



Designation: D4194 – 23

Standard Test Methods for Operating Characteristics of Reverse Osmosis and Nanofiltration Devices¹

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 (ϵ) 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 – 14
Test Method B—Nanofiltration Devices	15 – 21
Test Method B—Seawater Reverse Osmosis Devices	22 – 28

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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, health, and environmental 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

D512 Test Methods for Chloride Ion in Water (Withdrawn 2021)³

D1125 Test Methods for Electrical Conductivity and Resistivity of Water (Withdrawn 2023)³

¹ 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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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 The last approved version of this historical standard is referenced on www.astm.org.

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:

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

3.1.2 *brackish water, n*—water that contains dissolved matter at an approximate concentration range from 1000 to 30 000 mg/L.

3.1.3 *concentrate, n*—stream exiting a crossflow membrane device that has increased concentration of solutes and particles over the feed stream; portion of the feed stream that does not pass through the membrane; the stream in which dissolved solids or particulates, or both, are concentrated in a membrane separation process.

3.1.4 *hollow-fiber (HF) membrane*—self-supporting membrane fibers that have a hollow bore like a cylinder; in reverse osmosis, the membrane is usually on the outside with the bore conveying the permeate; in ultra and micro filtration, the membrane might be on the inside or outside of the fiber.

3.1.5 *nanofiltration (NF), n*—crossflow process with pore sizes designed to remove selected salts and most organics above about 300 molecular weight range, sometimes referred to as loose RO; a pressure-driven membrane separation process in which particles and dissolved molecules larger than about 2 nm are rejected.

3.1.6 *permeate, n*—that portion of the feed which passes through the membrane.

3.1.7 *reverse osmosis (RO), n*—separation process in which one component of a solution is removed from another component by flowing the feed stream under pressure across a semipermeable membrane that causes selective movement of solvent against its osmotic pressure difference; RO removes ions based on electrochemical forces, colloids, and organics down to 150 molecular weight; may also be called hyperfiltration.

3.1.8 *sea water, n*—water with approximate concentration of total dissolved solids ranging from 30 000 to 60 000 mg/L.