



Oils for reducing the viscosity of bituminous binders for pavements



AS 3568:2020

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- Australian Institute of Petroleum
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- Austroads
- Department of Transport (Vic)
- National Association of Testing Authorities Australia

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Preface

This Standard was prepared by the Australian Members of Joint Standards Australia/Standards New Zealand Committee CH-025, Bitumen and Related Products (for Roadmaking) to supersede AS 3568—1999, *Oils for reducing the viscosity of residual bitumen for pavements*.

The objective of this Standard is to specify the properties of hydrocarbon oils used to reduce the viscosity of bitumen and polymer modified binders (PMBs) when they are used in pavement construction.

This revision of the Standard was undertaken based on research conducted in Austroads Project No. APT2063, *Key properties of cutters for optimal sprayed seal performance*, the outcomes of which are published in Austroads Report No. AP-T344-19.

The major changes in this edition are as follows:

- (a) Requirements for the properties of cutter oil and high flash point cutter have been revised to include test properties relating to the performance of the oils in pavement construction. Requirements for aniline point, aromatic content, fluidity and water content have been removed and methods used to determine flash point and density at 15 °C have been updated so as to be consistent with the *Australian Code for the Transport of Dangerous Goods by Road and Rail* and also with laboratory practice.
- (b) An option to use certified Jet A-1 aviation fuel as cutter oil has been added.
- (c) Requirements for flux oil have been removed as they have been replaced by those of diesel which are covered by laws in Australia and New Zealand.
- (d) References to heavy flux oil have been removed as this material is no longer used in pavement construction.

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NOTES

Australian Standard®

Oils for reducing the viscosity of bituminous binders for pavements

1 Scope

This Standard sets out the requirements for hydrocarbon oils, derived from refined crude petroleum, to be used for reducing the viscosity of bituminous binders in sprayed sealing work and the preparation of bituminous cold mixes.

WARNING — THE USE OF THIS STANDARD MAY INVOLVE HAZARDOUS MATERIALS, OPERATIONS AND EQUIPMENT. THIS STANDARD DOES NOT PURPORT TO ADDRESS ALL OF THE SAFETY ISSUES ASSOCIATED WITH ITS USE. IT IS THE RESPONSIBILITY OF THE USER OF THIS STANDARD TO ESTABLISH APPROPRIATE SAFETY AND HEALTH PRACTICES, AND TO DETERMINE THE APPLICABILITY OF REGULATORY LIMITATIONS PRIOR TO USE.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements.

NOTE Documents referenced for informative purposes are listed in the Bibliography.

AS 2106.2, *Methods for the determination of the flash point of flammable liquids (closed cup), Part 2: Determination of flash point — Pensky-Martens closed cup method*

AS/NZS 2106.1, *Methods for the determination of the flash point of flammable liquids (closed cup), Part 1: Abel closed cup method*

ISO 13736, *Determination of flash point — Abel closed-cup method*

ASTM D86, *Standard test method for distillation of petroleum products and liquid fuels at atmospheric pressure*

ASTM D93, *Standard test methods for flash point by Pensky-Martens closed cup tester*

ASTM D445, *Standard test method for kinematic viscosity of transparent and opaque liquids (and calculation of dynamic viscosity)*

ASTM D1298, *Standard test method for density, relative density, or API gravity of crude petroleum and liquid petroleum products by hydrometer method*

ASTM D4052, *Standard test method for density, relative density, and API gravity of liquids by digital density meter*

DEF STAN 91-091, *Turbine fuel, kerosene type, Jet A-1; NATO Code: F-35: Joint Service Designation: AVTUR*

IP 170, *Determination of flash point — Abel closed-cup method*

JIG, *Aviation fuel quality requirements for jointly operated systems (AFQRJOS)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

bitumen

bituminous material obtained by processing the material obtained from the refining of naturally occurring crude petroleum

3.2**bituminous binder**

material which contains bitumen, including bitumen and polymer modified binders

3.3**cold mix**

mixture of bituminous binder and aggregate, with or without added mineral filler, produced warm or cold in a mixing plant, and delivered in a workable condition suitable for stockpiling, and spreading and compaction

3.4**cutter oil**

light petroleum distillate added to a bituminous binder to temporarily reduce its viscosity

Note 1 to entry: Cutter oils are typically lost from sprayed seals over a period of months.

