# DEHQ POOL PROGRAM UPDATES: NEW SUCTION OUTLET FITTING ASSEMBLY (SOFA) STANDARDS

August 21, 2025

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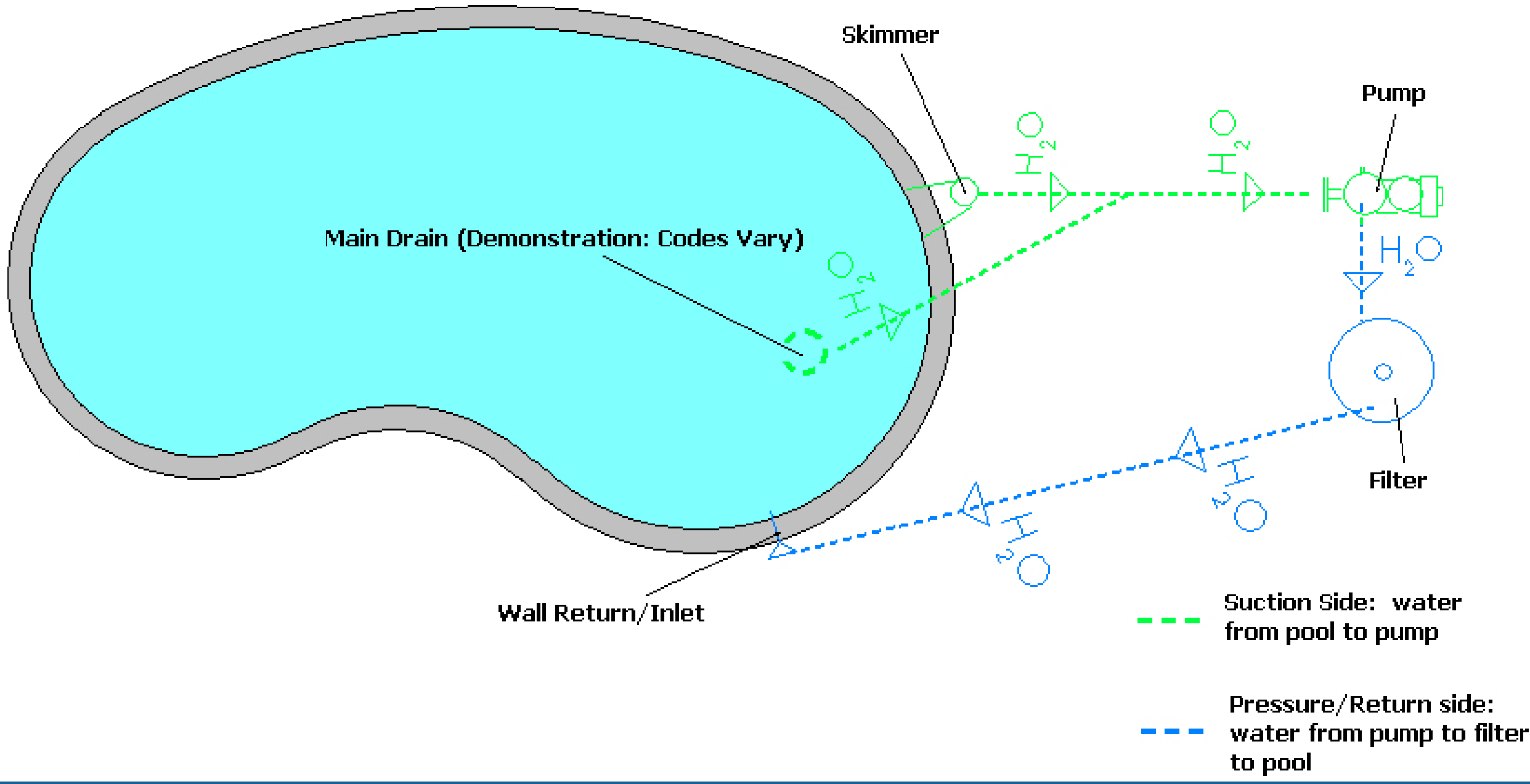
# AGENDA

- Recirculation System Refresher
- New Standards
- Gauges, Suction Outlet Covers, and TDH Readings,
- Next Steps
- New Minor Remodel/Renovation Submission Package
- Scenarios
- Deep Dive into TDH Calculations

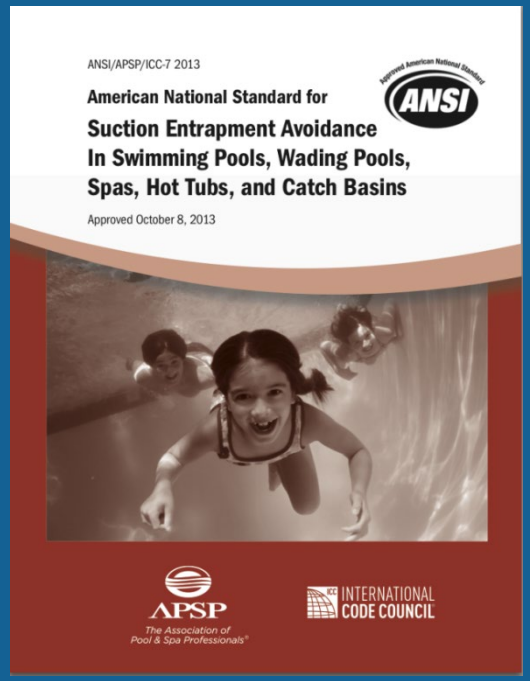
# RECIRCULATION SYSTEM REFRESHER

- The water starts in the pool/spa and travels through the recirculation system to be filtered and chemically treated prior to returning to the pool/spa.
  - The water travels from the pool/spa on the suction side via the main drains, skimmer, and if applicable, the skimmer equalizers to the recirculation pump(s).
  - From the recirculation pump(s), the flows through the return side via the filter(s), water heater(s), and chemically treated as the water returns to the pool/spa via the return inlets that are either wall mounted or floor mounted.


Skimmer
Pump
Main Drain (Demonstration: Codes Vary)
Filter
Wall Return/Inlet
Suction Side: water from pool to pump
Pressure/Return side: water from pump to filter to pool

# SUCTION ENTRAPMENT

- Entrapment avoidance means shall be provided in accordance with Section 310.




Section 310.1 refers to ANSI/APSP/ICC-7

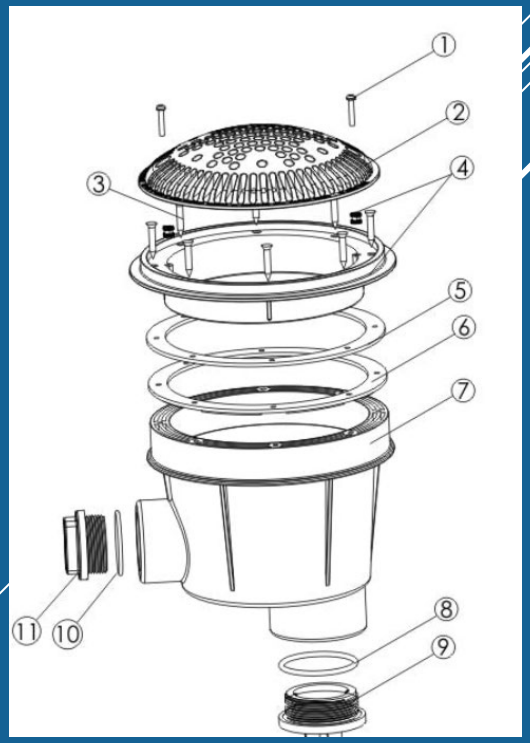
- Hair Entrapment **(#1 Type of Entrapment)**
- Body Entrapment
- Limb Entrapment
- Evisceration
- Mechanical Entrapment (non-suction)

*There is **no backup** for a missing or damaged suction outlet cover/grate. If any cover/grate is found to be damaged or missing, the pool or spa shall **be immediately closed** to bathers.*

Limb entrapments have occurred when no water was flowing through the pipe – the opening was exposed.

