

COATING SPECIFICATION

ELASTOMERIC POLYURETHANE PROTECTIVE COATING ON CONCRETE

COATING SPECIFICATION: I1

ISSUE: 4

DATE: APRIL 2023

1.0 SCOPE

This document summarises the procedure for high pressure, plural component spray applied elastomeric polyurethane or polyurea or hybrid protective coatings onto concrete structures.

Refer Design Standard, DS 95 (Standard for the Selection, Preparation, Application, Inspection and Testing of Protective Coatings on Water Corporation Assets) for additional information or clarification.

This Specification shall be read in conjunction with Water Corporation Specification **A5 - Surface Preparation for the application of Protective Coatings on Concrete**.

2.0 PURPOSE

The purpose of this coating specification is to describe the surface preparation and application of elastomeric coating for potable and non-potable water concrete structures. Typical applications include, but not limited to sludge digesters, potable water concrete tanks, etc.

For potable water applications, any materials and coating system that are exposed to potable water shall have AS/NZS 4020 (Testing of products for use in contact with drinking water) approval.

3.0 DEFINITIONS

ACA: Australasian Corrosion Association.

Adhesion Testing: Testing to determine the bonding strength of the coating to the substrates to which they are applied.

Contractor: The service provider or its sub-contractor who will undertake the works.

Corporation: Water Corporation and the Principal for the purposes of externally contracted asset delivery.

DFT: Dry Film Thickness.

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ITP: The detailed Inspection and Test Plan(s) for the Works.

NACE: National Association of Corrosion Engineers.

Spark Testing: Testing of the continuity of a fully-cured coating film for evidence of defects, pin holes, holidays (misses) or damage.

Superintendent: The Superintendent for the contract, as defined in the conditions of contract, who is appointed by the Water Corporation to manage/oversee the work under the contract on behalf of the Water Corporation.

Works: The surface preparation, coating application and inspection to be undertaken by the contractor to which this coating specification applies.

4.0 COATING APPLICATOR/PERSONNEL QUALIFICATION

- 4.1 The elastomeric coating and primer shall be from the same manufacturer to ensure compatibility, can only be applied by a Specialist Applicator and by a competent person. Expectations shall be granted with approval by the Principal.
- 4.2 The work shall be undertaken by an approved Water Corporation Protective Coating and Concrete Repair Services panel member unless approved otherwise by the Principal.
- 4.3 The contractor shall nominate a certified coating inspector to perform inspections and maintain appropriate records for the work performed. The Coating Inspector engaged in testing, monitoring, and verification of surface preparation and coating application shall hold relevant inspection qualifications and current certifications (e.g. NACE or ACA) or approved by the Principal. The coating inspector shall conduct the following:
 - Prepare Quality Assurance documentation to meet the specified standards given herein and the required acceptance criteria.
 - Perform inspections and maintain appropriate records for work performed.

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- Testing, monitoring, and verification of surface preparation and coating application.
- 4.4 On site testing shall be done to demonstrate the performance of the system and applicator to meet the requirements of this specification including:
- Abrasive blasted substrate complied with a roughness 60 grit sandpaper on a visual inspection.
 - Shore Hardness development in accordance with DIN53 505 or ASTM D 2240.
 - Holiday testing to all internal coated surfaces as per AS3894.1
 - Determination of residual contaminants for test area as per AS3894.6.
 - Determination of adhesion with 50 mm dollies as per AS3894.9, or tested as per manufacturers recommendations.
 - Determination of DFT as per AS3894.3.
 - Daily ambient condition report as per AS3894.10.
 - Abrasive wet blasting to provide an adequate key for subsequent coating as per AS/NZS 1627.4.
 - Concrete substrate moisture content method as per ASTM D4263.

5.0 CONCRETE REPAIR IDENTIFICATION

- 5.1 Prior to the application of the coating, the Contractor shall carry out a visual inspection and delamination survey by hammer tapping to identify and confirm areas of defective concrete for repair works. The Contractor shall identify and document concrete defect areas and record defects in Defects Mapping Sketch and/or Drawings in a format agreed with the Principal and submit to the Principal for review and approval for a minimum of 10 days prior to commencement of repair works.

