Designation: ~~C940 – 16~~ C940 – 22

Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory[1]

This standard is issued under the fixed designation C940; 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 determines the amount of expansion and accumulation of bleed water at the surface of freshly mixed hydraulic-cement grout commonly used in the production of preplaced-aggregate (PA) concrete and cementitious post-tensioning tendon grouts.

1.2 It is for use with hydraulic cement grout whether or not it includes fine aggregate or supplemental cementitious materials or both.

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

1.4 *This standard ~~may involve hazardous materials, operations, and equipment. 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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C125 Terminology Relating to Concrete and Concrete Aggregates
C219 Terminology Relating to Hydraulic and Other Inorganic Cements
C937 Specification for Grout Fluidifier for Preplaced-Aggregate Concrete
C1064/C1064M Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
E1272 Specification for Laboratory Glass Graduated Cylinders

3. Terminology

3.1 For definitions of terms used in this standard, refer to Terminology C125 and Terminology C219.

4. Summary of Test Method

4.1 Grout is placed in a graduated cylinder. Changes in total volume and accumulation of bleed water, if any, on the surface of the grout are observed over a period of time.

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[1] This test method is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregatesand 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.

5. Significance and Use

5.1 This test method is useful for determining the expansion and bleeding characteristics of freshly mixed fluid hydraulic cement grout commonly used in PA concrete and cementitious post-tensioning tendon grouts.

6. Interferences

6.1 Failure to obtain a uniformly smooth mixture, free of lumps, will cause excessive bleeding and may result in reduced expansion.

6.2 The capability of most admixtures to produce expansion and the tendency to bleed is related to the temperature of the grout during the period of test.

7. Apparatus

7.1 *Glass Graduate,* 1000 mL and meeting the requirements of Specification E1272 Style I or III TC.

7.2 *Glass Graduate,* 25 mL and meeting the requirements of Specification E1272 Style I or III TC.

7.3 *Temperature Measuring Device,* meeting the requirements of Test Method C1064/C1064M.

8. Test Sample

8.1 The grout test sample shall consist of approximately 1500 mL and shall be representative of the grout in the mixer.

9. Procedure

9.1 When sampling and testing are being performed in the laboratory for the purpose of designing or comparing mixtures or for qualifying admixtures including grout fluidifiers proceed in the following manner:

9.1.1 Maintain the ambient temperature of the room in which the test is performed at ~~23.0 ± 2°C,~~23.0 °C ± 2 °C, unless otherwise specified.

9.1.2 Bring the temperature of all dry materials and mixing water to a constant temperature of ~~23.0 ± 2°C~~23.0 °C ± 2 °C before mixing, unless otherwise specified.

9.1.3 Start volume measurements within 3 min of completion of mixing.

9.2 When sampling and testing are being performed in the field, record the temperature of the grout specimen and the ambient temperature of the area in which the test readings are made. Record the time interval between completion of mixing and start of test.

9.3 Immediately after the completion of mixing, measure the temperature of the grout. Then introduce the grout into a 1000-mL graduated cylinder until the volume of the specimen is ~~800 ± 10~~800 mL ± 10 mL. Record the volume of the specimen and the time at which the reading was made. Place the graduated cylinder on a level surface free of vibration. Cover to prevent evaporation of the bleed water.

9.4 Take and record the readings, estimated to the nearest 1 mL, of the upper surfaces of the grout and bleed water, if any, of the specimen in the graduate at ~~15-min~~15 min intervals for the first 60 min and thereafter at hourly intervals until two successive readings show no further expansion or bleeding. When the test for expansion and bleeding is used in connection with Specification C937, it shall be discontinued 3 h after the initial reading.

9.5 At the conclusion of the test, decant the bleed water into a ~~25-mL~~25 mL graduate by tilting the specimen and drawing the water off with a pipet or large medicine dropper. Record the final volume of bleed water to the nearest 0.5 mL.

10. Calculation

10.1 Calculate the expansion of the grout, and its bleeding and the combined expansion of grout plus bleed water as percentages of the initial volume of the grout, as follows:

$$Expansion,\ \% = \frac{V_g - V_1}{V_1} \times 100 \tag{1}$$

$$Bleeding,\ \% = \frac{V_2 - V_g}{V_1} \times 100\ at\ prescribed\ intervals \tag{2}$$

$$Combined\ Expansion,\ \% = \frac{V_2 - V_1}{V_1} \times 100 \tag{3}$$

$$Final\ bleeding,\ \% = \frac{V_w}{V_1} \times 100 \tag{4}$$

where:

V_1 = volume of specimen at beginning of test, mL,
V_2 = volume of specimen at prescribed intervals, measured at upper surface of water layer, mL,
V_g = volume of grout portion of specimen at prescribed intervals, at upper surface of grout, mL, and
V_w = volume of decanted bleed water, mL.

11. Report

11.1 The report shall include the following:

11.1.1 Identification of the grout.

11.1.2 Expansion of grout to the nearest 0.2 % for each prescribed interval.

11.1.3 Bleeding of grout to the nearest 0.2 % for each prescribed interval.

11.1.4 Combined expansion of grout plus bleed water to the nearest 0.2 % for each prescribed interval.

11.1.5 Final bleeding to nearest 0.2 %.

11.1.6 Temperature of grout specimen at start of test.

11.1.7 Ambient temperature of laboratory or testing area at the beginning and end of test.

12. Precision and Bias

12.1 *Precision:*

12.1.1 *Bleeding*—The single laboratory, three operators, standard deviation has been found to be 0.06 %.

12.1.2 *Combined Expansion*—The single laboratory, three operators, standard deviation has been found to be 0.37 %.

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

13. Keywords

13.1 bleeding; concrete; expansion; grouts; preplaced-aggregate; preplaced-aggregate concrete