



**Summary of Substantive Changes
between the 2011 and the 2017 editions of
ANSI/APSP/ICC-16 “Suction-Outlet Fitting Assemblies (SOFA) for Use in Pools,
Spas, and Hot Tubs”**

Presented to the IAPMO Standards Review Committee on June 11, 2018

General: There are significant formatting and technical changes to this standard which will likely have an impact on currently listed products. Some of the more significant additional requirements are follows:

- Expanded the scope to cover suction outlet fittings as well as the sump and accessories associated with the suction fitting like covers/grates (see Section 1.1).
- Revised the requirements for determining the flow rating of manufactured SOFAs (see Section 1.3).
- Added new requirements for electrical bonding of SOFA components made of metal (see Section 3.1.14).
- Added specific requirements for inclusion of the head loss curve and illustrations showing the location of measurements for each SOFA model (see Section 3.2.2).
- Added new requirement that SOFAs be categorized as blockable or unblockable (see Section 3.2.4).
- Added new requirements to include manufacturers instructions for cover/grate fasteners, replacement of covers, and confirmation of flow paths after installation (see Section 3.3).
- Added requirements for additional statements to be include in the SOFAs maintenance instructions (see Section 3.4).
- **Added new requirement that each SOFA configuration is to be tested whenever a suction pipe(s) opening is positioned within reach of the hair used for certification testing (see Section 3.5).**
- Added additional information to include in the manufacturers installation instructions including determination of the installed suction systems flow ratings and intended pool surface type (see Section 3.6).
- Added requirements for blockable and unblockable SOFAs. Blockable SOFAs in new pools are to be installed in multiple sofa systems only and in existing pools are required to be installed along with a VGBA Device to prevent entrapment (see Section 3.7 and 9.4).
- Clarified the requirements for RDP SOFAs, corrected Equation 1 to include a_B versus a_R in the denominator and removed requirements for Venturi Outlets and Swim Jet Fittings (see Section 3.9).
- Added a new test for threaded fasteners (see Section 4.10).
- **Changed the piping configuration to remove a required minimum of 16 in SCH 40 plastic pipe attached to the 90-degree elbow, added new requirements for the manufacturer to supply SOFA dimensions; and for the lab to measure and document the minimum flow path length for each SOFA, and included a new allowance for the models subject to testing for SOFA’s with a minimum flow path greater than 16 in (see Section 5.7).**
- **Changed the method of calculating the allowable removal force: replaced former Table 1, *Applicable Body Block Element – Calculation of Removal Force* with new Equation 2 (see Section 6.4).**
- **The differences between the former and current editions of the standard significantly change the requirements for product marking, packaging and instructions (see Sections 8 and 9).**
- Included requirements limiting systems designed to prevent suction entrapment for use with blockable SOFA systems to VGBA devices (see Section 9.4).



Note: Different color fonts are used throughout this summary of changes. These are intended to draw attention to specific changes in the standard but should not be considered to indicate all of the changes in the standard or important items to be considered.

- **Red-Strikeout:** Text removed from the previous edition of the standard
- **Blue Underline:** Text added that is now included in the current edition of the standard
- **Green Font:** Identify changes in testing or other requirements that are especially noteworthy and will likely significantly impact current products.
- **MI: Purple Font:** Identifies new requirements for manufacturer's instructions.

Title: The title was changed to indicate the scope expansion of this standard as follows:

~~American National Standard for Suction Fittings for Use in Swimming Pools, Wading Pools, Spas, and Hot Tubs~~
Suction-Outlet Fitting Assemblies for Use in Pools, Spas, and Hot Tubs

Section 1.1, Scope: The scope was expanded to cover suction outlet fittings as well as the sump and accessories associated with the suction fitting like covers/grates as follows:

1 GENERAL

1.1 Scope This standard establishes materials, testing, use, installation, and marking requirements for new or replacement bather-accessible Suction Outlet Fitting~~s~~ Assemblies (SOFA)s, other than maintenance drains, that are designed to be ~~totally~~ fully submerged for use in any pool, which include, but are not limited to a swimming pool~~s~~, hot tub, spa, portable spa, or non-portable wading pool, or other aquatic venue intended for swimming or recreational bathing. The term pool is used throughout this standard as an identifier for these bodies of water.

1.1.1 Effective date. This standard becomes effective 18 months after adoption by the U.S. Consumer Product Safety Commission (CPSC).

1.1.2 Existing product compliance. SOFA components that were manufactured or installed before the effective date of this standard, and that meet APSP-16 2011, shall be considered in compliance with this standard.

1.1.3 Service life. Cover/grates and all other SOFA components shall be replaced at or before the end of their service life as stated by the manufacturer. Service life begins the month and year in which a SOFA component is installed with or without water.

~~**1.1.2 Definition.** Suction fittings shall be defined as all components, including the sump and/or body, cover/grate, and hardware.~~

~~**1.1.3 Compliance.** Demonstration of compliance for this Standard is merely an indication that the product meets performance requirements and specifications contained in this Standard.~~

~~**1.1.4 Revisions.** The provisions of this Standard shall not be construed to prevent the use of any alternate material or method of construction provided any such alternate meets the full intent of the standard.~~

~~**1.1.5.2 1.1.5 Vacuum cleaner ports.** Vacuum connection covers shall be are excluded from evaluation to this standard the scope of this standard. See the International Association of Plumbing and Mechanical Officials (IAPMO) SPS-4, Special Use suction fittings for Swimming Pools, Spas and Hot tubs for Suction-Side Automatic Swimming Pool Cleaners.~~

Section 1.2, Suction Outlet Fitting Assembly types: The fitting types were revised to address the scope change including the following:



1.1.6 Types of Suction Fittings 1.2 Suction Outlet Fitting Assembly Types

1.1.6.1 1.2.1 General purpose SOFAs. ~~A manufacturer or designer of any suction outlet cover/grate shall indicate under which Type the cover/grate is listed.~~ A manufactured SOFA for transferring water from the pool directly or indirectly to a pump.

1.2.2 Maintenance drain and fire suppression water source outlet: A manufactured, restricted use fitting used only by pool maintenance personnel or fire suppression personnel ONLY at times when the pool is closed to bathers. Maintenance drains and fire suppression water source outlets are exempt from sections 5 and 6 of this standard. Any SOFA certified to this standard shall be permitted to serve this purpose.

1.1.6.6 1.2.3 Self-Contained Spa Fittings SOFAs. ~~Suction outlet fittings used~~ A manufactured, restricted use, SOFA that is distributed exclusively in as a component of a self-contained factory manufactured spas, shall be considered "Self-Contained Spa Fittings." where the self-contains spa SOFA has been further evaluated while installed in the spa at the time it is tested and certified in conformance with ANSI/UL 1563.

1.1.6.4 1.2.4 Swim jet combination Fittings SOFAs: ~~All swim jet combination fittings~~ A manufactured SOFA that combine merges a suction port(s) and discharge port(s) into as single assembly for use in a single SOFA system and/or a multiple SOFA system.

~~All swim jet combination fittings that combine suction and discharge into one housing, creating a high velocity, high volume stream of water to swim, jog, or walk against, as well as massage, shall be considered "Swim Jet Combination Fittings."~~

1.1.6.5 Submerged Suction Outlets. ~~All other suction outlets for use in swimming pools, wading pools, spas, and hot tubs, as well as all other aquatic facilities, shall be considered as "Submerged Suction Outlets."~~

Former Section 1.1.7: Removed description of Cover/grates for Single or Multiple Usage Outlet

1.1.7 Single or Multiple Usage

~~1.1.7.1 Cover/grates that pass the body entrapment portion of this Standard as well as meeting all other requirements in this Standard shall be permanently marked "For Single or Multiple Outlet Use," "For Single Outlet Use," or "For Multiple Outlet Use Only" at the manufacturer's option.~~

Section 1.3, Certifications: Some of the significant changes under Section 1.3 are as follows:

- Limited the acceptable credentials of Registered Design Professionals, Labs and Third-Party Certifiers working with SOFAs as well as the requirements for SOFAs intended to enter commerce within the US (see Sections 1.3.2, 1.3.4, 1.3.5, and 1.3.6);
- Added requirements for prohibited installations including a limited allowance of replacement cover/grates based on manufacturers designation (see Section 1.3/3);
- Revised the requirements for determining the flow rating of manufactured SOFAs (see Section 1.3.7)
 - For SOFA Configurations with suction piping opening less than 16 inches from the finished surface of the pool; **Each SOFA configuration is tested to determine the flow rating.**
 - SOFA Configurations with a suction piping opening greater than 16 inches from the finished surface of the pool; **The tested configuration is the one with the largest pipe opening and highest flow potential.**



- Clarified the specific requirements for designed SOFAS (i.e. Registered Design Professional (RPD) SOFA's) (see Section 1.3.7).
- Specified the water velocity design methodology for SOFA's to be determined through testing in accordance with Hair Entrapment and Body Entrapment Testing and limited by State and local Codes (see Section 1.3.9).
- Replaced Table 1, *Applicable Body Block Element – Calculation of Removal Force*, with Equation 2 in section 6.4 (see Section 1.3.10)

1.3 Certifications

1.3.1 Prohibited certifications.

~~1.1.7.2~~ **1.3.1.1** ~~Cover/grates that~~ **Manufactured SOFAs and RDP SOFAs that are not evaluated to all applicable sections or fail the body entrapment portion any applicable requirement of this standard or**

1.3.2 Required testing and certification.

1.3.2.1 *Manufactured SOFAs shall be tested by a laboratory in conformance with paragraph 1.3.4 and certified by an agency in conformance with paragraph 1.3.5.*

1.3.2.2 *RDP SOFAs shall be designed, installed, and certified in conformance with all applicable requirements of this standard by a registered design professional whose credentials are in conformance with the paragraph 1.3.6.*

1.3.2.3 *Manufacturers and registered design professionals of SOFAs intended to enter commerce within the United States shall make available a General Certificate of Conformity (GCC) for each SOFA model as required by 16 CFR Part 1450.*

1.3.3 Prohibited installations.

1.3.3.1 *Pools equipped with a SOFA(s) that does not result in an individual suction system flow rating equal to or greater than the pool's actual individual suction system flow rate, or pools with a SOFA(s) that was not installed in accordance with the SOFA specific instructions, including fasteners used with preexisting components, shall not be considered in conformance with this standard.*

1.3.3.2 *Cover/grate shall only be installed on existing SOFA components if the replacement cover/grate manufacturer has designated the products as suitable for attachment to previously installed SOFA components. When used, the designation shall include how to identify compliant fastener attachment points and/or how to install the replacement cover/grate without using existing attachment points.*

1.3.4 Testing laboratory accreditation. *Laboratories shall be accredited to ISO 17025 and shall ensure all testing of manufactured SOFAs conform to this APSP-16 standard.*

1.3.5 Certification agency accreditation. *Certification bodies shall be accredited to ISO 17065, and shall provide certification of all manufactured SOFAs to this APSP-16 standard.*

1.3.6 Registered design professional accreditation. *Any individual who designs and certifies RDP SOFAs shall be registered or licensed to practice their design profession as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the pool receiving the RDP SOFA is located.*

1.3.7 Flow rating determination – manufactured SOFAs.

The flow rating for each manufactured SOFA configuration shall be determined by the lowest passing flow rate obtained during any of the Type 1 hair tests, the Type 2 hair tests, and the body-blocking



element (BBE) test, unless the SOFA manufacturer specifies a lower flow rate, which shall then be the maximum allowable flow rate for that SOFA.

1.3.7.1 For all SOFA configurations with a suction piping opening less than 16 inches from the finished surface of the pool, the cover/grate shall be tested on each SOFA configuration in accordance with section 5. The distance shall be measured from the SOFA's designated finished surface of the pool using a string line to represent the greatest distance Type 1 and Type 2 hair can travel into the cover/grate and sump. Each of these SOFA configurations shall receive a flow rating.

1.3.7.2 For all SOFA configurations with a suction piping opening greater than 16 inches from the finished surface of the pool, measured in accordance with section 1.3.7.1, the cover/grate shall be tested on one SOFA configuration in accordance with section 5. The SOFA configuration tested shall be one using the largest pipe opening(s) size specified for the cover/grate resulting in the highest flow potential.

1.3.8 Flow rating determination – RDP SOFAs. The registered design professional shall determine the SOFA's flow rating in accordance with section 3.9.

1.3.9 Water velocity limits. For purposes of suction safety, this standard provides SOFA configuration specific water velocity limits through a cover/grate based on the SOFA tests of sections 5 and 6. These limits are expressed in gallons per minute (gpm), which can be converted directly into feet per second (fps) velocity units when desired. State and Local Codes may limit flow through a cover/grate based on water velocity (fps) rather than the marked flow rate (gpm) of the cover/grate. When this methodology is used, the resultant flow rating shall not exceed the cover/grate's SOFA specific flow rating in gallons per minute.

1.3.10 Removal force calculation. Table 1, Applicable Body Block Element – Calculation of Removal Force, referenced in ANSI/APSP – 16 2011 has been replaced with Equation 2 in section 6.4.

Section 1.4, Related Standards: The following standards were added, revised or deleted as follows:

16 CFR Part 1450 Virginia Graeme Baker Pool and Spa Safety Act
ANSI/APSP/ICC-7 Standard for Suction Entrapment Avoidance In Swimming Pools, Wading Pools, Spas, Hot Tubs, and Catch Basins
ANSI/APSP/ICC-14 Standard for Portable Electric Spa Energy Efficiency
ANSI/APSP/ICC-15 Standard for Residential Swimming Pool and Spa Energy Efficiency
UL 1563 Standard for Electric Spas, Equipment Assemblies, and Associated Equipment

Section 1.5, Normative References: The following standards were added, revised or deleted as follows:

ANSI/APSP/ICC-7 Standard for Suction Entrapment Avoidance In Swimming Pools, Wading Pools, Spas, Hot Tubs, and Catch Basins
ANSI/APSP/ICC-14 Standard for Portable Electric Spa Energy Efficiency
ANSI/APSP/ICC-15 Standard for Residential Swimming Pool and Spa Energy Efficiency
ASME B1.20.1 Pipe Threads, General Purpose (Inch)
ASTM D1056 Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber
ASTM D1785 Standard for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM G155 a Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non- Metallic Materials



[IAPMO/ANSI Z1033 Flexible PVC Hoses and Tubing for Pools, Hot Tubs, Spas, and Jetted Bathtubs](#)
[National Electrical Code, NFPA 70, Article 680 and Article 250.8.](#)
[UL 1439 Standard for Tests of Sharpness on Edges of Equipment](#)

Section 2, Definitions: Definitions were added, revised or deleted as follows:

[Additional device or system designed to prevent suction entrapment: Equipment or arrangements of piping and equipment as defined by the Virginia Graeme Baker Pool and Spa Safety Act \(VGBA\). See section 9.4.](#)

[Accessible: A surface that can be touched by a bather when all components are installed per the manufacturers or registered design professional's instructions.](#)

[Anticlastic: Having opposing curvatures ~~in two perpendicular directions~~, as the surface of a saddle](#)

[Anti-vortex: ~~The~~ A term ~~anti-vortex has been misused within the industry and largely misunderstood as somehow relating to entrapment prevention. Anti-vortex outlet used to describe covers/grates were that~~ are designed to prevent an air-entraining vortex from forming ~~The term anti-vortex should not be construed to impart any protection and should no longer be referenced in this regard.~~ between the suction piping and pool water's surface.](#)

[Aperture, small: A flow passage entrance into a cover/grate, or a flow passage entrance into a SOFA formed between a cover/grate and the finished surface of the pool, where the opening has two or more dimensions smaller than 1 in. \(25 mm\).](#)

[Aperture, large: A flow passage entrance into a cover/grate, or a flow passage entrance into a SOFA formed between a cover/grate and the finished surface of the pool, where the opening has only one dimension smaller than 1 in. \(25 mm\).](#)

[Applicable: A term used to limit the scope of a requirement based on a SOFA's Type, installation location, and any other attribute.](#)

~~[applicable body blocking element: A body blocking element that has a mandatory length to width ratio of 1.2777, a maximum size of 18 in. x 23 in. \(457 mm x 584 mm\), and a minimum size of 9 in. x 11.5 in. \(229 mm x 292 mm\). Its actual size for test purposes is the smallest size that will completely shadow the suction cover/grate being tested.](#)~~

[Bather: Any person entering a pool for any reason.](#)

~~[Body blocking element \(BBE\): A flat, rectangular shape with radiused corners of approved foam and backing of the A simulated human torso specimen measuring 18 in. x 23 in. \(457 mm x 584 mm\) with 4 in. \(102 mm\) corner radii as defined in paragraph 6.2.2.](#)~~

[Circulation system: The materials and equipment used to collect and return water to the pool.](#)

~~[complete system: Comprising a pump, suction outlet, \(and possibly inlet\), and connecting piping as specified by manufacturer. No other operating components or valves may be included. Safety devices, vents, suction vacuum release systems, etc., shall be used only as specified by the manufacturer. Non-operating components such as drains are permitted.](#)~~

~~[cover: A fitting or device generally placed between the suction piping and the bather. Not used in this document to avoid confusion. See also cover/grate.](#)~~

[Component: A part in a suction outlet fitting assembly \(SOFA\).](#)

~~[cover: A fitting or device generally placed between the suction piping and the bather. Not used in this document to avoid confusion. See also cover/grate.](#)~~

~~[Cover/grate: Covering fitting or assembly that separates the bather from the suction sump or piping, sometimes referred to as a "grate" or a "cover."](#)~~ ~~[dual outlets: Two suction outlets connected to an](#)~~



~~individual suction system but separated by a minimum of 3 feet (914 mm).~~ The component of the SOFA that separates the bather from the suction outlet.

