FBC Advanced Module: Entrapment Protection

Requirements of the
Florida Building Code
Section R4101.6.6

(ANSI/APSP-7, 2006 Suction Entrapment Avoidance in Swimming Pools, Wading Pools, Spas, Hot Tubs, and Catch Basins)

Presented by

Florida Swimming Pool Association

Speaker

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Swim, Incorporated

Lead Dog Aquatic Consulting

Topics

- Suction Entrapment Hazards
- Code Requirements for New Construction
- Compliance Options & Requirements
- Existing Pools & Spas

Suction Entrapment Hazards

- Hair Entrapment
- Body Suction Entrapment
- Limb Suction Entrapment
- Evisceration
- Mechanical Entrapment (non-suction)

Reported Entrapment Cases

- Data Available from the CPSC is collected from several sources:
  - NEISS – National Electronic Injury Surveillance System
  - INDP – A Review of In Depth Investigations
  - IPII – Injury and Potential Injury Incidence File
  - DTHS – Death Certificate File

APSP-7 Writing Committee, compiled, categorized, and evaluated each case in formulating the Standard.

U.S. Consumer Product Safety Commission Data

Table 5
Reported Circulation Entrapments Associated with Pools, Spas, and Whirlpool Bathtubs
by Entrapment Type and Product Category, 2008–2012

Circulation Entrapment Type	Pool	Spa	Whirlpool Bathtub	Row Total
Body	3	6	4	13
Limb	8	1	3	12
Mechanical	5	-	1	6
Hair	-	5	-	5
Evisceration/ Disembowelment	2	1	-	3
Total	18	13	8	39

Source: CPSC databases, including NEISS, IPII, DTHS, and INDP. Data extracted and entrapment database updated in January 2013. Reporting is ongoing for all of these years.

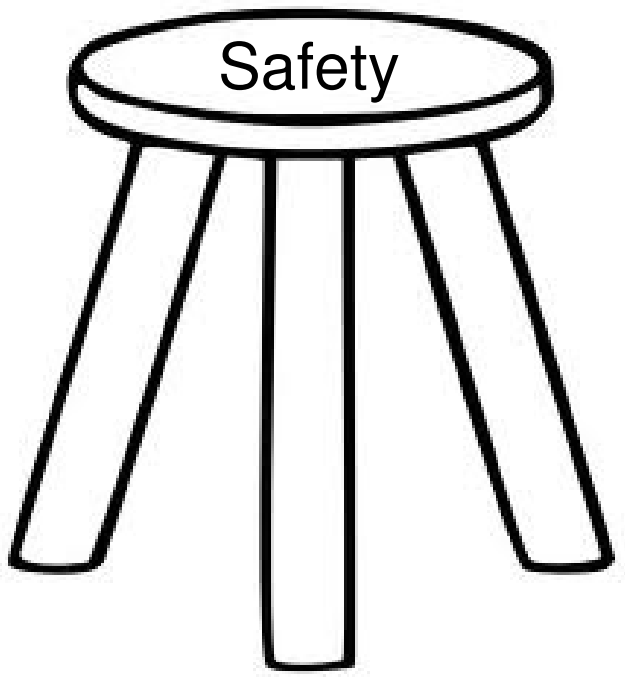
Three Root Causes

Flow – Suction - Mechanical

Flow – Suction – Mechanical

Three Root Causes

Suction Safety is like a stool with three legs. If one leg fails, the system fails
One leg cannot "backup" another leg
ANSI/APSP-7 includes all three legs



Flow – Suction - Mechanical

- **Water Flowing = Hair Entrapment**
  - Suction not excessive – unlisted, flat cover
  - Safety cover installed, properly maintained – flow to high
  - With SVRS, or Vent, or Gravity Drainage, or Multiple Drains.

- **The PROBLEM:**
  - Wrong cover flow rating for system flow
  - Drain cover not Certified (flow rating unknown)
  - Most not aware that this can be a problem

Flow – **Suction** - Mechanical

- **Water Flow Blocked = Body Entrapment**
  - Single suction outlet
  - No safety drain cover
  - Safety cover missing, broken, not properly maintained
  - Swimmer can block the outlet
  - Stomach, back, back and arms, upper leg

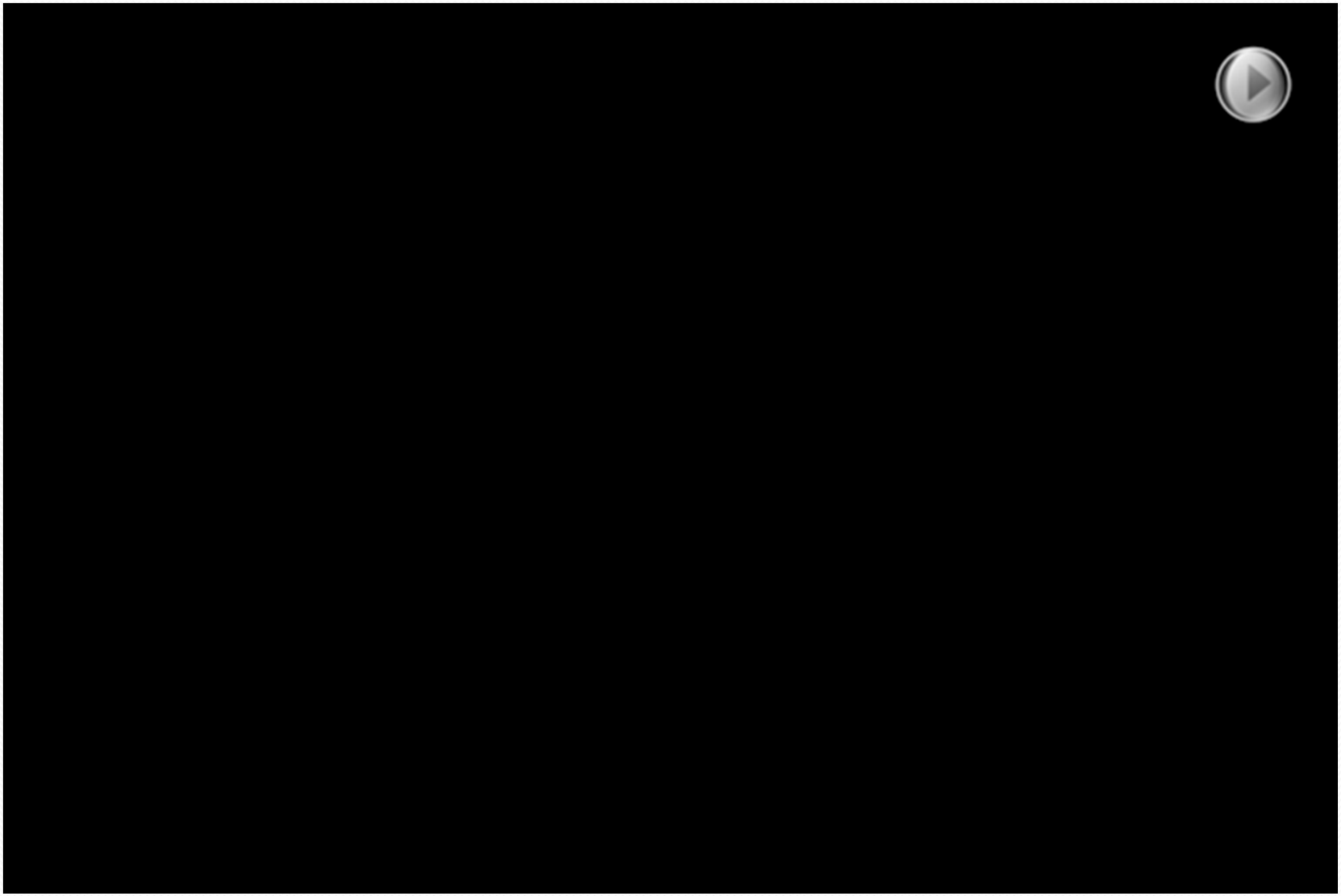
- **The PROBLEM:**
  - Single point suction that can be blocked

Flow – **Suction** - Mechanical

- **Evisceration**
  - Near instantaneous – ¼ of a second @ 60 gpm
  - Injury at the speed of flowing water
  - 2" pipe flowing at 63 GPM = 6 ft. per second / 18 ft. in 3 seconds (*8.7 lbs. of liquid per second*)

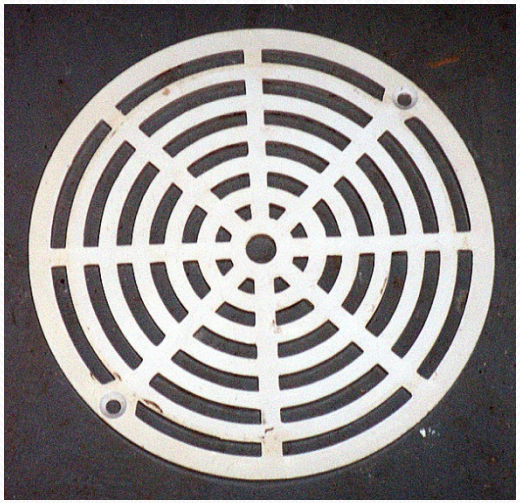
- **The PROBLEM:**
  - Single outlet and missing/broken cover and buttock seal

Cause of Evisceration



Flow – Suction - **Mechanical**

- **Open pipe = Injury or Death**
  - Openings large enough for hand or foot
  - Limb goes in, can't be pulled out
  - Rescuers need jackhammer
- **Suction increases Limb Entrapment hazard**
  - Suction surprises and pulls limb
  - Limb stuck after suction stopped
- **Small hole = finger entrapment**
  - ½ inch hole in thin drain cover
  - Entraps like sticking ring on finger
- **The PROBLEM:**
  - Broken or Missing drain covers
  - Drain covers not Certified



ANSI/APSP-7, 2006
Section 4.3

General Requirements

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 – it was just exposed.

Three Elements of the Code

1. **Listed Safety Covers** – what's required & how to comply

2. **Water Velocity** – what's required & how to comply

3. **Placement** of Submerged Suction Outlets (Drains) – what's required & how to comply

ANSI/APSP-7, 2006
Section 4.5

Listed Safety Covers

- **Listed suction outlet(s).** Suction outlet covers/grates shall be tested and listed by a nationally recognized testing laboratory as conforming to the most recent edition of ANSI/ASME A112.19.8 Standard for Suction Fittings for Use in Swimming Pools, Wading Pools, Spas and Hot Tubs and include a permanently marked flow rating tested to prevent hair entrapment.

ANSI/ASME A112.19.8

Standard for Suction Fittings (included in ANSI/APSP-7, 2006)

- Finger Entrapment Test
- Body Entrapment Test
- UV Testing
- Fastener Test
- Hair Test

ANSI/APSP-7, 2006
Section 4.6, 4.6.1 & 4.6.2

Minimum flow ratings

When used, submerged suction outlet arrangements shall be single unblockable, dual, or three-or-more.

- **Single or dual outlets.** The flow rating for each listed cover/grate shall be greater than the maximum system flow rate.
- **Three or more outlets.** For a system with three or more covers/grates, the sum of the flow ratings shall be at least twice the maximum system flow rate.

***Example*:** Two (2) 100 GPM cover/grates and one (1) 60 GPM cover/grate would have an allowable maximum system flow rate of 130 GPM
(100 + 100 + 60) / 2 = 130)

Covers may be verified at plans submittal and/or inspection

- Manufacturers specifications, showing make and model of the drain covers, may be required at plans submittal.

