Finding the Maximum Flow Rate of an Existing System

Preparation:

1. Open all valves to their full open position for pool or spa circulation. (For secured systems, do not adjust valves.)
2. Remove eyeball fittings from return inlets (when removable by hand).
3. Clean skimmer and pump baskets. Turn off skimmer to isolate outlet, if possible.
4. Backwash or clean sand filter/DE grids, or remove cartridge.

When inspecting existing installations, the maximum possible flow rate of suction system must be determined as explained in 4.4.9.*.

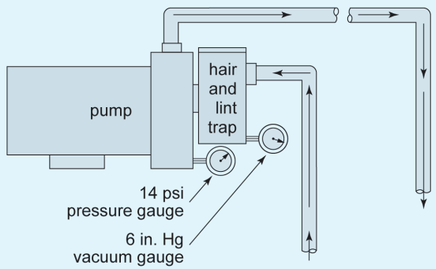
Pump Method 1: Measure flow rate with a flow meter accurate to ±10% (see Section 4.4.9).*

Pump Method 2: Calculate using pressure and vacuum gauge readings (see diagram below).

1. Install a vacuum gauge as close to the bottom of the strainer basket as possible.
2. Install a pressure gauge as close to the pump discharge as possible. NOTE: It may be necessary to use a National Pipe Thread (NPT) × barb fitting with a short section of plastic tubing connected to a gauge if gauges cannot be screwed into drain holes provided in pump.
3. Multiply vacuum reading by 1.13 and record.
4. Multiply pressure reading by 2.31 and record.
5. Add results of steps 3 and 4 together to get the approximate Total Dynamic Head (TDH) in feet of head.
6. Using the published curve for the pump, find the Total Dynamic Head calculated above on the vertical axis, and read the flow rate on the horizontal axis.
7. This will give you the maximum flow rate within approx. 10%.

Pressure head: gauge psi × 2.31 = feet of water
Suction head: gauge inches Hg × 1.13 = feet of water

EXAMPLE: If the pressure gauge reads 14 psi and the vacuum gauge reads 6 inches of mercury (Hg), the approximate Total Dynamic Head (TDH) of the system would be 39.12 feet.



Pressure Head	= 14 psi	× 2.31	= 32.34 feet
Suction Head	= 6 in. Hg	× 1.13	= 6.78 feet
Total Dynamic Head			= 39.12 feet

Gravity Flow Calculation

$$\text{Flow (gpm)} = \sqrt{\frac{1786 \times [\text{D (inch)}]^5 \times \text{H (inch)}}{\text{L (inch)} + [55 \times \text{D (inch)}]}}$$

(Where 55 D accounts for energy loss of stream)

EXAMPLE: Gravity flow through 2" IPS Schedule 40 PVC pipe with an inside diameter of 2.067" with 32.0 feet of pipe and 2 elbows of equivalent length of 6.0 feet. The top of the pipe opening into the collector tank is 8" below pool water level.

$$\text{Flow (gpm)} = \sqrt{\frac{1786 \times [2.067]^5 \times 8}{[32 + (2 \times 6)] \times 12 + [55 \times 2.067]}} = 29 \text{ gpm}$$

Cover/Grate Audit

Existing Pump _____ (Manufacturer) _____ (Model)

Pool Volume _____ (Gallons)

Filter _____ (Manufacturer) _____ (Model) _____ (Size (Sq. Ft.))

Existing Cover _____ (Manufacturer) _____ (Model) _____ (GPM)

Pressure _____ (PSI) Vacuum _____ (Inches of Hg)

TDH _____ (Feet of water) System Flow _____ (GPM) (from Pump Curve)

Maximum Flow _____ (GPM)

New Cover _____ (Manufacturer) _____ (Model) _____ (GPM)

Replacement Date _____/_____/_____

Maximum Drawdown _____ (Calculated)

_____ (Measured) _____ (Measured) _____ (Measured) _____ (Measured)

NOTE: Check cover manufacturer's installation instructions for the following items per ANSI/APSP-16.**

- ☐ Cover compatible with sump
- ☐ Attachments (hardware/screws)
- ☐ Field fabricated sump as specified by cover manufacturer

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ANSI/APSP/ICC-7 2013

American National Standard for Suction Entrapment Avoidance in Swimming Pools, Wading Pools, Spas, Hot Tubs And Catch Basins

This Appendix is not part of the American National Standard ANSI/APSP/ICC-7 2013 but is included for information only. Additional copies of the ANSI/APSP/ICC-7 standard and this Appendix can be purchased by contacting APSP Member Services at 703.838.0083, ext. 301.

Introduction

This field checklist for identifying suction entrapment hazards provides information and a systematic process that will help identify and eliminate suction entrapment hazards in swimming pools, wading pools, spas, hot tubs, and catch basins. This information and system is intended to address the hazards of hair entrapment, limb entrapment, body suction entrapment, evisceration/disembowelment, and mechanical entrapment. It does not replace or supersede the information in the body of the ANSI/APSP/ICC-7 standard. These guidelines are intended for use in inspecting, maintaining, and upgrading residential and public swimming pools, wading pools, spas, hot tubs, and catch basins. They are appropriate for use by service companies, builders, installers, facility owners/operators, home inspection specialists, parks and recreation personnel, and others who are responsible for pool and spa safety.

Reference numbers next to each block are used to facilitate telephone discussion. Mark the tracking boxes with an × to clearly document the current condition and actions needed and/or taken.

