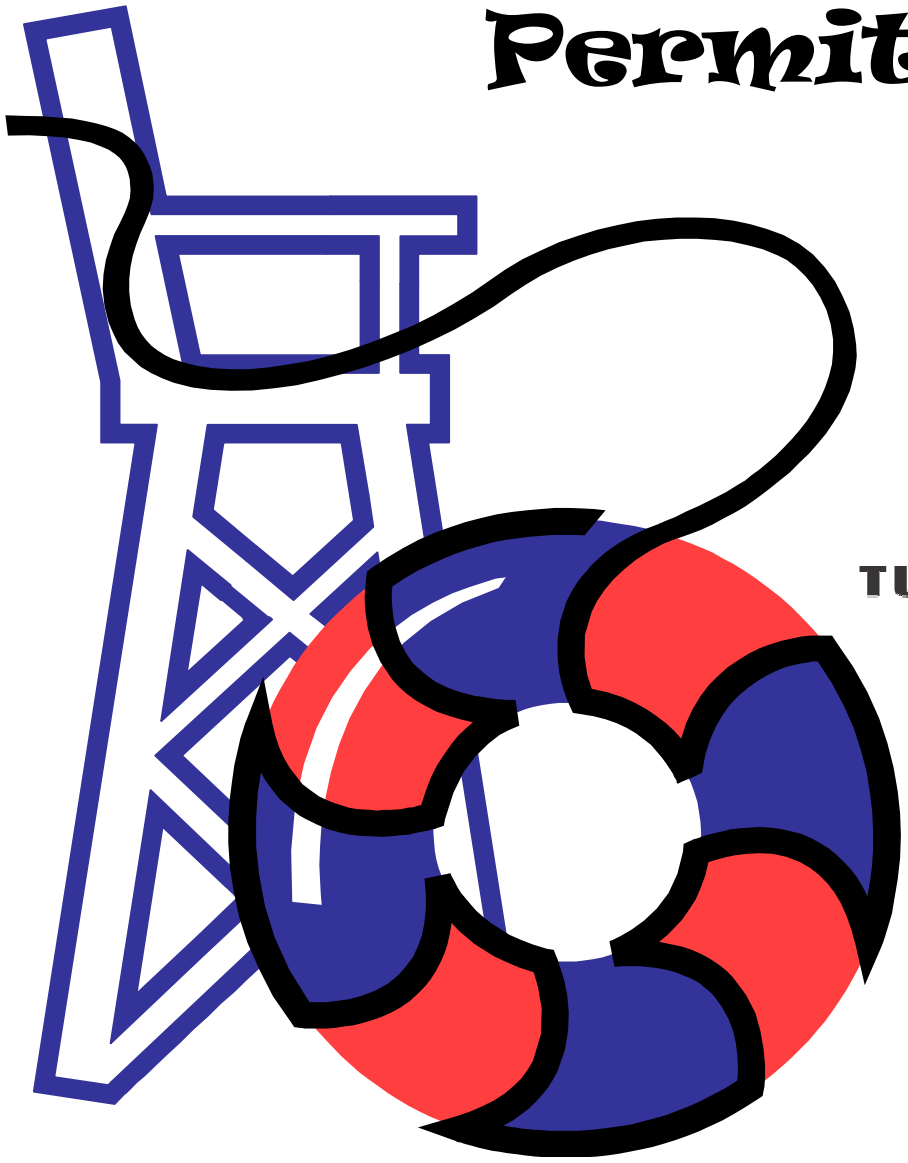
# Pool Operators Permit



TULSA HEALTH DEPARTMENT

# Instruction Manual

**Consumer Protection Services**
**4616 East 15th**
**Tulsa, Oklahoma 74112**
**Phone: (918) 595-4300**

Revised 02-1-2004

# TABLE OF CONTENTS

## Part I — Instruction Manual

# SECTION 1 - POOL AND SPA CALCULATIONS

## A. EQUIVALENTS:

Square Foot (sq. ft.) - a square 12" wide and 12" long

Cubic Foot (cu. ft.) - a cube 12" wide by 12" long by 12" high

Cubic Yard (cu. yd.) - a cube 36" wide by 36" long by 36" high

One cubic foot of water contains 7.48 gallons

One cubic foot of water weighs 62.4 pounds

One gallon of water weighs 8.33 pounds

One part per million (ppm) - represents 8.3 pounds of chemical per million gallons of water

## B. GEOMETRIC FORMULAS

A simple method of calculating pool size is the use of geometric formulas. Following are basic formulas:

A = Area

L = Length

W = Width

H = Height

r = radius = 1/2 diameter

$\pi$ = pi = 3.14 (a constant)

$\pi r^2$ = area of a circle

## C. CALCULATION FORMULAS

### 1. Amount Conversions

Ounces to Pounds..... Ounces ÷ 16 = Pounds
Fluid Ozs. to Gallons..... Fluid Ozs. ÷ 128 = Gallons

### 2. Distance Conversions

Yards to Feet ..... Yards X 3 = Feet
Meters to Feet..... Meters X 3.28 = Feet

### 3. Surface Areas

Rectangle/square..... Length x Width = Square Feet
Circle..... 3.14 x Radius x Radius = Sq. Ft.
Radius..... Diameter ÷ 2

### 4. Pool Volume

Length x Width x Average Depth x 7.48 = Gallons
Average Depth = Shallow + Deep ÷ 2

### 5. Turnover Rate

The amount of time needed to recirculate the entire volume of the pool or spa one (1) time. Measured in hours.

Pool Volume ÷ Flow Rate ÷ 60 = Hours

### 6. Flow Rate

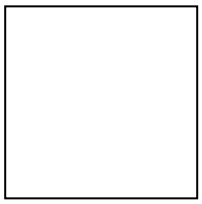
The amount of water passing through the recirculation and filtration system at a given time. Measured in gallons per minute (GPM). A flow meter measures flow rate.

Pool Volume ÷ Required Turnover Rate (Hrs) ÷ 60 = Gallons Per Minute (GPM)

## D. CALCULATING SURFACE AREAS

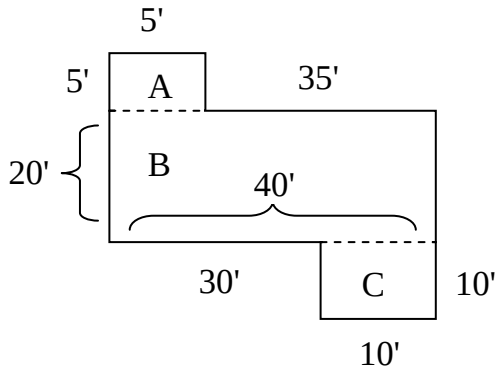
1. Area of a Square or Rectangle

A = L x W




A = 3' X 3'
A = 9 sq. ft.

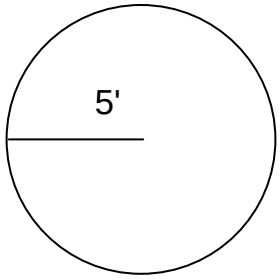
2. Surface Area of a Multi-sided Pool




Divide pool into rectangles (dotted lines).
Calculate and total Areas A, B, C.

| | | | | | |
|---|---|---|---|---|---|
| Area A | = | 5' x 5' | = | 25 | sq. ft. |
| Area B | = | 40' x 20' | = | 800 | sq. ft. |
| Area C | = | 10' x 10' | = | 100 | sq. ft. |
| TOTAL | ..... | | | 925 | sq. ft. |

3. Surface Area of a Circle




$A = \pi r^2$ ($\pi$ = 3.14 & r = $^1/_2$ diameter)

$A = 3.14 \times 5^2$
$A = 3.14 \times 25$ sq. ft.
$A = 78.5$ sq. ft.

## E. MAXIMUM USER CAPACITY

1. Pools

Swimming Area ..... Surface Area ÷ 15 = Load Limit
Diving Area..... Surface Area ÷ 24 = Load Limit

2. Spas - Larger Than 450 gallons

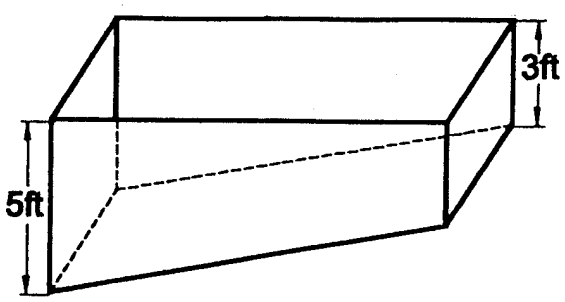
1 person per 3 linear ft. of spa perimeter, or
1 person per 200 gallons of water (whichever is less)

3. Spas - Smaller Than 450 gallons

1 person per 150 gallons

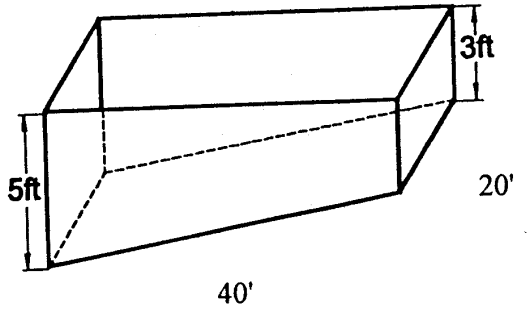
## F. CALCULATING POOL VOLUME (GALLONS)

1. Calculating Average Depth



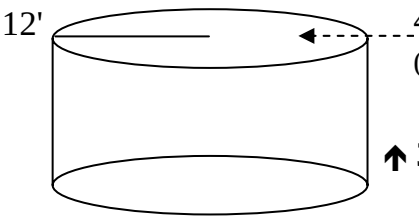

Deep End + Shallow End ÷ 2 = Avg. Depth
(5' + 3' = 8 ÷ 2 = 4' Average Depth)

2. Volume of Square or Rectangular Pool



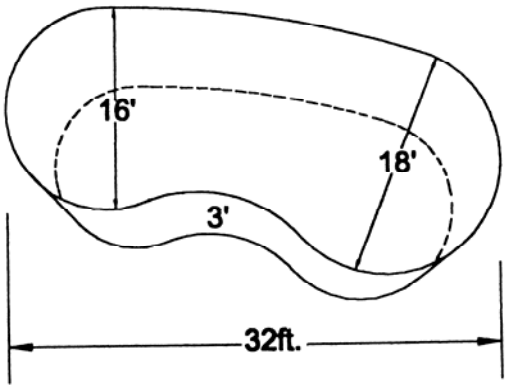

Volume = L x W x Average Depth x 7.48
(40' x 20' x 4' x 7.48 = 23,936 gallons)

3. Volume of Circular Pool




Volume = Surface Area x Average Depth X 7.48
(452.16 x 3.5 x 7.48 = 11,837.5 gallons)

4. Volume of Kidney-Shaped Pool




A + B x L x .45 x Avg. Depth x 7.48
(16 + 18 x 32 X .45 x 3.0 x 7.48 = 10,987 gallons)

16 + 18 = 34
34 x 32 = 1,088
1,088 x .45 = 489.6
489.6 x 3.0 = 1,468.8
1.468.8 x 7.48 = 10,987 (rounded up)

# Calculations

## Practice Worksheet

Surface Area (Formula: L x W = Surface Area)

| Length | Width | Surface Area |
|---|---|---|
| 65’ | 25’ | |
| 40’ | 20’ | |
| 80’ | 40’ | |
| 50’ | 25’ | |
| 60’ | 30’ | |

Average Depth (Formula: S + D ÷ 2 = Average Depth)

| Shallow | Deep | Average Depth |
|---|---|---|
| 3’ | 5’ | |
| 4’ | 10’ | |
| 0’ | 8’ | |
| 3’ | 1’ | |
| 5’ | 12’ | |

