Designation: ~~C939/C939M – 16a~~ C939/C939M – 22

Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)[1]

This standard is issued under the fixed designation C939/C939M; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*

1.1 This test method covers a procedure, used both in the laboratory and in the field, for determining the time of efflux of a specified volume of fluid hydraulic cement grout through a standardized flow cone and used for preplaced-aggregate (PA) concrete; however, the test method may also be used for other fluid grouts.

1.2 It is for use with neat grout and with grouts containing fine aggregate all passing a ~~2.36-mm~~2.36 mm (No. 8) sieve.

1.3 This test method is intended for use with grout having an efflux time of 35 s or less.

1.4 When efflux time exceeds 35 s, flowability is better determined by flow table, found in Test Method C109/C109M, using 5 drops in 3 s.

1.5 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system ~~may~~are not ~~be~~necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the ~~other. Combining~~other, and values from the two systems ~~may result in non-conformance with the standard.~~ shall not be combined. Some values have only SI units because the inch-pound equivalents are not used in practice (Note 1).

NOTE 1—Sieve size is identified by its standard designation in Specification E11. The alternative designation given in parentheses is for information only and does not represent a different standard sieve size.

1.6 *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~~ safety, health, and ~~health~~environmental practices and determine the applicability of regulatory limitations prior to use.*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

[1] This test method is under the jurisdiction of ASTM Committe C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.41 on Hydraulic Cement Grouts.

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[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.

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

C109/C109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens)
C125 Terminology Relating to Concrete and Concrete Aggregates
C219 Terminology Relating to Hydraulic and Other Inorganic Cements
C938 Practice for Proportioning Grout Mixtures for Preplaced-Aggregate Concrete
E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this test method, refer to Terminologies C125 and C219.

4. Summary of Test Method

4.1 The time of efflux of a specified volume of grout from a standardized flow cone is measured.

5. Significance and Use

5.1 This test method is applicable to the determination of the fluidity of various fluid grout mixtures.

6. Interferences

6.1 The presence of solid particles retained on the ~~2.36-mm~~2.36 mm (No. 8) sieve or lumps of unmixed material in the grout may cause the grout to flow unevenly through the discharge tube of the flow cone or stop the flow completely. Uneven flow will result in slower transit of the grout, thereby indicating a false consistency.

7. Apparatus

7.1 *Flow Cone,* with dimensions as shown in Fig. 1. The discharge tube shall be stainless steel. The body can be stainless steel, cast aluminum, or other essentially non-corroding metal.

NOTE 2—Cones with high-density polyethylene bodies are acceptable for field use in situations where precision as described in this test method is not required.

7.2 *Receiving Container,* capacity 2000 mL, minimum.

7.3 *Ring Stand* or other device, capable of supporting the flow cone in a vertical, steady position over the receiving container.

7.4 *Level,* carpenter's or similar.

7.5 *Stop Watch,* least reading of not more than 0.2 s.

7.6 *Grout Mixer,* conforming to Practice C938 or as required by the specifier of the tests (See Note 3).

NOTE 3—The type of mixer used will impact the test results of a given grout mixture.

