



Designation: **C937—16 C937 – 23**

Standard Specification for Grout Fluidifier for Preplaced-Aggregate Concrete¹

This standard is issued under the fixed designation C937; 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 specification covers fluidifier for grout used for preplaced-aggregate (PA) concrete.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 The text of this standard refers to notes and footnotes that provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

1.4 The following precautionary caveat pertains only to the test method portion, Section 8, of this standard: *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, safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use. (Warning—Fresh hydraulic cementitious mixtures are caustic and may cause chemical burns to exposed skin and tissue upon prolonged exposure.²)*

1.5 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:³

- C33/C33M Specification for Concrete Aggregates
- C125 Terminology Relating to Concrete and Concrete Aggregates
- C150/C150M Specification for Portland Cement
- C219 Terminology Relating to Hydraulic and Other Inorganic Cements
- C618 Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
- C637 Specification for Aggregates for Radiation-Shielding Concrete
- C938 Practice for Proportioning Grout Mixtures for Preplaced-Aggregate Concrete
- C939/C939M Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
- C940 Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory
- C941 Test Method for Water Retentivity of Grout Mixtures for Preplaced-Aggregate Concrete in the Laboratory
- C942/C942M Test Method for Compressive Strength of Grouts for Preplaced-Aggregate Concrete in the Laboratory

¹ This specification is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.41 on Hydraulic Cement Grouts.

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² See Section on Safety Precautions, Manual of Aggregate and Concrete Testing, Annual Book of ASTM Standards, Vol. 04.02.

³ 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

C953 Test Method for Time of Setting of Grouts for Preplaced-Aggregate Concrete in the Laboratory

3. Terminology

3.1 Definitions:

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

4. Ordering Information

4.1 The purchaser shall specify the material desired as “grout fluidifier for preplaced-aggregate concrete.” The material shall meet the requirements of this specification.

5. Materials

5.1 Grout ingredients shall conform to the following requirements:

5.1.1 Portland cement shall meet the requirements of Specification **C150/C150M** for the type to be used.

5.1.2 Pozzolan shall meet the requirements of Specification **C618**.

5.1.3 Fine aggregate shall meet the requirements of Specification **C33/C33M** except that grading shall conform to Specification **C637**, Table number 2, Grading 1 for Fine Aggregate.

6. Physical Requirements

6.1 The fluidifier, when tested in grout as specified herein, shall conform to the requirements of **Table 1**.

7. Sampling

7.1 The test sample of fluidifier shall have a mass of at least 225 g and shall be representative of the material supplied. If feasible, the test sample shall be composited from grab samples taken from not fewer than four packages selected at random.

8. Test Methods

8.1 *Summary of Method*—Physical properties of grout containing fluidifier are determined and compared with corresponding properties of grout made without fluidifier.

8.2 *Significance and Use*—The effects of adding fluidifier to a standard grout mixture are determined in order to evaluate its ability to reduce mixing water, prevent early stiffening, hold solid constituents in suspension, produce controlled expansion prior to initial setting, and maintain or increase compressive strength.

8.3 Procedure:

8.3.1 Have all grout materials including mixing water at $23.0 \pm 2.0^\circ\text{C}$ $23.0 \text{ }^\circ\text{C} \pm 2.0 \text{ }^\circ\text{C}$ at the start of the test.

8.3.2 Maintain the laboratory and curing room at $23.0 \pm 2.0^\circ\text{C}$ $23.0 \text{ }^\circ\text{C} \pm 2.0 \text{ }^\circ\text{C}$ at all times during testing.

8.3.3 Grout Preparation:

8.3.3.1 Proportion two grout mixtures, one a control mixture without and one a test mixture with the grout fluidifier under consideration, each containing equal parts, by mass, of cementitious material and fine aggregate, with sufficient water to produce a grout efflux time by Test Method **C939/C939M** of $21 \pm 2 \text{ s}$. $21 \text{ s} \pm 2 \text{ s}$. The cementitious material shall consist of two parts portland cement to one part of pozzolan, by mass.

8.3.3.2 The test mixture shall contain grout fluidifier equal to 1% of the combined mass of portland cement plus pozzolan; unless otherwise recommended by the manufacturer. The control mixture shall contain no fluidifier.

TABLE 1 Physical Requirements for Grout with Fluidifier

Reduction in mixing water, min, % of control (Test Method C939/C939M)	3
Expansion Limits, %:	...
Expansion, 3 h after mixing, (Test Method C940) with the fluidifier:	...
0.80 or more Alkali Content of Cement, % expressed as Na ₂ O	7 to 14
0.40 to 0.79 Alkali Content of Cement, % expressed as Na ₂ O	5 to 12
0.39 or less Alkali Content of Cement, % expressed as Na ₂ O	3 to 9
Bleeding, 3 h after mixing, (Test Method C940), max, % with the fluidifier	2
Increase in water retentivity (Test Method C941), min, % of control	60
Initial setting time, min, h (Test Method C953)	4
Final setting time, max, h (Test Method C953)	24
Compressive strength at 7 days and 28 days, (Test Method C942), min, % of control	90
Compressive strength at 7 days and 28 days, (Test Method C942/C942M), min, % of control	90

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8.3.3.3 The volume of each batch shall be approximately 0.03 m³.

8.3.3.4 Mix grout in a mixer of the type shown in Fig. 1 of Practice **C938**. Dampen the inside of the drum, start the mixer and charge ingredients within a period of 2 min in the following order: water, fluidifier (if used), pozzolan, cement, and fine aggregate. Mix for 33 min to 3¼ min.

8.3.3.5 Determine time of efflux by Test Method **C939/C939M**. If within acceptable range, proceed with tests to provide data required for the calculations.

8.4 *Calculations*—Calculate the following items:

8.4.1 Reduction in water requirement (R_w):

$$R_w = \frac{(W_c - W_t) \times 100}{W_c} \quad (1)$$

where:

R_w = reduction in water requirement, %,
 W_c = mass of water required in grout mixture without fluidifier, and
 W_t = mass of water required in grout mixture with fluidifier.

8.4.2 Increase in water retentivity (I_r):