



*NSF International Standard /
American National Standard*

NSF/ANSI 350 - 2014

Onsite Residential and Commercial
Water Reuse Treatment Systems



Document Sharing Hub

NSF International, an independent, not-for-profit, non-governmental organization, is dedicated to being the leading global provider of public health and safety-based risk management solutions while serving the interests of all stakeholders.

*This Standard is subject to revision.
Contact NSF to confirm this revision is current.*

Users of this Standard may request clarifications and interpretations, or propose revisions by contacting:

Chair, Joint Committee on Wastewater Technology
c/o NSF International
789 North Dixboro Road, P.O. Box 130140
Ann Arbor, Michigan 48113-0140 USA
Phone: (734) 769-8010 Telex: 753215 NSF INTL
FAX: (734) 769-0109
E-mail: info@nsf.org
Web: <http://www.nsf.org>

NSF International Standard/
American National Standard
for Drinking Water Additives —

Onsite residential and commercial water reuse treatment systems

Standard Developer

NSF International

NSF International

**Designated an ANSI Standard
December 8, 2014**

American National Standards Institute

Prepared by
The NSF Joint Committee on Wastewater Technology

Recommended for Adoption by
The NSF Council of Public Health Consultants

Adopted by
The NSF Board of Trustees
July 2011

Revised December 2012
Revised December 2014

Published by

NSF International
PO Box 130140, Ann Arbor, Michigan 48113-0140, USA

For ordering copies or for making inquiries with regard to this Standard, please reference the designation "NSF/ANSI 350 – 2014."

Copyright 2054 NSF International
Previous editions © 2015, 2012

Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from NSF International.

Printed in the United States of America.

Disclaimers¹

NSF International (NSF), in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of NSF represent its professional judgment. NSF shall not be responsible to anyone for the use of or reliance upon this Standard by anyone. NSF shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Standard.

NSF Standards provide basic criteria to promote sanitation and protection of the public health. Provisions for mechanical and electrical safety have not been included in this Standard because governmental agencies or other national standards-setting organizations provide safety requirements.

Participation in NSF's Standards development activities by regulatory agency representatives (federal, local, state) shall not constitute their agency's endorsement of NSF or any of its Standards.

Preference is given to the use of performance criteria measurable by examination or testing in NSF Standards development when such performance criteria may reasonably be used in lieu of design, materials, or construction criteria.

The illustrations, if provided, are intended to assist in understanding their adjacent standard requirements. However, the illustrations may not include **all** requirements for a specific product or unit, nor do they show the only method of fabricating such arrangements. Such partial drawings shall not be used to justify improper or incomplete design and construction.

Unless otherwise referenced, the annexes are not considered an integral part of NSF Standards. The annexes are provided as general guidelines to the manufacturer, regulatory agency, user, or certifying organization.

¹ The information contained in this Disclaimer is not part of this American National Standard (ANS) and has not been processed in accordance with ANSI's requirements for an ANS. As such, this Disclaimer 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.

This page is intentionally left blank.

Contents

1	General	1
1.1	Purpose	1
1.2	Scope	1
1.3	Alternate materials, design, and construction	1
1.4	Performance classification	2
2	Normative references	2
3	Definitions	4
4	Materials	4
4.1	Interior surfaces	5
4.2	Exterior surfaces	5
4.3	Welding	5
4.4	Dissimilar metals	5
5	Design and construction	5
5.1	Exposed surfaces	5
5.2	Structural integrity	5
5.3	Water tightness	6
5.4	Noise	6
5.5	Mechanical components	6
5.6	Electrical components	6
5.7	Access ports	6
5.8	Failure sensing and signaling equipment	7
5.9	Flow design	8
5.10	Dataplate and service label	8
6	Product literature	9
6.1	Owner's manual	9
6.2	Additional product literature	10
7	Other documentation	11
8	Performance testing and evaluation	11
8.1	Graywater treatment systems with capacities up to 5,678 L/day (1,500 gal/day)	12
8.2	Residential wastewater treatment systems/capacities	18
8.3	Commercial treatment systems with combined wastewater flows	20
8.4	Sample collection	20
8.5	Analyses	22
8.6	Criteria	22
9	Final report	25
Annex A		A1
Annex B		B1
Annex C		C1
Annex D		D1
Annex E		E1

This page is intentionally left blank.

