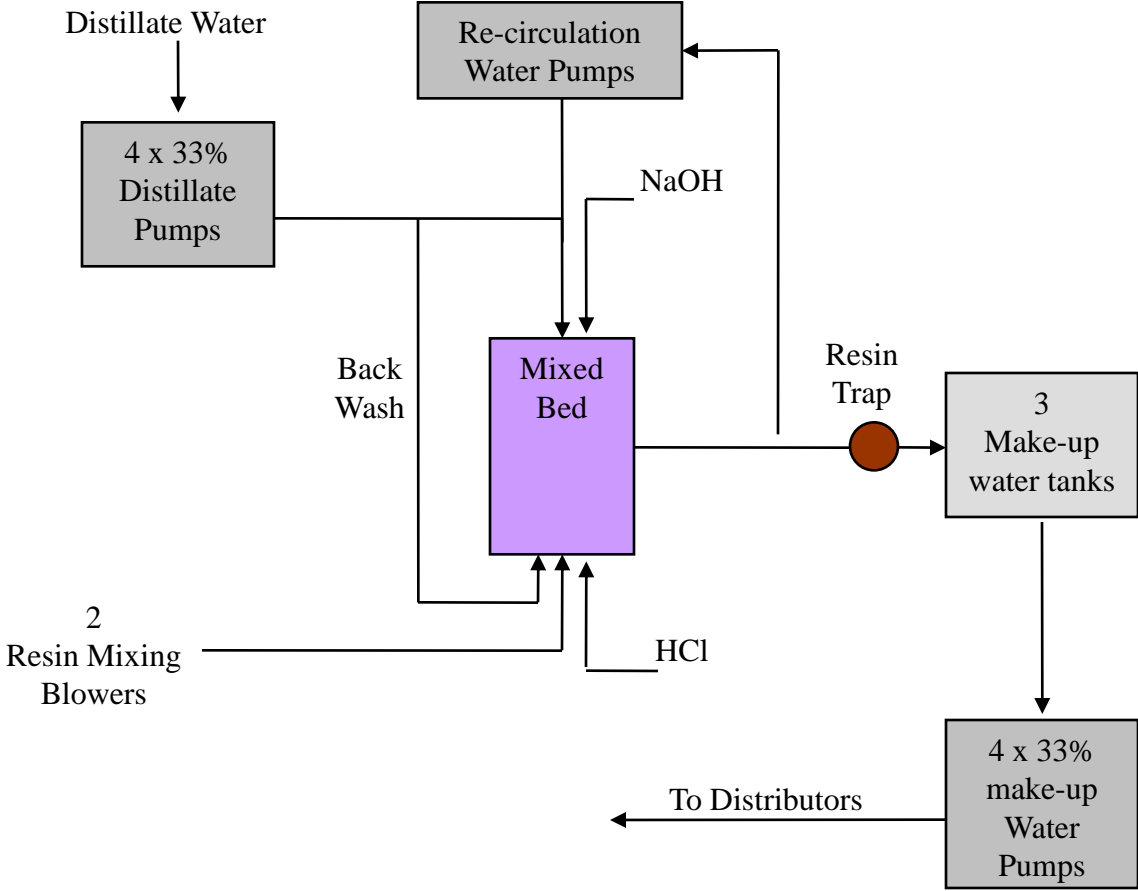


# Make up water system



## –Inlet

- Conductivity 50  $\mu\text{S}/\text{cm}$
- PH 5.8 – 8.7
- TDS 21.5 (NaCl)

## – Outlet

- Conductivity 0.2  $\mu\text{S}/\text{cm}$
- PH 6.5 – 7.5

## –Resin

- Anionic Resin (-)  $\longrightarrow$  (So<sub>4</sub>) (OH) (Cl) (NO<sub>3</sub>)
- Cationic Resin (+)  $\longrightarrow$  (Na<sup>+</sup>) (Mg) (Ca) (H<sup>+</sup>)

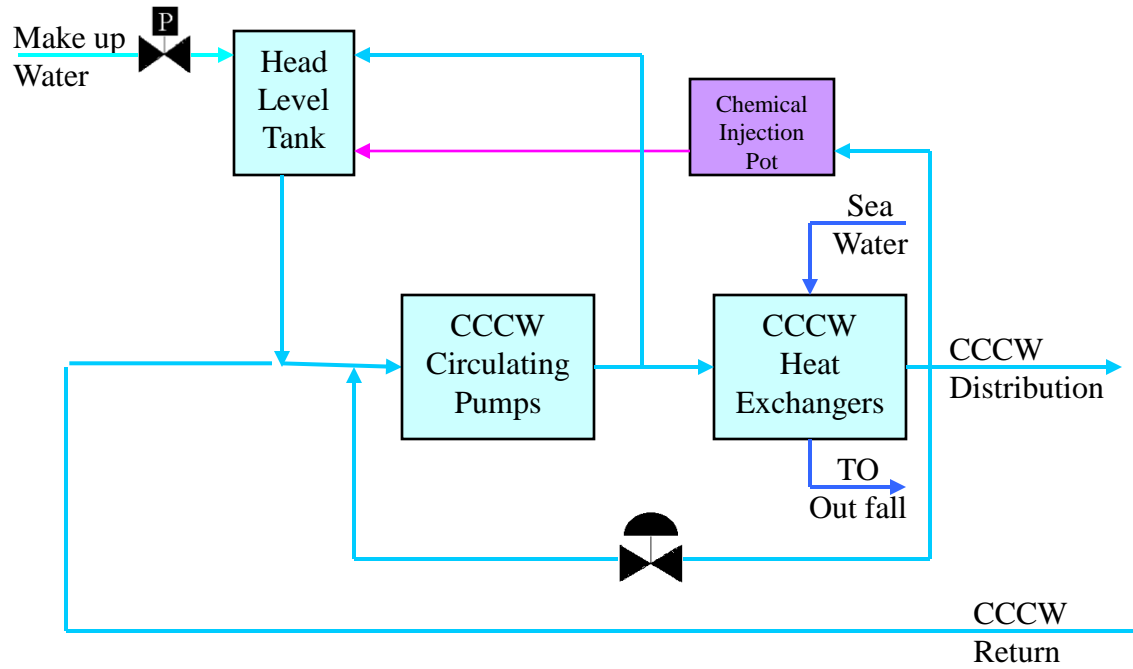
## –Distributors:

- Feed Water Deaerator
- BPST (Gland Condenser)
- CCCW
- GT , Boilers, Chemical & laboratory areas.

