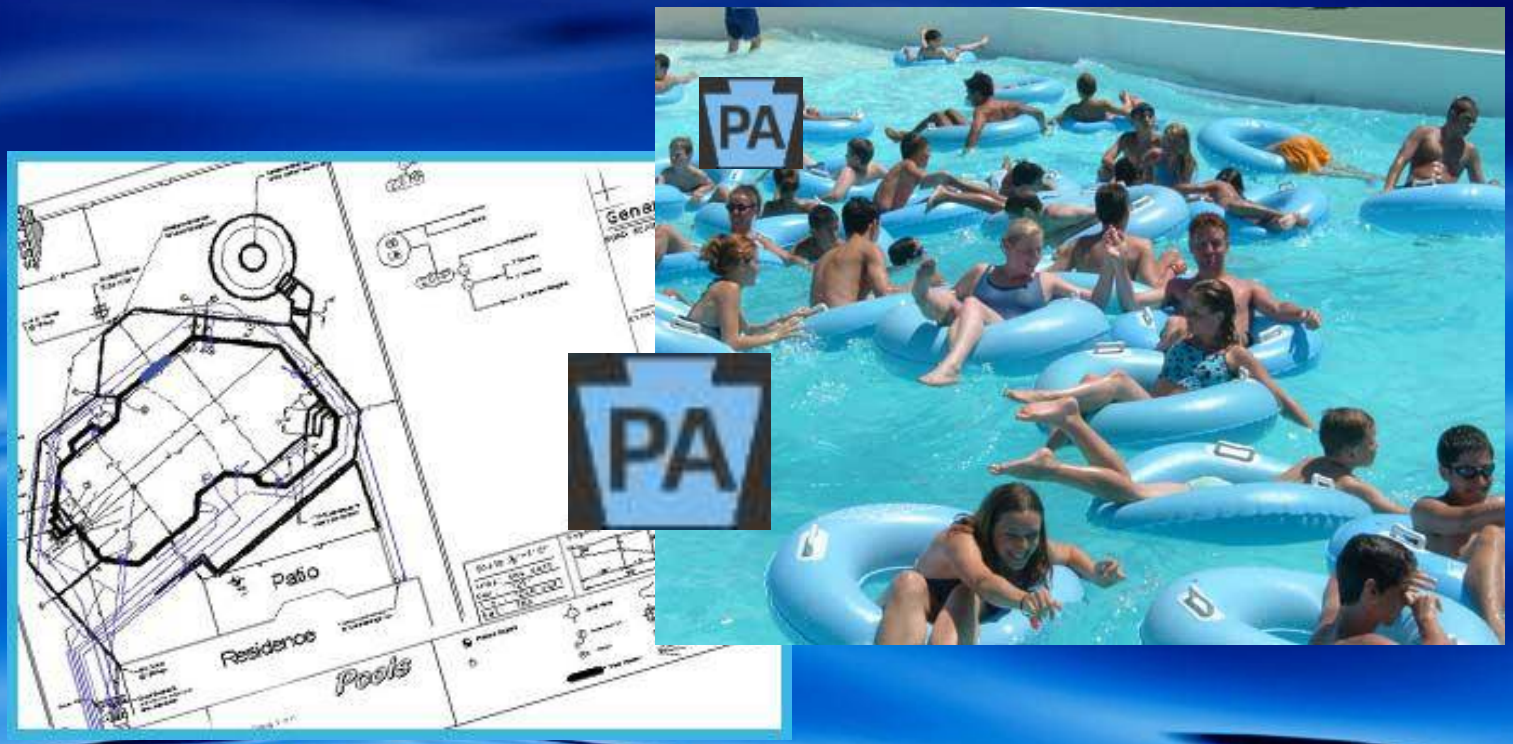
New England Municipal Building Officials – Preventing Drowning and Suction Entrapment through Code Compliance



2009 International Family of Codes Swimming Pools and Spas

2009 International Building Code

2009 International Residential Code

2009 International Existing Building Code

2009 International Mechanical Code

2009 International Plumbing Code

2009 International Energy Conservation Code

2009 International Fire Code

2008 National Electrical Code (NFPA-70)

- Connecticut
- Maine
- Massachusetts
- New Hampshire
- Rhode Island
- Vermont

Connecticut State Building Code

2005 Connecticut Supplement which includes the 2009 Amendment (effective August 1, 2009) to the 2005 State Building Code

- **2003 International Building Code**
- **2003 International Residential Code**
- 2003 International Existing Building Code
- 2003 International Mechanical Code
- 2003 International Plumbing Code
- 2006 International Energy Conservation Code *(adopted with changes-effective August 1, 2009)*
- ICC/ANSI A117.1-2003 Accessible and Usable Buildings and Facilities
- 2005 National Electrical Code (NFPA-70)

CT - continued

- Still in old 2003 language regarding suction entrapment
- State is in process of code revision
- Added section on closing pool if drain cover missing, broken or loose
- 36 “ drain separation is measured from inside cover to inside cover instead of centers

October 2013

- 2013 amends the 2009 which amended the 2005 State Building Code

- What does that mean !!!!

CT State Building Code – 2013 Amendment to 2005 Supplement

2003 International Building Code

2009 International Residential Code

2003 International Mechanical Code

2003 International Plumbing Code

2009 International Energy Conservation Code

2011 National Electrical Code (NFPA-70)

Maine MUBEC

Adopted Building Code December 1, 2010

2009 I-Code Family, but have not adopted any of the IRC Appendices, including G

IBC Swimming Pools 3109, which references the ANSI/APSP-7 Standard

State statutes says they must comply with VGB, Title 22, paragraph 2666

Massachusetts

- Office of Public Safety and Security
- August 2010, 8th edition of Building Code with separate amendments
- 2009 IBC and IRC
- Uses the I-Codes and then amendments can be downloaded off the web site

New Hampshire

- Department of Safety
- April 1, 2010
- 2009 I - Codes with amendments

Rhode Island

- Department of State, Secretary of State, Rhode Island State Building and Fire Code Regulations

- Building Code Standards Committee, in accordance with the rule making authority of Title 23 Health and Safety, Chapter 23-27.3 of State Building Code, adopted the provisions of the International Code Council family of codes, 2009 edition, effective July 1, 2010.

Vermont

- Follows 2012 I-code language
- Local jurisdictions have authority on swimming pool and spa construction
- 2012 I-Codes for Pools and Spas are the same as 2009 I-Codes

2009 International Family of Codes

2009 International Building Code

2009 International Residential Code

2009 International Existing Building Code

2009 International Mechanical Code

2009 International Plumbing Code

2009 International Energy Conservation Code

2009 International Fire Code

2008 National Electrical Code (NFPA-70)

Section 3109 - Swimming Pool Enclosures and Safety Devices

3109.1 General
3109.2 Definitions
3109.3 Public swimming pools
3109.4 Residential swimming pools
3109.5 Entrapment Protection

3109.2 Definitions

Swimming pools:

Use:

Swimming, recreational bathing and wading

Water depth: Over 24"

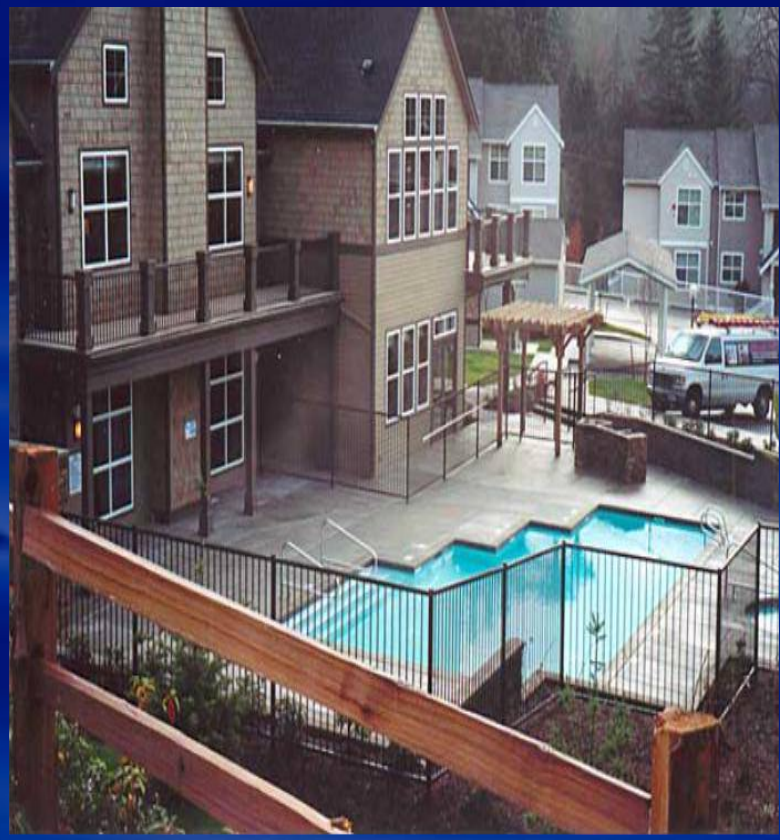
Includes:

In-ground, above-ground, on-ground pools, hot tubs, spas and fixed in place wading pools

3109.3 Public Swimming Pools

Public swimming pools shall be….

- Completely enclosed by fence or screen 4 feet high (health = 5ft)
- 4” sphere can not pass through
- Gates must be self-closing and self latching



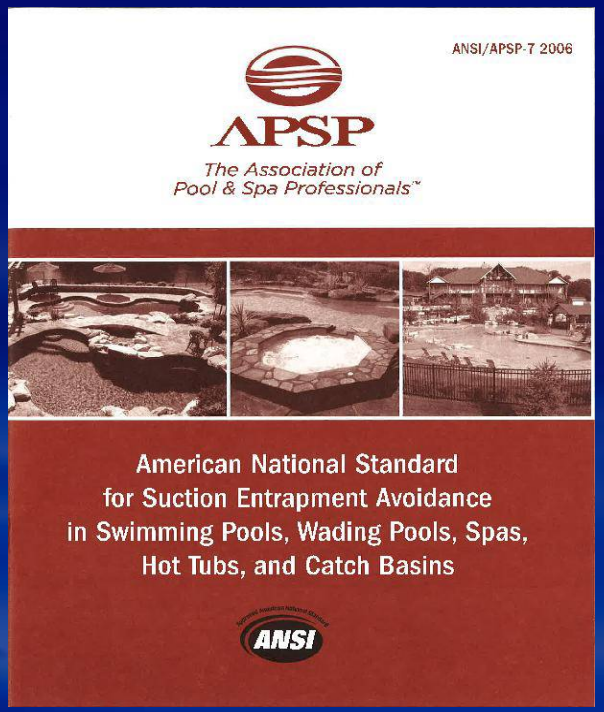
3109.4 – Residential Swimming Pool

- The wording is exactly the same as the IRC, Appendix G. We will discuss in that section.
- Point of interest – some other states do not adopt Appendices, but follow the IBC barrier language
- Slightly longer explanation on non-pedestrian gates in IBC

3109.5 Entrapment Avoidance

3109.5 Suction outlets shall be designed and installed in accordance with ANSI/APSP-7.

Review of standard presented in Residential section



3109.5 Entrapment Avoidance

ANSI/APSP–7 2006 Standard for Suction Entrapment Avoidance in Swimming Pools, Wading Pools, Spas, Hot Tubs, and Catch Basins

VGB requirements and the ANSI/APSP-7 standard are consistent in their suction entrapment prevention requirements

2009 International Residential Code

Appendix G - Swimming Pools, Spas and Hot Tubs

Barrier section of 3109 matches the barrier section of Appendix G

Appendix G - Swimming Pools, Spas and Hot Tubs

AG 101 - General

AG 102 - Definitions

AG 103 - Swimming Pools

AG 104 - Spas and Hot Tubs

AG 105 - Barrier Requirements

AG 106 - Entrapment Protection for Swimming Pool and Spa Suction Outlets

AG 107 - Abbreviations

AG 108 - Standards

2009 IRC - Appendix G

AG101 – General

Design & construction…on the lot of 1 & 2-family dwellings

2009 IRC - Appendix G

AG101.2 Pools in Flood Hazard Areas

AG101.2.1 Designated floodways - Documentation must be submitted which demonstrates construction will not increase flood elevation

AG101.2.2 Pools located where floodways have not been designated. Must provide a floodway analysis.....will not increase flood elevation more than 1 foot....