Direct-suction: A method for the transfer of water from a pool where the low pressure in the SOFA is produced by a piping arrangement that is connected between the SOFA sump to the inlet side of a pump, or pumps, such that the piping arrangement does not include a permanently open connection to atmosphere located above the overflow level of the pool.

Drain cover: A term used in the Virginia Graeme Baker Pool & Spa Safety Act (VGBA) to describe SOFAs.

Dual drain system: See multiple SOFA system.

~~dual outlets: Two suction outlets connected to an individual suction system but separated by a minimum of 3 feet (914 mm).~~

Edge: The line of intersection between any two surfaces ~~with an~~ within a SOFA flow passage aperture with an intersecting angle greater than 180 degree, measured face to face (see Figure 1), and having a transitional radius between the two faces of less than 0.75 in. (19 mm). Refer to Figure 1.

Existing: A pool previously installed and approved to open by the authority having jurisdiction.

Field-built sump: A sump formed in the structure of a pool in accordance with the cover/grate manufacturer's installation instructions, and for RDP SOFAs, in accordance with the certified plans of a registered design professional.

~~field fabricated: When applied to suction outlet hardware, shall indicate the use or design of conventional building materials or products, or of custom fabrication (i.e., weldments) to create specialized suction outlets.~~

Finished surface of the pool: The watertight interior surface that defines the plane used to measure the distance the cover/grate protrudes into the pool, depth of the suction pipe(s) opening, and the suction port(s) opening. Refer to Figure 2.

Fire suppression water source outlet: A SOFA used to transfer water from a pool to a fire hydrant, for purposes of using pool water to fight a fire after the pool is closed and confirmed to be clear of bathers.

Floor: The structure of a pool, where a SOFA is to be installed, that is sloped between 0 degrees and 45 degrees from horizontal.

Flow path length. The shortest distance water travels between the outer surface of any cover/grate aperture and the nearest edge of the suction pipe opening. Refer to Figure 3.

Flow path zone. Manufacturer specified minimum dimensions equal to or exceeding the flow path length boundary of the sump used during the SOFA specific test as described in section 5, Hair Entrapment Testing. Refer to Figure 3.

Frame: A SOFA component that shall be structurally attached to the pool, to which a cover/grate is attached.

Fully submerged: A condition where all components of an assembly are inside the waterline perimeter and below the overflow water level of a pool.

Indirect-suction: A ~~localized area of low pressure method~~ for the transfer of water from ~~a swimming pool, wading pool, spa, or hot tub by any means not to include suction created by the pool to~~ the inlet side of a pump(s) or turbine (e.g., gravity flow systems where the low pressure under a cover/grate is produced by a difference in water levels), where the low pressure in the SOFA is produced by a difference in water levels between the pool water's surface and a separate water vessel that includes a permanent connection to atmosphere, the opening of which is located above the overflow level of the pool. e.g., gravity flow and vent systems.

Individual suction system: A ~~single~~ direct-suction or indirect suction system piping arrangement that connects one or more ~~suction outlets~~ SOFAs to one or more pumps, or gravity flow reservoirs. ~~the~~



combination of which is used to determine the maximum system flow rating of the individual suction system.

Individual suction system flow rating: A calculation based on the quantity and type(s) of installed SOFA, where the rating is determined in accordance with the applicable paragraph 1.3.7 or 1.3.8.

Manufactured: When applied to fittings, fitting assemblies, cover/grates, or related devices a SOFA or SOFA component, indicates the routine commercial production of such item(s) for the purpose of providing suction outlet hardware for swimming pools, wading pools, spas, and hot tubs that are evaluated for conformance to this standard in accordance with paragraph 1.3.2.1.

Main drain: A term used in VGBA to describe SOFAs.

Maintenance drain: A water outlet that is only used by maintenance personnel at times when the pool is closed and confirmed to be clear of bathers, to remove water from the pool.

Maximum system flow rate: The highest flow rate that is achievable by an individual suction system in accordance with ANSI/APSP/ICC-7.

Model number: The designation used to identify unique SOFA configurations.

Mud ring: See frame.

Multiple drain SOFA use only: Indicating that the referenced suction outlet SOFA may not be used as the single sole source for water to a pump suction system only in conjunction with one or more additional SOFA serving an individual suction system.

Multiple SOFA system: When applied to suction outlets, shall mean two or more suction outlets SOFAs connected to an individual suction system.

Open area: The area available for water flow through or under a SOFA cover/grate, as measured parallel to the flow path at each opening. Refer to Figure 4.

Operational day: One day of use of a pool by bathers.

Part number. The designation used to identify individual SOFA components.

Permanent: Never changing, or not expected to change. e.g. piping below a pool.

Pool: Any outdoor or indoor structure intended for swimming or recreational bathing, including inground and onground structures, and includes hot tubs, spas, portable spas, infinity edge catch basins, slide and other amusement termination basins, and non-portable wading pools.

Pool owner: The person(s) recognized by the law as having the ultimate control over, and responsibility for the property on which a pool is located.

Product specifications: Information specific to a product, including, but not limited to model numbers, flow ratings, service life, SOFA type, etc., that is made available by the manufacturer or Registered Design Professional in advance of the product being sold and installed.

Registered Design Professional (RDP) SOFAs: A SOFA designed and certified as conforming to all applicable requirements of this standard by a registered design professional that is custom-made for a specific pool at the construction site, or custom-made for a specific pool at a facility not normally engaged in SOFA manufacturing.

Restricted use. A SOFA type that is only certified for used in a specific pool type, e.g., self-contained factory manufactured spa, or that is distributed exclusively as a component of a manufactured, individual suction system, e.g., venturi SOFA.

Self-contained factory-manufactured spa: A spa/hydrotherapy unit of irregular or geometric design in which all control, water heating and water circulation equipment is an integral part of the product (appliance). Self-contained factory-manufactured spas are assemblies that are complete with submerged suction outlets, fittings and connecting hoses assembled into the body or the shell of the spa at the time of manufacture. A spa that is certified in conformance with ANSI/UL 1563.



Service life: The period of time between the installation of a component in a pool, with or without water at the time of installation, and the end of its useful life as specified in conformance with paragraph 3.1.1.

Shadow: That portion of a SOFA sump that is hidden by the body-blocking element (BBE) to a person viewing perpendicularly to the mounting surface of the SOFA sump.

Sharp edge: An edge that can cause a cut-type injury when contacted during normal use by a bather. Refer to UL 1439 Standard for Tests of Sharpness on Edges of Equipment.

~~single drain use: Indicating that the referenced suction outlet may be used as the single sole source for water to a pump suction system.~~

~~single or multiple drain use: Indicating that the referenced suction outlet may be used as either the single sole source for water to a pump suction system, or may be used in conjunction with additional suction outlets to a pump suction system.~~

~~skin pad: Skin-like cushion consisting of ¼ in. (6.35 mm) thick Buna-N rubber, Shore A durometer 60 ±5.~~

Skimmer: A partially submerged suction outlet that is designed to remove water from the surface of a pool. Skimmers that are not fully submerged are not SOFAs; therefore, they are excluded from testing and certification to this standard.

SOFA configuration: A manufacturer or registered design professional specified assembly where any difference in mounting orientation (wall or floor), suction pipe opening size, or suction pipe opening orientation (horizontal or vertical exit from the sump) results in a different SOFA model number.

Suction outlet: ~~A fitting, fitting assembly, cover/grate, and related components~~ Any appurtenance that provide a localized low-pressure area for the transfer of water from a ~~swimming pool, wading pool, spa, or hot tub~~ to an individual suction system, e.g. SOFA, skimmer, gutter overflow, etc.

Suction pipe: A pipe used to convey water to an individual suction system.

Suction pipe opening: The inside diameter of suction pipe, suction port fitting, or other geometry through which water will flow exiting a sump.

Suction port: The portion of a SOFA sump used to connect the SOFA directly to the suction pipe.

Suction system flow rating: The maximum flow for which an individual suction system is permitted to operate while remaining in compliance with this standard.

Sump: The vessel between the suction outlet cover/grate and suction outlet piping. This may be manufactured or field-built.

Swim jet combination ~~fitting~~ SOFA: A ~~fitting~~ manufactured inlet/outlet SOFA that combines a suction port(s) and ~~discharge return port(s) in into~~ one ~~housing, creating a high velocity, high volume stream of water to swim, jog, or walk, as well as massage~~ suction outlet fitting assembly.

~~torso specimen: An 18 in. × 23 in. (457 mm × 584 mm) rectangular form with 4 in. (102 mm) radiused corners representing the flat portion of the 99th percentile adult male body (Mandatory Appendix I).~~

Total dynamic head (TDH): The total equivalent height that pool water is to be pumped, considering friction losses in the pipe. This term, along with flow rate, is used to specify the expected performance of a pool pump over its operating range, expressed as a curve plotted against head pressure versus flow rate.

Unblockable SOFA: A suction outlet fitting assembly that, when installed according to the manufacturer's instructions, cannot be shadowed by an 18" x 23" Body Blocking Element, and has a rated flow through the remaining open area beyond the shadowed portion that cannot create a suction force in excess of the force calculated in equation 2.

Vacuum connection cover: A cover over a fitting in the wall of a pool intended to provide a hose connection point for suction-side cleaners.



Venturi outlets: Venturi activated indirect suction cover/ grates or venturi activated debris collection systems.

Venturi SOFA: A restricted use, blockable SOFA distributed exclusively as a component of a water-driven suction system that returns all water to the pool without it passing through a pump.

Virginia Graeme Baker Pool & Spa Safety Act (VGBA): The federal law enacted by Congress and signed by the President on December 19, 2007. Designed to prevent suction entrapments in pools, the law became effective on December 19, 2008.

Wall: The structure of a pool, where a SOFA is to be installed, that is sloped more than 45 degrees and less than or equal to 90 degrees from horizontal.

Section 3, DESIGN, MATERIALS, AND INSTALLATION REQUIREMENTS

Section 3.1, Physical Design Requirements and Limitations: Some of the significant changes under Section 3.1 are as follows.

- Added a specific reference to UL 1439 for sharp edges (see Section 3.1.3)
- Changed the requirement for fastener removability to allow for winterizing (see Section 3.1.7)
- Clarified the fastener corrosion resistance requirements to specify alloys for the metal screws and threaded inserts or allow for equivalent corrosion resistant materials (see Section 3.1.9).
- **MI:** Added a new requirement for Manufacturer's installation instructions to prohibit adhesives for SOFA components requiring servicing (see Section 3.1.10).
- Included an allowance to make suction piping connections with flanges dimensionally in accordance with ASME B1.20.1 (see Section 3.1.12)
- **MI:** Added a new requirement that the cover/grate manufacturer shall specify the suction piping to be used (see Section 3.1.13)
- Added new requirements for electrical bonding of SOFA components made of metal (see Section 3.1.14)

2.3 FITTING DESIGN, ASSEMBLY, MATERIALS, AND MATERIAL INSTALLATION REQUIREMENTS

SOFAs shall be designed and installed to reduce the potential for hair, body, finger and limb entrapment.

3.1 Physical Design Requirements and Limitations

3.1.1 Service life designation. *Manufacturers and registered design professionals shall state the installed service life in years for each SOFA component.*

~~2.1.4~~ **3.1.2 Protrusion.** *Suction fittings shall not protrude from the installed surface SOFAs shall be designed such that when installed, they do not protrude more than 2 in. (51 mm) from the finished surface of the pool.*

~~2.1.3~~ **3.1.3 Sharp edges.** *There shall be no bather accessible sharp edges, as defined by UL 1439 Standard for Tests of Sharpness on Edges of Equipment, on fully assembled suction fittings SOFAs.*

3.1.4 Accessible openings. *All flow passage openings through and/or under cover/grates shall be designed and installed to reduce the potential for finger or limb entrapment. All manufactured SOFAs and all RDP SOFAs, shall be designed and installed in conformance with the requirements of section 7, finger and limb entrapment tests.*

3.1.5 Fasteners. *Cover/grate manufacturers shall provide all fasteners required for the proper installation of the SOFA in accordance with the cover/grate installation instructions.*

3.1.5.1 Cover/grate manufacturers shall designate if and when a cover/grate is suitable for attachment to previously installed SOFA components. When the replacement cover designation is used, installation



instructions shall address how the installer is to verify that the existing attachment points meet the manufacturer's requirements.

3.1.6 Fastener compliance. All threaded fasteners joining SOFA components that are bather-accessible shall comply with all requirements of this section.

~~2.1.1.2~~ **3.1.7 Fastener removability.** ~~Sumps intended to receive fasteners shall be designed for fifteen secure insertion, tightening, and removal cycles of the fasteners without stripping. The design shall inhibit inadvertent cross-threading.~~ Fasteners, excluding threaded inserts or anchors, shall be removable from the sump and any permanent SOFA components, including but not limited to, frames, mud rings, and support beams, for winterizing or replacement.

~~2.1.1.3 Sumps intended for use with self tapping screws (those not having threaded inserts) shall be designed and constructed to accommodate redrilling for insertion of a threaded insert in a stripped hole to accept the original size fastener.~~

~~2.1.1.4 If threaded inserts are used, they shall be chosen to preclude any corrosive or chemical reaction with screws provided for the sump by the manufacturer.~~

~~2.1.1.5~~ **3.1.8 Permitted fasteners.** ~~Both self tapping screws and~~ When threaded fasteners are used to secure SOFA components, machine screws with associated ~~threaded~~ metallic inserts or self-tapping screws shall be permitted.

3.1.9 Corrosion resistance. Metal screws shall be passivated stainless steel meeting ASTM A967 and UNS S31600 or SAE Type 316, or be made from equivalent corrosion resistant material. Metal threaded inserts shall be made from copper alloy C23000, C61400, C64700, C65100 or C65500 or equivalent corrosion resistant material.

~~2.1.1~~ **3.1.10 Tool required.** ~~When Fasteners are used, the suction fitting shall be designed so that tools are required for disassembly. shall not be removable without the use of a tool. Standard slotted screws shall not be permitted for affixing cover/grates to the suction fitting body. Fasteners shall have a corrosion resistance to the intended environment equivalent to grade 316 stainless steel as a minimum.~~

3.1.11 Service access. The use of adhesives or other attachment methods that prevent access to suction piping or SOFA components requiring periodic servicing is prohibited. Manufacturer's installation instructions shall provide this compliance information.

~~2.1.2~~ **3.1.12 Suction piping connections.** ~~Suction fitting assemblies~~ Sumps that connect directly to the suction piping shall have suction ports that attach by ~~a PVC an~~ end connection that is dimensionally in accordance with ASTM D2466, ~~or~~ by a threaded end connection in accordance with ASTM F1498, or by flanges dimensionally in accordance with ASME B1.20.1.

3.1.13 Suction piping requirements for self-contained spa SOFAs. The cover/grate manufacturer shall specify the suction piping to be used. Flexible PVC hose shall conform to IAPMO/ANSI Z1033. Rigid PVC pipe specification shall conform to ASTM D1785-Standard for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120. The cover/grate manufacturer's installation instructions shall provide this compliance information.

3.1.14 Metal component electrical bonding. SOFA components made of metal that will be exposed to pool water and that measure greater than 4 in. (100 mm) in any dimension shall provide a means for electrical bonding in conformance with the National Electrical Code, NFPA 70, Article 680. The bonding connection and wire shall not be bather-accessible when the SOFA is fully assembled and installed in the pool. The bonding connection provided shall not be located within a SOFA flow path zone or where it may pose a hair entanglement/entrapment hazard, nor prevent service access to suction piping.



[3.1.14.1 The bonding connection and associated bonding wire shall be considered non-bather accessible when it cannot be touched by any portion of the “UL Articulate Probe” when evaluating the SOFA in accordance with section 7, Finger and Limb Entrapment testing.](#)

Section 3.2, SOFA Configurations: Some of the significant changes under Section 3.2 are as follows:

- Added requirement to include a product identifier, for each component a part number, and for each SOFA configuration a model number (see Section 3.2.1).
- Added specific requirements for inclusion of the head loss curve and illustrations showing the location of measurements for each SOFA model (see Section 3.2.2)
- Added new requirement that SOFAs be categorized as blockable or unblockable (see Section 3.2.4, 8.1.1.3, 9.8.2 and 9.8.3).

