

## SIGNS AND DEPTH MARKINGS

POOL TYPE	SIGNS REQUIRED	LOCATION
ALL POOLS & SPAS WITH NO LIFEGUARD [265.199 e, f, j 265.205 f7]	<p>(WARNING in 4" letters, CHILDREN in 2")</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p><b>WARNING</b></p> <p><b>NO LIFEGUARD</b></p> <p><b>ON DUTY</b></p> <p><b>CHILDREN SHOULD NOT USE POOL</b></p> <p><b>WITH OUT ADULT SUPERVISION</b></p> </div> <p>(In 1" letters)</p> <div style="border: 1px solid black; padding: 2px; text-align: center;"> <p>IN CASE OF EMERGENCY CALL 911</p> </div> <p>(If phone is not visible)</p> <div style="border: 1px solid black; padding: 2px; text-align: center;"> <p>TELEPHONE LOCATION : _____</p> </div>	<p>SIGN MOUNTED VISIBLY AND SECURELY INSIDE POOL ENCLOSURE.</p> <p>ADDITIONAL SIGN FOR TELEPHONE LOCATION REQUIRED OUTSIDE FOR A, B &amp; C POOLS ON THE GATE, DOOR OR FENCE IF LOCKED</p>
ALL CLASS C & D POOLS WITH NO LIFEGUARD [265.199 e, f]	<div style="border: 1px solid black; padding: 5px; text-align: center;">  <p><b>NO DIVING</b></p> </div> <p>(in 4" letters and also a 4" international symbol)</p>	<p>SIGN MOUNTED SECURELY AND VISIBLY INSIDE POOL ENCLOSURE</p> <p>ALSO MOUNTED ON ANY PERMANENT STRUCTURE LIKELY TO BE USED FOR DIVING WITHIN 5 FT OF WATER SURFACE</p>
ALL SPAS [265.192 m, 205 f7]	<div style="border: 1px solid black; padding: 2px; text-align: center;"> <p>DO NOT USE THE SPA IF THE WATER TEMPERATURE IS ABOVE 104°F</p> </div> <div style="border: 1px solid black; padding: 2px; text-align: center;"> <p>CHILDREN SHOULD NOT USE SPA WITHOUT ADULT SUPERVISION</p> </div> <div style="border: 1px solid black; padding: 2px; text-align: center;"> <p>EMERGENCY CUTOFF SWITCH LOCATION</p> </div> <p>(in 1" letters)</p>	<p>SIGN MOUNTED SECURELY AND VISIBLY INSIDE POOL ENCLOSURE</p>
POST-10/1/99 POOLS & SPAS [265.183 b3 265.184 n 265.185 e 265.186 c10 265.188 f 265.203 j 265.205 f7]	<p>Sign 1)</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p>MAXIMUM NUMBER OF USERS IN THIS POOL IS:</p> <div style="display: flex; justify-content: space-around;"> <div style="border: 1px solid red; width: 30px; height: 30px; margin: 2px;"></div> <div style="border: 1px solid red; width: 30px; height: 30px; margin: 2px;"></div> <div style="border: 1px solid red; width: 30px; height: 30px; margin: 2px;"></div> </div> <p>SHALLOW 15 ft<sup>2</sup> user    DEEP 25 ft<sup>2</sup> user    DIVING 300 ft<sup>2</sup> user</p> </div> <p>Sign 2)</p> <div style="border: 1px solid black; padding: 2px;"> <p>DIVING EQUIPMENT: MFG'S NAME / ADDRESS BOARD EQUIPMENT LENGTH BOARD ID / JUMPING or DIVING FIXED FULCRUM SETTING ANSI / NSPI 1-1991 REFERENCE WEIGHT LIMITATIONS DATE OF INSTALLATION</p> </div> <p>Sign 3)</p> <div style="border: 1px solid black; padding: 2px;"> <p>FILTER AND SEPARATION TANK INSTRUCTIONS: _____</p> </div> <p>Sign 4)</p> <div style="border: 1px solid black; padding: 2px;"> <p>BACKWASH INSTRUCTIONS: 1. Clean Filter Pressure: _____ psi 2. Normal operating pressure 3. Pressure differentials that indicate the need for filter cleaning</p> </div>	<p>SIGN MOUNTED SECURELY:</p> <p>(Sign 1) INSIDE ENCLOSURE [265.203 j]</p> <p>(Sign 2) NEAR DIVING EQUIP [265.186 c10]</p> <p>(Sign 3) ON FILTER OR TANK [265.188 f]</p> <p>(Sign 4) NEAR FILTER [265.183 b3]</p>
POOLS WITH CHLORINE GAS [265.198 e, f6]	<p>(In 4" letters)</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p><b>DANGER</b></p> <p><b>CHLORINE</b></p> </div> <div style="border: 1px solid black; padding: 2px;"> <p>TELEPHONE NUMBERS: FIRE DEPARTMENT HAZMAT AGENCY CHLORINE DEALER</p> </div>	<p>SIGN MOUNTED TO EXTERIOR HOUSING DOOR. DOOR MUST HAVE A WINDOW OR A PORT</p>
ALL POOLS & SPAS [265.203 C2a]	<p>(In 1" letters)</p> <div style="border: 1px solid black; padding: 10px; text-align: center;"> <p><b>POOL CLOSED</b></p> </div>	<p>SIGN MOUNTED ON EXTERIOR OF GATE IF PUMP IS NOT OPERATING CONTINUOUSLY. HOWEVER, CLARITY AND DISINFECTANT LEVEL MUST BE MAINTAINED</p>
POOL TYPE	MARKINGS REQUIRED	LOCATION
ALL POOLS & SPAS [265.186 c7C 265.186 c10C 265.199b]	<p><b>DEPTH MARKINGS:</b></p> <ol style="list-style-type: none"> <li>4" PERMANENT LETTERS</li> <li>SLIP-RESISTANT</li> <li>CONTRASTING COLOR</li> <li>IN FEET OR METERS and FRACTION</li> </ol>	<ol style="list-style-type: none"> <li>ON DECK</li> <li>DEPTHS ARE MEASURED 3' OUT FROM WALL</li> <li>PLACED EVERY 25' OR LESS APART. FOR EVERY 2' CHANGE OF DEPTH. AND ALSO AT 5' DEPTH</li> <li>WITHIN 24" FROM AND FACING WATER EDGE</li> <li>ON VERTICAL WALLS, 4.5 INCHES FROM TOP, AND 50% OF LETTERS ABOVE WATER LEVEL</li> </ol>
	<p><b>FLOOR MARKINGS:</b></p> <ol style="list-style-type: none"> <li>4" FLOOR LINE IN CONTRASTING COLOR</li> <li>1" STEP LINE IN CONTRASTING COLOR</li> </ol>	<ol style="list-style-type: none"> <li>ON POOL FLOOR AT 5' TRANSITION POINT</li> <li>ON STEP EDGES</li> </ol>
	<p><b>LETTER MARKINGS:</b></p> <p style="text-align: center;"><b>NO DIVING</b> </p> <p>(Same letter qualities as above)</p>	<ol style="list-style-type: none"> <li>ON DECK</li> <li>AT 6' OR LESS DEPTHS, MINIMUM 2/ POOL</li> <li>25' OR LESS APART</li> <li>4" LETTERS &amp; SYMBOL READ FACING WATER</li> </ol>

