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SPECIFIC GRAVITY TEST FOR BITUMEN

STANDARD: I.S. 1202-2021

- This standard covers the methods for the determination of specific gravity of asphalt, bitumen, bituminous products, road tar, coal tar, coal tar pitch, creosote and anthracene oil.

DEFINATION

- Specific gravity is the ratio of the mass of a given volume of the substance to the mass of an equal Volume of water.

TYPE OF TEST

- Specific Gravity Bottle Method.

APPARATUS:

1. Specific Gravity Bottle (50 ml).
2. Constant Temperature Bath.
3. Glass Thermometer (as per IS).
4. Balance of capacity 500gm and sensitivity 0.01gm.

PROCEDURE

- Clean, dry and weigh the specific gravity bottle together with the stopper (A).
- Fill it with freshly boiled and cooled distilled water and insert the stopper firmly.
- Keep the bottle up to its neck for not less than half an hour in a beaker of distilled water at a temperature of 27.0 ± 0.1°C or any other temperature at which specific gravity is to be determined.
- Wipe all surplus moisture from the surface with a clean, dry cloth and weigh it (B).
- Bring the bituminous material to the fluid condition by gentle application of heat, care being taken to prevent loss by evaporation.
- When the material is sufficiently fluid, pour the bituminous material in to the clean, dry specific gravity bottle to fill at least half.

- Slightly warm the bottle before filling the material.
- Keep the material away from touching the sides above the final level of bottle and avoid the inclusion of air bubbles.
- The use of small funnel will prevent contamination of the neck of the bottle.
- To permit escape of entangled air bubbles, allow the partly filled bottle to stand for half an hour at a temperature between 60-70◦C, then cool to the specified temperature and weigh with the stopper (C).
- Fill the specific gravity bottle containing the asphalt with freshly boiled and cooled distilled water placing the stopper loosely in the specific gravity bottle.
- Do not allow any air bubble to remain in the specific gravity bottle.
- Place the specific gravity bottle in the water bath and press the stopper firmly in place.
- Allow the specific gravity bottle to remain in the water bath for a period of not less than 30 minutes.
- Remove the specific gravity bottle from the water bath, wipe all surplus moisture from the surface with a clean with a clean dry cloth and weigh it along with the stopper (D).

PRECAUTIONS

- Only freshly boiled and cooled distilled water shall be used.
- At no time of weighing shall the temperature of the apparatus be allowed to exceed the specified temperature.

-- End of SOP –

DUCTILITY TEST OF BITUMEN

STANDARD: I.S. 1208 (Part-1): 2023

- This standard covers the method of determination of ductility of distillation residue of cutback bitumen, blown type bitumen and other bituminous products.

DEFINATION

- The ductility of bituminous material is the distance in centimeters to which it will elongate before breaking when a briquette specimen of the materials is pulled a specified speed and at specified temperature.

APPARATUS

1. Ductility Mould made of brass.
2. Thermostatically Water Bath of 10-liter Capacity
3. Ductility testing Machine
4. Thermometer

PROCEDURE

- Unless otherwise specified this test shall be conducted at a temperature of 25 ±0.5°C and at a rate of pull of 50 ± 2.5mm/min.
- Melt the bitumen to be tested to a temperature of 75 to 100 °C above its approximate softening point till it becomes fluid.
- Assemble the mould on the brass plate and coated on all the sides with a mixture glycerin and dextrin of equal parts to avoid sticking of the material.
- Fill the mould until it is more than level full.
- In filling the mould, pour the material in a thin stream back & forth from end to end of the mould.
- Leave it to cool room temperature for 30 to 40 minutes and then place it in water bath maintained at a specified temperature for 30 minutes.

- Cut off bitumen by means of hot straight edged putty knife level full.
- Place the brass plate and mould with briquette specimen, in the water-bath and keep at the specified temperature for about 85 to 95 minutes.
- Remove the briquette from the plate; detach sidepieces and the briquette immediately.
- While the test is being conducted, make sure that the water in the tank of the testing machine covers the specimen above by at least 25 mm and is maintained continuously within ± 0.5 °C of specified temperature.
- Attach rings at each end of the clips to hooks in the testing machine and pull the two clips apart horizontally at a uniform speed as specified until the briquette ruptures.
- At least three determinations shall be made for each test.