2009 IRC - Appendix G

AG 102 – Definitions

Swimming Pool:

"Any structure intended for swimming or recreational bathing that contains water over 24 inches deep. This includes in-ground, above-ground, and on-ground swimming pools, hot tubs and spas."

24 inches ??

2009 IRC - Appendix G

AG 103 Swimming Pools

In-ground pools to be designed and constructed in conformance with ANSI/NSPI-5 as listed in AG 108 (*Standard for Residential In-ground Swimming Pools*)

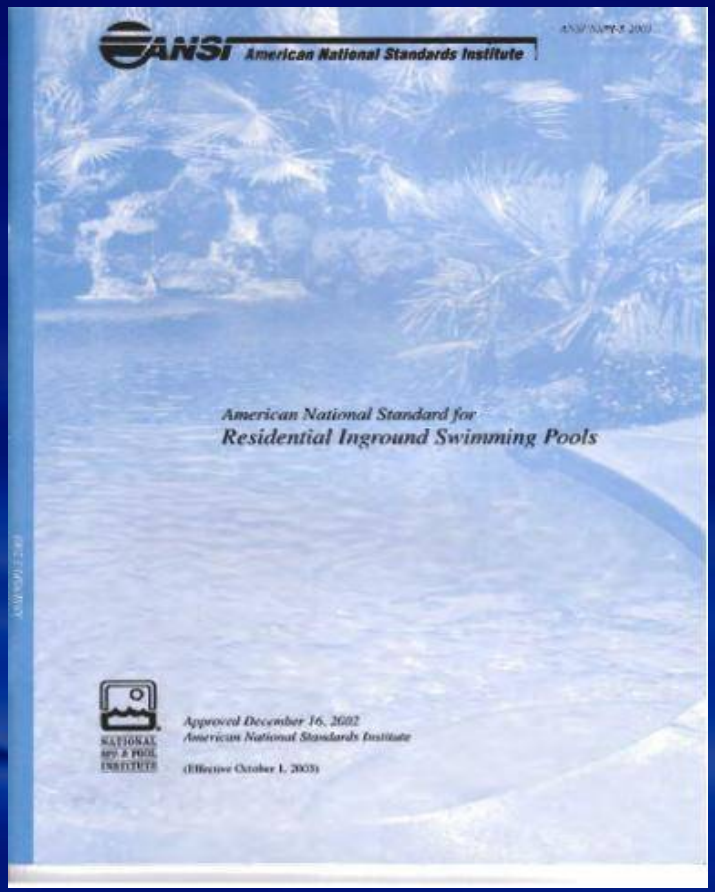
2009 IRC - Appendix G

AG103 – Swimming Pools

AG 103.1 – In-ground Pools

Designed and constructed in conformance with ANSI/NSPI-5

(Standard for Residential In-Ground Swimming Pools)



2009 IRC - Appendix G

AG103 – Swimming Pools

AG 103.2 – Above-Ground and On-Ground Pools shall be designed and constructed in conformance with ANSI/NSPI-4.

(Standard for Aboveground/On-ground Residential Pools)

2009 IRC - Appendix G

AG103 – Swimming Pools

AG 103.3 – Pools in Flood Hazard Areas. In flood hazard areas established by Table R301.2(1), pools in coastal high hazard areas shall be designed and constructed in conformance with ASCE 24

2009 IRC - Appendix G

- AG104 - Spas and Hot Tubs
  - AG104.1 Permanently installed spas and hot tubs
    - Designed and constructed in conformance with ANSI/NSPI-3 (Standard for Permanently Installed Residential Spas

2009 IRC – Appendix G

AG104.2 Portable spas and hot **tubs**

Designed and constructed in conformance with ANSI/NSPI-6

(Standard for Residential Portable Spas)

Portable Spas and Tubs

- Important to remember that these are in a category of their own. They are seen more as an appliance and do not have the same requirements as swimming pools.
- Circulation and suction outlets are engineered by manufacturer.
- Circulation and suction outlets are engineered by manufacturer in accordance with UL 1563 Section 36 (suction openings).

2009 IRC - Appendix G

AG105 - Barrier Requirements

AG105.1 Application. Controls design to protect against drowning by restricting access.

Barriers Required to Prevent Access

Barrier Requirements – AG 105

AG105.2 Outdoor swimming pool

In-ground, above ground, on ground

Swimming pool, hot tub or spa

Must comply with the following 10 items:

Barrier Requirements – AG 105.2

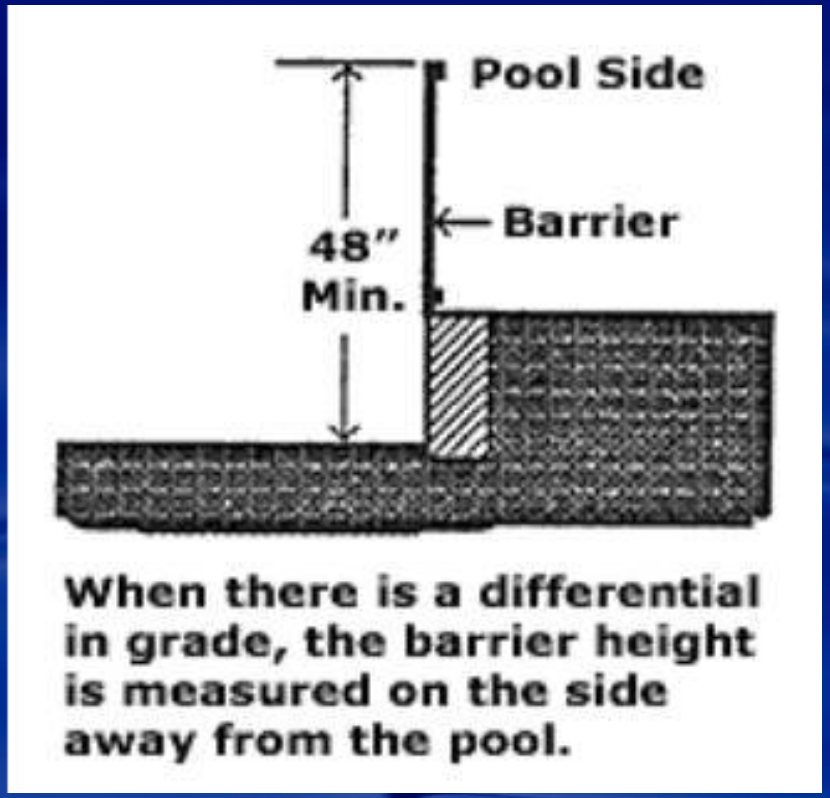
1. Height: 48" min. from outside
   2" max. opening at bottom (4" above ground)

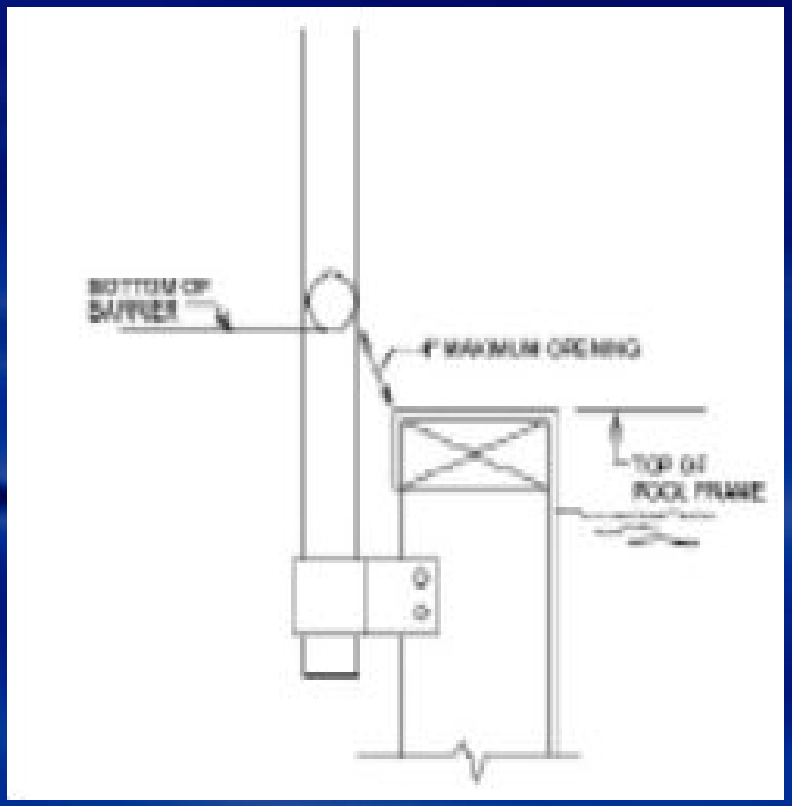
2. Openings: 4" sphere

3. Solid barriers: No indentations or protrusions

Barrier Requirements – AG 105.2

1.





Barrier Requirements-AG 105.2

2.

Barrier Requirements-AG 105.2

3.

