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| AUSTROADS TECHNICAL SPECIFICATION ATS 3110Supply of Polymer Modified Binders | A close up of a flag  Description automatically generated |

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# Scope

Austroads Technical Specification ATS 3110 sets out the requirements for the supply of polymer modified binders (PMBs) and crumb rubber modified binders for use in both sprayed sealing and asphalt applications.

# Referenced Documents

The following documents are referenced in this Specification or are relevant to this Specification:

|  |
| --- |
| **Australian / New Zealand Standards**AS/NZS 2341.4: Methods of testing bitumen and related roadmaking products: determination of dynamic viscosity by rotational viscometerAS 2341.18: Methods of testing bitumen and related roadmaking products: determination of softening point (ring and ball method)AS/NZS ISO 9001: Quality Management Systems: Requirements. |
| **Austroads**ATM-101 Method of sampling polymer modified binders, polymers and crumb rubberATM-102 Protocol for handling modified binders in preparation for laboratory testingATM-103 Mass change or loss on heating of polymer modified binders after rolling thin film oven (RTFO) treatmentAGPT/T108 Segregation of polymer modified bindersATM-111 Handling viscosity of polymer modified binders (Brookfield Thermosel)ATM-112 Flash point of polymer modified bindersAGPT/T121 Shear properties of polymer modified binders (ARRB elastometer)ATM-122 Torsional recovery of polymer modified bindersAGPT/T125 Stress ratio of bituminous binders using the Dynamic Shear Rheometer (DSR)ATM-132 Compressive limit of polymer modified bindersAGPT/T142 Rubber content of crumb rubber modified bitumen – Soxhlet methodAGPT/T143 Particle size and properties of crumb rubberAGPT/T144 Morphology of crumb rubber – bulk density testAGPT04F Guide to Pavement Technology Part 4F: Bituminous BindersAP-G41-15 Bituminous Materials Safety GuideAP-C87-15 Austroads glossary of terms (2015 edition) |
| **Australian Flexible Pavement Association (AfPA)**Advisory Note 7 Guide to the heating and storage of binders for sprayed sealing and asphalt manufacture. |

# Definitions

In addition to the definitions in AP-C87-15, the following definitions apply to this Specification:

|  |  |
| --- | --- |
| **Field-produced crumb rubber modified binders:** | Those binders that are simple blends of bitumen and crumb rubber which are blended close to the application site and are used within a short time frame (in no case more than 2 hours travelling time from the blend site). |
| **Batch:** | The quantity of polymer modified binder stored in a single tank by the manufacturer at any particular time. The binder in the storage tank is deemed to be a new batch whenever new material is added to the storage tank. |

Refer to the Austroads *Guide to Pavement Technology Part 4F: Bituminous Binders* (AGPT04F‑17) for details of the classification system applicable to PMBs.

# Quality System Requirements

The PMB must be manufactured under a quality management system which is certified to AS/NZS ISO 9001 by a JAS-ANZ accredited certifier (or accredited by another Accreditation Body Member of the International Accreditation Forum).

# Manufacture of Binders

The manufacturer must implement a documented process control system to produce PMBs of a consistent quality conforming to the requirements of this Specification.

As a minimum, the process controls must include:

1. a method for determining and controlling the formulation during the production process;
2. keeping records of the composition of the constituent materials for each batch; and
3. recording sampling frequencies and test results.

The manufacturer must:

1. operate an Inspection and Test Plan (ITP) which demonstrates that the PMB complies with this specification and includes testing of the PMB, analysis of results (including control charts);
2. ensure that all PMB supplied can be traced to the production batch and associated test report; and
3. ensure that procedures/guidelines for the handling, storing, and transport of the binders that ensures homogeneity and conformity at the time of incorporation into the works are readily available to the Principal and Contractor.

# Sampling and Testing of Binders

Representative samples of PMBs must be obtained in accordance with ATM-101. PMB samples must be prepared for testing using ATM-102.

Binders must be tested in accordance with the Test Methods specified in Tables 8.1, 8.2 and 8.3. Crumb rubber used in the production of crumb rubber binders must be tested in accordance with the Test Methods specified in Table 8.4.

The minimum frequency of testing must be in accordance with Tables 9.1 and 9.2.

