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Standard Test Method for STAINING PROPERTIES OF ASPHALT¹

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1. Scope

1.1 This test method covers the determination of the staining properties of asphalt by the modified pressure method.

1.2 This test method is applicable to asphalts having ring-and-ball softening points of 65°C (150°F) or greater, and should not be used for testing asphalts having softening points below 65°C, except for those having a penetration of 35 or less.

1.3 The values stated in SI units are to be regarded as the standard. The values stated in inch-pound units are provided for information.

1.4 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Applicable Documents

2.1 ASTM Standards:

D36 Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)²

D140 Methods of Sampling Bituminous Materials³

3. Summary of Method

3.1 The asphalt is placed in a specially designed mold and pressed against a stack of standard papers by application of gas pressure. The number of papers stained by exuded oil is designated as the Stain Index of the asphalt.

4. Significance and Use

4.1 This test method measures the tendency for oil components to separate spontaneously from bitumens.

4.2 The Stain Index is related to the thermodynamic stability of the asphalt. Higher Stain Index values indicate lower stability.

5. Apparatus and Materials

5.1 *Stain Molds*, as shown in Fig. 1.

5.2 *Mold Assembly Jig*, as shown in Fig. 2.

5.3 *Pressure Vessel*, as shown in Fig. 3.

5.4 *Source of Gas Pressure and Regulating Equipment (Compressed Air or Nitrogen)*—Metal tubing, 6 mm (¼ in.) in outside diameter, and compression fitting to connect to the pressure vessel. A shut-off valve should be installed between the source of gas pressure and the pressure gage to permit testing for leaks.

5.5 *Electric Oven*, with temperature control of $\pm 1.5^\circ\text{C}$ ($\pm 3^\circ\text{F}$) at 100°C (212°F), of sufficient size to permit the assembly of the pressure vessel and molds therein.

5.6 *Standard Paper*—The test paper shall be a porous, uncoated, and unfilled paper approximately 15 μm (0.6 mil) thick; typically a cigarette paper. It shall be agreed upon by buyer and seller. The paper used by different laboratories for comparative tests shall be obtained from the same source and shall be from the same lot.

5.7 *Torque Wrench*, 0 to 3.4 N·m (30 lbf·in.).

5.8 *Open-End Crowfoot Attachment for Torque Wrench*.

5.9 *American Swiss Arch Punch*, No. 5, with a 19-mm (¾-in.) hole for cutting disks of test paper.

5.10 *Vulcanized Rubber Sheet*, 1.5-mm (1/16-

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² *Annual Book of ASTM Standards*, Vol 04.04.

³ *Annual Book of ASTM Standards*, Vols 04.03 and 04.04.



in.) thick, of 40 to 50 durometer hardness.

5.11 *Ultraviolet Light Source*, range from wave length of 0.30 to 0.41 μm with peak from 0.35 to 0.36 μm .

5.12 *Viewing Box or Darkroom*, as shown in Fig. 4.

5.13 *Desiccator*, capable of maintaining $50 \pm 5\%$ relative humidity at 25°C (77°F), using 45 % H_2SO_4 solution as a desiccant.

5.14 *Asbestos-Graphite Gasket Material*, 1.5 mm ($1/16$ in.) thick.

5.15 *Cellophane Sheetting*, not moisture-proofed.

5.16 *Manila Folders*.

5.17 *Small Bench Vise*.

5.18 *Paperboard*, 645 g/m^2 , 0.65 to 0.75 mm (0.025 to 0.030 in.) thick, and having a hard smooth surface.

5.19 *Small Tweezers*, for handling test papers.

6. Sampling

6.1 Sample the material in accordance with Methods D 140.

7. Procedure

7.1 Preparation of Paper Disks:

7.1.1 Place 31 sheets of the test paper and one sheet of cellophane inside a manila folder. Mark each fifth sheet with light pencil lines to facilitate counting at the end of the test. Avoid touching the papers with the hands, as this may contaminate them with fluorescent oil.