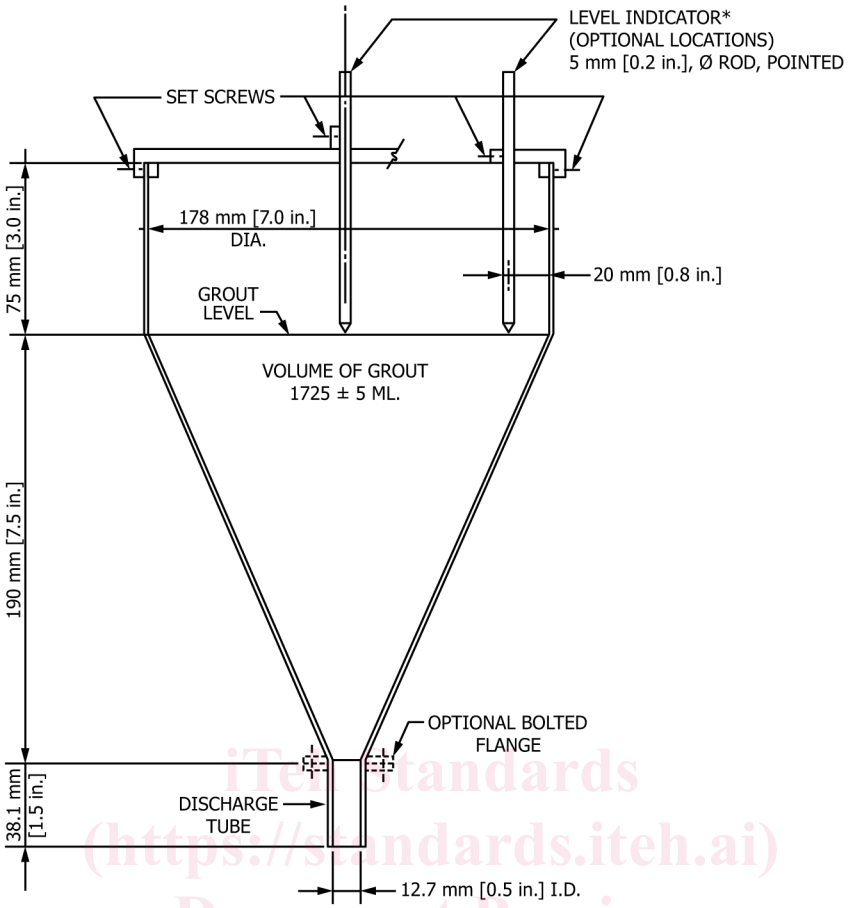
8. Test Sample

8.1 The grout test sample shall be in excess of 1725 mL and shall be representative of the grout in the mixer.

8.2 When sampling and testing is being done for the purpose of proportioning or comparing mixes or for qualifying materials, the temperature of the dry materials and mixing water shall be such that the temperature of the freshly mixed grout is ~~23.0~~23.0 °C ± ~~2.0°C [73.5~~2.0 °C [73.5 °F ± ~~3.5°F],~~3.5 °F], unless otherwise specified.

9. Calibration of Apparatus

9.1 Mount the flow cone firmly in such a manner that it is free of vibration. Level the top to assure verticality. Close the outlet



NOTE 1—Other means of indicating grout level may be used as long as accurate indication of grout level on volume is obtained.

FIG. 1 Cross Section of Flow Cone

of the discharge tube with a finger or a stopper. Introduce ~~1725~~1725 mL ± 5 mL of water into the cone. Adjust the point gage to indicate the level of the water surface. Then allow the water to drain.

9.2 Before first use of the flow cone with grout and periodically thereafter, check the accuracy of the cone by filling it with water as described in 9.1. After checking or adjusting the point gage, start the stop watch and simultaneously remove the finger. Stop the watch at the first break in the continuous flow of water. The time indicated by the stop watch is the time of efflux of water. If this time is 8.0 ± 0.2 s, the cone may be used for determining the time of efflux of grout.

10. Procedure

10.1 Moisten the inside of the flow cone by filling the cone with water and, 1 min before introducing the grout sample, allow the water to drain from the cone. Close the outlet of the discharge tube with a finger or a stopper. Introduce the grout into the cone until the grout surface rises to contact the point gage, start the stop watch, and simultaneously remove the finger or stopper. Stop the watch at the first break in the continuous flow of grout from the discharge tube, then look into the top of the cone; if the grout has passed sufficiently, such that light is visible through the discharge tube, the time indicated by the stop watch is the time of efflux of the grout. If light is not visible through the discharge tube, then the use of the flow cone is not applicable for grout of this consistency. At least two tests having times of efflux within 1.8 s of their average shall be made for each grout mixture.

10.2 The test for time of efflux shall be made within 1 min of drawing of the grout from the mixer or transmission line. When grout is being placed over a significant period of time, the time of efflux may be determined at selected intervals to demonstrate that the consistency is suitable for the work.

11. Report

11.1 Report the following information: