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(दूसरा पुनरीक्षण)

Indian Standard

BITUMEN EMULSION FOR ROADS (CATIONIC TYPE) — SPECIFICATION

(Second Revision)

ICS 75.140; 93.080.20

BUREAU OF INDIAN STANDARDS
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Indian Standard

BITUMEN EMULSION FOR ROADS (CATIONIC TYPE) — SPECIFICATION

(Second Revision)

1 SCOPE

This standard covers the physical and chemical requirements of bitumen emulsion (cationic type) for road works.

2 REFERENCES

The following standards contain provisions, which through reference in the text, constitute provisions of this standard. At the time of publication the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below:

IS No.	*Title*
73 : 1992	Paving bitumen (*second revision*)
269 : 1989	Ordinary Portland cement 33 grade (*fourth revision*)
334 : 1982	Glossary of terms relating to bitumen and tar (*second revision*)
460 (Part 2) : 1985	Test sieves : Part 2 Perforated plate test sieves (*third revision*)
1201 : 1978	Methods of testing tar and bituminous materials — Sampling (*first revision*)
1203 : 1978	Methods of testing tar and bituminous materials — Determination of penetration (*first revision*)
1208 : 1978	Methods of testing tar and bituminous materials — Determination of ductility (*first revision*)
1216 : 1978	Methods of testing tar and bituminous materials — Determination of solubility in trichloroethylene (*first revision*)
3117 : 2002	Specification for bitumen emulsion for roads (anionic type) (*first revision*)

3 TERMINOLOGY

For the purpose of this standard, the definition given in IS 334 and the following shall apply.

3.1 Cationic Emulsion

An emulsions in which the cation of the emulsifier is at the interface of the bitumen particle; an emulsion in which the particles are positively charged and the aqueous phase is acidic. Breaking of these emulsions occurs by neutralization of charge.

4 MATERIALS

4.1 Any suitable grade of bitumen as given in IS 73 with or without addition of suitable flux, may be used.

4.2 Any emulsifying agent or any other ingredient, which either quality-wise or quantity-wise, is likely to affect or harden the residue bitumen beyond the limits specified in Sl No. (ix) of Table 1 shall not be used.

5 GRADES

Emulsified bitumen shall be of the following five grades:

	Grade
a) Rapid Setting-1	RS-1
b) Rapid Setting-2	RS-2
c) Medium Setting	MS
d) Slow Setting-1	SS-1
e) Slow Setting-2	SS-2

6 REQUIREMENTS

6.1 Bitumen emulsion shall be homogeneous. Within one year after manufacture date, it shall show no un-dispersed bitumen after thorough mixing.

6.2 The physical and chemical requirements of the five grades of emulsions shall comply with the requirements specified in Table 1.

Table 1 Physical and Chemical Requirements of Bitumen Emulsion (Cationic Type)
(*Clauses* 4.2 *and* 6.2)

Sl No.	Characteristic	Grade of Emulsion					Method of Test, Ref to	
		RS-1	RS-2	MS	SS-1	SS-2	IS No.	Annex of this Standard
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
i)	Residue on 600 micron IS Sieve, percent by mass, *Max*	0.05	0.05	0.05	0.05	0.05	—	B
ii)	Viscosity by saybolt furol viscometer, seconds:						3117	—
	1) At 25° C	—	—	—	20-100	30-150	—	
	2) At 50° C	20-100	100-300	50-300	—	—		
iii)	Coagulation of emulsion at low temperature[1)]	Nil	Nil	Nil	Nil	Nil	—	C
iv)	Storage stability after 24 h, percent, *Max*	2	1	1	2	2	—	D
v)	Particle charge	Positive	Positive	Positive	Weak Positive	Positive	—	E
vi)	Coating ability and water resistance:						—	F
	1) Coating, dry aggregate	—	—	Good	—	—	—	
	2) Coating, after spraying	—	—	Fair	—	—	—	
	3) Coating, wet aggregate	—	—	Fair	—	—	—	
	4) Coating, after spraying	—	—	Fair	—	—	—	
vii)	Stability to mixing with cement (percentage coagulation), *Max*	—	—	—	2	2	—	G
viii)	Miscibility with water	No Coagulation	No Coagulation	No Coagulation	—	No Coagulation	—	H
ix)	Tests on residue:							
	1) Residue by evaporation, percent, *Min*	60	67	65	50	60	—	J
	2) Penetration25°C/100g/ 5 sec	80-150	80-150	60-150	60-350	60-120	1203	—
	3) Ductility 27° C/cm, *Min*	50	50	50	50	50	1208	—
	4) Solubility : In trichloroethylene, percent by mass, *Min*	98	98	98	98	98	1216	—
x)	Distillation in percent, by volume at:							
	1) 190°C	—	—	—	20 - 55	—	—	—
	2) 225°C	—	—	—	30 - 75	—	—	—
	3) 260°C	—	—	—	40 - 90	—	—	—
	4) 315°C	—	—	—	60 -100	—	—	—
xi)	Water content, percent by mass, *Max*	—	—	—	20	—	—	—

