

ALBERTA TRANSPORTATION
TECHNICAL STANDARDS BRANCH

B388 – OCTOBER 2019

SPECIFICATION FOR CONCRETE SEALERS

SCOPE - The approval requirements necessary prior to certification of the product for use as a concrete sealer are specified.

1.0 GENERAL

1.1 INTRODUCTION

This specification covers concrete sealer products consisting of one or two components.

The specification covers the approval requirements for certification of all concrete sealer products. The test requirements are designed to represent the service conditions the concrete sealer will encounter in the field.

The concrete surfaces to be sealed are subject to freeze-thaw cycles, exposure to de-icing salt, extreme temperatures, rapid temperature changes and abrasion from traffic. The concrete surfaces are also periodically re-sealed to restore performance levels.

Products containing $\text{CH}_3\text{Si}(\text{OR})_3$ have been identified as a health hazard which attacks the retina of the eyes and shall not be used in sealer products.

The current edition of the time of testing shall apply for codes and standards referred to within this specification and attached appendices.

1.1.1 Related Documents

The following documents are to be used in conjunction with B388, Specification for the Supply of Concrete Sealers.

BT001	Test Procedure for Measuring the Vapour Transmission, Waterproofing and Hiding Power of Concrete Sealers
BT002	Test Procedure for Alkaline Resistance of Penetrating Sealers for Bridge Concrete, Concrete Sealer
BT008	Test Procedure for Finger Printing Sealers Using Infrared Spectroscopy and Gas Chromatographic Separation

BT010 Test Procedure for Casting and Storing of Concrete Test Specimens for Use in Approval Testing of Sealers

The following published procedure is available from The American Society for Testing and Materials.

ASTM D5095 Standard Test Method for Determination of Nonvolatile Content in Silanes, Siloxanes and Silane-Siloxane Blends Used in Masonry Water Repellent Treatments.

ASTM D523 Standard Test Method for Specular Gloss

ASTM D344 Standard Test Method for Relative Hiding Power of Paints by the Visual Evaluation of Brushouts

ASTM D2805 Standard Test Method for Hiding Power of Paints by Reflectometry

1.2 CLASSIFICATION OF CONCRETE SEALERS

All proposed sealers shall be categorized into one of the types shown below:

Type 1 - penetrating sealers for use on traffic bearing surfaces exposed to abrasion. These sealers must not reduce the skid resistance of the wearing surface. These are divided into 3 categories depending on substrate exposure conditions:

Type 1a - penetrating sealers for application in sheltered conditions such as parkades where the deck is relatively dry, i.e. relative moisture content is a maximum of 55%. Relative moisture content is defined in BT001, "Test Procedure for Evaluation of Measuring the Vapour Transmission, Waterproofing and Hiding Power of Concrete Sealers."

Type 1b - penetrating sealers for application in outdoor conditions such as bridge decks where the deck relative moisture content is a maximum of 70%, representing 2 days drying in good drying conditions.

Type 1c - high performance penetrating sealers for application in outdoor conditions to new bridges and overlays cast with low water-cement ratio (0.30-0.45) concrete, where the relative moisture content is a maximum of 80%.

All waterbased sealers shall be tested to determine their ability to seal concrete surfaces that have been previously sealed with an alcohol or waterborne based sealer. This is in addition to the requirements of this specification, and applies to all three categories of the Type 1 sealer. The performance requirements shall be in accordance with Section 4.2.

Type 2 - clear, film forming sealers for use on non-traffic bearing elements such as portions of parapets, and curbs. These are divided into 2 categories depending on the number of components:

Type 2a - one component, clear coatings suitable for use by less experienced personnel on non-traffic bearing surfaces where the concrete relative moisture content is a maximum of 70%.

Type 2b - two or more component coatings for use by approved contractors where higher degrees of waterproofing performance are required and where the concrete relative moisture content is a maximum of 70%.

Type 3 - coloured film forming sealers for use on elements highly exposed to public view where aesthetics are a primary consideration. These products are for use on concrete surfaces where the relative moisture content is a maximum of 70%.