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 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), graywater 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 (multi-family 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:

- Graywater treatment systems having a rated treatment capacity up to 5,678 L/day (1,500 gal/day): this applies to onsite residential and commercial treatment systems that treat graywater, 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 L/day (1,500 gal/day): this applies to onsite residential treatment systems that treat combined wastewater generated by the occupants of residence(s). A reuse system treating 1,514 L/day (400 gal/day) to 5,678 L/day (1,500 gal/day) shall either be demonstrated to have met the Class I requirements of NSF/ANSI 40 *Residential wastewater treatment systems*, or shall meet these requirements during concurrent testing to this Standard. A treatment system treating less than 1,514 L/day (400 gal/day) shall not be required to have met the Class I requirements of NSF/ANSI 40.
- 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 graywater from commercial facilities with capacities exceeding 5,678 L/day (1,500 gal/day). 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 8.3 for performance testing and evaluation. The key elements of a field evaluation of a commercial onsite treatment system are described in Annex A.

This edition of NSF/ANSI 350 includes the following issues:

Issue 6

Revision of section 1.4 performance classification.

Issue 7

Revision of section 8 to clearly indicate the frequency for sample collection for surfactants, iron, FOG, color, odor, oily film and foam. A normative reference update is also included.

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. As such, 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.

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

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 on this Standard 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, USA.

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 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 treatment systems. Systems may include the following.

- Graywater treatment systems having a rated treatment capacity up to 5,678 L/day (1,500 gal/day). This applies to onsite residential and commercial treatment systems that treat graywater, those that treat laundry water from residential laundry facilities, and those that treat bathing water. See 8.1 for performance testing and evaluation.
- 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 graywater from commercial facilities with capacities exceeding 5,678 L/day (1,500 gal/day). 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 8.3 for performance testing and evaluation. The key elements of a field evaluation of a commercial treatment system are described in Annex A.

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 (multi-family 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 8.6, Criteria.

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.

Graywater treatment systems within a manufacturer's model series may be classified according to the performance testing and evaluation of the system (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 (8.2) with the smallest hydraulic capacity within the series. A series is limited to treatment capacities below 1,514 L/day (400 gal/day), and treatment capacities between 1,514 L/day (400 gal/day) and 5,678 L/day (1,500 gal/day).

Graywater and residential wastewater treatment systems having rated treatment capacities less than 378 L/day (100 gal/day) shall be within a manufacturer's model series having rated treated capacities at or above 378 L/day (100 gal/day).

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 graywater from commercial facilities with capacities exceeding 5678 L/day (1500 gal/day) performance tested and evaluated in accordance with 8.3 and Annex A, may be similarly classified within a manufacturer's model series. However, consideration must 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 provisions that, through reference in this text, constitute provisions of this Standard. At the time of publication, the indicated editions were valid. All standards are subject to revision, and parties are encouraged to investigate the possibility of applying the recent editions of the standards indicated below. The most recent published edition of the document shall be used for undated reference.

ANSI/AWS D1.1/D1.1M:2010. *Structural Welding Code -Steel*³

ANSI/AWS D1.3/D1.3M:2008. *Structural Welding Code – Sheet Steel*, 5th Edition, with Errata³

American Public Health Association (APHA), American Water Works Association (AWWA) & Water Environment Federation (WEF): *Standard Methods for the Examination of Water and Wastewater* (hereinafter referred to as *Standard Methods*)⁴

³ American Welding Society, 550 N.W. LeJeune Road, Miami, Florida 33126 <<http://www.aws.org>>.

⁴ Standard Methods for the Examination of Water and Wastewater <www.standardmethods.org>.

NFPA 70®. *National Electrical Code®* (NEC®), 2011⁵

NSF/ANSI 40. *Residential Wastewater Treatment Systems*

ISO 12103-1. *Road Vehicles – Test Dust for Filter Evaluation*⁶

2.2 Abbreviations

Common Abbreviation	Meaning
°C	degrees Celsius
cfu	colony forming unit
d, m:	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)

⁵ National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269-7471 <www.nfpa.org>.