⚠ DANGER: To avoid serious injury or death, close the pool or spa to bathers if any suction outlet cover/grate is missing, broken or inoperative.

Company _____	Pool _____
www. _____	Pump System _____
Address _____	Address _____
City _____	City _____
State _____ Zip _____	State _____ Zip _____
Date _____ Phone _____	Date _____ Phone _____
Inspected by _____	Owner/Operator _____

EVALUATION / ACTIONS TAKEN

_____

_____

_____

_____

_____

_____

_____

_____

_____

Inspector _____ (Print Name)	Owner/Operator _____ (Print Name)
_____ (Signature) _____ (Date)	_____ (Signature) _____ (Date)

The provisions described herein are not intended to prevent the use of any alternative configuration or system, provided any such alternative meets the intent and requirements of these Guidelines.

Start Here
Must End on **FINISH**
1

Are there outlets?
Fully submerged suction outlet(s) located in the floor, on the wall, or any skimmer equalizer fittings/lines.
12
☐ NO
☐ YES

How many pumps does the outlet (do the outlets) serve?
13
☐ ONE
☐ MULTIPLE

What is the Maximum System gpm of the single pump system?
(_____) gpm
See Instructions on reverse page.
2

What is the Maximum Combined gpm of the multi-pump system?
(___)+(___)+(___)=(_____) gpm
NOTE: Include ALL pumps.
See Instructions on reverse page.
14

Are there multiple outlets?
3
☐ NO
☐ YES

Are all outlets certified in accordance with ANSI-APSP-16?**
4
☐ NO
☐ YES

Does each dual outlet system have a cover with a flow rating equal to, or greater than, the Maximum System GPM?
See Section 4.*
5
☐ NO
☐ YES

Have you recorded the end-of-life date for each cover, based on the installation date and marked life?
6
☐ NO
☐ YES

Is each cover within the ANSI/APSP-16 service life?**
7
☐ NO
☐ YES

Is each cover undamaged?
8
☐ NO
☐ YES

Is each cover adequately secured to a sump/fitting/anchors for which the cover is certified in accordance with ANSI/APSP-16?**
9
☐ NO
☐ YES

Is the sump a Field Fabricated Sump?
10
☐ NO
☐ YES

Is the Field Fabricated Sump compatible with the cover manufacturer's instructions, including, but not limited to:
1. Clearance between the pipe and underside of cover(s)
2. Clearance between edge of frame and the bottom of the sump?

11
☐ YES
☐ NO, or Unknown

WARNING!
Covers are not compatible with all sumps/fittings. Replace with compatible cover and/or create compliant sump per cover manufacturer's instructions.
19

Are there two or more outlets for each pump?
18
☐ YES
☐ NO

Are all outlets unblockable, in accordance with ANSI/APSP-16,** or certified by a Registered Design Professional (RDP)?
15
☐ YES
☐ NO

WARNING! Suction Entrapment Hazard Non-compliant Outlet(s)
16

ACTION REQUIRED

This system requires ANSI/APSP-16-compliant** suction outlet fittings. Unblockable outlets may be certified by a Registered Design Professional (RDP) as having covers/grates, sumps, and fastening systems in accordance with ANSI/APSP-16.**

Manufactured product required to be tested and listed per ANSI/APSP-16 requirements.**

Each replacement cover must have a flow rating equal to or greater than the Maximum System GPM (See Section 4*) or the Maximum System GPM may be permanently reduced below the cover flow rating by replacing pump or permanently restricting the pump discharge flow, provided the maximum turnover time is not exceeded.
17

Pump/System: Date:

Revised Date 10-29-13S

VACUUM FITTING
20

Is there a dedicated vacuum cleaner fitting?
24
☐ NO
☐ YES

Is there a fitting lid (cover) tested and listed by an Independent Testing Laboratory in accordance with IAPMO-SPS 4?
25
☐ YES
☐ NO

Install or replace with fitting lid tested to IAPMO-SPS 4.
26

FINISH ☐
27

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Is the single outlet...
A. an equalizer line piped through the second port of a skimmer?
B. unblockable?
C. a combination outlet/inlet incorporated into a single fitting?
D. a venturi-driven system?
23
☐ NO
☐ YES

Is the center-to-center distance between the covers at least 36 inches, or are the outlets on separate planes?
22
☐ NO
☐ YES

Complete ☐
GO TO VACUUM FITTING
21

WARNING! Suction Entrapment Hazard Choose at Least One Option
28

Install ANSI/APSP-16-compliant** multiple outlets with adequate flow ratings, and with center-to-center distance between the covers of at least 36 inches, *or* with the outlets on separate planes. See Sections 5.3* and 5.4.*
29
☐

Convert single suction outlet to return inlet by changing the piping, provided that the system piping and skimmer(s) are capable of handling the full system flow.
30
☐

Convert to a gravity flow system.
31
☐

Install an engineered vent system.
32
☐

Install and test per manufacturer's installation instructions, a manufactured safety vacuum release system (SVRS) in accordance with Section 4.3.2.*
33
☐

Permanently disable the single outlet. Verify that the overflow and skimmers are capable of handling the required system flow and that minimum turnover rates are achieved.
34
☐

Complete ☐ **GO TO VACUUM FITTING**
35

* Unless explicitly noted, all section numbers refer to ANSI/APSP/ICC-7 2013. ** All references to ANSI/APSP-16 mean ANSI/APSP-16 Sor ASME A112.19.8 2007 or VGB 2008.

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