Gallons (Formula L x W x Average Depth x 7.48 = Gallons)

| Length | Width | Shallow | Deep | Gallons |
|---|---|---|---|---|
| 40’ | 20’ | 3’ | 5’ | |
| 50’ | 20’ | 5’ | 11’ | |
| 60’ | 30’ | 3’ | 5’ | |
| 35’ | 20’ | 3’ | 5’ | |
| 20’ | 10’ | 3’ | 3’ | |

Bather Load – Pool with No Diving Board (Formula: Surface Area ÷ 15 )

| Length | Width | Bather Load |
|---|---|---|
| 65’ | 25’ | |
| 40’ | 20’ | |
| 80’ | 40’ | |
| 50’ | 25’ | |
| 60’ | 30’ | |

## Practice Worksheet (Continued)

Bather Load – Spa (Formula: 3’ per person of Spa seating)

| Seating Bench | Bather Load |
|---|---|
| 12’ | |
| 8’ | |
| 9’ | |
| 16’ | |

Filter Size – High Rate Filter (Formula: GPM ÷ 15 = Filter Size)

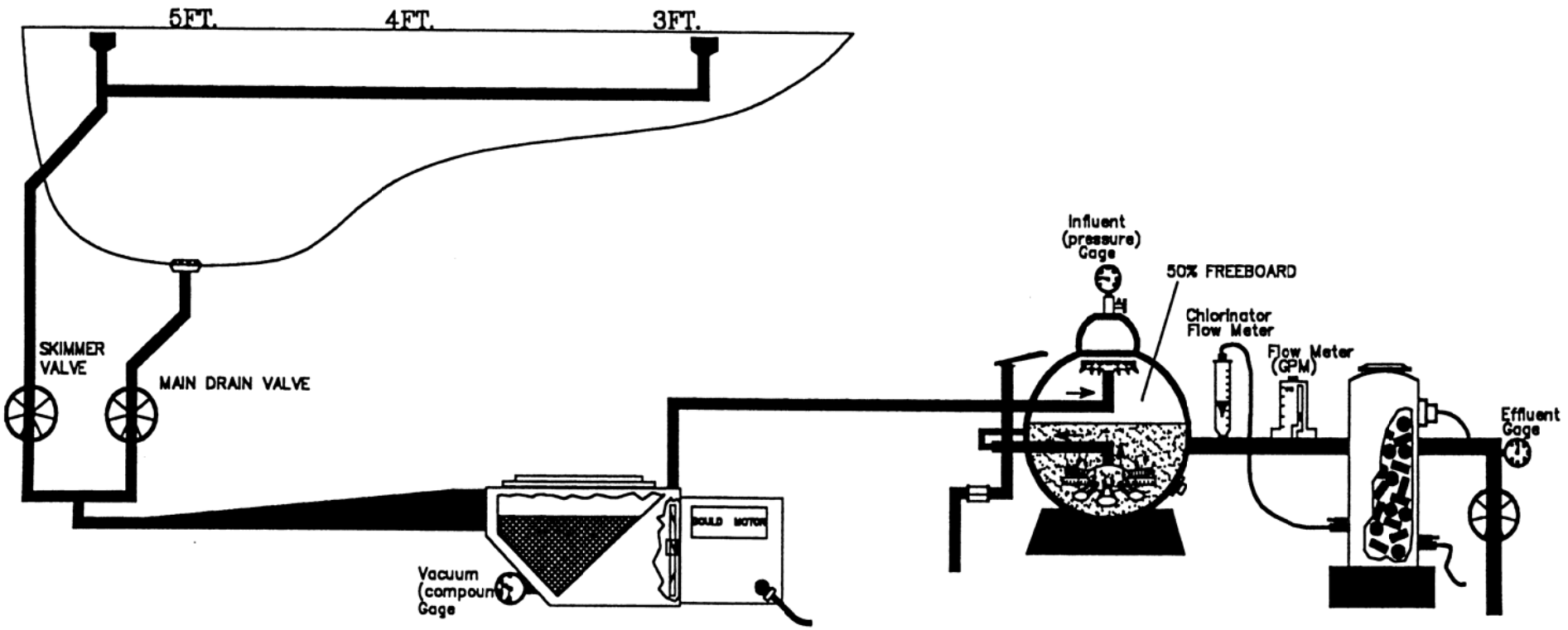
| GPM | Filter Size |
|---|---|
| 42 | |
| 84 | |
| 116 | |
| 66 | |

# Calculations

# BASIC CIRCULATION SYSTEM







# SECTION 2 — BASIC CIRCULATION SYSTEM

## A. OVERFLOW TROUGHS & SKIMMERS

1. 50% or more circulated water should pass through the skimmers or overflow troughs (75% skimmers/25% main drain recommended).

2. Weir or trough creates waterfall with thin layer of surface water (1/8" - 1/4"). This effect increases water velocity ensuring maximum surface skimming action.

## B. MAIN DRAINS

1. For bottom collection of water.

2. Cover or grate MUST be in place, secured and contrasting color.

3. Anti-vortex drain cover must be secured and contrasting color.

## C. SURGE OR BALANCE TANKS

1. Hold displaced water from pool overflow due to active swimmers or overcrowded conditions. Helps establish hydraulic equilibrium.

2. Each swimmer will displace 20 gallons of water.

## D. VALVES

1. Regulate flow of water through the system.

2. Many types and brands (Gate, Float, Ball, Butterfly).

## E. HAIR & LINT STRAINERS

1. Screens the pump from large debris that could clog or damage the impeller.

2. Hair & lint strainers should be checked and cleaned at each filter cleaning.

## F. PUMP & MOTOR

1. Pump capacity is measured in ***gallons per minute (GPM)*** and head pressure (resistance) is expressed in ***pounds per square inch (PSI)***.

   - Head pressure is also known as Total Dynamic Head (TDH).

2. Almost all swimming pool and spa pumps are classified as centrifugal pumps.

3. The ***Impeller*** spins in the volute, creating pressure, which moves water.

## G. TYPES OF FILTERS

1. <u>Rapid Rate Sand (Sand & Gravel)</u>

   - Multiple Large Tanks
   - Multiple layers of sand and gravel
   - Vacuum or pressure systems
   - Filtering rate is 3 GPM per sq. ft.
   - Must be backwashed individually
   - Flocculants is a compound usually used with sand-type filters to form a thin layer of gelatinous substance on the top of the sand. Flocculants are recommended.

2. High Rate Sand

- One large tank or multiple tanks — vertical or horizontal
- Single layer of sand (in addition, single layer of pea gravel 1/4" to 1/8" diameter may be used to protect the laterals)
- Always pressure system
- Filtering rate is 15 GPM per sq. ft.
- May be backwashed collectively
- Flocculants NOT recommended
- The amount of freeboard is normally 50% of the sand depth
- Must be NSF approved

(Backwashing: reversing flow through a filter to clean it)

3. Diatomaceous Earth (D.E.)

- Single tank with multiple screens or leaves (grids) to hold filter media (diatomaceous earth)
  - ✓ D. E. coats screens or leaves (grids) to provide filtering
- D. E. may be precoated or slurry (body) fed
- Vacuum or pressure systems
- Filtering rate is 2.5 GPM per sq. ft. of surface area
- May be backwashed or manually cleaned
  - ✓ Manually clean grids using TSP (trisodium phosphate) and water
  - ✓ Disposal of waste water through adequately sized separation tank
- Must be NSF approved

4. Cartridge

- Single or multiple pleated elements composed of synthetic fibrous material (usually polyester) attached to a cylindrical core
- Normally used on pressure systems
- Filtering rate is .375 to 1.0 GPM per sq. ft. (.375 GPM/sq. ft.)
- Must be manually cleaned
  - ✓ Clean with TSP (trisodium phosphate) and water
  - ✓ Use 10 to 1 diluted solution of muriatic acid to remove scale (Caution: If acid is used first, it will set oils.)
- Must be NSF approved

## H. GAUGES & METER

1. Monitor system performance (mandatory for optimum efficiency).
2. Influent and effluent pressure gauges monitor filters to indicate need to backwash or clean.
   - When influent pressure increases and effluent pressure decreases, clean filter (normally, 8 to 10 pound differential)
3. Flow Meters measure the speed that the water is moving through the system.
   - Measured in gallons per minute (GPM)

## I. CHEMICAL FEEDERS

1. Chemical Feeders feed needed chemicals automatically.
    - Erosion chlorine or bromine feeders
    - Peristaltic and diaphragm pumps feed liquid chlorine and pH adjusting chemicals
    - Gas chlorinators are vacuum operated solution feed design using venturi-operated injector
    - Must be NSF approved
2. Automation (controllers) monitors sanitizer and pH and direct chemical feeders to add chemicals as required.

## J. PIPING

1. Connects all equipment and fittings.
2. Size, length, and number of elbows determined by designer.
3. Amount of flow is limited by pipe size.
4. Label pipes as to direction of flow of water.
5. Must be NSF approved.

## K. INLETS OR RETURNS

1. In-wall or in-floor return of filtered, heated and chemically treated water.
    - Important for directing circulation pattern of pool — equal distribution
    - Pattern should move toward deep end and from bottom to surface

## L. CALCULATING FILTER SURFACE AREAS

1.

| Filter Type | Minimum Required Flow |
|---|---|
| High Rate Sand Filter | 15 GPM per sq. ft. |
| D.E. | 2.5 GPM per sq. ft. |
| Cartridge | .375 GPM per sq. ft. |

Pools and spas built after 1982 with skimmers shall have a minimum flow of 43 GPM per skimmer. Use whichever flow rate is higher.

2. Minimum Required Turnover Rate:

| | |
|---|---|
| Pool (8 hr. turnover) | gallons ÷ 480 = GPM |
| Wading Pools (4 hr. turnover) | gallons ÷ 240 = GPM |
| Spas (30 minute turnover) | gallons ÷ 30 = GPM |

Public pool filter systems must be capable of maintaining a flow rate at its code capacity even when being stressed or clogged by particulate matter or debris.

Sizing the pump and filter 25% larger than required will ensure adequate circulation as the filter becomes dirty.

# SECTION 3 — SANITIZERS

## A. CONTROL OF WATER CONTAMINANTS

1. Sanitation

   The process of destroying organisms that are harmful to people.

2. Oxidation

   The process of chemically removing organic debris from the water.

3. Algicides

   Algicides control the growth of algae in pool or spa water.

Chlorine sanitizes, oxidizes and controls algae growth.

## B. TYPES OF CHLORINE

1. Unstabilized (No *CYA)

   - Calcium Hypochlorite — 65% available chlorine
     pH = 10.8 - 11.8
   - Sodium Hypochlorite (Liquid) — 10 - 15% available chlorine
     pH = 13.0
   - Lithium Hypochlorite (Granular) — 35% available chlorine
     pH = 10.7
   - Chlorine Gas (Gas) — 100% available chlorine
     pH = < 1.0

2. Stabilized - Contains Cyanuric Acid (CYA)

- Sodium Dichlor — 55% available chlorine
  pH = 6.8 - 7.0
- Trichlor — 90% available chlorine
  pH = 2.8 - 3.0

Cyanuric Acid (Stabilizer)

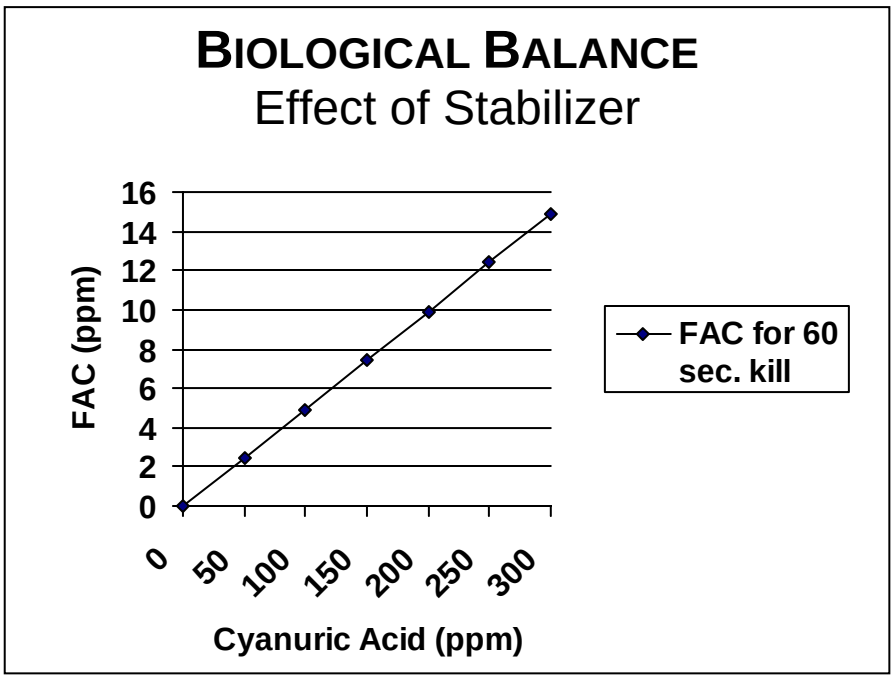
a. Sunlight destroys/degrades chlorine rapidly (90% of residual in 2 to 3 hours).

b. Cyanuric acid acts as sunscreen and cuts out up to 90% of the burn off.

c. Ranges:

| | | |
|---|---|---|
| Minimum | = | 10 ppm |
| Ideal | = | 30 to 50 ppm |

d. Cyanuric acid is not required for indoor pools/spas, or pools/spas that use bromine. The cyanuric acid level should be maintained between 10 to 50 ppm if the pool/spa has a ORP/pH controller. (as cyanuric acid levels increase, ORP levels decrease).



