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## REVISION REGISTER

<table>
<thead>
<tr>
<th>Ed/Rev Number</th>
<th>Clause Number</th>
<th>Description of Revision</th>
<th>Authorised By</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ed 1/Rev 0</td>
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<td>16.07.12</td>
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<td>Ed 2/Rev 0</td>
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<td>Updated to accord with base (non-D&amp;C) Specification B312 Ed 5/Rev 0.</td>
<td>MCQ</td>
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<td>Ed 2/Rev 1</td>
<td>Global</td>
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</tr>
</tbody>
</table>
COLD APPLIED SEALANT JOINTS

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IC-DC-B312

VERSION FOR:
DATE:
# CONTENTS

## CLAUSE | PAGE
--- | ---
**FOREWORD** | ii
TNSW Copyright and Use of this Document | ii
Base Specification | ii

1 **GENERAL** | 1
1.1 Scope | 1
1.2 Structure of the Specification | 1
1.3 Definitions | 1
1.4 Approved Bridge Components and Systems | 2
1.5 Sealant Selection | 2

2 **MATERIALS** | 3
2.1 Sealant – Classification | 3
2.2 Sealant – General Properties | 3
2.3 Sealant – General Performance Requirements | 4
2.4 Sealant – Specific Performance Requirements | 4
2.5 Delivery of Sealants | 5

3 **TESTING** | 5
3.1 Testing Laboratories | 5
3.2 Type Testing | 6
3.3 Production Testing | 6

4 **INSTALLATION** | 6
4.1 General | 6
4.2 Joint Gap | 7
4.3 Substrate Strength | 7
4.4 Preparatory Work | 7
4.5 Method of Application | 7
4.6 Curing | 8

5 **GUARANTEES OR WARRANTIES** | 8

ANNEXURES B312/A AND B312/B – (NOT USED). | 9

ANNEXURE B312/C – SCHEDULES OF HOLD POINTS AND IDENTIFIED RECORDS | 9
C1 Schedule of Hold Points | 9
C2 Schedule of Identified Records | 9

ANNEXURE B312/D – PLANNING DOCUMENTS | 10

ANNEXURES B312/E TO B312/L – (NOT USED) | 10

ANNEXURE B312/M – REFERENCED DOCUMENTS | 11

LAST PAGE OF THIS DOCUMENT IS | 11
FOREWORD

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When this document forms part of a deed

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BASE SPECIFICATION

This document is based on Specification TfNSW B312 Edition 5 Revision 1.
TfNSW SPECIFICATION D&C B312
COLD APPLIED SEALANT JOINTS

1 GENERAL

1.1 SCOPE

This Specification sets out the requirements for cold applied sealant joints in bridges, including sealant selection and installation.

1.2 STRUCTURE OF THE SPECIFICATION

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

1.2.1 (Not Used)

1.2.2 (Not Used)

1.2.3 Schedules of HOLD POINTS and Identified Records

The schedules in Annexure B312/C list the HOLD POINTS that must be observed. Refer to Specification TfNSW D&C Q6 for the definition of HOLD POINTS.

The records listed in Annexure B312/C are Identified Records for the purposes of TfNSW D&C Q6 Annexure Q/E.

1.2.4 Planning Documents

The PROJECT QUALITY PLAN must include each of the documents and requirements listed in Annexure B312/D and must be implemented.

1.2.5 (Not Used)

1.2.6 Referenced Documents

Standards, specifications and test methods are referred to in abbreviated form (e.g. AS 1234). For convenience, the full titles are given in Annexure B312/M.

1.3 DEFINITIONS

1.3.1 Definitions

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

The following definitions apply to this Specification:

Asphalt bridging layer An arrangement for bridging deck joint gaps, comprising a single layer or multiple layers of one or more materials effectively supporting the asphalt layer over the underlying joint gap.
Elastomeric sealant
Elastomer for sealing gaps comprising a macromolecular material that rapidly regains its approximate original dimensions after the release of a weak stress that has caused its substantial deformation.