PRECAUTION

- In filling the mould care shall be taken to see that no air bubbles shall be formed, and not to disarrange the parts and thus distorting the briquette.

-- End of SOP --

PENETRATION TEST OF BITUMEN

STANDARD: I.S. 1203-2022

- This standard covers the method for the determination of penetration of asphaltic bitumen and fluxed native asphalt and blown type bitumen.

DEFINATION:

- Penetration of a bituminous material is the distance in tenths of a millimeter that standard needle will penetrate vertically into a sample under standard condition of temperature, load & time.

APPARATUS:

1. Penetrometer
2. Time Measuring Device
3. Thermometer
4. Water Bath
5. Needle
6. Container
7. Transfer Dish

PROCEDURE:

- Soften the material to a pouring consistency at a temperature not more than 60 °C for tars and pitches and not more than 90 °C for bitumen above the approximate respective softening points.
- Stir it thoroughly until it is homogeneous and free from air bubbles and water.
- Pour the melt in to the container to a depth of at least 10mm in excess of the expected penetration.
- Protect the sample from dust and allow it to cool in atmosphere at a temperature between 15 to 30 °C for 1 to 2 hours for 45mm deep container and 1 to 1 hours for 35mm deep container.
- Unless otherwise specified carry out testing at a temperature of 25 ± 0.1 °C.

- Place it along with the transfer dish in the water bath 25 ± 0.1 °C and allow it remain for 1 to 2 hours for 45mm deep container and 1 to 1 hours for 35mm deep container.
- Fill the transfer dish with water from the water bath to a depth sufficient to cover the mould completely.
- Remove the transfer dish along with the mould from water bath after specified period of time and put it upon the stand of penetration apparatus.
- Adjust the needle (previously washed, cleaned well with benzene and dried) just to make contact with the surface of the sample.
- The sum of weights of the needle, carrier and super imposed weights i.e. the total moving weight shall be 100 ± 0.25 grams.
- Release the needle for five seconds and measure the distance penetrated.
- Make at least three determinations at points on the surface of the sample not less than 10mm apart and not less than 10mm from the side of the dish.
- After each test, return the sample and transfer dish to the water bath and wash the needle with benzene and dry.
- In case of material of penetration greater than 225 make three determinations on each of two identical test specimens using a separate needle for each determination, leaving the needle in the sample on completion of each determination to avoid disturbance of the specimen.

PRECAUTIONS

- If the sample contains extraneous matter, it should be sieve through I.S. Sieve 30.
- To avoid over heating at the bottom of the container, use of an air oven or sand bath is recommended.
- While the needle is penetrating into the sample, if there is any movement of the container, that determination shall be discarded.

-- End of SOP --

SOFTENING POINT TEST OF BITUMEN

STANDARD: I.S. 1205-2022

- This standard covers the method for the determination of softening point of asphaltic bitumen and fluxed native asphalt, road tar, coal tar pitch and blown type bitumen.

DEFINITION

- Softening point is the temperature at which the substance attains a particular degree of softening under specified conditions of test.

APPARATUS

1. Standard Ring and Ball Apparatus.
2. Brass Rings.
3. Thermometer.
4. Water Bath
5. Steel Balls.
6. Stirrer
7. Ball Guide
8. Beaker

PROCEDURE

- Heat the material to a temperature between 75 °C and 100 °C above its softening point,
- Stir until it is completely fluid and free from air bubbles and water, and filter if necessary, through IS sieve 30.
- Place the rings; previously heated to a temperature approximately to that of molten material on a metal plate, which has been coated with a mixture of equal parts of glycerin and dextrin.
- Fill the mould with sufficient melt to give excess above the level of the ring.
- Remove the excess material with a warmed sharp knife after cooling in air for 30 minutes.
- Assemble the apparatus with the rings, thermometer and ball guides in position.
- Fill the bath to a height of 50 mm above the upper surface of the rings with the freshly boiled distilled water or pure glycerin at a temperature of 5 °C.

