is given to inspect)

Task no.	Work Phase	Inspection and Testing Activities	Applicable Documents	Acceptance Criteria	Frequency	Verifying Document	Applicator (Sign/ Date)	Inspector (Sign/ Date)	SAW (Sign/ Date)
1. 1	Prior to start of work	Submission of design specification, inspection and testing plan, and product information	SAW-ENG-DOC-TS 0711.5	SAW acceptance	As required	SAW acceptance	X	W	H

Task no.	Work Phase	Inspection and Testing Activities	Applicable Documents	Acceptance Criteria	Frequency	Verifying Document	Applicator (Sign/ Date)	Inspector (Sign/ Date)	SAW (Sign/ Date)
2.	Project start-up meeting	Prestart meeting comprising: • SAW • SAW Superintendent or Representative • Main Constructor • Concrete repair Constructor • Coating Inspector • Coating Constructor • Coating Manufacturer • Other relevant parties	Section 4.3.4	SAW acceptance	Once before commencement on site.	Project start-up meeting minutes	X	X	X
3.	Products and equipment delivered on site	Coatings Inspect containers and labels Verify products are as per design specification Inspect storage conditions	Section 4.9 Section 4.11	Coatings as per the coating specification. Coating supplier's recommendations	At Start of project Each delivery	Signed delivery document	X	W	W
4.	Products and equipment delivered on site	Repair materials, solvents and cleaners Inspect container and labels Verify repair material, solvents and cleaners are suitable with the coatings Inspect storage conditions	Product Data Sheets and Safety Data Sheets	Coating supplier's recommendations Repair material's compressive strength is 20 MPa or more	At Start of project Each delivery	Signed delivery document	X	W	W

Task no.	Work Phase	Inspection and Testing Activities	Applicable Documents	Acceptance Criteria	Frequency	Verifying Document	Applicator (Sign/ Date)	Inspector (Sign/ Date)	SAW (Sign/ Date)
5.	Products and equipment delivered on site	Surface preparation equipment and media Verify equipment is in good condition and meets Safe Work Australia Model Code of Practice for Abrasive Blasting requirements (e.g., safety relief valve, earthing, dead man control, pressure rating) Verify media meets specification and is suitable to produce the required concrete surface profile Verify suitable environmental controls for dust and noise are in placed	Equipment Specifications and Operating manuals Product Data Sheets and Safety Data Sheets Section 4.11	Blast Media Material Certificates. Weekly testing to verify free from oils, grease, moisture and soluble salts.	At Start of project Each delivery	Signed delivery document AS 3894.11 (modified)	X	W	W
6.	Products and equipment delivered on site	Spraying equipment Verify equipment is suitable for applying the product (type and size)	Equipment Specifications and Operating manuals Product Data Sheets and Safety Data Sheets Section 4.11	As per coating supplier's recommendations	At Start of project Each delivery	Signed delivery document AS 3894.11 (modified)	X	W	W

Task no.	Work Phase	Inspection and Testing Activities	Applicable Documents	Acceptance Criteria	Frequency	Verifying Document	Applicator (Sign/ Date)	Inspector (Sign/ Date)	SAW (Sign/ Date)
7.	Products and equipment delivered on site	Monitoring and testing instruments Inspect climate monitoring equipment (Psychrometer and thermometer) Ensure surface profile testing equipment (CSP Profile Replicas) is on site Ensure pH test (e.g., universal indicator spray) is on site Ensure wet film thickness comb gauge is on site Verify dry film thickness gauge is calibrated Verify high voltage holiday tester is calibrated	Test Equipment Specifications and Operating manuals Product Data Sheets and Safety Data Sheets Sections 11.3, 11.4, 11.5, 11.6, 11.8, 11.9, 11.12, 11.16, 11.18, 0, 11.20	Test equipment is operating and calibrated. As per coating supplier's recommendations	At start of project Each delivery	Equipment and calibration register Equipment calibration certificates. AS 3894.11 (modified)	X	W	H
8.	Products and equipment delivered on site	Ventilation and/or dehumidification equipment Inspect equipment	Equipment Specifications and Operating manuals Test Equipment Specifications and Operating manuals Section 4.12	Equipment is operating and meets specified size to maintain RH of less than 85% Test equipment is operating and calibrated	At start of project Minimum every 4 hours during coating application.	AS 3894.11 (modified)	X	W	W

