Evaluation of components and devices used in wastewater treatment systems

NSF International Standard/ American National Standard

NSF/ANSI 46 – 2002

NSF International, an independent, not-for-profit, non-governmental organization, is dedicated to being the leading global supplier of public health and safety-based risk management services 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 Wastewater Technology —

Evaluation of components and devices used in wastewater treatment systems

Standard Developer

NSF International

Adopted May 2, 2002
NSF International

Designated as an ANSI Standard
May 2, 2002
American National Standards Institute

Prepared by
The NSF Joint Committee on Wastewater Technology
The NSF Council of Public Health Consultants

Adoption by
NSF International

Adopted by
The NSF Board of Directors
November 1997

Revised May 2000
Revised May 2002

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 46-2002."

Printed in the United States of America.

Disclaimers[1]

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 blank.

Contents

Foreword[2]

The purpose of this Standard is to establish minimum materials, design and construction, and performance testing and evaluation requirements for components and devices used in wastewater treatment systems. Minimum literature requirements to be supplied by manufacturers to authorized representatives and owners are also specified.

This edition of NSF/ANSI 46 contains a new section, 11, Chlorination devices. This section addresses chlorine dispensers, which deliver chlorine in the absence of a contact chamber, as well as chlorine disinfection devices, which deliver chlorine and provide a contact chamber. Both chlorine dispensers and chlorine disinfection devices disperse chlorine in controlled amounts to the effluent of secondary treated residential wastewater.

This new section also contains requirements for design and construction (11.4), product literature (11.5), and performance testing and evaluation (11.6). The performance testing and evaluation includes a Chlorine resistance test, which shall determine that no components of the chlorination device show visible signs of chemical attack or structural deformation; a Life test, which shall demonstrate that there will be no visible signs of damage or structural change that may adversely affect the operation of the chlorination device; and a Chlorination test, which determines that chlorine dispensers shall achieve a stated chlorine concentration at all hydraulic loading conditions and that chlorine disinfection devices shall achieve a stated fecal coliform reduction. Performance testing and evaluation requirements are also given for chlorination devices incorporating a positive displacement pump. A normative annex (D) provides test methods for the evaluation of chlorination devices.

ANSI Procedures prohibits the inclusion of commercial terms and conditions, such as manufacturers' warranties and guarantees, in American National Standards. However, the NSF Joint Committee on Wastewater Technology has historically believed strongly that all certifiers of NSF/ANSI 46 systems should have certification program policies that contain several key elements, including requirements for warranties. It is the Joint Committee's belief that these key elements provide valuable assurance of long-term performance as well as protection of public health and the environment. To emphasize the Joint Committee's convictions on this issue, two annexes, which are not part of this Standard, were added for informational purposes and guidance. These annexes are intended to establish a uniform program by which products meeting the scope of this Standard should be certified. Annex A provides the key elements of a certification program, and annex B is a sample warranty.

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 improvements of this Standard are welcome. Comments should be sent to Chair, Joint Committee on Wastewater Technology, c/o NSF International, Standards Department, PO Box 130140, Ann Arbor, Michigan 48113-0140, USA.

[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 page is intentionally blank.

NSF/ANSI Standard
for Wastewater Technology –

Evaluation of components and devices used in wastewater treatment systems

1 General

1.1 Purpose

The purpose of this Standard is to establish minimum materials, design and construction, and performance requirements for components and devices used in the handling, treating, recycling, reusing, or disposal of wastewater. This Standard is intended to protect public health and the environment as well as minimize nuisance factors.

1.2 Scope

This Standard is intended for use with components and devices not covered by other NSF wastewater standards. Components and devices covered by this Standard are intended for use with greywater or blackwater or both. Management methods for the end-products of these components and devices are not addressed in this Standard. This Standard shall in no way restrict new system designs, provided such designs meet the minimum specifications described herein.

All devices and components meeting the scope of this Standard shall comply with all of the requirements described in 1 through 8. In addition, devices and components shall comply with the applicable, subsequent section(s) contained in this Standard.

1.3 Alternate materials, design, and construction

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

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 herein.

APHA, *Standard Methods for the Examination of Water and Wastewater*[3], 19th edition (herein afterwards referred to as Standard Methods)

ANSI/HI Pump Standards[4]

ANSI/NFPA 70, 1996, *National Electrical Code*[5]

3 Definitions

3.1 appurtenances: Machinery, appliances, or auxiliary structures attached to a main structure to enable it to function but not considered an integral part of it.[6]

3.2 authorized representative: An organization, group, individual, or other entity that is authorized by the manufacturer to distribute, sell, install, or service a component or device.

[3] American Public Health Association, 800 I Street NW, Washington, DC 20001

[4] Hydraulic Institute, 9 Sylvan Way, Parsippany, NJ 07054-3802

[5] National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269

[6] Definition adopted from *Glossary, Water and Wastewater Control Engineering, third Edition*. American Public Health Association, American Society of Civil Engineers, American Water Works Association, Water Pollution Control Federation, 1981

3.3 blackwaste: Human body waste, toilet paper, and any other material intended to be deposited in a receptacle designed to receive urine, feces or both.

3.4 blackwater: Blackwaste and water or other medium used to flush and transport it.

3.5 components: All of the physical, mechanical, and electrical parts that comprise a system.

3.6 greywaste: Waste material, exclusive of urine, feces, or industrial waste, deposited in plumbing fixtures found in residences, commercial buildings, industrial plants, and institutions.

3.7 greywater: Greywaste and the water or other medium used to flush and transport it.

3.8 manufacturer: The entity that develops, designs, and produces the component or device.

3.9 product: The solid, liquid, and gaseous outputs from a component or device.

3.10 total process: A process receiving raw wastewater and discharging a treated effluent. Types of total processes may be classified as biological, chemical, physical/mechanical, or any combination of these processes.

3.11 unit process: A single step in the total treatment process (comminution, screening, aeration, sedimentation, chemical precipitation, vacuum filtration, centrifugation, incineration, chlorination, etc.).

3.12 wastewater: The spent or used water of a community or industry that contains dissolved and suspended matter.[6]

4 Materials

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

> NOTE – Because there are numerous design criteria suitable for the manufacture of components and devices used in wastewater treatment systems, manufacturers should acquire appropriate engineering expertise in evaluating the design of such components and devices.

4.1 Dissimilar metals

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

> NOTE – ANSI/HI 9.1-9.5-1994 provides guidance for protecting against galvanic corrosion. Manufacturers are encouraged to use these guidelines and similar guidelines for the design and construction of wastewater treatment devices and their components.

4.2 Welding

Welded seams and deposited weld materials 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.

5 Design and construction

Components and devices shall be fabricated to perform their intended function when installed and operated according to the manufacturer's instructions. They shall not be adversely affected by the use environment.

5.1 Serviceability

Component parts subject to malfunction or wear shall be accessible for repair or replacement.

5.2 Electrical equipment

Electrical components shall be protected by safety devices, such as circuit breakers and fuses. The NFPA 70, 1996, *National Electrical Code* shall be followed for all electrical components, electrical connections, system installation, and system operation.

5.3 Mechanical components and systems

Mechanical components and systems shall be protected against damage or impairment of efficiency for all normally anticipated operating conditions.

5.4 Data plate

A permanent data plate shall be provided. The plate shall be inscribed and installed to be easily seen and understood and be securely attached at a location normally visible following recommended installation. It shall include the following:

- name and address (city and state) of manufacturer;
- model and serial number designation; and
- design capacity or rated daily capacity, if applicable.

6 Product literature

All product literature shall contain the manufacturer's name, address, phone number, and model designation.

6.1 Installation manual

Manufacturers shall provide comprehensive and detailed installation 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 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; and
- a detailed start-up procedure.

6.2 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; and
- a detailed procedure for visual evaluation of system component functions.

6.3 Trouble shooting and repair manual

Manufacturers shall provide comprehensive and detailed trouble shooting 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 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.

6.4 Energy requirements

The manufacturer's engineering data and literature shall specify the energy sources and requirements for proper operation of components, devices, and any auxiliary system.

6.5 Chemical requirements

The manufacturer shall make available to owners and authorized representatives Materials Safety Data Sheets (MSDS) or other equivalent documentation explaining the proper use, handling, safety, and toxicity of all chemicals required for the operation of all components and devices.

7 Performance testing and evaluation

Performance testing and evaluation shall be independent of design and construction. However, structural weaknesses, undesirable noise, and other environmental defects and failures during the test shall be described in the final report (see 8).

7.1 The device shall be operated and maintained according to the manufacturer's instructions. If these instructions conflict with the performance testing and evaluation protocols of this Standard, the protocols contained in this Standard shall apply.

7.2 All sample collection and analytical methods shall be those established in the 19th edition of *Standard Methods*, except as otherwise specified.

7.3 The duration of the evaluation period shall be sufficient to ensure that results are reliable and applicable to anticipated operating conditions. The length of the evaluation period shall be specified in the test report.

8 Final report

A final report shall be prepared that presents all data collected in accordance with the testing and evaluation specified within this Standard.

