Designation: D8262 – 22

Standard Test Method for Determining the pH of Granular Material for Use in Embankments, Subgrades, and Retaining Wall Backfill[1]

This standard is issued under the fixed designation D8262; 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.

1. Scope

1.1 This test method uses a pH meter to measure the pH of as-received granular material that represents what will be used in the field for embankments, subgrades, and retaining wall backfill applications. The principal use of the test method is to supplement soil resistivity measurements to identify conditions under which the corrosion of metal embedded in granular material, or in contact with the granular material may be sharply accentuated.

1.2 The pH of granular material is often specified by agencies to meet criteria that are necessary to prevent or reduce corrosion of metal objects embedded in the granular material used in embankments, subgrade, and retaining wall backfill.

1.3 The types of granular material that can be tested for pH using this standard are natural or manufactured coarse sand, natural or crushed stone, natural or crushed gravel, air-cooled blast furnace slag, and aggregates: lightweight, heavyweight, or normal weight. According to AASHTO M 145, these granular materials generally fall into AASHTO classification groups A-1, A-2-4, A-2-5, or A-3. The ideal material is a well-graded, free draining material that has less than 10-15 % passing the 75 µm (No. 200) sieve.

1.4 This test is based on the volumetric method because the unit weight of the fill material will vary depending on source and project specifications.

1.5 *Units*—The values stated in SI units are to be regarded as standard. Except the sieve designations, they are identified using the "alternative" system in accordance with Specification E11, such as 3 in. and No. 200, instead of the "standard" of 75 mm and 75 µm, respectively. No other units of measurement are included in this standard. Reporting of test results in units other than SI shall not be regarded as nonconformance with this standard.

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values shall conform to the guidelines for significant digits and rounding established in Practice D6026, unless superseded by this test method.

1.6.1 The procedures used to specify how data are collected/recorded and calculated in the 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 data.

1.7 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.8 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C125 Terminology Relating to Concrete and Concrete Aggregates

C702/C702M Practice for Reducing Samples of Aggregate to Testing Size

D75/D75M Practice for Sampling Aggregates

D653 Terminology Relating to Soil, Rock, and Contained Fluids

D1193 Specification for Reagent Water

D3740 Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

D4972 Test Methods for pH of Soils

[1] This test method is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.06 on Physical-Chemical Interactions of Soil and Rock.

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[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.

D6026 Practice for Using Significant Digits and Data Records in Geotechnical Data
D6913/D6913M Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

2.2 *AASHTO Standards:*[3]
M 145 Standard Specification for the Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of common technical terms used in this standard, refer to Terminology D653 and Terminology C125.

4. Summary of Test Method

4.1 A bulk sample that is representative of the material for the intended application is obtained from the field. The bulk sample is reduced to obtain a representative sample. The representative sample is then reduced to obtain one or more test specimens. The test water and specimen(s) are mixed together in a specimen container at a ratio of five parts water to one part specimen. After 24 h, the pH of the test specimen in test water is measured.

5. Significance and Use

5.1 Granular material being used in embankments, subgrades, and retaining wall backfill must often meet certain specifications relating to corrosion potential, such as pH and electrical resistivity. This standard is used by manufacturers, suppliers, and recipients of the materials to measure the pH of the material for acceptance for its intended use.

5.2 Retaining wall manufactures often use a granular material specification similar to: 100 % passing the 100 mm (4 in.) sieve, 75-100 % passing the 75 mm (3 in.) sieve, and 0-15 % passing the 75 µm (No. 200) sieve. The specification may vary depending on availability of local materials.

5.3 Since the total surface area of the material being tested affects the test results, the sample and specimen must have the same grading as the material specified or proposed for use. Reducing the particle size by crushing is not permitted since this process may alter the pH of the material and will likely not be representative of the material actually being placed in the field.

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 assure reliable results. Reliable results depend on many factors; Practice D3740 provides a means of evaluating some of those factors.

6. Apparatus

6.1 *pH Meter*—Potentiometer equipped with an electrode system having a readability to the nearest 0.1 pH unit and an accuracy of ±0.1 pH units or better.

6.2 *Timing Device*—A clock, stopwatch, digital timer, or comparable device readable to 1 s or better.

6.3 *Thermometric Device*—A thermometric device capable of measuring the temperature range within which the test is being performed readable to 0.5°C or better and having an accuracy of at least ±0.5°C.

6.4 *Specimen Container*—A clean, chemically inert container or bucket having enough capacity to hold the specimen and test water. The container shall have solid walls that do not have any defects or holes that will allow water or the material to be lost after filling.

6.5 *Miscellaneous Items*—Items such as a chemically inert spatula or spoon, aluminum foil, lid, straightedge, graduated cylinders/beakers, and tissues are useful.

7. Reagents and Materials

7.1 *Purity of Reagents*—Reagent-grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society where such specifications are available.[4] Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

7.2 *Buffer Solutions*—Commercially available, providing they meet the purity of reagents as described above, or made in-house buffer solutions of 4.0, 7.0, and 10.0 shall be used (see Note 2). See Test Methods D4972 for making buffer solutions.

7.3 *Test Water*—Distilled water as defined by Types I, II, or III of Specification D1193 is the only permissible test fluid. The use of tap water is not permitted. The pH of the distilled water must be between 5.5 and 7.5. The test water must be at a temperature of 21 ± 2°C.

NOTE 2—In some cases it may be appropriate to also include a pH buffer of 12 if the suspected pH of the material could be higher than 10 or a buffer of 2 if the pH could be lower than 4. These solutions may cause eye and skin irritation. Care should be taken to avoid contact. The use of latex gloves and possibly safety glasses when using the solutions is recommended.

