Main Roads
Technical Standard

MRTS17

Bitumen

June 09

Queensland Government

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Bitumen

1 INTRODUCTION

This Technical Standard applies to the material requirements for bitumen for use in both sprayed sealing and asphalt applications for road construction, rehabilitation and maintenance.

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

This Technical Standard forms part of the Main Roads Specifications and Technical Standards Manual.

2 DEFINITION OF TERMS

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

Table 2 – Definition of Terms

Term	Definition
Auxiliary Storage Tank	Any tank that is neither a Primary Storage Tank nor a Secondary Storage Tank such as may be found at Supplier's regional bitumen supply depots.
Bitumen	Bituminous material obtained by processing the residue from the refining of naturally occurring crude petroleum.
Class 170 bitumen	Bitumen which has a viscosity at 60°C between 140 Pa.s and 200 Pa.s.
Class 320 bitumen	Bitumen which has a viscosity at 60°C between 260 Pa.s and 380 Pa.s.
Class 600 bitumen	Bitumen which has a viscosity at 60°C between 500 Pa.s and 700 Pa.s
Contractor's Storage Tank	A bitumen storage tank located at a Contractor's facility.
Manufacturer	An organisation which has the necessary plant and equipment to manufacture bitumen to this Standard. For supply only contracts, the Manufacturer shall be the Contractor.
Primary Storage Tank	The storage tank into which finished bitumen product is initially received within Australia, whether from an Australian refinery production process or from importation into Australia from an international refinery source.
Secondary Storage Tank	A storage tank into which bitumen has been transferred from a Primary Storage Tank.
Site	Where the bitumen is used (includes asphalt manufacturing plant).

3 REFERENCED DOCUMENTS

Table 3 lists documents referenced in this Technical Standard.

Table 3 – Referenced Documents

Reference	Title
AP-G41/08	Bituminous Materials Safety Guide – Austroads
AS 2008	Residual bitumen for pavements
AS 2341.2	Methods of testing bitumen and related roadmaking products – Sample preparation
AS 2341.7	Methods of testing bitumen and related roadmaking products – Determination of density using a density bottle
AS 2341.8	Methods of testing bitumen and related roadmaking products – Determination of matter insoluble in toluene

Reference	Title
AS 2341.10	Methods of testing bitumen and related roadmaking products – Determination of the effect of heat and air on a moving film of bitumen (rolling thin film oven (RTFO) test)
AS 2341.12	Methods of testing bitumen and related roadmaking products – Determination of penetration
AS 2341.14	Methods of testing bitumen and related roadmaking products – Determination of flashpoint of residual bitumen
AS 2475	Threaded hose connection fittings for bituminous materials
AS 2809.5	Road tank vehicles for dangerous goods
AS/NZS ISO 9001	Quality management systems – Requirements

4 STANDARD TEST METHODS

The standard test methods listed in Table 4 shall be used in this Technical Standard.

Further reference to test numbers and test descriptions is provided in Clause 4 of MRTS01 *Introduction to Technical Standards*.

Table 4 – Standard Test Methods

Property to be Tested	Method No.
Density	Q331 or AS 2341.7
Dynamic Viscosity (Vacuum Capillary Viscometer)	Q330 or AS 2341.2
Flash Point (Pensky-Martens Open Cup)	Q333 or AS 2341.14
Penetration	Q335 or AS 2341.12
Rolling Thin Film Oven Test	Q338 or AS 2341.10
Insolubles in Toluene	Q332 or AS 2341.8

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 Standards*.

The Witness Point applicable to this Standard is summarised in Table 5.1.

Table 5.1 – Witness Point

Clause	Witness Point
9.3.3	Sampling at the point of delivery

5.2 Conformance Requirements

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

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

6 MATERIAL

6.1 General

Bitumen shall comply with the property requirements of Table 6.1.

