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Asphalt emulsion

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of International Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by the Japan Emulsified Asphalt Association (JEAA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law.

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In the event of any doubts arising as to the contents,
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Asphalt emulsion

1 Scope This Japanese Industrial Standard specifies the asphalt emulsion used for road pavement, waterproofing of bank protection, slope protection, etc. (hereafter referred to as “emulsion”).

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard, the most recent editions (including amendments) of the standards indicated below shall be applied.

- JIS A 5001 *Crushed stone for road construction*
- JIS A 5008 *Limestone filler for bituminous paving mixtures*
- JIS B 0651 *Surface texture—Instruments for the assessment of surface texture—Profile method*
- JIS B 7410 *Liquid-in-glass thermometers for testing of petroleum products*
- JIS B 7411 *Solid-stem general purpose liquid-in-glass thermometers*
- JIS G 4303 *Stainless steel bars*
- JIS K 2207 *Petroleum asphalts*
- JIS K 2251 *Crude petroleum and petroleum products—Sampling*
- JIS K 2839 *Glasswares for testing apparatus of petroleum products*
- JIS K 8271 *Xylene*
- JIS K 8680 *Toluene*
- JIS R 3503 *Glass apparatus for chemical analysis*
- JIS R 5210 *Portland cement*
- JIS Z 8401 *Guide to the rounding of numbers*
- JIS Z 8402 *Accuracy (trueness and precision) of measurement methods and results*
- JIS Z 8801 *Test sieves*

3 Definitions The definitions of main terms used in this Standard shall be as follows:

- a) **asphalt emulsion** The asphalt emulsion means a liquid of brown colour dispersed with the pulverized (to about 1 μm to 3 μm) straight asphalt specified in **JIS K 2207** (hereafter referred to as “asphalt”) in water containing emulsifier, stabilizer, etc. That is classified into cationic asphalt emulsion (hereafter referred to as “cationic emulsion”) and nonionic asphalt emulsion (hereafter referred to as “nonionic emulsion”).
- b) **cationic emulsion** The cationic emulsion means a liquid, which indicates generally acidic, of the dispersed asphalt in water containing the cationic surface active agent to be used as emulsifier and stabilizer and the surface of asphalt particle has positive (+) charge.

- c) **nonionic emulsion** The nonionic emulsion means a liquid, which indicates generally weak acidic, of the dispersed asphalt in water containing the nonionic surface active agent to be used as emulsifier and stabilizer and the surface of asphalt particle has neither positive (+) nor negative (-) charge.
- d) **Engler viscosity** The Engler viscosity means the ratio between the efflux time of specified volume of the sample from the pores of the container of test apparatus at the specified temperature and that time of distilled water of the same volume at the same specified temperature from the pores of the container of test apparatus, and indicates the viscosity of emulsion.
- e) **Saybolt-Furol second** The Saybolt-Furol second means the efflux time in second required for specified volume of sample at specified temperature to flow out from the pores of the container of test apparatus, and indicates the viscosity of emulsion in second.

Remarks : That shall be applied for the determination of viscosity when the Engler viscosity exceeds 15.

- f) **residue retained on sieve** The residue retained on sieve means the mass ratio of residue obtained in such way that the sample is poured on the specified sieve, washed by water and then the residue on sieve is dried and weighed, to the sample, and shall be expressed by mass percentage. That is to judge whether the asphaltic coarse particles or lumps are produced in emulsion or not.
- g) **adhesiveness** The adhesiveness means the ratio of adhering area of residual asphalt-coated film obtained in such way that the specified one crushed stone is immersed into the sample for 1 min, left it at room temperature for 20 min and then washed by water, to the total area. The adhering area shall be expressed by ratio. That is to judge the ability of adhering of the asphaltic coating to the aggregates.

Remarks : That shall be applied only to the cationic emulsion.