- Inspector may require the covers to be on site at one of the inspection phases. Listed covers will have ”ANSI/ASME A112.19.8” and, a flow rating “X GPM”, and Manufacturer and Model.

Water Velocity Requirements

- Water velocity in field fabricated piping is based on the maximum system flow rate.

- Water velocity in branch suction piping is based on maximum system flow rate and shall be limited to 6 feet per second when one of a pair of drains is blocked. In normal operation then, the branch suction piping velocity is 3 feet per second.

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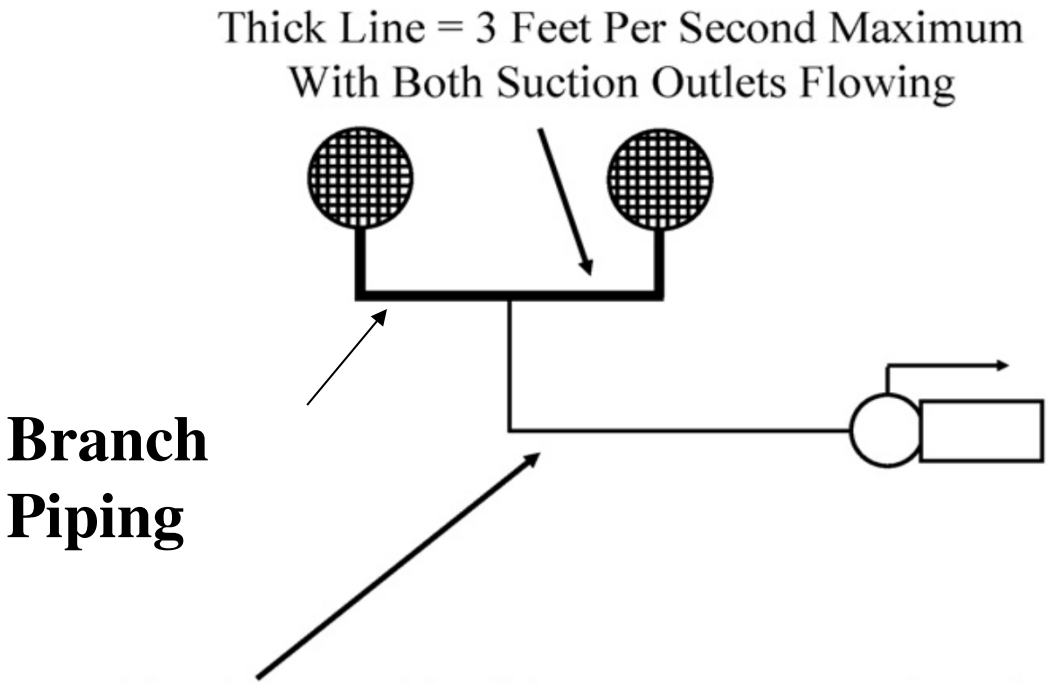
Section 4.4

Water Velocity



Specify Velocity at plans submittal

Builder must specify 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 ½ in.	38	51	64
2 in.	63	84	105
2 ½ in.	90	119	149
3 in.	138	184	230
4 in.	238	317	397
6 in.	540	720	900

ANSI/APSP-7, 2006
Section 4.4.1

Maximum System Flow Rate

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

- Total Dynamic Head (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

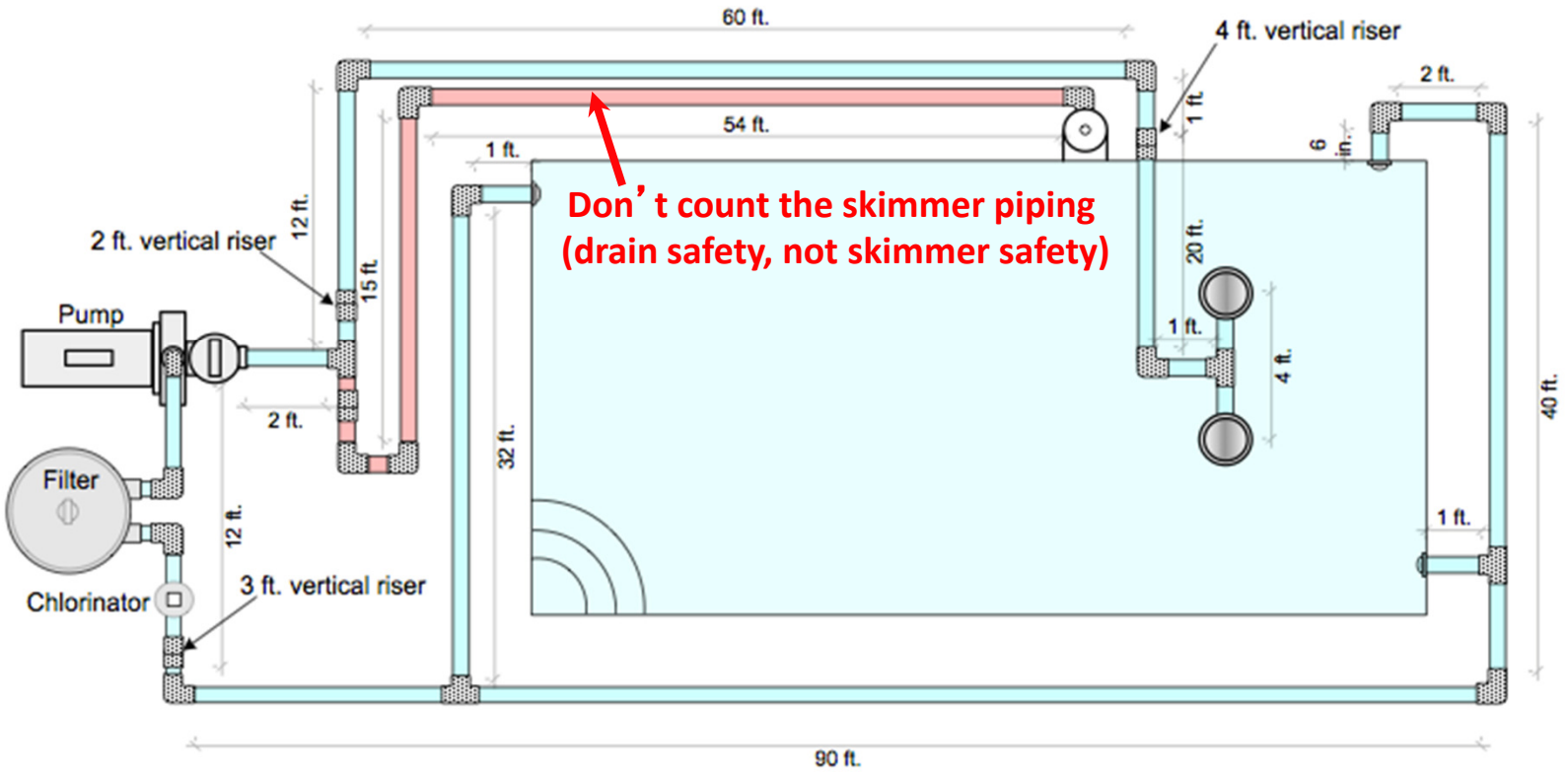
The Process

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

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.

Here's how TDH is Calculated



Measure the pipe, count the fittings, valves, equipment, return & drain fittings

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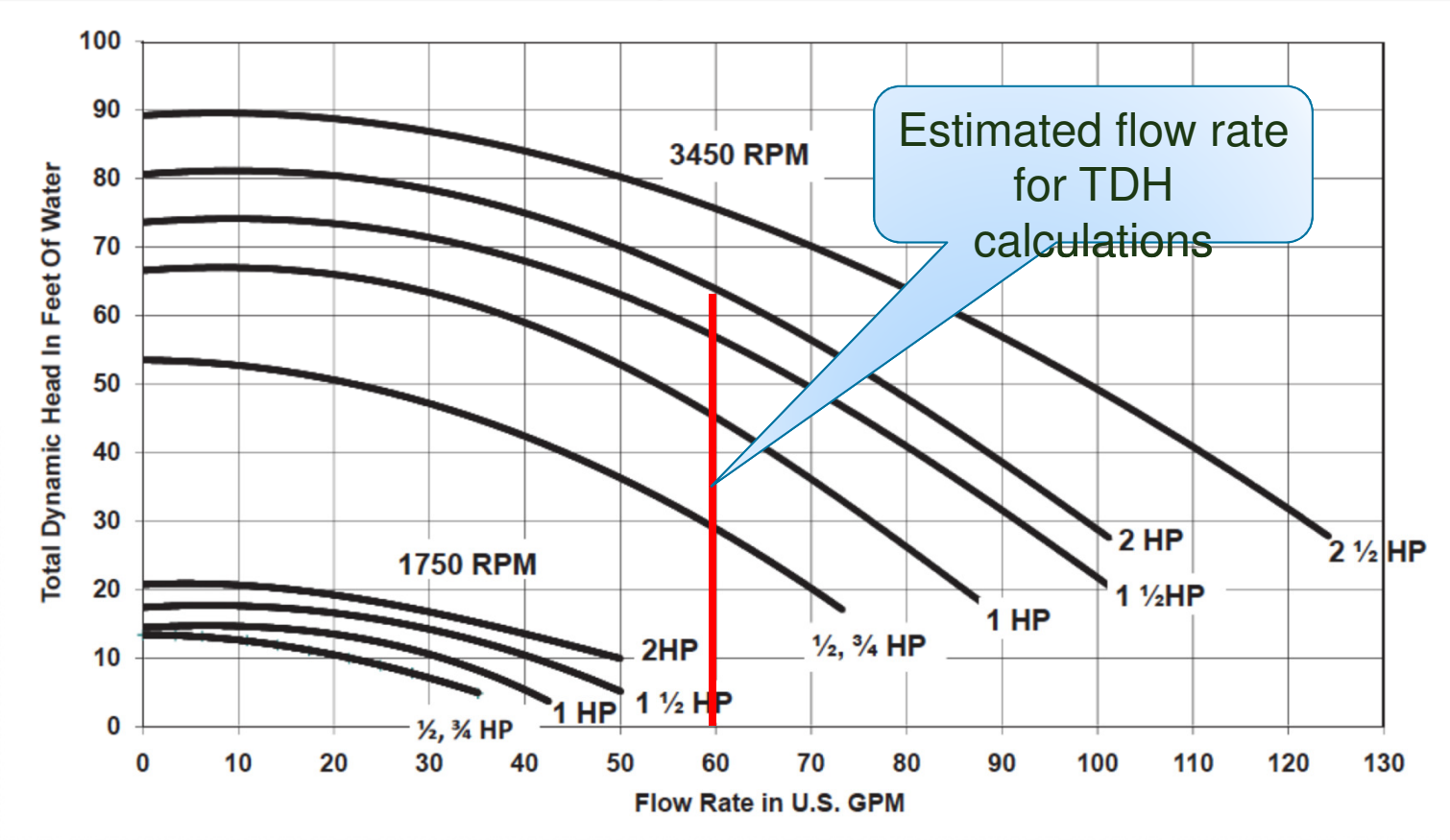
Our Working Example

