

# 073107 DRAFT - Standard Specification for Dual Drain Systems for Swimming Pools, Spas and Hot Tubs

## 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.

The model building codes require dual drains as one layer of protection against suction entrapment. In addition these models required ASME A112.19.8 suction fitting drain covers and ASME A112.19.17 safety vacuum release systems.

The '19.17 standard contains a performance requirement that a 15 pound buoyant element must be released within an elapsed time no greater than 3 seconds.

Research has documented that dynamic differential pressure may lead to hold-down forces that exceed 15 pounds force when one of the pair of dual drains is blocked.

ASME A112.19.8-listed covers are required to be marked with a maximum flow rate expressed in gallons per minute. This flow rate has no relationship to 15 pounds maximum force limit defined in this standard for 8 inch nominal drain sumps with covers. Therefore, safe maximum flow rates for dual drain systems may be less than the ASME A112.19.8-rated flow for the suction outlet cover.

Commercially available prepackaged sumps with suction outlet covers have characteristic hydraulic pressure drops influenced by available open area and flow path geometry. ASME A112.19.8 requires maximum flow rates to be permanently stamped on drain covers.

Tests demonstrate that the dynamic hold down force on a blocked sump in a dual drain system is proportional to the square of the flow rate, and is impacted by head loss through the suction outlet

cover, the sump outlet, connector pipe fittings, and the connector pipe length to the junction tee.

This standard provides requirements for constructing dual drains for swimming pools, spas, wading pools as required by the model building codes so that when one of a pair of dual drains is blocked the hold down force will not exceed 15 pounds.

## 1. Scope

1.1 This specification establishes requirements for dual drain suction outlet systems constructed using commercially available sumps and ASME A112.19.8-listed outlet covers for use in 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 standardized method of designing dual drain suction outlet systems and to limit dynamic differential pressure to less than 15 pounds force when one of the pair of dual drains is blocked.

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 *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:<sup>1</sup>

D-2466 Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40

D-2468 Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Fittings, Schedule 40

D-2855 Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings

F-402 Practice for the Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

F-2387 Standard Specification for Manufactured Safety Vacuum Release Systems (SVRS) for Swimming Pools, Spas and Hot Tubs

## 2.2 ASME Standard:<sup>2</sup>

ANSI/ASME A112.19.8M-87 Suction Fittings for Use in Swimming Pools, Wading Pools, Spas, Hot Tubs, and Whirlpool Bathtub Appliances

ANSI/ASME A112.19.17-02 Manufactured Safety Vacuum Release Systems (SVRS) For Residential and Commercial Swimming Pool, Spa, Hot Tub and Wading Pool Suction Systems

<sup>1</sup>For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [Service@astm.org](mailto:Service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>2</sup> Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990.

## 3. Terminology

### 3.1 Definitions of Terms Specific to This Standard:

3.1.1 *Branch*—The side opening of a tee fitting that is set at a 90 degree angle from the run.

3.1.2 *Computed Maximum Sealing Area*—The area circumscribed by the maximum diameter sealing circle (ring) of the sump expressed in square inches. **Example using 7-3/8 inch sealing circle:**  $(7.375/2)^2 (\pi) = 41.72 \text{ in}^2$

3.1.3 *Junction Tee*—The fitting used to connect dual drains where each drain sump connects to equal lengths of pipe at the run and the pump connects to the branch.

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 *Run*—that portion of the junction tee continuing in a straight line in the direction of the flow in the pipe to which it connects to dual drain sumps.

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.

## 4. Requirements

### 4.1 General:

4.1.1 Hold down force on a dual drain system shall be limited to 15 pounds maximum on a standard 8" diameter sump when one of the pair of sumps is blocked. This requirement shall be applicable to nominal eight inch diameter sumps exclusively.

4.1.1.1 The hold down force shall be calculated based on the product of the water manometer draw-down reading on the blocked drain (expressed in pounds per square inch units) and the computed maximum sealing area of the sump.