## C. CHLORINE RESIDUAL

1. A sanitizer must be continually active. It must provide a measurable residual.

2. When any type of chlorine is added to water, it forms hypochlorous acid (HOCI) and hypochlorite ions (OCI). Together these two compounds are Free Available Chlorine (FAC). We can measure FAC, TAC and CAC with a DPD test kit. Always maintain a minimum 1.0 ppm of FAC at all times.

   - (FAC) = Free Available Chlorine Min. 1.0 ppm

     $$\text{Chlorine} + H_20 = \underset{\text{(FAC)}}{HOCI + OCI}$$

   - HOCI = Hypochlorous Acid

     Unstable, Active Killing Form of Chlorine

   - OCI = Inactive Form of Chlorine

   - Total Available Chlorine (TAC)

     Total of all chlorine compounds in water

   - Combined Available Chlorine (CAC)

     Chloramines (TAC - FAC = CAC) NOT TO EXCEED 0.2 PPM

3. Chlorine is pH dependent. Proper pH = maximum killing power and dollars saved. See Figure 3.1 on next page.

## D. BROMINE RESIDUAL

1. Has a pH of 4.0 to 4.5

2. Operating range is 2.0 to 4.0 ppm

3. Like chlorine, bromine combines with organic impurities to form combined bromines or bromamines. However, combined bromine is still an effective sanitizer and it does not smell. Because of this, bromine is popular for spas.

# pH DOES MAKE A DIFFERENCE

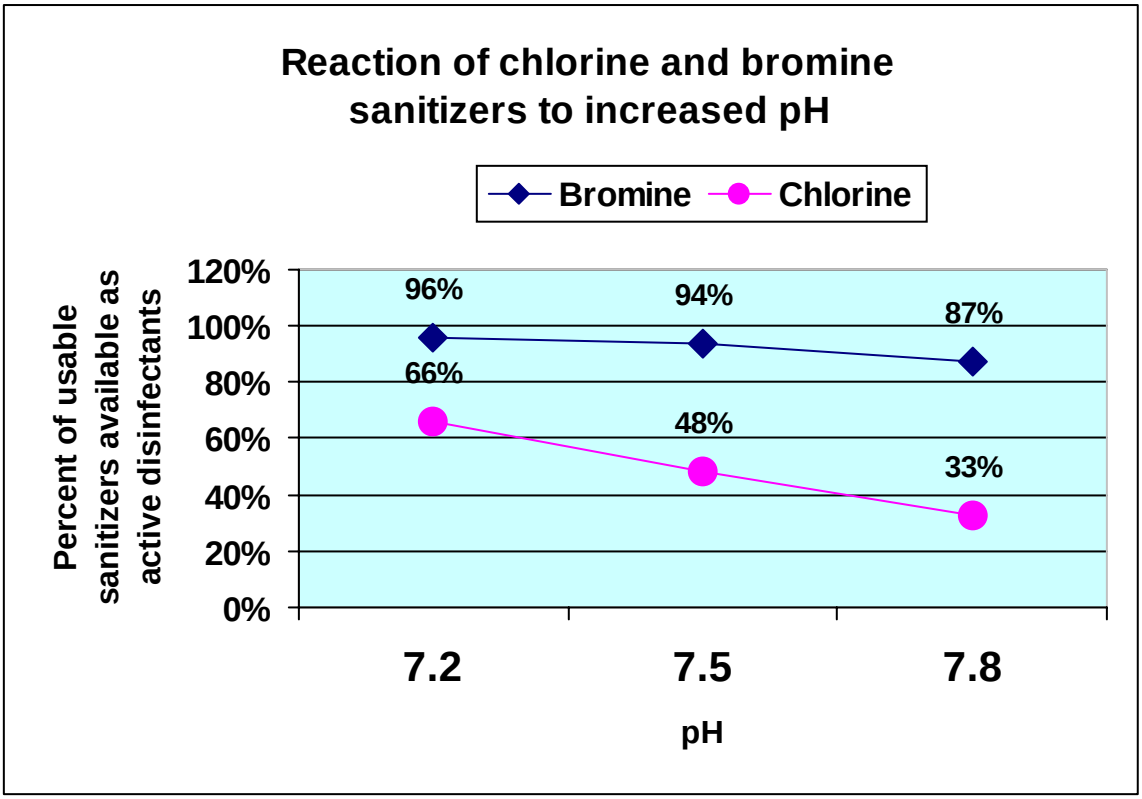



Figure 3.1

## E. COMBINED AVAILABLE CHLORINE (CAC)

1. The chlorine in a pool or spa can become "tied up" with contaminants (usually swimmer waste, rain, etc. - mostly nitrogen and ammonia) forming Combined Available Chlorine (CAC, or chloramines). Chloramines are:

   - Body, eye and skin irritants
   - Foul smelling

2. Definitions:

   - Weak disinfectant (40-60 times less effective than FAC)
   - Oxidized nitrogen compounds

## F. SUPERCHLORINATION

1. Process of eliminating CAC from water by adding a large dose of chlorine to reach chlorine breakpoint.

2. Breakpoint Chlorination - the point in a rising chlorine residual at which the concentration of available chlorine becomes great enough to completely oxidize all organic matter and ammonia compounds in a pool.

   To calculate the amount of chlorine required to reach breakpoint, test the FAC and TAC with a DPD test kit. This shall be done while the pool is not in use.

   - TAC - FAC = CAC
   - Multiply CAC x 10
   - Total equals ppm needed to reach breakpoint

PROBLEM

25,000 gallons

| | | | |
|---|---|---|---|
| TAC | 3.0 | | |
| FAC | -2.0 | | |
| CAC | 1.0 | X | 10 = 10 ppm for breakpoint for superchlorination |

## G. SUPPLEMENTAL TREATMENTS

1. Potassium monopersulfate – non-chlorine shock

2. Sodium chloride – electrolysis of salt

3. Ozone – strong oxidizer and disinfectant generated on site through UV light or electrical sparks

4. Ionizer – Use copper as algistat and/or silver as bacteriostat

All supplemental treatments have advantages and disadvantages. In all cases, you are still required to maintain a chlorine residual in addition to the supplemental treatment.

## PROCEDURES FOR FECAL AND VOMIT ACCIDENTS

### A. NORMAL DISCHARGE (CONTAINED, FORMED STOOL)

Instruct patrons to exit pool. Close the pool until all steps in this guideline are completed. Remove the visible feces. Add chlorine to the affected area (either 1 oz. of calcium hypochlorite or 4 to 5 ounces of sodium hypochlorite which has been mixed in a small bucket of water). Record the incident on your Bathing Place Operation Record. Wait approximately 30 minutes to ensure chlorine level and pH level meets the requirements as per code.

### B. WATERY FECAL DISCHARGE OR VOMIT

Watery fecal discharge or vomit presents the greatest likelihood of carrying harmful pathogens. All the following steps are to be followed when fecal matter is detected in the pool:

1. Immediately clear the pool.
2. Remove all visible physical fecal or vomit matter.
3. Raise the chlorine residual to a minimum of 20 ppm.
4. Maintain a pH level at or near 7.5 for at least 8 hours.
5. Backwash filters.
6. Then lower the chlorine to 5 ppm using sodium thiosulphate.

When watery fecal discharge or vomit occurs in spas or wading pools, the following steps should be taken:

1. The spa or pool shall be drained.
2. Brush the side and bottom with 100 ppm chlorine.
3. Refill the spa or pool and balance the water per code.

Pool operators should focus on preventing the watery accident. Educate parents to put swim diapers on your children, to teach their children appropriate places to go potty and, especially, not to drink pool water. Children and adults who have had diarrhea in the past month should not go swimming. This education can be done through signs, conversations, handouts or community newsletters.

# SECTION 4 — WATER BALANCE

## A. BALANCE

1. If pH, Total Alkalinity and Calcium Hardness are within recommended ranges

AND

The water is correctly saturated with calcium carbonate

THEN

There is no tendency to corrode or scale

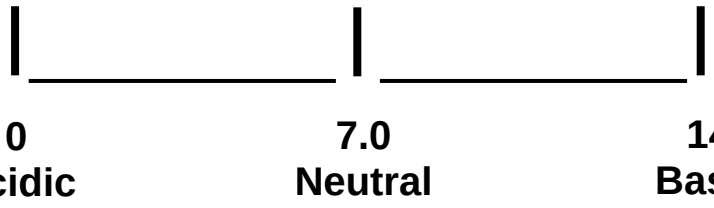
2. Calcium carbonate is found in all water

3. Calcium, the least soluble mineral, can become under or oversaturated

4. Calcium carbonate precipitate forms scale

## B. pH

1. pH is a value that determines how acidic (corrosive) or basic a solution is. pH is a temporary condition.



2. pH is important for 3 reasons:

   (1) Vessel and equipment protection
   (2) Swimmer comfort
   (3) Sanitizer effectiveness

| Low pH | High pH |
|---|---|
| 1. Etched plaster<br>2. Corroded metals<br>3. Stained plaster<br>4. Eye and skin irritation<br>5. Destruction of Total Alkalinity<br>6. Chlorine unstable | 1. Scale formation<br>2. Cloudy water<br>3. Short filter runs<br>4. Eye and skin irritation<br>5. Poor chlorine efficiency |

3. Ranges:

   Acceptable = 7.2 to 7.8 Ideal = 7.4 to 7.6

4. Adjusting

   To Raise: Use Soda Ash (sodium carbonate)

   To Lower: Use Muriatic acid (liquid) or Dry Acid (sodium bisulfate)

   <u>Always test and adjust total alkalinity before testing and adjusting pH.</u>

## C. TOTAL ALKALINITY

1. Measure of resistance to change of pH (buffering or acid neutralizing capacity of the water). The correct total alkalinity helps maintain pH.

| Low Total Alkalinity | High Total Alkalinity |
|---|---|
| 1. Etched plaster<br>2. Corroded metals<br>3. Stained plaster<br>4. Eye and skin irritation<br>5. Destruction of total alkalinity<br>6. Chlorine unstable | 1. pH hard to change<br>2. Scale formation<br>3. Poor chlorine efficiency<br>4. Eye and skin irritation<br>5. Cloudy water |
| | |

2. Ranges (based on type of sanitizer used):

   Acceptable = 80 ppm to 200 ppm

   - 80 - 100 ppm — Sodium hypochlorite, calcium hypochlorite or lithium hypochlorite
   - 100 - 120 ppm — Gas, dichlor, trichlor and bromine

3. Adjusting:

   To Raise: Use sodium bicarbonate

   To Lower: Use Muriatic Acid (liquid) or Dry Acid (sodium bisulfate)

## D. CALCIUM HARDNESS

1. Measure of Calcium and Magnesium Dissolved in Water

| Low Calcium Hardness | High Calcium Hardness |
|---|---|
| 1. Corrosive water<br>2. Water foaming | 1. Scale formation<br>2. Chemicals less effective<br>3. Cloudy water |

2. Ranges: 50 - 500 ppm

   Ideal = 200 to 400 ppm  Maximum = 500 ppm

3. Adjusting

   To Raise: Use calcium chloride (least soluble chemical)
   To Lower: Partially or completely drain pool and refill. Spas should be completely drained and refilled.