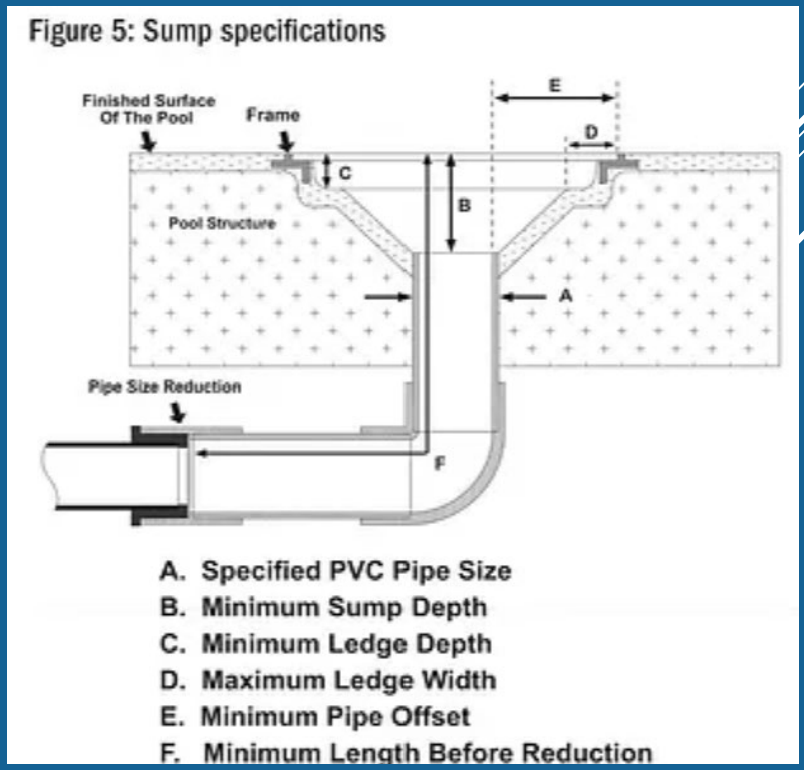
# STANDARDS

- Applicable codes:
  - **CBC (Title 24) 3162B.3** – every public swimming pool shall be equipped with anti-entrapment devices or systems that comply with ANSI/APSP/ICC-16 performance standard, or successor standard designed by the Federal Consumer Product Safety Commission (CPSC).
  - **ANSI/APSP/ICC-16 2017** – Section 1.4 Related Standards: Because the scope of this standard is directly related to suction fittings, it is important to mention that the fittings themselves represent only one portion of the section entrapment scenario. Additional standard to be consulted to provide coverage for the various other potential hazards pools. These other standards include, but are not limited to, the following:
    - ANSI/APSP/ICC-7 2020 - Standard for Suction Entrapment Avoidance in Pools
  - **ANSI/APSP/ICC-7 2020** – The term design flow rate will be used to determine the correct pipe size; maximum flow rate will be used to determine the correct suction outlet cover. Flow rates will need to be verified after a project is finished by using a vacuum and pressure gauge, or by using a flow meter that is installed per manufacturer instructions.
  - **CBC (Title 24) 3125B.2** Gauges – A pressure and a vacuum gauge shall be provided for each pump system. Each gauge shall have a scale range approximately 1 ¼ times the maximum anticipated working pressure or vacuum and shall be accurate within 2 percent of scale. The pressure gauge located on the filter shall be marked with the clean start up pressure reading.



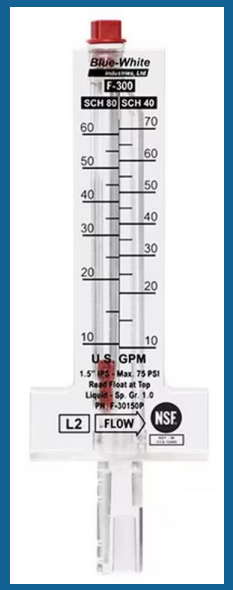
# SCOPE & DEFINITIONS

- Suction Outlet Fittings Assembly (SOFA) standards updated in 2017 and 2020.
  - ANSI/APSA/ICC-7 updated in 2020
  - ANSI/APSA/ICC-16 updated in 2017
- **Suction Outlet Fittings Assembly (SOFA)** – all components, including the cover/grate, used to attach a cover/grate(s) to the finished surface of a pool and to an individual suction system.
- **VGBA Drain Covers** – all components, including the sump, cover/grate, and hardware. They are also called Suction Outlet Fitting Assemblies
- **Total Dynamic Head (TDH)** – the total amount of pressure a pump needs to exert on a fluid to move it through a system. It is measured in feet and is a key factor in pump specifications.
  - Multiple ways to calculate TDH.
    - Using the system's piping or system's dynamics (pressure/vacuum).



# GAUGE REQUIREMENTS

- A flow meter, a vacuum gauge (pre-pump), and a pressure gauge (post-pump) will be required to be installed to verify flow rate and TDH. Code section 3125B.2.
  - Field staff will need access to pump rooms to confirm that all components have been properly installed. If not, a notice will be issued to have the missing gauges properly installed.
  - Plan Check will require installation and/or verification when new bodies of water are built or remodeled (dependent on scope of work).

