



NSF International Standard
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Onsite Residential and Commercial Water Reuse Treatment Systems

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for Wastewater Technology –

Onsite Residential and Commercial Water Reuse Treatment Systems

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Abbreviations

The following table is provided as a reference for unit abbreviations for common forms of measurement used within NSF documents.

time	second	s
	minute	min
	hour	h
	day	d
	week	wk
	month	mo
	year	yr
length	inch	in
	foot	ft
	yard	yd
	micrometer	µm
	nanometer	nm
	millimeter	mm
	centimeter	cm
	meter	m
	kilometer	km
liquid measure	milliliter	mL
	liter	L
	liters per day	LPD
	liters per minute	LPM
	ounce	oz
	pint	pt
	quart	qt
	gallon	gal
	gallons per minute	GPM
	gallons per day	GPD
weight	microgram	µg
	picogram	pg
	nanogram	ng
	milligram	mg
	centigram	cg
	gram	g
	kilogram	kg
	pounds	lb
	tons	t
	metric tons	mt

miscellaneous	colony-forming unit	CFU
	cup	c
	A-weighted decibel	dBA
	kilowatt-hour	kWh
	millijoule	mJ
	most probable number	MPN
	nephelometric turbidity unit	NTU
	standard unit	SU

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Foreword²

This American National Standard, NSF/ANSI 350: *Onsite Residential and Commercial Water Reuse Treatment Systems*, has been developed as part of the ongoing efforts of interested parties to establish minimum material, design and construction, and performance requirements for onsite residential and commercial water reuse treatment systems. This standard also specifies the minimum literature that manufacturers shall supply to authorized representatives and owners as well as the minimum service-related obligations that a manufacturer shall extend to owners. This standard is intended to address public health and environmental issues. Actual performance for any site or system may vary, depending on variations in raw water supply (such as in alkalinity and hardness), greywater constituents, and patterns of use. The end use of the effluent is the responsibility of the owner, design professionals, and regulatory officials.

Management methods and end uses appropriate for the treated effluent discharged from onsite residential and commercial treatment systems meeting Class R (single-family residential) or Class C (multifamily and commercial facilities) requirements of this standard include indoor restricted urban water use, such as toilet and urinal flushing, and outdoor unrestricted urban water use, such as surface irrigation.

Systems may include:

- **greywater treatment systems having a rated treatment capacity up to 5,678 LPD (1,500 GPD):** this applies to onsite residential and commercial treatment systems that treat greywater, those that treat laundry water from residential laundry facilities, and those that treat bathing water.
- **residential wastewater treatment systems having a rated treatment capacity up to 5,678 LPD (1,500 GPD):** this applies to onsite residential treatment systems that treat combined wastewater generated by the occupants of residence(s).
- **commercial treatment systems:** this applies to onsite commercial treatment systems that treat combined commercial facility wastewater and commercial facility laundry water of any capacity, and those treatment systems that treat greywater from commercial facilities with capacities exceeding 5,678 LPD (1,500 GPD). These systems shall be performance tested and evaluated at the location of the reuse system installation, using the wastewater generated onsite from the facility serving the treatment system. See Section [8.3](#) for performance testing and evaluation. The key elements of a field evaluation of a commercial onsite treatment system are described in Annex [N-1](#).

This edition of the standard contains the following revisions:

Issue 63

This revision incorporates pathogen log reduction targets into the standard. This included revisions to Sections [8.7](#) and [9](#), and the addition of Annexes [N-2](#) and [I-5](#). Normative references were also added to Section [2](#).

Issue 76

This revision will harmonize the language in Sections [5.10.1](#) and [5.10.2](#) with recently approved language regarding dataplates in other WWT standards.

² The information contained in this foreword is not part of this American National Standard (ANS) and has not been processed in accordance with ANSI's requirements for an ANS. Therefore, this foreword may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the standard.

Issue 77

This revision adds language addressing pre- and post-UV sample collection as new Section [8.4.4](#).

Issue 78

This revision clarifies language regarding vacation stress testing in Section [8.1.2.2.2](#).

Issue 80

This revision updates a normative reference in Section [2](#).

Issue 82

This revision updates language in Sections [8.1.2.2.2](#) and [8.1.2.2.3](#) regarding wash load testing.

This standard was developed by the NSF Joint Committee on Wastewater Technology using the consensus process described by the American National Standards Institute.

This standard and the accompanying text are intended for voluntary use by certifying organizations, regulatory agencies, and/or manufacturers as a basis of providing assurances that adequate health protection exists for covered products.

Suggestions for improvement of this standard are welcome. This standard is maintained on a continuous maintenance schedule and can be opened for comment at any time. Comments should be sent to: Chair, Joint Committee on Wastewater Technology at standards@nsf.org, or c/o NSF International, Standards Department, P.O. Box 130140, Ann Arbor, Michigan 48113-0140, U.S.A.

NSF/ANSI Standard for Wastewater Technology –

Onsite Residential and Commercial Water Reuse Treatment Systems

1 General

1.1 Purpose

The purpose of this standard is to establish minimum material, design, and construction, and performance requirements for onsite residential and commercial water reuse treatment systems. This standard also specifies the minimum literature that manufacturers shall supply to authorized representatives and owners as well as the minimum service-related obligations that a manufacturer shall extend to owners.

1.2 Scope

This standard contains minimum requirements for onsite residential and commercial water reuse treatment systems. Systems include the following:

- greywater treatment systems having a rated treatment capacity up to 5,678 LPD (1,500 GPD). This applies to onsite residential and commercial treatment systems that treat greywater, those that treat laundry water from residential laundry facilities, and those that treat bathing water. See Section [8.1](#) for performance testing and evaluation;
- residential wastewater treatment systems having a rated treatment capacity up to 5,678 LPD (1,500 GPD). This applies to onsite residential treatment systems that treat combined wastewater generated by the occupants of residence(s). See Section [8.2](#) for performance testing and evaluation; or
- commercial treatment systems. This applies to onsite commercial treatment systems that treat one or more of the following:
 - all wastewater from a commercial facility of any capacity;
 - laundry wastewater from a commercial facility of any capacity; or
 - greywater from commercial facilities with capacities exceeding 5,678 LPD (1,500 GPD).

These systems shall be performance tested and evaluated at the location of the reuse system installation, using the wastewater generated onsite from the facility serving the treatment system. See Section [8.3](#) for performance testing and evaluation. The key elements of a field evaluation of a commercial treatment system are described in Annex [N-1](#).

Management methods and end uses appropriate for the treated effluent discharged from onsite residential and commercial treatment systems meeting Class R (single-family residential) or Class C (multifamily and commercial facilities) requirements of this standard include indoor restricted urban water use, such as toilet and urinal flushing, and outdoor unrestricted urban water use, such as surface irrigation. Effluent quality criteria consistent with these uses are described in Section [8.6](#). This standard is intended to address public health and environmental issues. Actual performance for any site or system may vary, depending on variations in raw water supply (such as alkalinity and hardness), wastewater constituents, and patterns of

use. The end use of the effluent is the responsibility of the owner, design professionals, and regulatory officials.

System components covered under other NSF or NSF/ANSI standards or criteria shall also comply with the requirements therein. This standard shall in no way restrict new system designs, provided such designs meet the minimum specifications described herein.

1.3 Alternate materials, design, and construction

While specific materials, designs, and constructions may be stipulated in this standard, systems that incorporate alternate materials, designs, or constructions, may be acceptable when it is verified that such systems meet the applicable requirements of this standard.

1.4 Performance classification

For the purpose of this standard, systems are classified according to the chemical, biological, and physical characteristics of their effluents, as determined by the performance testing and evaluations described herein.

Greywater treatment systems within a manufacturer's model series may be classified according to the performance testing and evaluation of the system (Section [8.1](#)) expected to produce the poorest effluent quality within the series based upon design characteristics.

Residential wastewater treatment systems within a manufacturer's model series may be classified according to the performance testing and evaluation of the system (Section [8.2](#)) with the smallest hydraulic capacity within the series. A series is limited to treatment capacities < 1,514 LPD (400 GPD), and treatment capacities between 1,514 LPD (400 GPD) and 5,678 LPD (1,500 GPD).

Residential wastewater treatment systems having rated treatment capacities < 378 LPD (100 GPD) shall be within a manufacturer's model series having rated treated capacities ≥ 378 LPD (100 GPD).

Greywater treatment systems shall be capacity classified based on treated water output, not greywater input.

The manufacturer shall submit design drawings and specifications of the entire model series, which shall include critical design parameters for the systems. An engineering review of the design parameters may be completed in lieu of performance testing and evaluation of other systems within the series provided they are determined to be appropriately proportionate to the evaluated system based on sound engineering principles.

Commercial treatment systems that treat combined commercial facility wastewater and commercial facility laundry water of any capacity, and treatment systems that treat greywater from commercial facilities with capacities > 5,678 LPD (1,500 GPD) performance tested and evaluated in accordance with Section [8.3](#) and Annex [N-1](#), may be similarly classified within a manufacturer's model series. However, consideration shall be given to the conditions of the field evaluation of the system, including the wastewater characteristics, treatment system loading conditions, and other variables affecting performance. These conditions shall become limitations for classifying other systems within a manufacturer's model series.

2 Normative references

The following documents contain requirements that, by reference in this text, constitute requirements of this standard. At the time of publication, the indicated editions were valid. All of the documents are subject to revision and parties are encouraged to investigate the possibility of applying the most recent editions of the documents indicated below. The most recent published edition of the document shall be used for undated references.

ASTM D6908-06, *Standard Practice for Integrity Testing of Water Filtration Membrane Systems*³

AWS D1.1/D1.1M:2020, *Structural Welding Code – Steel, with Errata*⁴

AWS D1.3/D1.3M:2018, *Structural Welding Code – Sheet Steel, with Errata*⁴

APHA/AWWA/WEF, *Standard Methods for the Examination of Water and Wastewater* (hereinafter referred to as *Standard Methods*)⁵

Colorado Department of Public Health and Environment, *Baffling Factor Guidance Manual* (2014)⁶

ISO 12103-1, *Road Vehicles – Test Dust for Filter Evaluation*⁷

National Blue-Ribbon Commission for Onsite Non-Potable Systems (NBRC), *Health Risk-based Benchmarks for Onsite Treatment of Water* (2023)⁸

NFPA 70®, *National Electrical Code*® (NEC®), 2011⁹

NSF/ANSI 55, *Ultraviolet Microbiological Water Treatment Systems*

NSF/ANSI 437, *Glossary of Wastewater Technology Terminology*

NWRI/WRF, *Ultraviolet Disinfection: Guidelines for Drinking Water and Water Reuse*, 3rd edition (2017)¹⁰

U.S. EPA, *Disinfection Profiling and Benchmarking Technical Guidance Manual* (2020)¹¹

U.S. EPA, *Guidance Manual for Compliance with the Filtration and Disinfection Requirements for Public Water Systems Using Surface Water Sources* (1991)¹¹

U.S. EPA, *Long Term 2 Enhanced Surface Water Treatment Rule Guidance Manual* (2010)¹¹

U.S. EPA, LRT Updates: 2022 Update Using DALY Benchmark (2020)¹¹

U.S. EPA, *Membrane Filtration Guidance Manual* (2005)¹¹

U.S. EPA, *Ultraviolet Disinfection Guidance Manual for The Final Long Term 2 Enhanced Surface Water Treatment Rule* (2006)¹¹

³ ASTM International. 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959. <www.astm.org>

⁴ American Welding Society. 8669 NW 36 Street, #130, Miami, FL 33166-6672. <www.aws.org>

⁵ American Public Health Association, American Water Works Association, and Water Environment Federation. <www.standardmethods.org>

⁶ Colorado Department of Public Health & Environment, Water Quality Control Division Safe Drinking Water Program. 4300 Cherry Creek Drive South, Denver, CO 80246 <<https://cdphe.colorado.gov>>

⁷ International Organization for Standardization. Chemin de Blandonnet 8, Case Postale 401, 1214 Vernier, Geneva, Switzerland. <www.iso.org>

⁸ U.S. Water Alliance. P.O. Box 4658, Federal Way, WA 98063. <<https://uswateralliance.org>>

⁹ National Fire Protection Association. 1 Batterymarch Park, Quincy, MA 02169-7471. <www.nfpa.org>

¹⁰ National Water Research Institute. 18700 Ward Street. Fountain Valley, CA, 92708. <www.nwri-usa.org>

¹¹ U.S. Environmental Protection Agency. 1200 Pennsylvania Avenue NW, Washington, DC 20004. <www.epa.gov>

WaterVal, *Membrane Bio-reactor Validation Protocol* (2017)¹²

WaterVal, *Chlorine Disinfection Validation Protocol* (2017)¹²

WRF/NBRC, *Onsite Non-Potable Water System Guidance Manual* (2020)¹³

WRF, *Membrane Bio-Reactor Validation Protocols for Water Reuse* (2021)¹³

WRF, *Risk-Based Framework for the Development of Public Health Guidance for Decentralized Nonpotable Water Systems* (2017)¹³

2.1 Abbreviations

Common abbreviation	Meaning
°C	degrees Celsius
CFU	colony forming unit
d, mo	day(s), month(s)
dBA	decibel A-weighting
°F	degrees Fahrenheit
ft	foot / feet
g	gram(s)
gal	gallon(s)
h	hour(s)
in	inch(es)
kg	kilogram(s)
L	liter(s)
lb	pound(s)
m	meter(s)
mg	milligram(s)
mL	milliliter(s)
mm	millimeter(s)
MPN	most probable number
NTU	Nephelometric Turbidity Unit
oz	ounce(s)
SU	standard unit(s)
wk	week(s)

3 Definitions

Terms used in this standard that have a specific technical meaning are defined in NSF/ANSI 437.