Barrier Requirements – AG 105.2

3. No protrusions

Barrier Requirements – AG 105.2

4. Horizontal & vertical members where horizontal members less that 45" apart (top to top):

   Horizontal members on pool side

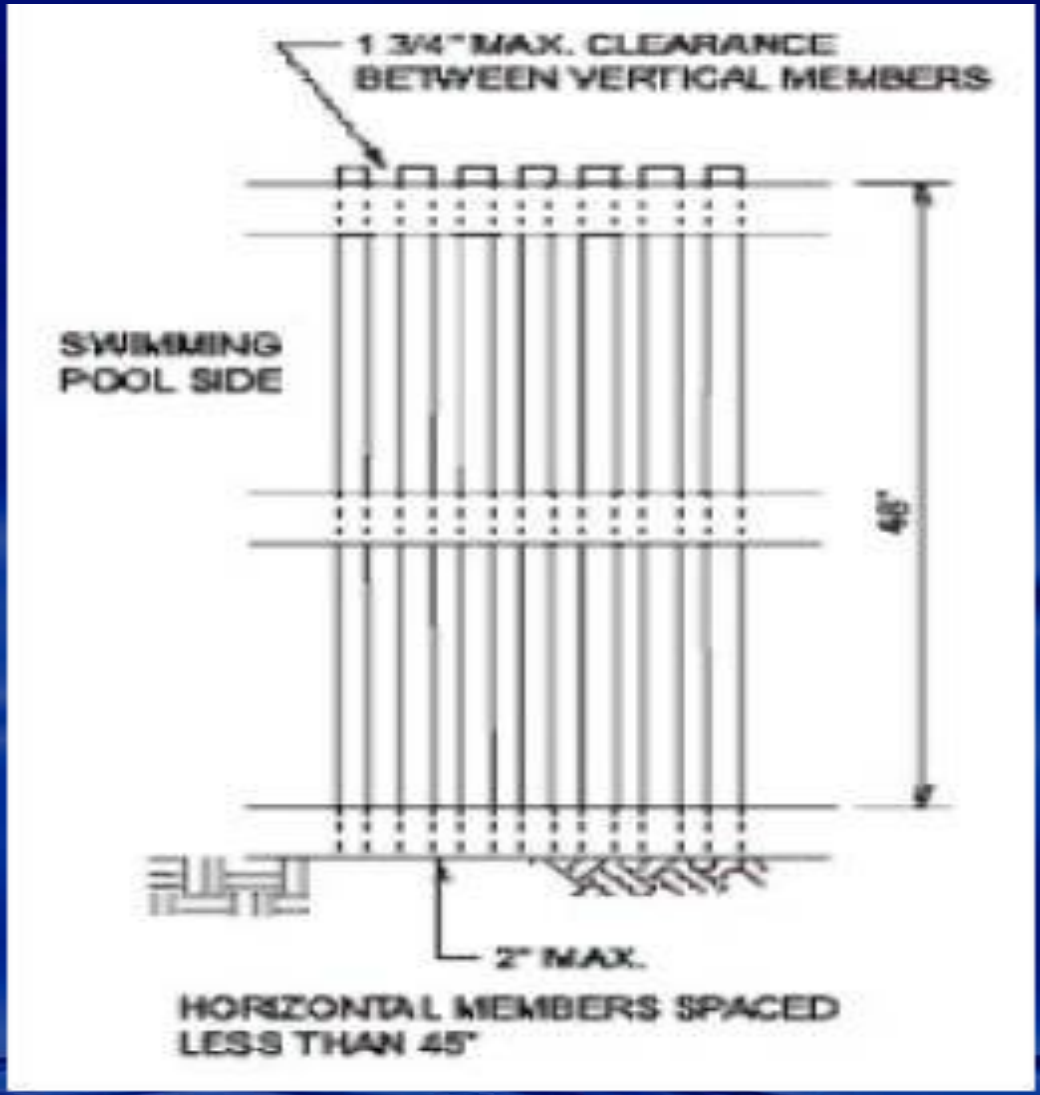
   1-3/4" max. between vertical members

   Decorative cutouts in vert. members,

   1-3/4" max. openings

Barrier Requirements – AG 105.2

4.



2009 IRC - Appendix G

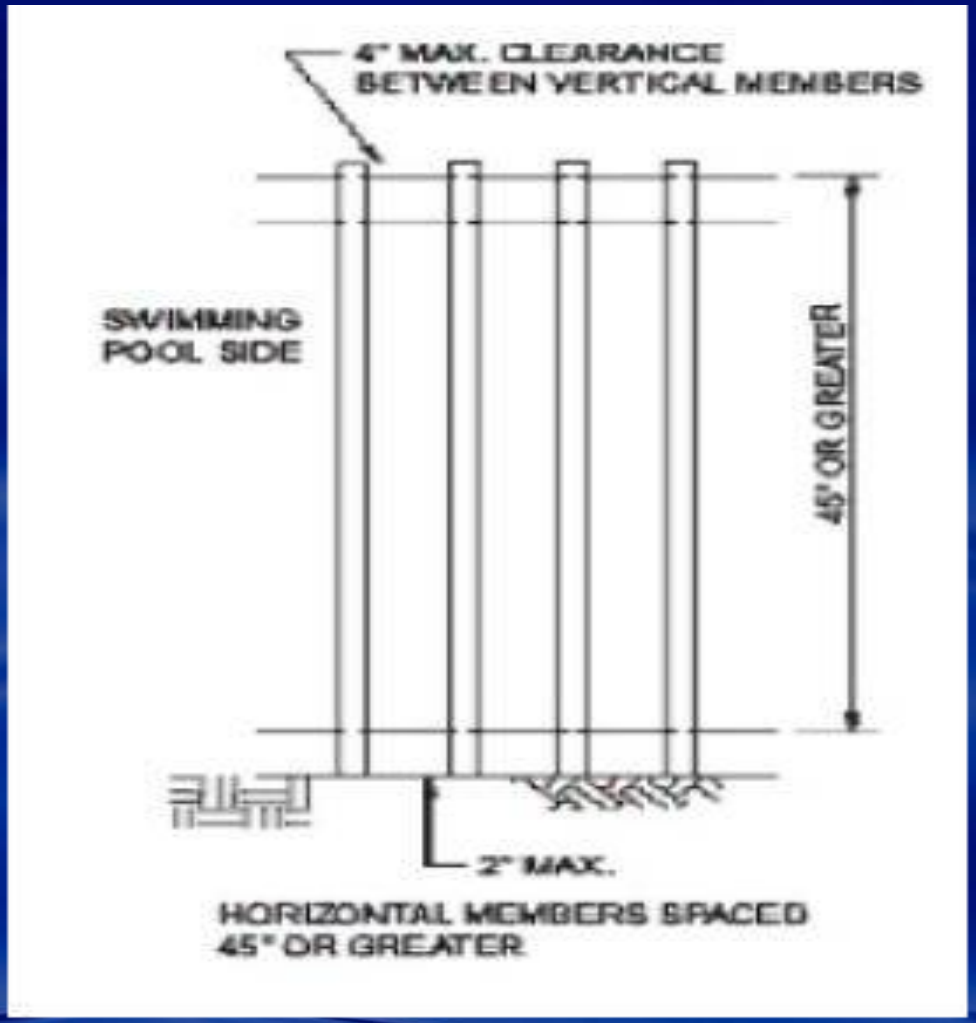
5. Horizontal & vertical members where horizontal members 45" or more apart:

   4" max. between vertical members

   Decorative cutouts in vert. members, 1-3/4" max. openings

Barrier Requirements – AG 105.2

5.

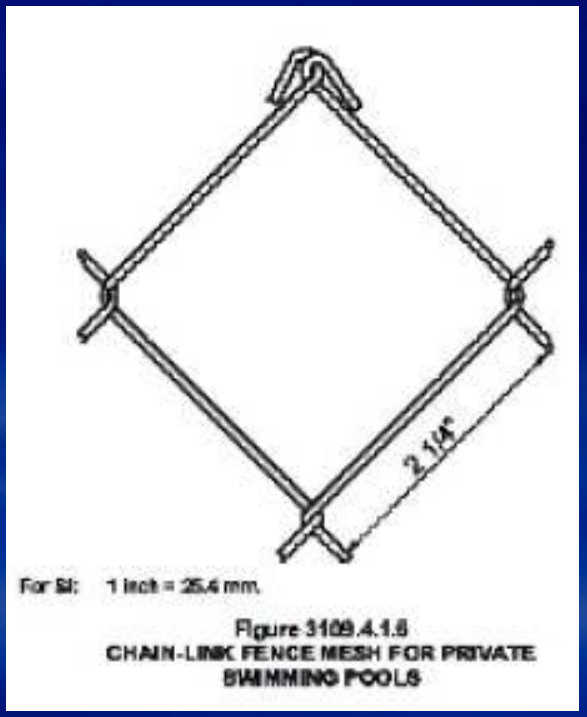


Barrier Requirements – AG 105.2

6. Chain link dimensions

Mesh size 2-1/4" square max.

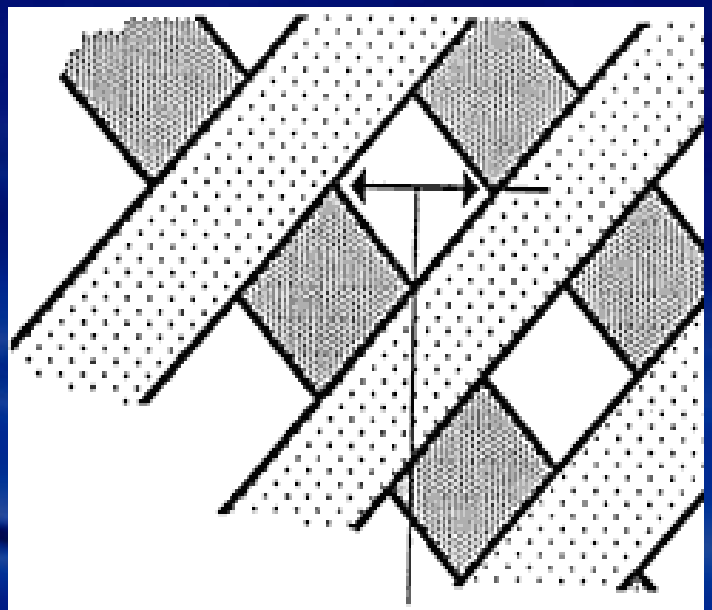
Slats fastened at top or bottom, reduce to 1-3/4“



Doesn’t agree with VGB 1406 Model Code language which states 1-3/4” mesh size

Barrier Requirements

7. Diagonal members:
   1-3/4" maximum
   openings



Barriers formed of diagonal members shall not have openings larger than 1 3/4" (44mm)

Barrier Requirements

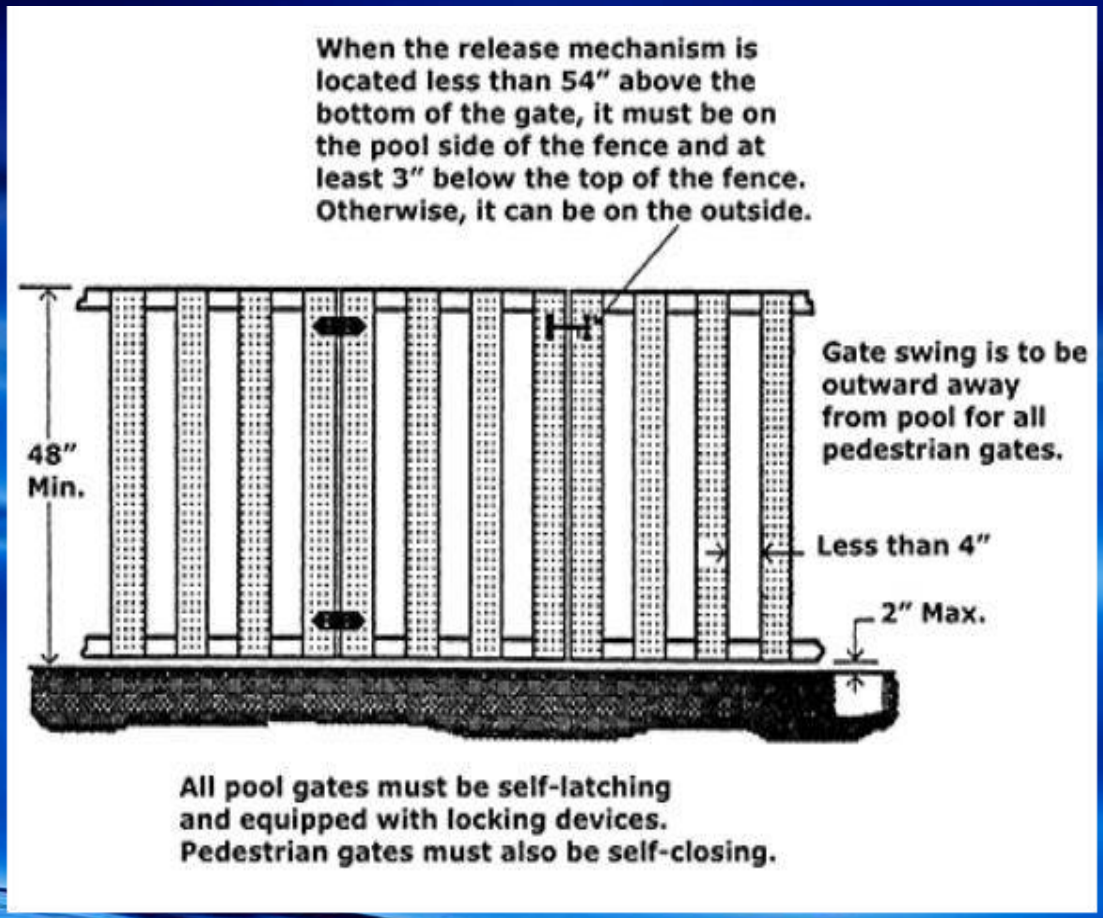
8. Access gates:

Comply with 1 - 7

- Accommodate a locking device
- Open outward
- Self-closing, Self-latching
- Other gates self-latching
- Release mechanism less than 54" high:
  - Pool side, at least 3" below top of gate, &
  - No opening greater than 1/2" within 18"

Barrier Requirements

8.