Joint gap
Joint width at sealant location irrespective of the width of the joint below or above the sealant.

Maximum joint gap
The joint opening at Ultimate Limit State in accordance with AS 5100.4.

Movement capability
Cyclic strain of a magnitude that can be accommodated by a sealant without damage where tested according to ASTM C719 with cement mortar substrate.

Non-sag sealant
Sealant that does not flow in vertical or inverted joints when applied at a temperature between 5°C and 50°C.

Rapid curing sealant
Sealant with tack-free time and adhesion-in-peel conforming to Table B312.2.

Self-levelling sealant
Sealant that flows sufficiently under gravity at a temperature not less than 5°C to become level when applied in a horizontal joint or to become smooth when applied to a joint on a crossfall.

Standard test conditions
A temperature of 23 ± 2°C and a relative humidity of 50 ± 5%.

1.3.2 Acronyms

ASTM
American Society for Testing and Materials

HDPE
High density polyethylene

ULS
Ultimate Limit State

1.4 APPROVED BRIDGE COMPONENTS AND SYSTEMS

Unless approved otherwise by the Principal, use only elastomeric sealant types that have been approved by TfNSW. The list of TfNSW approved bridge proprietary products can be found at: http://www.rms.nsw.gov.au/business-industry/partners-suppliers/documents/tenders-contracts/listofapprovedbridgecomponentssystems.pdf

1.5 SEALANT SELECTION

Select sealants in accordance with this Specification, AS 5100.4, the Design Documentation drawings and relevant Bridge Technical Directions. Sealants must satisfy all joint design and performance requirements, including strains in the sealant at maximum and minimum joint opening.

Where applicable, provide calculations verifying that the strains in the sealants at ULS are within the limits specified in AS 5100.4.
2 MATERIALS

2.1 SEALANT – CLASSIFICATION

Sealants for use under this Specification are classified as shown in Table B312.1.

<table>
<thead>
<tr>
<th>Classification (1)</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1</td>
<td>Joints sawn in asphalt road surface.</td>
</tr>
<tr>
<td>Type 2 (2)</td>
<td>Joints in concrete, as follows:</td>
</tr>
<tr>
<td></td>
<td>• Joints in concrete bridge decks underneath asphalt, with gaps at installation ≤ 15 mm but with maximum joint gap ≤ 25 mm.</td>
</tr>
<tr>
<td></td>
<td>• Joints in concrete bridge decks without asphalt overlay, with gaps at installation ≤ 25 mm but with maximum joint gap ≤ 38 mm.</td>
</tr>
<tr>
<td></td>
<td>• Joints in concrete components not subject to traffic, such as kerbs and barriers, with gaps at installation ≤ 40 mm but with maximum joint gap ≤ 50 mm.</td>
</tr>
<tr>
<td>Type 3 (3)</td>
<td>Joints in concrete, as follows:</td>
</tr>
<tr>
<td></td>
<td>• Joints in concrete bridge decks underneath asphalt, with gaps at installation &gt; 15 mm but with maximum joint gap ≤ 35 mm.</td>
</tr>
<tr>
<td></td>
<td>• Joints in concrete bridge decks without asphalt overlay, with gaps at installation &gt; 25 mm but with maximum joint gap ≤ 45 mm.</td>
</tr>
<tr>
<td></td>
<td>• Joints in concrete components not subject to traffic, such as kerbs and barriers, with gaps at installation &gt; 40 mm but with maximum joint gap ≤ 50 mm.</td>
</tr>
</tbody>
</table>

Notes:
(1) Sealants may qualify for more than one classification.
(2) Refer to Clause 4 for specified joint gaps for new bridge decks.
(3) Type 3 sealants are used in rehabilitation works only (refer to Clause 4).

2.2 SEALANT – GENERAL PROPERTIES

Sealants must be elastomeric and rapid curing, and cure chemically through moisture activation and/or by the use of crosslinking agents or promoters.

Sealants may be single or multi-component formulations.

