


 State of Connecticut
 Department of Administrative Services
 Division of Construction Services
 Office of Education and Data Management

Office of Education and Data Management
Spring 2017 Career Development Series

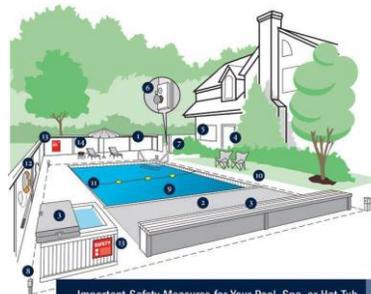
SWIMMING POOLS: IRC Appendix G and Chapter 42

Presented by
 Milton Gregory Grew, AIA
 Architect, Building Official and Code Consultant

Applicable Codes in CT

PUBLIC	RESIDENTIAL
2012 IBC <ul style="list-style-type: none"> ■ Section 3109 <ul style="list-style-type: none"> • Barriers ■ ANSI/APSP-7 (2006) <ul style="list-style-type: none"> • Entrapment Avoidance 2014 NEC <ul style="list-style-type: none"> ■ Article 680 DPH Regulations	2012 IRC <ul style="list-style-type: none"> Appendix G ANSI/NSPI-5 (2003) <ul style="list-style-type: none"> In-Ground ANSI/NSPI-4 (1999) <ul style="list-style-type: none"> Above & On-Ground Spas & Hot Tubs Barriers ANSI/APSP-7 (2006) <ul style="list-style-type: none"> Entrapment Avoidance Chapter 42 (Elect)

Layers of Protection



Important Safety Measures for Your Pool, Spa, or Hot Tub

2012 IRC 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 - Referenced Standards

2012 IRC - Appendix G

AG101 - General
 Design & construction...on the lot of 1 & 2-family dwellings



2012 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....

Pool in flood hazard area



2012 IRC - Appendix G

AG 102 - Definitions

Swimming Pool

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



2012 IRC - Appendix G

AG 102 - Definitions

Residential (amended)

That which is situated on the premises of a detached one- or two-family dwelling, or a one-family townhouse not more than 3 stories in height where the pool is intended to be used by the owners and invited guests.

Townhouse swimming pool



24 inches ??



11

2012 IRC - Appendix G

AG103 - Swimming Pools

AG 103.1 - In-ground Pools

Designed and constructed in conformance with ANSI/NSPI-5 (2003) (or ANSI/APSP-5)

Standard for Residential In-Ground Swimming Pools



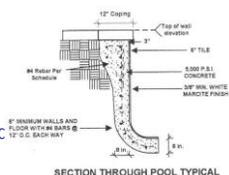
ANSI/APSP-5

4 Structural Design

4.1 The structural design and materials used shall be in accordance with generally accepted engineering practices and methods.

Compare to: 2012 IBC 3109.9 – Pool structure

The pool structure shall be engineered and designed to withstand the expected forces to which the pool will be subjected.



ANSI/APSP-5

5 Pool Dimensions and Tolerances

- Maximum slope of walls
- Floor slopes
- Diving equipment and minimum water envelope
- Diving platforms

ANSI/APSP-5

6 Entry / Exit

6.1 Required at shallow end if water deeper than 24".

6.1.1 Required at deep end if water depth 5 ft or more.

6.2.1 Treads 10" min., 240 sq in min.

6.2.1.1 If handrail provided, tread can be 8"

6.2.1.1.1 Bottom riser height can vary

Entry / Exit





ANSI/APSP-5

6.3 Shallow end detail for beach & sloping entries



ANSI/APSP-5

- 6.4 Handrails
- 6.5 Pool ladder design & construction
- 6.6 Recessed treads
- 6.7 Underwater seats, benches & swimouts



ANSI/APSP-5

- 7 Decks**
- 7.1 General requirements
- 7.2 Drainage
- 7.3 Concrete decks
- 7.4 Wood decks
- 7.5 Stone, brick, brick pavers, concrete pavers and tile decks
- 7.6 Deck steps