Task no.	Work Phase	Inspection and Testing Activities	Applicable Documents	Acceptance Criteria	Frequency	Verifying Document	Applicator (Sign/ Date)	Inspector (Sign/ Date)	SAW (Sign/ Date)
9.	Surface preparation	Prior to surface preparation Visual inspection for existing defects Repair any existing defects e.g., cracks, etc. Verify concrete works for sufficient curing	Section 6 Section 6.16	Test all areas No visual defects No remaining defects At least 28 days curing period	At completion of each area, daily.	AS 3894.10 (modified) AS 3894.11 (modified) AS 3894.13 (modified)	X	W	W
10.	Surface preparation	Following surface preparation Visual inspection for remaining laitance, contaminants, etc. Fill in voids and blow holes Remove dust and blast materials by vacuum cleaning Test surface pH level Inspect surface profile Concrete moisture	Section 6.1, 6.2, 6.4, Guideline No 310.2R ICRI Surface Profile Replicas Section 9.1 ASTM D 4263 ASTM F 1869 ASTM F 2170	Test all areas No contaminants No voids and blow holes No remaining dust or blast materials pH level >9 CSP 1 to CSP 3 ASTM D 4263, no visible moisture ASTM F 1869, <15 g/24 hr/m^2 ASTM F 2170 <80%RH	At completion of each area, daily. Prior to coating application.	AS 3894.10 (modified) AS 3894.11 (modified) AS 3894.13 (modified)			
11.	Surface preparation	Safe operation of abrasive blast cleaning and other concrete surface preparation equipment Visual observation	Section 6.4	Meets requirements of SafeWork SA Abrasive blasting Code of Practice	At completion of each area, daily. Prior to coating application.	AS 3894.10 (modified) AS 3894.11 (modified) AS 3894.13 (modified)			

Task no.	Work Phase	Inspection and Testing Activities	Applicable Documents	Acceptance Criteria	Frequency	Verifying Document	Applicator (Sign/ Date)	Inspector (Sign/ Date)	SAW (Sign/ Date)
12.	Fairing coat	Visual inspection Suitability for coating application	Section 6.20	Smooth surface for coating application	Prior to coating application	AS 3894.10 (modified) AS 3894.13 (modified)			
13.	Coating application	Mixing of coatings Visual observation	Section 7.3	Manufacturer's recommendations	Each mix		X	R	R
14.	Surface preparation	Monitor environmental conditions Relative humidity Substrate moisture content Ambient air temperature Substrate temperature Concrete Moisture	Section 7.4, 11.3, 0 Section 9.1 ASTM D 4263 ASTM F 1869 ASTM F 2170	Test every four hour minimum RH ≤ 85% 10°C ≥ T ≥ 35°C Substrate temperature ≥ 3°C above dewpoint, and 10°C ≥ T_s ≥ 35°C. Ensure substrate temperature is not rising during application ASTM D 4263, no visible moisture ASTM F 1869, <15 g/24 hr/m2 ASTM F 2170 <80%RH	Ambient Conditions: Monitor each half hour from prior to commencement of application to 48 hours after completion of application Concrete Moisture: 50 m^2 of coated concrete surface, with a minimum of one test for each 10 m of vertical rise commencing within 300 mm of the floor	AS 3894.14 (modified)	X	R	R

Task no.	Work Phase	Inspection and Testing Activities	Applicable Documents	Acceptance Criteria	Frequency	Verifying Document	Applicator (Sign/ Date)	Inspector (Sign/ Date)	SAW (Sign/ Date)
15.		Safe operation of spray painting Visual observation	Equipment Specifications and Operating manuals	Meets requirements of SafeWork SA Spray Painting and Powder Coating Code of Practice	AS 3894.11 (modified)		R	W	W
16.	Application	Primer coat (1st Coat) During application Wet film thickness (WFT) testing Visual inspection for holidays and discontinuities during application After application Allow sufficient curing time	Sections 7, 7.3, 7.4, 7.8, 7.5, 7.6, 0		Ambient Conditions: Monitor each half hour from prior to commencement of application to 48 hours after completion of application	AS 3894.10 (modified) AS 3894.13 (modified) AS 3894.14 (modified)	R	W	W

