

Engineering

TS 0400 – SA Water supplement to the Manual for Selection and Application of Protective Coatings: WSA 201

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**Government of
South Australia**

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Documents superseded by this standard

The following documents are superseded by TS 0400:

- a. TS 15 - Protection of Steelwork In Submersible Environments
- b. TS 16 - Protection of Steelwork In Atmospheric Environments
- c. TS 18 - Protection of Steelwork In Buried Environments
- d. TS 0711.5 - Concrete Remedial Works: Surface Protection and Lining of Concrete

Significant/major changes incorporated in this edition

Nil – this is the first issue of this Technical Standard.

Implementation of this standard

Following the release of this standard, all projects award or completed from the formal release shall incorporate the requirements of this technical standard.

Document controls

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1 Introduction

SA Water is responsible for the construction and commissioning of an extensive amount of engineering infrastructure such that it is safe and functional.

This standard has been developed to assist in the design, maintenance, construction and management of this infrastructure.

1.1 Purpose

The purpose of this document is to define minimum performance, assurance and acceptance requirements so that assets within its scope are constructed and maintained consistently, remain suitable for their service environment and achieve the required asset life. Prescriptive material or process requirements apply only where necessary to control a demonstrated safety, water-quality, durability, compatibility or operational risk.

1.2 Glossary

Terms and Abbreviations utilised in this Standard are included in the following sections. The definitions presented below are to be used when interpreting this Standard and actions undertaken in relation to this Standard. Where a conflict exists, clarification is to be sought from SA Water.

1.2.1 Terms and Definitions

The following is a list of Terms applicable to this document:

Term	Description
Accepted	Determined to be satisfactory by SA Water's Representative.
Allow	Means that the cost of the item referred to is the responsibility of the Constructor
Constructor	The organisation responsible for constructing and installing infrastructure for SA Water whether it be a third party under contract to SA Water or an in-house entity.
Contract	A set of documents supplied to Constructor as the basis for construction; these documents contain contract forms, contract conditions, specifications, drawings, addenda, and contract changes.
Designer	The organisation responsible for designing infrastructure for SA Water whether it be a third party under contract to SA Water or a Constructor, or an in-house entity. A Designer is a person who effects design, produces designs or undertakes design activities as defined in the <i>Work Health and Safety Act 2012 (SA)</i> .
Informative	Means "provided for information and guidance".
Manufacturer	A person, group, or company that owns and operates a manufacturing facility that provides materials for use in SA Water infrastructure.
Must	Indicates a requirement that is to be adopted in order to comply with the Standard.
Person/s	Each word implying a person, or persons shall, where appropriate, also be construed as including corporations.
Provide	Means "supply and install".
Responsible Discipline Lead	The engineering discipline expert identified in the 'Approvers' table (via SA Water's Representative).

Term	Description
SA Water Representative	The SA Water representative with delegated authority under a Contract or engagement, including (as applicable): <ul style="list-style-type: none"> • Superintendent's Representative (for example AS 4300 and AS 2124 etcetera) • SA Water Project Manager • SA Water nominated contact person
Should	Indicates practices which are advised or recommended, but is not required
Supplier	A person, group or company that provides goods for use in SA Water infrastructure.
Technical Dispensation Request Form	This form is part of SA Water's Technical Dispensation Request Procedure which details the process by which those required to comply, or ensure compliance, with SA Water's technical requirements may seek dispensation from those requirements.
Work	Elements of a project which require design and/or construction.

1.2.2 Abbreviations

The following is a list of Abbreviations, Acronyms and Initialisms used in this document:

Abbreviation	Description
ACA	Australasian Corrosion Association
AMPP	Association for Materials Protection and Performance
CIP	Coating Inspector Program
CSP	Concrete Surface Profile
DFT	Dry Film Thickness
FBE	Fusion Bonded Epoxy
FROSIO	The Norwegian Professional Council for Education and Certification of Inspectors for Surface Treatment
HDPE	High Density Polyethylene
HSS	Heat Shrink Sleeves
ICorr	The Institute of Corrosion
ICRI	International Concrete Institute
ITP	Inspection Test Plan
NACE	National Association of Corrosion Engineers
NCR	Non Conformance Report
NDFT	Nominal Dry Film Thickness
PCCP	Painting Contractor Certification Scheme
PVC	Poly Vinyl Chloride
QC	Quality Control
QP	Quality Procedures
SA Water	South Australian Water Corporation
SDS	Safety Data Sheet
SSD	Saturated Surface Dry
SSPC	The Society for Protective Coatings

Abbreviation	Description
TDRF	Technical Dispensation Request Form
TG	SA Water Technical Guideline
TS	SA Water Technical Standard
UV	Ultraviolet
WFT	Wet File Thickness
WMS	Work Method Statement
WSA	Water Services Associate

1.2.3 Terminology

The following is a list of specific interpretations for Terminology used in this standard.

- Where an obligation is given and it is not stated who is to undertake these obligations, they are to be undertaken by the Constructor.
- Directions, instructions and the like, whether or not they include the expression "the Constructor shall" or equivalent, shall be directions to the Constructor, unless otherwise specifically stated.
- Where a submission, request, proposal is required and it is not stated who the recipient should be, it is to be provided to SA Water's Representative for review.
- Each word imparting the plural shall be construed as if the said word were preceded by the word "all".
- "Authorised", "approval", "approved", "selected", "directed" and similar words shall be construed as referring to the authorisation, approval, selection or direction of SA Water's Representative in writing.
- "Submit" mean "submit to the SA Water Representative or their nominated delegate".
- Unless noted otherwise, submissions, requests, proposals are to be provided at least 10 business days prior to work commencing or material ordering (unless noted otherwise).

1.3 References

1.3.1 Australian and international

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

Reference	Title
AS 3894.1	Site testing of protective coatings, Method 1: Non-conductive coatings – Continuity testing – High voltage (brush) method
AS 3894.10	Site testing of protective coatings, Part 10: Inspection report – Daily surface and ambient conditions
AS 3894.11	Site testing of protective coatings, Part 11: Equipment report
AS 3894.12	Site testing of protective coatings, Part 12: Inspection report – Coating
AS 3894.13	Site testing of protective coatings, Part 13: Inspection report – Daily
AS 3894.14	Site testing of protective coatings, Part 14: Inspection report – Daily painting
AS/NZS 1680.2.4	Interior and workplace lighting: Industrial tasks and processes

Reference	Title
AS/NZS 1715	Selection, use and maintenance of respiratory protective equipment
AS/NZS 1716	Respiratory protective devices
AS/NZS 1891	Personal equipment for work at height
AS/NZS 2299.1	Occupational diving operations, Part 1: Standard operational practice
AS/NZS 2312.2	Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings: Hot dip galvanizing
AS/NZS 4020	Testing of products for use in contact with drinking water
AS/NZS 4361.1	Guide to Hazardous Paint Management Part 1: Lead and other hazardous metallic pigments in industrial applications
AS/NZS ISO 9001	Quality Management Systems - Requirements
ASNZS 4158	Thermal-bonded polymeric coatings on valves and fittings for water industry purposes
WSA 201	Manual for the Selection and Application of Protective Coatings

1.3.2 SA Water documents

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

Reference	Title
TS 0101	Safety in Design
TS 0105	Quality Requirements
TS 0109	Infrastructure Design
TS 0204	Colour Coding of Pipework
TS 0300	Supply and Installation of Low Voltage Electrical Equipment
TS 0420	Welding Requirements (Metal)
TS 0421	Welding of Thermoplastics
TS 0465	Mortar Repair Systems
TS 0711.5	Concrete Remedial Works: Surface Protection and Lining of Concrete
TS 0721	Design Requirements for Water Storage Tanks and Associated Works
TS 0730	Stainless Steel Durability, Fabrication and Erection
TS 0800	Materials in Contact with Drinking Water

2 Scope

This document covers the application of all coatings for SA Water infrastructure.

This includes:

- a. Protective coatings for assets in atmosphere
- b. Protective coatings for buried assets
- c. Protective coatings for submerged assets.

SA Water has adopted WSA 201 Manual for Selection and Application of Protective Coatings as its specification for coatings selection and application. This includes surface preparation details, coating thickness, and inspection requirements. The specification includes steel and concrete substrates.

This document contains SA Water's:

1. Amendments to WSA 201
2. Compliant products for protective coatings
3. Compliant products for tape wrapping
4. Specific details for valve refurbishment
5. Specific details for pump refurbishment.

Where there are contradicting requirements between WSA 201 and this document, the requirement specified in this document shall take precedence. In the case of any omissions or ambiguities in the WSA 201 or this document. Seek clarification from the Principal Materials Engineer, SA Water.

WSA Manual for Selection and Application of Protective Coatings provides a generic basis for coating selection but does not recommend specific brands or products. Due to variations amongst water authorities in terms of legacy conditions, operating licence constraints, regulatory requirements, topographical and meteorological conditions, and legislation, WSA was not able to mandate specific products. SA Water has reviewed the products available on the market, aligned these with the categories within WSA 201 and produced a list of products known to be compliant, which is contained in Section 15. In addition, specific product and application requirements are included in TS 0711.5 for concrete repairs, Appendix C for valve refurbishment and Appendix D for pump refurbishment.

Selection of colours for SA Water assets is covered in TS 0204.

2.1 Technical dispensation

Departure from any requirement of this Technical Standard shall require the submission of Technical Dispensation Request Form (TDRF) for the review and approval (or otherwise) of SA Water Principal Engineer listed in Page 4, on a case-by-case basis.

The Designer shall not proceed to document/incorporate the non-conforming work before the Principal Engineer has approved of the proposed action in writing via the [Technical Dispensation Request Form \(TDRF\)](#).

SA Water requires sufficient information to assess dispensation requests and their potential impact. The onus is therefore on the proponent to justify dispensation request submissions and provide suitable evidence to support them.

Design works that are carried out without being appropriately sanctioned by SA Water shall be liable to rejection by SA Water and retrospective rectification by the Designer/Constructor.

2.2 Hazards

Hazards shall be identified and addressed in accordance with TS 0101.

A Safety Checklist has been developed based on WSA 201 and is included at Appendix G for reference. This Checklist is to be completed prior to the start of work.

3 Hold points and witness points

3.1 Hold points

Hold points applicable to this Technical Standard can be found in Appendix A. Please refer to TS 0105 for further detail on hold points.

3.2 Witness points

The minimum required Witness Points are detailed within Appendix A of this Technical Standard. Please refer to TS 0105 for further detail on hold points.

3.3 Non-conformance

Please refer to TS 0105 for the requirements relating to non-conformance.

4 Amendments to WSA 201

WSA 201 is to be used as the basis for selection and application of protective coatings at SA Water.

Table 1 notes specific deviations from WSA 201 to meet SA Water's requirements. The table includes deviations, variations, deletions and additions. WSA 201 and this document are to be used together, taking into account the provisions in Table 1.

Tables and sections listed in Table 1 refer to those contained in WSA 201 unless otherwise noted.

Table 1: List of amendments to WSA 201 (Version 2.3 2021)

WSA 201 Clause	Amendment
1.2 Definitions	Add the following text at the end of clause 1.2: <i>See also Section 1.2 of this document.</i>
1.3 Alternative Solutions and Innovations	Supersede clause 1.3 with the following text: <i>Approval of alternatives shall be via the TDRF process described in Section 2.1.</i>
1.4.2 During Coating Application	Add the following text after the last bullet point in clause 2.3.1: <i>In addition to the Applicator following the methodology specified in WSA 201, they shall also follow the amendments, additions and variations listed in this Table.</i>
1.6 Referenced Documents	Add the following text at the end of clause 1.6: <i>See also Section 1.3 for referenced documents.</i>
1.7 Definitions	Add the following text after table in clause 1.3: <i>See also Section 1.2. Wherever there is a discrepancy between this document and WSA 201, this document takes precedence.</i>

WSA 201 Clause	Amendment
2 Quality Assurance	<p>Insert a new clause with the following content:</p> <ul style="list-style-type: none"> • Quality Assurance to be in accordance with TS 0105. • The Constructor must operate a Quality Management System in accordance with AS/NZS ISO 9001. • Confirmation that the Contractor's QMS complies with AS/NZS ISO 9001 constitutes a HOLD POINT. • The Constructor and their major sub-contractors and suppliers shall have a Quality Plan in place. • Approval of the Quality Plan shall be a HOLD POINT. • Provision of a Work Method Statement for the Works shall be submitted and approved prior to the start of the Works. This shall contain requirements for supply, storage, mixing, equipment, surface preparation, application, WFT, DFT, coating thickness, recoat times, curing, inspection, testing, repair of defects, and details of any deviation from these specifications. This approval shall be a HOLD POINT. • All Inspection and Test Plans (ITP) for the Works shall be submitted and approved prior to the Works commencing. This approval shall be a HOLD POINT. An example of an ITP is provided in Clause 11 of WSA 201. • The definition of Hold Points, Witness Points and Non-Conformances are provided in TS 0105. Note that identification of a nonconformity and the subsequent issue of an NCR constitutes a HOLD POINT, subject to acceptance of the proposed corrective actions.
2.2 Approved Applicator	<p>Supersede text of clause 2.2 with the following:</p> <p>For the purposes of satisfying the requirements of a 'recognised protective coating application scheme,' SA Water considers compliance with the Painting Contractor Certification Scheme (PCCP) or AMPP Quality Procedures (QP) Programs to be sufficient. Evidence of compliance and certification to these schemes shall be provided to the SA Water Representative. WITNESS POINT.</p>
2.5 Coating Inspector	<p>Supersede text of clause 2.6 with the following:</p> <p>SA Water may request that an independent inspector be engaged for the Works. In such case, the Contractor shall include the costs of the Inspector in their estimate for the Works. The Contractor may choose to engage an independent inspector at any time, regardless of the absence of any such request from SA Water.</p> <p>The Inspector shall be certified by either:</p> <ul style="list-style-type: none"> • Association for Materials Protection and Performance (AMPP). • Qualifications that meet the requirements of FROSIO (Norway) or ICorr (UK) may be considered on a case-by-case basis. <p>For coatings over structures, other than concrete, in extreme, immersion, and buried exposure class conditions, the Inspector shall hold a minimum of an AMPP CIP Level 2 certification.</p> <p>SA Water may consider the track record of a Contractor within a project when determining the frequency of inspection.</p>
3 Work Health and Safety	<p>Insert a new clause with the following content:</p> <p>Refer to Section 2.2 of this document for additional SA Water requirements.</p> <p>A safety checklist has been developed to align with WSA 201 and is found in Appendix E. This Checklist is to be completed prior to the start of work. A copy of this is to be provided to the SA Water Representative. This shall be a HOLD POINT.</p>

WSA 201 Clause	Amendment
4 Environmental Protection	Insert a new clause with the following content: <i>An environmental checklist has been developed to align with WSA 201 requirements and can be found in Appendix F. This Checklist is to be completed prior to the start of work. A copy of this is to be provided to the SA Water Representative. This shall be a HOLD POINT.</i>
5.2 Design Life of Assets	Supersede text of clause 5.2 with the following: <i>Design Life for SA Water assets are to comply with TS 0109. Text in Clause 5.2 of WSA 201 is guidance only and the provisions of TS 0109 shall apply.</i>
5.4.3 Protective Coatings Products	Insert the following text at the end of clause 5.4.3: <i>The Compliant Product List for SA Water is included at Appendix B.</i>
5.4.4 Products in Contact with Drinking Water or Recycled Water	Insert the following text after the first paragraph of clause 5.4.4: <i>The process for approval of products in contact with drinking water to be used in SA Water infrastructure shall be in accordance with TS 0800.</i>
5.4.6 Coatings for Concrete	Supersede all clause 5.2 with the following text: <i>Concrete coatings requirements shall be in accordance with Sections 0 and 6.</i>
5.5 Coating System Descriptions	Add the following notes at the end of Table 3 of clause 5.5: <ul style="list-style-type: none"> • <i>Application of Heat Shrink Sleeves (HSS) requires specific approval by SA Water. Details of the approval procedure are presented in Clause 8.19 of this table.</i> • <i>Glass flake and fibreglass-based coating systems are not included in clause 5.5 of WSA 201. These systems are applicable to SA Water infrastructure and have been listed in the Compliant Product List in Appendix B.</i>