[3.2 SOFA Configurations](#)

[3.2.1 Product identifier. Each SOFA component part shall be assigned a part number and each SOFA configuration shall be assigned a model number.](#)

~~7.2.1 (a) (5) maximum flow rating with head loss curve~~

[3.2.2 Head loss curve. Cover/grate manufacturers shall provide a legible head loss curve covering the full range of flow for each SOFA model. The curve shall plot the SOFA specific suction head loss in inches of mercury versus flow rate using data collected or confirmed in accordance with paragraph 5.4.5. The actual SOFA suction head loss curve shall be within a range of -3% to + 5% of the suction head or \$\pm\$ 5% of the flow rate, whichever is greater, indicated by the curve. The accuracy of the curve shall be verified at three points along the curve include the suction head loss at approximately 20, 50 and 100 percent of the SOFA’s certified flow range. The head loss curve shall be accompanied by a description and/or illustration showing the approximate location the suction head was measured to aid pool designers calculating the total dynamic head \(TDH\) of a recirculation system.](#)

~~1.1.7.1 3.2.3 Cover/grates used for multiple SOFA configurations. Cover/grates that pass the body entrapment portion of this Standard as well as meeting all other requirements in this Standard shall be permanently marked “For Single or Multiple Outlet Use,” “For Single Outlet Use,” or “For Multiple Outlet Use Only” at the manufacturer’s option.~~

~~It shall be permissible to use a single cover/grate part(s) as a component of multiple SOFAs.~~

[3.2.4 “Blockable” and “Unblockable” designations. SOFAs shall be categorized as blockable or unblockable, as appropriate, by physical examination using the dimensions of the body-blocking element \(BBE\) of paragraph 6.2.2. If the sump opening can be completely shadowed by the body-blocking element \(BBE\) when viewed perpendicular to the pool mounting surface in which the SOFA is installed, it shall be categorized as blockable; those that cannot be completely shadowed shall be categorized as unblockable.](#)

Section 3.3, Cover/Grate Security, Fasteners, and Servicing Instructions: MI: Added new requirements to include manufacturers instructions for cover/grate fasteners, replacement of covers, and confirmation of flow paths after installation as follows:

[3.3 Cover/Grate Security, Fasteners, and Servicing Instructions](#)



3.3.1 Fastener instructions. *Cover/grate manufacturers shall provide installation instructions that detail the type of fasteners to be used and the recommended installation torque. Instructions shall also include a statement to start installation of screws by hand to ensure proper thread engagement and to prevent cross threading, and state the following: “DO NOT USE POWER TOOLS TO INSTALL FASTENERS”.*

3.3.2 Replacement cover/grates for existing pools. *Manufacturer’s of replacement cover/grates and other SOFA components intended for installation on existing pools with unknown sumps and mud frames shall provide replacement specific instructions for identifying when it is acceptable to attach the new cover/grate and how to confirm the attachment was successful.*

3.3.3 Flow paths including pool surface. *For cover/grates where a portion of the flow path is formed by the interior surface of the pool, the cover/grate manufacturer’s installation instructions shall provide a method for the installer to verify the actual installation conforms to section 7.3.*

Section 3.4, User Maintenance Instructions: **MI:** Added requirements for additional statements to be include in the instructions as follows:

- field modifications not authorized by manufacturer’s instructions is void (See Section 3.4.1)
- modified SOFA structure or flow path required to be certified as new SOFA (See Section 3.4.2)
- In addition to the manufacturer providing winterizing instructions, registered design professionals are now required to provide winterizing instructions when applicable (See Section 3.4.4)
- observe cover/grate each operational day (See Section 3.4.5.1)
- broken cover/grates to be replaced before bathers are allowed to use the pool (See Section 3.4.5.2)
- loose cover/grates to be reattached before bathers are allowed to use the pool (See Section 3.4.5.3)
- SOFAS shall be free of obstructions during installation (see Section 3.4.5.4)
- the proper alignment and order of assembly of SOFA components (see Section 3.4.5.5)
- “DO NOT USE POWER TOOLS TO INSTALL” and start screws by hand to prevent cross threading (See Section 3.4.5.6)
- after installation hand check cover/grate for snugness to the sump/frame (See Section 3.4.5.7)
- How to check the integrity of SOFA components (See Section 3.4.5.8)
- when interior finish of the pool holds a SOFA component in place the surface must be free of deterioration and voids (See Section 3.4.5.9)
- reinstallation and repair of damaged fasteners including conditions to observe indicating removal and repair or replacement is necessary (See Section 3.4.5.10)

3.4 User Maintenance Instructions

All SOFA types shall be accompanied by user maintenance instructions containing all the information of this section that is applicable to the SOFA:

3.4.1 Field modifications. *A statement that any field modification made to a SOFA not authorized by the manufacturer’s installation instructions shall void the SOFA certification.*

3.4.2 Configuration modifications. *A statement that no modification shall be made to a SOFA structure or flow path unless the new configuration has been certified as new SOFA.*

3.4.3 Service life. *A statement that cover/grates and all other SOFA components shall be replaced at or before the end of their service life and that service life begins the month and year in which a SOFA component is installed with or without water.*



3.4.4 Winterizing instructions. Cover/grate manufacturers shall provide instructions stating how to winterize manufactured SOFAs. Registered design professionals shall provide winterizing instructions stating how to winterize the RDP SOFA when the pool is in a location known to require winterizing.

3.4.5 Service instructions. Cover/grate manufacturers shall provide service instructions, including a list of the required tools and the following:

~~7.2.1(c)~~ **3.4.5.1** A *note* statement that the suction fitting cover/grate, including fasteners, *should* shall be observed for damage or tampering ~~before each use of this facility~~ each operational day.

3.4.5.2 A statement that missing, broken, or cracked cover/grates shall be replaced before bathers are allowed to use the pool.

3.4.5.3 A statement that loose cover/grates and associated components shall be reattached before bathers are allowed to use the pool.

3.4.5.4 A statement indicating that SOFA components and fastener receptacles shall be clean and free of debris or obstructions during installation of cover/grate and fasteners.

3.4.5.5 Instructions shall indicate the proper alignment and assembly order of all SOFA components.

3.4.5.6 The statement “DO NOT USE POWER TOOLS TO INSTALL FASTENERS” and to start installation of screws by hand to ensure proper thread engagement and to prevent cross threading.

3.4.5.7 A statement indicating the requirement to hand-check cover/grate for snugness to the sump/frame after installation.

3.4.5.8 A statement indicating how to evaluate the integrity of SOFA components, including how to address color change, brittle components with chunks or pieces broken off, stripped screw holes, cracks, and if a mud ring is used, cracked or broken interior finish of the pool holding the mud ring in place.

3.4.5.9 A statement indicating that when any SOFA component is held in place by the interior finish of the pool, that surface shall be free of deterioration and voids.

3.4.5.10 Instructions for reinstallation or repair of damaged fasteners and corresponding receptacles either inserted, tapped, or self-threaded. Instructions shall include a description of the condition(s) indicating when it is necessary to remove the SOFA from service. Reinstallation and repair examples may include:

- Remove and replace SOFA component.
- Provide additional holes to receive fasteners in a different orientation.
- Instructions for drilling new holes, including conditions when and where it is appropriate, and how to confirm proper installation in conformance with the requirements of this standard.

Section 3.5. Flow Hazard Related Requirements and Limitations: Replaced former Figure 2 which specified the minimum sump dimensions with new limitations and allowances for the manufacturers specified dimensions based on the flow path boundaries, Section 5, hair entrapment test and new Figures 2, 3, 5 and 6. Added the new requirement that each SOFA configuration is to be tested whenever a suction pipe(s) opening is positioned within reach of the hair used for certification testing. From Section 1.3.7 and the length of the hair for testing that distance is 16 in from the finished surface of the pool.

3.5 Flow Hazard Related Requirements and Limitations

Sumps play an important role in addressing suction safety. Flowing water turbulence can twist and tangle hair in, under, and around the cover/grate and other SOFA components, including the suction



pipng itself. For this reason, the “Figure 2: Field-Built Sump” in the previous version of this standard has been revised and supplemented by Figures 3, 5 and 6.

Additionally, the standard now requires each SOFA configuration to be tested whenever a suction pipe(s) opening is positioned within reach of the hair used for certification testing. For SOFA configurations with all suction pipe openings positioned outside the reach of the test hair, the cover/grate only needs to be tested over a single, representative SOFA sump configuration with the highest flow potential.

3.5.1 Sump specifications. Cover/grates shall only be installed on sump configurations authorized by the manufacturer’s installation instructions resulting in a unique SOFA configuration, with a specific certified flow rating. Manufactured or field-built sumps shall be permitted. Refer to Figures 2, 3, 5 and 6.

3.5.1.1 The manufacturer’s product specifications and installation instructions, as appropriate, shall define each SOFA configuration and include the flow path zone, minimum suction pipe(s) opening depth below/behind the finish surface of the pool, pipe size, pipe orientation, and minimum suction pipe opening length before any reduction in pipe size. Refer to Figure 5 and 6.

3.5.1.2 The manufacturer shall specify the minimum flow path zone dimensions equal to or exceed the dimensions of the sump used during the SOFA specific test as described in section 5, Hair Entrapment Testing. The boundaries shall encompass the volume between cover/grate apertures and suction pipe(s) opening defined by the SOFA-specific flow path of 1.3.7.1. Refer to Figures 3, 4, 5 and 6.

Section 3.6, Installation Requirements and Limitations: **MI:** Added additional information to include in the manufacturers installation instructions including determination of the installed suction systems flow ratings and intended pool surface type as follows:

3.6 Installation Requirements and Limitations

All applicable information and safety considerations provided in this section shall be included in the manufacturer’s product specifications and/or installation instructions, as appropriate, to assist pool designers, installers, and owners in the proper selection, installation, operation, and maintenance of products certified to this standard.

3.6.1 Installation. All SOFAs shall be installed in accordance with the manufacturer’s installation instructions, or for RDP SOFAs, in accordance with the registered design professional’s engineering plans.

3.6.2 Field modifications. No modification shall be made to a SOFA structure or flow path unless the new configuration has been certified to the original SOFA.

3.6.3 Individual product flow ratings. This standard provides performance-based flow ratings for all SOFA(s). These flow limits are designed to prevent suction entrapment.

3.6.3.1 Compliance with this standard requires that these SOFA-configuration specific flow ratings NOT be exceeded at any time the pool is open to bathers.

3.6.3.2 Compliance with this standard requires selecting and installing a SOFA, or combination of SOFAs, such that the resulting individual suction system flow rating is greater than the pumping system’s maximum system flow rate.

It is also important to state that skimmers, gutters, and other overflow systems may not always be operational and could divert all the pump(s) flow through the SOFA suction system, therefore the flow capacity of these systems shall not be included when evaluating an individual suction system flow rating.

3.6.4 Installed suction system flow ratings:



3.6.4.1 The flow rating for pools with multiple, blockable SOFAs piped together in one body of water without isolation valves shall be determined by combining the flow rating of all SOFAs, minus the flow rating of one. If the flow ratings of all SOFAs are not equal, subtract the flow rating of the SOFA with the highest flow rating.

3.6.4.2 The flow rating for existing pools with a single, blockable SOFA is the flow rating of the SOFA, when also installed in conjunction with an additional device or system designed to prevent suction entrapment, where the additional device or systems is of a type listed in section 9.4. A single, blockable SOFA in a system that does not also include one of the additional devices or systems shall result in a flow rating of zero.

3.6.4.3 The flow rating for pools with single, or multiple unblockable SOFAs shall be determined by combining the flow rating of all SOFAs piped together in one body of water.

3.6.5 Protrusion. Cover/grates, when installed, shall not protrude more than 2 in. (51 mm) from the finished surface of the pool in which the SOFA is installed.

3.6.6 Pool surface types. Manufacturer's product specifications and installation instructions shall state the type of pool surfaces for which the SOFA is intended, e.g. concrete, vinyl lined, or composite pools.

3.6.7 Location limits. SOFAs shall not be located on seats or the backrests for seats.

Section 3.7, SOFA Specific Specifications and Instructions: Added requirements for blockable and unblockable SOFAs. Blockable SOFAs in new pools are to be installed in multiple sofa systems only and in existing pools are required to be installed along with a VGBA Device to prevent entrapment as follows:

3.7 SOFA Specific Specifications and Instructions

3.7.1 Cover/grates marked "Blockable" – for use in new pools. Blockable SOFAs shall be installed in a multiple SOFA system only.

3.7.1.1 When used in multiple-outlet systems, cover/ grates marked blockable shall be arranged such that the two outermost sumps/frames shall have a minimum separation of three feet, measured center to- center. If they are to be installed closer than three feet center-to-center, they shall be located on two different planes, i.e., one SOFA shall be located on the pool floor, and one shall be located on a vertical wall, or one SOFA shall be located on each of two separate walls.

3.7.2 Cover/grates marked blockable – for use in existing pools. Cover/grates marked blockable installed in existing pools with single SOFA systems shall also be installed in conjunction with an additional device or system designed to prevent suction entrapment, where the additional device or systems is of a type listed in section 9.4.

3.7.3 Unblockable SOFAs. Cover/grates marked unblockable are permitted for use in multiple SOFA systems, and single SOFA systems when authorized by the cover/grate manufacturer.



Section 3.8, Self-Contained Spa SOFAs: Added reference to ANSI/UL 1563 for self-contained factory-manufactured spas and a new requirement to specify suction pipe size for each model, between self-contained spa SOFAs as follows:

3.8 Self-Contained Spa SOFAs

3.8.1 Specifications and instructions. The cover/grate manufacturer shall provide product specifications and installation instructions stating:

~~2.3.5~~ **3.8.1.1** Self-contained spa SOFAs shall be used only in self-contained factory-manufactured spas ~~and at least two fittings shall be used for each pump. The installation shall conform to the applicable requirements of this standard~~ tested and certified in accordance with ANSI/UL 1563.

~~2.3.5.1 Installation.~~ **3.8.1.2** Self-contained spa ~~fittings~~ SOFAs shall be ~~installed~~ used into the body or shell of the spa at the time ~~of that the~~ spa is manufactured.

3.8.1.3 ~~When used, a~~ At least two Self-Contained Spa ~~Fittings~~ SOFAs shall be piped so that water is drawn through them simultaneously through a common line to the ~~related pump(s)~~. The use of valves or fittings capable of isolating one Self-Contained Spa ~~Fitting~~ SOFAs from any other on the common line to the related pump ~~shall be is~~ prohibited.

3.8.1.4 ~~This type fitting~~ Self-contained spa SOFAs shall be connected to the tee leading to the pump utilizing only the ~~fitting~~ SOFAs manufacturer's specified size(s) of ~~flexible~~ PVC hose or pipe. ~~The flexible PVC hose specified shall conform to IAPMO-PS-33.~~

~~2.3.5.1.1 Maximum Hose Length~~ **3.8.1.5** The maximum ~~length of hose length~~ difference between any self-contained spa ~~fitting~~ SOFAs and the tee leading to the pump, shall not exceed 13 ft (~~396.2 cm~~ 3.96 m).

3.8.1.6 The suction pipe size between self-contained spa SOFAs shall be specified for each SOFA model.

Section 3.9, Requirements for RDP SOFAs: Clarified the requirements for RDP SOFAs, corrected Equation 1 to include a_B versus a_R in the denominator and removed requirements for Venturi Outlets and Swim Jet Fittings as follows:

3.9 Requirements for RDP SOFAs

~~2.3.1.1 Suction Outlet Cover/Grates.~~ **3.9.1 Body entrapment flow rating methods.** ~~Suction outlet cover/grates that cannot be completely covered by the 18 in. x 23 in. (457 mm x 584 mm) body blocking element may be rated by the~~ RDP SOFAs shall be rated by the body entrapment test of section 6, or the following formulas, which shall yield the maximum allowable flow, Q, through the cover/grate. All calculations involve the open area of the cover/grate only.



3.9.1.1 Entrapping Force Criterion for Q

Equation 1

$$Q = a_R \sqrt{\frac{F}{C \frac{\rho}{2} a_B}}$$

where:

a_B = largest area of the cover/grate flow path openings in ft², that can be shadowed by the body blocking element (BBE).

a_R = area of the cover/grate flow path openings, in ft², that remains unblocked

C = flow coefficient based on the design of the flow path openings in the cover/grate. It shall ~~be taken at 2.1~~ based upon the actual loss coefficient of the cover/grate or representative sample from laboratory test data, unless otherwise demonstrated by calculation or test.

F = ~~allowable lifting load that can be exerted by a conscious entrapped person. It is taken at 120 lbf (534 N), about half the weight of the 99th percentile male whose weight is already entirely balanced by buoyancy.~~

Q = limiting flow rate in ft³/s based on the allowable entrapping force

ρ = ~~mass~~ density of water.

~~2.3.1 3.9.2 Water velocity limit through cover/grate. Field fabricated outlets are intended as but are not limited to a single suction outlet and RDP SOFAs are limited to a flow velocity of 1.5 ft/sec (0.46 m/s) of flow through the open area of the through any remaining cover/grate aperture not shadowed by the body blocking element of Figure 17, unless rated at a lower flow rate by a registered design professional. They shall be of such a size that the 18 in. x 23 in. (457 mm x 584 mm) body blocking element will not cause a differential pressure that could cause body entrapment as defined below. They are further governed by the stipulations of Mandatory Appendix II.~~

~~2.3.1.5 Alternate Test. As an alternate to para. 2.3.1.2, the Body Entrapment Test of section 5 may be performed.~~

~~2.3.1.6 3.9.3 Control of flow through cover/grate. RDP SOFAs shall have a sump below or behind the cover/grate of a design provided by a registered design professional documented to control flow through the open area of the cover/grate such that the design does not exceed the water velocity limits of paragraph 3.9.2. Refer to Figures 2, 3, 5 and 6.~~

~~2.3.1.7 Design 3.9.4 Certification report. The design of field fabricated outlets RDP SOFAs shall be further specified by a registered design professional in plans acceptable to the authority having jurisdiction (AHJ) for the specific pool and a written report addressed to the pool owner. The plans and report shall fully address the considerations of cover/grate loadings, durability, hair, finger and limb entrapment issues, cover/grate secondary layer of protection, related sump design, and used during SOFA certification and shall address all applicable requirements of sections/ paragraphs 1.2.5, 1.3, 3.1, 3.3 through 3.6, 3.6.4.3, 4.2 through 4.8, 4.10, 7, 8.5, 9.2, 9.3 through 9.7 as well as features particular to the specific site.~~

~~2.3.2 Venturi Outlets. Venturi outlets are outlets that are venturi activated through indirect suction through a single cover/grate generally designed for debris collection. Those that do not connect directly~~



~~to the circulation piping shall have the manufacturer's recommended sump below or behind the outlet cover/grate. They are further governed by the stipulations of Mandatory Appendix II.~~

~~**2.3.3 Swim Jet Combination Fittings.** Swim jet combination fittings are fittings that combine suction and discharge into one housing and may be used as single inlets/outlets. They shall connect directly to the circulation piping by a PVC end connection in accordance with ASTM D 2466, or by a threaded end connection in accordance with ASTM F 1498. They are further governed by the stipulations of Mandatory Appendix II.~~

Section 4, Physical Testing: The physical testing requirements were kept largely the same. The significant changes include:

- Removed allowance to hasten drying by wiping with a chamois after the crack detection test (see Section 4.1)
- Added an additional 720 h ultraviolet light exposure in accordance with ASTM G153 and included an additional verification of performance test, *Wall-Mounted Fitting Load and Deformation Test* following the UV exposures (see Section 4.2)
- Clarified the test specimen to use for the test method are those from Section 4.2.1 or new covers if Test method 2 from section 4.2.2 are used (see Sections 4.3 and 4.4)
- Added a detailed description for installation of the SOFA for the shear load test (see Section 4.6)
- Added an allowance to apply a Pressure or vacuum to develop the pressure differential required (see Section 4.7)
- Added a specific requirement for the permanent deformation to that exceeding 0.03 in. (0.76 mm) for the pull load test and included an exception for metal covers (see Section 4.8).
- Added a new test for threaded fasteners (see Section 4.10)

4.1 General

~~**3.1.2 Conditions for Tests and Evaluations.**~~ **4.1.1 Test Conditions.** All tests shall be conducted at ~~laboratory room~~ an air and water temperature of 73.4 °F ± 3 °F (23 °C ± 2 °C).