- h) **mixing property of coarse aggregate** The mixing property of coarse aggregate means the homogeneity when crushed stone, coarse sand, water and the sample are mixed in the specified condition.
- i) **mixing property of fine aggregate** The mixing property of fine aggregate means the homogeneity when crushed stone, fine sand, limestone powder, water and the sample are mixed in the specified condition.
- j) **mixing property of aggregate having soil** The mixing property of aggregate having soil means the homogeneity when the regular type of Portland cement and the sample are mixed. That indicates the miscibility of the emulsion with aggregate having soil, however, the regular type of Portland cement is used in place of aggregate having soil.
- k) **mixing property of cement** The mixing property of cement means the mass ratio of the lumps and coarse particles produced in mixing of the regular type of Portland cement with the sample under the specified condition to the original sample, and is expressed by mass percentage. That indicates the homogeneity of mixing the aggregate added with cement and the emulsion.

- l) **evaporation residue** The evaporation residue means the quantity of the residue obtained by evaporating of water in the emulsion, and is expressed by mass percentage.
- m) **electrical charge of particle** The electrical charge of particle means the electrical charge of the asphaltic particle contained in emulsion. When DC current energizes the emulsion, that is expressed by (+) in the case of transfer of asphaltic particles toward cathode and by (-) in the case of transfer toward anode.
- n) **settlement** The settlement means the difference of evaporation residue between the upper part sample and the lower part sample obtained in such way that a definite volume of sample is put in a test cylinder and paced quietly for 24 h, and is expressed by mass percentage. That indicates the storage stability of the emulsion before reaching the freezing point.
- o) **freezing stability** The freezing stability means the existence of coarse particles or lumps after the freezing and thawing of the sample are repeated twice under the specified condition. The availability shall be judged by investigating the state of emulsion against the freezing and thawing during storage.

4 Classes and symbols The emulsion shall be classified into two classes such as cationic emulsion and nonionic emulsion by its property and shall be as shown in Table 1.

Table 1 Classes and symbols

Class			Symbol	Use
Cationic emulsion	For penetrating	No. 1	PK-1	Penetrating for warm season and surface treatment
		No. 2	PK-2	Penetrating for cold season and surface treatment
		No. 3	PK-3	Prime coat and curing of cement
		No. 4	PK-4	Tack coat
	For mixing	No. 1	MK-1	Mixing of coarse aggregates
		No. 2	MK-2	Mixing of fine aggregates
		No. 3	MK-3	Mixing of aggregates with soils
Nonionic emulsion	For mixing	No. 1	MN-1	Mixing and curing of cement, asphalt emulsion

Remarks : P : Penetrating emulsion

M: Mixing emulsion

K: Cationic emulsion

N: Nonionic emulsion

5 Quality and performance The emulsion, when subjected to test in accordance with test method of 6, shall comply with the specification in Table 2.

Table 2 Quality and performance

Item	Class and symbol									
	Cationic emulsion					Nonionic emulsion				
	PK-1	PK-2	PK-3	PK-4	MK-1	MK-2	MK-3	MN-1		
Engler viscosity (25 °C)	3 to 15		1 to 6			3 to 40		2 to 30		
Residue retained on sieve (1.18 mm) mass %		0.3 max.						0.3 max.		
Adhesiveness		2/3 min.				—		—		
Mixing of coarse aggregate		—			Shall be homogeneous		—	—		
Mixing of fine aggregate			—			Shall be homogeneous	—	—		
Mixing of aggregate with soil mass %			—				5 max.	—		
Mixing of cement mass %				—				1.0 max.		
Electrical charge of particle										
Evaporation residue mass %		60 min.	50 min.			57 min.		57 min.		
Evaporation residue (25 °C) 1/10 mm	Over 100 up to and incl. 200	Over 150 up to and incl. 300	Over 100 up to and incl. 300	Over 60 up to and incl. 150	Over 60 up to and incl. 200	Over 60 up to and incl. 200	Over 60 up to and incl. 300	Over 60 up to and incl. 300		
		98 min.				97 min.		97 min.		
Soluble matter of toluene mass %										
Settlement (24 h) mass %				1 max.				1 max.		
Freezing stability (−5 °C)	—	Coarse particles and lumps shall not be found.			—			—		

Remarks : Engler viscosity shall be obtained according to 6.3 for the emulsion of 15 or less Engler viscosity, and the viscosity shall be obtained according to 6.4 and converted to Engler viscosity for the emulsion of over 15 Engler viscosity.

