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Standard Test Method for Sonic Shear Stability of Hydraulic Fluid[1]

This standard is issued under the fixed designation D 5621; 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.

1. Scope

1.1 This test method covers the evaluation of the shear stability of a hydraulic fluid in terms of the final viscosity that results from irradiating a sample of the hydraulic fluid in a sonic oscillator.

1.2 Evidence has been presented that a good correlation exists between the shear degradation that results from sonic oscillation and that obtained in a vane pump test procedure.[2]

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.*

1.4 This test method uses millimetres squared per second (mm^2/s), an SI unit, as the unit of viscosity. For information, the equivalent unit, cSt, is shown in parentheses.

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)[3]

D 2603 Test Method for Sonic Shear Stability of Polymer-Containing Oils[4]

3. Summary of Test Method

3.1 A convenient volume of hydraulic fluid is irradiated in a sonic oscillator for a period of time and the change in viscosity is determined by Test Method D 445. A standard reference fluid containing a readily sheared polymer is run frequently to ensure that the equipment imparts a controlled amount of sonic energy to the sample.

3.2 The conditions to obtain the data for the precision statement were: 30 mL sample, 12.5 min calibration, and 40 min sample irradiation at 0°C jacket temperature.

4. Significance and Use

4.1 This test method was developed using Test Method D 2803 – 91.

4.2 This test method permits the evaluation of shear stability with minimum interference from thermal and oxidative factors that may be present in some applications. It has been found applicable to fluids containing both readily sheared and shear-resistant polymers. Correlation with performance in the case of hydraulic applications has been established.

5. Apparatus

5.1 *Sonic Shear Unit*, fixed frequency oscillator and sonic horn.[5]

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 jacket temperature of 0°C.

5.2.2 *Griffin 50 mL Beaker*, borosilicate glass.

5.2.3 *Sonic-Insulated Box*, to enclose the sonic horn to reduce the ambient noise level produced by the sonic shear unit.

5.3 *Viscometer*, any viscometer and bath meeting the requirements of Test Method D 445.

6. Reference Fluids

6.1 The reference fluid is ASTM Reference Fluid B,[6] a petroleum oil containing a polymer capable of being broken down by turbulence at high rates of shear. This oil has a viscosity of about 13.5 mm^2/s (cSt) at 40°C. The viscosity of a specific lot is supplied by the provider of that lot.

7. Calibration of Apparatus

7.1 The reference fluid provides a practical way to define the performance (severity level) of a sonic oscillator unit so that satisfactory comparison can be made between tests run on different days in the same unit and between tests run with different units.

7.2 The decrease in viscosity observed for a given hydraulic fluid on irradiation in an oscillator unit depends on a number of

[1] This test method is under the jurisdiction of ASTM Committee D-2 on Petroleum Products and Lubricantsand is the direct responsibility of Subcommittee D02.N0.07on Lubricating Properties.

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[2] Stambaugh, R. L., Kopko, R. J., and Roland, T. F., "Hydraulic Pump Performance—A Basis for Fluid Viscosity Classification", SAE Paper No. 901633. Available from Society of Automotive Engineers, 400 Commonwealth Dr., Warrendale, PA 15096.

[3] *Annual Book of ASTM Standards*, Vol 05.01.

[4] *Annual Book of ASTM Standards*, Vol 05.02.

[5] In the round robin program, equipment from Sonic Systems, Inc., 109 Pheasant Run, Newtown, PA 18040 and Heat Systems Ultrasonic, Inc., 1938 New Highway, Farmingdale, NY 11735, were found to be satisfactory.

[6] This fluid can be obtained from Rohm and Haas Co., Research Laboratories, Spring House, PA 19477-0904.