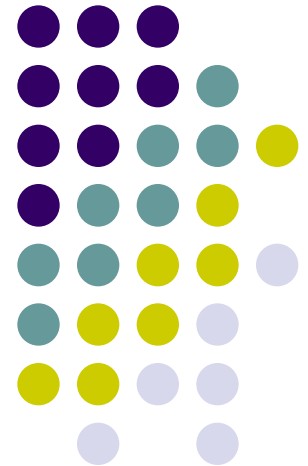
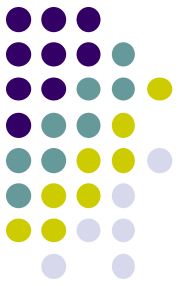


CHAT ENTERPRISE SDN BHD, BRUNEI



Water



- **Surface water**
Sea, River, Pond, Lake
- **Underground water**
Tube-Well
- **Precipitation**
Rain Water





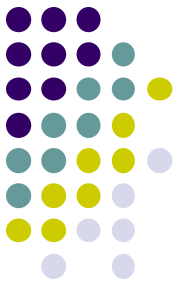
Impurities In Water

Suspended Solids and Gasses

- Mud, Sand, Silt, Colloidal Particles, Organic Matters etc.
- Dissolved Minerals
- Dissolved Gasses



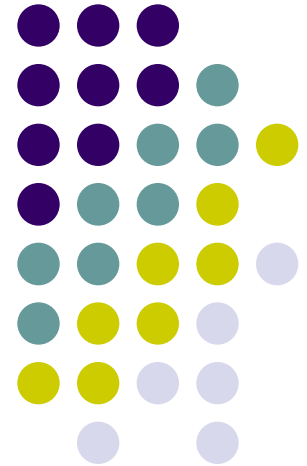
Water Chemistry



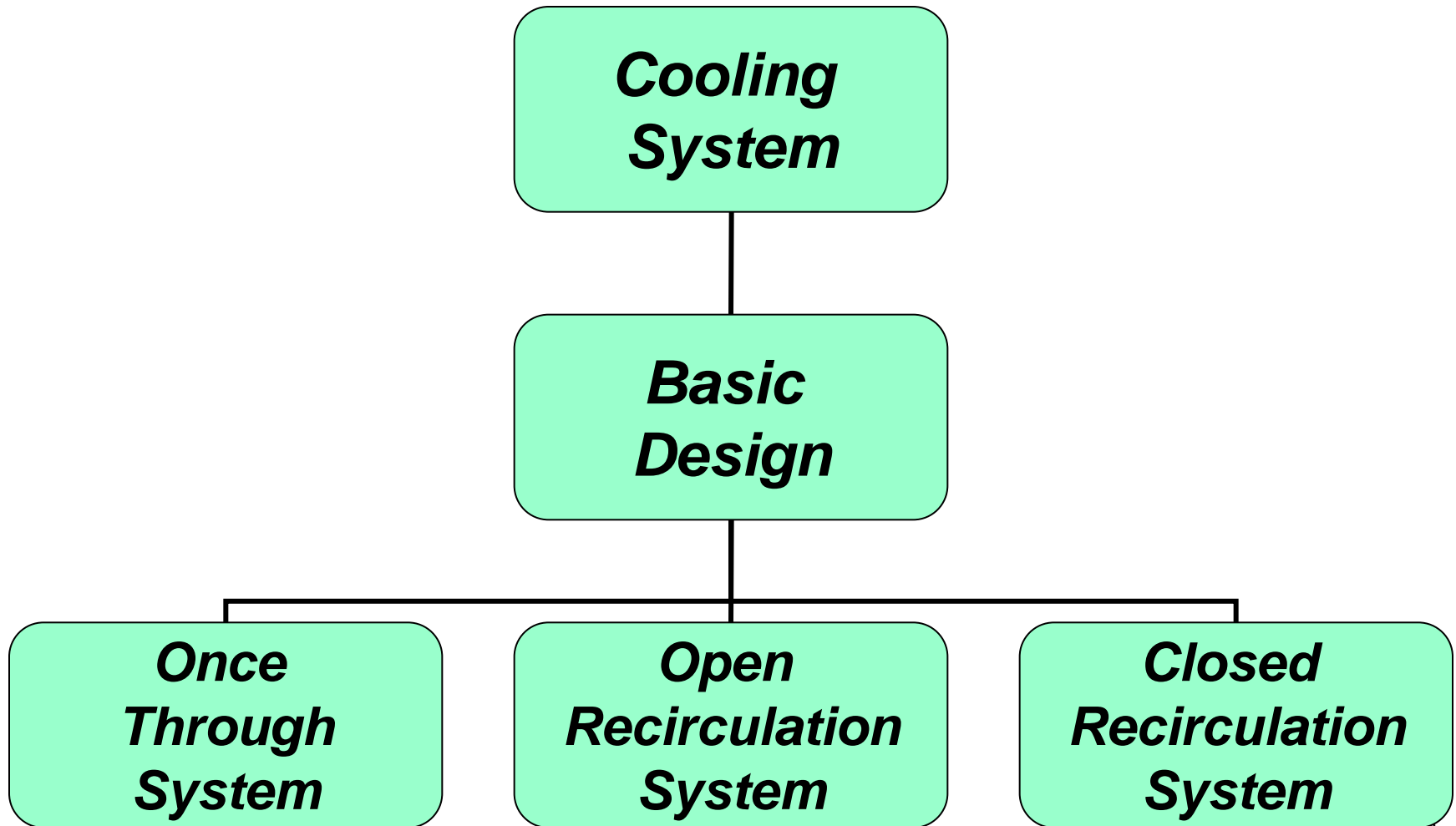
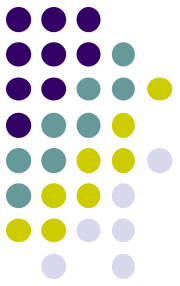
- pH
- Hardness
- Alkalinity
- Temperature
- Conductivity / Total Dissolved Solids
- Suspended Solids
- Turbidity, etc.