Task no.	Work Phase	Inspection and Testing Activities	Applicable Documents	Acceptance Criteria	Frequency	Verifying Document	Applicator (Sign/ Date)	Inspector (Sign/ Date)	SAW (Sign/ Date)
17.		Intermediate coat (2nd Coat) Before application Visual inspection of primer coat conditions (if applied) During application Wet film thickness (WFT) testing After application Allow sufficient curing time	Sections 7, 7.3, 7.4, 7.5, 7.6, 0	DFT 1200 µm Test every environmentals four hour minimum` RH ≤ 85% Ambient Temperature 10°C ≥ T_a ≥ 35°C Substrate temperature ≥ 3°C above dewpoint, and 10°C ≥ Ts ≥ 35°C. Ensure substrate temperature is not rising during application	Ambient Conditions: Monitor each half hour from prior to commencement of application to 48 hours after completion of application	AS 3894.10 (modified) AS 3894.13 (modified) AS 3894.14 (modified)	R	W	W

Task no.	Work Phase	Inspection and Testing Activities	Applicable Documents	Acceptance Criteria	Frequency	Verifying Document	Applicator (Sign/ Date)	Inspector (Sign/ Date)	SAW (Sign/ Date)
18.		Top coat (3rd Coat) Before application Visual inspection of intermediate coat conditions (if applied) During application Wet film thickness (WFT) testing After application Allow sufficient curing time Rub test for testing degree of cure (Method C of AS 3894.4) Bond strength test accordance with AS 3894.9 Dry film thickness measurement from bond strength test samples Holiday test in accordance with AS 3894.1 Visual inspection for defects	Sections 7, 7.3, 7.4, 7.5, 7.6, 0AS 3894.4 Method C AS 3894.9 Method C ASTM D6132	DFT 1200 µm Test every environmentals four hour minimum` RH ≤ 85% Ambient Temperature 10°C ≥ Ta ≥ 35°C Substrate temperature ≥ 3°C above dewpoint, and 10°C ≥ Ts ≥ 35°C. Ensure substrate temperature is not rising during application	Ambient Conditions: Monitor each half hour from prior to commencement of application to 48 hours after completion of application	AS 3894.10 (modified) AS 3894.13 (modified) AS 3894.14 (modified)	W		

Task no.	Work Phase	Inspection and Testing Activities	Applicable Documents	Acceptance Criteria	Frequency	Verifying Document	Applicator (Sign/ Date)	Inspector (Sign/ Date)	SAW (Sign/ Date)
19.	Joints and sealants	Surface preparation for installation of joint sealant. Sealant primer Installation of backing rod Installation of sealant.	Section 2.4 and 0 Sealant Manufacturers recommendations	Width to depth ratio of 2:1 Minimum joint size of 8 mm, maximum 50 mm	100% visual inspection of each joint	AS 3894.10 (modified)AS 3894.12 (modified) AS 3894.13 (modified) AS 3894.14 (modified)			
20.	Completion of protective coating application	Submission of work completion report including testing and any warranty certificates	ITP	All specified forms and documents completed and signed off	Every relevant form and document	Signed off ITP	R	X	X