8. Sampling and Test Specimens

8.1 Obtain the bulk sample in accordance with Practice D75/D75M making sure the gradation of the sample is representative of the material intended for use.

8.2 Reduce the bulk sample using either Practice C702/C702M or Test Method D6913/D6913M, Annex A2 in order to obtain a representative sample. The representative sample must have a minimum volume of 1.5 L.

[3] Available from American Association of State Highway and Transportation Officials (AASHTO), 444 N. Capitol St., NW, Suite 249, Washington, DC 20001, http://www.transportation.org.

[4] *Reagent Chemicals, American Chemical Society Specifications*, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see the *United States Pharmacopeia and National Formulary*, U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.

8.2.1 If only one test specimen is being tested, the representative sample becomes the test specimen and must have a volume between 1.5 and 2 L and have the gradation of the material intended for use.

8.2.2 If more than one test specimen is desired, make sure the volume of the representative sample is large enough to obtain the desired number of test specimens. Use C702/C702M or D6913/D6913M, Annex A2 to reduce the representative sample into one or more test specimens. The test specimens must each have a volume between 1.5 and 2 L and have the gradation of the material intended for use.

8.3 To obtain and measure the volume of the test specimen, use a clean, chemically inert container with a known volume (see Note 3). Pour the material into this container until it is level with the known volume line/mark on the container. This volume of material is the test specimen. Remove the test specimen from the container and put it into a labeled, sealable bag or other chemically inert sealable container and allow it to come to temperature equilibrium (21 ± 2°C). Record the volume of the test specimen to the nearest 0.1 L. Repeat these steps if it is desired to create more test specimens. Record the specimen identifier.

8.3.1 Determine the volume of water needed for each test specimen based on the volume of the test specimen. The ratio of test water to test specimen by volume is five parts test water to one part test specimen. Therefore, the volume of test water is five times the volume of the test specimen. For example, 7.5 L of test water is needed for a test specimen having a volume of 1.5 L.

NOTE 3—Any type of chemically inert container can be used to obtain the volume of the test specimen provided its volume has been verified. One way to verify the volume or to mark a container with a known volume line is to use water and graduated beakers or cylinders with known volumes. Using the appropriate beakers/cylinders measure the desired volume of water and pour the water into the container. Place the container on a level surface and allow the water to become still. Then mark the water line on the container. This line represents the fill line for the granular material to achieve the desired volume.

9. Standardization

9.1 Before each use, standardize the pH meter using the buffer solutions described in 7.2 following the manufacturer's instructions of the meter. Select buffers so that the expected pH value of the tested material is bracketed. Typically buffers of 4.0, 7.0, and 10.0 meet this requirement for most granular material; however, in some applications buffers with higher or lower pH values are needed (see Note 2). The temperature of the buffers shall be 21 ± 2°C. Measure and record the temperature of each buffer solution to the nearest 0.5°C or better just before beginning the standardization. If the pH meter does not automatically compensate for temperature, adjust the pH meter following manufacturer's instructions. Record the date, time, and name or initials of person completing the standardization. If other data in association with the standardization is determined, record this information (see Note 4).

NOTE 4—Some pH meters output a linearity or other data to indicate the meter is working properly.

9.2 After every ten specimens or at the end of testing, whichever occurs first, verify the pH meter's standardization by inserting the probe into the pH 7.0 buffer solution. Read and record the pH value to the nearest 0.1 pH unit. The value should be between 6.9 and 7.1. If the pH value falls outside of this range, the pH meter must be re-standardized and the previous specimens must be retested to verify the results.

10. Procedure

10.1 Conduct the test in a location having a temperature of 21 ± 2°C where it will not be subjected to any jarring or disturbance. The test water and test specimen must have a temperature of 21 ± 2°C before use. Allow the test water and test specimen to come to temperature equilibrium.

10.2 Obtain a clean specimen container and record its identification.

10.3 After the test water has come to temperature equilibrium and just prior to pouring it into the specimen container, measure and record the temperature of the test water to the nearest 0.5°C. Stir the test water with a chemically inert spatula or spoon and measure and record the pH of the test water to the nearest 0.1 pH unit to verify it has a pH between 5.5 and 7.5. Then pour the amount of test water in the specimen container as determined in 8.3.

10.4 Measure and record the temperature of the test specimen to the nearest 0.5°C.

10.5 Slowly stir the test specimen into the test water. Once the test specimen has been added to the test water, record the start time of the agitation to the nearest 0.25 min and continue to agitate the mixture by stirring for 2 min ± 15 s until thoroughly mixed. Record the end time of the agitation to the nearest 0.25 min.

10.6 Loosely cover with aluminum foil or a lid to prevent anything from falling into the specimen container. Make sure to prevent the aluminum foil from making contact with the contents of the container.

10.7 Allow the specimen to soak undisturbed for 24 h ± 30 min. Record the start and end time of the soaking to the nearest 1 min. Calculate and record the soaking duration to the nearest 0.5 h. Maintain the temperature of the test at 21 ± 2°C for the duration of the test.

10.8 After 24 h ± 30 min, remove the cover from the specimen container.

10.9 Measure and record the temperature of the solution to the nearest 0.5°C. Adjust the temperature controller according to the manufacturer's instructions of the pH meter just before measuring the pH if it does not automatically compensate for temperature.

10.10 Insert the electrode into the aqueous portion of the solution, slowly moving the electrode around to make good contact between it and the aqueous portion. Be careful not to hit the bottom or side of the container or any large granular particles with the electrode when immersing it into the container to prevent damage.

10.11 Allow the pH to stabilize before taking a reading. Follow the manufacturer's instructions for stabilization indication.