### Formula:

$$\text{Force (lbs}_f\text{)} = (\text{X}) \times (\mathbf{0.036}) \times (\text{A})$$

A = maximum sump sealing area in inches<sup>2</sup>

X = inches of water column draw-down

4.1.2 Suction outlet sump separation distances shall be held to a minimum and maximum horizontal distance of three feet.

4.1.3 Sump connection outlet ports used in dual drains shall be no less than 2" nominal threaded or solvent weld connections.

4.1.4 Connector piping and the junction tee between dual drains shall be minimum 2-1/2" nominal diameter PVC or ABS Schedule 40 pipe to reduce velocity and decrease dynamic hold down force.

4.1.5 All PVC end connections shall conform to Specification D 2466. ABS end connections of the device shall conform to Specification D 2468. Solvent weld connections shall be made in accordance with Practices D 2855 and F 402.

4.1.6 All threaded pipe connections shall conform to ANSI/ASME B1.20.1.

4.1.7 The use of 90 and 45 degree elbow type fittings between dual drain sumps is to be minimized as installation of 90 and 45 degree elbows in the connector piping increase the hold down force when one sump is blocked. When such fittings are used hold down force shall be determined and shall remain less than 15 pounds based upon equivalent pipe lengths as shown in Table 4.1, below:

Nom. Pipe Dia.	No. of 90° El's	Equivalent Length of Pipe <sup>3</sup>
2 inches	1	5 ft. – 8 in.
2 inches	2	11 ft. – 4 in.
2 inches	3	17 feet
2-1/2 inches	1	7 feet
2-1/2 inches	2	14 feet
2-1/2 inches	3	21 feet
3 inches	1	8 feet
3 inches	2	16 feet
3 inches	3	24 feet

<sup>3</sup> Source [www.EngineeringToolBox.com](http://www.EngineeringToolBox.com)

#### 4.2 Specific Requirements:

4.2.1 *Test Criteria*—Pre-packaged drain sumps and covers shall be tested by the manufacturer in accordance with 5.1 and 5.2 to determine maximum flow rates that insure dynamic differential pressure does not exceed 15 pounds force when one of the pair of dual drains is blocked

#### 4.3 Installation Instructions:

4.3.1 Installation instructions, use and maintenance instructions shall be provided with each prepackaged sump and cover that is intended for dual drain or single and dual drain applications.

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

4.3.2.1 This sump and cover shall be installed by an individual that meets the qualifications established by the authority having jurisdiction and the sump/cover manufacturer.

4.3.2.2 **Warning:** When this sump and cover is intended for dual drain installation the maximum flow rates as shown in the Table below shall not be exceeded.

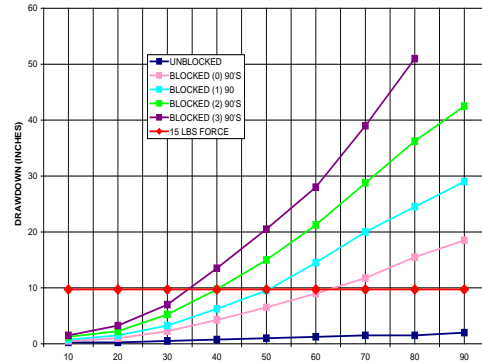
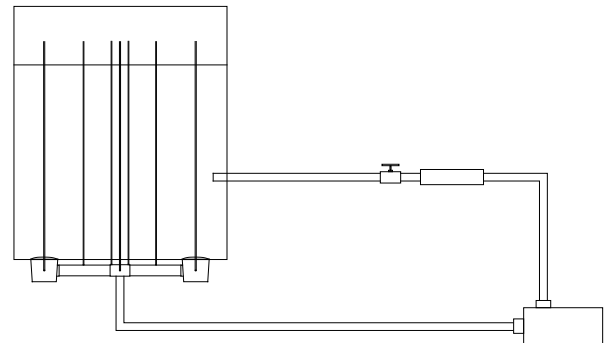


Table 4.3  
(For Example Only)

## 5. Test Methods

5.1 *Test Equipment* —See Figure 1. Fig. 1 illustrates the general layout for the test system to determine maximum safe flow rates for testing prepackaged sumps and covers intended for dual drain applications.