Appendix D : Termination Drawings

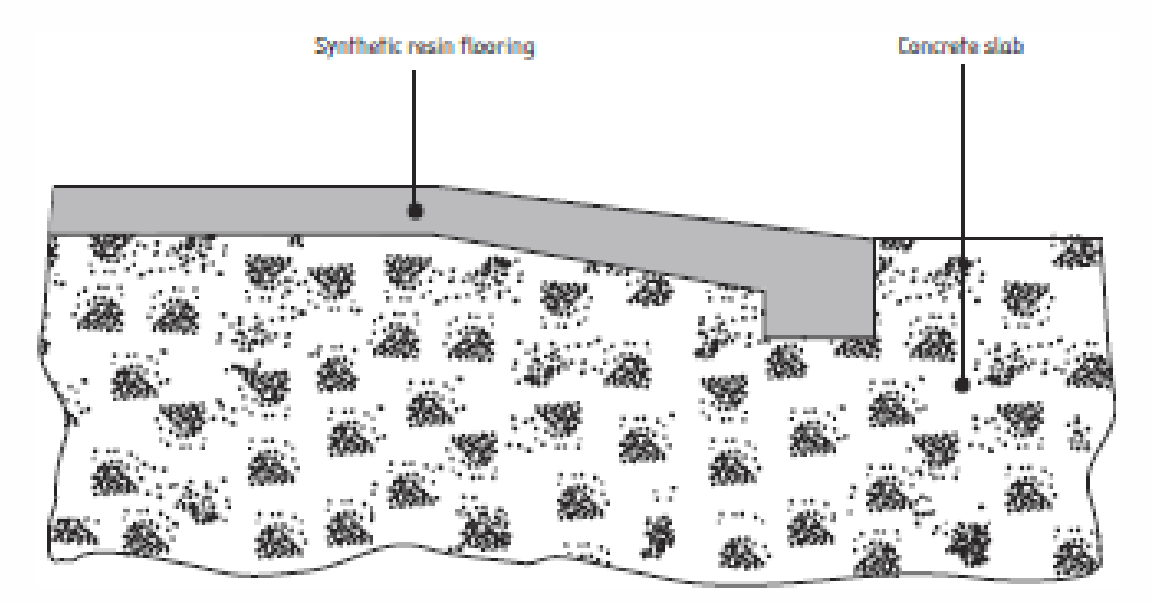

Figure 2: Toe-in Joint for Floor and Wall Terminations (Ref. BS 8204.6)

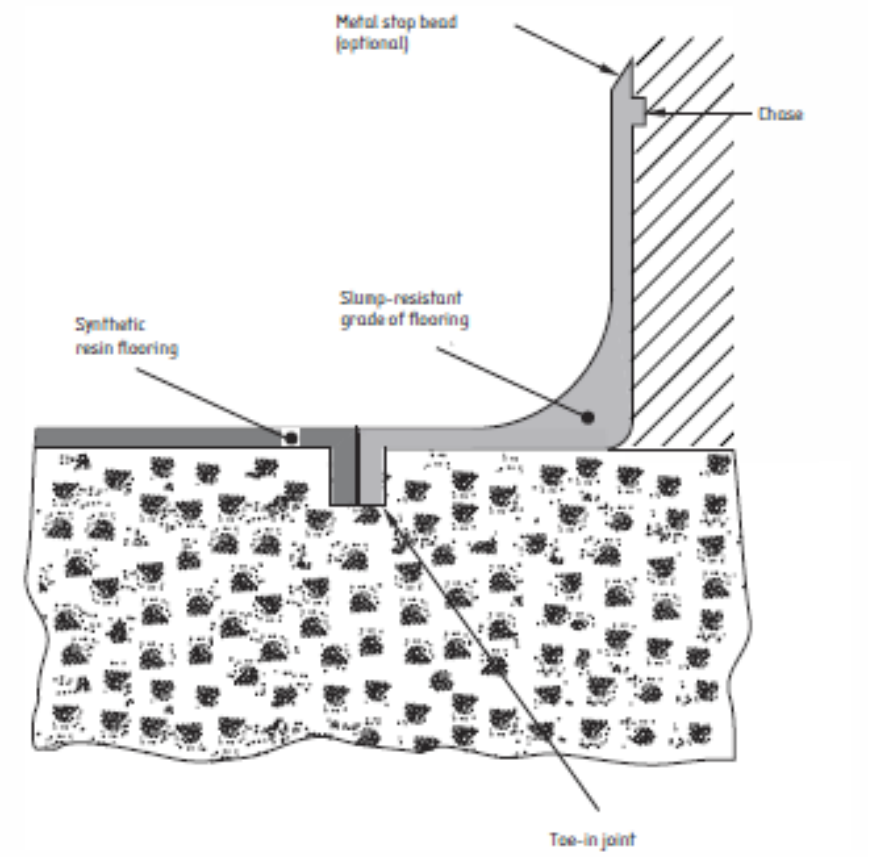

Figure 3: Floor to Wall Joint, Coving (BS 8204.6)

