Designation: D1140 – 14

Standard Test Methods for Determining the Amount of Material Finer than 75-µm (No. 200) Sieve in Soils by Washing[1]

This standard is issued under the fixed designation D1140; 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 amount of material finer than a 75-µm (No. 200) sieve by washing of material with a maximum particle size of 75 mm (3 in.).

1.2 The methods used in this standard rely on the use of water or a dispersant to separate and remove materials finer than a 75-µm (No. 200) sieve. During these processes soluble substances, such as salts and other minerals, may also be removed. It is not within the scope of this standard to differentiate between the removal of fine particles and soluble substances. It is recommended that materials containing significant amounts of soluble substances be tested using other methods of separation.

1.3 Two methods for determining the amount of material finer than the 75-µm (No. 200) sieve are provided. The method to be used shall be specified by the requesting authority. If no method is specified, the choice should be based upon the guidance given in 5.2, 5.3, and 5.4.

1.3.1 *Method A*—Test specimen is dispersed by soaking in water prior to wash sieving.

1.3.2 *Method B*—Test specimen is dispersed by soaking in a dispersing solution prior to wash sieving.

1.4 *Units*—The values stated in SI units are to be regarded as standard. Except the sieve designations are typically identified using the "alternative" system in accordance with Specification E11, such as 3 inch and No. 200, instead of the "standard" of 75-mm and 75-µm, respectively. Reporting of test results in units other than SI shall not be regarded as nonconformance with this test method. The use of balances or scales recording pounds of mass (lbm) shall not be regarded as nonconformance with this standard.

1.5 All observed and calculated values shall conform to the guidelines for significant digits and rounding established in Practice D6026, unless superseded by this test method.

1.5.1 The procedures used to specify how data are collected/recorded and calculated in this standard are regarded as the industry standard. In addition, they are representative of the significant digits that generally should be retained. The procedures used do not consider material variation, purpose for obtaining the data, special purpose studies, or any considerations for the user's objectives; and it is common practice to increase or reduce significant digits of reported data to be commensurate with these considerations. It is beyond the scope of these test methods to consider significant digits used in analysis methods for engineering design.

1.6 *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:*[2]

C702 Practice for Reducing Samples of Aggregate to Testing Size

D75 Practice for Sampling Aggregates

D422 Test Method for Particle-Size Analysis of Soils

D653 Terminology Relating to Soil, Rock, and Contained Fluids

D1586 Test Method for Penetration Test (SPT) and Split-Barrel Sampling of Soils

D1587 Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes

D2216 Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

D2487 Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

[1] These test methods are 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 Nov. 1, 2014. Published November 2014. Originally approved in 1950. Last previous edition approved in 2006 as D1140 – 00 (2006). DOI: 10.1520/D1140-14.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

*A Summary of Changes section appears at the end of this standard

D2488 Practice for Description and Identification of Soils (Visual-Manual Procedure)
D3740 Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
D4753 Guide for Evaluating, Selecting, and Specifying Balances and Standard Masses for Use in Soil, Rock, and Construction Materials Testing
D6026 Practice for Using Significant Digits in Geotechnical Data
D6913 Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves
E145 Specification for Gravity-Convection and Forced-Ventilation Ovens
E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods
E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of common technical terms in this standard, refer to Terminology D653.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *guard sieve*—a sieve or sieves that are placed over the actual wash sieve and are constructed of wire mesh instead of wire cloth.

3.2.1.1 *Discussion*—The guard sieve(s) acts to prevent coarse particles from contacting the wire cloth of the wash sieve resulting in punctures, tears, and damage that may require the sieve to be replaced.

4. Summary of Test Method

4.1 A soil specimen is washed over a 75-µm (No. 200) sieve. Clay, silt, and other particles that are dispersed by the wash water, as well as water-soluble materials, are removed from the soil during the test. The loss in mass resulting from the wash treatment is calculated as mass percent of the original sample specimen and is reported as the percentage of material finer than a 75-µm (No. 200) sieve by washing.

