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REVISION REGISTER

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<th>Clause Number</th>
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<tr>
<td>Ed 1/Rev 0</td>
<td></td>
<td>First issue.</td>
<td>GM, CPS</td>
<td>19.06.14</td>
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</table>
**General**

The waterproofing systems covered by this Specification are intended for use on concrete bridge decks with an asphalt wearing surface overlay. It is particularly suitable for the following cases:

- Membrane installation is to be carried out at low temperatures, and/or within a short time duration.
- On bridge decks with excessive cracking, for example, due to high alkali aggregate reactivity.
- On iconic bridges or bridges of high importance.
- On bridges where water leakage from under the bridge deck is not acceptable.

The initial cost of this type of waterproofing systems is higher than that of hot sprayed bituminous type covered in Specification RMS B344. However, the systems covered in this Specification can provide a reduced whole life cost solution due to its expected longer service life, and higher fatigue and damage resistance, particularly over cracks and joints.

**System Components**

This type of waterproofing system essentially comprises the following layers:

- Primer for bonding the waterproofing membrane to concrete bridge deck.
- Waterproofing membrane (preformed sheet or liquid applied).
- Tack coat for bonding the waterproofing membrane to the asphalt.

The systems may also include further layers as shown in the sketches below.

![Figure B343.GN1 - Waterproofing System Components](image)

Although the asphalt is not covered by this Specification, it is an essential component of the waterproofing system.

**System Approval Requirements**

The performance requirements in Annexure B343/F were obtained from BD 47/99 (refer to Annexure B343/M) with modifications as shown in the table below, to suit the weather conditions in NSW, and typical asphalt layer thickness of 60 mm to 90 mm, rather than 120 mm considered in BD 47/99. Testing in 2004 by the UK Highways Agency showed that higher adhesion strength membrane was required, for asphalt thickness less than 80 mm.
Table B343.GN1 - Comparison of Requirements Between B343 and BD 47/99

<table>
<thead>
<tr>
<th>Property</th>
<th>B343</th>
<th>BD 47/99</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile adhesion strength (waterproofing membrane to concrete)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>at -10°C</td>
<td>≥ 0.5 MPa</td>
<td>≥ 0.3 MPa</td>
</tr>
<tr>
<td>at 23°C</td>
<td>≥ 0.5 MPa</td>
<td>≥ 0.3 MPa</td>
</tr>
<tr>
<td>at 40°C</td>
<td>≥ 0.3 MPa</td>
<td>≥ 0.2 MPa</td>
</tr>
<tr>
<td>at 50°C</td>
<td>≥ 0.2 MPa</td>
<td>N/A</td>
</tr>
<tr>
<td>Shear adhesion strength (asphalt to waterproofing membrane)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>at -10°C</td>
<td>≥ 0.4 MPa</td>
<td>≥ 0.2 MPa</td>
</tr>
<tr>
<td>at 23°C</td>
<td>≥ 0.4 MPa</td>
<td>≥ 0.2 MPa</td>
</tr>
<tr>
<td>at 40°C</td>
<td>≥ 0.2 MPa</td>
<td>≥ 0.1 MPa</td>
</tr>
<tr>
<td>at 50°C</td>
<td>≥ 0.1 MPa</td>
<td>N/A</td>
</tr>
<tr>
<td>Tensile bond strength at 23°C (asphalt to waterproofing membrane)</td>
<td>≥ 0.2 MPa</td>
<td>≥ 0.1 MPa</td>
</tr>
<tr>
<td>Water absorption</td>
<td>≤ 5%</td>
<td>≤ 10%</td>
</tr>
</tbody>
</table>

**Installation**

Concrete bridge decks are required to be finished to Specification RMS B80. Project managers must verify whether an alternative surface finish is required for the waterproofing system chosen.

Surface milling, if required, is typically carried out in accordance with Specification RMS R101.
PREFORMED AND LIQUID APPLIED WATERPROOFING MEMBRANE SYSTEMS

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IC-QA-B343

VERSION FOR: 
DATE: 

Edition 1 / Revision 0
June 2014

ROADS AND MARITIME SERVICES
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FOREWORD

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REVISIONS TO PREVIOUS VERSION

All revisions to the previous version (other than minor editorial and project specific changes) are indicated by a vertical line in the margin as shown here, except when it is a new edition and the text has been extensively rewritten.