~~**3.1.3 4.1.2 Test Procedure.**~~ For the tests covered in ~~Section 3~~ this section a minimum of six cover/grates shall be tested in each test condition, unless otherwise stated. If the parts are made in different mold cavities, representative samples shall be taken from different mold cavities ~~for a total of six. Testing shall be performed immediately after conditioning, as described in para. 3.1.5.~~

~~**3.1.4 4.1.3 Test fixture.**~~ The SOFA shall be installed in a rigid fixture that ~~is capable of supporting~~ can support the ~~fittings~~ cover/grate in a manner ~~similar to~~ simulating the actual installation.

~~**3.1.5 4.1.4 Conditioning.**~~ All specimens shall be ~~submerged in water~~ kept at a temperature of 73.4 °F ± 3 °F (23 °C ± 2 °C) for at least ~~2~~ 24 hours before testing.

~~**3.1.6 4.1.5 Crack detection.**~~ After each physical test, the ~~unit~~ cover/grate shall be washed ~~in a standard liquid,~~ rinsed with ~~clear~~ potable water, and dried prior to application of ink ~~as specified in para. 3.1.6.1.~~ After inking, the ~~unit~~ cover/grate shall be visually inspected in accordance with ~~para~~ paragraph 4.1.7.

~~**3.1.6.2.**~~ ~~To hasten drying, the surface of the unit shall be permitted to be wiped with a clean chamois leather or a clean absorbent lint free material for this test only.~~



NOTE: Standard liquid detergent shall consist of (by volume):

- (a) Monsanto TKPP, 8.00%*
- (b) Sterox NJ, 7.00%*
- (c) Stepan SXS, 8.00%*
- (d) Butyl Cellosolve, 1.5%*
- (e) Water, 75.5%*

4.1.6 Inking procedure. ~~The entire finished surface of the fitting~~ exposed surfaces of the cover/grate, as if installed in a pool, shall be rubbed with a sponge and a 50% solution of potable water and water-soluble contrasting color ink after the unit has been washed and dried ~~as described in para. 3.1.6.~~ The ink shall be rinsed from the surface ~~and then dried before inspection~~ with potable water, and the cover/grate allowed to air dry before inspection.

~~3.1.6.2 Method of Inspection of the Fitting Surface.~~ **4.1.7 Inspection Method.** The exposed surfaces of the fitting cover/grate, as if installed in a pool, shall be inspected ~~with the unaided eye~~ for defects without the use of visual aids, except for corrective lenses, from a distance of between 1 ft. and 2 ft. (305 mm and 610 mm). The light source shall be equivalent to an ~~illumination intensity~~ illuminance near the surface to be inspected of 150 fc \pm 50 fc (1615 lx \pm 540 lx).

~~3.1.7~~ **4.1.8 Performance requirement.** The fitting shall be free from cracks as determined by inspection in accordance with paragraph 4.1.7. The presence of seams, flow lines, and knit lines ~~within suction fittings~~ shall be permitted and shall not be considered as to be cracks. ~~No failures shall occur.~~

~~3.2~~ **4.2 Ultraviolet Light Exposure Test** Polymeric materials, including fiberglass reinforced plastics, used for the manufacture of cover/grates and other SOFA components that may be exposed to direct sunlight when installed in a pool shall meet the requirements of this section.

~~Either test Method 1 or Test Method 2 of two test methods may shall~~ be utilized to test for ultraviolet light degradation testing. Test Method 1 is suited for products small enough to fit into an ultraviolet (UV) test chamber, while Test Method 2 is suitable for all products.

If Test Method 1 is used, then the ultraviolet test ~~as well as all~~ and the structural, tests are performed on fully assembled SOFAs.

If Test Method 2 is used, then the ultraviolet test is performed on two sets of "dog bone" samples molded per ASTM D638 from the same resin as the ~~final production samples~~ cover/grate ~~The tensile strength and Izod impact tests are performed on two sets of the "dogbone" samples.~~ Set A is not exposed to UV light, and Set B is exposed to the ultraviolet test UV light. In addition, all the applicable structural tests ~~(paras. 3.3 through 3.8)~~ described in sections 4.3 through 4.8 are also performed on the ~~complete (as-sold)~~ samples. The performance requirements for those tests, however, ~~will~~ shall be adjusted per paragraph ~~3.2.2.3~~ 4.2.2.3 of this standard.

~~Exception: Manufactured~~ Sumps and other fitting SOFA components that are not exposed to ~~natural UV radiation~~ direct sunlight when fully assembled and installed, ~~according to~~ per the cover/grate manufacturer's installation instructions, shall not be required to ~~be included in the Ultraviolet Light Exposure Test~~ meet the requirements of this section.

~~3.2.1~~ **4.2.1 Test method 1.** Twelve new ~~fitting specimens~~ cover/grates shall be exposed to ultraviolet light and water spray in accordance with 4.2.1.1, 4.2.1.2, 4.2.1.3, or 4.2.1.4 and 4.2.1.5 through 4.2.1.7:

~~(a)~~ **4.2.1.1** 720 hr. of twin enclosed carbon-arc (ASTM G153, Table X1.1 Cycle 1 except the Black Panel Temperature shall be 50 °C), or;



4.2.1.2 720 hr. of twin enclosed carbon-arc (ASTM G153, a programmed cycle of 20 minutes consisting of a 17-minute light exposure and a 3-minute exposure to water spray with light shall be used with a blackpanel temperature of 63 ± 3 °C), or;

~~(b)~~ 4.2.1.3 1,000 hr. of xenon-arc (ASTM G155, Table X3.1 Cycle 1 except the Black Panel Temperature should be 50 °C), or;

~~(c)~~ 4.2.1.4 750 hr. of fluorescent (ASTM G154, Table X 2.1 Cycle 1 except the 8-hour UV shall be at a Black Panel Temperature of 50 °C and the 4-hour condensation Black Panel Temperature shall be 40 °C).

~~3.2.1.1~~ 4.2.1.5 Specimens Cover/grates shall be mounted inside the test apparatus, with exposed surfaces of the specimens cover/grate that will be exposed after installation in a pool facing the UV lamps, and positioned so they receive exposure approximating a fully assembled and installed cover/grate fitting SOFA. After the exposure test, the specimens cover/grates shall be removed from the test apparatus and rejected if signs of deterioration such as cracking or crazing appear. Discoloration shall not be cause for rejection. ~~They~~ The UV exposed samples shall then be retained under conditions of ambient room temperature and atmospheric pressure of 73.4 °F \pm 3 °F (23 °C \pm 2 °C) for not less than 16 hours, and not more than 96 hours, before being subjected to the following tests:

- ~~(a)~~ Deflection Tests Floor-Mounted Fitting Load and Deformation Test
- Wall-Mounted Fitting Load and Deformation Test
- ~~(b)~~ Point Load to Protrusion Excess Test
- ~~(c)~~ Shear Load Test
- ~~(d)~~ Vacuum and Point Impact Test Pressure Differential and Point Impact Test
- ~~(e)~~ Pull Load Test

4.2.1.6 The intensification factor K shall be 1.0 for UV Test Method 1.

~~The exposed specimen shall be permitted to be transported from one laboratory to another, provided time requirements are met.~~

~~3.2.1.2~~ 4.2.1.7 Performance requirement. All the specimens Cover/grates that were subject to the UV Test Method 1 shall comply with all applicable performance requirements of the structural integrity tests in sections ~~3-3~~ 4.3 through ~~3-8~~ 4.8.

~~3.2.2~~ 4.2.2 Test method 2. ~~Samples~~ Specimens of the fitting component polymeric materials shall be exposed to ultraviolet light in accordance with the options specified in paragraphs 4.2.1.1, 4.2.1.2, 4.2.1.3, or 4.2.1.4, and then to the tests specified in paragraphs 4.2.2.1 and 4.2.2.2. For Test Method 2, K is derived from paragraph 4.2.2.3.

~~3.2.2.1~~ 4.2.2.1 Tensile strength. ~~Samples of virgin material~~ Specimens of non-exposed material (A) and UV-exposed material (B) shall be evaluated for tensile strength as described in the Standard Test Method for Tensile Properties of Plastics, ANSI/ASTM D638 (ISO 527-2) using Type 1 specimens of 0.125 in. \pm 0.02 in. (3.2 mm \pm 0.4 mm) thickness and testing speed of 0.2 in./min \pm 0.05 in./min (5.1 mm/min \pm 1.3mm/min). The tensile strength is to be that value recorded at the yield point, if the material yields, ~~otherwise at break~~ or the value at the break point if the material breaks.

~~3.2.2.2~~ 4.2.2.2 Izod Impact. ~~Samples of virgin material~~ Specimens of non-exposed material (A) and UV-exposed material (B) shall be evaluated for impact strength as described in Method A of the Standard Test Methods for Impact Resistance of Plastics and Electrical Insulating Materials, ASTM D256 or ISO 180, using a 0.125-in. (3.2-mm) thick specimen.



~~3.2.2.3~~ **4.2.2.3** Performance requirement. Samples of the material shall retain at least 70% of the ~~unconditioned (virgin)~~ non-exposed value when the tests indicated in ~~3.2.2.1~~ 4.2.2.1 and ~~4.2.2.2~~ 4.2.2.2 are performed. An intensification factor K shall be defined as the inverse of the lowest retained proportion of the non-exposed value when the tests in paragraphs 4.2.2.1 and 4.2.2.2 are performed. The ~~applicable~~ structural integrity tests, ~~i.e., paras. 3.3, 3.4, 3.5, 3.6, 3.7, and 3.8,~~ described in sections 4.3 through 4.8 ~~will shall~~ be conducted ~~on the complete (as sold) non-UV-exposed samples at~~ using non-UV exposed cover/ grates attached to a SOFA at loadings equal to the base values multiplied by the intensification factor, K. For example, if 80% of the tensile strength is retained in paragraph ~~3.2.2.1~~ 4.2.2.1, and 85% of the Izod unit energy ~~is retained~~ measured in paragraph 4.2.2.2 is retained, then $K = 1/0.80 = 1.25$. ~~This will ensure that adequate strength remains after service aging.~~
~~NOTE: In the following paragraphs, the factor K is derived from para. 3.2.1.1 (Test Method 1) or para. 3.2.2.3 (Test Method 2).~~

~~3.3 Vertical Load and Deformation~~ **4.3 Floor-Mounted SOFA Load and Deformation Test**

~~This test applies only to SOFAs intended for installation on the floor.~~ Six ~~fittings intended for installation in the floor or wall~~ cover/grates attached to a SOFA shall be tested at four locations. A point load machine readable to, at a minimum, 5 lbf (22 N) increments, and that is equipped with a steel tup of 2 in. (51 mm) minimum diameter steel tup, with a 2 in. \pm 0.5 in (51 mm \pm 13mm) radius nose ~~and a tup speed of 0.20 in./min to 0.25 in./min (5.1 mm/min to 6.4 mm/min) shall be used.~~ A skin pad consisting of a 0.25 in. (6.35 mm) thick buna-n rubber pad of Shore A durometer 60 ± 5 hardness shall be placed between the tup and the cover/grate being tested.

4.3.1 Test method. Cover/grates shall be from section 4.2.1 or new covers if Test method 2 from section 4.2.2 are used and tested as described in 4.3.1.1 through 4.3.1.3.

~~3.3.1~~ **4.3.1.1** Each SOFA shall be mounted on a horizontal plane.

~~3.3.1~~ **4.3.1.2** The steel tup and pad shall apply a vertical load at a total of four different locations on the cover/ grate; two points midway between the center and edge at two points between stiffeners, if any, and at two points furthest from any support element.

~~3.3.1 Test Method.~~ **4.3.1.3** Using the tup and a 2 in. (51 mm) diameter skin pad on the face of the tup, and a tup speed ~~described in para. 3.3~~ of 0.20 in./min to 0.25 in./min (5.1 mm/min to 6.4 mm/min), apply a load at each of the above locations until $300 \text{ lbf} \times K \pm 10 \text{ lbf}$ ($1334 \text{ N} \times K \pm 44 \text{ N}$) is reached.

~~3.3.2~~ **4.3.2 Performance requirement.** Suction fittings Cover/grates and their SOFA support components shall not ~~permanently deform~~ crack, or lose any material from the fitting, exclusive of plating or finish coatings.

~~3.4~~ **4.4 Horizontal Wall-Mounted SOFA Load and Deformation Test**

~~This test applies to cover/grates intended for installation on a wall. Fittings to be tested shall be the six as previously tested in para. 3.3.~~ Six cover/grates shall be tested and they shall be those from section 4.2.1 or new covers if Test method 2 from section 4.2.2 are used.

~~3.4~~ **4.4.1 Test method.** ~~This test is identical to the Vertical Test except that the~~ The tests described in section 4.3.1 shall be performed with a load of $150 \text{ lbf} \times K \pm 5 \text{ lbf}$ ($667 \text{ N} \times K \pm 22 \text{ N}$).

~~3.5~~ **4.5 Point Load to Excess Test**

~~Fittings~~ The cover/grates to be tested shall be the six ~~as~~ previously tested in ~~sections para. 3.3 and 3.4 loaded in the same manner~~ 4.3 or 4.4, as applicable, with loads applied in accordance with section 4.3.



3.6 4.6 Shear Load Test on the Horizontal Edge of Wall Mounted Cover/Grate

This test shall be applied to any cover/grate that protrudes 0.5 inch (13 mm) or more from the finished surface of the pool wall when installed per the manufacturer's installation instructions. The six fittings cover/grates to ~~shall~~ be tested. ~~They shall be those from the Ultraviolet Light Exposure test section 4.2.1 or new covers if Test method 2 from section 4.2.2 are used. This test shall be applied to all fittings that protrude 1/2 in. (13 mm) or more from the mounting plane.~~

4.6.1 Test method. *Each cover/grate shall be attached to a SOFA that is mounted in a manner simulating an actual installation as closely as possible. The loads transferred from the cover/grate to the rest of the SOFA and thence to the foundation shall represent the load paths of an actual installation.*

~~3.6.1~~ **4.6.1.1** *The fittings cover/grates shall be tested by the application of a 150 lbf × K ± 5 lbf (667 N × K ± 22 N) test load applied 30 degrees from the mounting plane.*

4.6.1.2 *The test load shall be applied by a steel plate that is 1/2 in. × 2 in. × 2 in. (12 mm × 51 mm × 51 mm), that is covered on its face with a 2 in. × 2 in. (51 mm × 51 mm) skin pad ~~on its face as defined in section 4.3.~~*

4.6.1.3 *The six fittings cover/grates shall be tested using the point load apparatus described in section ~~3.3~~ 4.3.*

4.6.1.4 *Three fittings cover/grates shall be tested with ~~fasteners~~ the load placed directly in line with the ~~load to test the fasteners strength and.~~*

4.6.1.5 *Three cover/grates shall be tested with the load midway between fasteners ~~for general strength,~~ when used.*

4.7 Pressure Differential and Point Impact Test

~~3.7.1(a)~~ **4.7.1** *Test method. ~~The fittings to be tested~~ Each cover/grate shall be mounted ~~on a horizontal surface and covered with a 20 mil (0.5 mm) plastic material or other suitable material.~~ in a manner simulating an actual installation as closely as possible. The loads transferred from the cover/grate to the rest of the SOFA and thence to the foundation shall represent the load paths of an actual installation. Pressure or vacuum may be used to develop the differential pressure that is required, the magnitude of which is determined by the value of K.*

4.7.1.1 *The cover/grate shall be covered with a 20-mil (0.5 mm) plastic material or other suitable material.*

4.7.1.2 *The cover/grate shall be subjected to an external differential pressure of 28.5 inHg × K ± 1 inHg (724 mmHg × K ± 25 mmHg) differential pressure within 60 s ± 5 s.*

4.7.1.3 *The differential pressure shall be sustained for 5 min ± 10 s.*

~~3.7.1(b)~~ **4.7.1.4** *The vacuum or pressure shall be removed from the system, the plastic film shall be removed, and the cover/grate shall be impacted at 15 ft-lbf × K (20.3 J × K) using the test method in ASTM D2444, with a 5 lbf (2.3 kg) steel tup, 2 in. (51 mm) minimum diameter with a 2 in. ± 1/2 in. (51 mm ± 13 mm) radius nose.*

~~3.7.1(b)~~ **4.7.1.5** *The tup shall be dropped onto the center of the fitting from 3 ft. × K (914 mm × K).*

4.7.1.6 *The cover/grate shall again be subjected to the 28.5 inHg × K ± 1 inHg (724 mmHg × K ± 25 mmHg) differential pressure within 60 s ± 5 s.*

4.7.1.7 *The differential pressure shall be sustained for an additional 5 min ± 10 s.*

4.7.1.8 *Remove the sample from the test fixture, and then apply water-soluble contrasting ink in accordance with paragraphs 4.1.5 through 4.1.8.*

4.7.1.9 *The components shall then be inspected for cracks, breaks, or fractures in accordance with paragraph 4.1.7.*



3.8 4.8 Pull Load Test

Pull Load Testing shall be required of all cover/grates with openings with at least two dimensions of 0.375 in. (9.53 mm) or greater. ~~The measurements shall be done on the anticlastic surface when required for the hair test, para. 4.1.5.7. The same six fittings used in the Vacuum and Point Impact Test (see para. 3.7) shall be tested.~~ The cover/grates to be tested shall be the six previously tested in section 4.7.

