This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

Designation: D7928 – 16ε1

Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis[1]

This standard is issued under the fixed designation D7928; 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.

ε1 NOTE—Editorially corrected A1.4.3.1, Fig. X1.5, and Fig. X1.6 in January 2017.

1. Scope

1.1 This test method covers the quantitative determination of the distribution of particle sizes of the fine-grained portion of soils. The sedimentation or hydrometer method is used to determine the particle-size distribution (gradation) of the material that is finer than the No. 200 (75-µm) sieve and larger than about 0.2-µm. The test is performed on material passing the No. 10 (2.0-mm) or finer sieve and the results are presented as the mass percent finer versus the log of the particle diameter.

1.2 This method can be used to evaluate the fine-grained fraction of a soil with a wide range of particle sizes by combining the sedimentation results with a sieve analysis resulting in the complete gradation curve. The method can also be used when there are no coarse-grained particles or when the gradation of the coarse-grained material is not required or not needed.

NOTE 1—The significant digits recorded in this test method preclude obtaining the grain size distribution of materials that do not contain a significant amount of fines. For example, clean sands will not yield detectable amounts of silt and clay sized particles, and therefore should not be tested with this method. The minimum amount of fines in the sedimentation specimen is 15 g.

1.3 When combining the results of the sedimentation and sieve tests, the procedure for obtaining the material for the sedimentation analysis and calculations for combining the results will be provided by the more general test method, such as Test Methods D6913 (Note 2).

NOTE 2—Subcommittee D18.03 is currently developing a new test method "Test Method for Particle-Size Analysis of Soils Combining the Sieve and Sedimentation Techniques."

1.4 The terms "soil" and "material" are used interchangeably throughout the standard.

1.5 The sedimentation analysis is based on the concept that larger particles will fall through a fluid faster than smaller particles. Stokes' Law gives a governing equation used to determine the terminal velocity of a spherical particle falling through a stationary liquid. The terminal velocity is proportional to the square of the particle diameter. Therefore, particles are sorted by size in both time and position when settling in a container of liquid.

1.5.1 Stokes' Law has several assumptions which are: the particles are spherical and smooth; there is no interference between the particles; there is no difference between the current in the middle of the container and the sides; flow is laminar; and the particles have the same density. These assumptions are applied to soil particles of various shapes and sizes.

1.6 A hydrometer is used to measure the fluid density and determine the quantity of particles in suspension at a specific time and position. The density of the soil-water suspension depends upon the concentration and specific gravity of the soil particles and the amount of dispersant added. Each hydrometer measurement at an elapsed time is used to calculate the percentage of particles finer than the diameter given by Stokes' Law. The series of readings provide the distribution of material mass as a function of particle size.

1.7 This test method does not cover procurement of the sample or processing of the sample prior to obtaining the reduced sample in any detail. It is assumed that the sample is obtained using appropriate methods and is representative of site materials or conditions. It is also assumed that the sample has been processed such that the reduced sample accurately reflects the particle-size distribution (gradation) of this finer fraction of the material.

1.8 *Material Processing*—Material is tested in the moist or as-received state unless the material is received in an air-dried state. The moist preparation method shall be used to obtain a sedimentation test specimen from the reduced sample. Air-dried preparation is only allowed when the material is received in the air-dried state. The method to be used may be specified by the requesting authority; however, the moist preparation method shall be used for referee testing.

1.9 This test method is **not** applicable for the following soils:

[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.

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