2.0 APPROVAL REQUIREMENTS

2.1 ARRANGEMENT FOR TESTING

The Supplier/Manufacturer shall have his product tested for approval according to the requirements as outlined in the specification. When he has written approval from the Department his product will be included on the approved product list.

The tests are to be carried out by an independent, CSA certified laboratory at the Supplier's/Manufacturer's expense.

The Supplier/Manufacturer shall supply at least the following information to the test laboratory: name and type of sealer, generic description, name of manufacturer and Alberta supplier, product data sheet, safety data sheet, application instructions, including number of immersions or brushings and drying time between each, coverage rate, pot life if applicable, time of cube immersion in Type 1 sealer if applicable, and curing instructions if necessary.

The test procedures allow for up to three immersions for Type 1a, 1b and 1c penetrating sealers and two brushings for other sealers.

In the event the Supplier's/Manufacturer's instructions conflict with the provisions of the specifications or procedures the specifications or procedures shall govern.

The test results shall be submitted by the Supplier/Manufacturer to:

Alberta Transportation
Technical Standards Branch
2nd Floor, Twin Atria Building
4999 - 98 Avenue
Edmonton, Alberta, T6B 2X3
Attention: Dave Besuyen, Bridge Materials Engineer
Telephone: (780) 415-1037 ; Fax: (780) 422-5426

The test report, when submitted will become the property of the Department. The product data sheet and safety data sheet shall also be included with the report.

2.2 LABORATORY TEST REPORT

The test results shall be submitted on the report form "Concrete Sealer Test Report" attached.

Original graphs of the spectrographic and chromatographic analysis showing frequency versus amplitude and separation versus time shall be included in the report. Two component sealers, such as epoxies, will require separate graphs for each component. Original hiding power test cards for Type 3 Sealers shall also be submitted. Xerox or fax copies are not acceptable.

2.3 LABORATORY DATA ACQUISITION FORM

The laboratory shall record all observations, weights and calculations on the report form "Laboratory Data Acquisition Form for Concrete Sealer Tests" in Accordance with BT001. The laboratory shall maintain these records for all products tested and shall submit this data if requested by Alberta Transportation.

2.4 EVALUATION OF TEST RESULTS

The Department will base the acceptance of a product according to the results of the performance requirements in Section 4.0, Qualifying Tests.

Type 3 sealer evaluation process field trial application assessment on a portion of a bridge no greater than 25 m² and approved by the Department prior to final acceptance of the product. Surface preparation, concrete finishing, application rates will be reviewed. Application shall be completed using the same equipment intended for the remainder of the work.

3.0 IDENTIFICATION OF SEALERS

3.1 SOLIDS CONTENT

For future purposes of quality control and verification that the sealers are identical to the sealers that have previously been tested and approved, all

proposed sealers shall be tested for the amount of active solids content.

Solids contents for Type 1 sealers such as silanes, siloxanes, and silane/siloxane blends shall be measured using Test Procedure ASTM D5095 "Standard Test Method for Determination of Nonvolatile Content in Silanes, Siloxanes and Silane-Siloxane Blends Used in Masonry Water Repellent Treatments." The method for determining solids content for Type 2 and Type 3 sealers shall be measured using the method described in Test Procedure BT001 "Test Procedure for Measuring the Vapour Transmission, Waterproofing and Hiding Power of Concrete Sealers."

3.2 SPECTROGRAPHIC AND CHROMATOGRAPHIC ANALYSIS

Each sealer shall be subjected to an infrared spectrographic and gas chromatographic analysis. The test shall be done in accordance with BT008 "Test Procedure for Sealers using Infrared Spectroscopy and Gas Chromatographic Separation". A graph of frequency versus amplitude and separation versus time shall be plotted for all sealers and submitted to the Department for review. Two component sealers, such as epoxies, will require separate graphs for each component.

4.0 QUALIFYING TESTS

4.1 CASTING AND STORING OF CONCRETE TEST SPECIMENS

Test specimen cubes for all sealer types except 1c represent typical, mature, 30 MPa concrete with a relatively high water cement ratio to simulate field cast bridge concrete. The test cubes for Type 1c represent newer, less mature 0.35 w/c concretes. For the purpose of evaluating sealers, it is important that test specimens be uniform with respect to permeability, void space, surface texture and both the amount and distribution of interior moisture.