PROJECT SPECIFIC CHANGES

Any project specific changes are indicated in the following manner:

(a) Text which is additional to the base document and which is included in the Specification is shown in bold italics e.g. Additional Text.

(b) Text which has been deleted from the base document and which is not included in the Specification is shown struck out e.g. Deleted Text.
RMS QA SPECIFICATION B343

PREFORMED AND LIQUID APPLIED WATERPROOFING MEMBRANE SYSTEMS

1 GENERAL

1.1 SCOPE

This Specification sets out the requirements for the selection, supply and application of a waterproofing membrane system on concrete bridge decks.

The selection, supply and application of sprayed bituminous waterproofing membranes is covered in Specification RMS B344.

The waterproofing membrane systems covered by this Specification are not suitable for use on steel or timber bridge decks.

The waterproofing membrane system comprises a primer, a preformed sheet or liquid applied membrane, and may also include a protective layer and a tack coat.

The waterproofing membrane is overlain by an asphalt wearing course. The requirements for the asphalt wearing course are covered elsewhere in other Specifications.

1.2 STRUCTURE OF THE SPECIFICATION

This Specification includes a series of annexures that detail additional requirements.

1.2.1 Measurement and Payment

The method of measurement and payment must comply with Annexure B343/B.

1.2.2 Schedules of HOLD POINTS, WITNESS POINTS and Identified Records

The schedules in Annexure B343/C list the HOLD POINTS and WITNESS POINTS that must be observed. Refer to Specification RMS Q for the definitions of HOLD POINTS and WITNESS POINTS.

The records listed in Annexure B343/C are Identified Records for the purposes of RMS Q Annexure Q/E.

1.2.3 Planning Documents

The PROJECT QUALITY PLAN must include each of the documents and requirements listed in Annexure B343/D and must be implemented.

In all cases where this Specification refers to the manufacturer’s recommendations, these must be included in the PROJECT QUALITY PLAN.
1.2.4 Frequency of Testing

Nominate in the Inspection and Test Plan your proposed frequency of testing to verify conformity of the item, which must not be less than the frequency specified in Annexure B343/L. Where a minimum frequency is not specified, nominate an appropriate frequency. Frequency of testing must conform to the requirements of RMS Q.

You may propose to the Principal a reduced minimum frequency of testing. The proposal must be supported by a statistical analysis verifying consistent process capability and product characteristics. The Principal may vary or restore the specified minimum frequency of testing, either selectively or permanently, at any time.

1.2.5 Referenced Documents

Unless specified otherwise or specifically supplied by the Principal, the applicable issue of a referenced document must be the issue current at the date one week before the closing date for tenders, or where there is no issue current at that date, the most recent issue.

Standards, specifications and test methods are referred to in an abbreviated form (e.g. AS 1234). For convenience, the full titles are given in Annexure B343/M.

1.3 DEFINITIONS

The terms “you” and “your” mean “the Contractor” and “the Contractor’s” respectively.

The following definitions apply to this Specification:

**Bonded membrane:** Waterproofing membrane applied and bonded to the concrete surface. This term is applicable to both preformed sheet and liquid applied membranes.

**Bonding agent:** An adhesive material applied to the waterproofing membrane or to the substrate to promote bonding.

**Liquid applied membrane (LAM):** A resin based membrane applied as a liquid, and does not contain any aggregates.

**Outgassing:** Release of water vapour from the voids in concrete bridge decks due to increase in the ambient air temperature.

**Oxidised bitumen:** Also known as blown bitumen. Bitumen whose rheological properties have been substantially modified by reaction with air at elevated temperatures.

**Pinhole:** A local failure in the waterproofing membrane caused by bursting of small blisters on the surface as a result of outgassing. If not repaired, pinholes may leave a permanent pathway for moisture to reach the concrete deck.

**Preformed waterproofing membrane (PWM):** A preformed membrane consisting of bituminised fabric, polymer or elastomer based sheets.

