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Standard Specification for Manufactured Safety Vacuum Release Systems (SVRS) for Swimming Pools, Spas and Hot Tubs[1]

This standard is issued under the fixed designation F2387; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

INTRODUCTION

The U.S. Consumer Product Safety Commission is aware of 138 swimming pool and spa drain suction entrapments between 1985 and 2001. During this time, 35 deaths due to drain suction entrapment have been confirmed, including 15 deaths due to hair entrapment, 15 deaths due to body entrapment and five deaths due to entrapment of an unknown type.

With the understanding of the potential hazard and despite the lack of extensive epidemiological data, the manufacturers, consumers, and users supported by CPSC staff decided on February 6, 2001 to proceed with dedicated time, expense, and effort toward development of a voluntary safety standard to reduce the possibilities of injuries due to swimming pool, spa, and hot tub body and limb entrapment.

If a cover or grate is unfastened, missing or broken, exposure to the drain suction force could produce evisceration. Even though it is expected that safety vacuum release devices may help in reducing cases of evisceration, the devices are not designed for nor intended to do so. More direct efforts are related to the use of proper drain covers, 12 by 12 in. or larger drain covers, pool covers, and so forth. "Layered protection" should be used as outlined in CPSC's "Guidelines for Addressing Potential Entrapment Hazards Associated with Swimming Pools and Spas."

This specification is not intended to and does not address hair entrapment.

Field fabricated vent pipes are excluded from this specification and will be addressed in a separate standard under development.

1. Scope

1.1 This specification covers requirements for safety vacuum release systems (SVRS) for use on swimming pools, spas, hot tubs, and wading pools.

1.2 This specification is intended to reduce the risk of drowning or entrapment by providing a rapid detection and rapid release of vacuum or preventing a dangerous vacuum altogether when a person becomes entrapped at the suction outlet serving a pumping system.

1.3 The values stated in customary English units are to be regarded as the standard. Any values in parentheses are given for information only.

1.4 The following safety hazards caveat pertains only to the test methods section, Section 5, of this specification. *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D2466 Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40

D2468 Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Fittings, Schedule 40 (Withdrawn 2003)[3]

D2855 Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings

[1] This specification is under the jurisdiction of ASTM Committee F15 on Consumer Products and is the direct responsibility of Subcommittee F15.51 on Safety Vacuum Release Systems for Swimming Pools, Spas and Hot Tubs.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] The last approved version of this historical standard is referenced on www.astm.org.

F402 Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

2.2 *ASME Standard:*[4]

ANSI/ASME B1.20.1 Pipe Threads, General Purpose, Inch

2.3 *Federal Document:*[5]

CPSC Document Guidelines for Addressing Potential Entrapment Hazards Associated with Swimming Pools and Spas

2.4 *NSF Document:*[6]

NSF 50 Circulatory System Components and Related Materials for Swimming Pools, Spas, Hot Tubs[7]

2.5 *UL Standards:*[8]

UL 1081 Standard for Safety for Swimming Pool Pumps, Filters and Chlorinators

UL 746A Plastics Testing

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *high vacuum occurrence*—event where the operating vacuum normally present within a pool circulation system suddenly increases due to a suction outlet blockage.

3.1.2 *interrupter element (IE)*—pad or mat used to simulate an entrapment event by blocking the suction outlet completely.

3.1.3 *non-mechanical SVRS*—SVRS with no moving parts.

3.1.4 *readily affixed*—to be easily retrofitted to existing systems where an entrapment hazard is possible using approved pipe fittings or approved adapters, or both.

3.1.5 *return inlet*—appurtenance for conveying water returned to the pool.

3.1.6 *safety vacuum release system (SVRS)*—system or device capable of providing vacuum release at a suction outlet caused by a high vacuum occurrence due to a suction outlet blockage. SVRS devices must allow for the vacuum release with or without suction outlet cover(s) in place, and shall operate in such a way as to not defeat or disengage other layers of protection installed to protect against suction entrapment.

3.1.7 *suction outlet*—appurtenance for conveying water out of a pool, spa, hot tub, whirlpool, therapy unit or similar fixture.

3.1.8 *test actuator (TA)*—device used to lower the interrupter element (IE) in a uniform manner and rate.