Figure 1 (For Illustrative Purposes Only)



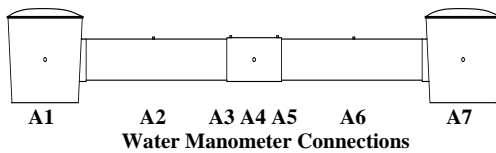
5.1.1 *Water Tank*—A commercial, cylindrical, vertical storage tank produced from high density linear polyethylene (HDLPE) 48 in. in diameter, and of adequate height to maintain a water level 4 ft above the suction outlet fittings under test.

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

5.1.3 *Suction Outlet Connector Piping*—The suction outlet fittings shall be piped so that separation distance between the two fittings is equal to 3 feet using 2 in., 2-1/2 in., and 3 in. connector piping and junction tee of rigid schedule 40 PVC pipe.

5.1.3.1 *Water Manometer Locations*— Water manometers shall be placed as shown in Figure 2. to measure water column draw-down in accordance with 5.1 – 5.2. Water manometer A1 shall be the blocked drain and A7 shall be the unblocked drain.

**Figure 2 (For Illustrative Purposes Only)**



5.1.4 *Suction/Return Lines*—The pipe run length of the return line shall always match the pipe run, type, length and size of the suction line, including elbows, and will incorporate a straight section for the accurate measurement of flow.

5.1.5 *Blocking Element*— The blocking element, the part used to block one of the pair of dual drains it shall provide a complete seal of the sump without the cover installed.

5.1.6 *Throttling Valve*—A valve shall be installed on the return line at the point where water is returned to the test tank. This valve is to be used to adjust test system flow and should be either a globe, diaphragm, or angle type globe valve.

5.1.7 *Water Flow Meter*—The flow meter (0 to 100 GPM minimum) is installed as per the manufacturer’s instructions in the straight length of the return line upstream of the flow throttling valve.

5.1.8 *Test Pump*—The test pump(s) shall be a self-priming swimming pool pump(s) capable of providing 0-100 GPM.

5.1.9 *Piping*—All piping shall be rigid schedule 40 PVC. All piping shall be rigidly supported.

5.2 *Testing:*

5.2.1 All of the following test criteria shall be performed and resulting data shall be used to establish maximum safe flow rates for the pre-packaged sump and cover intended for dual drain applications.

5.2.2 *Water*—The water level in the water tank shall be maintained 4 ft or greater above the top of the suction outlet fitting.

5.2.3 *Flow Rates*—Tests shall be performed at incremental flow rates at 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100 GPM or at 10 GPM increments until the maximum achievable flow is obtained. Flow shall be adjusted and set for each test by the throttling valve installed on the return line.

5.2.4 *Dual Drain Interconnecting Piping and Fittings*—Individual tests shall be run using 2, 2-1/2 and 3 inch interconnecting pipe and fittings.

5.2.5 *Suction/Return Pipe Size*—All tests shall be performed with 2 in. suction pipe and 2 in. return pipe.

## 6. Product Marking

6.1 Each sump or cover intended for use in dual drain suction systems shall be marked with the safe maximum flow rate for interconnecting pipe sizes as recommended by the manufacturer.

## 7. Labeling

7.1 Prepackaged sumps and covers meeting all the requirements of this standard may be labeled “Meets ASTM Safety Standard X XXXX–XX.”

## 8. Packaging and Package Marking

8.1 Each unit shall be permanently marked as follows:

8.1.1 Manufacturer’s name or trademark,

8.1.2 Model number, serial number, date coding and lot identification (this may be encoded within the serial number),

8.1.3 Labels identifying maximum flow and sizing limits clearly indicated for sumps and cover intended for dual drain applications, and

8.1.4 A contact phone number to acquire information.

## **9. Quality Assurance**

9.1 The manufacturer shall maintain a quality assurance program to ensure the reliability of all sumps and covers manufactured and distributed.

## **10. Keywords**

10.1 anti-suction devices; hot tubs; safety vacuum release systems; spas; swimming pools; suction fittings; dual drain systems