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- 5.2 Defective concrete is defined as areas of the concrete, which has cracking or delamination or spalling (including exposed corroded reinforcement) or rust stains and inadequate or failing past patch repairs.

6.0 CONCRETE REPAIRS

- 6.1 If concrete repairs are required prior to the application of the coating, the Contractor shall repair in accordance with Section 7.0 of this specification. Carry out patch repair to the areas of defective concrete which has cracking or delamination or spalling (including exposed corroded reinforcement) or rust stains and inadequate or failing past patch repairs.

- 6.1.1 The reinstatement repair mortar shall be a proprietary single-component polymer modified, a cement-based blend of powders such as Sika MonoTop 436 N or MonoTop 612 N or similar approved equivalent, depending on the size, depth and application of the patch repair.

- 6.1.2 The approved perimeter of the defective concrete to be removed shall be saw cut to a depth of 20mm to delineate the extent of the repair and to avoid feather edges in the repair. The saw-cut areas shall be kept as rectangular as possible.

- 6.1.3 Any exposed reinforcement shall be cleaned to AS 1627.4 Class 2.5 with particular attention to the back of exposed steel bars. No rebar is to be cut or augmented without the approval of Principal. After cleaning, apply epoxy primer such as Sikadur 32 as per manufacturer's recommendations.

- 6.1.4 Hand Applied Repair Method – Epoxy bonding agent, e.g., Sikadur 32 or similar approved equivalent shall be applied on the cleaned and sound substrate. Placement of mortar shall be performed while the bonding agent is still tacky. Where multiple layers are applied, the surface of the repair mortar shall be scarified before curing for adhesion of next layer.

Pourable Repair Method (Form & Pour) – Concrete substrate shall be clean sound and pre-soaked with clean water for a minimum of 24 hours before application ensuring

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that all pores and pits are adequately wet. Just prior to application, the concrete surface shall be in a surface saturated dry state (dark matt appearance without glistening) and pores and pits shall not contain water. Use pressurised air (oil free) to blow away any excess water in difficult to reach areas.

- 6.1.5 An adequate wet curing method, e.g., covering the concrete repair area with wet hessian shall be implemented for repair with a minimum wet curing time of 3 days immediately after initial set. **The use of curing compounds for curing is not permitted.**
- 6.1.7 **Any alternative concrete repair methodology and/or materials that are not stipulated in this Specification** shall be submitted to the Principal and subject to approval by the Principal prior to commencement of repair works.

7.0 SURFACE PREPARATION

- 7.1 The concrete substrate shall be minimum 28 days (new construction and after concrete movement/shrinkage has settled) and 7 days (concrete repair) old with a minimum compressive strength of 25MPa and moisture content <4%. The substrate shall be sound, dry, free from dust/dirt, any surface defects and contaminants (e.g. oil, grease, salts, chemicals, paint, formwork release agents, curing agents etc.) that may detrimental to the coating adhesion to the substrate.
- 7.2 Concrete surfaces to receive the coating shall be prepared by mechanical methods such as grinding or grit abrasive blasting to remove laitance, curing compounds and other loose materials, to provide a mechanical key for the coating system. The surface preparation of concrete shall meet and conform to Joint NACE6/SSPC-SP 13 standards and achieve a concrete surface profile of CSP3 to CSP 6 as per ICRI Guideline No.03732 for optimum performance.

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Figure 1 Typical surface preparation by grinding

- 7.3 If the coating is to be applied to a part of the structure or as a strip application, the coating shall be terminated by a termination groove. The termination groove shall be 5 mm (wide) x 5 mm (depth).