4. Requirements

4.1 *General:*

4.1.1 Exposed surfaces shall be free from rough or sharp edges.

4.1.2 An SVRS shall not be made dysfunctional without the use of tools.

4.1.3 Manufacturers shall evaluate all materials for exposure and environmental conditions (chemicals, etc.) expected to be encountered in the use condition over a period of time to insure long term durability and operation. NSF 50 and UL 1081 may be used as guidelines.

4.1.4 Materials exposed to outdoor elements shall be UV resistant and capable of withstanding ambient temperatures between -40 and 140°F (in accordance with 4.1.15 and 4.2.2).

4.1.5 Under normal system operating conditions, the SVRS shall not adversely affect pump suction, system pressure, system flow, or other equipment performance.

4.1.5.1 An SVRS must provide the means to protect the pump against consequential damage by a pump running dry due to a loss of prime.

4.1.6 An SVRS shall latch or lock out in the open or off (safe) position following a high vacuum occurrence until reset. Systems such as non-mechanical SVRSs that have no moving parts do not require this latch or lock out feature.

4.1.7 SVRSs, following a high vacuum occurrence, shall be manually reset or automatically reset to its original safe position without requiring special tools.

4.1.8 An SVRS shall fail in the open or off (safe) position in the event of a spring or loading mechanism failure. Systems such as non-mechanical SVRSs that have no moving parts are not required to provide this feature.

4.1.9 Any air inlet ports for SVRSs shall be designed and installed in such a manner that the air inlet port(s) cannot be defeated by reasonably anticipated conditions or in any manner, environmental or human, that would prevent the device from functioning as intended. This includes, but is not limited to, infestation, debris buildup, or microbiological contamination.

4.1.10 SVRSs that provide for field calibration and adjustment shall contain clearly defined permanent instructions. The means for effecting adjustments and calibration shall be tamper resistant, so that non-qualified personnel cannot make adjustments. Non-mechanical SVRSs that have no moving parts shall be pre-manufactured assemblies incorporating the appropriate internal geometry to limit their suction. Adjustment of these devices is limited to the elevation of their physical installation relative to the water level involved and field adjustment of internal water level coordinating mechanisms installed by the factory.

4.1.11 An SVRS shall be designed for on-site servicing and testing.

4.1.12 PVC end connections of the device shall conform to Specification D2466. ABS end connections of the device shall conform to Specification D2468. Solvent weld connections shall be made in accordance with Practices D2855 and F402.

4.1.13 Threaded pipe connections shall conform to ANSI/ASME B1.20.1.

4.1.14 Non-mechanical SVRSs must have built into them design specific tamper-proof features that will limit the transmission of suction at the suction outlet to prevent any potential

[4] Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990.

[5] Available from U.S. Consumer Product Safety Commission (CPSC), 4330 East-West Hwy., Bethesda, MD 20814.

[6] Available from NSF International, P.O. Box 130140, 789 N. Dixboro Rd., Ann Arbor, MI 48113-0140.

[7] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

[8] Available from Underwriters Laboratories (UL), Corporate Progress, 333 Pfingsten Rd., Northbrook, IL 60062.