~~3.8.1~~ **4.8.1** Test method. The cover/grate shall be ~~tested by the application of a~~ installed on a SOFA per the manufacturer's installation instructions. A total force of 150 lbf × K ± 5 lbf (667 N × K ± 22 N) test load shall be applied to the underside of the cover/grate assembly, and perpendicular to the mounting surface, in locations that will approximate the load bearing points available to a bather's ~~three~~ finger(s). The test shall be conducted once directly adjacent to fasteners, and conducted once midway between adjacent fasteners ~~when the fitting is installed in accordance with the manufacturer's instructions.~~ The test apparatus used shall apply an equal load to each bearing location.

4.8.2 Performance requirement

~~4.8.2.2~~ The cover/grate shall withstand a 150 lbf × K (667 N × K) pulling force. Distortion under load shall not compromise the fastener(s), loosen the cover/grate, ~~permanently deform, or crack the fitting, or cause permanent deformation exceeding 0.03 in. (0.76 mm).~~ Metal cover/grates are exempt from the deformation requirements.

~~4.8.2.3~~ The cover/grate shall be free from cracks as determined by inspection in accordance with paragraph 4.1.7.

3.9 4.9 Mold Stress Relief Distortion

~~3.9.1~~ **Test Method** ~~4.9.1~~ **High ambient temperatures.** One sample, ~~of the complete (as sold)~~ non-UV exposed fitting cover/grate, assembled with any other SOFA component(s) as intended for shipping and distribution, is to shall be placed in a full draft circulating air oven maintained at a uniform temperature of 140 °F ± 3 °F (60 °C ± 2 °C). The sample ~~is to shall~~ remain in the oven for 7 hrs. ~~The sample is then to be removed from the oven,~~ and then be allowed to return to room temperature before being assembled and installed in the SOFA mounting surface.

~~3.9.2~~ **4.9.2** Test sample. This sample shall be used for the Hair Entrapment Tests, section 5, and Body Entrapment Tests, section 6.

Section 4.10 Threaded Fastener Test: Added a new test for threaded fasteners as follows:

4.10 Threaded Fastener Test

4.10.1 Female receptacle. Each female thread or thread receptacle shall be tested to the maximum torque specified by the manufacturer.

4.10.1.1 The test shall be performed 15 times.

4.10.1.2 A torque-limiting driver shall be used.

4.10.1.3 The test shall be performed on a SOFA assembled per the manufacturer's instructions.

4.10.1.4 The screws shall be removed manually and started manually each time.

4.10.1.5 The screws and receptacle shall be at a temperature of 73.4 °F ± 3 °F (23 °C ± 2 °C).

4.10.1.6 The use of multiple screws shall be permitted to complete this test.

4.10.2 Performance Requirement. The female receptacle shall not strip or crack, and the fastener head shall not cause cracking of the cover/grate. Threaded inserts shall not strip, twist, or pull out of the SOFA component.



Section 5, Hair Entrapment Testing: Changed the hair entrapment test as follows:

- Revised the specifications for Type 1 hair specimen to require a new weighted down skull and clarified that hair should be evenly trimmed to a length of 16 in (see Section 5.2).
- Revised the test tank set-up and added a new water depth requirement (see Section 5.3)
 - Each sump/pipe configuration required if flow water less than 16 inches. Suction head measurement required during testing. No 10 GPM below and climb up for flow rating. New reporting format.
- Added additional specifications and requirements for the test equipment (see Section 5.4)
- Clarified the SOFA Mounting Surface (see Section 5.5)
- Changed the required piping configurations for the hair test (see Section 5.7)
 - removed the required minimum of 16 in SCH 40 plastic pipe attached to the 90-degree elbow,
 - Added new requirement for the manufacturer to supply SOFA dimensions;
 - Added new requirements for the lab to measure and document the minimum flow path length for each SOFA; and,
 - Added new requirement to test each SOFA model with flow path less than or equal to 16 in at the minimum distance from the top of the pipe opening to the finished surface of the pool;
 - Included an allowance for SOFA's with a minimum flow path greater than 16 in to only test the SOFA configuration resulting in the highest flow potential.
- Clarified the hair test procedure (see Section 5.9)
 - Clarified that the pull speed verification applies to a 2 lb and a 10 lb mass versus the entire range from 2-10 lb (see Section 5.9.2)
 - Hair Test Starting Position: Clarified the starting position of the free end of the hair and for the wall and floor mounted SOFA's (see Section 5.9.4)
 - Added a new requirement to test each SOFA configuration with a flow path length less than 16 inches, including each suction port combination for manufactured sumps with multiple suction ports and/or suction pipe opening sizes. (see Section 5.9.6).
 - Added a requirement to measure and report the suction head observed during the test (see Section 5.9.7)
- Added a new reporting format (see Appendix C)

45 HAIR ENTRAPMENT TESTING

The objective of this section is to measure the removal force of hair that may be drawn into a SOFA and manufacturer specified suction pipe opening.

4.1 5.1 General

4.1.1 Impedance 5.1.1 General performance requirement. *Hair drawn into or onto suction fittings shall not ~~impede~~ prevent the escape of a bather in accordance with the performance requirements of section 5.10.*

5.1.2 RDP SOFAs. *Hair entrapment tests are not required for RDP SOFAs certified by a registered design professional in conformance with section 3.10.*

4.1.2 Sample Types 5.2 Hair Specimens

Two types of hair shall be used in this test. Separate tests shall be run with each hair type.



~~4.1.2.1~~ **5.2.1 Type 1, (skull).** A full head of natural, fine, straight, blond European, human hair with cuticle on hair stems, 16 in. (406 mm) in length, weighing 5.5 oz. \pm 0.5 oz. (155 g \pm 15 g), shall be firmly affixed ~~in a manner approximating the normal distribution of hair with "hook and loop" to a Professional Wig Display Mannequin, Model No. FMH #1SC, or equivalent, properly weighted to achieve neutral buoyancy under the water to a simulated skull with a head circumference of 22.8" \pm 1", a head length of 7.9" \pm 1/2", and a head breadth of 6.2" \pm 1/2" in a manner approximating the normal distribution of hair.~~ The completed assembly shall weigh between 1 pound and 2 pounds when submerged at the test depth. An scale anchoring point shall be provided near the neck of the simulated skull. A fresh sample of hair shall be used for each fitting tested or when tangles in the hair cannot be removed. Hair shall be trimmed evenly to a length of 16 inches (406 mm) \pm 1/4 inch (6 mm), measured from the top of the skull, after being attached to the simulated skull.

~~4.1.2.2~~ **5.2.2 Type 2, (ponytail).** Natural, medium-to-fine, lightbrown colored human hair weighing 2 oz. \pm 0.11 oz. (57 g \pm 3 g) and having a length of 16 in. (406 mm) shall be affixed to a 1 in. (25 mm) diameter by 12 in. (305 mm) or longer wooden dowel, as may be required to properly place the hair sample for testing. Consideration shall be given to the buoyancy of the portion of the wooden dowel ~~in excess of more than~~ 12" (305 mm) in determining the removal force. A method for attaching a scale shall be provided on the opposite end of the dowel. ~~A fresh sample of shall be used for each fitting tested or when tangles in the hair cannot be removed.~~ Hair shall be trimmed evenly to a length of 16 inches (406 mm) \pm 1/4 inch (6 mm) measured from hair attachment end of the dowel.

5.3 Test Tank

~~4.2.3~~ **5.3.1 Water temperature.** ~~The tank shall be filled with~~ During all tests, the water shall be at a temperature at 90 °F \pm 10 °F (32°C \pm 6 °C) ~~to a depth of 12 in. \pm 1/2 in. (305 mm \pm 13 mm) above the top edge of the cover/grate, or to a depth in accordance with the manufacturer's instructions for swim jet combination fittings.~~

5.3.2 Water depth. During all tests and with water flowing, the minimum water level of the tank shall be above the shallowest cover/grate flow passages such that the hair test assembly, up to and including the pull mechanism attachment point of the skull or ponytail, is at least 2 in. below the water level. Refer to Figure 7.

~~4.1.6.4~~ **5.3.3 Water currents.** Influences of water currents shall be virtually absent in the test ~~pool tank,~~ as evidenced by the suspension of the hair sample in the ~~tank for 30 sec and noting its deviation from a vertical plumb line hung at a distance from the nonflowing test specimen of four times the least dimension of the test cover/grate.~~ water 2 in. above the center of the SOFA for 30 seconds with the pumping system running at the maximum anticipated, or actual, passing flow rate. Hair movement away from a vertical plumb line shall be observed and any ~~The~~ deviation shall not exceed 1 in. (25 mm) during this time. Refer to Figure 7.

~~4.1.5.1~~ **5.3.4 Optional test tank.** The test tank for evaluation of ~~suction fittings~~ the SOFA for the hair entrapment test shall ~~be in accordance~~ comply with Figures ~~4, 5, and 6~~ 8 and 9. The baffle plates shall be constructed as shown in ~~Figure 7 and be positioned as shown in~~ Figures ~~410 and 511.~~

~~4.1.5.3~~ **Pump Inlet.** ~~The pump inlet shall be connected to the 16 in. (406 mm) length of Schedule 40 plastic pipe using pipe lengths and adapters as necessary.~~

~~4.1.6~~ 5.3.5 Alternate test tanks

~~4.1.6.1~~ **5.3.5.1** The same tank as described in paragraph 5.3.4, with ~~baffles~~ Baffle C, bottom, sides, and only the one end where the fittings are tested may be used by ~~the insertion of~~ inserting the tank into a



larger body of water so that the submerged depth of the ~~tank is the same as in para. 4.2.3~~ simulated SOFA mounting surface is the same as in paragraph 5.3.2.

5.4 Test Equipment

5.4.1 Pump flow. The pump shall be capable of producing a flow rate at least 25% greater than the fitting cover/grate manufacturer's is recommended anticipated rating of the fitting shall be used SOFA configuration.

5.4.2 Flow measurement. A flow meter with an accuracy of $\pm 3\%$ at the anticipated cover rating SOFA configuration rating of the fitting shall be used shall be installed in the piping system in accordance with the flow meter manufacturer's installation instructions.

5.4.3 Flow control. A valve shall be used to adjust the test flow rate. Altering the speed of the pump motor shall not be use to vary the test flow rate.

5.4.4 Pump suction. The suction source for the hair and body entrapment tests shall be a pumping system that is capable of producing the required volumetric flow rate, and a suction head of at least 26.0 inHg, measured as close as practicable to the SOFA in accordance with paragraph 5.4.5, when the suction piping is completely blocked after the discharge is throttled to deliver the test flow rate. Refer to Figures 7 and 12.

5.4.5 SOFA suction. The suction head shall be measured with a pressure transducer or sensing device with an operating range appropriate for the test and with a minimum accuracy of 1% full scale. The elevation of the pressure sensor diaphragm or strain gauge above or below the water level of the test tank, as measured during the test shall be recorded, and the value shall be adjusted as required to correct for positive or negative water column. The maximum suction head reading (corrected for elevation) shall be recorded.

5.4.6 Hair pull mechanism. A pull mechanism with an anchoring point located directly above the area of the SOFA being tested, such that during any test, the hair specimen will be pulled vertically towards the surface of the water. It shall be capable of maintain a consistent speed of 5 in/s \pm 0.25 in/s (127 mm/s \pm 6 mm/s) when pulling either the Type 1, (skull) or Type 2 (ponytail) hair specimen. Refer to Figure 7.

~~4.1.5.4 Scale.~~ **5.4.7 Pull force measurement.** A scale accurate to ± 0.1 lbf (0.45 N) at a tension of 5 lbf (22 N) shall be used to ~~determine pounds of pull against the entrapment~~ measure the hair removal force.

5.5 SOFA Mounting Surfaces

~~4.2.2~~ **5.5.1 Test assembly.** The suction fitting SOFA, including ~~the sump to be tested (see Figure 6)~~ a cover/grate, as conditioned in accordance with paragraph 4.9.1 and the sump to be tested, shall be installed in accordance with the manufacturer's installation instructions on the ~~on the test drain~~ SOFA mounting surface, ~~with a surface area of sufficient size such that the BBE does not touch a mounting surface edge, or associated mounting hardware.~~ Refer to Figure 12.

~~4.1.5.6 Mounting Surface~~ **5.5.2 SOFA only flow path.** For assemblies where all flow passages are provided by the manufactured SOFA components, the SOFA mounting surface of Figure 6 12 shall be planar and represent actual field practices, with smooth surfaces immediately adjoining the top edge of the frame or sump, or as specified by the manufacturer, in accordance with their installation instructions.

~~4.1.5.7 Test Procedure~~ **5.5.3 Pool surface flow path.** For assemblies where a portion of the flow passage is the finished surface of the pool and is not controlled by the suction outlet cover/grate manufacturer, the ~~test~~ SOFA mounting surface shall represent field imperfections that may produce a hair entrapment



hazard. The nominally square planar mounting surface shall be distorted to an anticlastic (~~warped or saddle-shaped~~) surface such that one corner is 2 in. (51 mm) away from a plane defined by the other three corners of a 48 in. × 48 in. (122 mm × 122 mm) square as shown in Figure 8 13. A convenient means shall support three of the corners in a plane with 1 in. (25 mm) clearance from the nearby surface of the frame, then force the fourth corner 2 in. (51 mm) from the plane of the first three. Supports shall be localized, and 1.5 in. (38 mm) from the edges of the mounting surface. The test specimen shall be firmly attached to the anticlastic surface in a field installation manner as specified by the cover/grate manufacturer.

5.7 SOFA Sump and Piping Configurations for Hair Testing

5.7.1 Sump dimensions. Manufacturers shall provide the test lab with the dimensions of the sump to be used during each SOFA model test. Refer to Figures 3, 5 and 6.

5.7.1.1 The lab shall measure and document the minimum flow path length for each SOFA model for purposes of determining the hair test scope of either 5.7.2 or 5.7.3. Refer to Figure 3.

5.7.1.2 The flow path length shall be measured using a string line from the entrance of the nearest aperture to the closest suction pipe opening to identify the shortest distance Type 1 or Type 2 hair can travel from the cover/grate to a suction pipe opening.

4.2.2 5.7.2 Flow path length less than 16 inches.

Each SOFA model shall be tested at the minimum cover/grate manufacturer-specified distance from the top of the pipe opening to the finished surface of the pool to simulate actual installations including each suction port combination for manufactured sumps with multiple suction ports and/or suction pipe opening sizes. ~~The fitting~~ These SOFA models shall be ~~connected to~~ tested with a 90-degree elbow of the same size ~~of the fitting outlet, and as the suction pipe opening, installed~~ as close to the ~~suction fitting sump~~ as possible, with a minimum of 16 in. (406 mm) of straight Schedule 40 plastic pipe the same size as the fitting socket connected to the 90° elbow practical. All suction pipe openings shall be challenged as part of Type 1 and Type 2 hair tests.

5.7.3 Flow path length equal to or greater than 16 inches. Only the SOFA configuration with the largest manufacturer specified suction pipe opening size and suction pipe quantity, the configuration of which results in the highest flow potential for the cover/grate, shall require Type 1 and Type 2 hair tests. A 90-degree elbow of the same size as the suction pipe opening is not required when testing SOFAs with a flow path equal to or greater than 16 inches.

5.8 SOFA Test Positions

4.2.2 5.8.1 Floor-Mount. ~~and f~~ For suction fittings SOFAs intended to be installed only in the for floor-mounted installations, the test SOFA mounting surface shall be placed in the horizontal position.

4.2.2 5.8.2 Wall-Mount. For suction fittings SOFAs intended for wall mounted installation, the test SOFA mounting surface shall be placed in the vertical position;

4.2.2 5.8.3 Wall and floor-mount. SOFAs intended for installation in either the wall or floor position-mounted installations shall be tested in both positions with the SOFA mounting surface configured in both vertical and horizontal positions.

4.2.2 5.8.4 Non-uniform flow-path. For fittings tested in the vertical position, if the pattern of the For SOFAs intended for wall-mounted installation that have a cover/grate flow path pattern that is not uniform, ~~it~~ the cover/grate shall be tested in two clock positions representing that represent the essential geometric differences that may affect the hair removal force. Refer to Figures 15 and 16.



5.9 Hair Test Procedure

5.9.1 Starting flow rate. ~~The test pump shall be activated and the flow shall be regulated to 10 gpm (38 L/min) less than the fitting manufacturer's recommended gpm flow rate. If the fitting rating is not known, this test shall be started at 25 gpm (95 L/min).~~ The fitting manufacturer ~~may~~ **shall** specify the starting test flow rate for each fitting SOFA configurations to be tested.