- Mixed Bed Regeneration
  - Back Washing
  - Setting
  - Caustic Soda & Hydrochloric Acid Injection
  - Water Circuit
  - Reagents Circuit
  - Caustic Soda & Hydrochloric Acid Displacement
  - Levelling
  - Resin mixing
  - Venting
  - Final resin drain
  - Final resin recirculation



# CCCW



- Components:
- Two Head Level Tanks
  - To Compensate the Variations of the cooling water volume due to different thermal loads and ambient temperature.
  - To keep the pressure at the suction of the pumps constant.
- 2 Pneumatic On/Off Valves
  - Normally open
  - To control the head tanks level.
  - To restore any water loss in the tanks.
  - To supply DM water when a new user is placed into service after maintenance.
- (3 x 50 %) CCCW Pumps.
  - Two in Duty, one stand by.
- (3 x 50 %) CCCW Heat Exchangers.
  - Two CCCW heat exchangers in duty, one stand by
- 2 Pneumatic Control Valves.
  - One is operating and one is stand by.
  - To re-circulate CCCW water back to the pumps suction headers.
  - (Differential Pressure across CCCW circuit users)
  - $\Delta P$  is kept constant even if some users are out of service.
  - To ensure constant water flow to the users.
- Two Chemical Injection Pots
  - Corrosion inhibitors
  - Manually filled.
  - The flow from the pots to the tanks due to  $\Delta P$ .

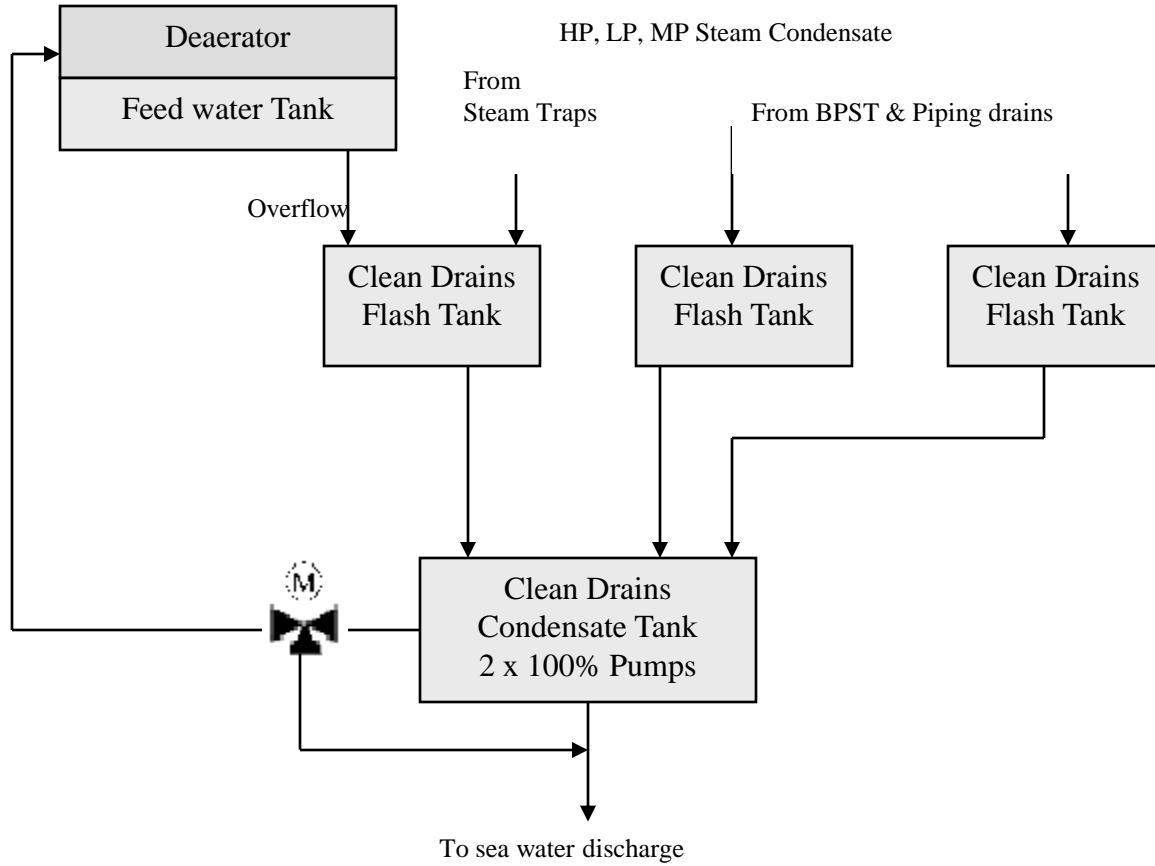
## Distributors:

- GT
  - Lube oil coolers
  - Fuel oil coolers
  - generator coolers
- WHRB & auxiliary boiler
  - Saturated steam sampling
  - Continues blow down sampling
  - Main steam sampling cooler
- BPST
  - Gland steam cooler
  - Generator cooler
  - Lube oil cooler
- Instrument and service air chillers
- Instrument and service air compressors
- Demi plant
  - NaoH cooler.
  - Sampling system rack.
  - Feed water pumps.

