ASME A112.19.17-2002

# MANUFACTURED SAFETY VACUUM RELEASE SYSTEMS (SVRS) FOR RESIDENTIAL AND COMMERCIAL SWIMMING POOL, SPA, HOT TUB, AND WADING POOL SUCTION SYSTEMS

AN AMERICAN NATIONAL STANDARD

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# MANUFACTURED SAFETY VACUUM RELEASE SYSTEMS (SVRS) FOR RESIDENTIAL AND COMMERCIAL SWIMMING POOL, SPA, HOT TUB, AND WADING POOL SUCTION SYSTEMS

## ASME A112.19.17-2002

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The 2002 edition of this Standard is being issued with an automatic addenda subscription service. The use of addenda allows revisions made in response to public review comments or committee actions to be published as necessary. The next edition of this Standard is scheduled for publication in 2006.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this Standard. The interpretations will be included with the above addenda service.



The American Society of Mechanical Engineers
Three Park Avenue, New York, NY 10016-5990

*In memory of, and dedicated to the life of,*
*our dear friend, colleague, and long-standing leader,*
*Patrick J. Higgins.*

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# FOREWORD

This Standard establishes requirements for manufactured Safety Vacuum Release System (SVRS) devices, for installation in residential and commercial swimming pool, spa, hot tub, and/or wading pool suction systems. It is intended to serve as a guide for producers, distributors, architects, code officials, contractors, installers and end users; to promote understanding regarding materials, manufacture, installation and performance; and to provide a means for identifying devices complying with this Standard.

The U.S. Consumer Product Safety Commission (CPSC) is aware of 138 cases of swimming pool and spa drain entrapments, including 35 confirmed deaths, between January 1985 and 2001. CPSC reports that some of the deaths were the result of drowning after the body, or a limb, was held against the drain by the suction of the circulation pump. Of the 35 deaths, CPSC reports that 15 deaths were due to hair entrapment, 15 due to body entrapment, and 5 deaths due to entrapment of an unknown type.

These incidents typically involved older children (8 to 16 years of age) with an average age of about 10 years. In some cases, it appeared that the child was playing with the open drain, inserted a hand or foot into the pipe, and then became trapped by the resulting suction. There are potentially many different circumstances of design and maintenance that can produce the conditions for this hazard. Body entrapment cases can occur in either pools or spas. Experience suggests that any open drain, or any flat grating that a body or limb can cover completely, coupled with a plumbing layout that allows sufficient buildup of suction if the drain is blocked, can produce the conditions which result in body entrapment.

The products covered under this Standard may generally be divided into three types:

*(a) Nonelectric Devices.* Available data suggests that an SVRS nonelectric device may effectively eliminate body entrapments. A child playing in the immediate vicinity of an SVRS nonelectric device-protected suction outlet will cause the device to activate upon sealing off the drain fitting. The device is intended to eliminate the high vacuum forces at the protected suction outlet, by venting air into the suction system and cavitating the circulating pump, thereby avoiding body entrapment.

*(b) Electrical Intervention Devices.* There are two types of electrical devices currently available for mitigation of suction entrapment hazards. One form of intervention, which some states and the National Electric Code are considering, is an emergency pump cut-off switch located in view of the pool or spa. At the present time these switches are generally located in the electric equipment room, and are in the line of sight of the apparatus as opposed to the line of sight of the pool or spa. Another SVRS electrical device typically includes a monitor or switch that responds to a sudden rise in pump suction vacuum by turning off the pump, and/or opening an electrically operated atmospheric vent valve.

*(c) Vent Tube SVRS Devices.* A vent tube is connected to the main suction outlet line between the suction outlet and the pump and would be open to atmosphere. The laws of physics require the vent tube to fill with water to a level equal to that of the pool at a static condition. Should the suction outlet become clogged or obstructed, the pump would then draw the water from the vent until air is introduced into the system and the suction is thereby broken.

This Standard establishes a safe "reaction time limit" for these devices as well as sets forth material and performance requirements that provide reasonable safety measures against bather entrapment when these devices are installed as a component of a pool circulation system.

