



Century Water Systems & Technologies Pte Ltd

Training

ULTRAPURE WATER FOR SEMICONDUCTOR

Presented by: Mr. Bernard Dass
Technical Director



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Agenda

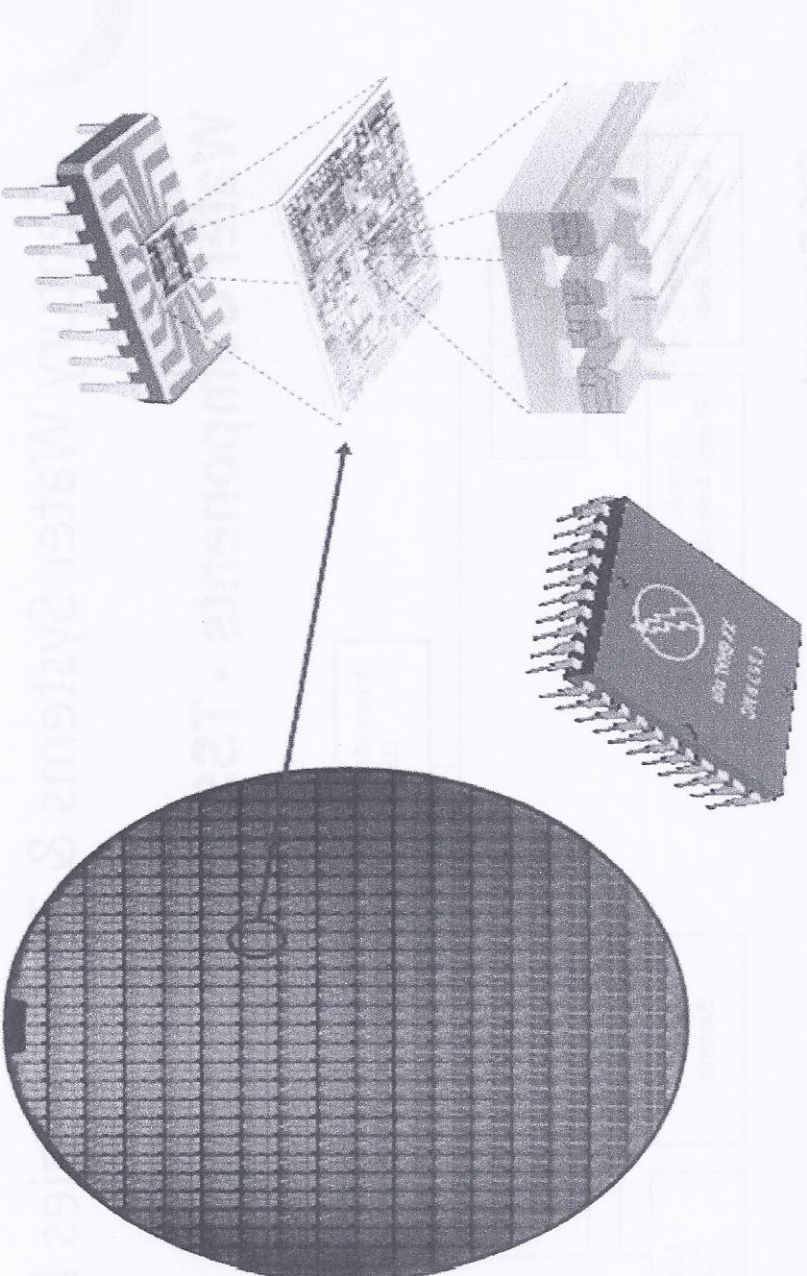
1. Pure water used for
2. Basic Water Chemistry
3. Process diagram
4. Water Quality
5. Process Flow diagram
6. Filtration
7. Ion Exchange
8. Ultra violet

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The product that uses Ultrapure for Semiconductor industries