Figure 2 Typical termination groove

- 7.4 Any sharp edge/ corner shall be chamfered /rounded.
- 7.5 After preparation, all surface voids or blow holes and surface imperfections in concrete shall be repaired using epoxy mortar such as Sikadur 31 or similar approved equivalent. Alternatively produce a workable mortar paste using Sikalastic 100 EP primer mixed with a blended of graded, kiln dried natural aggregate sands and/or with proprietary lightweight super fine thixatropo additive fillers e.g. Sikadur 513 or similar equivalent

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approved. Mix ratio of sand/filler to epoxy shall be 4-6 (sand/filler):1(epoxy) by volume or can be adjusted on site as necessary to achieve required result.

- 7.6 If the moisture content of concrete substrate is greater than 4%, apply a single continuous coat of Sikagard 720 EpoCem at nominal 2 mm thick to level surfaces to fill all blow holes and surface imperfections in concrete prior to priming. Sikalastic epoxy primers can be used as soon as the surface moisture of Sikagard 720 EpoCem has reached 4%. With this system, separate treatment as stated in 7.5 is not required.
- 7.7 After preparation and filling, the prepared substrate shall be primed with a suitable 2 part, 100% solid epoxy primer such as Sikalastic 100 EP Primer or similar approved equivalent at 5-6m²/L per coat (CSP 2-3) or 2-3m²/L per coat (CSP 4-5). If required, apply a second coat to blind up pinholes prior to coating layer. Recoat window 24 hours @20°C.
- 7.8 Lightly broadcast 0.3-0.8 mm quartz sand aggregate such as Sikadur 507 or similar approved equivalent into the wet primer at approx. 1.0-1.5kg/m².
- 7.8 Floor to wall joints, movement joint, pipe penetration, steel fixings etc. shall be treated as shown in Figure 3, Figure 4, Figure 5 and Figure 6.

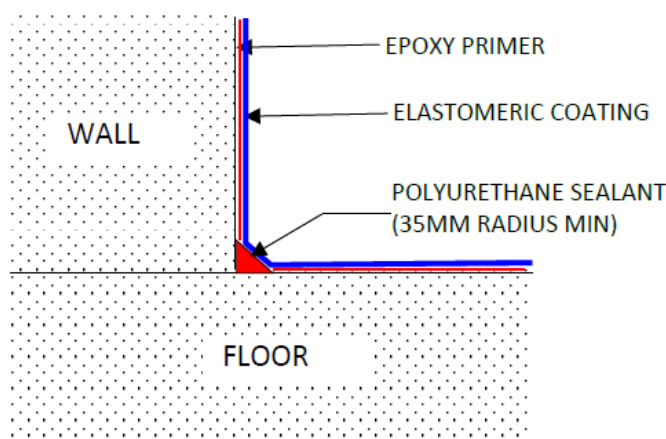


Figure 3 Typical Floor to Wall Joint Details

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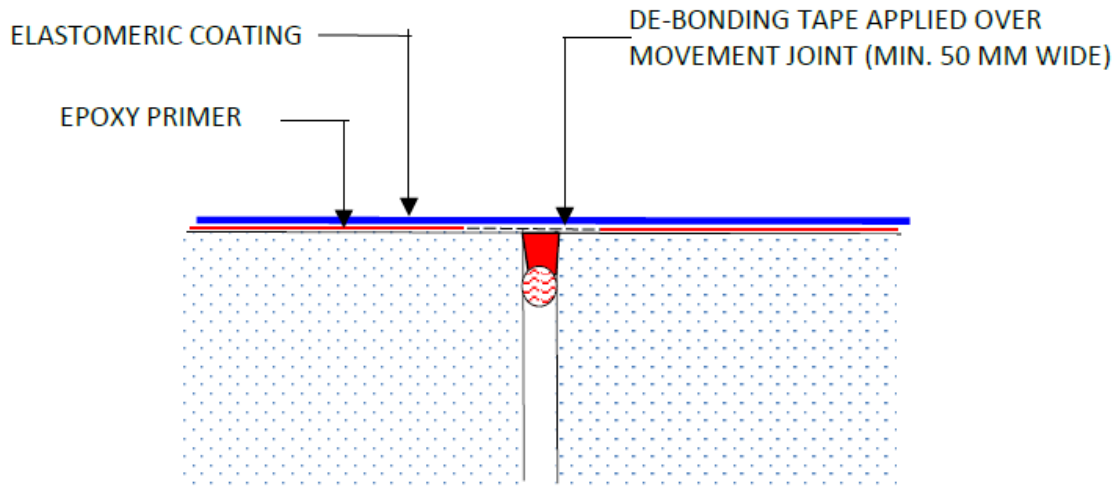