Condenser Water System (*Heat Transfer*)

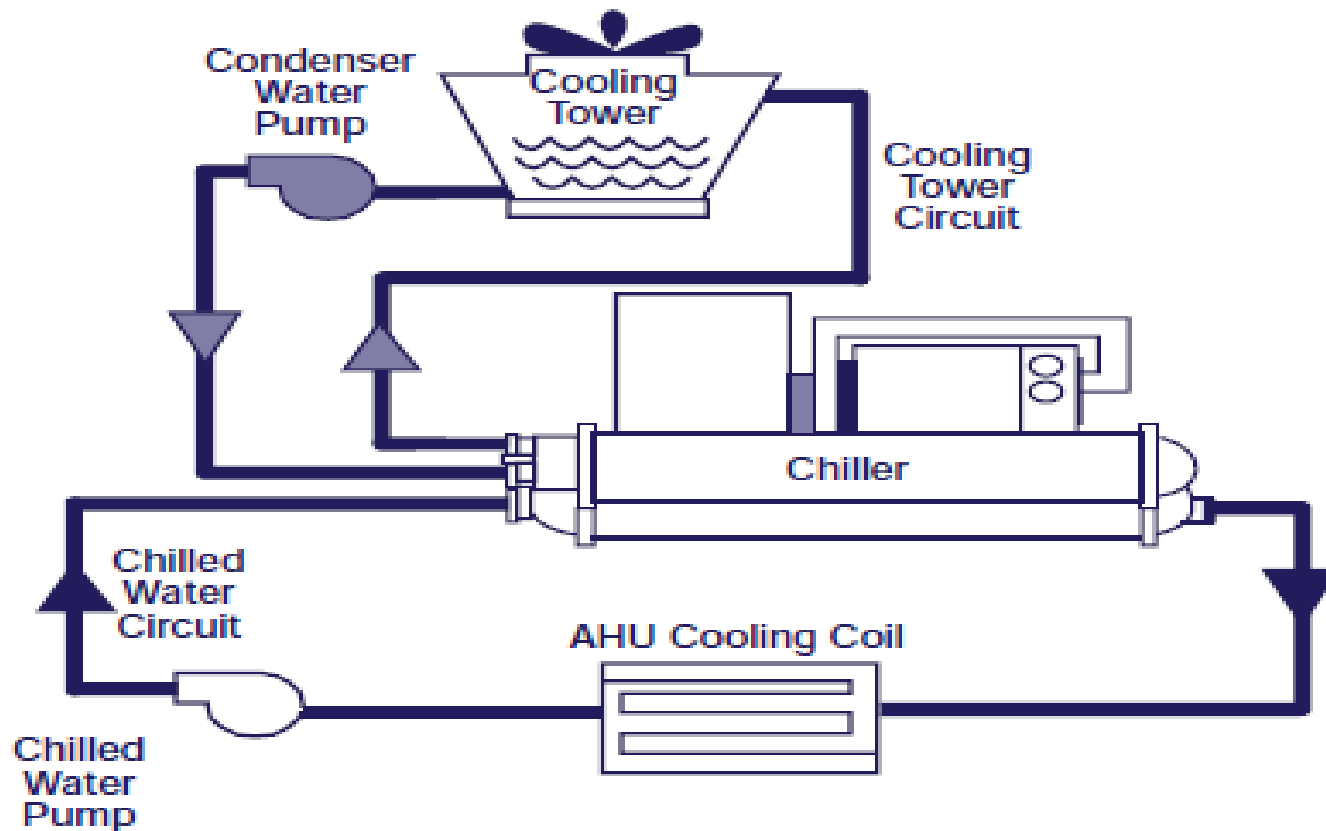
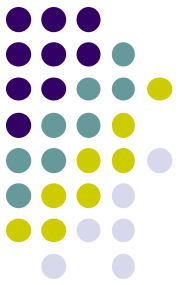