   **Note:** Do not add calcium chloride the same day as soda ash or sodium bicarbonate as the water may turn cloudy.

## E. TOTAL DISSOLVED SOLIDS (TDS)

1. TDS is the sum total of all dissolved materials in the water.

2. A high TDS can result in:

   - Salty-tasting water
   - Colored but clean water
   - Algae despite a good sanitizer level
   - Corrosion of metal parts (4000 ppm)
   - Cloudy Water
   - Eye and skin irritation
   - False test readings

3. Ranges: 300 - 1500 ppm

4. Adjusting:

   To Lower - Partially or completely drain and refill pool.

## F. WATER GRAM BALANCE

It is the nature of water to dissolve the things it contacts until the water becomes saturated. A commonly used tool in determining the degree of saturation in pool water is the Water Gram. Use the following instructions:

1. Determine

   - pH
   - Total Alkalinity
   - Calcium Hardness

2. Set total alkalinity opposite calcium hardness.

3. Read pH of saturation opposite temperature.

4. Subtract pH of saturation from pH of sample water. This value equals saturation index. If saturation index is 0.5 or greater, water may become cloudy or deposit scale. If saturation index is 0.5 or less, water is corrosive.

Example:

| Over Saturated | Balanced | Under Saturated |
|---|---|---|
| PH ..... 8.0<br>Total Alk. ..... 150<br>Calcium Hardness ... 500<br>Temperature ..... 76ºF<br><br>8.0<br>- 7.1 (pH Saturation)<br>+ 0.9 | PH ..... 7.4<br>Total Alk. ..... 100<br>Calcium Hardness .... 200<br>Temperature ..... 76ºF<br><br>7.4<br>- 7.6 (pH Saturation)<br>- 0.2 | PH ..... 7.2<br>Total Alk. ..... 50<br>Calcium Hardness ..... 90<br>Temperature ..... 76ºF<br><br>7.2<br>- 8.3 (pH Saturation)<br>- 1.1 |

# WATER BALANCE PROBLEMS

| Problem 1 | Problem 2 | Problem 3 |
|---|---|---|
| PH ..... 8.0<br>Total Alk. ..... 150<br>Calcium Hardness ... 500<br>Temperature ..... 80ºF | PH ..... 7.4<br>Total Alk. ..... 100<br>Calcium Hardness .... 200<br>Temperature ..... 80ºF | PH ..... 7.2<br>Total Alk. ..... 50<br>Calcium Hardness ..... 90<br>Temperature ..... 80ºF |
| Balanced: | Balanced: | Balanced: |
| Over Saturated | Over Saturated | Over Saturated |
| Under Saturated | Under Saturated | Under Saturated |

# CHEMICAL STANDARDS

| Chemical | Minimum | Ideal | Maximum |
|---|---|---|---|
| Free Chlorine (FAC) | Pool: 1.0 ppm<br>Spa: 1.0 ppm | 1.0 - 3.0 ppm<br>3.0 - 5.0 ppm | 5.0 ppm<br>10.0 ppm |
| Combined Chlorine (CAC) | None | None | 0.2 ppm |
| Bromine | Pool: 2.0 ppm<br>Spa: 2.0 ppm | 2.0 - 4.0 ppm<br>3.0 - 5.0 ppm | 4.0 ppm<br>10.0 ppm |
| PH | 7.2 | 7.4 - 7.6 | 7.8 |
| Total Alkalinity | 80 ppm | 80 - 120 ppm<br>(Depends on type of sanitizer) | 200 PPM |
| | Calcium hypochlorite and lithium hypochlorite | 80 - 100 ppm | |
| | Gas, dichlor, trichlor and bromine compounds | 100 - 120 ppm | |
| Calcium Hardness | 50 ppm | 200 - 400 ppm | 500 ppm |
| TDS | 300 ppm | | 1500 ppm |
| Iron & Copper (Heavy Metals) | None | None | 0.2 ppm |
| Stabilizer (Cyanuric Acid) | 10 ppm | 30 - 50 ppm | 100 ppm |
| Hot Water Facilities-Water Temperature | 90ºF | | 105ºF |
| Swimming Pools | 75ºF | | 90ºF |
| Indoor Pool-Air Temp (Excluding Hot Water Facilities) | Water Temp -2ºF | | Water Temp +8ºF |
| Turbidity | Must be able to clearly see main drain from pool sidewalk. | | |

## D. TESTING TECHNIQUES

The procedures for conducting the various pool tests are outlined in the instructions for your test kit. Regardless of the brand of the kit, the following guidelines should provide the most accurate results.

1. Conduct tests prior to adding chemicals.
2. Test a minimum of 4 times a day if pool is not automated (hourly for extremely heavy bather load).
3. Select well mixed samples - - away from return inlets - - 12" to 18 " down. In large pools, test the shallow and deep end.
4. Follow the instructions included with test kit.
5. Rinse test vials with pool water before and after each test.
6. Do not touch reagents, especially with dirty hands.
7. Do not interchange reagent caps and droppers.
8. Clean all testing equipment thoroughly after each use with clean, fresh water.
9. If the chlorine level is above 5.0, do not do the other tests; the readings will be invalid. High sanitizer levels can bleach the color of many common tests. Make sure to add a chlorine neutralizer to the test sample if the directions call for it.
10. To save time, fill both test vials simultaneously.
11. Hold test vial and dropper bottle vertically to ensure uniform drop size. Add test solution slowly, swirling or gently inverting after each drop. Never shake!
12. Read all test results immediately unless directed otherwise.
13. Compare colors out of sunlight and against a light or white background.

14. After adding reagents to the vials, do not return this water to the pool.

15. As with all chemicals, the test kit should be stored in a cool, dark place.

16. To ensure accurate and reliable tests, have the color standards checked once a year.

17. Replace test chemicals as needed.

18. Dilute high chlorine or cyanuric acid samples with distilled water to get accurate reading. Multiply reading by 2.

# SECTION 5 — CHEMICAL DOSAGE

## A. CHEMICAL DOSAGE TABLES

1. To use the chemical dosage tables[1], test the water to determine what adjustments must be made. Once all the tests for water balance have been completed, and the need for treatment determined, the tables on the following pages can be used to find the correct amount of treatment chemical to add. For example, for a 30,000 gallon pool, the column value for 20,000 plus 2 times the 5,000 gallon column value will give an approximate amount of treatment chemical needed.

   Examples:

   To Superchlorinate a 50,000 gallon pool to 10 ppm using calcium Hypochlorite (65%), go to 50,000 column:

   10.3 oz will raise chlorine level to 1 ppm
   10.3 oz times 10 = 103 oz
   103 oz ÷ 16 = 6.44 lbs.

   Algae Removal - 30 ppm Shock

   50,000 gallons using hypochlorite (65%) = 19.3 lbs.

   Increase pH using Taylor Base Demand procedures

   50,000 gallon pool, 4 Drop - use 6.41 lbs. Soda Ash

   Increase Alkalinity

   50,000 gallon pool to raise alkalinity from 60 ppm to 100 ppm use 28.0 lbs. sodium bicarbonate

[1] The tables are reprinted with permission from Pool & Spa Water Chemistry: A Testing and Treatment Guide, Copyright 1998 Taylor Technologies, Inc., Sparks, MD.

Table A
Amount of Chlorine Compound to Introduce 1 ppm Chlorine

| Volume of Water | | | | | | | |
|---|---|---|---|---|---|---|---|
| % Available Chlorine | 400 gallons | 1,000 gallons | 5,000 gallons | 10,000 gallons | 20,000 gallons | 50,000 gallons | 100,000 gallons |
| 5% | 1.02 fl oz | 2.56 fl oz | 12.8 fl oz | 1.60 pts | 1.60 qts | 1.00 gal | 2.00 gal |
| 10% | 0.51 fl oz | 1.28 fl oz | 6.40 fl oz | 12.8 fl oz | 1.60 pts | 2.00 qts | 1.00 gal |
| 12% | 0.43 fl oz | 1.07 fl oz | 5.33 fl oz | 10.7 fl oz | 1.33 pts | 1.67 qts | 3.33 qts |
| 35% | 0.15 oz | 0.38 oz | 1.91 oz | 3.82 oz | 7.63 oz | 1.19 lbs | 2.38 lbs |
| 60% | 0.09 oz | 0.22 oz | 1.11 oz | 2.23 oz | 4.45 oz | 11.1 oz | 1.39 lbs |
| 65% | 0.08 oz | 0.21 oz | 1.03 oz | 2.05 oz | 4.11 oz | 10.3 oz | 1.28 lbs |
| 90% | 0.06 oz | 0.15 oz | 0.74 oz | 1.48 oz | 2.97 oz | 7.42 oz | 14.8 oz |
| 100% | 0.05 oz | 0.13 oz | 0.67 oz | 1.34 oz | 2.67 oz | 6.68 oz | 13.4 oz |

Table B
30 ppm Shock Table for Algae Removal

| Volume of Water | | | | | | | |
|---|---|---|---|---|---|---|---|
| % Available Chlorine | 400 gallons | 1,000 gallons | 5,000 gallons | 10,000 gallons | 20,000 gallons | 50,000 gallons | 100,000 gallons |
| 5% | 1.92 pts | 2.40 qts | 3.00 gal | 6.00 gal | 12.0 gal | 30.0 gal | 60.0 gal |
| 10% | 15.4 fl oz | 1.20 qts | 1.50 gal | 3.00 gal | 6.00 gal | 15.0 gal | 30.0 gal |
| 12% | 12.8 fl oz | 1.0 qts | 1.25 gal | 2.50 gal | 5.00 gal | 12.5 gal | 25.0 gal |
| 35% | 4.58 oz | 11.4 oz | 3.58 lbs | 7.15 lbs | 14.3 lbs | 35.8 lbs | 71.5 lbs |
| 60% | 2.67 oz | 6.68 oz | 2.09 lbs | 4.17 lbs | 8.35 lbs | 20.9 lbs | 41.7 lbs |
| 65% | 2.47 oz | 6.17 oz | 1.93 lbs | 3.85 lbs | 7.70 lbs | 19.3 lbs | 38.5 lbs |
| 90% | 1.78 oz | 4.45 oz | 1.39 lbs | 2.78 lbs | 5.56 lbs | 13.9 lbs | 27.8 lbs |
| 100% | 1.60 oz | 4.01 oz | 1.25 lbs | 2.50 lbs | 5.01 lbs | 12.5 lbs | 25.0 lbs |