9 Grinder pumps and related components

9.1 Scope

This section establishes requirements for grinder pumps and associated pump basins, including check and air or vacuum release valves included in the grinder pump package. It is intended for grinder pumps and related components used for pumping wastewater from residential sources.

9.2 Model series classification

Grinder pumps and associated pump basins within a manufacturer's model series may be classified according to the performance testing and evaluation of the most representative model within the series.

9.3 Definitions

9.3.1 capacity: the total volume throughput per unit of time at suction conditions. It assumes no entrained gases at the stated operating conditions.[7]

9.3.2 discharge pressure: the pressure a pump must overcome to transfer liquid, as measured by a gauge in a pipe at the discharge point after the check valve for the pump.

9.3.3 grinder pump: a mechanical device designed to add pressure to a liquid to produce flow and to provide for reduction in the size of solids contained in the wastewater.

9.3.4 head: the expression of the energy content of the liquid referred to a datum. It is expressed in units of energy per unit weight of liquid. The measuring unit for head is meter (foot) of liquid.[8]

9.3.5 pump basin: a structure containing pumps and appurtenant piping, valves, and other mechanical and electrical equipment for pumping water, wastewater, or other liquids. It is also called a lift station.[7]

9.3.6 pump curve: a graph that shows the interrelation of dynamic head and flow capacity of a pump. It is also called a hydraulic performance curve.

9.3.7 shut off: the condition of zero flow where no liquid is flowing through the pump, but the pump is primed and operating.[7]

---

[7] Definition adopted from the definition of pump station contained in *Glossary, Water and Wastewater Control Engineering, third Edition*, American Public Health Association, American Society of Civil Engineers, American Water Works Association, Water Pollution Control Federation, 1981

[8] Definition adopted from ANSI/HI 1.6-1994, American National Standard for Centrifugal Pump Tests, Hydraulic Institute, 9 Sylvan Way, Parsippany, NJ 07054-3802

9.3.8 total head: the measure of the work increase per unit mass of the liquid, imparted to the liquid by the pump, and is therefore the algebraic difference between the total head at discharge and the total head at suction.

9.4 Performance testing and evaluation

This section describes the performance testing and evaluation requirements for both grinder pumps and pump basins. The manufacturer shall decide whether the grinder pump alone or pump and basin shall be tested and evaluated.

9.4.1 Performance testing and evaluation for grinder pumps

Prior to and after completing the performance testing and evaluation described in this section, the grinder pump shall be disassembled, and the dimensions of critical cutting elements shall be measured.

Performance testing and evaluation of grinder pumps shall consist of the following five procedures:

a) the development of a baseline hydraulic performance curve (see 9.4.1.1);

b) a household items loading test (see 9.4.1.2 through 9.4.1.4);

c) a shut off test (see 9.4.1.5);

d) a negative head test (see 9.4.1.6); and

e) the development of a final hydraulic performance curve (see 9.4.1.7).

All of these procedures shall be conducted on a single grinder pump in the chronological order shown. All testing shall be performed using potable water. The grinder pump and pump basin shall be assembled, operated, and maintained during each test period in accordance with the manufacturer's instructions. The pump basin shall be of sufficient diameter to ensure that all challenge materials are introduced to the grinder pump.

9.4.1.1 Development of a baseline hydraulic performance curve

A baseline hydraulic performance curve (baseline curve) shall be developed in accordance with the testing conditions specified in the current, applicable Hydraulic Institute testing standard (for example, centrifugal pumps shall be tested according to ANSI/HI 1.6-1994; rotary pumps shall be tested according to ANSI/HI 3.6-1994; and reciprocating pumps shall be tested according to ANSI/HI 6.6-1994). The baseline curve shall be developed by plotting two measured parameters, capacity and total head, using a minimum of five condition points, one of which shall be the shut off.

9.4.1.2 Household item loading test

During the test period described in 9.4.1.3 and 9.4.1.4, household items shall be added to the pump basin in accordance with table 1. Items shall be loaded in the sequence indicated in table 1. Discharged solids shall be removed from the water if the water is recycled during the test. At the conclusion of this test, all residual materials shall be removed from the pump. Any identifiable materials removed from the pump shall be described in the final report.

Table 1 – Household items added to the pump basin

Item	Frequency
toilet tissue, 24 perforated sheets (wetted in test water)	4 times per d, 5 d per week
facial tissue	2 per d, 5 d per week
filter tip cigarette	1 per d, 5 d per week
egg	1 per d, 5 d per week
paper towel[1]	1 per d, 5 d per week
condom[1]	1 per d, 5 d per week
sanitary napkin[1] (wetted in test water)	1 per d, 5 d per week
chlorine laundry bleach[1] (8 oz)	1 per d, 5 d per week
cotton swab[1] (plastic stick)	1 per d, 5 d per week
disposable diaper[1] (large children's size)	1 per d, 5 d per week
tampon[1] (plastic applicator added separately)	1 per d, 5 d per week
adhesive bandage[1] (paper wrapper added separately)	1 per d, 5 d per week
dental floss (12-in piece)	1 per d, 5 d per week
alkali drain cleaner (8 oz)	1 per week, at random
Handi-wipe® [2] (or equivalent)	1 per week, at random
acidic drain cleaner (8 oz)	1 per week, at random
liquid animal fat (4 oz)	1 per week, at random
one pair of nylon panty hose (size large)	1 per week, at random
cloth diaper (wetted in test water)	1 time during test, at random
toothbrush	1 time during test, at random
wood pencil	1 time during test, at random
plastic table utensil	1 time during test, at random
metal bottle cap	1 time during test, at random
HDPE bottle cap	1 time during test, at random
metal, toy car (Matchbox®[3] or Hotwheels®[3] or equivalent)	1 time during test, at random
eight-ounce drinking glass (crushed)	1 time during test, at random

[1] Items added separately each day in succession.

[2] Colgate-Palmolive, 300 Park Avenue, New York, NY

[3] Mattel, 333 Continental Blvd., El Segundo, CA 90245

9.4.1.3 Operating sequence during the household items loading test

The grinder pump shall be subjected to the following operational sequence. Capacities are based on the baseline curve developed in 9.4.1.1:

a) two weeks of operation at the low capacity condition point (progressive cavity design) or at 20% of the maximum flow point (centrifugal design);

b) two weeks of operation at the mid-capacity point;

c) two weeks of operation at the maximum capacity point; and

d) two hours of operation at the maximum capacity point with no challenge materials added to the system.

9.4.1.4 Hydraulic loading during the household items loading test

Hydraulic loading during the operating sequences described in 9.4.1.3 shall be based on the capacity of the pump basin, such that 10 pumping cycles occur every hour. The pump shall be operated 24 h/d, 7 d/week. The household items loading test shall be conducted 8 h/d, 5 d/week.

9.4.1.5 Shut off test

A shut off test shall be conducted by creating a discharge head pressure just below the maximum pressure claimed by the manufacturer then operating the pump while increasing the pressure to the condition of shut off. This test shall be conducted for a period of 24 h. This test shall be conducted using the minimum basin size specified by the manufacturer. The water level in the basin shall be maintained at 5.1 to 7.6 cm (2 to 3 in) above the "on" level in order to assure a continuous operational condition. Any water added to the basin during this test shall be at ambient laboratory temperature.

For pumps with automatic protection devices that turn the pump off during prolonged periods of shut off, the pump shall be allowed to stop and restart automatically during the 24 h of testing. A counter device shall be installed on the pump that records the number of on/off cycles that occurred during the 24-h testing period. The number of on/off cycles shall be recorded in the final report.

9.4.1.6 Negative head test

Testing against negative head shall be conducted by operating the pump for three on/off cycles, under each condition, with the discharge point 0.9, 1.8, 2.7, 3.7, and 4.6 m (3, 6, 9, 12, and 15 ft respectively) lower than the pump. During each test sequence, the power to the pump shall be monitored for amp draw, voltage, and watts. Any erratic behavior of the pump shall be noted in the final report, along with the elevation difference at which it was first observed.

NOTE – The negative head test conditions specified in this section are the conditions that shall exist at the pump. Negative head can be simulated using a vacuum source.

9.4.1.7 Development of a final hydraulic performance curve

A final hydraulic performance curve (final curve) shall be developed in accordance with the testing conditions specified in the current, applicable Hydraulic Institute testing standard (for example, centrifugal pumps shall be tested according to ANSI/HI 1.6-1994; rotary pumps shall be tested according to ANSI/HI 3.6-1994; and reciprocating pumps shall be tested according to ANSI/HI 6.6-1994). The final curve shall be developed by plotting two measured parameters, capacity and total head, using a minimum of five condition points.

9.4.2 Performance testing and evaluation of pump basins

The pump basin shall be installed during the performance testing and evaluation of the grinder pump, in accordance with the manufacturer's instructions. The pump basin shall be evaluated for both structural integrity (see 9.4.2.1) and basin leakage (see 9.4.2.2).

