Cooling Water Unit

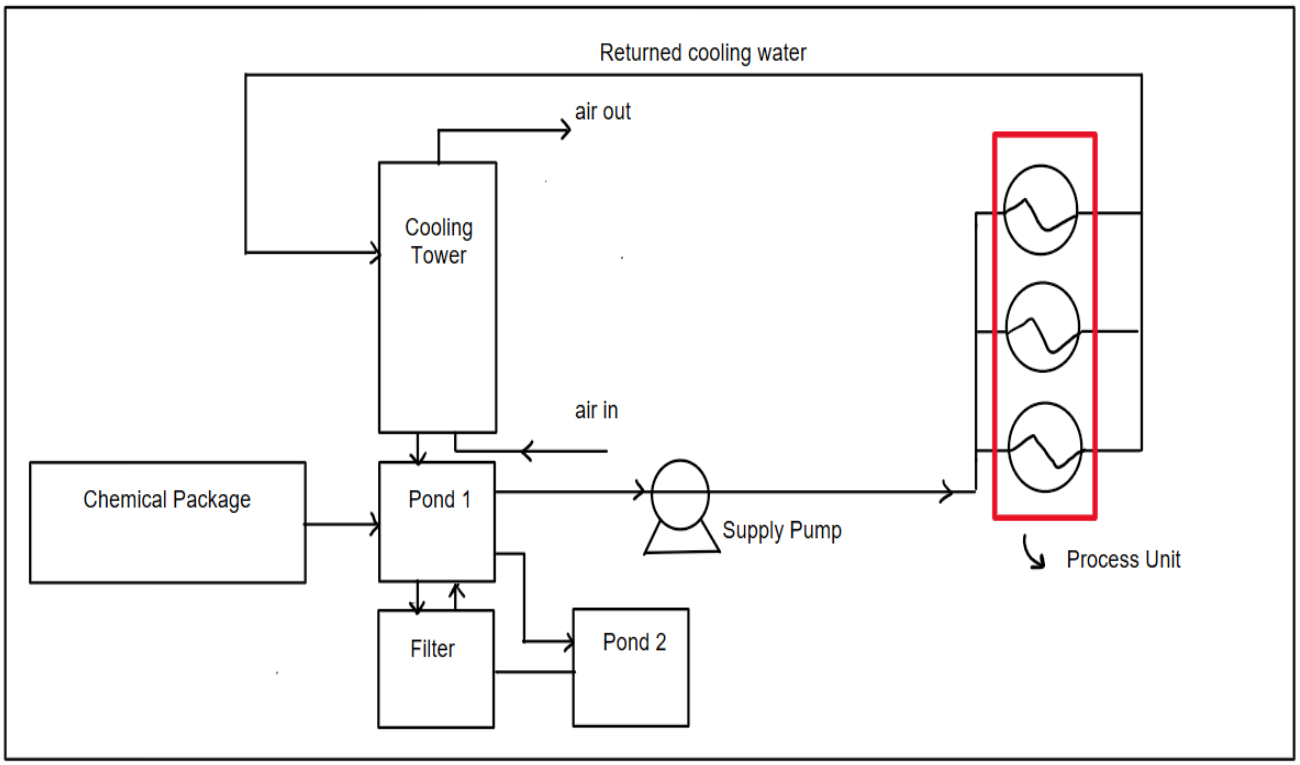
Description

Purpose of cooling water is to cool down hot stream

Cooling water unit components

- Cooling towers. to reduce returned cooling water by means of heat transfer between air and hot returned cooling water
- Chemical package: to protect piping against corrosion and keep PH in the range
- Pumps: to supply cooling water to process units.
- Filters: to remove particles from cooling water stream.
- Ponds: to store/ hold-up cooling water

So we need a int to incorporate the above components sth like below:



