Australian Standard™

Oils for reducing the viscosity of residual bitumen for pavements

This Australian Standard was prepared by Committee CH/25, Bitumen and Related Products (for Roadmaking). It was approved on behalf of the Council of Standards Australia on 1 January 1999 and published on 5 March 1999.

The following interests are represented on Committee CH/25:

ARRB Transport Research

Australian Asphalt Pavement Association

Australian Chamber of Commerce and Industry

AUSTROADS

Bureau of Steel Manufacturers of Australia

NZ Bitumen Contractors Association

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PREFACE

This Standard was prepared by the Standards Australia Committee CH/25, Bitumen and Related Products (for Roadmaking), to supersede AS 3568—1989.

The objective of this Standard is to provide specifiers and users of oils for the reduction of the viscosity of residual bitumen for pavements with the requirements for hydrocarbon oils derived from refined crude oil.

This revision of the Standard was undertaken to review the technical content as well as to incorporate changes to style, format and expression in accordance with current Standard Australian practice. In this revision some of the methods of test specified in Tables 1 and 2 have been updated to Australian methods, minor editorial corrections have been made to the document and requirements for high flashpoint cutter oil added to Table 1.

This Standard is applicable to sprayed work and to classification of oils used in the preparation of bituminous cold mix and fluxed asphalt.

CONTENTS

STANDARDS AUSTRALIA

Australian Standard

Oils for reducing the viscosity of residual bitumen for pavements

1 SCOPE This Standard sets out the requirements for hydrocarbon oils, derived from refined crude oil, to be used for reducing the viscosity of bitumen in sprayed work and in the preparation of bituminous cold mixes and fluxed asphalt.

2 REFERENCED DOCUMENTS The following documents are referred to in this Standard:

AS
2106 Methods for the determination of the flashpoint of flammable liquids (closed cup)

2341 Methods of testing bitumen and related roadmaking products
2341.6 Method 6: Determination of density using a hydrometer
2341.9 Method 9: Determination of water content (Dean and Stark)

ASTM
D86 Test method for distillation of petroleum products

D97 Test method for pour point of petroleum products

D445 Test method for kinematic viscosity of transparent and opaque liquids (the calculation of dynamic viscosity)

D473 Test method for sediment in crude oils and fuel oils by the extraction method

D611 Test methods for aniline point and mixed aniline point of petroleum products and hydrocarbon solvents

D1298 Practice for density, relative density (specific gravity), or API gravity of crude petroleum and liquid petroleum products by hydrometer method

D1319 Test method for hydrocarbon types in liquid petroleum products by fluorescent indicator adsorption

D1552 Test method for sulfur in petroleum products (high-temperature method)

3 DEFINITIONS For the purpose of this Standard the definitions below apply.

3.1 Cold mix—a 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.

3.2 Cutter oil—a light petroleum distillate added to bitumen to temporarily reduce its viscosity.

3.3 Flux oil—a petroleum distillate used to produce a long-term reduction in the viscosity of a binder.

3.4 Heavy flux oil—a petroleum residue used to produce a long-term reduction in the viscosity of a binder.

3.5 Residual bitumen—bituminous material obtained by processing the residue from the refining of naturally occurring crude oil.

3.6 Sprayed work—comprises priming, primer-sealing and sealing of prepared surfaces using bituminous binders which may contain oils for reducing their viscosity.

4 PROPERTIES

4.1 General Properties of the oils, when determined in accordance with the methods of test prescribed in Table 1, shall comply with the requirements specified therein. A heavy flux oil is also available and its properties shall comply with the requirements given in Table 2.

4.2 Cleanliness and fluidity The oil shall be clean and free of particulate matter. It shall be liquid at the prevailing temperature at the point of use.

4.3 Miscibility The oil shall be compatible with bitumen so that when one part by volume of the oil at ambient temperature is mixed with one part by volume of bitumen at a temperature of 80°C, and the mixture is allowed to cool to ambient temperature, it shall not separate after standing for one hour.

5 SAMPLING

5.1 General The purchaser should sample and test the oil at his discretion, either prior to its dispatch from the source of supply or subsequent to its delivery, or both. Representative samples shall be taken by the supplier in the presence of the purchaser's representative.

The viscosity of each of the samples may be determined in order to detect stratification.

5.2 Sample containers Containers for oil or cutback samples shall be clean, dry double-tight, friction-top cans of 1 L capacity, unless otherwise specified by the purchaser.

Containers for volatile diluent samples shall be appropriate to the consistency and volatility of the material.