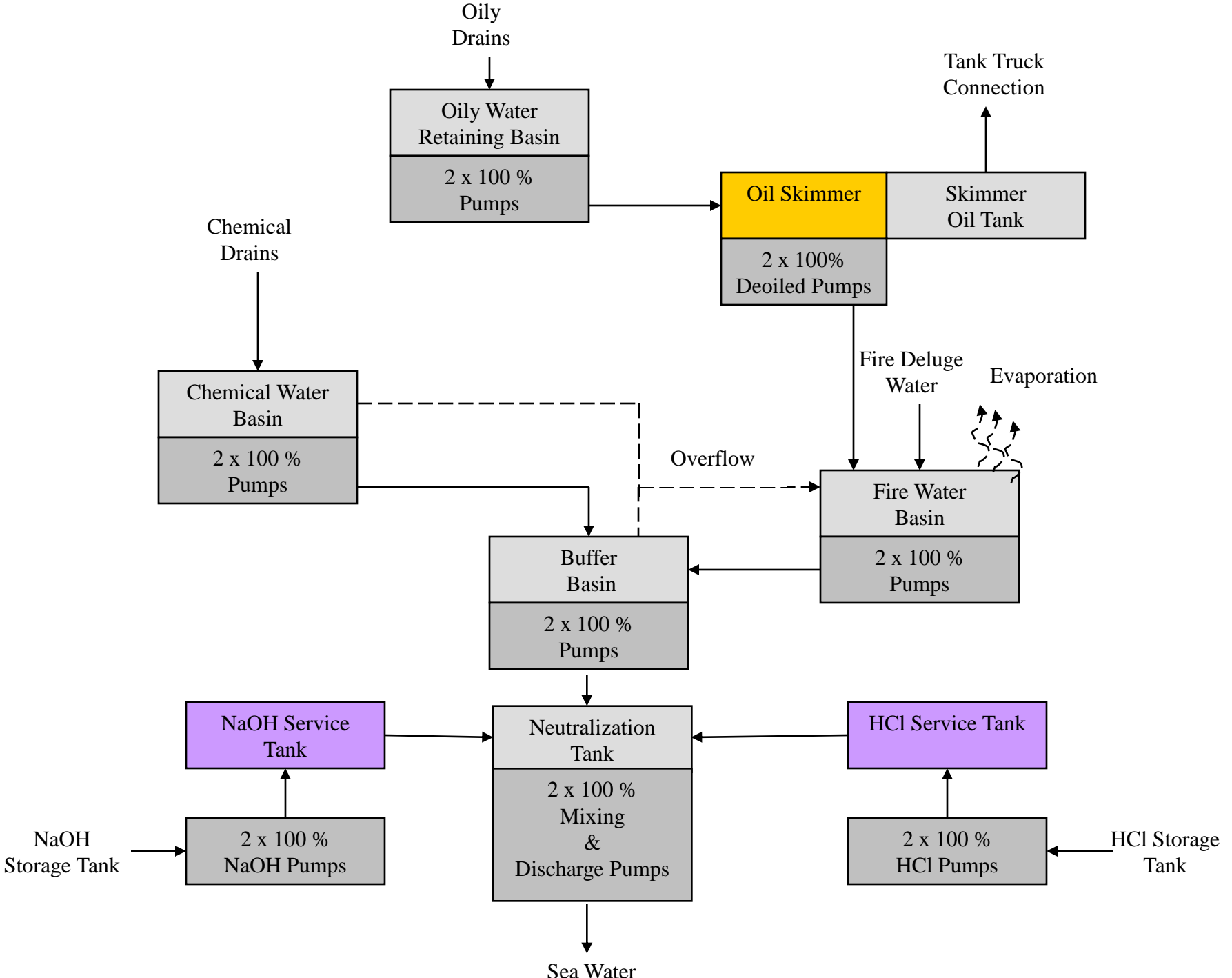




# Clean Drain System

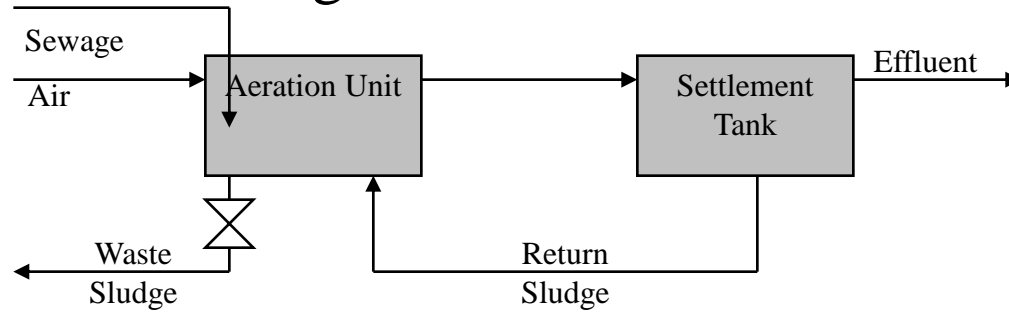


- Drain pump trip
  - Stand by pump is automatically started
- condensate high conductivity
  - Three way valve fitted emergency discharge line to the seawater
- Deaerator high level
  - Stop the pump
  - The level in the clean drain tank is not controlled



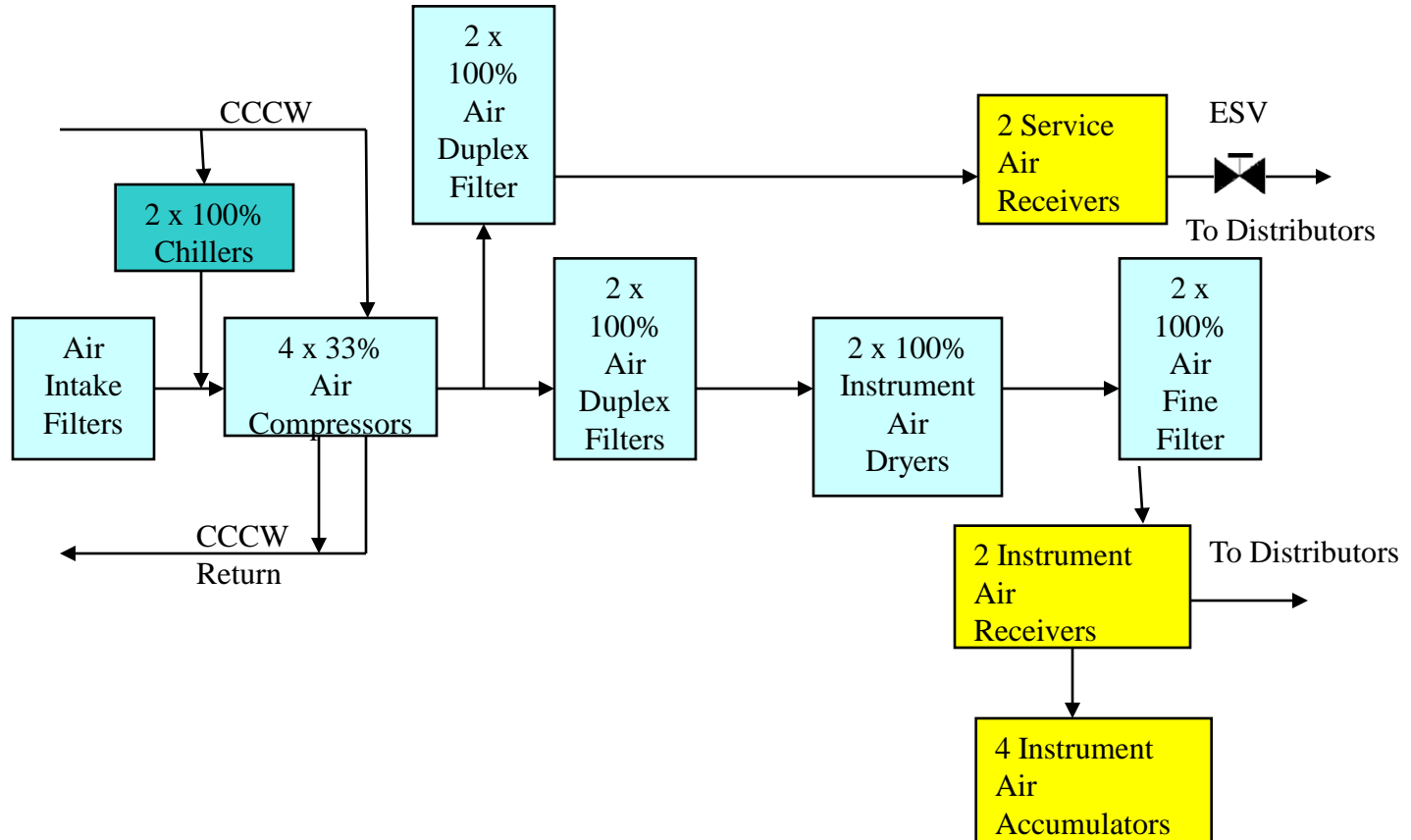
Pollutants	Unit	Value
Max Temperature	°C	60
pH		6 - 9
Total Suspended Solids	ppm	15 (max)
Turbidity	NTU	75 (max)
Oil & Grease	ppm	8