9.4.2.1 Structural integrity test

Connections to the pump basin shall be sealed, and a vacuum shall be applied to the basin for a period of 60 min. The applied vacuum pressure shall be equivalent to 150% of the pressure that the basin would experience if submerged vertically (normal upright position) in water to the basin's designed burial depth.

9.4.2.2 Basin leakage test

Immediately following the structural integrity test (see 9.4.2.1), the pump basin shall be assembled with discharge piping, electrical connections, and cover in accordance with the manufacturer's instructions. The connections to the pump basin shall be sealed, and the pump basin shall be filled with water to a point that is 30.5 cm (1 ft) above the pump basin's designed burial depth. The water shall be held in the basin for 24 h.

Pumps designed for installation within a building shall be subjected to a 61 cm (2 ft) head of water above the top of the basin.

9.5 Performance requirements

9.5.1 Performance criteria for grinder pumps

Grinder pumps shall:

– not clog, jam, or show evidence of mechanical failure during the performance testing and evaluation;

– show no more than a 20% increase in the gap between the stationary and rotating cutting elements at the conclusion of the performance testing and evaluation;

– remove solids and household items added to the pump basin as described in table 1 and show no significant accumulation of these materials; and

– exhibit no operational problems with the control systems arising from the water used for testing or the household items added to the pump basin as described in table 1.

The baseline curve in 9.4.1.1 shall be compared to the manufacturer's published hydraulic testing and performance curve (manufacturer's curve). All of the data collected for the baseline curve shall plot within + 5% to - 3% of the manufacturer's curve in terms of both capacity and total head.

After conducting all of the testing contained in 9.4.1, the final curve (see 9.4.1.7) shall be compared to the baseline curve (see 9.4.1.1). All of the data collected for the final curve shall plot within + 5% to - 5% of the baseline curve in terms of both capacity and total head.

The check valve as well as the air and vacuum release valves included in the pump package shall not be impaired or fouled during or at the completion of the performance testing and evaluation of the grinder pump.

9.5.2 Performance criteria for pump basins

Pump basins shall:

– show no significant accumulation of solids and household items on the sides or bottom of the pump basin;

– show no signs of wear at the conclusion of the performance testing of the grinder pump that adversely affect the performance of the pump or pump basin or both;

– show no structural damage, including breaks, cracks, or permanent deformation at the conclusion of the structural integrity test (see 9.4.2.1); and

– show no signs of leakage from the basin during the basin leakage test (see 9.4.2.2).

9.6 Design and construction

9.6.1 Design and construction requirements for pump basins

The pump basin shall be designed and constructed to:

– prevent the infiltration of groundwater and the introduction of precipitation, snow melt and similar surface water through openings provided for access, electrical wiring, and piping;

– prevent interferences between piping, wiring, and floats that would impact operation of the pump;

– provide gasketed access opening covers that bolt down, have a locking mechanism, or a net weight of 29.5 Kg (65 lbs) or more;

– provide easy access for the repair and replacement of the pump and all components, without the user having to enter the pump basin; and

– shall be equipped with a ventilation system.

9.6.2 Failure sensing and signaling equipment

9.6.2.1 The grinder pump controls shall possess a mechanism or process capable of detecting failures of electrical and mechanical components critical to the operation of the grinder pump and deliver a visible and audible signal to notify the owner of the failure.

9.6.2.2 Pump basins shall posses a mechanism or process capable of detecting a high water condition and deliver a visible and audible signal to notify the owner that the water is above normal operating specifications.

9.6.2.3 The visual portion of alarms shall be conspicuous from a distance of 15 m (50 ft) from the grinder pump and pump basin. The audible portion of the alarm shall be between 70 and 75 dbA at 1.5 m (5 ft) and shall be discernable from a distance of 15 m (50 ft) from the grinder pump and pump basin.

9.6.2.4 The visual and auditory signals shall continue to be functional in the event of an electrical, mechanical, or hydraulic malfunction of the grinder pump or pump basin.

10 Filtration devices for residential gravity flow septic tank systems

10.1 Scope

This section establishes minimum requirements for gravity flow filtration devices used in the outlet flow path of residential septic tank systems, which have a rated flow capacity between 1514 L/d (400 gal/d) and 5678 L/d (1500 gal/d). These requirements deal with structural integrity of the devices and their ability to prevent the discharge of specific sized manufactured particles. Reduction of sewage parameters such as BOD_5 and TSS are not addressed in 10.

10.2 Model series classification

Septic tank filters within a manufacturer's model series, of the same design and varying only in their rated capacity, may be classified according to the performance testing and evaluation of the most representative model within the series.

10.3 Definitions

10.3.1 septic tank: A watertight receptacle that is designed and constructed to receive residential wastewater, separate solids from the liquid, provide limited digestion of organic matter, store solids and allow clarified liquid to discharge for further treatment and disposal.

10.3.2 septic tank filter: A gravity flow device (including all assemblies and components) designed to enhance the retention of solids in a residential septic tank system.

10.4 Performance testing and evaluation of septic tank filters

A single septic tank filter, shall be installed on the test chamber (see figure 1) in accordance with the manufacturer's directions. The test chamber shall be designed and constructed so that performance testing conditions (for example: flow conditions, head pressures, and suspension of polystyrene spheres) described in 10.4.1 through 10.4.5 can be attained. The septic tank filter shall then be subjected to each of the following performance tests in the sequence shown:

a) flow test for clean filters (see 10.4.1);

b) flow test for partially clogged filters (see 10.4.2);

c) structural integrity test (see 10.4.3);

d) filtration efficacy - synthetic bead test (see 10.4.4); and

e) bypass protection test (see 10.4.5).

At the conclusion of each performance test, the septic tank filter and all assemblies shall be evaluated to the applicable criteria described in 10.5.

10.4.1 Flow test for clean filters

A clean septic tank filter shall be subjected to the flow conditions described in this section and evaluated to the applicable criteria described in 10.5.

The test chamber (see figure 1) shall be filled with tap water to the bottom of the 10.2 cm (4 in) outlet pipe. At this point, the initial water level in the tank shall be measured and recorded. A continuous flow of tap water shall then be delivered to the test chamber until a flow of 41.6 ± 1.9 L/min (11 ± 0.5 gal/min) is measured downstream of a completely assembled septic tank filtration device. After an equilibrium flow condition is established, the final water level in the test chamber shall be measured.

10.4.2 Flow test for partially clogged filters

A partially clogged septic tank filter shall be subjected to the flow conditions described in this section and evaluated to the applicable criteria described in 10.5.

The filter pores of the septic tank filter shall be covered by whatever means necessary (such as taped) to simulate an 85% clogged condition. Since the design of filters can vary, clogging of the filter pores shall be conducted according to the following applicable method:

- If the septic tank filter is designed in such a way that filter pores are located at a point higher than 5.1 cm (2 in) above the bottom of the outlet of the test chamber, then the clogging shall be conducted over 85% of the pores from a point 5.1 cm (2 in) above the bottom of the 10.2 cm (4 in) outlet pipe down to the lowest point of the filter. All filter pores located above a point that is 5.1 cm (2 in) above the bottom of the 10.2 cm (4 in) outlet pipe shall be clogged 100%.

- If the septic tank filter is designed in such a way that no filter pores are located at a point higher than 5.1 cm (2 in) above the bottom of the outlet of the test chamber, then the 85% clogging shall be conducted over the entire filter surface.

The clogged filter shall then be installed on the test chamber as shown in figure 1 according to the manufacturer's directions, and the test chamber shall be filled with tap water to the bottom of the 10.2 cm (4 in) outlet pipe. At this point, the initial water level in the test chamber shall be measured and recorded. A continuous flow of tap water shall then be delivered to the test chamber until the minimum flow for clogged conditions (MFCC) is attained downstream of the septic tank filter. After an equilibrium flow condition is established, the final water level in the test chamber shall be measured.

NOTE – The MFCC is the minimum flow criteria (measured as gal/min) for septic tank filters when tested according to the conditions described in 10.4.2. This flow rate is the product of the manufacturer's rated daily hydraulic capacity of the filter (between 1514 L/d [400 gal/d] and 5678 L/d [1500 gal/d]) and a multiplication factor of 0.00334. The 0.00334 factor is based on a stress condition in which 60% of the daily hydraulic capacity of the septic tank filter is passed through the filter during a 3-h period (i.e., 60% / 3 h / 60 min = 0.00334).

10.4.3 Structural integrity test

A septic tank filter shall be tested for structural integrity according to the procedures described in 10.4.3.1 through 10.4.3.3 and evaluated to the applicable criteria described in 10.5.

10.4.3.1 While the test chamber (see figure 1) is void of any water, all removable parts, such as filters, shall be removed from the assembly and reinstalled at least 4 times to simulate the normal stresses that the septic tank filtration device may encounter during maintenance.

10.4.3.2 While the test chamber (see figure 1) is filled with water, all removable parts, such as filters, shall be removed from the assembly and reinstalled at least 4 times to simulate the normal stresses that the septic tank filtration device may encounter during maintenance.

