



Designation: ~~D4266 – 96 (Reapproved 2009)~~^{ε1} D4266 – 17

Standard Test Methods for Precoat Capacity of Powdered Ion-Exchange Resins¹

This standard is issued under the fixed designation D4266; 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—Updated 5.2 editorially in June 2009.~~

1. Scope

1.1 These test methods cover the determination of the operating ion-exchange capacity of both powdered cation-exchange resins (hydrogen form) and powdered anion-exchange resins (hydroxide form). These test methods are intended for use in testing new powdered ion-exchange resins when used for the treatment of water. The following two test methods are included:

	Sections
Test Method A—Operating Capacity, Anion-Exchange Resin, Hydroxide Form	7 to 15
Test Method B—Operating Capacity, Cation-Exchange Resin, Hydrogen Form	16 to 24

1.2 The values stated 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.*

1.4 *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

[D1125 Test Methods for Electrical Conductivity and Resistivity of Water](#)

[D1129 Terminology Relating to Water](#)

[D1193 Specification for Reagent Water](#)

[D2687 Practices for Sampling Particulate Ion-Exchange Materials](#)

[D4456 Test Methods for Physical and Chemical Properties of Powdered Ion Exchange Resins](#)

[D5391 Test Method for Electrical Conductivity and Resistivity of a Flowing High Purity Water Sample](#)

[E200 Practice for Preparation, Standardization, and Storage of Standard and Reagent Solutions for Chemical Analysis](#)

3. Terminology

3.1 Definitions:

3.1.1 For definitions of other terms used in this standard, refer to Terminology [D1129](#).

3.2 Definitions of Terms Specific to This Standard:

3.1.1 For definitions of other terms used in these test methods, refer to Terminology [D1129](#).

3.2.1 *powdered ion-exchange material, n*—an ion-exchange resin that has undergone post-manufacturing size reduction to less than 300 μm .

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.

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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.

3.2.2 *resin dosage, n*—the weight of mixed resin applied per unit area of precoatable filter surface. This is expressed as dry pounds per square foot.

3.2.3 *resin floc, n*—that voluminous aggregate formed when powdered anion-exchange resin and powdered cation-exchange resin are slurried together in an aqueous suspension.

3.2.4 *resin ratio, n*—the ratio of the weights of powdered cation-exchange resin to powdered anion-exchange resin used to prepare a resin slurry. If not otherwise indicated, it is understood to be the ratio of the dry resin weights.

4. Significance and Use

4.1 The salt removal capacity of a powdered resin precoat is limited by the capacity of either the anion-exchange resin or the cation-exchange resin contained in it. Applications include condensate polishing in fossil-fueled electric generating plants, as well as condensate polishing, spent fuel pool water treatment, reactor water treatment, and low-level radioactive liquid waste treatment in nuclear-powered electric generating plants.

4.2 By determining the ion-exchange capacity profile of either a cation exchange resin or an anion-exchange resin (capacity expended per unit of time under specific conditions), it is possible to estimate runlength and remaining capacity when treating a liquid of the same makeup. Although they cannot accurately predict performance during condenser leaks, these test methods are useful for determining operating capacities as measured under the test conditions used.

4.3 These test methods may be used to monitor the performance of either powdered anion-exchange resin or powdered cation-exchange resin. The total capacity of either resin depends primarily upon the number density of ion-exchange sites within the resin. The operating capacity is a function of the total capacity, degree of conversion to the desired ionic form when received, and properties of the resin and the system that affect ion exchange kinetics.

5. Purity of Reagents

5.1 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

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

6. Sampling

6.1 Obtain a representative sample of the powdered ion-exchange resin in accordance with Practices **D2687** but substituting a 12.5-mm (½-in.) inside diameter tube.

TEST METHOD A—OPERATING CAPACITY, ANION-EXCHANGE RESIN, HYDROXIDE FORM

7. Scope

7.1 This test method covers the determination of ion-exchange capacity, on a dry weight basis, of new powdered anion-exchange resins in the hydroxide form.

7.2 The ion-exchange capacity obtainable in commercial installations depends not only upon the initial state of the powdered resin, but also on how the resin floc is prepared and applied, on the condition of the equipment on which it is to be used, and the pH and general chemistry of the water system being treated. Thus, this test method has comparative rather than predictive value and provides an upper limit on exchange capacity that may be expected.

8. Summary of Test Method

8.1 The powdered anion-exchange resin to be tested is slurried with an appropriate amount of powdered cation-exchange resin in the hydrogen form, and the resulting floc is precoat onto a filter disk. Then a dilute standardized solution of a strong acid is fed to the precoat while monitoring the effluent stream conductometrically.

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. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.