Pump Performance Curve



Spa design flow rate at 60 gpm

Slide 26

DJ1 Dan Johnson, 6/8/2013

ANSI/APSP-7, 2006
Compliance
Section 4.4.1

FRICTION LOSS - WATER

Flow Velocity & Friction Loss — Schedule 40 Pipe

Gallons/Minute	Velocity Ft./Second	Friction Loss Ft. Water/100 Ft.	Friction Loss PSI/100 Ft.	Velocity Ft./Second	Friction Loss Ft. Water/100 Ft.	Friction Loss PSI/100 Ft.	Velocity Ft./Second	Friction Loss Ft. Water/100 Ft.	Friction Loss PSI/100 Ft.	Velocity Ft./Second	Friction Loss Ft. Water/100 Ft.	Friction Loss PSI/100 Ft.	Velocity Ft./Second	Friction Loss Ft. Water/100 Ft.	Friction Loss PSI/100 Ft.	Velocity Ft./Second	Friction Loss Ft. Water/100 Ft.	Friction Loss PSI/100 Ft.	Velocity Ft./Second	Friction Loss Ft. Water/100 Ft.	Friction Loss PSI/100 Ft.	Velocity Ft./Second	Friction Loss Ft. Water/100 Ft.	Friction Loss PSI/100 Ft.
	½ in.			¾ in.																				
1	1.13	2.08	0.90	0.63	0.51	0.22	1 in.			1¼ in.			1½ in.											
2	2.26	4.16	1.80	1.26	1.02	0.44	0.77	0.55	0.24	0.44	0.14	0.06	0.33	0.07	0.03	2 in.			2½ in.			3 in.		
5	5.64	23.44	10.15	3.16	5.73	2.48	1.93	1.72	0.75	1.11	0.44	0.19	0.81	0.22	0.09	0.49	0.066	0.029	0.30	0.038	0.016	0.22	0.015	0.007
7	7.90	43.06	18.64	4.43	10.52	4.56	2.72	3.17	1.37	1.55	0.81	0.35	1.13	0.38	0.17	0.69	0.11	0.048	0.49	0.051	0.023	0.31	0.021	0.009
10	11.28	82.02	35.51	6.32	20.04	8.68	3.86	6.02	2.61	2.21	1.55	0.67	1.62	0.72	0.31	0.98	0.21	0.091	0.68	0.09	0.039	0.44	0.03	0.013
15	4 in.			9.48	42.46	18.39	5.79	12.77	5.53	3.31	3.28	1.42	2.42	1.53	0.66	1.46	0.45	0.19	1.03	0.19	0.082	0.66	0.07	0.030
20	0.51	0.03	0.013	12.65	72.34	31.32	7.72	21.75	9.42	4.42	5.59	2.42	3.23	2.61	1.13	1.95	0.76	0.33	1.37	0.32	0.14	0.88	0.11	0.048
25	0.64	0.04	0.017	5 in.			9.65	32.88	14.22	5.52	8.45	3.66	4.04	3.95	1.71	2.44	1.15	0.50	1.71	0.49	0.21	1.10	0.17	0.074
30	0.77	0.06	0.026	0.49	0.02	0.009	11.58	46.08	19.95	6.63	11.85	5.13	4.85	5.53	2.39	2.93	1.62	0.70	2.05	0.68	0.29	1.33	0.23	0.10
35	0.89	0.08	0.035	0.57	0.03	0.013				7.73	15.76	6.82	5.66	7.36	3.19	3.41	2.15	0.93	2.39	0.91	0.39	1.55	0.31	0.13
40	1.02	0.11	0.048	0.65	0.03	0.013				8.84	20.18	8.74	6.47	9.43	4.08	3.90	2.75	1.19	2.73	1.16	0.50	1.77	0.40	0.17
45	1.15	0.13	0.056	0.73	0.04	0.017	6 in.			9.94	25.10	10.87	7.27	11.73	5.08	4.39	3.43	1.49	3.08	1.44	0.62	1.99	0.50	0.22
50	1.28	0.16	0.069	0.81	0.05	0.022	0.56	0.02	0.009	11.05	30.51	13.21	8.08	14.25	6.17	4.88	4.16	1.80	3.42	1.75	0.76	2.21	0.60	0.26
60	1.53	0.22	0.095	0.97	0.07	0.030	0.67	0.03	0.013				9.70	19.98	8.65	5.85	5.84	2.53	4.10	2.46	1.07	2.65	0.85	0.37
70	1.79	0.30	0.13	1.14	0.10	0.043	0.79	0.04	0.017							6.83	7.76	3.36	4.79	[illegible]	1.42	3.09	1.13	0.49
75	1.92	0.34	0.15	1.22	0.11	0.048	0.84	0.05	0.022							7.32	8.82	3.82	5.13	3.71	1.61	3.31	1.28	0.55
80	2.05	0.38	0.16	1.30	0.13	0.056	0.90	0.05	0.022							7.80	9.94	4.30	5.47	4.19	1.81	3.53	1.44	0.62
90	2.30	0.47	0.20	1.46	0.16	0.069	1.01	0.06	0.026	8 in.						8.78	12.37	5.36	6.15	5.21	2.26	3.98	1.80	0.78
100	2.56	0.58	0.25	1.62	0.19	0.082	1.12	0.08	0.035	0.65	0.03	0.012				9 75	15.03	6.51	6.84	6.33	2.74	4.42	2.18	0.94
125	3.20	0.88	0.38	2.03	0.29	0.125	1.41	0.12	0.052	0.81	0.035	0.015							8.55	9.58	4.15	5.52	3.31	1.43
150	3.84	1.22	0.53	2.44	0.40	0.17	1.69	0.16	0.069	0.97	0.04	0.017							10.26	13.41	5.81	6.63	4.63	2.00
175	4.48	1.63	0.71	2.84	0.54	0.235	1.97	0.22	0.096	1.14	0.055	0.024	10 in.									7.73	6.16	2.67
200	5.11	2.08	0.90	3.25	0.69	0.30	2.25	0.28	0.12	1.30	0.07	0.030	0.82	0.027	0.012							8.83	7.88	3.41
250	6.40	3.15	1.36	4.06	1.05	0.45	2.81	0.43	0.19	1.63	0.11	0.048	1.03	0.035	0.015							11.04	11.93	5.17
300	7.67	4.41	1.91	4.87	1.46	0.63	3.37	0.60	0.26	1.94	0.16	0.069	1.23	0.05	0.022	12 in.								
350	8.95	5.87	2.55	5.69	1.95	0.85	3.94	0.79	0.34	2.27	0.21	0.091	1.44	0.065	0.028	1.01	0.027	0.012						
400	10.23	7.52	3.26	6.50	2.49	1.08	4.49	1.01	0.44	2.59	0.27	0.12	1.64	0.09	0.039	1.16	0.04	0.017						
450				7.31	3.09	1.34	5.06	1.26	0.55	2.92	0.33	0.14	1.85	0.11	0.048	1.30	0.05	0.022						
500				8.12	3.76	1.63	5.62	1.53	0.66	3.24	0.40	0.17	2.05	0.13	0.056	1.45	0.06	0.026						
750										4.86	0.85	0.37	3.08	0.28	0.12	2.17	0.12	0.052						
1000										6.48	1.45	0.63	4.11	0.48	0.21	2.89	0.20	0.087						
1250													5.14	0.73	0.32	3.62	0.31	0.13						
1500													6.16	1.01	0.44	4.34	0.43	0.19						
2000																5.78	0.73	0.32						
2500																7.23	1.11	0.49						

Friction Loss Through Fittings

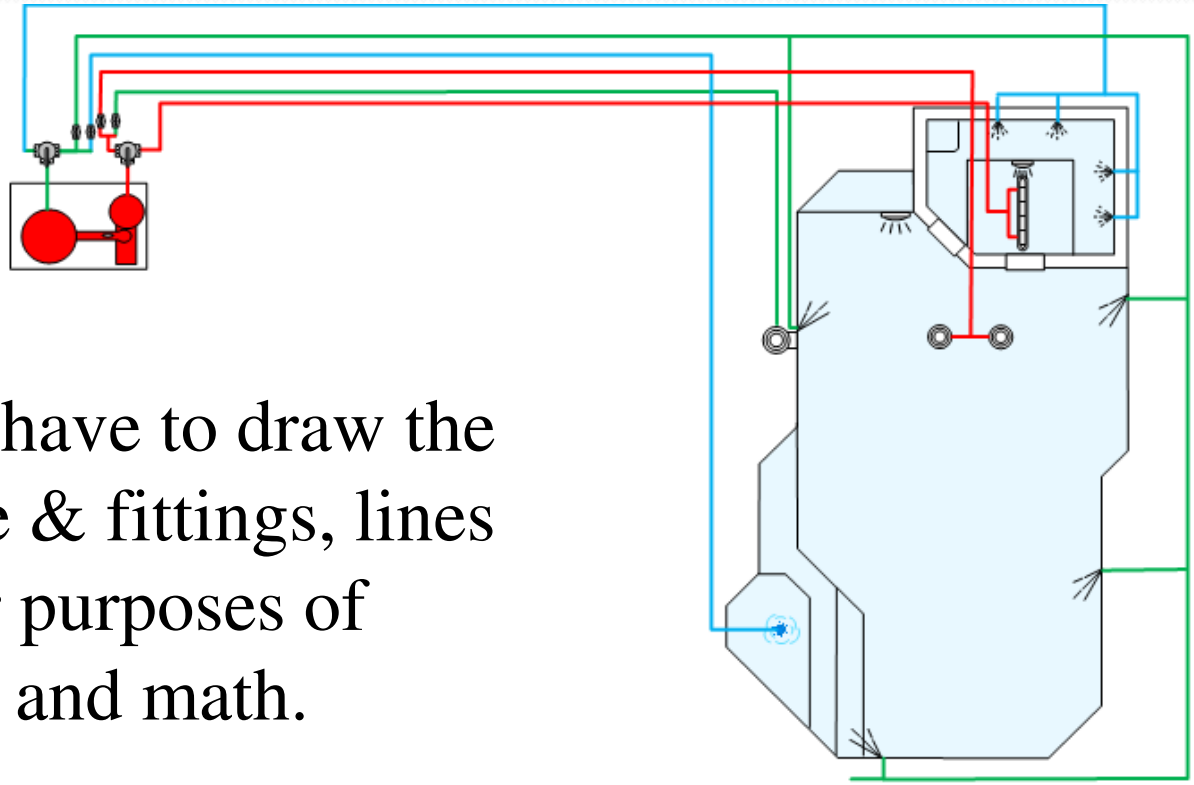
Equivalent length of straight pipe in feet

Pipe Size	1”	1.5”	2”	2.5”	3”	4”	5”	6”	8”
90º elbow	2.5	4.0	5.7	6.9	7.9	11.4	14.5	16.7	21.0
45º elbow	1.4	2.1	2.6	3.1	4.0	5.1	7.0	8.0	10.6
Tee through	1.7	2.7	4.0	4.9	6.1	7.9	9.7	12.3	14.0
Tee branch	6.0	8.4	12.0	14.7	16.4	22.0	26.2	32.7	49.0
Swing Check Valve	11.2	15.2	19.1	22.0	27.0	38.0			