ANSI/APSP-5

- 8 Materials of construction & finishes**
- 9 Circulations systems components & related equipment**
- 10 Water supply**
- 11 Waste water disposal**
- 12 Chemical feeders & ozone generators**
- 13 Electrical rqmts (adopted NEC)**

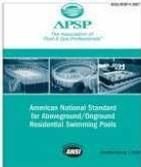
ANSI/APSP-5

- 14** Instructions for the circulation system, pressure filters & separation tanks
- 15** Safety features
- Appendix I Entrapment avoidance

2012 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 (1999) (or ANSI/APSP-4)

Standard for Aboveground/ Onground Residential Swimming Pools



Above-ground



On-ground





ANSI/APSP-4

1 Scope

- 1.1 Design, manufacturing, testing, care & use
- 1.2 For swimming & wading only. No diving boards, slides or other equipment to be added.

ANSI/APSP-4

3 Codes & compliance

- 3.2 Any after market or home-built deck, if allowed by manufacturer, shall comply with local code, including load capacity & fencing.
- 3.3 All decks shall meet local codes & comply with most recent ANSI/APSP-8.

ANSI/APSP-4

6 Pool & component design

- Pool manufacturer responsible for structural design & materials
- Component manufacturers responsible to ensure components can be protected from damage due to freezing
- Vinyl liner manufacturer responsible for brittleness, winterization and thickness

ANSI/APSP-4

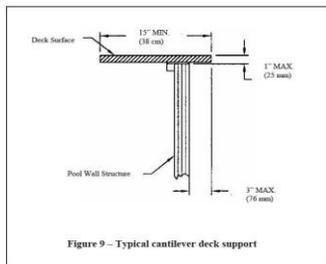
7 Instructions & responsibilities

- Manufacturers responsible to provide written instruction manuals
- 7.1.6 Manufacturers shall advise homeowners that the installation must comply with local codes & may require permits for building, electrical, zoning, etc
- 7.2.3 Must advise that a barrier is necessary
- 7.3 Installer responsible to follow regulations on setback, barriers, devices, and other conditions.

ANSI/APSP-4

• 10 Raised decks & fencing

LL 40 PSF
Slip resistant
Guards sim.
to IRC



ANSI/APSP-4

- 11.10 Return inlets & suction outlets
- References ANSI/APSP-7 2006 for suction entrapment avoidance

2012 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

2012 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 (1999) *Standard for Permanently Installed Residential Spas*



2012 IRC – Appendix G

AG104.2 Portable spas and hot tubs

Designed and constructed in conformance with ANSI/NSPI-6 (1999) *Standard for Residential Portable Spas*



Portable Spas & Hot 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 in accordance with UL 1563 Section 36 (suction openings).

UL 1563 - Electric Spas, Equipment Assemblies, and Associated Equipment

2012 IRC - Appendix G

AG105 - Barrier Requirements

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

Barriers Required to Prevent Access



41

State Bldg Code Interpretation I-22-12

Question:

Would the installation of a replacement fence for an existing swimming pool that is a required barrier under Section AG105.2 require a building permit? I realize that Section R105.2 would normally exempt most fences from the permit requirement.

Answer:

Yes. Section AG105, of the 2003 International Residential Code portion of the 2005 State Building Code, controls the design of barriers for residential swimming pools, spas and hot tubs in order to provide protection against potential drowning by restricting access to swimming pools, spas and hot tubs. If someone were to use a fence as a "barrier", then Section R105.2, of the above code, would not apply and a building permit would be required for the barrier.

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

44

Barrier Rqmts – AG 105.2

- 1.

48" Min.

Pool Side

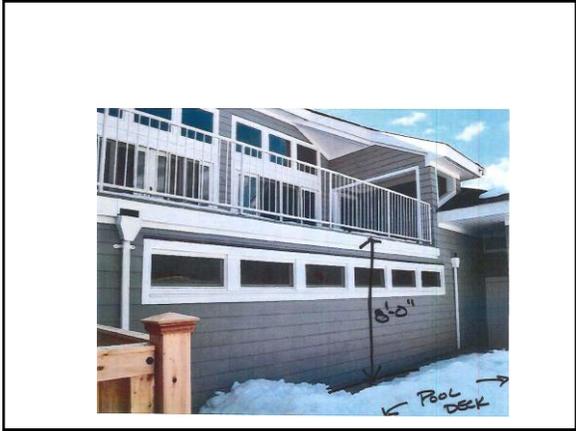
Barrier

BOTTOM OF BARRIER

4" MAXIMUM OPENING

TOP OF RAILING

When there is a differential in grade, the barrier height is measured on the side away from the pool.



