



# Standard Test Method for Relative Molecular Mass (Molecular Weight) of Hydrocarbons by Thermoelectric Measurement of Vapor Pressure<sup>1</sup>

This standard is issued under the fixed designation D 2503; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the Department of Defense.*

## 1. Scope

1.1 This test method covers the determination of the average relative molecular mass (molecular weight) of hydrocarbon oils. It can be applied to petroleum fractions with molecular weights (relative molecular mass) up to 3000; however, the precision of the method has not been established above 800 molecular weight (relative molecular mass). The method should not be applied to oils having initial boiling points lower than 220°C.

1.2 Values stated in SI units are to be regarded as the standard. The values given in parentheses are provided for information purposes 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.* For specific hazard statements, 5.2.1, 5.2.3, and 5.2.3.

## 2. Summary of Test Method

2.1 A weighed portion of the sample is dissolved in a known quantity of appropriate solvent. A drop of this solution and a drop of solvent are suspended, side by side, on separate thermistors in a closed chamber saturated with solvent vapor. Since the vapor pressure of the solution is lower than that of the solvent, solvent condenses on the sample drop and causes a temperature difference between the two drops. The resultant change in temperature is measured and used to determine the relative molecular mass (molecular weight) of the sample by reference to a previously prepared calibration curve.

## 3. Significance and Use

3.1 Relative molecular mass (molecular weight) is a fundamental physical constant that can be used in conjunction with other physical properties to characterize pure hydrocarbons and their mixtures.

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D-2 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.04 on Hydrocarbon Analysis.

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3.2 A knowledge of the relative molecular mass (molecular weight) is required for the application of a number of correlative methods that are useful in determining the gross composition of the heavier fractions of petroleum.

## 4. Apparatus

4.1 *Vapor Pressure Osmometer*, with operating diagram.<sup>2</sup>

## 5. Reagents and Materials

5.1 *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.<sup>3</sup> 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.

5.2 *Solvents*—Solvents that do not react with the sample must be used. Since many organic materials exhibit a tendency to associate or dissociate in solution, it is desirable to use polar solvents for polar samples and nonpolar solvents for nonpolar samples. The solvents listed have been found suitable for hydrocarbons and petroleum fractions.

### 5.2.1 Benzene

NOTE 1—**Warning:** Poison. Carcinogen. Harmful if swallowed. Extremely flammable. Vapors may cause flash fire. Vapor harmful, may be absorbed through skin.

### 5.2.2 Chloroform

NOTE 2—**Warning:** May be fatal if swallowed. Harmful if inhaled. May produce toxic vapors if burned.

### 5.2.3 1,1,1-Trichloroethane

<sup>2</sup> A vapor pressure osmometer is available from H. Knauer and Co., Berlin, West Germany. The manufacture of the Mechrolab instrument previously referred to in this footnote has been discontinued. However, some models may be available from stocks on hand at laboratory supply houses, or as used equipment from laboratory instrument exchanges.

<sup>3</sup> "Reagent Chemicals, American Chemical Society Specifications," Am. Chemical Soc., Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see "Analytical Standards for Laboratory U.K. Chemicals," BDH Ltd., Poole, Dorset, and the "United States Pharmacopeia."