



# Standard Test Methods for Operating Characteristics of Reverse Osmosis and Nanofiltration Devices<sup>1</sup>

This standard is issued under the fixed designation D4194; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 These test methods cover the determination of the operating characteristics of reverse osmosis devices using standard test conditions and are not necessarily applicable to natural waters. Three test methods are given, as follows:

|                                                      | Sections |
|------------------------------------------------------|----------|
| Test Method A—Brackish Water Reverse Osmosis Devices | 8 – 13   |
| Test Method B—Nanofiltration Devices                 | 14 – 19  |
| Test Method B—Seawater Reverse Osmosis Devices       | 20 – 25  |

1.2 *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:<sup>2</sup>

D512 Test Methods for Chloride Ion In Water  
D1125 Test Methods for Electrical Conductivity and Resistivity of Water  
D1129 Terminology Relating to Water  
D1193 Specification for Reagent Water  
D6161 Terminology Used for Microfiltration, Ultrafiltration, Nanofiltration and Reverse Osmosis Membrane Processes

## 3. Terminology

3.1 **Definitions**—For definitions of terms used in these test methods, refer to Terminology D1129 and D6161.

## 4. Summary of Test Methods

4.1 These test methods consist of determining the desalinating ability and permeate flow rate of reverse osmosis and

nanofiltration devices. They are applicable to both new and used reverse osmosis or nanofiltration devices.

## 5. Significance and Use

5.1 Reverse osmosis and nanofiltration desalinating devices can be used to produce potable water from brackish supplies (<10 000 mg/L) and seawater as well as to upgrade the quality of industrial water. These test methods permit the measurement of the performance of reverse osmosis devices using standard sets of conditions and are intended for short-term testing (<24 h). These test methods can be used to determine changes that may have occurred in the operating characteristics of reverse osmosis and nanofiltration devices but are not intended to be used for plant design.

## 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.<sup>3</sup> 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 Type III reagent conforming to Specification D1193.

## 7. Apparatus

7.1 The apparatus for both methods is schematically described in Fig. 1 and Fig. 2. A conductivity meter can be used to determine the salt concentration in accordance with Test Methods D1125.

<sup>1</sup> These test methods are under the jurisdiction of ASTM Committee D19 on Water and are the direct responsibilities of Subcommittee D19.08 on Membranes and Ion Exchange Materials.

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

<sup>3</sup> *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.