Barrier Requirements-AG 105.2

2.

Barrier Requirements-AG 105.2

3.

Barrier Requirements – AG 105.2

3. No protrusions



49

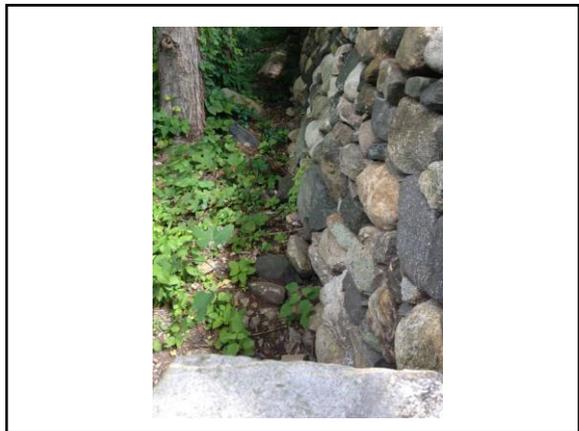
Seven horizontal lines for handwritten notes.



Seven horizontal lines for handwritten notes.

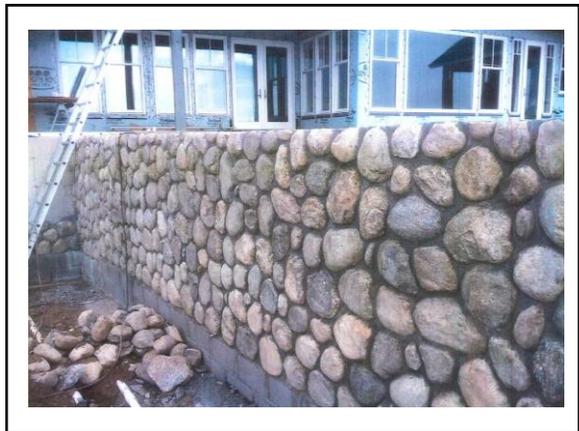


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Barrier Requirements - AG105.2

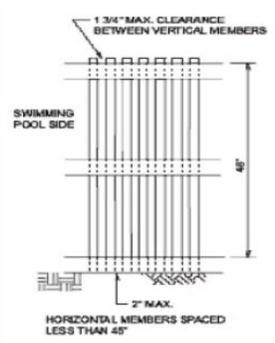
4. Horizontal & vertical members where horizontal members less than 45" apart (top to top):

Horizontal members on pool side 1-3/4" max. between vertical members

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

Barrier Requirements - AG105.2

4.



Barrier Requirements – AG105.2

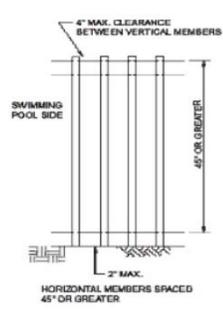
5. Horizontal & vertical members where horizontal members 45" or more apart:

4" max. between vertical members

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

Barrier Requirements – AG105.2

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"

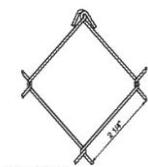


FIGURE 105.2-1.1.1 CHAIN-LINK FENCE MESH FOR PRIVATE SWIMMING POOLS

State Bldg Code Interpretation I-21-08

Question:

"While Section AG105.2 does not address a pool barrier made up only of horizontal members, Section AG105.2, Item #6, does address chain link mesh size of 2-1/4 inches square. Is a pool barrier made up of horizontal members to the height of 48 inches with a 3/4 inch space between the members a code compliant barrier?"

(A photograph is included illustrating the pool barrier composed of horizontal and vertical members with horizontal members not located on the swimming pool side.)