The specimens shall be made in accordance with BT010, "Test Procedure for the Casting and Storing of Concrete Test Specimens for Use in Approval Testing of Sealers."

The qualifying test results shall be the average of three test specimens.

4.2 PERFORMANCE REQUIREMENTS

Test procedures for waterproofing and vapour transmission performance shall be according to BT001, "Test Procedure for Measuring the Vapour Transmission, Waterproofing and Hiding Power of Concrete Sealers."

Test procedures for alkaline resistance shall be according to BT002, "Test Procedure for Alkaline Resistance of Penetrating Sealers for Bridge Concrete."

4.2.1 Waterproofing Performance

The tables below show the minimum waterproofing performance requirements for each type of sealer.

WATERPROOFING PERFORMANCE		
SEALER TYPE	BEFORE ABRASION	AFTER ABRASION
Type 1a	82.5%	75.0%
Type 1b	---	86.0%
Type 1c	---	*85.0%
Type 2a	82.5%	N/A
Type 2b	90.0%	N/A
Type 3	75.0%	N/A

*144 gram abrasion instead of usual 72 gram

4.2.2 Vapour Transmission Performance

The table below shows the minimum requirements for Vapour Transmission Performance for each type of sealer.

SEALER TYPE	MINIMUM VT
Type 1a	---
Type 1b	70%
Type 1c	85%
Type 2a	35%
Type 2b	20%
Type 3	35%

4.2.3 Alkaline Resistance Performance for Type 1 Sealers

Alkaline resistance tests shall be performed on the same test cubes as used for the waterproofing performance test. After 21 days of exposure to potassium hydroxide, waterproofing performance shall be within 3% of the actual measured after-abrasion waterproofing performance.

4.2.4 Hiding Power and Gloss for Type 3 Sealers

Type 3 Sealers must also meet the following:

- a) Hiding Power – Hiding Power shall be measured in accordance with ASTM D344 and performed using the rate of coverage established at the time the sealer is applied to the test cubes in test procedure BT001.

Hiding power shall also be measured by ASTM D2805 Standard Test Method for Hiding Power of Paints by Reflectometry.

- b) Gloss – Gloss for type 3 sealers shall be measured in accordance with ASTM D523-14.

As defined by The Masters Painters Institute, type 3 sealer shall produce a 'traditional matte finish-flat' (MPI Gloss Level 1) and gloss measured at 60° shall be less than or equal to '5' units.

The colour tested shall be similar to colour identification 35630 as shown in the US Federal Standard 595b Colors.

4.2.5 User-Friendliness

This specification recognizes that most sealers are applied by brush or spray equipment in the field in order to meet the specified application rate. In addition to the above requirements for waterproofing, breathability, etc. all sealers shall meet conventional standards for brushability or sprayability, whichever the manufacturer recommends. Products that are not user-friendly will not be approved.

4.2.6 VOC Sealers

The maximum VOC (g/L) for concrete sealers shall meet the Environment Canada Regulation of 400 g/L.

5.0 PACKAGING

5.1 QUALITY AND SIZE

Containers shall be of adequate strength with an airtight lid. The size of the containers shall not exceed 204 litres.

5.2 MARKING

The following information shall be marked on the outside of each container

- (a) Dangerous goods warning where applicable should be found on the label.
- (b) Product name
- (c) Manufacturer
- (d) Batch number

- (e) Volume of material
- (f) Date material was manufactured.
At time of shipping the product must not have been manufactured for more than 30 days.
- (g) Shelf Life
- (h) If 2 component designate A or B and indicate ratio of component mixtures.

6.0 QUALITY CONTROL

6.1 APPROVED PRODUCT

Only products meeting this specification will be considered for approval. The approved products will be shown on the approval list as to type, name, application rate, and manufacturer and Alberta supplier. The Department will not notify the Supplier/Manufacturer of the expiry date. It will be the responsibility of the Supplier/Manufacturer to retest his product, at his own expense, prior to the end of the 5 year period.

The approval is valid for 5 years from the date of approval.

Any subsequent change in the product or this specification will require re-qualification at the Supplier's/Manufacturer's expense.

