



Designation: C 1117 – 89 (Reapproved 1994)

Standard Test Method for Time of Setting of Shotcrete Mixtures by Penetration Resistance¹

This standard is issued under the fixed designation C 1117; 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 covers the determination of the time of setting of shotcrete, either in place or in shot panels, by means of penetration resistance measurements.

1.2 The values stated in inch-pound units are to be regarded as the standard.

1.3 *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 403 Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance²

D 1558 Test Method for Moisture Content Penetration Resistance Relationships of Fine-Grained Soils³

3. Terminology

3.1 Definitions:

3.1.1 *time of initial setting*—the elapsed time, after initial contact of cement and water, required for the shotcrete to reach a penetration resistance of 500 psi (3.5 MPa).

3.1.2 *time of final setting*—the elapsed time, after initial contact of cement and water, required for the shotcrete to reach a penetration resistance of 4000 psi (27.6 MPa).

4. Summary of Test Method

4.1 At regular time intervals, the resistance of the shotcrete to penetration by standard needles is measured. The penetration resistance is plotted as a function of the elapsed time, and the times of initial and final setting are determined.

5. Significance and Use

5.1 Since the setting of shotcrete is a gradual process, any definition of time of setting must necessarily be arbitrary. In this test method, the times of setting are defined in terms of the times required for the shotcrete to reach specified values of penetration resistance. This test method is an adaptation of Test Method C 403, with similar definitions for times of setting.

5.2 This test method is used for testing shotcrete in place or in prepared test panels.

5.3 This test method is applicable to normal-setting and rapid-setting shotcrete mixtures, and different testing procedures are prescribed to accommodate the two types of mixtures.

5.4 This test method is not recommended for shotcrete mixtures containing coarse aggregate with a nominal maximum size greater than 3/8 in. (9 mm). Interference by large aggregate particles can result in erratic values of penetration resistance.

5.5 This test method may be used to determine the effects of variables such as temperature, brand, type, and content of cementitious materials, mixture proportions, and admixtures upon the time of setting of shotcrete. This test method may also be used to determine compliance with time of setting requirements.

6. Apparatus

6.1 *Penetration Resistance Apparatus*—The penetration resistance apparatus shall be a spring reaction-type and graduated from 10 to 130 lbf (45 to 580 N) in increments of 2 lbf (9 N) or less; or it shall be a hydraulic reaction-type with a pressure gage having a capacity of 150 to 200 lbf (670 to 890 N) and graduated in increments of 2 lbf or less. Indications of needle loads shall be accurate to 2 lbf. Removable needles with the following bearing areas shall be provided: 1, 1/2, 1/4, 1/10, 1/20 and 1/40 in.² (645, 323, 161, 65, 32, and 16 mm²). Each needle shank shall be scribed circumferentially at a distance 1 in. (25 mm) from the bearing area. To minimize bending, the maximum length of the 1/40-in.² (16-mm²) needle shall be 3 1/2 in. (90 mm).

NOTE 1—A suitable apparatus is illustrated in Test Method D 1558.

¹ This specification is under the jurisdiction of ASTM Committee C-9 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.46 on Shotcrete.

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² *Annual Book of ASTM Standards*, Vol 04.02.

³ *Annual Book of ASTM Standards*, Vol 04.08.