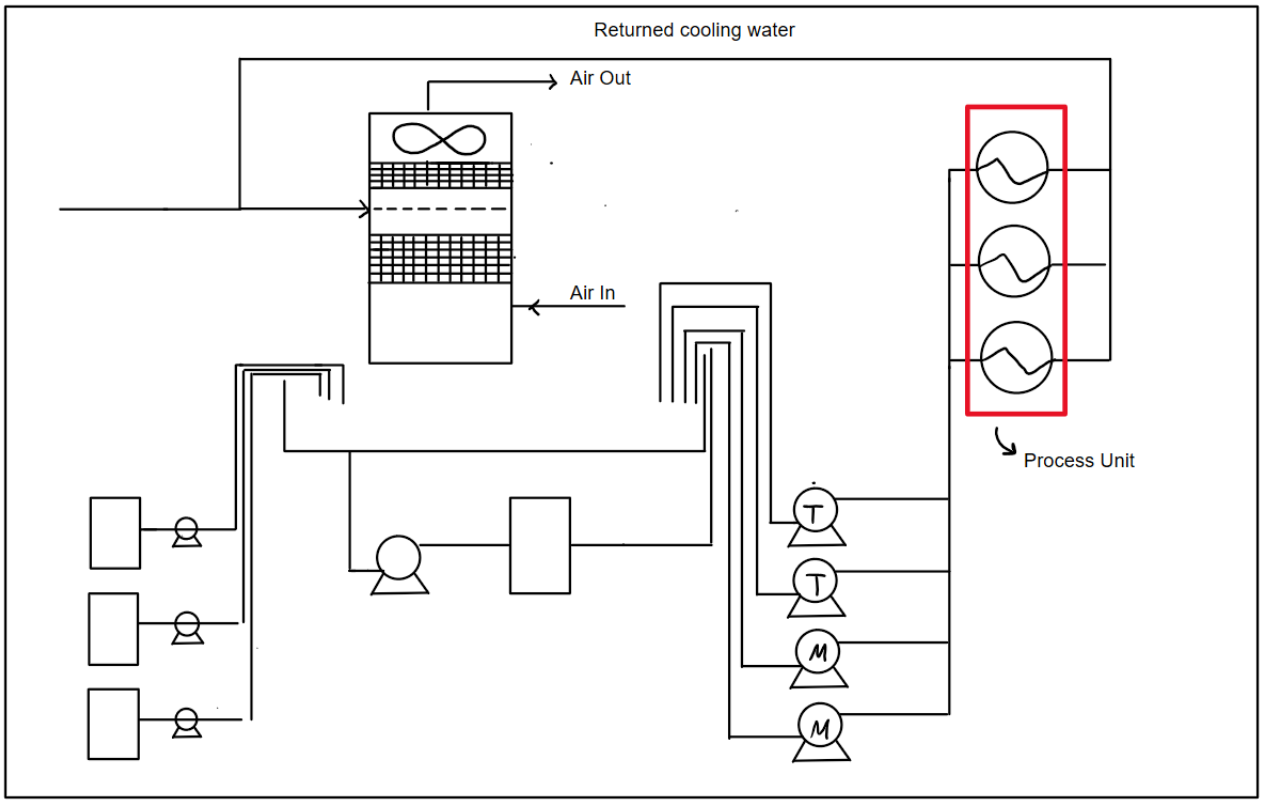
Now let's detail it:

1. Cooling towers
   - In order to increase heat transfer between air and hot returned cooling water, it is anormal practice to install packings.
   - In order to take out the air we need to have a fan

Chemical package
- we need to have a dosage of chlorination to remove bacteria/ algae, a dosage of corrosion inhibitors to prevent corrosion, a dosage of dispersant to prevent agglomeration
- Since we need to store them, we need storage tanks for each chemicals
- We also need to pump the chemicals; therefore, we need pumps. Note that for chemicals it is a normal practice to use reciprocating pumps.

3. Make-up water
   - Since we have evaporation, we need to add water to returned water to make up for the loss.
   - In order to control its flow rate, we need a control value to regulate the flow. Notice that in control rooms we check level of Pond 1 (basin) instead of flow; thus we use a It not a FV

