



Designation: D4052 – 16

Standard Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter¹

This standard is issued under the fixed designation D4052; 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.

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

1. Scope*

1.1 This test method covers the determination of the density, relative density, and API Gravity of petroleum distillates and viscous oils that can be handled in a normal fashion as liquids at the temperature of test, utilizing either manual or automated sample injection equipment. Its application is restricted to liquids with total vapor pressures (see Test Method [D5191](#)) typically below 100 kPa and viscosities (see Test Method [D445](#) or [D7042](#)) typically below about 15 000 mm²/s at the temperature of test. The total vapor pressure limitation however can be extended to >100 kPa provided that it is first ascertained that no bubbles form in the U-shaped, oscillating tube, which can affect the density determination. Some examples of products that may be tested by this procedure include: gasoline and gasoline-oxygenate blends, diesel, jet, basestocks, waxes, and lubricating oils.

1.1.1 Waxes and highly viscous samples were not included in the 1999 interlaboratory study (ILS) sample set that was used to determine the current precision statements of the method, since all samples evaluated at the time were analyzed at a test temperature of 15 °C. Wax and highly viscous samples require a temperature cell operated at elevated temperatures necessary to ensure a liquid test specimen is introduced for analysis. Consult instrument manufacturer instructions for appropriate guidance and precautions when attempting to analyze wax or highly viscous samples. Refer to the Precision and Bias section of the method and [Note 8](#) for more detailed information about the 1999 ILS that was conducted.

1.2 In cases of dispute, the referee method is the one where samples are introduced manually as in [6.3](#) or [6.4](#), as appropriate for sample type.

1.3 When testing opaque samples, and when not using equipment that is capable of automatic bubble detection, proper procedure shall be established so that the absence of air

bubbles in the sample cell can be established with certainty. For the determination of density in crude oil samples use Test Method [D5002](#).

1.4 The values stated in SI units are regarded as the standard, unless stated otherwise. The accepted units of measure for density are grams per millilitre (g/mL) or kilograms per cubic metre (kg/m³).

1.5 *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 warning statements, see [7.4](#), [7.5](#), and [10.3](#).*

2. Referenced Documents

2.1 ASTM Standards:²

- [D287](#) Test Method for API Gravity of Crude Petroleum and Petroleum Products (Hydrometer Method)
- [D445](#) Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)
- [D1193](#) Specification for Reagent Water
- [D1250](#) Guide for Use of the Petroleum Measurement Tables
- [D1298](#) Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method
- [D4057](#) Practice for Manual Sampling of Petroleum and Petroleum Products
- [D4177](#) Practice for Automatic Sampling of Petroleum and Petroleum Products
- [D4377](#) Test Method for Water in Crude Oils by Potentiometric Karl Fischer Titration
- [D5002](#) Test Method for Density and Relative Density of Crude Oils by Digital Density Analyzer
- [D5191](#) Test Method for Vapor Pressure of Petroleum Products (Mini Method)

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 [D02.04.0D](#) on Physical and Chemical Methods.

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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.

*A Summary of Changes section appears at the end of this standard