Friction Loss - Return Fittings

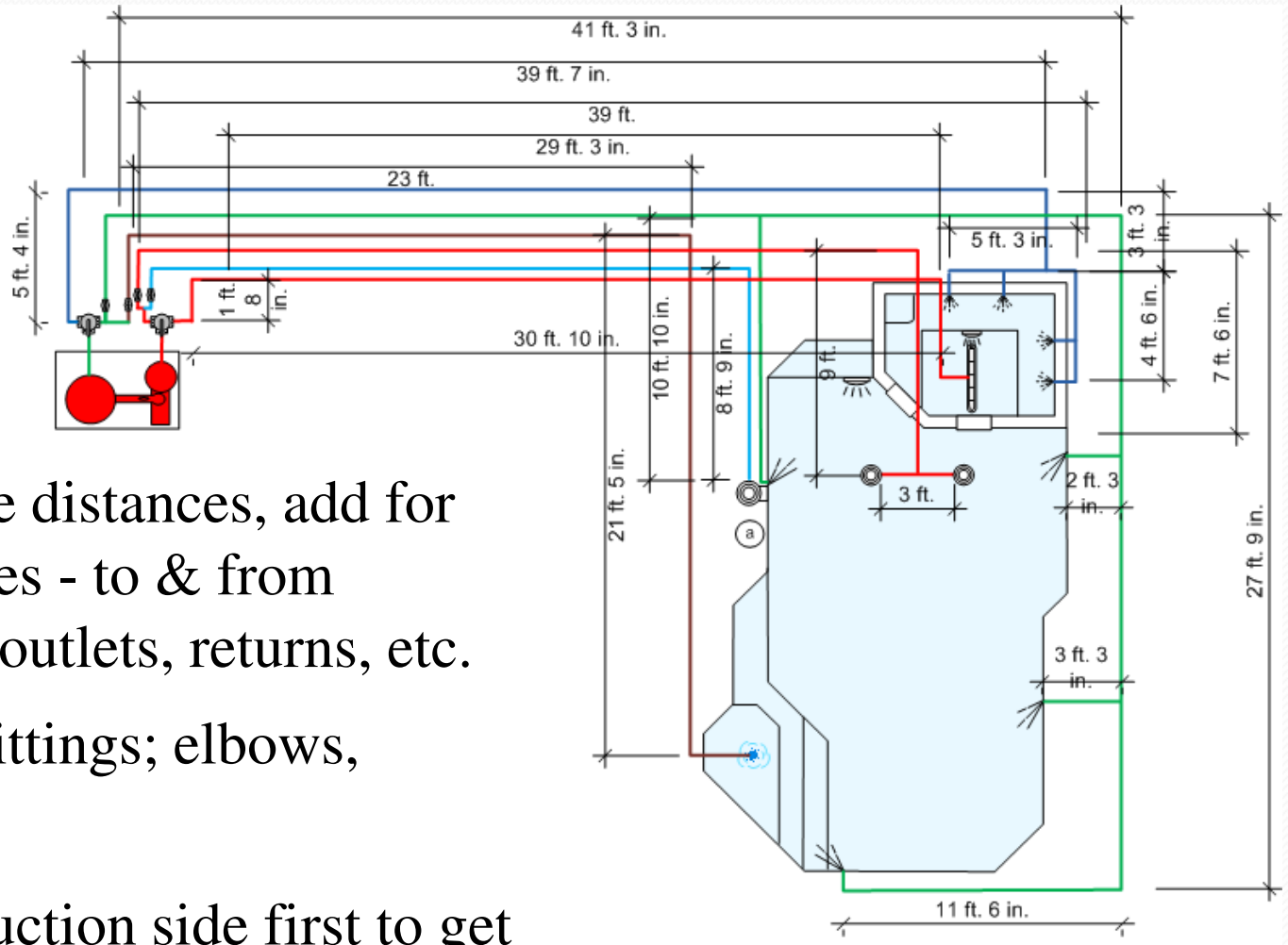
	½ in.		¾ in.		1 in.	
GPM	**Velocity in FPS**	**Loss in feet hd.**	**Velocity in FPS**	**Loss in feet hd.**	**Velocity in FPS**	**Loss in feet hd.**
5	8.2	1.0	3.6	.2		
10	16.3	4.2	7.3	.8		
15	24.5	9.3	10.9	1.9	6.1	.6
20			14.5	3.3	8.2	1.0
25			18.2	5.1	10.2	1.6
30			21.8	7.4	12.3	2.3
35					14.3	3.2
40					16.3	4.2
50					20.4	6.5

The Complete Piping System



You don't have to draw the actual pipe & fittings, lines will do for purposes of measuring and math.

ANSI/APSP-7, 2006
Compliance – Section 4.4.1



Measure the distances, add for vertical pipes - to & from submerged outlets, returns, etc.

Count the fittings; elbows, tees, etc.

Calculate suction side first to get pipe & fitting size correct – return piping is typically smaller.

Suction Side – the Pool

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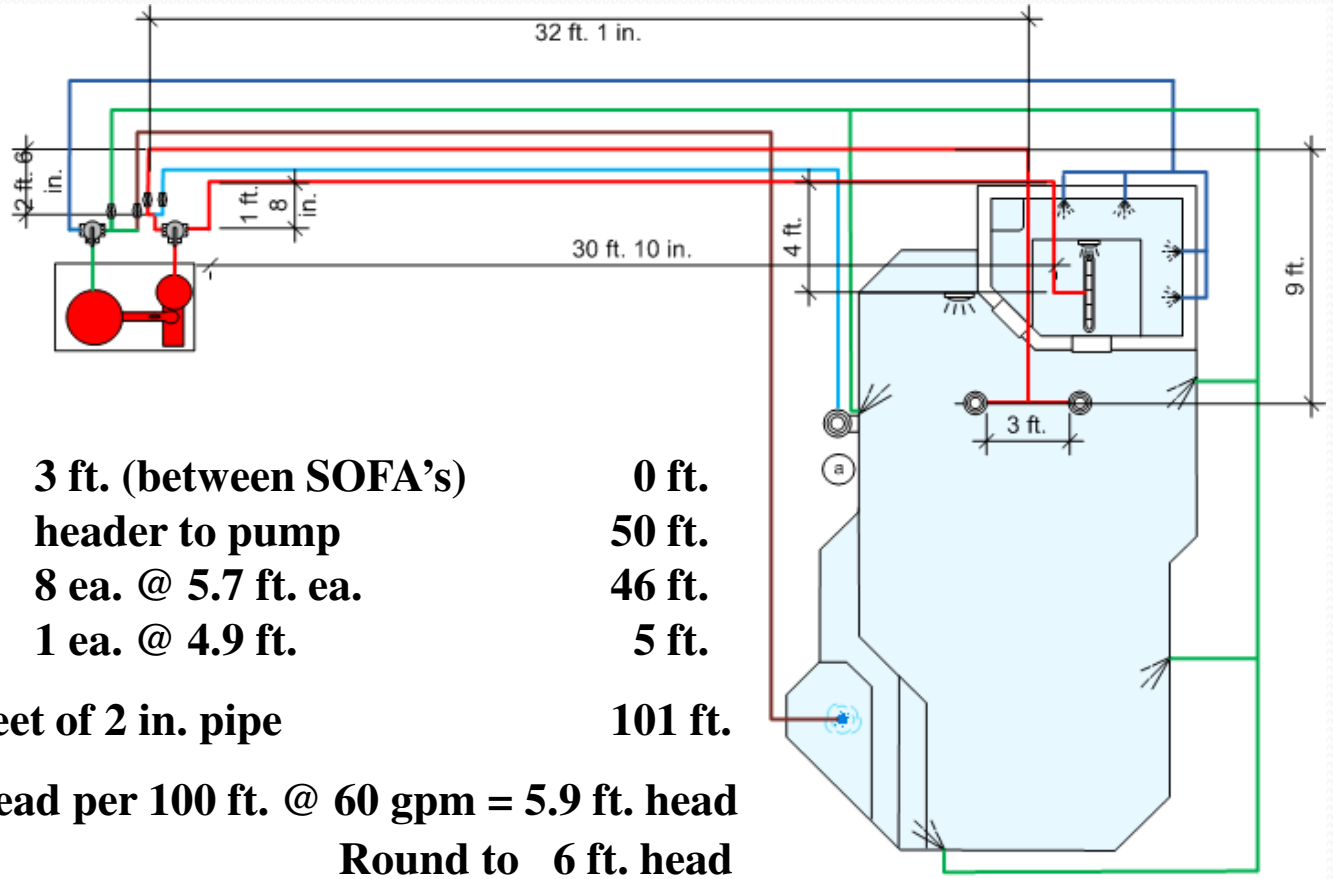
Compliance – Section 4.4.1



POOL:

2 ½ " pipe	3 ft. (between SOFA's)	0 ft.
2" pipe	header to pump	50 ft.
2" 90's	8 ea. @ 5.7 ft. ea.	46 ft.
2 1/2" Tee	1 ea. @ 4.9 ft.	5 ft.

Total equivalent feet of 2 in. pipe **101 ft.**

1.01 x 5.84 ft. of head per 100 ft. @ 60 gpm = 5.9 ft. head
Round to 6 ft. head

3 way valve	1 ea. @ 2 ft.	2 ft. head
2" ball valve	1 ea. @ 1 ft.	1 ft. head
SOFA's	2 ea. @ 2 ft.	4 ft. head

Total Dynamic Head – Pool Scution Side = **13 ft. TDH**

Suction Side – the Spa

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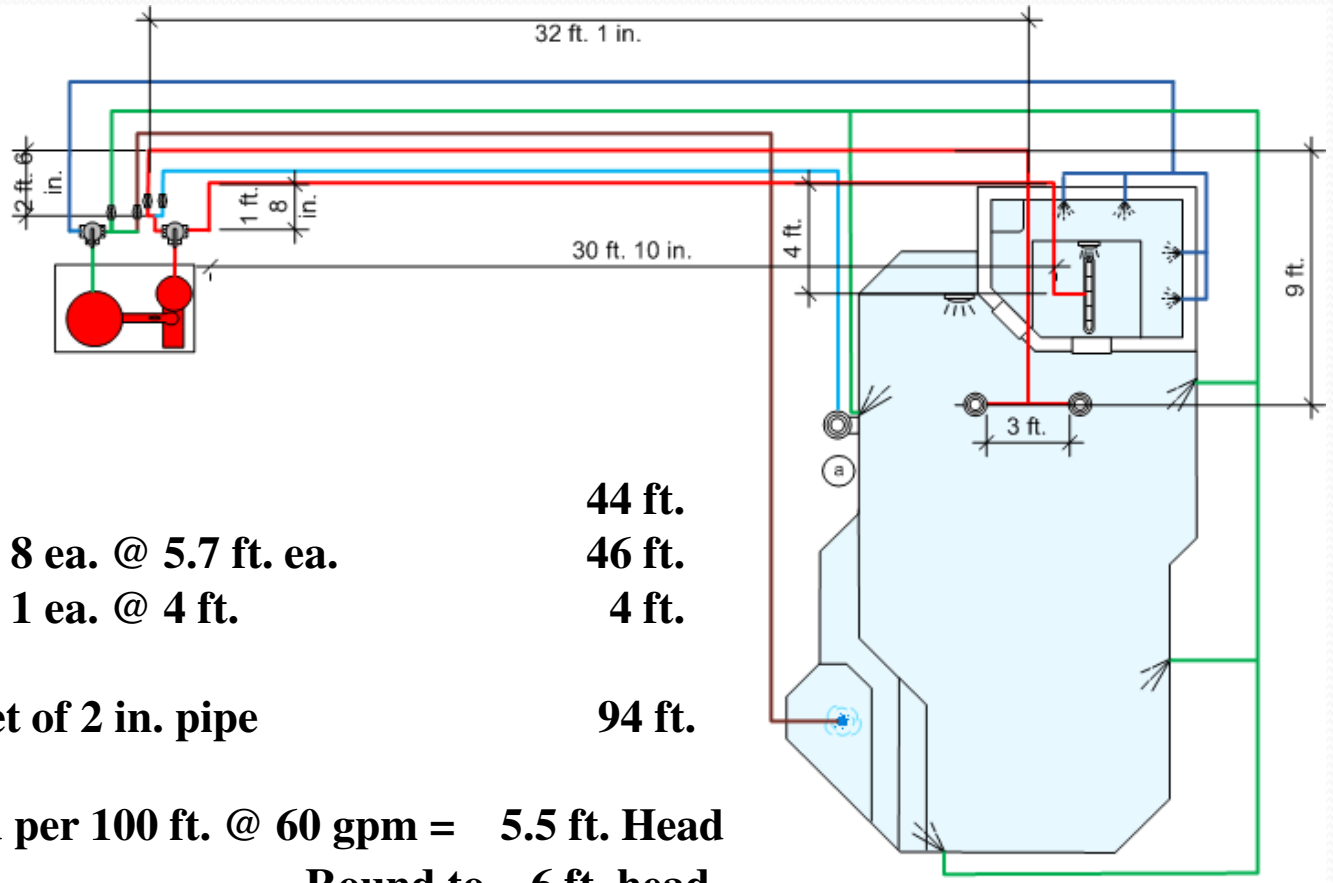
Compliance – Section 4.4.1



