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An American National Standard

Standard Test Methods for Shear Stability of Polymer-Containing Fluids Using a Diesel Injector Nozzle¹

This standard is issued under the fixed designation D 3945; 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.

NOTE—Procedures A and B of this method are in the process of being revised as separate ASTM Test Methods because tests of a series of polymer-containing fluids showed that the two procedures often give different results.

1. Scope

1.1 These test methods measure the percent viscosity loss at 100°C of polymer-containing fluids when evaluated by either of two diesel injector apparatus procedures. Procedure A uses European Diesel Injector Test Equipment and Procedure B uses Fuel Injector Shear Stability Test (FISST) equipment. The viscosity loss reflects polymer degradation due to shear at the nozzle.

NOTE 1—ASTM Test Method D 2603 has been used for similar evaluation of this property. It has many of the same limitations as indicated in the significance statement. No detailed attempt has been undertaken to correlate the results by the sonic and the diesel injector methods. Equipment and replacement parts are no longer available for Test Method D 2603.

NOTE 2—Procedure A of this method uses test apparatus as defined in CEC L-14-A-79, IP 294/76 and DIN 51382. The operational procedure is different on four specific points. Procedure A evaluates hydraulic-type fluids at 30 cycles, with viscosities measured at 100°C. Results are reported for single determinations. No equipment severity correction factor is used to adjust results.

1.2 *This standard does not purport to address all of the safety problems, 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)²

D 2603 Test Method for Sonic Shear Stability of Polymer-Containing Oils³

3. Summary of Test Method

3.1 The polymer-containing fluid is passed through a diesel injector nozzle at a shear rate that causes the less shear stable polymer molecules to degrade. The resultant degradation reduces the kinematic viscosity of the fluid under test.

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

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² Annual Book of ASTM Standards, Vol 05.01.

³ Annual Book of ASTM Standards, Vol 05.02.

The reduction in kinematic viscosity, reported as percent loss of the initial kinematic viscosity, is a measure of the shear stability of the polymer-containing fluid.

4. Significance and Use

4.1 Both Procedure A (using European Diesel Injector Test Equipment) and Procedure B (using Fuel Injector Shear Stability Test - FISST - equipment) of this method evaluate the percent viscosity loss for polymer-containing fluids resulting from polymer degradation in the high shear nozzle device. Minimum interference from thermal or oxidative effects would be anticipated. The two procedures exhibit essentially equal percent viscosity loss for each oil used in developing the method. Both procedures also show essentially comparable repeatability and reproducibility.

4.2 These methods are not intended to predict viscosity loss in field service for different polymer classes or for different field equipment. However, it may be possible to establish some correlation for a specific polymer type in specific field equipment.

PROCEDURE A—EUROPEAN DIESEL INJECTOR TEST

5. Apparatus

5.1 The apparatus basically consists of a fluid reservoir, a double-plunger pump with an electric motor drive, an atomization chamber with a diesel injector spray nozzle and a fluid cooling vessel, installed in an area with an ambient temperature of 20 to 25°C (68 to 77°F). Figure A1.1, Annex A1, shows the schematic representation of equipment.⁴

5.1.1 *Fluid Reservoir*, (7) in Fig. A1.1 Annex A1, is open on the top, has a capacity of about 250 cm³, has a 45-mm (1.772-in.) inner diameter and is calibrated in 25-cm³ intervals. It is fitted with an internal fluid distributor detailed as Fig. A1.2. A 40-mm (1.575-in.) diameter watch glass with serrated edges is an acceptable distributor plate. The distributor reduces the tendency of fluid channeling. Temperature is measured by a thermometer suspended in the center of the glass container ((7) in Fig. A1.1). The bottom of the thermometer bulb should be 10 to 15 mm above the entrance to the drain tube opening. Other temperature-measuring equipment positioned at the same location may

⁴ The complete assembly can be purchased from Hamburger Electro-Apparate Gmb Eidel-estdter Weg 225, Postfach 1244, D-2083 Halstenbek b. Hamburg, W. Germany or in North America, Petrolab, 874 Albany Rd., Latham, NY 12110.