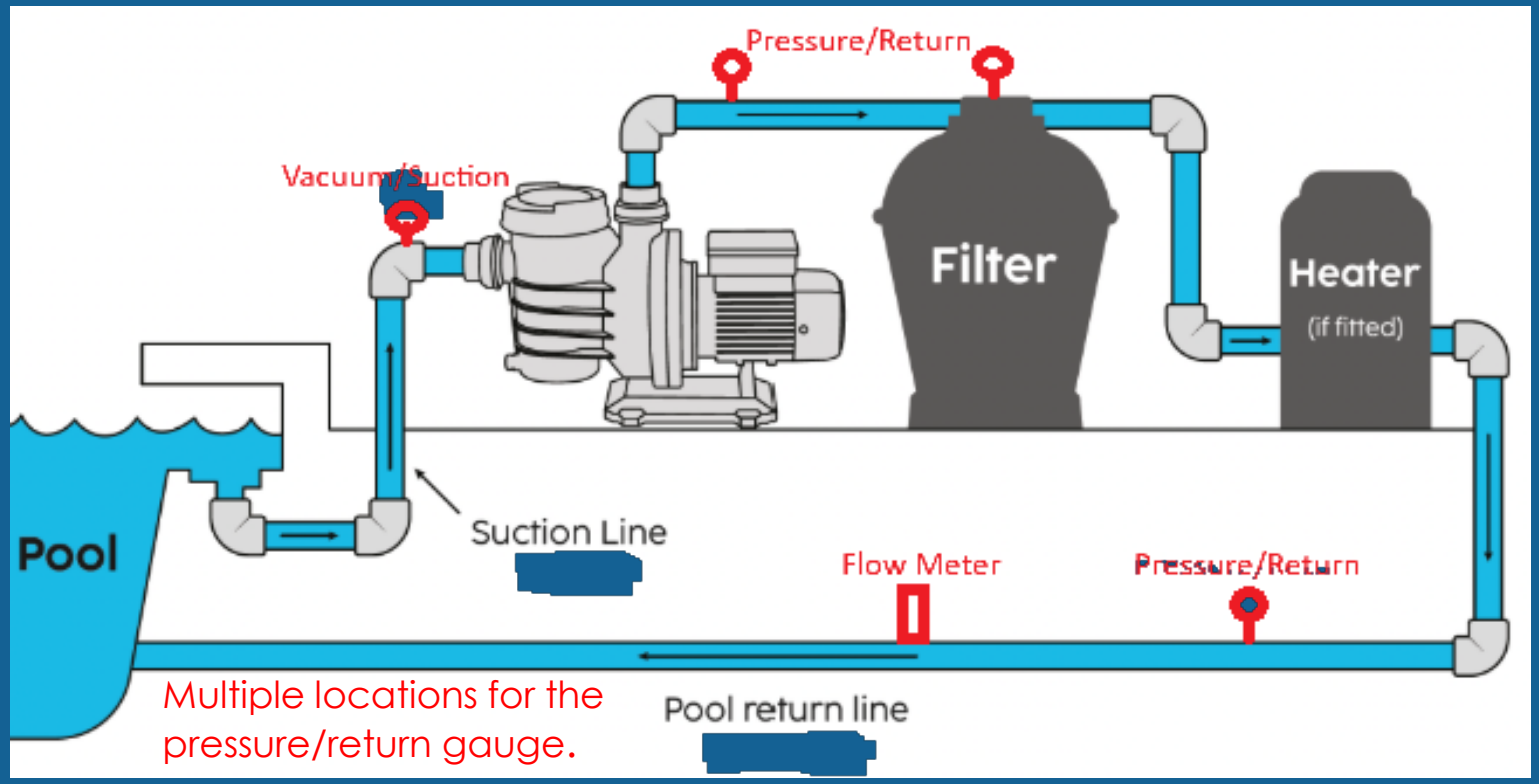


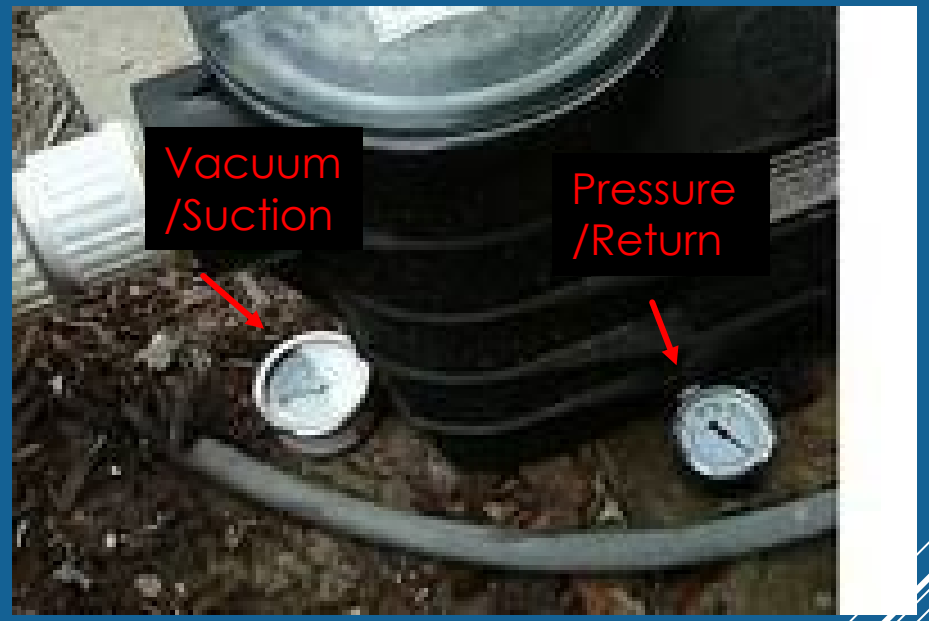
Flow Meter

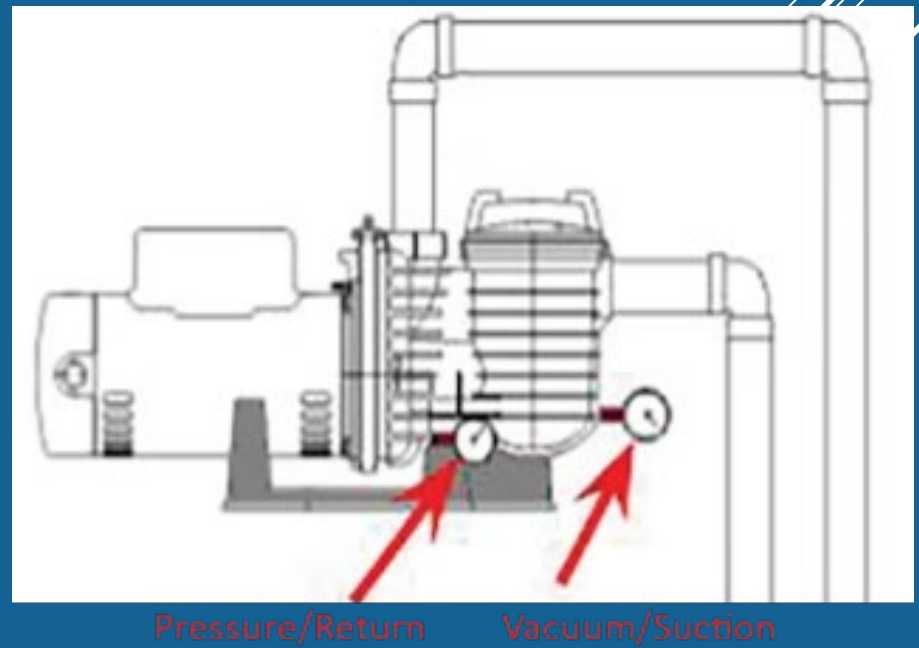
Vacuum Gauge

Pressure Gauge

# GAUGES & LOCATIONS



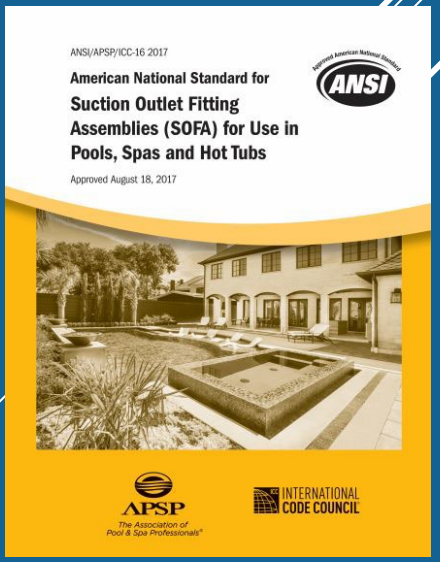
# Suction Outlet Fitting Assemblies (SOFA)

SOFA (Drain Covers) shall be in compliance with ANSI/APSP/ICC-16 2017.

- Suction outlet covers/grates shall be tested and listed by an accredited lab in conformance with ISO 17025 as conforming to ANSI/APSP/ICC-16 2017.
- The following language embossed on drain covers or permanently marked in a location that is visible when installed: *ANSI/APSP/ICC-16 2017, a flow rating "X GPM", and "Life: X Years", and Manufacturer and Model*

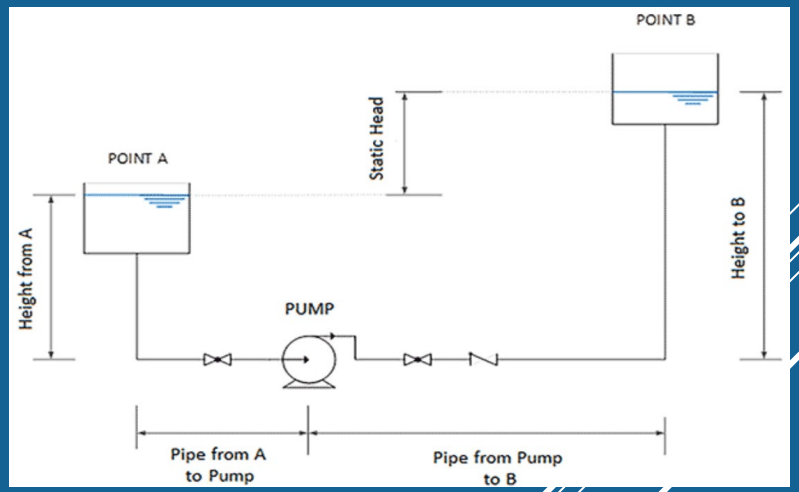

Drain Placement

- Dual cover/grate separation. Two covers/grates shall be separated by a minimum of 3 feet measured from center to center of suction pipes or located on two (2) different planes; i.e., one (1) on the bottom and one (1) on the vertical wall, or one (1) each on two (2) separate vertical walls.
- Be aware of manufacturer's recommendations.



# TOTAL DYNAMIC HEAD

- TDH for existing systems
  - Look at the gauges (vacuum and pressure)
    - Vacuum Gauge Reading: _____inHg x 1.13 = _____
    - Pressure Guage Reading: _____Psi x 2.31 = _____
      - Vacuum Gauge Result + Pressure Guage Result = _____ TDH
        - Example:
          - Vacuum Gauge Reading: 15 inHg x 1.13 = 16.95
          - Pressure Guage Reading: 20 Psi x 2.31 = 46.2
            - 16.95+ 46.2 = 63.15 TDH




**1 PSI = 2.31 Feet of Head / 1 Inch Hg = 1.13 Feet of Head**
**One Foot of Head = 0.433 PSI**

# WHAT IS A TDH READING GOOD FOR?

- One of the most important diagnostic tools in evaluating and maintaining recirculation system.
  - Low flow rates/ inadequate turnover
  - Clogged lines and/or filter
  - Scaling
  - Energy usage
- If the pump is not sized properly to overcome the resistance of the flow of water through the system, then the flow rates will be low and the pool won't turnover in the proper time frame and will impact the proper filtering and disinfection of the water.
- If the resistance of the flow of water through the system is not calculated properly, an incorrect pump may be installed that is too strong for the system and then the suction through the pipes will be higher than allowed and could lead to additional entrapment hazards.