Table 6.1 – Bitumen Properties

Property	Test Method	Unit	Class 170		Class 320		Class 600	
			Min	Max	Min	Max	Min	Max
Viscosity at 60°C	Q330 or AS 2341.2	Pa.s	140	200	260	380	500	700
Viscosity at 135°C	Q330 or AS 2341.2	Pa.s	0.25	0.45	0.40	0.65	0.60	0.85
Flash Point	Q333 or AS 2341.14	°C	250	–	250	–	250	–
Penetration at 25°C	Q335 or AS 2341.12	pu	62	–	40	–	20	–
RTFO Viscosity Ratio	Q338 or AS 2341.10	%	–	300	–	300	–	300
Insolubles in Toluene	Q332 or AS 2341.8	%	–	1.0	–	1.0	–	1.0
Density at 15°C	Q331 or AS 2341.7	t/m³	tbr	–	tbr	–	tbr	–

tbr – to be recorded

6.2 Homogeneity

Bitumen shall be homogeneous and free from any inorganic matter other than that naturally present in crude petroleum.

6.3 Foaming

Bitumen shall not foam when heated to a temperature of 175ºC. The formation of a thin layer of bubbles on the surface of the bitumen shall not be regarded as foaming.

7 MANUFACTURE

Bitumen shall be manufactured or imported only by an approved Manufacturer.

An approved Manufacturer shall –

a) operate a quality system certified to AS/NZS ISO 9001 for product manufactured in Australia;

b) operate a quality system certified to ISO 9001 or equivalent for product manufactured outside Australia;

c) operate to an inspection and test plan acceptable to Transport and Main Roads for manufacturing and supplying bitumen which demonstrates compliance with this Standard. The inspection and test plan shall include testing of bitumen (especially bitumen stored at depots), analysis of results (including run charts) and a requirement for a copy of the results to be forwarded promptly to Transport and Main Roads; and

d) ensure material supplied from depots can be traced to the production batch and associated test report.

8 DELIVERY OF BITUMEN

8.1 General

The operators of all heating and transfer equipment shall be classified as competent for these tasks in accordance with the relevant industry standards and any procedures or other requirements defined in the Contractor's Safety Plan or in the Contract.

8.2 Handling

Where handling of bitumen occurs, the procedures to be used shall be consistent with safe handling practices which apply to bitumen-based products as defined in the Austroads *Bituminous Materials Safety Guide*, AP-G41/08.

8.3 Storage and Transport

Bitumen shall be stored and transported in purpose-built containers in such a way that contamination does not occur. Containers shall comply with the following Australian Standards and be fitted with apparatus for heating of the bitumen within appropriate limits –

a) bitumen sprayers and tankers – AS 2809.5; and

b) hose couplings – AS 2475.

If contamination is suspected, additional testing may need to be carried out to check for contamination.

If it is necessary to change the type or class of material in a container, the procedures within Section 9 of AP-G41/8 shall be used in such manner that the properties of the resultant stored product comply with the relevant Standard and the performance of the stored product is not adversely affected.

8.4 Heating

Where heating is required for purposes of transfer of bitumen between delivery vehicles and/or storage tanks, in no circumstances shall the temperature of the bitumen be permitted to rise above the temperatures in Table 8.4. The rate of increase in temperature shall not be allowed to exceed 30°C per hour.

Table 8.4 – Maximum Heating Temperatures

Class of Bitumen	Maximum Heating Temperature (°C)
170	190
320	195
600	200

Before any heating has commenced, at least 150 mm of bitumen shall cover the heating tubes at all points. Where necessary, the lower heating tube may be used on its own in order to comply with this requirement.

8.5 Transfer

During transfer of bitumen into and between storage and delivery vessels and into bitumen sprayers, the bitumen shall not be contaminated by other materials which affect its performance. As necessary, storage and delivery vessels, sprayers and hoses shall be flushed or cleaned with appropriate solvent before transfer of bitumen is commenced and residues from flushing and cleaning shall be removed.

8.6 Delivery Dockets

Delivery of bitumen to the Site shall be accompanied by a delivery docket giving at least the following information –

a) name of the Manufacturer;

b) place of manufacture;

c) location of depot source;

d) bitumen class;

e) production batch number; and

f) certification that production has been sampled and tested as stated in Clause 9 and the properties comply with Clause 6.