- The water bath liquid shall be freshly boiled distilled water when testing materials having softening points below 80°C and pure glycerin for material having softening points above 80 °C.
- There shall be exactly 25mm difference between the bottom of the rings and the top surface of the bottom plate of the support, if any, and the bottom of the bath.
- Maintain the bath at a temperature of 5 °C for 15 minutes after which place the balls previously cooled to a temperature of 5 °C by forceps in each ball guide.
- Apply heat to the bath and stir the liquid so that the temperature rises at a uniform rate of 5 ± 0.5 °C per minute until the material softens and allow the balls to pass through the ring.
- Record the temperature shown by the thermometer for each ring and ball at the instant the sample surrounding the ball touches the bottom plate of the support, if any or the bottom of the bath.

PRECATUTIONS

- The stirrer shall be so placed that the moulds are not disturbed when the stirrer is in operation.
- The prescribed rate of heating shall be rigidly adhered to for ensuring accuracy of results.
- The rate of temperature rise shall not be averaged over the period of the test.

-- End of SOP –

ABSOLUTE VISCOSITY TEST OF BITUMEN

STANDARD: IS: 1206-(Part II) 2022

- This standard covers the determination of absolute viscosity of bitumen and cut-backs by vacuum capillary viscometers at any specified temperature. It is applicable to materials having a viscosity range of 42 to 200000 Poises.

APPARATUS:

1. Constant Temperature Bath
2. Silicone Bath Oil suitable up to 150 °C
3. Vacuum System
4. Thermometer for Bath–Mercury in glass, range 37.8 to 82 °C & graduations of 0.2 °C.
5. Timing Device – A stop watch or stop clock capable of reading up to ½ second.
6. Cannon-Manning Vacuum Viscometers- With manufacturers' calibration certificate, viscometer holder and silicone cork. Size 12 is suitable for testing VG-10, VG-20, VG-30, and VG-40 bitumen.

PROCEDURE:

- Heat the bitumen sample to a temperature not more than 90 °C above their respective approx. softening point until it has become sufficiently fluid (like motor oil) to pour easily.
- Transfer about 20 ml into a suitable container and maintain at a temperature of 135 ± 5.5 °C stirring occasionally to allow entrapped air to escape. Pour the hot bitumen in the Canning-Manning vacuum viscometer through the larger diameter filling tube A so that bitumen is within ± 2 mm of the fill line E.
- Place the charged viscometer in an oven or bath maintained at 135 ± 5.5 °C for a period of 10 ± 2 minutes to allow larger air bubbles to escape.

TESTING

- Maintain the test bath temperature at 60 ± 0.1 °C.
- Place the charged viscometer vertically in the test bath with the help of a holder so that that the uppermost timing mark is at least 2 cm below the surface of the bath liquid.
- Establish a vacuum of 30 ± 0.05 cm of mercury in the vacuum system and connect to the viscometer with the valve closed. After the viscometer has been in the bath for 30 ± 5 min, open the valve and allow the bitumen to flow in the viscometer.
- Measure the time required (to within ± 0.5 sec) for the leading edge of the meniscus to pass between successive pairs of timing marks. Report the first flow time which exceeds 60 sec between a pair of timing marks, noting the identification of the pair of the timing marks.

-- End of SOP –

KINEMATIC VISCOSITY TEST OF BITUMEN

STANDARD: I.S. 1206 (Part III) -2021

- This standard (Part III) covers the method for the determination of kinematic viscosity of paving grade and cut-back bitumen and distillation residues of cut-backs. It is applicable to the materials having a viscosity range of 30-100000.

DEFINITION:

- Kinematic viscosity is defined as the quotient of the absolute or dynamic viscosity divided by the density of the liquid both at the same temperature.

APPARATUS:

1. Constant Temperature Bath
2. Silicone Bath Oil suitable up to 150 °C, Vacuum
3. Thermometer for Bath – Mercury in glass, range 37.8 to 82 °C, and graduations of 0.2 °C.
4. Timing Device – A stop watch or stop clock capable of reading up to ½ second.
5. Cannon-Manning Vacuum Viscometers- With manufacturers' calibration certificate, viscometer holder and silicone cork. Size 6 is suitable for testing VG-10, VG-20, VG-30, and VG-40 bitumen.