**WARNING: Due to the lack of physiological data, it cannot be concluded that a device of this type referred to hereafter as a Safety Vacuum Release System (SVRS) will eliminate the potential for disembowelment.**

Suggestions for improvement of this Standard will be welcomed. They should be sent to The American Society of Mechanical Engineers; Standardization Dept.; Attn: Secretary, A112 Standards Committee; Three Park Avenue; New York, NY 10016-5990.

This Standard was approved as an American National Standard on October 31, 2002.

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| | |
|---|---|
| Subject: | Cite the applicable paragraph number(s) and the topic of the inquiry. |
| Edition: | Cite the applicable edition of the Standard for which the interpretation is being requested. |
| Question: | Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for an approval of a proprietary design or situation. The inquirer may also include any plans or drawings that are necessary to explain the question; however, they should not contain proprietary names or information. |

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# Manufactured Safety Vacuum Release Systems (SVRS) for Residential and Commercial Swimming Pool, Spa, Hot Tub, and Wading Pool Suction Systems

## 1 GENERAL

### 1.1 Scope

This Standard establishes general requirements, dimensions and tolerances, materials, installation instructions, testing requirements, and markings and identification for SVRS devices. SVRS devices are intended to be utilized on pool, spa, hot tub, and/or therapy unit suction systems. SVRS devices covered under this Standard are designed to prevent high vacuum occurrences that cause human body or body part suction entrapment.

Demonstration of compliance with this Standard is merely an indication that the product meets the performance requirements and specifications contained in this Standard. The responsibility for verification of the device's performance on any circulation system shall be the responsibility of the design professional.

The provisions of this Standard are not intended to prevent the use of any alternative material or method of construction, provided any such alternative meets the intent and requirements of this Standard.

### 1.2 Units of Measurement

Values are stated in U.S. customary units and in the International System of Units (SI). The U.S. customary units shall be considered as the standard.

In this Standard, gallons (U.S. liquid) per minute is abbreviated gpm and liters (metric liquid) per minute is abbreviated L/min.

### 1.3 References

The following documents form a part of this Standard to the extent specified herein. Unless otherwise specified, the latest edition shall apply.

ASME A112.19.8M, Suction Fittings for Use in Swimming Pools, Wading Pools, Spas, Hot Tubs, and Whirlpool Bath Appliances
ASME B1.20.1, Pipe Threads, General Purpose, Inch
Publisher: The American Society of Mechanical Engineers (ASME International), Three Park Avenue, New York, NY 10016-5990; Order Department: 22 Law Drive, Box 2300, Fairfield, NJ 07007-2300

ASTM D 2466, Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2468, Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Fittings, Schedule 40
Publisher: American Society for Testing and Materials (ASTM), 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959

NSF-50, Suction System Components for Swimming Pools, Spas, Tubs, and Whirlpools
Publisher: National Sanitation Foundation (NSF International), 789 North Dixboro Road, P.O. Box 130140, Ann Arbor, MI 48113-0140

UL-1081, Standard for Safety for Swimming Pool Pumps, Filters, and Chlorinators
Publisher: Underwriters Laboratories Inc. (UL), 333 Pfingsten Road, Northbrook, IL 60062-2096

### 1.4 Definitions

*blocking element:* the part used to simulate an entrapped victim constructed of a 12 in. × 12 in. (305 mm × 305 mm) maximum 5 in. (127 mm) thick closed cell foam block whose buoyancy force does not exceed 15 lb (6.8 kg).

*cycle:* a sequence where the SVRS latches or locks out in the vented or safe position following a high vacuum occurrence and then is manually reset.

*drain outlet:* an appurtenance for conveying water out of a pool, spa, hot tub, therapy unit, or similar appliance.

*end connection:* the point of attachment of the SVRS device to the suction system piping.

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

*hydrostatic valve:* a check valve found within a swimming pool main drain sump which allows ground water to flow into the pool if the hydrostatic pressure below the sump becomes greater than the pressure inside the pool.

*readily affixed:* to be easily retrofitted to existing systems where an entrapment hazard is possible using approved pipe fittings and/or approved adapters.