Unless specified otherwise, the properties listed in Tables 8.1 to 8.4 refer to testing of samples taken at the point of manufacture.

Sampling must be undertaken by a person who is competent in that sampling procedure. If requested, the Contractor must provide training records demonstrating evidence of that person’s competency.

The manufacturer must nominate in its Quality Management System the tests to be carried out prior to batch release of factory blended binders. At a minimum, this must include the requirements set out in Table 8.1 and 8.2.

# Records

The Contractor must ensure that the following records are made available prior to, or with, the delivery of the PMB:

1. Test results, from a NATA accredited laboratory, demonstrating that the PMB has been sampled and tested in accordance with Tables 8.1 to 8.4 and complies with the properties specified in those tables.
2. A delivery docket giving at least the following information:
3. name and address of the manufacturer;
4. location and date of manufacture;
5. polymer modified binder class;
6. production batch number;
7. storage and heating information (i.e. location, date, time, temperature; and
8. certification that the PMB has been sampled prior to release from the manufacturer and complies with this Specification.

# Properties of Binders

PMB properties must comply with the values specified in the following tables:

|  |  |
| --- | --- |
| Sealing Class Binders: | Table 8.1 |
| Asphalt Class Binders: | Table 8.2 |
| Field-Produced Crumb Rubber Modified Binders: | Table 8.3  |

Table 8.1: Properties of Polymer Modified Binders for Sprayed Sealing Applications

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test method** | **Class****Binder property** | **S10E** | **S15E** | **S20E** | **S25E** | **S35E** | **S9R(1)** | **S15R(1,6)** |
| AS/NZS 2341.4 or ATM-111(2) | Viscosity at 165 °C (Pa.s) max.(2) | 0.55 | 0.55 | 0.6 | 0.9 | 0.55 | 1.5 | 4.5(2) |
| ATM-122 | Torsional recovery at 25 °C, 30 s (%) | 22–50 | 32–62 | 38–70 | 55–80 | 16–32 | 15-45 | 25–55 |
| AS 2341.18 | Softening point (°C) | 48–64 | 55–75 | 65–95 | 82–105 | 48–56 | 50-60 | 55–65 |
| AGPT/T125 | Stress ratio at 10 °C min. | TBR(3) | TBR | TBR | TBR | TBR | TBR | TBR |
| AGPT/T121 | Consistency 6% at 60 °C (Pa.s) min.(4) | 300 | 400 | 500 | 900 | 250 | 400 | 800 |
| AGPT/T121 | Stiffness at 15 °C (kPa) max. | 140 | 140 | NA(5) | NA | 180 | NA | 180 |
| AGPT/T121 | Stiffness at 25 °C (kPa) max. | NA | NA | 35 | 30 | NA | NA | NA |
| ATM-132 | Compressive limit at 70 °C, 2 kg (mm) min. | NA | NA | NA | NA | NA | 0.1 | 0.2 |
| AGPT/T108 | Segregation (%) max. | -8 to +8 | -8 to +8 | -8 to +8 | -8 to +8 | -8 to +8 | -8 to +8 | -8 to +8 |
| ATM-112 | Flash point (°C) min. | 250 | 250 | 250 | 250 | 250 | 250 | 250 |
| ATM-103 | Mass Change (%) | -0.6 to +0.6  | -0.6 to +0.6  | -0.6 to +0.6  | -0.6 to +0.6  | -0.6 to +0.6  | -0.6 to +0.6  | -0.6 to +0.6  |

Notes

1. Class S9R and S15R binders must be manufactured by the incorporation of crumb rubber derived from used vehicle tyres.
2. L series Brookfield is recommended together with spindle SC4-31, except in the case of S9R and S15R classes where spindle SC4-29 is recommended. The shear rate involved in determining viscosity by AS/NZS 2341.4 and ATM-111 must be calculated and recorded. ATM-111 has been retained in Table 8.1 to allow laboratories sufficient time to adopt AS/NZS 2341.4.
3. ‘TBR’ throughout = to be reported.
4. Consistency 6% at 60 °C of S10E and S35E must be determined using mould B (breakpoint of 5 mm and a test speed of 1.5 mm/s). Other grades must be tested using mould A (breakpoint of 10 mm and a test speed of 1 mm/s).
5. ‘NA’ throughout indicates that the property is considered not applicable for that PMB class.
6. S45R has been renamed to S15R

