



Standard Test Method for High-Shear Viscosity Using the ICI Cone/Plate Viscometer¹

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1. Scope

1.1 This test method covers the determination of the viscosity of paints, varnishes, and related products at a rate of shear of $12\,000\text{ s}^{-1}$.

1.2 Paints and varnishes that dry very rapidly may not give reproducible results with this test method. Measurements made at elevated temperatures may also give poor precision due to loss of volatiles and to drying.

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 1210 Test Method for Fineness of Dispersion of Pigment-Vehicle Systems²
- D 3925 Practice for Sampling Liquid Paints and Related Pigmented Coatings²
- D 4958 Test Method for Comparison of the Brush Drag of Latex Paints³

3. Summary of Test Method

3.1 The material to be tested is placed between the cone and plate of a cone/plate viscometer, then subjected to a high shear rate while the viscosity is determined.

4. Significance and Use

4.1 The viscosity value obtained by this test method gives information about the flow properties of the material under high-shear conditions similar to those encountered during application: brushing (see Test Method D 4958), spraying, electrostatic disk, or roll coating.

4.2 This test method is suitable for all paints and varnishes whether they are Newtonian in behavior or not. However, due to the narrow gap between the stationary and rotary parts of high-shear viscometers, this test method is more reproducible

for paints having finer pigment dispersions as determined by Test Method D 1210.

5. Apparatus

5.1 *ICI Cone/Plate Viscometer*⁴ (see Fig. 1) or other cone/plate viscometer with cone/speed combination producing a rate of shear of $12\,000\text{ s}^{-1}$. The ICI cone/plate viscometer gives this shear rate with 0 to 10-P (0 to 1 Pa·s) and 0 to 5-P cones. With higher viscosity materials, other cones and speeds may be used on agreement between the producer and the user, but it should be noted that these may give lower shear rates not truly representative of application conditions. Other cone/plate viscometers may be used on agreement between the producer and the user as long as the same rate of shear is measured and it is approximately $12\,000\text{ s}^{-1}$. However, results may differ from those produced with an ICI cone/plate viscometer.

NOTE 1—The SI units for viscosity are pascal-seconds ($\text{Pa}\cdot\text{s} = 10\text{ P}$, $\text{mPa}\cdot\text{s} = 1\text{ cP}$).

6. Reagents and Materials

6.1 *Water or Solvent*—Water or a low viscosity solvent such as xylene or mineral spirits to be used for zeroing the instrument.

6.2 *Mineral Oils*—Three standard mineral oils with known viscosities (certified by an approved laboratory) lying between 10 and 90 % of full scale to be used for calibrating the instrument.⁵

NOTE 2—Silicone oils should be avoided because of their tendency to contaminate instruments, containers and other equipment and because of the possibility of shear thinning behavior at high shear rates.

7. Sampling

7.1 Take a representative sample of the product to be tested in accordance with Practice D 3925. If the sample has a tendency to settle or separate on standing, it must be stirred or shaken until homogeneous before a test specimen is taken from it. The specimen must be free of any foreign matter or air bubbles and its volume must be sufficient to cover the portion of the viscometer plate under the cone when the latter is

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² *Annual Book of ASTM Standards*, Vol 06.01.

³ *Annual Book of ASTM Standards*, Vol 06.02.

⁴ ICI cone/plate viscometers are manufactured by Research Equipment (London) Ltd., 72 Wellington Rd., Twickenham, Middlesex TW12 5NX, England and are available in North America from BYK-Gardner, Inc. 2435 Linden Lane, Silver Spring, MD 20910.

⁵ Such oils are available from The Cannon Instrument Co., P.O. Box 16, State College, PA 16801.