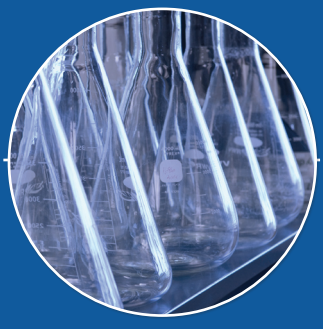
NSF International Standard /
American National Standard

NSF/ANSI 50 - 2016a

Equipment for Swimming Pools, Spas, Hot Tubs and Other Recreational Water Facilities


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 Recreational Water Facilities
c/o NSF International
789 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

Equipment for Swimming Pools, Spas, Hot Tubs and other Recreational Water Facilities–

Evaluation criteria for materials, components, products, equipment and systems for use at recreational water facilities

Standard Developer

NSF International

NSF International

Designated as an ANSI Standard
December 30, 2016
American National Standards Institute

Recommended for Adoption by
The NSF Joint Committee on Recreational Water Facilities
The NSF Council of Public Health Consultants

Adopted by
NSF International
May 1977

Revised May 1979
Revised June 1984
Revised November 1985
Revised May 1992
Revised July 1996
Revised January 2000
Revised May 2001
Revised March 2004
Revised October 2005
Revised April 2007
Revised October 2007
Revised February 2009
Revised May 2009
Revised August 2010
Revised August 2011
Addendum November 2011
Revised September 2012
Revised December 2013
Revised June 2014
Revised July 2015
Revised August 2016
Revised June 2017

Published by
NSF International
P. O. 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 50 – 2017."

Disclaimers[1]

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.

Participation in NSF 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 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. Therefore, 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

Foreword[2]

The purpose of this Standard is to establish minimum materials, design and construction, and performance requirements for components, products, equipment and systems, related to public and residential recreational water facility operation.

If a value for measurement is followed by a value in other units in parenthesis, the second value may be only approximate. The first stated value is the requirement.

In this edition of NSF/ANSI 50 editorial revisions and the following issues were incorporated:

Issue 108

Changes were made to the skimmer performance test procedure.

Issue 110

This issue changed the turbidity tolerance from 45 +/- 10 NTU to 45 +/- 5 NTU.

Issue 118

The upper limit of challenge organisms in H.1.6.2 was removed.

Issue 119

Language was added to specify that the Hydrostatic pressure test in 11.3 be performed on the same sample as the test in 11.2.

Issue 120

Requirements for pump voltage in 6.6 and C.1 were updated.

Issue 121

A discrepancy in units in B.4.3.1 was corrected.

Issue 122

Section N.2.3.3.1 was updated to require 4 ORP sensors, consistent with other language in Annex N.

Issue 123

Column titles in Tables O.1 through O.9 were updated for consistency.

Issue 125

This revision modified the test procedure for automated controllers.

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

The figure titles in this edition have also been changed to maintain consistency:

Previous edition of NSF/ANSI 50	Current edition of NSF/ANSI 50
Figure B.1	Figure 1
Figure C.1	Figure 2
Figure D.1	Figure 3
Figure D.2	Figure 4
Figure D.3	Figure 5
Figure D.4	Figure 6
Figure D.5	Figure 7
Figure D.6	Figure 8
Figure D.7	Figure 9
Figure H.1	Figure 11
Figure A.1	Figure 12
Figure H.2	Figure 13
Figure P.1	Figure 15

This Standard was developed by the NSF Joint Committee on Recreational Water Facilities using the consensus process described by 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 should be sent to Chair, Joint Committee on Recreational Water Facilities at standards@nsf.org. or c/o NSF International, Standards Department, PO Box 130140, Ann Arbor, MI 48113-0140, USA.

NSF/ANSI Standard

Equipment for Swimming Pools, Spas, Hot Tubs and other Recreational Water Facilities

Evaluation criteria for materials, components, products, equipment and systems for use at recreational water facilities

1 General

1.1 Scope

This Standard covers materials, components, products, equipment and systems, related to public and residential recreational water facility operation.

1.2 Variations in design and operation

A component varying in design and/or operation may qualify under this Standard. Appropriate tests and investigations shall indicate that the component performs as well as components conforming to this Standard. Such components shall meet the requirements for materials, finishes, and construction in this Standard.

1.3 Alternate materials

If specific materials are mentioned, other materials equally satisfactory from the standpoint of public health may be permitted.

1.4 Standard review

A complete review of this Standard shall be conducted at least every five years. These reviews shall be conducted by representatives from the industry, public health, and user groups, or agencies of the NSF Joint Committee on Recreational Water Facilities.

1.5 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 references.

