



Standard Test Method for Measuring Apparent Viscosity of Lubricating Greases¹

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This test method has been adopted for use by government agencies to replace Method 306 of Federal Test Method Standard No. 791b.

1. Scope

1.1 This test method covers measurement, in poises, of the apparent viscosity of lubricating greases in the temperature range from – 54 to 38°C (–65 to 100°F). Measurements are limited to the range from 25 to 100 000 P at 0.1 s^{–1} and 1 to 100 P at 15 000 s^{–1}.

NOTE 1—At very low temperatures the shear rate range may be reduced because of the great force required to force grease through the smaller capillaries. Precision has not been established below 10 s^{–1}.

1.2 This standard uses inch-pound units as well as SI (acceptable metric) units. The values stated first are to be regarded as standard. The values given in parentheses are for information only. The capillary dimensions in SI units in Fig. A1.1 and Fig. A1.2 are standard.

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.*

2. Referenced Documents

- 2.1 *ASTM Standards:*
 - D 88 Test Method for Saybolt Viscosity²
 - D 217 Test Methods for Cone Penetration of Lubricating Grease³
 - D 3244 Practice for Utilization of Test Data to Determine Conformance with Specifications⁴

3. Terminology

3.1 Definitions:

3.1.1 *apparent viscosity, n*—of a lubricating grease is the ratio of shear stress to shear rate calculated from Poiseuille's equation, and is measured in poises (see 10.1).

3.1.2 *capillary, n*—For the purpose of this method, a capillary is any right cylindrical tube having a length to diameter ratio of 40 to 1.

3.1.3 *shear rate, n*—the rate at which a series of adjacent layers of grease move with respect to each other; proportional to the linear velocity of flow divided by the capillary radius, and is thus expressed as reciprocal seconds.

4. Summary of Test Method

4.1 The sample is forced through a capillary by means of a floating piston actuated by the hydraulic system. From the predetermined flow rate and the force developed in the system, the apparent viscosity is calculated by means of Poiseuille's equation. A series of eight capillaries and two pump speeds are used to determine the apparent viscosity at sixteen shear rates. The results are expressed as a log-log plot of apparent viscosity versus shear rate.

5. Significance and Use

5.1 Apparent viscosity versus shear rate information can be useful in predicting pressure drops in grease distribution systems under steady-state flow conditions at constant temperature.

6. Apparatus

6.1 The assembled pressure viscometer consists of four major divisions, the power system, the hydraulic system, the grease system (described in the annex and shown in Fig. 1), and a bath of optional design. Fig. 2 is a photograph of the first three divisions as commonly used at room temperature. This form of the apparatus can be used with a cylindrical insulated tank 178 mm (7 in.) in diameter and 508 mm (20 in.) deep. The bath medium may be kerosene or alcohol cooled manually with dry ice. Alternatively the grease system, the grease and hydraulic system, or all three major divisions can be built into any liquid or air bath that will cover the temperature range and maintain the grease at test temperature ±0.25° C (±0.5°F).

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 D 02.G on Lubricating Grease.

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² *Annual Book of ASTM Standards*, Vol 04.04.

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

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