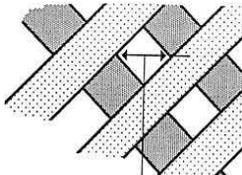
Answer:

Section AG105.2, Item #4 requires the barriers horizontal members, where the distance between the tops of the members is less than 45 inches, to have all horizontal members be located on the swimming pool side of the barrier.

Barrier Requirements – AG 105.2

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 – AG 105.2

8. Access gates:

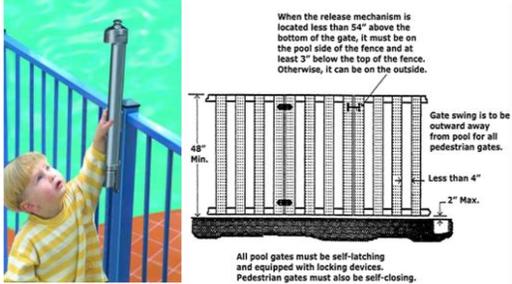
Comply with 1 – 7, plus

- Accommodate a locking device
- Open outward
- Self-closing, Self-latching
- Other gates self-latching
- Release mechanism less than 54" above bottom of gate:

- Pool side, at least 3" below top of gate,
- No opening greater than 1/2" within 18"

Barrier Requirements – AG 105.2

8.



Barrier Requirements – AG 105.2

9. Dwelling wall part of barrier

Meeting one of the following:

- 9.1 **Powered** safety cover per ASTM F1346
- 9.2 Doors accessing pool
 - Audible alarm for door & screen, 30 sec
 - Auto reset
 - Manual deactivation for single opening
 - Deactivation switch min. 54" high
- 9.3 Other means of protection acceptable of protection not less than 9.1 or 9.2

Barrier Requirements – AG 105.2

9.



Powered Safety Cover



67

Barrier Requirements – AG 105.2

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

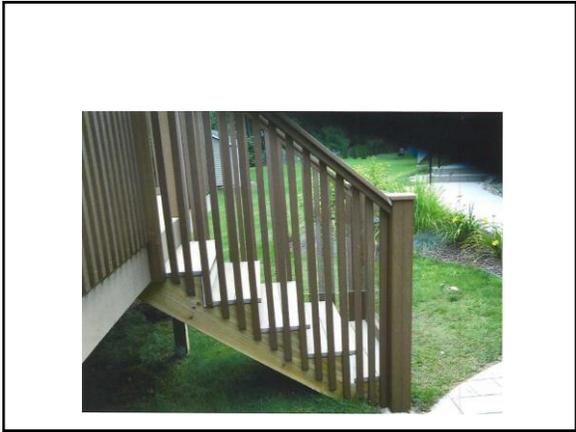


Barrier Requirements









Barrier Requirements – AG 105

AG105.4 Prohibited locations

Barriers shall be located to prohibit permanent structures, equipment or similar objects from being used to climb them.



Barrier Requirements

AG 105.5 Barrier Exceptions.



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

77

State Bldg Code Interpretation I-17-08

Question: Based on the manufacturer's product specification for strength and installation instructions, can deer fencing be used as barrier for a pool?

Answer: A barrier's purpose is to restrict access to swimming pools, spas and hot tubs. The deer fencing product submitted along with the manufacturer's product specification installation instructions does not demonstrate deer fencing as a code compliant barrier.

AG 105.6 - Temporary Enclosure (CT Add)

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

AG 105.6 - Temporary Enclosure

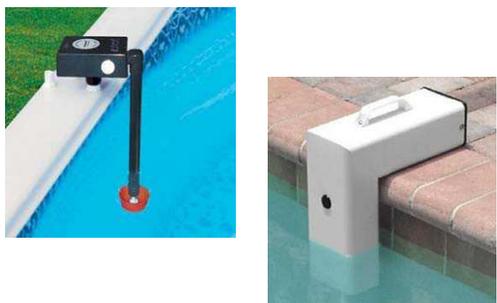


AG 105.7 - Pool Alarm (CT Add – CGS 29-265a)

- Must be on building permit for construction or 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

