

Superseded

Technical Specification

**Transport and Main Roads Specifications
MRTS18 Polymer Modified Binder (including Crumb
Rubber)**

July 2017

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1 Introduction

This Technical Specification applies to the material requirements for polymer modified binder (PMB), including binders incorporating crumb rubber, for use in both sprayed sealing and asphalt applications for road construction, resurfacing, rehabilitation and maintenance.

This Technical Specification shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements* and other Technical Specifications as appropriate.

This Technical Specification forms part of the Transport and Main Roads Specifications Manual.

2 Definition of terms

The terms used in this Technical Specification shall be defined in Clause 2 of MRTS01 *Introduction to Technical Specifications*. Additional terms used in this Technical Specification shall be as defined in Table 2.

Table 2 – Definition of terms

Term	Definition
Bitumen	Bituminous material obtained by processing the material obtained from the refining of naturally occurring crude petroleum
Crumb rubber (scrap rubber)	Rubber particles manufactured from waste or reclaimed rubber products such as vehicle tyres and graded to conform to a specified size range.
Compliance testing sample	The sample of binder taken by the Contractor for compliance testing
Manufacturer	An organisation which has the necessary plant and equipment to manufacture polymer modified binder to this Technical Specification. For supply only contracts, the manufacturer shall be the Contractor.
Polymer	A predominantly organic substance comprising a very large number of chemical entities. These chemical entities may comprise identical segments (producing a homopolymer) or a combination of two or more different segments (producing a copolymer).
Polymer modified binder (PMB)	A binder consisting of polymeric material (including crumb rubber) dispersed in bitumen with enhanced binder performance for particular applications
Polymer modified binder class	A type of polymer modified binder which is classified according to its torsional recovery at 25°C, softening point and consistency at 60°C as defined in AGPT/T190 <i>Specification Framework for Polymer Modified Binders</i>
Point of delivery	The point in the delivery process where the polymer modified binder is: <ol style="list-style-type: none"> transferred to the sprayer for sprayed sealing work, or located in the storage tank at the asphalt plant immediately prior to asphalt production
Site	Where the polymer modified binder is used (includes the asphalt manufacturing plant)

3 Referenced documents

Table 3 lists documents referenced in this Technical Specification.

Table 3 – Referenced documents

Reference	Title
AP-G41	<i>Bituminous Materials Safety Guide</i> , Austroads
AGPT/T101	<i>Method of Sampling Polymer Modified Binders, Polymers and Crumb Rubber</i> , Austroads
AGPT/T190	<i>Specification Framework for Polymer Modified Binders</i> , Austroads
AP-T235-13	<i>Guide to the Selection and Use of Polymer Modified Binders and Multigrade Bitumens</i> , Austroads
Advisory Note 7	<i>Guide to the Heating and Storage of Binders for Sprayed Sealing and Asphalt Manufacture</i> , Australian Asphalt Pavement Association (AAPA)
HSE Guide 5	<i>Guide to the Manufacture, Storage and Handling of Polymer Modified Binders</i> , Australian Asphalt Pavement Association (AAPA)
ISO 9001	<i>Quality Management Systems: Requirements</i> , International Organisation for Standardisation
AS/NZS ISO 9001	<i>Quality Management Systems: Requirements</i> , Standards Australia
EN07	<i>Conformance of Polymer Modified Binders</i>
MRTS01	<i>Introduction to Technical Specifications</i>
MRTS11	<i>Sprayed Bituminous Treatment</i>
MRTS30	<i>Asphalt Pavements</i>
MRTS50	<i>Specific Quality System Requirements</i>

4 Standard test methods

The test methods applicable to this Technical Specification are those listed in the latest version of the Austroads document AGPT/T190 *Specification Framework for Polymer Modified Binders*.

5 Quality system requirements

5.1 Hold Points, Witness Points and Milestones

General requirements for Hold Points, Witness Points and Milestones are specified in Clause 5.2 of MRTS01 *Introduction to Technical Specifications*.

The Witness Point applicable to this Technical Specification is shown in Table 5.1. There are no Hold Points or Milestones defined.

Table 5.1 – Hold Points, Witness Points and Milestones

Clause	Hold Point	Witness Point	Milestone
9.3.1		1. Sampling at the point of delivery	

5.2 Binder handling procedures

The Contractor shall prepare documented procedures for all required processes as defined in Clause 6 of MRTS50 *Specific Quality System Requirements* and be consistent with the requirements of this Technical Specification, MRTS30 *Asphalt Pavements* and MRTS11 *Sprayed Bituminous Treatments*, as appropriate. These procedures shall be included in the respective asphalt quality plan

or construction procedure specified in MRTS30 *Asphalt Pavements* or MRTS11 *Sprayed Bituminous Treatments*.