**Primer:** A bituminous or resinous solution of low viscosity and low surface tension used without aggregate to penetrate into concrete plastic shrinkage cracks and pores, and to promote adhesion and compatibility with the waterproofing membrane.
Protective Layer: An additional layer separate from, or integral with, the waterproofing membrane which is laid on top of the membrane to protect it from damage during construction.

Tack Coat: A coating applied to bond the waterproofing membrane to the protective layer or asphalt.

Unbonded Membrane: Waterproofing membrane material prior to installation. This term is applicable to both preformed sheet or liquid applied membranes.

Waterproofing Membrane: The main part of a waterproofing system which is either a Preformed Waterproofing Membrane (PWM) or a Liquid Applied Membrane (LAM).

Waterproofing System: Combination of materials in layers that may include primers, waterproofing membranes, protective layers and/or tack coats, applied to a concrete bridge deck forming a watertight system to protect the deck from ingress of water and/or chloride ions.

1.4 SAFETY AND ENVIRONMENTAL PROTECTION

1.4.1 Work Health and Safety

Implement Work Health and Safety measures, including preparation of Safe Work Method Statements, in accordance with Specification RMS G22.

1.4.2 Environmental Protection

Implement appropriate environmental control measures in accordance with Specifications RMS G36 and G38.

2 MATERIALS

2.1 GENERAL

Obtain materials only from manufacturers/suppliers that have implemented quality management systems to AS/NZS ISO 9001, with third-party certification accredited or accepted by JAS-ANZ or equivalent.

Provide evidence to the Principal that the manufacturer/supplier has the specified quality management systems in place, and the supplied materials conform to the requirements of this Specification.

2.2 PRIMERS

Bituminous primers must be bitumen, with or without polymer modification, blended together in a hydrocarbon solvent.

Resin based primers must be either moisture (from the air) curing, or two part chemical curing.

Resin based primers must have a pot life longer than the duration required for application of the primer.

Use primers of low viscosity to provide adequate workability at the application temperature.
2.3 Prefomed Waterproofing Membrane

Prefomed waterproofing membrane (PWM) used must be made of either bituminous fabric, polymer extrusions or elastomeric membranes.

Bituminised fabric membranes must comprise an absorbent fabric of polyester fleece or woven polypropylene impregnated and coated with bitumen.

Polymeric membranes must be extruded bituminised or laminated polymers, based on polymer plasticised polyvinylchloride or polyethylene.

Elastomeric membranes must be made of vulcanised polyisoprene rubber.

2.4 Liquid Applied Membrane

Liquid applied membrane (LAM) used must be made of polyurethane, acrylic, polyurea, polyester or other polymer derivatives with a thickness not less than 2 mm, and may consist of one or two components. The LAM may be air or chemically cured.

2.5 Protective Layer

Where required, use a protective layer to prevent damage to the waterproofing membrane during construction, particularly from the penetration of hot aggregates into the membrane during compaction rolling of the asphalt.

The protective layer may be either self-adhesive, or bonded to the membrane using oxidised bitumen.

Place the protective layer immediately following the installation of the membrane, unless more time is required for drying or curing of the membrane or other materials underneath it.

Do not use sand or mineral granules spread over the LAM as a protective layer, unless you submit working samples showing that the membrane thickness is not reduced, and adhesion to asphalt is not compromised by the use of the granules.

Granules that melt during asphalt application are permitted.

2.6 Tack Coat

Apply tack coats, where required, in accordance with the manufacturer’s recommendations to provide adequate adhesion of asphalt to the waterproofing membrane over its service life. Apply the tack coat uniformly to the waterproofing membrane with spraying equipment, or by another method acceptable to the Principal.

The tack coat must be formulated such that it is activated by the hot asphalt placed on the tackcoat.
3 WATERPROOFING MEMBRANE SYSTEM REQUIREMENTS

3.1 GENERAL

Selection of the waterproofing membrane system must take into consideration the asphalt overlay type shown on the Drawings.

3.1.1 Requirements During Construction

The waterproofing membrane system must meet the following requirements during construction:

(a) suitable for installation under the expected weather conditions;
(b) thermally stable under a temperature of up to 180°C, during asphalt laying;
(c) full adhesion of all interfaces, joints and overlaps;
(d) resistant to puncture by loose particles;
(e) integrity of the constituent materials prior to mixing, and ability to form a homogeneous material when mixed;
(f) safe to handle and work with, in accordance with work health and safety regulations.