# POOL OPERATOR'S HANDBOOK



*A Simplified Version of the*

## STANDARDS FOR PUBLIC SWIMMING POOLS & SPAS

(TAC, Title 25, Part 1, Chap 265 General Sanitation, Subchap L, Section 265.181 to 265.208)

Texas Department of State Health Services

[www.dshs.state.tx.us](http://www.dshs.state.tx.us)

*Prepared for*  
**GRAYSON COUNTY HEALTH DEPARTMENT**

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### ASSEMBLING INSTRUCTIONS FOR PAMPHLET FORMAT (8½" X 5½")

1. Download the six sheets of this booklet.
2. Print only the odd sheets, 1, 3, & 5. Invert these and return to printer.
3. Print the even sheets 2, 4, & 6 on the back sides so that sheet 1 is on the back of sheet 2.
4. Place the 3 double-sided sheets in proper order, fold, and staple.

### *Purpose:*

This publication has been prepared for public swimming pool operators and sanitarians to assist in making recreational waters as safe as possible. It is in a condensed version for easy use and has italicized codes for quick reference to the more comprehensive rules in TAC Title 25 §265 General Sanitation, Subchapter L, Texas Department of State Health Services. The latter takes precedence for compliance purposes.

### *Acknowledgements:*

Compiled by D. B. Rubiano, R.S. using *Standards for Public Swimming Pools and Spas*, Texas Department of State Health Services, 2005 rev, Texas Health and Safety Code Chapter 341, 757 and TAC 337, *Pool Operator's Manual*, Washington State Public Health Association and Washington State Environmental Health Association, 1997, *Aquatic Technology Newsletter*, US Filter's Stranco Products Aquatic Division, Bradley, IL, and *The Proper Management of Pool and Spa Water*, by Mitchell P. Kirk, Hydrotech Chemical Corporation (Great Lakes Chemical Corporation) 1988.

