



Designation: D 4287 – 00

## Standard Test Method for High-Shear Viscosity Using a Cone/Plate Viscometer<sup>1</sup>

This standard is issued under the fixed designation D 4287; 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 approval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 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 Systems by Hegman-Type Gage<sup>2</sup>
- D 3925 Practice for Sampling Liquid Paints and Related Pigmented Coatings<sup>2</sup>
- D 4958 Test Method for Comparison of the Brush Drag of Latex Paints<sup>3</sup>

### 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 *Cone/Plate Type Viscometer*; with cone/speed combination producing a rate of shear of  $12\,000\text{ s}^{-1}$ . The viscometer must provide a viscosity measurement range of either 0 to 10 (P) or 0 to 5 (P) at the above mentioned shear rate. With higher viscosity materials, other cones and speeds may be used upon 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. Refer to Fig. 1 and Fig. 2 of an analog and digital cone and plate viscometer.

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

### 6. Reagents and Materials

6.1 *Water or Solvent*—The viscometer should be zeroed according to the manufacturer's specification. Zeroing procedures that require liquid may be satisfied with water or a low viscosity solvent such as xylene or mineral spirits.

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.<sup>4</sup>

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 brought into contact with the plate.

<sup>4</sup> Such oils are available from The Cannon Instrument Co., P.O. Box 16, State College, PA 16801.

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.24 on Physical Properties of Liquid Paints and Paint Materials.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 06.01.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 06.02.