Barrier Requirements

9. Dwelling wall part of barrier

Meeting one of the following:

9.1 Powered safety cover per ASTM F1346

9.2 Doors accessing pool shall be equipped audible warning when door &/or screen are opened

9.3 Other means of protection acceptable of protection not less than 9.1 or 9.2

Barrier Requirements

9.

9.1 Power Safety Cover

9.2 Alarm Doors Accessing Pools

Alarm must meet UL 2017 –

30 sec response

Auto reset

Manual deactivation for single opening

Deactivation switch min. 54" high

- We are seeing imported products claiming to meet standard, but fall short

Barrier Requirements

10. Above-ground structure is used as barrier or mounted on structure the ladder or steps shall be surrounded by a barrier which meets 105.2, Items 1-9

Barrier Requirements

Pool is under 48 inches

Barrier Requirements – AG 105

AG 105.3 Indoor Swimming Pools

Walls surrounding an indoor pool shall comply with AG 105.2, Item 9 (wall of dwelling serves as barrier)

Barrier Requirements – AG 105

AG105.4 Prohibited locations

Pool barriers cannot be climbable from other structures, equipment or objects

Barrier Requirements

AG 105.5 Barrier Exceptions.

Spas and hot tubs with safety cover which complies with ASTM F 1346.

CT - AG 105.6 - Temporary Enclosure

- Must be in place prior to electrical inspection of any in-ground pool
- Min. 48" high
- 4" sphere rule
- Openings with a positive latching device

Improper Temporary Barrier

CT - AG 105.7 – Pool Alarm

Be on building permit and for substantial alteration

One or more families - residence

Must be installed with pool

50 db alarm when 15 lbs or more enters pool

Exempt: Hot tubs & portable spas

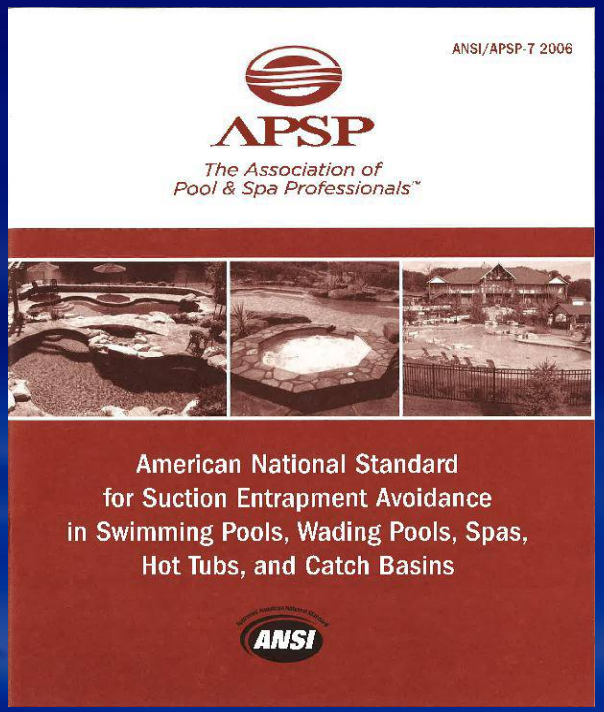
2009 IRC - Appendix G

AG106 – Entrapment Protection for Swimming Pool and Spa Suction Outlets

AG106.1 General. Suction outlets shall be designed and installed in accordance with ANSI/APSP-7. (2006)

AG 106 Entrapment Avoidance

106.1 Suction outlets shall be designed and installed in accordance with ANSI/APSP-7.



ANSI/APSP-7 Table of Contents

1. Scope
2. Normative references (to other standards)
3. Definitions
4. General requirements for suction entrapment avoidance systems and components
5. New construction
6. Existing pools and spas
7. Vacuum release systems

Section 1. Scope

1.1 General. This standard covers design and performance criteria for circulation systems including components, devices, and related technology installed to protect against entrapment hazards in residential and public swimming pools, wading pools, spas, hot tubs, and catch basins, hereinafter referred to as “pools and spas.”

Section 1.2 Alternative Methods

The provisions of this standard are not intended to prevent the use of any alternative material, system, or method of construction, provided any such alternative meets the intent and requirements of this standard and is approved by the authority having jurisdiction.

Section 1.3 Exception

Commercial water parks and their associated suction systems are outside the scope of the standard.

Section 4. General Requirements

4.1 Codes

4.2 Electrical components

4.3 DANGER

4.4 Water velocity

4.5 Listed suction outlets

ASME/ANSI A112.19.8

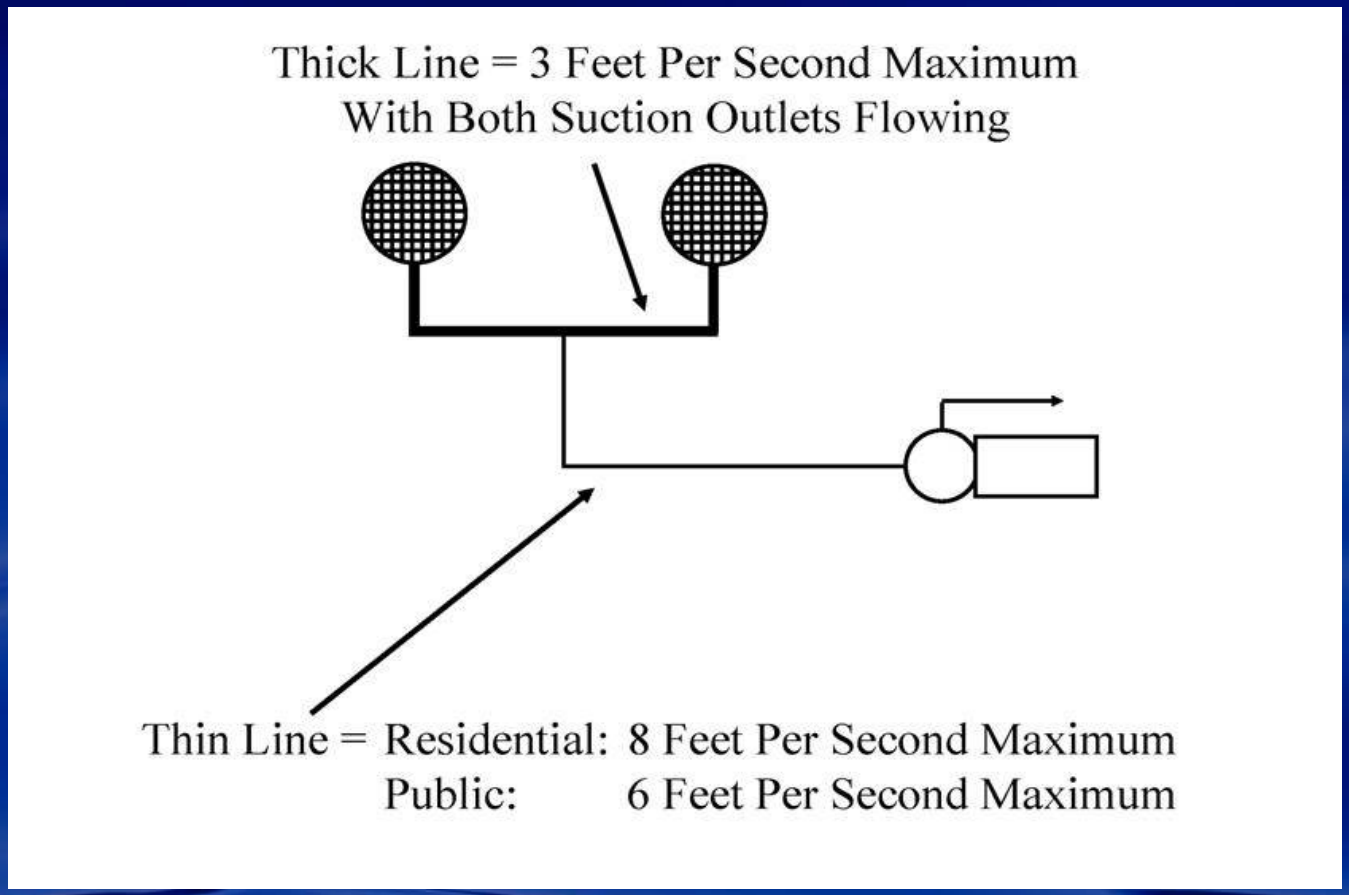
4.6 Minimum flow rating for each cover/grate

4.7 Dual cover/grate separation

4.8 Skimmers

4.9 Wall vacuum fittings

Section 4.4 Water Velocity



Section 4. General Requirements

4.1 Codes

4.2 Electrical components

4.3 DANGER

4.4 Water velocity

4.5 Listed suction outlets

ASME/ANSI A112.19.8

4.6 Minimum flow rating for each cover/grate

4.7 Dual cover/grate separation

4.8 Skimmers

4.9 Wall vacuum fittings

Section 4.5 Listed Suction Outlets

Must comply with AMSE/ANSI A112.19.8

Section 4. General Requirements

4.1 Codes

4.2 Electrical components

4.3 DANGER

4.4 Water velocity

4.5 Listed suction outlets

ASME/ANSI A112.19.8

4.6 Minimum flow rating for each cover/grate

4.7 Dual cover/grate separation

4.8 Skimmers

4.9 Wall vacuum fittings

Section 4.6 Min. Flow Rating for Each Cover

In dual and multiple submerged suction outlets (drains) each outlet must have the ability to handle 100% of the system's flow rate.

Check maximum flow rate capacity for each cover for submerged outlets (wall and floor).

Section 4. General Requirements

4.1 Codes

4.2 Electrical components

4.3 DANGER

4.4 Water velocity

4.5 Listed suction outlets

ASME/ANSI A112.19.8

4.6 Minimum flow rating for each cover/grate

4.7 Dual cover/grate separation

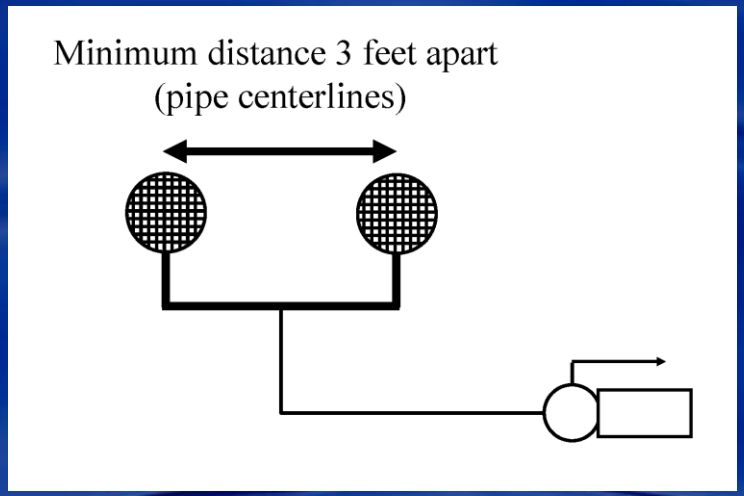
4.8 Skimmers

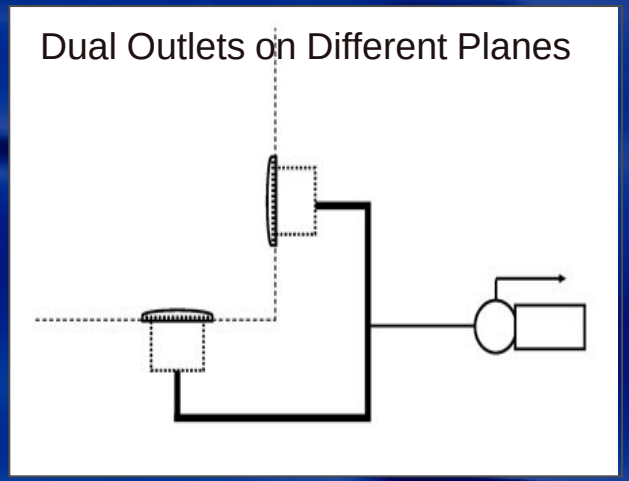
4.9 Wall vacuum fittings

Section 4.7 Dual Cover/Grate Separation

Separated by a minimum of 3 feet (center to center) of suction pipes, or

Located on two different planes (bottom/vertical wall) (separate vertical walls)