# Sewage Treatment Plant



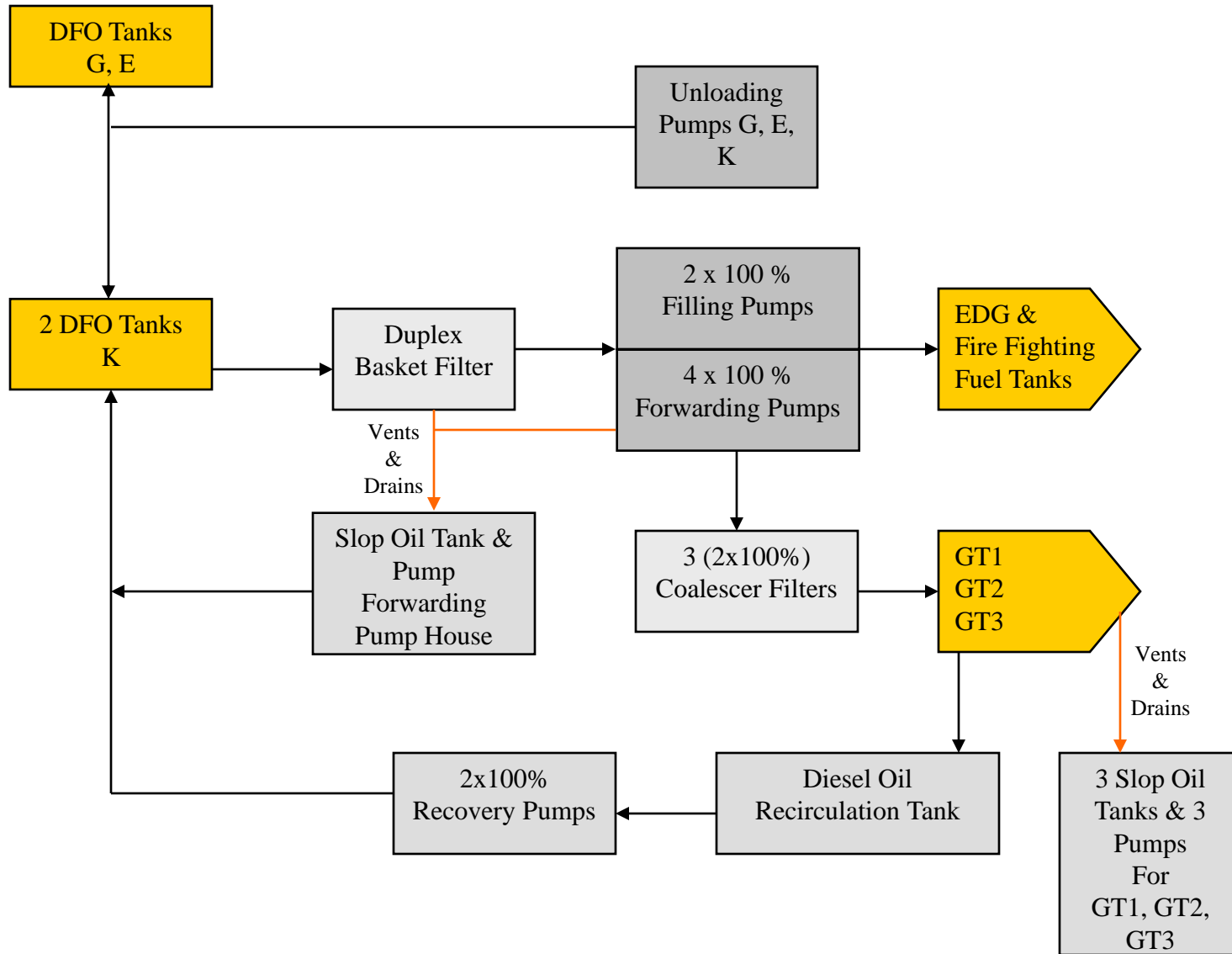
- **Dissolved oxygen concentration**
- It should be higher than 0.5 mg/l
- If less, the plant will not work satisfactory and the air supply must be increased.
- If 2 mg/l or more, the plant is being run at an unnecessarily high cost.
- **Mixed liquor suspended solids (MLSS)**
- The desired concentration range of MLSS is in between 2000 – 3000 mg/l
- The higher MLSS shows the need for dislodging and the lower MLSS means the plant can't operate at maximum efficiency.
- **PH**
- The degree of acidity and alkalinity
- The range of values should be 6.5 – 8.0
- Lower values are due to discharge of acidic wastes or to low loading rates causing the oxidation of ammonia to nitric acid (nitrification)
- It can be corrected by reducing the air supply or by adding lime or soda ash
- **Ammonia concentration**
- To indicate the amount of ammonia that remains in the effluent after treatment.
- It should be less than 5 mg/l.