Sealants used in horizontal joints may be self-levelling or non-sag. Sealants used in vertical joints must be non-sag.

Sealant used in joints under traffic must be capable of resisting punching from debris and particles accumulated over the joints.

Sealant used in joints sawn in asphalt road surface (Type 1) must be compatible with asphalt.

If specified, the colour of the sealant after 21 days of curing must be as shown on the Design Documentation drawings.

The sealant after installation and curing must not pick up dirt, be watertight and accommodate the required movements.
2.3 Sealant – General Performance Requirements

Sealants of all Types for use under this Specification must conform to the requirements shown in Table B312.2.

Table B312.2 – Sealant - General Performance Requirements

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Requirement</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow</td>
<td>C639</td>
<td>Smooth level surface</td>
<td>Only for self-levelling sealants.</td>
</tr>
<tr>
<td>Non-sagging</td>
<td>C639</td>
<td>Vertical sag ≤ 5 mm</td>
<td>Only for non-sag sealants.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No horizontal deformation</td>
<td></td>
</tr>
<tr>
<td>Extrudability</td>
<td>C1183</td>
<td>Extrusion rate ≥ 10 mL/min</td>
<td>Test multi-component sealants immediately after mixing. Test single component sealants as specified in ASTM C1183.</td>
</tr>
<tr>
<td>Tack-free Time</td>
<td>C679</td>
<td>≤ 4 hours</td>
<td>Film pulls off with no sealant adhering to it.</td>
</tr>
<tr>
<td>Adhesion-in-Peel</td>
<td>C794</td>
<td>Average peel force ≥ 30 N for standard mortar substrate</td>
<td>Cure for one day and test at the end of the curing, i.e. at an age of one day, with all being done under standard test conditions.</td>
</tr>
<tr>
<td>Adhesion / Cohesion and Movement Capability</td>
<td>C719</td>
<td>No debonding at substrate and no sealant failure</td>
<td>Test movement to be equal to the movement capability nominated by the manufacturer. Use only cement mortar substrates.</td>
</tr>
<tr>
<td>Indentation Hardness - Heat Aging</td>
<td>C661</td>
<td>Refer to Table B312.3 for “Shore A Hardness”</td>
<td>Age at 70°C ±2°C for 6 weeks after curing as specified in the relevant standard.</td>
</tr>
<tr>
<td>Durability (Accelerated Weathering)</td>
<td>C793</td>
<td>No cracks greater than those in Example 2 of Figure 1 and Figure 2 in C793</td>
<td></td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>D1475</td>
<td>As nominated by manufacturer</td>
<td>Test multi-component sealants immediately after mixing.</td>
</tr>
</tbody>
</table>

Note:
(1) All test methods referenced in table are ASTM standards.

2.4 Sealant – Specific Performance Requirements

Sealants for use under this Specification must conform to the requirements shown in Table B312.3 for the appropriate Types.
Table B312.3 – Sealant Type Specific Performance Requirements

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method (1)</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Type 1</td>
</tr>
<tr>
<td>Shore A Hardness</td>
<td>C661</td>
<td>5 to 15</td>
</tr>
<tr>
<td>Minimum Movement Capability (1)</td>
<td>C719</td>
<td>+100, −50</td>
</tr>
<tr>
<td>Tensile Modulus at 100% Strain</td>
<td>D412</td>
<td>&lt; 0.1</td>
</tr>
</tbody>
</table>

Note:
(1) All test methods referenced in table are ASTM standards.
(2) Positive and negative values are the movement capability under tension and compression, respectively.

2.5 DELIVERY OF SEALANTS

HOLD POINT

Process Held: Delivery of sealants to site.

Submission Details: At least five working days prior to delivery, submit a type test report which is not more than two years old verifying conformity to Clause 3.2, together with a production test report verifying conformity of the batches delivered to Clause 3.3.

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

Clearly identify and label all individual packages of sealant components and primers, including sealant classifications specified in Clause 2.1.

