



Standard Test Methods for Density of Soil and Rock in Place by the Sand Replacement Method in a Test Pit¹

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1. Scope*

1.1 These test methods cover the determination of the in-place density of soil and rock using a pouring device and calibrated sand to determine the volume of a test pit. The word “rock” in these test methods is used to imply that the material being tested will typically contain particles larger than 3 in. [75 mm].

1.2 These test methods are best suited for test pits with a volume from 0.03 to 0.17 m³ [1 to 6 ft³]. In general, the materials tested would have a maximum particle size of 75 to 125 mm [3 to 5 in.].

1.2.1 For larger sized excavations and soil containing larger particles, Test Method D5030 is preferred.

1.2.2 Test Method D1556 or D2167 are usually used to determine the volume of test holes smaller than 0.03 m³ [1 ft³]. While the equipment illustrated in these test methods is used for volumes less than 0.03 m³ [1 ft³], the test methods allow larger versions of the equipment to be used when necessary.

1.3 Two test methods are provided as follows:

1.3.1 *Test Method A—In-Place Density of Total Material* (Section 10).

1.3.2 *Test Method B—In-Place Density of Control Fraction* (Section 11).

1.4 *Selection of Test Methods:*

1.4.1 Test Method A is used when the in-place density of total material is to be determined. Test Method A can also be used to determine percent compaction or percent relative density when the maximum particle size present in the in-place material being tested does not exceed the maximum particle size allowed in the laboratory compaction test (refer to Test Methods D698, D1557, D4253, D4254, and D7382). For Test Methods D698 and D1557 only, the dry density determined in the laboratory compaction test may be corrected for larger particle sizes in accordance with, and subject to the limitations of Practice D4718.

1.4.2 Test Method B is used when percent compaction or percent relative density is to be determined and the in-place material contains particles larger than the maximum particle size allowed in the laboratory compaction test or when Practice D4718 is not applicable for the laboratory compaction test. Then the material is considered to consist of two fractions, or portions. The material from the in-place dry density test is physically divided into a control fraction and an oversize fraction based on a designated sieve size (see Section 3). The dry density of the control fraction is calculated and compared with the dry density(s) established by the laboratory compaction test(s).

1.5 Any materials that can be excavated with hand tools can be tested provided that the void or pore openings in the mass are small enough (or a liner is used) to prevent the calibrated sand used in the test from entering the natural voids. The material being tested should have sufficient cohesion or particle interlocking to maintain stable sides during excavation of the test pit and through completion of this test. It should also be firm enough not to deform or slough due to the minor pressures exerted in digging the hole and pouring the sand.

1.6 These test methods are generally limited to material in an unsaturated condition and are not recommended for materials that are soft or friable (crumble easily) or in a water condition such that water seeps into the hand-excavated hole. The accuracy of the test methods may be affected for materials that deform easily or that may undergo volume change in the excavated hole from standing or walking near the hole during the test.

1.7 The values stated in either SI units or inch-pound presented in brackets are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.8 All observed and calculated values shall conform to the guidelines for significant digits and rounding established in Practice D6026.

1.8.1 The procedures used to specify how data are collected, recorded or calculated in this standard are regarded as the industry standard. In addition they are representative of the

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