Section 4. General Requirements

4.1 Codes

4.2 Electrical components

4.3 DANGER

4.4 Water velocity

4.5 Listed suction outlets

ASME/ANSI A112.19.8

4.6 Minimum flow rating for each cover/grate

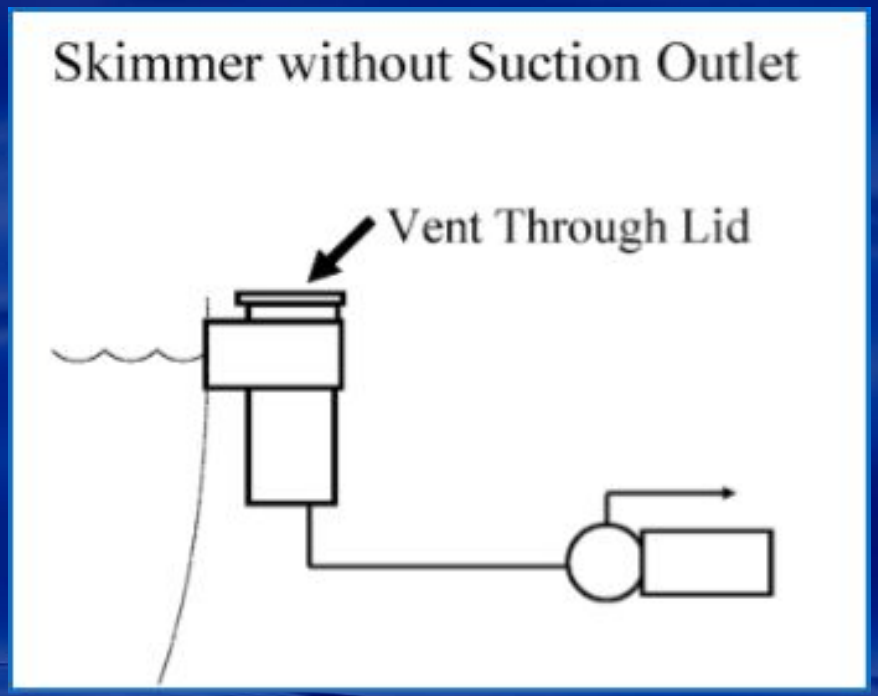
4.7 Dual cover/grate separation

4.8 Skimmers

4.9 Wall vacuum fittings

Section 4.8 Skimmers

Vented to atmosphere through openings in lid, through a separate vent pipe, or incorporate an equalizer line

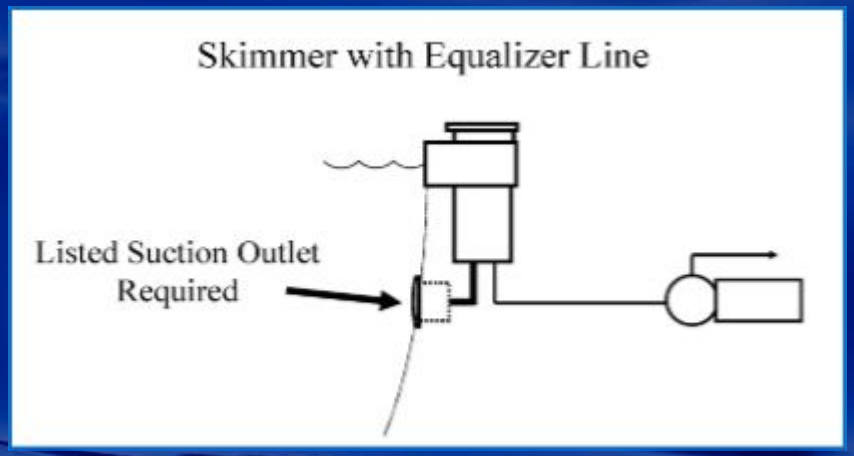


Section 4.8 Skimmers

Section 4.8.1

Equalizer lines, when used, shall be located on the wall with the center no more than 18 inches below the maximum operating level.

Protected by a listed suction outlet cover/grate



Section 4. General Requirements

4.1 Codes

4.2 Electrical components

4.3 DANGER

4.4 Water velocity

4.5 Listed suction outlets

ASME/ANSI A112.19.8

4.6 Minimum flow rating for each cover/grate

4.7 Dual cover/grate separation

4.8 Skimmers

4.9 Wall vacuum fittings

Section 4.9 Wall Vacuum Fittings

When used, vacuum cleaner fitting(s) shall be located in an accessible position(s) at least 6 inches and no greater than 18 inches below the water level and the self closing, self latching fitting shall comply with IAPMO SPS 4.

In addition the vacuum piping shall be equipped with a valve to remain in the closed position when not in use.

Section 5. New Construction

5.1 General

5.2 Submerged suction outlets are optional

5.3 Dual outlets

5.3.2 Dual outlet separation

5.4 Three-or-more outlets

5.5 Single unblockable suction outlet

5.6 Single outlet swim jet system

Section 5. New Construction

5.7 Single outlet – alternative suction system

5.8 Gravity flow systems

5.8.6 Fully submerged gravity outlet

5.8.7 Partially submerged gravity outlet

5.9 Outlet sumps in series

5.10 Other means. See 1.2

Suction Outlets (Main Drains)

ICC codes and Pool and Spa Safety Act refers to main drains, but new language is submerged suction outlets

Section 5.2 Submerged Outlets Optional

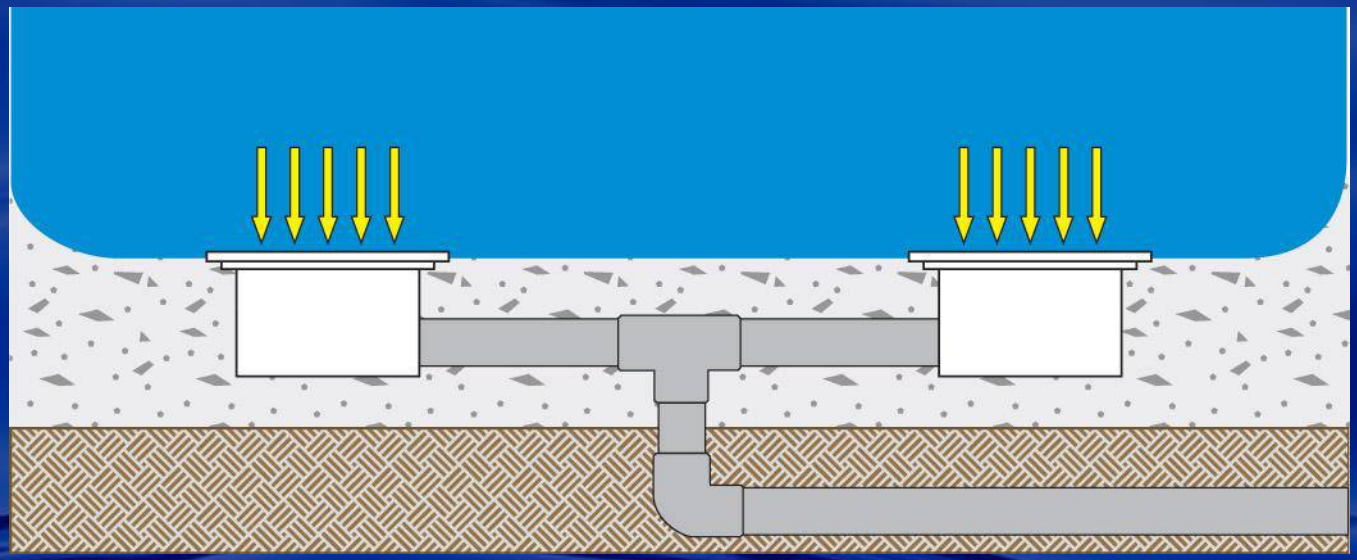
Pools without main drains

Skimmers or overflow systems must provide for 100 % of required system flow

Section 5.3 Dual Outlets

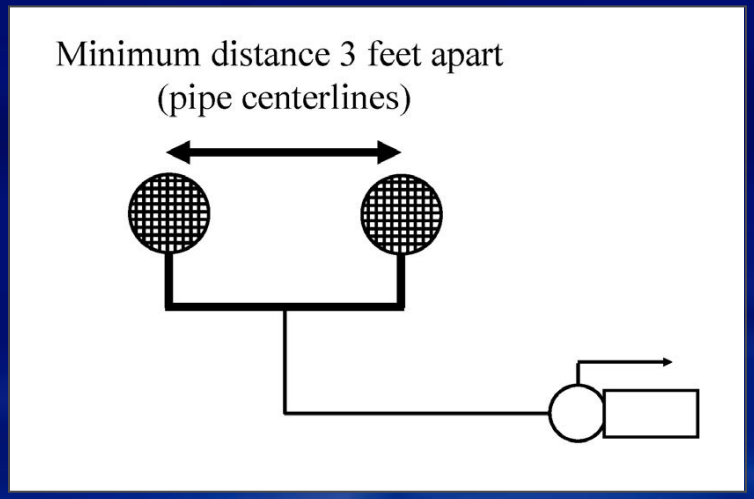
Listed outlets

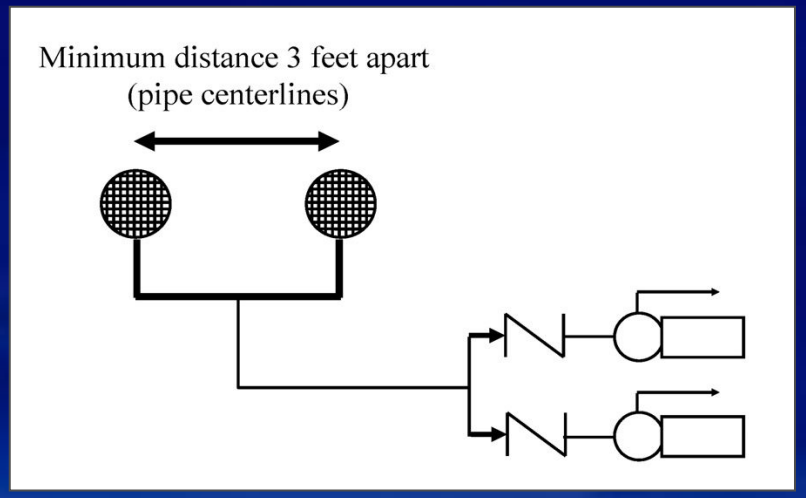
Tee feeding from common line between the suction outlets shall be located approximately midway between the outlets