¹² Water Research Australia, Ltd. 250 Victoria Square, Adelaide SA 5000. <<https://members.waterra.au>>

¹³ Water Research Foundation. 6666 W Quincy Avenue, Denver, CO 80235. <www.waterrf.org>

4 Materials

Materials shall be durable and capable of withstanding stresses and wear during shipping, assembly, installation, and operation. System materials shall not be adversely affected when subjected to the use environment.

NOTE — There are numerous design criteria suitable for the manufacture of residential greywater treatment systems. Manufacturers should acquire appropriate engineering expertise in evaluating the design of the system.

4.1 Interior surfaces

The interior surfaces of the system shall be free of spalls, honeycombs, and pits with the exception that rough surfaces, intended to support microbiological growth, shall be permitted. Interior surfaces shall show no visible signs of structural change following performance testing and evaluation including, but not limited to, flaking, pitting, or the formation of structurally significant cracks.

4.2 Exterior surfaces

Exterior surfaces shall show no visible signs of structural change following performance testing and evaluation including, but not limited to, flaking, pitting, or the formation of structurally significant cracks.

Small diameter and length surface cracks exhibited by concrete tanks (commonly called map cracking or crazing) are normally expected in some circumstances and shall not be considered structural defects.

4.3 Welding

Welded seams and deposited weld material shall meet the requirements of Sections [4.1](#) and [4.2](#). Welds and welding methods shall conform to AWS D1.1⁴ for steel 3.2 mm ($\frac{1}{8}$ in) and thicker, or AWS D1.3⁴ for steel that is < 3.2 mm ($\frac{1}{8}$ in). The welds shall be visually inspected and shall be acceptable if the criteria of Table 6.1 of AWS D1.1 are satisfied.

The location, type, and size of welds shall be shown on the drawings required in Section [9](#). Welds that do not conform to the manufacturer's drawings, based on visual examination of the weld, shall be repaired prior to testing and the repairs noted in the final report. The system shall be free from cracks at the interface between the base metal and the weld, or within the weld metal.

4.4 Dissimilar metals

Dissimilar metal materials, not considered compatible at the electromotive level, shall not be in direct contact. An electrically nonconductive insulating fitting shall be provided at the junction between such dissimilar metal parts or components.

5 Design and construction

5.1 Exposed surfaces

All exposed surfaces shall be free from nonfunctional rough or sharp edges that may cause injury to persons using, installing, maintaining, or servicing the system.

5.2 Structural integrity

The system, when filled or empty, shall maintain its structural integrity. An *in situ* visual evaluation shall be performed during and after the performance testing and evaluation.

5.3 Water tightness

5.3.1 For systems installed in the ground, the system, including all joints, seams, and components, shall preclude infiltration of ground water into the system and exfiltration of wastewater out of the system. Inlet and outlet ports shall have a short section of sewer pipe installed per the manufacturer's installation recommendations. The test pipe sections shall be capped and shall be leak free at the caps. The system shall be filled to the ceiling of the tank with tap water and held for 24 h. At the end of this 24-h period, there shall be no > 0.5% change from the initial water volume of the system and no visible leaks.

5.3.2 For systems installed above the ground, the system, including all joints, seams, and components, shall be watertight. A visual evaluation shall be performed during and after the performance testing and evaluation (Section [8.1](#) or [8.2](#)) for signs of any leakage.

NOTE — At the manufacturer's discretion, the system may be filled to the high water alarm level with tap water and held for up to 24 h prior to the start of the water tightness test.

5.4 Noise

When installed according to the manufacturer's instructions, the system shall not produce excessive noise.

Noise associated with systems designed for outdoor operation, measured at 1.2 m (47 in) above the ground surface, 6.00 m (236 in) in four directions, at 90°, 180°, 270°, and 360° from the system and its appurtenances shall not exceed 60 dBA.

Noise associated with systems designed for indoor operation, measured at 1.2 m (47 in) above the ground surface, 1.0 m (39 in) in four directions, at 90°, 180°, 270°, and 360° from the system and its appurtenances shall not exceed 60 dBA.

Measure the background noise level with all electrical and mechanical components of the system off. Minimize background noise to < 50 dBA if possible. If needed, correct the final operating noise level for high background noise according to the following table.

Table 5.1
Correction chart for sound level recordings

Difference between total and background sound readings (dBA)	Number to subtract from total to yield corrected noise level
0 to 2	reduce background levels
3	3
4 to 5	2
6 to 10	1
> 10	0

When the system operating noise level is < 60 dB, no correction is required.

