Designation: D6910/D6910M – 09

Standard Test Method for Marsh Funnel Viscosity of Clay Construction Slurries[1]

This standard is issued under the fixed designation D6910/D6910M; 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 provides an indirect measurement of the viscosity of clay slurries using a funnel (Marsh Funnel) and a graduated cup of specific dimensions. This test method provides a practical indicator of the viscosity on a routine basis. This test method has been modified from the API Recommended Practice 13B-2.

1.2 The result determined using the method is referred to as the Marsh Funnel Viscosity.

1.3 This test can be performed in the laboratory, or used in the field to assess the apparent viscosity of a clay slurry for quality control purposes. The most commonly used slurry is a bentonite clay slurry.

1.4 The values stated in either SI units or inch-pound units [given in brackets] are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.5 *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]

D653 Terminology Relating to Soil, Rock, and Contained Fluids

D3740 Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

2.2 *API Document:*

API Recommended Practice, Standard Procedure for Testing Drilling Fluids, Sixth Edition[3]

3. Terminology

3.1 *Definitions:* For common definitions of technical terms in this standard, refer to Terminology D653.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *marsh funnel viscosity (MFV)*—also known as *funnel viscosity*. The time required (in seconds) for 946 mL [1 qt] of a slurry to flow into a graduated cup from a funnel (known as a Marsh Funnel) with specific dimensions. The Marsh Funnel Viscosity is not a true viscosity, it is only an apparent value and good in a relative sense. High MFV values are obtained for slurries with high viscosity and low MFV values are obtained for slurries with low viscosity.

4. Summary of Test Method

4.1 In this method, a slurry is poured into a funnel with specific dimensions (Marsh Funnel). The slurry is then allowed to flow into a graduated cup. The time for the slurry to fill a volume of 946 mL [1 qt] is measured and reported as the Marsh Funnel Viscosity. The test temperature is also reported for comparison purposes.

5. Significance and Use

5.1 This test method allows for the assessment of an apparent viscosity of clay slurries in the laboratory and in the field. Viscosity is a fundamental characteristic for slurries in construction applications. The Marsh Funnel Viscosity test can be used for field quality control of slurries. Relative changes in slurry viscosity can be identified using Marsh Funnel measurements and modifications can be made to mixing and handling procedures.

5.2 In this test, it is assumed that the apparent viscosity of a slurry is directly related to the flow duration through a specially shaped funnel (the Marsh Funnel).

NOTE 1—The development of the Marsh Funnel is credited to Hallan N. Marsh of Los Angeles who published the design and use of his funnel viscometer in 1931.

[1] This test method is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.04 on Hydrologic Properties and Hydraulic Barriers.

Current edition approved Oct. 1, 2009. Published October 2009. Originally approved in 2004. Last previous edition approved in 2004 as D6910 – 04. DOI: 10.1520/D6910_D6910M-09.

[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] Available from American Petroleum Institute (API), 1220 L. St., NW, Washington, DC 20005-4070, http://www.api.org.

5.3 In slurry wall construction and other applications, the viscosity of a slurry must be maintained at a level high enough to assist in stabilizing the trench walls. Slurry viscosity is also directly related to filter cake permeability.

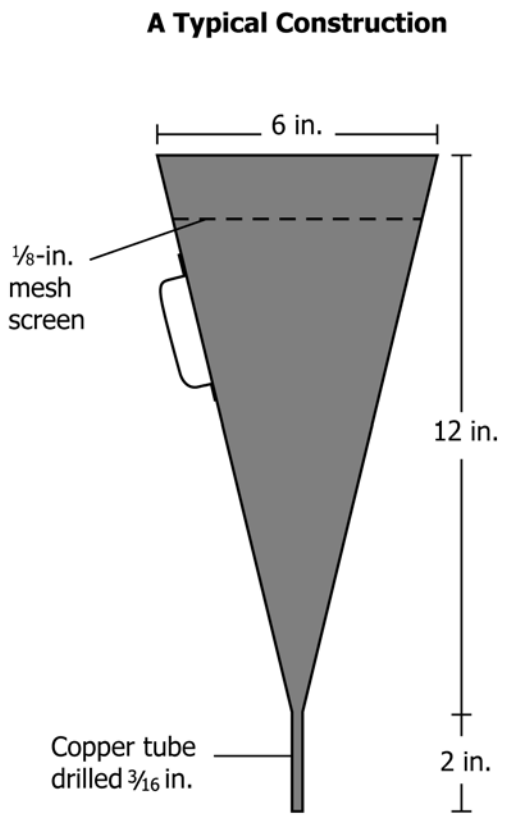
5.4 The Marsh Funnel Viscosity has been widely used in drilling soil and rock for water wells, oil, gas, soil stabilization, and the application of hydraulic barriers.

5.5 Inert suspended solids such as fine sands and additives affect the viscosity of slurries. This test may be used to determine the relative effects of this and other such materials on the viscosity of a slurry.

