Designation: F2707 – 10

Standard Safety Performance Specification for Safe Design and Installation of Field Fabricated Suction-Limiting Vent Systems for Suction Entrapment Prevention in Swimming Pools, Spas, Hot Tubs, and Wading Pools[1]

This standard is issued under the fixed designation F2707; 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.

1. Scope

1.1 This safety performance specification provides requirements for safety in design and installation when using a suction-limiting vent system for suction entrapment prevention in swimming pools, spas, hot tubs, or wading pools.

1.2 The purpose of the vent is to relieve the vacuum at the suction outlet(s) caused by any blockage of the suction outlet(s). The vent is intended to prevent body entrapment at the suction outlet(s) and may also mitigate limb entrapment. It is not intended to prevent other injuries caused by the suction outlet(s) such as hair entrapment, mechanical entrapment, or evisceration.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *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 *ANSI Standards:*[2]

ANSI Z535.2 Environmental and facility safety signs

ANSI Z535.4 Product safety signs and labels

ASME/ANSI A112.19.8 Suction Fittings for Use in Swimming Pools, Wading Pools, Spas, and Hot Tubs

3. Terminology

3.1 *Definitions:*

3.1.1 *allowable drawdown, n*—drawdown depth corresponding to the acceptable removal effort for a particular uncovered sump; it is physically built into the system.

3.1.2 *engineer, n*—registered professional engineer.

3.1.3 *field-fabricated vent (FFV), n*—open-to-atmosphere vent installed between the pool suction outlet(s) and the suction side of the pump in such a way as to relieve the vacuum caused by a blockage of the suction outlet(s).

3.1.4 *operating drawdown, n*—lowering of the water level in the vent from the static condition caused by normal operation.

3.1.5 *purge test, n*—placing a blocking element over the sump to ensure that air enters the vent system.

3.1.6 *startup surge, n*—transient lowering of the water level in the vent during pump startup.

3.1.6.1 *Discussion*—If excessive, the pump may lose prime.

4. Significance and Use

4.1 This performance specification outlines the requirements needed to design and install a field-fabricated vent for safety purposes. Vents only address suction outlet body and may mitigate limb entrapment. Vents have proven effective when installed correctly. It is not intended to prevent other injuries caused by suction outlet(s) such as hair entrapment, mechanical entrapment, or evisceration.

5. General Requirements

5.1 Design and installation instructions for field-fabricated vents (FFV) shall be certified only by a registered professional engineer. Multiple systems may be built to the same "vent design drawings and specifications" with the approval of the engineer.

5.2 The design and installation of the vent is specific to each piping system and shall consider all relevant parameters including but not limited to: elevations, flow rate, startup surge, minimum and maximum water operating levels, water depth at the suction outlet(s), pipe fittings, spacing between fittings, atmospheric vent fitting, and suction outlet configurations.

[1] This test method 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] Available fromAvailable from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

5.3 The vent shall be tested in place for proper function. See Section 7 for details.

6. Specific Requirements

6.1 The engineer shall specify minimum and maximum flow rates, pipe sizes, and minimum and maximum pipe length(s), including equivalent length of fittings, elevation of critical fittings with respect to normal pool operating level, as well as the make and model of the suction outlet approved cover in accordance with ASME/ANSI A112.19.8, including the head loss at the suction fitting and the make and model of the atmospheric vent termination fitting. Vent termination fittings are rated by the size of the pipe they can successfully vent. For larger pipes, the number of fittings shall equal or exceed the flow area of the large pipe divided by the flow area of the fitting's rated pipe size.

6.2 The vent shall be designed to insure that with any or all suction outlet(s) completely blocked, the sump or vent drawdown shall not exceed the values in Table 1 for the size of a given suction outlet sump with the vent termination fitting in place and with or without the cover in place.

6.3 The vent system and atmospheric vent termination fitting shall be designed so that neither can be disabled without the use of tools.