SPA:

2" pipe		**44 ft.**
2" 90's	**8 ea. @ 5.7 ft. ea.**	**46 ft.**
2 " Tee's	**1 ea. @ 4 ft.**	**4 ft.**

Total equivalent feet of 2 in. pipe **94 ft.**

94 x 5.84 ft. of head per 100 ft. @ 60 gpm = 5.5 ft. Head
Round to 6 ft. head

3 way valve	**1 ea. @ 2 ft.**	**2 ft. head**
SOFA	**1 ea. @ 1 ft.**	**1 ft. head**

Total Dynamic Head – Spa Suction Side = 9 ft. TDH

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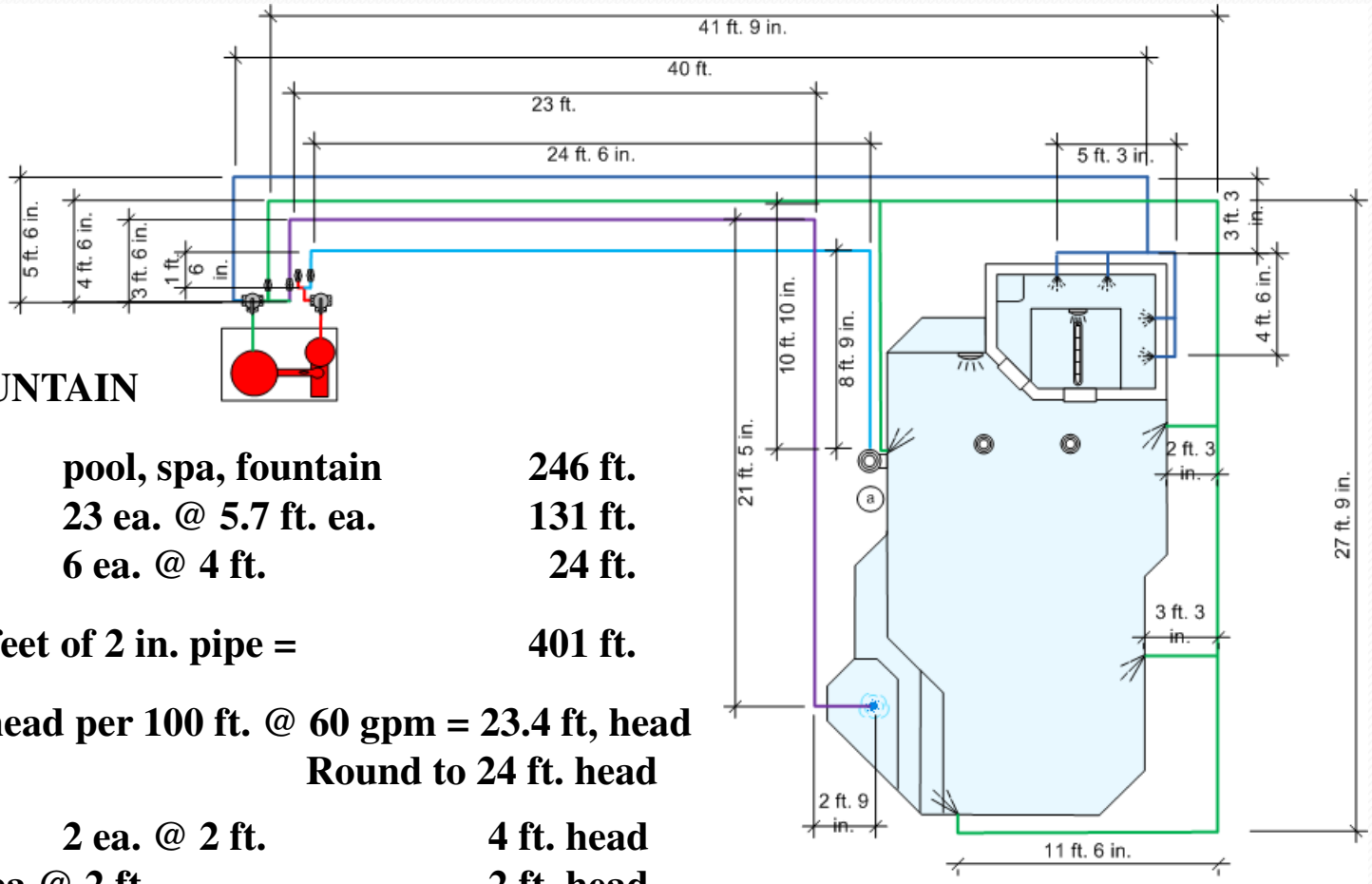
Return Side Calculations

ANSI/APSP-7, 2006
Compliance – Section 4.4.1



POOL, SPA, FOUNTAIN

2” pipe	**pool, spa, fountain**	**246 ft.**
2'' 90's	**23 ea. @ 5.7 ft. ea.**	**131 ft.**
2“ Tee	**6 ea. @ 4 ft.**	**24 ft.**

Total equivalent feet of 2 in. pipe = 401 ft.

4.01 x 5.84 ft. of head per 100 ft. @ 60 gpm = 23.4 ft, head
Round to 24 ft. head

3 way valve	**2 ea. @ 2 ft.**	**4 ft. head**
2” check valve 1 ea @ 2 ft.		**2 ft. head**
Chlorinator		**1 ft. head**
1 in. pool inlet fittings		**1 ft. head**
¼ in. spa jet fittings		**4 ft. head**

Total Dynamic Head – Return Side = 36ft. TDH

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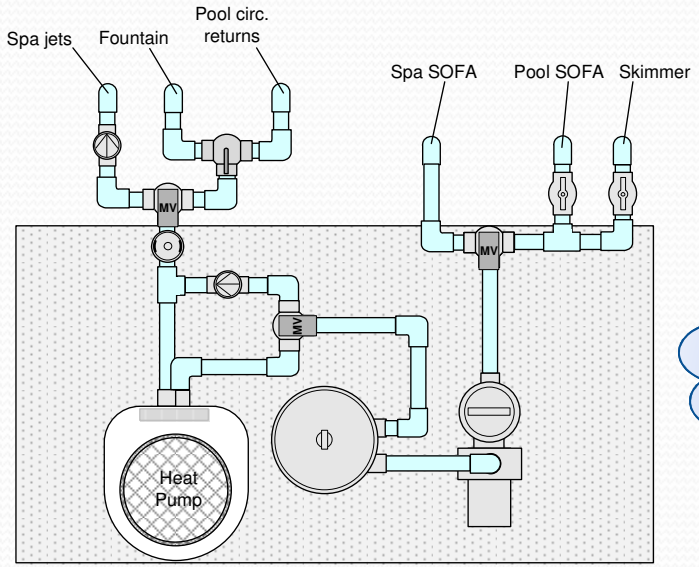
Equipment Loss

ANSI/APSP-7, 2006
Compliance – Section 4.4.1



Pool/Spa Equipment

Pump head loss is built in to the Pump Curve

Total feet - 2 in. pipe	10 ft.
2 in. 90 degree elbows 10 @ 5.7 ft. ea. =	57 ft.
Total equivalent feet of 2 in. pipe =	67 ft.
.67 x 5.84 =	3.9 ft. head
Filter =	3.7 ft. head
Heat Pump =	1.5 ft. head

Total TDH loss at Equipment = 9.1 ft. head

Round to 9 ft. head

TDH Calculations

ANSI/APSP-7, 2006
Compliance – Section 4.4.1

SPA Side TDH

Total Dynamic Head – Spa Suction Side = 9 ft. TDH

Total Dynamic Head – Return Side = 36 ft. TDH

Total Dynamic Head – Equipment = 9 ft. TDH

Spa System TDH = 54 ft.

POOL Side TDH

Total Dynamic Head – Pool Scution Side = 13 ft. TDH

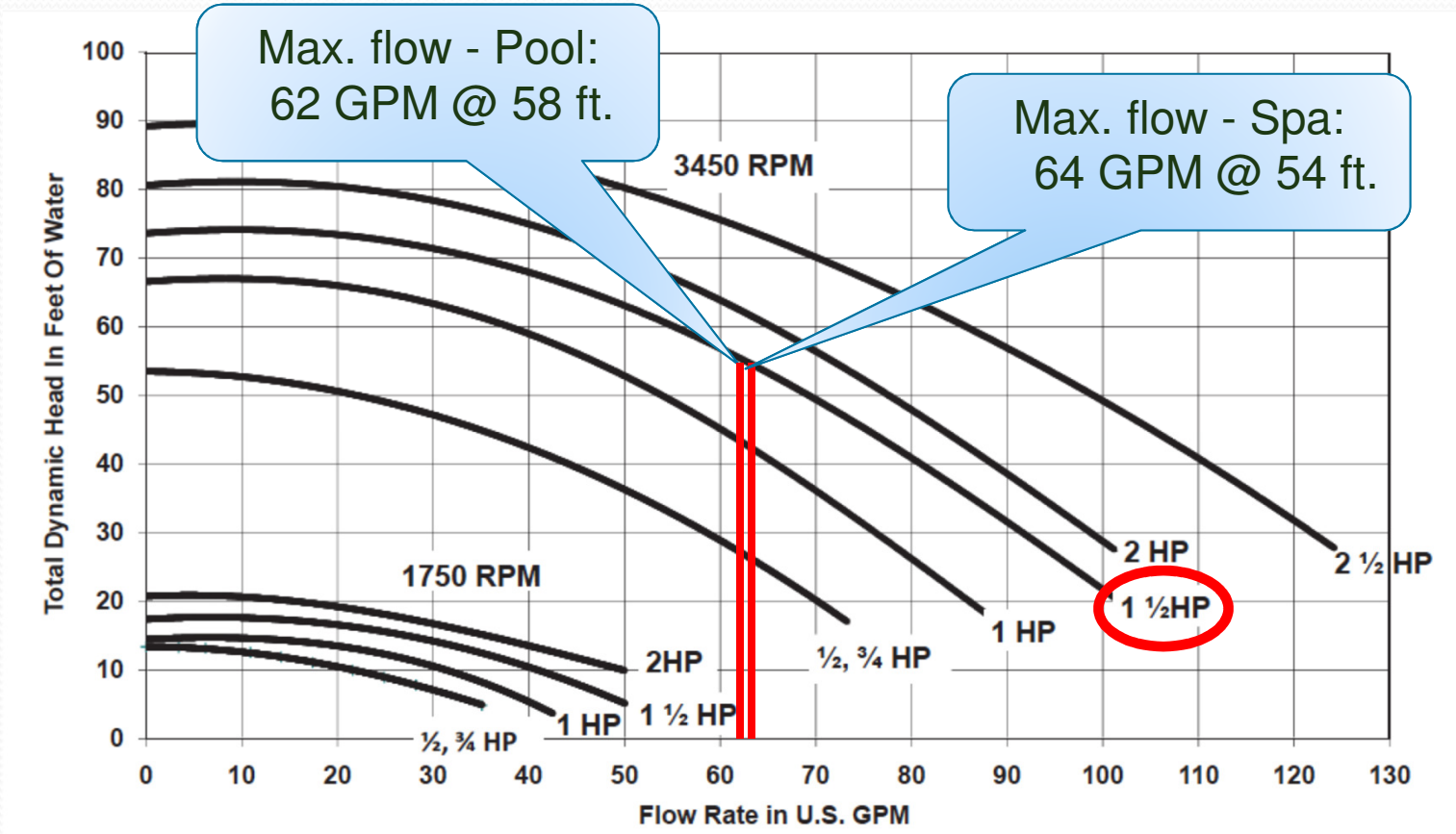
Total Dynamic Head – Return Side = 36 ft. TDH

Total Dynamic Head – Equipment = 9 ft. TDH

Pool System TDH = 58 ft.