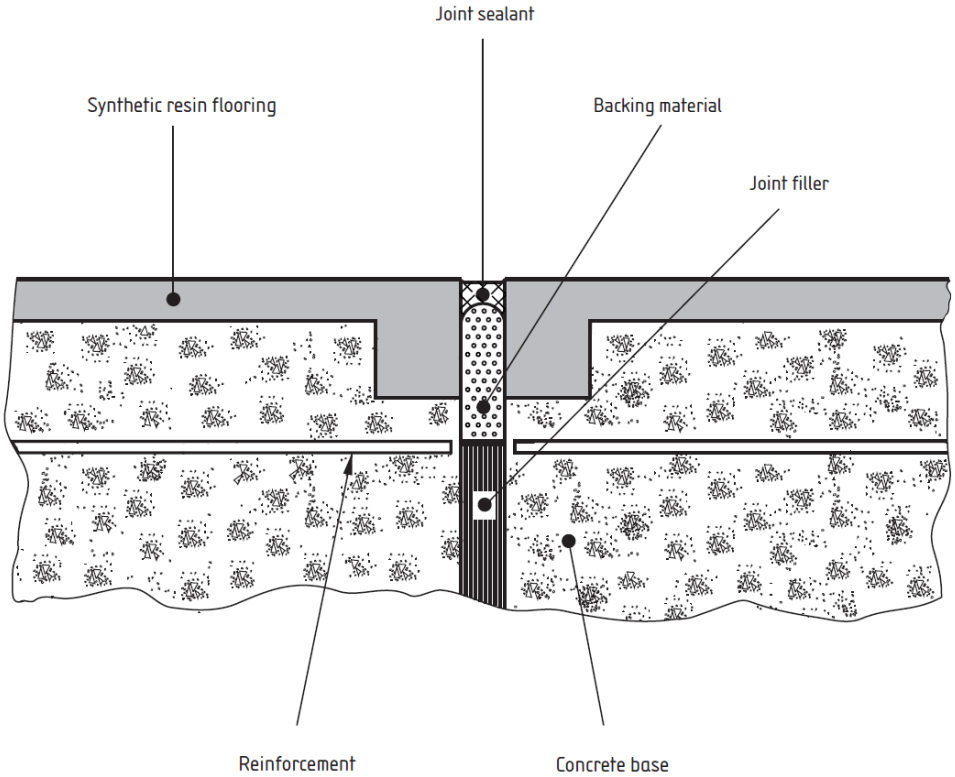

Figure 4: Movement Joint (BS 8204.6)