Figure 4 Typical Movement Joint Details

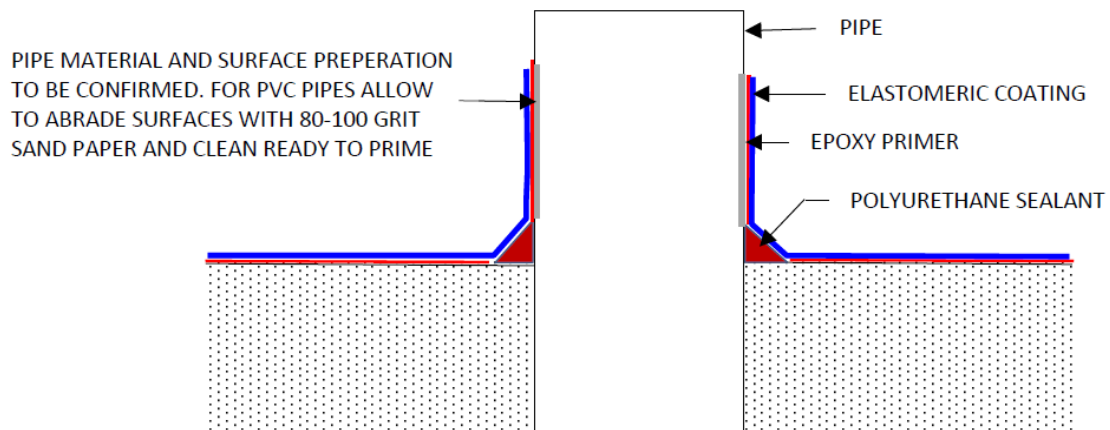


Figure 5 Typical Pipe Penetration Details

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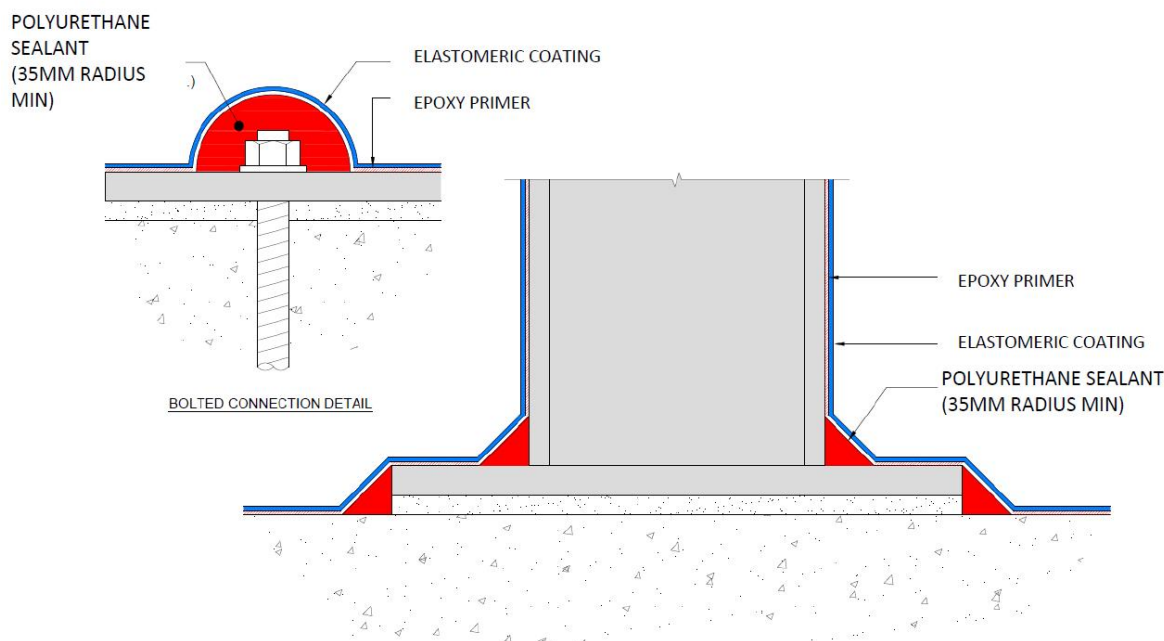