6 Test methods

6.1 Test apparatus general The test apparatus shall not be harmful in common use, it has sufficient endurance, be of correct shape capable of assembling easily and with no trouble mechanically and electrically.

Insulating resistance of electric heater shall be 5 M Ω or over when measured by using 500 V insulation-resistance tester between the live part and the frame, however, in the case of containing the circuit of electric heater, it may be 0.5 M Ω or over.

6.2 Method of sampling The sample of the emulsion shall be taken in accordance with 8.2 specified in JIS K 2251.

6.3 Method of test for Engler viscosity

6.3.1 Summary of test method To express the viscosity of the sample, the time of efflux for 50 ml of the sample from Engler viscometer and the time for the same amount of distilled water to flow out from viscometer shall be measured and calculate the ratio to express it as Engler viscosity.

6.3.2 Test apparatus The test apparatus shall be of construction as shown in Fig. 1 and consist of a) to c).

- a) **Engler viscometer** The engler viscometer shall be of shape and dimensions as shown in Fig. 1. The sample container shall be made of brass, and shape and dimensions are as shown in Fig. 2 and capable of keeping the sample temperature at 25 °C $\pm$ 0.1 °C. The receiver shall be as specified in Fig. 3 of JIS K 2839 and the thermometer shall comply with Fig. 3 and Table 3.
- b) **Microchronometer** The accuracy shall fall within $\pm$ 0.05 % per 15 min, and use stopwatch or electric timer and others with minimum graduation of 0.1 s.
- c) **Sieve** The sieve shall be of a shape and dimension with 850 μ m opening of sieve specified in JIS Z 8801 as shown in Fig. 4 and of wire net sieve.