5.5 Mechanical components

Mechanical components shall not require periodic maintenance or adjustment by the owner.

NOTE — Replacement of fuses and similar devices or visual inspection of warning devices do not qualify as periodic maintenance or adjustment.

5.6 Electrical components

Electrical components shall be protected by safety devices, such as circuit breakers and fuses. NFPA 70^{®9} shall be followed for all electrical components, electrical connections, system installation, and system operation.

5.7 Access ports

5.7.1 The system shall be demonstrated to have access ports that are sized and located to facilitate the installation, removal, sampling, examination, maintenance, and servicing of components and compartments that require routine maintenance and inspection. Systems installed below grade shall include ground level access ports.

The access ports shall be of sufficient size and located so as to allow for the following:

- visual inspection and removal of all mechanical or electrical components;
- periodic cleaning or replacement of components and removal of residuals as required by the manufacturer in the operation and maintenance manual;

NOTE — “Periodic” refers to all procedures specified in the manufacturer’s operation and maintenance manual that must be performed within intervals of 2 y.

- visual inspection and sampling as required by the manufacturer in the operation and maintenance manual, including a means for collecting a representative effluent sample and determining the need for residuals removal;
- removal (manually or by pumping) of collected residuals as required by the manufacturer in the operation and maintenance manual; and
- removal of stored treated or untreated reuse water.

5.7.2 Access ports shall be protected against unauthorized intrusions by methods compatible with the size of the access port. Acceptable protective measures for access ports that allow personal entry include, but are not limited to:

- a padlock;
- a cover installed using security fasteners; or
- a cover having a minimum net weight of 29.5 kg (65 lb).

5.8 Failure sensing and signaling equipment

The system shall possess a mechanism or process capable of detecting failures of electrical and mechanical components critical to the treatment processes and delivering a visible and audible signal to notify the owner or user of the failure. The system shall possess a mechanism or process capable of detecting a high water condition and delivering a visible and audible signal to notify the owner or user and service provider if the water level is above normal operating specifications.

The visual and auditory signals shall continue to be functional in the event of an electrical, mechanical, or hydraulic malfunction of the system providing power is available to the system and shall resume once power is restarted following the power outage. This does not mandate a battery back-up for the alarm system.

Compliance with the requirements of Sections [5.8.1](#) and [5.8.2](#) shall be determined by a group of three observers. Observers shall be employees of the test agency.

The system shall possess a mechanism or process capable of detecting a high-water condition and delivering a visible and audible signal to notify the owner or user and service provider that the water level is above normal operating specifications or that flow is being diverted to a bypass function caused by a system malfunction as described in Section [5.9](#).

5.8.1 Visual alarm test

The audible portion of the alarm shall be disabled during the visual alarm test. The visual portion of the signal shall be conspicuous from a distance of 15 ± 0.3 m (49.2 ± 1.0 ft). There shall be a minimum of five random on/off trials of the visual alarm. The observers shall turn their backs to the alarm panels such that they cannot see the visual portion of the alarm prior to each trial during the visual alarm test. The visual alarm shall be on for a minimum of one trial and off for a minimum of one trial during the test, but the on/off condition shall otherwise be selected randomly. Observers shall face the alarm panel when requested during the test. Compliance with these requirements is demonstrated only when all observers provide the correct answer for each trial.

5.8.2 Audible alarm test

The visual alarm shall be disabled during the audible alarm test. Observers shall have their backs to the alarm during the audible testing. The audible portion of the signal shall be discernible from a distance of 15 ± 0.3 m (49.2 ± 1.0 ft) with a minimum ambient noise level of 60 dBA. When the ambient noise level is < 60 dBA, it shall be augmented with a steady tone between 100 and 1,000 Hz. The ambient noise level shall be measured at the location where the observers will be located. The audible alarm shall be activated a minimum of three times. The observers shall record the number of times the audible alarm was heard. Compliance with these requirements is demonstrated only when all observers record the correct number of times the alarm was activated. The audible portion of the alarm shall not exceed 90 dBA at a distance of 3 m (10 ft) when measured outdoors with both the alarm panel and sound level meter located at a minimum of 7.6 m (25 ft) from any permanent structure.

5.8.3 In addition to the above, commercial wastewater and commercial greywater treatment systems shall include remote telemetry capable of delivering notification by electronic communication, such as by phone or email, to the owner or operator of the system during detection of failures.