4.2.4 5.9.2 Prior to energizing the test pump, the pull mechanism shall be verified to ensure a consistent speed when pulling ~~weights from 2 lbf to 10 lbf (8.9 N to 44 N), a 2 lbf (8.9 N) and a 10 lbf (44 N) weight.~~ Within that range of test weights For each test weight, the speed of the pull shall be 5-in./sec inches per second ±0.25-in./sec inches per second (127 mm/sec ±6 mm/sec). Refer to Figure 7.

5.9.3 Hair specimen. Test hair preparation and maintenance.

4.2.6 5.9.3.1 Prior to use, the hair shall be cleaned in a solution of 10% volume of Sodium Alpha Olefin Sulfonate (AOS) and potable water. ~~After cleaning thoroughly, rinse in potable water.~~ The hair test sample shall be rinsed in potable water after cleaning.

4.2.6 5.9.3.2 Dry The hair shall be submerged saturated in the test tank water for a minimum of 2 min minutes in the test tank prior to use. ~~When saturated, the hair shall be placed on the dowel/human skull and attached to the piston. When testing on a vertical fitting, the free end of the hair shall be placed approximately 12 in. (305 mm) in front of the suction fitting, 2 in. (51 mm) above the face of the fitting, as illustrated in Figure 10.~~

5.9.3.3 New hair shall be conditioned by performing ten test pulls prior to recording the hair removal force.

4.2.6 5.9.3.4 Hair samples shall be cleaned before first use and after every ten pulls.

5.9.3.5 A fresh sample of hair shall be used when tangles in the hair cannot be removed by combing.

4.2.7 5.9.5 Hair test approach and hold position

5.9.4 Hair Test Starting Position

5.9.4.1 The starting position of the free end of the hair for a wall-mount SOFA shall be in front of and 2 inches (51 mm) above the SOFA, as illustrated in Figures 15 and 16.

5.9.4.2 The starting position of the free end of the hair for a floor-mount SOFA shall be placed 2 in. (51 mm) above the area of the SOFA to be evaluated, as illustrated in Figure 7.

5.9.6 Hair test pull

5.9.6.1 Hair entrapment tests for SOFAs with a flow path length less than 16 inches; each SOFA configuration shall be tested, including each suction port combination for manufactured sumps with multiple suction ports and/or suction pipe opening sizes. Hair entrapment tests for SOFAs with a flow path length greater than 16 inches; the SOFA configuration that results in the highest flow potential shall be tested.

5.9.6.2 The area of the cover/grate adjacent to each suction port shall be challenged with the Type 1 (skull) and Type 2 (ponytail) hair specimens.

5.9.6.3 The scale shall be reset to zero prior to each pull test, if applicable.

4.2.8 5.9.7 Hair test consecutive runs

5.9.7.1 The flow rate shall be increased in 5 gpm ±3% (19 L/min) increments.

...

4.2.8.1 With the test pump still operating, 5.9.7.4 The amount of force necessary to free the



hair from the fitting shall be measured with the test pump(s) operating.

5.9.7.5 The skull or ~~dowel~~ ponytail shall be attached to the scale and the scale shall be zeroed while the skull or

ponytail is fully immersed in the test tank water

~~and then pulled in a vertical orientation~~

5.9.7.6 The skull or ponytail shall be pulled vertically

away from the fitting by activating the hair removal mechanism. ~~The force of the entrapment~~ The removal force and suction head shall be measured and recorded. ~~A sample reporting form for recording the data is provided in non-mandatory Appendix A.~~

...

Section 6, Body Entrapment Testing:

- Added specifications for the test equipment and additional clarification for the SOFA test configurations (see Section 6.2)
- Added a 2 s limit to the applied force timing and removal force during the test procedure (see Section 6.5)
- Changed the method of calculating the allowable removal force: replaced former Table 1, *Applicable Body Block Element – Calculation of Removal Force* with new Equation 2 (see Section 6.4).
- Added a new reporting format (see Appendix D)

5.6 BODY ENTRAPMENT TESTING

The objective of this section is to measure the removal force of a body that might be held against a cover/grate by the suction force of a pump.

6.1.1.1 RDP SOFAs shall be certified in accordance with either section 3.9 or section 6.

6.2 Body Entrapment Test Equipment

Tests shall be performed using the equipment specified in paragraphs 6.2.1 through 6.2.8.

6.2.1 Test tank. A test tank in accordance with section 5.3.

~~5.1.3 Test Equipment.~~ **6.2.2 Body blocking element (BBE).** ~~A torso specimen is defined as a rectangular form representing the flat portion of the 99th percentile adult male body (Mandatory Appendix I). Representing this form for test purposes is the body block element that is an 18 in. × 23 in. × 2 in. (457 mm × 584 mm × 51 mm) section of foam identified as~~ The body-blocking element (BBE) shall be constructed of 2-inch (51 mm) thick closed-cell nitrile butadiene rubber/(poly) vinyl chloride (NBR/PVC) foam with a compression deflection value of 1.5 psi to 3.0 psi (10 kPa to 21 kPa) at 25% deflection, as measured in accordance with ASTM D1056- 00. ~~The~~ foam shall be mounted ~~against to an 18 in. × 23 in. × ¾ in. (457 mm × 584 mm × 19 mm)~~ a ¾ in. (19 mm) waterproofed plywood backing, with the skin side of the foam facing away from the plywood. ~~with an eyebolt, hitching ring, or equivalent at the centroid as shown in Figures 11 and 12. The specimen shall be ballasted to neutral buoyancy, within 0.7 lbf (3.1 N), at the test depth.~~ The vertical corners of the applicable body-blocking element (BBE) shall be radiused with a radii of 22% of the width dimension have a radius of 4 inches. Refer to Figure 18.



6.2.3 BBE attachment. An eyebolt, or equivalent device located at the centroid of the body blocking element (BBE), shall be used to attach the body-blocking element (BBE) to the push/pull actuator as shown in Figure 18.

6.2.4 Push/pull actuator. An apparatus that can apply 120 lbf (534 N) vertically downward and upward on the body-blocking element (BBE), release the downward force within 2 seconds, then apply the upward force required to remove the body-blocking element (BBE) from the cover/grate.

6.2.5 Push/pull force measurement. A scale accurate within 0.5 lbf (2.2 N) at a compression/tension of 120 lbf (534 N) shall be used to measure the BBE removal force.

6.2.6 SOFA test configuration. The cover/grate shall be installed on and tested with the SOFA configuration of section 5 that provided the highest flow rating.

6.2.6.1 For SOFA's certified for wall only applications, the testing of section 6 may be performed in either the vertical or horizontal orientation. When a cover/ grate certified for walls only is to be tested in the wall mounted position, the push/pull actuator performance requirements of paragraph 6.2.5 shall be met except the push/pull forces shall be applied horizontally.

6.2.7 Pumping system. Shall be in accordance with paragraph 5.4.4.

5.2 Test Method 6.3 Body Entrapment Test Procedure

~~**5.2.1 6.3.1 Test orientation.** With the outlet flowing at the smaller of the maximum flow specified by the manufacturer or designer or as determined in para. 4.3, the 18 in. × 23 in. (457 mm × 584 mm) body block element, concentrically loaded, cover/grate installed on the SOFA configured in accordance with paragraph 6.2.6 and with the pumping system operating in conformance with paragraph 6.2.7, the body-blocking element (BBE) shall be placed on-centered over the cover/grate with an applied force of 120 lbf (534 N) and in such a position as to be centered or cover the largest area of the cover/grate and oriented to block the largest possible open area of the cover/grate.~~

~~**6.3.2 Applied force.** A force of 120 lbf (534 N) shall be applied through the eyebolt, or equivalent, to fully seat the body-blocking element (BBE) on the cover/grate.~~

~~**6.3.3 Applied force timing.** The applied force shall be removed from the body-blocking element (BBE) within 2 seconds.~~

~~**6.3.4 Applied removal force.** Within 2 seconds after removal of the applied force, the push/pull actuator shall begin to lift the body-blocking element (BBE) from the cover/grate.~~

~~**6.3.5 Recorded removal force.** The maximum force required to remove the body-blocking element (BBE) from the cover/grate shall be recorded as the removal force.~~

~~**5.2.1.1** For purposes of calculating the maximum allowable release force, the smallest blocking element that will completely shadow the suction outlet cover/grate being tested shall be referred to as the applicable body blocking element.~~

~~**5.2.1.2** Applicable body blocking elements may range in size from the 18 in. × 23 in. (457mm × 584 mm) size down to a minimum dimension of 9 in. × 11.5 in. (229 mm × 292 mm) as given in Table 1. Corners shall be rounded with a radius of 22% of the width dimension.~~

5.3 6.4 Body Entrapment Test Performance Requirement

~~**5.3.1 6.4.1 Allowable removal force.** Under these test conditions, to pass the Body Entrapment Test, the maximum allowable the removal force (in pounds), immediately after the 120 lbf (534 N) applied force is released, shall be based on the following calculation using the width of the smallest applicable body~~



~~blocking element. This maximum shall not be exceeded in three consecutive tests.~~ shall not exceed the value specified by the equation: ~~NOTE: See Table 1 for computation of the maximum removal force.~~

Equation 2

$$F_{max} = \left(\frac{W_{derived}}{9} \right)^3 15$$

where:

F_{max} = the maximum permissible removal force in pounds.

$W_{derived}$ = the minimum width in inches of a rectangular shape whose length is 1.28 times the width, with corners of radius 22% of the width dimension, which completely shadows the openings of the cover/grate, and shall in no case be smaller than 9 in. nor larger than 18 in.

~~5.3.1~~ 6.4.2 Number of tests. ~~This~~ The maximum permissible removal force shall not be exceeded in three consecutive tests.

6.4.4 Reporting test results. The maximum removal force, test flow rate, and maximum suction head shall be recorded and reported for the three passing tests.

Section 7, Finger and Limb Entrapment Testing: The finger and limb entrapment test is substantially the same with the exception of formatting changes editorial revision of the figures and some clarification of text.

6 7 FINGER AND LIMB ENTRAPMENT TESTING

Former Section 7, Packaging and Installation Instructions

New Section 8, Product Markings:

New Section 9, Instructions:

Former Section 7 for packaging and installation instructions is now covered by Sections 8 and 9.

The existing requirements were extensively revised and a number of new requirements for marking and instructions were added. **MI: The differences between the former and current editions of the standard significantly change the requirements for product marking, packaging and instructions.**

~~7-Packaging and Installation Instructions~~

8 PRODUCT MARKINGS

9 INSTRUCTIONS

~~7-Packaging and Installation Instructions~~

~~7.1 Marking of Suction Fittings~~

~~7.1.1 Fittings that comply with ASME A112.19.8 shall be permanently marked as follows in a manner that is visible in the installed position and where the text is no smaller than 0.08 in. (2.03 mm) tall:~~

~~(a) The following is an example of a typical marking:~~

~~EXAMPLE:~~



~~For Multiple Drain Use Only~~

~~108 GPM~~

~~Swim Jet Life: 7 Years~~

~~Wall Only~~

~~Quantum 1563-W~~

~~(b) The positioning or arrangement of this marking shall be in the following sequence when possible:~~

~~(1) Certification markings as required by responsible jurisdictional authority.~~

~~(2) The statement "For Single or Multiple Outlet Use," "For Single Outlet Use," or "For Multiple Outlet Use Only." Self-contained spa fittings shall be marked with "For Use in Self-Contained Factory Manufactured Spas Only" and "For Multiple Outlet Use Only."~~

~~(3) The lesser of the maximum flow rate in gpm as determined in accordance with para. 2.3.1.4, 4.3, or 5.3.2. A fitting shall be permitted to be marked with multiple flow rates (i.e., a flow rating for "Floor" installations and another for "Wall" installations).~~

~~(4) The "Type" of the fitting in accordance with para. 1.1.6.~~

~~(5) Fitting components shall be marked "Life: X Years" where the manufacturer indicates the appropriate installed life in years. Individual components may be marked with unique life spans.~~

~~(6) Installation position— "Wall Only," or "Floor Only," or "Wall or Floor" if allowed in both positions.~~

~~(7) Manufacturer's name or registered trademark.~~

~~(8) Model designation.~~

~~7.1.2 As an alternate to marking field fabricated outlets, the owner of the facility where these fittings will be installed shall be advised in writing by the Registered Design Professional the information called for in paras. 7.1.1(b)(1) through (8).~~

~~7.2 Packaging of Suction Ratings~~

~~7.2.1 The packaging and installation instructions for manufactured fittings shall contain~~

~~(a) information on installation and service, including:~~

~~(1) type designation in accordance with para. 1.1.6, including any requirement for multiple outlets required per pump~~

~~(2) instructions not to locate suction outlets on seating areas or on the backrests for such seating areas~~

~~(3) instructions stating that when two or more suction fittings are used on a common suction line, they shall be separated by a minimum of 3 ft~~

~~(914 mm), or if any are located closer, they shall be located on two different planes (i.e., one on the bottom and one on the vertical wall, or one each on two separate vertical walls), such that it is unlikely both could be simultaneously blocked~~

~~(4) instructions stating that in the event of one suction outlet being completely blocked, the remaining suction outlets serving that system shall have a flow rating capable of the full flow of the pump(s) for the specific suction system~~

~~(5) maximum flow rating with head loss curve~~

~~(6) acceptable connecting pipe size(s)~~

~~(7) mounting position(s)~~

~~(8) suction outlet part number(s), and/or model number(s), and detailed field build sump design specifications, when applicable~~

~~with multiple flow rates (i.e., a flow rating for "Floor" installations and another for "Wall" installations).~~

~~(4) The "Type" of the fitting in accordance with para. 1.1.6.~~



(5) Fitting components shall be marked "Life: X Years" where the manufacturer indicates the appropriate installed life in years. Individual components may be marked with unique life spans.

(6) Installation position—"Wall Only," or "Floor Only," or "Wall or Floor" if allowed in both positions.

(7) Manufacturer's name or registered trademark.

(8) Model designation.

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(5) maximum flow rating with head loss curve

(6) acceptable connecting pipe size(s)

(7) mounting position(s)

(8) suction outlet part number(s), and/or model number(s), and detailed field build sump design specifications, when applicable

(9) part number/description list, and "Replace within 'YY' installed years" for all parts

(10) tools required

(11) service and winterizing instructions

(b) a cautionary note not to exceed the maximum allowable flow rate stated on the suction fitting

(c) a note that the suction fitting including fasteners should be observed for damage or tampering before each use of this facility

(d) a statement that missing, broken, or cracked suction fittings shall be replaced before using this facility

(e) a statement that loose suction fittings shall be reattached or replaced before using this facility

(f) a statement "Read, then keep these instructions for future reference"

(g) a cautionary note about increasing flow by increasing pump size.

8 PRODUCT MARKINGS

8.1 Cover/Grate Markings Visible When Installed



8.1.1 Visibility and content. All manufactured cover/grates shall include markings permanently legible and located on an exposed surface that is readily visible after installation. The text font size shall be at least 0.08-in. (2.03 mm) tall and shall include the following:

8.1.1.1 The name, trade name or trademark of the manufacturer.

8.1.1.2 A distinctive part number.

8.1.1.3 The type of service, “Blockable” or “Unblockable” as appropriate.

8.1.1.4 The manufacturer specified service life in years, e.g., “Life # Years” where “#” is years.

8.1.1.5 “VGBA #####”, where ##### indicates the year this standard was approved by the American National Standards Institute.

8.1.1.6 Certification agency conformity markings.

8.1.2 Cover/grate flow ratings.

8.1.2.1 Single flow rating. Cover/grates with only one set of flow ratings shall be marked “Wall ### GPM”, and/or “Floor ### GPM”, or “Wall/Floor ### GPM as appropriate, where ### is the flow rating in GPM as certified in accordance with paragraph 1.3.7.

8.1.2.2 Multiple flow ratings. Cover/grates with multiple sets of flow ratings shall be marked “For Flow Ratings See Instructions” or all flow ratings shall be marked on the cover/grate in accordance with paragraph 8.1.7.1 such that flow ratings are adjacent or otherwise associated with the SOFA model number.

8.1.3 Self-contained spa SOFA. This type of cover/grate shall be marked with “For Use in Self-Contained Factory-Manufactured Spas Only”.

8.2 Cover/Grate Markings Not Visible When Installed

8.2.1 Manufacturing date. All manufactured cover/grate markings shall be permanently legible and located on any surface that is readily visible before or after installation.

The markings shall include the following:

8.2.1.1 The date of manufacture, or period of manufacture not exceeding one month.

8.3 Markings on Manufactured Sumps and Mud Frames

8.3.1 Visibility and content. All manufactured sump and mud frame markings shall be permanently legible and located on any surface that is readily visible after the part has been installed in the pool. These marking shall be permitted to be hidden when the cover/grate is installed.

The text font size shall be at least 0.08-in. (2.03 mm) tall for all markings except it is permissible for the text on standard injection molding date indicators to be smaller.

8.3.1.1 The name, trade name, or trademark of the manufacturer.

8.3.1.2 A distinctive part number.

8.3.1.3 The manufacturer specified service life in years, e.g., “Life # Years” where “#” is years.

8.3.1.4 The date of manufacture, or period of manufacture not exceeding one month.

8.4 Installation Information Label

8.4.1 Label specifications. Each manufactured cover/ grate shall be packaged with a label made from materials designed to exceed the service life of the cover/grate, and of sufficient size and format to be legibly filled-in by the installer at the time the cover/grate is installed. The manufacturer shall prefill-in the information required by paragraphs 8.4.1.1 through 8.4.1.4. Instructions shall be provided with the label requiring the cover/grate installer to fill-in the balance of the information required by paragraphs 8.4.1.5 to 8.4.1.7 before giving the label to the pool owner. The label instructions shall request it be permanently posted as near as feasible to the pump control, and that a copy of this information be given to the pool owner, to be kept with other important pool related documents.