# NEXT STEPS - GAUGES

- Changes will take effect October 1st, 2025
- Install a vacuum and/or pressure gauge if you are missing one per manufactures specifications
- Check that your flow meter is working and installed per manufacture specifications
- Document your flow meter reading after cleaning filter and/or TDH calculation for future plan submission needs when selecting new pump and/or drain covers

**REMINDER – no plan submission is required for the installation of vacuum and/or pressure gauges on the system.**

# NEXT STEPS – DRAIN/SUCTION COVERS

- Changes will take effect October 1st, 2025
- Drain Cover Replacement
  - Take readings from the pressure and vacuum gauges
  - Read the existing pump curve to determine the maximum flow
  - Select the drain cover that is certified to meet or exceed the pump's curve
  - Submit plans with specification sheets to DEHQ for review and approval
  - Install drain cover per manufacture specifications
  - Contact DEHQ to schedule final inspection

**REMINDER - plan submission and approval is required prior to installing new drain cover/suction outlet covers, or replacing existing ones.**

# POOL PLAN CHECK WEBSITE

https://www.sandiegocounty.gov/content/sdc/deh/fhd/pool/poolplancheck.html

# NEW MINOR REMODEL/RENOVATION/SINGLE EQUIPMENT CHANGE TEMPLATE SUBMISSION PACKAGE

**County of San Diego**

**DEPARTMENT OF ENVIRONMENTAL HEALTH & QUALITY**
**PUBLIC SWIMMING POOL PROGRAM**
P.O. BOX 129261, SAN DIEGO, CA 92112-9261
www.sdcountyplancheck.org
Plan Check Scheduling Line: (858) 505-6660

**POOL, SPA, WADER - MINOR REMODEL, RENOVATION, SINGLE EQUIPMENT CHANGE PLAN SUBMITTAL PACKAGE**

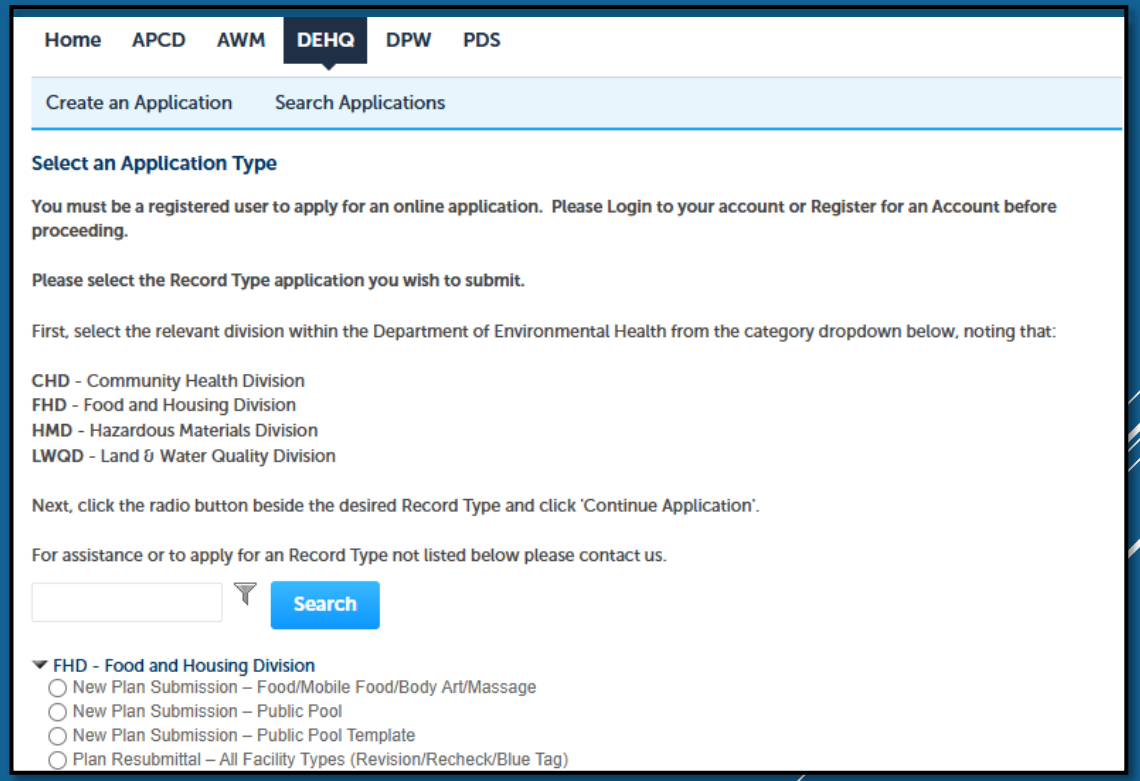
A public pool is defined in the California Building Code, Title 24 as an artificial basin, chamber, or tank constructed or prefabricated with impermeable surfaces that is used or intended to be used, for public swimming, diving, or recreational activities. Any renovation or remodeling to the pool or its ancillary facilities is required to be reviewed by this Department via plan submission (Title 24-3103B).

This packet can be used to draw or sketch your proposed pool/spa/wader Minor Remodel or Renovation scope of work and submit to our department for review and approval. You may draw your own plans using this document as guidance, but all items listed in this document must be represented in your submitted plans. Operators are required to have all plans approved prior to the start of construction work to prevent any additional costs that would be incurred if modifications are needed should changes be noted on the plans. For single equipment changes, unless replacing the equipment with a unit of the exact same make, manufacturer, and model number, a submittal is required. **All items provided on the following pages are required unless otherwise noted.**

**Definitions:**
*"Minor Remodel" means the remodeling of a Body of Water that includes resurfacing or replastering, decking work, above ground equipment changes, enclosure changes, and related ancillary facility modifications.*

*"Renovation" means making modifications to an existing Body of Water that include replacement or changes to the below ground plumbing of a Body of Water, including surge tanks and main drain alterations.*

*"Single Equipment Change" means the replacement of an existing single piece of equipment with a unit of the same function, in the same location, and meets similar specifications as the existing equipment. NOTE: Skimmers, Suction Vacuum Release Systems (SVRS), Drain Covers, and Underwater Lighting are not considered single equipment changes.* ***For a single equipment change, complete page 2 and 3 only (one application per body of water).***



# SCENARIO

- While doing a self-inspection at your pool you notice that a drain cover is slightly damaged.  What do you do?
  - SELF CLOSE
  - Contact your licensed pool service contractor so they can submit the necessary paperwork to DEHQ for review and approval before installing the replacement covers.
  - Ask your contractor for a copy of the approved plans for your record to verify that they obtained the proper approval to install new drain covers.
  - Reminder – If DEHQ staff observe a broken drain cover during an inspection, a Closure notice will be issued due to the entrapment hazard caused by a broken drain cover.  Plan Approval still needed prior to being approved to reopen.

# SCENARIO

- I just replaced drain covers with the exact make and model of drain covers that were installed. Do I need to submit plans?
  - No.  DEHQ will begin enforcement of new procedures October 1st, 2025.
  - Be prepared to show your inspector upon request, previously approved plans with the make and model of drain covers that match the new drain covers that were installed.
  - Ask your contractor for a copy of the approved plans for your record.
  - Submit a request to DEHQ for a copy of previously approved plans.

# SCENARIO

- I just replaced a drain cover with a different make and model of drain covers that were installed. Do I need to submit plans?
  - Yes.  This has been the requirement before the new SOFA standards went into effect.
    - You do NOT need to submit plans if you install the exact same model of the previously approved plans BEFORE October 1st, 2025.  If you install this drain cover after October 1st, 2025 new standards will apply and plan submission will be required.
  - Ask your contractor for a copy of the approved plans for your record.
  - Submit a request to DEHQ for a copy of previously approved plans.

# Contacts

- Plan Check Supervisor - Yazmin Amado-Vu
  - Yazmin.AmadoVu@sdcounty.ca.gov
- Senior Plan Check Specialist - Nolberto Colon-Droz
  - Nolberto.Colon-Droz@sdcounty.ca.gov
- For Plan Check General Inquiries:
  - www.sdcountyplancheck.org – submit an online inquiry
  - (858) 505-6660
- For Health Permit Inquiries:
  - FHDPermits@sdcounty.ca.gov
  - (858) 505-6666
- For General Inquiries:
  - fhdutyeh@sdcounty.ca.gov
  - (858) 505-6900

# TECHNICAL DEEP DIVE – TDH CALCULATIONS, DRAIN SIZING, PLAN CHECK REQUIREMENTS

# TDH, Friction Loss, and Equivalent Length

- When we verify/calculate the TDH, we need to refer to the friction loss/equivalent length and flow/friction loss tables, or any other manufacturer provided information.