Sealant components must have at least six months of shelf life remaining from the date of delivery under the storage conditions specified by the manufacturer.

3 TESTING

3.1 TESTING LABORATORIES

Tests must be carried out in laboratories accredited by NATA for the test, or in laboratories accredited for the test by an organisation with Mutual Recognition Agreement (MRA) with NATA.

If no such facilities are available for a test, the test must be carried out in a laboratory approved by the Principal with results reported in a format acceptable to the Principal. For any such approval, submit details of the testing facilities to the Principal, prior to carrying out the testing.

The Principal may request full access to audit the laboratory at any time. You must make available for inspection all test procedures, equipment calibration certificates and test results associated with both type testing and production testing.
3.2 **TYPE TESTING**

Carry out type testing to verify conformity of sealants with the general performance requirements specified in Table B312.2 and the specific requirements in Table B312.3 as relevant.

Submit a type testing report which is not more than two years old verifying conformity, to obtain an initial TfNSW pre-approval (refer to Clause 1.4) or to demonstrate continued compliance with the conditions of approval.

3.3 **PRODUCTION TESTING**

Carry out testing for every batch during production to verify consistency in the production process, and demonstrate conformity of each batch with the specified requirements.

Production testing must comprise testing for the following properties as a minimum:

(a) extrudability;
(b) tack-free time;
(c) adhesion-in-peel;
(d) Shore A hardness;
(e) specific gravity.

All properties listed above must comply with Table B312.2, except for Shore A hardness which must comply with Table B312.3.

Provide to the Project Verifier a production testing report with each batch of sealant delivered.

4 **INSTALLATION**

4.1 **GENERAL**

Install the sealant in conformity to the manufacturer’s instructions and the Design Documentation drawings.

The top of sealants in joint gaps exposed to traffic at maximum compression must be at least 2 mm lower than the road surface.

---

**HOLD POINT**

<table>
<thead>
<tr>
<th>Process Held:</th>
<th>Installation of sealant.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Submission Details:</td>
<td>At least two working days prior to installation, submit inspection reports confirming that the actual joint gap width and the prepared joint substrate conform to this Specification.</td>
</tr>
<tr>
<td>Release of Hold Point:</td>
<td>The Nominated Authority will consider the submitted documents and may inspect the joint gap prior to authorising the release of the Hold Point.</td>
</tr>
</tbody>
</table>
4.2 JOINT GAP

In new bridge works, the joint gap at the time of sealant installation (at the nominated temperature on the Design Documentation drawings) must be 15 mm in concrete bridge decks underneath asphalt and 25 mm in concrete bridge decks without asphalt overlay, unless otherwise specified on the Design Documentation drawings.

Measure the actual joint gap width at the time of sealant installation, and deduce the actual joint gap width at the assumed temperature shown on the Design Documentation drawings.

Where the joint gap width at the time of sealant installation does not accord with that assumed in the design, seek advice from the Principal who may confirm that the proposed sealant is suitable for the actual gap width, or require the use of an alternative sealant.

4.3 SUBSTRATE STRENGTH

The compressive strength of the concrete forming the joint gap at the time of sealant installation must be more than 30 MPa for sealant Types 2 and 3, to avoid concrete breaking out as the sealant cures.

The Principal may approve installation of these sealants at concrete compressive strengths ranging from 20 to 30 MPa if the sealant modulus is low and has been proven not to damage the concrete in similar situations.

4.4 PREPARATORY WORK

Prior to sealant installation:
(a) replace any joint fillers or formers incompatible with the sealant or are otherwise defective;
(b) clean the joint gap sides of any contamination or coatings;
(c) dry the joint gap and clean out all grit and loose particles;
(d) where specified, apply the specified primer in conformity to the manufacturer’s instructions to improve bonding to the substrate.

4.5 METHOD OF APPLICATION

Mix or extrude multi-component sealants using suitable power driven or mechanical mixers in conformity to the manufacturer’s instructions. Do not mix the sealant components manually.