## GLOSSARY

- AVS:** Atmospheric vent system designed to reduce entrapment by suction outlets
- BACKWASH:** Process of cleaning filters by reversing the water flow into the wastewater drain
- BREAKPOINT:** Combined chlorine destroyed by increasing free chlorine to 10 times that level
- DEPTH:** Shallow (less than 5 ft)      Deep (5 ft or more)
- FREE AVAILABLE CHLORINE:** Total chlorine minus combined chlorine
- POOL:** Post 10/1/99 (constructed on or after 10-1-99) / Pre-10/1/99 (constructed before 10-1-99)
- Class A - For accredited competitive aquatic events and recreation
  - Class B - For public recreation and general public
  - Class C - For hotels, motels, apartments, condominiums, mobile home parks, property owners associations, clubs, schools etc.
  - Class D - A wading pool with a maximum depth of 24"
  - Spa - Hot tub, whirlpool, hydrotherapy pool, mineral bath, air induction bubbles, hydrojet circulation, etc., at least 2 feet deep, and having a maximum surface area of 250 ft<sup>2</sup> or maximum volume of 3250 gal, and is not drained after each use
  - Therapeutic Pool – Pool/spa operated exclusively for medical or therapeutic purposes. These pools are inspected under Texas Health and Safety Code 341.064.
- SKIMMER WEIR:** Adjustable door, flap etc. that moves with small changes in water level to assure a steady continuous flow to draw floating debris.
- SRVD:** Safety vacuum release device (a mechanical or electrical system to reduce entrapment risk by suction outlets)
- SUCTION OUTLET:** Opening(s) which drains water to the filter under negative pressure. A skimmer is not a suction outlet.
- SUPERCHLORINATE (Shock):** Add chlorine to pool water to a level 10 times the amount of combined chlorine in the water. Shocking is successful when the *breakpoint* has been reached (see breakpoint above).
- TURNOVER:** Circulation of one volume of pool water equal to the total pool capacity
- WATER QUALITY:**
- Total Chlorine - all the chlorine in the pool water
  - Free Chlorine - that portion of total chlorine that actually destroys germs
  - Combined Chlorine – undesirable chlorine that combined with ammonia, nitrogen, or with human products such as sweat, saliva, urine, skin, lotions etc. Also called chloramine. Chloramine causes eye burn, has a strong chlorine odor and can be removed by superchlorinating. Combined chlorine is equal to total chlorine minus free chlorine.
  - pH - a value expressing acidic or basic properties. Chlorine is most effective at a pH between 7.0 and 7.8 in water.
  - Stabilizer – (cyanuric acid) it protects chlorine from the damaging effects of U.V. in sunlight. It is not effective indoors. Bromine cannot be stabilized.
  - Temperature - pool temperature is most critical in spas. (See p.3)
  - Turbidity (water clarity) - is the cloudy condition of water caused by the presence of fine particulate matter that interferes with the passage of light. Clear water is vital during emergencies.
  - Total Alkalinity - a measure of water's ability to resist change in pH. It consists mainly of carbonates, bicarbonates, and hydroxides.
  - TDS (total dissolved solids) - the amount of dissolved matter in water, such as calcium, magnesium, carbonates, metallic compounds. *NOTE:* Adding chemicals to pool water always increases TDS.
  - Hardness - the amount of calcium, magnesium, or other salts in water. Low hardness is corrosive. High hardness causes scaling.
  - Heavy Metals - copper, iron, manganese; may cause colored water, stains, or green hair.
  - Algae - one called chlorophyll-containing plants that can thrive in water. They are undesirable because they reduce water clarity, cause offensive odors, and harbor germs. Algae can be controlled by proper chlorine levels.

CLOSING POOLS	CONDITIONS REQUIRING CLOSURE
<u>SUCTION OUTLETS:</u> Main Drain Grate Anti-Vortex Cover Any Cover or Grate	Covers or grates missing, broken, or loose <i>[265.187 a, 189 a, and 265.190 b]</i>
DISINFECTANT LEVEL	Inadequate level, especially too low <i>[265.204 a, 207 a]</i>
FECAL MATERIAL	The presence of fecal material from humans or animals requires immediate closure regardless of the disinfectant level <i>[265.203, 204, 207, 341.064]</i>
WATER CLARITY	Bottom and main drain are not clearly visible in the deepest part of the pool or spa <i>[265.203 b,c,d,e]</i>
OTHER HAZARDS	Regulatory authority determines that the operation or maintenance of the pool or spa constitutes a serious health or safety hazard <i>[265.207 a, c, 341.064]</i>
OPERATING PERMIT	All pools and spas shall have a current and valid operating permit issued by the regulatory authority <i>[265.183 a, other ordinances]</i>
OFF SEASON CLOSURE	For pools not in use for extended periods of time, clarity shall be maintained, algae growth prevented, and no objectionable odors, insect breeding conditions, or other nuisance or safety hazard shall be present <i>[265.203 d,e]</i>
PUMP NOT OPERATING CONTINUALLY	A pool pump may operate for less than 24 hours a day if a pool closed sign is installed on every gate and clarity and disinfectant are maintained. <i>[265.203c2]</i>