WSA 201 Clause	Amendment
5.6 Recommended Coating Systems	<p>Add the following notes at the end of the following tables of clause 5.6:</p> <ul style="list-style-type: none"> Table 4 – Tank roof framing and support structures shall be coated in accordance with TS 0721. Table 4 – Stainless steel durability requirements are listed in TS 0730. Table 5– Note ABS pipe systems are not permitted by SA Water – refer TS 0109. <p>Table 5 and Table 6 - For new metal-seated valves, the Designer shall specify an internal lining system suitable for the defined exposure, hydraulic duty, and required design life.</p> <p>The lining shall demonstrate resistance to immersion, abrasion, cavitation where applicable, impact, under-film corrosion and service chemicals, together with adhesion, continuity, repairability and compatibility with the substrate and potable-water requirements where relevant.</p> <p>Fusion-bonded epoxy systems that have not demonstrated adequate performance for the intended duty, within South Australia, for comparable service requirements, shall not be used.</p> <p>An internal lining system including but not limited to, high-build barrier, ceramic-reinforced, polyurethane, hybrid polymer, or other lining technologies, may be proposed where supported by relevant test data and comparable service evidence from South Australian installations.</p> <ul style="list-style-type: none"> Table 5 and Table 6 - For new valves the designer shall specify internal coating from Appendix C1. For different coatings, a TDRF shall be submitted, and the selection shall be based on exposure class: <ul style="list-style-type: none"> Extreme: Coatings from Category C13 (Anti abrasion ceramic filled epoxy/polyurethane) in Appendix B shall be considered. Valves used on major pipeline systems are included in this category. Immersion: Coatings from Categories C3 (High build solvent free epoxy) and C4 (Ultra-high build epoxy) (C4) in Appendix B can be used. <p>Approval process for Coatings not listed in Appendix B shall be as per section 15.</p> <ul style="list-style-type: none"> Products Table 9 – careful consideration of the use of bituminous products is required. Compatibility with other products and future repairs and maintenance need to be considered. Table 9 – Rehabilitation of concrete sewerage structures is to be in accordance with this standard. Table 9 – Note earlier clarification about HSS – specific approval for use required by SA Water.
6.2.5 Cementitious Substrate	<p>Supersede all clauses with the following text:</p> <p>Refer to sections 0, 6 and 7 of this document for SA Water requirements for Concrete Repair.</p>
6.3.2 Rectification of Metal Defects	<p>Replace last paragraph of clause 6.3.2 with the following text:</p> <p>Where the corrosion has resulted in a loss of metal thickness greater than 2mm, advise SA Water to allow for more detailed assessment. HOLD POINT Do not apply coatings until approved by SA Water.</p>

WSA 201 Clause	Amendment
6.3.10 Preparation of concrete substrate for cementitious coating application	Supersede clause 6.3.10 with the following text: <i>Refer to section 8 of this document.</i>
7.3 Transportation and Storage	Add the following text after the second paragraph of clause 7.3: <i>When available the Australian Paint Approvals Scheme (APAS) 'APAS Record of Supply' shall be requested and obtained when the product is purchased.</i> <i>A 'Certificate of Test' can then be obtained by SA Water's Representative if problems in the application of the coating subsequently occur. Information and procedures concerning Records of Supply and Certificate of Test are detailed in APAS Document AP-D192.</i> <i>Returns, as required by APAS, shall be completed by the manufacturer, and submitted to SA Water's Representative by the Contractor for forwarding to SA Water Engineering, Materials Science.</i>
7.15 Finished Colours	Supersede clause 7.15 with the following text: <i>Colours are to be in accordance with SA Water TS 0204.</i>
7.17 Passivation of Stainless Steel	Supersede clause 7.17 with the following text: <i>Refer to SA Water TS 0420 for passivation of stainless-steel requirements.</i> <i>Maximum heat tint permissible is pale straw (Level 3 in TS 0420 Figure 2).</i>
7.18 Bi-Metallic Corrosion	Delete the last sentence of clause 7.8 and add the following text: <i>Insulating joint arrangement and electrical testing for continuity to be in accordance with drawing STD-04-00001_14.</i>
7.19 Cement Based Coating Application	Supersede clause 7.19 and all its subclauses with the following text: <i>Refer to Sections 9, 10, 11 and 12 of this document for application details of protective products for concrete substrates.</i>
8.3 CAC (Calcium Aluminate Cement Mortar)	Supersede clause 8.3 with the following text: <i>CAC render in accordance with Section 11.2 of this document.</i>
8.5 Cement Mortar Lining	Supersede clause 8.5 with the following text: <i>In situ cement mortar lining to be in accordance with SA Water TS 0465 – Mortar Repair Systems.</i>
8.6 CPL Concrete Protective Liner	Supersede clause 8.6 with the following text: <i>Concrete linings in accordance with Section 12 of this document.</i>

WSA 201 Clause	Amendment
8.7 EBS (Elastomeric Boot Seal)	Supersede clause 8.6 with the following text: <i>Elastomeric Boot Seal in accordance with Section 10.10 of this document.</i>
8.10 Epoxy High Build, solvent based for immersion service	Add the following note at the end of clause 8.10: <i>Products in contact with drinking water shall be approved in accordance with SA Water TS 0800.</i>
8.11 EHB-SF (epoxy high build, solvent free for immersion service)	Add the following note at the end of clause 8.11: <i>Products in contact with drinking water shall be approved in accordance with SA Water TS 0800.</i>
8.17 Hot dip galvanising	Add the following notes at the end of clause 8.17: <ul style="list-style-type: none"> • <i>For atmospheric and buried applications only.</i> • <i>For submerged applications top coating shall be applied. Refer to top coating with AS 2312.2.</i>
8.18 Geopolymer Cement Mortar	Supersede clause 8.18 with the following text: <i>Geopolymer cement mortar in accordance with Section 11 of this document.</i>
8.19 Heat Shrinkable Sleeve	Add the following notes at the end of clause 8.19: <i>For the use of heat-shrinkable sleeves in buried applications, a Technical Deviation Request Form (TDRF) shall be submitted to SA Water for review and approval. Where approval is granted, the following conditions shall apply:</i> <ul style="list-style-type: none"> • <i>The locations of all heat-shrinkable sleeves shall be submitted to SA Water for inclusion in the asset register.</i> • <i>All personnel installing heat-shrinkable sleeves shall be appropriately trained and competent in their application.</i> • <i>The Contractor shall provide documented evidence of training for all personnel undertaking the installation of heat-shrinkable sleeves.</i> • <i>HSS is not permitted for maintenance activities.</i> • <i>The A1 Procedure in the Steel Mains Handling and Installation Manual shall be applicable for new build pipelines and pipework.</i> • <i>Installers shall put the following identifiers on the installed sleeve:</i> <ul style="list-style-type: none"> ◦ <i>Date and Time</i> ◦ <i>Weather Conditions during installation</i> ◦ <i>Installer initials and Certification ID</i>

WSA 201 Clause	Amendment																		
8.29 Tape Wrapping	<p>Add the following notes at the end of clause 8.29:</p> <ul style="list-style-type: none">Tape wrapping includes wrapping with Bitumen Mastic tapes and Petrolatum tapes. The following table provides guidance for product selection. <table><tr><th>Application</th><th>Bitumen Mastic</th><th>Petrolatum</th></tr><tr><td>Bare Steel</td><td>✓</td><td>✗</td></tr><tr><td>Sintakote</td><td>✓</td><td>✗</td></tr><tr><td>Cast iron or ductile iron</td><td>✓</td><td>✓</td></tr><tr><td>Coal tar coating</td><td>✗</td><td>✓</td></tr><tr><td>Brass fittings</td><td>✗</td><td>✓</td></tr></table> <ul style="list-style-type: none">Training of Applicators. Applicators shall have completed appropriate competency-based training approved by SA Water prior to application of the products. A copy of these certificates shall be provided on request. This shall be a WITNESS POINT.Testing. Completed wrapping shall be tested using a high voltage spark tester in accordance with AS 3894.1 at an operating voltage of 15kV.	Application	Bitumen Mastic	Petrolatum	Bare Steel	✓	✗	Sintakote	✓	✗	Cast iron or ductile iron	✓	✓	Coal tar coating	✗	✓	Brass fittings	✗	✓
Application	Bitumen Mastic	Petrolatum																	
Bare Steel	✓	✗																	
Sintakote	✓	✗																	
Cast iron or ductile iron	✓	✓																	
Coal tar coating	✗	✓																	
Brass fittings	✗	✓																	
8.30 Thermal Spray Zinc	<p>Add the following note at the end of clause 8.30:</p> <p>Compliance with AS 2312.3 is required.</p>																		
9.0 Product Specifications	<p>The following product specifications (Table 10) to be replaced as follows:</p> <ul style="list-style-type: none">Calcium aluminate cement mortar (C12) – Refer to Section 6.7.3 of this document.Geopolymer cement mortar (C14) – Refer to Section 6.7.4 of this document.HDPE / PVC liner (T8) – Refer to Sections 6.9.3 and 6.9.4 of this document.																		
10.3.8 Moisture content – concrete and masonry structures	<p>Supersede clause 10.3.8 with the following text:</p> <p>Testing of concrete coatings to be in accordance with Section 14 of this document.</p>																		
10.3.11 Dry film thickness – concrete substrates	<p>Supersede clause 10.3.11 with the following text:</p> <p>Testing of concrete coatings to be in accordance with Section 14 of this document</p>																		

WSA 201 Clause	Amendment
10.3.14 Film continuity (holiday test) – Concrete substrates	Supersede clause 10.3.14 with the following text: <i>Testing of concrete coatings to be in accordance with Section 14 of this document</i>
10.3.16 Defects for cementitious coatings (CAC & GEO)	Supersede clause 10.3.16 with the following text: <i>Testing of concrete coatings to be in accordance with Section 14 of this document.</i>
10.4 Acceptance Testing for Cementitious Coatings (CAC & GEO)	Supersede clause 10.3.4 with the following text: <i>Testing of concrete coatings to be in accordance with Section 14 of this document.</i> Insert a new clause with the following content: <i>Water Storage Return to Service</i> <i>Refer to Section 13 of this document for cleaning and testing of water storage tanks details.</i>
13.1.2 Approved Protective Coating Products	Supersede clause 13.1.2 with the following text: <i>The Sydney Water supplement is NOT applicable to SA Water.</i> <i>Refer to Section 15 and Appendix B for the SA Water List of Compliant Products.</i>
13.1.3 Standard Colours	Supersede clause 13.1.3 with the following text: <i>SA Water standard colours are in accordance with TS 0204. Standard colours for electrical cabinets are in accordance with TS 0300.</i>

5 Concrete Surface Protection and Lining System Selection

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

Coating system recommendations in this document are based on Clause 5 of WSA 201.

The Designer shall:

- Select 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.

5.1 Exposure Class

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

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

Table 3 sets out the exposure classes by structure type and micro-environment and includes corresponding exposure classifications from Table 4.1 of AS 3735.

Wastewater structure exposure environments are shown in Figure 1.

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 ₂ S exposure)	5B, 4D, 2C
	Buried in aggressive soils for example, 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 ₂ S gas exposure)	5B, 2C
	Marine and coastal environments such as, 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 for example, 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

¹ Definitions in Table 2 of TS 0711.1.

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 >0.5m below min. level, < 4m/s velocity	Moderate	B2
	Continuously Submerged >0.5m below min. level, >4m/s velocity	High	B2
	All internal areas above (0.5m below min. sewage level) - open to air, fresh sewage	Moderate	B2
	All internal areas above (0.5m below min. sewage level) - open to air, stale sewage	High	D
	All internal areas above (0.5m below min. sewage level) - enclosed, fresh sewage	High	D
	All internal areas above (0.5m 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

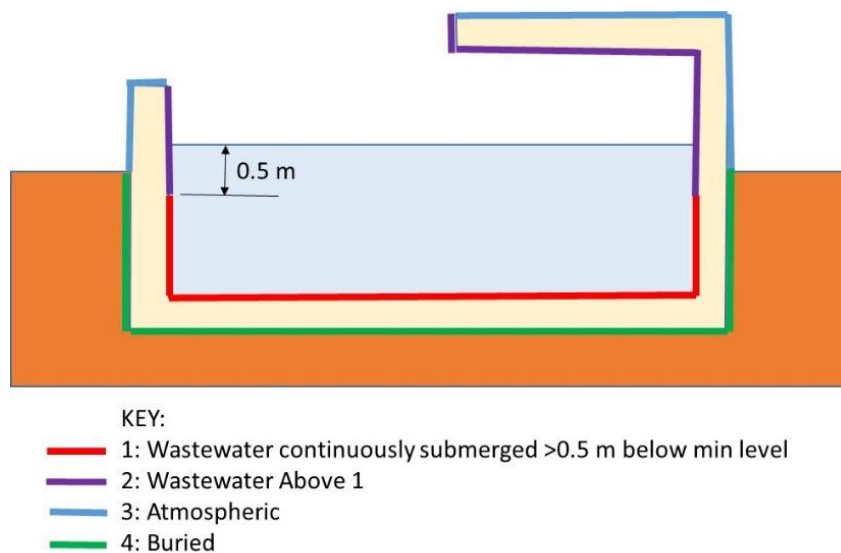


Figure 1: Wastewater Structure Exposure Environments

5.2 Coating Systems for concrete surfaces

Generic coating and liner systems are as per Table 3 of WSA 201 version 2.3.

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	WSA 201 Code	Material	Exposure Class	Type Description
B1	SLX	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	ACL	Acrylic Latex	Decorative	Water based acrylic- paint for decorative painting.
B5	PSL	Epoxy and Polysiloxane Systems	Moderate	A three-coat epoxy and polyurethane-based or polysiloxane-based coating system, for aesthetics, durability, and atmospheric corrosion protections. Polysiloxane topcoats provides anti-graffiti properties.

Type	WSA 201 Code	Material	Exposure Class	Type Description
B6	EWB	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 for example, garage workshops and stores. It is typically odourless, making it suitable for interior applications. Can be made non-skid by adding suitable aggregates.
B7	EPM	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	EBH-SB/ EBH-SF	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	EUH	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 structures with high exposure to H ₂ S gas acids found in wet wells, maintenance holes, and inlet works.
B10	NOV	Epoxy Novolac	High, Extreme	High build Novolac epoxy system for concrete exposed to corrosive chemicals for example, chemical bunds and septic sewer structures. Interior, high duty exposure including ponding, immersion or corrosive vapours.
B11	VES	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 0.4mm wide, or higher durability thick render.
B13	CAC	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	PUE	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	CPL	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	EBS	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: Allowable coating and liner material 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
Epoxy Mastic	Silane/siloxane	Ultra-High Build Epoxy	Waterproof render
High Build Epoxy		Vinyl Ester	
Waterproof render		Epoxy Novolac	

5.3 Chemical Exposure

Guidance for selection of protective coatings for concrete containment bunds occasionally exposed to typical chemicals used in the water industry is 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 Exposure²

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

² Based on Table 5.7 of WSA 201 version 2.1

Chemical	Concentration	Reinforced concrete bunds
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
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

5.4 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 15F.

5.5 Coatings to Treat Cracks

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

Table 7: Coatings to Coat over Cracks in Concrete

Crack Type	Coating Types	Detail	Clause
Inactive cracking HAIRLINE width in atmospheric	B1	All coatings	-
Active cracking FINE width in normal atmospheric exposure	B3	Elastomeric anti-carbonation coating	9
Inactive FINE cracking width in water retaining structures	B12	Waterproof cement slurry coating	10
		All coatings after crack repair	-
Active cracking Multiple ALL widths in water retaining structures	B14	Liquid applied or sheet membrane liners, positive pressure side	9, 11
	B15		

6 Materials for surface protection and lining of concrete

6.1 General Requirements

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

6.2 Compliant Products

Products not listed in Appendix B shall not be used until the product has been reviewed by SA Water's Representative and confirmed as suitable for use. Refer to section 15 and Appendix B for details on selection of products.

HOLD POINT

6.3 Materials Testing

Undertake materials testing in accordance with this Standard and Clause 5.9 of TS 0711.0.

List all tests proposed to be undertaken to demonstrate compliance with TS 0711 and this 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

6.4 Coatings and Lining General Requirements

6.4.1 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 (such as, 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.

6.4.2 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)	Minimum substrate adhesive bond strength (MPa)
>50	2.0
30 – 50	1.5
15 – 30	0.8

6.5 Penetrating Concrete Surface Treatment

Penetrating concrete surface treatments shall be selected according to the required mechanism and verified performance, including reduction of liquid-water ingress or sorptivity, penetration depth, vapour permeability, resistance to the relevant contaminants, compatibility with the substrate and subsequent treatments, durability under the exposure conditions, and any potable-water or environmental constraints. Silane-based hydrophobic treatments and colloidal-silica or other mineral pore-modifying treatments are recognised technology types, but equivalent penetrating systems may be proposed where they satisfy the applicable acceptance criteria.