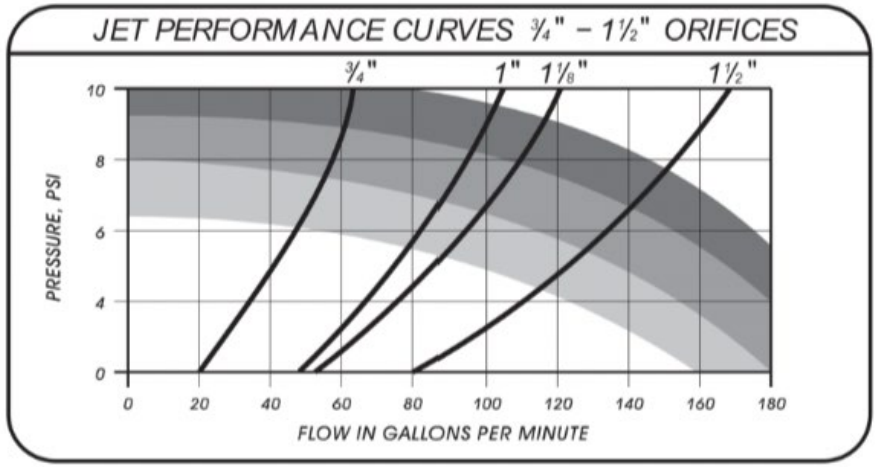
| Friction Loss - Equivalent Length (feet of straight pipe) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Fittings | Nominal Pipe Size (inches) | | | | | | | | | |
| | 1" | 1-1/2" | 2" | 2-1/2" | 3" | 4" | 5" | 6" | 8" | 10" |
| 90 Degree Elbow Long Sweep | 2.5 | 4.0 | 5.7 | 6.9 | 7.9 | 12.0 | 15.5 | 18.0 | 22.0 | 26.0 |
| 90 Degree Elbow Standard Sharp Inside Radius | 5.3 | 7.5 | 8.6 | 9.5 | 11.1 | 13.1 | 16.1 | 19.1 | 24.1 | 27.1 |
| 45 Degree Elbow | 1.4 | 2.1 | 2.6 | 3.1 | 4.0 | 5.1 | 6.0 | 8.0 | 10.6 | 13.5 |
| 90 Degree Street | 6.7 | 8.6 | 10.3 | 12.8 | 16.8 | 20.5 | 25.3 | 29.5 | 33.7 | 37.5 |
| 45 Degree Street | 2.3 | 3.5 | 4.5 | 5.4 | 6.6 | 8.7 | 10.5 | 12.1 | 14.6 | 16.3 |
| Tee - Straight | 1.7 | 2.7 | 4.3 | 5.1 | 6.2 | 8.3 | 10.4 | 12.5 | 16.5 | 17.5 |
| Tee - Branch | 6.0 | 8.0 | 12.0 | 15.0 | 16.0 | 22.0 | 26.0 | 32.7 | 49.0 | 57.0 |
| Coupling | 1.0 | 1.3 | 1.5 | 2.0 | 2.8 | 3.3 | 3.9 | 4.5 | 5.1 | 5.8 |
| Male / Female Adapter | 2.0 | 3.5 | 4.5 | 5.5 | 6.5 | 9.0 | 11.5 | 14.0 | 17.1 | 20.3 |
| Gate Valve - Fully Open | 0.6 | 1.2 | 1.5 | 2.0 | 3.0 | 3.5 | 4.0 | 4.5 | 5.1 | 5.7 |
| Swing Check Valve | 11.2 | 15.2 | 19.1 | 22.0 | 27.0 | 38.0 | 50.0 | 70.0 | 85.5 | 101.0 |
| Globe Valve - Open | 27.0 | 44.0 | 57.0 | 66.0 | 85.0 | 110.0 | 140.0 | 170.0 | 201.0 | 233.0 |

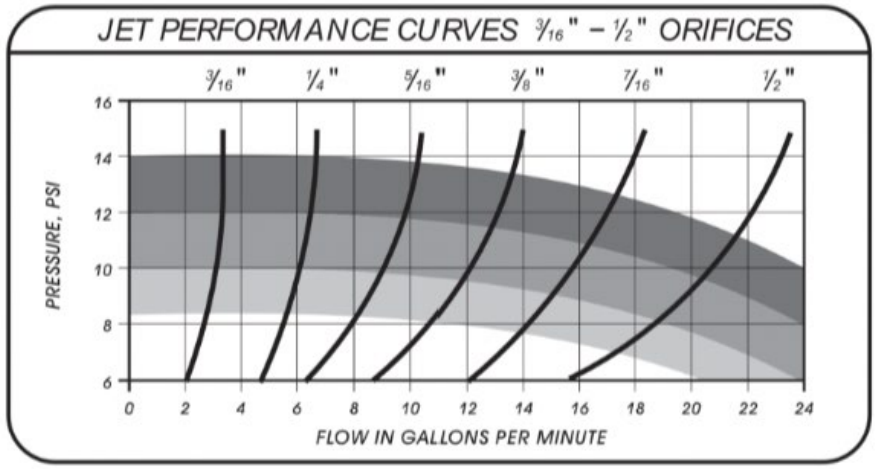
**Flow and Friction Loss Per Foot**
**Schedule 40 PVC Pipe**

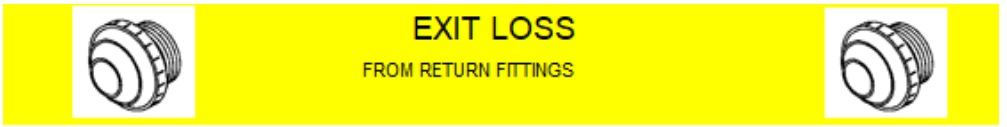
| | Velocity - Feet Per Second | | | | | |
|---|---|---|---|---|---|---|
| Pipe Size | 6 fps | | 8 fps | | 10 fps | |
| 1" | 16 gpm | 0.14' | 21 gpm | 0.23' | 26 gpm | 0.35' |
| 1.5" | 37 gpm | 0.08' | 50 gpm | 0.14' | 62 gpm | 0.21' |
| 2" | 62 gpm | 0.06' | 82 gpm | 0.10' | 103 gpm | 0.16' |
| 2.5" | 88 gpm | 0.05' | 117 gpm | 0.09' | 146 gpm | 0.13' |
| 3" | 136 gpm | 0.04' | 181 gpm | 0.07' | 227 gpm | 0.10' |
| 4" | 234 gpm | 0.03' | 313 gpm | 0.05' | 392 gpm | 0.07' |
| 6" | 534 gpm | 0.02' | 712 gpm | 0.03' | | |

# TDH, Friction Loss

- Orifices:




| 3/8" (.375 ID) | | |
|---|---|---|
| GPM | VEL. FPS | EXIT HD. FT. |
| 1 | 2.91 | .13 |
| 2 | 5.81 | .53 |
| 3 | 8.71 | 1.18 |
| 4 | 11.62 | 2.10 |
| 5 | 14.53 | 3.28 |
| 6 | 17.43 | 4.72 |
| 7 | 20.34 | 6.43 |
| 8 | 23.24 | 8.40 |
| 9 | 26.15 | 10.63 |
| 10 | 29.05 | 13.12 |

| 1/2" (.50 ID) | | |
|---|---|---|
| GPM | VEL. FPS | EXIT HD. FT. |
| 5 | 8.17 | 1.04 |
| 6 | 9.80 | 1.49 |
| 7 | 11.44 | 2.03 |
| 8 | 13.07 | 2.66 |
| 9 | 14.71 | 3.36 |
| 10 | 16.34 | 4.15 |
| 11 | 17.98 | 5.02 |
| 12 | 19.61 | 5.98 |
| 13 | 21.24 | 7.02 |
| 14 | 22.88 | 8.14 |
| 15 | 24.51 | 9.34 |
| 16 | 26.15 | 10.63 |
| 17 | 27.78 | 12.00 |
| 18 | 29.41 | 13.45 |
| 19 | 31.05 | 14.99 |
| 20 | 32.68 | 16.61 |