5. Significance and Use

5.1 Material finer than the 75-µm (No. 200) sieve can be separated from larger particles or soil aggregations can be broken down much more efficiently and completely by wet sieving than with dry sieving. Therefore, when accurate determinations of material finer than a 75-µm (No. 200) sieve are desired, these test methods are used on the test specimen prior to dry sieving, or as a determination of the percent of material that is finer than a 75-µm (No. 200) sieve. Usually the additional amount of material finer than a 75-µm (No. 200) sieve obtained in the dry sieving process is a small amount. If it is large, the efficiency of the washing operation should be checked, as it could be an indication of degradation of the soil (see Note 2).

5.2 Method A shall be used with non-cohesive soils containing fine material with little or no plasticity. The specimen is soaked in water to facilitate the separation of the fine and coarse fractions prior to washing through the 75-µm (No. 200) sieve.

5.3 Method B shall be used with soils, particularly clayey soils, where the fine material demonstrates plastic behavior and tends to adhere to the larger particles. To provide adequate fine grain dispersal, it is necessary to soak the specimen in a dispersing solution prior to washing through the 75-µm (No. 200) sieve.

5.4 To facilitate determination of which method to utilize, the sample may be classified as non-cohesive or having plastic characteristics based upon procedures outlined in Practice D2488 or other means of determining the soil properties.

NOTE 1—The quality of the result produced by this standard is dependent on the competence of the personnel performing it, and the suitability of the equipment and facilities used. Agencies that meet the criteria of Practice D3740 are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with Practice D3740 does not in itself ensure reliable results. Reliable results depend on many factors; Practice D3740 provides a means of evaluating some of those factors.

NOTE 2—As outlined in 5.1, if the sample is dry sieved after washing, such as for Test Methods D422 or D6913, some material may pass the 75-µm (No. 200) sieve that did not pass during washing operations. The material passing the 75-µm (No. 200) sieve may be a significant amount for samples with a high percentage of silt or clay.

6. Apparatus

6.1 *Balance*—A balance or scale conforming to the requirements of Specification D4753, having a readability with no estimation to four significant digits. The mass of the specimen may be determined in parts if necessary.

6.2 *Wash Sieve*—A 75-µm (No. 200) sieve with a diameter sufficient to handle the required size of specimen in 9.4. Usually 203-mm (8-in.) diameter sieves are adequate for the washing process. The 75-µm (No. 200) sieve shall have a minimum height above the screen of 50 mm (2 in.) to prevent loss of retained material while washing. The sieve may be reinforced with a larger mesh supporting the 75-µm (No. 200) mesh cloth. The reinforcing mesh shall be bonded to the sieve frame below the point where the 75-µm (No. 200) cloth is attached. It is recommended that the sieve cloth be stainless steel to offer more resistance to wear and damage. The sieve shall conform to the requirements of Specification E11 for compliance sieves.

6.3 *Guard Sieves (optional)*—A sieve or multiple sieves having a sieve opening of 425-µm (No. 40) or larger. The diameter of the guard sieve(s) frame shall be equal to or less than the 75-µm (No. 200) wash sieve when stacked. Guard sieves do not need to conform to the requirements of Specification E11.

6.4 *Drying Oven*—An oven of sufficient size, thermostatically controlled and capable of maintaining a uniform temperature of 110 ± 5°C (230 ± 9°F). The oven shall meet the criteria of Specification E145 and preferably be a forced draft oven.

6.5 *Specimen Containers*—The specimen containers shall be made of smooth walled, corrosion resistant material and of

sufficient size to accommodate the test specimen. The containers shall be without tight corners that may allow for material to lodge or become trapped.

6.6 *Washing Sink with Water Delivery System*—A sink having a mechanism to deliver a stream of water directly to the wash sieve. The delivery system may be a rigid or flexible line to facilitate the washing and transfer processes. The system preferably will include a spray nozzle capable of easily adjusting the flow of water used in the washing process. The water delivery system must have the ability to regulate the temperature of the water.

6.6.1 Water used for the washing process shall be maintained close to room temperature to avoid expansion or contraction of the sieve mesh cloth.

6.7 *Splitter or Riffle Box (optional)*—A device to obtain a representative smaller portion (specimen) from a larger portion (sample). This device has an even number of equal width chutes but not less than eight, which discharge alternately to each side of the splitter. For dry material having particles coarser than the 9.5 mm (⅜ in.), the minimum width of the chutes shall be approximately 1-½ times the largest particle in the material being split, but not less than 12.5 mm (½ in.).