6.5.1 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: 4mm, when tested in accordance with Section 14.13.
6. Compatible with subsequently applied film forming protective coatings if used.

6.5.2 Colloidal Silica Liquid

Penetrative concrete sealers shall be used for for concrete waterproofing and surface hardening, with the sealer to have the following properties:

- a. Be a water borne colloidal silica type concrete treatment that is 100% VOC free.
- b. Be suitable for low pressure spray application.
- c. For chloride related repairs, be capable of inhibiting reinforcement corrosion.
- d. Be proven to penetrate >75mm when topically applied into concrete pores to form a Calcium Silica Hydrate (CSH) gel.
- e. 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.
- f. Not wash out of concrete, on the basis that it complies with and is certified to AS/NZS 4020.

Where used in wastewater infrastructure, colloidal silica material shall include a biocide that is certified to kill the following bacteria on contact for 5 years (kill rate $\log_{10}$ CFU/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.

6.6 Film Forming Coatings and Linings

6.6.1 General Requirements

Concrete coating and lining systems shall satisfy the following 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 0.1mm wide.
3. Be compatible 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 (for example, 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 ultraviolet 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.

6.6.2 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.

6.6.3 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.

6.6.4 Anti-Carbonation Coating

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

Table 9: Anti-Carbonation Coating Properties

Property	Criterion	Standard
Equivalent Air Layer Thickness	$R > 150\text{m}$	AS/NZS 4548.5 Appendix D
Equivalent Thickness of Concrete	$S_c > 450\text{mm}$	AS/NZS 4548.5 Appendix D
CO₂ Diffusion Co-efficient	$D < 2 \times 10^{-7} \text{cm}^2/\text{s}$	AS/NZS 4548.5 Appendix D
Water Vapour Equivalent Air Layer Thickness	$S_d < 4\text{m}$	AS/NZS 4548.5 Appendix C
Minimum Dry film thickness/coat	$\text{DFT} < 150\mu\text{m}$	AS 1580.108.2

6.7 Cementitious Materials

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

6.7.1 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 $> 0.8\text{MPa}$.

6.7.2 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.

6.7.3 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.

6.7.4 Geopolymer/Inorganic Polymer Render

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

6.7.5 Fairing Coat

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

Epoxy resin fairing coat materials shall comply with the requirements of Section 6.8.

6.8 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 Clause 3.9 of TS 0711.1.

6.9 Sheet Membrane Lining

6.9.1 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 etcetera).
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.

6.9.2 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. Manufactures from one of the following materials:
 - a. Reinforced Polyvinyl Chloride (PVC) or HDPE:
 - Tensile breaking stress >15MPa to ASTM D6693 Type IV
 - Hardness Shore D >50 to ASTM D2240 or ISO 2039-1
 - Elongation at break >200% to ASTM D6693 Type IV
 - Minimum 2mm thick.
 - b. Chlorosulphonated polyethylene (CSPE)
 - c. PVC - Ethylene Interpolymer Alloy (EIA).
3. Minimise the requirement for field seaming as much as reasonably practicable.
4. Pre-fabricate complex elements.

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.

6.9.3 Anchor-Knob Liner

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

1. Hexene grade of HDPE minimum PE80 grade. For applications exposed to ultraviolet (UV) radiation, anchor-knob liners shall comply with the UV resistance requirements of GRI-GM13.
2. Tensile breaking stress >20MPa to ASTM D6693 Type IV.
3. Elongation at break >400% to ASTM D6693 Type IV.
4. Hardness Shore D >50 to ASTM D2240 or ISO 2039-1.
5. The embedment quality of the HDPE liner anchors shall be tested at a frequency sufficient to provide statistical confidence that a pull-out resistance of 400kPa, as facilitated by the anchor-knob studs, is achieved. 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 400kPa.
6. Minimum 2mm thick.

6.9.4 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.

6.10 Other Materials

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

6.11 Applicator Submissions

6.11.1 General

Comply with all parts of Clause 8.4.7 of TS 0711.0. 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 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.

6.11.2 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.

6.12 Water

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

7 Workmanship - General

7.1 Standards and Codes

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

7.2 Constructor Competency

7.2.1 General

Comply with all parts of Clause 4.1 of TS 0711.0.

7.2.2 Coating & Lining Applicator: Specific Competency

SA Water 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 Clause 7.8 of AS 2312.1.
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 as per requirements of TS 0421. Competent welders shall have installed a minimum of 10 projects and seamed a minimum total of 500m length of weld. Where personnel do not meet this requirement, they shall be supervised by a competent person at all times.

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7.3 Quality Assurance

Comply with all parts of Clause 5 of TS 0711.0, and the quality control testing requirements in Section 14.

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

7.3.1 Coating Inspector

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

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

7.3.2 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.

7.3.3 Inspection and Test Plans

Comply with ITP requirements in section 5.6 of TS 0711.0.

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 TS 0711.5.

7.3.4 Pre-Start Meeting

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

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7.3.5 Daily Records

Comply with requirements in Clause 5.11 of TS 0711.0.

Maintain records of the work daily 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, etcetera 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.

7.4 Health and Safety Requirements

Comply with health and safety requirements listed in Table 10.

Table 10: TS 0711.0 Health and safety requirements

TS 0711.0 Clause	Section Title
6.1	General
6.2	Works on existing sewers
6.3	Lighting
6.4	Concrete removal
6.5	Diving

TS 0711.0 Clause	Section Title
6.6	Traffic management
6.7	Barriers and signs
6.8	Equipment
6.9	Hazardous materials

7.5 Environmental Requirements

Comply with health and safety requirements in Table 11.

Table 11: TS 0711.0 Environmental requirements

TS 0711.0 Clause	Section Title
7.1	Noise emissions
7.2	Compressor silencing
7.3	Hand tools
7.4	Waste management/Disposal of contaminants
7.5	General cleaning and disposal of refuse
7.6	Dust and water
7.7	Existing flora.

7.6 Construction Requirements

Comply with the construction requirements in Table 12.

Table 12: TS 0711.0 Construction requirements

TS 0711.0 Clause	Section Title
8.1	Existing structures
8.2	Temporary works
8.3	Extent of works identification
8.4	Materials requirements
8.5	Trials
8.6	Pre-start meeting
8.7	Existing structures

7.7 Temporary Works

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

7.8 Pre-Work Survey

Undertake the pre-work survey requirements of TS 0711.0:

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.

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7.9 Materials Handling and Mixing

7.9.1 General

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

7.9.2 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.

7.10 Trials

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

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

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7.10.1 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 2m².

7.11 Equipment

Comply with Clause 6.8 of TS 0711.0.

7.12 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.

7.13 Generic Product Application Requirements

Generic product application requirements for coating and lining systems are provided in Clause 8 of WSA 201 Version 2.3 and Appendix E.

If coating systems are not 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.

8 Concrete Surface Preparation

8.1 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 Clause 8.4 of TS 0711.1, 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.

8.2 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:

- a. Abrasive blast cleaning (Wet and Dry)
- b. Grinding
- c. Scarifying
- d. Scabbling
- e. 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.

8.3 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.

8.4 Preparation of Concrete Substrate

Use a method in Section 8.2 at the water or blasting pressure, or mechanical effort, required to achieve the required surface profile specified in the Generic Product Application Requirements in Clause 8 of WSA 201 Version 2.3 or Appendix E 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 3mm 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.

8.5 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 Section 8.10 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.

8.6 Surface Repairs

Inspect the prepared surface for surface defects and irregularities.

Fill unwanted minor surface voids up to 3mm 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 Section 6.7.5.

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 Section 6.8, 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 Section 8.4.

8.7 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.

8.8 Cracks and Minor Defects

Repair cracks in accordance with TS 0711.3.

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

8.9 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 13.

Table 13: 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	$\leq 15\text{g}/24\text{hr}/\text{m}^2$
ASTM F2170 Relative humidity	$\leq 80\%$

The concrete surface moisture condition immediately before application of the coating material or primer shall be nominally as listed in Table 14, 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 14: 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

8.10 Substrate Inspection and Testing

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

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8.10.1 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 Section 14.4.

Verify using the ICRI replica profiles.

8.10.2 Oil and Grease

Test for oil and grease contamination in accordance with Sections 14.5 and 0.

8.10.3 Cracks

Inspect cracks to ensure that they are fully sealed and not leaking in accordance with Section 14.7.

8.10.4 Concrete Moisture Level

Test the degree of concrete residual moisture in accordance with Section 14.8 and ensure that the acceptance criteria in Section 14.8.2 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.

8.10.5 Concrete pH

Measure the pH of the prepared concrete substrate in accordance with Section 14.9.

8.10.6 Substrate Soundness/Flatness

For heavily contaminated concrete, test indicative concrete strength using a rebound hammer to confirm sound concrete in accordance with Section 14.10.

Following repair, check the surface flatness in accordance with Section 14.11.

8.10.7 Bond Strength of the Prepared Substrate

Conduct substrate bond strength testing to all prepared surfaces in accordance with Section 14.12.

8.11 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 Clause 6.2.5.2 of WSA 201.

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.

8.12 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 Section 8.13.

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 300mm up the support or equipment base where practicable.

8.13 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.

8.14 High Build Coatings - Edge Detailing

8.14.1 Anchorage Grooves

Avoid feather edging of high build coatings.

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

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

Provide a toe-in joint (example in Figure 2, Appendix F) for coatings, greater than 2mm thick, at level joints with existing uncoated surfaces, or around the outside perimeter of the area. Coatings less than 2mm 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.

8.14.2 Groove Geometry

Confirm anchorage groove requirements with the coating manufacturer.

Example anchorage groove details are provided in Figure 5 to Figure 10 in Appendix F.

- 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 5mm wide x 10mm deep.

- Light Traffic/Low Stress

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

8.14.3 Coving

Form a coved fillet at all horizontal and vertical joints 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 50mm radius and extended 100mm up the walls with a toe-in joint or chase at each end of the cove.

8.14.4 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 100mm in from the edge of the drain.

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

8.14.5 Falls

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

8.15 Floor Joints/Joint Sealants

8.15.1 General

The types of joints to consider are:

- a. Construction (cold) joints
- b. Expansion (horizontal and vertical) joints
- c. Construction (control) joints
- d. Isolation (treat as expansion) joints
- e. 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.

8.15.2 Design

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

Design all moving joints to an optimal width to depth ratio of 2:1, with a minimum joint size of 8mm sealant depth for non-porous surfaces and 20mm 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 F.

8.15.3 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 5mm 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.

8.16 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 50mm 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.

9 Application of Penetrating Concrete Surface Treatments

9.1 Application of Silane Type Materials

9.1.1 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 Section 8 to provide a dry sound absorbent substrate free of any contaminants 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

9.1.2 Application Method

Monitor atmospheric conditions in accordance with Section 14.3.

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

Manage environmental risks associated with overspray during handling and application.

9.1.2.1 Liquid Silane

Apply liquid silane material as follows:

1. Application rate shall be two flood applications at a minimum application rate of 0.3L/m² 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 70kPa 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.

9.1.2.2 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 0.45L/m² 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 70kPa 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 Section 14.6.

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 Section 14.13.

WITNESS POINT

9.1.3 Silane Application Trial

Undertake a trial area application of the silane treatment to a minimum 4m² area in accordance with the method in Section 9.1.2.

Obtain a minimum 2 no. cores from the trial area and test the cores for silane penetration depth in accordance with Section 14.13.

9.2 Application of Colloidal Silica Material

9.2.1 Surface Preparation

Complete concrete surface preparation as per Section 8 to provide a sound absorbent substrate free of any contaminants or previous coatings that would prevent penetration of the colloidal silica solution.

The concrete surface shall be SSD without standing water.

HOLD POINT

9.2.2 Application Method

Monitor atmospheric conditions in accordance with Section 14.3.

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

Manage environmental risks associated with runoff of excess liquid containing biocide during handling and application.

Apply colloidal silica solution at a typical coverage rate of 1.6m²/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 Section 14.14.

Core sample and test for concrete sorptivity in accordance Section 14.15.

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.

9.2.3 Colloidal Silica Application Trial

Undertake a trial area application of the colloidal silica solution treatment to minimum 4m² area in accordance with the method in Section 9.2.

Obtain minimum of three (3 off.) cores from the trial area and three (3 off.) cores from an untreated area in accordance with Section 14.14.

Test the cores on site for depth of colloidal silica solution penetration depth in accordance with Section 14.14.

Test the cores for sorptivity in accordance with Section 14.15.

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

HOLD POINT

10 Application of Film Forming Coatings and Membranes

10.1 Compliance Requirements

Apply materials in accordance with the following:

- a. Liquid applied film forming protective coatings to SSPC-PA 7.
- b. Liquid applied waterproof membranes to SSPC-TU 2/NACE 6G197.
- c. Manufacturer's product Technical Data sheets and recommendations.
- d. 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 etcetera.

10.2 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 colour and finish. Pay particular attention to the painting of corners, surface irregularities and edges.

10.3 Mixing of Liquid Materials

10.3.1 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.

10.3.2 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 (200rpm to 500rpm) 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.

10.3.3 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 (200rpm to 500rpm) 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 to minimize undesirable air entrainment.

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

10.4 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 Section 14.3.

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 $\geq 10^{\circ}\text{C}$ to $\leq 35^{\circ}\text{C}$
3. The concrete substrate surface temperature is $\leq 3^{\circ}\text{C}$ above the dew point
4. Ambient relative humidity $\geq 85\%$.

10.5 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.

10.6 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.

10.7 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 1mm 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 Section 14.21.

10.8 Film Forming Coating Application

Apply the liquid applied coating system in accordance with 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 Clause 8 of WSA 201 Version 2.3, or Appendix E. and the requirements in this Section 10.
2. Prepare the substrate in accordance with Section 8, and undertake Tests listed in Section 8.10.
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 Section 14.16. 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. Section 14.17 - Visual inspection of applied coating.
 - b. Section 14.18 - Dry Film Thickness.
 - c. Section 14.19 - 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.

10.9 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 Clause 8 of WSA 201 Version 2.3, or Appendix E. and the requirements in this Section 10.
2. Prepare the substrate in accordance with Section 8, other than application of filler/fairing coat, and undertake Tests listed in Section 8.10.
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 Section 14.16. 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. Section 14.17 - Visual inspection of applied coating.
 - b. Section 14.18 - Dry Film Thickness.
 - c. Section 14.19 - Coating adhesion.
 - d. Section 14.20 - Continuity test.

HOLD POINT

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.

10.10 Tank Boot Seal

Apply an Elastomeric Polyurethane/Polyurea system to stop water ingress between a steel tank and its concrete ring beam (Coating System EBS in Clause 8 of WSA 201 Version 2.3.).

Apply in accordance with the relevant generic application requirements for the coating type in Clause 8 of WSA 201 Version 2.3, and the requirements in Section 8.

1. Prepare the substrate in accordance with Section 6, other than application of filler/fairing coat, and undertake Tests listed in Section 6.10.
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 50µm to 75µm. 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 100mm up the walls of the tank and 100mm 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 Section 14.16. 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. Section 14.17 - Visual inspection of applied coating.
 - b. Section 14.18 - Dry Film Thickness.
 - c. Section 14.19 - Coating adhesion.

HOLD POINT

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

10.11 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.

10.12 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.

11 Application of Cementitious Protective Materials

11.1 Waterproof Cement Render or Slurry Coating

11.1.1 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 Clause 13 of TS 0711.1.
2. If required, treat any leaking cracks by routing and filling with waterproof mortar in accordance with Clause 8 of TS 0711.3.
3. Monitor atmospheric conditions in accordance with Section 14.3.
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 m² shall not be less than the cementitious slurry waterproofing Manufacturer's recommended coverage rate.

11.1.2 Surface Preparation

Complete concrete surface preparation as per Section 8 to provide a sound absorbent substrate free of any contaminants or previous coatings, with a CSP-3 to 5 profile for slurry coating, and CSP 5-10 for render. **HOLD POINT**

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.

11.1.3 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 Section 6.7.1.

Treat an area that extends at least 75mm 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 1.25mm 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. Section 14.17 - Visual inspection of applied coating.
2. Section 14.19 - Coating adhesion.