Figure 6 Typical steel connection details

7.0 COATING MATERIALS

- 7.1 The coating is elastomeric coating system e.g. Sikalastic 888 or similar approved equivalent. Other suitable coating system shall be selected in accordance with Appendix 3 of DS-95- commonly used coatings in potable water and wastewater infrastructures unless approved otherwise by the Principal. Prior to commencement of work.
- 7.2 The coating components shall be thoroughly mixed in the specified proportions. Material so prepared shall be used within the “pot-life” period claimed by the manufacturer for the relevant site conditions.
- 7.3 Coating specifications inclusive of datasheets, coating application, method statements and ITP’s shall be submitted to the Principal for approval at least 10 working days prior to commencement of the work.
- 7.4 Recommended drying times between coats for on site conditions shall not be exceeded.
- 7.5 Applied coatings shall be protected from rain or moisture until cured.

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8.0 ATMOSPHERIC CONDITIONS

- 8.1 Prior to and during coating application, the contractor shall record details in Daily Coating and Inspection Report pertaining to environmental conditions including daily ambient and surface temperature, relative humidity and dew point.
- 8.2 Prior to coating application, as a minimum the ambient temperature and relative humidity shall typically be $>10^{\circ}\text{C}$ and $\text{RH} < 80\%$.
- 8.3 The material shall not be applied if it is raining or such conditions appear to be imminent. The substrate temperature shall be at least 3°C above dew point and rising.

9.0 COATING APPLICATION

- 9.1 High pressure plural component equipment shall be used for mixing and application of the elastomeric coating and shall be mixed and applied in accordance with the manufacturer's recommendations.
- 9.2 Apply Elastomeric coating to the prepared and primed surface to produce 2.0 mm minimum dry film thickness. A minimum of 2.0 mm thickness of the coating system is required for fully immersed applications & water pressure up to 2.5 bar.
- 9.3 Preparation on overlaps and new to previously applied coating shall be as per Figure 7 to ensure a homogeneous layer. Overcoat windows and re-activation methods shall be as per the manufacture's recommendations.

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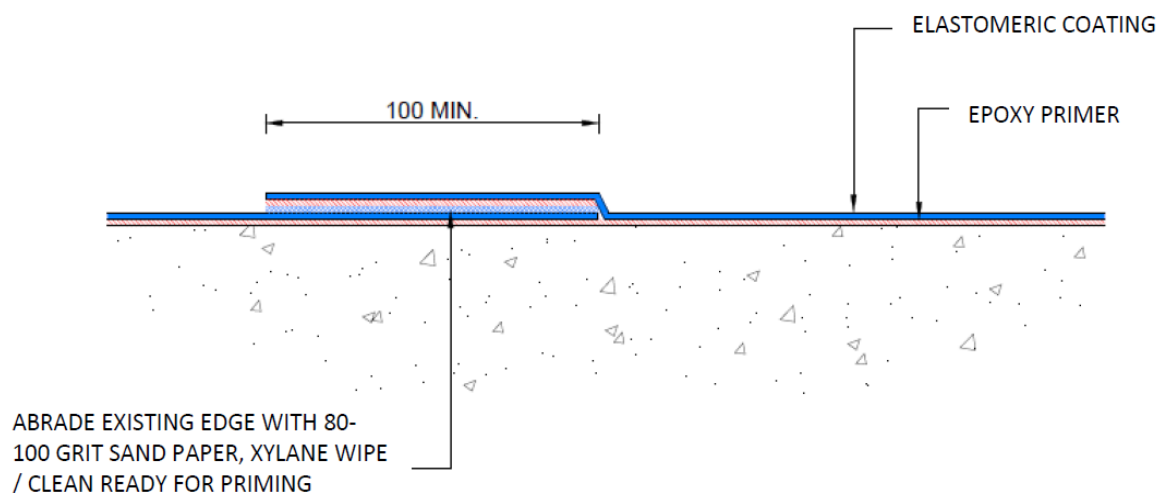