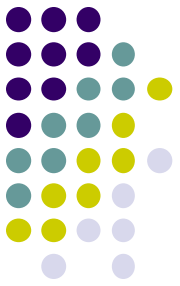
Cooling System Design



Cooling System Design

Basic Cooling Diagram

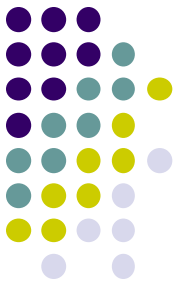




Problems Associated With Impurities

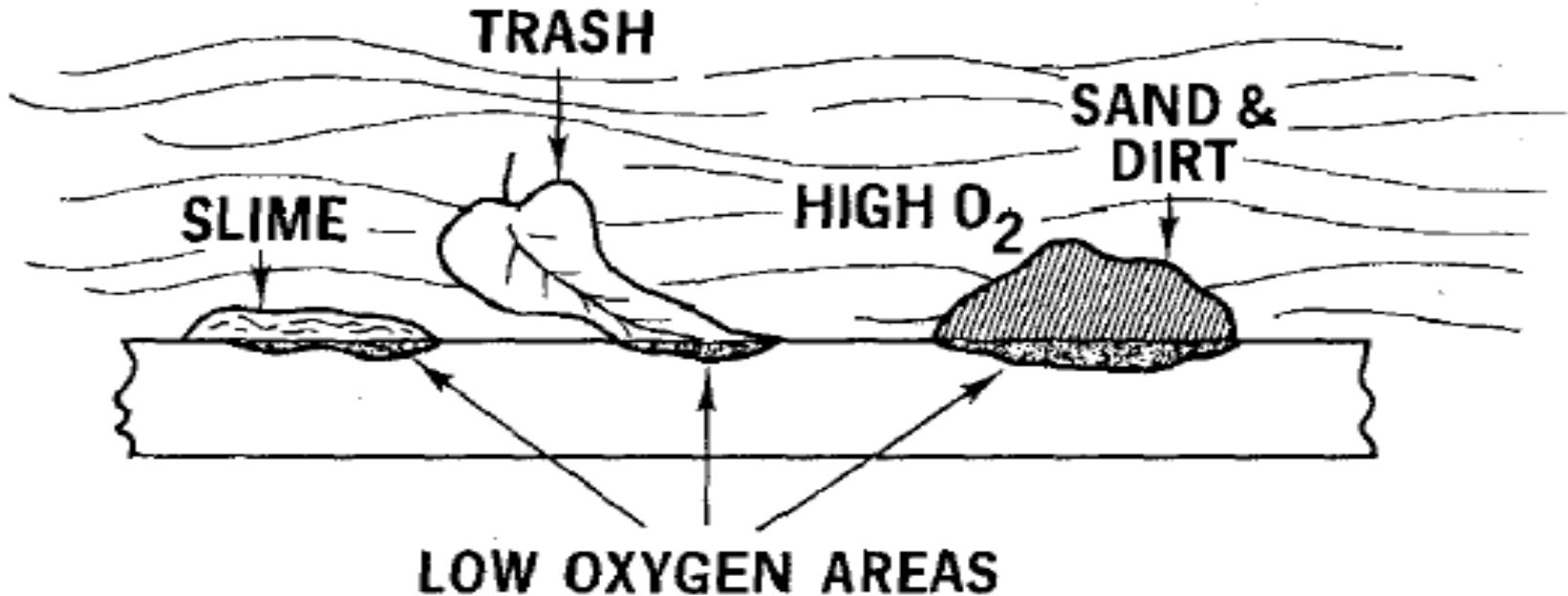
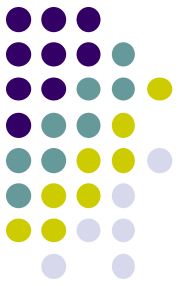
- **Corrosion**
- **Deposition**
 - Scale
 - Fouling
- **Microbiological**
 - Bacteria / Virus
 - Fungal
 - Algae