HOLD POINT

11.1.4 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 Section 6.7.2.

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 Section 7.9.

Place the waterproof patch repair mortar to reinstate the concrete by hand (in accordance with Clause 9.2 of TS 0711.1) or spray methods (in accordance with the requirements of Clause 10 of TS 0711.1), 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 in the range 10mm to 50mm thick.

Monitor the render thickness during application using a wet film comb or other gauge in accordance with Section 14.16. 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 50mm outside the repair area to minimum 1.25mm thickness.

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

11.1.5 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.

11.2 CAC Render

11.2.1 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 Clause 13 of TS 0711.1.
3. If required, treat any leaking cracks by routing and filling with waterproof mortar in accordance with Clause 8 of TS 0711.3.
4. Monitor atmospheric conditions in accordance with Section 14.3.
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 m² shall not be less than the cementitious slurry waterproofing Manufacturer's recommended coverage rate.

11.2.2 Surface Preparation

Complete concrete surface preparation as per Section 8 to provide a sound absorbent substrate free of any contaminants or previous coatings, with a CSP-5 to 10 profile.

The concrete surface shall be SSD without standing water.

HOLD POINT

11.2.3 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 Section 6.7.3.

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

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

WITNESS POINT

11.2.4 Inspection and Testing

Accurately measure the consumption of CAC material applied.

The applied coverage rate per m² shall not be less than the CAC material Manufacturer's recommended coverage rate.

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

WITNESS POINT

11.2.5 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 Section 11.2, subject to a trial application to verify the method and achieved material properties to the satisfaction of SA Water's Representative.

12 Application of Sheet Membrane Liner Systems

12.1 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, etcetera
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.

12.2 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.

12.3 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 Section 14.3.

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 $\geq 10^{\circ}\text{C}$ to $\leq 30^{\circ}\text{C}$
3. The concrete substrate surface temperature is $\leq 3^{\circ}\text{C}$ above the dew point
4. Ambient relative humidity $\geq 85\%$.

12.4 Welding of Sheet Membrane Liners

Welding of liners shall comply with TS 0421.

12.5 Drop-in/Loose Liner Installation

12.5.1 General

Install the drop-in liner in accordance with the drawings and instructions to be provided by the Fabricator as described in Section 6.11.2.

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.

12.5.2 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

12.5.3 Seams

Undertake welding of seams in accordance with Section 12.2 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 12.2.

12.5.4 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.

12.5.5 Inspection

Test site welds in accordance with TS 0421.

WITNESS POINT

12.6 Anchor Knob Liner Installation

12.6.1 General

Apply in accordance with the relevant generic application requirements for the liner type in Clause 8 of WSA 201 Version 2.3. and the requirements in this Section. Welding of liner as per TS 0421.

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.

12.6.2 Concrete Surface Preparation

Prepare the concrete substrate in accordance with Section 8, and undertake tests listed in Section 8.10.

12.6.3 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%) 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 3mm 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 Section 12.2. 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 15mm 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.

12.6.4 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 Clause 3.8.8 of TS 0711.1.

Apply grout in general accordance with Clause 15 of TS 0711.1. The clause shall be adapted to ensure successful grouting the HDPE anchor knob liner material.

12.6.5 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 3mm 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 Section 12.2. Remove or trim anchor knobs as required.

Mix and place a thixotropic cementitious mortar or grout in accordance with Clause 9 of TS 0711.1, 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 0.8MPa.

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.

12.6.6 Inspection

Test site welds in accordance with the requirements of TS 0421 and the Inspection and Test Plan. If welds cannot be vacuum tested, they shall be spark tested.

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

Test adhesive bond strength in accordance with Section 14.12.

WITNESS POINT

12.6.7 Void Repairs

Drill two small diameter holes at end of any voids and inject one with a cementitious grout complying with Section 12.6.1 until grout expels from the second hole.

Repair the holes in accordance with Section 12.8.

12.7 Adhered PVC Sheet Lining System Application

12.7.1 General

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

12.7.2 Concrete Surface Preparation

Prepare the concrete substrate in accordance with Section 8, to CSP 3-6, and undertake tests listed in Section 8.10.

HOLD POINT

12.7.3 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 5m²/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 5m²/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 25mm.

Monitor the wet film thickness (WFT) during application of the protective coating system in accordance with Section 14.16. 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 100mm.

Mix and immediately apply a 25mm 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.

12.7.4 Inspection

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

1. Section 14.17 - Visual inspection of applied coating.
2. Check for voids in the applied liner by light hammer tapping.
3. Section 14.12: Adhesive bond strength.

WITNESS POINT

12.8 Liner Repairs

12.8.1 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 150mm beyond the edges of the defect area.

Carry out repair work in accordance with the materials, procedures and test and inspection requirements outlined in this Section, 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 etcetera with a suitable sealant in accordance with TS 0711.2.

Retest the repair to ensure compliance with this Technical Standard.

12.8.2 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 6mm 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 150mm in all directions. Alternatively, extrusion weld the seam along the upper flap to the liner along the entire length of the failed seam.

12.8.3 PVC Panel

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

12.9 Installation Records

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

The following are minimum reporting format requirements:

1. Installation Record:
2. Date, panel/item identification, panel length and width and layout diagram
3. Trial Weld Report:
Date, time, technician, machine no., ambient temp, extrudate temp, pre-heat temp, sample ID, test type, and pass/fail
4. 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.
5. For vacuum testing this will include:
 - a. The initials of the tester.
 - b. The date.
 - c. Pass or fail result.
6. For spark testing this will include:
 - a. The initials of the tester.
 - b. The date.
 - c. Voltage setting.
 - d. Pass or fail result.

13 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 in accordance with TS 0600. This includes but is not limited to:

- Cleaning and flushing
- Hydrostatic testing
- Disinfection

HOLD POINT

13.1 Potable Water Storage - Disinfection and Sampling

Disinfection and sampling prior to the potable water storage going online shall be undertaken in accordance with Clause 4.13 of TS 0600.

HOLD POINT

14 Quality Control Testing for Concrete Structures

14.1 General

Comply with all Quality Control Testing requirements in Clause 5 of TS 0711.0, 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.

14.2 Coating and Liner - Quality Control Tests

The minimum testing requirements are listed in Table 15 as appropriate to the shape of the element and the test details follow.

Additional testing may be included in the submitted ITP.

Table 15: Coating and Liner Quality Control Tests and Frequency

Test Required	Performed By	Reference Section	Minimum Frequency of Testing
Atmospheric Conditions	QC Engineer	14.3	Every 30 minutes. Digitally recorded
Concrete Surface Profile	QC Engineer	14.4	100% of coated concrete surface
Water-Break Test	QC Engineer	14.5	100% of coated concrete surface
Black Light Test	QC Engineer	0	100% of coated concrete surface
Visual Inspection of Sealed Cracks	QC Engineer	14.7	All sealed cracks
Concrete Moisture	QC Engineer	14.8	One test per 50m ² of coated concrete surface with a minimum of one test for each 10m of vertical rise commencing within 300mm of the floor
Concrete Substrate pH	QC Engineer	0	100% of coated concrete surface
Soundness of Highly Contaminated Concrete	QC Engineer	14.10	All highly contaminated concrete
Concrete Surface Flatness	QC Engineer	14.11	One test per 5m ² of coated concrete surface
Concrete Substrate Bond Strength	QC Engineer	0	As per the test plan in AS 3894.9
Depth of Silane Penetration	QC Engineer	14.13	Three cores per 50m ² of treated concrete surface

Test Required	Performed By	Reference Section	Minimum Frequency of Testing
Depth of Colloidal Silica Penetration	QC Engineer	14.14	Three cores per 50m ² of treated concrete surface
Concrete Sorptivity	QC Engineer	14.15	Three cores test per 500m ² of treated concrete surface
Wet Film Thickness	Applicator	14.16	All coated areas, one test per 5m ² of coated concrete surface. Not recorded.
Visual Inspection of Applied Coating	QC Engineer	14.17	All coated areas
Dry Film Thickness	QC Engineer	14.18	As per the test plan in AS 3894.3
Coating Adhesion	QC Engineer	0	As per the test plan in AS 3894.9
Coating Continuity Testing	QC Engineer	14.20	100% of coated concrete surface
Slip Resistance	QC Engineer	14.21	One test per 50m ² of coated concrete surface
Visual Evaluation of Liner Welds	QC Engineer	TS 0421	All welds
Impact Testing of Liner Welds	QC Engineer	TS 0421	All welds
Peel and Shear Test of Liner Welds	QC Engineer	TS 0421	Daily weld test
Peel and Shear Test of Liner Welds	NATA Laboratory	TS 0421	10% of site tested welds
Vacuum Box Test of Liner Welds	QC Engineer	TS 0421	All weld, T intersections and weld repairs
Spark Test of Liner Welds	QC Engineer	TS 0421	All welds that cannot be Vacuum tested

14.3 Atmospheric Conditions

The atmospheric conditions are to 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.

14.3.1 Method

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

1. Dew point.
2. Surface temperature.
3. Ambient temperature.
4. ΔT (The difference between the surface temperature and the dewpoint).

14.3.2 Acceptance Criteria

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

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

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

14.4 Test Method - Surface Profile

14.4.1 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.

14.4.2 Acceptance Criteria

The concrete surface profile complies with the specified CSP range for the specified system in Generic Product Application Requirements in Clause 8 of WSA 201 Version 2.3, or Appendix E, using ICRI Guideline No. 310.2 moulded replicas which are available in the range of CSP 1 to CSP 10.

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

14.5.1 Method

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

14.5.2 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.

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

14.6.1 Method

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

14.6.2 Acceptance Criteria

No luminesce under black light.

14.7 Test Method - Visual Inspection of Sealed Cracks

14.7.1 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.

14.7.2 Acceptance Criteria

Crack fully sealed and no sign of moisture before coating.

14.8 Test Method - Concrete Moisture Level

14.8.1 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 50m² of coated concrete surface, with a minimum of one test for each 10m of vertical rise commencing within 300mm of the floor.

The test area is to be left open to ambient conditions for a minimum of 24 hour 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).

14.8.2 Acceptance Criteria

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

ASTM F 1869 (Calcium Chloride Test): Maximum result of 15g/24hr/m².

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 that these limits apply in the absence of the coating Manufacturer's limits.

14.9 Test Method – Concrete Surface pH

14.9.1 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 25mm diameter form can be used), of distilled or deionised water. Determine the pH with the aid of a pH indicating strip after 1 minute.

14.9.2 Acceptance Criteria

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

14.10 Test Method – Soundness of Highly Contaminated Concrete

14.10.1 Method

Remove contaminated material from an area 500mm x 500mm (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 Section 14.9.

14.10.2 Acceptance Criteria

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

14.11 Test Method – Concrete Surface Flatness

14.11.1 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.

14.11.2 Acceptance Criteria

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

Edges and surfaces in plan and level over 2m distance: $\pm 3\text{mm}$.

14.12 Test Method – Concrete Substrate Bond Strength

14.12.1 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 10m² of repair area.

14.12.2 Acceptance Criteria

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

14.13 Test Method - Depth of Silane Penetration

14.13.1 Sampling Method

A minimum of 7 days following the application of silane, cut two 50mm nominal diameter cores 50mm 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.

14.13.2 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.

14.13.3 Acceptance Criteria

Minimum penetration depth: 4mm.

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.

14.14 Test Method - Depth of Colloidal Silica Penetration

14.14.1 Sampling Method

1. Trial Application:
 - a. A minimum of 48 hours following the application of colloidal silica solution, cut three 100mm nominal diameter cores 70mm deep through the treated concrete, ensuring that the core is perpendicular to the concrete surface and does not damage the reinforcement.
 - b. Use these cores for the sorptivity test in Section 14.15.
2. Site Testing:

Cores for routine QC tests of colloidal silica penetration depth may be 50mm diameter.
3. General
 - a. Whenever possible, core using a vacuum-clamped coring machine.
 - b. Where metallic fixings are used, remove them subsequent to coring.
 - c. Repair fixing holes and core holes with an approved hand applied repair mortar (refer TS 0711.1) and re-treat the area.

14.14.2 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.

14.14.3 Acceptance Criteria

Minimum penetration depth shall be 75mm, 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.

14.15 Test Method – Concrete Water Sorptivity

14.15.1 Method

A minimum of 48 hours following the application of colloidal silica solution, cut three 100mm nominal diameter cores 70mm 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.

14.15.2 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.

14.16 Test Method – Wet Film Thickness

14.16.1 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.

14.16.2 Acceptance Criteria

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

14.17 Test Method – Visual Inspection of Applied Coating

14.17.1 Method

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

14.17.2 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.

14.18 Test Method – Dry Film Thickness

14.18.1 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.

14.18.2 Acceptance Criteria

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

14.19 Test Method – Coating Adhesion

14.19.1 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, for example, 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 Clause 4.2 of AS 3894.9.

Record the type of failure.

Repair all core and test locations to the specified coating system in accordance with Section 10.12.

14.19.2 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.

14.20 Test Method – Coating Continuity Testing

14.20.1 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 AMPP 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.

AMPP 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.

14.20.2 Acceptance Criteria

The pass criterion is zero defects after all repairs.

14.21 Test Method – Slip Resistance

14.21.1 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 50m² of coated concrete surface.

14.21.2 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.

14.22 Test Method - Pull-out Testing of HDPE Anchors

14.22.1 Method

Test the embedment quality of the HDPE concrete protection liner anchors using the method in Section 14.19.

14.22.2 Acceptance Criteria

Pull-out resistance $\geq 0.4\text{MPa}$

15 Compliant Coating Systems

Appendix B provides a list of Coating Systems known to comply with this standard and aligned with WSA 201 categories. Contractors can use products listed in Appendix B in SA Water projects.

Applicators are required to obtain the most recent technical datasheets from the suppliers for each project before starting work.

Similarly, contractors are required to review the Safety Datasheet (SDS) for each product before mixing and applying.

If an unlisted product is proposed for a project, a Technical Dispensation Request Form (TDRF) shall be submitted to SA Water for review of the technical data and performance as per Section 2.1, providing suitable performance information.

A Schedules of hold points, witness points and identified records

A1 Schedule of hold points and witness points

Section / Clause	Type	Description
3	Hold	Compliance with AS/NZS ISO 9001
3	Hold	Quality Plan
3	Hold	WMS
3	Hold	ITP
3	Hold	NCR Acceptance
WSA 201 2.2	Hold	PCCP Compliance
WSA 201 2.5	Hold	Coating inspector certification.
WSA 201 2.6	Hold	Pre-job Meeting
WSA 201 5.4.4	Hold	Compliance with Contact with Drinking Water standards, specifically AS/NZS 4020 and TS 0800.
WSA 201 6.3.2	Hold	Corrosion greater than 2mm depth
App E	Hold	Safety Checklist
App F	Hold	Environment Checklist
6.2	Hold	Compliant materials
6.3	Hold	Materials testing
7.2.2	Hold	Coating & lining applicator: specific competency
7.3.4	Hold	Pre-start meeting
7.8	Hold	Markup of areas to be repaired
8.10	Hold	Following trial application of coating systems
9.2.3	Hold	Colloidal Silica Application Trial
8.10	Hold	Substrate inspection and testing following surface preparation
9.1.1	Hold	Substrate inspection and testing for silane type materials
9.2.1	Hold	Substrate inspection and testing for colloidal silica materials
11.1.2	Hold	Substrate inspection and testing for waterproof cement render
11.2.2	Hold	Substrate inspection and testing for CAC render
12.5.2	Hold	Substrate inspection and testing for drop-in / loose liner
12.6.2	Hold	Substrate inspection and testing for anchor knob liner
12.7.2	Hold	Substrate inspection and testing for adhered PVC sheet lining
10.8	Hold	Testing and inspection of primer/intermediate/final coat
10.9	Hold	Testing and inspection of film forming coatings and membranes
10.10	Hold	Testing and inspection of tank boot seal application
11.1.3	Hold	Testing and inspection of waterproof slurry coating application

Section / Clause	Type	Description
11.1.4	Hold	Testing and inspection of waterproof render mortar application
13	Hold	Storage cleaning and flushing
11.1.4	Witness	Application of the bonding agent
9.1.2	Witness	Core sample and test for silane type materials
9.2.2	Witness	Core sample and test for colloidal silica materials
11.2.3	Witness	CAC render application
11.2.4	Witness	Inspection and testing of CAC render application
12.5.5	Witness	Inspection of site welds of drop-in / loose liner
12.6.6	Witness	Inspection of anchor know application
12.7.4	Witness	Inspection of adhered PVC sheet lining application

A2 Schedule of identified records

Section / Clause	Description of Identified Record
WSA 201 7.1	Surface preparation, coating application, ambient environmental conditions, film thickness measurements in accordance with AS 3894.10-14.
7.2.2	Constructor competency verification
7.3	Constructor submission of WMS & ITP
7.3	Submission of the As-Repaired Report.
7.10	Submission of Trial Repair Report, if trial repair is deemed necessary by SA Water.