Table C
To Decrease Free Chlorine Using Sodium Sulfite

| Volume of Water | | | | | | | |
|---|---|---|---|---|---|---|---|
| Desired decrease in ppm | 400 gallons | 1,000 gallons | 5,000 gallons | 10,000 gallons | 20,000 gallons | 50,000 gallons | 100,000 gallons |
| 1 ppm | 0.09 oz | 0.24 oz | 1.19 oz | 2.37 oz | 4.75 oz | 11.9 oz | 1.48 lbs |
| 2 ppm | 0.19 oz | 0.47 oz | 2.37 oz | 4.75 oz | 9.49 oz | 1.48 lbs | 2.97 lbs |
| 3 ppm | 0.28 oz | 0.71 oz | 3.56 oz | 7.12 oz | 14.2 oz | 2.23 lbs | 4.45 lbs |
| 4 ppm | 0.38 oz | 0.95 oz | 4.75 oz | 9.49 oz | 1.19 lbs | 2.97 lbs | 5.93 lbs |
| 5 ppm | 0.47 oz | 1.19 oz | 5.93 oz | 11.9 oz | 1.48 lbs | 3.71 lbs | 7.42 lbs |
| 10 ppm | 0.95 oz | 2.37 oz | 11.9 oz | 1.48 lbs | 2.97 lbs | 7.42 lbs | 14.8 lbs |
| 15 ppm | 1.42 oz | 3.56 oz | 1.11 lbs | 2.23 lbs | 4.45 lbs | 11.1 lbs | 22.3 lbs |
| 20 ppm | 1.90 oz | 4.75 oz | 1.48 lbs | 2.97 lbs | 5.93 lbs | 14.8 lbs | 29.7 lbs |
| 30 ppm | 2.85 oz | 7.12 oz | 2.23 lbs | 4.45 lbs | 8.90 lbs | 22.3 lbs | 44.5 lbs |
| 50 ppm | 4.75 oz | 11.9 oz | 3.71 lbs | 7.42 lbs | 14.8 lbs | 37.1 lbs | 74.2 lbs |

Table D

To Increase pH Using Soda Ash (Sodium Carbonate, 100%)

with Taylor Base Demand Procedure

| Volume of Water | | | | | | | |
|---|---|---|---|---|---|---|---|
| Demand Reagent | 400 gallons | 1,000 gallons | 5,000 gallons | 10,000 gallons | 20,000 gallons | 50,000 gallons | 100,000 gallons |
| 1 drop | 0.21 oz | 0.51 oz | 2.56 oz | 5.13 oz | 10.3 oz | 1.60 lbs | 3.20 lbs |
| 2 drops | 0.41 oz | 1.03 oz | 5.13 oz | 10.3 oz | 1.28 lbs | 3.20 lbs | 6.41 lbs |
| 3 drops | 0.62 oz | 1.54 oz | 7.69 oz | 15.4 oz | 1.92 lbs | 4.81 lbs | 9.61 lbs |
| 4 drops | 0.82 oz | 2.05 oz | 10.3 oz | 1.28 lbs | 2.5 lbs | 6.41 lbs | 12.8 lbs |
| 5 drops | 1.03 oz | 2.56 oz | 12.8 oz | 1.60 lbs | 3.20 lbs | 8.01 lbs | 16.0 lbs |
| 6 drops | 1.23 oz | 3.08 oz | 15.4 oz | 1.92 lbs | 3.85 lbs | 9.61 lbs | 19.2 lbs |
| 7 drops | 1.44 oz | 3.59 oz | 1.12 lbs | 2.24 lbs | 4.49 lbs | 11.2 lbs | 22.4 lbs |
| 8 drops | 1.64 oz | 4.10 oz | 1.28 lbs | 2.56 lbs | 5.13 lbs | 12.8 lbs | 25.6 lbs |
| 9 drops | 1.85 oz | 4.61 oz | 1.44 lbs | 2.88 lbs | 5.77 lbs | 14.4 lbs | 28.8 lbs |
| 10 drops | 2.05 oz | 5.13 oz | 1.60 lbs | 3.20 lbs | 6.4 lbs | 16.0 lbs | 32.0 lbs |

Table E

To Decrease pH Using Muriatic Acid (20º Baumé/31.45% HCI)

with Taylor Acid Demand Procedure

| Volume of Water | | | | | | | |
|---|---|---|---|---|---|---|---|
| Demand Reagent | 400 gallons | 1,000 gallons | 5,000 gallons | 10,000 gallons | 20,000 gallons | 50,000 gallons | 100,000 gallons |
| 1 drop | 0.37 fl oz | 0.92 fl oz | 4.58 fl oz | 9.16 fl oz | 1.15 pts | 1.43 qts | 2.86 qts |
| 2 drops | 0.73 fl oz | 1.83 fl oz | 9.16 fl oz | 1.15 pts | 1.15 qts | 2.86 qts | 1.43 gal |
| 3 drops | 1.10 fl oz | 2.75 fl oz | 13.7 fl oz | 1.72 pts | 1.72 qts | 1.07 gal | 2.15 gal |
| 4 drops | 1.47 fl oz | 3.67 fl oz | 1.15 pts | 1.15 qts | 2.29 qts | 1.43 gal | 2.86 gal |
| 5 drops | 1.83 fl oz | 4.58 fl oz | 1.43 pts | 1.43 qts | 2.86 qts | 1.79 gal | 3.58 gal |
| 6 drops | 2.20 fl oz | 5.50 fl oz | 1.72 pts | 1.72 qts | 3.44 qts | 2.15 gal | 4.30 gal |
| 7 drops | 2.57 fl oz | 6.41 fl oz | 1.00 qts | 2.00 qts | 1.00 gal | 2.51 gal | 5.01 gal |
| 8 drops | 2.93 fl oz | 7.33 fl oz | 1.15 qts | 2.29 qts | 1.15 gal | 2.86 gal | 5.73 gal |
| 9 drops | 3.30 fl oz | 8.25 fl oz | 1.29 qts | 2.58 qts | 1.29 gal | 3.22 gal | 6.44 gal |
| 10 drops | 3.67 fl oz | 9.16 fl oz | 1.43 qts | 2.86 qts | 1.43 gal | 3.58 gal | 7.16 gal |

Table F

To Decrease pH Using Dry Acid (Sodium Bisulfate, 93.2%)

with Taylor Acid Demand Procedure

| Volume of Water | | | | | | | |
|---|---|---|---|---|---|---|---|
| Demand Reagent | 400 gallons | 1,000 gallons | 5,000 gallons | 10,000 gallons | 20,000 gallons | 50,000 gallons | 100,000 gallons |
| 1 drop | 0.49 oz | 1.23 oz | 6.16 oz | 12.3 oz | 1.54 lbs | 3.85 lbs | 7.70 lbs |
| 2 drops | 0.99 oz | 2.46 oz | 12.3 oz | 1.54 lbs | 3.08 lbs | 7.70 lbs | 15.5 lbs |
| 3 drops | 1.48 oz | 3.70 oz | 1.16 lbs | 2.31 lbs | 4.62 lbs | 11.6 lbs | 23.1 lbs |
| 4 drops | 1.97 oz | 4.93 oz | 1.54 lbs | 3.08 lbs | 6.16 lbs | 15.4 lbs | 30.5 lbs |
| 5 drops | 2.46 oz | 6.16 oz | 1.93 lbs | 3.85 lbs | 7.70 lbs | 19.3 lbs | 38.5 lbs |
| 6 drops | 2.96 oz | 7.39 oz | 2.31 lbs | 4.62 lbs | 9.24 lbs | 23.1 lbs | 46.2 lbs |
| 7 drops | 3.45 oz | 8.63 oz | 2.70 lbs | 5.39 lbs | 10.8 lbs | 27.0 lbs | 53.9 lbs |
| 8 drops | 3.94 oz | 9.86 oz | 3.08 lbs | 6.16 lbs | 12.3 lbs | 30.8 lbs | 61.6 lbs |
| 9 drops | 4.44 oz | 11.1 oz | 3.47 lbs | 6.93 lbs | 13.9 lbs | 34.7 lbs | 69.3 lbs |
| 10 drops | 4.93 oz | 12.3 oz | 3.85 lbs | 7.70 lbs | 15.4 lbs | 38.5 lbs | 77.0 lbs |

Table G

To Increase Alkalinity Using Baking Soda (Sodium Bicarbonate, 100%)

| Volume of Water | | | | | | | |
|---|---|---|---|---|---|---|---|
| Desired increase | 400 gallons | 1,000 gallons | 5,000 gallons | 10,000 gallons | 20,000 gallons | 50,000 gallons | 100,000 gallons |
| 10 ppm | 0.90 oz | 2.24 oz | 11.2 oz | 1.40 lbs | 2.80 lbs | 7.00 lbs | 14.0 lbs |
| 20 ppm | 1.79 oz | 4.48 oz | 1.40 lbs | 2.80 lbs | 5.60 lbs | 14.0 lbs | 28.0 lbs |
| 30 ppm | 2.69 oz | 6.72 oz | 2.10 lbs | 4.20 lbs | 8.41 lbs | 21.0 lbs | 42.0 lbs |
| 40 ppm | 3.59 oz | 8.97 oz | 2.80 lbs | 5.60 lbs | 11.2 lbs | 28.0 lbs | 56.0 lbs |
| 50 ppm | 4.48 oz | 11.2 oz | 3.50 lbs | 7.00 lbs | 14.0 lbs | 35.0 lbs | 70.0 lbs |
| 60 ppm | 5.38 oz | 13.4 oz | 4.20 lbs | 8.41 lbs | 16.8 lbs | 42.0 lbs | 84.1 lbs |
| 70 ppm | 6.28 oz | 15.7 oz | 4.90 lbs | 9.81 lbs | 19.6 lbs | 49.0 lbs | 98.1 lbs |
| 80 ppm | 7.17 oz | 1.12 lbs | 5.60 lbs | 11.2 lbs | 22.4 lbs | 56.0 lbs | 112 lbs |
| 90 ppm | 8.07 oz | 1.26 lbs | 6.30 lbs | 12.6 lbs | 25.2 lbs | 63.0 lbs | 126 lbs |
| 100 ppm | 8.97 oz | 1.40 lbs | 7.00 lbs | 14.0 lbs | 28.0 lbs | 70.0 lbs | 140 lbs |

Table H

To Decrease Alkalinity Using Dry Acid (Sodium Bisulfate, 93.2%)

| Volume of Water | | | | | | | |
|---|---|---|---|---|---|---|---|
| Desired decrease | 400 gallons | 1,000 gallons | 5,000 gallons | 10,000 gallons | 20,000 gallons | 50,000 gallons | 100,000 gallons |
| 10 ppm | 1.37 oz | 3.44 oz | 1.07 lbs | 2.15 lbs | 4.30 lbs | 10.7 lbs | 21.5 lbs |
| 20 ppm | 2.75 oz | 6.87 oz | 2.15 lbs | 4.30 lbs | 8.59 lbs | 21.5 lbs | 43.0 lbs |
| 30 ppm | 4.12 oz | 10.3 oz | 3.22 lbs | 6.45 lbs | 12.9 lbs | 32.2 lbs | 64.5 lbs |
| 40 ppm | 5.50 oz | 13.7 oz | 4.30 lbs | 8.59 lbs | 17.2 lbs | 43.0 lbs | 85.9 lbs |
| 50 ppm | 6.87 oz | 1.07 lbs | 5.37 lbs | 10.7 lbs | 21.5 lbs | 53.7 lbs | 107 lbs |
| 60 ppm | 8.25 oz | 1.29 lbs | 6.45 lbs | 12.9 lbs | 25.8 lbs | 64.5 lbs | 129 lbs |
| 70 ppm | 9.62 oz | 1.50 lbs | 7.52 lbs | 15.0 lbs | 30.1 lbs | 75.2 lbs | 150 lbs |
| 80 ppm | 11.0 oz | 1.72 lbs | 8.59 lbs | 17.2 lbs | 34.4 lbs | 85.9 lbs | 172 lbs |
| 90 ppm | 12.4 oz | 1.93 lbs | 9.67 lbs | 19.3 lbs | 38.7 lbs | 96.7 lbs | 193 lbs |
| 100 ppm | 13.7 oz | 2.15 lbs | 10.7 lbs | 21.5 lbs | 43.0 lbs | 107 lbs | 215 lbs |

