Designation: C 939 – ~~97~~02

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

This standard is issued under the fixed designation C 939; 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 Department of Defense.

[1] This test method is under the jurisdiction of ASTM Committe ~~C-9~~ C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.41 on Concrete for Radiation Shielding.

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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 (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 C 109/C 109M, using 5 drops in 3 s.

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

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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

C 109/C 109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)[2]

C 938 Practice for Proportioning Grout Mixtures for Preplaced-Aggregate Concrete[3]

3. Summary of Test Method

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

4. Significance and Use

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

5. Interferences

5.1 The presence of solid particles retained on the 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.

6. Apparatus

6.1 *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 noncorroding metal.

NOTE 1—Cones with high-density polyethylene bodies are acceptable for field use in situations where precision as described in this test method is not required.

[2] *Annual Book of ASTM Standards*, Vol 04.01.

[3] *Annual Book of ASTM Standards*, Vol 04.02.

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

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

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

6.4 *Level*, carpenter's or similar.

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

6.6 *Grout Mixer*, conforming to Practice C 938.

7. Test Sample

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

7.2 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 ~~73.4~~ 23.0 ± ~~3°F (23~~ 2.0°C (73.5 ± ~~1.7°C),~~ 3.5°F), unless otherwise specified.

8. Calibration of Apparatus

8.1 Mount the flow cone firmly in such a manner that it is free of vibration. Level the top to assure verticality. Close the outlet of the discharge tube with a finger or a stopper. Introduce 1725 ± 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.

8.2 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 8.1. 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.

9. Procedure

9.1 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.

9.2 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.

10. Report

10.1 Report the following information:

10.1.1 Identification of sample,

10.1.2 Identification of materials in the sample, the proportions, and whether laboratory-prepared or taken from the field production mix,

10.1.3 Average time of efflux to nearest 0.2 s and time interval from completion of mixing at which the test was made, and

10.1.4 Temperature, ambient and of the sample at the time of test.

11. Precision and Bias

11.1 *Precision*—The following within-laboratory, multiple-operator precision applies. The single laboratory standard deviation has been found to be 0.88 s. Therefore, results from two properly conducted tests on the same material should not differ by more than 2.49 s.

11.2 *Bias*—No statement on bias can be prepared because there are no standard reference materials.

12. Keywords

12.1 flow cone; grout; preplaced—aggregate concrete; time of efflux