

*American National Standard for
Residential Inground Swimming Pools*



*Approved December 16, 2002
American National Standards Institute*

(Effective October 1, 2003)

ANSI
NSPI-5-2003
Revision of
ANSI/NSPI-5-1995

American National Standard
for Residential Inground Swimming Pools

Sponsor

National Spa and Pool Institute

Approved December 16, 2002
American National Standards Institute, Inc.

(Effective October 1, 2003)

Important Notice About This Document

NSPI standards are developed through a consensus process approved by the American National Standards Institute. This process brings together volunteers representing varied viewpoints and interests to achieve consensus. While the NSPI administers the process and establishes rules to promote fairness in the development of consensus, it does not independently test, evaluate, or verify the accuracy of any information or the soundness of any judgments contained in its standards.

The NSPI disclaims liability for any personal injury, property or other damages of any nature whatsoever, whether special, indirect, consequential or compensatory, directly or indirectly resulting from the publication, use of, or reliance on this document. The NSPI also makes no guaranty or warranty as to the accuracy or completeness of any information published herein.

In issuing and making this document available, the NSPI is not undertaking to render professional or other services for or on behalf of any person or entity. Nor is the NSPI undertaking to perform any duty owed by any person or entity to someone else. Anyone using this document should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstance.

The NSPI has no power, nor does it undertake, to police or enforce compliance with the contents of this document. Nor does the NSPI list, certify, test or inspect products, designs, or installations for compliance with this document. Any certification or other statement of compliance with the requirements of this document shall not be attributable to the NSPI and is solely the responsibility of the certifier or maker of the statement.

**AMERICAN
NATIONAL
STANDARD**

Approval of an American National Standard requires verification by the American National Standards Institute (ANSI) that the requirements for due process, consensus, and other criteria for approval have been met by the standard developer.

Consensus is established when, in the judgment of the ANSI Board of Standard Review, substantial agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that a concerted effort be made toward their resolution.

The use of American National Standards is completely voluntary; their existence does not in any respect preclude anyone, whether he has approved this standard or not, from manufacturing, marketing, purchasing or using products, processes or procedures not conforming to the standards.

The American National Standards Institute does not develop standards and will in no circumstances give an interpretation of any American National Standard. Moreover, no person shall have the right or authority to issue an interpretation of an American National Standard in the name of the American National Standards Institute. Requests for interpretations should be addressed to the secretariat or sponsor whose name appears on the title page of this standard.

CAUTION NOTICE: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken periodically to reaffirm, revise, or withdraw this standard.

STATEMENT: This voluntary standard has been developed under the published procedures of the American National Standards Institute. The National Spa and Pool Institute, its members, and those participating in its activities do not accept any liability resulting from compliance or noncompliance with the provisions given herein, for any restrictions imposed on materials, or for the completeness of the text.

NSPI does not monitor or enforce compliance with the contents of this document, and any certification of products stating compliance with requirements of this document are at the sole responsibility of the certifier.

It is assumed and intended that pool users will exercise appropriate personal judgment and responsibility and that operators will create and enforce rules of behavior and warning appropriate for their pool.

National Spa & Pool Institute
2111 Eisenhower Avenue, Alexandria, VA 22314
Phone: (703) 838-0083
Fax: (703) 549-0493
www.nspi.org

Copyright © 2003 by the National Spa and Pool Institute.

All rights reserved. No part of this book may be reproduced, stored in a retrieval system, or transcribed, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without written permission from the publisher: National Spa & Pool Institute, 2111 Eisenhower Avenue, Alexandria, VA 22314-4698.

Foreword

(This Foreword is not part of the American National Standard ANSI/NSPI-5 2003)

This standard is a revision of ANSI/NSPI-5 1995, *Standard for Residential Inground Swimming Pools*, which was first approved by the American National Standards Institute on April 25, 1995 as an American National Standard. This standard was approved December 16, 2002. The effective date is October 1, 2003. The effective date is established by the National Spa and Pool Institute and not by the American National Standards Institute.

The objective of this standard is to provide recommended minimum guidelines for the design, equipment, installation, and use of residential inground swimming pools. It is also intended to assist local jurisdictions and other regulatory bodies, where necessary, in the development and promulgation of criteria for residential inground swimming pools.

The design recommendations and construction practices in this standard are based upon sound engineering principles, research and field experience which, when applied properly, contribute to the delivery and installation of a safe product.

The words “safe” and “safety” are not absolutes. While the goal of this standard is to design and construct a safe, enjoyable product, it is recognized that risk factors cannot, as a practical matter, be reduced to zero in any human activity. This standard does not replace the need for good judgment and personal responsibility. In permitting use of the pool by others, owners must consider the skill, attitude, training and experience of the expected user.

As with any product, the specific recommendations for installation and use provided by the manufacturer should be carefully observed.

This standard was prepared by the NSPI-5 Residential Inground Swimming Pool Standards Writing Committee of the National Spa and Pool Institute (NSPI) in accordance with American National Standards Institute (ANSI) *Procedures for the Development and Coordination of American National Standards* utilizing the ANSI-accredited canvass method. Consensus approval was achieved by ballot of the NSPI-5 canvass list.

The consensus committee that approved this standard was balanced to ensure that individuals from competent and concerned interests have had an opportunity to participate. The proposed standard was made available for public review and comment, which provides an opportunity for additional input from industry, academia, regulatory agencies, and the public at large.

The following organizations, recognized as having an interest in the standardization of residential inground swimming pools, were contacted prior to the approval of this standard. Inclusion in this list does not necessarily imply that the organization concurred with the submittal of the proposed standard to ANSI.

Organizations Represented

Name of Representative

Advantis Technologies	John Puetz
Alaska Department of Labor	Alan W. Dwyer
Aquasport/Seasonmaster	Don Aymes
Balboa Instruments	Lee West
Bio-Lab, Inc	Tom Lachocki
Building Officials & Code Administrators	Gary Nelson
Cantar	Gary Crandall
Cardinal System	Terry Maurer
Con-Serv	Wally James
Dover Pools	Burton Greene
Fiber Tech West, Inc.	Hugh Lynch
Fox Pool Corp	Robert E. Seitz
Garrett Liners	Kenneth Garrett
Gary Pools	Leif Zars
Gym & Swim	Bob Wason
Hawaiian Fiberglass Pools, Inc.	Roger Erdelac

Horner Equipment of Florida	Bill Kent
Hunsaker associates, Inc./Counselman	Dale DeClue
Fibre Tech West, Inc.	Hugh Lynch
International Association of Professional Mechanical Officials	Michael Kobel
Imperial Pools, Inc.	William Churchman
Inter-Fab, Inc.	Michael Hagerty
J. S. Associates	Joe Schmerler
J.M.K. Construction.....	Jeff McGalliard
L.K. Consultant.....	Les Kowalsky
Maryland Dept. of Health & Mental Hygiene.....	Pamela Engle
National Sanitation Foundation	Megan Cleary
Oras, Wayne.....	Wayne Oras
Recreation Safety Institute	Arthur H. Mittelstaedt, Jr.
Rizzo Pools, Inc.	Al Rizzo
Sandel Consulting Services	Bonnie Sandel
S.R. Smith	Tom Masterson
Southern Building Code Congress International	John Battles
Sta-Rite, Inc.	Tim Ruesch
Underwriter Laboratories	Robert Williams
U.S. Centers for Disease Control & Prevention	Patrick O. Bohan*
U.S. Consumer Products Safety Commission	Troy Whitfield*
U.S. Department of Labor/OSHA	Carl Sall*
U.S. Diving	Don Leas
University of Texas at Austin	Kim Tyson
Waterpik Technologies Laars Jandy Products	David Nibler
Wells Consulting	Gene Wells
Witte & Associates	Don Witte

*non-voting

In accordance with American National Standards Institute (ANSI) procedures, this document will be reviewed periodically. The National Spa and Pool Institute welcomes your comments and suggestions, and continues to review all NSPI standards, which include:

ANSI/NSPI-1 2003 Standard For Public Swimming Pools
 ANSI/NSPI-2 1999 Standard For Public Spas
 ANSI/NSPI-3 1999 Standard For Permanently Installed Residential Spas
 ANSI/NSPI-4 1999 Standard For Aboveground/Onground Residential Swimming Pools
 ANSI/NSPI-5 2003 Standard For Residential Inground Swimming Pools
 ANSI/NSPI-6 1999 Standard For Residential Portable Spas
 NSPI-7 Workmanship Standards For Swimming Pools and Spas
 ANSI/NSPI-8 1996 Model Barrier Code for Residential Swimming Pools, Spas and Hot Tubs
 BSR/NSPI/WWA-9 Standard for Aquatic Recreation Facilities (In Progress)
 BSR/NSPI-10 Standard for Public Swimspas (In Progress)
 BSR/NSPI-11 Standard for Residential Swimspas (In Progress)

Special thanks to the following whose contributions and dedication made this standard possible:

Writing Committee

Gene Wells (Chair).....	Wells Consulting
Marc Campbell	San Juan Pools
Ray Cronise.....	RTR Group, Inc.
John Bentley.....	Rosebrook Carefree Pools, Inc.
Dick DalPino.....	DalPino Quality Pools, Inc.
Roger Erdelac	Hawaiian Pools, Inc.
Jeff Fausett.....	Aquatech Corporation
Ken Garrett.....	Garrett Liners
Janet Jordan	American Pools, Inc.
Les Kowalsky	L.K. Consultant
Robert MacKinnon	Triac Industries

Thomas M. MastersonS.R. Smith, LLC
Rex RichardBYOP
Al RizzoRizzo Pools, Inc.
Tim RueschSta-Rite Industries
Robert Rung Hayward Pool Product
Fred Schall Delair Group, Inc.
Joe Schmerler J.S. Associates
Don WitteWitte and Associates

NSPI Staff

Bernice Crenshaw Standards Programs Director

Contents

Page

1	Scope	1
2	General design criteria.....	1
3	Plans and permits	1
4	Structural design	1
5	Pool dimensions and tolerances	1
6	Entry and exit.....	7
7	Decks	10
8	Materials of construction and finishes	10
9	Circulation systems components and related equipment	11
10	Water supply	15
11	Waste water disposal	15
12	Chemical feeders and ozone generators.....	15
13	Electrical requirements	16
14	Instructions for the circulation system, pressure filters and separation tanks	16
15	Safety features.....	16

Figures

1	Maximum allowable wall slope	2
2	Typical pool design configurations.....	2
3	Minimum water envelope.....	3
4	Offset ledges	4
5	Shallow end depths	4
6	Top view examples of accessory equipment and pool features prohibited in the water envelope.....	6
7	Pool stairs - side view.....	8

Tables

1	Minimum water envelope.....	4
----------	-----------------------------	---

Appendices

A	Chemical operational parameters.....	18
B	Use of ozone	28
C	Use of elemental chlorine.....	29
D	Recommendations to warn against shallow water diving	31
E	Safety considerations and warning recommendations	32
F	Safety brochures and education programs	33
G	Wooden deck materials	33
H	Metric conversion table	34
I	Entrapment avoidance	35
J	Glossary	37
K	Sources of material	55

ANSI/NSPI-5 2003

Standard for Residential Inground Swimming Pools

1 Scope

1.1 Residential pools. This standard applies to permanently installed residential inground swimming pools intended for noncommercial use as a swimming pool by not more than three owner families and their guests and exceeding 24 inches (61 cm) in water depth and having a volume over 3,250 gallons (12,303 L).

1.2 Construction. This standard covers specifications for new construction and rehabilitation or residential inground swimming pools and includes design, equipment, operation and installation.

1.3 Variation in designs. This standard permits variations in equipment, materials, and design, including special features such as but not limited to ledges beach entries, waterfalls, fountains, bridges, planters, seats, benches, swimouts, in-pool tables and bar stools, walls over 12 inches (30.5 cm), scuba pools, spas, lap pools, swimspas, spillways, slides, coves, beams, etc. to accommodate special needs consideration and advances in technology.

1.3.1 Special purpose pools. Examples of special purpose pools include, but are not limited to, island pools, scuba pool, spas, lap pools and swimspas.

1.4 Important safety consideration. The variations in 1.3 shall consider safety for the intended use and the circulation of the swimming pool water.

1.5 Other standards. This standard does not apply to pools and spas covered by ANSI/NSPI-1 Standard for Public Swimming Pools, ANSI/NSPI-2 Standard for Public Spas, ANSI/NSPI-3 Standard for Permanently Installed Spas, ANSI/NSPI-4 Standard for Aboveground/Onground Residential Swimming Pools, ANSI/NSPI-6 Standard for Residential Portable Spas and Swimspas.

1.6 Workmanship. All work shall be performed in accordance with the 1996 NSPI Workmanship standard or the latest revision.

2 General design criteria

2.1 Materials of components and accessories. The materials of components and accessories used for permanently installed residential swimming pools shall be compatible with the user and the environment in which they are installed. The materials shall be capable of fulfilling the design, installation and the intended use requirements in this standard.

2.2 Selection of materials. The selection of materials, manufactured components, accessories and construction processes shall be such that external surfaces and edges that come in contact with the user are arranged, and furnished so they will not constitute a cutting, pinching, puncturing or abrasion hazard.

2.3 Entrapment avoidance. There shall be no protrusions or other obstructions in the swimming area, which may cause the entrapment or entanglement of the user.

3 Plans and permits

3.1 Approval of state or local authority. Prior to construction, rehabilitation, or alteration of a permanently installed residential pool, plans and specifications shall be submitted as required by the state or local authority for review, approval, and issuance of a permit.

4 Structural design

4.1 Structural design. The structural design and materials used shall be in accordance with generally accepted structural engineering practices and methods.

4.2 Freezing. In climates subject to freezing temperatures, the pool shell shall be so designed and constructed to protect it from structural damage due to freezing.

5 Pool dimensions and tolerances

5.1 General requirements. Design dimensions shall comply with specifications in this standard. The pool shall be constructed to these design dimensions within the tolerances listed in 5.1.1.

5.1.1 Construction tolerances. There shall be construction tolerances allowed on dimensional designs. The overall length, width and depth shall be limited to a tolerance of plus or minus 3 inches (± 7.6 cm). All other dimensions shall be limited to a tolerance of plus or minus 2 inches (± 5.1 cm), unless otherwise specified.

5.2 Perimeter shape. No limits are specified for shape of pools except that consideration shall be given to shape from the standpoint of circulation of the swimming pool water and safety to the user.

5.3 Walls - requirements

5.3.1 Walls in the shallow area and deep area of the pool shall not slope greater than 11° (1:5 slope

ratio) to a transition point. The transition point shall not be less than 2 feet and 9 inches (83.8 cm) below the waterline. See figure 1.

5.3.2 As shown in figure 2, at the depths of (a) and (b), the walls are permitted to join the floor.

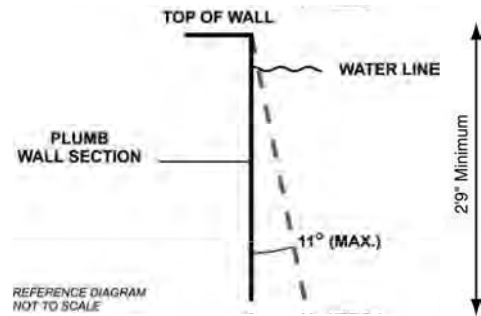


Figure 1 – Maximum allowable wall slope

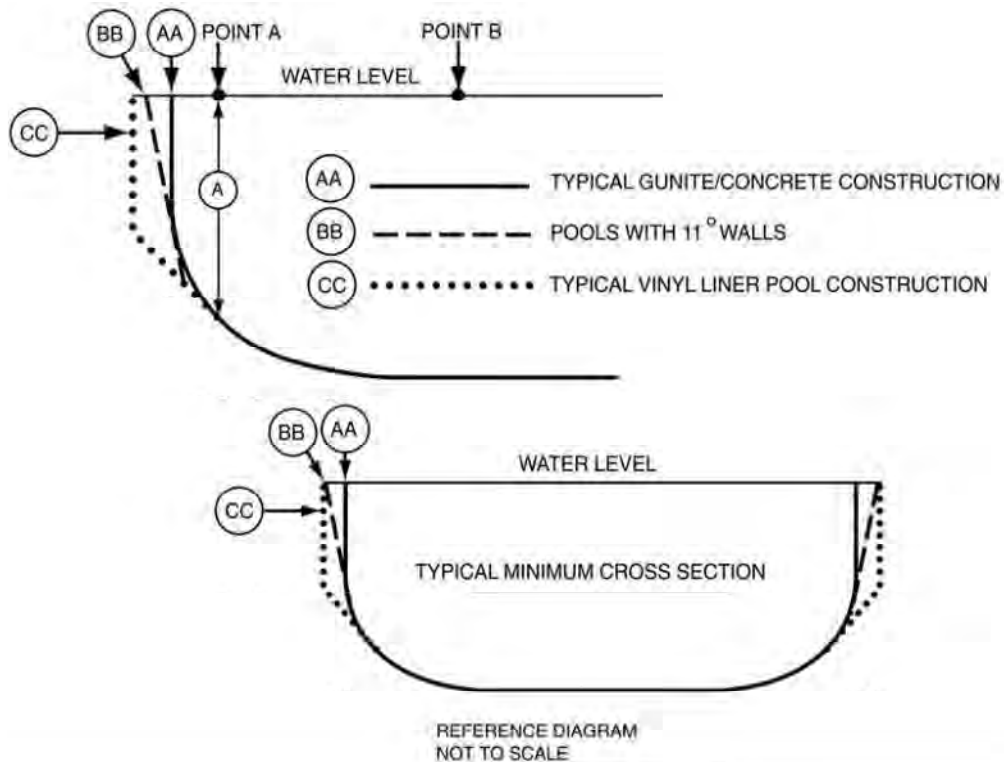


Figure 2 – Typical pool design configurations

5.3.3 The walls of Type I pool, when defining the minimum diving water envelope, shall be plumb or outside of Type 1 water geometry. (See figure 3, table 1.)

5.4 Maximum allowable wall slope

5.4.1 Maximum allowable wall slope shall not slope greater than 11° from plumb.

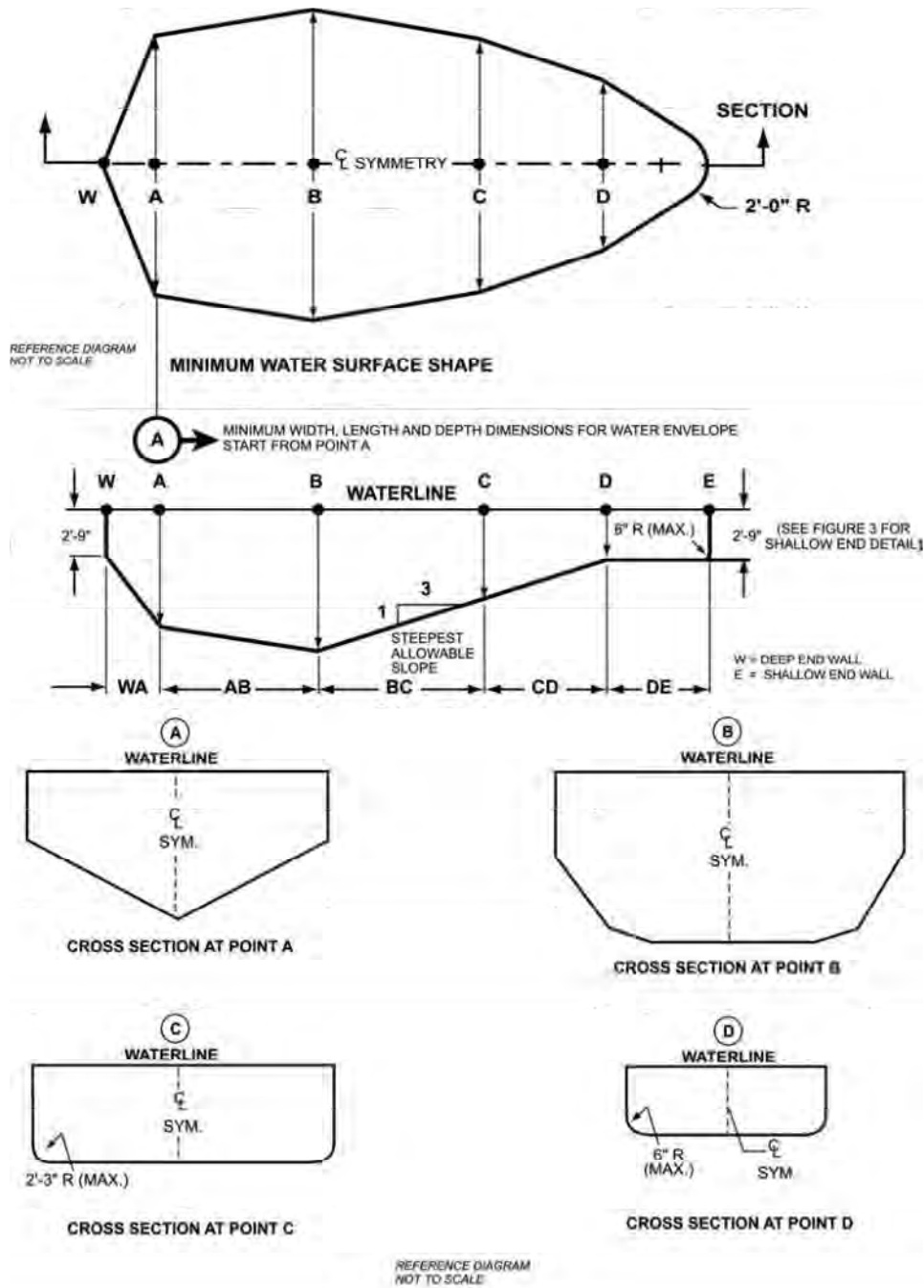


Figure 3 – Minimum water envelope

Table 1 – Minimum water envelope

Pool type	Minimum depths at point				Minimum widths at point				Minimum lengths between points					
	A	B	C	D	A	B	C	D	WA	AB	BC	CD*	DE	WE
O	Manufactured diving equipment is prohibited													
I	6'-0"	7'-6"	5'-0"	2'-9"	10'-0"	12'-0"	10'-0"	8'-0"	1'-6"	7'-0"	7'-6"	Varies	6'-0"	28'-9"
II	6'-0"	7'-6"	5'-0"	2'-9"	12'-0"	15'-0"	12'-0"	8'-0"	1'-6"	7'-0"	7'-6"	Varies	6'-0"	28'-9"
III	6'-10"	8'-0"	5'-0"	2'-9"	12'-0"	15'-0"	12'-0"	8'-0"	2'-0"	7'-6"	9'-0"	Varies	6'-0"	31'-3"
IV	7'-8"	8'-6"	5'-0"	2'-9"	15'-0"	18'-0"	15'-0"	9'-0"	2'-6"	8'-0"	10'-6"	Varies	6'-0"	33'-9"
V	8'-6"	9'-0"	5'-0"	2'-9"	15'-0"	18'-0"	15'-0"	9'-0"	3'-0"	9'-0"	12'-0"	Varies	6'-0"	36'-9"

NOTE:

- *Minimum length between points CD may vary based upon water depth at point D and the slope between points C & D.
- Figure 3 drawings are not to scale. (For pool types, see Glossary.)