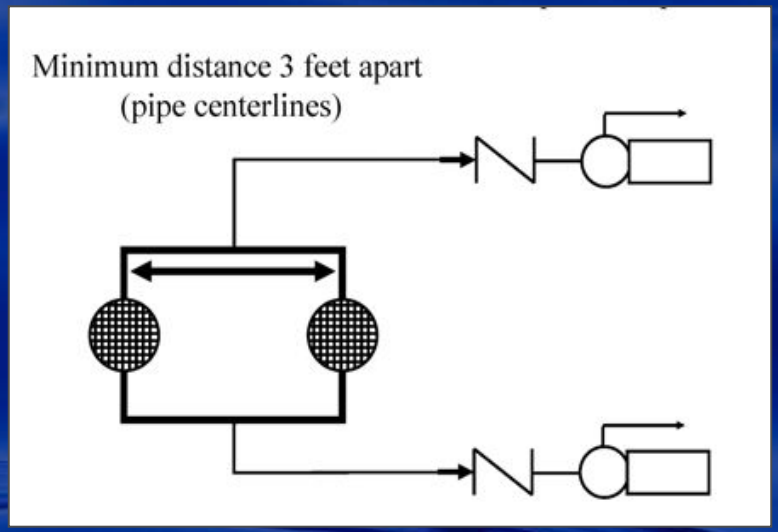


Dual Outlets

Section 5.3 Dual Outlets



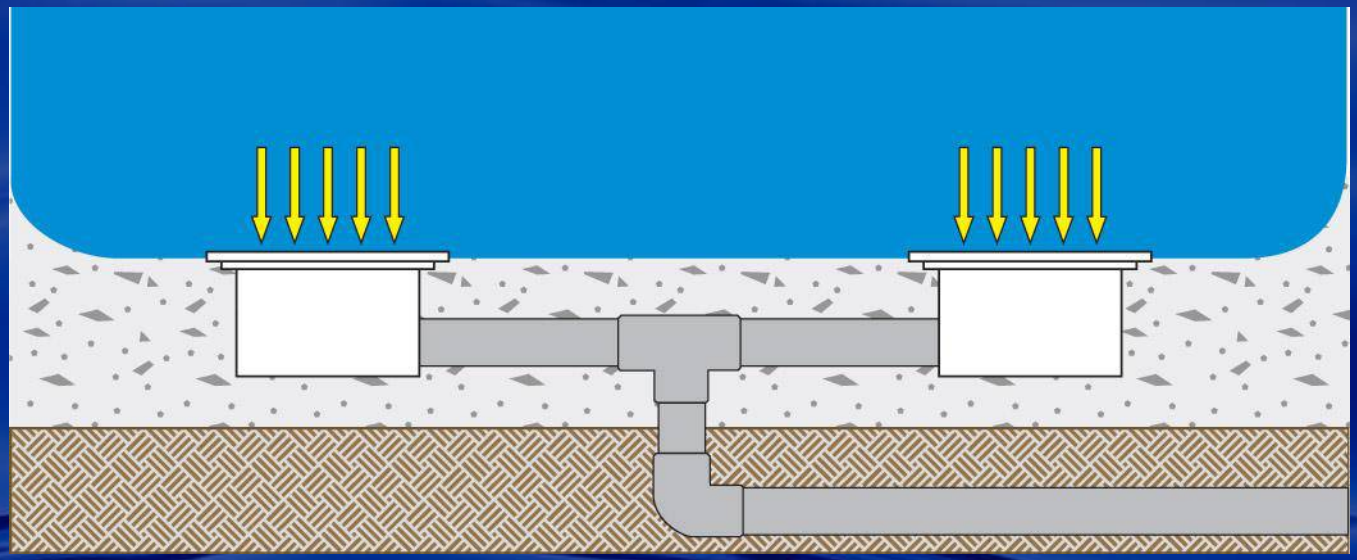




Section 5.3 Dual Outlets

5.3.1

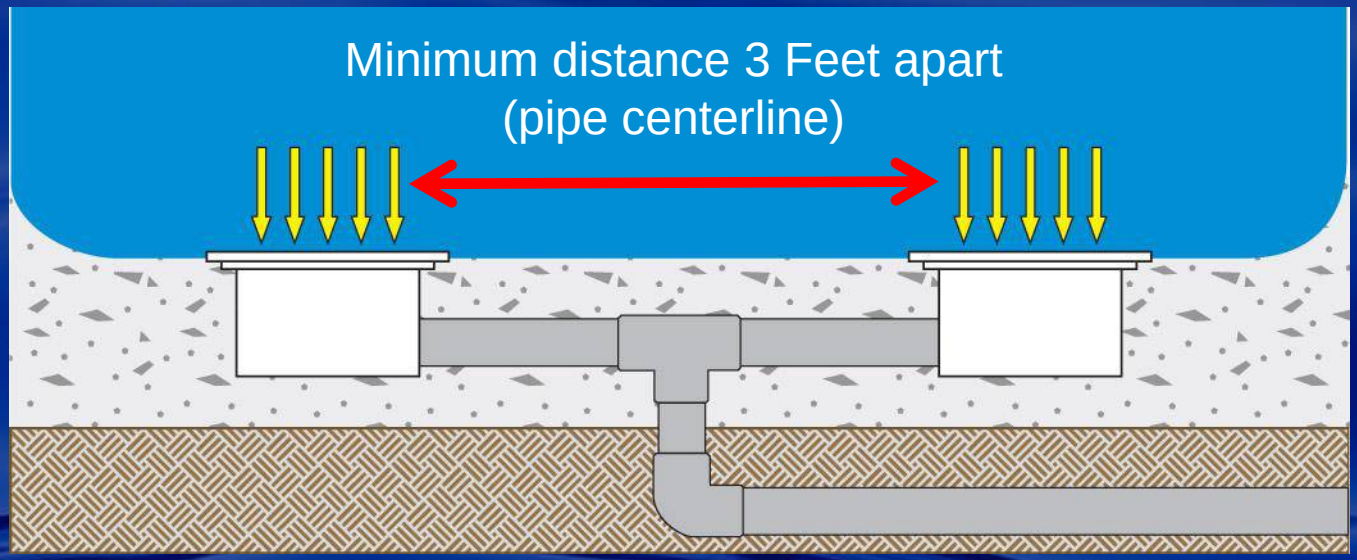
Flow rating of each cover/grate shall be at least equal to the system's maximum flow rate



Section 5.3 Dual Outlets

5.3.2 Dual outlet separation

Minimum of 3 feet measured from center to center of the suction pipe. Or located on separate planes.



Section 5.3 Dual Outlets

5.3.2 Dual outlet separation

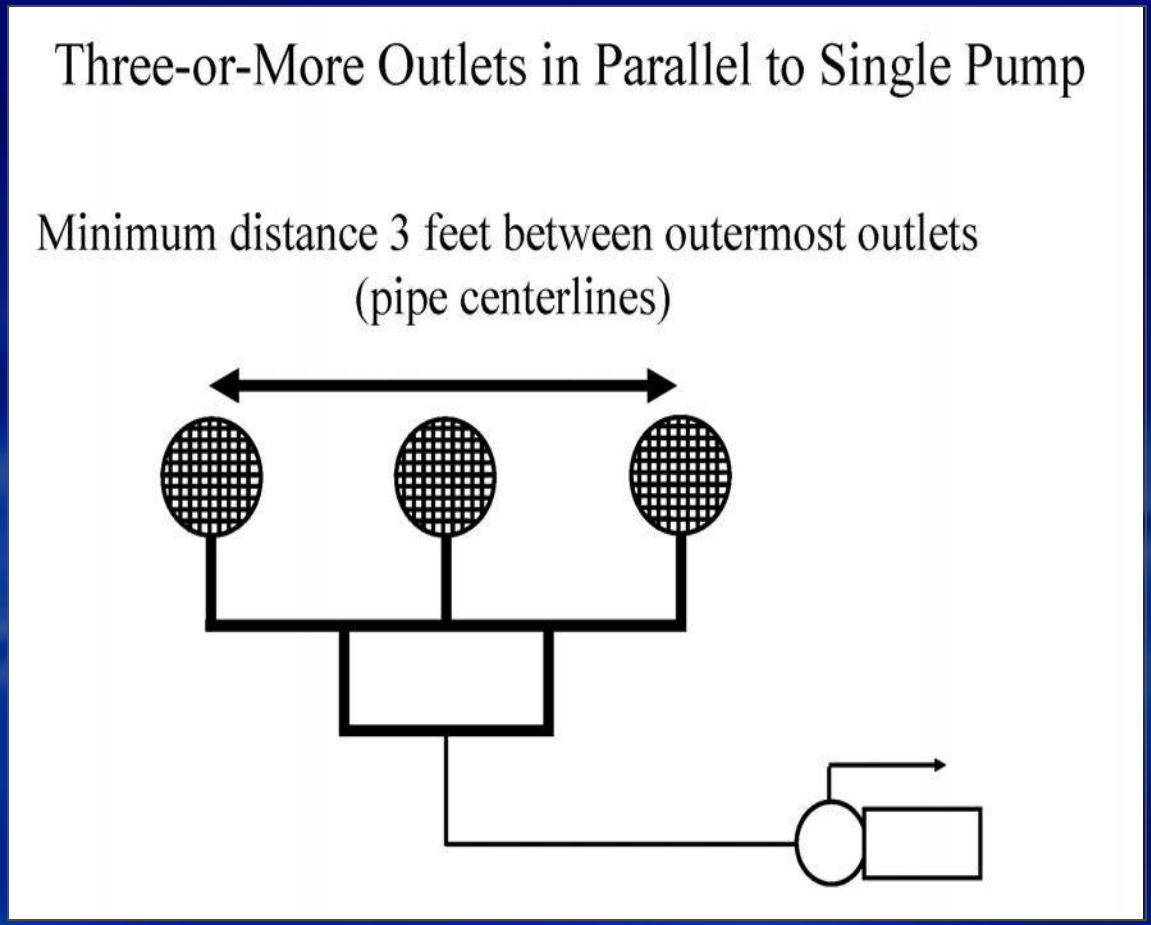
Minimum of 3 foot of separation measured center to center of the suction pipes

