



Standard Test Method for Solvent Extractables in Petroleum Waxes¹

This standard is issued under the fixed designation D 3235; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

1. Scope

1.1 This test method covers the determination of solvent extractables in petroleum waxes.

1.2 The values stated in acceptable metric units are to be regarded as the standard. The values in parentheses are for information only.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

- D 740 Specification for Methyl Ethyl Ketone²
 - D 841 Specification for Nitration Grade Toluene²
 - D 1078 Test Method for Distillation Range of Volatile Organic Liquids²
 - D 1218 Test Method for Refractive Index and Refractive Dispersion of Hydrocarbon Liquids³
 - D 1364 Test Method for Water in Volatile Solvents (Fischer Reagent Titration Method)²
 - D 1613 Test Method for Acidity in Volatile Solvents and Chemical Intermediates Used in Paint, Varnish, Lacquer and Related Products²
 - E 1 Specification for ASTM Thermometers⁴
 - E 128 Test Method for Maximum Pore Diameter and Permeability of Rigid Porous Filters for Laboratory Use⁵
- #### 2.2 IP Standard:⁶
- Colour, Lovibond, IP 17, Method B

3. Summary of Test Method

3.1 The sample is dissolved in a mixture consisting of 50 volume % methyl ethyl ketone and 50 volume % toluene. The solution is cooled to -32°C (-25°F) to precipitate the wax,

then filtered. The solvent extractables content is determined by evaporating the solvent from the filtrate and weighing the residue.

4. Significance and Use

4.1 The solvent extractables in a wax may have significant effects on several of its properties such as strength, hardness, flexibility, scuff resistance, coefficient of friction, coefficient of expansion, melting point, and staining characteristics. Whether these effects are desirable or undesirable depends on the intended use of the wax.

5. Apparatus

5.1 *Filter Stick and Assembly*, consisting of a 10-mm diameter sintered glass filter stick of 10 to 15 μm maximum pore diameter as determined by the method in the Appendix, provided with an air pressure inlet tube and delivery nozzle. It is provided with a ground-glass joint to fit a 25 by 170-mm test tube. The dimensions for a suitable filtration assembly are shown in Fig. 1.

NOTE 1—A metallic filter stick may be employed if desired. A filter stick⁷ made of stainless steel and having a 12.7-mm (0.50-in.) disk of 10 to 15 μm maximum pore diameter, as determined by Test Method E 128, has been found to be satisfactory. The metallic apparatus is inserted into a 25 by 150-mm test tube and held in place by means of a cork.

5.2 *Cooling Bath*, consisting of an insulated box with 25.4-mm (1.00-in.) holes in the center to accommodate any desired number of test tubes. The bath may be filled with a suitable medium such as kerosine, and may be cooled by circulating a refrigerant through coils, or by using solid carbon dioxide. A suitable cooling bath to accommodate three test tubes is shown in Fig. 2.

5.3 *Dropper Pipet*, dispensing device capable of delivering 0.5 ± 0.05 g of molten wax.

5.4 *Transfer Pipet*, or equivalent volume dispensing device, capable of delivering 15 ± 0.06 mL.

5.5 *Air Pressure Regulator*, designed to supply air to the filtration assembly (8.5) at sufficient pressure to give an even flow of filtrate. Either a conventional pressure-reducing valve or a mercury bubbler-type regulator has been found satisfactory. The latter type, illustrated in Fig. 3, consists of a 250-mL

⁷ A suitable metal filter stick with designated porosity G may be obtained from the Pall Trinity Micro Corp., Route 281, Cortland, NY 13045. A list of United Kingdom suppliers can be obtained from the Institute of Petroleum, 61 New Cavendish St., London, W. 1, England.

¹ This test method is under the jurisdiction of ASTM Committee D-2 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.10 on Properties of Petroleum Wax.

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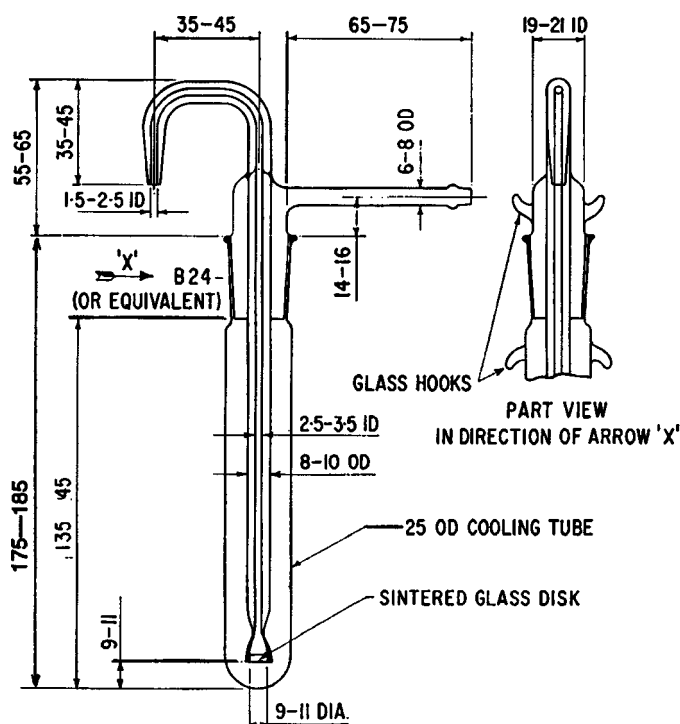
² Annual Book of ASTM Standards, Vol 06.04.