# Instrument & Service Air system



- Very low instrument air:
  - Emergency shut-off valve closes (at the service air discharge header)
  - Pressure at the high limit opens the emergency shut-off valve.
- Start up
  - Pre-condition (1 air dryer + 1 air chiller + 2 compressors not in malfunction & all measurements not in fault condition)
  - Sequence start up
    - Start command for each compressor in sequence
    - Get the feed back signals from each compressor.
    - Get the pressure reading normal (2 o 3)
- Shut down sequence
  - Pre-condition
    - Start up sequence completed
    - Plant shutdown request
  - Shut down sequence start up
    - Stop command to all compressors
    - Get the feed back signals.
- Dew point analyser (– 20 °C) dew point

# Diesel Fuel Oil Process Diagram





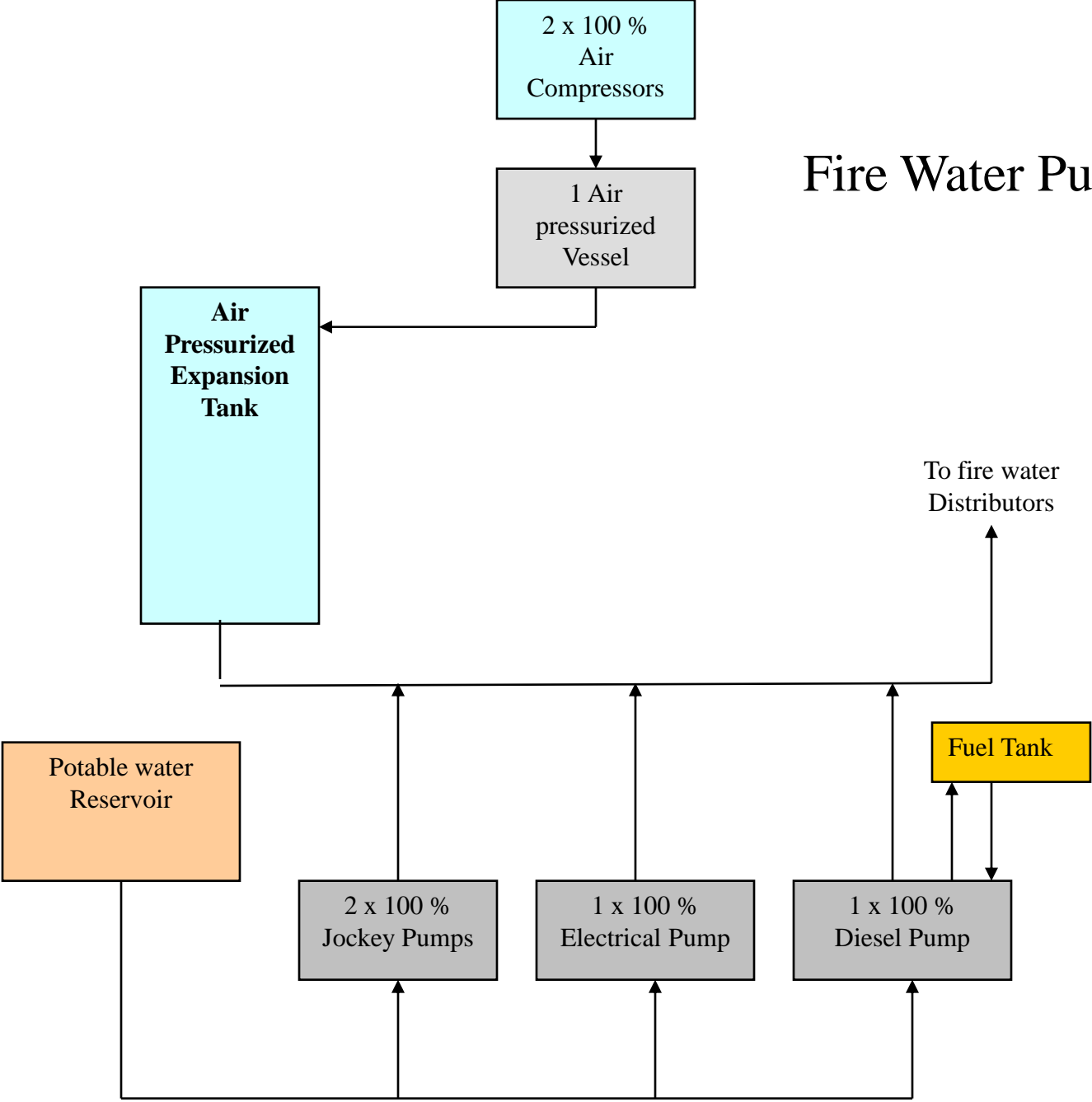
- Normal operation
- Active mode
  - Consumption of fuel in the GT
  - GT isolation valve will open when the pressure is at least 4 bar
  - When 1 isolation valve opens 1 pump will start ( 2 for 2 & 3 for 3)
- Passive mode
  - One filling pump will be in operation ( one stand by)
  - To maintain the system under pressure at the conditions required by GT fuel system (GT is in fuel gas).
  - To make up the loss in the system and to fill the day tanks of EDG & fire fighting motor pumps.
  - The filling pump is independent of the redundant pressure transmitter (EDG & fire fighting)
- Test mode
  - All three isolation valves should be closed
  - Start and stop the pumps manually.

## Transient Operation

- Start up & shut down of the system
- Incidents
- Low gas pressure
  - Auto change over
- Low fuel oil pressure
  - Fuel oil pressure in the system
  - Diesel filling pump starts by the redundant pressure transmitters (GT inlet)
  - If the fuel oil pressure falls below the set low pressure, the stand by pump shall be actuated.
- Fire
  - GT on fire
    - ESD valve closed
    - All forwarding pumps stopped



# Fire Water Pump House



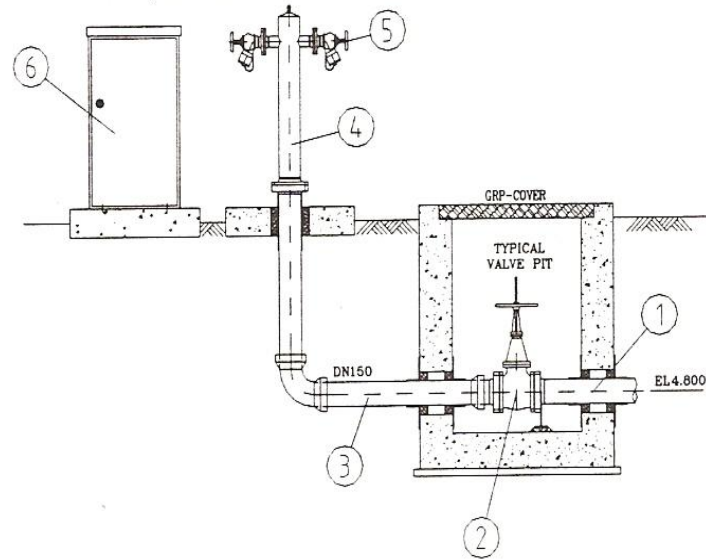
A common suction line feeds the system from the firewater storage tanks

To supply water to

- Underground hydrant main supply line
- Indoor and outdoor water hydrants
- Water spray systems
- Water sprinkler systems
  
- Main components:
  - 1 electric driven fire pump
  
  - 1 diesel engine fire pump
  
  - 2 Jockey pumps
    - One on duty & one stand by
    - To maintain the water amount and pressure in the main supply line.
    - The jockey pump and the air compressor will stop automatically after the normal conditions have been reached or when one of the main pumps is operated.
  