RE-OPENING A CLOSED POOL OR SPA *[265 208e]*

**Operation of a closed pool or spa may be resumed only by the explicit authorization of the regulatory authority. A reinspection may be required.**

**TRAINING**

**OPERATION AND MANAGEMENT.**

Personnel responsible for the operation of the disinfection agent and other potentially hazardous chemicals shall be properly trained. Protective equipment and clothing, including rubber gloves and goggles, and any other protective gear and safety information shall be provided;

- (1) Trained personnel shall be provided to comply with §265.197(b)(3) of this title (relating to Disinfecting Equipment and Chemical Feeders for Post-10/01/99 and Pre-10/01/99 Pools and Spas);
- (2) Two persons trained in the performance of routine chlorination operation and emergency procedures shall be readily available during normal operating hours;
- (3) Pool personnel shall be informed about leak control procedures; only trained designated personnel shall operate the chlorinator and change chlorine cylinders; and
- (4) Required operator certification for certain types of post-10/01/99 and pre-10/01/99 pools and spas. Post-10/01/99 and pre-10/01/99 Class A or B pools and Class D pools operated in conjunction with a Class A or B pool shall be maintained under the supervision and direction of a properly trained and certified operator who is responsible for the sanitation, safety, and proper maintenance of the pool or spa, and for maintaining all physical and mechanical equipment and records. Training and certification can be obtained by completion of one of the following courses or their equivalent:
  - (a) NRPA, "Aquatic Facility Operator" (A.F.O.);
  - (b) NSPF, "Certified Pool-Spa Operator" (C.P.O.);
  - (c) YMCA, "Pool Operator on Location" (P.O.O.L.);
  - (d) NSPI, "Professional Pool & Spa Operator" (P.P.S.O.); or the ASPSPA, "Licensed Aquatic Facility Technician" (L.A.F.T.).

**INSTRUCTIONS FOR POST-10/01/99 POOLS AND SPAS.** Upon completion of construction of a post-10/01/99 pool or spa, the owner shall obtain from the pool or spa builder complete written operational instructions for the pool or spa. Written instructions shall include items such as procedures for filtration, backwash, cleaning, and operation of all chemical feed devices and general maintenance of pool or spa. In addition, the following are required:

- (1) Labeling of valves
- (2) Labeling of exposed pipes
- (3) Clean filter pressures, normal operating pressures, and pressure differentials that indicate the need for filter cleaning

**LIFEGUARD PERSONNEL STANDARDS** at post-10/01/99 and pre-10/01/99 pools. Post-10/01/99 and pre-10/01/99 pools shall comply with the following lifeguard requirements:

- (1) Lifeguards shall hold a current ARC "Lifeguard Training" certificate or the equivalent certification from an aquatic safety organization, which also includes training in ARC "Adult, Infant, and Child CPR" and "Community First Aid" or their equivalent;
- (2) An additional lifeguard, or second responder who is monitoring and readily available at the pool, and who has a minimum training in (ARC) "Adult, Infant, and Child CPR" and "Community First Aid" or equivalent training, shall also be in the pool area when the pool is in use;
- (3) All lifeguards and second responders shall receive training in the application of effective pool emergency procedures for events such as submersions, suspected spinal injury, medical emergencies, missing persons, bad weather, etc. Such training will be reviewed as necessary and kept current;
- (4) Pool facilities shall provide alertness/response drills and other training including documentation of the following:
  - (a) a pre-season training program
  - (b) a continual "in-service" training program for all lifeguards, and other aquatic personnel totaling a minimum 60 minutes per week
  - (c) performance "audits" as recommended by the ARC or YMCA or equivalent aquatic safety organization
  - (d) an emergency action plan similar to the one outlined by the ARC or YMCA or equivalent aquatic safety organization
  - (e) management at each facility shall maintain a current file with each staff person's current certification including expiration dates

**MATERIAL SAFETY DATA SHEETS (MSDS):** Manufacturer's description of the significant hazard information and shall be maintained for every chemical used and must be available for emergency responders upon request. Information in the MSDS sheets shall include: storage, labeling, protective equipment for operators, safety, and first aid treatment.

