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)
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
Rhode Island

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

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 a fence or screen 4 feet high (health = 5ft)
- A 4” sphere cannot 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


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

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
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.

[Diagram showing barrier requirements with text: 1 3/4" max. clearance between vertical members, swimming pool side, 2" max., horizontal members spaced less than 45°]
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
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. When the release mechanism is located less than 54” above the bottom of the gate, it must be on the pool side of the fence and at least 3” below the top of the fence. Otherwise, it can be on the outside.

Gate swing is to be outward away from pool for all pedestrian gates.

All pool gates must be self-latching and equipped with locking devices. Pedestrian gates must also be self-closing.
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 with 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
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)
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

Thick Line = 3 Feet Per Second Maximum
With Both Suction Outlets Flowing

Thin Line = Residential: 8 Feet Per Second Maximum
Public: 6 Feet Per Second Maximum
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

Minimum distance 3 feet apart (pipe centerlines)

Minimum distance 3 feet apart (pipe centerlines)
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)
Plan Drawing for Permit
Section 5.5 Single Unblockable Suction Outlet

Any Shape

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
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

Thick Line = 3 Feet Per Second Maximum
With Both Suction Outlets Flowing

Thin Line = Residential: 8 Feet Per Second Maximum
Public: 6 Feet Per Second Maximum
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.

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>6 fps (branch)</th>
<th>8 fps (trunk)</th>
<th>10 fps (return)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sch. 40 PVC</td>
<td>GPM</td>
<td>GPM</td>
<td>GPM</td>
</tr>
<tr>
<td>1½ in.</td>
<td>38</td>
<td>51</td>
<td>64</td>
</tr>
<tr>
<td>2 in.</td>
<td>63</td>
<td>84</td>
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<tr>
<td>2½ in.</td>
<td>90</td>
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<td>4 in.</td>
<td>238</td>
<td>317</td>
<td>397</td>
</tr>
<tr>
<td>6 in.</td>
<td>540</td>
<td>720</td>
<td>900</td>
</tr>
</tbody>
</table>
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.