GENESIS®
EDUCATE. CERTIFY. CONNECT.

Position Statement #1

Hydraulic Safety for Pools, Spas, and Water Features

Introduction

GENESIS provides an international forum for continuing education and the establishment of higher standards in watershape design, engineering, and construction. In pursuit of this goal, GENESIS hereby publishes this Position Statement regarding hydraulic safety.

This Position Statement was assembled with input from leading professionals in the pool and spa industry, including individuals that are not members of GENESIS. The contributors share a common goal of improving safety, reducing energy consumption, raising the current standards, and building better quality projects. The positions are not biased toward specific manufacturers or products.

This document is not a consensus standard or building code. It has not gone through the consensus procedures of any recognized standards writing authority. GENESIS has no interest in pursuing the consensus process that would only dilute these positions with inferior concepts based on specific products, technology, maintaining backwards-compatibility, or other conflicts of interest. Use of this document is completely voluntary.

This document is made available in the public domain. GENESIS encourages the free distribution, use, and reference of this document in whole or in part. Individuals or firms involved with the design, engineering, construction, maintenance, and operation of pools, spas, and water features may use this Position Statement to guide their work; however, in no way does this relieve them from compliance with all laws, codes, standards, regulations, ordinances, or other requirements. Individuals and companies involved with the development of standards and codes are encouraged to consider these Position Statements and the associated Commentary. Authorities having jurisdiction may reference this document directly as a building code in whole or in part.

GENESIS reserves the right to add to, delete from, or otherwise modify this document at any time without notice. The positions stated herein represent sound thinking on the date of publication given the current state of technology, experience, and information. GENESIS recognizes that “one size does not fit all” and that there are exceptions to every rule.

In publishing this document, GENESIS disclaims all liability and is not responsible for any loss, damages, or injuries that may result from reliance upon the statements contained herein.

Format

There are two columns. The first column clearly and concisely states our position. The second column provides commentary and justification for the corresponding position statement.

Hydraulic Safety for Pools, Spas, and Water Features

Position Statement	Commentary
1.1 Flow Rate Reference	
1.1.1 The flow rate that should be referenced for the configuration, line size determination, and cover/grate selection of the suction outlets shall be the maximum flow rate of the pump at its maximum RPM (3,450 for variable frequency drive systems); or,	Even if a pump is set to a lower flow rate, or if a valve is throttled to reduce the flow rate, it is possible that the system could be changed to a higher flow rate that exceeds the design of the suction outlet system. Designing for the worst-case scenario ensures that safety will be maintained at all times.
1.1.2 For retrofits only, if the pump has variable frequency drive technology, the speed shall be locked so that the flow rate cannot exceed the existing configuration, line sizes, or cover/grate selection.	It is possible that even if a variable speed pump can operate at 3,450 RPM, a locking system may limit that to some lower RPM in a way that prevents the accidental operation at a higher RPM. This is acceptable for retrofits but new construction should be configured and sized to handle the flow rate at maximum RPM even if the speed-locking feature is available.
1.2 Suction Outlet Configuration	
1.2.1 Suction outlets shall be configured in split pairs or more.	Where suction outlets are unavoidable, nothing has proven safer than outlets configured in split pairs with properly sized covers/grates and properly sized plumbing to handle the flow rate. The split outlets shall be configured so that when one is blocked, the remaining outlet(s) will handle 100% of the flow rate without exceeding 6 feet-per-second in the plumbing.
1.2.2 When isolation valves are located between a suction outlet and pump, any isolatable suction line shall be sized for 100% of the system's reference flow rate per section 1.3 below.	Valves are easily adjusted or closed and if certain valves cause an undersized line to be isolated as the sole suction point, the velocity could be dangerously high.
1.3 Suction Outlet Plumbing Velocities	
1.3.1 The velocity limit in the plumbing at the outlets is 6 feet-per-second by code (ANSI/APSP-7). We recommend that the maximum design velocity on the suction side of the pump be limited to 5 feet-per-second.	Several things can increase the velocity in a line between the time that the design is established and when the system is actually built and operated. For example, the design flow rate might only be 50 gallons per minute, but when the pump is selected it may be necessary to choose a fixed-speed pump that is slightly larger than needed and this will result in higher flow rates than desired. If 50 gallons per minute results in a velocity of 6 feet-per-second in the plumbing, the pump selection alone might result in a velocity that exceeds the 6 feet-per-second code limit.