Table 8.2: Properties of Polymer Modified Binders for Asphalt Applications

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test method | ClassBinderproperty | A35P | A20E | A15E | A10E | A5E | A18R(1) |
| AS/NZS 2341.4 or ATM-111(2) | Viscosity at 165 °C (Pa.s) max.(2) | 1.1 | 0.6 | 0.9 | 1.1 | 0.9 | 6.2 |
| ATM-122 | Torsional recovery at 25 °C, 30 s (%) | 6–30 | 38–70 | 55–80 | 60–86 | 25-40 | 30-70 |
| AS 2341.18 | Softening point (°C) | 62–74 | 65–95 | 82–105 | 88–110 | 82-105 | 62-80 |
| AGPT/T125 | Stress ratio at 10 °C min. | TBR(3) | TBR | TBR | TBR | TBR | TBR |
| AGPT/T121 | Consistency 6% at 60 °C (Pa.s) min.(4) | 1000 | 500 | 900 | 1000 | 2500 | 1000 |
| AGPT/T121 | Stiffness at 25 °C (kPa) max. | 120 | 35 | 30 | 30 | NA | NA(5) |
| AGPT/T121 | Stiffness at 25 °C (kPa) min. | NA | NA | NA | NA | 90 | NA |
| ATM-132 | Compressive limit at 70 °C, 2 kg (mm) min. | NA | NA | NA | NA | NA | 0.1 |
| AGPT/T108 | Segregation (%) max. | -8 to +8 | -8 to +8 | -8 to +8 | -8 to +8 | -8 to +8 | -8 to +8 |
| ATM-112 | Flash point (°C) min. | 250 | 250 | 250 | 250 | 250 | 250 |
| ATM-103 | Mass Change (%) | -0.6 to +0.6 | -0.6 to +0.6 | -0.6 to +0.6 | -0.6 to +0.6 | -0.6 to +0.6 | -0.6 to +0.6 |

Notes

1. Class A18R binders must be manufactured by the incorporation of crumb rubber derived from used vehicle tyres.
2. L series Brookfield is recommended together with spindle SC4-31, except in the case of the A18R class where spindle SC4-29 is recommended. The shear rate involved in determining viscosity by AS/NZS 2341.4 and ATM-111 must be calculated and recorded. ATM-111 has been retained in Table 8.2 to allow laboratories sufficient time to adopt AS/NZS 2341.4.
3. ‘TBR’ throughout = to be reported.
4. Consistency 6% at 60 °C of all grades must be tested using mould A (breakpoint of 10 mm and a test speed of 1 mm/s).
5. ‘NA’ throughout indicates that the property is considered not applicable for that PMB class.

Table 8.3: Properties of Field-Produced Crumb Rubber Binders

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Property | Method | S9RF(1,2) | S15RF(1,2) | S18RF(1,2) | A27RF(3) |
| Nominal rubber concentration (%) |  | 9 | 15 | 18 | 25–30 |
| Rubber content by analysis (%) min. | AGPT/T142 | 7 | 13 | 16 | – |
| Torsional recovery (%) min. | ATM-122 | 15 | 25 | 30 | – |
| Softening point (°C) min. | AS 2341.18 | 50 | 55 | 62 | – |
| Consistency 6% at 60 °C (Pa.s)(4) | AGPT/T121 | Report | Report | Report | – |

Notes:

1. Specification for two grades of crumb rubber (see Table 8.4) available for either of the sealing classes.
2. For sealing grade field produced crumb rubber binders, sampling is to be untaken from the mixing vessel after digestion but prior to the addition of cutter oil. Samples must be free of diluents for subsequent testing to be meaningful. The agreed digestion period (at mixing temperature) must be completed before sampling.
3. ‘Dry mix’ asphalt is normally based on an asphalt mix design with the crumb rubber added at, typically, 25% crumb rubber in the total binder. Size 30 is normally used for the ‘Dry mix’ asphalt system.
4. Consistency 6% at 60 °C of all field produced crumb rubber binder grades must be tested using mould A (breakpoint of 10 mm and a test speed of 1 mm/s).