| 3/4" (.75 ID) | | |
|---|---|---|
| GPM | VEL. FPS | EXIT HD. FT. |
| 5 | 3.63 | .21 |
| 6 | 4.36 | .30 |
| 7 | 5.08 | .41 |
| 8 | 5.81 | .53 |
| 9 | 6.54 | .67 |
| 10 | 7.27 | .82 |
| 11 | 7.99 | .99 |
| 12 | 8.72 | 1.18 |
| 13 | 9.44 | 1.39 |
| 14 | 10.17 | 1.61 |
| 15 | 10.89 | 1.85 |
| 16 | 11.62 | 2.10 |
| 17 | 12.35 | 2.37 |
| 18 | 13.07 | 2.66 |
| 19 | 13.80 | 2.96 |
| 20 | 14.53 | 3.28 |
| 21 | 15.25 | 3.62 |
| 22 | 15.98 | 3.97 |
| 23 | 16.70 | 4.34 |
| 24 | 17.43 | 4.72 |
| 25 | 18.16 | 5.13 |
| 26 | 18.88 | 5.54 |
| 27 | 19.60 | 5.98 |
| 28 | 20.34 | 6.43 |
| 29 | 21.06 | 6.90 |
| 30 | 21.79 | 7.38 |

| 7/8" (.875 ID) | | |
|---|---|---|
| GPM | VEL. FPS | EXIT HD. FT. |
| 10 | 5.34 | .44 |
| 11 | 5.87 | .54 |
| 12 | 6.40 | .64 |
| 13 | 6.94 | .75 |
| 14 | 7.47 | .87 |
| 15 | 8.00 | 1.00 |
| 16 | 8.54 | 1.13 |
| 17 | 9.07 | 1.28 |
| 18 | 9.60 | 1.43 |
| 19 | 10.14 | 1.60 |
| 20 | 10.67 | 1.77 |
| 21 | 11.21 | 1.95 |
| 22 | 11.74 | 2.14 |
| 23 | 12.27 | 2.34 |
| 24 | 12.81 | 2.55 |
| 25 | 13.34 | 2.77 |
| 26 | 13.87 | 2.99 |
| 27 | 14.41 | 3.23 |
| 28 | 14.94 | 3.47 |
| 29 | 15.47 | 3.72 |
| 30 | 16.01 | 3.98 |
| 31 | 16.54 | 4.25 |
| 32 | 17.08 | 4.53 |
| 33 | 17.61 | 4.82 |
| 34 | 18.14 | 5.11 |
| 35 | 18.68 | 5.42 |
| 36 | 19.21 | 5.74 |
| 37 | 19.74 | 6.06 |
| 38 | 20.28 | 6.39 |
| 39 | 20.81 | 6.73 |
| 40 | 21.34 | 7.08 |

| 1.0" (1.0 ID) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| GPM | VEL. FPS | EXIT HD. FT. | GPM | VEL. FPS | EXIT HD. FT. | GPM | VEL. FPS | EXIT HD. FT. |
| 15 | 6.13 | .58 | 27 | 11.03 | 1.89 | 39 | 15.93 | 3.95 |
| 16 | 6.54 | .66 | 28 | 11.44 | 2.03 | 40 | 16.34 | 4.15 |
| 17 | 6.95 | .75 | 29 | 11.85 | 2.18 | 41 | 16.75 | 4.36 |
| 18 | 7.35 | .84 | 30 | 12.26 | 2.34 | 42 | 17.16 | 4.58 |
| 19 | 7.76 | .94 | 31 | 12.66 | 2.49 | 43 | 17.57 | 4.80 |
| 20 | 8.17 | 1.04 | 32 | 13.07 | 2.66 | 44 | 17.98 | 5.02 |
| 21 | 8.58 | 1.14 | 33 | 13.48 | 2.83 | 45 | 18.38 | 5.25 |
| 22 | 8.99 | 1.26 | 34 | 13.89 | 3.00 | 46 | 18.79 | 5.49 |
| 23 | 9.40 | 1.37 | 35 | 14.30 | 3.18 | 47 | 19.20 | 5.73 |
| 24 | 9.81 | 1.50 | 36 | 14.71 | 3.36 | 48 | 19.61 | 5.98 |
| 25 | 10.21 | 1.62 | 37 | 15.12 | 3.55 | 49 | 20.02 | 6.23 |
| 26 | 10.62 | 1.75 | 38 | 15.52 | 3.75 | 50 | 20.43 | 6.49 |

Step 1) determine pool gpm (not including water feature) Step2) size of the eyeball desired Step 3) how many eyeballs used in the pool Step 4) divide step 3 into step 1 to get gpm per eyeball
Step 5) using the chart find exit loss for gpm per eyeball and enter that figure in EXIT LOSS on Page 1
Note: only enter the exit loss for 1 eyeball, not the quantity you get in step 3.

# TDH, Friction Loss

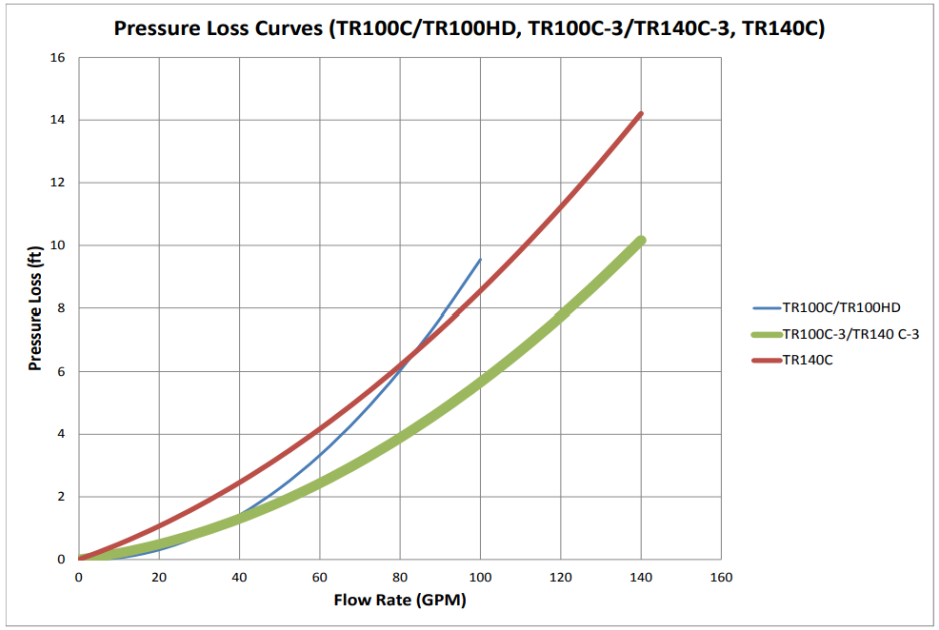
- Skimmer:

**Renegade Vinyl Liner Skimmers, Standard Mouth [2]**

| | | | |
|---|---|---|---|
| 540-5700 | 540-5720 | 540-8400 | 540-8420 |
| 540-8430 | 540-8440 | | |

[2] Round white, light gray, dark gray, black and tan lids only. Tested and Listed with a maximum flow rate of 75 GPM. Head loss 1.5 ft. Certified for Pool use only.

- Filter:




- Heater:

For deck-level heater installations, the Water Pressure switches are factory set at 3.00 psi (20.6 kPa). **Note: See Below Pool Level Installation, on page 21.** If the

**ENGINEERING DATA**

UNITS OF MEASURE

| | |
|---|---|
| Amperage = | Watts / Volts |
| Watts = | Volts x Amperage |
| WHP = | Water Horsepower (output HP of pump) = g.p.m x total head / 3960 |
| HP input (to motor) = | KW input x 1.341 |
| Total Head = | Discharge head + Pumping water level (ft) |
| Discharge Head = | Discharge Pressure (PSI) x 2.31 ft. of head |

# Suction Head Loss - Example

Amount of Fittings x Equivalent Length = Total Length in Ft

- Suction - 2″
  - Skimmer - 5: EPL = 5 x 1.5′ = 7.5′
  - Elbows - 2: EPL = 2 x 8.6′ = 17.2′
  - Tees - 5: EPL = 5 x 4.3 = 21.5′
  - Branch Tee: - 1 = 1 x 16′ = 16′
  - Pipe length: 25′ + 5′ + 15′ + 15′ + 10′ + 8′ + 75′ + 30′ + 17.2′ + 21.5+ 16′ + 7.5′ = 245.2′
    - Head/Friction Loss = 245.2′ x 0.06 = 14.712′

- Suction - 3″
  - Elbows - 5: Equivalent Pipe Length (EPL) = 5 x 11.1′ = 55.5′
  - Tees - 2: EPL = 2 x 6.2′ = 12.4′
  - Valves - 3: EPL = 3 x 3′ = 9′
  - Main Drains: EPL = 2 x 1.3′ = 2.6′
  - Pipe length = 5′ + 2.5′ + 15′ + 10′ + 3′ + 55.5′ + 12.4′ + 9′ + 10′ + 7′ + 12′ + 2′ + 2.6′ = 196′
    - Head/Friction Loss = 196′ x 0.04 = 7.84′