B Compliant products

Material descriptions in this Technical Standard identify functional classes rather than exclusive chemistries unless an exclusion is expressly stated. Examples include penetrating hydrophobic treatments, pore-blocking mineral treatments, barrier coatings, flexible crack-bridging membranes, chemically resistant linings, cementitious or inorganic protective renders, polymeric sheet linings, corrosion-control wraps and metallic protective systems. A product may be proposed within, across or outside these classes where its suitability is demonstrated against the specified performance and acceptance criteria.

B1 Compliant Products List for WSA 201 aligned coatings

Table 16: WSA 201 products – P1 to P6

Supplier	P1 Zinc rich epoxy primer	P2 Epoxy zinc phosphate primer	P3 Non-inhibitive / holding epoxy primer	P4 Concrete epoxy primer	P5 Waterborne acrylic primer / sealer	P6 Vinyl ester primer
Dulux	Zincanode 402 Zincanode 202	Duremax GPE Zinc Phosphate Durepon EZP	Luxepoxy 4 White Primer Duremax GPE	Durebild STE Luxafloor LGE	Acrylic Sealer Undercoat	
Hempel WattyI	Avantguard 860	Fast Dry 17410	Prepare 130	Prepare 110	Acrylic Sealer Undercoat	Prepare 120
International Akzo Nobel	Interzinc 5282 Interzinc 52	Intercure 200	Interline 982 Intergard 269	Ceilmate 680M	Intercryl 853	Ceilmate 380
Jotun	Barrier Barrier Plus	Penguard Special Penguard Express ZP	Jotacote F60	Penguard ClearSealer		
PPG	Sigmazinc 109 HS Sigmazinc 68HS		SigmaCover 256 SigmaPrime 200			
Aqa Shield Technologies						Aqa V725
Belzona	Belzona 6111					
Carboline	Carbozinc 858	Carboguard 504 ZP	Carboguard 504 Buff Phenoline 311	Carboguard 1340	Resene Quick Dry	

Supplier	P1 Zinc rich epoxy primer	P2 Epoxy zinc phosphate primer	P3 Non-inhibitive / holding epoxy primer	P4 Concrete epoxy primer	P5 Waterborne acrylic primer / sealer	P6 Vinyl ester primer
Chesterton ARC				Chesterton ARC 797		Chesterton ARC NVE PC
DENSO						Archco PD2 primer
Enecon Chemclad				Durafill		
Epirez				Epirez 133 GP Epoxy Mortar Binder		
Hychem				Hychem E300 primer		
Mapei				Primer SN Eporip Planiseal MR	Primer 3296	
Master Builders Solutions BASF	MasterEmaco P 5000ZR			MasterEmaco 2525		
Sherwin Williams	Zinc-Clad IV Zinc-Clad 4500	Macropoxy 4600	Macropoxy 240	Macropoxy 920 Pre-Primer	Waterbased DTM Acrylic Coating	Magnalux 42PP
STOPAQ Anti Corrosion Technologies						Corrosol UV-Curing Primecoat / Sealcoat
Peerless Epigen				Epigen 402		

Table 17: WSA 201 products – P7 to P11

Supplier	P7 Epoxy mortar	P8 Alkyd zinc phosphate metal primer	P9 Galvanized iron primer	P10 Inorganic zinc silicate	P11 Silane / siloxane
Dulux	Fosroc Nitomortar 903 Fosroc Nitomortar AP	Metashield HB Luxaprime ZP	Metalshield All Surface Primer	Durezinc i90	Fosroc Nitocoat SN511
Hempel Wattyl		Uniprimer 13140	Galvit EZ	Galvosil 15700	Hempaxane Light/Classic
International Akzo Nobel		Interprime 4198		Interzinc 2280	Interfine 979 Polysiloxane
Jotun		Pilot QD Primer		Resist 86	
PPG				Ameron D9	
Carboline		Multi-Gard GP 5	ECZ Cold Galvanising	Carbozinc 11 WB	
Enecon Chemclad	Duraquartz				
Epirez	Epirez 633 Non-Sag Epoxy Mortar Binder				
Hychem	Hychem E500T Epoxy Mortar				Hychem Hydraguard S
Mapei	Adesilex PG4 Adesilex PG2				
Master Builders Solutions BASF	MasterBrace 1444 MasterBrace 1446				MasterSeal 355, H 1100, H 1150 (cream)
Rust Bullet			Rust Bullet		
Sherwin Williams		Kem Kromik Universal Primer	Macropoxy 925	Zinc-Clad II Zinc-Clad 2500	

Supplier	P7 Epoxy mortar	P8 Alkyd zinc phosphate metal primer	P9 Galvanized iron primer	P10 Inorganic zinc silicate	P11 Silane / siloxane
Zinga			Zinga		
Peerless Epigen					Epigen T20P

Table 18: WSA 201 products – C1 to C7

Supplier	C1 Surface tolerant epoxy	C2 High build epoxy	C3 High build solvent free epoxy	C4 Ultra high build epoxy	C6 Ultra high build vinyl ester	C7 High build chlorinated rubber
Dulux	Durebild STE	Durebild STE Duremax GPE	Duremax GFX	Luxepoxy UHB		Luxachlor
Hempel Watty	Multi 500	Multi 500 Epinamel DTM985	Hempadur 35560	Epinamel UHB 1000	Defend 740	Hempel Hi Build 46330
International Akzo Nobel	Interplus 356 Interplus 1180	Interplus 1180 Interline 850 Interzone 954	Interline 975P	Interzone 485 Interline 975P	Ceilcote Flakeline 242	
Jotun	Jotamastic 90 Marathon 550	Jotamastic 90	Tankguard 412	Jotacote UHB	Chemflake Special	
PPG	Amerlock 400/2K Amerlock 400 (MIO) / 2KSigmaCover 350	Amerlock 400/2K Sigmaguard CSF 650 SigmaShield 880		Amercoat CC703/2 SigmaShield 880 SigmaShield 880 XS		
Aqa Shield Technologies					Aqa V770	
Belzona	Belzona 1212 Belzona 1161 Belzona 5831	Belzona 1341	Belzona 1341 Belzona 5812DW			
Carboline	Carbomastic 615	Carboguard 690 Carboguard 690 (N53 and White) Drinking Water	Phenoline 341	Carboguard UHBE Plasite 4550 Carboguard 696 UHBE Drinking Water	Plasite 4110 Plasite 4310	
Chesterton ARC	Chesterton CP STP-EP	Chesterton CP STP-EP-HV Chesterton ARCS1PW	Chesterton CP STP-EP-HV Chesterton ARCS1PW	Chesterton ARC S1HB Chesterton S1PW/HB	Chesterton ARC S7	

Supplier	C1 Surface tolerant epoxy	C2 High build epoxy	C3 High build solvent free epoxy	C4 Ultra high build epoxy	C6 Ultra high build vinyl ester	C7 High build chlorinated rubber
DENSO	Denso ST Epoxy	Denso ST Epoxy Protal 7700		Protal 7700	Archco 423D	
Enecon Chemclad		Chemclad GP Chemclad XC Ceramalloy CL Chemclad SC	Chemclad GP Chemclad XC Chemclad SC			
Hychem		Hychem TL6 High Build Epoxy	Hychem TL6 High Build Epoxy	Hychem TL5		
Mapei	Mapecoat I 24 Mapecoat W SP	Mapefloor I 302 SL		Mapefloor I 302 SL		
Master Builders Solutions BASF	MasterEmaco 2525	MasterBrace 1444	MasterBrace 1444 BluRez 333AR	MasterBrace 1444		
Universal Corrosion Coatings	MarineSeal Surface Tolerant Epoxy Mastic 90	MarineSeal High Build Epoxy	MarineSeal High Build Epoxy	MarineSeal Ultra High Build Epoxy		
Sherwin Williams	Dura-Plate 301 Dura-Plate SW501	Macropoxy 860HB	Nova-Plate UHS Dura-Plate UHS (White only)	Nova-Plate 360 Dura-Plate UHS	Magnalux 41V2	
STOPAQ Anti Corrosion Technologies					Corrosol Vinylester UV-curing GP	
Peerless Epigen	Epigen 1412	Epigen 1311 Epigen 1344 Epigen 1369 Epigen 1412 Epigen Chemproof 4029	Epigen 1311 Epigen 1344 Epigen 1369 Epigen 1412 Epigen Chemproof 4029	Epigen 1311 Ultra Epigen XD005 Ultra		

Table 19: WSA 201 products – C8 to C13

Supplier	C8 Ultra high build epoxy / polyurethane mortar	C9 Water based epoxy	C10 Alkyd aluminium leafing grade	C11 Polymer modified bitumen	C12 Calcium aluminate cement	C13 Anti abrasion ceramic filled epoxy / polyurethane
Dulux	Flexituff PU2 Nitofloor PU600 Nitofloor PU200	Enviro epoxy WBE	Industrial Aluminium		Fosroc Renderoc CAC	
Hempel Wattyl						Multi Strength 35870 Hempaprime Strength 530/560
International Akzo Nobel	Polybrid 705E		Intertherm 891		Intercrete 4840	
PPG	SigmaDur 550					
Belzona						Belzona 1321 Belzona 1341
Carboline		Altra~Shield WB-V	Multi-Gard GP 14			
Chesterton ARC						Chesterton ARC SD4i Chesterton ARC S1PW
DENSO				Densopol 60 tape		
Enecon Chemclad						Ceramalloy CL Ceramalloy CP Ceramalloy CBX
Epirez	Epirez 733 UHB					Devcon Brushable Ceramic Devcon Sprayable Ceramic

Supplier	C8 Ultra high build epoxy / polyurethane mortar	C9 Water based epoxy	C10 Alkyd aluminium leafing grade	C11 Polymer modified bitumen	C12 Calcium aluminate cement	C13 Anti abrasion ceramic filled epoxy / polyurethane
Hychem	Hychem TL5	Hychem W90				
Mapei		Planiseal MR Mapecoat TNS Extreme Mapecoat TNS Primer EPW		Plastimul		
Master Builders Solutions BASF					MasterEmaco S 680 MasterEmaco S 620	
Sherwin Williams		Waterbased Macropoxy 2011		Sher-Tar 2000		Nova-Plate 325
STOPAQ Anti Corrosion Technologies						Dura-Coat Abrasion 300-series Dura-Coat Metal 400
Vortex Alumina Liner					Quadex Aluminaliner Plus	
Peerless Epigen	Epigen 402 Epigen 405 Epigen 1513					Epigen 806BR

Table 20: WSA 201 products – T1 to T6

Supplier	T1 Gloss 2-pack acrylic polyurethane	T2 Polysiloxane	T3 Waterborne gloss acrylic	T4 Flexible high build acrylic	T5 Anti graffiti top coat	T6 Alkyd enamel
Dulux	Quantam 221 - Acrathane IF Weathermax HBR - Luxathane HPX	Quantam Si70	Weathershield	Acrashield Advance		Super Enamel
Hempel Wattyl	Hempathane HS 55610 Hempatop Finish 775	Hempaxane Light/Classic	Wattyl Solagard		Poly U400 Anti-Graffiti Clear	Duranamel BR22
International Akzo Nobel	Interthane 990 Interthane 870	Interthane 979	Intercryl 853		Interfine 979	Interlac 649
Jotun	Hardtop AX	Hardtop Optima	Jotun Acrylic Gloss			Pilot QD Primer Alkydprimer
PPG			Taubmans All Weather Gloss		PSX700	
Carboline	Carbothane 134 HG	Carboxane 2000	Resene Hi-Glo		Carbothane 130 + Easy~Clean SX	Multi-Gard GP 14
Mapei				Elastocolor Paint Mapelastick Smart		
Master Builders Solutions BASF				MasterProtect 150 & 160		
Sherwin Williams	Acrolon 7300 Acrolon 7700	Sher-Loxane 800	Waterbased DTM Acrylic Coating			Sherkyd Enamel Alkyd Finish
STOPAQ Anti Corrosion Technologies				ShieldCoat EZ Shield coat		
Peerless Epigen		Epigen T20P				

Table 21: WSA 201 products – T7 to T11

Supplier	T7 Epoxy novolac	T8 HDPE/PVC liner	T9 Petrolatum/bitumen/vi sco-elastic tape wrap	T10 Heat shrinkable polyolefin coatings (Dispensation is required for underground applications)	T11 Polyurea
Dulux	Fosroc Nitoflor N				Flexituff PU1
Hempel Wattyl	Hempadur 85671 Defend 630 (Solvent Free)				
International Akzo Nobel	Ceilcote Flakeline 662				
Jotun	Tankguard Storage Tankguard SF				
Belzona			Belzona SuperWrap II		
Carboline	Phenoline 353 LTE Plasite 4550		Carbowrap Petroleum Tape		
Chesterton ARC	Chesterton CS4				
DENSO	Archco 701 ESR		Denso Tape Densopol Tape Viscotag Tape	Denso 50HSS Denso Premier 30 ST	
Enecon Chemclad	Ceramalloy CL				

Supplier	T7 Epoxy novolac	T8 HDPE/PVC liner	T9 Petrolatum/bitumen/vi sco-elastic tape wrap	T10 Heat shrinkable polyolefin coatings (Dispensation is required for underground applications)	T11 Polyurea
Epirez	Epirez Supatuff AR - Acid Resistant Epoxy Coating Epirez 733 AR Acid Resistant UHB Epoxy				
Hychem	Hychem TL9				
Mapei		Mapeplan TU Mapeproof SA			Purtop 1000 Purtop 500
Master Builders Solution BASF	BluRez 333AR	BluSeal AKS			
Petrogard			PetroGard Primer PetroGard Profiling Mastic PetroGard Tape ST PetroGard OverWrap		

Supplier	T7 Epoxy novolac	T8 HDPE/PVC liner	T9 Petrolatum/bitumen/vi sco-elastic tape wrap	T10 Heat shrinkable polyolefin coatings (Dispensation is required for underground applications)	T11 Polyurea
Universal Corrosion Coatings			UCC Petrolatum Primer UCC Petrolatum Mastic UCC Petrolatum Tape UCC PVC Overwrap Tape UCC Protek Visco Primer UCC Uniflex 1500 PVC - Bitumen Laminate Tape Canusa WRAPID Bond Visco Elastic Tape Canusa Wrapid Coat PVC Overwrap UCC ViscoSeal Paintable Visco Elastic Tape UCC ViscoSeal Mastic Filler UCC AcryliSeal Weathering Top Coat	UCC Protek (Butyl) Multi Primer UCC Butyl Mastic Strip Canusa KLON Heat Shrink Sleeve UCC Butyl Mastic Strip Canusa CRP 65 Repair Patch	
Sherwin Williams	Nova-Plate UHS				

Supplier	T7 Epoxy novolac	T8 HDPE/PVC liner	T9 Petrolatum/bitumen/vi sco-elastic tape wrap	T10 Heat shrinkable polyolefin coatings (Dispensation is required for underground applications)	T11 Polyurea
STOPAQ Anti Corrosion Technologies		STOPAQ Outerwrap PVC STOPAQ Outerwarap HSPE / HSPEX STOPAQ Outerwrap HTPP	STOPAQ CZH Wrappingband STOPAQ CZHT Wrappingband STOPAQ CZH / CZHT Paste STOPAQ 4200 Filler STOPAQ WSH Wrappingband STOPAQ EZ / EZHT Wrappingband EasyQote SC Patch HT		
Peerless Epigen	Epigen Chemproof (4000 series)				

B2 Concrete Protection Products

Product Category	SIKA	Master Builders Solutions	FOSROC	AGRU
HDPE Liner		MasterShield AKS 1000 MasterShield AKS 2000 MasterShield AKS 3000 MasterShield AKS 4000 MasterShield AKS 5000		HDPE Ultra Grip
Novolac Epoxy Coating	Sikagard 63N	MasterShield CHR 360		
SBR Repair Mortar Primer		MasterCrete PRI 157		
Silane / Siloxane			Nitocote SN502	
Silane			Nitocote SN508 Crème Nitocote SN511	
Floor Coatings			Nitoflor FC150 HP with antislip broadcast Nitoflor AP with antislip broadcast	
Drinking Water Coating			Nitocote EP405 FOSROC Polyurea WPE110 Vandex Cemelast, Vandex BB75E-Z Vandex Plug Vandex Concrete Grey	
Chemical Resistance Coating	Sikagard 62		Nitocote EP410 Nitoflor N	
Geopolymer Render			Renderoc G	
CAC			Renderoc CAC	
Anticarbonation Coating			Dekguard Elastic with DG Primer	

Product Category	SIKA	Master Builders Solutions	FOSROC	AGRU
Curing Compound			Concure A99	
Concrete Additive			Edencrete	
Waterproofing - Crystalline			Vandex Concrete Grey Vandex BB75E-Z Vandex Cemelast	
Polyurea Membrane			FOSROC Polyurea WPE110	
Rapid Setting Plug			Vandex Plug	

C New Gate Valves and Refurbished E&WS Gate Valves

This section specifies the approved materials and coating systems for the restoration of internal gate valve body surfaces, including products used for metal surface rebuilding and protective coatings. These requirements apply to the refurbishment of E&WS gate valves undertaken by SA Water workshops or approved external contractors, as well as the manufacture and supply of new gate valves. Section C3 presents a typical ITP for the E&WS Gate valve refurbishment.