5.5 Offset ledges

5.5.1 Offset ledges shall be a maximum of 8 inches (20.3 cm) wide.

5.5.1.1 Offset ledges, located less than 42 inches (1067 mm) below waterline shall be proportionately less than 8 inches (20.3 cm) wide and fall within 11° from plumb, measured from the top of the waterline. See figure 4.

5.6 Floor slopes. Floor slopes shall be reasonably uniform and comply with 5.6.1 through 5.6.3.

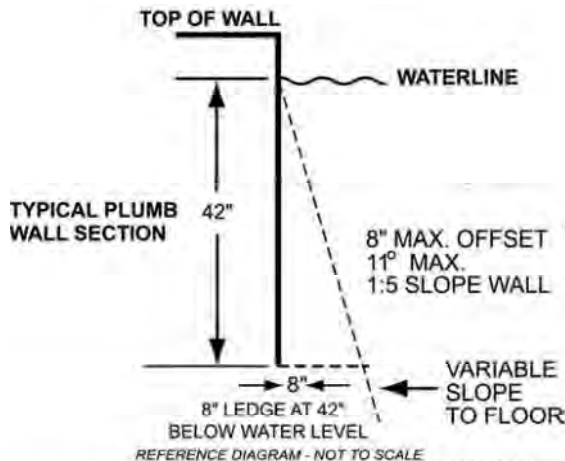


Figure 4 – Offset ledges

5.6.1 The slope of the floor from the shallow end wall towards the deep area shall not exceed 1 foot in 7 feet (30 cm: 213 cm) to the point of the first slope change as shown in figure 5.

5.6.2 Changes in slope between shallow and deep areas shall be at a minimum water depth of 2 feet 9 inches (83.8 cm) and be at least six feet (182.9 cm) from the shallow end, except as specified in 6.3.

5.6.3 The slope of the floor from the point of the first slope change toward the deep end shall not exceed 1 foot in 3 feet (30 cm: 91 cm).

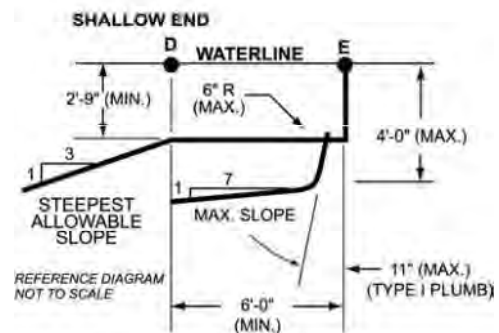


Figure 5 – Shallow end depths

5.7 Shallow end water depths. Water depth in the shallow area shall be a minimum of 2 feet 9 inches (83.8 cm) except for those locations specified in 6.3 "Shallow End Detail for Beach and Sloping Entries." The water depth at the shallowest point shall not exceed four feet (121.9 cm) as shown in figure 5.

5.8 Manufactured diving equipment for in-ground swimming pools (diving board/stand combination or manufactured platform)

NOTE – For consumer safety information, warnings and education programs, See appendices D, E, and F.

5.8.1 When manufactured diving equipment is installed, it shall conform to the specifications set forth in 5.8 through 5.9 and shall be located in the deep area of the pool so as to provide the minimum dimensions as shown in 5.9.

5.8.1.1 Manufactured diving equipment shall not be installed on Type 0 pools.

5.8.2 Diving equipment. Diving equipment shall be designed for swimming pool use and shall be installed in accordance with the manufacturer's specifications.

5.8.2.1 Diving equipment installation and use instructions shall be provided by the diving equipment manufacturer and shall specify the minimum water dimensions required for each diving board and diving stand combination. They may refer to the water envelopes type of their choice by dimensionally relating their products to Point A on the water envelopes as shown in figure 3 and table 1, 5.9.1 through 5.9.3.

5.8.2.2 Diving equipment shall be permanently labeled and affixed to the diving equipment or jump boards and shall include but not be limited to:

- manufacturer's name and address;
- date of manufacture;
- minimum water envelope required for each diving board and diving stand combination; and
- maximum weight limitations of the user as specified by the board manufacturer.

5.8.2.3 Diving equipment shall have slip-resisting tread surfaces.

5.9 Figure 3 contains suggested drawings and diagrams for minimum water envelope for swimming pools designated type I - V. Individual pool types are shown in figure 3 and table 1.

5.9.1 Location of point A. Point A shall be defined as a point located on the minimum water envelopes.

5.9.1.1 Point A. Point A is a construction location nearest the deep end wall where the minimum water depth is satisfied.

5.9.1.2 Point A as shown in figure 3 and table 1 shall be the reference point of origin for all dimensions defining the minimum water envelope.

5.9.2 Type 0 pool (where diving is prohibited) shall not be limited in width, length, or water depth except as specifically provided for in this standard.

5.9.3 Location of equipment and pool features in the minimum water envelope. If the pool is designed for use with diving equipment, steps, pool stairs, ladders, underwater benches, special features and other accessory items shall be located outside the minimum water envelope. (See figure 6)

5.9.4 Typical pool design configurations. Vinyl liner, shotcrete, fiberglass and concrete constructions shall conform to, but are not limited to, the typical pool configurations shown in figure 2.

5.10 Stationary diving platform(s) and diving rock(s). Stationary diving platform(s) and diving rock(s) built on site shall be allowed to be flush with the wall and located in the diving area of the pool. Point A shall be in front of the wall at the platform or diving rock centerline.

NOTE – For consumer safety information, warning, and education programs, See appendices D, E, and F.

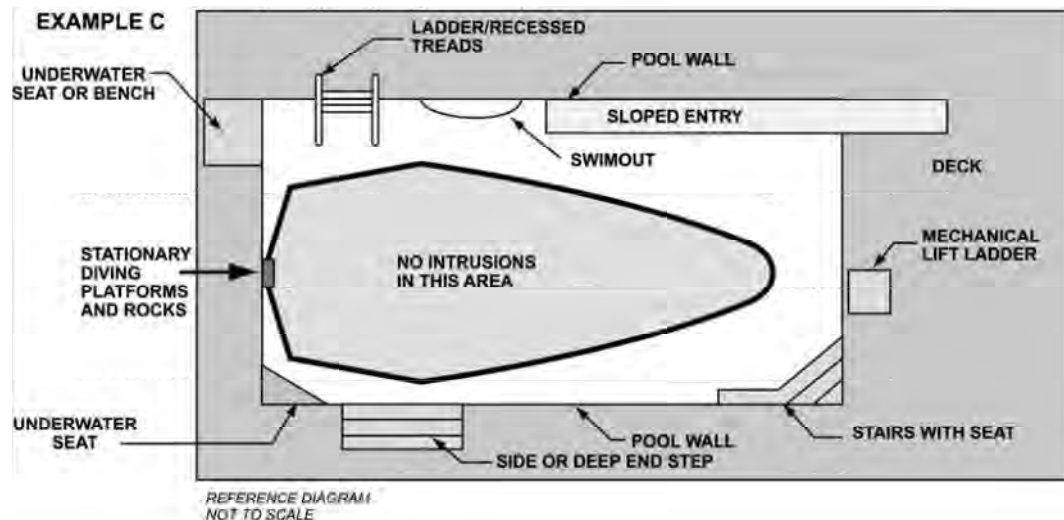
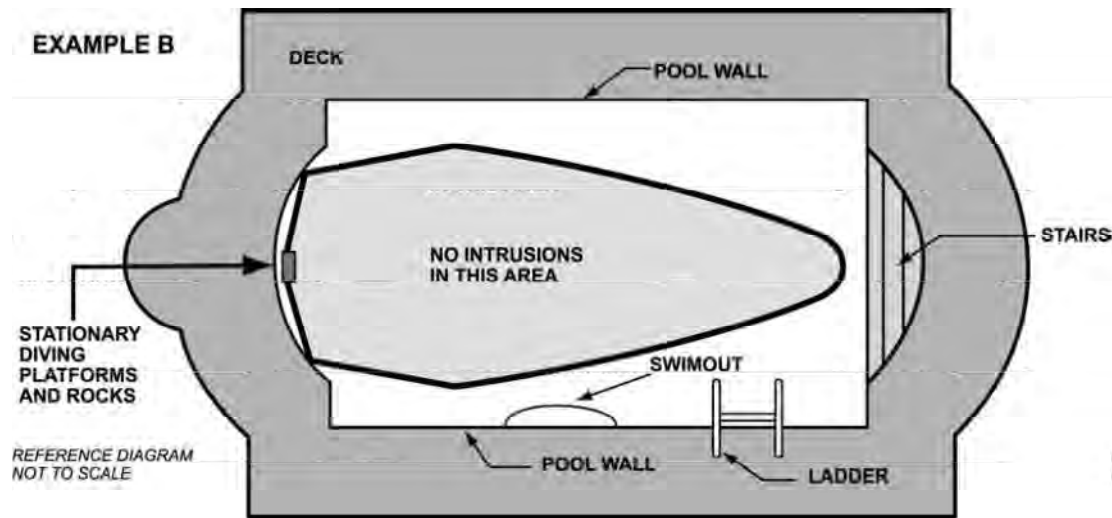
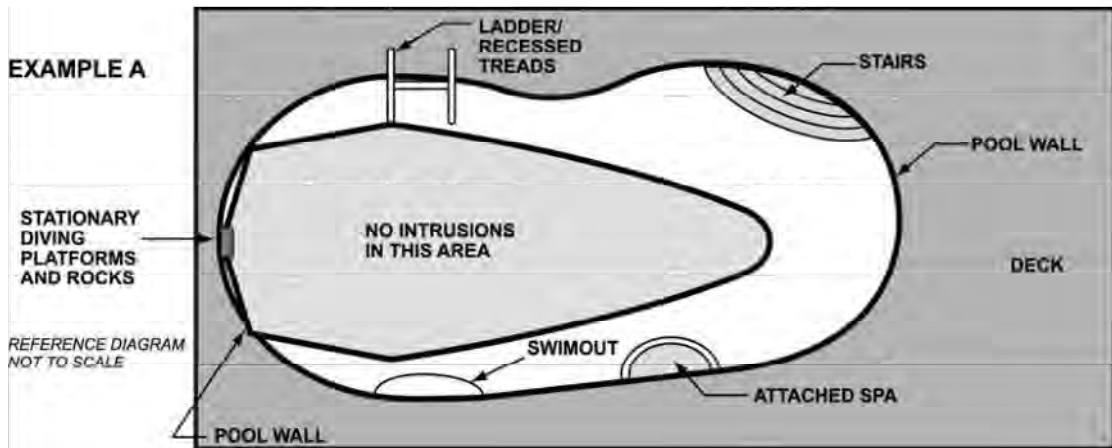


Figure 6 – Top view examples of accessory equipment and pool features prohibited in the water envelope

5.10.1 The maximum height of the stationary diving platform or diving rock above the waterline shall be as follows:

- Pool Type I 42 inches (106.7 cm);
- Pool Type II 42 inches (106.7 cm);
- Pool Type III 50 inches (127.0 cm);
- Pool Type IV 60 inches (152.4 cm); or
- Pool Type V 69 inches (175.3 cm)

5.10.2 Stationary diving platform(s) and diving rock(s) shall not be permitted on Pool Type 0.

5.10.3 The diving equipment manufacturer shall specify minimum headroom above water.

5.11 Swimming pool slides

5.11.1 Slides, where installed, shall be installed in accordance with manufacturer's specifications.

NOTE – For consumer safety information, warnings, and education programs, see appendices D, E, and F.

6 Entry/exit

6.1 Entry/exit. All pools shall have a means of entry/exit in the shallow area if water depth exceeds 24 inches (61 cm) at the shallowest point. The means of entry/exit shall be located on the shallow side of the first slope change.

6.1.1 A means of entry/exit shall be provided in the deep area of the pool if the water depth is 5 feet (152.4 cm) or greater.

6.1.2 Entries/exits shall consist of one (1) or a combination of the following: steps, stairs, ladders, treads, ramps, beach entries, underwater seats, benches, swimouts, mechanical lifts, and other designs or products that provide the minimum utility as specified in this standard.

6.1.3 Pools over 30 feet (914.4 cm) in width shall provide entries/exits on both sides of the deep area of the pool.

6.1.4 Entries, exits, pool stairs, (as shown in figure 6) ladders, underwater benches, special features and other accessories shall be located outside the minimum water envelope as shown in figure 6 when pool is designed for use with diving equipment.

6.1.5 All treads shall have slip-resisting surfaces.

6.2 Pool stairs. The design and construction of stairs into the shallow end and recessed pool stairs shall conform to 6.2 through 6.3. See figure 7.

6.2.1 Treads shall have a minimum unobstructed horizontal depth of 10 inches (25.4 cm) and a minimum unobstructed surface area of 240 square inches (1548 cm²).

6.2.1.1 When stairs are equipped with a handrail, treads shall have a minimum unobstructed horizontal depth of 8 inches (20.3 cm) and a minimum unobstructed surface area of 240 square inches (1548 cm²).

6.2.1.1.1 The bottom riser height is allowed to vary to the floor.

6.2.2 All risers at the centerline shall have a maximum uniform height of 12 inches (30.5 cm), except the top or bottom riser, which may vary in height, but shall not exceed 12 inches (30.5 cm).

6.2.2.1 The vertical distance from the pool coping, deck or step surface to the upper-most tread shall be a maximum of 12 inches (30.5 cm).

6.2.2.2 When stairs are located in water depth over 48 inches (121.9 cm), the lowest tread shall be no less than 48 inches (121.9 cm) below the deck and visually set apart and located outside the wall of the pool.

6.3 Shallow end detail for beach and sloping entries

6.3.1 Sloping entries used, as a pool entrance (see figure 6-C) shall not exceed 1 foot in 7 feet (30 cm 213 cm).

6.3.2 Sloping entries are permitted to be used in conjunction with steps and benches.

6.3.2.1 Where benches are used in conjunction with sloping entries the vertical riser distance shall not exceed 12 inches (30.5 cm). For

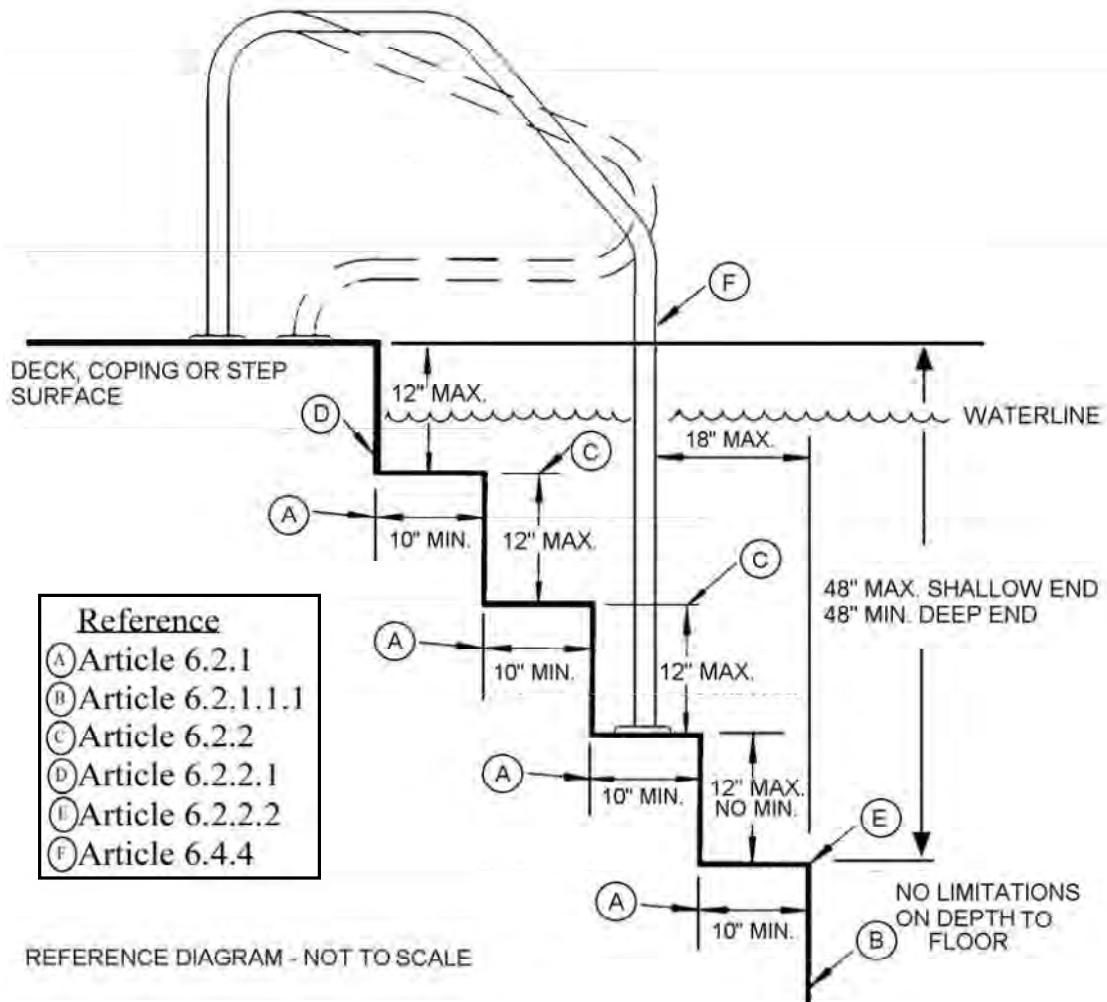


Figure 7 – Pool stairs - side view

steps used in conjunction with sloping entries all requirements of 6.2 shall apply.

6.3.2.2 A vertical drop exceeding 12 inches (30.5 cm) inside a sloping entry shall be protected by a handrail.

6.3.3 Architectural features are not required to comply with the 1 foot in 7 feet (30 cm:213 cm) slope unless used as an entrance.

6.3.4 Beach and sloping entries surfaces shall be of slip resisting materials.

6.4 Handrails. If handrails are used, they shall conform to 6.4.1 through 6.4.4.

6.4.1 Handrails shall be of corrosion-resisting materials.

6.4.2 Handrails shall be installed so they cannot be removed without the use of tools.

6.4.3 The leading edge of handrails/handholds facilitating stairs and pool entry/exit shall not exceed 18 inches (45.7 cm) back from the vertical face of the bottom riser. See figure 7.

6.4.4 The outside diameter of handrails shall be a minimum of 1-inch (25.4 cm) and not exceed 1.9 inch (48.3 cm). See figure 7.

6.5 Pool ladder design and construction. Design and construction of ladders shall conform to 6.5.1 through 6.5.7.

6.5.1 All steps and ladders shall be located outside the minimum diving water envelope. See figure 7.

6.5.2 All ladder and staircase treads shall have slip-resisting surfaces.

6.5.3 Ladders shall provide two (2) handholds or two (2) handrails.

6.5.4 There shall be a clearance of 3 inches (76.2 cm) minimum and six inches (152.4 cm) maximum between the pool wall and the ladder.

6.5.5 The clear distance between ladder handrails shall be 17 inches (432 mm) minimum and 24 inches (61 cm) maximum.

6.5.6 There shall be a vertical uniform distance between ladder treads, with a 7-inch (178-mm) minimum and 12 inch (30.5 cm) maximum.

6.5.7 Ladder treads shall have a minimum horizontal uniform depth of 2 inches (51 mm).

6.6 Recessed treads. The design and construction of recessed treads in the pool wall shall conform to 6.6.1 through 6.6.6.

6.6.1 All recessed treads shall have slip-resisting surfaces.

6.6.2 Recessed treads at the centerline shall have a uniform vertical spacing of 7 inches (178 mm) minimum and 12 inches (305 mm) maximum.

6.6.3 The vertical distance between the pool coping edge, deck, or step surface and the uppermost recessed tread shall be 12 inches (305 mm) maximum.

6.6.4 Recessed treads shall have a depth of 5 inches (127 mm) minimum, and width of 12 inches (305 mm) minimum.

6.6.5 Recessed treads shall drain into the pool.

6.6.6 Recessed treads shall be provided with a handrail, grabrail, or handhold on each side of the treads.

6.7 Underwater seats, benches and swimouts. The design and construction of underwater seats, benches and swimouts shall conform to 6.7.1 through 6.7.3. (See figure 6A, 6B, and 6C.)

6.7.1 Underwater seats, benches and swimouts, when provided, shall be at 20 inches (508 mm) maximum below the waterline.

6.7.2 Underwater seats, benches and swimouts shall be permitted in the deep area of the pool. They shall be visually set apart and located outside of the required minimum diving water envelope if the pool is designed for use with diving equipment, as shown in figure 6A, 6B, and 6C.

6.7.3 Underwater seats, benches or swimouts are permitted to be part of the stairs, recessed treads, beach entries, or ramps, or other special features.

7 Decks

7.1 General requirements. There is no requirement to provide decking around pools.

7.1.1 Deck(s), when provided, shall be designed and installed in accordance with local construction practices for the decking type and the site condition.

7.1.2 All deck surfaces shall be of slip-resisting materials, including but not limited to special deck features such as markers and brand insignias.

7.1.3 Deck(s) shall be installed so as to protect the coping tile and its mortar bed from damage as a result of deck movement.

7.1.4 Deck(s) shall be edged, radiused, or otherwise be relieved to eliminate sharp comers.

7.2 Drainage

7.2.1 Deck(s) shall be sloped to effectively drain towards the perimeter areas or deck drains.

7.2.2 Level areas for diving equipment installations are permitted.

7.2.2.1 A minimum slope for decking of 1/8 inch per linear foot (3 mm:305 mm) shall be provided, except for wood decking.

7.2.3 Site drainage shall direct all perimeter deck drainage, general site and roof drainage away from the pool area.

7.2.4 Backwash water that depends on surface drainage for removal must be diverted away from the adjacent deck area.

7.3 Concrete decks

7.3.1 Work for the concrete deck(s) shall be performed in accordance with local construction practices and the recommendations of the latest American Concrete Institute (ACI) standard 302.1R-96, *Guide for concrete floor and slab construction* or the latest revision.

7.3.2 Typical slopes for immediate pool (the area from the water's edge to the point of first drainage) decking are:

– 1/8 inch per 1 foot (3 mm: 305 mm) shall be provided for textured, hand-finished concrete decks;

– 1/4 inch per 1 foot (6 mm: 305 mm) for exposed aggregate concrete decks; and

– 1/2 inch per foot (13 mm: 305 mm) for indoor/outdoor carpeted concrete decks, unless an alternative drainage method is provided.