[1)] This requirement shall be applicable only under situations where the ambient temperature is below 15°C.

7 SAMPLING

7.1 For the purpose of testing, the size of the sample and the sampling procedure from drums, barrels or bulk supply shall be as described in IS 1201 subject to the following:

a) *From Drums or Barrels* — The content of drum or barrel from which the sample is to be taken shall be thoroughly mixed by rolling the container to and fro for a period of 2 to 3 min, successively in opposite direction, allowing at least five revolutions of the container in each direction and then up-ending the container through two revolutions first in one direction and then in the opposite direction.

b) *From Bulk* — Where practicable, bulk delivery of bitumen emulsion shall be agitated by forced circulation or air agitation, before sampling.

c) The sample of bitumen emulsion shall be drawn within 24 h after delivery and tested within 7 days from the date of drawing, unless otherwise specified.

7.1.1 *Preparation of Samples*

Before carrying out any of tests, the sample shall be mixed by gentle shaking to ensure uniformity.

7.2 If the single sample from a single run fails to fulfil the test requirements specified in **6**, sample shall be drawn on the basis of **7.1** for testing in the same manner. If these samples conform to requirement of **6** the lot shall be accepted otherwise the lot shall be rejected.

8 MARKING

8.1 Each container shall be legibly and indelibly marked with the following :

a) Indication of the source of manufacture,
b) Month and year of manufacture,
c) Type/Grade,
d) Batch number, and
e) Date of expiry.

8.1.1 *BIS Certification Marking*

The container may also be marked with the Standard Mark.

8.1.1.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act,* 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

ANNEX A

(Foreword)

RECOMMENDED USE OF CATIONIC EMULSION

A-1 The recommended uses of five types of emulsified bitumen of the cationic type suggested in this revision are given below:

Type	*Recommended Uses*
RS-1	Rapid setting emulsion grade RS-1 is specially recommended for tack coat applications.
RS-2	Rapid setting emulsion grade RS-2 specially recommended for surface dressing work.
MS	A medium setting emulsion used for plant or road mixes with coarse aggregates minimum 80 percent, all of which is retained on 2.36 mm IS Sieve and practically none of which passes 180 micron IS Sieve, and also for surface dressing and penetration macadam.
SS-1	SS-1 is used for other applications such as fog seal, crack sealing, prime coat applications.
SS-2	A slow setting emulsion used for plant or road mixes with graded and fine aggregates, a substantial quantity of which passes a 2.36 mm IS Sieve, and a portion of which may pass a 75 micron IS Sieve. Examples of its uses are cold mixed MSS, SDBC and slurry seal.

ANNEX B

[*Foreword* and *Table* 1, *Sl No.* (i)]

METHOD FOR DETERMINATION OF RESIDUE BY SIEVING THROUGH 600-MICRON IS SIEVE

B-1 APPARATUS

B-1.1 600 Micron IS Sieve — A circular sieve approximately 100 mm in diameter and 40 mm height.

B-1.2 Metal or Glass Dish — A small metal or glass dish about 110 mm in diameter (such as a clock glass).

B-1.3 Oven — A well ventilated oven thermostatically controlled to 100 to 110 °C.

B-1.4 Balances — One of capacity 250 g and accuracy of 0.01 g and one of capacity 10 kg and accuracy of 1 g.

B-1.5 Container — A clean, weighed, 1.5-litre container.

B-2 MATERIALS

B-2.1 Solution — Distilled water

B-2.2 Solvents — Xylene and acetone.