³ Annual Book of ASTM Standards, Vol 05.01.

⁴ Annual Book of ASTM Standards, Vol 14.03.

⁵ Annual Book of ASTM Standards, Vol 14.02.

⁶ Available from the Institute of Petroleum, 61 New Cavendish St., London, W.1, England.



All dimensions are in millimetres

FIG. 1 Filter Stick

glass cylinder and a T-tube held in the cylinder by means of a rubber stopper grooved at the sides to permit the escape of excess air. The volume and pressure of the air supplied to the filtration assembly is regulated by the depth to which the T-tube is immersed in mercury at the bottom of the cylinder. Absorbent cotton placed in the space above the mercury prevents the loss of mercury by spattering. The air pressure regulator is connected to the filter stick and assembly by means of rubber tubing.

5.6 *Thermometers*, two, having a range as shown below and conforming to the requirements as prescribed in Specification E 1 or in the specifications for IP Standard Thermometers. One thermometer is required for the cold bath and a second thermometer is required for the sample solution.

Thermometer Number	Range
ASTM 71F	-35 to + 70°F
IP 72C	-32 to + 21°C
IP 72F	-35 to + 70°F

5.7 *Weighing Bottles*, conical in shape and glass-stoppered, having a capacity of 15 mL.

5.8 *Evaporation Assembly*, consisting of an evaporating cabinet and connections, essentially as illustrated in Fig. 4, and capable of maintaining a temperature of $35 \pm 1^\circ\text{C}$ ($95 \pm 2^\circ\text{F}$) around the evaporation flasks. Construct the jets with an inside diameter of 4 ± 0.2 mm for delivering a stream of clean, dry air vertically downward into the weighing bottle. Support each jet so that the tip is 15 ± 5 mm above the surface of the liquid at the start of the evaporation. Supply air at the rate of 2 to 3 L/min per jet, purified by passage through a tube of 1-cm bore packed loosely to a height of 20 cm with absorbent cotton. Periodically check the cleanliness of the air by evaporating 4 mL of the solvent mixture described in 6.3 by the procedure

specified in 8.5. When the residue does not exceed 0.1 mg, the evaporation equipment is operating satisfactorily.

NOTE 2—Investigations by the European World Federation have indicated that improved precision may be achieved by individually calibrating each nozzle to deliver a flow rate of 2 to 3 L/min.

5.9 *Analytical Balance*, capable of reproducing weights to 0.1 mg. The sensitivity should be adjusted so that 0.1 mg will deflect the pointer one half division on the pointer scale.

5.10 *Wire Stirrer*—A piece of stiff made of iron, stainless steel, or Nichrome wire of about No. 20 Bands (0.9 mm in diameter) or 16 swg. gage, 250 mm long. A 10-mm diameter loop is formed at each end, and the loop at the bottom end is bent so that the plane of the loop is perpendicular to the wire.

6. Solvent

6.1 *Methyl Ethyl Ketone*, conforming to Specification D 740, or to Table 1.

6.2 *Toluene*, conforming to Specification D 841.

6.3 *Solvent Mixture*—Prepare a mixture of 50 volume % methyl ethyl ketone and 50 volume % toluene.