7.3.3 Expansion or control joints shall be provided to help control cracks due to expansion, contraction, and movement of the slab.

7.4 Wood decks (See appendix G for suggested wooden deck materials)

7.4.1 There is no minimum slope requirement for wood decks. The maximum slope for wood decks shall be 1/4 inch per foot (6 mm: 305 mm).

7.4.2 Gaps shall be required between deck boards consistent with good construction practices with respect to the type of wood used.

7.5 Stone, brick, brick pavers, concrete pavers and tile decks

7.5.1 Installation of these types of decks shall follow local accepted construction practices. Drainage slope requirements shall be in accordance with the drainage requirements of 7.2 through 7.2.4.

7.6 Deck steps

7.6.1 Steps. Step risers for the deck shall be uniform and have a maximum height of 7-1/2 inches (191 mm). The minimum tread depth shall be 10 inches (254 mm).

8 Materials of construction & finishes

8.1 Surfaces. The surfaces within the pool intended to provide footing for bathers shall be designed of slip-resisting materials. The roughness or irregularity of such surfaces shall not cause injury or be an abrasion hazard during normal use.

8.1.1 The interior surfaces of the pool shall be watertight.

8.2 Finishes (paint). All paints and finishes shall be in compliance with the *U.S. Code of Federal Regulations (CFR) 1303.1 et. Seq. (1997)*.

9 Circulation systems components and related equipment

9.1 Compliance. Circulation systems, components, and equipment shall comply with ANSI/NSF 50, 2000 *Circulation system components and related materials for swimming pools, spas/hot tubs* or the latest revision.

9.1.1 Location. A circulation system consisting of pumps, piping, return inlets, suction outlets, filters, and other necessary equipment shall be provided for circulation of water throughout the pool and shall be located as to prevent their being used as a means of access to the pool by young children.

9.1.2 Temperature. In climates subject to freezing temperature, the appurtenances, piping, filter system, pump and motor, and other components shall be designed and constructed to protect from damage due to freezing.

9.1.3 Turnover and water clarity. The equipment shall be sized to provide a turnover of the pool water at least once every twelve (12) hours. The system shall be designed to give the proper turn over rate based on the manufacturer's specified maximum flow rate of the filter, in clean media condition of the filter. Water clarity shall be maintained. (Clarity is a function of proper filtration and maintenance of proper chemical operational parameters.) (For recommendations see appendix A.) When standing at the pool's edge at the deep end, the deepest portion of the pool floor shall be visible.

9.1.4 Installation and accessibility. Circulation system components, which require replacement or servicing, shall be accessible for inspection, repair, or replacement, and shall be installed according to the manufacturer's instructions. Circulation equipment shall be properly installed to prevent damage from settlement and to minimize the potential for the accumulation of debris and moisture.

9.1.5 Pressure test. Circulation system piping, other than that integrally included in the manufacture of the pool, shall be subject to an induced static hydraulic pressure test (sealed system) at 15 pounds per square inch (psi) for 30 minutes. The test shall be performed before the deck is poured and the pressure shall be maintained through the deck pour.

9.2 Water velocity. The water velocity in the pool piping shall not exceed 10 feet (304.8 cm) per second for pressure piping and 8 feet (243.8 cm) per second for suction piping, unless summary calculations are provided to show that greater flow is possible with the pump and piping provided. In copper pipe, the velocity shall not exceed 8 feet (243.8 cm) per second for suction and pressure piping. Pool piping shall be sized to permit the rated flows for filtering and cleaning without exceeding the maximum head of the pump.

9.2.1 Flow rates through suction grates shall not exceed 1.5 feet/sec (457 mm/sec) (See 9.1.4.)

9.3 Piping and fittings. The circulation system piping and fittings shall be considered to be process piping, and shall be of material compatible with the user and able to withstand operating at 1-1/2 times the design working pressure.

9.3.1 The suction piping shall not collapse when there is a complete shutoff of flow on the suction side of the pump.

9.3.2 Equipment shall be designed and fabricated to drain the pool water from the equipment, together with exposed face piping, by removal of drain plugs and manipulating valves, or by other methods. Refer to manufacturer's instructions for specific information on draining the system.

9.3.3 Valves installed in or under any deck(s) shall be provided with an adequately sized access cover and valve pit to facilitate operation and servicing.

9.4 Filters

9.4.1 Filters. Swimming pool filters shall be tested and approved by a nationally recognized testing laboratory to comply with the ANSI/NSF 50 2000 *Circulation system components and related materials for swimming pools, spas/hot tubs* or the latest revision.

9.4.2 Filters installed on swimming pools shall be capable of providing water clarity noted in 9.1.3.

9.4.3 All filter elements, media, and other components which require servicing shall be accessible for inspection, removal and repair, and shall be installed in accordance with the filter manufacturer's instructions.

9.5 Relieving accumulated air pressure. Pressure-type filters shall provide an automatic internal or a manual external means to relieve accumulated air pressure inside the tank. Filter tanks composed of upper and lower tank lids that are held in place by a perimeter clamp shall provide a slow and safe release of air pressure before the clamp disengages the lids.

9.5.1 Any separation tank used in conjunction with any filter tank shall have an air release, a lid or a manual means which provides a slow and safe release of pressure as it is opened as a part of its design.

9.6 Piping. Piping furnished with the filter shall be of suitable material capable of withstanding one and one-half (1-1/2) times the rated maximum working pressure of the pump.

9.7 Filter components. Filter components that require servicing shall be accessible for inspection and repair and shall be installed according to the manufacturer's instruction.

9.8 Pressure or vacuum gauge. A pressure or vacuum gauge or other means of indicating system conditions shall be provided in the circulation system in an easily readable location.

9.9 Time clock/related devices. The circulation system shall be capable of maintaining water clarity and water chemistry requirements. See appendix A. Time clocks and/or other devices are permitted to set the operating period of the circulation system.

9.9.1 When appurtenant devices such as chemical/disinfectant feeders, heaters, and other devices are used and are dependent upon circulation pump flow, they shall be permanently wired into the time clock (when applicable). See manufacturer's specifications.

9.10 Pumps

9.10.1 Swimming pool pumps shall be tested and approved by a nationally recognized testing laboratory to comply with the ANSI/NSF 50 2000 *Circulation system components and related materials for swimming pools, spas/hot tubs* or latest revision. Pumps rated five (5) horsepower or less shall comply with the latest revision of ANSI/UL 1081,1997 *Standard for swimming pool pumps, filters and chlorinators*.

9.10.2 Horsepower rating. Pump horsepower rating and labeling shall not exceed the brake horsepower of the motor.

9.10.3 A pump and motor shall be provided for circulation of the pool water. Performance of all pumps shall meet or exceed the conditions of flow required for filtering and cleaning (if applicable) the filters against the total dynamic head developed by the complete system.

9.10.4 Pressure filter systems with a cleanable strainer or screen shall be provided between the pool and the circulation pump(s) to remove solids, debris, hair and lint.

9.10.5 Access to the pump(s) and motor(s) shall be provided for inspection and service.

9.10.6 Pump(s) and component parts shall be installed to provide access so as not to be hazardous to the operator or maintenance personnel.

9.10.7 Where a mechanical pump seal is provided, components of the seal shall be corrosion resisting and capable of operating under conditions normally encountered in pool operation.

9.10.8 All motors shall have an open drip-proof enclosure (as defined by the latest National Electrical Manufacturers Association (NEMA) standard MG-1998 or the latest revision and be constructed electrically and mechanically to perform satisfactorily and safely under the conditions of load and environment normally encountered in swimming pool installations.

9.10.9 Motor(s) shall be capable of operating the pump under full load with a voltage variation of $\pm 10\%$ from the nameplate rating. If the maximum service factor of the motor is exceeded (at full voltage), the manufacturer shall indicate this on the pump curve.

9.10.10 All motors shall have thermal or current overload protection.

9.10.11 When the pump is below the waterline, valves shall be permanently connected in the suction and discharge lines.

9.11 Surface skimmer systems

9.11.1 A surface skimming system or a perimeter overflow system shall be provided and shall be designed and constructed to skim the pool surface.

9.11.1.1 Surface skimming devices shall be tested by a national recognized testing laboratory and comply with ANSI/NSF 50 2000 *Circulation system components and related materials for swimming pools, splash hot tubs* or the latest revision.

9.11.2 Skimming devices shall be designed and installed so as not to constitute a hazard to the user.

9.11.3 Where automatic surface skimmers are used as the sole overflow system, at least one (1) surface skimmer shall be provided for each 800 square feet (74.32 m²) or fraction thereof of the water surface area. When skimmers are used, they shall be located to optimize skimming action over the surface of the pool.

9.12 Inlets and outlets

9.12.1 Entrapment avoidance. The suction outlet(s) including covers, fittings and hardware shall be designed in accordance with manufacturers specifications to provide protection from body and hair entrapment. (See appendix I, Entrapment avoidance.)

9.12.2 Testing and certification. Suction outlet(s) (other than skimmers) that measure less than 12 inches X 12 inches (144 sq. in.) shall be provided with covers that have been tested by a nationally recognized testing laboratory and comply with ASME/ANSI A112.19.8 M 1987(R 1996) *Suction fittings for use in swimming pools, wading pools, spas, hot tubs, and whirlpool bathtub appliances* or the latest revision.

9.12.3 Outlets per pump. If a single or multiple pump suction system is located below the waterline and any one of the suction outlets becomes blocked, the flow through the remaining suction outlet shall be designed to accommodate 100% of the circulation turnover rate. If located at the waterline, a single suction outlet (such as a skimmer, overflow grate, infinity wall, etc.) shall be permitted, provided it is vented to the atmosphere.

9.12.4 Water velocity. Water velocity through suction grates shall be permitted to exceed 1.5 ft/sec (0.4m/sec) if the grate(s) comply with ASME/ANSI A112.19.8 M 1987 (R 1996) *Suction fittings for use in swimming pools, wading pools, spas, hot tubs and whirlpool bathtub appliances* or the latest revision.

9.12.5 Performance. Inlets and outlet(s) shall be provided and arranged to produce a uniform circulation of water and maintain the distribution of sanitizer residual throughout the pool.

9.12.6 Number of inlets. The number of return inlets (s) shall be based on a minimum of one (1) return inlet per 300 square feet (27.87 m²) of pool surface area, or fraction thereof. Return inlet fittings shall be of sufficient size or quantity to allow a full turnover rate of the circulation system in accordance with the manufacturer's specifications for return inlets.

9.12.7 Inlets and outlets from the circulation system shall be designed so that they do not constitute a hazard to the user.

9.12.8 Important safety consideration. The pool shall not be operated if any outlet grate is missing, broken, or secured in such a way that it is removable without the use of tools, unless removable still provides the equivalent means of protection.

9.12.9 If a suction outlet system, such as a filtration system booster system, automatic cleaning system, solar system, etc., has a single suction outlet, or multiple suction outlets which are capable of being isolated by valves, each suction outlet shall protect against bather entrapment by any of the following:

- an anti-entrapment cover that meets the ASME/ANSI A112.19.8M-1987 (R1996) *Suction fittings for use in swimming pools and wading pools, spas, hot tubs and whirlpool bathtub appliances* or the latest revision;
- a 12 inch X 12 inch (305 mm X 305 mm) grate or larger, which allows a maximum flow rate not to exceed 1.5 feet per second (fps) (457 per second); or
- by alternate designs or means that produce equivalent protection.

NOTE – See “Guidelines for Addressing Entrapment Hazards with Pools and Spas”, U.S. Consumer Product Safety Commission, Publication # 363-009801, (301) 504-0400 or www.cpsc.gov/cpsc/pub/pubs/363.pdf

9.12.10 Where provided, the vacuum cleaner fitting(s) shall be located in an accessible position(s) at least 6 inches (152 mm) and no greater than 18 inches (457 mm) below the minimum operating water level or as an attachment to the skimmer(s).

9.13 Heaters

9.13.1 Important safety consideration. Fossil Fuel like swimming pool heaters, produce poisonous carbon monoxide gas as a by-product of combustion. Proper venting of exhaust gases and the correct sizing of gas meters, gas supply piping, make-up air intakes, etc. are critical installation considerations in preventing potential carbon monoxide gas poisoning or loss of life.

9.13.2 This section pertains to appliances using either fossil fuels such as natural gas, propane (LPG), #2 fuel oil, or electric heating equipment for heating pool water.

9.13.3 Heaters shall be tested and comply with the requirements of ANSI-Z21.56-1991 *Gas fired pool heaters* or latest revision and/or UL 1261 2001 *Electrical water heaters for pool and tubs* or the latest revision. Heat pumps shall comply with UL 1995 *Standard for heating and cooling equipment* 1999 or latest revision.

9.13.4 Owner/operator shall routinely check the in-pool water to ensure that the temperature does not exceed 104 °F (40 °C). If adjustments are necessary, those adjustments shall be performed in accordance with manufacturer's instructions or by a qualified technician.

9.13.5 Sizing. For efficient and economical operation, it is important that the heater be properly sized. Determine the proper size heater by first determining the area of the swimming pool in square feet. Then select from the manufacturer's charts the heater that is properly sized for that particular pool.

9.13.6 Installation. The heater(s) shall be installed in accordance with all federal, state, and local codes as well as the manufacturer's recommendations.

9.13.7 Support. Heaters shall be installed on a surface with sufficient structural strength to support the heater when it is full of water and operating. The heater shall be level after plumbing, gas and/or electrical connections are completed.

9.13.8 Combustible surfaces. If the heater requires a non-combustible surface as required by the manufacturer, it shall be placed on a cement or other accepted surface per ANSI Z21.56 1991, or the latest revision, or federal, state, and local codes.

9.13.9 Clearances. When installing a heater, adequate clearances shall be maintained on all sides and over the top of the unit. Consult manufacturer's instructions for proper clearances.

9.13.10 Ventilation. The heater shall have adequate ventilation in order to ensure proper operation.

9.13.11 Make-up air. When installing a fossil fuel heater indoors, proper openings to the room are a necessity. The heater shall be installed in accordance with federal, state, or local codes and the manufacturer's specifications.

9.13.12 Important safety consideration. Some manufacturers recommend that the heater be turned off prior to stopping the water flow. Mechanisms such as a "fireman's switch" adapted to the time clock will turn the heater off long enough for it to cool down before the time clock turns the pump off.

NOTE – The "fireman's switch" does not protect against a manual override or a system shut down in the event of power failure.

9.13.13 Important safety consideration. Heaters shall be so located as to prevent their being used as a means of access to the pool by young children.

9.13.14 Heating energy source

9.13.14.1 Natural gas energy supply. The heater gas supply piping shall comply with manufacturer's specifications and ANSI/NFPA 54-1992, or the latest revision.

9.13.14.1.1 Important safety consideration. A gas cock shall be installed, properly sized and readily accessible outside the jacket, to stop the flow of natural gas at the heater for service or emergency shutdown.

9.13.14.2 Propane energy supply. Whenever a propane (LPG) appliance is installed, special attention shall be given to ensure that the storage tank, supply piping, and regulator shall be

adequately sized to ensure operating fuel pressures as specified by the appliance manufacturer. Consult the fuel supply company and ensure that the system is installed in accordance with ANSI Z223.1/NFPA 58 2000 *National fuel gas code* or the latest revision.

9.13.14.2.1 Important safety consideration. Propane gas is heavier than air and therefore can create an extreme hazard of explosion or suffocation if the heater is installed in a pit or enclosed area. NFPA 58- 2000 or the latest revision contains provisions for installing valves and other controls in pits and similar areas.

9.13.14.2.2 Important safety consideration. A gas cock shall be installed, properly sized and readily accessible outside the jacket, to stop the flow of propane (LPG) at the heater for service or emergency shutdown.

9.13.14.3 Electrical energy supply. Electric heating appliances shall be installed in accordance with the National Electrical Code 1999 (NEC®) or the latest revision and any federal, state, or local codes.

9.13.14.3.1 Important safety consideration. Grounding and Bonding. The requirements for grounding and bonding are particularly important and shall be adhered to. Heater circulation system water flow through the heater, and any plumbing installations shall be done in compliance with manufacturer's specifications and local codes.

10 Water supply

10.1 Treatment. The water supply shall be of a quality that will allow adjustment to meet the water quality standards in appendix A.

10.2 Backflow. No direct mechanical connection shall be made between the potable water supply and the pool or its appurtenances, unless it is protected against back pressure and back-siphonage in a manner approved by the state or local authority or through an air gap meeting the latest American National Standards Institute Standard A112.1.2, *Air Gaps in Plumbing Systems* or other equivalent means approved by the state or local authority.

10.3 Fill spout. A fill spout, if used, shall be located under a diving board, adjacent to a ladder, or

otherwise properly shielded so as not to create a hazard. Its open end shall have no sharp edges and shall not protrude more than 2 inches (51 mm) beyond the edge of the pool.

10.4 Hose use. If a hose is used to fill the pool, the end of the hose shall not be permitted to hang inside the pool basin unless the hose bibb is protected with a backflow prevention device approved by the appropriate state or local authority.

11 Waste water disposal

11.1 Backwash water. Backwash water is permitted to be discharged into a sanitary sewer through an approved air gap, or into an approved subsurface disposal system or by other means approved by state or local authority.

12 Chemical feeders and ozone generators

12.1 Compliance. When chemical feeders are used to add sanitizing agent to pool or spa water, the chemical feeders shall be capable of introducing a sufficient quantity of an EPA-registered sanitizing agent to maintain the appropriate residual concentrations. (For recommendations, see appendix A.)

12.1.1 Electrically operated chemical feeders and ozone generators shall be tested and approved by a national recognized testing laboratory.

12.2 Chemical feeders. Manufacturer's specifications shall be used when installing and maintaining chemical feeders.

12.2.1 Chemical feed systems shall be installed so they cannot operate unless there is return flow to properly disburse the chemical throughout the pool as designed. If the device has an independent timer, the filter and chemical feed pump timers shall be interlocked.

12.3 Ozone-generating equipment. If used, the installation of ozone-generating equipment shall be limited to low ozone output generating equipment. The installation and use of ozone generating equipment shall conform to manufacturer's specifications. For recommendations, see appendix A and appendix B.

12.3.1 Ozone-generating equipment shall be used in conjunction with an EPA-registered sanitizer and other chemical treatments to meet the chemical operating parameters. For recommendations, see appendix A and appendix B.

12.3.2 Manufacturer's specifications shall be used to determine where and how ozone shall be injected.

13 Electrical requirements

13.1 Electrical components. All electrical components installed in and/or adjacent to an inground residential swimming pool shall comply with the requirements of the National Electrical Code 2002, Article 680, or the latest revision and any state or local code.

14 Instructions for the circulation system, pressure filters, and separation tanks

14.1 Written operation and maintenance instructions. Written operation and maintenance instructions shall be provided to the homeowner for the circulation system.

14.2 Labeling for circulation system, pressure filters and separation tanks. Pressure filters and separation tanks shall have operation instructions permanently installed on the filter or separation tank and shall include a precautionary statement not to start-up the system after maintenance without first opening the air release and proper re-assembly of the filter and/or separation tank. The statement shall be visible and noticeable within the area of the air release.

15 Safety features

15.1 Handholds. Handholds shall be provided around pool edge in any area where the water depth exceeds 4 feet (121.9 cm)

15.1.1 Handhold shall be accessible within 4 feet (121.9 cm) not to exceed 8 feet (243.8 cm) at any two points along the inside of the pool perimeter where the water depth exceeds 4 feet (121.9 cm). Handholds may include but not limited to any one or combination of the following items listed in 15.1.1.1 through 15.1.1.5.

15.1.1.1 Deck, coping and ledges located not more than 12 inches (305 mm) above the waterline.

15.1.1.2 Rocks, masonry joints and tooled joints that allow a handhold within 12 inches (305 mm) of the waterline

15.1.1.3 Ladders, stairs and underwater seats or ledges

15.1.1.4 Secured rope or rail placed within 12 inches (305 mm) above the waterline.

15.1.1.5 Any finish or design that will afford a single handhold within 12 inches of the water line.

15.2 Rope and float. In pools where the point of first slope change (See figure 2) occurs in water depths less than 4 feet 6 inches (137.2 cm), a rope and float assembly shall be installed across the width of the pool generally parallel to, and at a minimum of 1 foot (305 mm) and a maximum of 2 feet (610 mm) on the shallow side of the change in floor slope.

15.2.1 The rope anchor devices shall be permanently attached to the pool wall, coping or deck in a manner which provides for their reinstallation should they be required to be removed for maintenance or repair.

15.2.2 Replacement vinyl liners shall be supplied with notification of the responsibility to reinstall the replacement of rope anchor devices and the rope and float assembly following the installation of the liner.

15.3 Pool lighting. The use of artificial pool lighting is at the discretion of the pool owner. Lighting, when installed, shall be in accordance with applicable electrical codes in consultation with a qualified electrical professional.

NOTE – For consumer safety information, warnings and education programs, see appendices D, E, and F.

15.4 Pool alarms. Pool alarms, if used shall be in compliance with ASTM F-15.49 on *Pool alarms for swimming pools, spas and hot tubs*.

15.5 Safety covers. When an automatic power/manual safety cover for swimming pool is used as a barrier it shall be in compliance with ASTM 1346-1991 *Emergency standard performance specification for safety covers and labeling requirements*.

15.6 Model child protection/barrier code. If a model child protection/barrier code is used, it shall be in compliance with ANSI/NSPI-8 1996 *Model barrier code* or the latest revision.

(This appendix is not part of the American National Standard ANSI/NSPI-5 2003, but is included for information only)

Appendix A

CHEMICAL OPERATIONAL PARAMETERS

These guidelines set forth the suggested operational parameters for the proper chemical treatment and maintenance of pools and spas. Applicable health department guidelines and label directions supersede these parameters.

Chemical treatment alone will not produce sanitary pool and spa water. A filtration system in proper operational condition is also required to attain clear and sanitary water.

NSPI Standard	Minimum	Ideal	Maximum	Comments
A. Sanitizer Levels				
1. Free Chlorine, ppm				
NSPI-1 NSPI-4 NSPI-5 NSPI-9	1.0	2.0 – 4.0	10.0	Hot water/heavy use may require operation at or near maximum levels. <ul style="list-style-type: none"> Test kits are available for a variety of free chlorine ranges. Free chlorine test color (DPD) may be completely or partially bleached by chlorine levels greater than 5 ppm to give a false low reading. For appropriate test kit, consult pool professional or test kit manufacturer. Regular oxidation is recommended and remedial practices may be necessary.
NSPI-2 NSPI-3 NSPI-6 NSPI-10 NSPI-11	2.0	3.0 – 5.0	10.0	Public Spas and Swimspas: <ul style="list-style-type: none"> During hours of operation, test the water hourly, record results, maintain the ideal range continually and shock treat at the end of the daily use period. Residential Spas and Swimspas: <ul style="list-style-type: none"> Maintain these levels continually during hours of operation. Test water before use. During extended use test water hourly. Shock treat water after use.