3.5**flux oil**

petroleum distillate used to reduce the viscosity of a bituminous binder over a longer period than cutter oil or high flash point cutter

3.6**high flash point cutter**

light petroleum distillate similar to cutter oil which has a higher flash point than cutter oil

3.7**may**

indicates the existence of an option

3.8**polymer modified binder****PMB**

bituminous binder produced by modifying bitumen with a natural or synthetic polymer, or crumb rubber

3.9**shall**

indicates that a statement is mandatory

3.10**should**

indicates a recommendation

3.11**sprayed sealing work**

work that includes priming, initial sealing and sealing of pavements using bituminous binders

4 Properties

4.1 General

The properties of cutter oil shall either—

- (a) conform with the requirements of [Table 1](#) when determined in accordance with the methods of test specified in [Table 1](#); or
- (b) conform with the requirements for Jet A-1 aviation fuel in DEF STAN 91-091 or JIG AFQRJOS.

The properties of high flash point cutter shall conform with the requirements of [Table 1](#) when determined in accordance with the methods of test specified in [Table 1](#).

Table 1 specifies five different test methods for determining the flash point of cutter oil and high flash point cutter. Each method lists a range of flash point temperatures at which oils may be tested. Flash point tests shall be conducted using a method of test that is applicable to the sample being tested.

Requirements for the properties of flux oil are not covered in this Standard.

NOTE Properties of flux oil (diesel) are covered in the following:

- (a) In Australia: *Fuel Quality Standards Act 2000* (Cth) and *Fuel Quality Standards (Automotive Diesel) Determination 2019* (Cth).
- (b) In New Zealand: *Engine Fuel Specifications Regulations 2011* (NZ).

Table 1 — Properties of cutter oil and high flash point cutter

Property	Requirements				Method of test
	Cutter oil		High flash point cutter		
	Min.	Max.	Min.	Max.	
Appearance	Clean, bright and visually free from solid matter and undissolved water at ambient temperature				—
Flash point (°C)	38	—	61.5	—	AS 2106.2; or AS/NZS 2106.1; or ASTM D93; or IP 170; or ISO 13736
Distillation range					
Initial boiling point (IBP) (°C)	140	—	140	—	ASTM D86
Final boiling point (FBP) (°C)	—	300	—	300	
Viscosity at 40 °C (mPa.s); or	0.5 (Note 1)	2.0 (Note 1)	0.5 (Note 1)	2.0 (Note 1)	ASTM D445
Viscosity at 40 °C (mm ² /s)	0.7 (Note 2)	2.5 (Note 2)	0.7 (Note 2)	2.5 (Note 2)	
Density at 15 °C (kg/m ³)	Report				ASTM D1298; or ASTM D4052
NOTE 1 Specified limit when viscosity at 40 °C result is reported in dynamic viscosity units (i.e. mPa.s).					
NOTE 2 Specified limit when viscosity at 40 °C result is reported in kinematic viscosity units (i.e. mm ² /s).					

4.2 Reporting of viscosity at 40 °C

Viscosity at 40 °C test results shall be reported in either dynamic viscosity units (i.e. mPa.s) or kinematic viscosity units (i.e. mm²/s).

ASTM D445 specifies a method of test for determining viscosity at 40 °C in kinematic viscosity units (i.e. mm²/s). Where required, to convert these units into dynamic viscosity units the following equation shall be used:

$$\eta = \frac{v \times \rho \times 10^{-3}}{1 + f(T - 15)}$$

where

η = viscosity in dynamic viscosity units (mPa.s)

v = viscosity in kinematic viscosity units (mm²/s)

- ρ = measured oil density at 15 °C (kg/m³)
- f = oil coefficient of expansion (°C⁻¹) = 0.00099 °C⁻¹ for kerosene-type solvents
- T = viscosity test temperature (°C)

4.3 Miscibility

Cutter oil, high flash point cutter and flux oil shall be completely miscible with bitumen. No precipitation shall occur when mixed with a bituminous binder.

5 Sampling

Oils shall be sampled so as to obtain a representative sample of the larger quantity of oil from which the sample is obtained.

NOTE The methods described in ASTM D4057 for obtaining representative samples may be used.

6 Labelling

Samples shall be firmly packed for transport to the testing laboratory. They shall be clearly identified by markings on the body of the container.

The following information shall be shown on the container or label:

- (a) Product name or description.
- (b) Identification mark or batch number.
- (c) Date and time of sampling.
- (d) Supplier.
- (e) Place of sampling.
- (f) Quantity of material represented by sample where known.
- (g) Type and identifying number of container or vehicle from which the sample was taken.
- (h) Name of the sampler.

Bibliography

Austroads. *Relationships between cutter oil properties and sprayed seal performance*.
Report No. AP-T344-19, 2019

ASTM D4057, *Standard Practice for Manual Sampling of Petroleum and Petroleum Products*

Engine Fuel Specifications Regulations 2011 (NZ)

Fuel Quality Standards Act 2000 (Cth)

Fuel Quality Standards (Automotive Diesel) Determination 2019 (Cth)

National Transport Commission. *Australian Code for the Transport of Dangerous Goods by Road and Rail*

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