- Total SUCTION Head Loss: 14.712′ + 7.84′ = 22.552′

**Flow and Friction Loss Per Foot**
**Schedule 40 PVC Pipe**

| Pipe Size | Velocity - Feet Per Second | | | | | |
|---|---|---|---|---|---|---|
| | 6 fps | | 8 fps | | 10 fps | |
| 1" | 16 gpm | 0.14' | 21 gpm | 0.23' | 26 gpm | 0.35' |
| 1.5" | 37 gpm | 0.08' | 50 gpm | 0.14' | 62 gpm | 0.21' |
| 2" | 62 gpm | 0.06' | 82 gpm | 0.10' | 103 gpm | 0.16' |
| 2.5" | 88 gpm | 0.05' | 117 gpm | 0.09' | 146 gpm | 0.13' |
| 3" | 136 gpm | 0.04' | 181 gpm | 0.07' | 227 gpm | 0.10' |
| 4" | 234 gpm | 0.03' | 313 gpm | 0.05' | 392 gpm | 0.07' |
| 6" | 534 gpm | 0.02' | 712 gpm | 0.03' | | |

Suction Head Loss + Return Head Loss = Total Dynamic Head

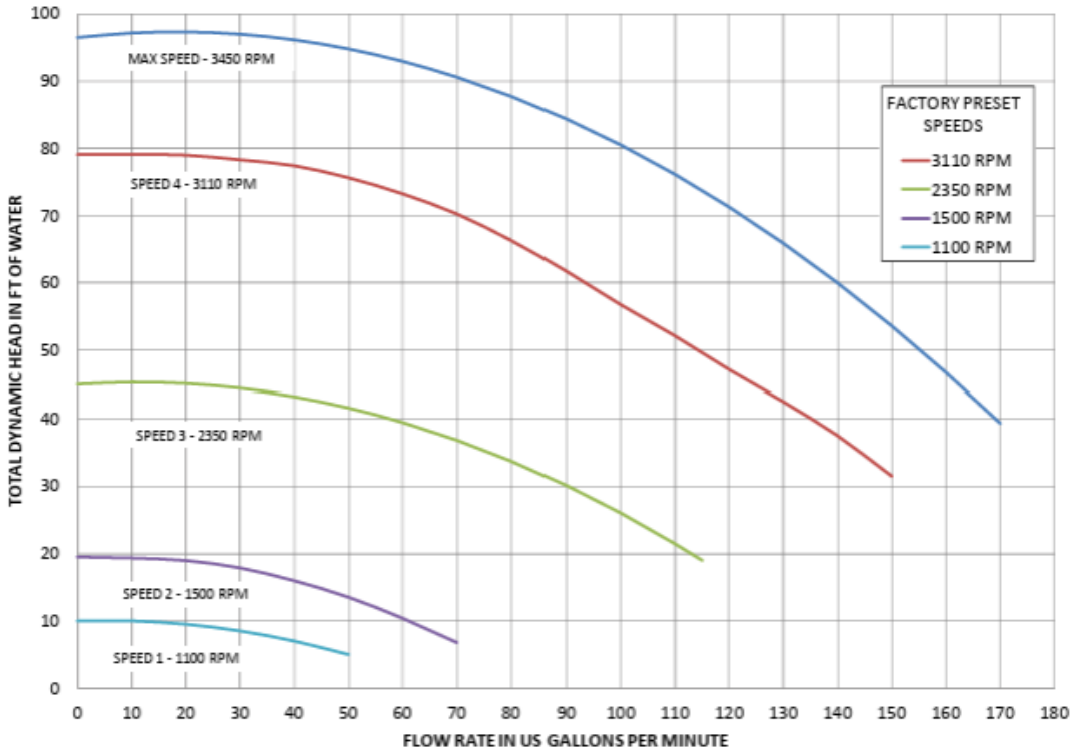
# TDH – Existing/Minor Remodel Systems

- TDH for existing systems
  - Look at the gauges (vacuum and pressure)
    - Vacuum Gauge Reading: _____inHg x 1.13 = _____
    - Pressure Guage Reading: _____Psi x 2.31 = _____
      - Vacuum Gauge Result + Pressure Guage Result = _____ TDH
        - Example:
          - Vacuum Gauge Reading: 15 inHg x 1.13 = 16.95
          - Pressure Guage Reading: 20 Psi x 2.31 = 46.2
            - 16.95+ 46.2 = 63.15 TDH

**1 PSI = 2.31 Feet of Head / 1 Inch Hg = 1.13 Feet of Head**
**One Foot of Head = 0.433 PSI**

# TDH & Pump - Existing

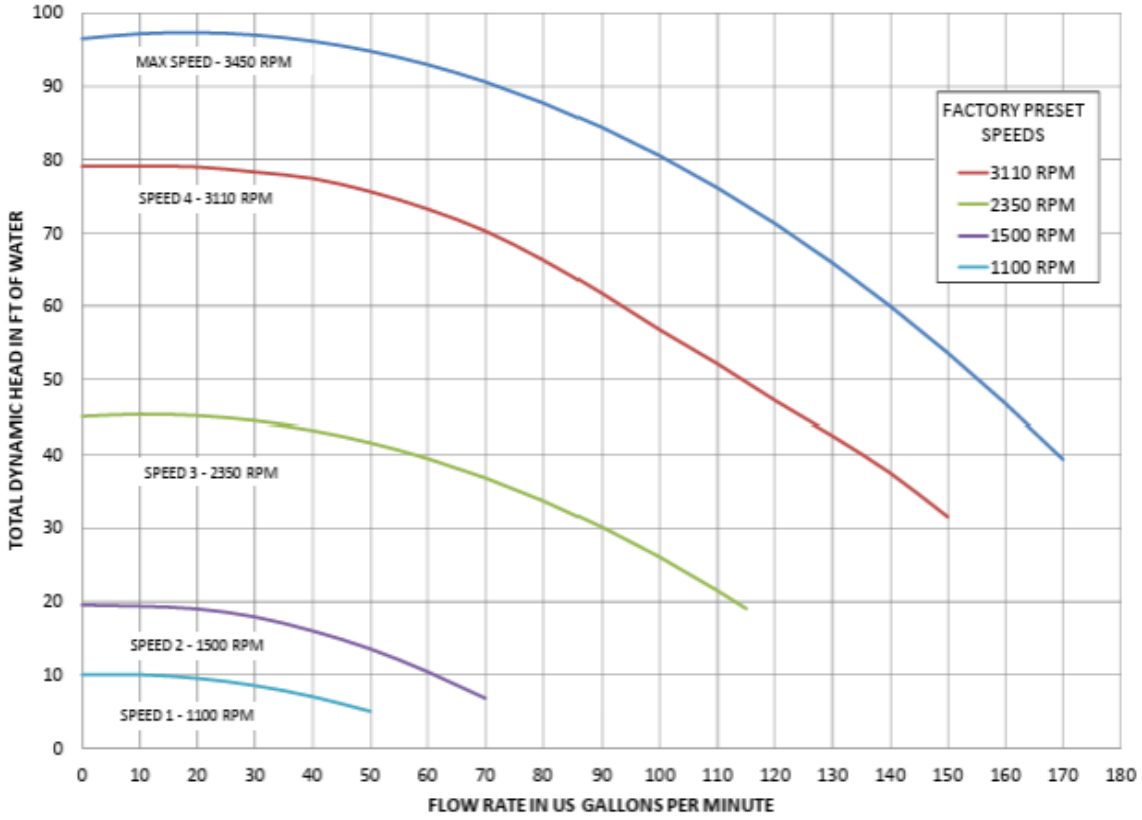
- Using the TDH from the previous example (63.15 TDH) and if the designed flow rate is 80 GPM, then the pump would need to be set at approximately 3110 RPM.




**Note: IntelliFlo VS+SVRS minimum speed is 1100 RPM**

# Main Drain Sizing – New or Existing

- Sizing the main drain covers would require the maximum pump flow rate.
  - This would mean to either size the covers to the max flow rate based on the pump curve at the lowest TDH possible. OR,
  - Run the existing pump at the highest possible RPM, with a clean filter, and check the flow meter for the max flow rate (before cavitation).

