Designation: D1782 – 95 (Reapproved 2009)

Standard Test Methods for Operating Performance of Particulate Cation-Exchange Materials[1]

This standard is issued under the fixed designation D1782; 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 These test methods cover the determination of the operating capacity of particulate cation-exchange materials when used for the removal of calcium, magnesium, and sodium ions from water. It is intended for use in testing both new and used materials. The following two test methods are included:

	Sections
Test Method A—Sodium Cycle	8 to 14
Test Method B—Hydrogen Cycle	15 to 21

1.2 The values given in SI units are to be regarded as the standard. The inch-pound units given in parentheses are for information only.

1.3 *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]

D1067 Test Methods for Acidity or Alkalinity of Water
D1126 Test Method for Hardness in Water
D1129 Terminology Relating to Water
D1193 Specification for Reagent Water
D2687 Practices for Sampling Particulate Ion-Exchange Materials

3. Terminology

3.1 *Definitions*—For definitions of terms used in these test methods, refer to Terminology D1129

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 Certain terms in these test methods that relate specifically to ion exchange are defined as follows:

3.2.2 *free mineral acidity*—the quantitative capacity of aqueous media to react with hydroxyl ions to pH 4.3.

3.2.3 *hydrogen cycle*—the operation of a cation-exchange cycle wherein the removal of specified cations from influent water is accomplished by exchange with an equivalent amount of hydrogen ion from the exchange material.

3.2.4 *theoretical free mineral acidity*—the free mineral acidity that would result from the conversion of the anions of strong acids in solution to their respective free acids.

4. Summary of Test Methods

4.1 Test Method A consists of repeated cycles of backwash, brine regeneration, rinse, and exhaustion of the sample in the form of a bed in a transparent column. The exhausting medium used is an ion-exchange test water.

4.2 Test Method B consists of repeated cycles of backwash, acid regeneration, rinse, and exhaustion of the sample in the form of a bed in a transparent column. The exhausting medium used is an ion-exchange test water.

5. Apparatus

5.1 *Test Assemble* (see Fig. 1), consisting of the following:

5.1.1 *Column,* transparent, vertically supported, 25.4 ± 2.5 mm (1.0 ± 0.1 in.) in inside diameter and approximately 1500 mm (60 in.) long. The bottom of the column shall be closed and provided with an outlet of approximately 6-mm inside diameter. Connections shall be provided at top and bottom for admission and removal of solutions as described in Section 10. Adequate means for measuring and regulating flow shall be provided. Calibrate the column in such a manner that the volume readings required by the test method can be made. Make all measurements at 25 ± 5°C.

5.1.2 *Support,* for the sample, so designed that the distance from the sample to the column outlet is at least 50 mm. A suggested supporting bed utilizes quartz, glass beads, or other material 1.5 to 3.5 mm in diameter, insoluble in the reagents used, and retained on a corrosion-resistant screen. However, other supports such as fritted glass or polyester screens may be used at the discretion of the interested parties.

[1] These test methods are under the jurisdiction of ASTM Committee D19 on Water and are the direct responsibility of Subcommittee D19.08 on Membranes and Ion Exchange Materials.

Current edition approved May 1, 2009. Published June 2009. Originally approved in 1960. Last previous edition approved in 2007 as D1782 – 95 (2007). DOI: 10.1520/D1782-95R09.

[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.

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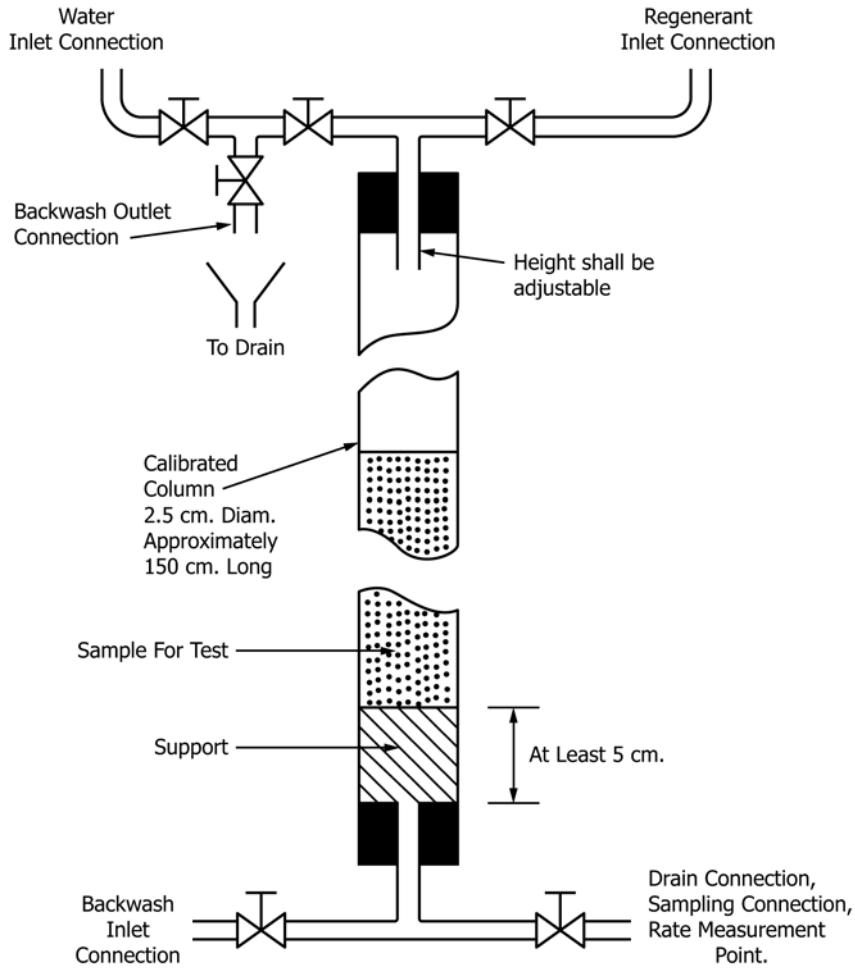

FIG. 1 Typical Arrangement of Apparatus for Performance Testing of Ion-Exchange Materials

6. Reagents

6.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.[3] 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.

6.2 *Purity of Water*— Unless otherwise indicated, references to water shall be understood to mean reagent water, Type IV, conforming to Specification D1193.

7. Sampling

7.1 To obtain a representative sample of particulate ion-exchange material, either from a shipment of new product in the manufacturer's original packages or from a bed of used material, refer to Practices D2687.

7.2 Transfer the laboratory sample to a 2-L beaker and add enough water to bring the water level up to that of the ion-exchange material and soak for 1 h (see Note 1). Mix the sample thoroughly and transfer a sufficient representative portion to fill a 400-mL beaker. Use this portion of sample in the procedure.

NOTE 1—Where new materials are shipped dry, follow the manufacturer's instructions for preconditioning.

TEST METHOD A—SODIUM CYCLE

8. Scope

8.1 This test method is designed to simulate operating conditions on a sodium cycle used for the removal of calcium and magnesium and other divalent ions from water.

9. Significance and Use

9.1 Cation exchange materials are frequently used in the sodium form to exchange divalent and trivalent ions in the influent water for sodium ions on the resin sites. This process is commonly referred to as *softening* water. This test method

[3] *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 *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmaceutical Convention, Inc. (USPC), Rockville, MD.

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