21 CFR Chapter 1. *Code of Federal Regulations*[3]

21 CFR Part 58, Subchapter A. *Code of Federal Regulations*[3]

[3] USFDA, 5600 Fishers Lane, Rockville, MD 20857 <www.fda.gov>

40 CFR Part 136. *Guidelines Establishing Test Procedures for the Analysis of Pollutants*[4]

40 CFR Part 141. *National Primary Drinking Water Regulations*[4]

40 CFR Part 143. *National Secondary Drinking Water Regulations*[4]

ASME, *Boiler and Pressure Vessel Code. 2010*[5]

ANSI/APSP–16 2011. *Standard Suction Fittings for Use in Swimming Pools, Wading Pools, Spas, and Hot Tubs*[6]

ANSI/ASME A112.3.1 (2007). *Stainless Steel Drainage Systems for Sanitary DWV, Storm, and Vacuum Applications Above and Below Ground.*[5]

ANSI/ASME A112.6.3 – 2001 (R2007). *Floor and Trench Drains*[5]

ANSI/ASME A112.6.4 – 2003 (R2008). *Roof, Deck and Balcony Drains*[5]

ANSI/ASME A112.19.17 (2010). *Safety Vacuum Release Systems (SVRS) for Residential & Commercial Swimming Pool, Spa, Hot Tub, Wading Pool Suction System*[5]

ANSI/ASME B40.100 – 2005. *Pressure Gauge and Gauge Attachments*[5]

ANSI/IAPMO Z124.7 1997. *Prefabricated Plastic Spa Shells*[7]

ANSI/IAPMO Z124.1.2 – 2005. *Plastic Bathtub and Shower Units*[7]

ANSI/IAPMO Z1033-2015. *Flexible PVC Hoses and Tubing for Pools, Hot Tubs, Spas, and Jetted Bathtubs*[7]

ANSI/UL 1081 2011. *Swimming Pools, Pumps, Filters and Chlorinators*[8]

ANSI/UL 1261 2011. *Electric Water Heaters for Pools and Tubs*[8]

ANSI/UL 1563 2009. *Standard for Electric Hot Tub, Spas and Associated Equipment*[8]

ANSI/UL 2017 2011. *General Purpose Signaling Devices and Systems*[8]

APHA, *Standard Methods for the Examination of Water and Wastewater,* twentieth edition[9]

ASTM C136-2006: *Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates, 2004*[10]

ASTM D1894 – 11e1. *Stand Test Method for Static and Kinetic Coefficients of Plastic Film and Sheeting*[10]

ASTM D2464 – (2006). *Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80*[10]

---

[4] USEPA Environmental Monitoring and Support Laboratory, Cincinnati, OH 45268 <www.epa.gov>

[5] ASME, 3 Park Avenue, New York, NY 10016-5990 <www.asme.org>

[6] Association of Pool and Spa Professionals, 2111 Eisenhower Avenue, Alexandria, VA 22314 <www.apsp.org>

[7] IAPMO, 5001 E. Philadelphia St., Ontario, CA 91761 <www.iapmo.org>

[8] UL – Underwriters Laboratory, 2600 N.W. Lake Rd., Camas, WA 98607-8542 <www.ul.com>

[9] American Public Health Association, 800 I Street NW, Washington, DC 20001 <www.APHS.org>

[10] ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2859 <www.ASTM.org>

ASTM D2466 – (2006). *Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40*[10]

ASTM D2467 – (2006). *Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80*[10]

ASTM, D3739 – 2010. *Standard Practice for Calculation and Adjustment of the Langelier Saturation Index for Reverse Osmosis*[10]

ASTM E11 – 2009. *Standard Specification for Wire Cloth Sieves for Testing Purposes, 2009*[10]

ASTM F1346-03. *Standard Performance Specification for Safety Covers and Labeling Requirements for All Covers for Swimming Pools, Spas, and Hot Tubs*[10]

ASTM F2049-10 *Standard Guide for Fences/Barriers for Public, Commercial and Multi-Family Residential Use Outdoor Play Areas*[10]

ASTM F2208-2008. *Standard Safety Specification for Residential Pool Alarms*[10]

ASTM F2387 (2004). *Standard Specification for Manufactured Safety Vacuum Release Systems (SVRS) for Swimming Pools, Spas and Hot Tub*[10]

ASTM F2409-10. *Standard Guide for Fences for Non-Residential Outdoor Swimming Pools, Hot Tubs, and Spas*[10]

ASTM F2699-08 *Standard Guide for Fences for Commercial and Public Outdoor Water Spray/Play Areas*[10]

ASTM G154-06: *Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials*[10]