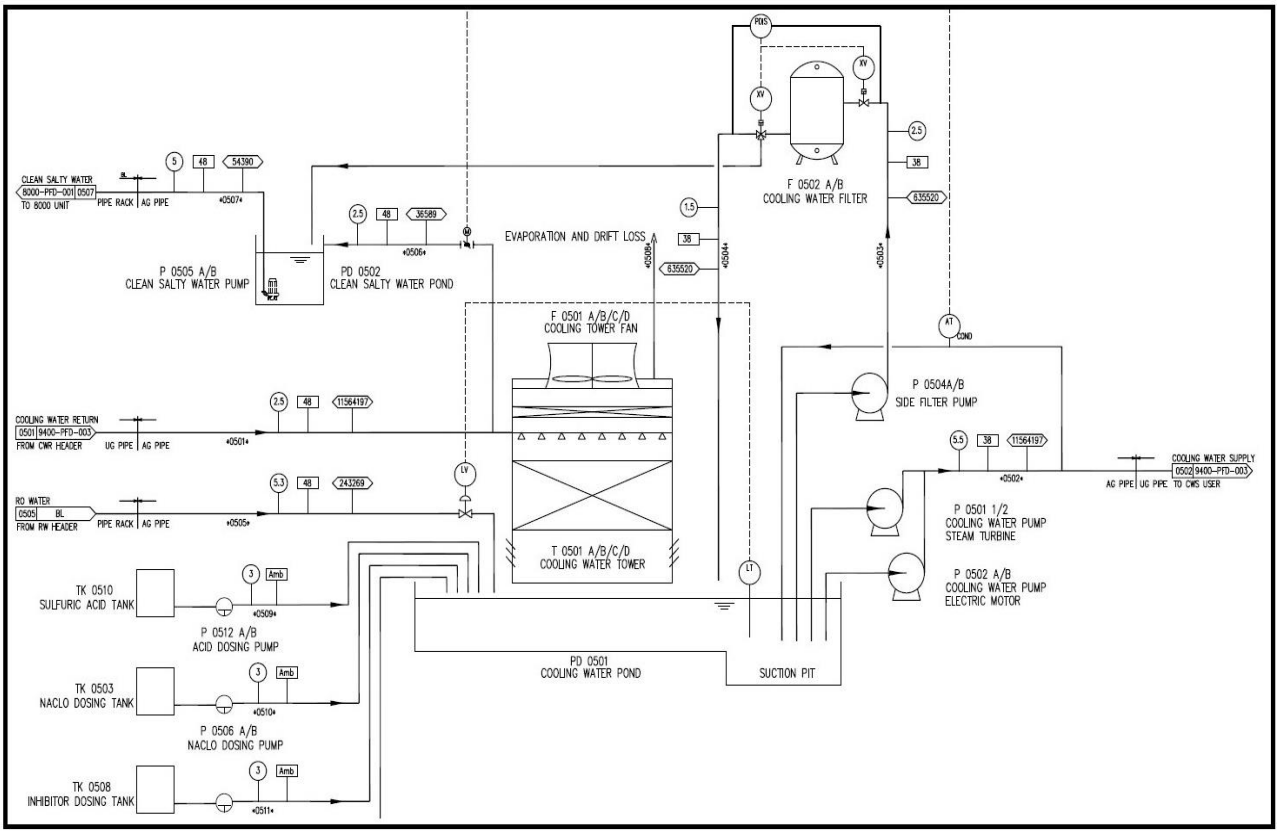
4.Pumps
- Since the demand of cooling water from process units is very high (5000-40000ton/hr.), then we need minimum 2 pumps.
- Because of energy optimization, it is a normal practice to use turbine-driven pumps alongside motor-driven pumps.
- We also need a circulation pump to send a part of cooling water to filters.



Note: In actual and practical PFD, we are supposed to demonstrate flow rate, temperature, pressure. Here are some of these information we need for the PFD:

- Dry bulb temperature 48
- Wet bulb temperature 33
- Barometric pressure 990~1100 bar
- The cooling water system operating data as follow:
- The normal cooling water demand is 11694m3/h
- The maximum cooling water demand is 13477m3/h
- Cooling water supply pressure (B.L. of Process Unit): 4.5Barg
- Cooling water return pressure (B.L. of Process Unit): 2.5Barg
- Cooling water supply temperature: 38
- Cooling water return temperature: 48
- Concentration ratio: 4
- Makeup water normal consumption: 246 m3/h
- Makeup water max consumption: 283 m3/h
- Normal blow down: 37 m3/h
- Max blow down: 43 m3/h

If we incorporate the above data in previous PFD, then it would become like this.



Now let's review what we have learnt.

The heated circulating water returns into the cooling tower by residual pressure, and goes through the packing then into the water pond (PD 0501) after heat exchange with air. The cooling water is delivered to the user by the cooling water supply pumps(P0501 1/2, P0502 A/B). Screen will be installed on the suction pit and conical strainer will be installed in suction pipe of cooling water pump. The makeup water source of the cooling water system is the pretreated water. The blow down is pumped to the clean salty water piping system and finally discharged to the outside of the plant. Two rows of side filters are applied for cooling water system and each row consists of 8 sets of filters. When the pressure difference of filter arrives at 0.5bar, the automatic valve on the outlet will be closed. At the same time, the 3-way valve of the first filter will shift to the backwash channel. The backwash water will be drained to Clean Salty Water Pond PD 0502 from the outlet of 3-way valve. After the backwash procedure, 3-way valve will shift the inlet direction. The backwash for 8 sets of filters will be finished one by one, and then the valve on the outlet will be open. Chemical dosing facility is applied for the cooling water system, that intends to prevent scaling, corrosion and deposit. And the sodium hypochlorite is added intermittently for control of biological growth. The chemical dosing system includes NaClO solution, inhibiter solution, anti-scale solution and H2SO4 dosing system. Main equipment technological parameters as follows: Cooling tower(T0501A/B/C/D), four cells, three run and one standby, the capacity of each cell: Q=4500m3/h. The clapboard material is reinforced concrete and the maintenance structure is FRP. The size of each tower will be 17000x17000mm. Fan, four sets, three run and one standby, design parameters of each fan: D=9.75m, P=200kW. Three are running and one is standby.

Cooling water pump(P0501 1/2), two sets, two run, steam turbine driven, design parameters of each pump: Q 4500m3/h, H 55m. Cooling water pump(P0502A/B), two sets, one run and one standby, electric driven, design parameters of each pump: Q 4500m3/h, H 55m, P 1120kW. Side filter, two groups, the filter capacity is 320m3/h.

Pictures

Cooling Water Unit Overview

Pumps

Filters

Chemical Package

Pond