Figure 7 Typical Coating Lap Details

10.0 COATING FINISH

10.1 The finished coating shall be of uniform thickness, colour, appearance and gloss. It shall be fully cured, adherent, coherent and free from holidays, laps, sags, blistering, checking, wrinkling, overspray, patchiness and any other defects that may impair the performance and/or appearance of the coating.

11.0 INSPECTION AND TESTING OF COATING

11.1 **Visual Testing** - Coatings shall be visually examined for surface defects and any discontinuity arising after curing shall be recorded.

11.2 **Spark Testing** - The finished coating shall be holiday tested in accordance with NACE Standard SP0188 – Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates. Refer Figure

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Figure 8 Example of spark test

11.3 **Adhesion Testing** - This test shall be conducted in accordance with AS/NZS 1580 Method 408.5 to determine the adhesion strength of the coating to the substrate. Reference shall also be made to ASTM Standard D4541-09, ASTM D7234-05 and ASTM C1583/C1583M-04.

11.3.1 The minimum acceptable adhesion value for elastomeric coatings on concrete shall be in accordance with the coating manufacturer's recommendation or minimum 1.5MPa to substrate failure at substrate using 50 mm dolly in accordance with AS1580.408.5

11.3.2 The location of test sites shall be identified and agreed upon by both the Contractor and the Principal prior to the start of attaching the dollies to the substrate.

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Figure 9 Example of adhesion test

11.4 Thickness Testing – the finished coating shall be tested for thickness as per AS 3894.3. Wherever the adhesion testing has been performed, the thickness of the test sample shall be measured using vernier calipers. Refer Figure 10 for example of DFT testing.

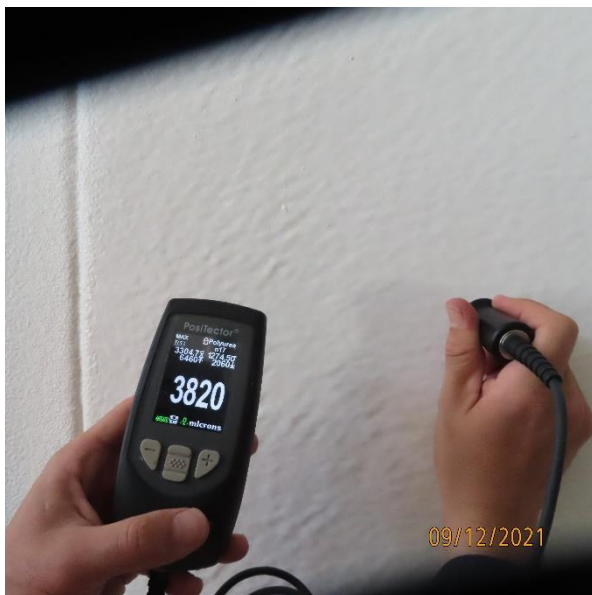


Figure 10 Example of DFT test

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11.5 The results of all testing shall be submitted to the Superintendent at the completion of work.

12.0 REPAIR OF A DEFECTIVE COATING AND RETESTING

12.1 Defects such as pinholes, cracks, blisters, voids, foreign inclusions and irregular profile peaks shall be marked for repair and retested upon full cure of the repaired coating.

12.2 Pinholes shall be rectified by abrading and overcoating with the same coating. Pinholes shall be filled with polyurethane sealant such as Sikaflex Tank N or similar approved equivalent prior to pinholes rectification.