SAFETY	REQUIREMENTS																
LIFEGUARDS [265.199 g]	(1) Required at Class A, B, and C (with diving board or unlocked slide) (2) Minimum number for adequate supervision (see Training P.1)																
RING BUOY [265.199 i]	(1) Required at Class A, B & C visibly within 20' of pool (2) U.S. Coast Guard approved, 15 to 24" diam (3) Attached to a 1/4 to 3/8 inch rope, 2/3 pool width (4) 1 ring. One additional ring & pole if over 2000 ft <sup>2</sup> water surface																
REACHING POLE [265.199 j]	(1) Required at Class A, B & C visibly within 20' of pool (2) Light weight, strong, non-telescopic, 12 ft min (3) Fiberglass or non-conducting; body hook with blunted ends (4) 1 pole. One additional pole & ring if over 2000 ft <sup>2</sup> water surface																
FLOAT LINE or FLOOR MARKING (Over 5 ft depth) [265.199 b]	(1) Both required at Class A & B pools, either required at Class C (2) Placed at 5 ft depth, 1 to 2 ft on shallow side (3) Floats spaced 7 ft max apart (4) Sufficient size and strength for handhold support (5) Side wall attachments are corrosion resistant and non-projecting when rope is detached. (6) Floor marking is 4" wide in contrasting color																
HANDHOLDS [265.186 b7,8 and 199 a]	(1) Required at Post 10/1/99 pools/spas if depths exceed 42" and there is no seatbench/swimout/lounge below water perimeter (2) May include rope, ladder, ledge, deck, coping (2" or less) etc. (3) Located along immediate top edge of pool, no more than 9" above design water level, 4" min horizontal width, slip-resistant (4) Handrails must be provided if lifeguards are required. Access to pool's edge and stairs must comply with ADA and fair housing.																
ENCLOSURES [265.200, 757]	<table border="1"> <thead> <tr> <th>Pool Type</th> <th>Fence Opening</th> <th>Height</th> <th>Gates (open outward)</th> </tr> </thead> <tbody> <tr> <td>Class A, B</td> <td>Max 1 1/4" (&gt;1.5")</td> <td>6 ft (7ft)</td> <td>Supervised or locked</td> </tr> <tr> <td>Under Chap 757</td> <td>Max 1 3/4 "</td> <td>4 ft</td> <td>Self-closing, latching*</td> </tr> <tr> <td>Class C, D</td> <td>Max 4"</td> <td>4 ft</td> <td>Self-closing, latching* *3 ft above deck</td> </tr> </tbody> </table> <p>Chain link only permitted for fences installed on or after 9-1-04 for pre-10/1/99 pools</p>	Pool Type	Fence Opening	Height	Gates (open outward)	Class A, B	Max 1 1/4" (>1.5")	6 ft (7ft)	Supervised or locked	Under Chap 757	Max 1 3/4 "	4 ft	Self-closing, latching*	Class C, D	Max 4"	4 ft	Self-closing, latching* *3 ft above deck
Pool Type	Fence Opening	Height	Gates (open outward)														
Class A, B	Max 1 1/4" (>1.5")	6 ft (7ft)	Supervised or locked														
Under Chap 757	Max 1 3/4 "	4 ft	Self-closing, latching*														
Class C, D	Max 4"	4 ft	Self-closing, latching* *3 ft above deck														
SPA EMERGENCY SHUTOFF [265.192 m]	Required for all spas, 5 ft or more away (except for air switches), in 1" letters, within sight of spa (or a sign stating the location of the switch).																
ELECTRICAL DISCONNECT [265.192eh]	Required for all pools, a disconnecting means of all hot wires of pool equipment, located within sight of pool. Also, GFI required.																
LIGHTING [265.192e, 199 k]	Required if operated during low illumination: <u>underwater</u> (0.5 watts per ft <sup>2</sup> water surface); <u>overhead</u> (0.5 foot candles per deck surface) with no bottom glare. Also, GFI required.																
TELEPHONE [256.199 i]	Required for all pools and spas (within 200 ft, no locked doors/gates)																
FIRST AID KIT [265.205 f]	Required at Class A, B & others w / lifeguards. Standard OSHA 24 unit.																
THERMOMETER [265.205 f]	Required at all spas. Must be unbreakable type. Also, a visible clock is recommended near each spa.																
DEPTH MARKINGS	See outer back cover																
SUCTION OUTLET COVER	See Circulation p.5																
BATHER LOAD [265.185 e]	The maximum user load shall not exceed one person per 9 ft <sup>2</sup> of water surface, (see required <i>sign</i> on outer back cover).																