Corrosion



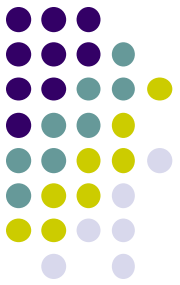
- *Electrochemical process* in which a difference in electrical potential develops between two metals or between different parts of a single metal.
- The process requires an *anode*, a *cathode*, and an ionic conduction path through an *electrolyte* (i.e. water).
- Corrosion causes *lost of metal* from its structure.

Corrosion



- The destructive oxidation of system metals, primarily caused by *oxygen-saturated water*.

Corrosion



Factors Affecting Corrosion

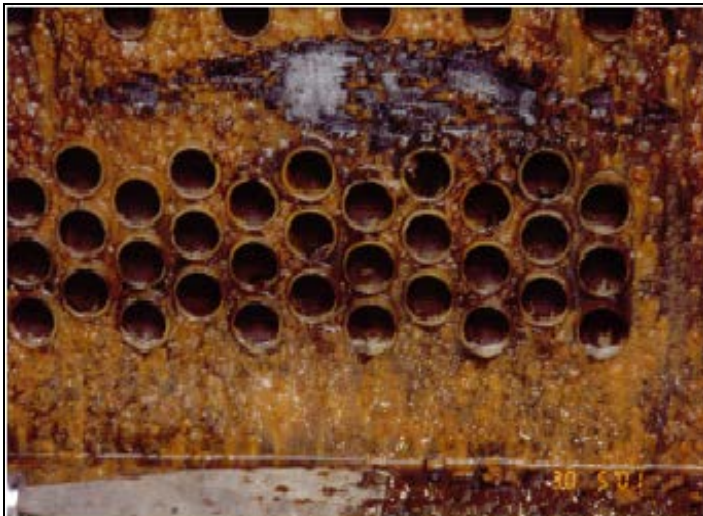
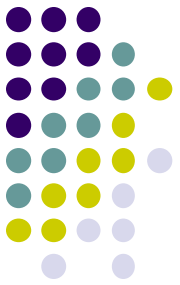
● Physical Factors

- Relative Areas
- Temperature
- Velocity
- Heat Transfer
- Metallurgy

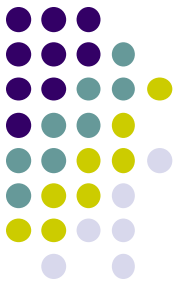
● Chemical Factors

- pH
- Dissolved Salts
- Dissolved Gasses
- Suspended Solids
- Microorganism

Corrosion



Deposition



Scale

- The precipitation of crystalline salts, usually hardness salts.
- Dissolution of Calcium Carbonate
$$\text{CaCO}_3 + \text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{Ca}(\text{HCO}_3)_2$$
- During heat exchange, this reaction is reversed:
Precipitation
$$\text{Ca}(\text{HCO}_3)_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{CaCO}_3$$

