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Microfiltration and Ultrafiltration Membrane Systems

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American Water Works Association

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STANDARD Since 1881

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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 standardization 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 and integrity testing to ensure continued compliance. 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, the last edition was approved on Jan. 24, 2019, and this edition was approved on Oct. 13, 2025.

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* American National Standards Institute, 1180 Avenue of the Americas, 10th Floor, New York, NY 10036.

† NSF International, 789 North Dixboro Road, Ann Arbor, MI 48105.

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

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 *(Da [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 module/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; and (4) 8 to 20 percent recovery per module/element.

‡ For a description of typical MBR characteristics, please refer to ANSI/AWWA B130 Membrane Bioreactor Systems.

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I.C. *Acceptance.* In May 1985, the US Environmental Protection Agency (USEPA) entered into a cooperative agreement with a consortium led by NSF International (NSF) to develop voluntary third-party consensus standards and a certification program for direct and indirect drinking water additives. Other members of the original consortium included the Water Research Foundation (formerly AwwaRF) and the Conference of State Health and Environmental Managers (COSHEM). The American Water Works Association (AWWA) and the Association of State Drinking Water Administrators (ASDWA) joined later.

In the United States, authority to regulate products for use in, or in contact with, drinking water rests with individual states or USEPA.[‡] Local agencies may choose to impose requirements more stringent than those required by the state. To evaluate the health effects of products and drinking water additives from such products, state and local agencies may use various references, including

1. Specific policies of the state or local agency.

2. Five standards developed under the direction of NSF: NSF/ANSI/CAN[§] 60, Drinking Water Treatment Chemicals—Health Effects; NSF/ANSI/CAN 61, Drinking Water System Components—Health Effects; NSF/ANSI 372, Drinking Water System Components—Lead Content; NSF/ANSI/CAN 600, Health Effects Evaluation and Criteria for Chemicals in Drinking Water; and NSF/ANSI 419, Public Drinking Water Equipment Performance—Filtration, which is an NSF/ANSI national standard for microfiltration (MF) and ultrafiltration (UF) membrane modules, as well as bag and cartridge filter systems.

3. Other references, including AWWA standards, *Food Chemicals Codex*, *Water Chemicals Codex,*[¶] and other standards considered appropriate by the state or local agency.

Various certification organizations may be involved in certifying products in accordance with NSF/ANSI/CAN 61. Individual states or local agencies have authority to accept or accredit certification organizations within their jurisdictions. Accreditation of certification organizations may vary from jurisdiction to jurisdiction.

NSF/ANSI/CAN 600 (which formerly appeared in NSF/ANSI/CAN 60 and 61 as Annex A, "Toxicology Review and Evaluation Procedures") does not stipulate a maximum allowable level (MAL) of a contaminant for substances not regulated by a

[‡] Persons outside the United States should contact the appropriate authority having jurisdiction.

[§] Standards Council of Canada, 55 Metcalfe Street, Suite 600, Ottawa, ON K1P 6L5 Canada.

[¶] Both publications available from National Academies Press, 500 Fifth Street, NW, Washington, DC 20001.

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USEPA final maximum contaminant level (MCL). The MALs of an unspecified list of "unregulated contaminants" are based on toxicity testing guidelines (noncarcinogens) and risk characterization methodology (carcinogens). Use of NSF/ANSI/CAN 600 procedures may not always be identical, depending on the certifier.

ANSI/AWWA B112 does not address additives requirements. Users of this standard should consult the appropriate state or local agency having jurisdiction in order to

1. Determine additives requirements, including applicable standards.
2. Determine the status of certifications by parties offering to certify products for contact with, or treatment of, drinking water.
3. Determine current information on product certification.

II. Special Issues. There is no consensus of opinion on the precise definitions of microfiltration (MF), ultrafiltration (UF), reverse osmosis (RO), and nanofiltration (NF). 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, provincial, territorial, tribal, 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 Sec. 4.3.3.e).
7. Record drawings format (Sec. 4.3.4).
8. Whether compliance with NSF/ANSI/CAN 60 or NSF/ANSI/CAN 61 or other standards, rules, or regulations in addition to the requirements of the Safe Drinking Water Act is required (Sec. 4.6.4, Sec. 4.6.4.1, and Sec. 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 (I&C) requirements on project drawings (Sec. 4.6.8.5).

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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. Storage solution 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. Major revisions made to the standard in this edition include the following:

1. Several definitions were revised in Section 3.
2. Revisions to operations and maintenance (O&M) manual requirements in Sec. 4.6.

V. Comments. If you have any comments or questions about this standard, please call AWWA Standards and Optimization Programs at 303.794.7711; write to the department at 6666 West Quincy Avenue, Denver, CO 80235-3098; or email standards@awwa.org.

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ANSI/AWWA B112-25
(Revision of ANSI/AWWA B112-19)

AWWA Standard

Microfiltration and Ultrafiltration Membrane Systems

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.

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