5.9 Flow design

Systems shall have a designated flow path that is reflective of the entire treatment process. During periods of normal system operation, as well as periods of system and component malfunction, the design and construction of the system shall preclude discharge of wastewater from an opening external to the designated flow path.

Components (treatment, storage, or both) installed inside a home or building shall meet the following:

- treatment systems shall possess a minimum storage capacity equal to 500% of the daily rated treatment capacity, or a means of bypass for discharge of untreated water to a locally approved wastewater treatment and disposal system and shall be activated during periods of system malfunction; and
- treatment systems shall possess a means to control the volume of treated water in any storage vessel and shall prevent overflow to any location other than to a locally approved wastewater treatment and disposal system.

5.10 Dataplate and service label

5.10.1 Wastewater treatment systems

The system shall have a permanent and legible data plate. The data plate shall include:

- manufacturer's name and address;
- model number;
- identification or tracking number options including, but not limited to:
 - batch number; or
 - lot number; or
 - date code; or
 - serial number; and
- rated daily hydraulic capacity of the system; and
- the system classification of single-family residential (R), or multifamily or commercial (C), as determined by the performance testing and evaluation requirements described herein.

5.10.2 Greywater treatment systems

The system shall have a permanent and legible dataplate. The dataplate shall include:

- manufacturer's name and address;
- model number;
- identification or tracking number options including, but not limited to:
 - batch number; or
 - lot number; or
 - date code; or
 - serial number; and
- rated daily hydraulic capacity of the system;
- restrictions on the source of greywater treated by the system, being either laundry or bathing water or both, as determined by the performance testing and evaluation requirements described herein; and
- the system classification of single-family residential (R), or multifamily or commercial (C), as determined by the performance testing and evaluation requirements described herein.

5.10.3 A clearly visible label or plate that provides instructions for obtaining service shall be permanently located near the failure signal.

5.11 Alternate air delivery components

To ensure stabilized air flow conditions are met, proposed alternate air delivery components – either air compressors or blowers – that create air pressure shall be run for a minimum of 4 h at the system pressure recorded at the outset of the evaluation of the system as outlined in Sections [8.1.1.8](#), [8.2.1.8](#), and [8.5.2](#). The alternate air delivery components shall deliver flow in the range of 90% to 130% of the flow produced by the original air delivery component. Justification for qualifying air delivery components with flows higher

than 130% may be considered by the certification body based on sound engineering principles. Air delivery components with flows lower, or higher, than the stated range of 90% to 130% may be considered for qualification by the certification body based on system performance testing.

5.12 Backflow prevention

Units intended to be connected to a water supply system under pressure shall have one of the following:

- an air gap at least twice the diameter of the water supply inlet but not < 25 mm (1.0 in); or
- an approved backflow prevention device as per local code of authority having jurisdiction; or
- a statement in the installation instructions and on a label permanently affixed to the equipment that clearly indicates that the equipment is to be installed with adequate backflow protection to comply with applicable federal, state, and local codes for high hazard water connections.

6 Product literature

6.1 Owner's manual

Each system shall be accompanied by a manufacturer prepared owner's manual. The authorized representative shall provide the manual to the owner at the time of system installation. The manual shall be written so as to be easily understood by the intended reader and shall include, at a minimum:

- the system's model designation;
- a statement designating the classification of the system:
 - residential or commercial;
 - greywater only or residential wastewater; and
 - for greywater, laundry water only, bathing water only, or both laundry and bathing water.
- a confirming statement that the system meets the requirements in NSF/ANSI 350 corresponding to the designated classification;
- a functional description of system operation, including diagrams illustrating basic system design and flow path;
- a clear statement of the end uses appropriate for the treated effluent discharged from the onsite treatment systems;
- a clear statement of examples of the types of waste that can be effectively treated by the system;
- a list of household substances that, if discharged to the system, may adversely affect the system, the process, or the environment;
- comprehensive operating instructions that clearly delineate proper function of the system, operating and maintenance responsibilities of the owner and authorized service personnel, and service related obligations of the manufacturer;
- requirements for the periodic removal of residuals from the system;
- a course of action to be taken if the system is to be used intermittently or if extended periods of nonuse are anticipated;

- detailed methods and criteria to be used to identify system malfunction or problems;
- a statement instructing the owner to reference the system dataplate in the event that a problem arises or service is required;
- the name and telephone number of an appropriate service representative to be contacted in the event that a problem with the system occurs; and
- a description of the initial and extended service policies.

If not appearing on the system, electrical schematics for the system shall be included in the owner's manual.