Section 5.3 Dual Outlets

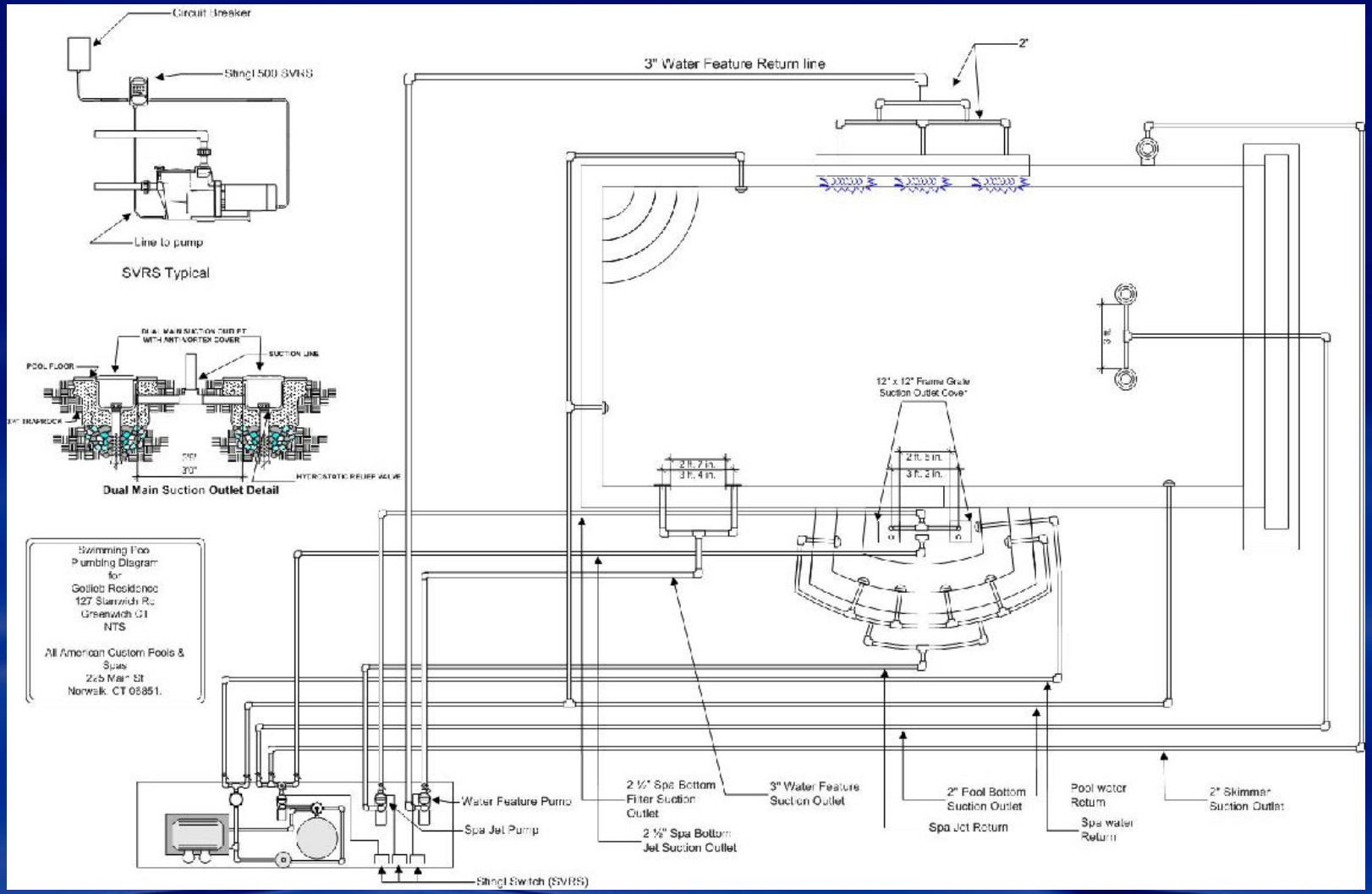
5.3.2 Dual outlet separation

- Can be on different planes

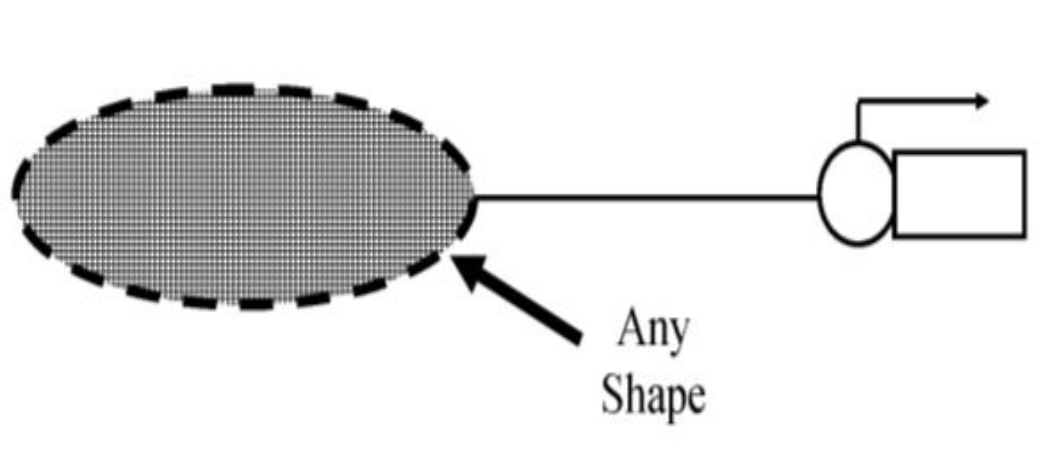
Section 5.4 Three or More Outlets



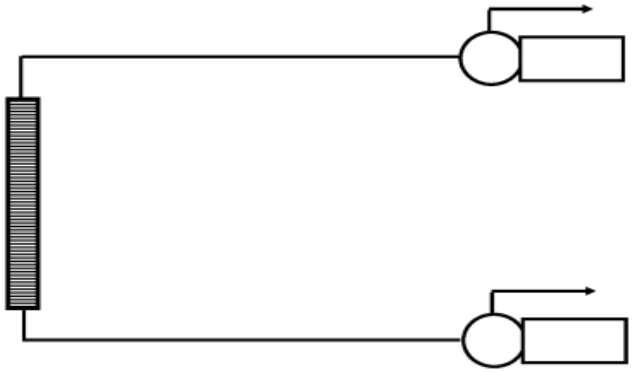
Plan Drawing for Permit



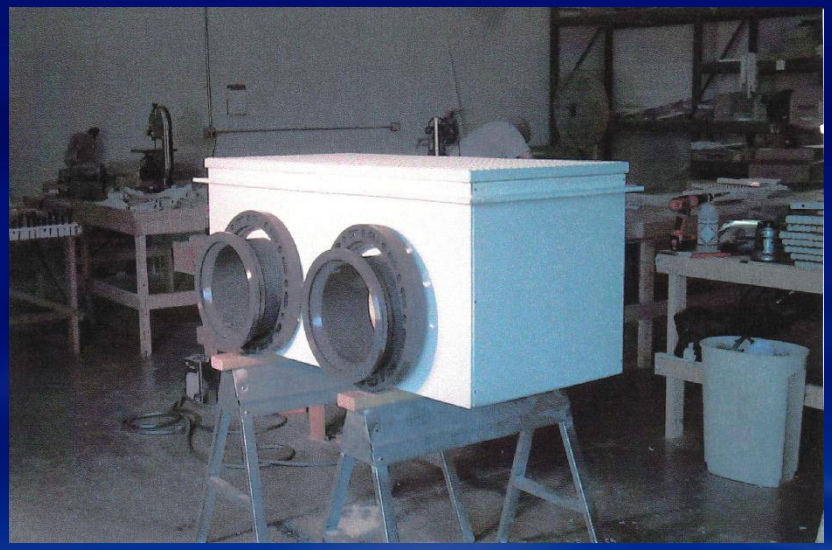
Section 5.5 Single Unblockable Suction Outlet

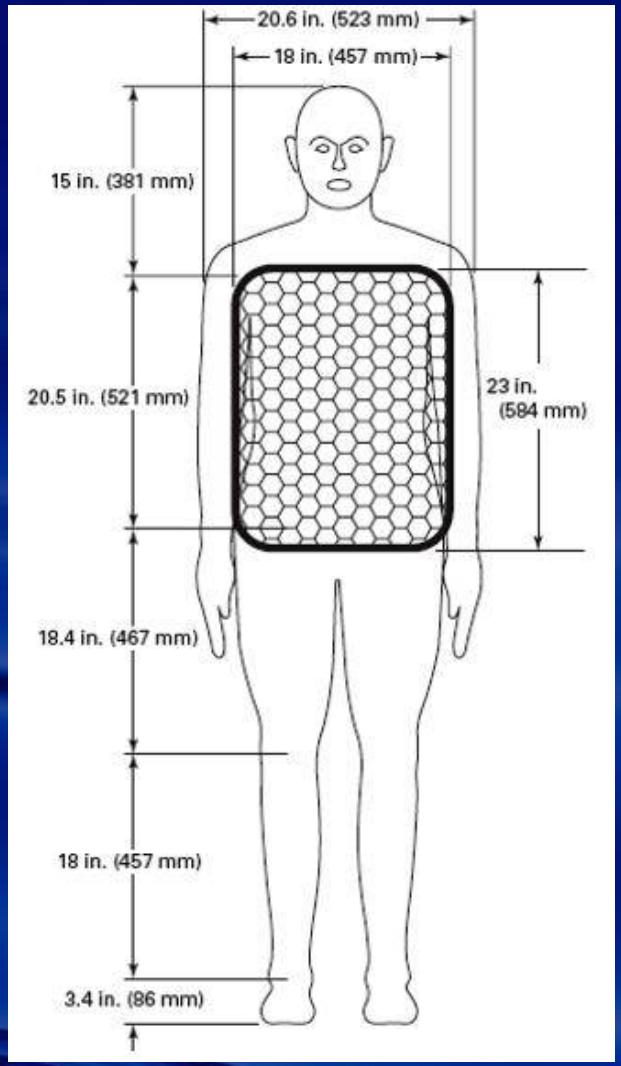


Single Unblockable Channel Outlet to Two Pumps



Section 5.5 Single Unblockable Suction Outlet



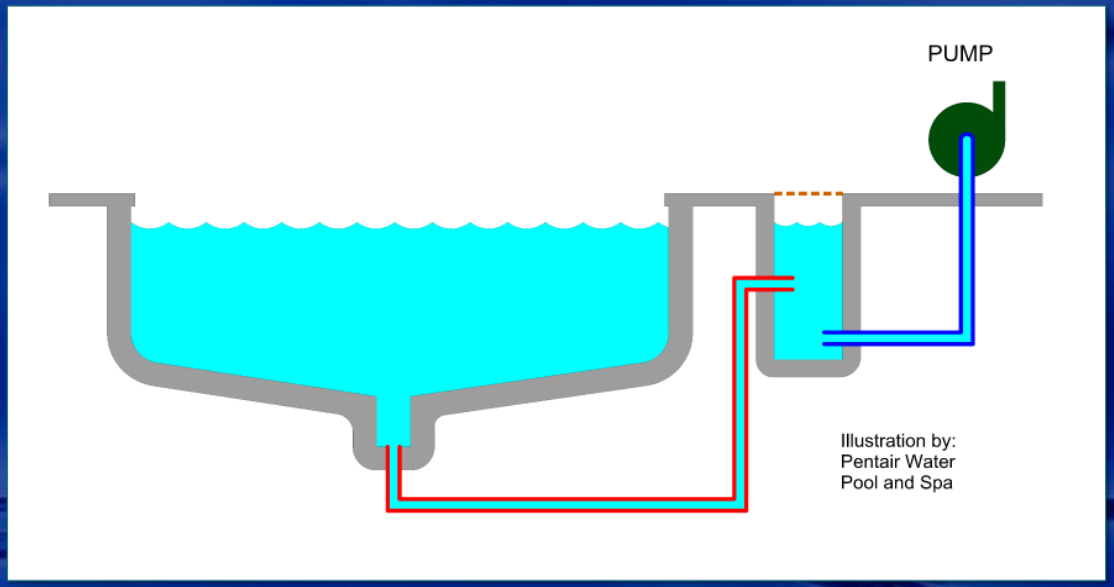


Section 5.6 Single Outlet Swim Jet System

Section 5.7
Single Outlet – Alternative Suction System

Section 5.8 Gravity Flow Systems

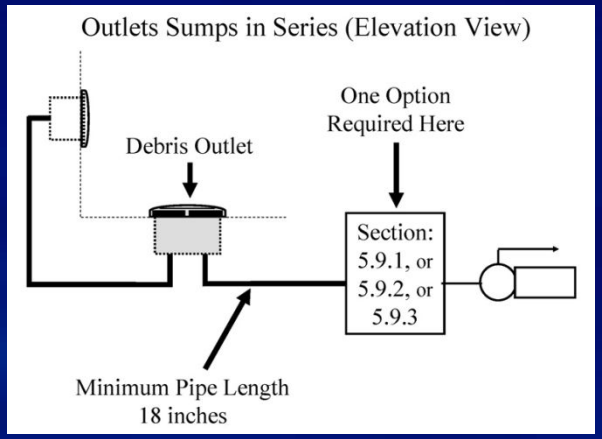
- Flow from a pool or spa to a vented reservoir may be partially or fully submerged
- 5.8.6 Fully submerged gravity outlet
- 5.8.7 Partially submerged gravity outlet



Section 5.9 Outlet Sumps in Series

Must have listed suction outlet covers/ grates

Between outlet and pump there shall be one of the listed options:



- One additional suction outlet located a min. of 18 inches from the tee in the suction line to the pump(s); or
- An engineered vent system (7.2); or
- Listed SVRS in accordance with 7.1

Section 7 Vacuum Release Systems

NOTE: All vacuum release systems shall be tested on a single suction outlet with a listed safety cover in place. These devices/systems are not considered “backup” systems as there is no known suction vacuum release system that will completely protect against four of the five known hazards and presenting vacuum release systems as “backup” systems would promote a false sense of security among the users of these devices/systems.