3.1.2 Requirements During Service

The waterproofing membrane system must meet the following requirements during service:

(a) full adhesion to the concrete bridge deck and the overlying asphalt;
(b) no delamination and able to maintain its watertightness;
(c) capable of bridging over cracks of up to 1 mm width in the concrete deck;
(d) resistance to puncture by the asphalt aggregates under traffic loads;
(e) able to withstand asphalt milling and resurfacing;
(f) able to maintain shear resistance of all interfaces to stresses from the traffic, including that during braking and turning;
(g) resistance to moisture transmission from traffic-induced pressure;
(h) chemically resistant to spillage of fuel and other substances.

3.2 ACCEPTABLE WATERPROOFING SYSTEMS


The system must be installed by an applicator approved by the system owner/supplier.

If you wish to use a system that is not shown on “Lists of RMS Approved Bridge Components and Systems”, submit details of the system, including test results confirming compliance with the performance requirements specified in Annexure B343/E.

Unless approved otherwise by the Principal, test certificates submitted must be less than one year old and must reference the relevant standards or this Specification.
HOLD POINT

Process Held: Commencement of installation of waterproofing membrane.

Submission Details:
- Details of your proposed waterproofing membrane system
  - for systems on the approved system list: at least 5 working days,
  - for systems NOT on the approved system list: at least 15 working days,
  prior to the commencement of installation of the waterproofing membrane.

Release of Hold Point: The Principal will consider the submitted documents prior to authorising the release of the Hold Point.

4 PRODUCTION TESTING

For every Lot/batch delivered, submit a Certificate of Conformity, and the relevant test results for the production tests shown in Table B343.1, verifying conformity of the supplied materials.

Table B343.1 – Production Tests of Membrane

<table>
<thead>
<tr>
<th>Test Description</th>
<th>Test Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness variation</td>
<td>Up to ± 10 % of nominal</td>
</tr>
<tr>
<td>Unit weight variation</td>
<td>Up to ± 10 % of nominal</td>
</tr>
<tr>
<td>Water absorption</td>
<td>≤ 5 % of specimen weight</td>
</tr>
</tbody>
</table>

Note: All tests must be in accordance with BD 47/99, Appendix B, clause B4.

The test reports must not be more than one year old or older than the shelf life, whichever is less. Include with each delivery of material a Lot/batch number identifiable and traceable to the associated test reports.

5 MEMBRANE APPLICATION

5.1 GENERAL

5.1.1 Planning

Submit, as part of your PROJECT QUALITY PLAN, details of plant and equipment, and method of application of the waterproofing system components.

Provide details of the temperature range specified by the manufacturer for installation of the waterproofing membrane system, and during placing of the overlying asphalt.

Take necessary precautions to prevent the primer, liquid membrane, adhesives, tack coats or any other material from entering or adhering to gratings, kerbs, expansion joints and associated concrete surfaces, and other road fixtures. Clean and remove any excess material immediately after application of the waterproofing membrane, to leave the bridge deck in a satisfactory condition for surfacing.
Unless specified otherwise by the manufacturer’s recommendations, apply debonding wax tape to deck joints prior to the waterproofing application.

5.1.2 Weather Conditions

Apply the waterproofing materials only within the range of ambient temperature and relative humidity specified by the manufacturer. Do not commence application when rain appears imminent, during high winds, or under dusty conditions.

Measure and document the air temperature and relative humidity, deck temperature and moisture, and (liquid) material consumption rate at regular intervals during the work, and the time at the start and end of application of each waterproofing layer, to ensure compliance with the manufacturer's recommendations.

5.1.3 Coverage

Coverage of the waterproofing membrane must be continuous over the entire deck area, including service bays, between parapets, medians and kerbs.

Detail the layout of the waterproofing membrane to prevent water seeping beneath the membrane, particularly at the area around the deck joints and scuppers.

At the junction with vertical concrete surfaces, continue the membrane up the vertical concrete surface, terminating at a level 10 mm below the top level of the proposed asphalt surface.

