Department of Transport and Main Roads

Technical Specification

Transport and Main Roads Specifications MRTS21 Bituminous Emulsion

July 2025

Queensland Government

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1 Introduction

This Technical Specification applies to the material requirements for conventional bituminous emulsions to be used in road construction, rehabilitation and maintenance. It does not cover the requirements for polymer modified bituminous emulsions.

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 as 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
Anionic emulsion	Bituminous emulsion in which the dispersed bitumen particles are negatively charged.
Bituminous emulsion	A liquid product in which bitumen is dispersed in a finely divided condition in water by means of emulsifying and stabilising agents.
Cationic emulsion	Bituminous emulsion in which the dispersed bitumen particles are positively charged.
Manufacturer	An organisation which has the necessary plant and equipment to manufacture bituminous emulsion to this Technical Specification. For supply only contracts, the Manufacturer shall be the Contractor.

3 Referenced documents

Table 3 lists documents referenced in this Technical Specification.

Table 3 – Referenced documents

Reference	Title
AP-G41/15	*Bituminous Materials Safety Guide* - Austroads
AS 1160	*Bituminous emulsions for the construction and maintenance of pavements*
AS 2341.25	*Methods of testing bitumen and related roadmaking products, Method 25: Determination of consistency*
AS 2341.28	*Methods of testing bitumen and related roadmaking products, Method 28: Determination of stone coating ability and water resistance*
AS 2341.29	*Methods of testing bitumen and related roadmaking products, Method 29: Determination of breaking behaviour by setting time*
AS 2341.9	*Methods of testing bitumen and related roadmaking products, Method 9: Determination of water content (Dean and Stark)*
AS 2475	*Threaded hose connection fittings for bituminous materials*
AS 2809.5	*Road tank vehicles for dangerous goods – Tankers for bitumen-based products*

Reference	Title
AS/NZS 2341.22	*Methods of testing bitumen and related roadmaking products, Method 22: Determination of particle charge*
AS/NZS 2341.23	*Methods of testing bitumen and related roadmaking products, Method 23: Determination of residue from evaporation*
AS/NZS 2341.24	*Methods of testing bitumen and related roadmaking products, Method 24: Calculation of non-aqueous volatiles content (by difference)*
AS 2341.26	*Methods of testing bitumen and related roadmaking products, Method 26: Determination of sieve residue*
AS 2341.27	*Methods of testing bitumen and related roadmaking products, Method 27: Determination of sedimentation*
AS/NZS ISO 9001	*Quality management systems - Requirements*
MRTS17	*Bitumen and Multigrade Bitumen*
MRTS19	*Cutter Oils*

4 Standard test methods

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

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

Table 4 – Standard test methods

Property to be Tested	Method No.
Particle Charge	AS/NZS 2341.22
Residue from evaporation	AS/NZS 2341.23
Water Content	AS 2341.9
Non-aqueous Volatiles Content	AS/NZS 2341.24
Consistency (Engler)	AS 2341.25
Sieve Residue	AS 2341.26
Sedimentation	AS 2341.27
Stone Coating Ability and Water Resistance	AS 2341.28
Setting Time	AS 2341.29

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 summarised in Table 5.1. There are no Hold Points or Milestones defined.

Table 5.1 – Hold Points, Witness Points and Milestone

Clause	Hold Point	Witness Point	Milestone
9.3.1		1. Sampling at the Site	

5.2 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

The grades of bituminous emulsion covered by this Technical Specification are as follows:

a) 60% Binder Content Grades:
   i. Anionic Rapid Setting (ARS)
   ii. Anionic Medium Setting (AMS)
   iii. Anionic Slow Setting (ASS)
   iv. Cationic Rapid Setting (CRS)
   v. Cationic Medium Setting (CMS)
   vi. Cationic Slow Setting (CSS), and
   vii. Cationic Aggregate Mixing (CAM).

b) High Binder Content Grades:
   i. Cationic Rapid Setting (CRS), and
   ii. Cationic Aggregate Mixing (CAM).

6.2 Bitumen, cutter oil, flux oil

Bitumen, cutter oil and flux oil used in the manufacture of bituminous emulsion shall comply with the Technical Specifications listed in Table 6.2.

Table 6.2 – Constituent materials specifications

Material	Technical Specification
Bitumen	MRTS17 *Bitumen and Multigrade Bitumen*
Cutter Oil and Flux Oil	MRTS19 *Cutter Oils*

6.3 Other ingredients

All other ingredients used in the manufacture of emulsion including emulsifying and stabilising agents, shall have no known deleterious effect on the properties of the residual binder.