PROCEDURE:

- Heat the sample to a temperature not more than 60 °C for tars and pitches and not more than 90 °C for bitumen above the corresponding approximate softening point temperature respectively until it attains pouring consistency.
- Stir it thoroughly and transfer approximately 20 ml in a 30 ml container. Local over-heating and entrapped air should be avoided.
- Mount the BS U-tube viscometer in the constant temperature bath keeping tube ***L*** vertical.
- Pour sample through tube N to a point just above filling mark G, allow the sample to flow freely through capillary R, taking care that the liquid column remains

unbroken until the lower mark H and then arrest its flow by closing the timing tube with a cork or rubber stopper in tube **L.**

- Add more liquid, if necessary, to bring the upper meniscus slightly above mark G.
- After allowing the sample to attain bath temperature and any air bubble to rise to the surface (usually about 20-30 min is required), gently loosen the stopper allowing the sample to flow until it is approximately at the lower filling mark **H** and press back the stopper to arrest flow.
- Remove the except sample above filling mark G by inserting the special pipette until its cork rests on top of the tube N and apply gentle suction until air is drawn through.
- The upper meniscus shall coincide with mark G.
- Allow the viscometer to remain in the constant temperature bath for a sufficient time to ensure that the sample reaches temperature equilibrium.
- It takes about 20 min at 38 °C, 25 min at 100 °C and 30 min at 135 °C. Remove the stopper in the tube N and L respectively and allow the sample to flow by gravity.
- Measure to the nearest 0.1 s the time required for the leading edge of the meniscus to pass from timing mark E to timing mark I. If this efflux time is less than60 s, select a viscometer of smaller capillary diameter and repeat the operation.
- Upon completion of the test, clean the viscometer thoroughly by several mixing with an appropriate solvent completely miscible with the sample followed by a completely volatile solvent. Dry the tube by passing slow stream of filtered dry air through the capillary until the last trace of solvent is removed.

-- End of SOP --

DETERMINATION OF LOSS ON HEATING

STANDARD IS 1212: 2022: -

- This standard covers the procedure for determining of loss on heating of asphaltic bitumen.

APPARATUS: -

1. Oven
2. Perforated metal shelf
3. Thermometer
4. Container

PROCEDURE: -

- Stir and agitate thoroughly the material as received, warming, if necessary, to ensure a complete mixture before a portion is removed for the test.
- Heat the container in an oven at 100 to 110˚C for 30 minutes, cool and weigh.
- Weigh into the container 50.0 ± 0.5 g of the material correct to the nearest 0.01 g.
- Bring the oven to a temperature of 163 ± 1°C and place the sample container in the revolving shelf near the circumference or in one of the recesses if the recommended shelf is used.
- Close the oven and rotate the shelf during the entire test at a rate of 5 to 6 rev/min, the temperature being maintained at 163 ± 1°C for 5 h after the sample has been introduced and the oven has again reached the temperature.
- The 5-hour period & all start when the temperature reaches 162°C and in no case shall the total time, during which the sample is in the oven, be more than 5 hours 15 minutes.
- At the end of the specified heating period, remove the containers, cool to room temperature and weigh to 0.01 g.
- In ordinary circumstances, a number of samples having about the same degree of volatility may be tested at the same time, but samples varying greatly in volatility shall be tested separately. However, when extreme accuracy is required, only one material, that is, two containers shall be placed in the oven at one time.

-- End of SOP –

DETERMINATION OF LOSS ON HEATING

STANDARD IS 1212: 2022: -

- This standard covers the procedure for determining of loss on heating of asphaltic bitumen.

APPARATUS: -

5. Oven
6. Perforated metal shelf
7. Thermometer
8. Container

PROCEDURE: -

- Stir and agitate thoroughly the material as received, warming, if necessary, to ensure a complete mixture before a portion is removed for the test.
- Heat the container in an oven at 100 to 110˚C for 30 minutes, cool and weigh.
- Weigh into the container 50.0 ± 0.5 g of the material correct to the nearest 0.01 g.
- Bring the oven to a temperature of 163 ± 1°C and place the sample container in the revolving shelf near the circumference or in one of the recesses if the recommended shelf is used.
- Close the oven and rotate the shelf during the entire test at a rate of 5 to 6 rev/min, the temperature being maintained at 163 ± 1°C for 5 h after the sample has been introduced and the oven has again reached the temperature.
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