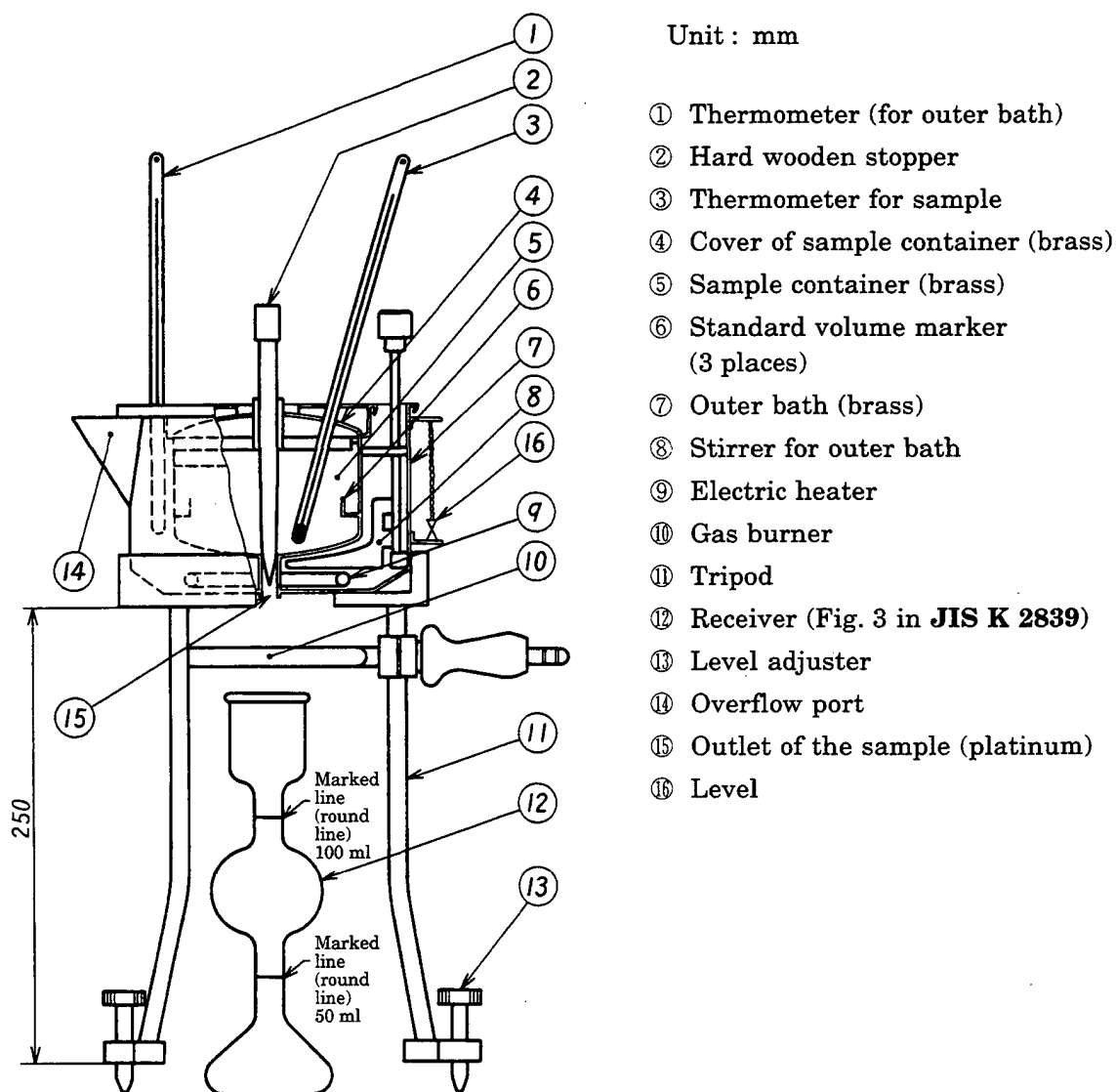


Fig. 1 engler viscometer (an example)

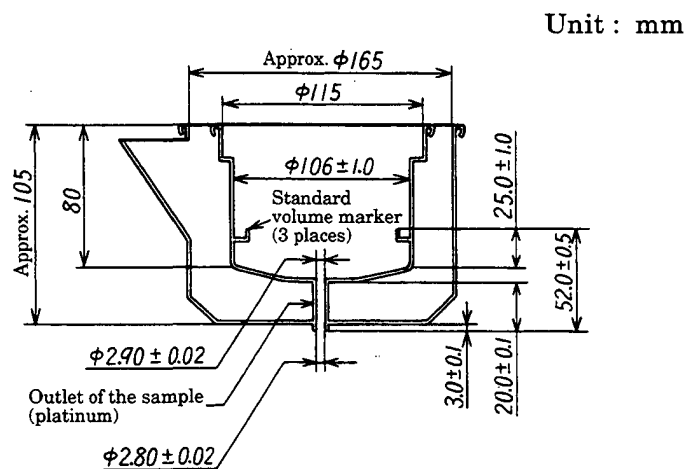


Fig. 2 Sample container

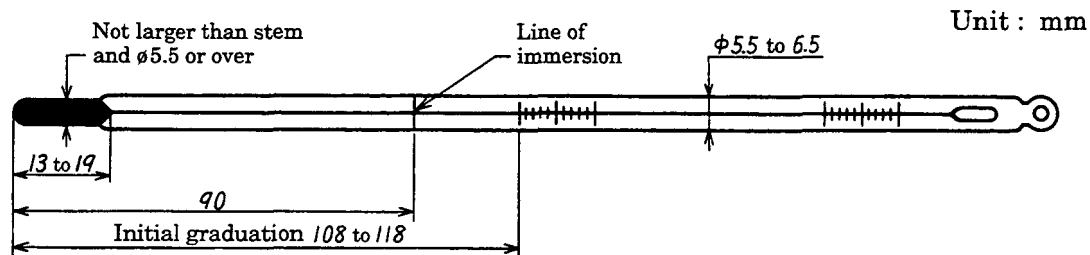


Fig. 3 Thermometer for sample

Table 3 Thermometer for sample

Range of graduation	Test temperature	Scale interval	Long graduation line	Figure of graduation	Error on scale	Maximum temperature graduation	Total length	Permissible heating temperature
18 °C to 28 °C	25 °C	0.2 °C	1 °C	2 °C	0.2 °C	From lower end of mercury 160 mm to 177 mm	212 mm ± 5 mm	100 °C