6.4 Emulsion properties

The properties of the bituminous emulsion with 60% binder content shall comply with the requirements of Table 6.4(a), while bituminous emulsion with high binder content shall comply with the requirements of Table 6.4(b).

Table 6.4(a) – Bituminous emulsion properties (60% binder content)

Property	Test Method	Emulsion Grade						
		ARS	**AMS**	**ASS**	**CRS**	**CMS**	**CSS**	**CAM**
Particle Charge	AS/NZS 2341.22	Negative	Negative	Negative	Positive	Positive	Positive	Positive
Residue from evaporation (%)	AS/NZS 2341.23	60 min	60 min	60 min	60 min	60 min	60 min	60 min
Water Content (%)	AS 2341.9	40 max	40 max	39 max	40 max	40 max	39 max	34 max
Non-aqueous Volatiles Content (%)	AS/NZS 2341.24	2 max	2 max	2 max	2 max	2 max	2 max	6 – 15
Consistency at 25°C (Degrees Engler)	AS 2341.25	3.5 to 10.0	3.5 to 10.0	3.5 to 10.0	3.5 to 10.0	3.5 to 10.0	4.0 to 10.0	–
Sieve Residue (%)	AS 2341.26	0.15 max	0.15 max	0.15 max	0.15 max	0.15 max	0.15 max	0.15 max
Sedimentation (%)	AS 2341.27	3 max	3 max	3 max	3 max	3 max	3 max	3 max
Stone Coating Ability and Water Resistance:	AS 2341.28							
Dry Aggregate (%)		–	–	–	–	–	–	60 min
Damp Aggregate (%)		–	–	–	–	–	–	80 min
Setting Time (minutes)	AS 2341.29	3 max	4 to 7	8 min	3 max	4 to 7	8 min	–

min – Minimum, max – Maximum

Table 6.4(b) – Bituminous emulsion properties (high binder content)

Property	Test Method	Emulsion Grade	
		CRS	CAM
Particle Charge	AS/NZS 2341.22	Positive	Positive
Residue from evaporation (%)	AS/NZS 2341.23	67 min	67 min
Non-aqueous Volatiles Content (%)	AS/NZS 2341.24	3 max	5 min
Sieve Residue (%)	AS 2341.26	0.25 max	0.25 max
Stone Coating Ability and Water Resistance: Dry Aggregate (%) Damp Aggregate (%)	AS 2341.28	 – –	 60 min 80 min
Setting Time (minutes)	AS 2341.29	3 max	–

6.5 Age

Bituminous emulsion shall not be more than 90 days old at the date of application unless such product is sampled and tested for compliance with the property requirements of Table 6.4(a) or Table 6.4(b), as appropriate.

6.6 Storage

Storage of bituminous emulsion shall comply with the following:

a) the emulsion shall be protected against freezing conditions, and

b) where the emulsion is stored in drum containers, the containers shall be rotated end over end at least 6 times at intervals not exceeding 14 days.

7 Manufacture

Bituminous emulsion shall be manufactured only by an approved Manufacturer.

An approved Manufacturer shall:

a) Operate a quality system certified to AS/NZS ISO 9001.

b) Operate to an inspection and test plan acceptable to Transport and Main Roads for manufacturing and supplying bituminous emulsion which demonstrates compliance with this Standard. The inspection and test plan shall include testing of bituminous emulsion (especially emulsion 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

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

8 Delivery of bituminous emulsion

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 bituminous emulsion 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-G41/15.

8.3 Storage and transport

Bituminous emulsion 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 emulsion 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-G41/15 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 bituminous emulsion between delivery vehicles and/or storage tanks, in no circumstances shall the temperature of the bituminous emulsion be permitted to rise above those in Table 8.4. The material shall be circulated while heating, with the rate of temperature increase not to exceed 15°C per hour.

Table 8.4 – Maximum heating temperatures

Type of Bituminous Emulsion	Maximum Heating Temperature (°C)
60% Binder Content	60
High Binder Content	90

8.5 Transfer

During transfer of bituminous emulsion into and between storage and delivery vessels and into bitumen sprayers, the emulsion 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 bituminous emulsion is commenced and residues from flushing and cleaning shall be removed.

8.6 Delivery dockets

Delivery of bituminous emulsion 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) date of manufacture

d) location of depot source

e) emulsion grade

f) production batch number, and

g) 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

Compliance sampling and testing shall be undertaken on the basis of a lot. Sufficient sampling shall be carried out so that subsequent testing ensures that the emulsion complies with the property requirements of Clause 6.

9.2 Sampling and testing by the manufacturer

Sampling of emulsion shall be undertaken in accordance with the procedures defined in AS 1160, Appendix A (Sampling).

