



Designation: D445 – 15

British Standard 2000: Part 71: Section 1: 1996

Designation: 71 Section 1/97

Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)¹

This standard is issued under the fixed designation D445; 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 specifies a procedure for the determination of the kinematic viscosity, ν , of liquid petroleum products, both transparent and opaque, by measuring the time for a volume of liquid to flow under gravity through a calibrated glass capillary viscometer. The dynamic viscosity, η , can be obtained by multiplying the kinematic viscosity, ν , by the density, ρ , of the liquid.

Note 1—For the measurement of the kinematic viscosity and viscosity of bitumens, see also Test Methods D2170 and D2171.

Note 2—ISO 3104 corresponds to Test Method D445 – 03.

1.2 The result obtained from this test method is dependent upon the behavior of the sample and is intended for application to liquids for which primarily the shear stress and shear rates are proportional (Newtonian flow behavior). If, however, the viscosity varies significantly with the rate of shear, different results may be obtained from viscometers of different capillary diameters. The procedure and precision values for residual fuel oils, which under some conditions exhibit non-Newtonian behavior, have been included.

1.3 The range of kinematic viscosities covered by this test method is from 0.2 mm²/s to 300 000 mm²/s (see Table A1.1) at all temperatures (see 6.3 and 6.4). The precision has only been determined for those materials, kinematic viscosity ranges and temperatures as shown in the footnotes to the precision section.

1.4 The values stated in SI units are to be regarded as standard. The SI unit used in this test method for kinematic viscosity is mm²/s, and the SI unit used in this test method for dynamic viscosity is mPa·s. For user reference, 1 mm²/s = 10⁻⁶ m²/s = 1 cSt and 1 mPa·s = 1 cP = 0.001 Pa·s.

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 D02.07 on Flow Properties.

Current edition approved Feb. 1, 2015. Published March 2015. Originally approved in 1937. Last previous edition approved in 2014 as D445 – 14a. DOI: 10.1520/D0445-15.

In the IP, this test method is under the jurisdiction of the Standardization Committee.

1.5 **WARNING**—Mercury has been designated by many regulatory agencies as a hazardous material that can cause central nervous system, kidney and liver damage. Mercury, or its vapor, may be hazardous to health and corrosive to materials. Caution should be taken when handling mercury and mercury containing products. See the applicable product Material Safety Data Sheet (MSDS) for details and EPA's website—<http://www.epa.gov/mercury/faq.htm>—for additional information. Users should be aware that selling mercury and/or mercury containing products into your state or country may be prohibited by law.

1.6 *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:²

- D446 Specifications and Operating Instructions for Glass Capillary Kinematic Viscometers
- D1193 Specification for Reagent Water
- D1217 Test Method for Density and Relative Density (Specific Gravity) of Liquids by Bingham Pycnometer
- D1480 Test Method for Density and Relative Density (Specific Gravity) of Viscous Materials by Bingham Pycnometer
- D1481 Test Method for Density and Relative Density (Specific Gravity) of Viscous Materials by Lipkin Bicapillary Pycnometer
- D2162 Practice for Basic Calibration of Master Viscometers and Viscosity Oil Standards
- D2170 Test Method for Kinematic Viscosity of Asphalts (Bitumens)

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

Astm D 445 Manual

Jin-Ying Zhang



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Manual on Hydrocarbon Analysis, 1977 *The Biodiesel Handbook* Gerhard Knothe, Jürgen Krah, Jon Van Gerpen, 2015-08-13 The second edition of this invaluable handbook covers converting vegetable oils animal fats and used oils into biodiesel fuel The Biodiesel Handbook delivers solutions to issues associated with biodiesel feedstocks production issues quality control viscosity stability applications emissions and other environmental impacts as well as the status of the biodiesel industry worldwide Incorporates the major research and other developments in the world of biodiesel in a comprehensive and practical format Includes reference materials and tables on biodiesel standards unit conversions and technical details in four appendices Presents details on other uses of biodiesel and other alternative diesel fuels from oils and fats Fuels and Lubricants Handbook , **Field Manuals** United States. War Department, 1979-10-02 **Manuals Combined:**

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Revision F 539 pages System Safety Program Requirements 117 pages Test Method Standard Microcircuits Revision E 705 pages Test Method Standard Microcircuits Revision F 708 pages Procedures for Performing a Failure Mode Effects and Criticality Analysis Revision A 54 pages , *Tribology Data Handbook* E. Richard Booser,1997-09-26 This handbook is a useful aid for anyone working to achieve more effective lubrication better control of friction and wear and a better understanding of the complex field of tribology Developed in cooperation with the Society of Tribologists and Lubrication Engineers and containing contributions from 74 experts in the field the Tribology Data Handbook covers properties of materials lubricant viscosities and design friction and wear formulae The broad scope of this handbook includes military industrial and automotive lubricant specifications evolving areas of friction and wear performance and design considerations for machine elements computer storage units and metal working and more Important guidelines for the monitoring maintenance and failure assessment of lubrication in automotive industrial and aircraft equipment are also included Current environmental and toxicological concerns complete this one stop reference With hundreds of figures tables and equations as well as essential background information explaining the information presented this is the only source you need to find virtually any tribology information *Handbook of Lubrication and Tribology* George E. Totten,2006-04-06 When it was first published some two decades ago the original Handbook of Lubrication and Tribology stood on technology's cutting edge as the first comprehensive reference to assist the emerging science of tribology lubrication Later followed by Volume II Theory and Design and Volume III Monitoring Materials Synthetic Lubricants and Applications it has continued to serve as the cornerstone of every tribology and lubrication science library providing engineers researchers and technicians with the information they need to do their work and pioneer the advancements that have dramatically reshaped this field Now due to those advances the time has come to retool tribology's master text In addition to offering tribologists the facts figures and equations they need everyday Volume I Application and Maintenance Second Edition positions itself at the forefront of the field to address the latest technology related to application and maintenance procedures as well as changes in our understanding of how lubrication principles impact implementation Completely reorganized to aid the reader in identifying chapters and topics of interest every one of the chapters retained from the first edition has either been fully updated and revised or completely rewritten by a peer recognized team of experts who are currently active in a wide variety of industry segments With the addition of several new subject areas it now boasts a total of 37 chapters **Improving ASTM D445, the Manual Viscosity Test, by Video Recording** Hung Khuu,Nay Yee,Albert Butterfield,Mark Meiser,Tao Wei,Alexander Gutsol,Michael Moir,2018 Video recording of the manual version of the ASTM D445 Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids and Calculation of Dynamic Viscosity effectively automated this method resolved ergonomic concerns reduced chemical exposure of an operator drastically reduced probability of errors of the operator significantly improved productivity and simplified the analyst training process and work turnover The accuracy of

results is acceptable from the standpoint of the ASTM D445 method

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web the circuit can sense a soda can at a depth of six inches and metal pipes at an even greater distance the unit is powered by two 9v batteries in series the detector has a current draw of approximately 9 ma at 18 vdc as a result the batteries should last a long time figure 1 four transistor metal detector schematic theory

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