ANSI/AWWA B112-19
(Revision of ANSI/AWWA B112-15)

American Water Works Association

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AWWA Standard

Microfiltration and Ultrafiltration Membrane Systems

Effective date: May 1, 2019.
First edition approved by AWWA Board of Directors Jan. 24, 2015.
This edition approved Jan. 24, 2019.
Approved by American National Standards Institute Feb. 1, 2019.

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AWWA Standard

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ISBN-13, print: 978-1-62576-3[illegible]-9

eISBN-13, electronic: 978-1-61300-513-2

DOI: http://dx.doi.org/10.12999/AWWA.B112.19

Committee Personnel

The AWWA Standards Subcommittee on Microfiltration and Ultrafiltration Membrane Systems for Water Treatment, which developed and reviewed revisions to this standard, had the following personnel at the time of subcommittee approval:

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The AWWA Standards Committee on Membranes, which reviewed and approved this standard, had the following personnel at the time of committee approval:

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Contents

All AWWA standards follow the general format indicated subsequently. Some variations from this format may be found in a particular standard.

Foreword

This foreword is for information only and is not a part of ANSI/AWWA B112.*

I. Introduction.

I.A. *Background.* The purpose of ANSI/AWWA B112 is to provide purchasers with a standard for the purchase and installation of microfiltration (MF) and ultrafiltration (UF) membrane systems.

Membranes are made from a variety of polymeric and inorganic materials, although polymeric varieties currently predominate. Measurements of membrane performance, including separation and output, are not universally standardized by regulatory agencies. However, some standards groups have published standardized measurement methods, and the industry has developed common and accepted approaches. This is one of the purposes of the testing requirements outlined in the USEPA *Membrane Filtration Guidance Manual* (USEPA 2005) associated with the Long Term 2 Enhanced Surface Water Treatment Rule (USEPA 2006) as well as in NSF†/ANSI 419, *Public Drinking Water Equipment Performance—Filtration.*

Regulatory concerns may or may not be the primary drivers for the use of membranes by a municipality, but in all cases the regulations must be assessed for applicability. At present, US federal drinking water standards covering membrane treatment deal mainly with how much removal credit can be received from membrane treatment's use as a microbial barrier. Other issues such as acceptable water contact materials and meeting the primary and secondary contaminant levels in the finished water may also apply.

This standard should be considered as a list of minimum requirements for planning, procurement, selection, construction, and commissioning of MF- and UF-based treatment systems. However, its proper application requires this standard to be coupled with a thorough professional review of site-specific water treatment conditions.

I.B. *History.* The AWWA Standards Council authorized a new AWWA standard for MF and UF systems in September 2010 and assigned the task of development to the AWWA Standards Committee on Membranes. The first edition was approved Jan. 24, 2015, and this edition was approved on Jan. 24, 2019.

A guide to the AWWA membrane systems standards is presented in Table 1.

* American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036.
† NSF International, 789 North Dixboro Road, Ann Arbor, MI 48105.

Table 1 Guide to AWWA membrane standards and typical membrane characteristics

Membrane Type	Applicable AWWA Standard	Nominal Pore Size *(µm)*	≥3-µm Particle or Surrogate Organism Removal	Virus (MS2 Phage) Removal	Typical Molecular Weight Cutoff *(daltons)*	Salt (NaCl) Rejection *(%)**
Microfiltration (MF)	B112	0.1 to 0.5	≥99.9% (≥3 log)	<90% (<1 log)	≥200,000	None
Ultrafiltration (UF)	B112	0.005 to 0.1	≥99.9% (≥3 log)	≥90% (≥1 log)	10,000 to 200,000	None
Nanofiltration (NF)*,†	B114	0.001 (approximate conceptual value)	Same as UF, but typically not designed for verifiable removal	Same as UF, but typically not designed for verifiable removal	~200 to >500	0% to 95%
Reverse osmosis (RO)†	B114	0.001 (approximate conceptual value)	Same as UF, but typically not designed for verifiable removal	Same as UF, but typically not designed for verifiable removal	<200 to 500	>95%
Electrodialysis/ ion-exchange membranes (IEMs)	B116	Not applicable	Not applicable: demineralized product does not pass through a membrane barrier	Not applicable: demineralized product does not pass through a membrane barrier	Not applicable	>45%
Membrane bioreactors (MBRs)	B130	§	§	§	§	§

* NF is similar to RO with the key differences being that NF has lower sodium chloride rejection than RO, and NF exhibits greater selectivity in the types of ions that are removed such that NF allows a comparatively higher percentage of monovalent ions to pass to the permeate than multivalent ions.