5.1.4 Trial Installation

Prior to the Works, the Principal may direct you to carry out trials to demonstrate adequate bond between the proposed waterproofing membrane and the bridge deck concrete. The costs of such trials will be borne by the Principal.

5.2 Preparation and Priming of Concrete Surfaces

5.2.1 Age of Concrete

Do not apply waterproofing membranes to concrete which is less than 28 days old, unless approved otherwise by the Principal, to minimise outgassing and subsequent pinholes or bubbles in the membrane.

5.2.2 Concrete Surface Preparation

Unless specified otherwise, the surface finish of bridge concrete decks must be in accordance with Specification RMS B80, and/or the surface after milling of the bridge deck, where applicable, must be in accordance with Specification RMS R101.

Where recommended otherwise by the manufacturer, include details of further or alternative surface preparation in the PROJECT QUALITY PLAN.

The concrete surface must be dry, clean, and free from laitance, loose materials and curing compounds prior to the application of the primer. Do not install waterproofing membrane on wet concrete surfaces.
5.2.3 Primer Application

**WITNESS POINT**

Process Witnessed: Inspection of concrete surface prior to application of primer.

Submission Details: Notify the Principal at least 24 hours in advance of the proposed time for the commencement of concrete preparation and primer application.

Apply primers by brush, mop, broom or spray in accordance with the manufacturer's recommendations.

Resinous primers generally have limited pot life/gel and cure time at high ambient temperatures. Provide sufficient resources for the application of resinous primers to ensure that the area to be primed is covered within the specified time limits.

For solvent-based primers, apply it in uniform thickness layers to avoid leaving pockets of liquid beneath the dry skin. The trapped solvents may expand rapidly under hot asphalt which may lead to premature failure of the membrane.

Primed surfaces which have become brittle or powdery are considered nonconforming. In such instances, remove the deteriorated primer, and apply a new primer coat.

5.2.4 Membrane Application

After application of the primer, install the waterproofing membrane as soon as possible, and in no case later than 14 days, after the primer has cured, to prevent deterioration or contamination of the primed surface.

Do not allow air to be trapped at the concrete/primer/membrane interfaces.

5.3 Prefomed Waterproofing Membranes (PWM)

5.3.1 Application Method

**WITNESS POINT**

Process Witnessed: Installation of PWM.

Details: Notify the Principal at least 3 hours in advance of the proposed time for the commencement of the proposed installation of the PWM.

Start laying the preformed sheets at the lowest section and proceed to higher sections, so that water does not flow into any joints during service.

Take necessary precautions during asphalt application to avoid softening, indentation and damage of the waterproofing membrane.

Comply with the manufacturer's recommendations for heating method, duration of heating and temperature of oxidised bitumen adhesives, to prevent embrittlement, and long-term degradation and debonding from the concrete substrate.
Join preformed sheets by lapping, with minimum end and side lap lengths of 100 mm and 150 mm respectively, unless specified otherwise by the manufacturer. Arrange the joints so that:

(a) at any point on the joint, there is a maximum overlap of three sheet layers;
(b) water will drain away from the exposed edge.

5.3.2 Repair Method

Repair preformed sheets, where required, by cutting back the affected area using a sharp knife, or similar tool, until undamaged and well-bonded membrane is exposed. Unless specified otherwise by the manufacturer, use liquid bitumen to seal the exposed edges of the preformed sheets.

Abrate the area under repair and apply the primer by brush or spray. Allow the primer to cure for the minimum recommended time. Apply the membrane, at minimum film thickness of 2 mm, ensuring a peripheral lap of 100 mm around the repair. Allow to set and cure, prior to tack coat application.

5.3.3 Pour-and-Roll Type

Pour-and-roll type membranes are bonded to the primed deck using a layer of heated oxidised or modified bitumen.

Uniformly heat and pour bitumen in front of the sheet during unrolling, and press the sheet into the molten bitumen to assist with the bonding. Use excess bitumen exuded by this process to seal the lap joints.

5.3.4 Torch-Applied Type

Torch applied membranes are supplied with a layer of bonding agent such as modified bitumen or similar.

As the membrane is rolled out onto the deck, heat the bonding layer on the underside, preferably with a butane gas torch. Avoid overheating of the bonding layer.