Table I

To Decrease Alkalinity Using Muriatic Acid (20º Baumé / 31.45%)

| Volume of Water | | | | | | | |
|---|---|---|---|---|---|---|---|
| Desired decrease | 400 gallons | 1,000 gallons | 5,000 gallons | 10,000 gallons | 20,000 gallons | 50,000 gallons | 100,000 gallons |
| 10 ppm | 1.02 fl oz | 2.56 fl oz | 12.8 fl oz | 1.60 pts | 1.60 qts | 3.99 qts | 2.00 gal |
| 20 ppm | 2.04 fl oz | 5.11 fl oz | 1.60 pts | 1.60 qts | 3.20 qts | 2.00 gal | 3.99 gal |
| 30 ppm | 3.07 fl oz | 7.67 fl oz | 1.20 qts | 2.40 qts | 1.20 gal | 3.00 gal | 5.99 gal |
| 40 ppm | 4.09 fl oz | 10.2 fl oz | 1.60 qts | 3.20 qts | 1.60 gal | 3.99 gal | 7.99 gal |
| 50 ppm | 5.11 fl oz | 12.8 fl oz | 2.00 qts | 3.99 gal | 2.00 gal | 4.99 gal | 9.98 gal |
| 60 ppm | 6.13 fl oz | 15.3 fl oz | 2.40 qts | 1.20 gal | 2.40 gal | 5.99 gal | 12.0 gal |
| 70 ppm | 7.16 fl oz | 1.12 pts | 2.80 qts | 1.40 gal | 2.80 gal | 6.99 gal | 14.0 gal |
| 80 ppm | 8.18 fl oz | 1.28 pts | 3.20 qts | 1.60 gal | 3.20 gal | 7.99 gal | 16.0 gal |
| 90 ppm | 9.20 fl oz | 1.44 pts | 3.59 qts | 1.80 gal | 3.59 gal | 8.99 gal | 18.0 gal |
| 100 ppm | 10.2 fl oz | 1.60 pts | 3.99 qts | 2.00 gal | 3.99 gal | 9.98 gal | 20.0 gal |

Table J
To Increase Calcium Hardness Using Calcium Chloride (77%)

| Volume of Water | | | | | | | |
|---|---|---|---|---|---|---|---|
| Desired increase | 400 gallons | 1,000 gallons | 5,000 gallons | 10,000 gallons | 20,000 gallons | 50,000 gallons | 100,000 gallons |
| 10 ppm | 0.77 oz | 1.92 oz | 9.61 oz | 1.20 lbs | 2.40 lbs | 6.01 lbs | 12.0 lbs |
| 20 ppm | 1.54 oz | 3.85 oz | 1.20 lbs | 2.40 lbs | 4.81 lbs | 12.0 lbs | 24.0 lbs |
| 30 ppm | 2.31 oz | 5.77 oz | 1.80 lbs | 3.61 lbs | 7.21 lbs | 18.0 lbs | 36.1 lbs |
| 40 ppm | 3.08 oz | 7.69 oz | 2.40 lbs | 4.81 lbs | 9.61 lbs | 24.0 lbs | 48.1 lbs |
| 50 ppm | 3.85 oz | 9.61 oz | 3.00 lbs | 6.01 lbs | 12.0 lbs | 30.0 lbs | 60.1 lbs |
| 60 ppm | 4.62 oz | 11.5 oz | 3.61 lbs | 7.21 lbs | 14.4 lbs | 36.1 lbs | 72.1 lbs |
| 70 ppm | 5.38 oz | 13.5 oz | 4.21 lbs | 8.41 lbs | 16.8 lbs | 42.1 lbs | 84.1 lbs |
| 80 ppm | 6.15 oz | 15.4 oz | 4.81 lbs | 9.61 lbs | 19.2 lbs | 48.1 lbs | 96.2 lbs |
| 90 ppm | 6.92 oz | 1.08 lbs | 5.41 lbs | 10.8 lbs | 21.6 lbs | 54.1 lbs | 108 lbs |
| 100 ppm | 7.69 oz | 1.20 lbs | 6.01 lbs | 12.0 lbs | 24.0 lbs | 60.1 lbs | 120 lbs |

## B. ORDER OF APPLICATION

1. Chemicals or sanitizers for water balance adjustments should be added in the following sequence:

   (a) Free available chlorine (FAC)
   (b) Total alkalinity
   (c) pH
   (d) Calcium Hardness
   (e) Cyanuric Acid (outdoor pools)

2. Adding Chemicals:

   (a) Add large amounts gradually in thirds over a two-hour period.
   (b) Add directly into the pool or spa when no swimmers are present and time is sufficient to permit even distribution of the chemicals.
   (c) Add granular chlorine or soda ash solution directly to the pool, but separately. Always mix chemicals into plastic containers that have been filled with water first.

## WATER QUALITY PROBLEMS

**Calculate for 20,000 Gallons:**

| | |
|---|---|
| Free CL | 2.0 ppm |
| Total CL | 3.0 ppm |
| PH | 7.0 ppm |
| Total Alk. | 50 ppm |
| Calcium Hardness | 100 ppm |
| Temperature | 80 ºF |

What is the ppm for breakpoint chlorination? _____
Use how much calcium hypochlorite 65% to shock pool?_____
How much for a 30 ppm shock for algae removal?_____
How much sodium bicarbonate to raise to 100 ppm?_____
pH 4-drop test; how much soda ash?_____
Is water under or over saturated?_____

**Calculate for 50,000 Gallons:**

| | |
|---|---|
| Free CL | 1.0 ppm |
| Total CL | 3.0 ppm |
| PH | 8.0 ppm |
| Total Alk. | 180 ppm |
| Calcium Hardness | 500 ppm |
| Temperature | 80 ºF |

What is the ppm for breakpoint chlorination? _____
Use how much calcium hypochlorite 65% to shock pool?_____
How much for a 30 ppm shock for algae removal?_____
How much muriatic acid to lower to 100 ppm?_____
pH 4-drop test; how much muriatic acid?_____
Is water under or over saturated?_____

# SECTION 6 — SPAS

A casual attitude regarding maintenance and safety standards for spas can quickly produce an unhealthy and unsafe environment. Six bathers in a 7-foot, 600-gallon spa are equivalent to 410 bathers in a 25' x 50' x 4' swimming pool. This comparison indicates the dramatic effect bather load has on spas and emphasizes the need for paying strict attention to care and maintenance guidelines. Refer to page 5-7 for chemical standards.

Spas require a significant chlorine demand because of the high turnover rate, higher temperatures, higher soil loads, and higher bather loads. It is more difficult to maintain sanitization levels in a spa or hot tub than in a swimming pool. Disinfectants (chlorine or bromine) are consumed at an accelerated rate during periods of use; therefore, the operator must closely monitor disinfectant levels. In addition the operator must:

1. Enforce rules and regulations through proper signs.
2. Ensure the water does not exceed 105ºF.
3. Ensure that the main drains is secured and clearly visible.
4. Test and keep records as per code.
5. Drain the spa after heavy use (especially if the tub is 2,000 gallons or less). The required schedule for draining is two (2) times a month if the spa is sparsely used.
6. Drain the spa and clean it out whenever in doubt.

# SECTION 7 — CHEMICAL SAFETY

When dealing with swimming pool and spa chemicals, certain precautions must be taken concerning their usage, storage and handling to avoid a potentially dangerous situation. Following is a list of general safety guidelines. This list is by no means complete. Remember to always use common sense and keep safety in mind.

## DO

- ✓ Always follow label directions.
- ✓ Store chemicals in a cool and dry place.
- ✓ Always use a separate, clean measuring cup for each chemical.
- ✓ Always keep containers tightly sealed.
- ✓ Always add chemicals to water - slowly. Never add water to chemicals.
- ✓ Keep chemicals out of reach of children.
- ✓ Always use caution when transporting chemicals.
- ✓ Always store pool chemicals separately from other chemicals (fertilizers, insecticides, cleaners, solvents, etc.)
- ✓ Always carry and store liquid (muriatic) acid or liquid chlorine bottles upright. The vented caps can cause leakage.
- ✓ Protect eyes and skin.

## DON'T

- Mix chemicals of any kind together.
- Add more than one pint of muriatic acid per 10,000 gallons of pool water at any one time.
- Smoke around dry chlorine or any pool chemicals
- Inhale fumes or allow chemicals to contact eyes, nose or mouth.
- Store incompatible pool chemicals together.
- Add calcium chloride the same day as sodium bicarbonate.
- Add large amounts of chemicals at one time (add in thirds over extended period of time).
- Add chemicals to the pool with swimmers present.
- Add chelating/sequestering agents the same day as polymeric clarifiers.

# SECTION 8 — TROUBLESHOOTING

## A. IDENTIFYING PROBLEMS

1. Test and analyze the water.
2. Use your senses.
   - ✓ Touch
   - ✓ Smell
   - ✓ Sight
   - ✓ Sound
3. Check pressure gauges and flow meters.
4. Eliminate the possibilities one by one. Identify and correct the problem.
5. Call in a professional if problem is beyond your scope of expertise.

## B. BASIC CIRCULATION SYSTEM PROBLEMS

The following will cover basic troubleshooting of a swimming pool/spa circulation system.

1. Pressure Leaks

   When a pool pump has to be primed each time it is turned on, but the pump operates without air problems, the system has a pressure side air leak. To find the leak, look for signs of water. Some of the common causes include:

   - ♦ Defective filter tank "O" ring or gasket
   - ♦ Defective air relief or pressure gauge
   - ♦ Pin hole in piping or defective connection

- Defective or worn backwash valve stem "O" rings
- Worn pump seal in booster pump or defective hose
- Split or pin hole in chlorinator hose
- Improperly sealed filter tank or pin hole in tank

If the cause of the problem cannot be found, install a check valve on the suction side of the pump. This will eliminate the need for daily pump priming.

2. Suction Leaks

The most apparent sign of a suction leak (suction side of pump) is air bubbles continually shooting out the return lines. Some of the common causes include:

- Worn pump lid "O" ring or need for lubrication
- Cracked/warped pump lid or housing
- Pump seal
- Loose nut on gate valve or ball valve
- Worn shaft "O" ring on Jandy or Ortega valve
- Deformed suction gasket (if applicable)
- Chlorinator suction hose pinhole or split
- Pump drain plug loose or stripped
- Loose or poor threaded connection at inlet
- Pin hole in suction pipe
- Low water level

3. Clogged Skimmer Or Pump Basket

   A clogged skimmer or pump basket will generally cause pool suction and low filter pressure. These areas should be checked first if you are experiencing water flow problems.

4. D.E. In Filter Grids

   If D.E. filter grids are full of D.E., the most common causes include:

   - Filter is plumbed backwards
   - D.E. was added while backwash valve was in the backwash position

5. Sudden Filter Pressure Drop

   A sudden drop in filter pressure is generally caused by the following:

   - Clogged impeller
   - Broken impeller
   - Suction leak
   - Clogged pump basket
   - Clogged skimmer basket
   - Clogged suction line
   - Pump motor inoperable
   - Partially closed valve

6. Impeller Sizing

   Never upsize an impeller. Putting an impeller with a higher horsepower than the stated motor horsepower will place an excessive load on the motor. If your pump has too much flow with the current impeller, you can downsize the impeller one size. This generally will solve the problem without damaging the motor.

7. Filter Pressure

   Under most circumstances, the filter should not operate at a pressure in excess of 25 pounds. A high reading usually indicates that there is a need for a complete manual cleaning or that there is a malfunction in the system.