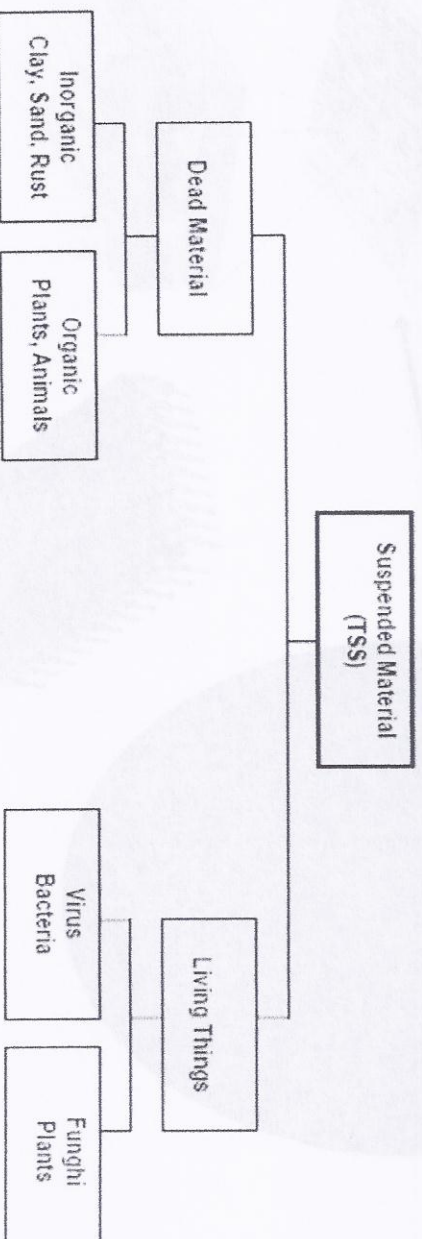


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Water Components - TSS



TSS Removal

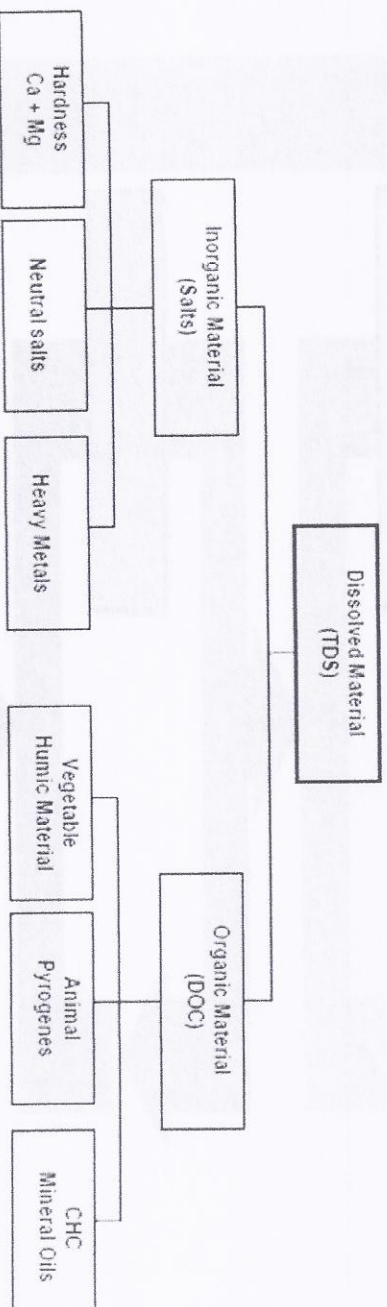
- Flocculation, Sedimentation,
- Sand Filter, Multimedia Filter, Activated Carbon
- Precoat Filter
- Microfiltration, Ultrafiltration

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Water Components - TDS



TDS Removal

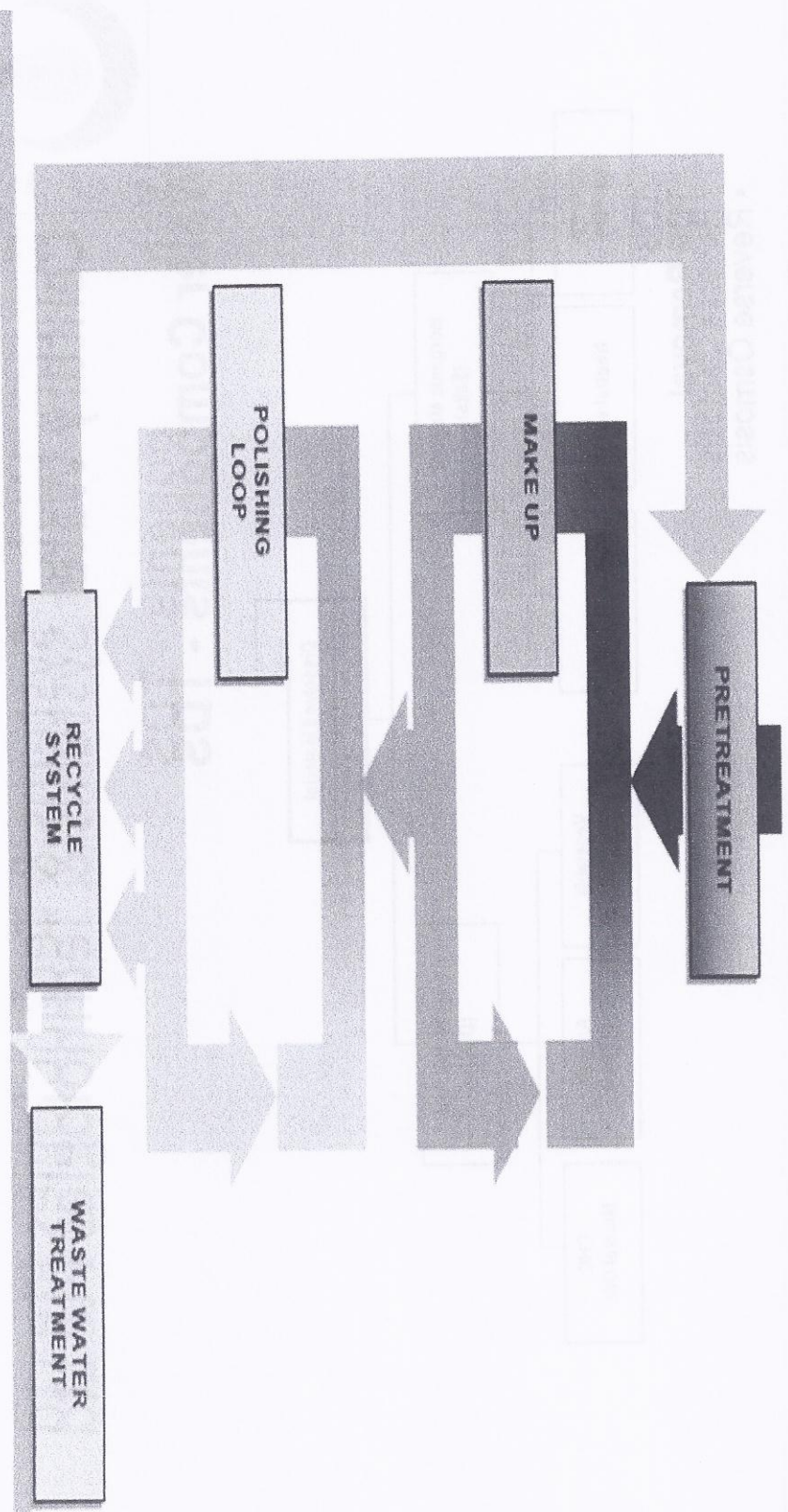
- Reverse Osmosis
- Ion Exchange
- Continuous Electro Deion., Electro Dialysis
- Distillation, Degasification, Ultra Violet Treatment, Oxidation