C1 Reinstatement of Lost Metal

For deep corrosion pits or mechanical damage that does not need structural repair, the lost metal is to be reinstated using an approved compound. A list of compounds is provided below. Repair material for potable water pumps must be compliant with TS 0800 Materials in Contact with Drinking Water.

Reinstatement Compounds:

- Belzona 1311 (Ceramic R Metal)
- Belzona 1111 (Super Metal)
- Devcon Titanium Putty
- Chesterton ARC 10
- Metaline Series XL

C2 Internal Coatings

For the refurbishment of E&WS Gate valves, and for new gate valves the following internal coating systems are preferred:

Coating System	WSA-201 Category	Minimum Dry Film Thickness	Volume solids	Comments
Belzona 1341 (Supermetalgilde)	C3 and C13	<ul style="list-style-type: none"> • 1 x 250 microns grey • 1 x 250 microns blue 	100%	<ul style="list-style-type: none"> • Internal coating for body, gate and dome. • For efficiency enhancement. • Coating application shall be performed by an applicator trained and accredited by Belzona International.
AES Potable Ceramic (Aesseal)	C13	<ul style="list-style-type: none"> • 1 x 250 microns red • 1 x 250 microns blue 	100%	<ul style="list-style-type: none"> • Internal coating for body and dome.
Archco-Rigidon System 423D	C6	<ul style="list-style-type: none"> • Primer coat Archco PD2 Derakane 50 microns 	98%	<ul style="list-style-type: none"> • Internal coating for body and dome. First coat
		<ul style="list-style-type: none"> • Filler Archco 532D thickness varies to fill any pits 	99%	
		<ul style="list-style-type: none"> • Filler Archco 432D 500 microns 	96%	
		<ul style="list-style-type: none"> • Final coat Archco 432D 1500 microns 	96%	

Alternative Coatings

Workshops or contractors may propose coating products from the anti abrasion ceramic filled epoxy/polyurethane category (C13) for the gate, and products from the high build solvent free epoxy (C3) or ultra-high build epoxy (C4) categories for body and dome in Appendix B.

Approval process for Coatings not listed in Appendix B as per Section 15.

C3 External Coatings

For the refurbishment of E&WS Gate valves, the following coating systems are preferred:

Coating Properties	Jotun Marathon 550	Jotun Jotamastic 90	Interzone 954
WSA 201 Category	C1	C1 and C2	C2
DFT	2 x 250 microns	2 x 250 microns	2 x 250 microns
Volume solids	85%	80%	85%
Mix Ratio	4:1	3.5:1	4:1
Pot Life	1 hour @23°C	2-hour @23°C	45min @25°C
Overcoat time (Min/Max)	8 hours / 7 days @23°C	3 hours / 7 days @23°C	5.5 hours / 7 days @25°C
Cure time	7 days @23°C	7 days @23°C	7 days
Spark testing	2000V	2000V	2000V

Alternative Coatings

Workshops or contractors may propose coating products from the surface tolerant epoxy (C1), high build epoxy (C2) and the high build solvent free epoxy (C3) categories in Appendix B.

Approval process for Coatings not listed in Appendix B as per Clause 15.

C4 Typical Inspection Test Plan for Refurbishment of E&WS Gave Valves

	Project details	
	Project Number	
	Valve size	
	Valve pressure rating	
	Valve drawing	
	Valve Serial Number	

	Inspection / Test Activity	Responsible	Period	Inspection / Test method	Acceptance criteria	Record	SA Water	Sign
1	Preliminaries							
	Drawings and dimensions	PM	Prior	Review	Understood	Record sheet	R	
	Obtain Serial number	PM	Prior	Review	Obtained	ITP	R	
	Review Specifications, Technical Data and ITP	Workshops	Prior	Review	Understood	ITP	R	
	Pressure test calibration certificates	Workshops	Prior	Review	Calibration certificates	Pressure test record sheet	R	
	Coating inspection calibration certificates	Workshops	Prior	Review	Calibration certificates	C2.1 Gauge calibration	R	
2	Disassembly							
	Initial pressure test	Workshop - Fitter	Before disassembly	Test	Meets Test Pressure	Pressure test record sheet	H / DS	
	Disassembly	Workshop - Fitter	During	Visual	Conducted		W	
	Removal of studs	Workshop - Fitter	During	Visual	Conducted		W	
	Dye pen of shaft	Welding Supervisor	During	Dye Pen	No cracks	Dye pen Report	H / DS	
	Flatness of flanges	Workshop - Fitter	During	Measure	Drawing	App D Valve Assembly / Fitting	I	

	Inspection / Test Activity	Responsible	Period	Inspection / Test method	Acceptance criteria	Record	SA Water	Sign
	Flatness of body/dome	Workshop - Fitter	During	Measure	Drawing	App D Valve Assembly / Fitting	I	
	Inspection of components	Workshop - Fitter	During	Visual / photograph	Report	Condition Assessment Report	I	
3	Initial Cleaning							
	Removal of soil, tapes and grease	Workshops – Blaster/ Painter	During	Visual	Removed	ITP	W	
	Solvent cleaning of oil and grease	Workshops – Blaster/ Painter	During	Visual	Conducted	ITP	W	
	Degreasing of all surfaces AS1627.1	Workshops – Blaster/ Painter	During	Visual	Conducted	ITP	W	
	Tape sealing rings and flange surfaces	Workshops – Blaster/ Painter	During	Visual	Protected	ITP	W	
	Abrasive blasting to remove all graphitisation	Workshops – Blaster/ Painter	During	Visual	No Graphitisation	ITP	W	
	Washing with copious amounts of water	Workshops – Blaster/ Painter	During	Visual	Conducted	ITP	W	
	Drying in oven	Workshops – Blaster/ Painter	During	Visual	Conducted	ITP	W	
4	Condition Inspection							
	Inspection of components for metal loss and rating 1 to 3	Workshop - Fitter	During	Visual	Condition 1/2	Condition Assessment Report	H / DS	
5	Secondary Cleaning							
	Testing to AS 3894.6 Grease and oils	Workshops – AMPP Basic Coating Inspector	During	Visual	Test	Coating Inspection Record	H	
	Abrasive blasting to remove all graphitisation	Workshops – AMPP Basic Coating Inspector	After Cleaning	Test	No Graphitisation	Coating Inspection Record	H	

	Inspection / Test Activity	Responsible	Period	Inspection / Test method	Acceptance criteria	Record	SA Water	Sign
	Salt testing AS3894.6	Workshops – AMPP Basic Coating Inspector	After Cleaning	Test	<25 mg/m2	Coating Inspection Record	H	
	Check surface profile AS3894.5	Workshops – AMPP Basic Coating Inspector	After Cleaning	Test	>75 Microns	Coating Inspection Record	H	
	Washing with copious amounts of water	Workshops – Blaster/ Painter	During	Visual	Conducted	ITP		
	Drying in oven	Workshops – Blaster/ Painter	During	Visual	Conducted	ITP		
6	Grinding and machining							
	Valve modifications	Workshop - Fitter	During	Visual	Conducted	Instructions	I	
	Apply radius adjacent to sealing faces	Workshop - Fitter	During	Measure	3mm radius	Valve Assembly / Fitting Dimension Records	I	
	Grinding, blending, smoothing areas	Workshop - Fitter	During	Visual	As per spec	Valve Assembly / Fitting Dimension Records	I	
7	Internal Filler Application							
	Gauge calibration	Workshops – AMPP Basic Coating Inspector	Prior to use	Visual	In Calibration	Gauge calibration	R	
	Blasting Equipment Inspection	Workshops – AMPP Basic Coating Inspector	Prior to use	Visual	No oil or water in blast air	Blasting Equipment inspection		
	Internal Final Surface Inspection	Workshops – AMPP Basic Coating Inspector	Before application	Various	Sa3, 3mm radius, 75 micron profile, no contamination	Internal Final Surface Inspection	H	
	Environmental conditions	Workshops – AMPP Basic Coating Inspector	Before and during application	Gauge	Air 5-40C, Sub 5- 40C, RH<85% Dew point >3C	Climatic Coating Conditions	H	
	Application of Fillers	Workshops – Blaster/ Painter	After application	Visual	Visually smooth	Filler Application	S	

	Inspection / Test Activity	Responsible	Period	Inspection / Test method	Acceptance criteria	Record	SA Water	Sign
	Machining / grinding	Workshop - Fitter	Once cured	Measurement	To dimensions	Valve Assembly / Fitting Dimension Records	W	
8	Internal Coating Application							
	Sweep blasting (if required)	Workshops – Blaster/ Painter	Before coating	Visual	roughened	Coating Application Internal Record	S	
	Environmental conditions	Workshops – AMPP Basic Coating Inspector	Before and during application	Gauge	Air 5-40C, Sub 5-40C, RH<85% Dew point >3C	Climatic Coating Conditions Record	H	
	Application of Internal Coating First coat	Workshops – Blaster/ Painter	After coating	Visual and DFT	Minimum 250 microns	Coating Application Internal Record	S	
	Application of Internal Coating Second coat	Workshops – Blaster/ Painter	After coating	Visual and DFT	Minimum 500 microns	Coating Application Internal Record	S	
	Internal Holiday testing	Workshops – AMPP Basic Coating Inspector	Once cured	Spark tester	No Holidays	Coating Application Internal Record	I	
	Internal Coating Repairs	Workshops – AMPP Basic Coating Inspector	During	Visual	Repaired	Coating Application Internal Record	H	
9	Internal Coating Application							
	Environmental conditions	Workshops – AMPP Basic Coating Inspector	Before and during application	Gauge	Air 5-40C, Sub 5-40C, RH<85% Dew point >3C	Climatic Coating Conditions Record	H	
	Application of External Coating First coat	Workshops – Blaster/ Painter	After coating	Visual and DFT	Minimum 250 microns	Coating Application Internal Record	S	

	Inspection / Test Activity	Responsible	Period	Inspection / Test method	Acceptance criteria	Record	SA Water	Sign
	Application of External Coating Second coat	Workshops – Blaster/ Painter	After coating	Visual and DFT	Minimum 500 microns	Coating Application Internal Record	S	
10	Reassembly							
	Measurements and tolerances	Workshop - Fitter	During	Measure		Valve Assembly / Fitting Dimension Records	I	
11	Pressure testing							
	Body pressure test	Workshop - Fitter	During	Test	Test Pressure	Pressure and Leak Testing Record	H	
	Leak test both ways	Workshop - Fitter	During	Test	Leak Criteria	Pressure and Leak Testing Record	H	
12	Transport							
	Wrapping	Workshops – Blaster/ Painter	After coating	Visual and DFT	Flanges wrapped	ITP	I	
	Packaging	Workshop - Fitter	During	Test	Ready for transport	ITP	I	
	Gate shut for transport	Workshop - Fitter	During	Test	Closed	ITP	H	

D Specific Instructions for Pump Refurbishment

Pump housing coating repair falls into two categories:

1. Reinstatement of lost metal
2. Application of new lining

Determination of repair scope is based on condition assessment following pump dismantling. For components exhibiting evidence of corrosion, advice is to be sought from the Original Equipment Manufacturer (OEM) as to whether structural repairs are required. Structural repairs are to be performed in accordance with the OEM's directions.

D1 Reinstatement of Lost Metal

For deep corrosion pits or mechanical damage that does not need structural repair, the lost metal is to be reinstated using an approved compound. A list of compounds is provided below. Repair material for potable water pumps must be compliant with TS 0800 Materials in Contact with Drinking Water.

Reinstatement Compounds:

- Belzona 1311 (Ceramic R Metal)
- Belzona 1111 (Super Metal)
- Devcon Titanium Putty
- Chesterton ARC 10
- Metaline Series XL

Reinstatement compounds are to be applied in accordance with the manufacturer's requirements.

D2 Application of New Lining

New lining application may be via localised repair of the existing lining or wholesale application of a new lining. For pump applications that require abrasion resistance, a ceramic filled epoxy shall be applied. New linings for potable water pumps must be compliant with TS 0800 Materials in Contact with Drinking Water.

New Lining Products:

- Belzona 1321 (Ceramic S-Metal)
- Belzona 1341 (Supermetalgilde)
- Epigen 1311
- Devcon Brushable Ceramic /Devcon Sprayable Ceramic
- Metaline Series 700

Lining products are to be applied in accordance with the manufacturer's requirements.

Alternative Coatings

Workshops or contractors may propose coating products from the anti-abrasion ceramic filled epoxy/polyurethane category (C13) in Appendix B.

Steps to approving products see Section 15.

E Generic Product Application Requirements for Concrete Surfaces

Material descriptions in this Technical Standard identify functional classes rather than exclusive chemistries unless an exclusion is expressly stated. Examples include penetrating hydrophobic treatments, pore-blocking mineral treatments, barrier coatings, flexible crack-bridging membranes, chemically resistant linings, cementitious or inorganic protective renders, polymeric sheet linings, corrosion-control wraps and metallic protective systems. A product may be proposed within, across or outside these classes where its suitability is demonstrated against the specified performance and acceptance criteria.

E1 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
	Nominal depth of penetration:			50mm	25mm	
	Total minimum depth of concrete surface penetration:			75mm		

Asset Area of use	Preliminary cleaning	Oil and grease removal	Surface Preparation	1st Coat	2nd Coat	3rd Coat
Quality Control Requirements (Minimum)		Surface temperature Dew point / Humidity Concrete Surface Profile Sorptivity		AS 3894.7 Whirling Psychrometer or Humidity Meter ICRI Guideline No. 310.2 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.		
<p>Notes:</p> <ol style="list-style-type: none"> 1. 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. 2. Failure of the concrete surface preparation will likely result in areas NOT FULLY TREATED. 3. 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 4. Remove all traces of the existing coating. 5. Open out blow holes and remove laitance. 6. Do not fill blow holes or cracks etc before applying colloidal silica using low pressure airless spray. 7. Concrete may require additional applications to achieve the depth of colloidal silica impregnation 8. Report QA records in a format similar to AS 3894 Parts 10 to 14, where applicable. 						