⁶ International Organization for Standardization (ISO), Case postale 56, CH-1211 Geneve 20, Switzerland <www.iso.org>.

3 Definitions

3.1 authorized representative: An organization, group, individual, or other entity that is authorized by the manufacturer to distribute, sell, install, or service certified onsite residential and commercial treatment systems.

3.2 commercial facilities: Businesses such as lodging establishments, business parks and campuses, shopping facilities, places of public assembly where no manufacturing, assembly, industrial or food processing is involved, and laundering facilities for hospitals, hotels, rental uniforms, and other facilities likely to handle high amounts of soiling or high strength commercial cleaners. Wastewater from commercial facilities may exhibit moderately high concentrations of biochemical oxygen demand, chemical oxygen demand, total suspended solids and salts. Commercial facilities do not include multi-family residential applications.

3.3 commercial wastewater treatment system: An organized and coordinated system of components that functions to treat all wastewater generated by a commercial facility.

3.4 components: All of the physical, mechanical, and electrical parts of the product.

3.5 data day: Any day in which the required daily grab and composite samples have been collected and evaluated, establishing influent and effluent values.

3.6 graywater: Wastewater from water bearing fixtures, including laundry, such as clothes washers and laundry sinks, and bathing, such as bathtubs, showers, or sinks, but excluding toilets, urinals, bidets, kitchen sinks, and dishwashers.

3.7 graywater treatment system: An organized and coordinated system of components that functions to treat graywater generated by residences and commercial facilities.

3.8 manufacturer: The entity that develops, designs, and produces onsite treatment systems.

3.9 product: A system of components that functions to treat and/or disperse reuse water.

3.10 residential laundry facilities: Laundering for residences, and businesses that launder residential type laundry such as coin-operating facilities.

3.11 residential wastewater: Human body waste and liquid waste generated by the occupants of an individual residence.

3.12 residential wastewater treatment system: An organized and coordinated system of components that functions to treat all wastewater generated by individual residence(s).

3.13 restricted urban water use (indoor and outdoor): Treated water acceptable for use in toilet/urinal flushing (indoor); and subsurface irrigation and dispersal (outdoor).

3.14 unrestricted urban water use (outdoor): Treated water acceptable for use in surface irrigation and subsurface irrigation, including irrigation of edible crops, provided that the edible portion does not come in direct contact with the treated water.

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 graywater 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.

NOTE – 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 4.1 and 4.2. Welds and welding methods shall conform to ANSI/AWS D1.1 for steel 3.2 mm (1/8 in) and thicker or ANSI/AWS D1.3 for steel that is less than 3.2 mm (1/8 in). The welds shall be visually inspected and shall be acceptable if the criteria of Table 6.1 of ANSI/AWS D1.1 are satisfied.

The location, type and size of welds shall be shown on the drawings required in 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 hours. At the end of this 24-hour period, there shall be no more than a 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 (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 system operation, measured at 1.2 m (4 ft) above the ground surface, 6 m (20 ft) in four directions, at 90, 180, 270, and 360° from the system and its appurtenances shall not exceed 60 dbA. These requirements apply both to systems installed inside and outside the building.

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® 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:

- 1) visual inspection and removal of all mechanical or electrical components;
- 2) 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 two years.

- 3) 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;
- 4) removal (manually or by pumping) of collected residuals as required by the manufacturer in the operation and maintenance manual; and
- 5) 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 that can be removed only with specialized tools; 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 that the water level is above normal operating specifications or that flow is being diverted to a bypass function as described in 5.9.

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 section 5.8.1 and 5.8.2 shall be determined by a group of three observers. Observers shall be employees of the test agency.

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 m (50 ft). There shall be a minimum of 5 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 m (50 ft) with a minimum ambient noise level of 60 dbA. When the ambient noise level is less than 60 dbA, it shall be augmented with a steady tone between 100 and 1000 hertz. 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 3 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