Key

NSPI-1 Public Inground Pools

NSPI-2 Public Spas

NSPI-3 Residential Permanent Spas

NSPI-4 Residential Aboveground/Onground Pools

NSPI-5 Residential Inground Swimming Pools

NSPI-6 Residential Portable Spas

NSPI-9 Aquatic Recreation Facilities

NSPI-10 Public Swimspas

NSPI-11 Residential Swimspas

NSPI Standard	Minimum	Ideal	Maximum	Comments
2. Combined Chlorine, ppm				
NSPI-1 NSPI-3 NSPI-4 NSPI-5 NSPI-6 NSPI-9 NSPI-11	0	0	0.2	High combined chlorine results in reduced sanitizer efficacy. Take remedial action to reduce combined chlorine. Other signs of combined chlorine: Sharp chlorine-like chlorinous odor and eye irritation (e.g., mucous membrane).
NSPI-2 NSPI-10	0	0	0.5	
3. Total Bromine, ppm				
All facilities	2.0	4.0 – 6.0	10.0	<p>All facilities: Hot water/heavy use may require operation at or near maximum levels. Regular oxidation is recommended.</p> <ul style="list-style-type: none"> • During hours of operation, test the water regularly, record results, and maintain the ideal range continually. <p>NSPI-2, 3, 6, 10 and 11: Test water before use. During extended use test water hourly. Shock treat water after use.</p>
4. PHMB (polyhexamethylene biguanide), ppm as product				
All facilities	30.0	30.0 - 50.0	50.0	<p>Certain classes of pool chemicals or treatment processes are incompatible with PHMB sanitizer. The pool or spa owner should consult with the supplier of PHMB if there is any question about compatibility of an auxiliary chemical or process. These include, but are not limited to:</p> <ul style="list-style-type: none"> • Chlorine/bromine sanitizers • Copper-based algicides • Monopersulfate (peroxymonosulfate) oxidizers • Phosphate-based chelators and detergents • Electrolytic chlorinators • Copper/Silver ionizers <p>When used with ozone, follow manufacturer's directions.</p> <p>Consult pool professional or test kit manufacturer for appropriate test kit.</p> <p>Regular oxidation is recommended.</p>

NSPI Standard	Minimum	Ideal	Maximum	Comments
---------------	---------	-------	---------	----------

B. Chemical Values				
1. pH				
All facilities	7.2	7.4 - 7.6	7.8	<p>Operating pH at the minimum level requires alkalinity and hardness to be operated at a higher level. At maximum pH, calcium hardness and total alkalinity may have to be adjusted downward to maintain proper water balance. (See "saturation index" in NSPI Glossary.)</p> <p>If pH is too high:</p> <ul style="list-style-type: none"> • Low chlorine efficacy • Scale formation • Cloudy water • Eye discomfort <p>If pH is too low:</p> <ul style="list-style-type: none"> • Rapid dissipation of sanitizer • Plaster and concrete etching • Eye discomfort • Corrosion of metals • Vinyl liner wrinkling
2. Total Alkalinity (Buffering) ppm as CaCO₃				
All facilities	60	<p><u>80 – 100</u> For calcium hypochlorite, lithium hypochlorite and sodium hypochlorite</p> <p><u>100 – 120</u> For sodium dichlor, trichlor, chlorine gas and bromine compounds</p>	180	<p>If total alkalinity is too low:</p> <ul style="list-style-type: none"> • pH bounce • Corrosion tendency <p>If total alkalinity is too high:</p> <ul style="list-style-type: none"> • Cloudy water • Increased scaling potential • pH tends to be too high <p>These values are based on the carbonate alkalinity.</p>

NSPI Standard	Minimum	Ideal	Maximum	Comments
---------------	---------	-------	---------	----------

3. Total Dissolved Solids (TDS)				
All facilities	NA	NA	1500 ppm greater than TDS at pool or spa start-up.* *Start-up TDS includes source water TDS and any other inorganic salt added at start-up.	An increase in TDS may indicate an accumulation of impurities during the course of operation. Excessively high TDS may lead to hazy water and scale formation, corrosion of fixtures, and may inhibit sanitation. TDS can be reduced by partial draining and addition of fresh water. For Spas: TDS should be periodically reduced by draining. (See Section K, Water Replacement Procedure)
4. Calcium Hardness, ppm, as CaCO₃				
NSPI-1 NSPI-4 NSPI-5 NSPI-9	150	200 – 400	1000	Lower alkalinity and lower pH must be used with hardness over 500 ppm.
NSPI-2 NSPI-3 NSPI-6 NSPI-10 NSPI-11	100	150 – 250	800	
5. Heavy Metals				
All facilities	NA	NA		If excessive heavy metals (such as copper, iron and manganese) are present: <ul style="list-style-type: none"> • Staining may occur • Water may discolor • Filter cycle may decrease and require more frequent back-washing • May indicate pH too low, corrosion, etc.
C. Biological Values (Maintaining adequate sanitizer levels is critical to prevent growth of algae and bacteria)				
1. Visible Algae				
All facilities	None visible	None visible	None visible	If algae growth is observed recommendations may include but are not limited to: <ul style="list-style-type: none"> • Superchlorinate the pool or spa. • Use an EPA-registered algicide according to label directions. • Supplement with brushing and vacuuming. Some algicides may cause foaming.

NSPI Standard	Minimum	Ideal	Maximum	Comments
---------------	---------	-------	---------	----------

2. Bacteria				
All facilities	None	None	Refer to Local Code	Public Facilities: If bacteria count exceeds local health department requirements, superchlorinate and follow proper maintenance procedures. Residential Facilities: Maintain proper sanitizer level and pH to control bacteria.
D. Stabilizer				
1. Cyanuric Acid, ppm				
All facilities	10	30 – 50	150	If stabilizer is too low: Chlorine residual is rapidly destroyed by sunlight. If stabilizer is too high: May reduce chlorine efficacy to algae. NOTE: Since less sunlight is found in indoor pools, the benefit of stabilizers is less important. Cyanuric acid does not stabilize bromine sanitizers.
E. Oxidation				
(Regular oxidation is recommended for pools and spas with normal bather load as a preventive treatment)				
1. Chlorine Products				
NSPI-1 NSPI-4 NSPI-5 NSPI-9	As needed	Weekly	Determined by bather load, weather conditions, etc.	Some high-use pools may require oxidation several times per week. Regular oxidation is recommended to prevent the build-up of contaminants, maximize sanitizer efficiency, minimize combined chlorine and improve water clarity. Chlorine should not be used to oxidize a pool or spa sanitized by PHMB.
NSPI-2 NSPI-3 NSPI-6 NSPI-10 NSPI-11		At the end of each day facility is used.		

NSPI Standard	Minimum	Ideal	Maximum	Comments
2. Potassium Monopersulfate				
NSPI-1 NSPI-4 NSPI-5 NSPI-9	As needed	Weekly	Determined by bather load, weather conditions, etc.	Some high-use pools may require oxidation several times per week. Regular oxidation is recommended to prevent the build-up of contaminants, maximize sanitizer efficiency, minimize combined chlorine and improve water clarity. Potassium monopersulfate will measure as combined available chlorine in DPD test system.
NSPI-2 NSPI-3 NSPI-6 NSPI-10 NSPI-11		At the end of each day facility is used		Refer to test kit manufacturer's directions. Potassium monopersulfate should not be used to oxidize a pool or spa sanitized by PHMB.
3. Hydrogen Peroxide				
All facilities	Monthly	As needed	Determined by bather load, weather conditions, etc.	Hydrogen peroxide should be used only with PHMB sanitizers. Hydrogen peroxide should not be used as an oxidizer for pools and spas sanitized by chlorine or bromine.
4. Chlorine Dioxide				
NSPI-1 NSPI-4 NSPI-5	As needed	3-4 weeks	Determined by occurrence of biofilms in skimmer or plumbing or by abrupt disappearance of hydrogen peroxide.	Chlorine dioxide may be used to kill bacterial biofilm or fungal biofilm growing in the plumbing in PHMB-treated pools. Follow EPA label directions.

NSPI Standard	Minimum	Ideal	Maximum	Comments
---------------	---------	-------	---------	----------

F. Remedial Practices

1. Superchlorination

All facilities				<p>Follow label directions. Use a registered chlorine sanitizer.</p> <p>Do not re-enter pool or spa until water meets the prescribed values in Section A.</p> <p>Do not superchlorinate a pool or spa treated by PHMB.</p> <p>Some symptoms that may indicate a need for superchlorination are:</p> <ul style="list-style-type: none"> • Cloudy water • Slime formation • Musty odors • Difficulty in maintaining a sanitizer residual • Algae and/or high bacteria counts
----------------	--	--	--	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

2. Superchlorination to establish breakpoint, dosage in ppm

NSPI-1 NSPI-2 NSPI-4 NSPI-5 NSPI-9 NSPI-10 NSPI-11	At least 10 times combined chlorine			<p>High dosage may be required to satisfy chlorine demand. If combined chlorine persists, water replacement should be considered.</p> <p>If a pool or spa is treated with PHMB, do not superchlorinate to establish breakpoint</p>
----------------------------------------------------------------------	-------------------------------------	--	--	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

3. Shock Treatment

All facilities				<p>Some conditions that may indicate a need for shock treatment are:</p> <ul style="list-style-type: none"> • Cloudy water • Difficulty in maintaining a sanitizer residual • Periods after heavy bather use • Adverse weather. <p>Non-chlorine shocks are not sanitizers. They are effective in oxidizing organic contaminants. If the purpose of shock treatment is to treat bacteria or visible algae, an EPA-registered product for that use should be used; follow label directions.</p> <p>Spas should be shock treated on a daily basis when used.</p>
----------------	--	--	--	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

NSPI Standard	Minimum	Ideal	Maximum	Comments
4. Chlorine Dioxide				
		As needed	Determined by occurrence of biofilms in skimmer or plumbing or by abrupt disappearance of hydrogen peroxide.	White or pink-colored biofilms can infest the plumbing of PHMB pools and eventually spread onto pool surfaces. On other occasions, the biofilms will be hidden from view, but will cause a rapid decrease in hydrogen peroxide. Chlorine dioxide kills the peroxide-degrading organisms but should only be used to treat the plumbing and not the pool itself. Follow label directions
5. Clarification/Flocculation				
All facilities		As needed		Follow manufacturer's directions.
6. Algicides				
All facilities		As needed		Use U.S. EPA-registered products. Follow manufacturer's directions. Use of some algicides may cause foaming.
7. Foam Control				
All facilities		As needed		Foam may harbor persistent micro-organisms. If foaming is not adequately controlled, consider daily shock treatment, water replacement, or an appropriate anti-foam agent. Follow manufacturer's directions.
G. Temperature				
All facilities	Personal Preference	For pools: 78° – 82° F For Spas: Personal preference For swimspas 78° – 82° F	104° F	If temperature is too low: <ul style="list-style-type: none"> • Bather discomfort If temperature is too high: <ul style="list-style-type: none"> • Excessive fuel requirement • Increased evaporation • Bather discomfort • Increased scaling potential • Increased use of sanitizers Overexposure to hot water may cause nausea, dizziness and fainting.

NSPI Standard	Minimum	Ideal	Maximum	Comments
H. Water Clarity				
All facilities	The deepest part of the pool or spa and/or main drain shall be visible and sharply defined.			If water is turbid: <ul style="list-style-type: none"> • Sanitizer level may be low • Filtration/circulation system may require maintenance • Improper chemical balance (Section B) • Consult remedial practices (Section F)
I. Ozone				
All facilities Concentration in air above pool or spa water, ppm			0.1 over 8- hour time weighted average. See OSHA Standard	<ul style="list-style-type: none"> • Serves as oxidizer of water contaminants. Must be used with an EPA-registered sanitizer. • Indoor installations should have adequate ventilation.
J. Oxidation Reduction Potential (ORP)				
NSPI-1 NSPI-2 NSPI-9 NSPI-10	650 MV			<p>When chlorine or bromine is used as the primary sanitizer, ORP is commonly used to control sanitizer feed. The use of ORP controllers does not eliminate or supersede the need for testing the sanitizer level with standard test kits. For PHMB-treated pools, levels for ORP values are not applicable.</p> <p>ORP reading may be affected by a number of factors including, but not limited to, pH, probe condition, cyanuric acid, sanitizer type, and supplemental oxidizers.</p> <p>Follow manufacturer's recommendations.</p>
K. Water Replacement				
NSPI-2 NSPI-3 NSPI-6 NSPI-10	Water in spas/hot tubs that have high bather use requires partial or complete replacement of water periodically.	Water in spas/hot tubs that have high bather use requires complete replacement of water per the replacement guidelines below.		Water replacement is necessary to dilute dissolved solids, to maintain water clarity, and to do necessary routine maintenance.

This procedure provides guidelines on how to determine the frequency for which spa or hot tub water should be replaced.

Test the TDS (Total Dissolved Solids) and calculate the WRI (Water Replacement Interval) to determine when your spa needs to be drained. Drain the spa completely, clean it thoroughly, and refill it with source water when either of the following conditions is met:

1. The Total Dissolved Solids (TDS) in the spa water exceeds the source-water TDS by 1,500 ppm or more.

Or

2. The Water Replacement Interval (WRI) is less than or equal to the number of days since the last time the water was drained. WRI is calculated as shown in the formula and examples below.

$$\text{WRI, days} = (1/3) (\text{Spa Volume, U.S. Gallons}) / (\text{No. Bathers/Day})$$

Example 1

The TDS of the original source water was measured and recorded to be 800 ppm. The TDS of the spa water is now reading 2,500 ppm. The difference is greater than 1,500 ppm (2,500 ppm - 800 ppm = 1,700 ppm) and therefore the spa should be drained immediately.

Example 2

Consider a 600-gallon spa that was last drained and refilled Sunday evening. Each day the operator estimates the number of bathers that used the spa that day and calculates the WRI. This calculated value is then rounded off to yield a whole number. Referring to the table below, the operator would have calculated based on 85 bathers on Monday:

$$\begin{aligned} \text{Water Replacement Interval, days} &= (1/3) \times 600 / 85 = \\ &200 / 85 = \\ &2.4 \text{ or about } 2 \text{ days} \end{aligned}$$

The spa water was replaced Tuesday evening because the Monday bather load (85) dictated that a two-day Water Replacement Interval was required.

	Mon	Tue	Wed	Thur	Fri	Sat	Sun
Bathers/day	85	2	19	20	105	100	<50
Calculated days to replace water	2.4	100	10.5	10	1.9	2	>4
Days to replace water (WRI)	2	100	11	10	2	2	>4
Drain the Spa?	no	Yes	No	no	yes	no	yes

Example 3

Referring to the table above, the WRI values for Wednesday and Thursday did not indicate a need to drain the spa. The water was replaced on Friday evening because the Friday bather load (105) dictated a two-day Water Replacement Interval (Friday is already three days after Tuesday).

Example 4

The water was replaced again Sunday evening because of the Saturday bather load (100). The bather load on Sunday was irrelevant because the spa would be drained regardless due to the high bather load on Saturday.

(This appendix is not part of the American National Standard ANSI/NSPI-5 2003, but is included for information only)

APPENDIX B

USE OF OZONE

1. GENERAL

Ozone (O_3) is a high energy, allotropic (i.e., containing only atoms of a single element) form of the element oxygen. Oxygen exists normally as a diatomic molecule, O_2 . Ozone, like oxygen, is a gas and is partially soluble in water, being approximately thirteen (13) times more soluble than oxygen itself at standard temperature and pressure. Ozone has a distinct odor and is readily identified by most humans even in very low (0.02 ppm) concentrations.¹ The smell of ozone is often noted in the air after an electrical storm because some ozone is generated by lightning. Ozone molecules in air or in water decompose to oxygen and energetic free radicals, which also are formed when ozone reacts with contaminants. Since ozone decomposes, it cannot be packaged, but it must be generated and used on site.

Although its decomposition precludes the possibility of large amounts of ozone being present, like all chemicals capable of oxidation, it is a hazardous substance, and ozone-generating equipment can produce dangerous levels of the gas. The United States Occupational Safety and Health Administration (OSHA) has standards for exposure to ozone. -- Research indicates that there are no irreversible effects caused by accidental exposure to low, non-lethal concentration of ozone. As a general principle, however, breathing even low levels of ozone should be avoided at all times. Further information can be obtained from

OSHA or from the International Ozone Association, Pan American Group, 31 Strawberry Hill Avenue, Stamford, CT 06902; (203) 348-3542-1 Fax: (203) 967-4845.

¹ As reported in "OZONE AND OTHER PHOTOCHEMICAL OXIDANTS, and published by The National Academy of Sciences, Washington, D.C., 1977, Henschler et al. reported that the characteristic pungent odor of ozone was detected instantaneously at low concentrations (less than 0.02 ppm), depending on individual sensory perception acuity. At higher concentrations, the odor was perceived as stronger and persisted for an average of thirteen (13) minutes."

Ref. Henschler, D., A. Stier, H. Beck, and W. Neumann. Geruchsschwellen einiger wichtiger Reizgase (Schwefeldioxyd, Ozon, Stickstoffdioxyd) und Erscheinungen bei der Einwirkung Geringer Konzentrationen auf den Menschen. Arch Gewerbepath. Gcwerbehyg. 17:547-570, 1960.

² The Permissible Exposure Limit to ozone, as specified by the OSHA, is 0.1 ppm., time weighted average over 8-hour day, with Short Term (up to 15 minutes) Exposure Limit of 0.3 ppm. Ref Federal Register 54(12): 2519 (Jan. 19, 1989).

(This appendix is not part of the American National Standard ANSI/NSPI-5 2003, but is included for information only)

Appendix C

USE OF ELEMENTAL CHLORINE

1. GENERAL

Chlorine is one of the chemical elements. The gas has a characteristic odor and greenish yellow color and is about two and one-half (2-1/2) times as heavy as air. Chlorine is shipped in Department of Transportation specification steel containers; standard sizes contain either 100 or 150 pounds of chlorine. In the cylinder the chlorine has both a liquid and a gas phase. All cylinders are equipped with the Chlorine Institute standard chlorine cylinder valve.

Chlorine is a "hazardous material" subject to Department of Transportation requirements. When used for pool disinfection, chlorine is considered a pesticide and as such is subject to pertinent regulations of the U.S. Environmental Protection Agency, as well as various state agriculture and environmental regulations.

Users of chlorine must be trained as to the proper procedures for handling chlorine and as to appropriate emergency procedures. Detailed information is available from chlorine suppliers and the Chlorine Institute, 2001 L Street, N.W., Washington, D.C. 20036.

2. EQUIPMENT AND INSTALLATION

- 2.1 Chlorination equipment should be located so that equipment failure or malfunction will have minimum effect on evacuation of pool patrons in an emergency.
- 2.2 Elemental chlorine feeders (chlorinators) should be activated by a booster pump using recirculated water supplied via the recirculation system. The booster pump should be interlocked to the filter pump to prevent feeding of chlorine when the recirculation pump is not running.
- 2.3 The chlorinator, cylinders of chlorine and associated equipment should be housed in a reasonably gas-tight and corrosion-resisting housing having a floor area adequate for the purpose. Cylinders should always be stored in an upright position and properly secured.

- 2.4 All enclosures should be located at or above ground level. The enclosure should be provided with: ducts from the bottom of the enclosure to the atmosphere in an unrestricted area, a motor-driven exhaust fan capable of producing at least one air change per minute, and louvers of good design near the top of the enclosure for admitting fresh air. Warning signs should be posted on the doors. It is recommended that the doors to the chlorine room should open away from the pool.
- 2.5 Electrical switches for the control of artificial lighting and ventilation should be on the outside of the enclosure adjacent to the door.
- 2.6 Contents of a chlorine cylinder can be determined only by weight; therefore, facilities should include a scale suitable for weighing the cylinders. Changing cylinder(s) should be accomplished only after weighing proves contents of cylinder to be exhausted. Care must be taken to prevent water suck-back into the cylinder when empty by closing the cylinder valve.
- 2.7 Connections from the cylinders to the system depend on the type of chlorinator to be used and should comply with the chlorinator manufacturer's recommendation.
- 2.8 It is recommended that an automatic chlorine leak detector and alarm be installed in the chlorinator room.
- 2.9 Respirators approved by the National Institute for Occupational Safety and Health (NIOSH) should be provided for protection against chlorine. It is recommended that at least one approved self-contained breathing apparatus be provided. Respiratory equipment should be mounted outside the chlorine enclosure. Occupational Safety and Health Administration (OSHA) regulations require training and maintenance program for respirators.
- 2.10 Containers may be stored indoors or outdoors. Full and empty cylinders should be segregated and appropriately tagged. Storage conditions should: (a) minimize external corrosion, (b) be

clean and free of trash, (c) not be near an elevator or ventilation system, (d) be away from elevated temperatures or heat sources.

3. OPERATIONAL PROCEDURES

- 3.1 A specific person should be made responsible for chlorination operations and should be trained in the performance of routine operations including emergency procedures and leak control procedures.

Chlorine cylinders must be handled with care. Valve protection caps and valve outlet caps should be in place at all times except when the cylinder is connected for use. Cylinders must not be dropped and should be protected from falling objects. Cylinders should be used on a first-in, first-out basis. New, approved washers should be used each time a cylinder is connected.

- 3.3 It is recommended that a safety wall chart be posted in or near the chlorine enclosure and a second chart in the pool office near the telephone. Such charts are available from many suppliers and from the Chlorine Institute, 2001 L Street, N.W., Washington, D.C. 20036. The telephone number of the chlorine supplier should be shown on this chart.
- 3.4 Although chlorine suppliers make every effort to furnish chlorine in properly conditioned cylinders, chlorine gas leaks may still occur. Pool personnel should be informed about leak control procedures and consideration should be given to providing a Chlorine Institute Emergency Kit A..
- 3.5 Chlorine suppliers are equipped with a Chlorine Institute Emergency Kit A, which contains devices for capping leaks at cylinder valves and some leaks which occur in the cylinder wall. Further information on these kits and training slides demonstrating their use are available from the Chlorine Institute.
- 3.6 As soon as a container is empty, the valve should be closed and the lines disconnected. The outlet cap should be applied promptly and the valve protection hood attached. The open end of the disconnected line should be plugged or capped promptly to keep atmospheric moisture out of the system.

- 3.7 To find a chlorine gas leak, use a plastic bottle containing 26E BE Ammonia capable of releasing only vapors when squeezed. A white cloud will result if there is any chlorine leakage. Never use water on a chlorine leak.

For additional information, contact The Chlorine Institute, Inc, 2001 L Street, N.W., Washington, D.C. 20036, (202) 775-2790, and request a copy of the "Chlorine Manual" and the wall chart entitled "Handling Chlorine Cylinders & Ton Containers."