B-3 PROCEDURE

Wash the sieve with xylene and then with acetone. Place it in the dish, dry in the oven at 100 to 110°C for 1h, cool and weigh, together with the dish, to the nearest 0.01 g (W_1). Remove the sieve from the dish and moisten with the solution. Remove uniformly the 4-litre sample by gentle agitation and strain immediately through the sieve into the clean, dry, weighed container (W_4). Sieve the low and high viscosity emulsion at room temperature and 50°C respectively. When whole of the emulsion has been passed through the sieve, remove the sieve and weigh the container to the nearest 1g (W_2). Wash the sieve repeatedly with distilled water until the washings run clear. Place the sieve in the small dish to dry for 2 h in the oven at 105 ± 5°C. Cool and reweigh together to the nearest 0.01 g (W_3).

B-4 CALCULATIONS

$$\text{Percentage retained} = \frac{W_3 - W_1}{W_2 - W_4} \times 100$$

where

W_1 = mass, in g, of sieve and small dish;
W_2 = mass, in g, of container and emulsion;
W_3 = mass, in g, of sieve, small dish and residue; and
W_4 = mass, in g, of container.

B-5 REPORT

The percentage of mass retained as calculated under **B-4** shall be reported.

B-6 PRECISION

The duplicate test results should not differ by more than the following:

Sieve Test, Percent *Retained*	*Repeatability,* Percent	*Reproducibility,* Percent
0 to 0.05	0.02	0.04

ANNEX C

[*Table* 1, *Sl No.* (iii)]

METHOD FOR DETERMINATION OF COAGULATION OF EMULSIONS AT LOW TEMPERATURE

C-1 APPARATUS

C-1.1 Glass Boiling Tube — 150 mm long and 25 mm in internal diameter, provide with a cork and central hole 13 mm in diameter.

C-1.2 Sieve — 600-micron IS Sieve.

C-1.3 Beaker — Two, 600-ml capacity.

C-1.4 Water-Bath — Thermostatically controlled.

C-2 MATERIALS

C-2.1 Solution

One percent solution of cetrimide (a mixture of alkyltrimethyl ammonium bromide) in N/10 hydrochloric acid.

C-2.2 Solvents

Xylene and acetone.

C-3 PROCEDURE

Wash 600-micron IS Sieve with xylene, acetone and distilled water. Moisten the clean sieve with cetrimide. Pass some of the emulsions through the sieve and introduce 20 ml of sieved emulsion into the boiling tube. Bring the emulsion by plunging the tube into the water at 30°C and stir gently with the thermometer until temperature of the emulsion is constant. Remove the tube from warm water and plunge into the beaker containing iced water at the bottom of which crushed ice is retained by piece of wire gauge. During the cooling process stir slowly. Lower the temperature of water by adding common salt, to −1 to − 1.5°C so that the temperature of the emulsion is reduced to 0 °C. At 0°C discontinue stirring and transfer the tube to another beaker with a freezing mixture at a temperature of − 3 to − 4°C and allow the emulsion to remain quiescent for 30 min. Remove the tube from the freezing mixture without disturbance and allow the temperature of the content to rise spontaneously to room temperature. Moisten the sieve with cetrimide and pass the emulsion through the sieve. Wash the tube free from emulsion and other residue with cetrimide and pass the washings through the sieve. The coagulated bitumen, if any, will be retained on the sieve.

C-4 REPORT

Report the emulsion as passed, if no coagulation takes place.

NOTE — If the emulsion is exposed to temperature below 4°C during storage/transportation the following additional criteria shall apply:

a) Subzero temperature −15°C;
b) Freezing and thawing cycle shall be repeated three times; and
c) After the third cycle, the emulsion shall be examined for homogeneity.

ANNEX D

[*Table* 1, *Sl No.* (iv)]

METHOD OF DETERMINATION OF STORAGE STABILITY

D-1 APPARATUS

D-1.1 Cylinders — Two 500-ml glass cylinders, with pressed or moulded glass bases and cork or glass stoppers, having an outside diameter of 50 ± 5 mm and having 5 ml graduations.

D-1.2 Glass Pipette — A 60 ml siphon glass tube pipette.

D-1.3 Balance, capable of weighing 500 g within ± 0.1g.

D-1.4 Glass Beakers — Three glass beakers of 600 or 1 000-ml capacity, made of borosilicate glass.