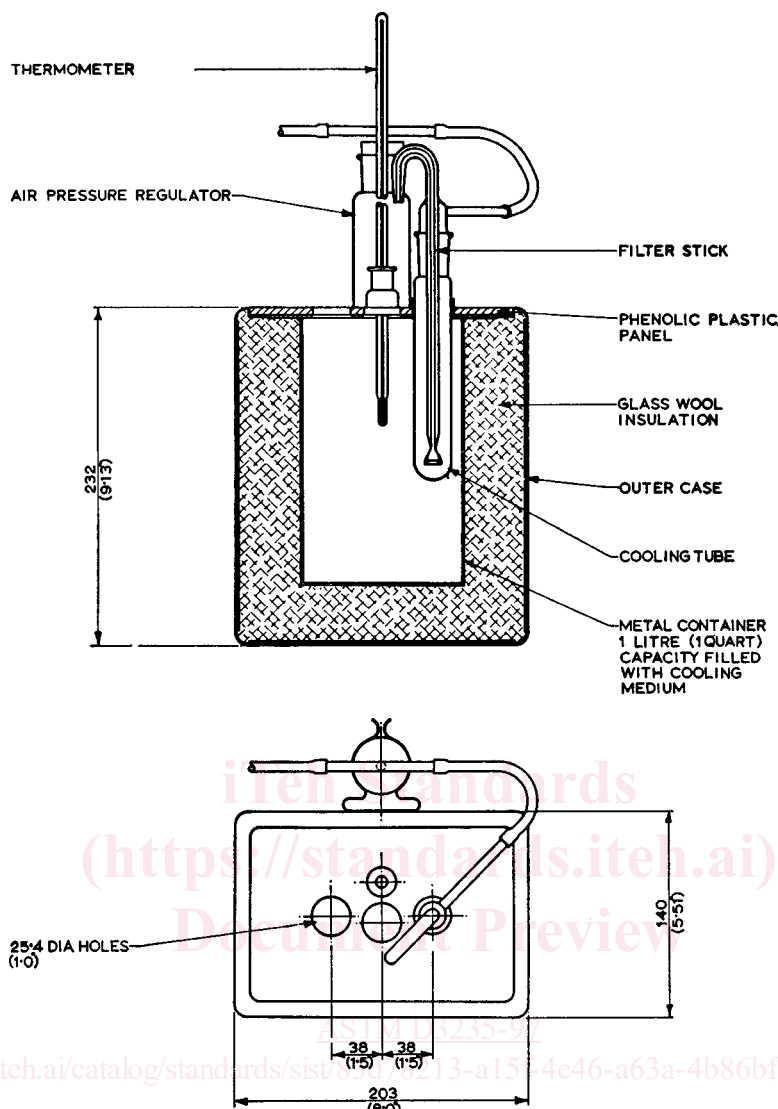
6.4 Store the solvent mixture over anhydrous calcium sulfate (5 weight % of the solvent). Filter prior to use.

7. Sample

7.1 Obtain a representative portion by melting the entire sample and stirring thoroughly. This is necessary because the extractables may not be distributed uniformly throughout the solidified sample.

8. Procedure

8.1 Melt a representative portion of the sample, using a water bath or oven maintained at 70 to 100°C (158 to 212°F).



All dimensions are in millimetres (inches)

FIG. 2 Cooling Bath

As soon as the wax is completely melted, thoroughly mix. Preheat the pipet or equivalent measuring device in order to prevent the solidification of wax in the tip, and withdraw a portion of the sample as soon as possible after the wax has melted. The mass of wax transferred to the test tube must be 1.00 ± 0.05 g. Allow the test tube to cool, and weigh to the nearest 1 mg.

NOTE 3—The weight of a test tube which is cleaned by means of solvent will not vary to a significant extent. Therefore, a tare weight may be obtained and used repeatedly.

8.2 Pipet 15 ml of the solvent mixture into the test tube and place the latter just up to the level of its contents in a hot water or steam bath. Heat the solvent-wax mixture, stirring up and down with the wire stirrer, until a homogeneous solution is obtained. Exercise care to avoid loss of solvent by prolonged boiling.

NOTE 4—Very high-melting wax samples may not form clear solutions. Stir until the undissolved material is well dispersed as a fine cloud.

8.2.1 Plunge the test tube into an 800-mL beaker of ice

water and continue to stir until the contents are cold. Remove the stirrer. Remove the test tube from the ice bath, wipe dry on the outside with a cloth, and weigh to the nearest 0.1 g.

NOTE 5—During this operation the loss of solvent through vaporization should be less than 1 %. The weight of the solvent is, therefore, practically a constant, and, after a few samples are weighed, this weight can be used as a constant factor.

8.3 Place the test tube containing the wax-solvent slurry in the cooling bath, which is maintained at $-34.4 \pm 1^\circ\text{C}$ ($-30 \pm 2^\circ\text{F}$). During this chilling operation stir the contents of the tube by means of a thermometer placed in the tube. It is important that stirring by means of the thermometer be almost continuous, in order to maintain a slurry of uniform consistency as the wax precipitates. Do not allow the wax to set up on the walls of the cooling vessel nor permit any lumps of wax crystals to form. Continue stirring until the temperature reaches $-31.7 \pm 0.3^\circ\text{C}$ ($-25 \pm 0.5^\circ\text{F}$).

8.4 Remove the thermometer from the tube and allow it to drain momentarily into the tube, then immediately immerse in