



Test Method for Sonic Shear Stability of Polymer-Containing Oils¹

This standard is issued under the fixed designation D 2603; 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 Department of Defense.

1. Scope

1.1 This test method covers the evaluation of the shear stability of an oil containing polymer in terms of the permanent loss in viscosity that results from irradiating a sample of the oil in a sonic oscillator. This test method can be useful in predicting the continuity of this property in an oil where no change is made in the base stock or the polymer. It is not intended that this test method serve to predict the performance of polymer-containing oils in service.

1.2 Evidence has been presented that correlation between the shear degradation results obtained by means of sonic oscillation and those obtained in mechanical devices can be poor. This is especially true in the case of automotive engines. Further evidence indicates that the sonic technique may rate different families of polymers in a different order than mechanical devices.^{2,3}

1.3 Because of these limitations, the committee under whose jurisdiction this test method falls has developed an alternative shear test method using a diesel injector nozzle, Test Method D 3945. While that test method has found some utility in the evaluation of crankcase oils, the stress imparted to the sample has been found to be insufficient to shear polymers of the shear-resistant type found in aircraft hydraulic fluids.

1.4 This test method is used for polymeric additive specifications, especially in the hydraulic fluid market.

1.5 The values stated in SI units are to be regarded as the standard. The values given in parentheses are provided for informational purposes only.

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:

D 445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)⁴

D 3945 Test Methods for Shear Stability of Polymer-Containing Fluids Using a Diesel Injector Nozzle⁵

D 6022 Practice for Calculation of Permanent Shear Stability Index⁶

3. Summary of Test Method

3.1 A convenient volume of polymer-containing oil is irradiated in a sonic oscillator for a period of time and the changes in viscosity are determined by Test Method D 445. Standard reference fluids containing either a readily sheared or shear-resistant polymer are run frequently to ensure that the equipment imparts a controlled amount of sonic energy to the sample.

NOTE 1—The conditions to obtain the data for the precision statement were a 30 mL sample, 10 min, and at 0°C.

4. Significance and Use

4.1 This test method permits the evaluation of shear stability with minimum interference from thermal and oxidative factors which may be present in some applications. Within the limitations expressed in the scope of this test method, it has been successfully applied to hydraulic fluids, transmission fluids, tractor fluids, and other fluids of similar applications. It has been found applicable to fluids containing both readily sheared and shear-resistant polymers. Correlation with performance in the case of automotive engine applications has, to date, not been established.

5. Apparatus

5.1 *Sonic Shear Unit*, fixed frequency oscillator and sonic horn.

5.2 *Auxiliary Equipment*—To facilitate uniform performance, the following auxiliary equipment is recommended:

5.2.1 *Cooling Bath or Ice Bath*—To maintain a desired temperature such as 0°C.

¹ This test method is under the jurisdiction of ASTM Committee D-2 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.07 on Flow Properties.

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² *The Effects of Polymer Degradation on Flow Properties of Fluids and Lubricants*, ASTM STP 382, ASTM, 1965. Available from ASTM Headquarters, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

³ *Shear Stability of Multigrade Crankcase Oil*, ASTM DS 49, ASTM, 1973. Available from ASTM Headquarters, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

⁴ *Annual Book of ASTM Standards*, Vol 05.01.

⁵ *Annual Book of ASTM Standards*, Vol 05.02.

⁶ *Annual Book of ASTM Standards*, Vol 05.03.