D-1.5 Glass Rods, with flame polished ends, 6.5 ± 0.5 mm in diameter and 175 ± 5 mm in length.

D-1.6 Oven — Thermostatically controlled, capable of maintaining temperature of 163 ± 2.8 °C.

D-2 PROCEDURE

D-2.1 Bring the bitumen emulsion to room temperature (20 to 30°C). Place a 500 ml representative sample in each of the two glass cylinders. Stopper the cylinders and allow them to stand undisturbed, at laboratory air temperature (20 to 30°C), for 24 h. After standing for this period, remove approximately 55 ml from the top of the emulsion by means of the pipette or siphon without disturbing the rest. Thoroughly mix each portion.

D-2.2 Weigh 50 ± 0.1 g of each sample into separately weighed 600 or 1 000 ml glass beakers, each beaker having previously been weighed with the glass rod (*see* **D-1.5**). Adjust the temperature of the oven to 163 ± 2.8°C. Then place the beakers containing the rods and sample in the oven for 2 h. At the end of this period remove each beaker and thoroughly stir the residue. Replace in the oven for 1 h, then remove the beakers from the oven, allow to cool to room temperature, and weigh, with the rods (*see* Note).

NOTE — Care shall be taken to prevent loss of bitumen from the beaker through foaming or spattering or both. For this reason, 1 000 ml beakers are recommended. Also, the placing of beakers and emulsion samples in a cold or warm oven and bringing the oven and sample up to a temperature of 163°C together is permissible. If preferred, preliminary evaporation of water may be accomplished by careful heating on a hot-plate followed by oven treatment at 163°C for 1 h.

D-2.3 After removal of the sample, siphon off the next 390 ml (approximate) from each of the cylinders. Thoroughly mix the emulsion remaining in the cylinders and weigh 50 ± 0.1 g into separate weighed 600 or 1 000 ml glass beakers. Determine the bituminous residue of these samples in accordance with **D-2.2**.

D-3 CALCULATION

Calculate the storage stability as the numerical difference between the average percentage of bituminous residue found in the two top samples and that found in the two bottom samples.

D-4 PRECISION

D-4.1 Duplicate determinations by the same operator shall not be considered suspect if the determined values do not differ by more than 0.5 percent.

D-4.2 Reproducibility

The values reported by each of the two laboratories representing the arithmetic average of duplicate determinations shall not be considered suspect values, if the reported values do not differ by more than 0.6 percent.

ANNEX E

[*Table* 1, *Sl No.* (v)]

METHOD FOR DETERMINATION OF PARTICLE CHARGE

E-1 APPARATUS

E-1.1 Current Source — A 12 V battery.

E-1.2 Rheostat, of 2 000 Ohm capacity.

E-1.3 Ammeter, of 0.1 Ampere capacity.

E-1.4 Stainless Steel Plates — Two, 25 mm × 75 mm size.

E-1.5 Glass Container, of 500 ml capacity.

E-2 PROCEDURE

Take sufficient quantity of a representative sample of bitumen emulsion in the glass container. Immerse two stainless steel plates 25 mm × 75 mm which are connected to a 12 V battery circuit through a switch, a rheostat and an ammeter, to a depth of 25 mm and mark the +ve and –ve plates. Close the switch and adjust the rheostat so that the current in the circuit is more than 4 mA. Open the circuit after 30 min and remove the plates. Gently wash the plates, if necessary with distilled water to remove unbroken emulsion and then examine.

E-3 REPORTING

An appreciable layer (continuous opaque film) of deposited bitumen on the negative plate (cathode) with a relatively clean bitumen free positive plate (anode) indicates a cationic emulsion of positively charged particles.

ANNEX F

[*Foreword* and *Table* 1, *Sl No.* (vi)]

COATING ABILITY AND WATER RESISTANCE

F-1 APPARATUS

F-1.1 Mixing Pan — A whole enamelled kitchen pan with handle, of approximately 3-litre capacity.

F-1.2 Mixing Blade — A putty knife with a 30 mm × 90 mm steel blade with rounded corners. A 254 mm kitchen mixing spoon may be used as an alternative.

F-1.3 Sieve — Standard sieve of 19 mm and 4.75 mm conforming to IS 460 (Part 2).

F-1.4 Constant Head Water Spraying Apparatus — An apparatus for applying tap water in a spray under a constant head of 775 mm. The water shall issue from the apparatus in a low velocity spray.