  - 1 pressurized expansion tank with connected air compressor
    - To maintain the system pressure at 9.8 bar
    - Air compressor 10 bar
    - 3 Level float switches (H & L 60 mm, HH & LL 120 mm)
    - (Stop jockey pump at H level, report at HH)
    - (Start jockey pump at L level, report at LL)
  
- During shut down periods of the water can be supplied from G station main or stand by fire fighting pump.



TYPICAL HYDRANT ARRANGEMENT  
FIRE HOSES AND EQUIPMENT WET BARREL TYPE HYDRANT



- 1 - Underground Hydrant Main
- 2 - Underground Hydrant Stop Valve OS&Y Type
- 3 - Underground Hydrant Feed Pipe
- 4 - Fire Hydrant
- 5 - Hose Connection
- 6 - Outdoor Hydrant Cabinet

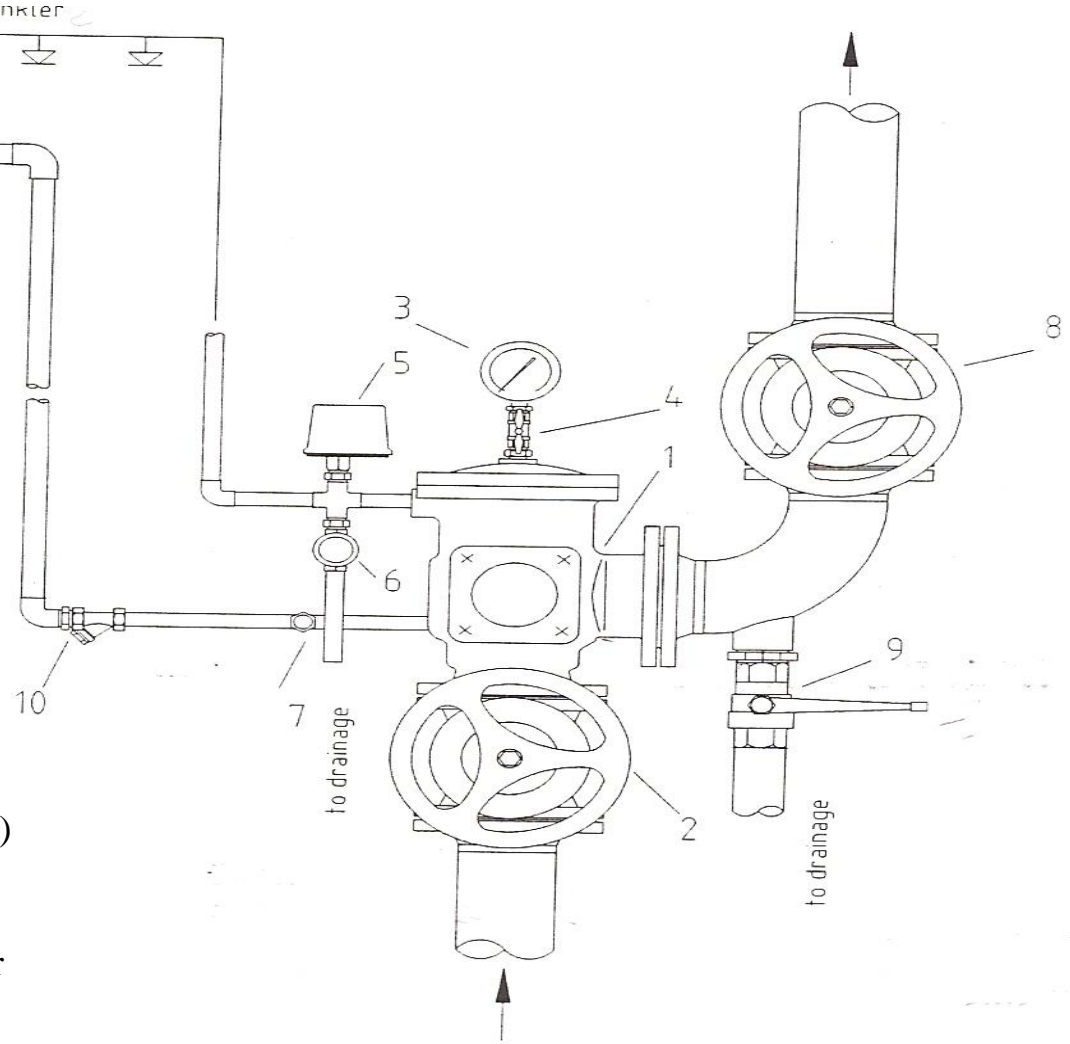
During shut down periods of the (SGA) water can be supplied from G station main or stand by fire fighting pump.

The hydrant ring main is routed underground throughout the plant:

- Permanently pressurized 8.2 bar
- Sectional valves
- Wet barrel fire hydrants with fire hose connection