6.4 Under normal operation, the vent system shall not adversely affect pump suction, system flow, or other equipment performance.

6.5 No check valves or valves shall be installed between any suction outlet and the atmospheric opening of the system.

6.6 The vent shall be piped to a location specified by the registered professional engineer. If the vent is located outside the deck area, the vent shall be clearly visible and above grade as indicated by the engineer.

6.7 If the pool is not equipped with an overflow, the vent opening shall be installed above the highest water level possible in the pool it is protecting.

6.8 The vent line shall be provided with an atmospheric termination vent fitting as specified by the registered professional engineer and installed in accordance with the manufacturer's or engineer's instructions (see Fig. 1).

6.9 Vent lines shall be Schedule 40 or Schedule 80 polyvinyl chloride (PVC) pipe, minimum 1 ½-in. (3.8-cm) iron pipe size (IPS), to assure rapid evacuation and resistance to accidental damage.

6.10 The "maximum allowable drawdown," derived from Table 1 (using linear interpolation if needed), shall be specified in the documentation for use in field testing.

TABLE 1 Allowable Drawdown for Circular and Square Open Sump

KcircLT9=		KcircGT9=		KsqLT9=		KsqGT9=	
Diam (in.)	Drawdown (in.)	Diam (in.)	Drawdown (in.)	Side (in.)	Drawdown (in.)	Side (in.)	Drawdown (in.)
2	132.4	9	6.5	2	104.0	9	5.1
2.25	104.6	9.25	6.7	2.25	82.1	9.25	5.3
2.5	84.7	9.5	7.0	2.5	66.5	9.5	5.5
2.75	70.0	9.75	7.1	2.75	55.0	9.75	5.6
3	58.8	10	7.4	3	46.2	10	5.8
3.25	50.1	10.25	7.4	3.25	39.4	10.25	5.8
3.5	43.2	10.5	7.7	3.5	33.9	10.5	6.0
3.75	37.6	10.75	7.8	3.75	29.6	10.75	6.1
4	33.1	11	7.9	4	26.0	11	6.2
4.25	29.3	11.25	8.2	4.25	23.0	11.25	6.4
4.5	26.1	11.5	8.3	4.5	20.5	11.5	6.5
4.75	23.5	11.75	8.5	4.75	18.4	11.75	6.7
5	21.2	12	8.8	5	16.6	12	6.9
5.25	19.2	12.25	8.9	5.25	15.1	12.25	7.0
5.5	17.5	12.5	9.0	5.5	13.7	12.5	7.1
5.75	16.0	12.75	9.3	5.75	12.6	12.75	7.3
6	14.7	13	9.4	6	11.6	13	7.4
6.25	13.6	13.25	9.8	6.25	10.6	13.25	7.6
6.5	12.5	13.5	9.9	6.5	9.8	13.5	7.8
6.75	11.8	13.75	10.0	6.75	9.1	13.75	7.8
7	10.8	14	10.1	7	8.5	14	7.9
7.25	10.1	14.25	10.3	7.25	7.9	14.25	8.1
7.5	9.4	14.5	10.6	7.5	7.4	14.5	8.3
7.75	8.8	14.75	10.7	7.75	6.9	14.75	8.4
8	8.3	15	10.8	8	6.5	15	8.5
8.25	7.8	15.25	11.1	8.25	6.1	15.25	8.7
8.5	7.3	15.5	11.3	8.5	5.8	15.5	8.9
8.75	6.9	15.75	11.4	8.75	5.4	15.75	9.0
9	6.5	16	11.6	9	5.1	16	9.1
		16.25	11.8			16.25	9.3
		16.5	11.9			16.5	9.4
		16.75	12.2			16.75	9.6
		17	12.3			17	9.7
		17.25	12.5			17.25	9.8
		17.5	12.7			17.5	10.0
		17.75	12.9			17.75	10.1
		18	13.1			18	10.3