AG 105.7 – Pool Alarm



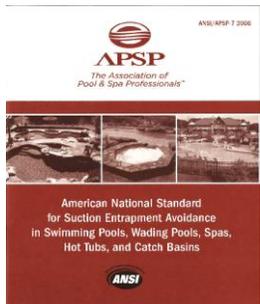
82

2012 IRC - Appendix G

AG106 – Entrapment Protection for Swimming Pool and Spa Suction Outlets

AG 106 Entrapment Protection

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



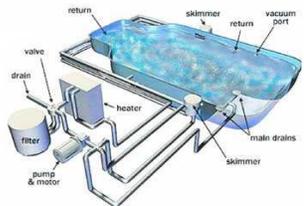
ANSI/APSP-7 Table of Contents

- 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

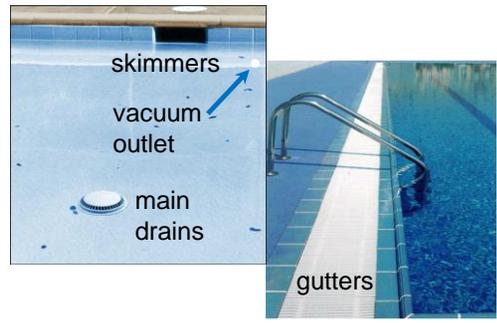
Section 1. Scope

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.”

Suction System Components



System Components: Suction Outlets



System Components



What is Suction ?

"The act of exerting a force upon a solid, liquid or gaseous body by reason of reduced air pressure over a part of its surface."

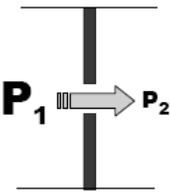
Webster's 9th Collegiate Dictionary

Why do we need suction?

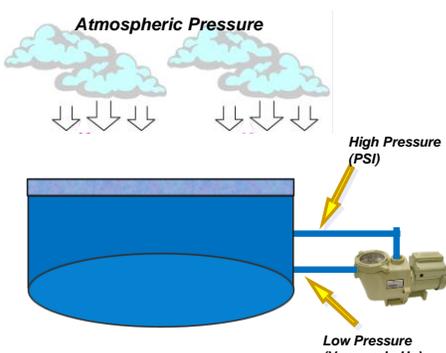
- Return water to the pump for filtration and circulation
- Skimmers take surface dirt with water and then it gets filtered
- Helps keep pool clean and disinfected

Theory of Suction

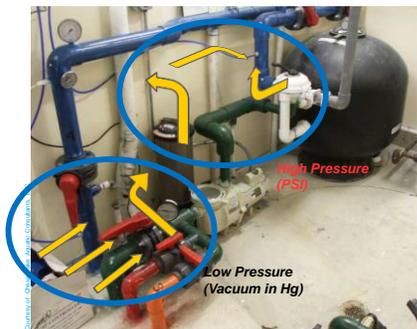
- Requires a change in pressure
- Flow is always from high pressure side to low pressure side
- Referred to as "delta-P"
- Flow can be driven by decreasing one side, or increasing the other
- Atmospheric Pressure at sea level = 14.7 psi



Suction In a Pool



Suction in a Pool



Trapping Force vs. Area

Trapping Force Vs. Area

- The maximum trapping force, $F = \text{Area} \times \Delta P$
- Different trapping forces exist for covers, open outlets, and piping with the same ΔP

Area	ΔP psi	Force
1.8 in ²	14.7	26.5 lbs.
7.0 in ²	14.7	102.9 lbs.
47.2 in ²	14.7	693.8 lbs.



What is Suction Entrapment

A condition in which a bather is trapped by the flow or suction created by rapid flowing water and/or turbulence around a main drain or other suction outlet; or entrapped by entanglement with the outlet cover.

Types of Entrapment

1. Hair Entrapment
2. Limb Entrapment
3. Body Entrapment
4. Evisceration
5. Mechanical Entrapment

Virginia Graeme Baker

7 yr-old Graeme drowned after she was entrapped under water by the suction from a spa drain.

She had been a member of her community swim and diving team and able to swim without assistance since she was three years of age.