For field blended or plant blended crumb rubber modified binders, the construction procedures shall address the following specific issues:

- method for achieving a homogeneous product that can be sprayed to achieve a uniform application of binder across the pavement during sealing operations, free of streaking
- the management of crumb rubber blending, digestion, and storage times and temperatures
- the maximum time / temperature conditions that field produced / plant blended product can be stored and / or transported without loss of properties
- the maximum distance that the product can be transported from a blending site without degradation of properties
- circulation of the product during transportation and storage, and
- requirements for spraying plant and spraying practices including adjustments to nozzles (if required).

5.3 Conformance requirements

Materials supplied to this Technical Specification shall be sampled and tested in accordance with Clause 9.

The conformance requirements which apply to this Technical Specification are summarised in Clause 6.

6 Material

6.1 General

Polymer modified binders shall comply with the property requirements and associated notes listed in the latest version of AGPT/T190 *Specifications Framework for Polymer Modified Binders*.

The crumb rubber used to produce S15RF and S18RF binders shall meet the requirements for a size 16 crumb rubber in accordance with Table 5.4 of AGPT/T190.

Transport and Main Roads has adopted the Austroads classification system for polymer modified binders. AGPT/T190 can be downloaded for free from the Austroads publications website.

<https://www.onlinepublications.austroads.com.au>

The nearest equivalent Austroads PMB class (AGPT/T190) to the previous MRTS18 (November 2011) PMB class is listed in the table below.

Austrroads PMB Class (AGPT/T190)	Previous PMB Class (MRTS18 – November 2011)
Sprayed Sealing Applications	
S10E	S0.25S
S15E	S0.7S
S20E	–
S25E	S4.5S
S35E	S0.3B
S45R	S1.8R
S15RF	S15RF
S18RF	S18RF
Asphalt Applications	
A10E	A10S
A15E	A5S
A20E	A0.6S
A25E	A0.6B
A35P	A2V

6.2 Polymer types

Polymer modified binders shall be manufactured using the polymer types listed in Table 6.2.

Table 6.2 – Polymer type to be used in binder

Polymer Type	Polymer Modified Binder Class
Styrene-butadiene-styrene (SBS)	S10E, S15E, S20E, S25E, A10E, A15E, A20E
Polybutadiene (PBD)	S35E, A25E
Ethylene vinyl acetate (EVA)	A35P
Crumb rubber (CR)	S45R, S15RF, S18RF

6.3 Foaming

Polymer modified binder shall not foam at any time when heated up to a temperature of 180°C. The formation of a thin layer of bubbles on the surface of the binder is not regarded as foaming.

7 Manufacture

The polymer modified binder manufacturer shall:

- a) Operate a quality management system certified to AS/NZS ISO 9001 for material manufactured in Australia.

- b) Operate a quality system certified to ISO 9001 or equivalent for material manufactured outside Australia.
- c) Operate to an inspection and test plan acceptable to Transport and Main Roads for manufacturing and supplying polymer modified binder which demonstrates compliance with this Technical Specification. The inspection and test plan shall include testing of polymer modified binder, analysis of results (including control charts) and a requirement for a copy of the results to be forwarded promptly to Transport and Main Roads.
- d) Ensure all polymer modified material supplied can be traced to the production batch and associated test report.

8 Delivery of polymer modified binder

8.1 General

The handling, storage, transport, heating and transfer of polymer modified binder shall comply with the requirements and practices outlined in the latest versions of the following documents:

- a) Austroads – *Bituminous Materials Safety Guide*, AP-G41
- b) Austroads – *Guide to the Selection and Use of Polymer Modified Binders and Multigrade Bitumens*, AP-T235-13
- c) AAPA – *Guide to the Heating and Storage of Binders for Sprayed Sealing and Asphalt Manufacture*, Advisory Note 7, and
- d) AAPA – *Guide to the Manufacture, Storage and Handling of Polymer Modified Binders*, HSE Guide 5.

8.2 Binder contamination

Polymer modified binder shall be heated, stored and transported in purpose-built containers and transferred between containers in such a way that contamination does not occur, the resultant product complies with this Technical Specification and the performance of the product is not adversely affected.

As necessary, storage and delivery vessels, sprayers and hoses shall be flushed or cleaned with appropriate solvents before transfer of binder has commenced. Residues from flushing and cleaning shall be removed before transfer.