*Safety Vacuum Release System:* a system or device capable of providing vacuum release at a suction outlet caused by a high vacuum occurrence due to a suction outlet flow blockage, by either venting the circulation system to atmosphere, turning off the circulating pump, or reversing circulating flow. The device or system provides vacuum release with or without suction fitting cover(s) in place.

*submerged suction:* a pool, spa, hot tub, wading pool, or similar appliance whose circulation system pump suction inlet or inlets are located below the static water level in the appliance (flooded suction).

*suction lift:* a pool, spa, hot tub, wading pool, or similar appliance whose circulation system pump suction inlet or inlets are located above the static water level in the appliance (nonflooded suction).

*suction outlet:* an appurtenance for conveying water into a circulating system; i.e., a pump suction within a pool, spa, hot tub, wading pool, or similar appliance.

*suction system:* that portion of the circulation piping located between the pool suction outlet and the inlet side of the pump and usually includes the following: main outlet piping, skimmer piping, vacuum piping, and surge tank piping.

## 2 REQUIREMENTS

### 2.1 General

**2.1.1** Field-adjustable SVRS devices shall be provided with a vacuum gauge graduated in ½ in. (13 mm) Hg increments with an accuracy of ±1 in. (25 mm) of Hg to provide continuous indication of system vacuum level.

**2.1.2** Where SVRS devices are capable of field adjustment to site-specific hydraulic conditions, the means for effecting adjustments shall be tamper resistant, so that nonqualified personnel cannot make adjustments inadvertently.

**2.1.3** SVRS devices shall be designed for on-site servicing and testing.

**2.1.4** SVRS devices shall either vent to atmosphere, or shut off the circulating pump, or reverse the circulating system flow following a high vacuum occurrence.

**2.1.5** SVRS devices shall latch or lock out in the vented, or safe position following a high vacuum occurrence.

**2.1.6** SVRS devices, following a high vacuum occurrence, shall be manually reset without requiring special tools, replacement parts, the introduction of special fluids, and/or gases before allowing normal suction levels to resume.

**2.1.7** SVRS device internal vacuum release mechanisms shall operate in a dry state.

**2.1.8** SVRS devices shall fail in the open, vented, or safe position in the event of spring, loading, or sensing mechanism failure.

### 2.2 Dimensions and Tolerances

**2.2.1** Where the SVRS device is provided with a PVC end connection, the end connection shall conform to Tables 1 and 2 of ASTM D 2466.

**2.2.2** Where the SVRS device is provided with an ABS end connection, the end connection shall conform to Tables 1 and 2 of ASTM D 2468.

**2.2.3** Where the SVRS device is provided with a threaded end connection, the threaded end connection shall conform to ASME B1.20.1.

### 2.3 Materials

**2.3.1** The materials used for constructing the device shall be in conformance with NSF-50 and UL 1081.

**2.3.2** When plastic materials are used, UV inhibitors shall be added to the polymer mixture.

### 2.4 Installation Instructions

**2.4.1** Installation instructions, use and maintenance instructions, and adjustment instructions, and proper testing procedures shall be provided with each unit.

**2.4.2** Installation instructions provided with the unit shall contain the following statements.

**2.4.2.1** SVRS devices shall only be installed in conjunction with an ASME A112.19.8 suction fitting, or a 12 in. × 12 in. (305 mm × 305 mm) drain grate or larger, or an approved channel drain system at each suction outlet or drain outlet.

**2.4.2.2** Check valves and hydrostatic valves shall not be used in suction systems protected by SVRS devices.

**WARNING: The presence of a hydrostatic valve in the suction piping has been shown to prolong the high vacuum present at the drain, even though the drain was protected by an SVRS device.**

**2.4.2.3** All SVRS devices shall be factory set or field adjusted to site-specific hydraulic conditions. Once installed, the system shall be tested by simulating an entrapment event.

**2.4.2.4** A ball, butterfly, or sliding gate valve shall be installed within 2 ft (0.6 m) upstream from the SVRS (between the SVRS and the protected suction outlet), or a test mat shall be used to cover the suction outlet to simulate an entrapment event. There shall be three simulated entrapment tests conducted to verify proper adjustment and operation of the device.