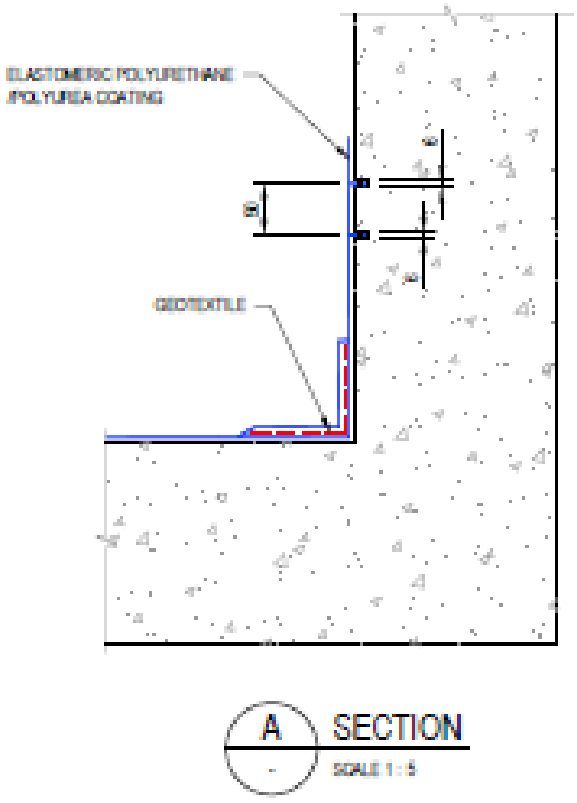

Figure 5: Groove Detail at Wall to Floor Intersection

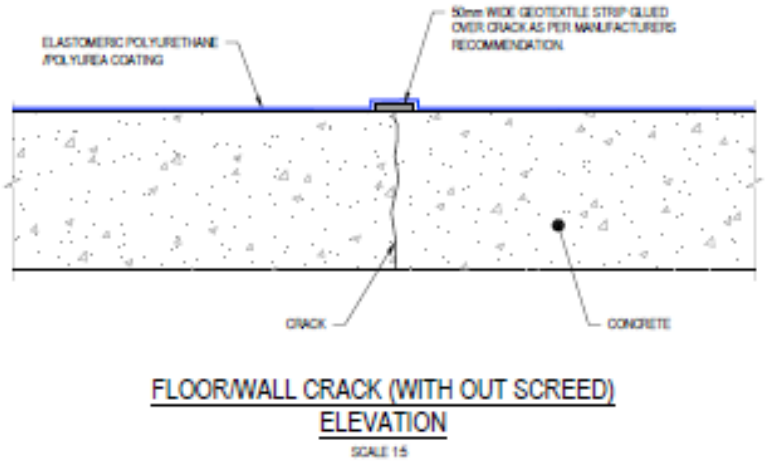

Figure 6: Groove Detail at Floor or Wall Crack

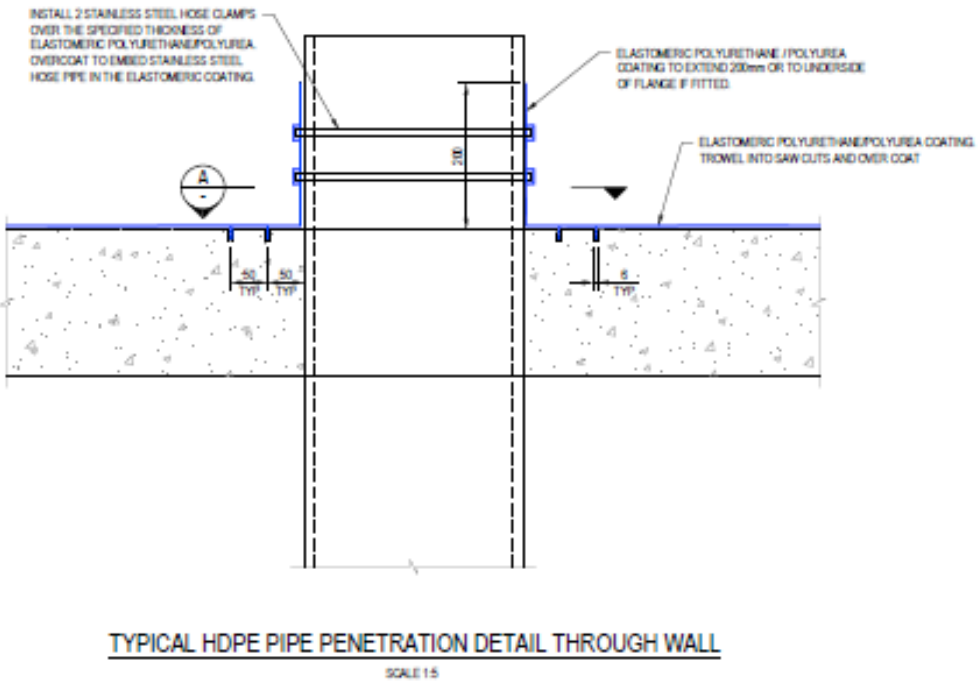