6.2 Additional product literature

Manufacturers shall provide authorized representatives with additional product literature intended to accommodate all persons who may be involved in the installation, maintenance, or repair of systems. Each system shall be accompanied by manufacturer prepared literature including specific instruction for system installation, operation and maintenance, and troubleshooting and repair. This information may be provided in the form of discrete manuals or may be combined into a comprehensive manual(s) as the manufacturer deems appropriate.

6.2.1 Installation manual

Manufacturers shall specify who is authorized to install their system, and provide comprehensive and detailed installation instructions to these authorized representatives. The manual shall be written so as to be easily understood by the intended reader and shall include, at a minimum:

- a numbered list of system components and an accompanying illustration, photograph, or print in which the components are respectively identified;
- design, construction, and material specifications for the system's components;
- wiring schematics for the system's electrical components;
- off-loading and unpacking instructions including safety considerations, identification of fragile components, and measures to be taken to avoid damage to the system;
- a process overview of the function of each component and the expected function of the entire system when all components are properly assembled and connected;
- a clear definition of system installation requirements including plumbing and electrical power requirements, ventilation, air intake protection, bedding, hydrostatic displacement protection, water tightness, slope, and miscellaneous fittings and appurtenances;
- a sequential installation procedure;
- repair or replacement instructions in the event that a system possesses flaws that would inhibit proper functioning and a list of sources where replacement components can be obtained;
- a detailed start-up procedure;
- systems designed for indoor restricted urban water use, such as toilet and urinal flushing, shall include a description of how to plumb the system to ensure availability of a potable water supply during periods when treated reuse water is not available, such as during maintenance and treatment system malfunction; and

- statement that the system and installation shall comply with applicable state and local regulations, including specific language regarding proper backflow prevention and protection against cross connections assuring protection of the public water supply.

6.2.2 Operation and maintenance manual

Manufacturers shall provide comprehensive and detailed operation and maintenance instructions to authorized representatives. The manual shall be written so as to be easily understood by the intended reader and shall include, at a minimum:

- a maintenance schedule for all components;
- requirements and recommended procedures for the periodic removal of residuals from the system;
- a detailed procedure for visual evaluation of system component functions;
- recommended methods for collecting effluent samples; and
- the expected effluent quality produced by the operational system as established through analytical methods described or referenced in this standard.

6.2.3 Troubleshooting and repair manual

Manufacturers shall provide comprehensive and detailed troubleshooting and repair instructions to authorized representatives.

The manual shall be written so as to be easily understood by the intended reader and shall include, at a minimum:

- a guide for visually evaluating the system and narrowing the scope of the problem based on alarm activation, effluent characteristics, system operation, and history;
- a sequential method for isolating specific component failure; and
- a step-by-step guide for repairing or replacing all system components.

7 Other documentation

The manufacturer shall prepare and maintain documentation for each system including, at a minimum:

- a basic description of the system;
- drawings of the system;
- design basis data; and
- a comprehensive and detailed discussion of process fundamentals.

8 Performance testing and evaluation

The analytical methods listed in Table [N-1.2](#) shall be used for testing. Alternate methods are permissible, provided equivalency is demonstrated by technical review and the review is documented. An equivalent method involves the same measurement technique. Equivalent methods are known to be capable of generating reliable results to equivalent quality requirements. All sample collection methods shall be in accordance with *Standard Methods*⁵ unless otherwise specified.

8.1 Greywater treatment systems with capacities up to 5,678 LPD (1,500 GPD)

This section describes the methods used to evaluate the performance of onsite residential and commercial greywater treatment systems that treat greywater, those that treat laundry water from residential laundry facilities, and those that treat bathing water. Systems shall be classified as Class R (single-family residential), or Class C (multifamily or commercial), in accordance with Section [8.6](#). The performance classification shall be based upon the evaluation of effluent samples collected over a minimum 6-mo (26-wk [182-d]) testing period. Manufacturers that recommend a service frequency longer than 6-mo (26-wk [182-d]) shall be tested for the full period of the recommended service frequency.

8.1.1 Preparations for testing and evaluation of greywater treatment systems

8.1.1.1 The system shall be assembled, installed, and filled in accordance with the manufacturer's instructions.

8.1.1.2 Some greywater treatment systems provide a means to top off the treated water storage tank with potable water. This assures the user that water will always be available for the intended use. For performance testing, this feature shall be disabled. Some greywater treatment systems require a potable water connection to provide water for a backflush or other function. This feature may be active during performance testing, provided the volume of water used does not exceed 5% of the daily hydraulic capacity and a minimum 90% of the fresh water used in the process goes directly to waste. For example, fresh water could be used to flush the treated water storage tank every 5 d with the flush going to sewer. However, if this process results in > 10% of the flush water remaining in the treated water storage tank, the feature shall be disabled during performance testing.