5.3.5 Self-Adhesive Type

Roll out self-adhesive membranes and immediately apply manual pressure to adhere to the concrete deck.

5.4 LIQUID APPLIED MEMBRANE (LAM)

WITNESS POINT

Process Witnessed: Installation of LAM.
Submission Details: Notify the Principal at least 3 hours in advance of the proposed time for the commencement of the proposed installation of the LAM.

Apply LAM by spraying or using roller or squeegee to form a continuous and seamless film with uniform thickness and complete area coverage.

Use multi-component airless spray equipment to apply membranes formulated from mixing two constituents, where applicable, to ensure correct mix proportions.
Preformed and Liquid Applied Waterproofing Membrane Systems B343

Repair and make good all defects, including pinholes and blisters, prior to application of subsequent layers, in accordance with the manufacturer’s recommendations.

5.5 PROTECTION OF WATERPROOFING MEMBRANE DURING THE WORKS

Provide suitable temporary protection of the membrane to the satisfaction of the Principal.

Allow only plant and equipment that are fitted with rubber tyres to stand or travel on the waterproofing membrane, and solely for the purpose of installing subsequent layers. Regularly inspect and remove any embedded stones in tyre threads of plant or equipment.

Do not permit rollers to stand or travel directly on the waterproofing membrane.

Use protective system to prevent damage of the waterproofing membrane associated with the high temperature during asphalt rolling.

5.6 POST INSTALLATION OF MEMBRANE

The protective layer or asphalt must be firmly bonded to the waterproofing membrane.

Where a tack coat for the asphalt is not provided as part of the waterproofing system, a satisfactory bond to the waterproofing membrane must be obtained from the binder within the asphalt.

Where a tack coat for the asphalt is provided, include in the PROJECT QUALITY PLAN the manufacturer’s recommended time required for the tack coat to cure.

Place the asphalt as soon as the tack coat is fully cured and without delay, to avoid over-curing or contamination of the tack coat.

6 INSPECTION

Include in the PROJECT QUALITY PLAN methods for the verification of the integrity and compliance of the successive layers of the waterproofing system to the requirements of this Specification.

Verification of the integrity of the system must include the detection of leaking paths and debonded areas.

Compliance testing must cover measuring of membrane thickness (for LAM only) and tensile adhesion of membrane to concrete.

Measured membrane thickness must be within ± 10% of nominated thickness.

Minimum measured adhesion tensile strength must comply with Table B343.2.
Table B343.2 - Field Test Tensile Adhesion Requirement

<table>
<thead>
<tr>
<th>Temperature at Time of Testing</th>
<th>Tensile Adhesion (MPa)</th>
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</thead>
<tbody>
<tr>
<td>0 – 23°C</td>
<td>≥ 0.5</td>
</tr>
<tr>
<td>40°C</td>
<td>≥ 0.3</td>
</tr>
<tr>
<td>50°C</td>
<td>≥ 0.2</td>
</tr>
<tr>
<td>Other temperatures</td>
<td>Linear interpolation acceptable</td>
</tr>
</tbody>
</table>

Inspect all system layers throughout the Works in accordance with the Inspection and Test Plan.

Submit details of the test locations for concurrence of the Principal prior to testing.

The cost of rectifying any nonconformities, including any restoration work to underlying or adjacent surfaces or structures, which becomes necessary as a result of such work will be borne by you.

7 GUARANTEES OR WARRANTIES

Provide a guarantee or warranty for the supply and installation of the waterproofing system with a minimum serviceability of ten years from the date of installation. Within this period, rectify all defects in the waterproofing membrane resulting from defective or workmanship, at your own costs.

The guarantees or warranties must be transferred to the Principal in accordance with the Conditions of Contract.
ANNEXURE B343/A – (NOT USED)

ANNEXURE B343/B – MEASUREMENT AND PAYMENT

Refer to Clause 1.2.1.

Payment will be made for all activities associated with completing the work detailed in this Specification (excluding asphalt layer) in accordance with the following item:

(a) Selection, supply and application of waterproofing membrane system to concrete bridge decks

The unit of measurement is the square metre of bridge deck to which the waterproofing membrane system is applied.