10.4.3.3 The pores of the septic tank filter shall be covered by whatever means necessary (such as taped) to simulate a 100% clogged condition. The clogged filter shall be installed on the test chamber as shown in figure 1 according to the manufacturer's instructions. The test chamber shall be filled with water to a point that is equivalent to 30.5 cm (12 in) of head above the bottom of the outlet. This clogged condition and water level shall be maintained for 48 h.

10.4.4 Filtration efficacy (synthetic bead test)

A septic tank filter shall be tested for the retention of solids according to the procedures described in this section and evaluated to the applicable criteria described in 10.5.

Following the manufacturer's installation instructions, the filter shall be installed on the test chamber as shown in figure 1. Two hundred polystyrene spheres per gallon of the test chamber capacity shall be placed in the test chamber. The spheres shall have an outside diameter of 0.48 ± 0.005 cm ($^{3}/_{16}$ ± 0.002 in) and a specific gravity of 1.05. Tap water shall be delivered to the test chamber at a rate of 41.6 ± 1.9 L/min (11 ± 0.5 gal/min) for a minimum of 8 continuous hours per day for a total of 7 d or until the filter is 100% clogged, whichever occurs first.

10.4.5 Bypass protection test

A septic tank filter shall be tested for bypass protection according to the procedures described in this section and evaluated to the applicable criteria described in 10.5.

The pores of the septic tank filter shall be covered to simulate a completely clogged filter. Following the manufacturer's installation instructions, the filter shall be installed in the test chamber as shown in figure 1. A 0.16 cm ($^{1}/_{16}$ in) mesh screen shall be installed downstream of the filter. Two hundred polystyrene spheres per gallon of the test chamber capacity shall be placed in the test chamber. The spheres shall have an outside diameter of 0.48 ± 0.005 cm ($^{3}/_{16}$ ± 0.002 in) and a specific gravity of 1.05. Tap water shall be delivered to the test chamber to raise and maintain the water level to an elevation of 10.2 cm (4 in) above the top of the filter assembly for a minimum of 8 continuous hours per day for a total of 2 d.

10.5 Performance requirements for septic tank filters

Septic tank filters, assemblies, and all applicable components of the device shall comply with the following applicable requirements:

- At the conclusion of each performance test (see 10.4.1 through 10.4.5), the septic tank filter, assemblies, and all applicable components of the device shall be inspected and show no visible signs of cracking, collapse, or permanent deformation.

- After an equilibrium flow condition is established in accordance with 10.4.1 and 10.4.2, the final water level in the test chamber shall not exceed 5.1 cm (2 in) of head rise above the initial water level.

- At the conclusion of the 1-week solids reduction testing (see 10.4.4), the flow to the test chamber shall be shut off, and the area downstream of the septic tank filter and preceding the 0.16 cm ($^{1}/_{16}$ in) screen shall be inspected for any polystyrene spheres. There shall be zero spheres in this area of the testing device.

- At the conclusion of 48 h of bypass protection testing (see 10.4.5), the flow to the test chamber shall be shut off, and the area downstream of the septic tank filter and preceding the 0.16 cm ($^{1}/_{16}$ in) screen shall be inspected for any polystyrene spheres. There shall be zero spheres in this area of the testing device.

- During all stages of performance testing and evaluation (see 10.4.1 through 10.4.5), the septic tank filter shall remain in its normal operating position. The filter shall not become dislodged as a result of flow conditions or hydraulic pressure differentials created across the filter or filter assembly.

10.6 Data plate

Septic tank filters shall have a permanent data plate attached to the device or be permanently marked with the manufacturer's name and telephone number. This information shall be located so as to be easily seen during normal maintenance.

10.7 Final report

A final report shall be prepared that presents all data collected and observations made in accordance with the performance testing and evaluation specified in 10.

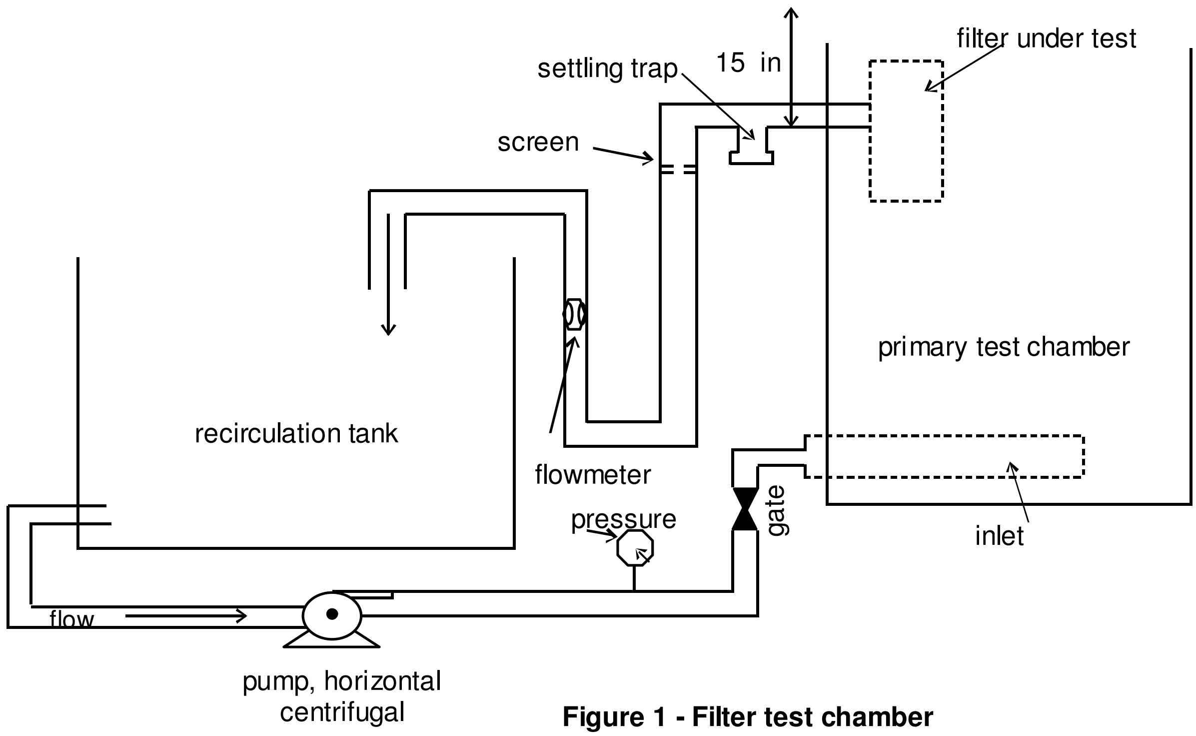

Figure 1 - Filter test chamber

11 Chlorination devices

11.1 Scope

This section establishes the requirements for chlorinators used to disperse controlled amounts of chlorine into the effluent of secondary treated residential wastewater. It is intended for devices that deliver chlorine in the absence of a contact chamber (hereafter referred to as chlorine dispensers) and for devices that deliver chlorine and provide a contact chamber for demonstrating fecal coliform reduction (hereafter referred to as a chlorine disinfection devices). The rated capacities for both chlorine dispensers and for chlorine disinfection devices shall be between 1514 L/d (400 gal/d) and 5678 L/d (1500 gal/d).

Chlorine products may also be evaluated to the requirements of this Standard. The chlorine product manufacturer shall specify and provide a chlorination device for the purpose of the evaluation. The results of the evaluation may be applied to chlorination devices that have also been evaluated to the requirements of this Standard, allowing use of the alternate chlorine product in the absence of additional testing of the chlorination device. The chlorination device shall be similar in design, construction and materials, and equivalent in the dimensions of the chlorine product reservoir, as that of the chlorination device used for the evaluation of the alternate chlorine product.

All chlorine products used in the evaluation of chlorination devices shall be acceptable for wastewater applications.

11.2 Model series classification

Chlorination devices within a manufacturer's model series may be classified according to the performance testing and evaluation of the most representative model within the series. The series shall be comprised of chlorination devices proportionally similar in design, construction and materials, and proportionally equivalent in the dimensions of the chlorine product reservoir.

Chlorine disinfection devices shall be tested with the smallest tank size, as specified by the manufacturer. Performance testing and evaluation of larger tank sizes within the series may not be necessary provided that the dimensions, hydraulics, mixing and other applicable design characteristics are proportionally similar to the evaluated system.

11.3 Definitions

11.3.1 chlorination device: A device that applies chlorine or chlorine compounds to wastewater.

11.3.1.1 chlorine dispenser: A device that delivers chlorine only and does not provide for a contact chamber.

11.3.1.2 chlorine disinfection device: A device that includes both a chlorine dispenser and a contact chamber.

11.3.2 contaminant: Undesirable organic and inorganic, soluble and insoluble substances in water including microbiological organisms.

11.3.3 disinfection: Killing of fecal coliform by the addition of chlorine.

11.3.4 mechanical component: A part of the chlorination device that has an individual and distinct function to perform some type of work in dispensing chlorine, e.g., a lever, wheel, pulley, etc.

