WAKA KOTAHI
NZ TRANSPORT AGENCY

NZTA M01: 2022

SPECIFICATION FOR BITUMEN

New Zealand Government

1 SCOPE

This specification sets out the physical characteristics for bitumen used for pavements in New Zealand. It defines the minimum criteria that bitumens manufactured in New Zealand, bitumens imported into New Zealand and bitumens used in road pavement construction must meet.

2 RELATED DOCUMENTS

2.1 Waka Kotahi Documents

(a)	NZTA M01-A	Specification for Performance-Graded Asphalt Binder
(b)	NZTA Q05	Specification for Managing Bitumen Quality
(c)	NZTA T13	Durability Test Method for Bitumen

2.2 American Society for Testing and Materials

(a)	ASTM D5	Standard Test Method for Penetration of Bituminous Materials
(b)	ASTM D70	Density of Semi-Solid Bituminous Materials (Pycnometer Method)
(c)	ASTM D92	Flash and Fire Points by Cleveland Open Cup Tester
(d)	ASTM D113	Standard Test Method for Ductility of Bituminous Materials
(e)	ASTM D140	Standard Practice for Sampling Bituminous Materials
(f)	ASTM D664	Standard Test Method for Acid Number of Petroleum Products by Potentiometric Titration
(g)	ASTM D2042	Standard Test Method for Solubility of Asphalt Materials in Trichloroethylene
(h)	ASTM D2170	Standard Test Method for Kinematic Viscosity of Asphalts (Bitumens)
(i)	ASTM D2171	Standard Test Method for Viscosity of Asphalts by Vacuum Capillary Viscometer
(j)	ASTM D2872	Effect of Heat and Air on a Moving Film of Asphalt (Rolling Thin-Film Oven Test)
(k)	ASTM D3230	Standard Test Method for Salts in Crude Oil (Electrometric Method)
(l)	ASTM D4311	Standard Practice for Determining Asphalt Volume Correction to a Base Temperature
(m)	ASTM D7175	Determining the Rheological Properties of Asphalt Binder Using a Dynamic Shear Rheometer.

2.3 Standards New Zealand

(a)	NZS ISO/IEC 17025	General Requirements for the Competence of Testing and Calibration Laboratories
(b)	AS/NZS ISO 9001	Quality Systems – Requirements
(c)	AS/NZS 2341.2	Determination of Dynamic Viscosity by Vacuum Capillary Viscometer
(d)	AS 2341.8	Determination of Matter Insoluble in Toluene
(e)	AS/NZS 2341.10	Determination of the Effect of Heat and Air on a Moving Film of Bitumen

3 MATERIALS AND MANUFACTURE

The binder shall be derived from crude petroleum oil. The bitumen must be homogenous, storage stable and free of water and deleterious materials. It shall not foam when heated to 175°C. The formation of a thin layer of bubbles is not considered to be foaming.

4 QUALITY SYSTEM

The bitumen supplier shall establish, implement and maintain a quality system in accordance with the requirements of AS/NZS ISO 9001. The quality system shall be certified and regularly audited by a JAS-ANZ registered agency

The bitumen supplier shall develop and maintain a quality plan that describes the specific processes for inspection and testing, acceptance/rejection criteria, details of proposed methods and other quality-related issues. It shall describe how the requirements of this specification will be met at all times and how evidence demonstrating this compliance is provided and maintained. As a minimum standard the requirements of NZTA Q05 shall form the basis of the systems and procedures used to provide assurance that bitumen complying with this specification is supplied.

All sampling and testing to demonstrate compliance with this specification shall be carried out by a laboratory accredited to NZS ISO/IEC 17025.

5 APPROVAL OF BITUMEN

All bitumen manufactured in New Zealand or imported for use in road pavements shall be subject to an approval process as specified by NZTA Q05. The approval is based on the refining process and crude oil feedstock. An approval which shall be valid for five years may be granted to an entity or organisation following submission of all the information listed below. Applications shall be made to the Waka Kotahi Principal Surfacings Engineer and may be granted at the sole discretion of the Waka Kotahi Lead Advisor Pavements.

Applications for approval shall contain the information required by NZTA Q05 clause 4 and the testing information required by Table 5.1 below.