ANNEXURE B343/C – SCHEDULES OF HOLD POINTS, WITNESS POINTS AND IDENTIFIED RECORDS

Refer to Clause 1.2.2.

C1 SCHEDULE OF HOLD POINTS AND WITNESS POINTS

<table>
<thead>
<tr>
<th>Clause</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.2</td>
<td>Hold</td>
<td>Details of waterproofing membrane system</td>
</tr>
<tr>
<td>5.2.3</td>
<td>Witness</td>
<td>Inspection of concrete surface prior to application of primer</td>
</tr>
<tr>
<td>5.3.1</td>
<td>Witness</td>
<td>Installation of PWM</td>
</tr>
<tr>
<td>5.4</td>
<td>Witness</td>
<td>Installation of LAM</td>
</tr>
</tbody>
</table>

C2 SCHEDULE OF IDENTIFIED RECORDS

The records listed below are Identified Records for the purposes of RMS Q Annexure Q/E.

<table>
<thead>
<tr>
<th>Clause</th>
<th>Description of Identified Record</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Production testing results and certificates of conformity</td>
</tr>
<tr>
<td>5</td>
<td>Air temperature and relative humidity, deck temperature and moisture, prior to application of each layer</td>
</tr>
<tr>
<td></td>
<td>Time at the start and end of each layer application</td>
</tr>
<tr>
<td>5</td>
<td>Consumption rates of LAM</td>
</tr>
</tbody>
</table>
ANNEXURE B343/D – PLANNING DOCUMENTS

Refer to Clause 1.2.3.

Submit the following information as part of the PROJECT QUALITY PLAN:

(a) Description of the system components and material specifications;
(b) Method statement for application of the system addressing limitations and proposed equipment/plant (Clause 5);
(c) Work health and safety measures, and Safe Work Method Statements (Clause 1.4.1);
(d) Proposed details of waterproofing at deck joints, kerbs and drainage systems including deck gradient and cross fall (Clause 5);
(e) Proposed placement sequence and recommended time for commencement of asphalt application;
(f) Work program and contingency plan for adverse weather conditions;
(g) Recommended concrete deck surface finish and type of primer (Clause 5.2);
(h) Protection required during the operation of plant and equipment on waterproofing system (Clause 5.5);
(i) Details of inspection and testing throughout the Works for verifying the integrity of the installed system on site (Clause 6);
(j) Details of the waterproofing repair method where required (Clause 5.3 or 5.4).
ANNEXURE B343/E – PERFORMANCE REQUIREMENTS

E1 UNBONDED MEMBRANE

Unbonded sheets, boards and film (liquid applied) must meet the performance requirements of Table B343/E1, when tested in accordance with the specified test methods.

Table B343/E1 – Performance Requirements of Unbonded Membrane

<table>
<thead>
<tr>
<th>Test Description</th>
<th>Membrane Type</th>
<th>PWM</th>
<th>LAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness variation</td>
<td></td>
<td>≤ 10 % of nominal</td>
<td></td>
</tr>
<tr>
<td>Straightness of sheets</td>
<td></td>
<td>≤ 10 mm in 2 m length</td>
<td>N/A</td>
</tr>
<tr>
<td>Width of sheets</td>
<td></td>
<td>Uniform within ± 10 mm</td>
<td>N/A</td>
</tr>
<tr>
<td>Unit weight variation</td>
<td></td>
<td>≤ 5 % of nominal</td>
<td></td>
</tr>
<tr>
<td>Water absorption</td>
<td></td>
<td>≤ 5 % of specimen weight</td>
<td></td>
</tr>
<tr>
<td>Water penetration</td>
<td></td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>Pliability</td>
<td></td>
<td>N/A</td>
<td>No break</td>
</tr>
<tr>
<td>Handling</td>
<td></td>
<td>Satisfy BD 47/99 or similar</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Note: All tests in accordance with BD 47/99, with the exception of pliability, which is in accordance with ASTM D146M. Equivalent test methods may be accepted by the Principal.
### E2 BONDED MEMBRANE

Bonded sheets, boards and films (liquid applied) must meet the requirements of Table B343/E2, when tested in accordance with the specified test methods.

