



Standard Test Method for Viscosity by Dip-Type Viscosity Cups¹

This standard is issued under the fixed designation D4212; 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.

1. Scope

1.1 This test method covers the determination of viscosity of paints, varnishes, lacquers, inks, and related liquid materials by dip-type viscosity cups. This test method is recommended for viscosity control work within one plant or laboratory and should be used to check compliance with specifications only when sufficient controls have been instituted to ensure adequate comparability of results.

1.2 Viscosity cups are designed for testing of Newtonian and near-Newtonian liquids. If the test material is non-Newtonian, for example, shear-thinning or thixotropic, another method, such as Test Methods [D2196](#), should be used. Under controlled conditions, comparisons of the viscosity of non-newtonian materials may be helpful, but viscosity determination methods using controlled shear rate or shear stress are preferred.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 *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:²

- [D1200](#) Test Method for Viscosity by Ford Viscosity Cup
- [D2196](#) Test Methods for Rheological Properties of Non-Newtonian Materials by Rotational Viscometer
- [D4287](#) Test Method for High-Shear Viscosity Using a Cone/Plate Viscometer
- [E1](#) Specification for ASTM Liquid-in-Glass Thermometers

¹ 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 & Paint Materials.

Current edition approved Feb. 1, 2016. Published February 2016. Originally approved in 1982. Last previous edition approved in 2014 as D4212 – 10 (2014). DOI: 10.1520/D4212-16.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3. Terminology

3.1 Definitions:

3.1.1 *near-Newtonian liquid, n*—a liquid in which the variation of viscosity with shear rate is small and the effect on viscosity of mechanical disturbances such as stirring is negligible.

3.1.2 *Newtonian liquid, n*—a liquid in which the viscosity is independent of the shear stress or shear rate. If the ratio of shear stress to shear rate is not constant, the liquid is non-Newtonian.

4. Summary of Test Method

4.1 The cup is completely immersed in the material to be tested, withdrawn, and the time for the material to flow through a hole in the base of the cup is measured.

5. Significance and Use

5.1 Viscosity is a measure of the fluidity of a material. Viscosity data are useful in the determination of the ease of stirring, pumping, dip coating, or other flow-related properties of paints and related fluids.

5.2 This type of cup is used to measure viscosity because it is easy to use, robust, and may be used in tanks, reservoirs, and reactors.

5.3 There are other types of apparatus for measuring viscosity in the laboratory that provide better precision and bias, including the Ford viscosity cup (Test Method [D1200](#)), and the rotational viscometer (Test Methods [D2196](#)).

5.4 Certain higher shear rate devices such as cone/plate viscometers (Test Method [D4287](#)) provide more information about sprayability, roll coatability, and other high-shear rate related properties of coatings.

6. Apparatus

6.1 *Zahn Viscosity Cup*—No. 1 through No. 5 Zahn viscosity cups made of corrosion- and solvent-resistant materials. The nominal capacity of the cup is 44 mL, but may vary from 43 to 49 mL, depending on the manufacturer. A diagram of a Zahn cup is given in [Fig. 1](#). The dimensions, including orifices, are only approximate because the cups are not made to a uniform specification. Each manufacturer produces a different cup and considerable variation between batches from some