Where applicable, mix the sealant uniformly in accordance with the manufacturer’s instructions to obtain a consistency suitable for installation.

Apply all sealants using applicators or guns suitable for the purpose.

Isolate sealants in concrete joints overlaid by asphalt or bituminous surfacing using suitable HDPE bondbreaker tape overlaid with an acceptable preformed membrane such as Bituthene® 5000 or Emer-Proof® HD or equivalent to form an asphalt bridging layer. The membrane must have adequate bonding to the substrate at each side of the joint gap.

Where heating and pressing the membrane is recommended by the manufacturer to obtain the bonding, carry out the procedure without damaging the reinforcement embedded in the membrane.
Apply sealants in asphalt joints only after the asphalt has cooled to less than 40°C. Place the backing rod at the bottom of the asphalt joint gap before applying the sealant to prevent the sealant adhering to the bottom of the gap.

Where a non-sag sealant is used, tool it with a depressor or other suitable tool.

4.6 Curing

Single component sealants used in concrete joints underneath asphalt must be fully cured prior to placing the asphalt overlay.

For joint rehabilitation projects, for operational reasons, the Principal may approve the placement of the asphalt bridging layer and asphalt overlay just after the sealant has become tack free, or at a later time, if it is proven to be satisfactory in similar situations.

5 Guarantees or warranties

Obtain a warranty from the sealant supplier for a period of a minimum of five years, on the serviceability of the joint, together with a commitment from the sealant supplier to rectify all defects in the joint arising from defects in the sealant within this period.
ANNEXURES B312/A AND B312/B – (NOT USED)

ANNEXURE B312/C – SCHEDULES OF HOLD POINTS AND IDENTIFIED RECORDS

Refer to Clause 1.2.3.

C1 SCHEDULE OF HOLD POINTS

<table>
<thead>
<tr>
<th>Clause</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5</td>
<td>Delivery of sealant</td>
</tr>
<tr>
<td>4.1</td>
<td>Submission of inspection reports of joints prior to sealant installation</td>
</tr>
</tbody>
</table>

C2 SCHEDULE OF IDENTIFIED RECORDS

The records listed below are Identified Records for the purposes of TfNSW D&C Q6 Annexure Q/E.

<table>
<thead>
<tr>
<th>Clause</th>
<th>Description of Identified Record</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>Calculations verifying that the sealant strains are within specified limits</td>
</tr>
<tr>
<td>3.2</td>
<td>Type testing report</td>
</tr>
<tr>
<td>3.3</td>
<td>Production testing report</td>
</tr>
<tr>
<td>4.1</td>
<td>Inspection reports of joints prior to sealant installation</td>
</tr>
</tbody>
</table>
ANNEXURE B312/D – PLANNING DOCUMENTS

Refer to Clause 1.2.4.

The following documents are a summary of documents that must be included in the PROJECT QUALITY PLAN. Review the requirements of this Specification and other contract documents to determine any additional documentation requirements.

<table>
<thead>
<tr>
<th>Clause</th>
<th>Description of Document</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>Procedure for selection of sealant</td>
</tr>
<tr>
<td>4</td>
<td>Procedure for sealant installation</td>
</tr>
</tbody>
</table>

ANNEXURES B312/E TO B312/L – (NOT USED)
ANNEXURE B312/M – REFERENCED DOCUMENTS

Refer to Clause 1.2.6.

**TfNSW Specifications**

TfNSW D&C Q6  Quality Management System (Type 6)

**Australian Standards**

AS 5100.4  Bridge design – Bearings and deck joints

**ASTM Standards**

ASTM C639  Standard Test Method for Rheological (Flow) Properties of Elastomeric Sealants
ASTM C661  Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer
ASTM C719  Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants under Cyclic Movement (Hockman Cycle)
ASTM C793  Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants
ASTM C1183 Standard Test Method for Extrusion Rate of Elastomeric Sealants
ASTM D412  Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
ASTM D1475 Standard Test Method for Density of Liquid Coatings, Inks, and Related Products