



Designation: D2007 – 19 (Reapproved 2024)^{ε1}

Standard Test Method for Characteristic Groups in Rubber Extender and Processing Oils and Other Petroleum-Derived Oils by the Clay-Gel Absorption Chromatographic Method¹

This standard is issued under the fixed designation D2007; 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 reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

ε¹ NOTE—Editorially updated Terminology Section 3 in March 2024.

1. Scope

1.1 This test method covers a procedure for classifying oil samples of initial boiling point of at least 260 °C (500 °F) into the hydrocarbon types of polar compounds, aromatics and saturates, and recovery of representative fractions of these types. This classification is used for specification purposes in rubber extender and processing oils.

NOTE 1—See Test Method [D2226](#).

1.2 This test method is not directly applicable to oils of greater than 0.1 % by mass pentane insolubles. Such oils can be analyzed after removal of these materials, but precision is degraded (see [Appendix X1](#)).

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* Specific warning statements are given in [6.1](#), Section [7](#), [A1.4.1](#), and [A1.5.5](#).

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

¹ This test method is under the jurisdiction of ASTM Committee [D02](#) on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee [D02.04.0C](#) on Liquid Chromatography.

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2. Referenced Documents

2.1 ASTM Standards:²

- [D2226](#) Classification for Various Types of Petroleum Oils for Rubber Compounding Use
- [D4175](#) Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants
- [D5309](#) Specification for Cyclohexane 999
- [E691](#) Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms used in this test method, refer to Terminology [D4175](#).

3.2 Definitions of Terms Specific to This Standard:

3.2.1 The following terms refer to the hydrocarbon types and structural groups as measured by this test method:

3.2.2 *aromatics, n*—material that, on percolation, passes through a column of adsorbent clay in a *n*-pentane eluent but adsorbs on silica gel under the conditions specified.

3.2.3 *asphaltenes, or n-pentane insolubles, n*—insoluble matter that precipitates from a solution of oil in *n*-pentane under the specified conditions.

3.2.4 *polar aromatics, n*—synonym for polar compounds.

3.2.5 *polar compounds, n*—material retained on adsorbent clay after percolation of the sample in *n*-pentane eluent under the conditions specified.

3.2.6 *saturates, n*—material that, on percolation in a *n*-pentane eluent, is not adsorbed on either the clay or silica gel under the conditions specified.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

4. Summary of Test Method

4.1 The sample is diluted with solvent and charged to a glass percolation column containing clay in the upper section and silica gel plus clay in the lower section. *n*-pentane is then charged to the double column until a definite quantity of effluent has been collected. The upper (clay) section is removed from the lower section and washed further with *n*-pentane. A toluene-acetone mixture 50 to 50 by volume is then charged to the clay section for desorption and a specified volume of effluent collected. The lower (gel) column may be desorbed by recirculation of toluene.

4.2 The solvents are completely removed from the recovered *n*-pentane and the toluene-acetone fractions and the residues are weighed and calculated as saturate and polar compounds contents. Aromatics may be calculated by difference, or measured following evaporation of the toluene used for desorption of the gel column.

4.3 When the sample contains more than 0.1 % by mass of *n*-pentane insolubles, this test method cannot be used directly. The insoluble matter must be removed from the sample prior to charging to the column. A method for this removal is given as an appendix.

4.4 Alternative methods are provided (1) for recovery of aromatics from the gel column, and (2) for analysis of oil with high-polar content.

5. Significance and Use

5.1 The composition of the oil included in rubber compounds has a large effect on the characteristics and uses of the compounds. The determination of the saturates, aromatics, and polar compounds is a key analysis of this composition.

5.2 The determination of the saturates, aromatics, and polar compounds and further analysis of the fractions produced is often used as a research method to aid understanding of oil effects in rubber and other uses.

6. Apparatus

6.1 *Beakers, Anticreep*, 150 mL capacity, as illustrated in Fig. 1. (**Warning**—Beakers should be examined for sharp edges and fire polished, if necessary.)

6.2 *Clay-Gel Column*, constructed as illustrated in Fig. 2.

6.3 *Conical Flasks*, (Erlenmeyer), 250 mL capacity.

6.4 *Solvent Receiver*, capable of collecting solvent, without splashing or loss of material during the analysis. A wide-mouth, graduated, 500 mL capacity Erlenmeyer flask is one such example that has been found suitable to use.

6.5 *Filter Funnel*, long stem; for use with 185 mm ready folded, fine-texture, rapid filter paper.

6.6 *Separatory Funnel*, 500 mL.

6.7 *Hot Plate*, explosion proof, controlled to a surface temperature of 100 °C to 105 °C.

NOTE 2—Temperatures should be uniform on the top of the hot plate. Some laboratory hot plates benefit by the inclusion of an aluminum plate, approximately 6 mm thick, included under or on top of regular plate top.

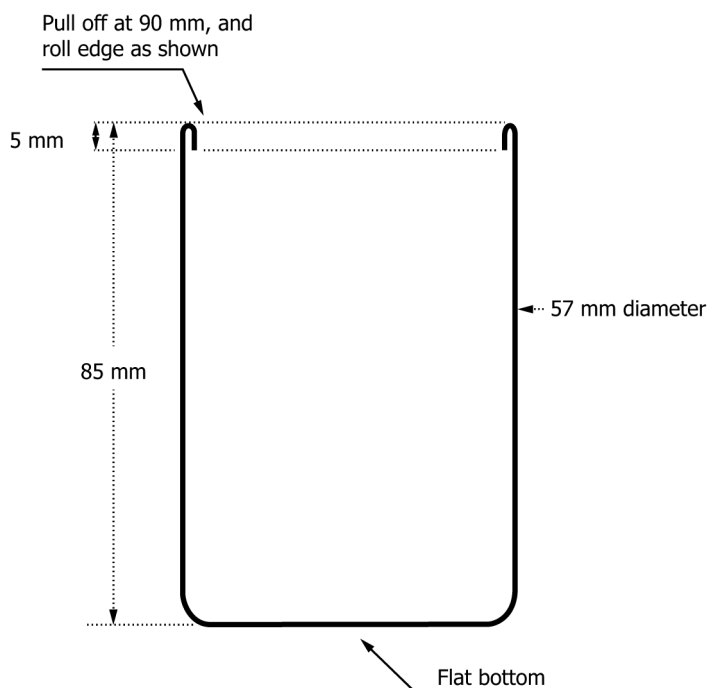


FIG. 1 Anticreep Beaker

6.8 *Round Bottom Flask*, 3-necked, borosilicate, 500 mL capacity (Fig. 3).

6.9 *Condenser*, borosilicate (Fig. 3).

6.10 *Adapter Tube* with Vigreux column (Fig. 3).^{3,4}

6.11 *Flexible Joint*, TFE-fluorocarbon and borosilicate, 24/40 T_S ground glass joints on each end.^{4,5}

7. Reagents and Materials

7.1 *Purity of Reagents*, Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the committee on Analytical Reagents of the American Chemical Society, where such specifications are available.⁶ Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

7.2 *Acetone*, reagent grade, minimum purity. (**Warning**—Acetone is extremely flammable.)

7.3 *Calcium Chloride*, anhydrous granules.

³ The sole source of supply of the adapter tube known to the committee at this time is Owens Glass Apparatus, Inc., 128 River Road, Channelview, TX 77530. This item can be fabricated at any scientific glassblowing shop.

⁴ If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,¹ which you may attend.

⁵ Cole Parmer No. 6675-40 has been found suitable for this purpose.

⁶ *ACS Reagent Chemicals, Specifications and Procedures for Reagents and Standard-Grade Reference Materials*, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.