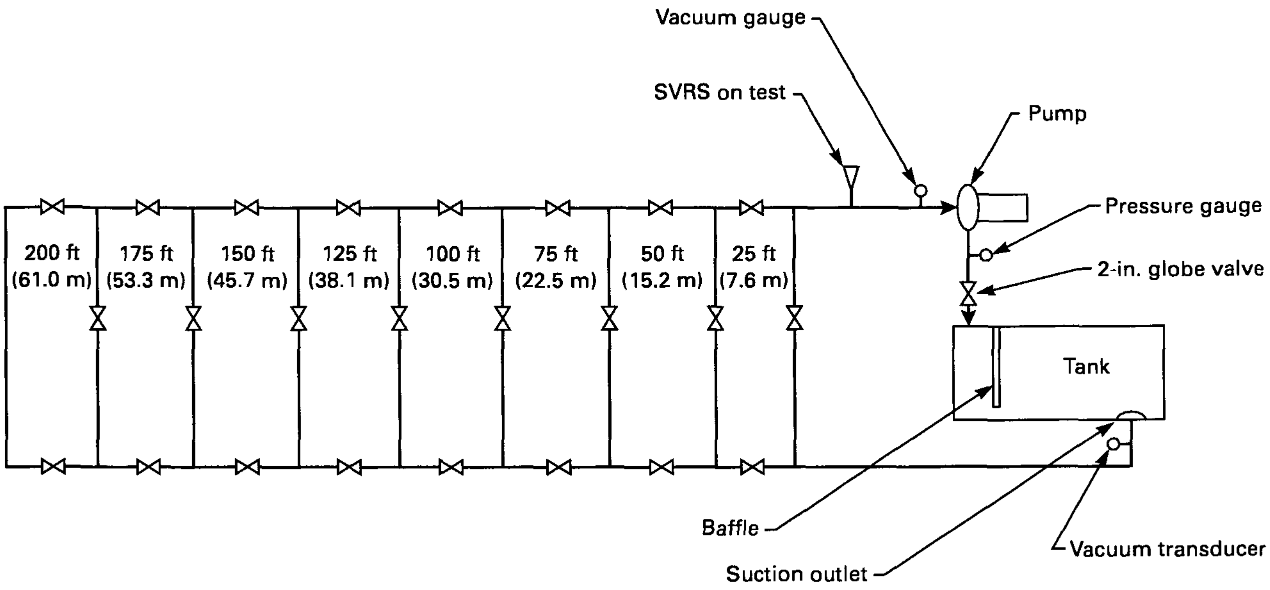



**Fig. 1 Vacuum Response Versus Time Test Set-Up (For illustrative purposes only)**

**2.4.2.5** One SVRS device shall be installed for each circulating pump plumbed directly to the suction outlet(s) without the use of valves that could isolate the SVRS device from the suction system.

## 3 TESTING

### 3.1 General

The purpose of these tests is to establish proper device application criteria, i.e., submerged suction and/or suction lift applications, for pump horsepower ranging from ½ hp to 3 hp. These tests will measure device performance relative to criteria established below. The vacuum transducer shall be capable of reading a minimum of 50 vacuum readings per second (see Fig. 1 for a general schematic of the test set-up). SVRS devices shall cause the release of the vacuum at the suction outlet within 3 sec to 4.5 sec after onset of the high vacuum event, as detailed below. The vacuum level shall be measured at the suction outlet protected by the device. The vacuum shall decay to a level equal to or less than the level present at the suction outlet prior to the suction outlet blockage within an elapsed time of less than 3 sec at all suction piping distances less than or equal to 100 ft (30.5 m). The vacuum shall decay to a level equal to or less than the level present within the system prior to the blockage within an elapsed time of less than 4.5 sec at all suction piping distances greater than 100 ft (30.5 m) and less than or equal to 200 ft (61.0 m). Record the vacuum response in inches of Hg (y-scale) and plot the time in minimum 0.1 sec intervals (x-scale) as a wave-form graph. (See Fig. 2.)