† For NF and RO, rejection is generally based on test conditions for a single element, but there is some variation among membrane manufacturers and membrane models. In general, test conditions tend to vary as follows: (1) feed solutions: 500 to 700 mg/L sodium chloride, magnesium chloride, calcium chloride, or mixed solute solutions for NF; 1,500 to 2,000 mg/L sodium chloride for brackish water RO membranes; 32,000 to 38,000 mg/L sodium chloride for seawater RO membranes; (2) 25°C (77°F) temperature or corrected to that temperature; (3) 6 to 8 pH; (4) 8 to 20 percent recovery per element.

§ For a description of typical MBR characteristics, please refer to AWWA Standard B130 Membrane Bioreactor Systems.

II. Special Issues. There is no consensus of opinion on the precise definitions of reverse osmosis (RO), nanofiltration (NF), ultrafiltration (UF), and microfiltration (MF). The definitions and typical membrane characteristics of the membrane types shown in this standard are considered applicable to this standard and its use.

III. Use of This Standard. It is the responsibility of the user of an AWWA standard to determine that the products described in that standard are suitable for use in the particular application being considered.

III.A. *Purchaser Options and Alternatives*. The following items should be provided by the purchaser:

1. Standard used—that is ANSI/AWWA B112, Microfiltration and Ultrafiltration Membrane Systems, of latest revision.
2. Details of federal, state, and local requirements (Sec. 4.1.1).
3. Required equipment (Sec. 4.2.1).
4. Excluded systems and facilities (Sec. 4.2.2).
5. Required net production rate (Sec. 4.3.1.b).
6. Required documents for permitting (Sec. 4.3.1.u and 4.3.3.e).
7. Record drawings format (Sec. 4.3.4).
8. Whether compliance with NSF/ANSI 60 or NSF/ANSI 61 or other standards, rules, or regulations in addition to the requirements of the Safe Drinking Water Act is required (Sec. 4.6.4, 4.6.4.1, 4.6.4.2).
9. Spare part requirements (Sec. 4.6.7.1).
10. Interface coordination requirements on project drawings (Sec. 4.6.8.1).
11. Electrical coordination requirements on project drawings (Sec. 4.6.8.4).
12. Instrumentation and control requirements on project drawings (Sec. 4.6.8.5).
13. Pneumatic requirements on project drawings (Sec. 4.6.8.6).
14. Flushing requirements (Sec. 5.1.2).
15. Installation requirements (Sec. 5.1.3).
16. Preservative flushing and disposal requirements (Sec. 5.1.4).
17. Requirements for approval of field testing (Sec. 5.4.1).
18. Demonstration testing requirements (Sec. 5.4.4).
19. Performance testing requirements (Sec. 5.4.5).
20. Basis for rejection (Sec. 5.5).
21. Affidavit of compliance (Sec. 6.3).

III.B. *Modification to Standard.* Any modification to the provisions, definitions, or terminology in this standard must be provided by the purchaser.

IV. Major Revisions.

1. Section I.A. Background was revised.
2. Section 3 Definitions was updated.
3. System Description Table in Appendix B was updated.

V. Comments. If you have any comments or questions about this standard, please contact AWWA Engineering & Technical Services at 303.794.7711; FAX at 303.795.7603, write to the department at 6666 West Quincy Avenue, Denver, CO 80235-309, or email at standards@awwa.org.

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SECTION 1: GENERAL

Sec. 1.1 Scope

This standard sets minimum requirements for microfiltration (MF) and ultrafiltration (UF) membrane systems for water and reclaimed water filtration systems. This standard does not cover the membranes used in biological wastewater treatment, such as membrane bioreactors.

Sec. 1.2 Purpose

The purpose of this standard is to provide a minimum set of requirements for MF and UF systems used for water and reclaimed water filtration systems. This standard is intended to assist with the design, procurement, installation, and commissioning of MF and UF systems.

Sec.1.3 Application

This standard can be referenced for design, procurement, installation, and commissioning of MF and UF systems used for water and reclaimed water filtration systems.