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Ultrapure Water Basic design

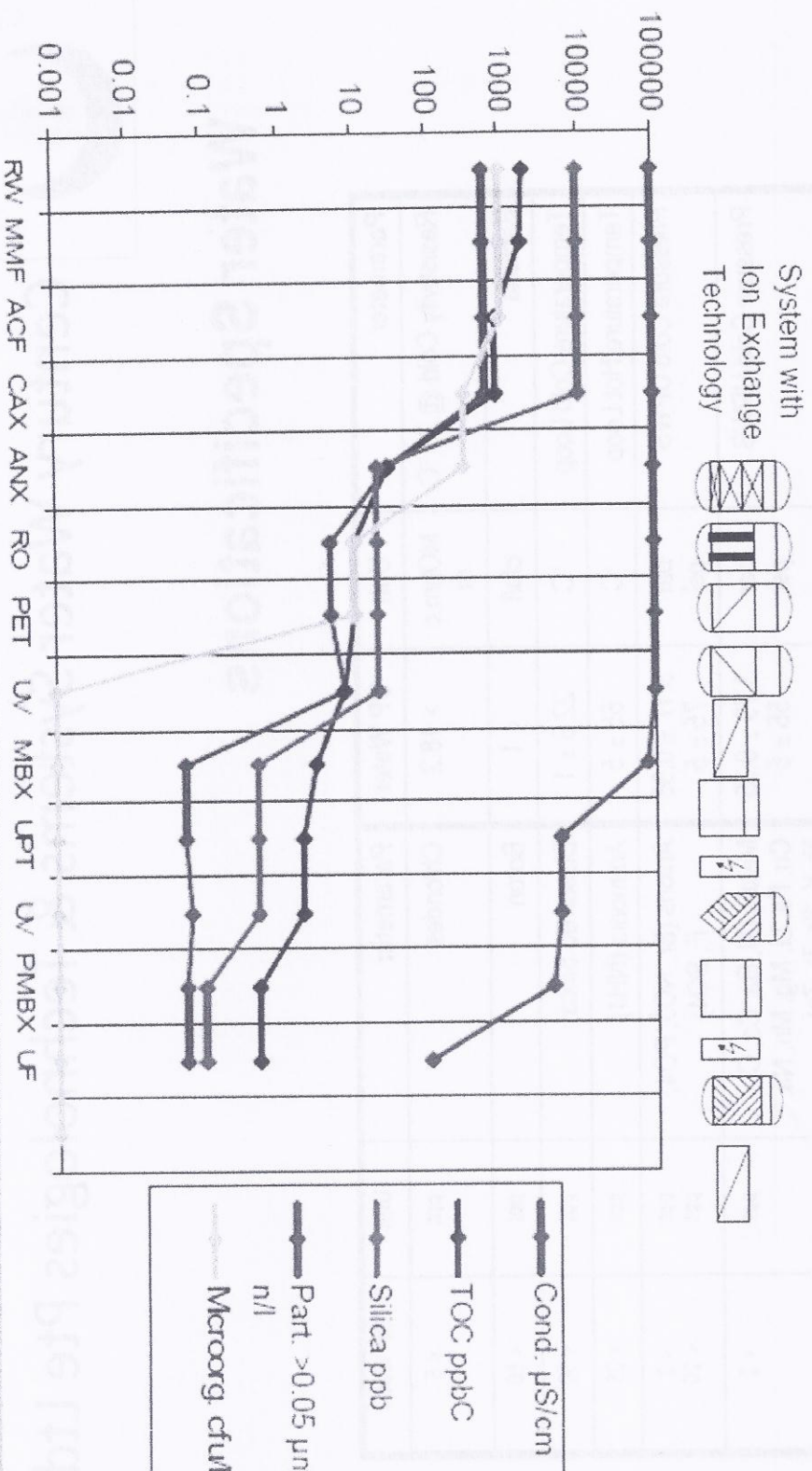


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Water Qualities



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Water Specifications

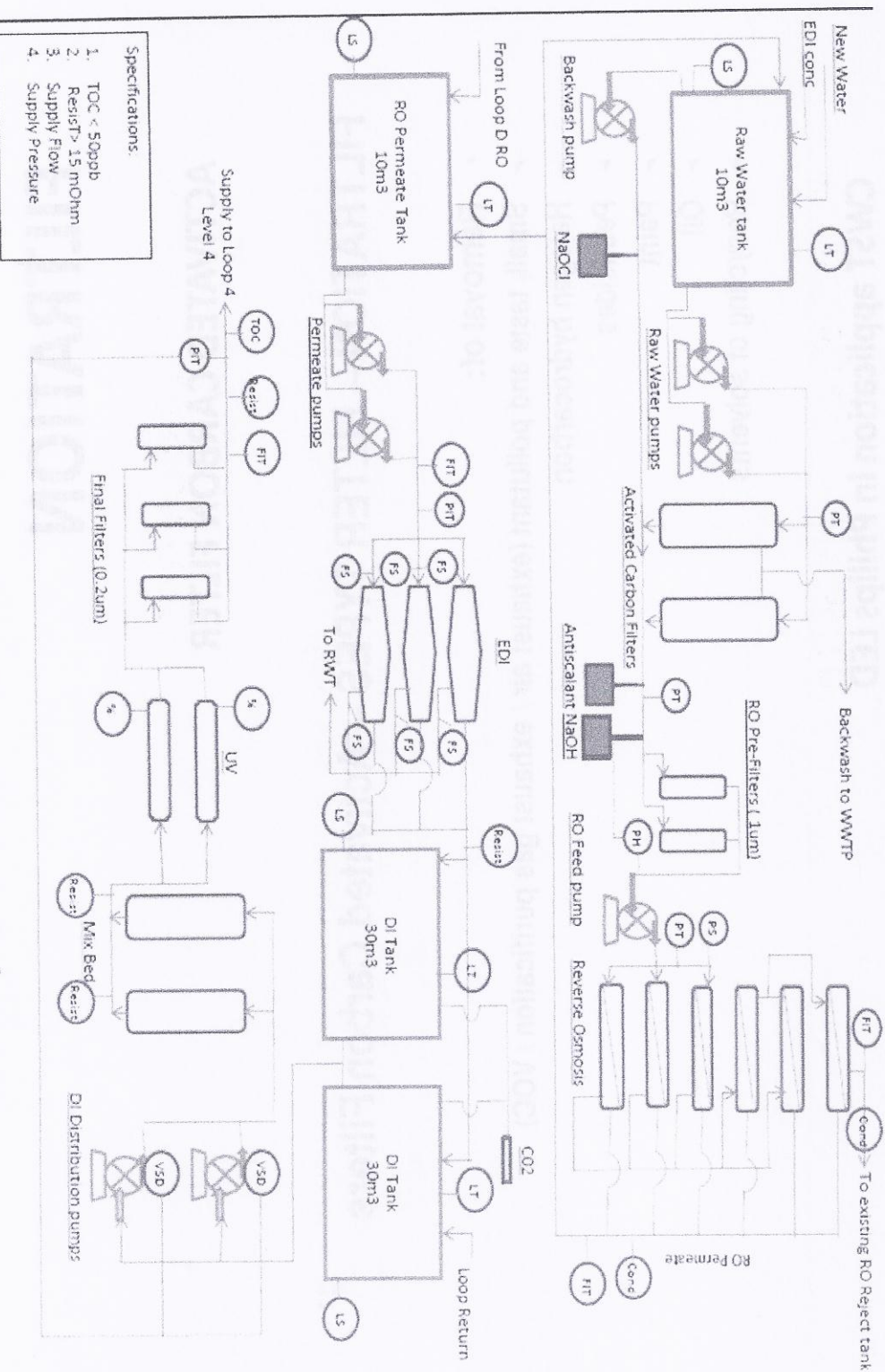
Parameter	Unit	UP Water	Parameter	Unit	UP Water
Resistivity Cold @ 25 °C	Mohm.c m	> 18.2	Chlorides	ppb	< 5
Bacteria	cfu/l	≤ 1	Boron	ppb	< 50
Temperature Cold Loop	°C	22.5 ± 1	Dissolved Silica	ppb	< 50
Temperature Hot Loop	°C	65 ± 5	Ammonia (NH ₄)	ppb	< 25
Pressure Cold UPW/S	bar psi	5.17 ± 0.35 75 ± 5	Anions (Br, NO ₃ , PO ₄ , F, SO ₄)	ppb ppb	< 2 < 20
Pressure Cold UPW/S	bar psi	3.79 ± 0.35 55 ± 5	Metals (Al, Ba, Ca, Cr, Cu, Fe, Li, Mg, Mn, Na, Ni, K, Sr, Ti, Zn)	ppb	< 2
Particles, > 0.05 µm	N/l	< 300	TMA (Tri-Methylamine)	ppb	< 20
Dissolved Oxygen	N/l	≤ 5			
TOC	ppb	< 1.0			