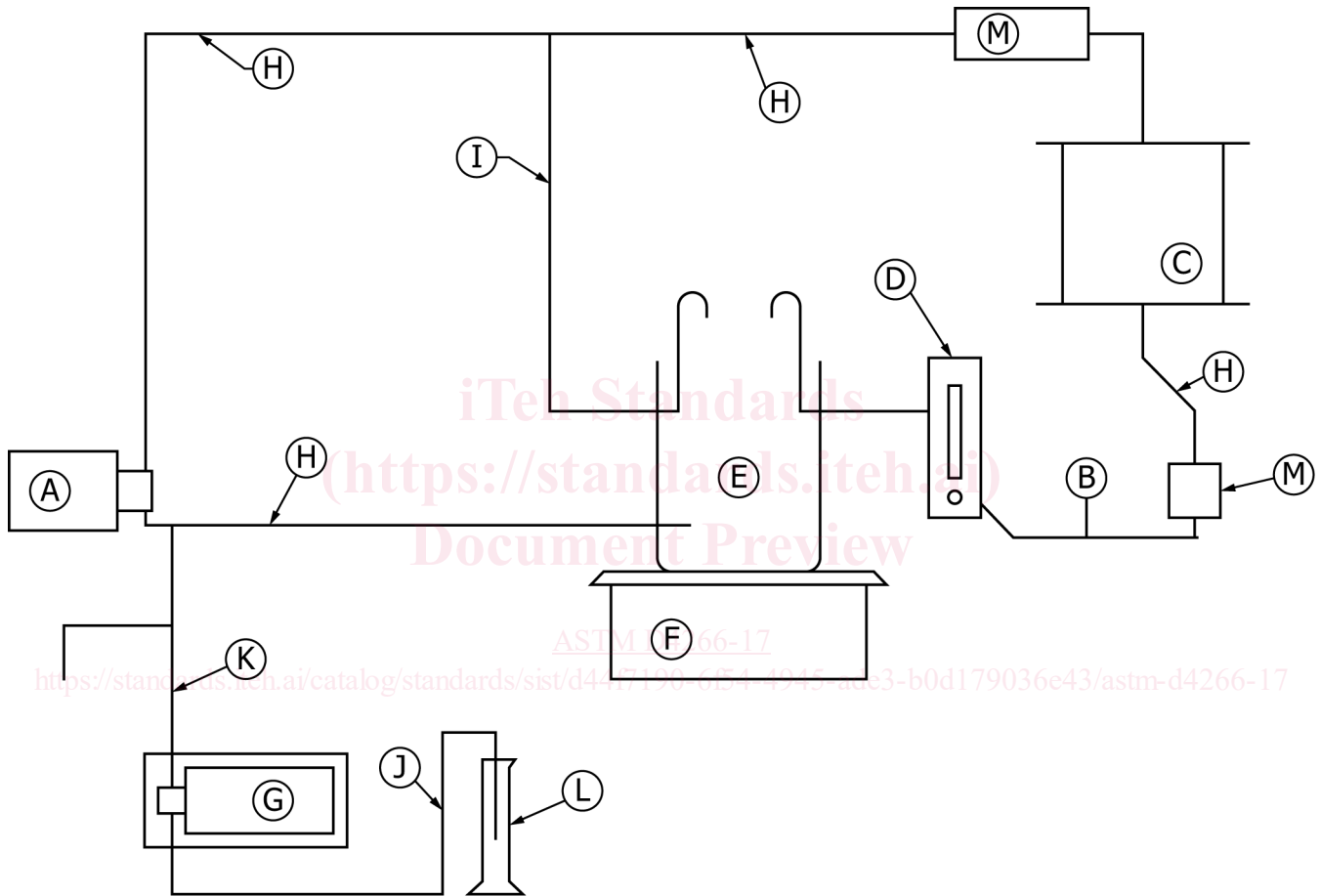
9. Apparatus

9.1 Test apparatus, as shown in Fig. 1, with the following components:

9.1.1 *Water Pump*—adjustable between 0 to 7.57 L/min (0 to 2 gal/min) at 2.76×10^5 Pa (40 psig) pressure.⁴

9.1.2 *Pressure Gauges* (two), 0 to 4.137×10^5 Pa (0 to 60 psig) with appropriate snubbers.

⁴ The sole source of supply of the Millipore pump (ZPN100400) apparatus known to the committee at this time is the Millipore Corporation, 290 Concord Rd., Billerica, MA 01821. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,¹ which you may attend.



- (A) *Pump*, adjustable between 0 to 2 gal/min at 40 psig (0.27 MPa) pressure. Millipore pump (ZPN100400) has been found satisfactory for this use.
 - (B) *Gauges*, 0 to 60 psig (0.41 Pa) pressure with appropriate snubbers.
 - (C) *Disk filter holder*, 142-mm diameter with sufficient clearance above the filter disk to allow for a ½ in. (12.5 mm) powdered resin precoat. Millipore filter holder (YY2214230) with acrylic cylinder (XX4214201) and accessories has been found satisfactory for this use.
 - (D) *Flow metre*, 0 to 30 gal/h with regulating valve.
 - (E) *Stainless steel beaker*, 4-L volume with bulkhead fittings installed at the tubing penetrations.
 - (F) *Magnetic stirrer and hotplate*.
 - (G) *Instrument Pump*, with pumping rate between 30–300 mL/h at 100-psig pressure. Provide external pressure relief protection set for 100 psig. Milton Roy pump (1960066002) has been found satisfactory for this use.
 - (H) *Tubing*, 3/8 in. (9.5 mm), precoat circuit.
 - (I) *Tubing*, ¼ in. (6.4 mm), including regulating valve.
 - (J) *Tubing*, 1/8 in. (3.2 mm).
 - (K) *Tubing*, 1/16 in (1.6 mm), including three-way ball valve and flushing line.
 - (L) *Graduated Cylinder*, 250 mL.
- Disk Filters*, 142 mm, either polypropylene or cellulose.
 Nominal rating 25–30 µm.
 Absolute rating 40–60 µm.
 BG or DG filters have been found satisfactory for this use.
- (M) *Electrical conductivity cell and measurement apparatus*, including temperature measurement.

FIG. 1 Equipment Layout for Precoat Capacity Determination