The minimum frequency of sampling and testing from production plant and depots to be performed by the Manufacturer shall be as stated in Table 9.2(a) or Table 9.2(b), as appropriate. In the event of any nonconformance being detected in any sample, additional tests shall be performed so that the sample is assessed in relation to other properties listed in Table 6.4(a) or Table 6.4(b), as appropriate.

Table 9.2(a) – 60% Bituminous emulsion supply testing schedule

Properties to be Tested	Frequency of Testing			
	Production Plant		Depots	
	Every Batch	Every 10th Batch	Bulk	Drums
			Weekly †[1]	3 Monthly
Particle Charge	✓	✓		
Residue from evaporation (%)	✓	✓		
Water Content (%)		✓		
Non-aqueous Volatiles Content (%)		✓		
Consistency at 25°C †[2] (Degrees Engler)	✓	✓		
Sieve Residue (%)	✓	✓	✓	✓
Sedimentation (%)	✓	✓	✓	
Stone Coating Ability and Water Resistance (%) †[3]		✓		
Setting Time (minutes) †[2]	✓	✓		

†[1] If stored longer than 1 week
†[2] Excluding CAM grade
†[3] CAM grade only

Table 9.2(b) – High binder emulsion supply testing schedule

Properties to be Tested	Frequency of Testing			
	Production Plant		Depots	
	Every Batch	Every 10th Batch	Bulk	Drums
			Weekly †[1]	3 Monthly
Particle Charge	✓	✓		
Residue from evaporation (%)	✓	✓		
Non-aqueous Volatiles Content (%)		✓		
Sieve Residue (%)	✓	✓	✓	✓
Stone Coating Ability and Water Resistance (%) †[3]		✓		
Setting Time (minutes) †[2]	✓	✓		

†[1] If stored longer than 1 week
†[2] Excluding CAM grade
†[3] CAM grade only

9.3 Sampling and testing at the point of delivery to site

9.3.1 General

Compliance sampling shall be undertaken on a lot basis.

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

The maximum lot size for sampling and testing of bituminous emulsion shall be as stated in Table 9.3.1.

Table 9.3.1 – Maximum lot size

Testing frequency	Maximum lot size (tonnes)
Normal	100
Reduced	200
Tightened	40

Random sampling of emulsion for compliance testing shall be undertaken before the bitumen is transferred to sprayers. **Witness Point 1**

9.3.2 Testing

Compliance testing undertaken by the Administrator shall be not less than every second sample taken from the lots.

Samples shall be tested only for apparent bitumen content and sieve residue. In the event of any nonconformance being detected in the sample, additional tests shall be performed to assess that sample in relation to other properties listed in Table 6.4(a) or Table 6.4(b), as appropriate.

The frequency for compliance testing for each class from each manufacturer shall be conducted at the normal level. A reduced frequency may be adopted after no nonconformances have occurred in 4 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 2 consecutive tested lots.

10 Nonconformance

10.1 General

A major nonconformance means a departure from specified properties for particle charge or sieve residue. All other nonconformances shall be classified as minor.

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

10.2 Emulsion sampled by manufacturer

Bituminous emulsion from which a minor nonconformance has been detected shall not be delivered to the Site unless it has been established that such nonconformance shall not materially affect the performance of the product. All relevant documentation used in this process shall be made available to the Administrator and shall be included in the quality records.

10.3 Emulsion sampled on delivery to site

10.3.1 General

A lot of bituminous emulsion used at the Site which is represented by samples as taken under Clause 9.3.1 from 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 10.4.

10.3.2 Calculation of defects for a lot of emulsion delivered to site

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

Calculation of defects for a lot of bituminous emulsion shall be determined in accordance with Table 10.3.2 based on variations from the specified properties listed in Table 6.4(a) or Table 6.4(b), as appropriate.

Table 10.3.2 – Schedule for calculating defects in bituminous emulsion delivery lot

Property	Variations †	No. of Defects
Water Content (%)	Each 0.4%, or part thereof, outside the limit	1
Non-aqueous Volatiles Content (%):		
All grades excepting CAM	Each 0.1% outside the limit	5
CAM grade	Each 0.1% outside the limit	1
Stone Coating Ability and Water Resistance (%)	Each 1% outside the limit for each of dry aggregate and damp aggregate	1
Consistency at 25°C (Degrees Engler)	Each 0.1°E below the limits	3
	Each 0.1°E above the limits	1
Setting Time (minutes):		
ARS and CRS grades	Each 0.25 minutes above the limit	4
AMS and CMS grades	Each 0.25 minutes outside the limits	2
ASS and CSS grades	Each 0.25 minutes below the limit	2

† Outside the property limits of Table 6.4(a) and Table 6.4(b), as appropriate.

10.3.3 Determination of reduced value

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

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