If contamination of the binder is suspected, additional sampling and testing may be ordered by the Administrator to confirm compliance of the binder with the requirements of this Technical Specification.

8.3 Heating

Polymer modified binder shall not be heated to temperatures greater than the maximum values listed in the latest version of AAPA Advisory Note 7 – *Guide to the Heating and Storage of Binders for Sprayed Sealing and Asphalt Manufacture*. The rate of increase in temperature shall not exceed 15°C per hour.

8.4 Records

Records shall be kept for the handling, storage, transport, heating and transfer of binder from the date/time of sampling at the point of release from the manufacturer until such time as the binder is incorporated into the works.

These records shall include the binder's class and history, including (as relevant):

- a) dates, times, production batch numbers, polymer modified binder classes and volumes of transfers in to and out of the storage container
- b) date, time and amount of any additives (e.g. cutter oil and/or adhesion agent) incorporated into the binder, and
- c) duration of storage, temperature over time, and degree of agitation during any period of storage.

8.5 Delivery dockets

Delivery of polymer modified binder to the Site shall be accompanied by a delivery docket giving at least the following information:

- a) name and address of the manufacturer
- b) location and date of manufacture
- c) polymer modified binder class
- d) production batch number
- e) storage and heating information (i.e. location, date, time, temperature), and
- f) certification that the polymer modified binder has been sampled prior to release from the manufacturer, tested as stated in Clause 9 and its properties comply with Clause 6.

Delivery dockets shall be made available for inspection by the Administrator and shall be included in the quality records for each relevant construction lot.

9 Compliance sampling and testing

9.1 General

Sufficient sampling and testing shall be carried out to ensure that the polymer modified binder complies with the property requirements of Clause 6. Sampling of polymer modified binder shall be undertaken in accordance with the procedures defined in AGPT/T101 *Method of Sampling Polymer Modified Binders, Polymers and Crumb Rubber*.

Sampling and testing shall take place at the point of release from the manufacturer and at the point of delivery. The minimum requirements are as follows:

- a) Sampling and testing at the point of release from the manufacturer shall be in accordance with Clause 9.2.
- b) Sampling and testing at the point of delivery to the sprayer or from the asphalt binder storage tank shall be in accordance with Clause 9.3.

9.2 Sampling and testing at the point of release from the manufacturer

Sampling and testing of polymer modified binder at the point of release from the manufacturer shall be undertaken by the manufacturer.

A batch shall be defined as the quantity of polymer modified binder stored in a single tank by the manufacturer at any particular time. The binder in the storage tank shall be considered a new batch whenever new material is added to the storage tank.

The minimum frequency of sampling and testing performed by the manufacturer shall be in accordance with the testing frequency requirements and associated notes listed in the latest version of AGPT/T190 *Specification Framework for Polymer Modified Binders*.

All test results obtained from each batch shall be included in the relevant construction lot record.

9.3 Sampling and testing at the point of delivery

9.3.1 Sampling

Polymer modified binder shall be sampled by the Contractor at the point of delivery.

For sprayed sealing work, a compliance testing sample and a sample for the Administrator shall be taken from the tanker/storage tank immediately prior to transfer or during each transfer of binder from the tanker/storage tank to the sprayer **Witness Point 1** Unless otherwise directed by the Administrator, where a single tanker/storage tank load of binder is being transferred multiple times to the sprayer during the same work shift, only one pair of samples needs to be obtained.

For asphalt works, a compliance testing sample and a sample for the administrator shall be taken from the binder storage tank immediately prior to the commencement of asphalt production for each work shift.

Each sample shall be one litre (1 L) of polymer modified binder. The Contractor shall retain the compliance testing samples and forward the samples taken for the Administrator to the Administrator, unless otherwise directed by the Administrator.

Samples shall be labelled at the time of sampling and appropriately stored to avoid contamination or deterioration for a minimum of 12 months, or for the duration of the project's defect liability / correction period, whichever is greater.

Sample labels would typically contain the following information:

- designation or classification of the binder
- name of supplier / manufacturer
- batch or identification number
- date and time of sampling
- sampling location
- type and identifying number of the container or vehicle where the sample was taken
- name of sampler
- identification mark or sample number
- project name or number
- sampling temperature

9.3.2 Testing

9.3.2.1 Testing frequencies

The minimum testing frequencies for point of delivery testing are provided in Table 9.3.2.1.