8.4.1.1 Manufacturers name.



8.4.1.2 Cover/grate part number.

8.4.1.3 Service life of the cover/grate.

8.4.1.4 The certified Cover/grate flow rating(s), as they are permanently marked in accordance with paragraph 8.1.7.1, when applicable.

8.4.1.5 The certified flow rating specific to the SOFA configuration and installed orientation, i.e., wall or floor, for cover/grates permanently marked "For Flow Ratings See Instructions".

8.4.1.6 Location of the installed SOFA, such that it can be successfully identified in the future.

8.4.1.7 The date the cover/grate was installed in the pool, where the month and year indicators on the label are easily activated in the field.

8.5 Equivalent Markings for RDP SOFA

8.5.1 RDP SOFA identification. *The registered design professional that certifies an RDP SOFA shall either apply the applicable markings to the SOFA in conformance with sections 8.1 through 8.3 and provide an information label in conformance with section 8.4, or the equivalent information shall be posted on a permanently mounted sign, that is adjacent to the pool circulation pump(s).*

When posting adjacent the pump(s) is not feasible, the sign shall be posted in the equipment area and indicate which pump(s) to which the SOFA(s) is installed. The minimum text size of the sign lettering shall be 0.33 in. tall.

9 INSTRUCTIONS

Each product certified to this standard shall be provided with installation instructions, user-maintenance instructions, and important safety instructions. Installation instructions shall only include SOFA configurations that have been certified in accordance with section 1.3.

9.1 Installation Instructions for all Manufactured SOFAs

9.1.1 *The installation instructions shall include all information required by section 3 that is applicable to product for which these instructions are intended.*

9.2 Installation Instructions for RDP SOFA

9.2.1 RDP responsibility. *Registered design professionals who certify and supervise the installation of an RDP SOFA shall not be required to provide installation instructions. Those that do not supervise the installation shall provide installation instructions applicable to the specific SOFA in accordance with paragraph 9.1.1.*

9.3 General Certificate of Conformity (GCC)

The SOFA manufacturer shall provide a "General Certificate of Conformity (GCC)" with each SOFA, or instructions how to secure this information via electronic means. The GCC shall include the following information, which was current at the time this standard was approved, however manufacturers and registered design professionals shall consult CPSC.gov for current GCC requirements.

9.3.1 Identification of the product covered by this certificate: *Describe the SOFA covered by this certification in enough detail to match the certificate to each product it covers and no others.*

9.3.2 Citation to VGBA to which this product is being certified: *The certificate must identify the Virginia Graeme Baker Pool and Spa Safety Act, the consumer product safety rule that is applicable to SOFAs.*

9.3.3 Identification of the U.S. importer or domestic manufacturer certifying compliance of the product: *Provide the name, full mailing address, and telephone number of the importer or U.S. domestic manufacturer certifying the product.*



9.3.4 Contact information for the individual maintaining records of test results: *Provide the name, full mailing address, e-mail address, and telephone number of the person maintaining test records in support of the certification.*

9.3.5 Date and place where this product was manufactured: *For the date(s) when the product was manufactured, provide at least the month and year. For the place of manufacture provide at least the city (or administrative region) and country where the product, was manufactured or finally assembled. If the same manufacturer operates more than one location in the same city, provide the street address of the factory.*

9.3.6 Provide the date(s) and place when the product was tested for compliance with this standard: *Provide the location(s) of the testing and the date(s) of the test(s) or test report(s) on which certification is being based.*

9.3.7 Identification of any third-party laboratory on whose testing the certificate depends.

Section, 9.4 VGBA Devices and Systems Designed to Prevent Suction Entrapment: Included requirements limiting systems designed to prevent suction entrapment for use with blockable SOFA systems to VGBA devices as follows:

9.4 VGBA Devices and Systems Designed to Prevent Suction Entrapment

9.4.1 Blockable SOFAs. *For cover/grates marked blockable the cover/grate manufacturer's installation instructions shall include a statement that the SOFAs be installed ONLY in multiple SOFA systems, or the manufacturer's instructions shall state that the installer shall include one or more of the following devices or systems designed to prevent suction entrapment:*

9.4.1.1 SAFETY VACUUM RELEASE SYSTEM- *A system that ceases operation of the pump, reverses the circulation flow, or otherwise releases the vacuum in a circulation system when a blockage is detected, that has been tested by an independent third party and found to conform to ASME/ANSI standard A112.19.17 or ASTM standard F2387.*

9.4.1.2 SUCTION-LIMITING VENT SYSTEM- *A circulation system that incorporates a tamper-resistant atmospheric vent that is hydraulically located between the suction outlet and the circulation pump, which allows air to enter the circulation system and release the vacuum within the system when the suction outlet is blocked and the circulation pump is operating.*

9.4.1.3 GRAVITY DRAINAGE SYSTEM- *A powered circulation system, which utilizes a collector tank hydraulically located between the pump and the suction outlet that is filled by the gravitationally induced flow of water from the suction outlet, and is vented to the atmosphere by a tamper-resistant opening.*

9.4.1.4 AUTOMATIC PUMP SHUT-OFF SYSTEM- *A system that is designed to sense blockage of the suction fitting and then turn-off the power to the pump, and subsequently release the vacuum in the circulation system when a blockage is detected.*

9.4.1.5 DRAIN DISABLEMENT- *A device or system that permanently stops the flow of water from a SOFA.*

9.4.1.6 OTHER SYSTEMS- *Any other system determined by the Consumer Product Safety Commission to be equally effective as, or better than, the systems described in paragraphs 9.4.1.1 through 9.4.1.5 above, at preventing or eliminating the risk of injury or death associated with pool drainage systems.*

9.5 User Maintenance Instructions



The manufacturers and registered design professionals responsible for any product certified to this standard shall provide user maintenance instructions that shall include all applicable information in section 3.4.

9.6 Important Safety Instructions

The important safety instructions shall be separated in format from the other instructions and shall appear before the user-maintenance instructions specified in section 3.4. The important safety instructions shall be in the exact words specified or in equally definitive terms. No substitution shall be made for the words "WARNING" or "DANGER." The first and last items specified in the important safety instructions shall be first and last, respectively. Other precautionary items considered appropriate by the manufacturer may be included. The letter size in the important safety instructions shall be as follows:

- Uppercase letters shall be no less than 1/12 inch (2.1 mm) high;
- Lowercase letters shall be no less than 1/16 inch (1.6 mm) high; and
- The phrases "IMPORTANT SAFETY INSTRUCTIONS," "READ, UNDERSTAND, AND FOLLOW ALL WARNINGS AND INSTRUCTIONS," and "SAVE THESE INSTRUCTIONS " shall be in letters no less than 3/16 inch (4.8 mm) high.

9.7 SOFA Instructions

9.7.1 Required statements. The following statements shall be included in all SOFA instructions:

9.7.1.1 "When installing and using this equipment, basic safety precautions shall always be followed, including the following: IMPORTANT SAFETY INSTRUCTIONS".

9.7.1.2 READ, FOLLOW, AND UNDERSTAND ALL INSTRUCTIONS AND WARNINGS.

9.7.1.3 Any modification that increases the flow rate of the circulation system shall require re-evaluation of the cover/grate and sump to ensure that the flow rating of the Suction Outlet Fitting Assembly (SOFA) is not exceeded.

9.7.1.4 Missing, broken, or cracked cover/grates, sumps, mud-frames, or any other SOFA component shall be replaced before bathers are allowed to use the pool.

9.7.1.5 Loose cover/grates shall be reattached before bathers are allowed to use the pool.

9.7.1.6 SAVE THESE INSTRUCTIONS

9.8 Removal Tags for Cover/Grate Packaging

9.8.1 Required tag or label. Each manufactured cover/grate shall include with a removal tag or affixed label stating the following:

9.8.1.1 "READ, FOLLOW, AND UNDERSTAND ALL INSTRUCTIONS AND WARNINGS"

9.8.1.2 This VGBA Suction outlet has an installation specific flow rating and this product SHALL NOT be installed on a pumping system that is capable of exceeding this limit, which varies based on the number and location of installed suction outlets. READ and FOLLOW the section of the included installation instructions explaining how to calculate the suction system flow ratings and that of the installed pumping system.

9.8.2 For cover/grates marked blockable. The cover/grate manufacturer shall include at least one of the following statements, or a combination of these statements:

9.8.2.1 "WARNING! This is a BLOCKABLE VGBA Suction Outlet that must ONLY be installed in a multiple VGBA Suction Outlet system"

9.8.2.2 "WARNING! This is a BLOCKABLE VGBA Suction Outlet that must ONLY be installed in a suction system that also includes one or more of the following devices or systems designed to prevent suction entrapment." The cover/grate manufacturer shall then list one or more of the devices or systems of section 9.4 and/or a specific product(s) of the type listed in section 9. The list may also include the option of installing one, or more additional VGBA Suction Outlets.



9.8.3 For cover/grates marked unblockable. The cover/grate manufacturer shall include at least one of the following statements.

9.8.3.1 "This is an UNBLOCKABLE VGBA Suction Outlet that may be installed as the sole source of water for a single suction outlet."

9.8.3.2 "This is an UNBLOCKABLE VGBA Suction Outlet that must ONLY be installed in a multiple VGBA Suction Outlet System."

9.8.3.3 This is an UNBLOCKABLE VGBA Suction Outlet that must ONLY be installed in a suction system that also includes one or more of the following devices or systems designed to prevent suction entrapment." The cover/grate manufacturer shall then list one or more of the devices or systems of section 9.4 and/or a specific product(s) of the type listed. The list may also include the option of installing one, or more additional VGBA Suction Outlets.

9.8.4 For all cover/grates. The cover/grate manufacturer shall include the following statement. "THIS (TAG/LABEL) IS TO BE REMOVED BY THE INSTALLER ONLY"

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Figure 1: *Finger-Probe* Edge – Figure was replaced, and note was deleted

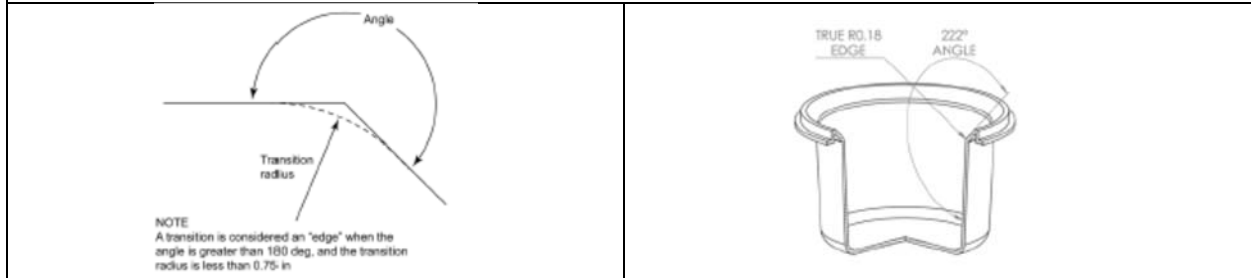


Figure 2: Field Built Sump – Figure was replaced and notes were deleted

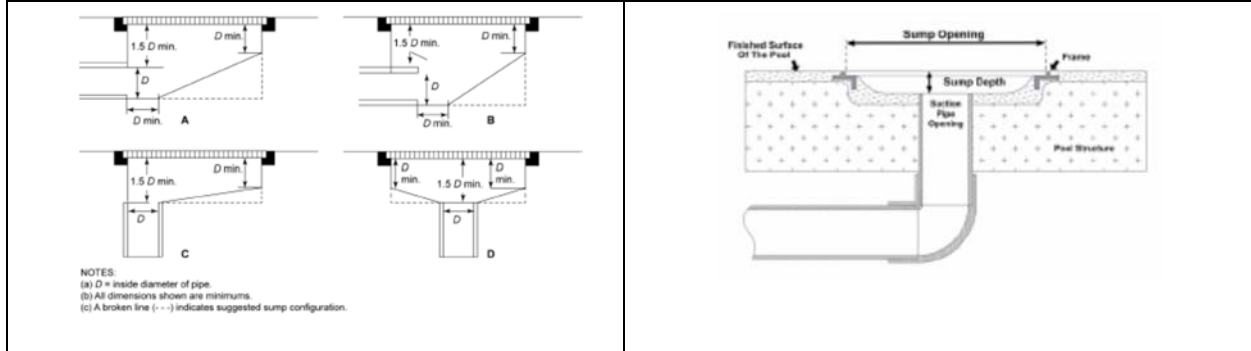


Figure 3: *Flow path length and zone* – Figure was added

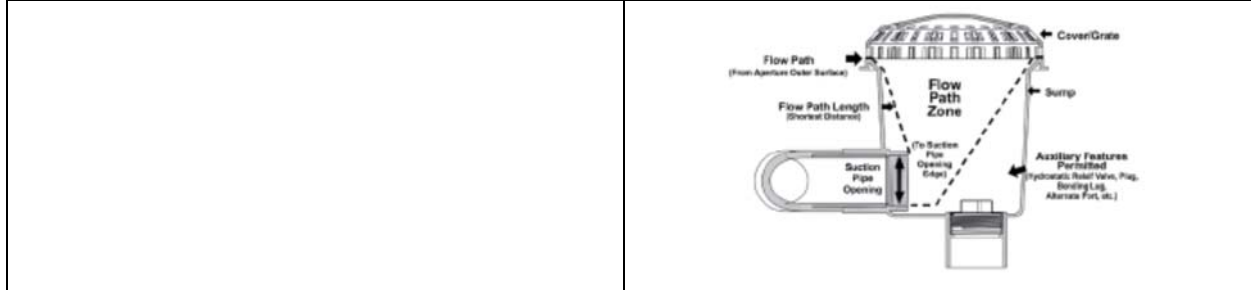
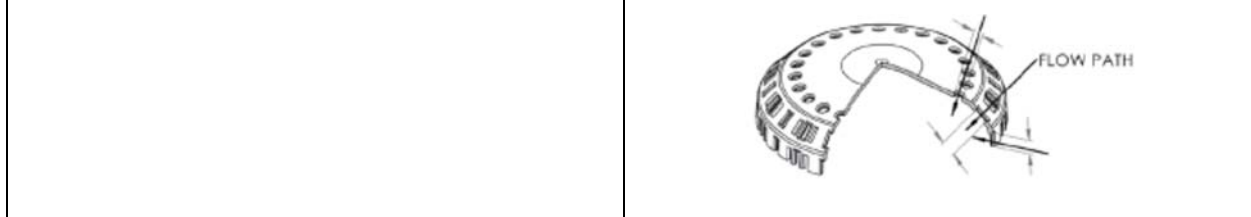
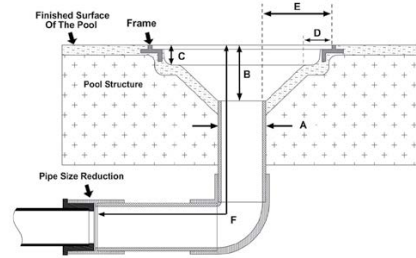


Figure 4: *Measurement of open area* – Figure was added

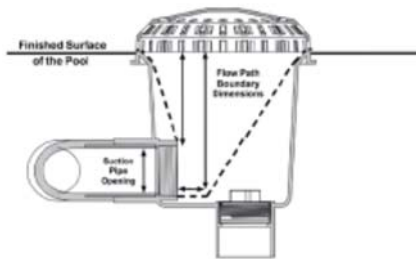


[Figure 5: Sump specifications](#) – Figure was added

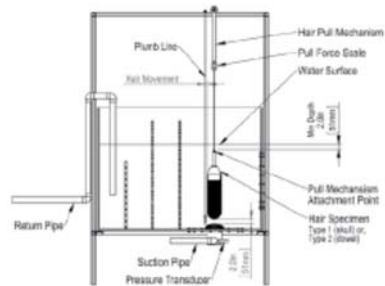


[Figure 6: Flow path zone dimensions](#) – Figure was added

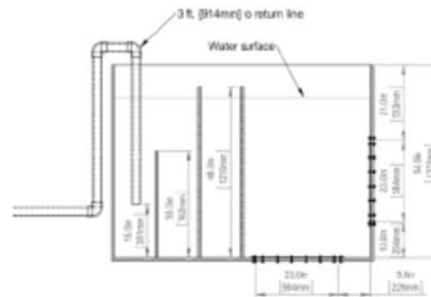
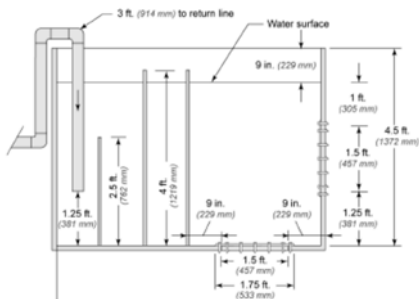
Figure 6