(This appendix is not part of the American National Standard ANSI/NSPI-5 2003, but is included for information only)

Appendix D

RECOMMENDATIONS TO WARN AGAINST SHALLOW WATER DIVING

Recommended methods to warn against shallow water diving may include but not be limited to:

A. Safety Signs

The use of warning signs, as a device to warn against shallow water diving is still an open question before the Human Factors Society and others as to whether or not signage is an effective means that will modify human behavior to prevent accidents.

If warning signs are chosen as a means to warn against shallow water diving, the signage should be in compliance with ANSI Z535 1998 Series of standards for safety signs and colors or the latest revision.



This sign is based upon a study entitled "*Design of Swimming Pool Warnings*". This sign has been reviewed by the staff of the U.S. Consumer Product Safety Commission and supports its use.

B. Additional Signage Use

The ANSI-Z535 1998 Series of Standards reflects the consensus of various experts on warning sign appearance and content. Signage, which is consistent with the ANSI-Z535 Standards, is permitted to be added to components, equipment, facilities or installations, to provide additional information.

Manufacturers are permitted to either affix additional signage to their products or packaging, or to supply the signage with the product to be affixed at the time of installation.

(This appendix is not part of the American National Standard ANSI/NSPI-5 2003, but is included for information only)

Appendix E

SAFETY CONSIDERATIONS AND WARNING RECOMMENDATIONS

The National Spa and Pool Institute (NSPI) suggests that the builders/installers of swimming pools advise the initial owner/operator of a Residential Pool of the following:

Warning Recommendations: The NSPI suggests the builder/installer advise the pool owner of the risk of drowning, especially for children under the age of five, and the risk of diving into shallow water in one or more of the following ways: **verbally, through publications or signage**. The following are suggested recommendations:

Lifesaving Equipment: The NSPI suggests the builder/installer advise the pool owner/operator that basic lifesaving equipment including one or more of the following items should be on hand at all times:

A light, strong, rigid pole not less than twelve feet (12') long.

A minimum one-fourth inch (6 mm) diameter throwing rope as long as one and one-half (1 1/2) times the maximum width of the pool or fifty feet (15.2 meters), whichever is less, which has been firmly attached to a Coast Guard approved ring buoy having an outside diameter of approximately fifteen inches (38.1 cm), or some other similar flotation device.

Safety Considerations for Pool Owner/Operators: For additional safety information see www.nspi.org.

This standard **does not** replace good judgment and personal responsibility. In permitting use of the pool by others, owners/operators must consider the skill, attitude, training and experience of the expected user. It is the pool owner/operator's responsibility to learn, understand and enforce these basic safety principles and rules:

- Encourage children to learn how to swim.
- Never allow diving, jumping or sliding into shallow water.

- Adult supervision is always required when children five (5) years or younger are present.
- Encourage parents to learn CPR.
- Encourage children to never swim alone.
- Keep all electrical radios, speakers and other appliances away from the swimming pool.
- Do not allow roughhousing and horseplay.
- Keep deck clean and clear of objects that may create a hazard.
- Keep all breakable objects out of the pool area.
- Alcohol consumption and pool activities do not mix. Never allow anyone to swim, dive or slide under the influence of alcohol or drugs.

Do's and Don'ts for Diving into swimming pools with manufactured diving equipment, diving rocks, and stationary diving platforms:

- **Do** know the shape of the pool bottom and the water depth before you dive or slide headfirst.
- **Do** plan your path to avoid submerged obstacles, surface objects or other swimmers.
- **Do** hold your head up, arms up, and **steer up** with your hands.
- **Do** practice carefully before you dive or slide.
- **Do** test the diving board for its spring before using.
- **Do** remember that when you dive down, you must **steer up**.
- **Do** dive straight ahead - not off the side of the diving board.
- **Don't** drink and dive.
- **Don't** dive or slide headfirst in the shallow part of the pool.
- **Don't** dive across the narrow part of the pool.
- **Don't** run and dive.
- **Don't** dive from any place that is not specifically designed for diving.
- **Don't** engage in horseplay on diving or sliding equipment.
- **Don't** use diving equipment as a trampoline.
- **Don't** do a back dive.
- **Don't** try fancy dives; keep the dives simple.
- **Don't** dive or slide headfirst at or through objects such as inner tubes.
- **Don't** put diving or sliding equipment on a pool that wasn't designed for it.
- **Don't** swim or dive alone.
- **Don't** dive into unfamiliar bodies of water.

**Rules for General Use of Swimming Pool Slides.*
Under all circumstances you should prohibit:**

- Prohibit all headfirst entry from slide.
- Horseplay.
- Any slide entries by non-swimmers into deep water, to protect them from drowning.
- Standing on the top of a slide or outside the guardrails.
- Jumping from a slide.
- Diving from a slide.
- Sliding into areas with submerged obstacles, surface objects or other swimmers.

*Consult safe use instructions of the pool slide manufacturer

(This appendix is not part of the American National Standard ANSI/NSPI-5 2003, but is included for information only)

Appendix F

SAFETY BROCHURES AND EDUCATION PROGRAMS

Consumer awareness information is available from the following sources:

- *"The Sensible Way to Enjoy Your Inground Swimming Pool"* ... Published by the NSPI
- *"Children Aren't Waterproof"* ... Published by the NSPI
- *"Layers of Protection"* ... Published by the NSPI
- *"Pool and Spa Emergency Procedures for Infants and Children"* ... Published by the NSPI
- *"Knowing How to Dive"* ... Published by the National Spa and Pool Institute (NSPI)

Copies of the above brochures are available free from the NSPI at 1 800 323-3996.

Also go to NSPI's website at www.nspi.org and consult "Consumer Information".

SAFETY EDUCATION PROGRAMS AND MATERIALS

Educational programs and materials (i.e., seminars, workshops, brochures, videos, instructional guides, etc.) are available from NSPI, NSPF, other aquatic safety groups, and by private firms. As a means of communicating useful safety information to pool owners/operators and users, industry members are permitted to provide such information to owners/

operators and to request or require owners/operators to sign a statement that they have received, read and will follow the guidelines.

NSPI
2111 Eisenhower Avenue
Alexandria, VA 22314
(703) 838-0083
www.nspi.org

(This appendix is not part of the American National Standard ANSI/NSPI-5 2003, but is included for information only)

Appendix G

WOODEN DECK MATERIALS

As a guide, it is recommended that the following standards be referenced. American Wood Preservers Bureau Quality Control and Inspection Procedures for:

- LP-2-88 Softwood Lumber, Timber and Pressure Treated with Waterborne Preservatives for Aboveground Use.
- LP-22-88 Softwood Lumber, Timber and Plywood Pressure Treated with Waterborne Preservatives for Ground Contact Use.
- FDN - 88 Softwood Lumber, Timber and Plywood Pressure Treated with Waterborne Preservative for Ground Contact Use in Residential and Light Commercial Foundations.

(This appendix is not part of the American National Standard ANSI/NSPI-5 2003, but is included for information only)

Appendix H

ENGLISH STANDARD--METRIC/METRIC-- ENGLISH STANDARD CONVERSION TABLES

	Symbol	When You Know	Multiply By	To Find	Symbol
Length:	in.	inches	2.5	centimeters	cm
	ft.	feet	30.48	centimeters	cm
	yd.	yards	0.9	meters	m
	mi.	miles	1.6	kilometers	km
Area:	in ²	square inches	6.5	sq. centimeters	cm ²
	ft ²	square feet	0.09	square meters	m ²
	yd ²	square yards	0.8	square meters	m ²
	mi ²	square miles	2.6	sq. kilometers	km ²
		acres	0.4	hectares	ha
Mass:	oz.	ounces	28.35	grams	g
	lb.	pounds	0.45	kilograms	kg
		short tons (2000 lb.)	0.9	metric tons	t
Volume:	tsp.	teaspoons	5	milliliters	mL
	Tsp.	tablespoons	15	milliliters	mL
	in ³	cubic inches	16	milliliters	mL
	fl.oz.	fluid ounces	30	milliliters	mL
	c.	cups	0.24	liters	L
	pt.	pints	0.47	liters	L
	qt.	quarts	0.95	liters	L
	gal.	gallons	3.8	liters	L
	ft. ³	cubic feet	0.03	cubic meters	m ³
	yd. ³	cubic yards	0.76	cubic meters	m ³
Temperature:	°F	degrees Fahrenheit (after subtracting 32)	5/9	degrees Celsius	°C
Length:	mm	millimeters	0.04	inches	in.
	cm	centimeters	0.4	inches	in.
	m	meters	3.3	feet	ft.
	m	meters	1.1	yards	yd.
	km	kilometers	0.6	miles	mi.
Area:	cm ²	sq.centimeters	0.16	square inches	in ²
	m ²	square meters	10.8	square inches	yd ²
	km ²	sq.kilometers	0.4	square miles	mi ²
	ha	hectares (10,000m ²)	2.5	acres	
Mass:	g	grams	0.035	ounces	oz.
	kg	kilograms	2.2	pounds	lb.
	t	metric ton (1,000kg)	1.1	short tons	
Volume:	mL	milliliters	0.03	fluid ounces	fl.oz.
	mL	milliliters	0.06	cubic inches	in ³
	L	liters	2.1	pints	pt.
	L	liters	1.06	quarts	qt.
	L	liters	0.26	gallons	gal.
	m ³	cubic meters	35	cubic feet	ft ³
	m ³	cubic meters	1.3	cubic yards	yd ³
Temperature:	°C	degrees Celsius (then Fahrenheit add 32)	9/5	degrees	°F

(This appendix is not part of the American National Standard ANSI/NSPI-5 2003, but is included for information only)

Appendix I

ENTRAPMENT AVOIDANCE

Since the last approval of this standard, ANSI/NSPI -5 1995, suction entrapment has seen increased attention in the media and in legislative actions. Annual reported entrapment events to The Consumer Products Safety Commission (CPSC) are shown to be declining especially when calculating the increase of millions of residential and commercial pools and spas during this period of time.

Today, the perceived rise in entrapment cases is largely due to an increase in reporting of these tragic and sometimes fatal events. Because the consumer and regulatory agencies may be unaware of the hazards associated with suction outlets in swimming pools and spas, NSPI is exploring new warnings and better-defined performance criteria for suction outlet entrapment. The NSPI has been actively involved in writing ANSI voluntary consensus standards for the United States, which include construction methods that decrease the chance of suction entrapment since the early 80s. In addition, the CPSC released its 1996 "*Guideline for Entrapment Hazards: Making Pools and Spas Safer.*"

Based upon a review of the reported cases of injury or death, solicitation to its membership, and through open forums on entrapment issues, the NSPI has identified 5 potential hazards associated with suction outlets in a circulation system.

- **Evisceration/Disembowelment** – negative pressure applied directly to the intestines through an unprotected (e.g. missing or broken cover) suction outlet.
- **Body Suction Entrapment** – negative pressure applied to a large portion of the body or limbs resulting in an entrapment
- **Limb Entrapment** – a limb inserted into an opening of a circulation outlet in the pool resulting in a mechanical bind or swelling.
- **Hair Entanglement** – Hair becomes knotted or snagged in an outlet cover or opening.
- **Mechanical Entrapment** – Potential for jewelry, swimsuit, hair decorations, finger,

toe or knuckle to be caught in an opening of an outlet or cover.

One complication arises from looking at these different forms of entrapment. To date, a single solution to address all forms of entrapment has not been proposed, other than completely removing the suction outlet. This has become confusing for local building officials and even state regulatory agencies, because specific safety devices are often perceived as complete entrapment solutions. Often they will address one or more, but not all, of the hazards. These devices are a critical part of a total solution, but future legislation, codes and standards must not be centered on a particular device or solution. Legislation, codes, and standards should be written to allow all valid engineering solutions based on performance criteria.

In an effort to move toward performance-criteria for each identified hazard, the following hazard mitigation description is provided. For each category, guidelines are given in an effort to avoid an occurrence.

- **Evisceration** – Prevent the seal with direct suction, particularly in shallow water.
- **Body Suction Entrapment** – Prevent the seal of any outlet or cover; minimize the total open area on outlet covers, or make the cover too large to be blocked by a torso or large limb.
- **Limb Entrapment** – Prevent the seal; prevent access of a limb into an outlet.
- **Hair Entanglement** – Reduce water velocity through all openings; where direct suction is removed from system, provide safety covers that are easily and quickly detached if hair is entangled.
- **Mechanical Entrapment** – Warn against jewelry & decorative risks. Use smaller openings to prevent access of fingers or limbs in opening or keep the opening large enough for no chance of trapping. Test with "standard finger."

General recommendations:

- Direct suction may be eliminated through the use of properly engineered gravity flow systems (vented to atmosphere) and/or replacement of suction outlets with return inlets, which may improve circulation.
- Where direct suction outlets have been removed, but outlets are still present below the waterline, consider the use of removable (break-away) outlet covers to prevent drowning from hair entanglement. Be sure uncovered outlet poses no new safety hazard.
- When a direct suction is applied below the waterline, be certain to use multiple outlets, such that any outlet cannot be easily sealed. This can be accomplished by using a dual drain arrangement, surface venting, drains with high aspect ratios (trough or channel systems), or other means to prevent seal with multiple outlets.
- When multiple outlets are used, blockage of the primary outlet must not result in the secondary outlet having a greater hazard associated than the primary outlet alone.

(This appendix is not part of the American National Standard ANSI/NSPI-5 2003, but is included for information only)

Appendix J

GLOSSARY

Abrasion Hazard: A surface that presents an unreasonable risk of irritation to the skin upon contact.

Accessible: 1. Methods providing access to physically challenged users. 2. Easily and readily exposed for inspection and the replacement of materials and/or parts with the use of tools.

Acid: A liquid or dry chemical used to lower the pH and/or alkalinity of pool or spa water.

Acid Demand: A measure of the unit of acidic material.

Acidic: Having a pH below 7.0. Opposite of basic.

Acid Wash: A procedure using an acid solution to clean an interior surface of a pool with subsequent neutralization of the acid.

Acrylic: A thermoplastic material that can be extruded, injection molded, or vacuum formed into usable shapes and surfaces.

Action Pool: A wave pool in which standing waves are generated in an assortment of patterns.

Activated Carbon: A charcoal-like material used to remove colors, odors, and/or excess oxidizer from water.

Activity Pool: Any pool designed primarily for play activity that uses constructed features and devices including lily pad walks, flotation devices, small slide features, and similar attractions.

Admixture: A material (other than aggregate, cement, or water) added in small quantities to concrete to produce some desired change in properties.

Adult Supervision: A situation whereby a child at rest or play is within the constant sight and hearing of an adult charged with safeguarding the child. Such supervision must be of a nature that is uninterrupted — without absences, voids, or distractions that separate adult from child by distance, obstacles, or any hindrance to sight and sound communication.

AF: See *Alkalinity Factor*.

Aggregate: Marble dust, sand, rocks, pebbles, colored quartz, dolomite, and other similar materials used as components of concrete or plaster.

Aggressive Water: Water that is corrosive because it is low in pH, and/or calcium hardness, and/or alkalinity.

Air Blower: A device that produces a continuous flow of air.

Air Channel: A system whereby a volume of air is introduced into hollow ducting built into a spa floor, bench, or other location. The air channel is activated by a separate air power unit (blower).

Air Control: A means for spas and hot tubs to regulate air flow in the air induction system, increasing or decreasing hydrotherapy action.

Air Entrained Concrete: A type of concrete mixture that is more resistant to freezing when exposed to water and deicing chemicals.

Air Induction System: A system whereby a volume of air is introduced into hollow ducting built into a spa floor, bench, or hydrotherapy jets.

Air Switch System: An isolated device that utilizes a pulse of air sent down a tube to remotely operate electrical equipment.

Algae: Microscopic plant-like organisms that contain chlorophyll.

Algicide: Any chemical or material that kills algae. ALGAECIDE.

Algistatic: Able to inhibit the growth of algae.

Alkali: A term applied to bases, usually carbonates, bicarbonates, and hydroxides, that raise the pH and alkalinity when added to water.

Alkaline: Having a pH above 7.0.

Alkalinity: See *Total Alkalinity*.

Alkalinity Factor (AF): Used to calculate the saturation index of water.

Alum (Aluminum Sulfates): A compound used to cause suspended solids in the water to form filterable masses (floculate).

Ammonia (NH₃): A chemical compound of hydrogen and nitrogen that combines with free chlorine in pools to form chloramines or combined chlorine. It also combines with free bromine to form bromamines.

Amperage: The strength of a current of electricity expressed in amperes.

Ampere (Amp): A unit of electrical current that is equivalent to a flow of one coulomb per second or to the steady current produced by one volt applied across a resistance of one ohm. It also applies to the strength of a current of electricity expressed in amperes.

Amphoteric: Having the ability to serve as either an acid or a base.

Analog Meter: A testing device in which a needle is used to indicate readings on the dial face.

Ancillary Facility: Area used in conjunction with, or the operation of, a pool such as public dressing, locker, shower, or bathroom area, equipment room, pool deck area or building space intended to be used by pool users.

Antivortex Drain Cover (Antivortex Plate or Cover): A plate or cover that is affixed to the main outlet of a swimming pool or spa that prevents a vortex from forming as water passes through to the main outlet.

Aquatic Recreation Facility: A facility, open to the public, that is designed for free-form aquatic play and recreation. The facilities may include, but are not limited to, wave or surf action pools, leisure rivers, sand bottom pools, vortex pools, activity pools, inner tube rides and body slides, and interactive play attractions.

Available Chlorine: A rating of a chemical's total chlorine content based on a comparison to elemental (gaseous) chlorine having 100% available chlorine.

Backboard: Device for immobilizing a person with a suspected injury to the spinal column.

Back Pressure: Resistance to flow, normally expressed in pounds per square inch (kilograms per square centimeter).

Backwash: The process of cleansing the filter medium and/or elements by the reverse flow of water through the filter.

Backwash Cycle: The time required to backwash the filter medium and/or elements and to remove debris in the filter vessel.

Backwash Rate: The rate of water flow through the filter media per unit of area (U.S. gallons/minute/square feet) of effective filter area. One U.S. gallon per minute per square foot is equivalent to 40.74704 liters per minute per square meter.

Bacteria: Single-celled microorganisms of various forms, some of which cause infections or disease.

Bactericide: Any chemical or material that kills bacteria.

Balance: In pools and spas, used to refer to a condition of the water that is neither scaling nor corrosive.

Ball Valve: A device that can partially or totally obstruct the flow of water, using a ball-shaped diverter.

Barrier: A means to limit, delay, or restrict access to a pool, spa, or hot tub. (Refer to ANSI/NSPI-8, *Model barrier code for residential swimming pools, spas, and hot tubs*, 1996, or latest revision.)

Base: A chemical used to raise pH and/or total alkalinity of pool or spa water.

Base Demand: A measure of the amount of alkaline material required to raise pH to a predetermined level. This can

be accomplished by use of a base demand test, whereby a standard base is added by drop to the pH test solution until the desired pH is reached.

Basic: Having a pH above 7.0. Opposite of acidic.

Bather: Any person using a pool, spa, or hot tub and adjoining deck area for the purpose of water sports, recreation, therapy or related activities. USER.

Bather Load: The number of persons in the pool/spa water at any given moment or during any stated period of time. SWIMMER LOAD.

Batter Board: One of two horizontal boards nailed to a post set up near the proposed corner of an excavation. Cord is attached for locating the exact corner of the excavation.

Beach Entry: Sloping entry starting above the water line at deck level and ending below the water line. (Does not refer to sand only). ZERO ENTRY.

Beginner's Area: Those areas in pools that are three feet (3') [0.9144 meters] or less in water depth.

Bleach (NaOCl): Sodium hypochlorite. A chlorine source that typically has between 5% and 16% available chlorine. LIQUID CHLORINE.

Bleeder Valve: A device that allows air to be vented from a system.

Blister: An area of raised surface detached from the structural matrix of a material.

Body Coat: A layer of diatomaceous earth or similar materials on a filter element that acts as the filtering media.

Body Feed: A controlled amount of diatomaceous earth that is continuously added to the filter element during the course of a filter run to help maintain filter porosity.

Bond Beam: Reinforced masonry units designed to resist horizontal and vertical forces.

Bond Failure: Failure of plaster or other surfaces to adhere to the underlying subsurface; delamination.

Bonding, Electrical: The joining of metallic parts to form an electrically conductive path that will ensure electrical continuity.

Booster Pump System: A pump that is completely independent of the filtration and heating system. Used to provide support for hydrotherapy jets, cleaning systems, and gas chlorinators, or special water features.

Bottom Rail: The lower portion of an aboveground pool frame used as a structural retainer for aboveground pool wall.

Break In Grade: Occurs when the slope of the pool floor changes to a greater slope.

Breakpoint Chlorination: The addition of a sufficient amount of chlorine to water to destroy the combined inorganic chlorine present. Normally, the amount added is ten times the combined chlorine concentration.

Bridging: Build-up of a body coat on diatomaceous earth filter elements to the point where the body coats of two adjacent elements touch.

Broadcast: A method of applying chemicals into a pool or spa by spreading them uniformly over the water surface.

Bromamines: Bromine-ammonia compounds exhibiting sanitizing properties similar to hypobromous acid.

Bromide: A salt that contains a bromide (Br^-) ion. Bromide becomes hypobromous acid when it reacts with oxidizers such as chlorine, ozone, or persulfates.

Brominator: A device to add or deliver bromine disinfectant at a controlled rate.

Bromine (Br_2): One of several chemicals that yield hypobromous acid when added to water.

Bromine Feeder: A device to add or deliver bromine sanitizer at a controlled rate.

Bromine Generator: See *Electrolytic Chlorine/Bromine Generator*.

Brown Coat: A coat of plaster applied with a fairly rough texture prior to the finish coat.

BTU: British thermal unit. A unit of measurement used to define the capabilities of heaters. One BTU is capable of raising the temperature of one pound of water by one degree Fahrenheit. One BTU is capable of raising the temperature of one kilogram of water by 1.2248 degrees Celsius.

Buffer: Chemical that when dissolved in water will resist pH change. Also a chemical solution used to calibrate pH instrument.

Bull Nose: A brick, stone, or coping with a rounded edge.

Burner: The component of the heater where the combustion of fossil fuel takes place.

Bypass Valve: A valve used to limit or adjust the amount of water flowing through a device in a bypass loop to divert flow to an alternate plumbing path.

Calcification: Formation of calcium carbonate on walls of pools or pipes, or in a filter or heater, due to low solubility of calcium salts.

Calcium Carbonate (CaCO_3): An insoluble calcium compound that is the major component of scale. CaCO_3 occurs normally in limestone, marble, various eggshells, seashells, etc.

Calcium Chloride (CaCl_2): A soluble white salt used to raise the calcium hardness of pool and spa water.