ANSI/APSP-7, 2006 Compliance Section 4.4.1

Pump Performance Curve



Pipe Size	1.5"	2"	2.5"	3"	3.5"	4"	5"	6"
Nominal GPM @ 6fps	38	63	90	138	185	238	374	540
Nominal GPM @ 8fps	51	84	119	184	247	317	499	720

Simplified TDH Calculation

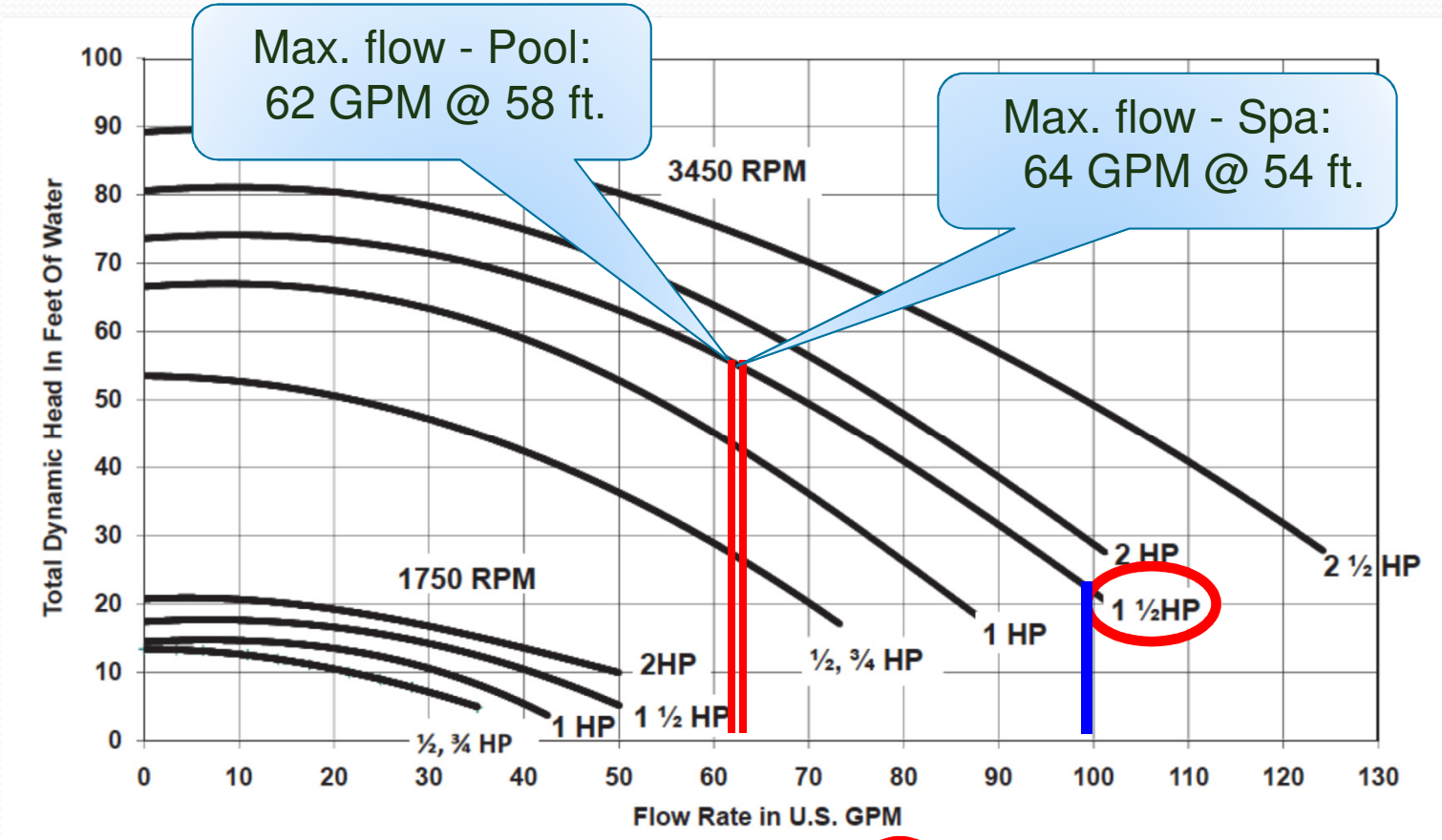
350 ft. of pipe to & from the pool, spa, etc.

3.5 x 5.84 =	20.4 ft. head
Filter loss =	3.7 ft. head
Total = 24.1 ft. head	

Note: simplified TDH will always lead to a lower value than the actual TDH, insuring a safer system. A pump sized to a lower resistance (TDH) will produce a lower flow rate when installed in a system that actually has higher resistance, thereby reducing velocity at the drains.

Pump Curve w/Simplified TDH

ANSI/APSP-7, 2006 Compliance Section 4.4.1



Pipe Size	1.5"	2"	2.5"	3"	3.5"	4"	5"	6"
Nominal GPM @ 6fps	38	63	90	138	185	238	374	540
Nominal GPM @ 8fps	51	84	119	184	247	317	499	720

ANSI/APSP-7
Compliance
Section 4.4

Velocity Compliance

To comply with the velocity requirements of the new code, the builder must specify the branch piping size which will limit velocity between drains to 6 ft. per second.

To validate this velocity, the contractor shall specify the maximum system flow rate, system resistance determined by one of the three prescribed methods, and specify the pump which will achieve the stated flow rate at the calculated resistance.

Building Dept. may verify safe velocity and pipe sizing at plans submittal and/or field inspection

PIPE SIZE	6 fps (branch)	8 fps (trunk)	10 fps (return)
Sch. 40 PVC	GPM	GPM	GPM
1 ½ in.	38	51	64
2 in.	63	84	105
2 ½ in.	90	119	149
3 in.	138	184	230
4 in.	238	317	397
6 in.	540	720	900

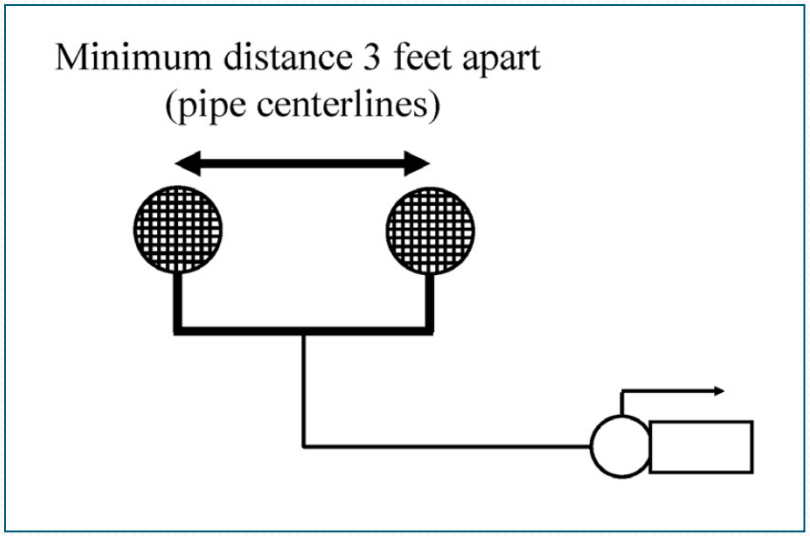
ANSI/APSP-7, 2006
Section 4.7 & 5.3.2

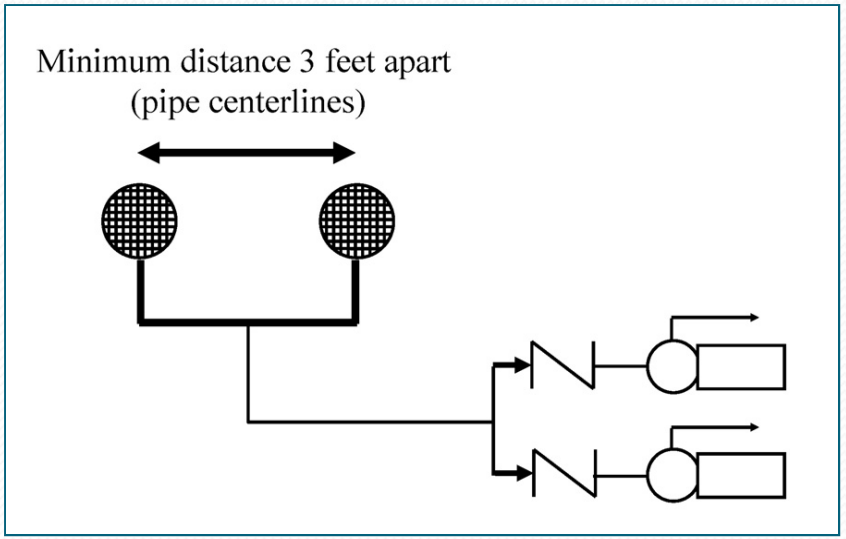
Drain Placement

- **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.

ANSI/APSP-7, 2006
Section 5.3

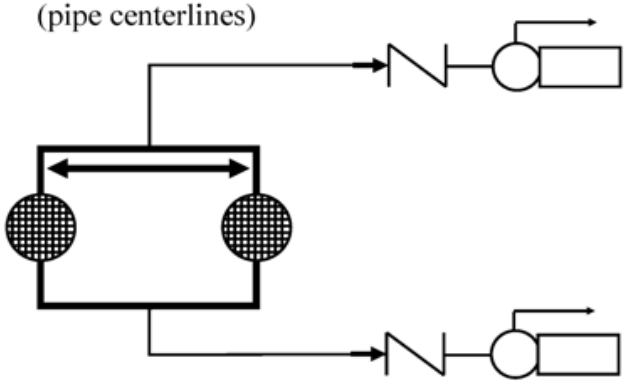
Drain Configuration Options



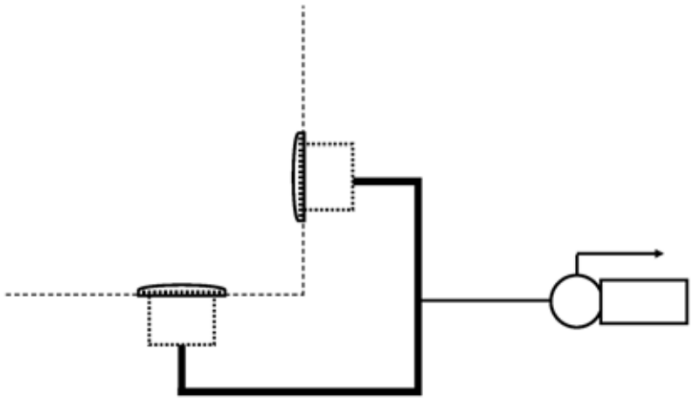


The tee feeding from the common line between the suction outlets, to the pump(s) shall be located approximately midway between the outlets with flow out of the branch of the tee.