CEC-400-2009 Title 20. *California Energy Commission 2009 Appliance Efficiency Regulations*[11]

DVGW 2006. *UV disinfection devices for drinking water supply—requirements and testing*. DVGW W294-1, -2, and -3.[12]

IAPMO, PS-33-2010c. *Flexible PVC Hose for Pools, Hot Tubs, Spa, and Jetted Bathtubs*[7]

NFPA 70, Article 30. 2005. *National Electrical Code* (NEC)[13]

NSF/ANSI 14. *Plastics piping system components and related materials*

NSF/ANSI 42. *Drinking water treatment units – Aesthetic effects*

NSF/ANSI 51. *Food equipment materials*

NSF/ANSI 60. *Drinking water treatment chemicals – Health effects*

NSF/ANSI 61. *Drinking water system components – Health effects*

[11] California Energy Commission, 1516 Ninth St., Sacramento, CA 95814 <www.energy.ca.gov>

[12] German Gas and Water Management Union (DVGW), Bonn, Germany. <www.dvgw.de/english-pages/>

[13] National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269 <www.NFPA.org>

NSF/EPA ETV, *Generic Protocol for Development of Test / Quality Assurance Plans for Ultraviolet (UV) Reactors*

ÖNORM M 5873-1 *Plants for the disinfection of water using ultraviolet radiation - Requirements and testing - Low pressure mercury lamp plants*, 2001[14]

SAE Steel Numbering System[15]

USEPA, 1993. *Methods for the Determination of Inorganic Substances in Environmental Samples*[16]

USEPA, 1990. *Methods for the Determination of Organic Compounds in Drinking Water Supplement*[16]

USEPA-600/4-79-020. *Methods for the Chemical Analysis of Water and Wastes*, March 1983[16]

USEPA *Ultraviolet Disinfection Guidance Manual for the Final Long Term 2 Enhanced Surface Water Treatment Rule,* November 2006[16]

2 Definitions

2.1 accessible: Fabricated to be exposed for cleaning and inspection using simple tools (screwdriver, pliers, open-end wrench, etc.).

2.2 accuracy: The nearness of a measurement to the accepted or true value.[17] The accuracy is expressed as a range, about the true value, in which a measurement occurs (i.e. ± 0.5 ppm). It can also be expressed as the % recovery of a known amount of analyte in a determination of the analyte (i.e. 103.5 %).

2.3 agitation: Mechanical or manual movement to dislodge filter aid and dirt from the filter element.

2.4 air assist backwash: A compression of air in the filter effluent chamber using an air compressor or water pressure from the recirculating pump. When released, it rapidly decompresses and forces water in the filter tank through the elements in reverse direction to dislodge the filter aid and accumulated dirt and carry them to waste.

2.5 alternate sand-type media: Granular material(s) specified to be used instead of sand in a sand-type filter.

2.6 amps: The current, in amperes, under the motor data plate horsepower at rated volts.

2.7 analyte: Parameter that is a subject of the water analysis such as pH or free chlorine.

2.8 automated controller: A system of at least one chemical probe, a controller, and auxiliary or integrated component, that senses the level of one or more swimming pool or spa / hot tub water parameters and provides a signal to other equipment to maintain the parameter(s) within a user-established range.

2.9 backwash: Flow of water through filter element(s) or media in a reverse direction to dislodge accumulated dirt and/or filter aid and remove them from the filter tank.

[14] Beuth Verlaq GmbH, 10772 Berlin, Germany <http.//www.beuth.de/langanzeige/OENORM-5873-1/en/41105768.html>

[15] SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-001 < www.sae.org>

[16] Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402<www.gpo.gov>

[17] Skoog D.A., West D. M., *Fundamentals of Analytical Chemistry, 2nd* ed., Holt Rinehart and Winston, Inc. 1969, p.26

2.10 backwash cycle: Time required to thoroughly backwash the filter system.

2.11 backwash rate: Rate of application of water through a filter during backwash expressed in gal/min/ft^2 (L/min/m^2) of effective filter area.

2.12 body feed: Continuous addition of controlled amounts of filter aid during operation of a diatomite-type filter to maintain a permeable filter cake. If added as a slurry, this may be referred to as slurry feed.

2.13 bromine: A chemical that works as a sanitizer or disinfectant to kill bacteria and algae in pool and spa water.

2.14 cartridge: A depth- or surface-type filter component with fixed dimensions and designed to remove suspended particles from water flowing through the unit.

2.15 chemical feed rate indicator: Mechanism that produces reproducible results expressed in units of weight or volume of chemical per unit of time or per unit of volume of water. The mechanism may be a direct reading instrument or may require the use of a reference chart.