Crumb rubber used to the manufacture of crumb rubber binders must be:

1. processed from waste tyres generated in Australia;
2. processed by a supplier accredited with Tyre Stewardship Australia or another organisation approved by the Principal; and
3. free from cord, wire, fluff and other deleterious material.
4. meet the properties included in Table 8.4.

Table 8.4: Properties of Crumb Rubber

|  |  |  |  |
| --- | --- | --- | --- |
| Test | Method | Size 16 | Size 30 |
| Grading | AGPT/T143 |  |  |
| passing 2.36 mm | 100 | 100 |
| passing 1.18 mm | 80 min. | 100 |
| passing 600 µm | 10 max. | 60 min. |
| passing 300 µm  | – | 30 max. |
| Particle length (mm) max. | AGPT/T143 | 3 | 3 |
| Bulk density (kg/m3) | AGPT/T144 | Report | Report |
| Water content (%) max. | AGPT/T143 | 1 | 1 |
| Foreign materials – metallic iron (%) max. | AGPT/T143 | 0.1 | 0.1 |

# Frequency of Testing

The frequency of testing of PMBs and field produced crumb rubber binders must comply with the values specified in the following tables:

|  |  |
| --- | --- |
| Polymer Modified Binders: | Table 9.1 |
| Field-Produced Crumb Rubber Modified Binders: | Table 9.2  |

Table 9.1 Minimum Frequency of Testing of Polymer Modified Binders

|  |  |  |
| --- | --- | --- |
| Binder property | Polymer Modified Binders for Sprayed Sealing Applications | Polymer Modified Binders for Asphalt Applications |
| Viscosity at 165 °C (Pa.s)  | Each batch | Each batch |
| Torsional recovery at 25 °C, 30 s (%) | Each batch | Each batch |
| Softening point (°C) | Each batch | Each batch |
| Stress ratio at 10 °C | Monthly | Monthly |
| Consistency 6% at 60 °C (Pa.s) | 3-monthly(1) | 3-monthly |
| Stiffness at 15 °C (kPa) or Stiffness at 25 °C (kPa) | 3-monthly(1) | 3-monthly |
| Compressive limit at 70 °C, 2 kg (mm) | 3-monthly | 3-monthly |
| Segregation (%) | 3-monthly | 3-monthly |
| Flash point (°C) | Annually | Annually |
| Mass change (%) | Annually | Annually |

Notes:

1. For classes S10E, S15E and S20E, the minimum testing frequency is 1-monthly.

Table 9.2 Minimum Frequency of Testing Field-Produced Crumb Rubber Binders

|  |  |
| --- | --- |
| Property | Minimum testing frequency |
| Rubber content by analysis (%) | Weekly |
| Torsional recovery (%) | Weekly |
| Softening point (°C) | Weekly |
| Consistency 6% at 60 °C (Pa.s) | Weekly |

Annexure A: Summary of Hold Points, Witness Points and Records

The following is a summary of the Witness Points / Hold Points that apply to this specification and the Records that the Contractor must supply to the Principal to demonstrate compliance with this specification.

|  |  |  |  |
| --- | --- | --- | --- |
| **Paragraph**  | **Hold Point** | **Witness Point** | **Record** |
| 7.1 a) |  |  | Test Results |
| 7.1 b) |  |  | Delivery docket |

Amendment Record

|  |  |  |  |
| --- | --- | --- | --- |
| Amendment no. | Clauses amended | Action | Date |
| - | New specification | New | January 2020 |
| 1 | Table 8.1: addition of properties for S9R grade; S45R renamed to S15R; change to the way segregation and mass loss limits are expressed. | Substitution | June 2023 |
| Table 8.2: addition of properties for A18R and A5E grades; removal of A25E grade; modification of A35P properties to reflect changes in polymer sources; change to the way segregation and mass loss limits are expressed. | Substitution |
| Table 8.3: addition of properties for S9RF grade. | Substitution |
| Table 8.4: removal of properties for the maximum % of foreign materials other than iron. | Substitution |

|  |  |
| --- | --- |
| **Key** |  |
| Format | Change in format |
| Substitution | Old clause removed and replaced with new clause |
| New | Insertion of new clause |
| Removed | Old clauses removed |