Pool & Spa Safety Act Virginia Graeme Baker Act (VGB)

Enacted by Congress in Dec. 20 2007
Became a law on Dec. 19, 2008

Goals:

- Enhance safety of public/private pools/spas
- Reduce child drownings (nearly 300 annually for children under 5 years)
- Reduce suction entrapment incidents, injuries and deaths
- Educate public - importance of constant supervision of children in and around water

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

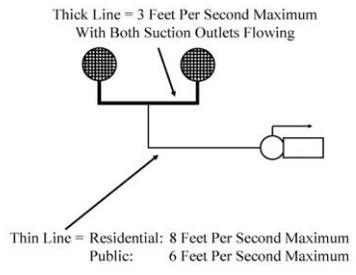
Commercial water parks and their associated suction systems are outside the scope of the standard.



Section 4. General Requirements

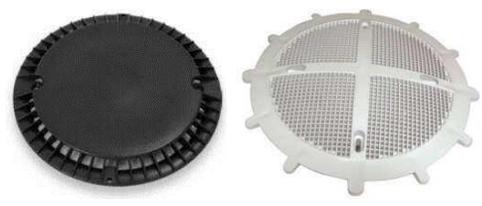
- 4.1 Codes
- 4.2 Electrical components
- 4.3 DANGER
- 4.4 Water velocity
- 4.5 Listed suction outlets ASME/ANSI A112.19.8
- 4.6 Minimum flow rating for each cover/grate
- 4.7 Dual cover/grate separation
- 4.8 Skimmers
- 4.9 Wall vacuum fittings

Section 4.4 Water Velocity



Section 4.5 Listed Suction Outlets

Must comply with AMSE/ANSI A112.19.8



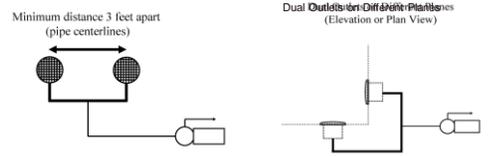
ASME/ANSI A112.19.8

- Suction Outlet Covers Tested For:
- Finger & Limb Entrapment Test
 - Body Entrapment Test
 - Shear Load & Pull Load Tests
 - UV Weathering before structural test
 - Fastener Test
 - Full Head of Hair Test
 - Pony Tail Test
 - No Size Limit
- Manufactured products require testing and certification by "Nationally Recognized Testing Laboratory"

Section 4.7 Dual Cover/Grate Separation

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

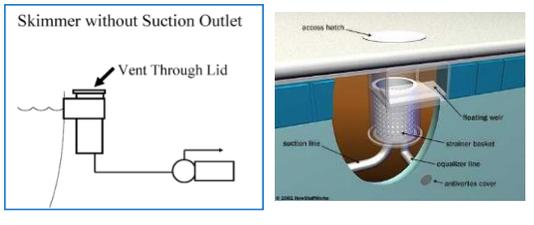
Located on two different planes (bottom/vertical wall) (separate vertical walls)



112

Section 4.8 Skimmers

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

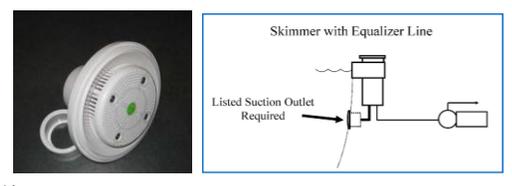


113

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



114

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.

115

Section 4.9 Wall Vacuum Fittings



116

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**

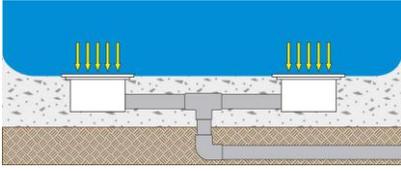
Pools without main drains

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

Section 5.3 Dual Outlets

Listed outlets

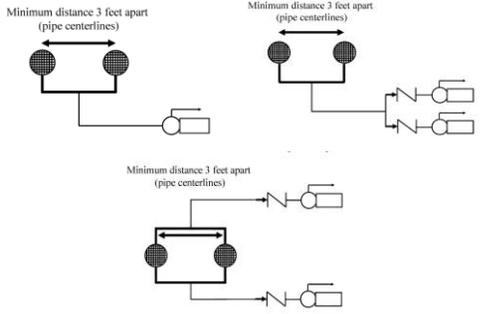
Tee feeding from common line between the suction outlets shall be located approximately midway between the outlets