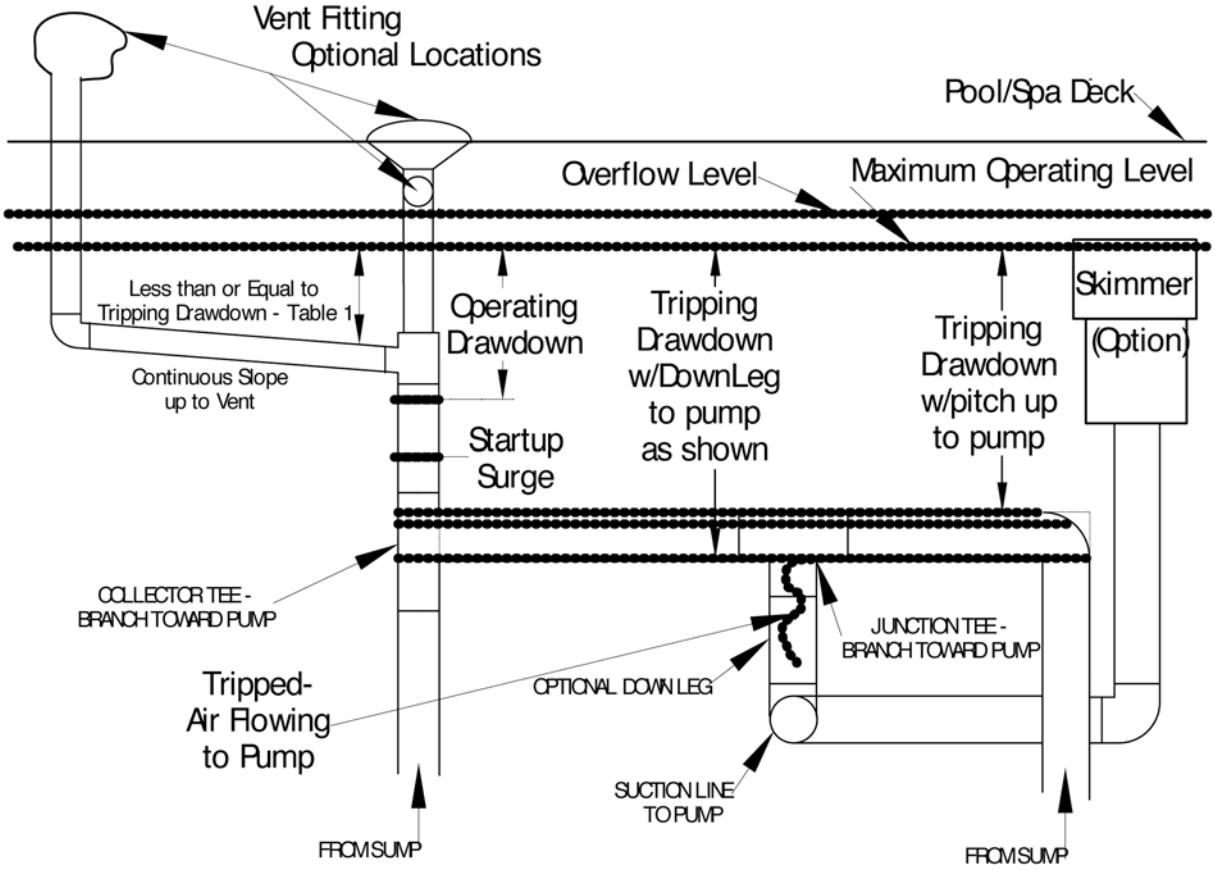

FIG. 1 Vent Tee Arrangement

6.11 The requirements of Section 6 shall be incorporated in "vent design drawings and specifications."

7. Field Testing

7.1 *Purge Testing:*

7.1.1 A purge test shall be conducted on each vent system to verify correct piping arrangement and open passages.

7.1.2 Upon initial startup by pool contractor, conduct purge test.

7.1.3 Contractor shall advise homeowner in writing to test on an annual basis.

7.2 Acceptance testing shall be in accordance with 7.2.1 or 7.2.2.

7.2.1 Acceptance testing is not required in the following cases:

7.2.1.1 In jurisdictions that perform pool piping inspections by local building officials, and

7.2.1.2 The vent system installation is field certified by a registered professional engineer.

7.2.2 *Acceptance Test by Physical Measurement of Drawdown*—The actual sump or vent drawdown is measured and the lesser value of the two results is compared to the maximum allowable drawdown in Table 1. This information is given for selected square and round sumps, respectively. The following tests shall be conducted at normal pool operating level with the skimmer valves or the skimmer basket blocked to simulate a clogged condition and all other suction ports closed so all flow is through the submerged suction outlet(s).

7.2.2.1 With the suction outlet cover(s) in place, the sump or vent drawdown of the water level in the vent line shall be measured.

7.2.2.2 The sump or vent drawdown shall be less than or equal to the "allowable drawdown" to assure operability.

7.2.2.3 Any or all outlets shall be blocked with or without covers. The sump or vent drawdown shall not exceed the allowable drawdown for more than 3 s. This shall be true for any combination of open and blocked outlets.

7.2.2.4 The sump or vent drawdown shall never exceed the allowable drawdown limits of Table 1 when one or all suction outlets are blocked.

7.2.2.5 Startup surge shall not cause a loss of pump prime.

8. Site Signage

8.1 Signage shall be displayed at the pool equipment area and vent location if in different locations.

8.2 ANSI Z535.2 and ANSI Z535.4 shall be used as guides.

8.3 Signage shall be permanently affixed. An in-wall fitting shall have information molded or permanently marked, or a custom tile may be provided.