#### Table B343/E2 – Performance Requirements of Bonded Membrane

<table>
<thead>
<tr>
<th>Test Description</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile adhesion (waterproofing membrane to concrete deck)</td>
<td></td>
</tr>
<tr>
<td>-10°C</td>
<td>≥ 0.5 MPa</td>
</tr>
<tr>
<td>23°C</td>
<td></td>
</tr>
<tr>
<td>40°C</td>
<td>≥ 0.3 MPa</td>
</tr>
<tr>
<td>50°C (2)</td>
<td>≥ 0.2 MPa</td>
</tr>
<tr>
<td>Shear adhesion (asphalt to waterproofing membrane)</td>
<td></td>
</tr>
<tr>
<td>-10°C</td>
<td>≥ 0.4 MPa</td>
</tr>
<tr>
<td>23°C</td>
<td></td>
</tr>
<tr>
<td>40°C</td>
<td>≥ 0.2 MPa</td>
</tr>
<tr>
<td>50°C (2)</td>
<td>≥ 0.1 MPa</td>
</tr>
<tr>
<td>Tensile bond (asphalt to waterproofing membrane)</td>
<td>≥ 0.2 MPa</td>
</tr>
<tr>
<td>Resistance to chloride ion penetration (after 28 days) at 23°C</td>
<td>≤ 0.04%</td>
</tr>
<tr>
<td>Resistance to heat aging Tensile test at 23°C</td>
<td>≥ 0.5 MPa</td>
</tr>
<tr>
<td>Resistance to heat aging Chloride ion test at 23°C</td>
<td>≤ 0.04%</td>
</tr>
<tr>
<td>Resistance to chisel impact Chloride ion test at</td>
<td>≤ 0.04%</td>
</tr>
<tr>
<td>23°C</td>
<td></td>
</tr>
<tr>
<td>40°C</td>
<td></td>
</tr>
<tr>
<td>Resistance to aggregate indentation Chloride ion test at</td>
<td>≤ 0.04%</td>
</tr>
<tr>
<td>80°C</td>
<td></td>
</tr>
<tr>
<td>125°C</td>
<td></td>
</tr>
<tr>
<td>Volume change at 40°C</td>
<td>≤ 50 %</td>
</tr>
<tr>
<td>Resistance to pin or blow hole</td>
<td>No blisters</td>
</tr>
<tr>
<td>Notes:</td>
<td></td>
</tr>
</tbody>
</table>

(1) All tests in accordance with BD 47/99.

(2) Additional tests to that specified in BD 47/99. Test method must be in accordance with BD 47/99, but tested at 50°C.
# ANNEXURE B343/L – MINIMUM FREQUENCY OF TESTING

Refer to Clause 1.2.4.

<table>
<thead>
<tr>
<th>Characteristic Analysed</th>
<th>Test</th>
<th>Frequency of Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Sprayed Area</td>
</tr>
<tr>
<td>Thickness</td>
<td>Regular thickness checks using a micrometer of cured membrane film samples</td>
<td>≤ 50 m²</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; 50 m², ≤ 200 m²</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; 200 m²</td>
</tr>
<tr>
<td>Membrane tensile adhesion</td>
<td>Pull-off test (1)</td>
<td>≤ 100 m²</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; 100 m², ≤ 200 m²</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; 200 m²</td>
</tr>
<tr>
<td>Integrity of system</td>
<td>Visual inspection/ electronic pinhole survey</td>
<td>Entire area</td>
</tr>
</tbody>
</table>

**Note:**
(1) In accordance with ASTM D4541.
ANNEXURE B343/M – REFERENCED DOCUMENTS

Refer to Clause 1.2.5.

RMS Specifications

RMS G22    Work Health and Safety (Construction and Maintenance Works)
RMS G36    Environmental Protection
RMS G38    Soil and Water Management
RMS Q    Quality Management System
RMS B80    Concrete Work for Bridges
RMS R101    Cold Milling of Road Pavement Materials

ASTM Standards

D4541    Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

Other Documents

BD 47/99    Design Manual for Roads and Bridges, Vol.2, Section 3, Part 4 - Waterproofing and Surfacing of Concrete Bridge Decks, the Highways Agency, August 1999