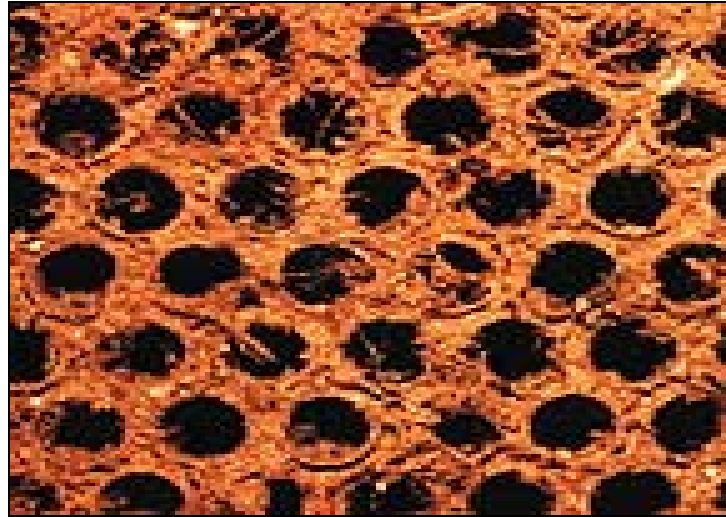
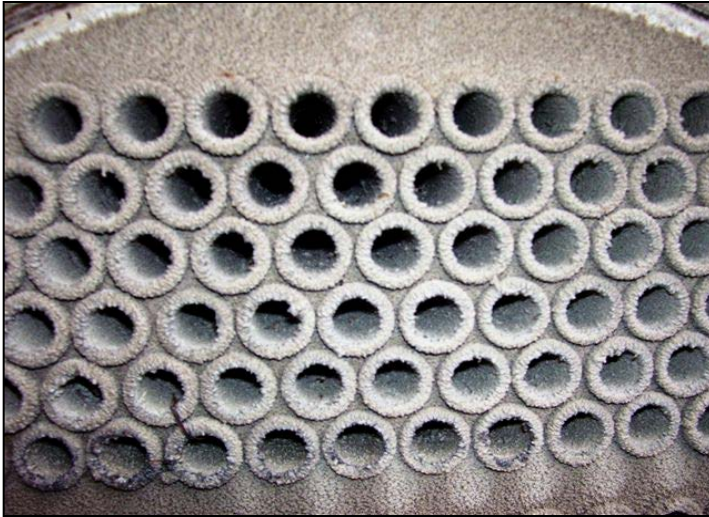
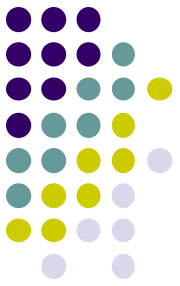


Fouling

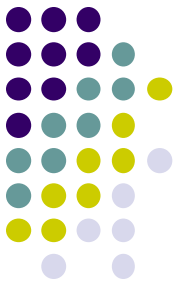
- The sedimentation of suspended material such as mud, silt, sand, clay, bio-matter, etc.



Deposition

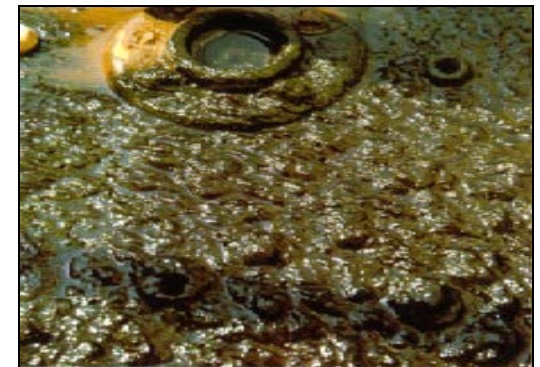
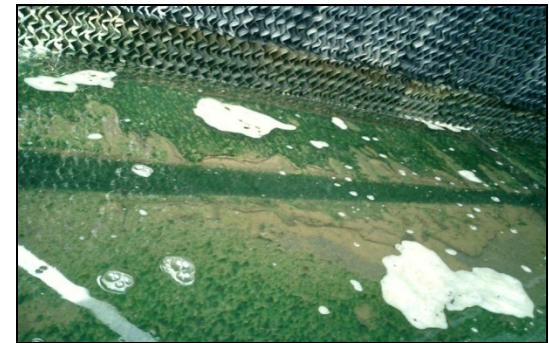


Microbiological Growth

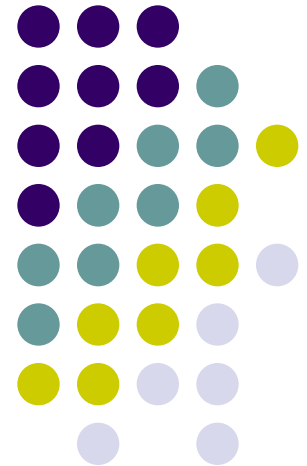


Bacterial, Fungal, and Algae growth resulting from the excellent breeding environment of the open system.