Dual Outlets

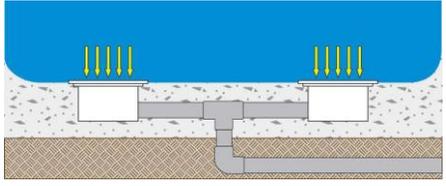


Section 5.3 Dual Outlets



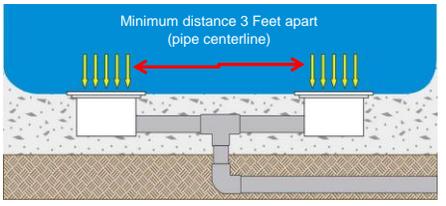
Section 5.3 Dual Outlets

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

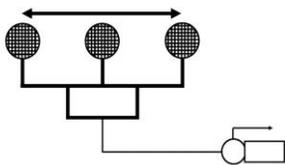




Section 5.4 Three or More Outlets

Three-or-More Outlets in Parallel to Single Pump

Minimum distance 3 feet between outermost outlets (pipe centerlines)



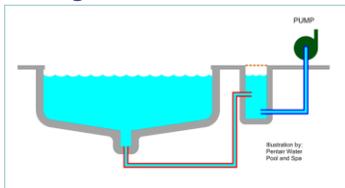
Section 5.7 Single Outlet – Alternative Suction System

Single outlet alternative suction systems consist of a single listed suction outlet cover/grate utilizing a venturi-driven system for circulating water. Such systems shall be tested and listed by a nationally recognized testing laboratory as conforming to the most recent edition of ASME/ANSI A112.19.17 and ASTM F 2387-04.

133

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

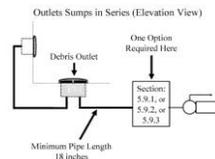


Section 5.9 Outlet Sumps in Series

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



135

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.

Electrical

- E4203.1 Swimming pools- receptacle outlets location: Receptacles shall not be located less than six feet from the inside wall of any pool or other body of water specifically identified in each of the following sections: NEC 680.22, 680.34, 680.43, 680.62, 680.71

Electrical

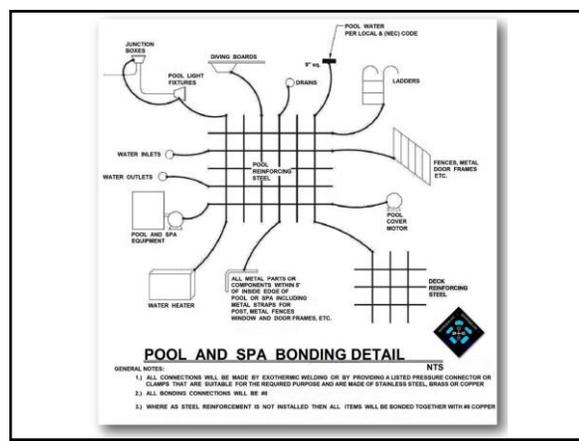
- E4203.1.3 Swimming pools - GFCI protection: All 15 and 20 amp, 125 or 240 v, single phase outlets supplying pool pump motors require GFCI protection whether supplied by a receptacle and cord connection or hard wired to the branch circuit outlet.

Electrical

- E4204.2 Swimming pools- bonded parts:
At least one #8 AWG copper conductor must be secured within or under the pool perimeter surface.

Electrical

- E4204.3 Swimming pools- pool water:
The pool water shall be intentionally bonded by means of a conductive surface area not less than 9 square inches installed in contact with the pool water.
This bond shall be permitted to consist of parts that are required to be bonded in Section E4204.2.



Equipotential Bonding

- Connecting various pool components together with bare copper wire to make them the same potential.
- The purpose of equipotential bonding is to equalize the pressure (or voltage) around the pool so your body doesn't create the circuit between areas of differing potential which would result in getting shocked.
- This is done by creating a "bonding grid"

Questions?

Thanks for attention!