2009 IRC Appendix G

AG 107 Abbreviations (new)

APSP - Association of Pool and Spa Professionals

ASCE – American Society of Civil Engineers

2009 IRC Appendix G

AG 108 Standards (new)

ANSI/APSP-7-06 Standard for Suction Entrapment Avoidance in Swimming Pools, Wading Pools, Spas, Hot Tubs and Catch Basins

ASCE/SEI-24-05 Flood Resistant Design and Construction

ANSI/NSPI (APSP) Standards

QUESTIONS?

EVALUATION

THANK YOU!

Supplemental Material on Swimming Pool Flow Rates and Velocity

Velocity and Rate of Flow

Velocity is stated in feet per second (fps)

Rate of flow is stated in gallons per minute (gpm)

The quantity of water traveling through the circulation system is referred to as the gallons per minute and the speed (velocity) of the water is calculated in feet per second.

Velocity and Rate of Flow

GPM is increased or decreased by horse power of pump

FPS is increased or decreased by the size of the piping and/or open area water is flowing through

Velocity and Rate of Flow

Recommended maximum velocity:

- 6 fps public pools/8 fps residential pools*
- 3 fps in branch piping during normal operation; 6 fps in branch suction piping when one of a pair is blocked*
- Do not exceed these recommended maximums—
  - Risk of suction entrapment
  - Would erode pipe and fittings

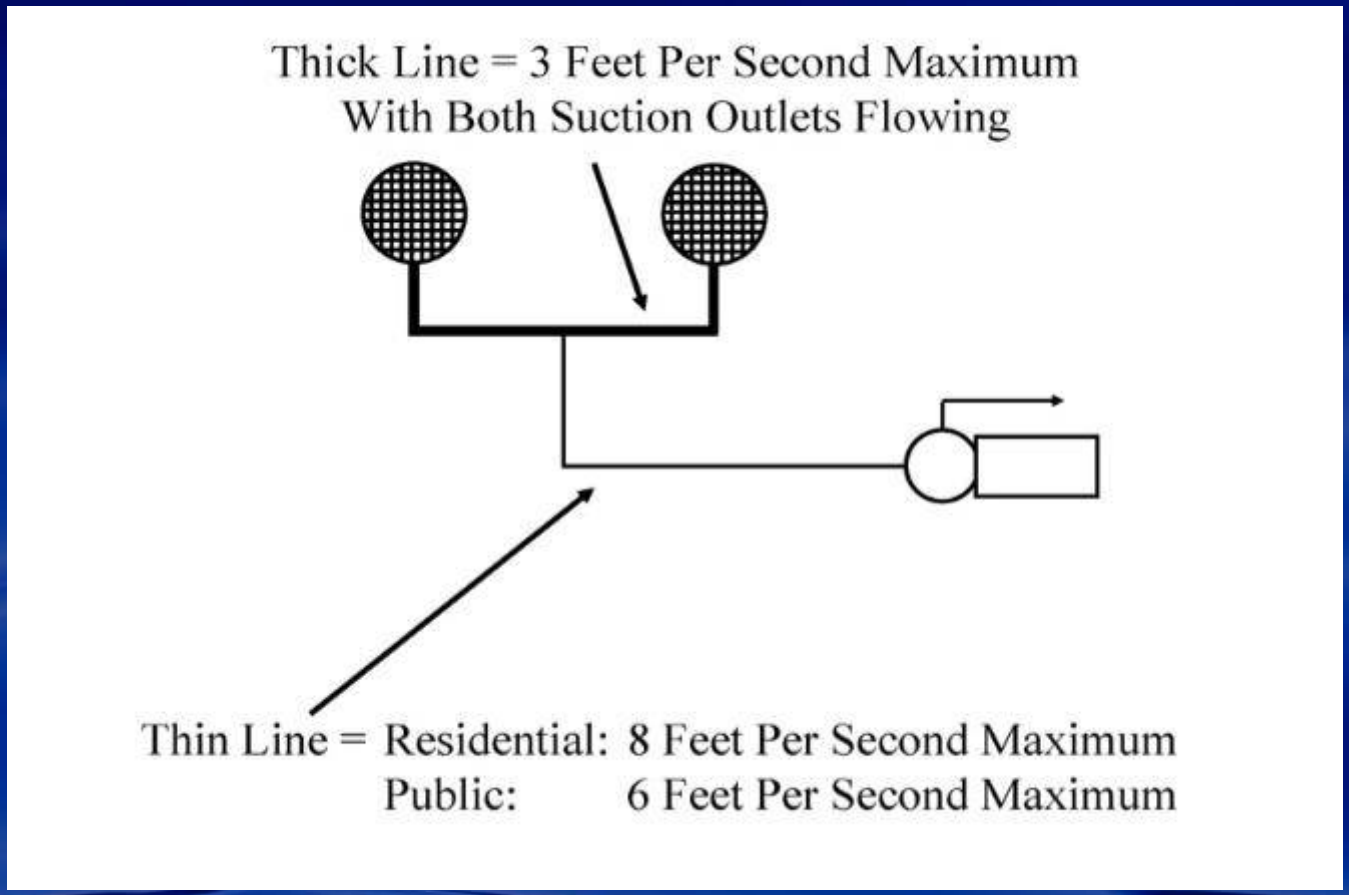
* ANSI/APSP-7 Standard for Suction Entrapment Avoidance

Velocity and Rate of Flow

The open area of a main drain cover will vary from manufacturer to manufacturer, but will be listed in the specifications for each cover.

Each cover will also list the maximum gallons safely permitted through the cover

Water Velocity



Maximum System Flow Rate

The maximum system flow rate shall be determined by one of the following:

- TDH calculation for the circulation system of each pump; or
- Simplified TDH calculation (see definition); or
- The maximum flow capacity of the new or replacement pump,

which shall be limited by the criteria of the maximum velocity requirements

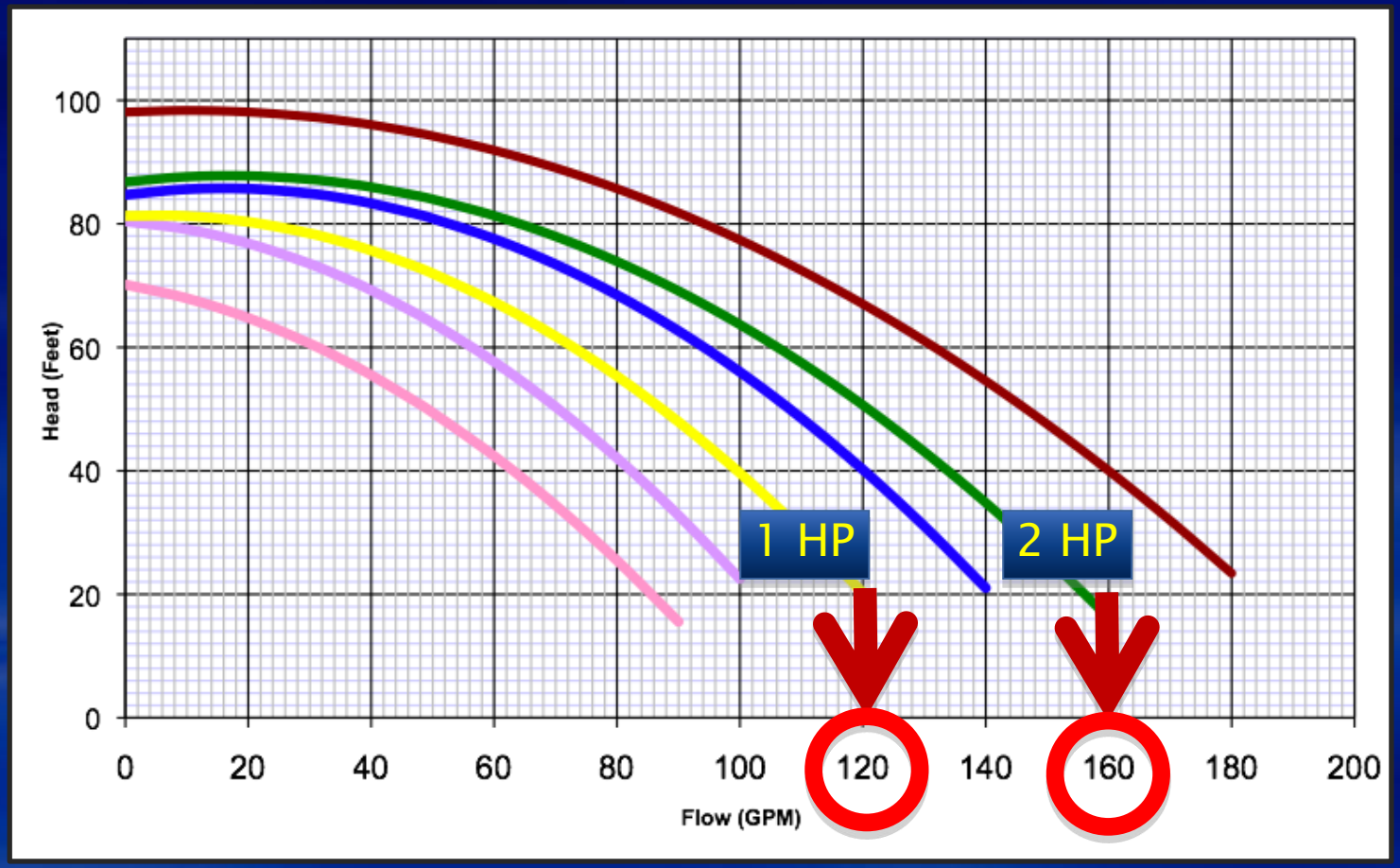
The Calculations

Total dynamic head (TDH): The sum of all resistances in a complete operating system (pipe, fittings, valves, filter, heater, etc.)

Simplified TDH calculation: A method of determining the maximum system flow rate using hydraulic calculations based on the lowest possible total dynamic head (TDH) for a circulation system. For example, using the shortest distance between the pool and the pump, omitting the calculations for fittings/valves, and using the best performance ratings for filters and heaters.

Maximum System Flow

Using Maximum Pump Flow is Most Conservative



The Process for the Contractor

1) Determine the pool (spa) volume in gallons.
2) Determine the required (or desired) flow rate in gpm.
3) Size piping based on achieving the specified flow rate and velocities
4) Calculate the Resistance in the system (TDH)
5) Select pump using pump curve to deliver the specified flow rate

Verify velocity with plans submittal

Builder specifies flow rate & pipe size with plans submittal.
Chart shows pipe size required per flow rate specified.

Pipe Size	6 fps (branch)	8 fps (trunk)	10 fps (return)
Sch. 40 PVC	GPM	GPM	GPM
1 in.	38	51	64
2 in.	63	84	105
2 in.	90	119	149
3 in.	138	184	230
4 in.	238	317	397
6 in.	540	720	900

Verify Covers With Plans and/or Inspection

Permit application can include the Manufacturer, make and model of the drain covers, including the flow ratings.

You may require the covers to be on site at one of the inspection phases. They will have the following language embossed on them or permanently marked in a location that is visible when installed.

Verify Covers With Plans and/or Inspection

Confirm:

- ASME A112.19. 8 2007
- Flow rating “X GPM” appropriate,
- Designed for location (floor/wall)
- Life: “X Years”, and
- Manufacturer and Model.

Verify Drain Placement With Plans & Inspection

Drain placement details should be shown on the permit application drawings.

Field inspection; measuring for distance between suction pipe centers or observing placement on different planes.

Field inspection; for field fabricated sumps, measure from top of pool shell floor to top of suction pipe.