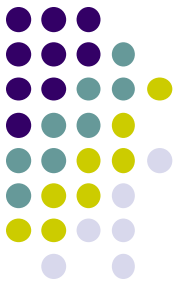
- Algae
- Fungi
- Bacteria
- *Legionella pneumophila*



Condenser Water Treatment & Control

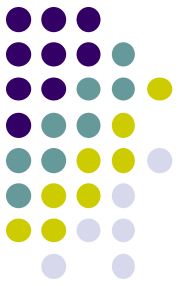


Objective



- To prevent **deposition** and **scaling**
(Scale/deposits will decrease heat transfer and increase energy usage)
- To inhibit **corrosion**
(Corrosion will shorten the life of the equipment)
- To control **microbiological** growth
(Microbiological activity will cause system blockages and potential health hazards)
- To disperse and fluidize **suspended matters**
(Suspended matters will cause system blockages, decrease heat transfer and increase energy usage)
- To control **Legionella Pneumophila** bacteria
(Legionnaire's disease will cause health hazards)

Condenser Water Treatment Chemical



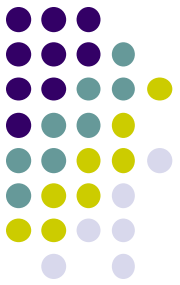
Corrosion Inhibitor

Cathodic Inhibitor

- Polyphosphate
- Zinc
- Phosphonates
- Tannins & Lignins

Anodic Inhibitor

- Nitrites
- Silicates
- Molybdates
- Orthophosphates

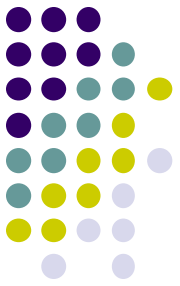


Condenser Water Treatment

Corrosion Inhibitor

**CWT 3753 / CWT 3693 /
GreenChem CT-C9**

- It is a blend of organic corrosion and deposit / scale control agents for use in once through or recirculation water system. It contains a high molecular weight polymer, which is highly effective against fouling caused by airborne dust.



Condenser Water Treatment

MicroBiocides

CWT 3012 NF / 3045 / 3025 /

GreenChem CT-B3

- It is a broad-spectrum biocide in controlling the growth of algae, bacteria and fungi in recirculation water system.



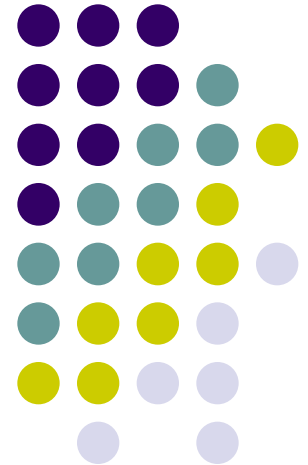
Methods of Dosing Chemicals

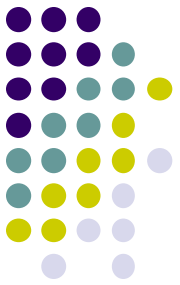
- Semi Automatic System
- Fully Automatic System
- Manual Dosing



