



Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density¹

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1. Scope

1.1 These test methods cover the determination of the minimum index density/unit weight of cohesionless, free-draining soils.

1.2 System of units:

1.2.1 The testing apparatus described in this test method has been developed and manufactured using values in the gravimetric or inch-pound system. Therefore, test apparatus dimensions and mass given in inch-pound units are regarded as the standard.

1.2.2 It is common practice in the engineering profession to concurrently use pounds to represent both a unit of mass (lbm) and a unit of force (lbf). This implicitly combines two separate systems of units; that is, the absolute system and the gravitational system. It is scientifically undesirable to combine the use of two separate sets of inch-pound units within a single standard. This test method has been written using the gravitational system of units when dealing with the inch-pound system. In this system the pound (lbf) represents a unit of force (weight). However, balances or scales measure mass; and weight must be calculated. In the inch-pound system, it is common to assume that 1 lbf is equal to 1 lbm. While reporting density is not regarded as nonconformance with this test method, unit weights should be calculated and reported since the results may be used to determine force or stress.

1.2.3 The terms density and unit weight are often used interchangeably. Density is mass per unit volume, whereas unit weight is force per unit volume. In this test method density shall be given only in SI units. After the density has been determined, calculations for determining unit weights shall be given.

1.3 Three alternative procedures are provided to determine the minimum index density/unit weight, as follows:

1.3.1 Test Method A—Using a funnel pouring device or a hand scoop to place material in mold.

1.3.2 Test Method B—Depositing material into a mold by extracting a soil filled tube.

1.3.3 Test Method C—Depositing material by inverting a graduated cylinder.

1.4 The test method to be used should be specified by the individual assigning the test. If no test method is specified, the provisions of Test Method A shall govern. Test Method

A is the preferred procedure for determining minimum index density/unit weight as used in conjunction with the procedures of Test Methods D 4253. Test Methods B and C are provided for guidance of testing used in conjunction with special studies, especially where there is not enough material available to use a 0.100 ft³ (2830 cm³) or 0.500 ft³ (14 200 cm³) mold as required by Test Method A.

1.5 These test methods are applicable to soils that may contain up to 15 %, by dry mass, of soil particles passing a No. 200 (75- μ m) sieve, provided they still have cohesionless, free-draining characteristics (nominal sieve dimensions are in accordance with Specification E 11).

1.5.1 Test Method A is applicable to soils which 100 %, by dry mass, of soil particles pass a 3-in. (75-mm) sieve and which may contain up to 30 %, by dry mass, of soil particles retained on a 1-1/2-inch (37.5-mm) sieve.

1.5.2 Test Method B is applicable to soils in which 100 %, by dry mass, of soil particles pass a 3/4-inch (19.0-mm) sieve.

1.5.3 Test Method C is applicable only to fine and medium sands in which 100 %, by dry mass, of soil particles pass a 3/8-in. (9.5-mm) sieve and which may contain up to 10 %, by dry mass, of soil particles retained on a No. 10 (2.00-mm) sieve.

1.5.4 Soils, for the purposes of these test methods, shall be regarded as naturally occurring cohesionless soils, processed particles, or composites or mixtures of natural soils, or mixtures of natural and processed particles, provided they are free-draining.

1.6 *This standard does not purport to address all of the safety problems, 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 127 Test Method for Specific Gravity and Absorption of Coarse Aggregate²

D 422 Method for Particle-Size Analysis of Soils³

D 653 Terminology Relating to Soil, Rock and Contained Fluids³

D 854 Test Method for Specific Gravity of Soils³

D 2216 Test Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures³

¹ This test method is under the jurisdiction of ASTM Committee D-18 on Soil and Rock and is the direct responsibility of Subcommittee D18.03 on Texture, Plasticity, and Density Characteristics of Soils.

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² Annual Book of ASTM Standards, Vol 04.02.

³ Annual Book of ASTM Standards, Vol 04.08.