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

11.4 Design and construction

All chlorination devices shall comply with the requirements of 11.4.1 through 11.4.6.

11.4.1 Noise

When installed according to the manufacturer's instructions, the chlorination device shall not produce excessive noise. Noise associated with operation, measured at 1.2 m (4 ft) above the ground surface, 6 m (20 ft) in 4 directions, at 90, 180, 270, and 360 degrees from the chlorination device and its appurtenances, shall not exceed 60 dbA.

11.4.2 Failure sensing and signaling equipment

11.4.2.1 The chlorination device 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 of the failure.

11.4.2.2 When evaluated using a minimum of 10800 lux (1000 foot candles) of ambient lighting, the visual portion of the signal shall be conspicuous from a distance of 15 m (50 ft) from the chlorination device and its appurtenances. The audible portion of the signal shall be between 70 and 90 dbA at 1.5 m (5 ft) and shall be discernable from a distance of 15 m (50 ft) from the chlorination device and its appurtenances.

11.4.2.3 The visual and auditory signals shall continue to be functional in the event of an electrical, mechanical, or hydraulic malfunction of the chlorination device.

11.4.3 Flow design

Chlorination devices 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 chlorination device and component malfunction, the design and construction of the chlorination device shall preclude alternative flow paths and prevent the discharge of untreated wastewater from an opening external to the designated flow path.

> NOTE – The discharge of wastewater from access ports shall be permissible during chlorination device malfunction.

11.4.4 Service label

A clearly visible label or plate that provides instructions for obtaining service shall be permanently located in a visible location on the chlorination device, including the manufacturer's or authorized representative's name, address, and telephone number. The label shall also specify the acceptable type of chlorine to be used in the chlorination device. For chlorine dispensers, the minimum size(s) of contact tank(s) to be used with the chlorine dispenser shall be specified.

11.4.5 Data plate

The data plate shall specify the device as a "chlorine dispenser" or a "chlorine disinfection device."

11.4.6 Ease of cleaning

Chlorination devices requiring cleaning and maintenance shall allow for easy access to all parts.

11.4.7 Valve and component identification

All valves and performance indication components shall have a permanent, easily read, and conspicuous label or tag identifying their operation.

If the chlorination device is not supplied with plumbing and assorted components including piping, valves, venturi and fittings, the manufacturer shall provide a piping diagram, parts list, and installation instructions. Closing and sealing devices such as clamps, gaskets, and tightening elements shall be adequate and ensure the operator is protected from hazardous and toxic gases and chemicals, e.g., caustic chemicals, chlorine gas.

11.5 Product literature

All product literature shall contain applicable caution statements (prominently displayed).

11.5.1 Installation manual

For chlorination devices used on tanks that operate on a pump delivery system for discharge of the chlorinated effluent, the installation manual shall specify the proper minimum retention time necessary prior to activation of the pump.

11.5.2 Owner's manual

Each chlorination device shall be accompanied by a manufacturer-prepared owner's manual. The manual shall be provided to the owner at the time of installation. The manual shall be written so as to be easily understood by the reader and shall include, at a minimum:

- the model designation;
- a statement confirming that the chlorination device meets the applicable requirements of Standard 46, and whether the chlorination device was evaluated as a chlorine dispenser or chlorine disinfection device;
- a functional description of device operation, preferably including diagrams illustrating basic design and flow path;
- comprehensive operating instructions that clearly delineate proper function of the chlorination device including operating and maintenance responsibilities of the owner and authorized service personnel;
- a statement indicating the minimum period of time before cleaning or maintenance or both is required for adequate chlorination device operation;
- a course of action to be taken if the chlorination device is to be used intermittently or if extended periods of non-use are anticipated;
- detailed methods and criteria to be used to identify chlorination device malfunction or problems;
- a statement instructing the owner to reference the chlorination device data plate 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 chlorination device occurs;
- an electrical schematic for the chlorination device, if not appearing on the device; and
- all applicable design features that are necessary for effective dispensing of chlorine, including but not limited to, the type of chlorine to be used, the minimum contact tank size, and minimum contact time.

11.6 Performance testing and evaluation

Performance testing and evaluation of chlorination devices shall consist of the following procedures:

a) chlorine resistance test (see 11.6.1);

b) life test (see11.6.2); and

c) chlorination test (see11.6.3).

These tests shall be conducted on one or more chlorination devices. However, the life test and chlorination test shall be conducted on a single device in the order indicated above.

In addition to the testing and evaluation specified in 11.6, components or devices that have positive displacement pumps or are designed to operate with increased hydraulic pressure shall be tested and evaluated to the applicable requirements specified in 11.7 and 11.8, respectively.

11.6.1 Chlorine resistance test

Parts normally in contact with chlorine shall be exposed, as they would be in field applications, to the maximum in-use concentration or maximum output for a period of 100 d.

11.6.1.1 Method

a) Fill the chlorine device to the maximum level with the applicable chemicals as specified by the manufacturer.

b) Fill the chlorine device flow path with a potable water supply, which meets the requirements of Section Water and shall completely pass from inlet to outlet.

c) Seal all inlet and outlet ports with the exception of one port above the flood level to allow any generated gases to escape. Water shall fill the flow path from inlet to outlet when sealed.

d) Expose for a period of 100 d ± 6 h at an ambient room temperature of 20 ± 5 °C (68 ± 10 °F).

e) Examine the feeder approximately every 20 d and check for any signs of leakage, damage, or any other noticeable changes. Once the test period has elapsed, drain the feeder and examine.

11.6.1.2 Criteria

At the conclusion of this test, all components of the chlorination device shall show no visible signs of chemical attack or structural deformation.

11.6.2 Life test

Chlorination devices shall be capable of operating for 30 d. During the life test, no maintenance shall be performed on the chlorination device.

– Chlorination devices shall be assembled, installed, and operated in accordance with the manufacturer's specifications.

– Manufacturers shall specify all key elements for effective chlorination, including but not limited to, design flow conditions, minimum contact time, and mixing requirements. If a chlorine dispenser is submitted for testing without a manufacturer-specified mixing tank or contact chamber, it shall be tested and evaluated by attaching the device to a default tank (hereafter referred to as "test contact chamber"). This tank shall be a mixing tank or contact chamber and is designed to allow for the minimum contact time specified by the manufacturer. The tank shall also be tested by tracer study to confirm that it provides the minimum contact time specified by the manufacturer (see annex D).

– The chlorine dispenser manufacturer shall specify the maximum and minimum gallons per day wastewater flow rates for which the device is designed and minimum contact time required between the wastewater and the chlorine disinfectant.

– The chlorine dispenser manufacturer shall specify the chlorine to be used with the device. In the case of tablets, the manufacturer shall specify the manufacturer and model of the tablet. In the case of liquid, the manufacturer shall specify the proper use concentration. This test shall be repeated for alternate tablets, if varying in tablet formulation and size, and alternate liquids, if varying in chlorine concentration.

11.6.2.1 Hydraulic loading

Flow conditions shall be as follows:

6 a.m. to 9 a.m.	35% of total minimum daily flow
11 a.m. to 2 p.m.	25% of total minimum daily flow
5 p.m. to 8 p.m.	40% of total minimum daily flow

11.6.2.2 Influent wastewater characteristics

11.6.2.2.1 Chlorine dispenser

Influent water shall be from a potable water supply. If the water supply is chlorinated, the water shall be dechlorinated prior to use.

pH	6.0 to 9.0
temperature	60 ± 5 °F (16 ± 2.5 °C)
chlorine	≤ 0.1 mg/L

11.6.2.2.2 Chlorine disinfection device

Influent water shall be secondary treated residential wastewater meeting the following specifications: (average of 24-h composite samples collected on day 1, 8, 15, 22, and 30 of the test for a total of five samples, with the exception of ammonia, which is to be collected on days 29 and 30):

$CBOD_5$	≤ 25 mg/L
TSS	≤ 30 mg/L
fecal coliform	10^4 to 10^6 organisms/100ml
pH	6.0 to 9.0
temperature	60 ± 5 °F (16 ± 2.5 °C)
ammonia[9]	≤ 2.0 mg/L

11.6.2.3 Analytical methods

Influent challenge water samples shall be analyzed according to *Standard Methods*.

11.6.2.4 Criteria

At the conclusion of the test, there shall be no visible signs of damage or structural change that may adversely affect proper operation of any components of the chlorination device.

> Note – This evaluation is performed following completion of the chlorination test, as specified in 11.6.3.

11.6.3 Chlorination test

The chlorination test shall be conducted immediately following the life test using the same chlorination device that was tested and evaluated during the life test. No maintenance shall be performed between the life test and the chlorination test. Chlorination devices with two or more disinfectant feed settings shall be tested at the minimum and maximum feed settings.

11.6.3.1 Hydraulic loading

For each feed setting (maximum and minimum), flow shall be introduced to the chlorination device continuously over a 3-h period at approximately 40% of the rated minimum and maximum daily hydraulic capacity.