Table 5.1: Minimum testing information required for bitumen approval submission

Property		Test Method	Requirement
Penetration at 25° C	(1/10 mm)	ASTM D5	Report
Density at 25°C	(kg/m³)	ASTM D70	Report
Dynamic Viscosity at 60° C[a]	(Pa.s)	ASTM D2171	Report
Kinematic Viscosity at 135° C	(mm²/s)	ASTM D2170	Report
Total Acid Number	(mg/g)	ASTM D664	Report
Durability	(MPa)	NZTA T13	Report
Salt Content	(mg/kg or PTB)	ASTM D3230	Report
Rheological Properties at 64° C		ASTM D7175	
Complex Modulus[b] G*	(kPa)		Report
Phase Angle δ	(°)		Report
Flash Point	(°C)	ASTM D92	218 minimum
Solubility: Trichloroethylene, or	(%)	ASTM D2042, or	99.5 minimum
Toluene	(%)	AS/NZS 2341.8	99.0 minimum
Rolling Thin-Film Oven:		ASTM D2872 or AS/NZS 2341.10	
Retained Penetration (of original, minimum) at 25° C	(%)	ASTM D5	50 minimum
Mass Change	(%)	ASTM D2872	-1.000 - 1.000
Ductility at 25° C	(m)	ASTM D113	0.60 minimum
Complex Modulus[b]/sine of phase angle at 64° C	(G*/sinδ)	ASTM D7175	Report

Notes:

(a) Dynamic viscosity at 60°C measurements shall be carried out using the Asphalt Institute design capillary tubes as specified in Table 6.2 for the appropriate grade.

(b) Complex modulus to be determined at a shear rate of 10rad/s.

Written application for approval including all the information required above shall be made to the Waka Kotahi Principal Surfacings Engineer at pavements@nzta.govt.nz. This will be considered by the Lead Advisor Pavements and, based on the submitted information, track record for the bitumen and any other relevant information, a decision to award or deny approval will be made at the absolute discretion of the Lead Advisor Pavements.

6 BITUMEN QUALITY

All manufactured batches or shipments of bitumen shall comply with the requirements of Table 5.1.

Samples shall be taken in accordance with ASTM D140 or equivalent method recognised by Waka Kotahi.

All bitumens used for road pavements construction, supplied or blended by New Zealand-based bitumen blending facilities shall meet all the requirements of Table 6.1 or M01-A specification for the grade supplied. Frequency of testing shall be at least one test per grade supplied following delivery of a shipment into a bulk blending facility. All bitumen handling facilities shall be operated under a registered AS/NZS ISO 9001 compliant quality assurance system.

Table 6.1: Requirements for Bitumen

Property	Test Method	Grade				
		40/50	60/70	80/100	130/150	180/200
Penetration at 25° C (1/10 mm)	ASTM D5	40 - 50	60 - 70	80 - 100	130 - 150	180 - 200
Density at 25° C (kg/m^3)	ASTM D70	Report				
Dynamic Viscosity[a] 60° C, min. (Pa.s)	ASTM D2171	330	190	115	58	36
Kinematic Viscosity 135° C (mm^2/s)	ASTM D2170	600-1150	360-850	300-650	190-450	140-350
Flash Point (°C)	ASTM D92	218 minimum				
Solubility: Trichloroethylene, or (%)	ASTM D2042, or	99.5 minimum				
Toluene (%)	AS/NZS 2341.8	99.0 minimum				
Rolling Thin-Film Oven[b]:	ASTM D2872	-				
Retained Penetration (minimum) (%)	ASTM D5	45	50			
Mass Change (%)	ASTM D2872	-1.000 – 1.000				
Ductility at 25° C (minimum) (m)	ASTM D113	0.60				
Durability (maximum) (MPa)	NZTA T13	Report		100		

Notes:

(a) Dynamic viscosity at 60° C measurements shall be carried out using the Asphalt Institute design capillary tubes as specified in Table 6.2 for the appropriate grade

(b) Either ASTM D2872 or AS/NZS 2341.10 may be used for the Rolling Thin-Film Oven test. These two methods return slightly different results.

Table 6.2: Asphalt Institute Capillary Viscometers for Bitumen Grades

Bitumen Grade	Asphalt Institute Tube and Bulb
40/50	AI Size 100 bulb B
60/70	AI Size 100 bulb B
80/100	AI Size100 bulb C
130/150	AI Size 50 bulb C
180/200	AI Size 50 bulb C

7 BITUMEN VOLUME CORRECTION

Where bitumen quantities are to be converted from a hot or cold volume to mass (or vice versa) the factors of ASTM D4311 Table 1, column A shall be used.

8 APPENDIX: TEST METHOD EQUIVALENCIES

The table below lists test methods that are functionally equivalent but published by different organisations. For the purposes of assessing bitumen test results from non-New Zealand refineries and laboratories, these equivalent test methods are acceptable for use.

Table 8.1: List of Equivalent Test Methods

Test	Standard Method	Equivalent methods
Penetration of Bituminous Materials	ASTM D5	AASHTO T 49
Density	ASTM D70	AASHTO T 228
Flash and fire points by Cleveland open cup	ASTM D92	AASHTO T 48
Sampling asphalt materials	ASTM D140	AASHTO R 66
Solubility of bituminous materials	ASTM D2042	AASHTO T 44
Kinematic Viscosity	ASTM D2170	AASHTO T 201
Dynamic Viscosity	ASTM D2171	AASHTO T 202
Effect of heat and air (RTFOT)	ASTM D2872	AASHTO T 240
Rheological properties using dynamic shear rheometer	ASTM D7175	AASHTO T 315