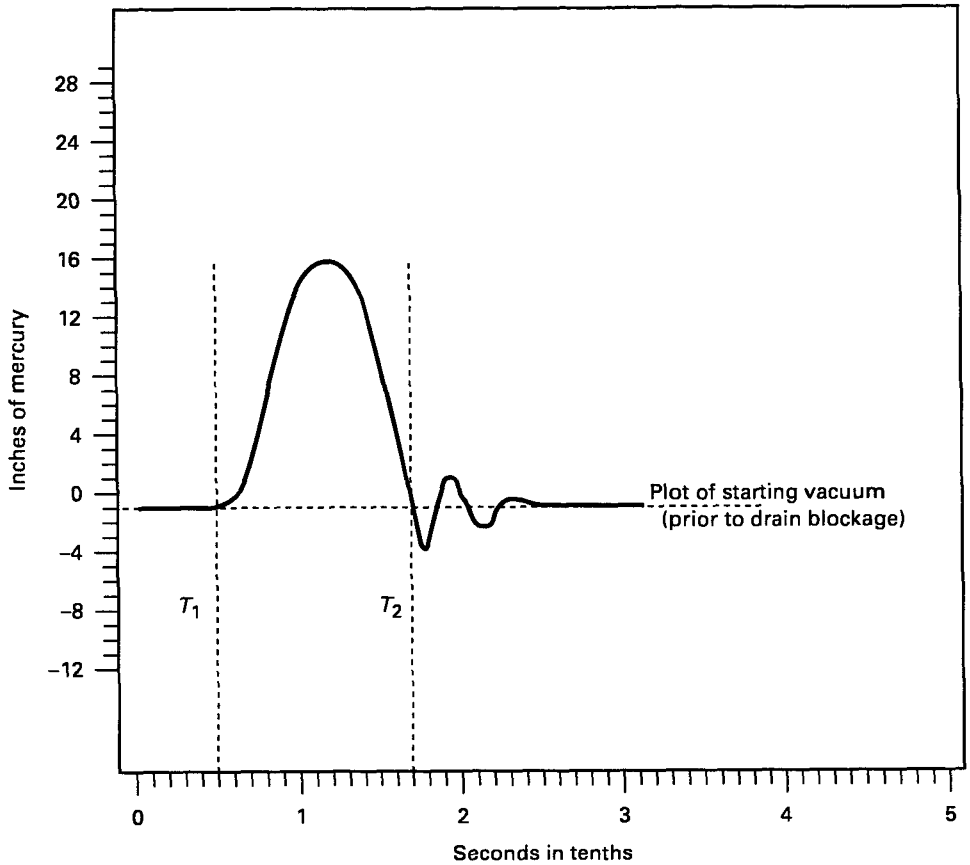
### 3.2 Time Versus Vacuum Response Test

**3.2.1** SVRS devices shall be preconditioned as described in paras. 3.3 and 3.4 prior to being subjected to vacuum response versus time tests, with the device placed at distances of 25 ft to 200 ft (7.6 m to 61.0 m) in 25 ft (7.6 m) increments, from a circulating pump suction. These tests are to be performed at 60 gpm (227 L/min), or at the maximum flow rate produced by the pump, or at the flow rate that produces the maximum vacuum level recommended by the SVRS manufacturer. Perform the tests in para. 3.2.2 and/or para. 3.2.3 on an 8-in. diameter suction outlet sump, once with a flat grate installed and once without a cover or grate installed, piped with 2-in. diameter suction piping by blocking the suction outlet using the test actuator described below.

**3.2.1.1 Test Actuator.** A mechanical test actuator shall support a blocking element centered on the vertical axis of the suction outlet sump with a minimum of 6 in. (152 mm) between the top of the sump and the bottom of the blocking element. The test actuator shall lower the blocking element at a rate not to exceed 6 in./sec (152 mm/s) onto the top of the sump. The test actuator must immediately cease downward force at the moment contact is made at the sump and allow the blocking element to move vertically free. (See Fig. 3 for a general schematic of the test actuator.)