2.16 chemical feeder output rate: Weight or volume of active ingredients delivered by a chemical feeder expressed in units of time.

2.17 chemical probe (sensor): Component of an automated controller that monitors a given control parameter (pH, ORP, free Cl_2, etc.).

2.18 chlorine: A chemical that works as a sanitizer or disinfectant in pool and spa water to kill bacteria and algae, and oxidizes ammonia and nitrogen compounds that can enter the pool/spa from swimmer body wastes and other sources.

2.19 cleaning: Physical removal of soiling materials.

2.20 combined chlorine: Chlorine that has combined with ammonia, nitrogen, or other organic compounds.

2.21 comply (complies, compliance): Meeting the requirements of the standard, which includes standards incorporated by reference in the text.

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

2.23 controller: Component of an automated controller that receives signals from chemical probes or sensors, and sends an output signal to actuate equipment.

2.24 coolant flow rate: The flow rate of the coolant used to remove heat from the reaction chamber(s) of the ozone generator.

NOTE — The critical factor for heat removal is the mass flow rate (kg/hr) of the coolant. The mass flow rate of the coolant is equal to the volumetric flow rate m^3/hr, ft^3/hr) of the coolant times the density (Kg/m^3, lb/ft^3) of the coolant.

For liquid cooled systems the density of the coolant (liquid) is virtually independent of temperature and pressure and can be specified as the volumetric flow rate of the cooling liquid (m^3/hr, ft^3/hr, gpm, Lpm).

For gas cooled systems the density (and therefore the mass flow rate) of the coolant gas is dependent on temperature and pressure. For this Standard, the pressure and temperature ranges are small. The volumetric flow rate (m$^{3/}$hr, ft^3/hr, Ipm, ft$^{3/}$m, CFM) of the coolant shall be specified. As a practical approximation of the mass flow rate.

2.25 corrosion resistant: Capable of maintaining original surface characteristics under prolonged contact with the use environment.

2.26 cover mounting ring: Fitting containing a recess located in the deck to receive the cover of a surface skimmer.

2.27 dead weight: Mass expressed typically in pounds (kg) per square foot (meter) to assist in assessment of use relative to floor strength and loading requirements. The intrinsic, invariable weight of a structure such as a spa, including the water and bather weight.

2.28 depth-type cartridge: Filter cartridge with media relying on penetration of particles into the media for removal and providing adequate holding capacity of such particles.

2.29 dew point (dew-point temperature): The temperature saturation (assuming air pressure and moisture content are constant). For Corona Discharge ozone generation greater than 2 grams per hour the minimum dew point is -76 °F (-60 °C). For systems less than 2 grams per hour, the minimum dew point is -40 °F (-40 °C).

NOTE — For systems less than 2 grams per hour, the amount of nitric acid produced is negligible.

2.30 diatomite filter element: Device in a filter tank to trap solids and convey water to a manifold, collection header, pipe, or similar conduit. Filter elements usually consist of a septum and septum support.

2.31 disinfection: Killing of pathogenic agents by chemical or physical means directly applied.

2.32 easily cleanable: Manufactured so that dirt and debris and other soiling material may be removed by manual cleaning methods.

2.33 effluent: The treated stream emerging from a unit, system, or process.

2.34 electronic water quality test device: A device that requires power supply (such as line current or a battery) to yield a result.

2.35 electrolytic chlorinator: A device that converts dissolved chloride salt (sodium chloride) into chlorine and its reaction products.

2.36 equalizer line: An automatically operating line from below the pool surface to the body of a skimmer, designed to prevent air being drawn into the filter when the water level drops below the skimmer inlet.

2.37 feed gas: The gas (ambient air, dry air or oxygen) delivered to the inlet side of the ozone generator. The required quality and feed gas flow rate is determined by the manufacturer.

2.38 feed gas flow rate: The flow rate of the feed gas through the reaction chamber(s) of the ozone generator.

NOTE — The critical factor for the reaction is the mass flow rate (kg/hr) of the feed gas. The mass flow rate is the volumetric flow rate (m^3/hr, ft^3hr) of the feed gas times the density (kg/m^3, lb/ft^3) of the feed gas.

The density of a gas is dependent on the temperature and pressure. Because of the continuous variability of the parameters affecting density and volumetric flow rate in an ozone generator, there is no practical method to determine the true mass flow rate of the feed gas. For this Standard, due to the small range of pressure and temperature, the volumetric flow rate is specified as an approximation of the mass flow rate.

For pressurized systems, the manufacturer specifies the volumetric flow rate and the gauge pressure of the feed gas at the inlet to the ozone generator.