E2 Elastomeric Anti-Carbonation Coating

Asset Area of use	Preliminary cleaning	Oil and grease removal	Surface Preparation	1st Coat (Primer)	2nd Coat	3rd Coat
<p>Water based Elastomeric Anti-Carbonation Coating for decorative painting.</p> <p>All coatings should be applied in accordance with the Manufacturer's recommendations.</p> <p>This specification forms part of the coating specification and should be read in its entirety.</p>	<p>New concrete Remove all surface contamination.</p> <p>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.</p> <p>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.</p>	<p>Use detergent water cleaning and steam cleaning per ASTM D4258 to remove oils and grease from concrete.</p> <p>Do not use solvents.</p>	<p>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.</p> <p>Repair blow holes and apply a fairing coat if required.</p> <p>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.</p>	<p>Solvent borne primer/sealer</p> <p>APAS 0171 AS/NZS 3730.22</p> <p>Apply to all prepared surfaces</p>	<p>Latex - Membrane Coating</p> <p>Water based acrylic membrane coating for AS/NZS 4548.2 systems</p> <p>APAS 0117/3</p>	<p>Latex - Membrane Coating</p> <p>Water based acrylic membrane coating for AS/NZS 4548.2 systems</p> <p>APAS 0117/3</p>
	Nominal Dry Film Thickness:			15µm	400µm	400µm
	Total minimum Dry Film Thickness:			815µm		
Quality Control Requirements (Minimum)	<p>Surface temperature</p> <p>Dew point / Humidity</p> <p>Surface preparation grade</p> <p>Surface profile</p> <p>WFT</p> <p>DFT</p>			<p>AS 3894.7</p> <p>Whirling Psychrometer or Humidity Meter</p> <p>ICRI Guideline No. 310.2</p> <p>ICRI Guideline No. 310.2</p> <p>AS 3894.3 Appendix C</p> <p>ASTM D6132</p>		

Asset Area of use	Preliminary cleaning	Oil and grease removal	Surface Preparation	1st Coat (Primer)	2nd Coat	3rd Coat
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Notes:

1. 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.
2. Failure of the concrete surface preparation will likely result in unbonded or breached areas of the protective coating system.
3. 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
4. If the original protective coating system is compatible with the new protection system it may be overcoated.
5. With many existing coating systems, all traces of the existing coating may have to be removed.
6. Products are to be approved by the superintendent prior to use.
7. Apply the coating system in accordance with the Manufacturer's recommendations.
8. Applicator to be recommended by the coating manufacturer.
9. 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.
10. Structural control or expansion joints, cracks and flaws should be filled in accordance with the manufacturer's recommendations.
11. Elastomeric Anti-Carbonation Coating systems may require additional film build and/or number of applications to achieve the required aesthetics.
12. 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.
13. Colour as specified by SA Water's Representative.
14. Report QA records in a format similar to AS 3894 Parts 10 to 14, where applicable.
15. For topcoat touch-ups, apply coating to an edge or a masked straight line for a neat finish.

E3 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 0.4mm 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.	<p>New concrete Remove all surface contamination.</p> <p>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</p> <p>Previously applied protection systems: Remove any existing protective coating system.</p>	Use detergent water cleaning and steam cleaning per ASTM D4258 to remove oils and grease from concrete. Do not use solvents.	<p>Remove existing coatings, remove loose and weak materials and contaminants from the surface</p> <p>Abrasive blast clean, grind, scarify, scabble 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</p> <p>CSP 3 -5 (Slurry) CSP 5 -10 (Render)</p> <p>or as per the Manufacturer's recommended range.</p>	<p>Ensure that substrate is fully saturated with water to achieve a Saturated Surface Dry (SSD) surface during application.</p> <p>Slurry Coat: "concentrated" hydrophilic crystalline cementitious material</p> <p>Render: Slurry mix of the waterproof render mortar</p>	Waterproof Slurry Coat: Waterproof render mortar	Waterproof Slurry Coat:
	Nominal Dry Film Thickness			Slurry Coating: <ul style="list-style-type: none"> • 1.25mm Render: <ul style="list-style-type: none"> • 1-2mm 	Slurry Coating: <ul style="list-style-type: none"> • 1.25mm Render: <ul style="list-style-type: none"> • 10-50mm 	Slurry Coating: <ul style="list-style-type: none"> • 1.25mm
	Total minimum Slurry Coat Dry Film Thickness:			4mm		
	Total minimum Render Dry Film Thickness:			25mm		
Quality Control Requirements (Minimum)	Surface temperature Dew point / Humidity Surface preparation grade Surface profile WFT			AS 3894.7 Whirling Psychrometer or Humidity Meter ICRI Guideline No. 310.2 ICRI Guideline No. 310.2 AS 3894.3 Appendix C		

Asset Area of use	Preliminary cleaning	Oil and grease removal	Surface Preparation	1st Coat (Primer)	2nd Coat Spray/Trowel Coat	3rd Coat
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Notes:

1. 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.
2. Failure of the concrete surface preparation will likely result in unbonded or breached areas of the protective coating system.
3. 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
4. If the original protective render system is compatible with the new protection system it may be overcoated.
5. With many existing coating systems, all traces of the existing coating may have to be removed.
6. Apply by brush or specialised spray equipment.
7. Work primers in well with stiff brush or broom.
8. 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.
9. Cut cold joints straight and flush to achieve a neat finish between panels after final set
10. 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.
11. Cure by fine mist spray minimum 3 days
12. Report QA records in a format similar to AS 3894 Parts 10 to 14, where applicable.

E4 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
<p>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.</p> <p>All coatings should be applied in accordance with the Manufacturer's recommendations.</p> <p>This specification forms part of the coating specification and should be read in its entirety.</p>	<p>New concrete:</p> <p>Remove all surface contamination.</p> <p>Aged Concrete:</p> <p>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.</p> <p>Remove degraded concrete and other contamination</p> <p>Previously applied protection systems:</p> <p>Remove any existing protective coating system.</p>	<p>Use detergent water cleaning and steam cleaning per ASTM D4258 to remove oils and grease from concrete.</p> <p>Do not use solvents.</p>	<p>Remove existing coatings, remove loose and weak materials and contaminants from the surface</p> <p>Abrasive blast clean, grind, scarify, scrubble 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.</p>	<p>100% solids hybrid epoxy applied at rate of 0.2L/m².</p> <p>Allow to tack prior to application of the Structural Polymer.</p> <p>Consult manufacturer.</p> <p>Ensure that substrate is fully saturated with water to achieve a Saturated Surface Dry (SSD) surface during application.</p>	Structural Polymer Mastic	PVC sheet liner
	Nominal Dry Film Thickness:			N/A	Min 25mm	
	Total minimum Dry Film Thickness:			25mm		
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		

Asset Area of use	Preliminary cleaning	Oil and grease removal	Surface Preparation	1st Coat (Primer)	2nd Coat Spray/Trowel Coat	3rd Coat
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Notes:

1. 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.
2. Failure of the concrete surface preparation will likely result in unbonded or breached areas of the protective coating system.
3. 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.
4. With many existing coating systems, all traces of the existing coating may have to be removed.
5. Develop a sequencing and layout plan to minimize waste and improve production rates.
6. Pre-cut the PVC liner for the areas and configuration to be completed according to the sequencing and layout plan.
7. 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.
8. Trowel or spray correctly mixed structural polymer to the primed surface as per the Manufacturer's recommendations.
9. Install detail strips and corners before laying up Rigid PVC Liner Panel.
10. 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.
11. Spray structural Polymer on the overlap area of a PVC sheet before the next sheet is installed.
12. Ensure all seams are fully embedded and overlapped at least 100mm. Apply a 25mm bead of seam material to the edge of the overlap using tape or a seaming tool to produce a neat and clean edge.
13. Visually monitor the wave of mastic under the PVC at all times to prevent hollow areas that will need repaired.
14. Apply seam material immediately after mixing while it is soft and easy to apply.
15. Check all surfaces to make certain PVC is smooth and fully embedded and seams are tight with no open areas or voids.
16. Test the total area for drumminess between the coating and the concrete surface.
17. Where drumminess is detected, undertake adhesion pull-off testing on these areas to determine the degree of coating adhesion.
18. Areas determined to be unsatisfactory are to be stripped, repaired and re-tested to confirm satisfactory results.
19. Colour as specified by SA Water's Representative.
20. Report QA records in a format similar to AS 3894 Parts 10 to 14, where applicable.
21. For topcoat touch-ups, apply coating to an edge or a masked straight line for a neat finish.

F Termination Details

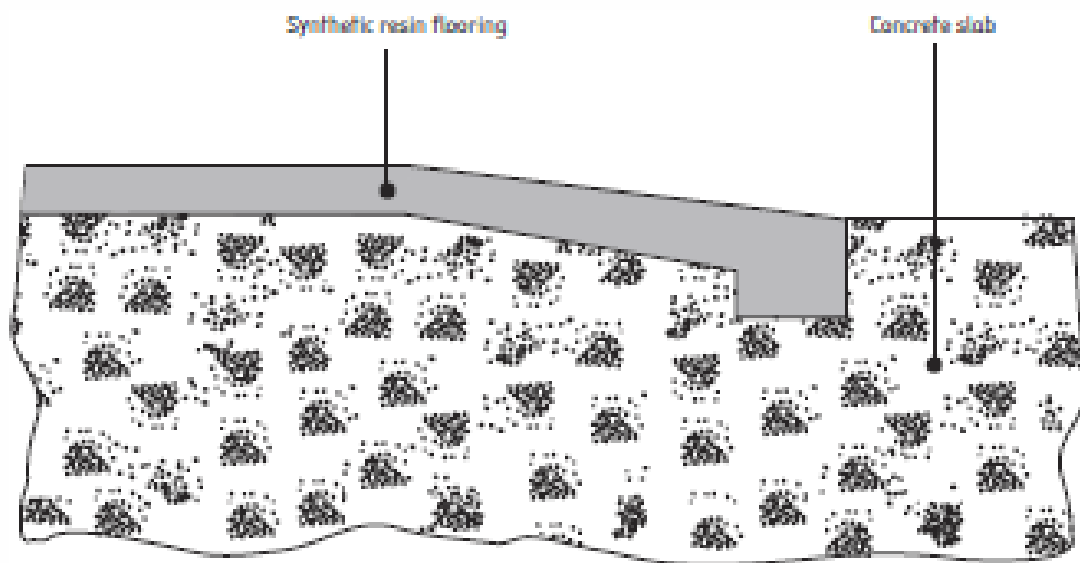


Figure 2: Toe-in Joint for Floor and Wall Terminations (Ref. BS 8204.6)

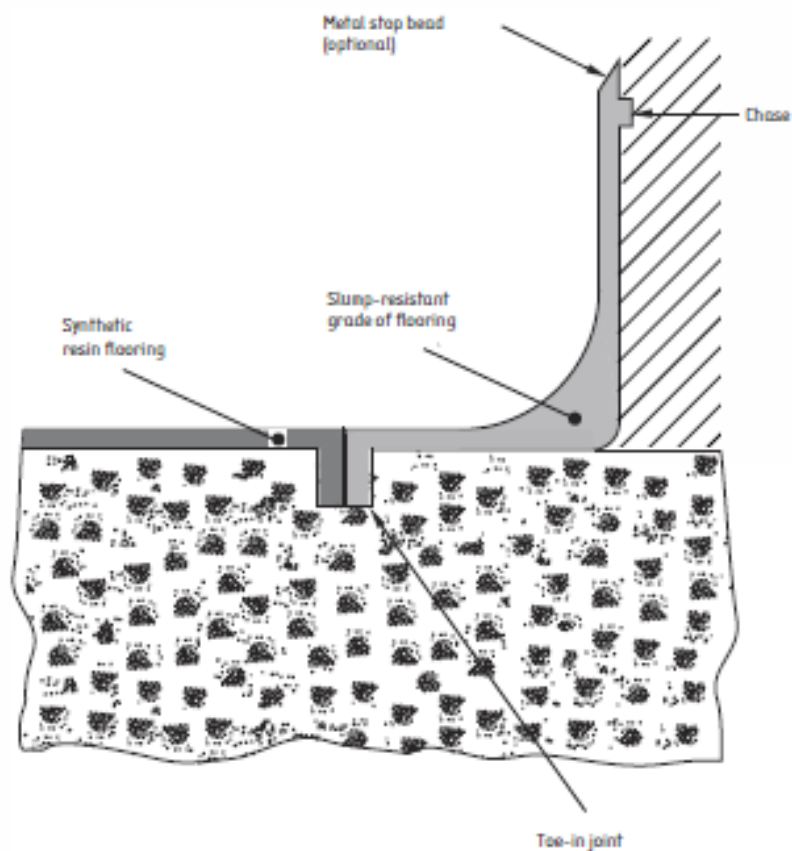


Figure 3: Floor to Wall Joint, Coving (BS 8204.6)

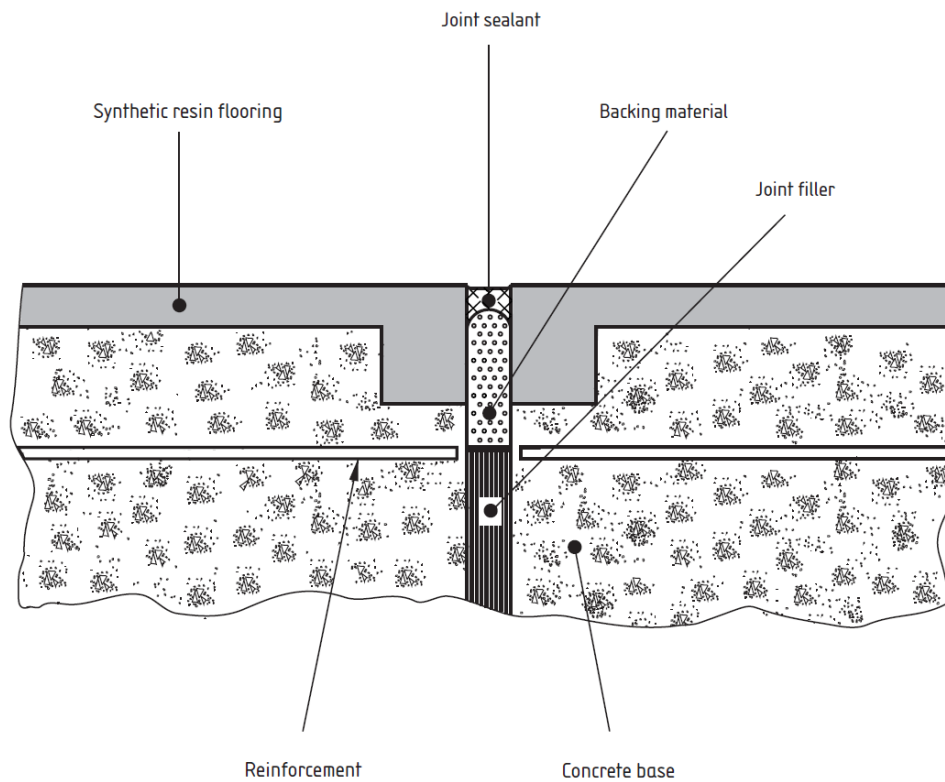


Figure 4: Movement Joint (BS 8204.6)