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Overview Of DI Plant at Philips LED Singapore



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FILTRATION

ACTIVATED CARBON FILTER

FILTRATION – FILTER TYPES – Activated Carbon Filters

- Removal of:
 - Small, taste and pollutant (exhaust air / exhaust gas purification / VOC)
 - Halogen hydrocarbon
 - Pesticides
 - Paint
 - Oil
 - Recycling of solvents

CWST application in Philips LED

- Oxidants (ozone, hydrogen peroxide, chlorine...)
- TOC removal
- Iron and manganese removal (with pretreatment: Oxidation respectively flocculation)



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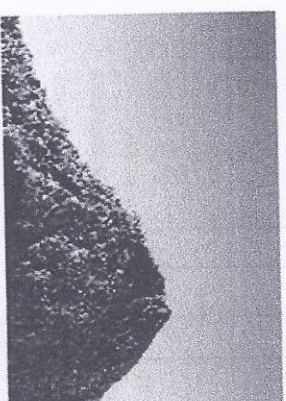
FILTRATION



GRANULATED ACTIVATED CARBON (GAC)

Grain portion over 0,18 mm > 90 %

Applications: Liquids and gases

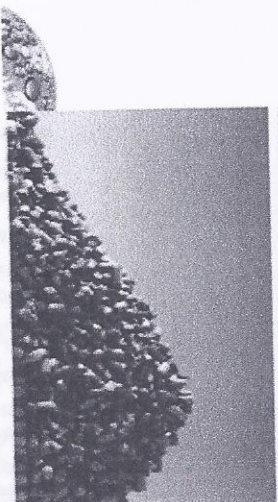


POWDER ACTIVATED CARBON (PAC)

Grain portion below 0,18 mm > 90 %

Pressure loss PAC >> Pressure loss GAC

Applications: Liquids and exhaust gases
Decoloration, oxidant removal



PELLETED ACTIVATED CARBON

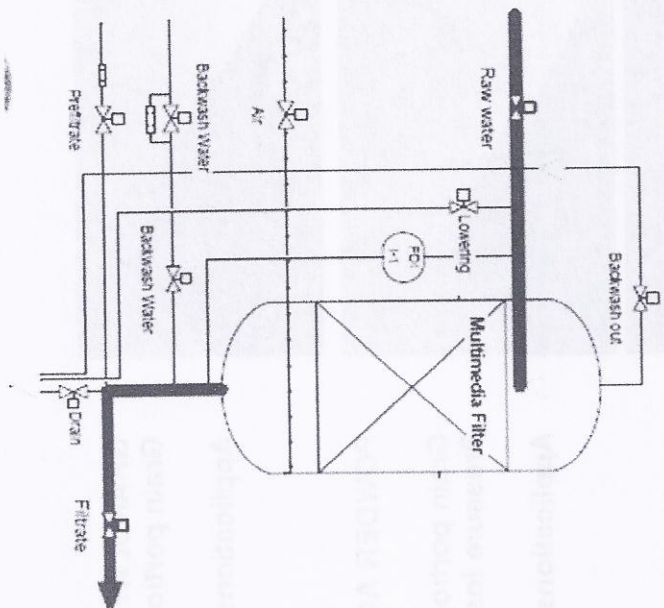
Low pressure loss

Applications: Exhaust gases
Gas separation

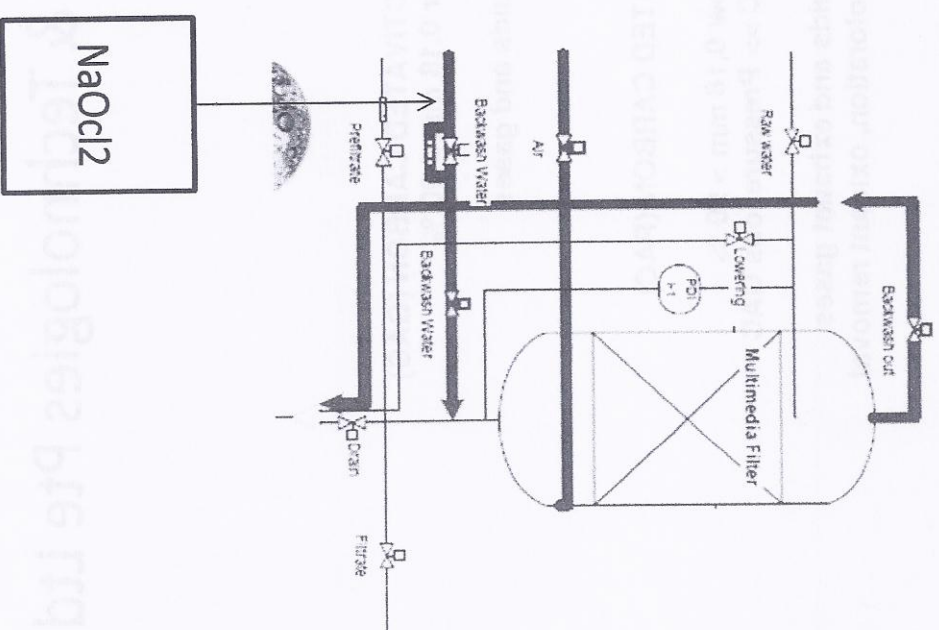
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FILTRATION