7.1.2 Condition the paper assembly at $50 \pm 5\%$ relative humidity at room temperature of 23°C (74°F) for at least 18 h prior to use.

7.1.3 Cut cylindrical sections, consisting of 31 disks of test paper, one disk of cellophane, and two disks of manila paper from the pad by means of the punch with the 19-mm ($3/4$ -in.) hole. Discard the two disks of manila paper. Also cut one hard paperboard disk and a disk of rubber 19 mm ($3/4$ in.) in diameter for use with each mold assembly.

7.2 Test Specimens:

7.2.1 Heat the asphalt with care to prevent local overheating with frequent stirring until it has become sufficiently fluid to pour. In no case, however, shall the temperature be raised to more than 110°C (230°F) above softening point. Avoid incorporating air bubbles in the test sample.

7.2.2 Bring the asphalt to the pouring temperature in not more than 2 h.

7.2.3 Place the center section of the stain-test

mold (Fig. 1) on a sheet of untreated cellophane sheeting and pour the molten asphalt into the mold until it is about half full. When the asphalt has cooled to room temperature, moisten the cellophane sheet, and strip it from the asphalt. This provides a flat, fresh, clean surface of asphalt for the test.

7.2.4 Fasten the mold assembly jig in the vise with the screw at the top. Then place the center section of the mold on the small button at the bottom of the jig with the flat asphalt surface up.

7.2.5 Place the 31 disks of test paper on top of the asphalt surface. First lay the disk of cellophane, then the disk of rubber, and then the hard paperboard disk on top of the papers.

7.2.6 Rest the bottom section on the center section, and pull the sections together by turning the threaded collar by hand. Gently lower the screw of the jig until it engages the bottom section of the mold. Place the crowfoot attachment on the threaded collar and use the torque wrench to apply a force of 2.8 N·m (25 lbf·in.) within a period of 15 to 30 s.

7.3 Exposure:

7.3.1 Remove the completed assembly of the center and bottom sections from the jig and screw it into the top section of the mold, which is attached permanently to the pressure vessel. Use a 1.5-mm ($1/16$ -in.) asbestos graphite washer with a 3-mm ($1/8$ -in.) diameter center hole to prevent leakage between the center and top sections. Apply no torque to the bottom section when screwing the completed assembly of the center and bottom sections into the top section. Application of torque at that point would change the edge pressure on the disks of test paper.

7.3.2 Place the pressure vessel with attached molds in the oven and connect it to the gas pressure line. Maintain a temperature of $100 \pm 15^\circ\text{C}$ ($212 \pm 3^\circ\text{F}$) and a pressure of 350 ± 20 kPa (51 ± 3 psi) on the assembly for 18 h. No detectable air leakage is permissible, since it will cause local variation in temperature in different sections of the assembly.

7.3.3 After 18 h release the pressure, cool the unit, and disconnect the individual molds from the pressure vessel.

7.4 Counting Stained Papers:

7.4.1 Separate the center and bottom sections and mount the test papers in sequence on a white sheet of paper. A pressure-sensitive adhesive tape with its adhesive side exposed through a row of 6-mm ($1/4$ -in.) diameter holes in the white sheet

can be used for mounting the papers. Handle the papers with tweezers, and avoid touching them with the hands to prevent contamination with oil.

7.4.2 Place the mounted papers in the viewing box or darkroom and examine them in ultraviolet light. The oil-stained papers can be readily observed by the fluorescence of the spots. All papers are considered stained which show any trace of oily fluorescence on any part of the paper, either center or edge.

8. Report

8.1 Report the number of stained papers, ex-

cluding the paper in direct contact with the asphalt, which is always stained.

8.2 The count of the stained papers is designated as the Stain Index of the asphalt.

8.3 Identify the asphalt type and source.

9. Precision

9.1 Results should not differ from the mean by more than the following:

	Repeatability, One Operator and Apparatus	Reproducibility, Different Operators and Apparatus
Percentage of average Stain Index	10	15