5.3 Sampling from drums A number of drums shall be selected at random, the number to be approximately equivalent to, but not less than, the cube root of the total number of drums in the lot.

Each drum from which a sample is to be taken shall be agitated unless stratification is suspected, in which case it shall be sampled in layers. From each drum a sample of not less than 100 mL shall be taken from at least 100 mm below the surface and at least 100 mm from the side of the drum.

The samples shall be combined and thoroughly mixed to form a composite sample. A representative portion of about 1 L shall be taken from the composite sample and placed in a sample container to allow 5 percent to 10 percent ullage. The container shall be sealed immediately after filling, to prevent loss of oil.

5.4 Sampling from bulk storage When sampling is to be carried out from bulk storage, the inlet to and outlet from the storage tank shall be sealed and separate samples of about 1 L shall be drawn from the top, middle and bottom of the tank by one of the following methods:

(a) From drain cocks on the side of the tank if these are available and suitably located. The initial material withdrawn from each cock shall be discarded.

(b) By lowering into the material a weighted can fitted with a stopper which may be removed after the can has been lowered to the required depth (see Figure 1).

The samples shall be combined and thoroughly mixed to form a composite sample. A representative portion of about 1 L shall be taken from the composite sample and placed in a sample container to allow 5 percent to 10 percent ullage. The container shall be sealed immediately after filling, to prevent loss of oil.

Alternatively, if the supplier and purchaser agree that the material in the storage tank has been thoroughly mixed and is homogeneous, a single sample of about 1 L may be drawn from a sampling cock built into a recirculating or discharge line and designed for that purpose, if available.

6 CONTAINERS Samples shall be firmly packed for transport to the laboratory. Packaging shall not be in broken, punctured or otherwise damaged.

7 MARKING Samples shall be clearly marked for identification, either on the container or by means of a waterproof tag.

The label shall include the following particulars:

(a) Type of material.

(b) Identification mark or batch number.

(c) Place and date of sampling.

(d) Supplier.

(e) Quantity represented.

(f) Sampling officer's name.