Figure 7: Groove Detail at Typical Pipe Through Penetration

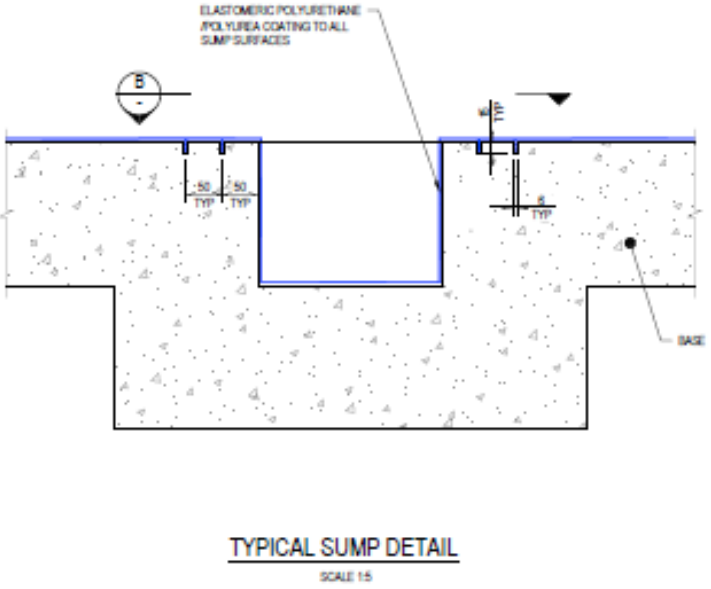

Figure 8: Groove Detail at Sump Pit

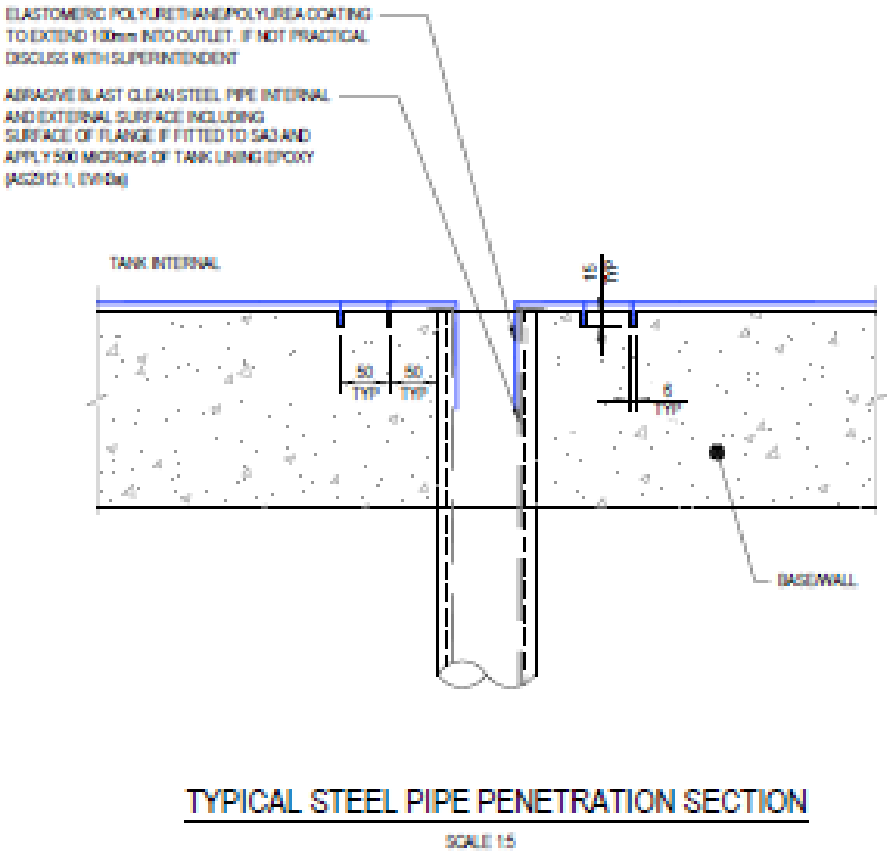

Figure 9: Groove Detail at Flush Pipe Penetration

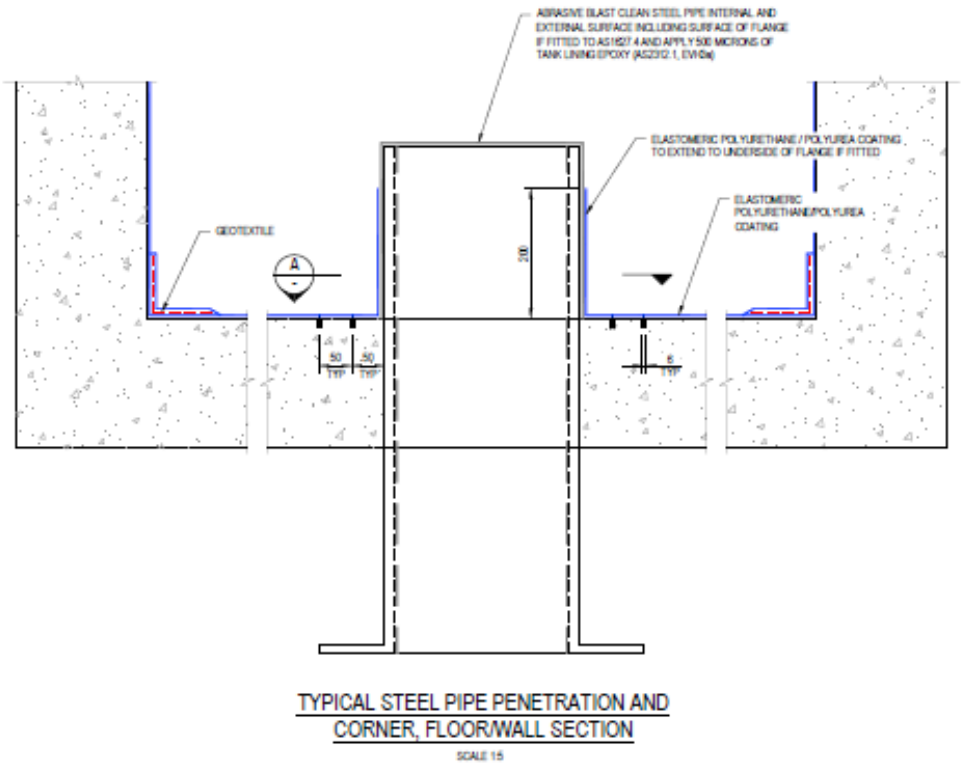