F-1.5 Thermometer — It shall be of the mercury in-glass type nitrogen filled, with the stem made of lead glass or other suitable glass. It shall be engraved and enamelled at the back and provided with an expansion chamber and glass ring at the top. The bulb shall be cylindrical, made of suitable thermometric glass. The dimensions, tolerances and graduations of the thermometer shall be as follows:

Range	:	–2 °C to 80 °C
Graduation at each	:	0.2 °C
Longer lines at each	:	1 °C
Figures at each	:	2 °C
Immersion, mm	:	Total
Overall length, mm	:	378-384
Length of graduated portion, mm	:	243-279
Length of bulb, mm	:	9-14
Bulb diameter	:	No larger than stem diameter
Stem diameter, mm	:	6.0-7.0
Distance from bottom of bulb to 0°C, mm	:	75-90
Scale error, *Max*	:	0.2°C

F-1.6 Balance, capable of weighing 1 000 g within ± 0.1 g.

F-1.7 Pipette, of 10-ml capacity.

F-2 MATERIALS

F-2.1 Aggregate — Standard limestone aggregate shall be a laboratory washed and air cooled aggregate graded to pass 19 mm sieve and retained on 4.75 mm sieve.

F-2.2 Calcium Carbonate — Chemically pure precipitated ($CaCO_3$) shall be used as a dust to be mixed with the standard aggregate.

F- 2.3 Water — Tap water of not over 250 ppm $CaCO_3$ hardness for spraying over the sample.

F-3 SAMPLE

The sample shall be representative of the bitumen emulsion to be tested.

F-4 PROCEDURE FOR TEST WITH WET AGGREGATE

F-4.1 Carry out the test at 24 ± 5.5°C.

F-4.2 Weigh 460 g of the air dried/graded limestone aggregates in the mixing pan.

F-4.3 Weigh 4 g of $CaCO_3$ dust in the mixing pan and mix with the 460 g of aggregate for approximately 1 min by means of a mixing blade to obtain uniform film of dust on the aggregate particles. The total weight of aggregate shall be 460 g.

F-4.4 Pipette 9.3 ml of water to the aggregate and $CaCO_3$ dust mixture into the mixing pan and mix thoroughly to obtain uniform wetting.

F-4.5 Weigh 35 g of bitumen emulsion into the aggregate in the pan and mix vigorously with the mixing blade for 5 min by a back and forth motion in an elliptical path of the mixing blade of spoon. At the end of the mixing period, tilt the pan and permit any excess emulsion not on the aggregate to drain from the pan.

F-4.6 Remove approximately one half of the mixture from the pan and place it on absorbent paper and evaluate the coating.

F-4.7 Immediately spray the mixture remaining in the pan with tap water from the constant head water spraying apparatus to cover the mixture. The distance from the spray head to the sample shall be (305 ± 75 mm). Then carefully pour off the water. Continue spraying and pouring off the water until the overflow water runs clear. Carefully drain off the water on the pan. Scoop the mixture from the mixing pan on to

absorbent paper for evaluation of coating retention in the washing test.

F-4.8 Evaluate the mixture immediately by visual estimation as to the total aggregates surface area that is coated with bitumen.

F-4.9 Report the evaluation by visual estimation of the coating of the aggregate surface area by bitumen after the mixture has been surface air dried in the laboratory at room temperature. A fan may be used for drying if desired.

F-5 REPORTING OF TEST RESULTS

F-5.1 Evaluate and report the following information for tests with both dry and wet aggregates.

F-5.2 At the end of the mixing period record the coating of the total aggregate surface area by the bitumen emulsion as good, fair or poor. Where a rating of good means fully coated by the bitumen emulsion is exclusive of pinholes and sharp edges of the aggregates; a rating of fair coating applies to the condition of an excess of coated area over uncoated area; and a rating of poor applies to the condition of an excess of uncoated area over coated area.

F-5.3 After spraying with water record the coating of the total aggregate surface area by the bitumen as good, fair or poor.

F-5.4 Comments about the results of the test may be included in the valuation.

ANNEX G

[*Table* 1, *Sl No.* (vii)]

STABILITY TO MIXING WITH CEMENT

G-1 APPARATUS

G-1.1 Sieve — A 1.40 mm IS Sieve approximately 100 mm in diameter and 40 mm in height and 150 micron IS Sieve approximately 200 mm in diameter.