TROUBLE SHOOTING	CAUSE	CORRECTION
CLOUDY WATER	High combined chlorine	Superchlorinate (shock)
	Chemical imbalance	Correct pH, alkalinity, hardness
	Clogged filter	Backwash
	High TDS	Add coagulant or partial pool drain
	High cyanuric acid	Total or partial pool drain
EYE BURN SKIN IRRITATION CHLORINE ODOR	D.E. spill, or floc overuse	Repair filter septum, use cationic floc
	High combined chlorine	Superchlorinate (shock)
GREEN HAIR OR COLORED WATER	Low total alkalinity	Add soda ash or bicarbonate
	Low pH	Add soda ash or caustic soda
	Low hardness	Add calcium chloride
	Copper or other minerals present	Reduce copper algacide or use a non-copper type. Also, chemicals for treating pool water may not be iron free. It is also possible that minerals in the make-up water are over 1.0 ppm.
EXCESSIVE FOAM, FILM OR SCUM	Build-up of body oils, cosmetics, other	Superchlorinate (shock) Enforce showering prior to pool use
	QAC algacide excess	Use non-foaming algacide
	Low disinfectant	Superchlorinate (shock)
SCALE DEPOSITS	High pH	Add muriatic acid
	Low total alkalinity	Add soda ash or bicarbonate
	High hardness	Add sodium hexametaphosphate or partial pool drain
METAL PARTS CORRODING	High heavy metal	Chelation treatment
	Low pH or tot alkalinity	Add soda ash or caustic soda
ALGAE	Low hardness	Add calcium chloride
	Low chlorine	Superchlorinate (shock, non-stabilized form) Also, treat water with QAC algacide.
	High cyanuric acid	Total or partial pool drain
	High phosphorous	Add lanthium carbonate or apply spot treatment with calcium hypochlorite

MAINTENANCE	ACTION REQUIRED
DISINFECTANT	Too Low: Add disinfectant to feeder Too High: Add sodium thiosulfate
pH	Too low: Add soda ash or caustic soda Too high: Add muriatic acid or sodium bisulfate
TOTAL ALKALINITY	Too low: Add soda ash or sodium bicarbonate Too high: Add muriatic acid
COMBINED CHLORINE	<b>SHOCKING (superchlorination):</b> Add sufficient chlorine to burn away (or oxidize) all products formed when chlorine combines with human waste such as sweat, urine, skin, lotions, etc.
	<b>WHEN TO SHOCK:</b> (1) Whenever <b>combined chlorine</b> is detected on tests: <i>Example:</i> total chlorine 1.5 free chlorine (subtract) 1.0 <b>combined chlorine 0.5</b> (2) Whenever eye or skin irritation, sharp chlorine odor, flat hazy water, or algae is noted, or (3) <u>Daily</u> <u>Monthly</u> <u>Weekly</u> Spas Pools Pools if water temperature is over 85
	<b>HOW TO SHOCK:</b> (1) Remove all bathers. If indoors, open doors/windows, fans on. (2) Measure the <b>combined chlorine</b> . Multiply that by 10 or 12. (3) Increase the free residual chlorine to that level, as follows: <i>Example:</i> $\boxed{\phantom{000}} \times 7.5 \times \boxed{\phantom{000}} \div 1,000,000 \times 12 = \boxed{\phantom{000}}$ pool volume (lb/gal) <b>combined chlorine</b> (ppm) gal of beach* <i>*If other shock treatments are used in lieu of bleach, be sure to divide this number by the % hypochlorite. For instance, divide the number by 0.65 when using calcium hypochlorite (65%). This is in pounds.</i>
	(4) Re-open pool when <b>combined chlorine</b> is finally zero ppm.

#### PRECAUTIONS WHEN WORKING WITH CHEMICALS

PERSONNEL	Always wear protective equipment such as goggles and gloves. Use only EPA registered chemicals and according to manufacturer's instructions.
DO NOT MIX	⇒ Acids and bases EXAMPLE: muriatic acid and sodium hydroxide
	⇒ Dry organic and inorganic chemicals such as: <u>ORGANIC</u> <u>INORGANIC</u> Dichlor Sodium carbonate, bicarbonate, bisulfate, Trichlor hydroxide, thiosulfate, Calcium hypochlorite
	⇒ Water into chemicals. Instead, always add chemicals <u>to</u> water.
	⇒ Chemicals directly into skimmers. Children often play here.
STORAGE	Store chemicals in a dry, well ventilated, isolated area. Remove petroleum products. Cover chemicals and be sure labels are readable.

