



# Standard Practice for Rheological Characterization of Architectural Coatings using Three Rotational Bench Viscometers<sup>1</sup>

This standard is issued under the fixed designation D7394; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope\*

1.1 This practice covers a popular industry protocol for the rheological characterization of waterborne architectural coatings using three commonly used rotational bench viscometers. Each viscometer operates in a different shear rate regime for determination of coating viscosity at low shear rate, mid shear rate, and at high shear rate respectively as defined herein. General guidelines are provided for predicting some coating performance properties from the viscosity measurements made. With appropriate correlations and subsequent modification of the performance guidelines, this practice has potential for characterization of other types of aqueous and non-aqueous coatings.

1.2 The values in common viscosity units (Krebs Units, KU and Poise, P) are to be regarded as 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:<sup>2</sup>

- D562 Test Method for Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer
- D869 Test Method for Evaluating Degree of Settling of Paint
- D1005 Test Method for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers
- D1200 Test Method for Viscosity by Ford Viscosity Cup
- D2196 Test Methods for Rheological Properties of Non-Newtonian Materials by Rotational (Brookfield type) Viscometer

<sup>1</sup> This practice 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> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

- D2805 Test Method for Hiding Power of Paints by Reflectometry
- D4040 Test Method for Rheological Properties of Paste Printing and Vehicles by the Falling-Rod Viscometer
- D4062 Test Method for Leveling of Paints by Draw-Down Method
- D4287 Test Method for High-Shear Viscosity Using a Cone/Plate Viscometer
- D4400 Test Method for Sag Resistance of Paints Using a Multinotch Applicator
- D4414 Practice for Measurement of Wet Film Thickness by Notch Gages
- D4958 Test Method for Comparison of the Brush Drag of Latex Paints

## 3. Terminology

### 3.1 Definitions:

3.1.1 *coating rheology, n*—the viscosity profile obtained for a fluid coating over a range of shear rates.

3.1.2 *high-shear viscosity (HSV), n*—the viscosity of a fluid coating at high shear rate (typically measured at 10,000 or 12,000  $\text{sec}^{-1}$ ), and for architectural coatings, it is often referred to as the “ICI” or “brush-drag” viscosity.

3.1.3 *leveling, n*—the ability of a wet coating to flow out to a smooth dry film after application, thereby minimizing or eliminating coating surface irregularities that occur during brushing, rolling or spraying (see also Test Method D4062).

3.1.4 *low-shear viscosity (LSV), n*—the viscosity of a coating fluid at low shear rate (typically in the range of 0.001 to 1  $\text{s}^{-1}$ ), often referred to as the “leveling viscosity” or inversely as the “suspension viscosity.”

3.1.5 *mid-shear thickener efficiency (MSTE), n*—the weight of active thickener per unit volume of wet coating required to give the target MSV, commonly expressed as lb active thickener/100 gal wet coating (or in g/L units).

3.1.6 *mid-shear viscosity (MSV), n*—the viscosity of a coating fluid at medium shear rate (typically in the range of 10 to 1000  $\text{s}^{-1}$ ), often referred to as the “consistency” or the “mixing viscosity.”

\*A Summary of Changes section appears at the end of this standard