Minimum distance 3 feet apart
(pipe centerlines)

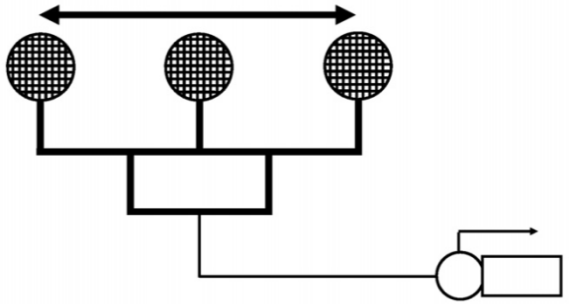


Dual Outlets on Different Planes
(Elevation or Plan View)



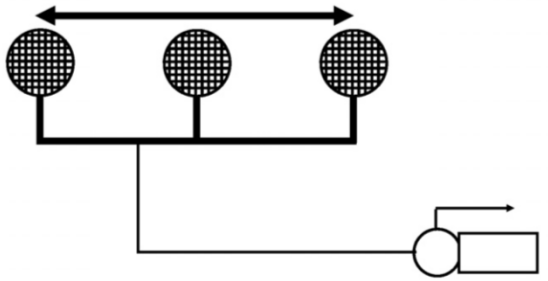
Three-or-More Outlets in Parallel to Single Pump

Minimum distance 3 feet between outermost outlets
(pipe centerlines)



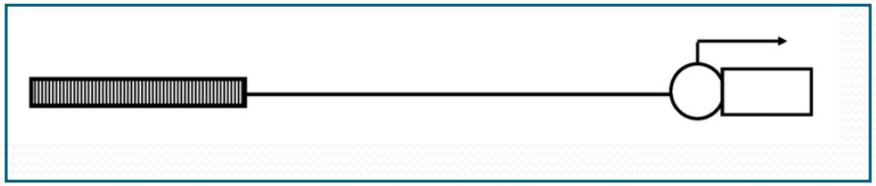
Three-or-More Outlets in Parallel to Single Pumps

Minimum distance 3 feet between outermost outlets
(pipe centerlines)



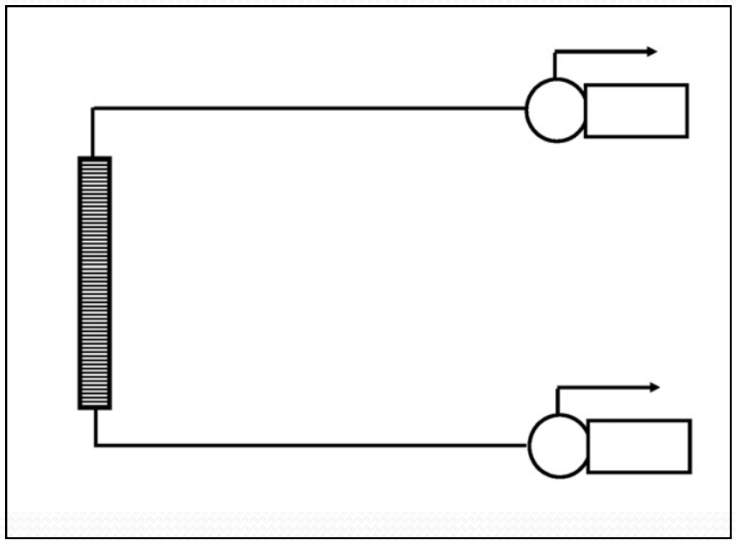
ANSI/APSP-7, 2006
Section 5.5.1 & 5.5.2

Channel Drain (min. 3” x 31” open area)



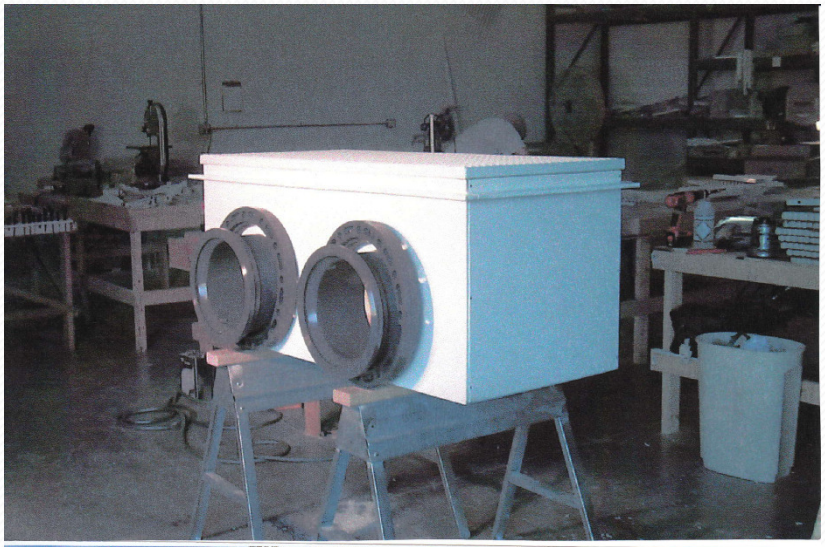
Single Unblockable Drain: Of a size & shape such that the torso of the 99 percentile man (18” x 23” with 4 in. radius corners) cannot block it.

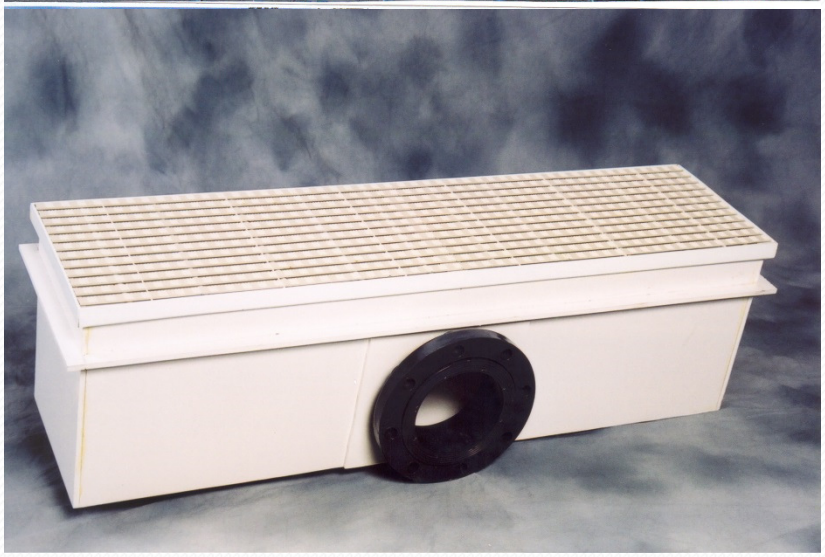
Optional Configuration

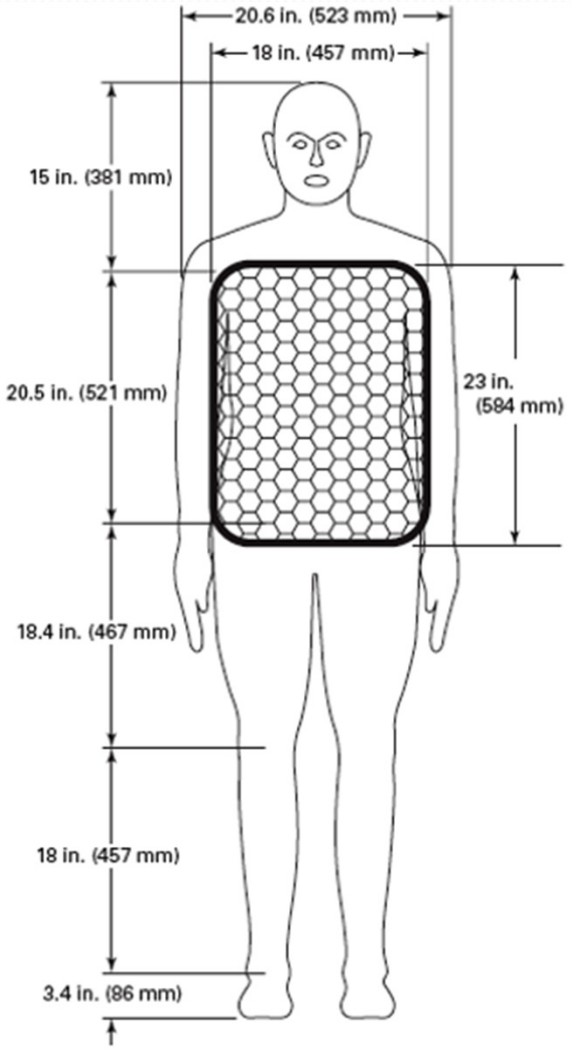


ANSI/APSP-7, 2006
Section 5.5.2

Single Unblockable Drains



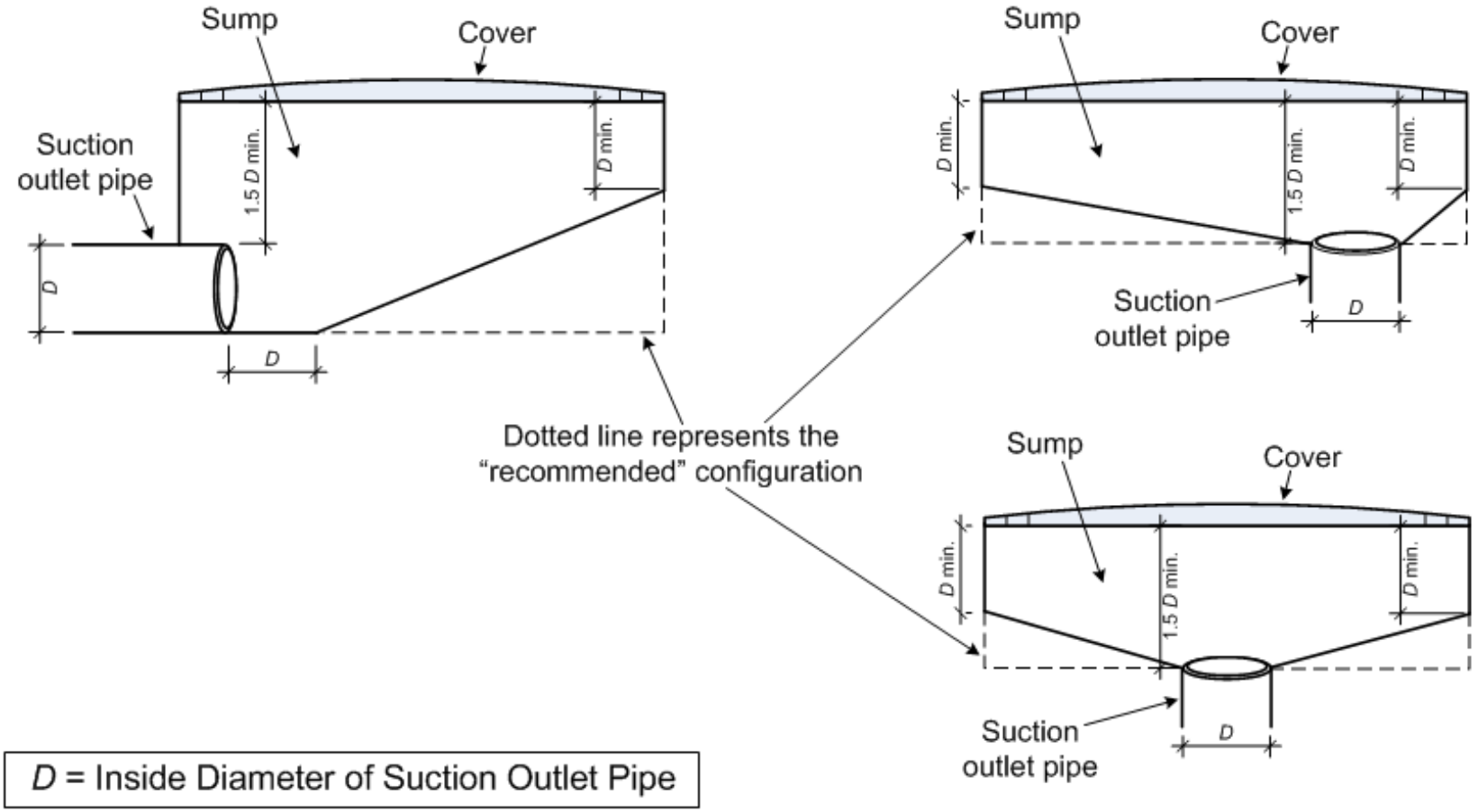




ANSI/APSP-7, 2006
Section 4.5.1

Field Built Sumps

If manufacturer's instructions do not specify field built sump design they must be constructed as shown here