In operation



Backwash





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FILTRATION

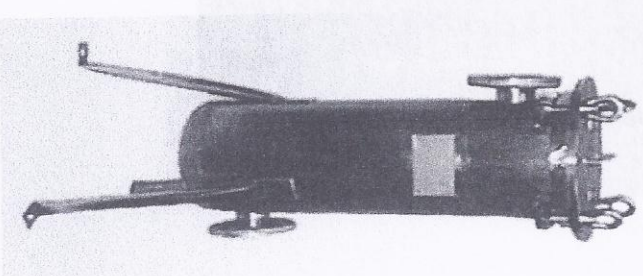
Cartridge filter for RO pre-filter and final filter

Specification for RO pre-filter

- 20 cartridge per housing
- 2 housing per RO skid
- Length 40"
- Surface area 4m²
- Porosity 5 um

Specification for Final Filter

- 20 cartridge per housing
- 2 housing
- Length 40"
- Surface area 4m²
- Porosity 5 um



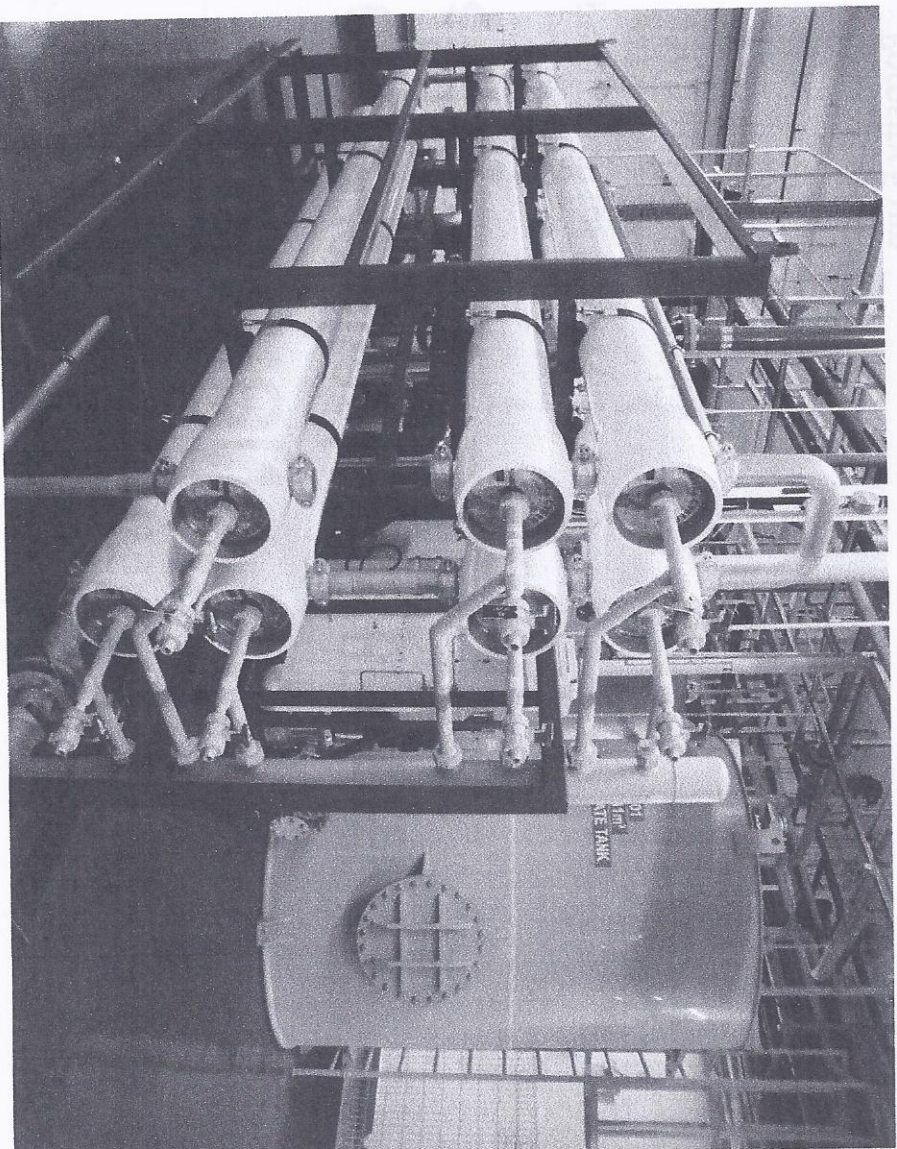
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FILTRATION

REVERSE OSMOSIS (RO)