8. Troubleshooting Tip

   The pool designer/engineer sized the filter and pump for optimum efficiency. Never replace existing filter without considering the pool and pump size. Improper sizing of the filter or pump can create filtration and circulation problems. In addition, remember the following:

   - Don't oversize the pump
   - Don't undersize the pipes or filter

9. Filtration Problems

   Most filtration problems occur because of the following:

   - Air in the system
   - Not using the proper type and/or amount of sand
   - Not using the proper amount of D.E.
   - Improper backwashing/cleaning
   - Pump and/or filter not properly sized
   - Mechanical problems with filter and/or backwash valve (damaged components)
   - Improper water balance
   - Particle size of suspended materials

10. Using Gauges to Identify Problems

| | Vacuum Gauge | Influent Gauge (P-1) | Effluent Gauge (P-2) | Trouble Indicated |
|---|---|---|---|---|
| 1 | Down from Start-up Reading | Up from Start-up Reading | Down from Start-up Reading | Filter Require Cleaning |
| 2 | Up from Start-up Reading | Down from Start-up Reading | Down from Start-up Reading | Blocked Suction or Clogged Strainer |
| 3 | Down from Start-up Reading | No Change from Start-up Reading | No Change from Start-up Reading | Defective Pump Seal, Clogged Impeller or Air Suction |
| 4 | Down from Start-up Reading | Up from Start-up Reading | Up from Start-up Reading | Restriction in Pool, Return Line, or Partial Closed Valve |
| 5 | Up from Start-up Reading | Up from Start-up Reading | Up from Start-up Reading | Increased Flow Due to Pump Cleaning Itself, or the Opening of a Partially Closed Valve |

## C. VENTILATION

1. What's the first sign that your facility may have indoor air quality problems? It will probably be health complaints from your patrons. The following are common symptoms from poor ventilation of indoor pools.

   - Chronic respiratory problems such as sinus congestion, nosebleeds, asthma and sore throats
   - Drowsiness, fatigue, irritability, headaches and inability to concentrate
   - Persistent viral and bacterial infections
   - Skin rashes, dry skin, hypersensitivity diseases, and other dermatological problems

2. It is important to record all complaints made by patrons or staff related to air quality.

3. While there are numerous steps to take to ensure proper indoor air quality, the following basic checklist includes the most important provisions to maintaining optimum air quality:

   - ✓ Maintain air temperature 2 ºF to 7 ºF above pool water temperature
   - ✓ Cover the spa/pool when not in use
   - ✓ Maintain relative humidity between 40 and 50 percent
   - ✓ Ventilate at a rate of 0.5 cfm per square foot of facility area, plus 20 cfm for each anticipated bather or spectator
   - ✓ Ensure eight complete air exchanges per hour
   - ✓ Distribute air from low to high and across the surface of the pool
   - ✓ Cross ventilate - introduce and exhaust air on all four sides of the pool
   - ✓ Comply with OSHA's "Permissible Exposure Limits" and the American Conference of Governmental Industrial Hygienists' "Threshold Limit Values" exposure standards
   - ✓ Maintain $C0_2$ levels below 0.1 percent or 1,000 ppm
   - ✓ Sample and analyze natatorium air quality
   - ✓ Make sure the natatorium has a positive pressure to allow pollutants to travel from positive to negative pressure areas
   - ✓ Design to avoid drafts, thermocline formation or temperature gradients

# SECTION 9 — PREVENTATIVE MAINTENANCE

Preventative maintenance is the key to efficient, economical operation of a pool facility. Like the old adage says, "Pay me now or pay me later", a preventative maintenance program equals increased operational savings.

## A. PUMP AND MOTOR

The pump was sized to the filter and pool for optimum efficiency by the pool designer/engineer. Never increase the horsepower of your pump without considering the size of the filter and pipes. An oversized pump will create pump and filtration problems.

1. Motors

   The electric motor that powers the pump is considered an electric appliance and must be protected from foreign matter, water, and the weather. The motor should be shaded from the sun and have good cross ventilation; the motor is air-cooled and any material blocking the air suction vents can cause the motor to overheat. In addition, any water from equipment leaks or rain can be drawn into the motor and cause it to short out. Whenever a motor has become wet, allow it to dry completely before running it again. If a motor is exposed to direct sunlight and the elements, a vented motor cover should be used for protection.

2. Pumps

   The hair and lint strainer (pump basket) should be checked daily and cleaned/emptied as required. After cleaning the strainer, inspect the pump lid for deformities or cracks. Also inspect the lid "O" ring to be sure it is still round and pliable. If there is a gasket, make sure it is not torn or stretched. Replace the gasket if necessary.

   Place a light coat of Teflon-based lubricant on the pump lid "O" ring or gasket.

Note: Remember, the skimmer baskets will normally trap most leaves and debris. If your pump basket is continually full, check your skimmer baskets for cracks and tears.

Inspect the equipment area daily for signs of leakage. Replace the pump seal as required.

When priming the pump, do not let the pump run for more than 30-45 seconds; operating it without water will damage the water-lubricated pump seal. Repeat procedure until it is fully primed.

When replacing the pump seal, never lubricate the white ceramic surface and the black molded graphite impregnated plastic surface of the seal.

## B. FILTERS

Most filters require little maintenance other than a normal manual cleaning, purging of air and a thorough visual inspection. Inspect the tank "O" ring or gasket and lightly lubricate with a Teflon-based or pure silicone-based lubricant.

The filter grids, cartridge or sand bed (depending on the filter) should be visually inspected for tears, broken parts, scale formation, deformities or contamination. Replace as necessary. Clean the outside of the tank as required.

## C. GAUGES AND FLOW METERS

Pressure gauges and flow meters are relatively trouble-free.

- Gauges should register "Zero" when the pump is shut off.
- Flow meters should be kept clean. Should the meter fail to read, make sure the pilot tube is free of obstructions.

## D. POOL LIGHTS

All swimming pool light units are designed for easy maintenance. They can be quickly removed from the light niche and generally have 8 to 10 feet of extra cord so that they can be brought up onto the deck for bulb replacement. With all new style wet niche lights, the pool does not have to be partially drained to service the light.

Because a pool light is water cooled, NEVER operate a pool light unless it is submerged. To do so could result in an explosion of the lens, a broken bulb and a damaged gasket. ALWAYS shut off the circuit breaker prior to working on a pool light. ALWAYS make sure the new bulb is the same style, voltage and wattage as the old bulb. ALWAYS replace the old light gasket with a new light gasket. This must be done every time the light is opened up. ALWAYS apply a thin coat of Teflon based lubricant on the sealing surfaces of the light gasket. If the unit is sealed by screws, lubricate those too.

## E. BACKWASH VALVES

Normal backwash valve (rotary multiport valve or a push-pull type valve) preventative maintenance consists of a visual inspection for leaks or cracks, and "O" ring, puck or gasket replacement.

1. Rotary Multiport Valve Maintenance

   Most multiport valves require little maintenance. However, periodically you should check the following:

   - Make sure the handle turns freely. If not, the Teflon washer on the rotor could be cracked or deformed and must be replaced. Also check the internal valve seat or spider gasket for an accumulation of dirt or sand.
   - If water is present in the sight glass, also check internal valve seat or spider gasket, Teflon washer and the spring.
   - If water is present in the cover, the rotor "O" rings are worn.

- When changing the handle position on a backwash valve, the pump must always be off. Additionally, if the pool needs to be drained, use a submersible pump. This will prevent possible pump or filter damage.

- The rotor "O" rings should be lubricated with a Teflon-based lubricant. When reassembling a rotary multiport valve, make sure the position of the rotor matches the original position of the handle.

2. Push-Pull Valve Maintenance

- Push-pull type valves require only occasional maintenance. Signs that attention is needed are D.E. or sand returning to the pool during normal operation, leaking from around handle or very difficult operation of the valve. All of these are indicators that the "O" rings or piston pucks require replacement.

- There are four or five "O" rings/pucks depending on the brand and model of the valve. Generally, one "O" ring seals the top cover and valve body. A small "O" ring seals the shaft where it passes through the top cover. There are usually two "O" ring or pucks on the piston.

- The valve "O" rings or piston pucks should be lubricated on a regular basis. This will ensure proper operation and longer "O" ring life. Always use a silicone-based lubricant. Whenever the valve is disassembled, the pucks and shaft should be checked for wear.

- Important: Never vacuum the pool with the valve in the backwash position.

## F. CHLORINATORS/BROMINATORS

Because there are many brands and models of chlorinators/ brominators available, each general type will be addressed.

1. Erosion and Suction-Pressure (Cross Pump) Feeders

   Normal erosion feeder (Hayward, Rainbow, etc.) and suction-pressure feeder (Watermatic, etc.) preventative maintenance includes:

   - Inspect tubing and connections
   - Inspect/clean check valves, flow indicators and screens, measuring cups
   - Lid "O" ring (if applicable) — lubricate with a silicone-based lubricant
   - Inspect housing for cracks or deformities — clean unit if necessary

2. Peristaltic and Diaphragm Feeder Pumps

   Normal peristaltic (Blue White, Stenner, etc.) and diaphragm (Pulsatron, Chemtech, LMI, etc.) feeder pump preventative maintenance includes:

   - Inspect physical operating condition of the pump — abnormal sounds, excessive vibration, low flow, cracked or deformed components.
   - Repeated short-term deterioration of valve seats and balls, pumphead, "O" rings, etc. indicate the need to review suitability of wetted materials selected for the chemical in use.
   - Inspect tubing, foot valve and injectors for leaks and obstructions — clean or replace as required.

- Flush tubing and pumphead assembly periodically with fresh water or other suitable neutralizing solutions.

- If sodium hypochlorite is utilized as the primary sanitizer, the chemical should be pumped full-strength to prevent salt-related deposits.

## G. CONTROLLERS

Normal controller preventative maintenance includes:

- Unit calibration

- Cleaning flow/sample cell and tubing

- Cleaning ORP/pH probes (First, soapy water and then muriatic acid)

- Inspect/clean unit

## H. SKIMMERS, GRATES AND INLETS

Normal skimmer, main drain grate and inlet fitting/cover preventative maintenance includes:

- Inspect drain grates, inlet fittings and covers for breakage. Replace as required.

- Inspect skimmer body, cover and skimmer basket for cracks. Repair/replace as required.

- Inspect equalizer/float valve assembly and weir for proper operation. Replace as required.

## I. HEATERS

Normal heater preventative maintenance includes:

- Keep the heater area free of debris, especially the top. Never store combustible materials near the heater.

- Inspect and clean vent piping if necessary.

- Use a mirror to inspect the burner and heat exchanger for soot accumulation. Clean as required.
- Inspect the pilot and burner for full, clean flames.
- Maintain proper water balance. This will prevent many problems.

## J. DIVING BOARD, HAND RAILS, LADDERS & LIFEGUARD STANDS

Normal diving board, handrail, ladder and lifeguard stand preventative maintenance includes:

- Inspection of bolts, treads, hand rails, fulcrum pads, etc. If corrosion is evident, repair/replace as required.
- Keep ladders and diving board treads free of accumulated debris.

## K. WATER BALANCE

- Proper water balance ensures long equipment and vessel life. Add a sequestering agent to prevent scale and surface discoloration.
- Enzymes may be used to help prevent oil build-up and deposits, and provide extended filter runs.

## L. DECKING, COPING AND TILE

The decking, coping and tile should be kept clean and free of debris. Use a tile cleaner as required and scrub the deck with a bleach and water solution (20 parts water to one part bleach) to prevent mold, mildew and bacterial growth.