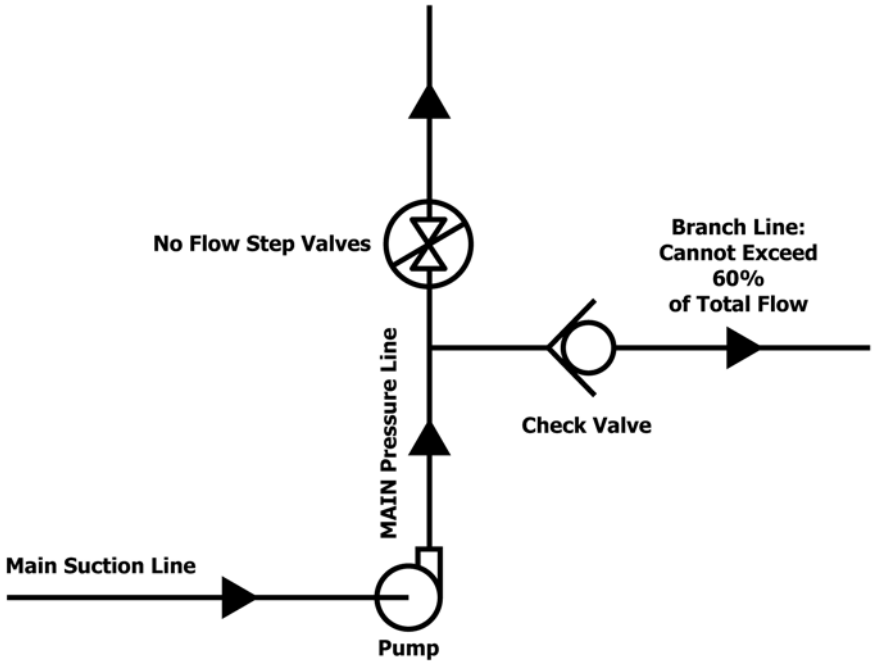

FIG. 1 Acceptable Check Valve Installation

entrapment hazard regardless of all system operating parameters such as pump HP, pipe sizes, pump elevation, and so forth.

4.1.15 An SVRS exposed to outdoors shall meet environmental exposure testing for UV as described in UL 746A.

4.2 *Specific Requirements:*

4.2.1 *Test Criteria*—The SVRS shall actuate without failure at each of two elevations of the pump (3 ft below and 3 ft above the water surface level), releasing the blocking element within 3 s or less when tested by the manufacturer in accordance with 5.1 and 5.2.

4.2.2 The SVRS used to test in 4.2.1 shall be exposed to ten cycles of heat/cold in accordance with 5.2.5 prior to testing. Non-mechanical SVRSs shall be exempt from this test.

4.2.3 An SVRS selected by the manufacturer's sampling plan (see Section 9), shall be tested 100 times against criteria in 4.2.1 without failure.

4.3 *Installation Instructions:*

4.3.1 Installation instructions, use and maintenance instructions, proper calibration and adjustment instructions, proper start-up, and periodic testing procedures shall be provided with each unit.

4.3.2 Installation instructions provided with the unit shall contain the following statements or equivalent:

4.3.2.1 This device shall be installed by an individual that meets the qualifications established by the SVRS manufacturer.

4.3.2.2 Check valves shall not be used to carry the water flow within circulation systems protected by an SVRS. (**Warning—** Check valves must be removed from the circulation system.) The presence of a check valve used to carry the water flow within the circulation system has been shown to prolong the high vacuum present at the drain, even though the drain was protected by an SVRS. For this reason, check valves which carry the water flow within the circulation system must be removed. Removal of these check valves from the circulation system must be clearly described in the SVRS manufacturer's installation instructions.

NOTE 1—Exception to 4.3.2.2—If permitted by the SVRS manufacturer's installation instructions, check valves may be used to carry a portion of the water flow within circulation lines protected by an SVRS provided they are used only on pressure side lines (downstream from the circulation pump) which branch off the main pressure circulation line, and the circulation system cannot be valved to direct more than 60 % water flow of the circulation system through the check valve (see Fig. 1).

4.3.2.3 All SVRSs shall provide a means for field adjustment, if applicable, and be adjusted to site-specific hydraulic conditions. Once calibrated, the system shall be tested by simulating an entrapment event.

4.3.2.4 There shall be three simulated entrapment tests conducted in the field to verify proper installation, calibration and operation of the device.

5. Test Methods

5.1 *Test Equipment*— See Figs. 2 and 3. Fig. 2 illustrates the layout for the test system for testing an SVRS which attaches to a circulation suction line which is directly plumbed to the pump. Fig. 3 illustrates the layout for a test system for testing an SVRS which incorporates a vacuum-induced, indirect circulation drain system.

5.1.1 *Water Tank*—A commercial, cylindrical, vertical storage tank produced from high density linear polyethylene (HDLPE) 48 in. in diameter, and of adequate height to maintain a water level 8 ft above the suction outlet fitting.

5.1.2 *Suction Outlet Fitting*—The bottom of the tank shall terminate in a prefabricated 8 in. diameter uncovered outlet sump, as commonly used in in-ground swimming pools.

5.1.3 *Suction Line*—The suction outlet fitting shall be piped with 100 ft of 2 in. rigid schedule 40 PVC pipe from the