Calcium Hardness: A measure of the amount of calcium dissolved in water and expressed in parts per million (ppm) or milligrams per liter (mg/L) as calcium carbonate.

Calcium Hardness Factor (CF): Used to calculate the saturation index of water.

Calcium Hypochlorite (Ca(OCl)_2): A solid white form of chlorine found in both granular and tablet forms (65% - 75% available chlorine).

Cantilever: A projector beam supported only at one end.

Capacitor: A device that consists essentially of two conductors (such as parallel metal plates) insulated from each other by a dielectric and that introduces capacitance into a circuit, stores electrical energy, blocks the flow of direct current, and permits the flow of alternating current.

Carbon Dioxide (CO_2): Common gas found in air. Can be used to lower pH in a pool.

Cardiopulmonary Resuscitation (CPR): A lifesaving technique involving both chest compressions and mouth-to-mouth breathing, to circulate oxygen and blood to vital organs.

Cartridge: A replaceable porous element designed to retain suspended particles from water.

Cartridge Filter: A filter that utilizes a porous element that acts as a filter medium.

Catch Pool: A pool or designated section of a pool used as a terminus for waterslide flumes. See *Splash Pool*.

Caustic: Sodium hydroxide, lye; used in pools, an extremely high pH alkalizer; referring generally to high pH.

Caustic Soda (NaOH): Sometimes called caustic sodium hydroxide or lye. A highly alkaline substance sometimes used to raise pH.

Caution: See *Signal Word*.

Cavitation: Formation of partial vacuums when the pump capacity exceeds water replacement supply.

Cement: A powdered substance of lime and clay generally mixed with water and aggregate to make concrete.

Centrifugal Force: The outward force exhibited by a circular motion.

Centrifugal Pump: A pump to circulate water using a shaft-mounted impeller, powered by an electric motor or gasoline engine. The centrifugal force of the spinning impeller creates the flow through the pump.

CF: See *Calcium Hardness Factor*.

CFM: Cubic feet per minute (of air). One cubic foot per minute is equivalent to 0.0283 cubic meters per minute.

Channelization: The undesirable process whereby filter sand is permeated by tubes or channels of calcified or oily material allowing water to pass freely, without filtration.

Check Valve: A valve allowing flow in one direction and obstructing flow in the other direction.

Chemical Feeder: A device (floating or mechanical) for adding a chemical to pool or spa water.

Chemical Feeder Output Rate: Amount of chemical or active ingredient delivered by a feeder per unit time (for example, pounds of chlorine per hour). One pound per hour is equivalent to 0.4536 kilograms per hour.

Children's Pool/Ride: Ride, flume ride, or other slide attraction, at a water theme park, designed primarily for the use of small children.

Chine: That portion of the stave of a hot tub below the bottom of the croze.

Chine Joist: A brace that provides support to the floor of a hot tub.

Chloramines: They are formed when free chlorine combines with nitrogen-containing compounds (for example: perspiration, ammonia). These compounds can cause eye and skin irritation, have strong objectionable odors, and low sanitizing capability. COMBINED CHLORINE.

Chlorinator: A device to add or deliver a chlorine sanitizer at a controllable rate.

Chlorine: See *Calcium Hypochlorite, Sodium Dichlor, Isocyanurates, Sodium Hypochlorite, and Trichloro-Iso-Cyanurate.*

Chlorine Demand: The amount of chlorine that will be consumed by readily oxidizable impurities in pool or spa water.

Chlorine Gas (Cl₂): A gaseous form of chlorine used to sanitize pools and spas; contains 100% available chlorine.

Chlorine Generator: See *Electrolytic Chlorine/Bromine Generator.*

Chlorine Neutralizer: A chemical used to reduce chlorine residuals.

Chlorine Residual: See *Residual.*

Circuit: The complete path of an electric current.

Circuit Breaker: A device designed to open and close an electrical circuit manually and to open a circuit automatically at a predetermined level, thus providing protection to the wiring and electrical components.

Circulation Equipment: The components of a circulation system.

Circulation System: The mechanical components that are a part of a re-circulation system on a pool or spa. Circulation equipment may be, but is not limited to, categories of pumps, hair and lint strainers, filters, valves, gauges, meters, heaters, surface skimmers, inlet/outlet fittings, and chemical feeding devices. The components have separate functions, but when connected to each other by piping, perform as a coordinated system for purposes of maintaining pool or spa water in a clear and sanitary condition.

Clarifier: A chemical that causes fine suspended solids in water to combine into filterable clusters. See *Floculant.*

Clarity: The degree of transparency of pool water. Characterized by the ease with which an object can be seen through a given depth of water.

Cleat: See *Kicker.*

Coliform Bacteria: Bacteria found in the intestines and fecal matter of warm-blooded animals. The detection of coliforms is used to indicate the possibility of disease-causing bacteria.

Collector, Solar: An assembly of components used to collect solar energy for heating, i.e., rooftop structure, floating devices, etc.

Combined Chlorine: COMBINED AVAILABLE CHLORINE. See *Chloramines.*

Commercial/Public Pool: Any pool, other than a residential pool, that is intended to be used for swimming or bathing and is operated by an owner, lessee, operator, licensee, or concessionaire, regardless of whether a fee is charged for use. (Refer to ANSI/NSPI-1, *Standard for public swimming pools*, 1991, or latest revision).

Commercial/public pools shall be further classified and defined as follows:

Class A, Competition Pool: Any pool intended for use for accredited competitive aquatic events such as La Federation Internationale De Natation Amateur (FINA), U.S. Swimming, U.S. Diving, National Collegiate Athletic Association (NCAA), National Federation of State High School Associations (NFSHSA), etc. The use of the pool is not limited to competitive events.

Class B, Public Pool: Any pool intended for public recreational use.

Class C, Semi-Public Pool: Any pool operated solely for and in conjunction with lodgings such as hotels, motels, apartments, condominiums, etc.

Class D, Other Pool: Any pool operated for medical treatment, therapy, exercise, lap swimming, recreational play, and other special purposes, including, but not limited to, wave or surf action pools, activity pools, splasher pools, kiddie pools, and play areas. These pools are not intended to be covered within the scope of NSPI standards.

Public pools may be diving or non-diving. If diving, they shall be further classified into types as an indication of the suitability of a pool for use with diving equipment.

Type VI-IX: Public pools suitable for the installation of diving equipment by type.

Type N: A non-diving public pool. (No diving allowed.)

Competitive Diving Equipment: Competitive diving equipment includes diving boards and adjustable fulcrum-setting diving stands intended for competitive diving.

Coping: The cap on the wall that provides a finishing edge around the pool/spa. Can be formed, cast in place, precast, brick, stone, or pre-fabricated from metal or plastic materials. It may be used as part of the system that secures a vinyl liner to the top of the pool wall.

Cove: The radius that joins the floor and wall of a pool or spa.

Cover: Something that covers, protects, or shelters a pool, spa, or hot tub. Types of covers are:

Safety Cover: As defined by ASTM in F1346-1991, *Standard performance specification for safety covers and labeling requirements for all covers for swimming pools, spas and hot tubs*, 1996, or latest revision, a barrier (intended to be completely removed before entry of users) for swimming pools, spas, hot tubs or wading pools, attendant appurtenances and/or anchoring mechanisms that will, when properly labeled, installed, used, and maintained in accordance with the manufacturer's published instructions, reduce the risk of drowning of children under five years of age by inhibiting their access to the contained body of water and by providing for the removal of any substantially hazardous level of collected surface water. (These covers may be power or manual.)

Solar Cover: A cover that when placed on a pool or spa surface increases the water temperature by solar activity and reduces evaporation.

Thermal Cover: An insulating cover used to prevent evaporation and heat loss from pools or spas.

Winter Cover: A cover that is secured around the perimeter of a pool or spa that provides a barrier to debris, when the pool or spa is closed for the season.

Craze: See *Checks*.

Cross Connection: An unprotected connection between domestic water supply and pool water or other non-potable water, where a contamination of the domestic system could occur.

Cuddle Cove: See *Swimout*.

Cyanuric Acid: A chemical that reduces the loss of chlorine in water due to the ultraviolet rays of the sun. STABILIZER, ISOCYANURIC ACID, CONDITIONER, TRIAZINETRIONE.

Danger: See *Signal Word*.

Dead Load: The weight of all permanent structural and nonstructural components of a building, such as walls, floors, roofs, ceilings, stairways, and fixed service equipment.

Deck Dive: A dive performed from the deck area of a pool into five feet (5') [1.524 meters] or more of water depth.

Decks: Those areas immediately adjacent to or attached to a pool or spa that are specifically constructed or installed for sitting, standing, or walking. Generally made of concrete, wood, or masonry.

Deep Area: Water depth areas exceeding five feet (5') [1.524 meters].

Design Rate of Flow: The rate of flow used for design calculations in a system.

Diatomaceous Earth (DE): A white powder used as a filtering medium composed of microscopic fossil skeletons of diatoms.

Diatomaceous Earth Filter: A filter that utilizes a coating of diatomaceous earth (DE) over a porous fabric as its filter medium.

Diatomite Filter Element: Device used in a filter tank called a filter grid or element coated with a fabric that traps diatomite on its surface.

Dichlor: See *Sodium Dichlor*.

Diethylphenylene Diamine (DPD): A chemical testing reagent that measures bromine or free available and total chlorine; produces a series of colors from pale pink to dark red.

Diffuser: A component of a pump whose function is to reduce velocity and increase static pressure of a fluid passing through a system.

Digital Multimeter: This meter is read by means of an LED or LCD display.

Discharge Head: The resistance, caused by friction and/or changes in elevation, of the water flow encountered on the discharge side of the pump back to the swimming pool or spa.

Dive: A free-fall entry into water from a planned acrobatic maneuver into a designated diving area of a pool.

Diving Area: The area of a swimming pool that is designed for diving.

Diving Board: A flexible board secured at one end that is used for diving.

Diving Platform: Stationary platform designed for diving.

Diving Stand: Any supporting device for a springboard or diving board.

Draft Hood: Part of a heater venting system used to prevent a downdraft.

Dry Acid (NaHSO₄): Most commonly used in kits to measure free chlorine, total chlorine, and total bromine. See *Sodium Bisulfate*.

Dynamic Head: The sum of the total resistance, caused by friction and/or changes in elevation, of the water flow through the entire circulation system that the pump has to overcome to achieve the necessary flow rate.

Edge Guards: Shields designed to cover sharp edges in aboveground pools.

Effective Filter Area: Total surface area through which designed flow rate will be maintained during filtration.

Cartridge Type: The total effective filter area is the cartridge fabric area that is exposed to the direct flow of water, figured in square footage of fabric. This excludes cartridge ends, seals, supports, and other areas where flow is impaired.

Diatomaceous Earth (DE) Type: The actual area of the element is the total effective area of the porous fabric septum, less any area of a septum support member greater than one-fourth inch (1/4") [6.35 millimeters] wide contacting the septum during filtration.

Permanent Medium Type: The effective filter area is the filter surface that is perpendicular to the flow direction.

Sand Filtration Type: The top surface area of the filter medium within the filter, calculated in square inches or square feet. One square inch is equivalent to 6.4516 square centimeters. One square foot is equivalent to 0.0929 square meters.

Effluent: The outflow of water from a filter, pump, or pool.

Egress: Means of exit.

Electrical Induction: The process by which an object having electrical or magnetic properties produces similar properties in a nearby object, usually without direct contact. See *Air Induction*.

Electrolysis: Flow of electric current through acidic liquid or damp earth that corrodes metals.

Electrolytic Chlorinator: See *Electrolytic Chlorine/Bromine Generator*.

Electrolytic Chlorine/Bromine Generator: An electrolytic device used to generate free available chlorine or total

bromine from either chloride or bromide salts. See *Chlorine Generator*.

Electron: A minute particle of negatively charged electricity.

Entry Pool: Pool at a water theme park that is provided at the entrance of a water slide or inner tube ride.

Equalizer Line: A line below the pool surface to the body of a skimmer that prevents air from being drawn into the pump. Also a pipe between two pools/spas to equalize water levels.

Equipment Area: Area used to house recirculation and disinfecting equipment and related appurtenances.

Erosion: 1. Act of destroying or dissolving by slow disintegration or wearing away. **2.** In an erosion feeder, it is the way water dissolves the chemical being fed.

Erosion Feeder: A device that dispenses a sanitizer by directing a flow of water past tablets, briquettes, or pellets.

Etching: Corrosion on the surface; the pitting or eating away of a material such as the surface of plaster.

Evaporation: Conversion of liquid molecules into vapor.

Exercise Bar: A tubular device installed in the wall as a handhold.

Expansive Soil: Clay soil that absorbs moisture and swells, creating the potential for structure damage.

Feet of Head: The resistance in a hydraulic system based on the equivalent to the height of a column of water that causes the same resistance (100 feet of head equals 43 pounds per square inch). The total dynamic head is the sum of all resistances in a complete operating system. One pound per square inch is equivalent to 6.89473 KiloPascal (kPa). One pound per square inch is also equivalent to 70.3 grams per square centimeter. 100 feet of head is equivalent to 296.47339 KiloPascal (kPa). 100 feet of head is equivalent to 3.02325 kilograms per square centimeter.

Ferric Iron (Fe⁺³ or Iron III): Generally insoluble in water, commonly precipitating as rust.

Ferrous Iron (Fe⁺² or Iron II): Found in groundwater. It is soluble in water and will generally impart a pale green color. In the presence of oxidizers, it will convert to Iron III.

Fiberglass: Fine-spun filaments of glass that are available in a rope or mat form. When used in a process with polyester resins and hardeners, can be formed and molded into pools, spas, and related equipment.

Filter: A vessel that removes undissolved particles from water by recirculating the water through a porous substance (a filter medium or elements).

Cartridge Filter: A filter that utilizes a porous element that acts as a filter medium.

Diatomaceous Earth Filter: A filter that utilizes a thin coating of diatomaceous earth (DE) or other filter aid over a porous fabric as its filter medium.

Permanent Medium Filter: A filter that utilizes a filter medium (sand).

Filter Agitation: The mechanical or manual movement to dislodge the filter aid and dirt from the filter element.

Filter Aid: Usually refers to powder-like substances such as diatomaceous earth or volcanic ash used to coat a septum type filter. Also used as an aid to sand filters. Finely divided medium (diatomaceous earth, processed perlite, etc.) used to coat a septum of a diatomite-type filter.

Filter Cartridge: A filtering element, usually of fibrous material.

Filter Cycle: The operating time between cleaning or backwash cycles.

Filter Element: A device within a filter tank designed to entrap solids and conduct water to a manifold, collection header, pipe, or similar conduit and return it to the pool, spa, or hot tub. A filter element usually consists of a septum and septum support, or a cartridge.

Filter Medium: A finely graded material (such as sand, diatomaceous earth, polyester fabric, anthracite, etc.) that removes solid particles from the water.

Filter Sand: A hard silica-like material free of carbonates or other foreign material used in sand filters as the media.

Filtration: The process of removing undissolved particles from water by recirculating the water through a porous substance (a filter medium or elements).

Filtration Flow: The design rate of flow, in volume per time (GPM, GPH), through the filter system installed per manufacturer's instructions with a new, clean filter medium. One U.S. gallon per minute is equivalent to 3.7854 liters per minute. One U.S. gallon per hour is equivalent to 3.7854 liters per hour.

Filtration Rate: The rate of water flowing through a filter during a given period of time, expressed in U.S. gallons per minute per square foot of effective filter area. One U.S. gallon per minute per square foot is equivalent to 40.74704 liters per minute per square meter. FILTRATION FLOW RATE.

Firebox: A chamber in the pool/spa heater where combustion takes place.

Firebrick: A refractory brick capable of sustaining high temperatures.

Fireman's Switch: A mechanism adapted to the time clock that will turn the heater off long enough for it to cool down before the time clock turns the pump off.

Float Valve: A valve controlled by the level of a fluid.

Flocculant (floc): A chemical that causes fine suspended solids in water to combine into large clusters that settle out.

Floor: The interior bottom surface of a pool or spa.

Flow: The rate of the movement of water, typically in gallons per minute. One U.S. gallon per minute is equivalent to 3.7854 liters per minute.

Flow Balance Valve: Device that regulates the flow from skimmers, drains, or other outlets.

Flow Meter: A device that measures the rate of flow of water or other liquid through piping.

Flow Rate: The volume of liquid flowing past a given point in a specified time period. Usually expressed as U.S. gallons per minute (GPM) or gallons per hour (GPH). One U.S. gallon per minute is equivalent to 3.7854 liters per minute. One U.S. gallon per hour is equivalent to 3.7854 liters per hour.

Flow Rider: Pool at a waterpark that uses wave sheet technology for body boarding or body surfing activity.

Flow Switch: A safety device that prevents the equipment from firing if there isn't adequate water flow through the system.

Flume: A trough-like or tubular structure, generally recognized as a water slide, that directs the path of travel and the rate of descent by the rider.

Flume Slide: Slides of various configurations that are characterized by having deep riding channels, vertical and lateral curves, high water flows, and accommodate riders using or not using mats, tubes, rafts, and other transport vehicles. Included but not limited to family raft rides, inner-tube rides, body slides, and speed slides.

Fly Ash: A fine particulate, essentially non-combustible refuse, carried in the gas stream from a furnace. A product used in concrete mixtures.

Frame: The structure that defines and/or supports the outline or shape of the aboveground pool wall.

Free Available Chlorine: That portion of the total that is not combined chlorine and is available as a sanitizer.

Freeboard: Clear vertical distance in a sand filter between the top of the filter media and the upper distribution system.

Freeze-Thaw Cycle: Seasonal weather and temperature changes that can cause stress to a surface.

Friction Head: Head specifically caused by friction or drag.

Friction Water: Resistance created by the liquid passing the inner surface of the conductor pipe and fittings.

Fusible Link (Gas Heater): A thermal safety cut-off device in the control circuitry that melts if temperature parameters are exceeded.

Gallonage: A specific quantity of fluid in terms of gallons. One U.S. gallon is equivalent to 3.7854 liters.

Galvanic Action: The creation of electrical current by the process of electro-chemical action of dissimilar metals in a liquid.

Galvanic Corrosion: The deterioration of metal produced when two dissimilar metals are exposed to the electrical current produced by electro-chemical action.

Gate Valve: A device in a pipe that can partially or totally obstruct the flow of water, using an internal "gate" that moves in and out as the valve is operated.

Gelcoat: A colored polyester-resin material applied in liquid form that hardens to a smooth, durable form when applied over a mold.

GFCI: See *Ground Fault Circuit Interrupter*.

GPD: Gallons per day. One U.S. gallon per day is equivalent to 3.7854 liters per day.

GPH: Gallons per hour. One U.S. gallon per hour is equivalent to 3.7854 liters per hour.

GPM: Gallons per minute. One U.S. gallon per minute is equivalent to 3.7854 liters per minute.

Grab Bar/Rail: Rails used to enter or leave a pool or spa.

Groover: See *Jointer*.

Ground Fault Circuit Interrupter (GFCI): A device intended for the protection of people and/or equipment that functions to de-energize an electrical circuit within an established period of time when current to ground exceeds some pre-determined value ($5/1000^{\text{th}}$ of an ampere (.005)).

Grounding: Connecting to or providing a conducting path to earth or to some conducting body that serves in place of earth.

Gunite: A pneumatically applied (sprayed) concrete that is a dry mixture of cement, aggregate, and/or sand. Water is applied to the mix at the hose nozzle.

Gutter: Overflow trough in the perimeter wall of a pool that is a component of the circulation system or flows to waste.

Hair and Lint Strainer: A device attached on or in front of a pump to which the influent line (suction line) is connected for the purpose of entrapping lint, hair, or other debris that could damage the pump.

Halogen: Any of the family of chemical elements including fluorine, chlorine, bromine, and iodine. Chlorine and bromine are commonly used as sanitizers or oxidizers in recreational water.

Handhold/Handrail: A support device that is intended to be gripped by a user for the purpose of resting or steadying. It is typically located within or at exits to the pool or spa or as part of a set of steps.

Hardness: The amount of calcium and magnesium dissolved in water; measured by a test kit and expressed as parts per million (ppm) of equivalent calcium carbonate.

Hazard: A condition or set of circumstances that has the potential of causing or contributing to injury or death.

Head: A measure of the amount of pressure or resistance in a hydraulic system expressed in "feet." 100 feet of head is equivalent to 296.47339 KiloPascal (kPa). 100 feet of head is also equivalent to 3.02325 kilograms per square centimeter.

Head Loss: The amount the flow would reduce as the head increases.

Header: A manifold in a heater that directs the flow of water into and out of the heat exchanger.

Heater: Fossil-fueled, electric, or solar device to heat the water of pools or spas.

Direct Electric: Uses resistive heating element placed in line with the circulation system.

Fossil-Fueled: Natural gas, propane gas, or fuel oil. They utilize an open flame to heat a heat exchanger.

Heat Pump: Uses a compressor with a closed freon loop to exchange heat between either the ambient air or external water source with the pool or spa water.

Solar: Uses energy from the sun to heat the collector or through the blanket to heat the water.

Other ways to categorize heaters include:

Direct Heaters that heat the tubes in which water circulates.

Indirect Heaters that circulate steam or hot water inside a heat exchanger through which water flows.

Heat Exchanger: A device with coils, tubes, and plates that takes heat from any liquid, or air, and transfers that heat to another fluid without intermixing the fluids.

Heat Loss: The natural drop in water temperature as heat is transferred to the surrounding air.

Heat Pump: A refrigeration compressor, usually electrically driven, that is operated in reverse. To obtain heat, the evaporator side (cooling coil) is exposed to water, air, or ground. The coil takes the heat from this source and transfers it to the condenser coil where it discharges the heat to the pool/spa to be heated.

Heat Sink: A type of device capable of absorbing and dissipating heat.

High Limit Switch: A temperature control switch that can deactivate a control circuit at a preset temperature. They are normally preset at the factory and are non-adjustable. Some must be manually reset.

High Permeability Element: Mechanically interlocked, non-woven filter material designed to remove suspended solids.

Hoop: 1. A circular constraint that provides the structural bonding of staves of a hot tub to prevent separating. **2.** A device used to secure sections of a filter together.

Hoop Connector: A tightening and connection device.

Horsepower: A unit for expressing the power of motors or engines, equal to a rate of 33,000 foot-pounds per minute. One horsepower is equivalent to 42.41 BTU per minute. One horsepower is also equivalent to 745.7 watts.

Hose Bib: A valve with a treaded connection.

Hot Tub/Spa: A warm water reservoir with hydromassage jets that are manufactured from prefabricated materials at a factory. Hot tubs/spas may be "self-contained," or "non-self-contained." (Refer to ANSI/NSPI-6, *Standard for portable spas*, 1996, or latest revision.)

