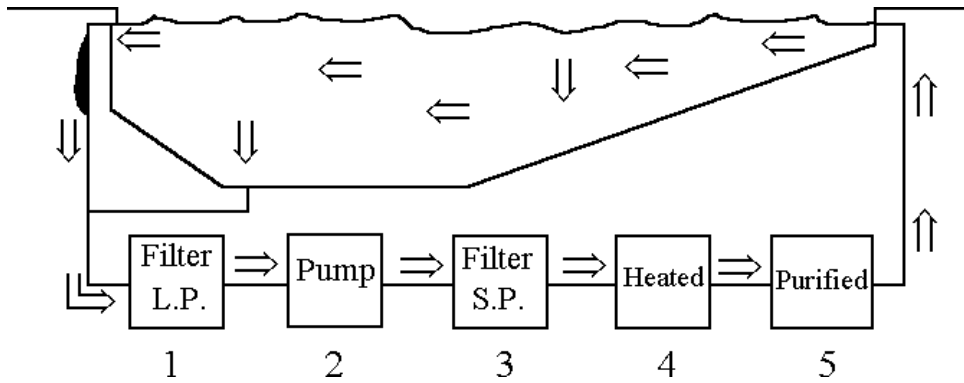


## Pool Maintenance

### Water flow in a pool



Pool water is taken from the main drain and the overflow gutters.

#### 1. LARGE PARTICLE FILTER (hair lint strainer)

- Removes large objects from the water such as Band-Aids, hair, etc.
- Prevents these particles from clogging the pump

#### 2. CENTRIFUGAL PUMP



- Main job is to move water
- Must have a turnover rate of 6 hours (BC Health Act)

$$\text{Turnover Rate} = \frac{\text{Pool Capacity}}{\text{Rate of Flow (G.P.M.)} \times 60}$$

- As the filters become clogged the turnover rate is longer

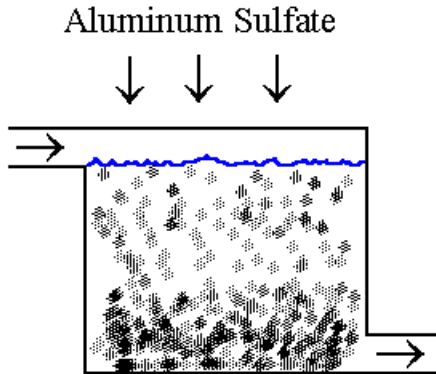
#### 3. SMALL PARTICLE FILTER

## 4 Types of Filters

### A) Conventional Sand and Gravel

- Top layer of sand
- Next 3 levels of gravel

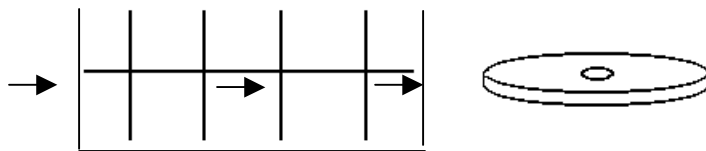
### B) High Rate Sand



- Is no gravel
- Uses Aluminum Sulfate to push sand to bottom

### C) Pressure Diatomaceous Earth

- Diatoms are microscopic plants which grew millions of years ago
- Each diatom is filled with tiny openings
- These diatoms can filter out even the smallest particles
- D.E. is coated on a series of baffle plates
- Once coated filtration begins
- A Slurry now body feeds the D.E. into the filter tank
- Thus there is a build-up of D.E. on the plates as well as a build-up of filtered material
- When a complete a complete build-up occurs, a back wash is done
- To backwash, stop filtration, hose off used D.E. and begin again
- Excellent filtration
- More costly than sand and gravel



### D) Vacuum Diatomaceous Earth Filter

- same as above except
  - i. open tank - not closed
  - ii. pump after tank - not before
  - iii. must be at or below water level - NEVER ABOVE!

### E) Ozone

- See handout

## 4. HEATER

2 Types

**I. Direct Fire Heater**

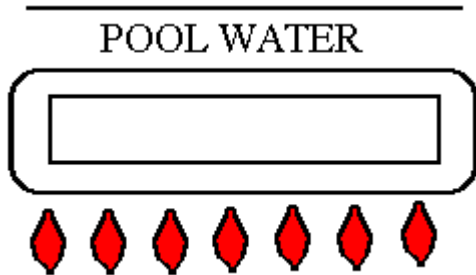
- The pipes carrying the pool water are directly heated



- Usually heated by natural gas or electricity

**II. Heat Exchanger**

- Pipes carrying water are heated, which then heat the pipes carrying the pool water



- Thus the heat is exchanged

**5. PURIFICATION**

**pH**

- $\text{pH} = -\log [\text{H}^+]$
- The pH scale is between 1 & 14



- $\text{pH} > 7.0$  is basic  
*To lower pH, add Muriatic Acid or Hydrochloric Acid*
- $\text{pH} = 7.0$  is neutral
- $\text{pH} < 7.0$  is acidic  
*To raise the pH add Soda Ash or Sodium Bicarbonate (Baking Soda)*