#### 3.2.2 Submerged Suction Test

**3.2.2.1 Method.** Perform tests utilizing a self-priming ½ hp circulating pump with the pump elevation at 3 ft (914 mm) below the static water level in the test




GENERAL NOTES:
(a) Example reflects a 1.20 sec elapsed time.
(b) The total elapsed time between $T_1$ and $T_2$ shall not exceed the limits in para. 3.1.

**Fig. 2 Wave Form Graph Plotting Example (For illustrative purposes only)**

tank by blocking the drain utilizing the test actuator and recording vacuum response versus time as described in para. 3.2. Perform the tests again utilizing a self-priming 3 hp circulating pump.

**3.2.2.2 Performance Criteria.** The failure of a device to respond within the required time, or failure to latch out or lock out in the vented or safe position and require manual resetting, or a vacuum condition remaining at the suction outlet exceeding the level present prior to the suction outlet blockage, shall be cause for rejection of the SVRS device for submerged suction applications.

### 3.2.3 Suction Lift Test Method

**3.2.3.1 Method.** Perform tests utilizing a self-priming ½ hp circulating pump with the pump elevation at 5 ft (1.5 m) above the static water level in the test tank by blocking the suction outlet utilizing the test actuator and recording and measuring the vacuum response over time event as described in para. 3.2. Perform the tests again utilizing a self-priming 3 hp circulating pump.

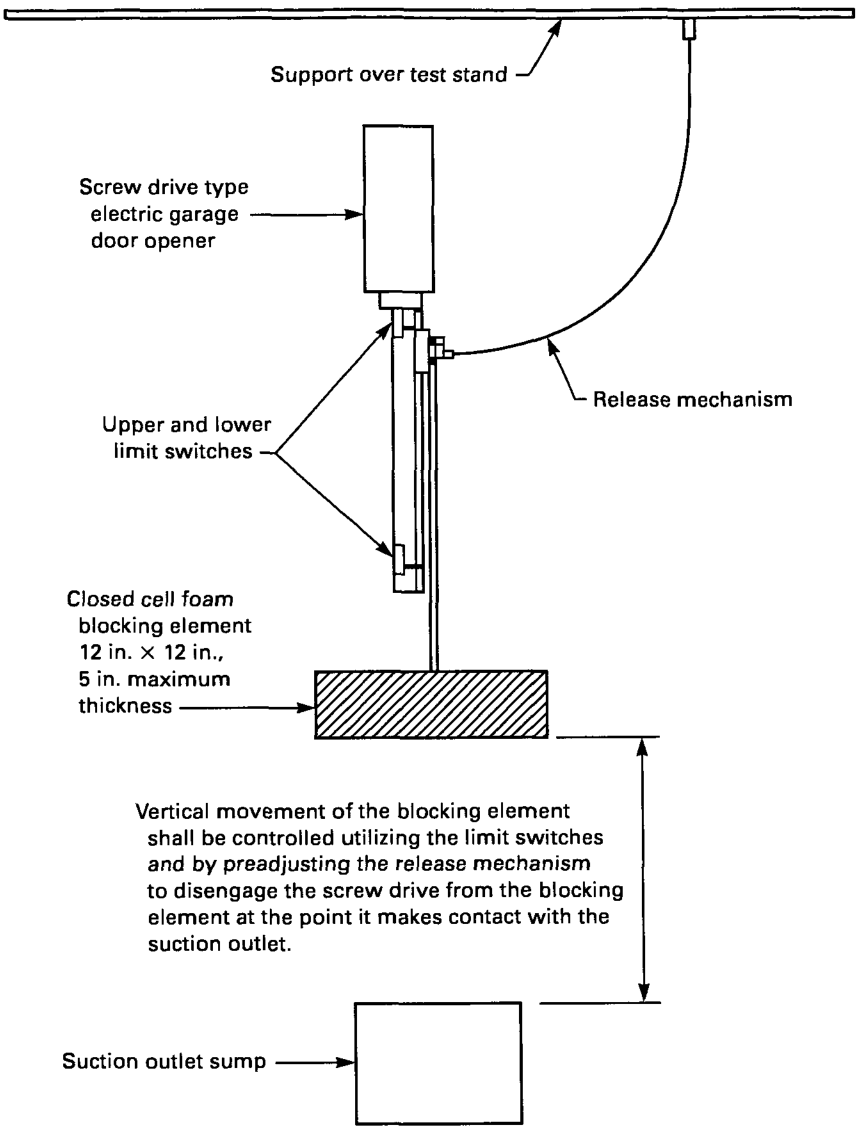
**3.2.3.2 Performance Criteria.** The failure of a device to respond within the required time, or failure to latch out or lock out in the vented or safe position and require manual resetting, or a vacuum condition remaining at the suction outlet exceeding the level present at the suction outlet prior to the suction outlet blockage, shall be cause for rejection of the SVRS device for suction lift applications.