8.4 Signage shall have the following words or equivalent to be displayed at pool equipment area:

8.4.1 This pool is equipped with a safety vent system.

8.4.2 Safety vent system fitting located at _____ (location).

8.4.3 Do not tamper, cover, block, or disable this system.

8.4.4 This system shall operate between ___ and ___ GPM.

8.4.5 Any changes in the circulation system require retesting.

9. Vent Fitting Signage

9.1 The vent fitting, or permanent placard, within 6 in. (15 cm) of the atmospheric vent fitting shall be permanently labeled:

SAFETY VENT
Do not tamper or remove

10. Keywords

10.1 atmospheric vent; entrapment; hot tub; safety vent; spa; swimming pool; vent pipe; vent system

ANNEX

(Mandatory Information)

A1. BASIS OF TABLE 1

A1.1 The allowable sump or vent drawdown is based on the allowable release force defined in ASME/ANSI A112.19.8-2007, which is a function of the size of the bather. The critical case for a given sump is the smallest torso width that can block it. Subcommittee F15.51 is reviewing these tables with the intent of proposing an eccentricity correction when further test data becomes available and is reviewed. The committee is investigating the correction for the following reasons:

A1.1.1 To simulate a skin specimen and further adjust for an eccentricity of the bather's release effort.

A1.1.2 The skin specimen replicates the observed behavior of human skin as it separates from the body. It has a favorable effect on square sumps in which the skin can relatively easily separate from the corners. This leads to the allowable drawdown for a square sump being greater than a circular sump.

A1.1.3 The bather's release effort is assumed to be eccentric to the center of the sump because of several observations:

A1.1.3.1 The likelihood of the weakest bather being centered on the sump is very low.

A1.1.3.2 The bather will likely try multiple movements and positions in efforts to release.

A1.1.3.3 The eccentricity being investigated is proportional to the body size and 20 % has been chosen as a reasonable estimate. For the smallest child, with a 9-in. (23-cm) torso width, this is 1.8 in. (4.6 cm).

A1.1.3.4 Finally, a safety margin of 25 % is applied. (This is the same as hair entrapment testing in ASME/ANSI A112.19.8-2007.)