> NOTE – This specification requires that hydraulic loading be carried out at 3 h per combination of feed and flow rates (four different combinations) for a total of 12 h. The four combinations are as follows:

1	maximum feed at 40% of maximum flow
2	maximum feed at 40% of minimum flow
3	minimum feed at 40% of maximum flow
4	minimum feed at 40% of minimum flow

11.6.3.2 Influent water characteristics

Influent water shall meet the specifications of 11.6.2.2.

11.6.3.3 Effluent sampling and analysis

A total of five grab samples shall be collected beginning after a minimum of 2 chamber volumes of the influent wastewater has passed through the device and continuing at 10-min intervals. Chamber volume includes the contact chamber volume.

11.6.3.3.1 Chlorine dispensers

Effluent samples for chlorine dispensers shall be collected after the test contact chamber. Analysis shall be performed immediately for total residual chlorine concentration.

11.6.3.3.2 Chlorine disinfection devices

Sample containers shall contain disinfection neutralizer sufficient to halt the disinfecting action. Analysis shall be performed within 24 h of sample collection.

11.6.3.4 Analytical methods

Influent challenge water and final effluent samples shall be analyzed according to *Standard Methods.*

[9] The level of ≤ 2.0 mg/L shall be met only during the final 48 h of the test. All other times do not need to be tested for ammonia.

11.6.3.5 Criteria

11.6.3.5.1 Chlorine dispensers

The average chlorine concentration of all hydraulic loading conditions shall be ≥ 15 mg/L.

11.6.3.5.2 Chlorine disinfection devices

Chlorine disinfection devices shall achieve an average fecal coliform concentration of all hydraulic loading conditions of ≤ 200 organisms/100mL.

11.7 Performance testing and evaluation for positive displacement pumps

11.7.1 Suction lift

Chlorination devices incorporating a positive displacement pump operating with a suction lift of 1.2 m (4 ft) of water, at 80% back pressure and 100% of their rated capacity, shall deliver an output rate that is within ±10% of the delivery specified by the manufacturer.

11.7.2 Apparatus

- 19 L (5 gallon) container;
- stopwatch accurate to ± 0.1 s;
- injection manifold with pressure tap and throttling valve;
- pressure gauge meeting ANSI B40.1 Grade 3A specifications and sized to yield the measurement within 25% to 75% of scale;
- measuring device accurate to 1.6 mm ($^1/_{16}$ in);
- recirculation tank with a pump capable of delivering sufficient back pressure; and
- scale accurate to ± 0.005 kg (± 0.01 lb).

11.7.3 Water temperature

The temperature of the water used to test suction lift of chlorination devices shall be room temperature.

11.7.4 Method

a) Assemble the chlorination device in accordance with the manufacturer's instructions and set the delivery to 100% of its capacity.

b) Attach the chlorination device discharge line to the injection manifold.

c) Fill the 19 L (5 gal) container with water conditioned to the temperature specified in 11.7.3. Place the container on the scale and position the chlorination device 1.2 m (4 ft) above the water level in the container.

d) Fully prime the chlorination device according to the manufacturer's instructions.

e) Start the recirculation pump and adjust the back pressure to 80% of the maximum pressure specified on the manufacturer's delivery output data plate.

f) Note the weight (W_1) on the scale while starting the stopwatch. Allow the chlorination device to operate for 1 ± 0.1 h. Note the weight (W_2) on the scale while stopping the stopwatch and record the duration of the test (time). Determine the density of water at the test temperature (D).

g) Calculate the delivery as follows:

$$\text{Delivery} = [(W_1 - W_2)/D]/\text{time}$$

NOTE – Delivery should be specified in units of volume per unit of time.

11.7.5 Criteria

The chlorination device having a positive displacement pump shall deliver an ouput rate that is within ± 10% of the delivery specified by the manufacturer.

11.8 Performance testing and evaluation for chlorination devices intended to operate under increased hydraulic pressure

11.8.1 Purpose

To verify that a chlorination device and its components can withstand hydrostatic pressure 1½ times the manufacturer's maximum operating pressure.

11.8.2 Apparatus

– pressure gauges meeting ANSI B40.1 Grade 3A specifications sized to yield the measurement within 25% to 75% of scale;

– hydrostatic pressure station; and

– thermometer accurate to ± 0.5 °C (± 1 °F).

11.8.3 Water temperature

The temperature of the water used to perform hydrostatic pressure testing of chlorination devices shall be room temperature.

11.8.4 Method

a) Install the chlorination device in accordance with the manufacturer's instructions.

b) Fill the chlorination device with water conditioned to the applicable temperatures specified in 11.8.3 and bleed off all entrapped air.

c) Uniformly increase the pressure to obtain 1½ times the maximum rated working pressure and hold the pressure for no less than 5 min. Examine the chlorination device and components for signs of leakage during the test period.

d) Slowly release the pressure and examine the unit.

11.8.5 Criteria

Chlorination devices intended for pressure applications shall show no evidence of rupture, leakage, burst, or permanent deformation when subjected to a hydrostatic pressure 1½ times the manufacturer's maximum operating pressure.

11.9 Final report

A final report shall be prepared that presents all data collected and observations made in accordance with the performance testing and evaluation specified within 11.

Annex A[10]

Key elements of a certification program for components and devices used in wastewater treatment systems

A certification program for components and devices used in wastewater treatment systems should contain the following program elements.

A.1 Marking the product

– Certified devices should bear a registered trademark that includes reference to NSF/ANSI 46.

– Certified components intended to be used with other components to make a complete functional system, as defined by NSF/ANSI 46, should bear a component mark.

– Each system should have a model designation.

A.2 Listing certified companies

A listing of all certified systems and components should be published. The listing format should include at least the following information:

– company name and address;

– product description;

– trademark/model designation; and

– rated capacity.

A.3 Annual audits

Actual physical audits of all facilities and production locations of the certified company annually.

A.4 Testing

– testing in accordance with NSF/ANSI 46 requirements prior to certification; and

– a retest program that includes reevaluation and retesting at least once every seven years.

A.5 Corrective action

Corrective action for all items of noncompliance found during audits and reevaluation.

A.6 Enforcement

Enforcement action by the certifier for the following:

– use of a mark on a noncertified product;

– general noncompliance;

– unauthorized change to a certified product;

– unauthorized shipment or disposal of product placed on hold;

– bribes; and

– recall of products.

[10] The information contained in this Annex 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 Annex 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.

A.7 Administrative review

Provisions for an administrative review as requested by any party directly affected by a decision or action of the certifier.

A.8 Appeals

Provisions for an appeals process as requested by any party directly affected by a decision or action of the certifier resulting from an administrative review.

A.9 Complaints

– provisions for investigation of complaints related to certified products, misuse of the mark by a certified company, or use/misuse of the mark by a noncertified company; and

– certified company retention and disclosure of complaint records and remedial actions for certified products.

A.10 Advertising

Proper use of the mark on sales literature, technical publications, promotional materials, packaging, catalogs, and advertising.

A.11 Records

Provisions for verification of complete certified company records, including:

– installation and service for fabricators and distributors;

– purchased materials and components; and

– production, shipment, and inventory.

A.12 Public notice

Provisions for issuing a public notice for noncompliance with any requirement of certification.

A.13 Confidentiality

Provisions for nondisclosure of any confidential information supplied to the certifier by the company regarding the product, including formulations, components, processes, ingredients, or the identity of the company's suppliers and distributors.

A.14 Warranty

A policy requiring manufacturers to warrant all components of their residential wastewater treatment system to be free from defects in material and workmanship for a minimum of 2 years from the date of installation. The manufacturer should fulfill the terms of the warranty by repairing or exchanging any components that, in the manufacturer's judgment, show evidence of defect. (See the sample limited warranty in annex B.)

Annex B[11]

Sample limited warranty

Controlled performance testing of limited duration is a means of establishing the capability of equipment to perform in a prescribed manner. Such testing cannot reproduce all conditions encountered by the equipment in actual use. Use experience dictates that service and maintenance are required to insure continued satisfactory performance. Comprehensive warranty and service programs will facilitate that end. Manufacturers of proprietary devices covered by these criteria are required to provide such programs.

LIMITED WARRANTY

(manufacturer) warrants the parts in each treatment process/device to be free from defects in material and workmanship for a period of two years from the date of installation treating household wastewater. Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply. Sole obligation under this warranty is as follows: (manufacturer) shall fulfill this warranty by repairing or exchanging any component part, F.O.B. factory, that in (manufacturer's) judgment shows evidence of defects, provided said component part has been paid for and is returned through an authorized dealer, transportation prepaid. The warrantee must also specify the nature of the defect to the manufacturer.

The warranty does not cover treatment processes/devices that have been flooded, by external means, or that have been disassembled by unauthorized persons, improperly installed, subjected to external damage or damage due to altered or improper wiring or overload protection.

This warranty applies only to the treatment process/device and does not include any of the house wiring, plumbing, drainage, or disposal system. (manufacturer) is not responsible for any delays or damages caused by defective treatment process/device components or materials, or for loss incurred because of interruption of service, or for any other special or consequential damages or incidental expenses arising from the manufacture, sale, or use of this process/device.