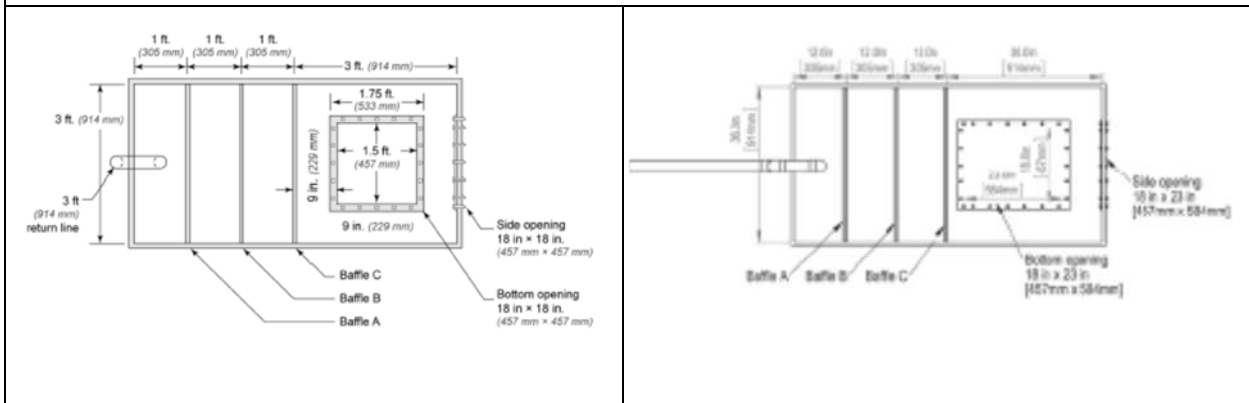
[Figure 7: Water and test equipment](#) – Figure was added



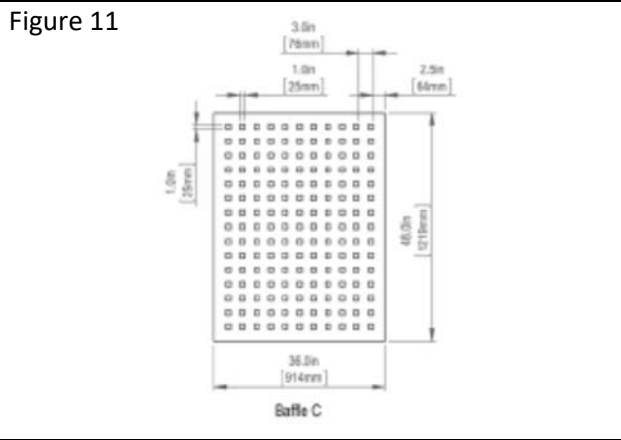
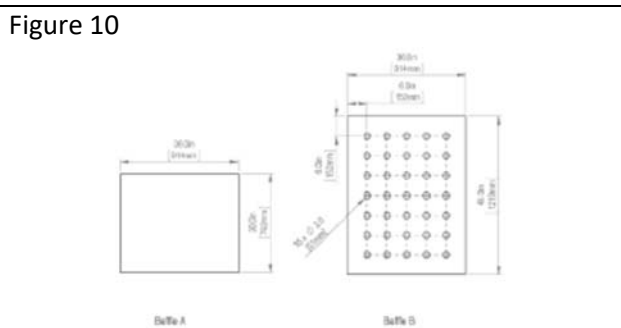
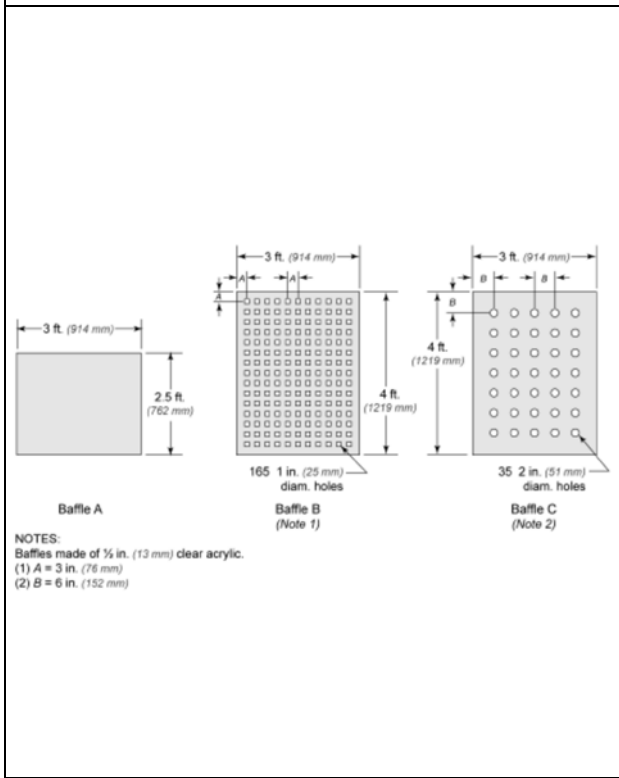
Former Figure 4: Test tank side view – Replaced with Figure 8



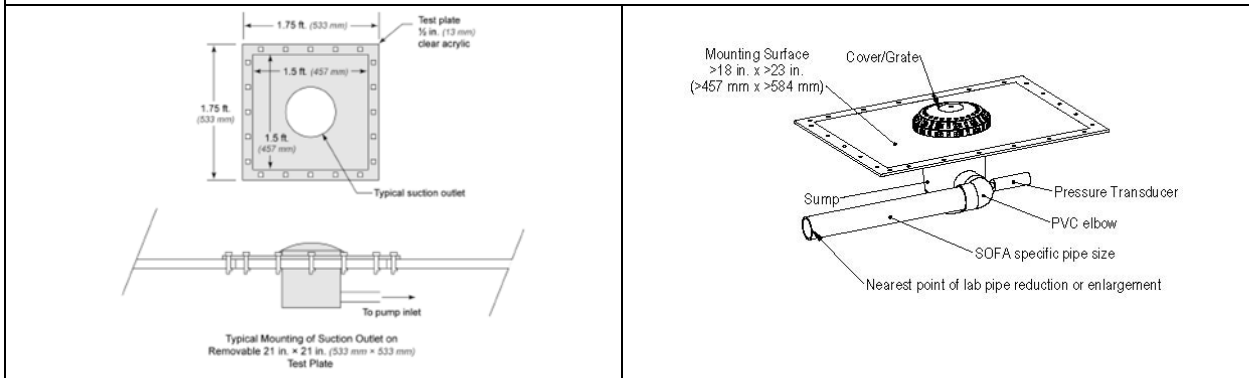
Former Figure 5: Test tank top view – Replaced with Figure 9



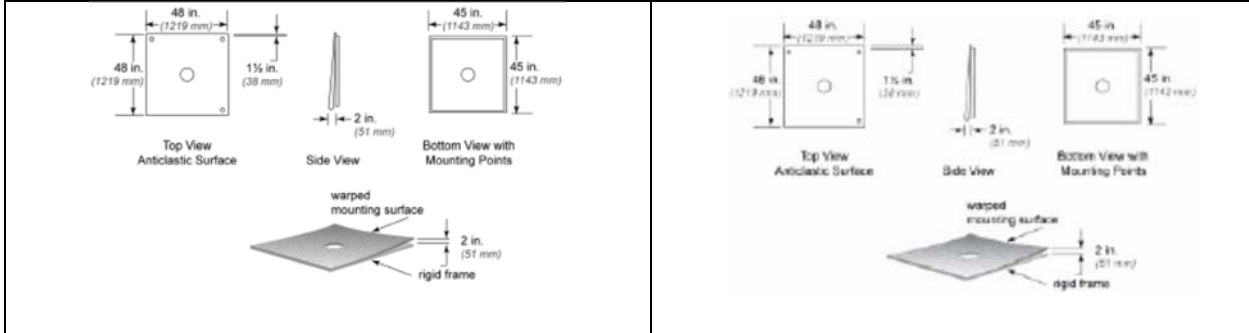
Former Figure 7 (A-C): Test Tank Baffles – This figure has been split into two figures. They are now Figure 10: Test tank baffles A and B. Figure 11: Test tank baffle C.



Former Figure 6: Test Tank Mounting Plate – Replaced with Figure 12



Former Figure 8: Anticlastic Mounting Surface *(Typical)* – Replaced with Figure 13



Former Figure 9: *Hair Test Configuration for* Self-Contained Spa Fittings – Replaced with Figure 14 and notes were deleted

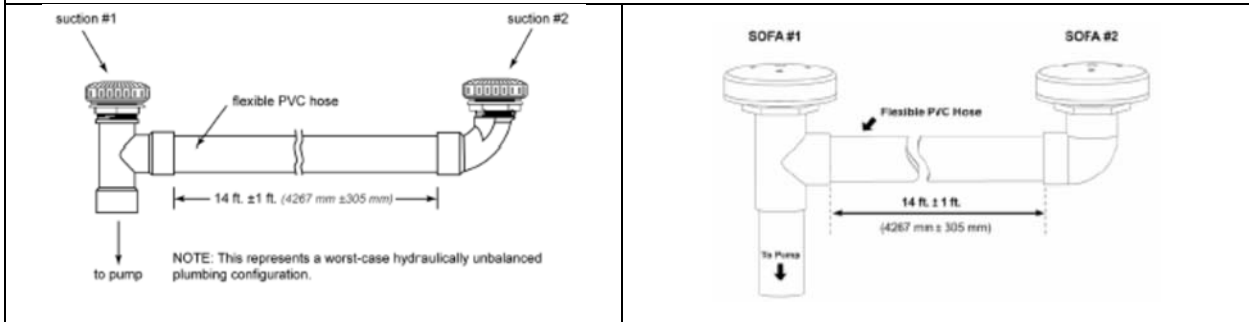


Figure 15: Flow path down – Figure was added

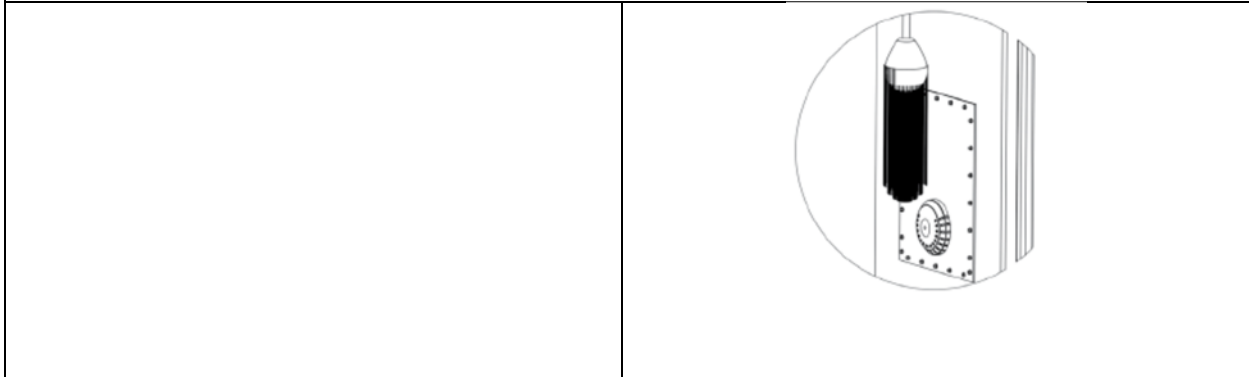


Figure 16: Flow path up – Figure was added

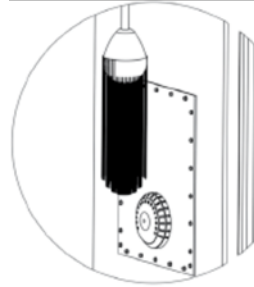
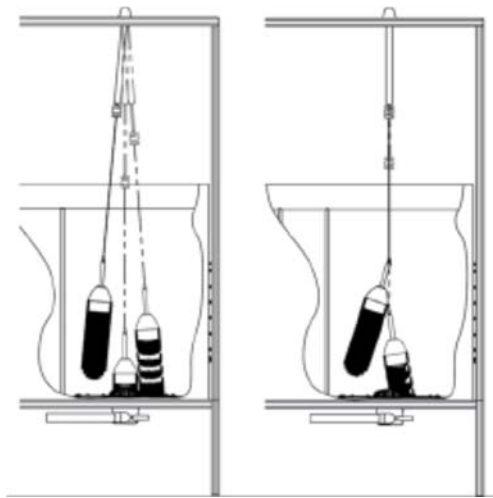
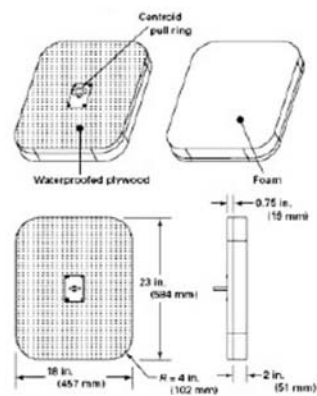
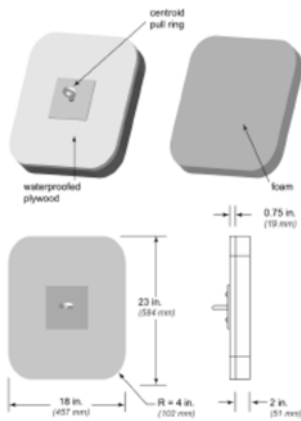


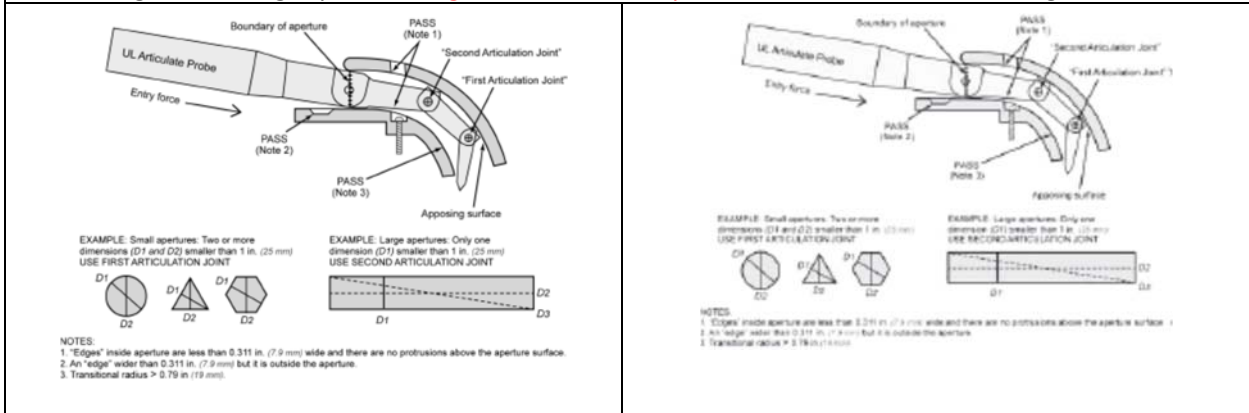
Figure 17: Hair test approach – Figure was added



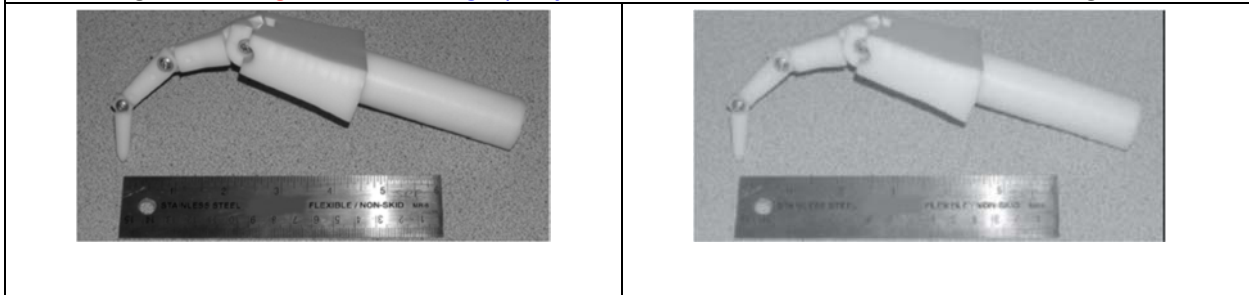
Former Figure 12: Body Block Blocking Element Dimensions (BBE). Renumbered to Figure 18



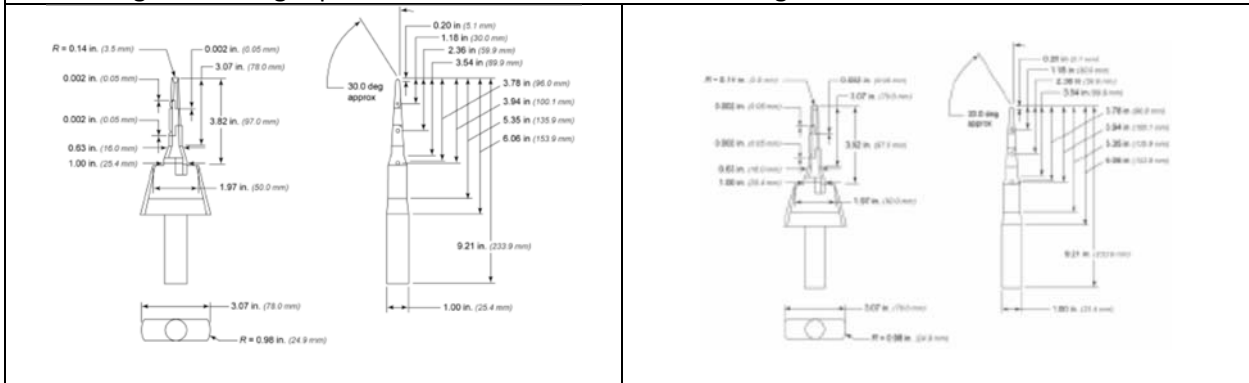
Former Figure 13: Finger probe – ~~Finger and Limb Entrapment~~ test – Renumbered to Figure 19



Former Figure 14: ~~Finger Probe~~ Photograph of "UL Articulated Probe" – Renumbered to Figure 20



Former Figure 15: Finger probe dimensions – Renumbered to Figure 21



Former Figure 16: Finger probe knuckle dimensions – Renumbered to Figure 22