Where the Contractor is able to provide suitable, traceable and auditable records to the Administrator that demonstrate the binder has been handled, stored, transported, heated and transferred in accordance with this Technical Specification and the latest version of AAPA Advisory Note 7 – *Guide to the Heating and Storage of Binders for Sprayed Sealing and Asphalt Manufacture*, the frequency of compliance testing for each class of polymer modified binder from each manufacturer shall be at the ‘normal frequency’. If the Contractor is unable to demonstrate compliance with the above requirements, an ‘increased frequency’ shall be adopted.

A ‘normal frequency’ shall immediately change to an ‘increased frequency’ if a nonconforming sample has been detected. The frequency may return to the ‘normal frequency’ after no nonconformances have occurred in four consecutive compliance testing samples.

Where the binder has not been stored in accordance with the latest version of AAPA Advisory Note 7 – *Guide to the Heating and Storage of Binders for Sprayed Sealing and Asphalt Manufacture*, the ‘increased frequency’ shall apply.

In addition to the requirements of MRTS50 *Specific Quality System Requirements*, and unless otherwise specified or agreed with the Administrator, the extents of conforming and nonconforming works shall be determined based on the midpoint between adjacent binder tests.

Table 9.3.2.1 – Minimum testing frequencies

Frequency	Normal Frequency	Increased Frequency
Testing of samples required:	The first compliance testing sample and then every 10th compliance testing sample thereafter for a particular binder class (that is compliance testing sample 1, 11, 21 and so on)	Each compliance testing sample

9.3.2.2 Testing requirements

Samples shall be tested for torsional recovery at 25°C and softening point, and assessed for conformance with the requirements of Table 9.3.2.2. In the event of a nonconformance being detected, additional tests shall be performed on the same sample so that the one sample is tested for the following additional properties:

- a) consistency
- b) segregation
- c) viscosity, and
- d) rubber content (where applicable).

For the purpose of undertaking these tests, reheating of binder samples shall be minimised as much as possible.

Table 9.3.2.2 – Binder properties

Binder Class	Softening Point (°C)		Torsional Recovery at 25°C (%)	
	Point of Release from the Manufacturer ¹	Point of Delivery	Point of Release from the Manufacturer ¹	Point of Delivery
A35P	62 – 74	62 – 74	6 – 21	6 – 21
A25E	52 – 62	52 – 62	17 – 30	16 – 30
A20E	65 – 95	59 – 95	38 – 70	25 – 70
A15E	82 – 105	76 – 105	55 – 80	45 – 80
A10E	88 – 110	81 – 110	60 – 86	49 – 86
S10E	48 – 64	48 – 64	22 – 50	14 – 50
S15E	55 – 75	52 – 75	32 – 62	20 – 62
S20E	62 – 88	56 – 88	45 – 74	30 – 74
S25E	82 – 100	75 – 100	54 – 85	44 – 85
S35E	48 – 56	48 – 56	16 – 32	15 – 32
S45R	55 – 65	53 – 65	25 – 55	23 – 55
S15RF	–	≥ 55	–	≥ 25
S18RF	–	≥ 62	–	≥ 30

¹: Requirements for softening point and torsional recovery at the point of release from the manufacturer are given in Tables 5.1 and 5.2 of AGPT/T190, and are repeated in this table for information purposes.

Variation of binder property between the point of release from the manufacturer and the point of delivery

A reduction in torsional recovery and softening point can occur with some binder grades over time due to ageing, particularly for moderately to heavily modified SBS binder grades. Such changes do not have a significant detrimental effect on the performance of the binder and have been accounted for in the lower point of delivery requirements. However, reductions in torsional recovery and softening point caused by other means (such as nonconforming binder properties at the point of release from the manufacturer, contamination or mishandling) can have a detrimental effect on the performance of the binder.

All properties, other than softening point, torsional recovery and consistency should not vary between the point of release from the manufacturer and the point of delivery.

Acceptance of nonconforming binder

For binder that does not conform to the point of delivery requirements but has been assessed by the Administrator as being suitable to remain in the Works, the reduction in value of the binder would typically be determined in accordance with Technical Note EN07 *Conformance of Polymer Modified Binders*. Additionally, the project's defect liability / correction period for sprayed seals and asphalt containing nonconforming binder would typically be extended to a period of at least 24 months after the date of installation, as the performance implications associated with the

nonconformance cannot be fully evaluated until it has been subject to a period of sustained hot weather.

Audit testing undertaken by the Administrator

When audit testing is undertaken by the Administrator, samples are typically tested for the following properties:

- softening point
- torsional recovery
- consistency, and
- segregation.

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