(manufacturer) reserves the right to revise, change, or modify the construction and design of the treatment process/device for household wastewater or any component part or parts thereof without incurring any obligation to make such changes for modifications in previously sold equipment. (manufacturer) also reserves the right, in making replacements of component parts under this warranty, to furnish a component part which, in its judgment, is equivalent to the company part replaced.

Under no circumstances will (manufacturer) be responsible to the warrantee for any other direct or consequential damages, including but not limited to lost profits, lost income, labor charges, delays in production, and/or idle production, which damages are caused by a defect in material and/or workmanship in its parts. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty is expressly in lieu of any other express or implied warranty, excluding any warranty of merchantability or fitness, and of any other obligation on the part of (manufacturer) .

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

[11] The information contained in this Annex 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 Annex 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 blank.

Annex C[12]

Definitions of analytical parameters

The following definitions are not requirements of this Standard, but they are included for the purpose of providing clarification and general information. With the exception of those definitions marked with an asterisk (*), the definitions contained in this annex were adopted from the *Glossary, Water and Wastewater Control Engineering, third Edition.*

acidity: The quantitative capacity of aqueous solutions to react with hydroxyl ions. It is measured by titration with a standard solution of a base to a specified end point. Usually expressed as milligrams of calcium carbonate per liter.

alkalinity: The capacity of water to neutralize acids, a property imparted by carbonates, bicarbonates, hydroxides, and occasionally borates, silicates, and phosphates. It is expressed in milligrams of equivalent calcium carbonate per liter.

ammonia nitrogen: The quantity of elemental nitrogen present in the form of ammonia (NH_3).

***carbonaceous 5-day biochemical oxygen demand ($CBOD_5$):** The concentration of oxygen (expressed as mg/L) utilized by microorganisms in the non-nitrogenous oxidation of organic matter during a 5-day period at a temperature of 20 °C (68 °F).

chemical oxygen demand (COD): A quantitative measure of the amount of oxygen required for the chemical oxidation of carbonaceous (organic) material in wastewater using inorganic dichromate or permanganate salts as oxidants in a 2-h test.

chlorine demand: The quantity of chlorine that would be consumed in a specified period by reaction with substances present in water, if the chlorine supply were not limited. The demand for any given water varies with both time of contact and temperature.

chlorine residual: The amount of chlorine in all forms remaining in water after treatment to insure disinfection for a period of time.

dissolved oxygen (DO): The oxygen dissolved in water, wastewater, or other liquid, usually expressed in milligrams per liter or percent of saturation.

***drainability:** A measure of the dewatering characteristics of sludge.

fecal coliform: Aerobic and facultative, Gram-negative, nonspore-forming, rod-shaped bacteria capable of growth at 44.5 °C (112.1 °F), and associated with fecal matter of warm-blooded animals.

head loss: Energy losses due to the resistance of flow of fluids. May be classified into conduit surface and conduit form losses.

methylene blue active substance: Anionic surfactants, including linear alkylate sulfonate (LAS) and alkyl sulfate, which react with methylene blue to form a blue chloroform-soluble complex; the intensity of color is proportional to concentration.

moisture content: The quantity of water present in soil, wastewater sludge, industrial waste sludge, and screenings, usually expressed in percentage of wet weight.

***nitrate nitrogen (NO_3-N):** The end product in the oxidation of ammonia or organic nitrogen, expressed as mg/L as N.

***nitrite nitrogen (NO_2-N):** An intermediate product in the oxidation of ammonia or organic nitrogen, or reduction of nitrate.

pH: A measure of the hydrogen-ion concentration in a solution, expressed as the logarithm (base ten) of the reciprocal of the hydrogen-ion concentration in gram moles per liter. On the pH scale (0-14) a value of 7 at 25 °C (77 °F) represents a neutral condition. Decreasing values, below 7, indi-

[12] The information contained in this Annex 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 Annex 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.

cate increasing hydrogen-ion concentration (acidity); increasing values, above 7, indicate decreasing hydrogen-ion concentration (alkalinity).

phosphate (PO_4): A salt or ester of phosphoric acid.

pressure (P): (1) The total load or force acting on a surface. (2) In hydraulics, unless otherwise stated, usually the pressure per unit area or intensity of pressure above local atmospheric pressure expressed, for example, in pounds per square inch, kilograms per square centimeter.

***psig (pounds per square inch gauge):** The pressure above or below atmospheric, as measured by a pressure gauge.

sensitivity level: The least amount of concentration that can be detected and quantified by a test method.

settleable (flotable) solids: (1) That matter in wastewater which will not stay in suspension during a preselected settling period, such as one hour, but settles to the bottom (floats to the top). (2) In the Imhoff cone test, the volume of matter that settles to the bottom of the cone in one hour. (3) Suspended solids that can be removed by convectional sedimentation.

sludge volume index: The ratio of the volume in milliliters of sludge settled from a 1,000 ml sample in 30 min to the concentration of mixed liquor in milligrams per liter multiplied by 1,000.

suspended solids (SS): (1) Insoluble solids that either float on the surface of, or are in suspension in, water, wastewater, or other liquids. (2) Solids organic or inorganic particles (colloidal, dispersed, coagulated, flocculated) physically held in suspension by agitation or flow. (3) The quantity of material removed from wastewater in a laboratory test, as prescribed in *Standard Methods for the Examination of Water and Wastewater,* and referred to as the residue retained on the filter.

temperature: (1) The thermal state of a substance with respect to its ability to communicate heat to its environment. (2) The measure of the thermal state on some arbitrary chosen numerical scale.

total organic carbon (TOC): The amount of carbon bound in organic compounds in a sample. Because all organic compounds have carbon as a common element, total organic carbon measurements provide a fundamental means of accessing the degree of organic pollution.

***total coliform:** All aerobic and facultative anaerobic, gram-negative, nonspore-forming, rod shaped bacteria that ferment lactose with gas formation within 48 h at 35 °C (95 °F); all bacteria that produce a red colony with a metallic sheen within 24 h at 35 °C (95 °F) on an endo-type medium containing lactose.

***total organic nitrogen (TON):** All of the nitrogen combined in organic molecules such as proteins, amines, and amino acids, expressed as mg/L as N.

total solids: The sum of dissolved and suspended solid constituents in water or wastewater.

volatile suspended solids (VSS): That fraction of suspended solids, including organic matter and volatile inorganic compounds, which will ignite and burn when placed in an electric muffle furnace at 550 °C (1022 °F) for 60 min.

Annex D
(normative)

Test methods for the evaluation of wastewater disinfection treatment devices.

D.1 Hydraulic retention time verification

D.1.1 Purpose

To verify the hydraulic retention time of a default contact chamber or mixing tank used to evaluate chlorine dispensers submitted for testing without a manufacturer specified mixing tank or contact chamber. This test is intended to confirm that a given contact chamber or mixing tank will provide the minimum contact time (i.e., hydraulic retention time) specified by the chlorination device manufacturer at wastewater flow rate(s) also specified by the manufacturer.

D.1.2 Apparatus/materials

– See figure D1 in this annex.

– Supply tank (see annex D, figure D1): The supply tank volume shall exceed the volume of the test contact chamber such that no refills of the supply tank will be necessary for completing the verification test.

– Test contact chamber (see annex D, figure D1): The test contact chamber volume shall be determined according to 11.6.2, which requires the chlorination device manufacturer to specify maximum and minimum wastewater flow rates and the minimum contact time required for disinfection. The following formula may be used:

minimum test contact chamber volume =

(maximum wastewater flow rate [L/min]) x (minimum contact time [min])

– additional items:

- chloride ion-selective electrode;
- sodium chloride (NaCl);
- deionized (DI) water;
- 19 L (5 gal) container (see ”challenge concentrate container” in Figure D1); and
- test contact chamber as described in 11.6.2.

D.1.3 Method

a) Fill supply tank (see annex D, figure D1) with tap water or DI water.

b) Dissolve 75g NaCl in deionized water. Add this solution to one 5 gal bucket (hereafter referred to as ”challenge concentrate container”), and add DI water to bring the volume to 15 L (4 gal) for a chloride solution of approximately 3000 ppm. Mix the solution well for 1 min. Measure the chloride level in the container using a chloride ion-specific electrode. Record this number as the chloride concentration of the tracer slug (hereafter referred to as ”chloride water”). Weigh the container with the chloride water in it, and record it as the challenge concentrate container weight (with water) at time zero (w_0).

c) Level the test contact chamber.

d) Fill the test contact chamber with water possessing the same background chloride level as that of the water used to fill the supply tank in step D.1.3 a). Allow the water to stand in the chamber for 1 h and evaluate it for leaks. If no leaks are present, mix the tank contents for a minimum of 15 min. Then measure the background chloride level of the water and record it. If leaks are present, repair them and start the method over at step D.1.3 a).

e) Start the flow of the chloride water to the test contact chamber at the maximum wastewater flow rate specified by the disinfection device manufacturer. Allow the chloride water to flow into the test contact chamber for 1 min. Verify the flow rate of the chloride water according to steps D.1.3 j) and k). The volumetric flow rate of the chloride water as calculated shall be within 5% of the maximum wastewater flow rate specified by the disinfection device manufacturer.

f) After allowing the chloride water to flow for 1 min, switch the flow to originate from the supply tank containing the water prepared in Step D.1.3 a). This flow shall be introduced at the maximum wastewater flow rate specified by the disinfection device manufacturer. Measure and record the flow rate of water coming from the supply tank every 10 min, and adjust as needed. The average of individual flow rate measurements must be within 5% of the maximum wastewater flow rate specified by the disinfection device manufacturer. Individual flow rate measurements shall be within 5% of the average of all flow rate measurements taken.

g) Allow the supply tank water to flow into the test contact chamber for the full minimum contact time specified by the manufacturer of the disinfection device. This minimum contact time will be referred to as the "testing time period."