WATER QUALITY	REQUIREMENTS [265.204]	TESTING FREQUENCY
DISINFECTANT (ppm)	Free chlorine Pools 1 to 8 Spas 2 to 8	<b>Required</b> every 2 hrs for Class A, B or D/spa (located at A or B), or daily for auto systems  <b>Recommended</b> every 2 hrs for Class C or D/spa (located at C), or daily for auto systems  <b>NOTE: RECORDS MAY BE REQUIRED IF INSPECTIONS INDICATE NON-COMPLIANCE. SAVE FOR 2 YRS [265.204 e.]</b>
	Free bromine* 2.5 to 12 4.5 to 12	
	Combined chlorine (total minus free) 0 0	
	ORP (Oxidation-Reduction Potential) 650 MV min* 650 MV min* <small>*Readings may be affected by pH or cyanuric acid</small>	
pH	7.0 to 7.8	"
CYANURIC ACID (ppm)	100.0 max (none for bromine)	As necessary to assure proper chemical control
TEMPERATURE	Spas 104°F max	"
WATER CLARITY	Pool bottom and the main drain at the deepest part of pool are clearly visible	"
TOTAL ALKALINITY (ppm)	60 to 180 (Recommended)	"
TDS (ppm)	5000 max (Recommended)	"
HEAVY METALS	None (Recommended)	"
HARDNESS	150 to 1000 (Recommended)	"
ALGAE/BACTERIA	None (Recommended)	"

#### TEST KIT [265.204 b,c,d]

1. A reliable means of testing the above is required. Check expiration dates often.
2. Proper storage according to manufacturer's recommendations is required.
- \*3. If a DPD chlorine test kit is used for bromine, multiply test result by 2.25.

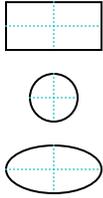
#### COMMON TEST KIT ERRORS

ERROR	CAUSE	COMMENT
<b>DPD kit: false yellow or clear color</b>	High disinfectant	Normal pink color is bleached (flash off) by excess disinfectant. Dilute new sample with distilled water. Retest. If in normal range, lower pool disinfectant.
<b>pH kit: false yellow or red color</b>	Limited range of phenol red	Add distilled water to pool water and retest. If new pH is in normal range, pool water pH is wrong.
<b>pH kit: purple color</b>	High disinfectant	Phenol red is reacting with the excess disinfectant. Lower the disinfectant.
<b>Total alkalinity: blue-to-green color</b>	High disinfectant	Normal green-to-red shift is bleached out by excess disinfectant. Resample, add chlorine neutralizer (e.g. thiosulfate) to the sample, then retest.

# CIRCULATION

## REQUIREMENTS

### Pool Sizing



#### STEP ONE: DETERMINE AVERAGE POOL DEPTH

Add deep end depth (ft) \_\_\_ + shallow end depth (ft) \_\_\_ ÷ 2 = avg. depth (ft) \_\_\_

#### STEP TWO: DETERMINE POOL VOLUME

Rectangular pools:

Length (ft) \_\_\_ x Width (ft) \_\_\_ x Avg. Depth (ft) \_\_\_ x 7.5 = GAL

Round pools:

Long Diameter (ft) \_\_\_ x Short Diameter (ft) \_\_\_ x Avg Depth (ft) \_\_\_ x 5.9 = GAL

### Turnover

[265.187 b,c]

Pool Type	Turnover Rate
Spa	½ hour
Wading	1 hour
Post-10/1/99 pool <4ft avg depth (x 1.5)	4½ hours
Post-10/1/99 pool ≥4 ft avg depth	6 hours
Pre-10/1/99 pool (heavy bather load)	6 hours
Pre-10/1/99 pool (normal load)	8 hours

*NOTE: Generally, wading pools, spas, and heavier loads require faster turnover rates since more organic substances such as sweat, urine, feces, skin, etc. are expected to be present.*

#### HOW TO CALCULATE THE FLOWMETER READING:

$$\frac{\text{Pool Volume}}{\text{Turnover Rate} \times 60} = \text{GPM}$$

*Examples:*

Pool Volume (gal)	Reading (GPM)
1,000 Wading	16.6
1,000 Spa	33.3
10,000	27.8
15,000	41.7
20,000	55.5
20,000 Pre-10/1/99 pool	41.6

### Flowmeters

[265.187 b9, c7]

#### WHEN FLOWMETER READINGS ARE TOO LOW

- (1) Filter clogged, backwashing may be necessary
- (2) Skimmers, screens, strainers may need cleaning
- (3) Flowmeter itself may need cleaning. It may also be installed incorrectly (see below).
- (4) Pump malfunction