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

9 COMPLIANCE SAMPLING AND TESTING

9.1 General

Sufficient sampling and testing shall be carried out to ensure that the bitumen complies with the property requirements of Clause 6.

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. Subject to Clauses 10.1 and 10.2, product shall not be released from the point of manufacture for use on the Works unless it conforms to the specified requirements in Clause 6.1 when tested in accordance with Clause 9.2. Sampling and testing costs shall be borne by the Manufacturer and incorporated into the pricing for the product.

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 9.3.1 and Clause 9.3.2 or 9.3.3 as appropriate. The cost of testing shall be borne by the Contractor (eg. Where the project is using the MRS series, this cost is included in the appropriate MRS11 *Sprayed Bituminous Surfacing (Excluding Emulsion*) Item Number (5103, 5104, 5105 or 5106 as appropriate.))

9.2 Sampling and Testing at Point of Release from the Manufacturer

Sampling of bitumen shall be undertaken in accordance with the procedures defined in AS 2008, Appendix B (Sampling).

The maximum batch size shall comprise the discrete quantity of bitumen in the Manufacturer's storage tank. The bitumen in the storage tank shall represent a new batch when either –

a) bitumen is added to the storage tank; or

b) bitumen has not been added to the storage tank for a period of 14 days.

The minimum frequency of sampling and testing from Manufacturer's storage tanks shall be as stated in Table 9.2. In the event of any nonconformance being detected in any sample taken from a storage tank, additional tests shall be performed so that the sample is tested for other properties listed in Table 9.2, as appropriate.

Table 9.2 – Bitumen Supply Testing Schedule

Properties to be Tested	**Frequency of Testing**				
	Primary Storage Tank		**Secondary Storage Tank**		**Auxiliary Storage Tank***
	Each Batch	**12 Weekly**	**4 Weekly**	**12 Weekly**	**4 Weekly**
Viscosity at 60°C (Pa.s)	✓	✓	✓	✓	✓
Viscosity at 135°C (Pa.s)	✓	✓			
Density at 15°C (t/m³)		✓			
Flash Point (°C)		✓			
Penetration at 25°C (pu)	✓	✓		✓	
RTFO Viscosity Ratio (%)	✓	✓		✓	
Insolubles in Toluene (%)		✓			

*For tanks currently in service only (ie. above 150°C)

All test results shall be forwarded to Pavements and Materials Branch.

9.3 Sampling and Testing at the Point of Delivery

9.3.1 General

Point of delivery is where the product is transferred to the sprayer for hot sprayed sealing work and from the asphalt binder storage tank for asphalt production.

Sampling and testing shall be undertaken on the basis of a lot.

Sampling shall be undertaken in accordance with Clauses 9.3.2 and 9.3.3 as appropriate, and testing shall be undertaken in accordance with Clause 9.3.4.

The frequency of compliance sampling for each class of bitumen from each Manufacturer shall be at the normal level. A reduced frequency may be adopted after no nonconformances have occurred in four consecutive lots. A reduced level shall revert to normal frequency or a normal level shall revert to tightened frequency once a nonconforming sample has been detected. For tightened frequency, a normal level may be adopted once no nonconformances have occurred in two consecutive tested lots.

Two 1 L samples of bitumen shall be taken by the Contractor on each sampling occasion. The Contractor shall retain one of these samples and forward the other sample to the Administrator.

9.3.2 Sampling of Bitumen for Asphalt Works

A lot shall comprise the discrete quantity of bitumen in the Contractor's storage tank at the commencement of asphalt production. The bitumen in the storage tank shall represent a new lot when either –

a) bitumen is added to the storage tank; or

b) bitumen has not been added to the storage tank for a period of 14 days.

Compliance sampling shall be not less than the following –

a) Normal frequency Every fourth lot;

b) Reduced frequency Every tenth lot; and

c) Tightened frequency Every second lot.

9.3.3 Sampling of Bitumen for Sealing and Other Works

A lot shall consist of a homogeneous quantity of bitumen of the same class.

The maximum lot size for sampling of bitumen shall be –

a) Normal frequency 150 tonnes;

b) Reduced frequency 300 tonnes; and

c) Tightened frequency 60 tonnes

Sampling shall be undertaken before or during the transfer bitumen to sprayers Witness Point.