Chilled Water System

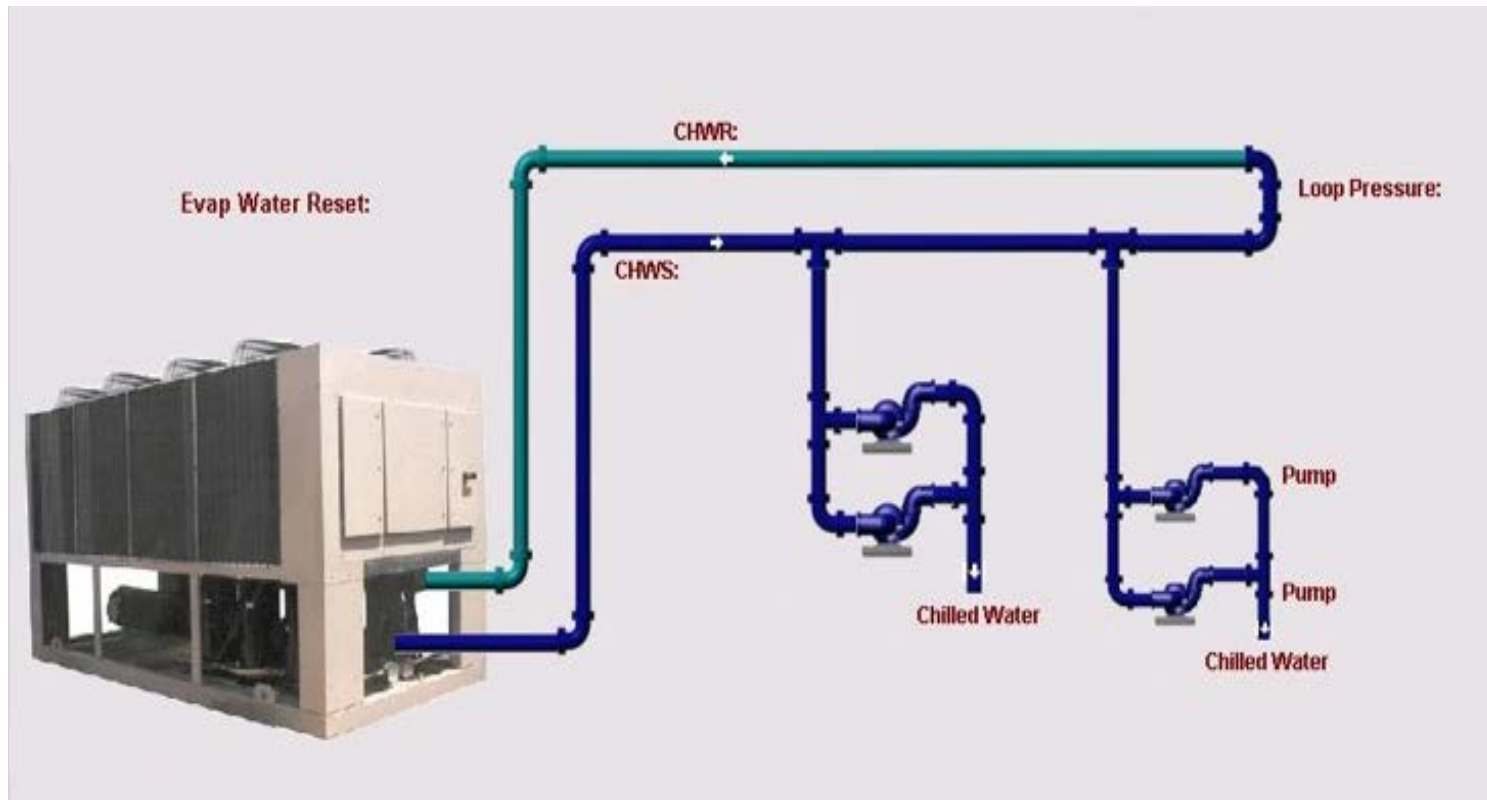
(Closed Recirculation System)



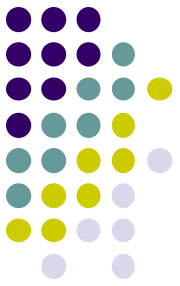


Chilled Water System Design

Closed Recirculation System



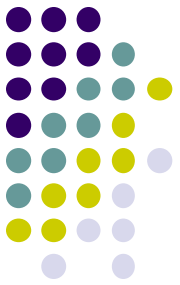
Problems Associated



Corrosion

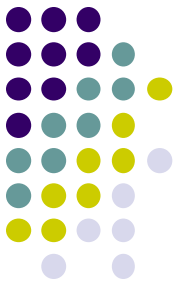


Slime / Microbiological



Objective Of Chilled Water Treatment

- To control and *minimize the corrosion* of all metals associated with the system by reducing oxygen content in the chilled water system. (*Main problem*)
- To control and *minimize microbiological* problems. (*Minor problems*)



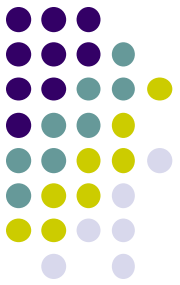
Chemical Treatment

Corrosion Inhibitor

CWT 3707 / CWT 3317 /

GreenChem CH-C2

It is a corrosion inhibitor for sealed cooling systems and chilled water circuits. It is suitable for most metals including copper and aluminium.