G-1.2 Metal Dish — A round-bottomed metal utensil of approximately 500-ml capacity.

G-1.3 Steel Rod — A steel rod with rounded ends 13 mm in diameter.

G-1.4 Balance — 250 g capacity accurate to 0.1 g.

G-1.5 Graduated Cylinder, of 100 ml capacity.

G-1.6 Shallow Pan, of 100-mm diameter and of about 50-ml capacity.

G-1.7 Oven — A well-ventilated oven controlled at 110°C.

G-2 MATERIAL

Ordinary Portland cement conforming to IS 269. It shall be kept in sealed container and not exposed to atmosphere before use.

G-3 PROCEDURE

Make up the water content of the emulsion to 50 percent by adding extra water, if necessary. Pass the cement through 150 micron IS Sieve and weigh 50 g into the metal dish. Weigh the 1.40 mm IS Sieve and shallow pan to nearest 0.1 (W_1). Add 100-ml of emulsion to the cement in the dish and stir the mixture at once with the steel rod with a circular motion making about 60 rev/min. At the end of 1 min mixing period add 150 ml freshly boiled distilled water at room temperature and continue stirring for 3 min. Maintain the ingredients at a temperature of approximately 25°C during mixing. Pour the mixture through the weighed 1.40 mm IS Sieve and rinse with distilled water. Place the sieve in weighed pan, heat in the oven at 110°C until dry and weigh to nearest 0.1 g (W_2).

G-4 CALCULATION

$$\text{Coagulation value} = \frac{W_2 - W_1}{W_3} \times 100$$

where

W_1 = mass, in g, of weighed sieve and pan;
W_2 = mass, in g, of the sieve and pan and the material retained on them; and
W_3 = mass, in g, of binder in 100-ml of diluted emulsion determined according to Annex J.

G-5 REPORT

Report the coagulation value as percentage the nearest whole number.

G-6 PRECISION

The duplicate test results shall not differ by more than the following:

Cement Mixing Mass, Percent	*Repeatability Mass*, Percent	*Reproducibility Mass*, Percent
0 to 2	0.2	0.4

NOTE — Ordinary portland cement conforming to IS 269 shall be used.

ANNEX H

[*Table* 1, *Sl No.* (viii)]

METHOD FOR DETERMINATION OF MISCIBILITY WITH WATER

H-1 PROCEDURE

Gradually add 150 ml distilled water, with constant stirring to 50 ml of emulsion in a 400-ml beaker at a temperature of 20-30°C. Allow the mixture to stand for 2 h and examine it for any appreciable coagulation of the bitumen content of the emulsion.

ANNEX J

[*Table* 1, *Sl No.* (ix)(1)]

METHOD FOR DETERMINATION OF RESIDUE BY EVAPORATION

J-1 APPARATUS

J-1.1 Glass Beakers — Low form of 1 000-ml capacity made of borosilicate glass.

J-1.2 Glass Rods, with flame polished 6.5 ± 0.5 mm in diameter and 175 ± 0.5 mm in length.

J-1.3 Balance, of 500 g capacity and accurate to ± 0.1 g.

J-1.4 Oven — Thermostatically controlled at a temperature of 163 ± 2.8 °C.

J-2 PROCEDURE

Weigh 50 ± 0.1 g of thoroughly mixed emulsion into each of three beakers each of which has previously been weighed with the glass rod. Place the beaker along with the rod in the oven at 163 ± 2.8 °C for 2 h. At the end of this period remove each beaker and stir the residue thoroughly. Replace in the oven for another 1 h then remove and cool at room temperature, weigh the beakers along with the rods.

J-3 CALCULATION

J-3.1 Residue, percent = 2 *(A – B)*

where

A = mass of beaker, rod and residue, in g; and

B = tare mass of beaker and rod, in g.

J-3.2 Take the average of three values obtained for residue, percent.

J-4 TESTS ON RESIDUE

J-4.1 Penetration

Determine penetration on a sample of the residue in accordance with IS 1203.

J-4.2 Ductility

Determine the ductility on a representative portion of the residue in accordance with IS 1208.

J-4.3 Solubility in Trichloroethylene

Determine the solubility in trichloroethylene on a representative sample of the residue in accordance with IS 1216.