12.3 Any other localised defects such as blisters shall be cut out and patched as per Figure 11 or as per the manufacturer's recommendations. Reapply the primer and sand broadcasting as per Section 7.0.

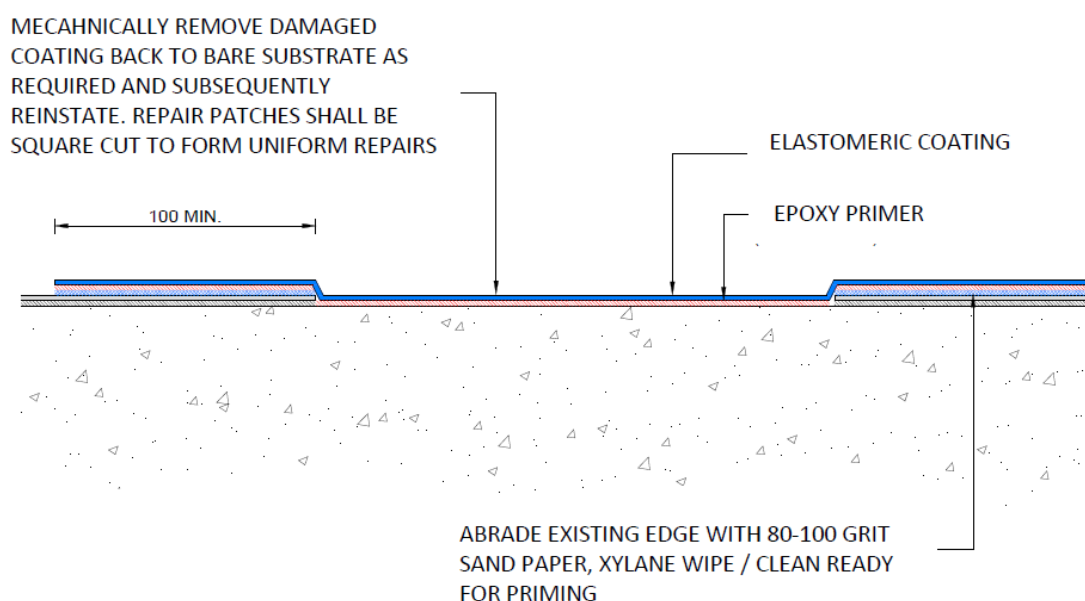


Figure 11 Typical patch repair details

13.0 RECORDING AND REPORTING

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13.1 Following testing a report shall be submitted by the Contractor. The Contractor shall keep detailed records and reports including the following:

- Environmental conditions (i.e., daily temperature, relative humidity, dew point, etc.)
- Concrete surface moisture content
- Surface preparation profile
- Applied coating (equipment records) – processing temperatures & pressures
- Coating dry film thickness readings
- Adhesion test readings
- Holiday testing readings
- Photographic evidence of surface preparation, coating application, and other quality
- Inspection and testing results.

13.2 The Completion Report shall be made available to the Principal's Representative at the completion of the project.

14.0 CONTRACTOR'S RESPONSIBILITY

14.1 The Contractor shall supply all necessary plant, equipment, materials and labour, prepare the surface, repair concrete substrate defects, apply the protective coating, and carry out quality control inspection tests and records in accordance with this specification and the coating manufacturer's requirements.

14.2 A list of all items to be inspected and the relevant drawing reference shall be forwarded to the Water Corporation Coating Inspector prior to the inspection being undertaken.

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- 14.3 The preceding inspection clauses shall not relieve the Contractor of their responsibility to supply materials and perform work in accordance with the requirements of any overriding contract documentation.

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Document Revision History					
Sect	Issue	Date	Revision Description	RVWD	APROV
4	4	08/02/2023	Amend personal qualifications	AO	SS
6	4	08/02/2023	Amend concrete repair	AO	SS
7	4	20/04/2023	Amend surface preparation	AO	AO
9	4	20/04/2023	Amend Coating application	AO	AO
11	4	20/04/2023	Amend Inspection and testing	AO	AO
12	4	20/04/2023	Repair of defective coating	AO	AO

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