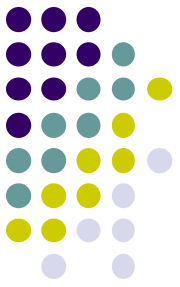
Chemical Treatment

Micro-biocide

CWT 3028 / GreenChem CH-B2

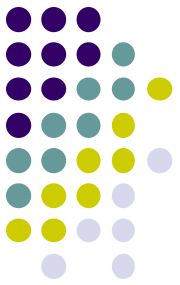
- It is a modern and comprehensive blend of biocidal agents formulated to control slime forming and SRB, fungi and algae in recirculation cooling systems. Its unique chemistry allows it to be used with oxidising biocides for optimum microbial control at an economic cost.
- It is approved by the EPA of the USA for use in various cooling systems, pasteurisers and air washers. It is environmentally safe and non polluting. It is prove to be effective against Legionella Pneumophila the causative agent of Legionnaire's disease.

Methods of Dosing Chemicals



- Chiller Pot Feeder
- Chemical Dosing Pump
- Expansion Tank

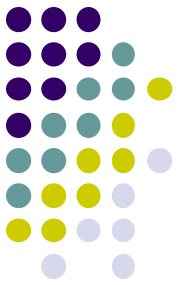




Technical Service

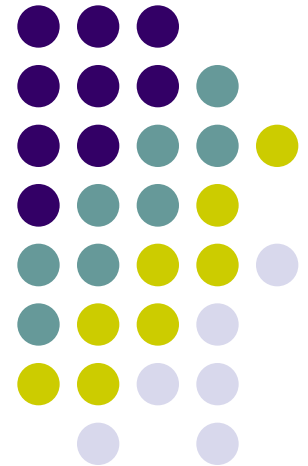
- On site ***water analysis test*** will be carried out during our service call.
- Technical ***discussion*** with operators and plant working personal on any problems related with water treatment.
- ***Check and inspect*** each system and plant being treated.
- A complete ***water analysis report*** for chiller water treatment will send to your attention.
- ***Check and report*** any irregularities related to the treatment program.
- ***Application of chemical*** will be carried out by our experienced service executive.

Pre-Cleaning System

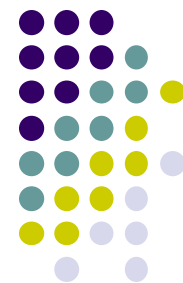


- Pre-cleaning of cooling & chiller water systems is necessary to ensure maximum service life of heat exchange equipment.
- All new equipment should be pre-cleaned to *remove grease, oil, mill scale or dirt*.
- Should be conducted just prior to start-up.
- Immediately after pre-cleaning, surfaces should be rapidly *passivated* as outlined in the pre-filming to avoid initial high corrosion rates.

Chemical Safety & Handling



Chemical Safety



Hazards Identification & First Aids Measures

- **Eye contact** After flushing the affected eyes with running water for at least 15 minutes, consult an eye specialist immediately.
- **Skin contact** Immediately remove contaminated clothing and shoes. Wash thoroughly with soap and water. Obtain medical attention.
- **Inhalation** Remove to fresh air. Give artificial respiration if necessary.
- **Ingestion** Drink one or two glasses of water to dilute. Consult a doctor immediately.



Chemical Safety Cont...

Handling and Storage

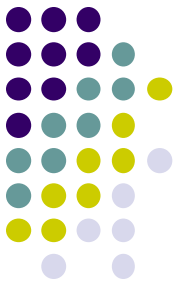
- **Handling**

Wear proper protective equipment during handling. Keep container tightly closed. Do not breath fumes or vapours from the container.

- **Storage**

Do not store with strong oxidizing agents. Temperature for storage is 5 - 40°C.

Chemical Safety Cont...



Personal Protection Equipments

- **Eyes** Safety goggles / glasses (ANSI Z87.1 or approved equivalent)
- **Hand** Rubber gloves
- **Skin** Safety shoes, cloths or apron
- **Respiratory** Mist / dust respirator or filter



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