NOTE 2—The quality of the result produced by this standard is dependent on the competence of the personnel performing it, and the suitability of the equipment and facilities used. Agencies that meet the criteria of Practice D3740 are generally considered capable of competent and objective testing, sampling/inspection/etc. Users of this standard are cautioned that compliance with Practice D3740 does not in itself assure reliable results. Reliable results depend on many factors; Practice D3740 provides a means of evaluating some of those factors.

6. Apparatus

6.1 *Marsh Funnel* (see Fig. 1)—The Marsh Funnel will comply with the following:



Dimensional Equivalents

mm	in.
3.2	0.125
4.75	0.1825
51.0	2.0
152.0	6.0
305.0	12.0

FIG. 1 Marsh Funnel

6.1.1 *Funnel Cone*—A cone with a length of 305-mm [12-in.] and a diameter of 152-mm [6-in.] equipped with a screen at the top and an orifice tube at the bottom. The capacity of the cone from the orifice opening to the bottom of the screen shall be 1500 mL [1.6 qt]. It may be manufactured from plastic, metal, or other rigid and durable material, and may be provided with handles or stands.

6.1.2 *Funnel Orifice*—An orifice tube of 51-mm [2-in.] in length, with an inside diameter of 4.75-mm [3⁄16-in.]. The diameter of this outlet directly affects the Marsh Funnel test results and has been standard with the test since the inception of this method.

6.1.3 *Screen*—A screen with openings of approximately 3.2 mm [0.125 in.]. The screen is normally placed at the 1500 mL [1.6 qt] level of the funnel; approximately 19 mm [0.75 in.] below the top of the funnel. The screen is used to separate larger particles that could plug the orifice during the test.

6.2 *Graduated Cup*—A metal or plastic graduated cup with a 946-mL [1-qt] marking.

6.3 *Timer*—A stopwatch or equivalent timer with a resolution of 0.5 s or better.

6.4 *Thermometer*—A thermometer with a range of 0 to 105°C [32 to 220°F] with a resolution of 1°C [2°F].

6.5 *Sampling and Cleaning Equipment.*

7. Hazards

7.1 Appropriate eye and hand protection is recommended for direct work with the slurries.

8. Sampling

8.1 Obtain a 7.5 L [2 gal] representative sample of the slurry to be tested using dippers, buckets, mud or slurry samplers, or equivalent equipment from a field construction operation (for example, from a hydrated mix pond) or from a laboratory slurry mix. A specimen 1500 mL [1.6 qt] in volume is required for a test.

9. Calibration Checks

9.1 Periodically check the Marsh Funnel and the graduated cup for damage or wear. For the Marsh Funnel pay special attention to the orifice tube. Verify that the graduation marks are present and readable in the funnel and the cup. In particular, make sure that the 946 mL mark is readable in the cup.

9.2 Fill the Marsh funnel with 1500-mL [1.6-qt] of water while holding a finger over the orifice. If the water surface is at the screen, no further marking is required. If the surface is above or below the screen, a mark should be placed inside the funnel for reference when running the test.

9.3 Verify that the flow duration for 946 mL [1 qt] of water is 26 ± 0.5 s at a temperature of 21 ± 3°C [70 ± 5°F]. If the Funnel does not meet these criteria for fresh water, clean the orifice tube and inspect to verify that the tube has not been bent, flattened or otherwise distorted. If the funnel continues to provide inaccurate readings, it may have been damaged and the funnel should be replaced.

10. Procedure

10.1 Verify that the funnel and cup are both clean and dry.

10.2 Cover the Marsh Funnel orifice with a finger and pour the freshly sampled slurry through the screen into the upright funnel.

10.3 Holding the funnel over the graduated cup, remove the finger and start the timer.

10.4 Measure the time for the slurry to fill the graduated cup to the 946 mL [1 qt] line.

10.5 Determine the temperature of the slurry.

NOTE 3—Repeating the test several times and averaging the results may reduce the chance for error and provide more reproducible results.

11. Report

11.1 Test data forms or test reports will include the following:

11.1.1 The source of the sample.

11.1.2 The date and time of the test.

11.1.3 The elapsed time to the nearest second for 946-mL [1-qt] of the slurry to flow into the graduated cup. This value to be recorded as the Marsh Funnel Viscosity.

11.1.4 The temperature of the slurry.

12. Precision and Bias

12.1 *Precision*—Test data on precision is not presented due to the nature of this test method. It has not been feasible at this time to have ten or more agencies participate in an in situ testing program at a given site.

12.1.1 The Subcommittee D18.20 is seeking any data from the users of this test method that might be used to make a limited statement on precision.

12.2 *Bias*—There is no accepted reference value for this test method, therefore bias cannot be determined.

13. Keywords

13.1 bentonite slurry; clay slurry; funnel viscosity; hydraulic barriers; marsh funnel; slurry; viscosity