	Energy efficiency is greatly enhanced by lowering the line velocity. Cavitation, operating noise, and suction entrapment hazards are also reduced by lowering the line velocity. Equipment life is extended.
1.3.2 We recommend minimum line velocities in drains and returns be 1.0 feet-per-second.	Slower velocities still allow for proper pipe scour.
1.4 Suction Outlet Covers	
1.4.1 The recommended maximum water velocity through any suction outlet cover/grate deemed unblockable and designed by a certified design professional shall not exceed 1.5 feet-per-second or the safe operating limit determined by independent testing, whichever is lower.	Some jurisdictions already use a 1.5 feet-per-second maximum velocity. The ANSI/APSP-16 American National Standard for Suction Outlet Fitting Assemblies (SOFA) for Use in Pools, Spas and Hot Tubs provides a somewhat complicated method for manufacturers to test and list much higher velocities. Our position is that this process promotes differing interpretations and test results at the expense of safety. Some suction outlet covers/grates are actually listed for velocities that exceed our recommended suction velocities in the plumbing.
1.4.2 Velocities across manufactured suction outlet covers/grates must never exceed the manufacturer's certified velocities with all connected pumps operating at maximum capacity.	There is at least one suction outlet cover on the market that is listed for over 6 feet-per-second, which actually exceeds the velocity limit of the associated plumbing. Velocity limits are sometimes established by hair entrapment testing and even if a cover passes a test at over 6 feet-per-second, we do not agree that it should be used at a velocity that exceeds the plumbing.
1.4.3 The recommended flow rate for an unblockable cover/grate used in a single configuration must be calculated by applying the maximum 1.5 feet-per-second velocity across the remaining open area of the cover/grate after the representative torso has blocked as much of the cover as possible.	This criteria will result in two flow rates for all unblockable covers. The first flow rate will represent the maximum flow that the cover/grate can pass at 1.5 feet-per-second after the representative torso has blocked as much of the cover as possible. The second flow rate will represent the maximum flow that the cover can pass at 1.5 feet-per-second when it is unblocked.

1.4.4 Skimmer equalizers are prohibited under the ISPSC and ANSI/APSP-7. When required by local jurisdictions, they shall be installed in split pairs separated by 3-feet clear in accordance with sections 1.1 through 1.4 above. Floor or wall suction outlets shall not be installed in isolated, stand-alone pools classified as “wading” or “baby” pools. Skimmers or gutters are permitted but floor or wall suction devices are no longer permitted in “wading” or “baby” pools.	Skimmer equalizers are used to prevent pump damage when the skimmer runs dry due to low water level or blockage by debris. The low water level issue is easily solved with automatic fill devices that are standard on all new pools. Skimmer blockage by leaves or other debris is a valid concern in some environments but not all. Many pools (e.g., indoor or those without problematic vegetation) may never have blocked skimmers, so there is no justification for the equalizers.
1.5 Dedicated Vacuum Ports	
1.5.1 Dedicated vacuum ports shall have approved positive-sealing covers and isolation valves.	Such ports may not exceed 12-inches in depth below water surface. Some states no longer allow vacuum ports.
1.6 Engineered Vent Stacks	
1.6.1 Engineered vent stacks shall not be used.	When a suction outlet system is operating properly, the engineered vent stack will be partially full of water that is never circulated, filtered, or sanitized. The engineered vent stack provides a location for pathogens and algae to reproduce.
1.7 Validation of Results	
	It is incumbent on the pool builder to validate safe flow velocities in pipes through the use of gages or meters following completion of the construction.