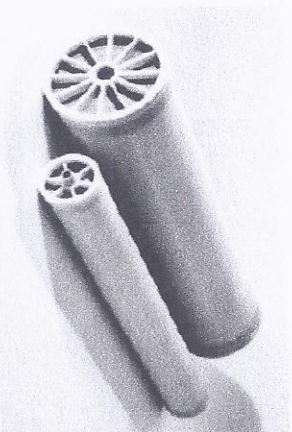
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FILTRATION

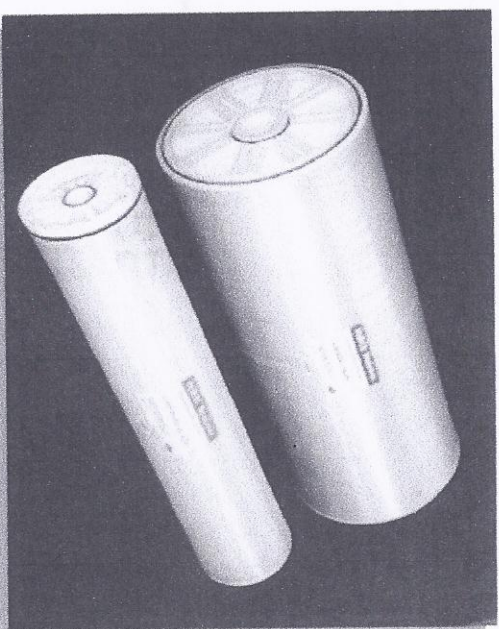
NEW RO MODULE SIZE



Standard Module Size:

4 Inch (10cm) diameter and 100cm length

8 Inch (20cm) diameter and 100cm length



New large RO Module:

16 Inch (40cm) diameter and 100cm/
150cm length

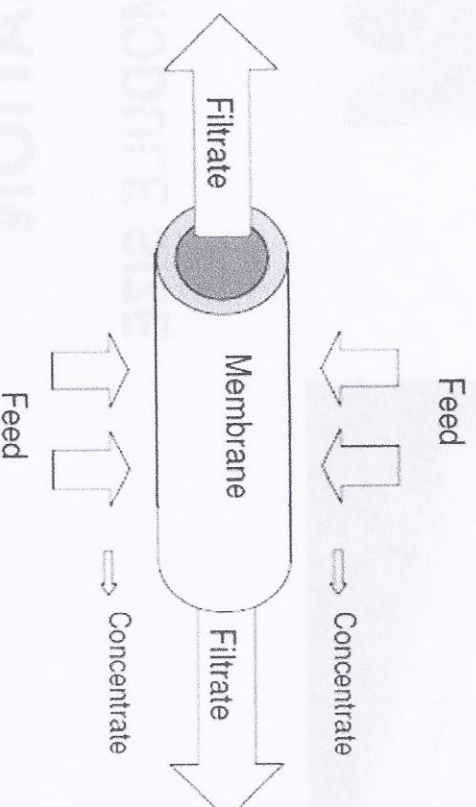
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FILTRATION

OPERATION OF HOLLOW FIBRE



Out / In operation of hollow fibre is used for raw water ultra filtration and for pure water filtration in the semiconductor industry.

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ION EXCHANGE

- Process for removing of *ionizable* species from liquids, i.e. water, using ion conductive materials.
- The driving force is an electrical field due to an external electrical potential.
- The transport mechanism is based on a facilitated transfer of ions at the surface of the ion conductive materials by migration, diffusion and convection.

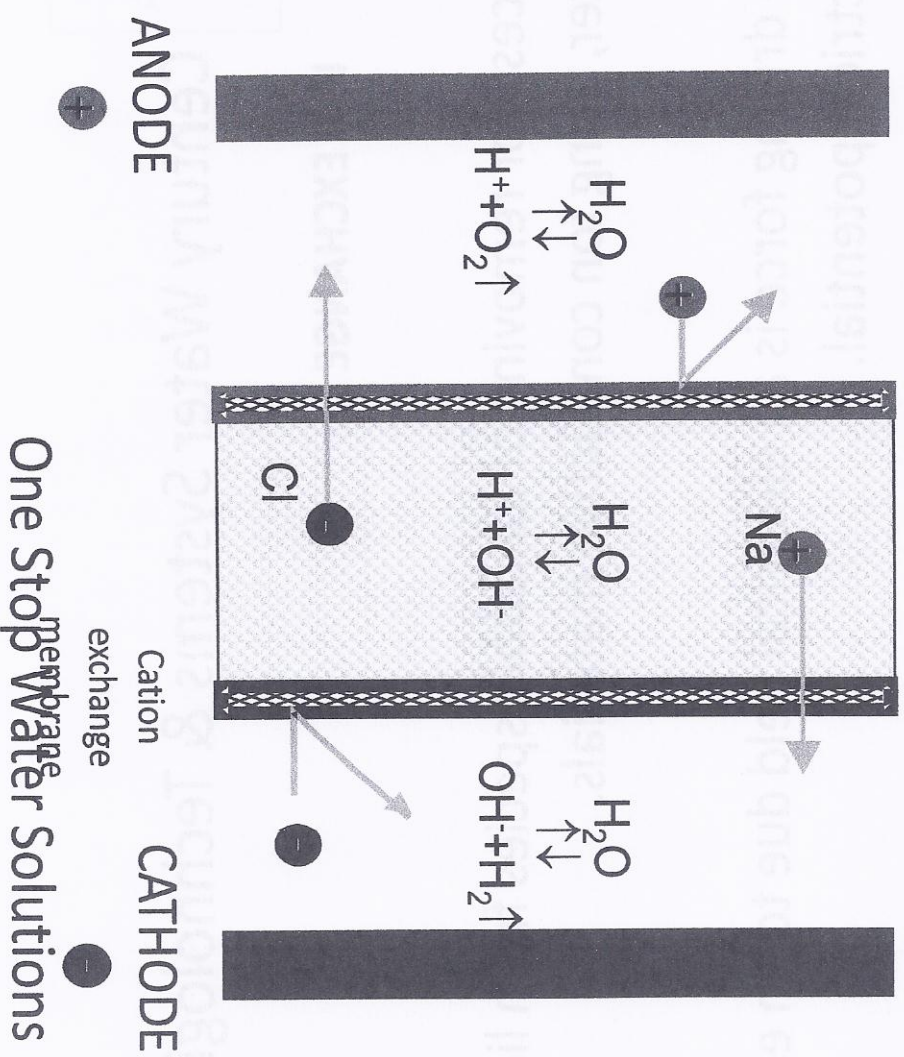
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ION EXCHANGE