NOTE – One volume of the test contact chamber should be replaced by the end of this testing time period (i.e., the theoretical contact time).

h) Weigh the challenge concentrate container, which holds the remaining chloride water after step D.1.3 e). Record this as the challenge concentrate container weight (still containing the chloride water) at time = 1 min (w_1).

i) Throughout the testing time period measure and record the chloride level of the water coming out of the test contact chamber every 2 min until the effluent chloride concentration drops to within 5 ppm of the measured background concentration in the supply tank for two consecutive measurements. Record the time at which each measurement is taken.

j) Determine the chloride water mass flow rate by the following formula:

chloride water mass flow rate in grams/min (W) $= w_0 - w_1$

where w_0 = challenge concentrate container weight with water (grams) at time = 0 min; and

w_1 = challenge concentrate container weight with water (grams) at time = 1 min.

k) Verify the chloride water volumetric flow rate by the following formula [see D.1.3 e)]:

Chloride water volumetric flow rate in liters/min = W * (1/1000)

where W = chloride water flow rate (g/min) derived in step D.1.3 j).

l) Stop the water flow and measurements after the full testing time period has elapsed, even if the chloride concentration for two consecutive measurements does not reach a level within 5 ppm of the measured background chloride concentration in the supply tank at the start of the test.

m) Measure the total volume of water delivered from the supply tank during the testing time period, i.e., beginning with step D.1.3 e) and ending with step D.1.3 l), using the flow meter/totalizer (see figure D1).

n) Record all calculations.

D.1.4 Acceptance criteria

At the end of the testing time period, two consecutive measurements of the chloride concentration shall not be more than 5 ppm greater than the measured background chloride concentration prior to the start of the chloride water flow. The volume of water displaced from the test contact chamber by the end of the testing time period (i.e., the theoretical contact time) shall not vary from the total volume of the test contact chamber by more than 5%.

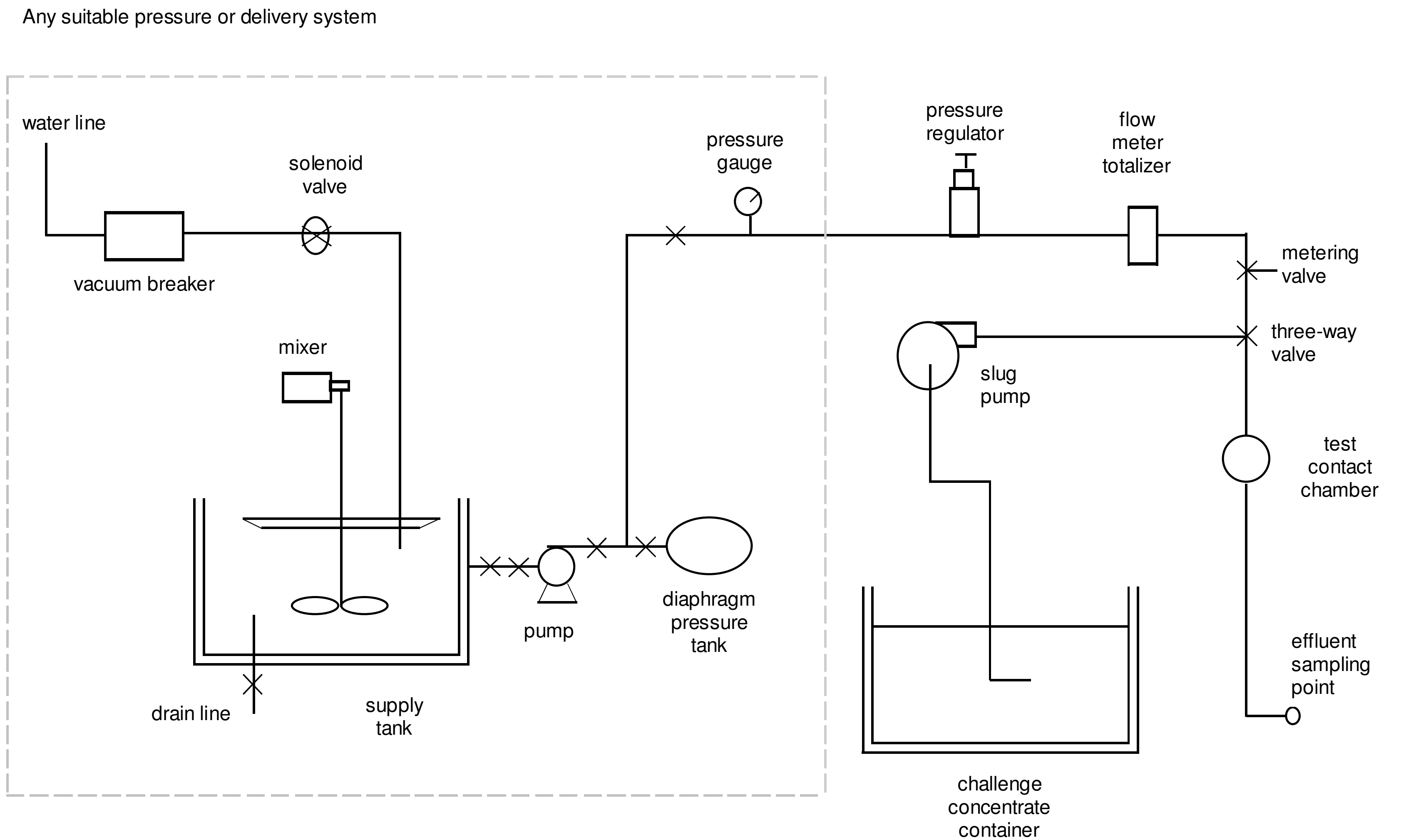

Figure D1 - Example of testing apparatus

This page is intentionally blank.

Standards and Criteria[13]

The following standards and criteria established and adopted by NSF as minimum voluntary consensus standards are used internationally:

2 Food equipment
3 Commercial warewashing equipment
4 Commercial cooking, rethermalization, and powered hot food holding and transport equipment
5 Water heaters, hot water supply boilers, and heat recovery equipment
6 Dispensing freezers
7 Commercial refrigerators and freezers
8 Commercial powered food preparation equipment
12 Automatic ice making equipment
13 Refuse processors and processing systems
14 Plastics piping system components and related materials
18 Manual food and beverage dispensing equipment
20 Commercial bulk milk dispensing equipment
21 Thermoplastic refuse containers
24 Plumbing system components for manufactured homes and recreational vehicles
25 Vending machines for food and beverages
29 Detergent and chemical feeders for commercial spray-type dishwashing machines
35 High pressure decorative laminates (HPDL) for surfacing food service equipment
36 Dinnerware
37 Air curtains for entranceways in food and food service establishments
40 Residential wastewater treatment systems
41 Non-liquid saturated treatment systems
42 Drinking water treatment units – Aesthetic effects
44 Residential cation exchange water softeners
46 Evaluation of components and devices used in wastewater treatment systems
49 Class II (laminar flow) biosafety cabinetry
50 Circulation system components and related materials for swimming pools, spas/hot tubs
51 Food equipment materials
52 Supplemental flooring
53 Drinking water treatment units – Health effects
55 Ultraviolet microbiological water treatment systems
58 Reverse osmosis drinking water treatment systems
59 Mobile food carts
60 Drinking water treatment chemicals – Health effects
61 Drinking water system components – Health effects
62 Drinking water distillation systems
75 Non-potentially hazardous foods
116 Non-food compounds used in food processing facilities – Food grade lubricants (draft standard for trial use)
173 Dietary supplements (draft standard for trial use)
184 Residential dishwashers
14159 Safety of machinery – Hygiene requirements for the design of machinery
14159-1 Hygiene requirements for the design of meat and poultry processing equipment
C-2 Special equipment and/or devices

[13] The information contained in this Standards and Criteria page 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 Standards and Criteria page 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.

SPES HOMINUM

THE HOPE OF MANKIND rests in the ability of man to define and seek out the environment which will permit him to live with fellow creatures of the earth, in health, in peace, and in mutual respect.

Printed 5/03/02