

Introduction

Genesis 3, Inc. 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.

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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.

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 4.5 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.

Slower velocities do allow for proper pipe scour.

1.4 Suction Outlet Covers

1.4.1 The recommended maximum water velocity through any suction outlet cover/grate 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 Fittings for Use in Swimming Pools, Wading 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.

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.

Energy loss through hydraulic fittings and orifices is directly proportional to the square of the water velocity. In other words, if the velocity doubles the energy loss (head loss) quadruples. Covers listed for 4.5 feet-per-

second will result in about 89% energy savings when the velocity is limited to 1.5 feet-per-second.

1.4.2 Low-profile anti-vortex suction outlet cover/grates shall not be used.

At this time, the term “low profile” is undefined. However, most anti-vortex covers are designed with a raised upper surface and the openings located at least partly on the sidewall of the perimeter. This configuration is more difficult to block than the low profile versions where the upper surface is not raised much and the perimeter openings are essentially flush with the floor and upper surface of the cover.

1.4.3 The recommended flow rate for an unblockable cover/grate used in a single configuration should 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 used in split pairs or more. The second flow rate is not reduced by the blockage of the representative torso.

Currently, certain “unblockable” suction outlet cover/grates are listed with high flow rates but the representative torso can easily block over 80% of the drain, which results in potentially dangerous hair entrapment velocities through the remaining area.

1.4.4 Skimmer equalizers shall not be required unless the skimmer is the sole source of suction for a pump. When installed, they shall be installed in split pairs separated by 3-foot clear in accordance with sections 1.1 through 1.4 above.

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.

When equalizers are installed they need to be installed in split pairs separated by 3-feet clear or on different planes in conformance with all the standards pertaining to regular split suction outlet pairs. This is because a float valve or equalizer valve (e.g., Hayward SP1078) in the skimmer will effectively turn the equalizer into a suction outlet.

Some states are requiring them to be plugged in commercial applications.

1.5 Dedicated Vacuum Ports

1.5.1 Dedicated vacuum ports shall have approved positive-sealing covers *and* isolation valves.

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.