Self-Contained Hot Tub/Spa: *A hot tub/spa that has a cabinet that houses the controls, the pump, heater, and filter. Most "portable hot tubs/spas" are made of an acrylic thermoplastic shell and are surrounded by a cabinet made of wood, alternative wood, or thermoplastic. A "self-contained hot tub/spa" can be moved to another location and reinstalled. A "self-contained hot tub/spa" has all control, water heating and water circulating equipment as an integral part of the product. A "self-contained hot tub/spa" may be permanently wired or cord connected. Also known as a "portable hot tub/spa."*

Non-Self-Contained Hot Tub/Spa: A hot tub/spa that is made of an acrylic or thermoplastic shell molded at the factory to comfortably fit the body's contours. A "non-self-contained hot tub/spa" does not have water heating and circulating equipment as an integral part of the product. "Non-self-contained hot tubs/spas" may employ separate components such as an individual filter, pump, heater and controls, or they may employ assembled combinations of various components.

Hydraulics: Deals with the physical movement of water through the entire circulation system and is concerned with such matters as friction and turbulence generated in the pipes and other components of the system by the moving water.

Hydrochloric Acid (HCl): Also called muriatic acid when diluted. A very strong acid used in pools or spas for pH control and for certain specific cleaning needs. A by-product of the addition of chlorine gas to water. Use extreme caution in handling.

Hydrogen Peroxide (H₂O₂): Compound consisting of hydrogen and oxygen supplied in an aqueous solution, used as an oxidizer. Will neutralize halogen sanitizer in water.

Hydrostatic Pressure: The pressure created by a depth of water, such as the upward pressure that high ground water may exert on the bottom.

Hydrostatic Relief Valve: A fitting installed in the bottom of the pool that is designed to open automatically or manually to relieve upward ground water pressure by allowing water to flow into the pool or spa.

Hydrotherapy Jet: A fitting that blends air and water, creating a high-velocity turbulent stream of air-enriched water.

Hypobromous Acid (HOBr): A chemical compound that acts as a sanitizer and algicide in water.

Hypochlorinator: A chemical feeder through which liquid solutions of chlorine-bearing chemicals are fed into the pool water at a controlled rate. See *Chlorinator*.

Hypochlorite: A family of chemical compounds including calcium hypochlorite, lithium hypochlorite, sodium hypochlorite, etc., found in various forms for use as a chlorine carrier in pool/spa water.

Hypochlorite Ion (OCI): The anion from ionization of hypochlorous acid.

Hypochlorous Acid (HOCl): A chemical compound that acts as an algicide. The most powerful sanitizer of chlorine in water.

Impeller: The rotating part of a centrifugal pump that creates the flow of water.

Inertia: The tendency of all matter to persist in its state of rest or uniform motion until acted upon by some external force.

Influent: The water entering a filter or other device.

Ingress: Means of entry.

Inlet Fitting: A pipe that allows water to enter a pool, spa, or hot tub.

Insulator: In electricity, any device that serves as a non-conductor.

Intermediate Pool: Any section of a quiescent water flow between the entry and landing pools in attractions at a waterpark that utilize a series of pools.

Intermittent Ignition Device: An electrical spark device used to ignite a gas heater.

Iodine (I₂): A chemical element that exists as a grayish-black granule in its normal state or as a part of a chemical compound that is a biocidal agent.

Ionization: The process whereby a compound in solution separates into positive ions (cations) and negative ions (anions).

Ionizer: A device that electro-chemically generates metal ions such as silver and/or copper ions from anodes of these metals.

Iron: See *Ferric* or *Ferrous*.

Isocyanurates (ISOS): Sanitizer products that are self-stabilizing due to release of free available chlorine and cyanuric acid when they dissolve.

Jets: See *Hydrotherapy Jet*.

Jointer: Tool used to prepare, make, or simulate joints in concrete flat work. GROOVER.

Joist: See *Chine Joist*.

Jump Board: A premanufactured diving board that has a coil spring, leaf spring, or comparable device located beneath the board that is activated by the force exerted by jumping on the board's end.

Kicker: A block of wood attached to form work to take the thrust of another form work member.

Kilowatt: A unit of power equal to 1000 watts. One kilowatt is equivalent to 56.89 BTU per minute. One kilowatt is also equivalent to 1.341 horsepower.

Kilowatt Hour: A unit of work or energy equal to that expended by one kilowatt in an hour. One kilowatt hour is equivalent to 3413 BTU. One kilowatt hour is also equivalent to 3.6 million joules.

Ladder: A structure for ingress/egress that usually consists of two long parallel side pieces joined at intervals by cross-pieces (treads).

Ladders for aboveground/onground pools consist of the following:

"A-Frame" Ladder: An entry ladder that straddles an aboveground/onground pool wall and is either removable or has a built-in entry limiting feature.

Double Access Ladder (Type A): An "A-Frame" ladder that straddles the pool wall of an aboveground pool and provides ingress and egress and is intended to be removed when not in use.

Limited Access Ladder (Type B): An "A-Frame" ladder that straddles the pool wall of an aboveground/onground pool. Type B ladders are removable and have a built-in feature that prevents entry to the pool when the pool is not in use.

Staircase Ladder (Type C): A "ground to deck" staircase ladder that allows access to an aboveground pool deck and has a built-in entry-limiting feature.

"In-pool" Staircase Ladder (Type E): Located in the pool to provide a means of ingress and egress from the pool to the deck.

Landing Pool: Pool at a waterpark that is located at the end of a flume that is designed to safely receive the rider of an attraction.

Langelier Index: A numerical calculation, based on the Langelier water balance equation, that indicates whether the water may be corrosive or scale forming. See *Saturation Index*.

Leaching: The extracting of a soluble substance from some material, commonly tannic acid from redwood or cedar in hot tubs or a mineral extracted from plaster.

Lifeguard: A qualified person who is responsible for supervision and lifesaving at a pool.

Lifeline: An anchored line thrown to aid in rescue.

Line Level: A small spirit level that can be suspended from a stringline.

Liner: See *Vinyl Liner*.

Liquid Acid (HCl): Chemical used to lower pH and total alkalinity, most commonly muriatic acid.

Liquid Chlorine: See *Sodium Hypochlorite*.

Liquid Propane Gas: The liquid form of propane gas, a heavy hydrocarbon occurring naturally in petroleum.

Lithium Hypochlorite (LiOCl): A white solid used as a sanitizer and oxidizer in pools and spas that has a pH of approximately 9 and that typically contains 35% available chlorine.

Lower Distribution System: A device used in the bottom of a permanent medium filter to collect water during filtering and distribute it during backwashing (underdrain).

Magnesium Hardness: A measure of the amount of magnesium dissolved in water and expressed in parts per million (ppm) or milligrams per liter (mg/L) as calcium carbonate.

Main Drain: An outlet located at the bottom of a pool or spa to conduct water to the recirculating pump.

Make-Up Water: Water used to fill or refill a pool/spa. SOURCE WATER.

Manifold: A pipe with several openings for making multiple connections.

Manometer: An instrument that measures vacuum or pressure differential.

Manufactured Diving Equipment: Manufactured diving equipment shall include diving boards, jump boards, springboards, and starting platforms. Architectural features

such as decorative rocks and elevated bond beams are not considered to be manufactured diving equipment.

Marcite®: Marcite® is a registered trademark of Paddock of California, Inc. See *Plaster*.

Maximum Pool User Load: The maximum number of people allowed in a pool/spa at any one time.

Mechanical Seal: A device to prevent the passage of water in or out of a centrifugal pump at the motor shaft.

Medical Facility Pool: Special purpose pool used by a medical institution.

Micron: One millionth of a meter. Used to describe the size of particles that filters are capable of trapping.

Microorganism: A microscopic plant or animal life. Usually refers to bacteria, protozoa, and algae in the water.

Millivolt: A measure of electrical potential equal to one thousandth of a volt.

Millivolt Ignition (Flame): Heat from a continuous pilot is used to generate electrical energy that opens the main gas valve.

Moment: Rotation force.

Motor: A machine for converting electrical energy into mechanical energy. When electrical current is supplied to a series of wires (windings), a magnetic field is created that spins the rotor and shaft to drive a pump impeller.

Mottling: A different coloration of plaster similar to the shading difference of cumulus clouds with no apparent pattern. A blotch, spot, or streak of different shades of color, usually in a variegated pattern.

Multiple Function Filter: CONTROL VALVE. See *Multiport Valve*.

Multiport Valve: A device that allows for the multidirectional control of the passage or flow of water through a system.

Muriatic Acid (HCl): A commercial name for hydrochloric acid.

National Sanitation Foundation (NSF International): An independent, nonprofit organization of scientists, engineers, educators, and others engaged in research and testing and in the development of standards in selected public health and environmental areas.

National Swimming Pool Foundation (NSPF): A nonprofit organization dedicated to research and education in aquatic safety.

Natural Gas: Admixture of gaseous hydrocarbons, chiefly methane, occurring naturally underground, often in association with petroleum products.

Negative Edge: See *Vanishing Edge*.

Nitrogen (N₂): An element present in ammonia, sweat, urine, fertilizers, and a variety of personal care products and environmental sources. When inadvertently introduced into pools or spas it readily reacts with chlorine to form chloramines.

Non-Swimming Area: Any portion of a pool where water depth, off-set ledges, or other irregularities prevent normal swimming activities.

Non-Toxic: Generally having no adverse physiological effect on human beings or other living organisms.

Ohm: A unit of measure of electrical resistance.

Ohm's Law: An electrical relation between volts, amperes, and ohms that can be expressed as follows: amps = volts/ohms, or current = voltage/resistance, or $I=E/R$.

Organic Matter: Carbon-based substances, generally originating from living organisms, often introduced to pools or spas by bathers and the environment. For example, perspiration, urine, saliva, suntan oil, cosmetics, lotions, and dead skin.

Organisms: Plant or animal life. Usually refers to algae or bacteria-like growth in pool water.

Orifice: An opening in a device, usually calibrated in size, through which water, air, or gas flows.

Orifice Plate: A disk, placed in a water flow line, with a concentric, sharp-edged circular opening in the center that creates a differential pressure to measure flow and to operate feeders and instruments or other hydraulic equipment.

ORP: See *Oxidation Reduction Potential*.

Orthotolidine (OTO): A colorless reagent that reacts with chlorine or bromine to produce yellow-to-orange colors that indicate the amount of total chlorine or bromine in water. OTO measures total chlorine. Because OTO is a suspected carcinogen and very acidic, use caution when handling this chemical.

Outdoor Stack: A type of equipment to be used on outdoor heaters in areas of extreme, constant winds.

Outlet: The aperture or fitting through which the water flows from the pool, spa, or hot tub.

Outlet, Suction: See *Suction Outlet*.

Overflow Gutter: The gutter around the top perimeter of the pool/spa, which is used to skim the surface of the water and carry off the waste or collect it for return to the filters.

Overflow System: Refers to removal of pool/spa surface water through the use of overflows and surface water collection systems of various design and manufacture.

Oxidation-Reduction Potential (ORP): A measure of the oxidation-reduction potential of chemicals in water. It is

generally measured in millivolts by means of an electronic meter and depends upon the types and concentrations of oxidizing and reducing chemicals in the water.

Oxidizers: Products used to destroy organic and inorganic contaminants in water.

Ozone (O₃): A gaseous molecule composed of three (3) atoms of oxygen that is generated on site and used for oxidation of water contaminants. It can also be used to regenerate bromine from bromide ions and as a supplemental contact sanitizer in conjunction with an EPA-registered sanitizer that provides a constant residual.

Ozone Contact Concentration: The amount of ozone that is dissolved in pool/spa water.

Ozone Generator: A device that produces ozone, generally exposing oxygen or air to corona discharge or ultraviolet light.

Ozone, Low Output Generating Equipment (Ozonator): Refers to units that will produce ozone in air at a concentration less than 500 ppm. Usually this term will refer to ultraviolet (UV) generators.

Parts Per Million (PPM): The unit of measurement used in chemical testing that indicates the parts by weight in relation to one million parts by weight of water. It is essentially identical to the term milligrams per liter (mg/L) in pool water.

Pass Through: Openings between vertical pickets of a fence.

Pathogens: Disease-causing microorganisms.

Pathological Agents: Toxins, microbes, etc. capable of causing diseases.

Permanently Installed Swimming Pool: A pool that is constructed in the ground or in a building in such a manner that it cannot be readily disassembled for storage.

pH: A value used to express acidity of a substance. Expressed as a number on a scale of 0 to 14, with 7.0 being neutral; values less than 7.0 are acidic and values greater than 7.0 are basic.

Phenol Red: A test kit reagent that is used to measure pH.

pH Meter: An electronic device that measures pH by means of a pH electrode immersed in the water to be tested.

Pilot Flame Generator: The component in a millivolt system that transforms heat from the pilot into electrical energy. THERMAL COUPLING, THERMOCOUPLE.

Pilot Light: A small permanent flame used to ignite gas at the first burner.

Pinching Hazard: Any configuration of component that may pinch the user.

Pitting: A form of etching or the deterioration of the integrity of the surface.

Plaster: A hand-applied, hand-troweled product. Plaster is the combination of cement, aggregate, and admixtures that form the decorative, aesthetic, maintainable shell of the pool. The functional purpose of plaster is to be watertight and smooth. The plaster has no structural strength. MARCITE®, WHITECOAT, TOPCOAT.

Polyvinyl Chloride (PVC): Thermoplastic resin commonly used for pool piping and plumbing components and pool liners.

Pool: A body of water contained in a reservoir used for recreational purposes.

See *Residential Pool*. See *Commercial/Public Pool*.

Pool Slide: An attraction having a configuration as defined in The Code of Federal Regulations (CFR) Ch II, Part 1207 or is similar in construction to a playground slide used to allow users to slide from an elevated height to a pool.

Pool User: Any person using a pool and adjoining deck area for the purpose of water activities or other related activities.

Potable Water: Water that is safe and satisfactory for drinking.

Potassium Monopersulfate (KHSO₅): A solid oxidizer used to prevent the build-up of contaminants in pool and spa water. POTASSIUM PEROXYMONOSULFATE.

Pozzolan: A siliceous or aluminosiliceous material that will chemically react with the calcium hydroxide released by the hydration of portland cement to form compounds possessing cement-like properties. A plaster additive that makes the plaster whiter and harder.

Precipitate: A substance separating out in the form of solid particles from a liquid. A result of a chemical or physical change that settles out or remains as a haze in suspension (turbidity).

Pre-Coat: The coating of filter aid on the septum of a diatomaceous earth type filter at the beginning of each filter cycle.

Pre-Coat Feeder: A chemical feeder designed to inject filter agents such as diatomaceous earth into a filter in sufficient quantity to coat the filter septum at the start of a filter run.

Pressure: A type of force that is exerted uniformly in all directions. It is expressed as pounds per square inch, feet of liquid, or feet of head.

Pressure Differential: The difference in pressure between two parts of a hydraulic system, such as the influent and effluent of a filter.

Pressure Gauge: A gauge that measures the amount of pressure within a closed system.

Pressure Switch (Heater): A device that will not allow the equipment to operate unless there is adequate water pressure in the system.

Pressure Test: A test for leaks in a closed system.

Primary Structural Members: Any part of the above-ground/onground pool structure that carries or retains any static load or stress caused by water pressure, surge, and/or natural forces, and for the reasonable foreseeable use.

Priming: A term used to define re-establishing the water flow by the recirculating pump.

PSI: Pounds per square inch. One pound per square inch is equivalent to 6.89473 KiloPascal (kPa). One pound per square inch is also equivalent to 70.3 grams per square centimeter.

Public Pool: See *Commercial/Public Pool*.

Pump: A mechanical device, usually powered by an electric motor, that causes hydraulic flow and pressure for the purpose of filtration, heating, and circulation of the pool or spa water. Typically, a centrifugal pump design is used for pools, spas, or hot tubs.

Pump Capacity: The volume of liquid a pump is capable of moving during a specified period of time against a given total head.

Pump Curve: A graph of performance characteristics of a given pump under varying horsepower, flow, and resistance factors. Used in checking and sizing a pump.

Pump Strainer: A device, placed on the suction side of a pump, that contains a removable strainer basket designed to trap debris in the water flow with a minimum of flow restriction. Sometimes referred to as a hair/lint pot or trap.

Puncture Hazard: Any protrusion that is capable of causing injury to skin.

Push-pull Valve: A device that allows for the dual directional control or flow of water through a system.

Quaternary Ammonium (QUAT): Organic compound of ammonia used as an algistat and an algicide.

Radius of Curvature: The curved surface from the springline (vertical sidewall) to the pool bottom. WALL COVE.

Rated Pressure: The pressure rating specified for a piece of equipment.

Rate of Flow: The quantity of water flowing past a point within a specified time, such as the number of gallons flowing in one minute (GPM). One gallon per minute is equivalent to 3.7854 liters per minute.

Reagents: The chemical used to test various aspects of water quality.

Rebar: See *Reinforcing Bar*.

Recessed Treads: A series of vertically spaced cavities in a pool/spa wall creating tread areas for step holes.

Recirculation System: See *Circulation System*.

Rehabilitation: The activity of restoring all or part of a pool or spa structure, and its component parts, back into good condition, including the rebuilding and/or replacing of worn and broken parts or components. See *Remodel*.

Reinforcing Bar: Steel bars embedded in concrete to increase its ability to withstand bending and stretching. REBARS.

Relay: A device that responds to a current or voltage change by activating switches or other devices in an electric circuit.

Remodel: To install cosmetic changes, accessory add-ons, or modernizations. Includes both residential and commercial installations.

Remote Switch: Any device used to activate/deactivate an apparatus from a distance.

Removable: Capable of being easily disassembled or removed.

Residential Pool: Any pool that is intended for non-commercial use as a swimming pool by three (3) families or less and their guests and that is over twenty-four inches (24") [60.96 centimeters] in water depth and has a volume greater than 3250 gallons [12,301.25 liters]. (Refer to ANSI/NSPI-5, *Standard for residential inground swimming pools*, 1995, or latest revision.)

Type I-V: Residential pools suitable for the installation of diving equipment by type.

Type O: Residential pools where the installation of diving equipment is prohibited.

See *Residential Aboveground Swimming Pool* and *Residential Ongoing Swimming Pool*.

Residential Aboveground Swimming Pool — Type O: A removable pool of any shape that has a minimum water depth of thirty-six inches (36") [0.9144 meters] and a maximum water depth of forty-eight inches (48") [1.2192 meters] at the wall. The wall is located on the surrounding earth and may be capable of being disassembled or stored and reassembled to its original integrity. Diving and the use of a water slide are prohibited (Refer to ANSI/NSPI-4, *Standard for aboveground/onground residential swimming pools*, 1999, or latest revision). See *Residential Ongoing Swimming Pool*.

Residential Ongoing Swimming Pool — Type O: A removable pool package whose walls rest fully on the surrounding earth and has an excavated area below the ground level where diving and the use of a water slide are prohibited. (Refer to ANSI/NSPI-4, *Standard for aboveground/onground residential swimming pools*, 1999, or latest revision). The slope adjacent to the shallow area shall have a maximum slope of 3:1, and the slope adjacent to the

sidewalls shall have a maximum slope of 1:1. See *Residential Aboveground Swimming Pool*.

Residual: The measurable sanitizer present in water.

Response Time: The time between recognition of pool user distress and rescue by a lifeguard.

Return Inlet: The aperture or fitting through which the water under positive pressure returns into a pool or spa.

Return Piping: The piping that is referred to as effluent, returning water to the pool or spa.

Reverse Circulation: The name given to a water circulation system in which water is taken from the surface and returned through inlets at the bottom of the pool or spa.

Rimflow Overflow System: Perimeter overflow system in which the overflow rim is at the same elevation as the deck.

Ring Buoy: A ring-shaped floating buoy capable of supporting a user. Usually attached to a throwing line.

Risk: The possibility of suffering harm or loss.

Rope and Float Line: A continuous line not less than one-fourth inch (1/4") [6.35 millimeters] in diameter that is supported by buoys and attached to opposite sides of a pool to separate the deep and shallow ends.

Salinity: The salt content of water.

Sand Filter: A filter using sand or sand and gravel as a filter medium.

Saturation Index: A number that indicates whether water will have a tendency to deposit calcium carbonate from a solution, or whether it will be potentially corrosive. Five factors are used in the computation: pH, total alkalinity, calcium hardness, temperature, and TDS. When correctly balanced, the water will be neither scale-forming nor corrosive.

Scale: The precipitate that forms on surfaces in contact with water when the calcium hardness, pH, or total alkalinity levels are too high.

Screed: In cement masonry flatwork, the wood or metal straightedge used to strike off or level newly placed concrete.

Sealant: A substance that is applied on a surface or between surfaces to prevent the entry of moisture.

Secondary Structural Members: Any part of the aboveground/onground pool structure that is not subject to load caused by water pressure.

Sediment Trap: A device used on gas piping and other systems to collect sediment and moisture.

Self Priming: A rating given to centrifugal pumps indicating that the pump is capable of operating above pool water level, after initial filling with water.

Septum: Part of a diatomite-type filter element consisting of cloth, wire screen, or other porous material on which filter aid is deposited.

Sequestering Agent: A chemical that combines with metals keeping them in solution and preventing them from depositing on and staining pool surfaces. Some sequestering agents are chelating agents.

Service Factor: The degree to which an electric motor can be operated above its rated horsepower without danger of overload failure.

Shallow Areas: Portions of a pool or spa with water depths less than five feet (5') [1.524 meters].

Shock Treatment: The practice of adding significant amounts of an oxidizing chemical to water to destroy inorganic and organic contaminants in water.

Shotcrete: A pneumatically applied (sprayed) mixture of cement and sand, applied onto contoured and supported surfaces to build a pool or spa. Shotcrete is pre-mixed and pumped wet or dry through hoses to the nozzle.

Shut-Off Head: The amount of head against which the pump can no longer circulate water.

Sight Barrier: Available opening space in any given or total fence area.

Signal Word: A visual alerting device in the form of a decal or label placard or other marking such as an embossing, stamping, etching, or other process that advises the observer of the nature and degree of the potential hazard(s) that can cause property damage, injury, or death. It can also provide safety precautions or evasive actions to take, or provide other directions to eliminate or reduce the hazard. Aquatic safety signage shall conform to specifications as described in the ANSI Z-535 series of standards on product safety signs and labels.

Signal word: to convey the gravity of the risk

Consequences: what are likely to happen if the warning is not heeded

Instructions: appropriate behavior to reduce or eliminate the hazard

CAUTION: Indicates a potentially hazardous situation that, if not avoided, could result in minor or moderate injury. It may also be used to alert against unsafe practices.

DANGER: Danger indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations.

WARNING: Warning indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.

Single-Phase Current: Electrical alternating current flow that reaches one peak in each direction per cycle.

Skimmer: A device installed in the pool or spa that permits the removal of floating debris and surface water to the filter.

Skimmer Cover: A removable lid to close deck opening to the skimmer housing.