# Spray Deluge System



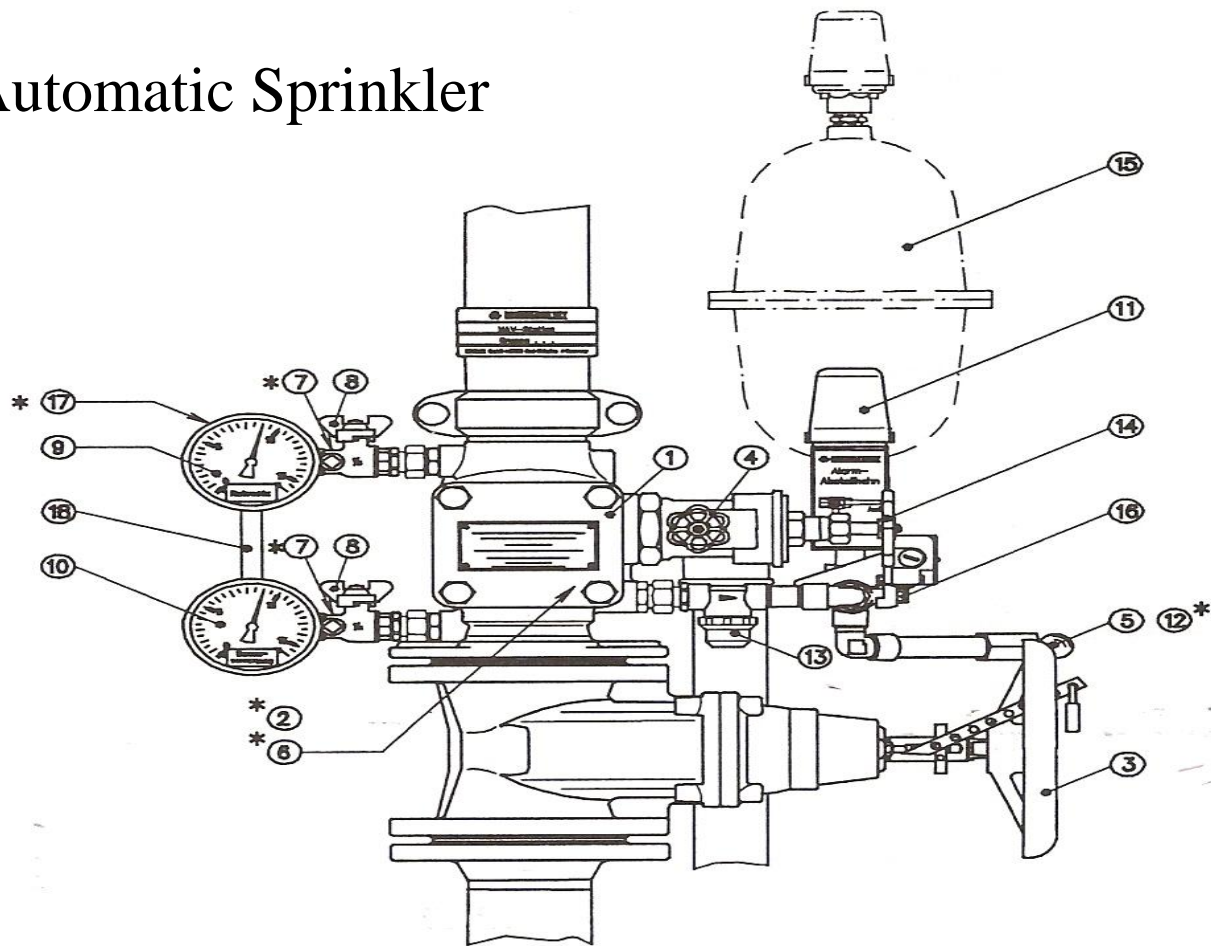
## Protected areas:

- 132 KV GIS control Building (cable tunnels)
- Control & switch gear building
- Auxiliary boilers & WHRB
- BPST bearing, lube oil package, transformer
- GT main & auxiliary transformer

## Description of Items

- |                            |                       |
|----------------------------|-----------------------|
| 1 deluge valve             | 8 gate valve          |
| 2 gate valve               | 9 test valve          |
| 3 pressure gauge           | 10 strainer           |
| 4 valve for pressure gauge | 11 alarm gong         |
| 5 pressure switch          | 12 manual release box |
| 6 manual release valve     |                       |
| 7 drainage valve           |                       |

# Wet Pipe Automatic Sprinkler



- |     |                                     |      |                                 |
|-----|-------------------------------------|------|---------------------------------|
| 1   | Wet pipe alarm valve NMX            | 10   | Pressure gauge for water supply |
| * 2 | Valve head                          | * 11 | Alarm pressure switch           |
| 3   | Gate valve for water supply         | 12   | Water motor alarm gong - AG 2   |
| 4   | Alarm test valve                    | 13   | Strainer                        |
| 5   | Drip check valve                    | 14   | Drain valve                     |
| * 6 | Valve seat                          | 15   | Retard chamber                  |
| * 7 | Vent valves                         | * 16 | Alarm shut-off valve            |
| 8   | Shut-off valves for pressure gauges | 17   | Non-return valve                |
| 9   | Pressure gauge for pipe work        | 18   | By-pass pipe                    |



- Quartzoid bulb with different temperature set point.
- The commonly used by JAPS are
  - the yellow bulb (79°C)
  - and green bulb (93-100°C).
  - 30°C over the maximum expected temperature



## **CO2 Fire Fighting System:**

The system uses carbon dioxide as the extinguishing agent.

- The CO2 is chemically neutral, color & odorless gas, electrically non conductive, it leaves no residues and it is non-corroding.
- It suffocates the fire by decreasing the oxygen content of the air to at least 15 VOL%.
- The CO2 penetrates the flooding area (switch gear, cable, relay & battery rooms) rapidly and evenly.
- There are multi area CO2 system, which consists essentially of an appropriate number of CO2 cylinders arranged in groups in racks (where CO2 is pressurized into liquid) calculated for the largest space to be protected, the necessary valves and a permanently laid network of piping with discharge nozzles suitable to be distributed to the desired location.
- Multi area systems are provided with an installed 100% spare CO2 capacity.

The evacuation time (retardation of release) is done once by an electrical delay time (1 to 255 sec) usually less than 60 sec, and twice with a mechanical delay time in the release box (1 to 30 sec).

The CO2 release can be stop during the electrical time delay by hold push button.



CO2 Room



CO2 Release Piston valves



Mechanical  
Timer

Solenoid  
valve



CO2 release nozzle

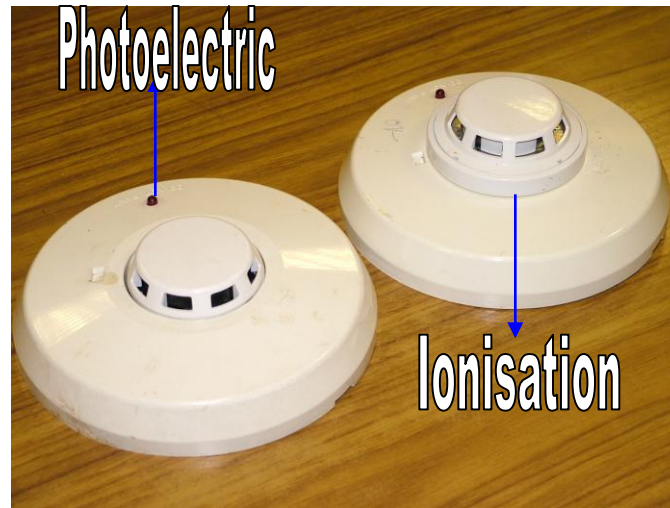
# Foam system

- Foam forms a coherent floating blanket on flammable and combustible liquids lighter than water.
- it extinguishes fire by air injection into the foam solution.
- The protected areas are: auxiliary boiler burner plant, fuel oil tank.
  
- A wet, heavy fire fighting foam is obtained by adding a low percentage of air to a foam & water mixture.
  
- foam classified as follows:
  - Low expansion foam: at rate of 1: 5 to 1: 7, rapid spreading, used in burning liquids, gas line, oils
  - Medium expansion foam: at rate of 1: 40 to 1: 150, fluid and intensive to heat, used in ground level, store rooms
  - High expansion foam: up to 1: 1000, dry, very light, used in large rooms, production halls.