**IMPLICATIONS FOR SWIMMING POOLS**

- Water with improper pH may be corrosive (Acidic) or cause a scale build-up (Basic)
- Under Chlorinated conditions, water should have a pH of 7.5
- Water with a pH of 7.8: ~ scale will form  
~ eye & skin irritation
- Water with a pH of 7.2 or less: ~ will corrode pipes  
~ will cause eye & skin irritation
- When adjusting pH always add chemicals in SMALL amounts

- Large additions of chemicals can cloud the water
- Always add chemicals to water... not vice-versa
- Adding water to chemicals may cause an explosion

## CHLORINE

- Is used to disinfect the water
- Regular chlorine level is usually set around 1.0 - 1.5 ppm (parts per million)
- Goes through the following chemical reaction  
$$\text{Cl}_2 + \text{H}_2\text{O} \rightarrow \text{HOCl} + \text{HCl}$$
- Chlorine + water results in Hypochlorus
- Acid (disinfecting agent) + Hydrochloric Acid (lowers pH)
- As the chlorine combines with ammonia products (sweat, urine, etc.) it forms a chloramine
- A chloramine is 100 times less effective as a disinfecting agent and causes the water to smell
- To rid your pool of chloramines, "Superchlorinate"
- A superchlorination is when the level of free (uncombined chlorine) is raised to 10 parts per million and "BURNS" the combines chlorine off
- A superchlorination should be done when chloramine level = amount of free available chlorine

*FAC = FREE AVAILABLE CHLORINE*

*CAC = COMBINED AVAILABLE CHLORINE*

*TAC = TOTAL AVAILABLE CHLORINE*

TAC Total chlorine

- CAC Chlorine with "baddies" in it

-----

FAC Left over effectiveness (available to fight)

- There are three forms of Chlorine
  - ~ Solid
  - ~ Liquid
  - ~ Gas
- **SOLID:** ~ H.T.H. & HiChlon are common brand names
  - ~ Calcium hypochlorite
  - ~ 65 - 70% chlorine by weight
  - ~ Raises the pH slightly
  - ~ Raises the alkalinity slightly
  - ~ May be explosive if water is introduced into the container
  - ~ Dust from the container is very irritating to breath
  - ~ The chemical on your skin is **very corrosive** especially if your skin is wet

### SAFETY PRECAUTIONS

- ~ Use gloves
  - ~ Work in a well ventilated area
  - ~ Use a dust mask
  - ~ Always add chemical to water NEVER vice-versa
- 
- **LIQUID:** ~ Miraclean is a common brand name
    - ~ Sodium hypochlorite
    - ~ 12 - 15% available chlorine
    - ~ Loses strength if: A) stored for a long period of time

- B) Stored in sunlight
- C) Stored in a warm place

~ Raises the pH

- **GAS:** ~ Greenish at room temperature
  - ~ Heavier than air
  - ~ **Deadly Poisonous**
  - ~ Very irritating odor
  - ~ 100% pure chlorine
  - ~ Lowers the pH
  - ~ Inexpensive and the most frequently used

**SAFETY PRECAUTIONS**

- ~ use extreme care when handling
- ~ Do not handle alone
- ~ Have a gas mask readily available outside the chlorine room
- ~ Prepare a chlorine leak evacuation procedure. Move patrons to higher ground and upwind

**ALKALINITY**

- Should be maintained between 80 to 100 p.p.m.
- Is used to stabilize the pH
- Low alkalinity causes pH to bounce
- To raise alkalinity add sodium bicarbonate (baking soda)

**HARDNESS**

- A measure of the dissolved solids in the water
- Pools usually measure Calcium hardness
- Should be maintained between 150 to 250 p.p.m.
- Too high can cause calcification of the pipes and filters
- To increase hardness add Calcium Chloride

**WATER TESTS**

**According to the BC Health Act Water Tests Must Include the Following:**

- . Pool water must be tested at least once per day
- . pH must be maintained at a value greater than 7.4
- . Free Available Chlorine must be maintained at a value greater than 0.5 p.p.m.
- . The water cannot be artificially heated above 85°C

**The Following Rules Should be Followed When Taking Water Tests:**

- . Measure all reagents accurately
- . Keep test condition consistent
- . Ensure all equipment is clean
- . Rinse hands well if using them to cover the vials
- . Store the test kits out of direct sunlight
- . Use fresh reagents
- . Follow directions carefully
- . \* Take water samples 18 inches below the surface

**The Following Parameters Should be Followed:**

- ◆ pH 7.4 - 7.6
- ◆ Free Available Chlorine 0.5 - 1.5 p.p.m.
- ◆ Temperature 75°C - 85°C
- ◆ Alkalinity 80 - 100 p.p.m.
- ◆ Hardness 150 - 250 p.p.m.

**OUTDOOR POOL**

- Have specific problems due to the weather
- Sunlight dissipates chlorine
- Cyanuric acid can be used to bind the chlorine
- There can be problems with dust, leaves, dirt, etc. entering the water
- Heat loss is usually a major concern.

**PROBLEM: CLOUDY WATER**

What do you do?

- . Take a water test
- . Balance the water chemically
- . Check the filters and backwash if necessary
- . Vacuum the pool
- . Superchlorinate (if required)

**ORDER OF THINGS TO DO IN A NEW POOL:**

- 1) Hardness
- 2) Alkalinity
- 3) pH
- 4) Chlorine
- 5) Heating