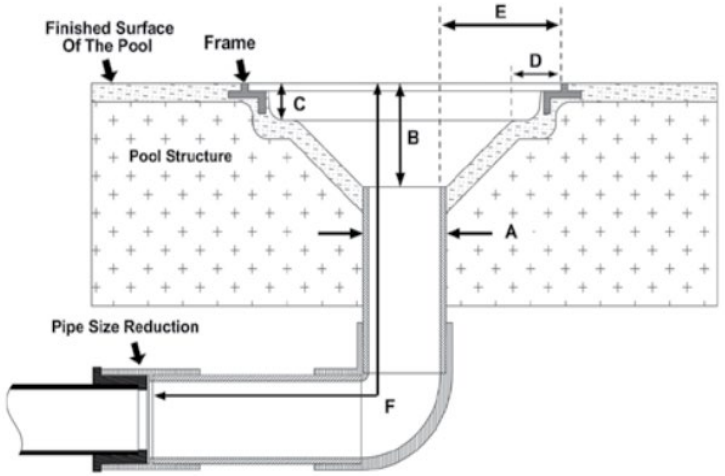



**Note: IntelliFlo VS+SVRS minimum speed is 1100 RPM**

# Main Drain Installation

- Due to SOFA standards, the covers, rings, and sumps would need to meet manufacturer installation requirements.
- Any reduction of suction piping size within the 16" length from top of cover would need to be identified on plans. For example, a suction split going from a 2.5" to a 2' within the 16" length.
- Sumps may be required to be altered to meet manufacturer specifications.
- If existing conditions do not allow for sump modifications, then an alternate cover would need to be proposed (sumpless).
- If more than one suction outlet is under a cover, then possibly providing a second set of sumps to separate the suction outlets.

Figure 5: Sump specifications




A. Specified PVC Pipe Size
B. Minimum Sump Depth
C. Minimum Ledge Depth
D. Maximum Ledge Width
E. Minimum Pipe Offset
F. Minimum Length Before Reduction

# Plan Check Updates – TDH & SOFAs

- Due to ANSI/APSP/ICC-7 2020, the design flow rate and maximum flow rate would be determined in conjunction with the respective total dynamic heads (TDHs).
  - Previously, a system was sized to presumptive TDH based on code.

- Plan Review & Inspection:
  - New/Major Remodel – we will require the design flow rate to size the system, and the maximum flow rate to size the main drain covers.
  - Renovation/Minor Remodel – we will require the maximum flow rate to size the main drain covers.
    - A flow meter, a vacuum gauge (pre-pump), and a pressure gauge (post-pump) will be required to be installed to verify flow rate and TDH. Code section 3125B.2.

# Plans - Total Dynamic Head – New/Major Builds

- Pumps & TDHs
  - For new/major remodeled BOWs, the pool designer/contractor would show the designed flow rate and TDH based on the piping and equipment.
  - The TDH calculation would be required to be shown on plan.
  - Or provide the TDH piping and fittings schedule along with piping lengths so we can verify the proposed TDH.
    - With the provided pipe sizes and lengths, elbows, tees, valves, filter(s), and heater(s) we would then verify the TDH.
      - We need to consider the following:
        - Every pipe size will have a different friction loss per foot
        - Every fitting and fitting size will have a different friction loss per foot
        - Every filter will have a different friction loss based on manufacturer
        - Every heater will have a different friction loss based on manufacturer
- Once the TDH is verified, we can look at the pump curve and confirm the proposed pump matches the designed flow rate at that specific TDH.

# Plans – New/Major Remodels

- What we need to see on plans for new/major renovation:
  - Design flow rate
    - System sized to design flow rate (except MDs)
  - TDH for system – show calculation on how TDH was determined
    - Plan Check would verify this
    - Plan Check would verify the pump to the determined TDH to make sure it meets of exceeds the designed flow rate
  - Max flow rate (theoretical)
    - Size MD covers to max flow rate
    - Verified at time of final (actual)
  - A flow meter, a vacuum gauge (pre-pump), and a pressure gauge (post-pump) will be required to be installed to verify flow rate and TDH. Code section 3125B.2.

# Plans – Existing/Minor Remodel

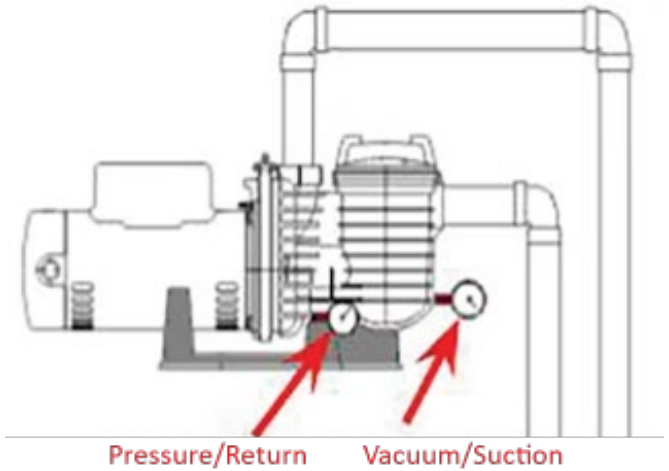
- What we need to see on plans for minor/resurfaces/splits/pump changes
  - Design flow rate (as typically shown on plans)
  - TDH for system
    - Based on vacuum and pressure gauges
  - Max flow rate (theoretical or actual)
    - Size MD covers to max flow rate
    - Verified at time of final (actual)
      - We are hoping to have the actual max flow rate at time of plan submittal
  - Flow meter, vacuum gauge, and pressure gauge will be required and will be assessed during a remodel review of a BOW (dependent on scope of work).
    - Anytime there is some type of plumbing, drain cover, equipment remodel the pressure gauges will be required.

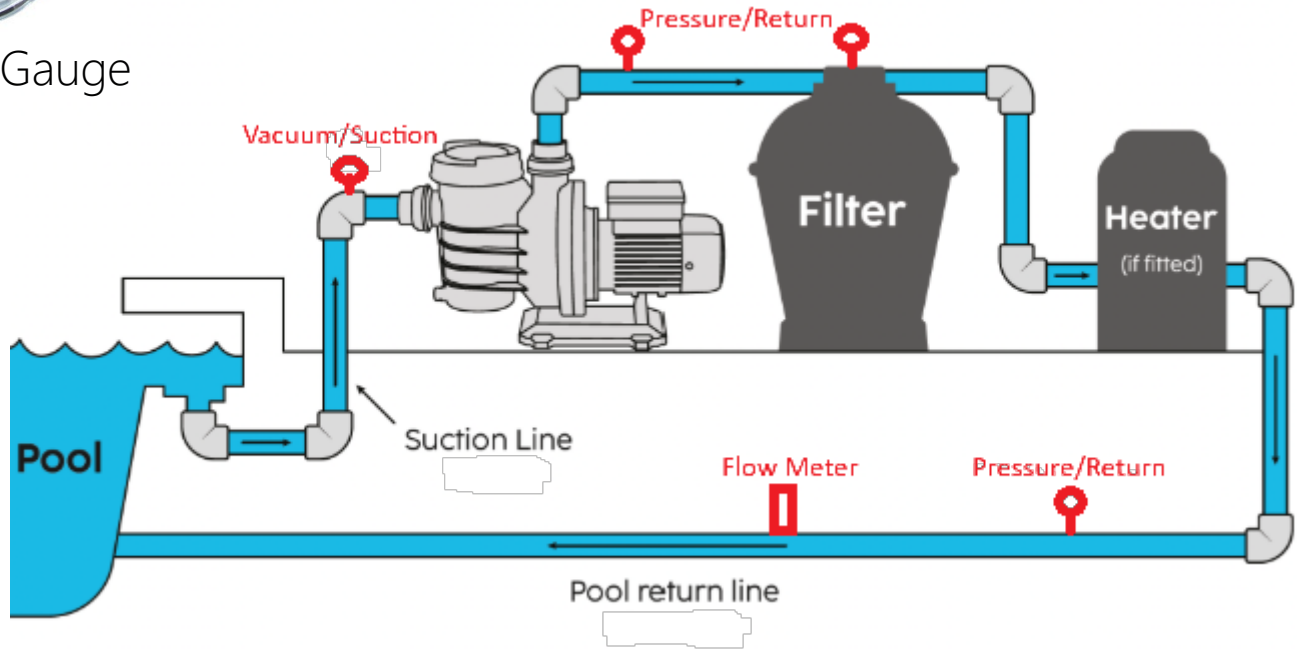
# TDH & Flow Rate – Inspection

- We would verify the TDH and flow rate and final inspection reading the gauges and flow meter.
- Main Drains would need to match plans and exceed the max flow rate of pump.


Vacuum Gauge


Pressure Gauge



# QUESTIONS

# APSP-16 HAIR TEST

# APSP-16 HAIR TEST

# APSP-16 BODY BLOCK TEST