6.2 RIGHT TO REJECT

The Department reserves the right to run laboratory tests, reject material and withdraw the product from the approval list should it not meet the requirements of the specifications.

In addition to the tests listed in BT001, the Department may perform tests such as spectrographic and chromatographic analysis (see Section 2.2), solids content and other identification tests to establish that the material delivered to the construction site is identical to the laboratory test sample on which approval was based.

Only materials that are identical to the original approval test sample within reasonable limits will be accepted by the Department. The sealer Supplier/Manufacturer shall maintain sufficient quality control to ensure material uniformity. The quality control data shall be submitted to the Department when requested within 30 days. Failure to pass identity tests will result in withdrawal of the Department's approval.

Unsatisfactory performance, whether short term or long term shall also be grounds for withdrawal of the approval.

CONCRETE SEALER TEST REPORT - B388



LABORATORY _____ PROJECT/FILE No.: _____

PART 1 - PRODUCT DETAILS

Name of Product: _____
 General Description of Product: _____

Classification: Penetrating Sealer Film Forming Sealer Pigmented Sealer Viscosity: Low Medium
 Type 1a Type 1b Type 1c Type 2a Type 2b Type 3 High

Gloss: High Gloss Semi Gloss Flat Measured Specific Gravity: _____

Manufactured By: _____ **Distributed By:** _____ **Email:** _____

PART 2 - CONCRETE TEST CUBES

CONCRETE MIX PROPORTIONS

Batch Size _____ m³
 Cement Type GU _____ kg **Effective**
 Coarse Agg. SSD _____ kg Moisture Content _____ %
 Fine Agg. SSD _____ kg Moisture Content _____ %
 Water, Net _____ L
 Type and Amount of Air Entraining Agent: _____

CONCRETE TEST DATA

Date Cast : _____
 28 Day Compr. Str. _____ MPa Air Content _____ %
 Slump _____ Water/Cement Ratio _____
 Average Total Cube Moisture Content _____ g
 Relative Moisture Content of Concrete Cubes _____ %
 Surface Voids _____

PART 3 - APPLICATION OF SEALER

Date of Sealer Application: _____
 Type of Application: Immersion Coating Other _____
 Number of Applications _____
 Duration of Each Application _____ Min.
 Average Time Between Applications _____ Min.
 Average Weight of Sealer Gained _____ g.
 Total Coverage Rate of All Applications _____ m²/L*
 _____ ml/m²*
 _____ ft² / US gal*

PART 11 - NOTES

Tested By: _____ Date: _____

PART 4 - 5 DAY IMMERSION CONTROL SAMPLES

Average Weight Gain of Control Samples _____ g
 Date of Test of Control Sample Absorption: _____

PART 5 - VAPOR TRANSMISSION

Average Wt. Loss _____ % VT _____ %
 Average Weight Loss of Control Cubes _____ g

PART 6 - WATERPROOFING

Average Cube Weight Prior to Test _____ g
 Average Initial Weight Gain of Test Samples _____ g
 Initial Waterproofing Performance _____ %

PART 7 - WATERPROOFING AFTER SURFACE ABRASION

Average Weight Gain After Sandblasting _____ g
 Waterproofing Performance After Sandblasting _____ %

PART 8 - ALKALI RESISTANCE

(For Type 1 Products Only)
 Wt. Gained During 21 Days in KOH _____ g
 Average Weight Gain of Test Samples _____ g
 Final Waterproofing Performance _____ %

PART 9 - PRODUCT IDENTIFICATION TESTS

Non-Volatile Content (Ns) _____ %
 Solids Content (SC) _____ %
 Infrared Spectrogram (Report Attached)
 Gas Chromatograph (Report Attached)

PART 10 - Hiding Power & Gloss (Type 3 only)

Gloss @ 60°_{D523} : (≤ 5) _____ units M.P.I Gloss Level: _____
 Gloss @ 60°D523: Pass Fail
 Hiding_{D344}: Pass Fail Coverage Rate*: _____ ml/m²
 Hiding_{D2805} (H_{0.98}): _____ ml/m²

* Coverage rate for ASTM D344 shall be as per Part 3 - Application of Sealer

Signature: _____