8.1.1.3 The manufacturer shall inspect the system for proper installation. If no defects are detected and the system is judged to be structurally sound, it shall be placed into operation in accordance with the manufacturer's start-up procedures. If the manufacturer does not provide a filling procedure, $\frac{2}{3}$ of the system's capacity shall be filled with water meeting the specifications of Section [8.1.2.1](#), and the remaining $\frac{1}{3}$ shall be filled with greywater meeting the specifications of Sections [8.1.2.1.1](#), [8.1.2.1.2](#), or [8.1.2.1.3](#), as appropriate, based upon manufacturer's decision to test with bathing water, laundry water, or both.

8.1.1.4 The system shall undergo design loading (see Section [8.1.2.2.1](#)) until testing and evaluations are initiated. Sample collection and analysis shall be initiated within 3 wk (21 d) of filling the system and, except as specified in Section [8.6.1.2](#), shall continue without interruption until the end of the evaluation period.

8.1.1.5 If the system is to be installed outdoors, and conditions at the testing site preclude installation of the system at its normally prescribed depth, the manufacturer shall be permitted to cover the system with soil to achieve normal installation depth.

8.1.1.6 If the system is to be installed outdoors, performance testing and evaluation of systems shall not be restricted to specific seasons.

8.1.1.7 When possible, electrical or mechanical defects shall be repaired to prevent evaluation delays. All repairs made during the performance testing and evaluation shall be documented in the final report.

8.1.1.8 The system shall be operated in accordance with the manufacturer's instructions. Routine service and maintenance of the system shall not be permitted during the performance testing and evaluation period. Routine refilling or topping off of disinfection device reservoirs, such as tablet or liquid chlorinators or other similar disinfection devices, is permissible once every 30 d and shall be documented in the final report.

It is permissible for the manufacturer to recommend or offer more frequent service and maintenance of the system, but for the purpose of performance testing and evaluation, service and maintenance shall not be performed beyond what is specified in this standard.

8.1.1.9 Prior to initiation of design loading, the air delivery component (if one is utilized) – either air compressor or blower – shall be connected to the system and run for a minimum of 4 h. Air pressure shall be measured by a pressure gauge installed near the exhaust port of the air delivery component and that reading recorded. Then the air compressor or blower component shall be disconnected from the system and the air flow measured at the system pressure and recorded.

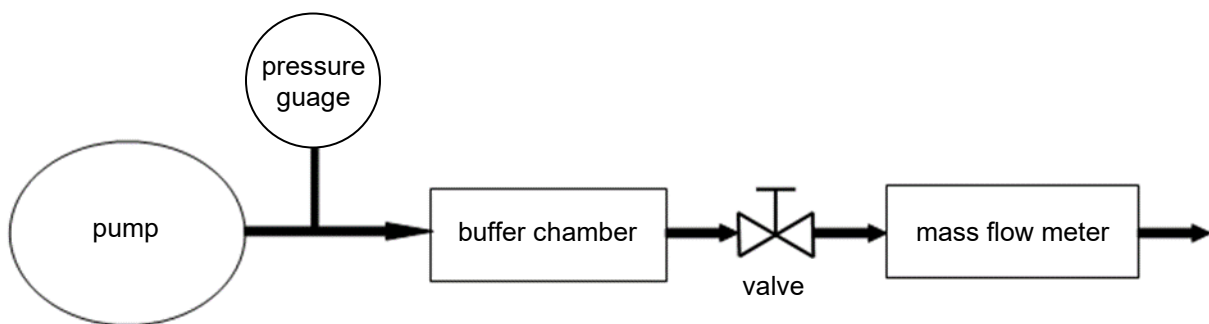


Figure 1

8.1.2 Testing and evaluation conditions, hydraulic loading, and schedules

8.1.2.1 Greywater challenge water – Base water supply

A public water supply shall be used as the base water to which individual ingredients are added, as described in Sections [8.1.2.1.1](#), [8.1.2.1.2](#), and [8.1.2.1.3](#). The 30-d average concentration of the base water supply shall meet or be adjusted to meet the following requirements:

Parameter	Required range
hardness	110 to 220 mg/L
alkalinity	> 40 mg/L as CaCO ₃

8.1.2.1.1 Greywater challenge water – Systems treating bathing source water

Prepare the challenge water according to the following formula:

Wastewater components ^a	Amount per 100 L
body wash with moisturizer	30 g
toothpaste	3 g
deodorant	2 g
shampoo	19 g
conditioner	21 g
lactic acid	3 g
secondary effluent	2 L
raw influent screened to ≤ 1 mm	1 L
bath cleaner	10 g