## 3.3 Cold Temperature Preconditioning and Life Cycle Test

**3.3.1 Method.** Subject the complete device to a temperature of −40°F (−40°C) for a period of 12 hr. Allow the unit to return to room temperature. Cycle the device 500 times.

## 3.4 Hot Temperature Preconditioning and Life Cycle Test

**3.4.1 Method.** Subject the complete device to a temperature of 140°F (60°C) for a period of 12 hr. Allow the




**(a) Test Actuator**
**Side View — No Scale**

**Fig. 3 Test Actuator Schematic**
**(For illustrative purposes only)**

unit to return to room temperature. Cycle the device 500 times.

**3.4.2 Performance Criteria.** Test the unit to determine performance pursuant to paras. 3.1, 3.2.2, and/or 3.2.3.

## 4 CLASSIFICATION OF DEVICES

SVRS devices tested in accordance with para. 3 shall be permitted to be listed and labeled for suction lift applications, submerged suction applications, or both suction lift and submerged suction applications.

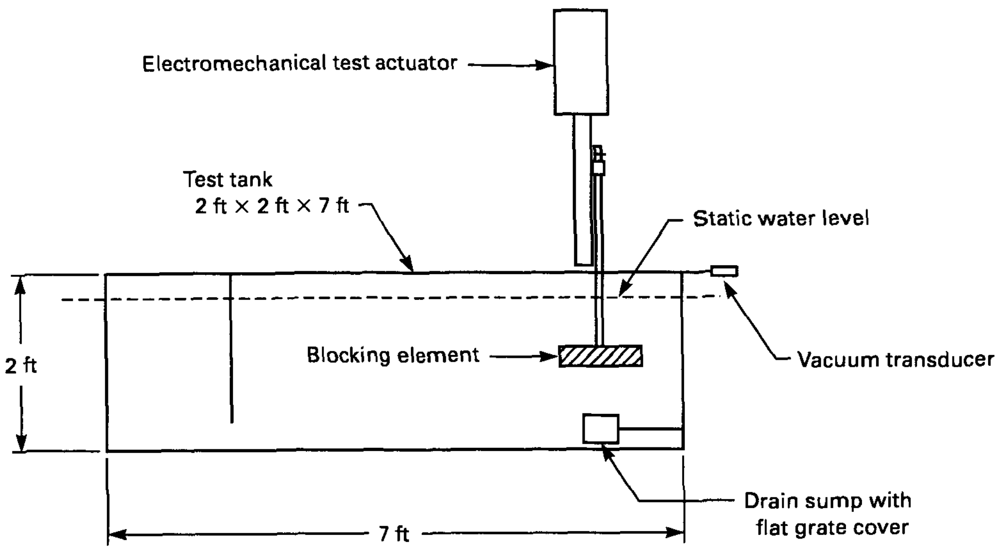
## 5 MARKING AND IDENTIFICATION

Each unit shall be permanently marked as follows:

*(a)* manufacturer's name or trademark

*(b)* model number, serial number, date coding, and lot identification (this may be encoded within the serial number)

*(c)* one of the following application limits: suction lift, submerged suction, or all applications.




**(b) Tank and Blocking Element Detail**
**Side View — No Scale**

**Fig. 3 Test Actuator Schematic (Cont'd)**
**(For illustrative purposes only)**

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