Skimmer Equalizer Pipe: Connection from skimmer housing to the pool, spa, or hot tub below the weir and sized to satisfy pump demand and prevent air lock or pump loss of prime.

Skimmer Equalizer Valve: A device on the equalizer line that operates to draw water from the equalizer line when water level inside the skimmer body drops below operating level.

Skimmer Housing: Structure that attaches to or contains skimmer weir, strainer basket, float valve, and other devices used in the skimming operation.

Skimmer Weir: Part of a skimmer that adjusts automatically to small changes in water level to ensure a continuous flow of water to the skimmer.

Slip Resisting: A surface that has been so treated or constructed to significantly reduce the chance of a user slipping. The surface shall not be an abrasion hazard.

Slope: An inclined surface.

Slump: A measurement of water in concrete. A low-slump concrete has a stiff consistency.

Slurry: A free-flowing, pumpable suspension of fine, solid material in liquid.

Smooth: Having a surface free from irregularities, roughness, or projections. EVEN.

Soda Ash: See *Sodium Carbonate*.

Sodium Bicarbonate (NaHCO₃): Also baking soda or sodium hydrogen carbonate. A white powder (pH = 8.3) used to raise total alkalinity in water.

Sodium Bisulfate (NaHSO₄): Also known as dry acid. A granule used to lower pH and/or total alkalinity in water.

Sodium Carbonate (Na₂CO₃): A white powder used to raise pH of the water.

Sodium Dichlor (Sodium Dichloro-Isocyanurate) (C₃N₃O₃Cl₂Na): Contains between 56% and 64% available chlorine. Sanitizer product that is self-stabilizing due to release of free available chlorine and cyanuric acid when they dissolve. SODIUM DICHLORO-S-TRIAZINETRIONE.

Sodium Hypochlorite (NaCl): A clear liquid form of an inorganic chlorine compound obtainable in concentrations of 5% to 16% available chlorine. LIQUID CHLORINE, BLEACH.

Sodium Thiosulfate (Na₂S₂O₃): A chemical used to neutralize chlorine.

Soft Water: Water that has a low calcium and magnesium content.

Solar Panel: See *Collector*.

Soot: A black, powdery, carbonaceous substance created by improper air-fuel mixture in combustion of fossil fuels. Soot is a by-product of incomplete combustion.

Spa: A warm water reservoir permanently installed with hydromassage jets that are constructed out of concrete (gunite, shotcrete, etc.). Spas may or may not be attached to a pool.

Permanent Residential Spa: A spa in which the water heating and water circulating equipment is not an integral part of the product. The spa shall be intended as a permanent plumbing fixture and shall not be intended to be moved. (Refer to ANSI/NSPI -3, *Standard for permanently installed residential spas*, 1999, or latest revision.)

Public Spa: Any spa other than a permanent residential spa or hot tub that is intended to be used for bathing and is operated by an owner, licensee, concessionaire, regardless of whether a fee is charged for use. (Refer to ANSI/NSPI-2, *Standard for public spas*, 1999, or latest revision.)

Hydrotherapy Spa: A unit having a therapeutic use, but that is not drained, cleaned, or refilled for each individual. It includes, but is not limited to hydrotherapy jet circulation, hot water, cold water mineral baths, air induction bubbles, or any combination thereof. Industry terminology for a spa includes, but is not limited to (1) a therapeutic pool, (2) a hydrotherapy pool, (3) a whirlpool, (4) a hot spa, etc. NSPI standards exclude facilities used by or under direct supervision and control of licensed medical personnel.

Spalling (Concrete or Plaster): The separation of the top layer of cement-rich material, exposing the underlying aggregate layer.

Spa User: Any person using a spa and adjoining deck area for the purpose of water activity or other related activity.

Special Purpose Pool: A pool intended to be used exclusively for a specific activity, such as instruction diving, competition, or medical treatment.

Splash Pool: A pool having a water depth not exceeding 18 inches (18") [0.4572 meters] that has as its intended primary use random play by small children. The pool could include constructed play devices including small flume type water slides and other play devices. CHILDREN'S ACTIVITY POOL. See *Catch Pool*.

Splasher (Wader) Pools: A splasher pool shall have a maximum water depth of thirty-six inches (36") [0.9144 meters]. These pools are not intended to be covered within the scope of NSPI standards.

Spray Pool: A pool or basin occupied by constructed features that spray water in various arrays for the purpose of wetting the persons playing in the spray streams. Maximum depth of accumulated water in the pool or basin area is six inches (6") [15.24 centimeters].

Springline: A line from which the pool wall breaks from vertical and begins its radius arc of the curvature.

Stabilizer: CYANURIC ACID.

Stairs: A series of steps, each consisting of a riser and a tread.

Static Head: Head resistant caused by the weight of a standing water column to be moved. It is encountered on both the suction and discharge side.

Static Suction Head: The vertical distance in feet (meters) between the pump centerline and the level of the liquid being pumped when the liquid is below the impeller centerline, expressed in feet of head.

Static Suction Lift: Vertical distance in feet (meters) from center line of the pump impeller to pool water level.

Steps: See *Stairs*.

Story Pole: A pole marked to measure vertical heights during construction and to set elevations.

Strainer Basket: Readily removable, perforated, or otherwise porous container used in the pump lint strainer to catch coarse material.

Structural Crack: A break or split that weakens the structural integrity of the pool.

Suction Head: The head, in feet, that a pump must provide on the inlet side to raise the liquid from the pool/spa supply well to the level of the pump.

Suction Outlet: The aperture or fitting, other than a skimmer, on the side wall of a swimming pool or spa through which the water under negative pressure (vacuum) is drawn from the pool or spa to the pump or circulation system.

Suction Piping (Influent): The piping that is connected to the suction side of the pump.

Superchlorination: The practice of adding a sufficient amount of a chlorinating compound to reduce cloudy water, slime formation, musty odors, algae and bacteria counts, and/or improve the ability to maintain sanitizer residuals.

Surface Checks: Spider-webbing pattern in a surface. Not all the way through, not an open crack.

Surface Crack: A repairable break in the surface, not major, not self-curing.

Surface Skimming System: A device or system installed in the pool/spa that permits the removal of floating debris and surface water to the filter.

Surge: Displacement of water in a pool — static and dynamic. WAVE ACTION.

Surge Capacity: The storage volume in a surge chamber, gutter, and plumbing lines. See *System Capacity*.

Surge Chamber: A storage vessel within the pool recirculating system used to absorb the water displaced by bathers. SURGE PIT.

Swimmer Load: See *Bather Load*.

Swimming Area: Area of pool in excess of three feet (3') [0.9144 meters] in depth that is devoted to swimming.

Swimout: An underwater seat area that is placed completely outside of the perimeter shape of the pool. When located at the deep end, swimouts are permitted to be used as the deep-end means of entry/exit of the pool. LOVE SEAT.

System Surge Capacity: The total storage, including surge chamber, gutter system and piping, within the pool recirculating system used to absorb the water displaced by bathers.

Tamperproof: Requiring tools to alter or remove portions of the equipment. VANDAL-PROOF.

Tangent: A line touching a curve at a single point making contact, but not intersecting.

Temperature Factor (TF): Used when determining the saturation index.

Temperature Rise: The difference between the desired water temperature and the temperature of the body of water.

10/20 Rule: A pool or aquatic facility shall be provided with a qualified lifeguard or a number of lifeguards trained and stationed in a manner that will permit them to identify an incident or trauma within ten (10) seconds of its initiation. Upon identification of the incident or trauma, the guard shall be able to respond to and initiate indicated protocol appropriate to the circumstance within twenty (20) additional seconds.

Test Kit: Equipment used to determine specific chemical residual and physical properties of water.

Texture: The visual or tactile condition of a surface.

Therm: A unit of thermal measurement equal to 100,000 BTUs.

Thermostat: A temperature-controlling device that cycles the heater on and off to maintain the desired temperature.

Three-Phase Current: Current flow that reaches a peak in each direction three times during a cycle.

Time Clock: A device that automatically controls the periods that a pump, filter, heater, blower, and other electrical devices are in operation.

Titration: A method for measuring alkalinity, hardness, available chlorine or other such chemical parameters by measured addition of reagents that yield a foreseeable end point as indicated by a change in color.

Top Coat: See *Plaster*.

Top Rail: The part of the frame located on top of or adjacent to the outer edges of the aboveground/onground pool wall.

Total Alkalinity: A measure of the pH buffering capacity of water. Alkalinity is generally expressed in terms of the equivalent concentration of calcium carbonate in mg/L (or ppm).

Total Alkalinity (TA) Factor: Used when determining the saturation index.

Total Chlorine: The sum of both the free available and combined chlorines.

Total Dissolved Solids (TDS): The measure of the total amount of dissolved matter in water.

Total Dynamic Head: See *Feet Of Head*.

Toxic: A substance having an adverse physiological effect on human beings or other living organisms.

Tread Contact Surface: Foot contact surfaces of a ladder, step, stair, or ramp.

Trichloro: A form of organic chlorine, most commonly found in compressed form (tablets or sticks).

Trichloro-Iso-Cyanurate (C₃N₃O₃Cl₃): Sanitizer product that is self-stabilizing due to release of free available chlorine and cyanuric acid when it dissolves. A form of organic chlorine that reacts with water to form 90% available chlorine and cyanuric acid. TRICHLORO-S-TRIAZINETRIONE. See *Isocyanurates*.

Tsunami Pool: A wave pool designed to generate a single transitional wave in each cycle. These pools are characterized by strong cross currents and counter currents after the passage of each wave. The operating pattern for the Tsunami pool produces a single wave form at frequencies ranging from several seconds to several minutes.

Tube Ride: A gravity flow attraction found at a waterpark designed to convey riders on an inner tube-like device through a series of chutes, channels, flumes, or pools.

Turbidity: Cloudy condition of water due to the presence of extremely fine particulate materials in suspension that interfere with the passage of light.

Turnover Rate: The period of time (usually in hours) required to circulate a volume of water equal to the pool or spa capacity.

Two-Speed Pump: A centrifugal pump that has a motor that operates at two different speeds.

Underwater Ledge: A narrow shelf projecting from the side of a vertical structure whose dimensions are defined in the appropriate standard.

Underwater Light: A fixture designed to illuminate from beneath the water surface.

Wet Niche Light: A watertight and water-cooled light unit placed in a submerged niche in a pool, spa, or hot tub wall and accessible only from the interior.

Dry Niche Light: A light unit placed behind a watertight window in the pool, spa, or hot tub wall.

Upper Distribution System: Those devices designed to distribute the water entering a permanent medium filter in a manner to prevent movement or migration of the filter medium. Also collects water during filter backwashing unless other means are provided.

Upright Support: That portion of the frame that is adjacent to the aboveground/onground wall in a vertical position that supports the top rail and braces the wall.

User: Any person engaging in water activities or related activities at a pool, spa, or hot tub, including the adjoining deck.

User Load: The total number of persons permitted in the pool/spa complex at any given time. See *Bather Load*.

Vacuum: The reduction of atmospheric pressure within a pipe, tank, pump, or other vessel. Vacuum is measured in inches of mercury. One inch of mercury is equivalent to 1.13 Feet of Head One inch of mercury is also equivalent to 345.3 kilograms per square meter.

Vacuum Filter: A filter through which water is pulled by a pump mounted on the effluent side of the filter.

Valve: Any device in a pipe that will partially or totally obstruct the flow of water (such as a ball, gate, globe, or butterfly valve) or permit flow in one direction only (as with a check or foot valve).

Vanishing Edge: Water-feature detail in which water flows over the edge of at least one of the pool walls and is collected in a catch basin. NEGATIVE EDGE.

Velocity: The speed at which a liquid flows between two specified points, expressed in feet per second. One foot per second is equivalent to 0.3048 meters per second.

Venting (Heaters): The system responsible for the introduction of air for combustion and for dispersal of the flue products.

Venturi Jet: See *Hydrotherapy Jet*.

Venturi Tube: A tube mounted in a circulation line so as to cause restrictions of flow. The restriction causes a pressure differential that is used to measure flow rate or to operate hydraulic chemical feeders such as sanitizers, clarifiers, etc.

Vertical Wall: A wall that, from its top, may slope up to 11° (eleven degrees) from plumb to the interior of the pool.

Vinyl Liner: A suitable material constructed of vinyl or vinyl compounds that acts as a container for water when used in conjunction with a structural support system.

Voltage: The measure of electrical potential or electromotive force in units called volts.

Volume: The capacity of a specified container (e.g., a pool or spa) expressed in gallons or liters. One U.S. gallon is equivalent to 3.7854 liters.

Wading Pool: A pool that has a shallow depth used for wading.

Waler: A horizontal bracing member used in form construction. RANGER, WHALER.

Wall: The surface of a vertical barrier.

Wall Closure: The fastening device(s) that connect the aboveground wall ends together.

Warning: See *Signal Word*.

Waste Water Disposal System: All water disposal systems approved by the authority having jurisdiction, such as a storm sewer, sanitary sewer, open pit, leach field, or irrigation system.

Waterline: The waterline shall be defined in one of the following ways: **1. Skimmer System:** The waterline shall be at the midpoint of the operating range of the skimmers when there are no users in the pool or spa. **2. Overflow System:** The waterline shall be at the top of the overflow rim.

Water Pressure Switch: See *Pressure Switch*.

Watt: The measure of electrical power computed by multiplying voltage times current (volts x amperes). Equal to 1/746 of one horsepower unit.

Watt Density: The amount of watts generated in a heating element per inch. The lower the amount of watts per square inch, the lower the density. One square inch is equivalent to 6.4516 square centimeters.

Wave Pool Caisson: A large chamber used in wave generation. This chamber houses pulsing water and air surges in the wave generation process and is not meant for human occupancy.

Weir: See *Skimmer Weir*.

Wet Niche Light: See *Underwater Light*.

White Coat: See *Plaster*.

Winterized Liner: A vinyl liner that is manufactured with sufficient plasticizers to withstand exposure to its rated lowest temperature or -20 °F [-28.89 degrees Celsius] per ASTM standard D-1790-99, *Standard test method for brittleness temperature of plastic sheeting by impact*, 2001, or latest revision.

Winterizing: Preparation of pools and spas for cold or freezing weather.

Wrinkle: A small ridge or crease in an otherwise smooth vinyl liner

(This appendix is not part of the American National Standard ANSI/NSPI-5 2003, but is included for information only)

Appendix K

SOURCES OF MATERIAL

ACI	American Concrete Institute 38800 Country Club Drive Farmington Hills, MI 48331 (248) 848—3800	NEC	National Electrical Code see NFPA
ANSI	American National Standards Institute 25 West 43rd Street New York, NY 10036 (212) 642-4900	NFPA	National Fire Protection Association Batterymarch Park Quincy, MA 02269 (617) 770-3000
ASME	American Society of Mechanical Engineers 345 East 47th Street New York, NY 10017-2392 (212) 705-7800	NSF	NSF International (Formerly National Sanitation Foundation) 3475 Plymouth Road P.O. Box 130140 Ann Arbor, MI 48101-0140 (313) 930-0906
ASTM	(formerly American Society of Testing & Materials) 100 Barr Harbor Drive West Conshohocken, PA 19428-2959 (610) 832-9585 (610) 832-9555 (Fax)	NSPI	National Spa and Pool Institute 2111 Eisenhower Avenue Alexandria, VA 22314 (703) 838-0083 (703) 549-0493
IAPMO	International Association of Plumbing & Mechanical Office 20001 South Walnut Drive Walnut, CA 91789 (909) 595-8449	UL	Underwriters Laboratories 333 Pfingsten Road Northbrook, IL 60062-2096 (847) 272-8800



LIMITED WARRANTY



You're always able to count on the quality and long service life of Pentair products. We use the very best standards of workmanship, materials, and manufacturing processes to deliver value and peace of mind. Please review this document for details of general warranty terms and conditions and visit www.pentair.com/warranty for information regarding the coverage duration and any possible warranty exceptions for your specific pool and spa equipment. Pentair offers:

- **LIMITED WARRANTY:** Pentair warrants its products to be free from defects in material and/or workmanship for a period of sixty (60) days (parts only) from the original date of purchase and/or installation. Customer agrees to prepay all shipping charges to Pentair.
- **EXTENDED WARRANTY:** To receive a product extended warranty (longer than 60 days from the original date of installation), customer must:
 1. Register the product;
 2. Provide a copy of the sales receipt; and
 3. Provide a copy of the installation invoice, provided by the qualified installer, within 60 days of installation (if required). Certain products do not require qualified installation but still require product registration and copy of the sales receipt to receive the extended warranty.
- **TRADEGRADE WARRANTY:** TradeGrade products must be purchased from a retail store (brick and mortar), pool builder or pool service company. If purchased online (via internet) the product will only receive a sixty (60) day limited warranty.

GENERAL WARRANTY TERMS AND CONDITIONS

Denial of Warranty Claim

A warranty claim may be denied under the following circumstances:

1. Damage caused by careless handling, improper repackaging, or shipping.
2. Damage due to misapplication, misuse, abuse or failure to operate equipment as specified in the owner's manual.
3. Damage caused by failure to install products as specified in the owner's manual.
4. Damage due to unauthorized product modifications or failure to use Pentair original replacement parts.
5. Damage caused by negligence, or failure to properly maintain products as specified in the owner's manual.
6. Damage caused by failure to maintain water chemistry in conformity with the standards of the swimming pool industry for any length of time.
7. Damage caused by water freezing inside the product.
8. Accidental damage, fire, acts of God, or other circumstances outside the control of Pentair.

Pentair Warranty Obligations

Should a defect in workmanship and/or material in any item covered by this warranty become evident during the term of the warranty, then upon the customer following the procedures set forth below, Pentair will, at its sole option, repair or replace such product or part of equal value, in lieu of repair. Pentair is not, however, responsible for any cost of shipping or transportation of the product or parts thereof to or from the Technical Service Department. Also, Pentair is not liable for any loss of time, inconvenience, incidental expenses such as telephone calls, labor or material charges incurred in connection with the removal or replacement of the equipment, or any other incidental or consequential damages. The above mentioned warranties are void if the product is repaired or altered in any way by any persons, agents or representatives other than those authorized by Pentair. Expendables including, but not limited to refrigerant, recovery of refrigerant, or transportation for components are not covered under this limited warranty. Reasonable vehicle trip and evaluation charges may be assessed by a Pentair service representative. 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. All extended warranties are applicable to the original owner only, beginning on the date of installation and are not enforceable by any third party.

- Continued on Back Side -

© 2019 PENTAIR WATER POOL AND SPA, INC. ALL RIGHTS RESERVED.
1620 HAWKINS AVE., SANFORD, NC 27330 • 10951 W. LOS ANGELES AVE., MOORPARK, CA 93021
800.831.7133 WWW.PENTAIR.COM

P/N 151632.A 7/19

Please detach along dotted line and mail this section. Keep the warranty card for your records.

PRODUCT REGISTRATION CARD



allow us to communicate with you quickly. **Incomplete or missing information such as your serial number will prevent your product from being registered.** Your Limited Warranty is attached to this card. Please detach and review thoroughly so you are familiar with the terms of your warranty coverage. Please keep in a safe place.

TO RECEIVE EXTENDED WARRANTY: 1. REGISTER YOUR PRODUCT 2. PROVIDE SALES RECEIPT AND INSTALLATION INVOICE¹, PROVIDED BY THE QUALIFIED INSTALLER, WITHIN 60 DAYS OF INSTALLATION.

TWO WAYS TO COMPLETE YOUR PRODUCT WARRANTY REGISTRATION:

- 1) **ONLINE:** Visit www.pentair.com/registration to complete registration, upload sales receipt and installation invoice (best for registering multiple products).
- 2) **BY MAIL:** Complete this card and attach sales receipt, and installation invoice.

1 PRODUCT INFORMATION

Serial Number(s): _____

Product Name(s): _____

This product: Replaced an existing unit Did not replace an existing unit (New)

Where did you purchase your Pentair product(s)?

Pool Builder Pool Store Pool Service Co. Mail Order Internet Other

2 POOL OWNER INFORMATION

Pool Type: Inground Inground Pool/Spa Combination Aboveground Spa Only

Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Phone: _____ Email: _____

I do not wish to receive promotional emails or surveys from Pentair.

3 PURCHASE & QUALIFIED INSTALLER INFORMATION

Please attach a copy of the sales receipt and qualified installer's invoice to this card as proof of qualified installation and purchase.



Be sure your documents include the following purchase and installation information:

- Company name and location of purchase
- Date of purchase
- Name, location, and phone number of installer
- Date of installation

¹ A qualified installation invoice is not needed if your product does not require professional installation in order to receive an extended warranty. Refer to www.pentair.com/warranty for details.

LIMITED WARRANTY



GENERAL WARRANTY TERMS AND CONDITIONS (continued)

Warranties by Others

Some Pentair products incorporate components manufactured by other manufacturers. Some of these manufacturers provide warranties in addition to the warranty provided by Pentair herein. In all such cases, a copy of the third party manufacturer's warranty will be provided with the product. To the extent protection provided under any such third party warranty exceeds the Limited Warranty provided herein, the Customer will have to contact the specific manufacturer for the additional protection.

No Other Warranties

To the maximum extent permitted by applicable law, Pentair disclaims all other warranties, either expressed or implied, including, but not limited to, implied warranties of merchantability and fitness for a particular purpose, with regard to the product(s), part(s) and/or any accompanying written materials.

Procedure for Obtaining Performance

In order to obtain the benefits of this warranty, the consumer who made the original retail purchase must contact the Pentair Technical Service Department as soon as possible after discovery of the product related issue, but in no event later than the expiration date of the respective warranty periods provided herein. Upon receipt of this communication, Pentair will promptly notify the customer of the address to which the product may be shipped. The customer shall then ship the product, freight prepaid, to the address indicated, together with a "RETURN GOODS AUTHORIZATION" form obtained from Technical Service and a brief description of the problems encountered. Unauthorized returns will not be accepted. Freight must be prepaid by customer.

Warranties or Representations by Others

No third party has any authority to make any warranties or representation concerning Pentair or its products. Accordingly, Pentair is not responsible for any such warranties or representations.

Other Rights

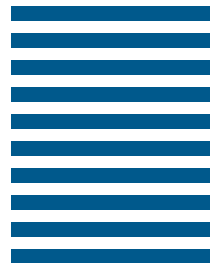
This warranty gives you specific legal rights and you may also have other rights, which vary from state to state.

Sole Warranty

Supersedes all previous warranty publications.



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES



BUSINESS REPLY MAIL
FIRST-CLASS MAIL PERMIT 8 FARMINGTON MO

POSTAGE WILL BE PAID BY ADDRESSEE

PENTAIR WATER POOL AND SPA, INC.
PO BOX 1228
FARMINGTON MO 63640-9852



FOLD IN HALF AND SEAL FOR MAILING