Principle - EDI





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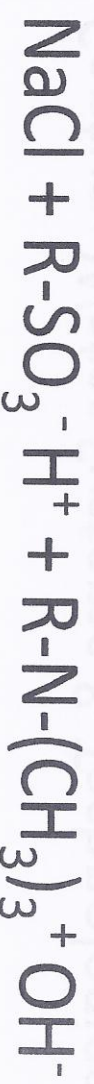
ION EXCHANGE

Electrochemical regeneration

1. Water dissociation due to the electrical field



2. Continuous regeneration under electrical current



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ION EXCHANGE

Advantages of CED I

Compared to mixed bed

- CED I does not require chemicals for regeneration
- CED I does not require shutdown for regeneration
- Continuous process
- No neutralization
- Provides water of consistent quality

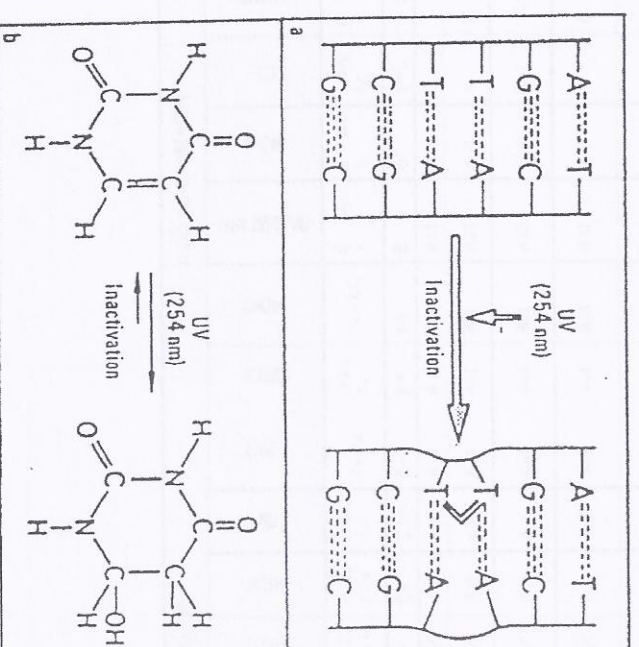
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UV-TREATMENT

UV to inactivate microorganisms (254 nm)

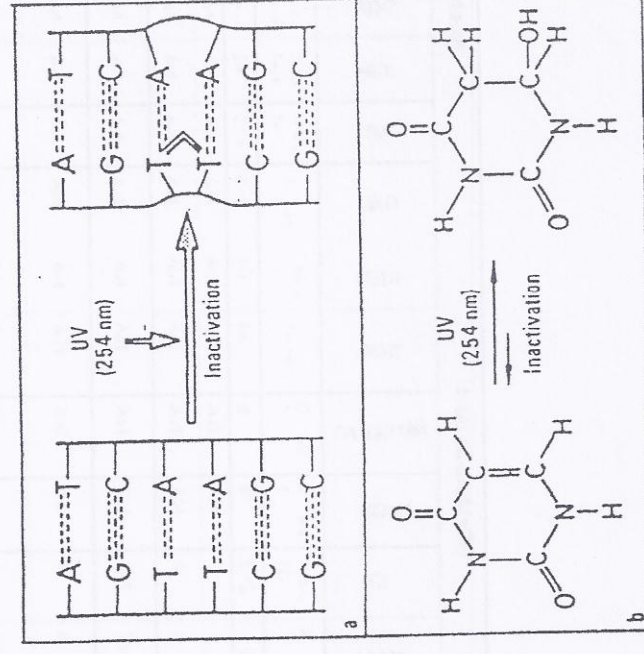
The radiation absorbed by the nucleic acid (biological molecules) attack the genetic material.

A cell that can not reproduce is considered dead since it is unable to multiply to infectious numbers



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