9.3.4 Testing and Limits

Testing of bitumen at the point of delivery shall be undertaken or arranged by the Contractor.

The testing undertaken shall be not less than every second sample taken from the lots. Samples shall be tested only for viscosity at 60°C (Pa.s), and assessed for conformance with the requirements of Clause 6.1. In the event of nonconformance being detected in the sample, additional tests shall be performed so that the sample is tested for other properties listed in Table 9.2, as appropriate.

All test results shall be forwarded to the Administrator and the Principal Advisor (Materials Testing), Pavements and Materials Branch.

Where testing for compliance and payment is specified at the point of delivery, any nonconformance shall be treated in accordance with Clause 10.

10 NONCONFORMANCE

10.1 General

A major nonconformance means a departure from stated properties for foaming, flashpoint or toluene insolubles. All other nonconformances shall be classified as minor.

All bitumen which is represented by samples from which a major nonconformance has been detected shall be rejected.

In the event of nonconformance being detected, the Contractor shall test the adjacent samples and undertake corrective action.

10.2 Bitumen Sampled by the Manufacturer

Bitumen for which a minor nonconformance has been detected shall not be delivered to Site unless approved by the Administrator.

10.3 Bitumen Sampled at the Point of Delivery

10.3.1 General

A lot of bitumen used at the Site which is represented by samples as taken under Clause 9.3.2 or Clause 9.3.3 as appropriate, for which a minor nonconformance has subsequently been detected may be assessed for utilisation with a reduced level of service based on the number of defects as determined in Clause 10.3.2.

10.3.2 Calculation of Defects for a Lot of Bitumen Delivered to Site

The number of defects in a lot of bitumen shall be calculated as the total number of defects in the sample representing that lot.

Calculation of defects for a lot of bitumen shall be determined in accordance with Table 10.3.2 based on variations from the specified properties listed in Table 6.1.

Table 10.3.2 – Schedule for Calculating Defects in a Bitumen Delivery Lot

Viscosity at 60°C (Pa.s)	Number of Defects †
Class 170	
from 135 to 96	1 defect for each 4 Pa.s, or part thereof, below 136 Pa.s
from 95 to 76	10 defects plus 1 defect for each 2 Pa.s, or part thereof, below 96 Pa.s
from 75 to 56	20 defects plus 1 defect for each 1 Pa.s, or part thereof, below 76 Pa.s
less than 56	40 defects plus 3 defects for each 1 Pa.s or part thereof, below 56 Pa.s
from 207 to 356	1 defect for each 2 Pa.s, or part thereof, above 206 Pa.s
Greater than 356	75 defects plus defect for each 1 Pa.s, or part thereof, above 356 Pa.s
Class 320	
from 251 to 222	1 defect for each 3 Pa.s, or part thereof, below 252 Pa.s
from 221 to 202	10 defects plus 1 defect for each 2 Pa.s, or part thereof, below 222 Pa.s
less than 202	20 defects plus 2 defects for each 1 Pa.s, or part thereof, below 202 Pa.s
from 393 to 592	1 defect for each 4 Pa.s, or part thereof, above 392 Pa.s
Greater than 592	50 defects plus 1 defect for each 2 Pa.s, or part thereof, above 592 Pa.s
Class 600	
from 483 to 409	1 defect for each 5 Pa.s, or part thereof, below 484 Pa.s
from 408 to 379	15 defects plus 1 defect for each 3 Pa.s, or part thereof, below 409 Pa.s
less than 379	25 defects plus 1 defect for each 2 Pa.s, or part thereof, below 379 Pa.s
from 724 to 1123	1 defect for each 10 Pa.s, or part thereof, above 723 Pa.s
Greater than 1123	40 defects plus 1 defect for each 5 Pa.s, or part thereof, above 1123 Pa.s

† Based on variations from the specified limits of Table 6.1.

10.3.3 Determination of Reduced Value

The percentage reduction in value of a lot of bitumen shall be equal to the number of defects determined in Clause 10.3.2.