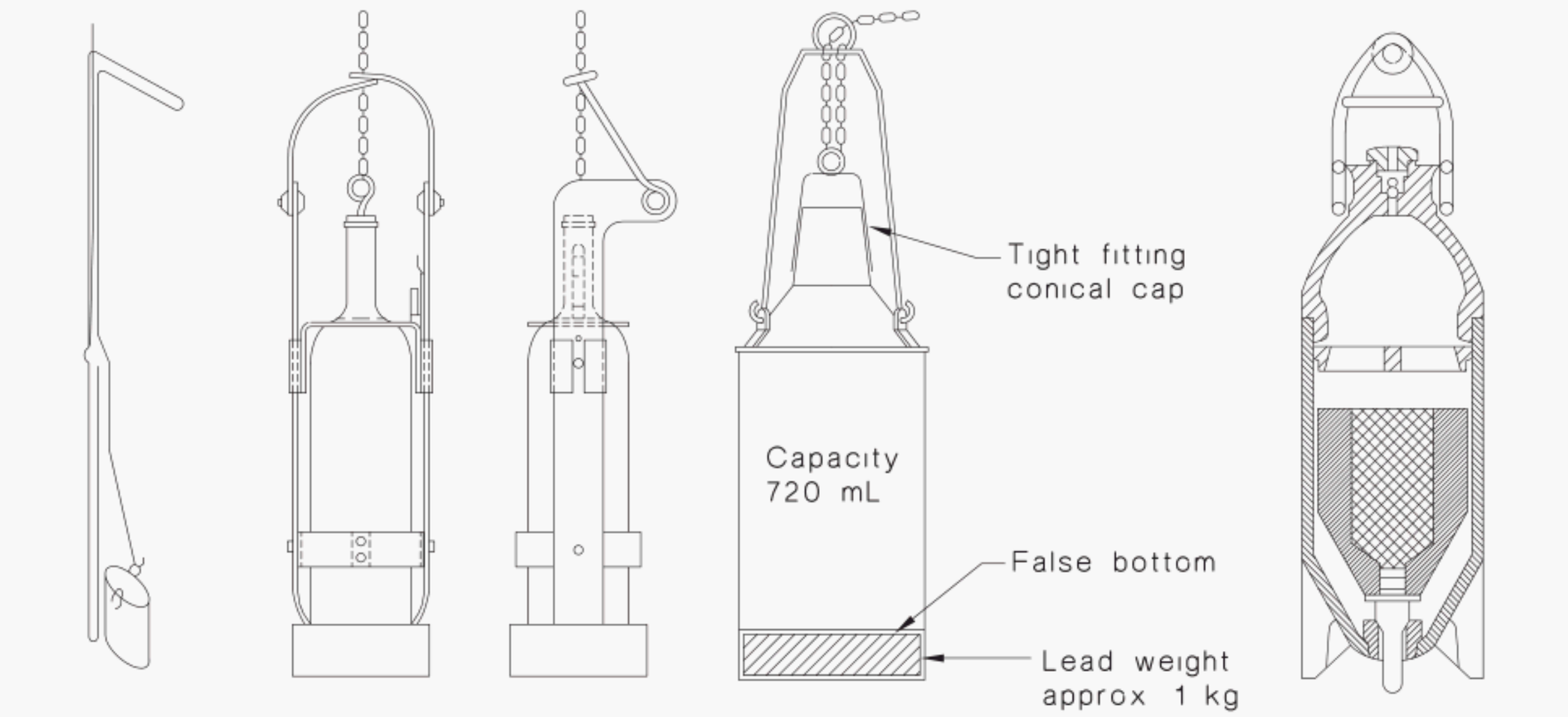

FIGURE 1 EXAMPLES OF SAMPLING DEVICES

TABLE 1

PROPERTIES OF CUTTER OILS AND FLUX OILS

Property	Requirements						Method of test
	Cutter oil		Flux oil		High flash point cutter		
	Min.	Max.	Min.	Max.	Min.	Max.	
Aniline point, °C	—	65	—	75	—	—	ASTM D611
or							
Aromatic content, %, by volume (see Note 1)	15	—	15	—	15	—	ASTM D1319
Density at 15°C, kg/m^3	775	830	790	880	780	840	ASTM D1298 AS 2341.6
Distillation range							
IBP (initial boiling point), °C	140	—	175	230	140	—	ASTM D86
% of original volume recovered at:							
150°C	—	10	—	—	—	10	
200°C	—	80	—	10	—	80	
250°C	80	—	—	—	80	—	
300°C	—	—	—	80	—	—	
350°C	—	—	80	—	—	—	
FBP (final boiling point), °C	—	270	—	—	—	270	
Flashpoint, °C (see Note 2)							
Abel apparatus, °C	38	—	—	—	61.5	—	AS 2106
Pensky-Martens closed cup	—	—	61.5	—	—	—	AS 2106
Fluidity	To comply with Clause 4.2		To comply with Clause 4.2		To comply with Clause 4.2		
Miscibility	Complete with no precipitation		Complete with no precipitation		Complete with no precipitation		Clause 4.3
Water content, % by volume	—	0.1	—	0.1	—	0.1	AS 2341.9
Viscosity, mPa.s at 40°C (see Note 3)	—	2.0	1.6	4.6	—	2.0	ASTM D445

NOTES:

1 ASTM Method D611 gives a rapid indication of the aromaticity of an oil. For quantitative determination of the aromatic content of an oil ASTM Test Method D 1319 should be used.

2 Lower flashpoint oils may be used for particular applications provided that the oil meets the required distillation range and that equipment and procedures used comply with the relevant safety legislation.

3 ASTM D445 produces a kinematic viscosity result in centistokes. To convert centistokes to Pascal seconds, the following conversion equation should be used:

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

where

η = dynamic viscosity, in millipascal seconds
ν = kinematic viscosity, in square millimetres per second
ρ = density at 15°C, in kilograms per cubic metre
f = coefficient of expansion, in reciprocal degrees Celsius
T = temperature of test, in degrees Celsius

and where

f = 0.00061 per degree Celsius for bitumen and related products

TABLE 2
PROPERTIES OF HEAVY FLUX OIL

Property	Requirements		Method of test
	Min.	Max.	
Distillation			ASTM D86
Initial boiling point, °C-	190	—	
Temperature at 50% recovery, °C	320	—	
* Viscosity at 50°C, mPa.s	45	90	ASTM D445
Flashpoint (°C)			
Pensky-Martens closed cup	61.5	—	AS 2106
Miscibility	Complete with no precipitation		Clause 4.3
Water content, % by volume	—	0.5	AS 2341.9
Sulfur content, % by mass	—	3.5	ASTM D1552
Sediment content, % by mass	—	0.15	ASTM D473
Pour point, °C	—	6	ASTM D97

* See Table 1, Note 3.

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