Figure 10: Groove Detail at Wall to Floor Intersection and Pipe Penetration

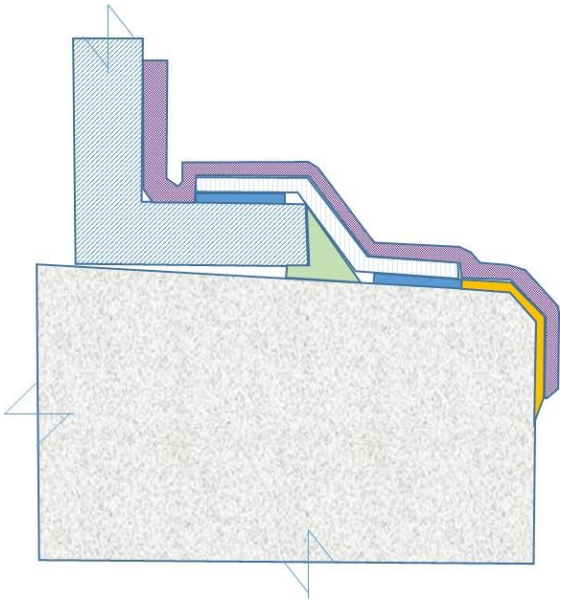

Figure 11: Tank Boot Seal Detail

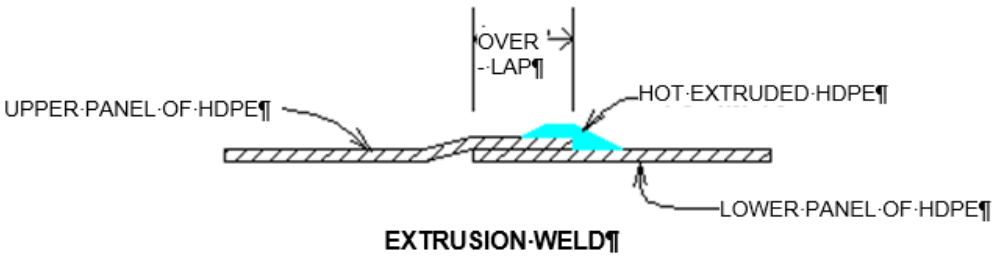

Figure 12: HDPE Extrusion Weld Detail