1. Photoelectric: it installed within the cable tunnels and floor voids,
- it's fitted with a pulsating LED to indicate the power and it glows continuously to indicate an alarm.
  - It uses a stable LED light source and silicon photodiode as a receiving element.
  - Under normal condition, the light sensor does not have the ability to detect the pulsing LED light because it's out of the light beam direct bath.
  - When the smoke enters the sensing chamber, light from the pulsing LED light source is reflected by the smoke particles onto the surface of the photodiode light sensor.

1. Ionisation: installed within the offices, floor and ceiling voids.
- The detector incorporates a single radioactive source and an inner reference chamber.
  - The presence of smoke particle will result to a change in the chamber voltage and this will be measured by the detector and transmitted to the control panel area.



*Smoke Detectors*

Heat detectors:

- They are installed in turbine enclosure, cable tunnels, and kitchens.
- Heat detector is a combination rate of Rise/ Fixed temperature sensor.
- The rate of rise operation is selectable in either (8.3°C, 11.1°C) / min.
- Fixed temperature is selectable for 47.2°C, 57.2°C alarm initiation.

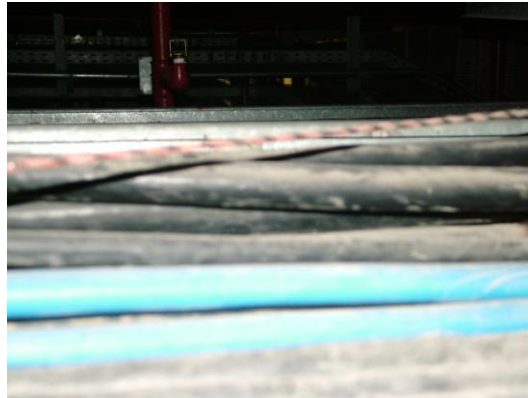


Heat detector



## Linear Heat Detector:

- (Protect wire linear heat detector)
- The main component is the proprietary cable that detects heat conditions anywhere along its length.
- The sensor cable is comprised of two steel conductors individually insulated with a heat sensitive polymer.
- The insulated conductors are twisted together to impose a spring pressure between them, then wrapped with a protective tape and finished with an outer jacket suitable for the environment in which the detector will be installed



Linear Heat Detector

## Flam detector:

- UV/IR: it is the ultraviolet and infrared detector, which consists of an ultraviolet phototube that responds to radiation in (185 to 260) nanometer region when the radiation strikes the cathode.
- This will cause a movement of electron (Cathode (-ve) to the Anod (+ve)) is going faster when the flam radiation is more.
- The detector will give alarm only if it detects (UV and IR) to gather.



Flame detector



## Gas detection:

- The gas detection comprises of gas sensor located in GT Enclosure, gas-receiving plant (NGPRS), and Electro chlorination plant (sea water intake system).
- It is used for measuring the concentrations of combustible gases in the range of (0-100%) lower explosion level (LEL).
- The gas sensor consists of two catalytic bead sensors, one used as a reference other located in sampling chamber.
- When the gas/air mixture enters the sensor above 25% LEL, this will operate a warning of gas being present.
- Usually trip at 60 %



Gas detector

# Emission Limits

<b>Substance</b>	<b>Fuel Type</b>	<b>Emission Limit ppmV</b>
Carbon Oxides (CO & CO <sub>2</sub> )	All	1309
Sulphur Oxides (SO <sub>2</sub> & SO <sub>3</sub> )	All	190
Nitrogen Oxides (NO & NO <sub>2</sub> )	Gaseous Fuel	37
	Other Fuel	80

Emission Control:

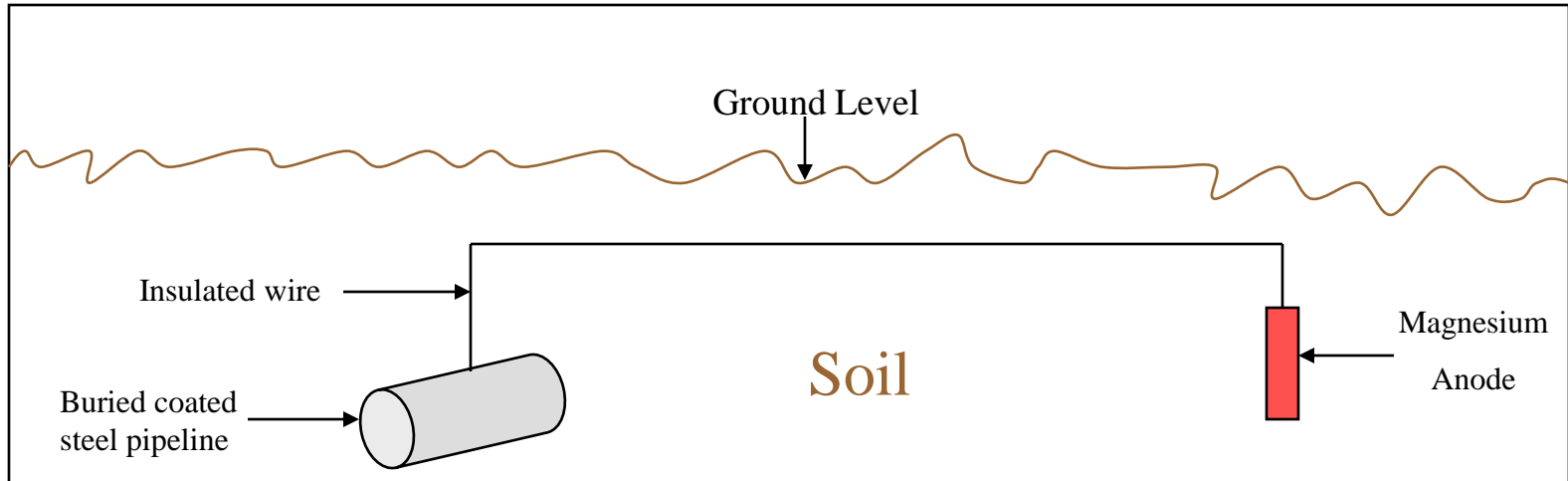
- Water pr steam injection (diffusion flame)
- Premix combustion
- Catalytic clean up of Nitrogen Oxides & Carbon monoxide
- Continues emission monitoring system

# Underground Services

- Sea Water & Product Distillate.
- Potable & Service Water.
- Fire Fighting.
- Oil Drainage.
- Chemical Drainage.
- Sewage & Irrigation.
- Fuel Lines.
- Earthing System.
- Electrical Cables.
- Etisalat Cables.

# Cathodic Protection

## *Sacrificial Anode*



## *Impressed Current*