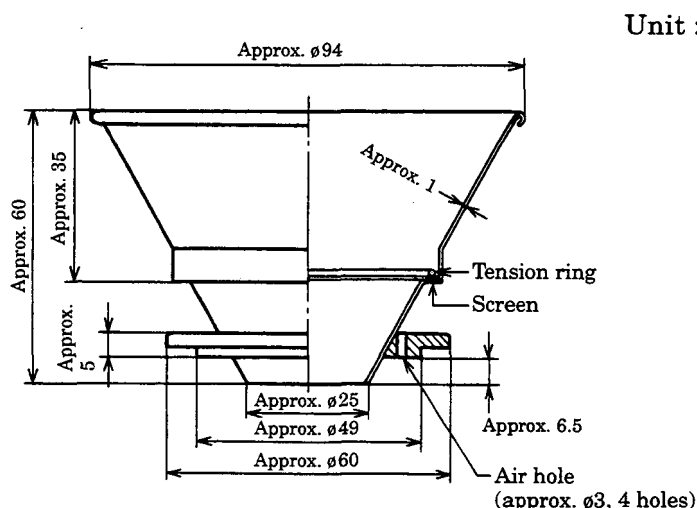


Fig. 4 Test sieve (an example)

6.3.3 Preparation of sample The preparation of sample shall be as follows.

- Take 500 ml or over of sample into a seamless deep shaped container and agitate the sample thoroughly with avoiding the producing of air bubbles.
- Allow the container of the sample to be dipped into water bath for 30 min or over at $25\text{ °C} \pm 0.1\text{ °C}$.
- Screen the sample through the test sieve specified in 6.3.2 c).

6.3.4 Procedure of test The procedure of test shall be as follows.

- Before using the sample container, the container shall be washed with xylene specified in JIS K 8271 and then with distilled water.

- b) For the Engler viscosity, the test⁽¹⁾ by distilled water shall be carried out three times and the mean value shall be the standard time (s) of the Engler viscometer.

Note (1) Close the outlet of Engler viscometer with a hard wooden stopper, coincide the level of distilled water with the standard volume of level tip, confirm the temperature to be $25\text{ }^{\circ}\text{C} \pm 0.1\text{ }^{\circ}\text{C}$, then place the receiver on the specified position, flow down the distilled water to be flowed out on the wall of receiver so as slightly to touch the wall of receiver avoiding air bubbling and measure the time (s) at the time filled up to 50 ml.

- c) Measurement of the efflux time of sample shall be carried out once by the way according to Note (1).
- d) From the efflux time of sample and that of distilled water, calculate Engler viscosity according to the following formula and round off to the integer according to **JIS Z 8401**.

$$E = \frac{T_s}{T_w}$$

where, E : engler viscosity
 T_s : efflux time of sample (s)
 T_w : efflux time of distilled water (s)

Remarks : In the case of Engler viscosity of 15 or more, carry out the test according to Saybolt-Furol second test method of **6.4** and convert the result into engler viscosity.

6.4 Method of test for Saybolt-Furol second

6.4.1 Summary of test method This test is intended to measure the viscosity of the sample where Engler viscosity exceeds 15 and express it as Engler viscosity by using the following conversion formula:

$$E = 0.280T's^{(2)}$$

Note (2) $T's$: Efflux time of the sample by Saybolt-Furol viscometer (s)

6.4.2 Test apparatus The test apparatus shall be constructed as shown in Fig. 5, and consist of a) to i).

- a) **Sample tube** The sample tube shall be made of metal with shape and dimension as shown in Fig. 6, and screwed in the lower part with outlet of efflux made of stainless steel.
- b) **Thermostat** The thermostat shall be made of metal, having construction and dimension as shown in Fig. 5, capable of keeping the sample at $25\text{ }^{\circ}\text{C} \pm 0.1\text{ }^{\circ}\text{C}$. The insulation resistance of the heater shall be as specified in **6.1**.
- c) **Replacement ring** The replacement ring shall be made of metal with shape and dimension as shown in Fig. 7.
- d) **Cleaning tool** The cleaning tool shall be made of metal with shape and dimension as shown in Fig. 8 and fixed with leather and others at one end.