



Standard Practice for Integrity Testing of Water Filtration Membrane Systems¹

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1. Scope

1.1 This standard covers the determination of the integrity of water filtration membrane elements and systems using air based tests (pressure decay and vacuum hold), soluble dye, and TOC monitoring tests for the purpose of rejecting particles and microbes. The tests are applicable to systems with membranes that have a nominal pore size less than about 1 μm . The TOC and Dye tests are generally applicable to NF and RO class membranes only.

1.2 This standard does not purport to cover all available methods of integrity testing.

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:

D 1129 Terminology Relating to Water²

D 2777 Determination of Precision and Bias of Applicable Tests Methods of Committee D19 on Water²

D 3370 Practices for Sampling Water from Closed Conduits²

D 3923 Practice for the Determination of Leaks Within a Reverse Osmosis Device³

D 4839 Total Carbon and Organic Carbon in Water by Ultraviolet, or Persulfate Oxidation, or Both, and Infrared Detection³

D 5173 On-Line Monitoring of Carbon Compounds in Water by Chemical Oxidation, by UV Light Oxidation, by Both, or by High Temperature Combustion Followed by Gas Phase NDIR or by Electrolytic Conductivity²

D 5904 Total Carbon, Inorganic Carbon and Organic Carbon in Water by Ultraviolet, Persulfate Oxidation and Membrane Conductivity Detection³

D 5997 On-Line Monitoring of Total Carbon, Inorganic Carbon in Water by Ultraviolet, Persulfate Oxidation, and

Membrane Conductivity Detection²

D 6161 Terminology Used for Crossflow Microfiltration, Ultrafiltration, Nanofiltration and Reverse Osmosis Membrane Processes³

E 128 Maximum Pore Diameter and Permeability of Rigid Porous Filters for Laboratory Use⁴

3. Terminology

3.1 *Definitions*—For definitions of terms used in this practice, refer to Terminologies D 6161 and D 1129.

3.1.1 For description of terms relating to cross flow membrane systems, refer to Terminology D 6161.

3.1.2 For definition of terms relating to dissolved carbon and carbon analyzers, refer to D 5173, D 5904 and D 5997.

3.1.3 *bubble point*—when the pores of a membrane are filled with liquid and air pressure is applied to one side of the membrane, surface tension prevents the liquid in the pores from being blown out by air pressure below a minimum pressure known as the bubble point.

3.1.4 *equivalent diameter*—the diameter of a pore or defect calculated from its bubble point using Eq 1 (see 9.3). This is not necessarily the same as the physical dimensions of the defect(s).

3.1.5 *integrity*—measure of the degree to which a membrane system rejects particles of interest. Usually expressed as a log reduction value (LRV).

3.1.6 *log reduction value (LRV)*—a measure of the particle removal efficiency of the membrane system expressed as the log of the ratio of the particle concentration in the untreated and treated fluid. For example, a 10-fold reduction in particle concentration is an LRV of 1.

3.1.7 *membrane system*—refers to the membrane hardware installation including the membrane, membrane housings, interconnecting plumbing, seals and valves. The membrane can be any membrane with a pore size less than about 1 μm .

4. Significance and Use

4.1 The integrity test methods described are used to determine the integrity of membrane systems, and are applicable to systems containing membrane module configurations of both hollow fiber and flat sheet; such as, spiral-wound configuration. In all cases the practices apply to membranes in the RO, NF,

¹ This practice is under the jurisdiction of ASTM Committee D19 on Water and is the direct responsibility of Subcommittee D19.08 on Membranes and Ion Exchange Materials.

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² Annual Book of ASTM Standards, Vol 11.01.

³ Annual Book of ASTM Standards, Vol 11.02.

⁴ Annual Book of ASTM Standards, Vol 14.02.