## M. **POOL WINTERIZING CHECKLIST**

_____ 1. Adjust chemical balance of pool water to recommended levels.
_____ 2. Superchlorinate.
_____ 3. Add an algaecide to prevent algae growth.
_____ 4. Add sequestering or chelating agents to prevent mineral staining and scale build-up.
_____ 5. Clean and vacuum the pool, because any debris left in the water will consume chlorine during the off season.
_____ 6. Empty and store skimmer baskets and hair-and-lint traps for the winter.
_____ 7. Backwash the filter thoroughly.
_____ 8. Clean the filter media or elements.
_____ 9. Drain sand filters. Remove cartridges or DE filter elements, inspect for tears or excessive wear and store for the winter.
_____ 10. Lower the water level to below the skimmers and return lines. If needed, remove the remaining water from the recirculation lines using an air compressor or industrial type tank vacuum cleaner.
_____ 11. Open all pump room valves and loosen the lid from the hair-and-lint skimmer. However, if the filter is below pool water level, close the valves leading from the pool to the filter.
_____ 12. Grease all plugs and threads.
_____ 13. Add a non-toxic antifreeze such as propylene glycol (1 part antifreeze diluted in 2 parts water) to the pipes to prevent freeze damage and possible bursting. Do not use automotive antifreeze.
_____ 14. Plug skimmer or gutter lines. Winterize with antifreeze and expansion blocks. Secure skimmer lids to the deck to prevent their loss.
_____ 15. Plug vacuum and return lines and the main drain.
_____ 16. Make sure the hydrostatic relief valve is operational.
_____ 17. Drain and protect recirculation pumps. If a pump and motor will be exposed to severe weather, disconnect, lubricate, perform seasonal maintenance, replace seals and store. Add antifreeze to help protect pumps and seals form any residual water left after draining.
_____ 18 Clean surge pits or balancing tanks.
_____ 19. If underwater wet-niche lights are exposed to the elements, remove them from their niches and lower them to the bottom of the pool.
_____ 20. Disconnect all fuses and open circuit breakers.
_____ 21. Drain pool water heater. Grease drain plugs and store for the winter.
_____ 22. Turn off the heater gas supply, gas valves and pilot lights.
_____ 23. Install the winter safety cover.
_____ 24. Return any unopened chemical and empty storage containers to the distributor.
_____ 25. Properly store opened chemicals in tightly sealed containers in a well-ventilated room. Dispose of test reagents, sanitizers and other chemicals that will lose their potency over the winter.
_____ 26. Disconnect, clean and store the chlorinator, controllers and other chemical feed pumps. Store controller electrodes in liquid.
_____ 27. Clean and protect gauges, flowmeters, thermometers and hygrometers.
_____ 28. Store all deck furniture (chairs, lounges, tables, umbrellas). Identify and separate all furniture in need of repair.
_____ 29. Remove deck equipment, hardware and non-permanent objects such as ladders, rails, slides, guard chairs, starting blocks, drinking fountains, disabled lifts, portable ramps, clocks, wires and rescue equipment to prevent vandalism. Store the items in a clearly marked, identifiable, weather-protected location. Cap all exposed deck anchors or sockets.
_____ 30. Remove the diving boards. Store the boards indoors, upside down and flat so they will not warp.
_____ 31. Open hose bibs and fill spouts.
_____ 32. Turn off the water supply to restroom showers, sinks and toilets. Drain the pipes; add antifreeze. Remove any shower heads and drinking fountain handles.
_____ 33. Have the phone company disconnect the pool telephone and discontinue service for the winter.
_____ 34. Install a pool or deck alarm system.
_____ 35. Inventory supplies and equipment. Make suggestions for preventive maintenance and repair, upgrading and needed equipment purchases.

## N. COMMONLY OVERLOOKED ITEMS

You should pay special attention to the following operational requirements. The code requires that you:

1. Test and record four (4) times per day:
   (a) Free chlorine or bromine
   (b) pH
   (c) Turbidity
   (d) Temperature (if heated-water facility)

2. Test and record once per day:
   (a) Combined chlorine
   (b) Turnover rate

3. Test and record weekly:
   (a) Total alkalinity
   (b) Calcium hardness
   (c) Cyanuric acid (if used)
   (d) Copper (if heated-water facility)
   (e) Iron (if heated-water facility)
   (f) Total dissolved solids (if heated-water facility)

4. Keep daily operation records:
   (a) Record all testing and other pertinent information.
   (b) Keep accessible for inspection and maintain records for a three-year period.

5. Properly label piping and valves.

6. Post the following signs:
   (a) Bathing load limits (in pool area)
   (b) Rules and precautions for patrons (in pool area)
   (c) "No lifeguard or attendant on duty sign" (in pool area, at pools not open to the general public)
   (d) Pool volume and turnover rate (in equipment area)
   (e) "Pool chemicals" (on door of chemical storage room)
   (f) Spa Health Caution Sign

7. Post pool license.

8. Post current inspection form (in a conspicuous place visible to all who use the facilities).

9. Post each lifeguard's life saving certificate (convenient point so as to be easily read by patrons).

10. Report all drownings and accidents requiring hospitalization to the Health Department immediately by telephone and in writing within seven (7) days.

11. Close pool if:

    (a) Turbidity exists where you cannot see the main drain from the edge of the deck.
    (b) Free available chlorine is less than 1.0 ppm; Bromine less than 2.0 ppm.
    (c) pH is less than 7.2 or greater than 7.8.
    (d) No lifeguard is on duty (pools open to general public).
    (e) No safety equipment at pool side.
    (f) Gaseous chlorine facilities are not in code compliance.
    (g) Water temperature is over 105ºF (Spas).
    (h) Anti-vortex drain cover off or not secured.

12. Assure that all gauges are in good repair and are properly operating. Your pool must have the following meters and/or gauges:

    (a) Influent (measures pressure coming into the filter)
    (b) Effluent (measures pressure leaving the filter)
    (c) Compound (tells whether or not the hair and lint strainer is clogged)
    (d) Flowmeter (measures the gpm flow of water through the system)

13. Assure that spa water temperature is 105 ºF or less and that patron warning regulations are posted.

14. Assure that the required life saving equipment is in place and accessible.

    (a) For pools with 1,600 square feet of surface area you must have:

        (1) Shepherd crook with 16 foot pole attached
        (2) Two 15-18 inch ring buoys with attached 1/4 inch rope long enough to reach the length of the pool

    (b) For pools with over 1,600 square feet of surface area and the above listed equipment is doubled and a backboard is required.

15. Make sure the effective barrier (fence is in good repair and has operable self-closing, self-latching gates).

16. Make sure that required depth markings are on the pool sidewalk and deck.

17. Assure that approved vacuum breakers are included at all hose connections.

18. Lock all gates and post "Pool Closed" signs when the pool is not open.

19. Ground fault interrupter type circuit breakers shall be provided for all outlets within 15' of the pool and those located in bath house and pump room.

20. Vacuum and brush at least once a week.

This listing is not intended to be all inclusive.

# Bathing Place Operation Record

Week of:

1. Facility Name: | Type of Facility:

Address: | City: | Zip:

2. Size: gallons | Required Turnover: gallons/min (MIN)

| | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
|---|---|---|---|---|---|---|---|
| 3. Safety Equipment Checked (time) | | | | | | | |
| 4. Pool Clean / Vacuumed (time) | | | | | | | |
| 5. Floors / Decks Disinfected (time) | | | | | | | |
| 6. Number of Patrons (daily) | | | | | | | |
| 7. Number of Accidents (daily) | | | | | | | |
| 8. Number of Guards / Attendants (daily) | | | | | | | |
| 9. Pool Hours (Open/Closed) | | | | | | | |
| FILTER: | | | | | | | |
| 10. Backwashed (time) | | | | | | | |
| 11. Gauge Readings (influent / effluent) | | | | | | | |
| 12. Gallons Makeup Water Added | | | | | | | |
| 13. Strainer Gauge Reading | | | | | | | |
| 14. Flowmeter Reading (gpm) / temp (F) | | | | | | | |
| **CHEMICALS ADDED - Amount** | | | | | | | |
| 15. Chlorine _____ Bromine _____ | | | | | | | |
| 16. Soda Ash | | | | | | | |
| 17. Muriatic Acid | | | | | | | |
| 18. Sodium Bicarbonate | | | | | | | |
| 19. Calcium Chloride | | | | | | | |
| 20. Cyanuric Acid (stabilizer) | | | | | | | |
| 21. Other | | | | | | | |
| REQUIRED TESTS - DAILY | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
| 22. Combined Chlorine (ppm - daily) | | | | | | | |
| Enter: time / sanitizer reading / pH | T S pH | T S pH | T S pH | T S pH | T S pH | T S pH | T S pH |
| 23. First Test Series | / / | / / | / / | / / | / / | / / | / / |
| 24. Second Test Series | / / | / / | / / | / / | / / | / / | / / |
| 25. Third Test Series | / / | / / | / / | / / | / / | / / | / / |
| 26. Fourth Test Series | / / | / / | / / | / / | / / | / / | / / |
| Enter: time / turbidity / drain cover on | T Tu DC | T Tu DC | T Tu DC | T Tu DC | T Tu DC | T Tu DC | T Tu DC |
| 27. First Observation Series | / / | / / | / / | / / | / / | / / | / / |
| 28. Second Observation Series | / / | / / | / / | / / | / / | / / | / / |
| 29. Third Observation Series | / / | / / | / / | / / | / / | / / | / / |
| 30. Fourth Observation Series | / / | / / | / / | / / | / / | / / | / / |
| REQUIRED TESTS - WEEKLY MIN (recommend daily) | | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
| 31. Total Alkalinity | | | | | | | |
| 32. Calcium Hardness | | | | | | | |
| 33. Water Balance Ph | | | | | | | |
| 34. Cyanuric Acid (stabilizer) | | | | | | | |
| 35. Copper | | | | | | | |
| 36. Iron | | | | | | | |
| 37. Total Dissolved Solids | | | | | | | |
| 38. Pool Operator's Permit | | | | | | | |
| 39. Pool Manager/Owner | | | | | | | |

Signed: | Date:

**Tulsa City-County Health Department — 4616 East 15th, Tulsa, Oklahoma 74112**

**Phone: (918) 595-4300 — Fax: (918) 595-4339**

RETAIN COPY FOR THREE YEARS

**COPY BOTH SIDES**

## INSTRUCTIONS FOR FILLING OUT RECORD FORM

This form is filled out for each pool. Some of this information does not change so keep a blank form filled out for each pool to make copies from. Fill out all applicable blanks every day the facility is open or whenever maintenance is done. Keep a copy in the pump room and one in the file. Retain copies for a minimum of three years.

Line 1: Under "Facility Name" designate the facility name, Facility type and address. (Example: Conan's Health Club - Men's Spa or Seabrook Club - East Pool)

Line 2: Enter the size of the pool/spa in gallons and the minimum flow required for the type of pool (480 min/pool, 240/wading pool, 30/spa).

Line 3: Time safety equipment is checked (usually at opening).

Line 4: Time pool/spa is cleaned and/or vacuumed (usually at opening).

Line 5: Time bathhouse floor and/or deck are cleaned and disinfected (usually at opening).

Line 6: Operators estimate of the total number of persons using the pool/spa that day.

Line 7: Number of accidents. For accidents involving death, drowning or hospitalization the Health Department must be called immediately and a written report sent within 7 days.

Line 8: Number of certified lifeguards on duty during the time of maximum load.

Line 9: Time pool/spa is opened and closed for use. Example: "10am/8pm".

Line 10: Time the filter is backwashed.

Line 11: Inlet and outlet (influent/effluent) gauge readings (prior to backwash)

Line 12: Gallons of make-up water added.

Line 13: Strainer/compound gauge reading.

Line 14: Flowmeter reading and temperature of water.

Line 15: Type and amount of sanitizer in use.

Line 16-21 Amount of other chemicals added to the pool/spa.

Line 22: Combined chlorine reading taken at closing each day. Max. = 0.2 ppm

Line 23-26: Enter test readings 4 times per day. T = time, S= sanitizer, pH - pH

Line 27-30: Enter test readings/observations 4 times per day. T = time

Tu = Turbidity

S = satisfactory,

M = marginal for cloudy water but still able to see main drain;

U = cannot see main drain

DC = Main drain cover securely in place

Line 31-37: Enter when run Total Alkalinity, Calcium hardness and Cyanuric Acid/stabilizer (required weekly - recommended daily).

Copper, Iron, TDS weekly on spas only.

Line 38: Name of person responsible for the operation of the pool/spa (Pool Operator's Permit)

Line 39: Name of owner, manager or person in charge of the facility.

The form must be signed by one of the persons on Line 38 or 39.

## IMMINENT HAZARD ITEMS

**Immediate Correction or Closure Required Summarily**

Turbidity: Main drain must be **clearly** visible

Free Available Chlorine must be 1.0 ppm, Bromine 2.0 ppm.

pH must be between 7.2 and 7.8

Main Drain must be Secured