6.8 *Quartering Accessories*—A hard, clean, level surface and a durable nonporous fabric or plastic sheet having approximate dimensions of 2 to 2.5 m (6 to 8 ft): a straight edge scoop, shovel or trowel; a broom or brush.

6.9 *Dispersion Shaker (optional)*—A device to hold and vibrate the washing sieve nest while the water spray is directed onto the specimen contained in the sieve nest.

6.10 *Wash Bottle*—Used for transferring washed material from the wash sieve into a drying container.

7. Reagents

7.1 *Dispersant*—Sodium hexametaphosphate (may be referred to as sodium metaphosphate) used in Method B to facilitate separation of fine grained particles in soils during the soaking period.

7.1.1 Sodium hexametaphosphate shall be mixed with water at a concentration sufficient to disperse fine grained soil particles. Dispersant that has not fully dissolved shall not be washed through the wash sieve with the specimen.

8. Sieve Verification

8.1 Prior to initial use, the 75-µm (No. 200) wash sieve must be examined for general condition and opening size of wire cloth for a compliance sieve as specified in Specification E11. Prior to each use, a visual examination of the wash sieve shall be made to check for tears, separations of the wire cloth from the rim or visible stretching of the wire cloth. If one of these conditions exists, the sieve must be removed from service.

8.2 Verification of the 75-µm (No. 200) wash sieve outlined in Specification E11 shall be performed and documented on a 12-month interval.

9. Sampling

9.1 Procurement of the sample(s) shall be conducted in accordance with Practice D75, D1586, D1587, or other standard methods of sample collection, providing that the collection process obtains a representative sampling of the soil (see Note 3).

9.1.1 The specimens may be obtained from bulk samples (bag or bucket samples), jar samples, tube (intact) samples or from samples or specimens that have been tested for other properties, such as consolidation, compressive strength or hydraulic conductivity.

9.2 Thoroughly mix the soil sample and reduce the quantity for testing to a mass meeting the requirements listed in 9.4. The test specimen shall be the end result of the reduction.

9.3 The sample may be reduced to an acceptable size by using one of several methods.

9.3.1 For non-cohesive soils the sample can be placed on a solid surface, thoroughly mixed and quartered until the correct specimen size is obtained.

9.3.2 The use of a riffle splitter may also be used to separate non-cohesive soils, as described in Practice C702. If a riffle splitter is used, it must be limited to only two passes per sample and only on soils that have little or no fines. If during the splitting process dust is created, indicating the loss of fines, the spitting process should be stopped and the quartering method of sample reduction should be used to complete the process.

9.3.3 For jar samples it may be necessary to use the entire sample for the test.

9.3.4 Intact samples may be non-cohesive soils but will normally demonstrate cohesive properties. A representative section of the sample should be selected. If additional sample reduction is necessary, the sample may be cut lengthwise into quarters.

9.4 Reduction to an exact predetermined mass is not permitted. The dry mass of the test specimen, shall conform to the following except as noted in 9.4.1:

Maximum Particle Size (100 % Passing) mm	Standard Sieve Size	Minimum Dry Mass of Test Specimens
0.425	No. 40	75 g
2.00	No. 10	100 g
4.75	No. 4	200 g
9.5	⅜ in.	165 g
19.0	¾ in.	1.3 kg
25.4	1 in.	3 kg
38.1	1½ in.	10 kg
50.8	2 in.	25 kg
76.2	3 in.	70 kg

9.4.1 When sufficient material is not available to meet the minimum mass requirement, a smaller mass specimen may be used. The report shall record the mass used for the test and indicate that sufficient material was not available to meet the minimum mass requirement.

NOTE 3—Sampling following Test Method D1586 may crush or fracture granular soil particles, possibly influencing the test results.

NOTE 4—The applicable minimum dry mass requirements listed above also comply with the minimum dry mass requirements for Test Methods D422 and D6913 should the same specimen be tested for sieve analysis.

10. Procedure

10.1 After obtaining a representative specimen of sufficient size in accordance with 9.2, transfer the test specimen into a pre-weighed container. Dry the entire test specimen to a