



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

This standard is issued under the fixed designation D4254; 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 These test methods cover the determination of the minimum-index dry density/unit weight of cohesionless, free-draining soils. The adjective “dry” before density or unit weight is omitted in the title and remaining portions of this standards to be consistent with the applicable definitions given in Section 3 on Terminology.

1.2 System of Units:

1.2.1 The testing apparatus described in this standard 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 standard, 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 standard, density is given only in SI units. After the density has been determined, the unit weight is calculated in SI or inch-pound units, or both.

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

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

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

1.3.3 Method C²—Depositing material by inverting a graduated cylinder.

1.4 The method to be used should be specified by the agency requesting the test. If no method is specified, the provisions of 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 D4253. 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 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 E11).

1.5.1 Method A is applicable to soils in 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 1½-inch (37.5-mm) sieve.

1.5.2 Method B is applicable to soils in which 100 %, by dry mass, of soil particles pass a ¾-inch (19.0-mm) sieve.

1.5.3 Method C is applicable only to fine and medium sands in which 100 %, by dry mass, of soil particles pass a ⅜-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

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

Current edition approved March 1, 2016. Published March 2016. Originally approved in 1983. Last previous edition approved in 2014 as D4254 – 14. DOI: 10.1520/D4254-16.

² Kolbuszewski, J. J., “An Experimental Study of the Maximum and Minimum Porosities of Sands,” *Proceedings, Second International Conference on Soil Mechanics and Foundation Engineering*, Rotterdam Vol I, 1948, pp. 158–165.