D = Inside Diameter of Suction Outlet Pipe

Drain Options

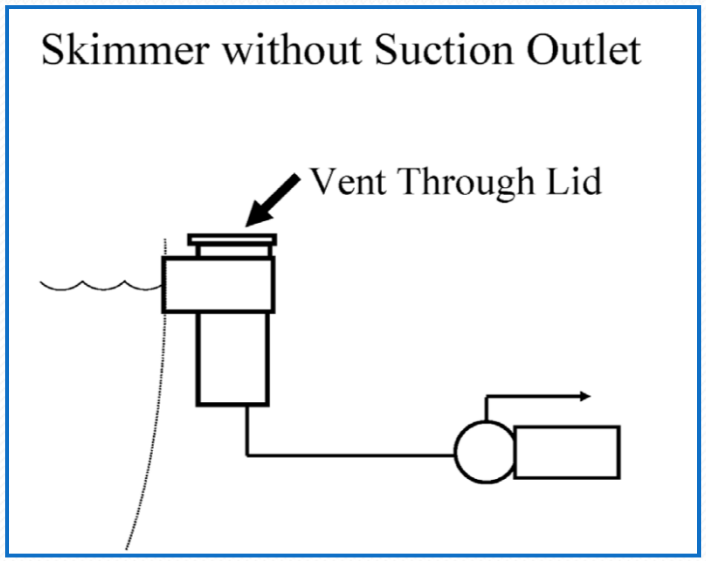
- Submerged Suction Outlets are Not Required
- Dual Drains w/Listed Covers (Limited Velocity)
- Multiple Drains w/Listed Covers (Limited Velocity)
- Single Unblockable Drains w/Listed Covers (Limited Velocity)
- Gravity Flow Systems w/Listed Covers (Except Skimmers)

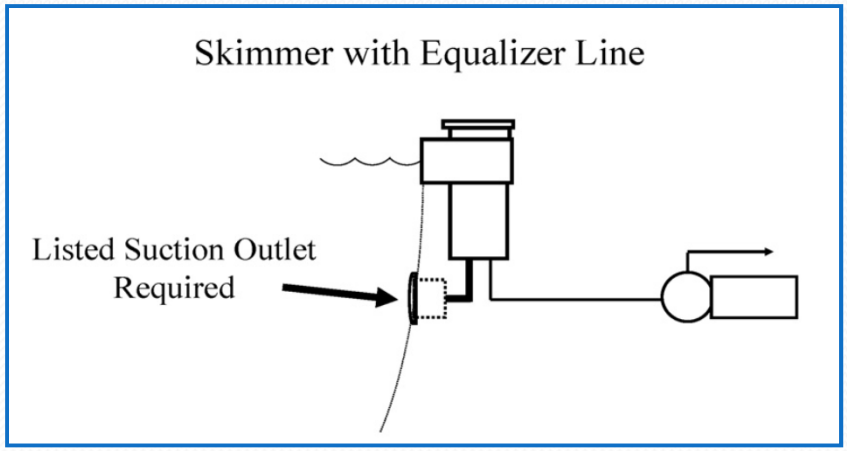
Drain placement may be verified with plans and/or field inspection

- 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.

ANSI/APSP-7, 2006
Section 4.8 & 4.8.1

Skimmer Requirements





Existing Pools (FYI)

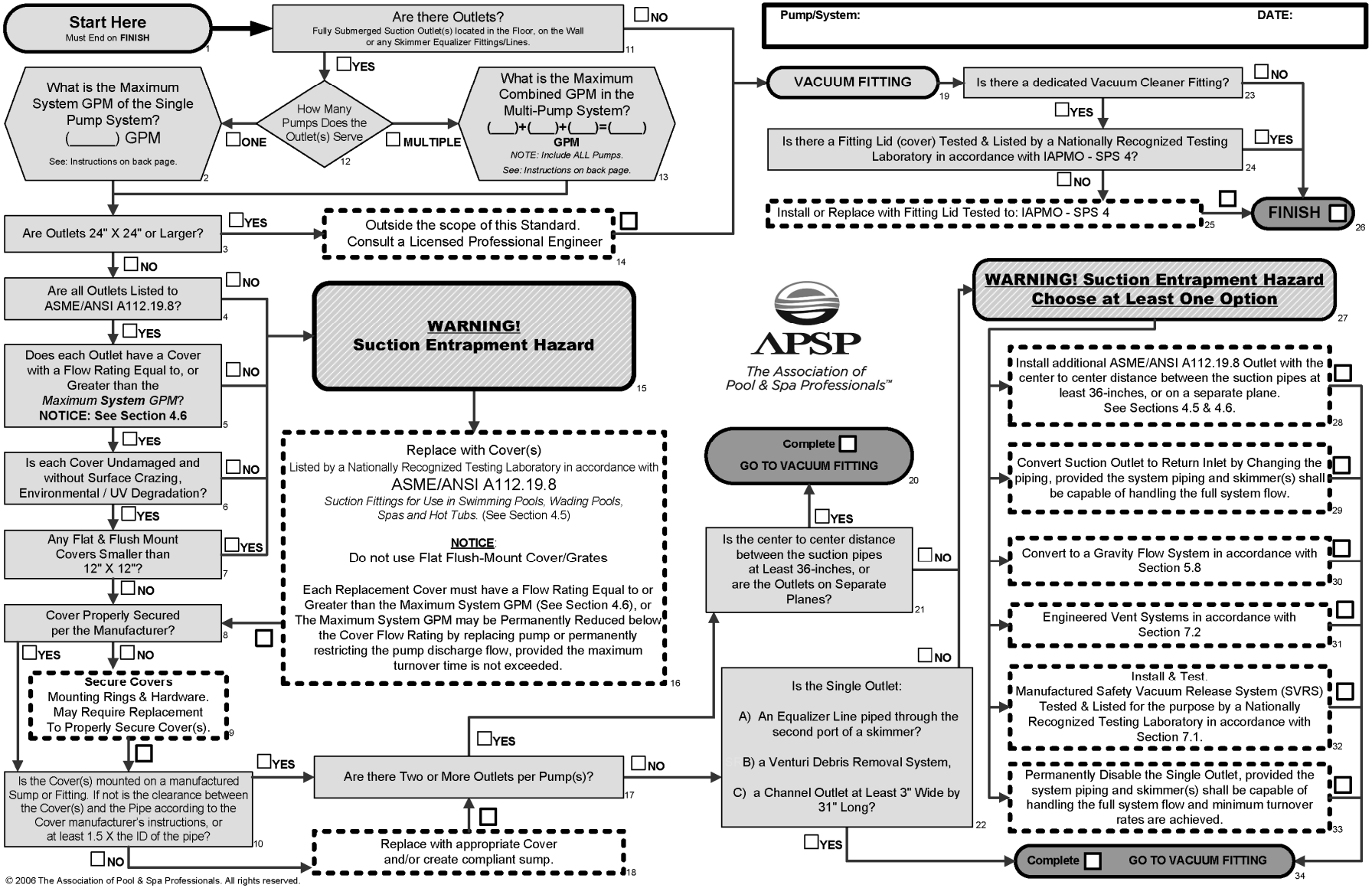
When retrofitting existing installations with a single suction outlet that is not listed and approved for use as a single suction outlet, the existing suction outlet shall be retrofitted with either a listed single unblockable suction outlet or a listed suction outlet cover/grate and at least one of the following shall be added.

ANSI/APSP-7, 2006
Section 6.3

Options for Existing Single Outlets (Drains)

- One or more additional listed suction outlet cover/grates; or
- Convert suction outlet to return inlet by changing the piping, provided the system piping and skimmer(s) shall be capable of handling the full system flow; or
- Gravity flow system; or
- Engineered vent system; or
- Listed manufactured SVRS; or
- Permanently disable the single outlet, provided the system piping and skimmer(s) shall be capable of handling the circulation and distribution requirements.

Appendix B - Field checklist for identifying suction entrapment hazards



WARNING

Drowning Hazard

Avoid Drain Covers

Avoid Body Entrapment

Avoid Evisceration

Avoid Hair Entanglement

Avoid Finger Entrapment

- Never play or swim near drains or suction fittings. Your body or hair may be trapped causing permanent injury or drowning.
- Never enter the pool or spa if a suction fitting or drain cover is loose, broken, or missing.
- Immediately notify the pool/spa owner or operator if you find a drain cover loose, broken or missing.

For further information contact The Association of Pool and Spa Professionals.

Visit the U.S. Consumer Product Safety Commission website to read their entrapment guidelines at:
www.cpsc.gov/cpscpub/pubs/363.pdf

IMPORTANT SAFETY NOTE: If you choose to display this warning device as a sign, please make sure that it conforms to ANSI/NEMA Z535.4-2002 Standard for Product Safety Signs and Labels, or latest revision.

ANSI/APSP-7 2013
What the future holds

Velocity limits through SOFAs are set by APSP-16

Skimmer equalizer lines are prohibited

Velocity limits in piping are set by APSP-5 & APSP-15

Maximun system flow rates redefined

Submerged suction outlets prohibited in wading pools

Maximum System Flow Rate

Determined by system control type:

Certified Secured control systems
Unsecured control systems

Certified Secured control system:
Flow rates set by Registered Design Professional

No access by unauthorized personnel who could make adjustments changing flow rates.

No Access:
Locked
Password protected
Valve handles locked, etc.

Certified Secured Control System

Maximum system flow rate:

Highest operating pump speed designated by Registered Design Professional

Verified by flow meter accurate to +/- 10%

NIST traceable & certified by 3rd party

Installed in accordance with Manufacturer's instructions

Unsecured Control Systems

Accessible by anyone

Maximum system flow:

Measured with flow meter accurate to +/- 10%

Calculated TDH per manufacturers certified pump curve

Measured TDH using pumps drain plugs w/pressure & vacuum gauges

Questions?