#### CORRECT INSTALLATION OF A FLOWMETER

- (1) Match flowmeter with pipe size and flow direction arrow (→)
- (2) Flowmeter shall read at least 1½ times design flow rate.
- (3) Install flowmeter after the filters to avoid clogging flowmeter.
- (4) Install it on a straight pipe at a minimum distance from all elbows, tees, or reducers using the following rule:  
**(10 times pipe diameter upstream and 4 times downstream. to avoid flowmeter inaccuracies due to internal turbulence)**

*Examples:*

Pipe Size	10 X Upstream (from filter)	4 X Downstream (to pool)
1"	10"	4"
1½"	15"	6"
2"	20"	8"
2½"	25"	10"

Suction Outlets [265.190]	Outlets	Every suction line shall have a minimum of <b>2 hydraulically-balanced suction outlets</b> 3 to 20 feet apart from cover edges. Water velocity shall not exceed the following:  <table border="0"> <tr> <td><u>Velocity</u></td> <td><u>Location</u></td> </tr> <tr> <td>6 ft/sec</td> <td>In pipes</td> </tr> <tr> <td>1½ ft/sec</td> <td>Thru a 24" diagonal grate</td> </tr> <tr> <td>Flow rate stamped on cover</td> <td>Thru a A112.19.8M cover</td> </tr> </table> <p>Also, for 4 ft max depth pools with grates less than 24", an atmospheric vent system (AVS) or safety release vacuum system (SRVS) is required. Sump clearance = the lesser of 1½ X suction pipe diameter or 8".</p>	<u>Velocity</u>	<u>Location</u>	6 ft/sec	In pipes	1½ ft/sec	Thru a 24" diagonal grate	Flow rate stamped on cover	Thru a A112.19.8M cover
	<u>Velocity</u>	<u>Location</u>								
	6 ft/sec	In pipes								
1½ ft/sec	Thru a 24" diagonal grate									
Flow rate stamped on cover	Thru a A112.19.8M cover									
Covers	Every suction outlet shall have an ASME/ANSI <b>approved cover</b> stamped with 112.19.8M and gallons per minute. Also, a replacement spare cover on-site is required. As an alternative, an <b>approved grate</b> with a minimum diagonal measurement of 24" may be substituted for the approved cover. If used, all fasteners must be stainless or brass removable only with a tool.									
Upgrading (by 1-1-05)	Pre-10/01/99 pools or spas must comply as follows: [265.190 e]  <table border="0"> <tr> <td><u>DEPTH</u> (4 ft or less)</td> <td><u>DEPTH</u> (over 4 ft)</td> </tr> <tr> <td>Dual hydraulically balanced outlets 3 to 20 ft apart with either (1) approved covers or grates and an AVS or SVRD, or (2) 24" grates, or</td> <td>Dual hydraulically balanced outlets 3 to 20 ft apart with approved covers or grates, or</td> </tr> <tr> <td>Single outlet with a 24" grate and an AVS or SVRD</td> <td>Single outlet with approved cover or grate and an AVS or SVRD</td> </tr> </table>	<u>DEPTH</u> (4 ft or less)	<u>DEPTH</u> (over 4 ft)	Dual hydraulically balanced outlets 3 to 20 ft apart with either (1) approved covers or grates and an AVS or SVRD, or (2) 24" grates, or	Dual hydraulically balanced outlets 3 to 20 ft apart with approved covers or grates, or	Single outlet with a 24" grate and an AVS or SVRD	Single outlet with approved cover or grate and an AVS or SVRD			
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Exemption [265.190 e 1C]	A Pre-10/1/99 pool or spa, less than 3 feet deep which meets the required turnover and feeds directly into another pool having a main drain, is not required to have a main drain.									
Skimmers	Weirs shall be present.									
Vacuums	Automatically closes & latches, must be closed and latched when pool is open. May be permanently sealed.									
Equalizers	Approved covers or permanently sealed.									

### HOW TO BACKWASH [265.188 h]

- (1) Follow the manufacturer's instructions.
- (2) If instructions are not available, backwash when the pressure between the inlet and the outlet of the filter is 10 to 12 psi., as follows:  
  

**Filter with 1 pressure gauge:** First backwash completely and record the cleaned filter pressure; this is the **reference pressure** for a clean filter. Later, when the gauge measures 10 to 12 psi above the **reference pressure**, then backwashing is necessary.

**Filter with 2 pressure gauges:** Backwash when the difference between the two gauges measures 10 to 12 psi.
- (3) NOTE: Backwashing should not be done too frequently since freshly backwashed filters are not very efficient. However, efficiency increases as the pressure nears 10 to 12 psi.
- (4) Flowmeter reading may be reduced noticeably when filter begins to clog.
- (5) Instructions for backwashing, filtration, cleaning, operation, and general maintenance shall be available.