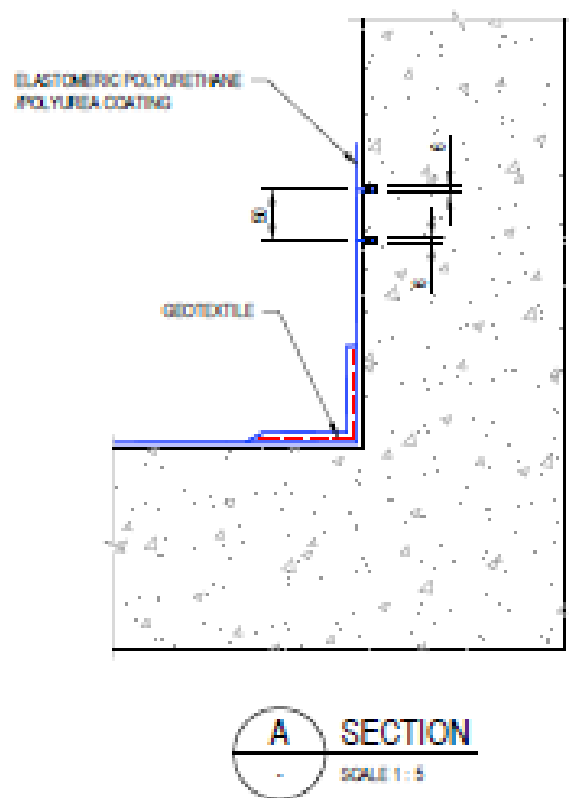


Figure 5: Groove Detail at Wall to Floor Intersection

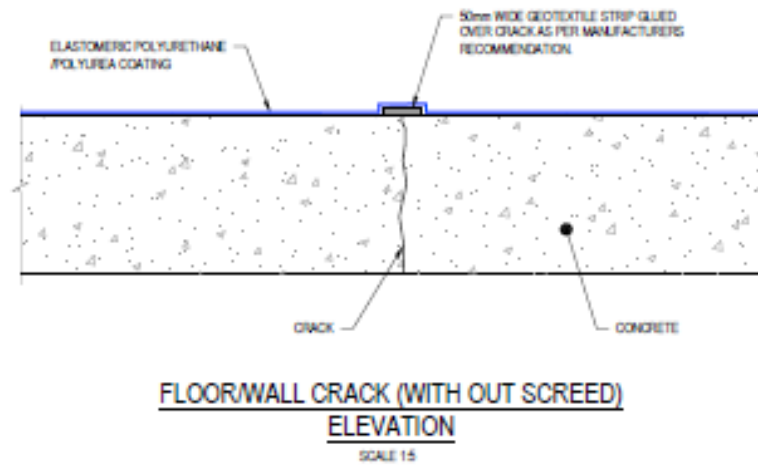


Figure 6: Groove Detail at Floor or Wall Crack

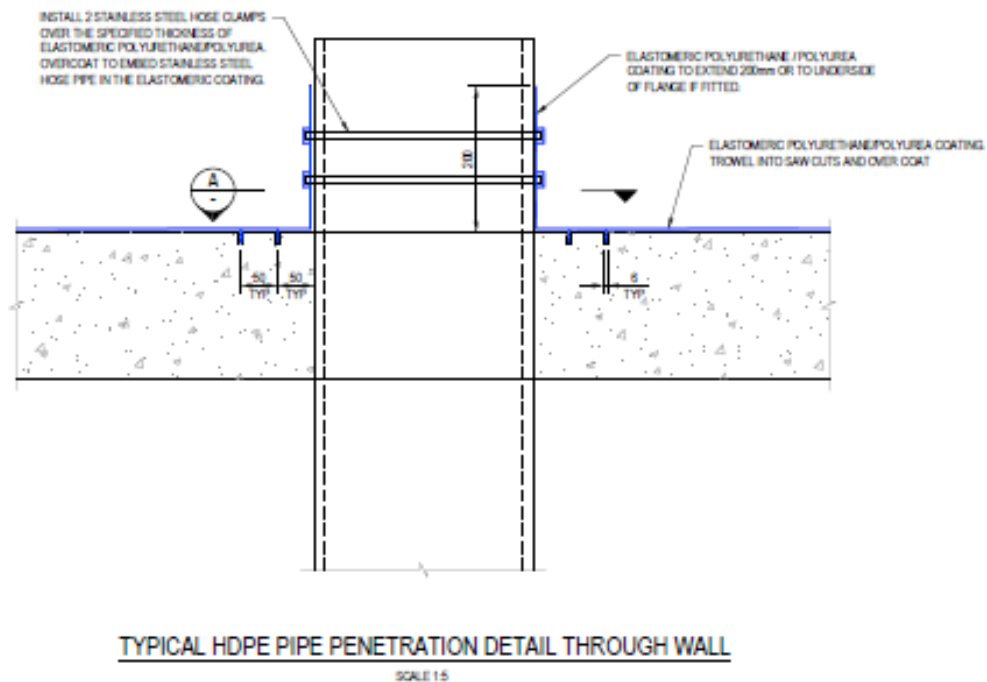


Figure 7: Groove Detail at Typical Pipe Through Penetration

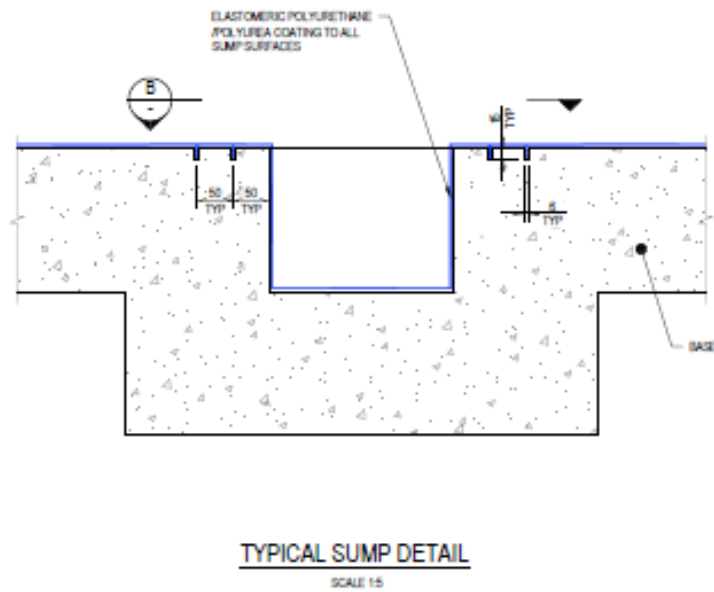


Figure 8: Groove Detail at Sump Pit

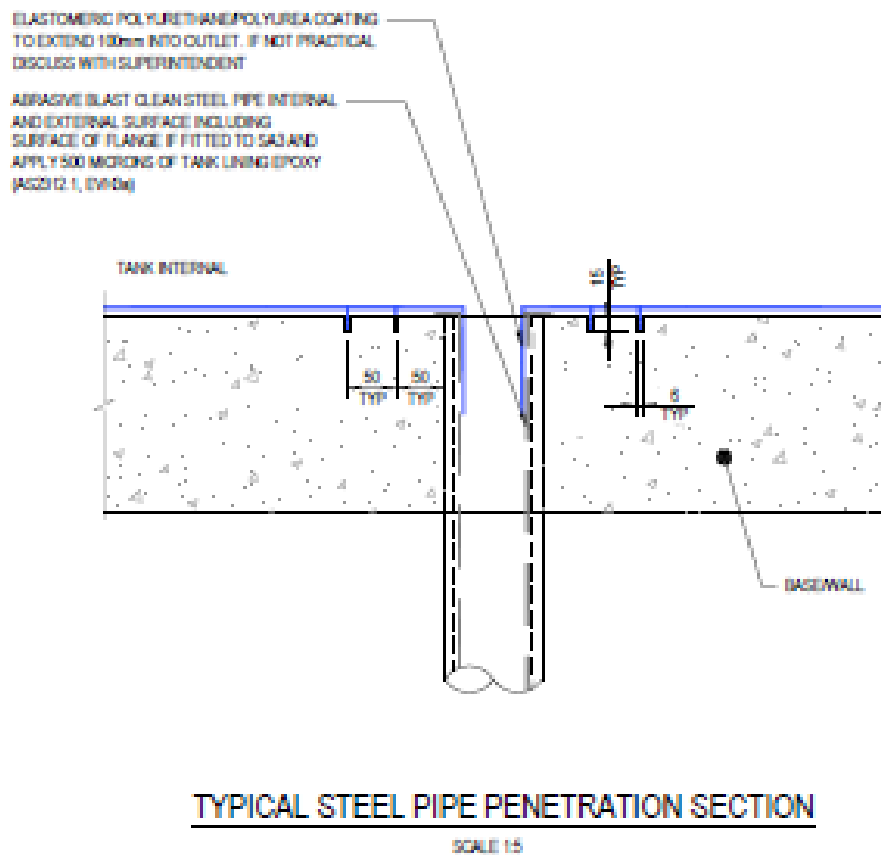


Figure 9: Groove Detail at Flush Pipe Penetration

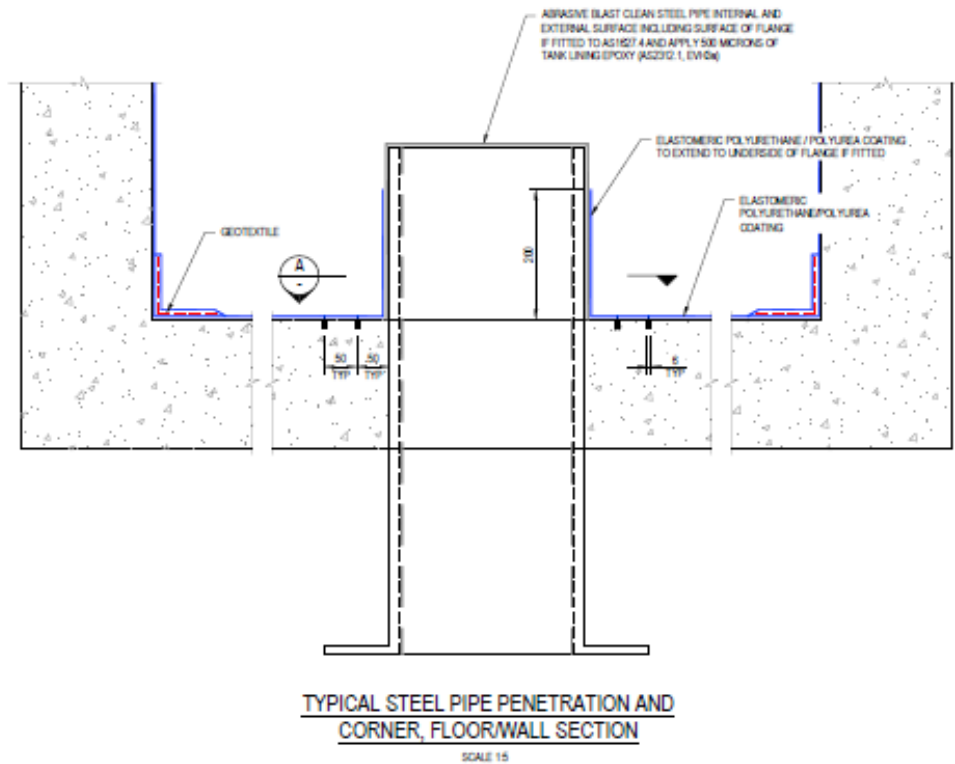


Figure 10: Groove Detail at Wall to Floor Intersection and Pipe Penetration

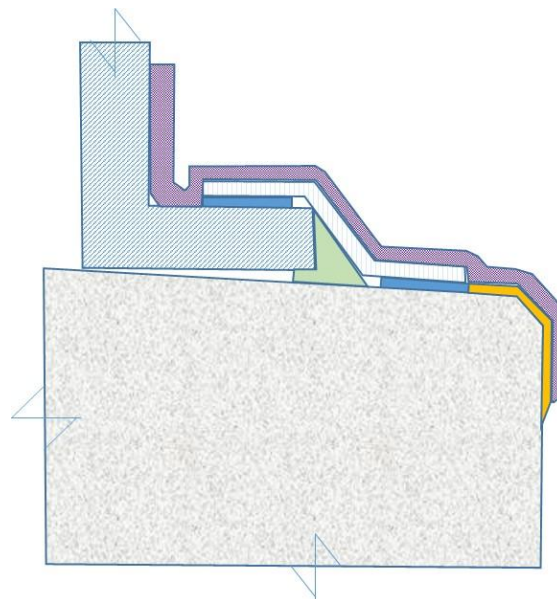


Figure 11: Tank Boot Seal Detail

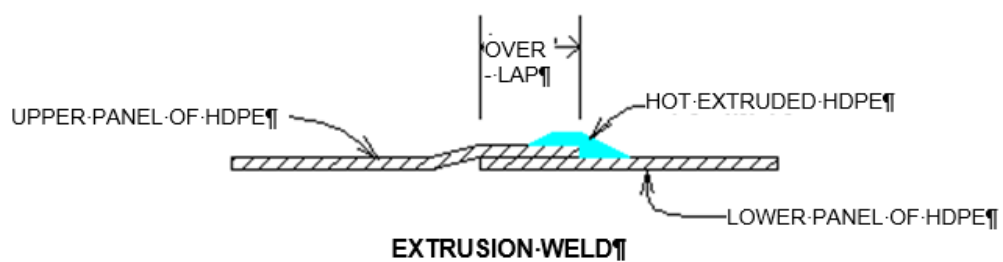


Figure 12: HDPE Extrusion Weld Detail

G Safety Checklist

Safety Checklist	Required	N/A
Preliminary requirements		
Safety Management System – specifically for industrial coating applications	☐	☐
Compliance with SA Water WHS requirements	☐	☐
Compliance with SafeWork SA	☐	☐
Compliance with SafeWork Australia Model Codes of Practice (see Clause 3.4 WSA 201)	☐	☐
Approvals – EPA	☐	☐
Approvals – WorkCover	☐	☐
Approvals – SA Water	☐	☐
Handling of Chemicals (WSA 201 Clause 3.5)		
Safety Data Sheets (SDS) available	☐	☐
Chemical safety procedures available	☐	☐
Compliance with Warning labels	☐	☐
'No Smoking' and 'Flammable Liquid' signs in place	☐	☐
Compliance with Supplier's instructions for safe handling	☐	☐
PPE and protective barriers in place	☐	☐
[Disposal] – environment	☐	☐
Pressure Equipment (see WSA 201 Clause 3.6)		
Safe operating instructions available	☐	☐
Compliance with equipment inspection method and frequency	☐	☐
Mechanical restraint on all hose-hose and hose-equipment connections	☐	☐
Safety clips on all blast hose connections	☐	☐
Dead man switches on all abrasive blasting nozzles and water jetting nozzles	☐	☐
Maintenance record of dead man switches	☐	☐
Dead man switch operation check at start of shift and every relocation	☐	☐
Earthing (see WSA 201 Clause 3.7)		
All spraying, abrasive blasting and other equipment that may develop electrostatic charge is earthed	☐	☐
PPE, Ventilation and Lighting (see WSA 201 Clause 3.8)		
PPE available as per SDS	☐	☐
Air-fed masks available for abrasive blasting and coating	☐	☐
Air supply compliance with AS/NZS 1715	☐	☐
Air testing and certification program	☐	☐
Air quality monitoring and alarm system	☐	☐
Diver grade air lines	☐	☐
Dedicated lines and fittings	☐	☐

Safety Checklist	Required	N/A
Adjacent personnel to wear respirators compliant to AS/NZS 1715 and AS/NZS 1716	☐	☐
First aid equipment and eye wash bottles available	☐	☐
Adequate ventilation	☐	☐
Dust extractor fans to achieve 6 air changes per hour	☐	☐
Lighting in accordance with AS/NZS 1680.2.4	☐	☐
Access (see WSA 201 Clause 3.9)		
Scaffolding, platforms, lifts, floating stages erected and operated by licensed and qualified personnel	☐	☐
Access structure tags prominently displayed	☐	☐
Warning signs in place for overhead work	☐	☐
Confined Space (see WSA 201 Clause 3.10)		
'Working in confined space' training certification – HOLD POINT	☐	☐
Permit in place	☐	☐
Rescue plan in place	☐	☐
Air quality monitoring in place	☐	☐
Adequate ventilation	☐	☐
PPE	☐	☐
Working at Heights (see WSA 201 Clause 3.11)		
'Working at Heights' training certification – HOLD POINT	☐	☐
'Elevated Work Platform' training certification	☐	☐
Control measures in accordance with AS/NZS 1891	☐	☐
Compliance with WorkSafe Code of Practice	☐	☐
Harnesses inspection record	☐	☐
Harnesses in date	☐	☐
Working at Heights PPE	☐	☐
Working in, on or around water (see WSA 201 Clause 3.12)		
Exclusion zone established	☐	☐
Isolate and de-energise equipment	☐	☐
Approvals	☐	☐
Emergency rescue plan in place and tested	☐	☐
Personal Flotation Devices (PFDs) available and compliant with Australian Standards	☐	☐
Divers medically fit	☐	☐
Diving operations in accordance with AS/NZS 2299.1	☐	☐
Heat Stress (see WSA 201 Clause 3.13)		
Heat stress prevention strategies in place	☐	☐
Temperature monitoring	☐	☐
Heat Risk Management Plan	☐	☐
Fatigue Management (see WSA 201 Clause 3.14)		

Safety Checklist	Required	N/A
Fatigue management processes in place	☐	☐
Fatigue identification and management training provided	☐	☐
Barriers and Masking (see WSA 201 Clause 3.15)		
Barriers and warning signs for;		
Fire hazards	☐	☐
Dust	☐	☐
Abrasive blasting	☐	☐
Dangerous fumes	☐	☐
Protection for adjacent areas	☐	☐
Operation of monitoring equipment and emergency equipment	☐	☐
Hazardous Substances (see WSA 201 Clause 3.16)		
No coatings containing coal tar, bitumen, asphalt, lead or zinc chromate	☐	☐
Identify existing coatings containing lead, chromates, coal tar or other hazardous substances	☐	☐
Implement protective measures	☒	☐

H Environment Checklist

H1 Environment Checklist

Environment Checklist	Required	N/A
Compliance with paint emissions regulations	☐	☐
Compliance with waste management regulations	☐	☐
PCCP certification for working with hazardous substances, including lead	☐	☐
Work methodology that includes ventilation, encapsulation, air monitoring and waste disposal for any work involving hazardous substances, including lead	☐	☐
Suitable containment (AS4361.1)	☐	☐
Capture, and disposal of removed coating, spent abrasive and waste	☐	☐
Emission management to Level 2 in WSA 201Table 1	☐	☐