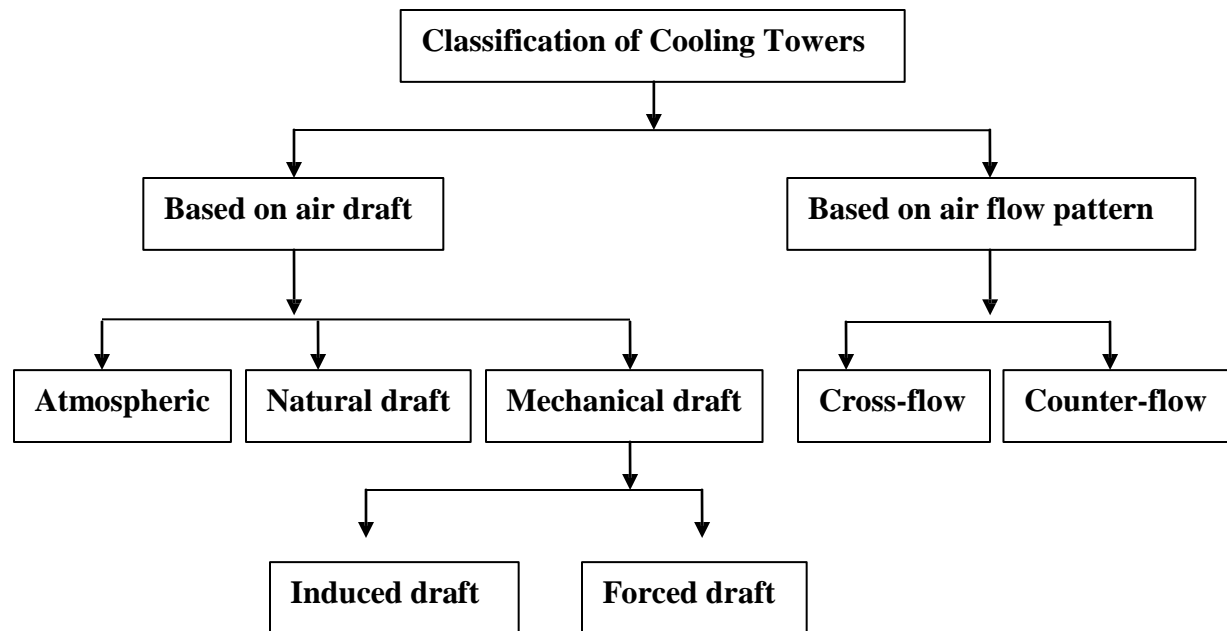
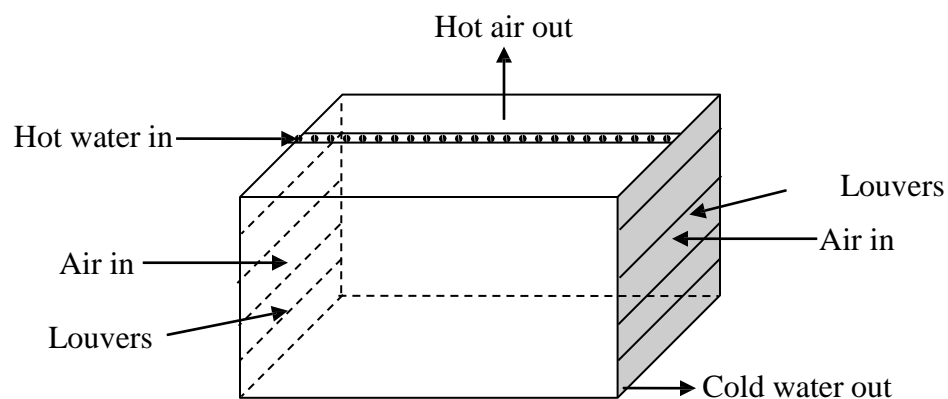


## ***Types of equipment – Cooling Tower***



### **(A) Atmospheric Towers**

It is a big rectangular chamber with two opposite 'louvered' walls. Tower is packed with a suitable 'tower fill'. Atmospheric air enters the tower through louvers driven by its own velocity. Direction and velocity of wind greatly influence its performance. Figure 1 shows the schematic of the atmospheric cooling tower.



**Figure 1: Schematic of atmospheric cooling tower.**

## (B) Natural Draft Towers

A natural draft cooling tower has a large reinforced concrete shell of hyperbolic shape (also called 'hyperbolic tower'). Natural flow of air occurs through the tower; hence it is called natural draft (refer Figure 2).

### ***Factors responsible for creating natural draft***

- (a) A rise in temperature and humidity of air in the column reduces its density
- (b) Wind velocity at the tower bottom

Fan is used to enhance the air flow rate in fan assisted natural draft tower. The typical diameter of tower is 150 m and capacity is 5,00,000 gallon/minute.

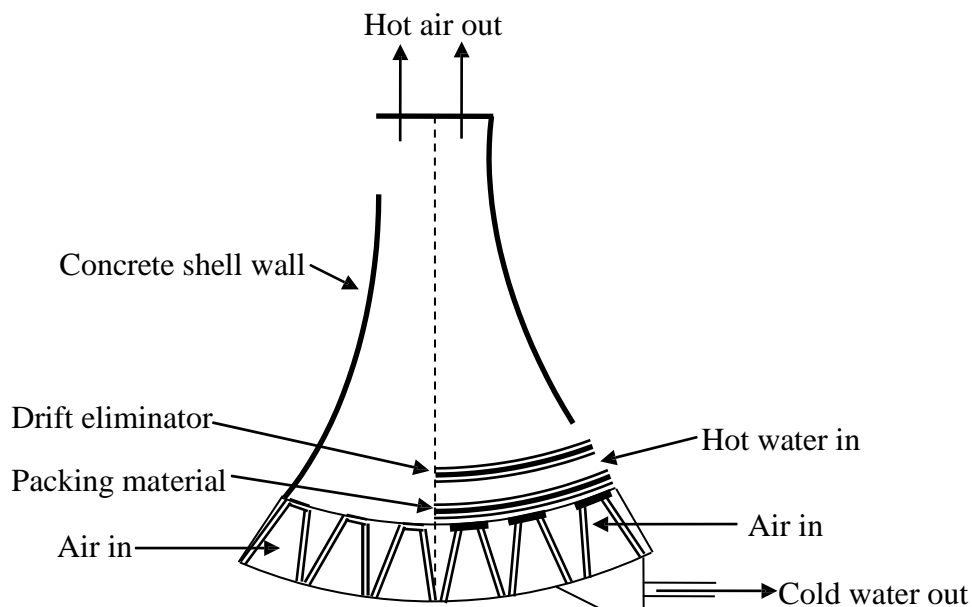


Figure 2: Schematic of natural draft tower.

### ***Why hyperbolic shape?***

- (i) *More packing materials can be placed at the bottom*
- (ii) *The entering air gets smoothly directed towards the centre*
- (iii) *Greater structural strength and stability*

**(C) Mechanical Draft Towers: forced draft towers and induced draft towers**

Fans are used to move air through the tower in mechanical draft cooling towers. Two types of mechanical draft towers are there, namely, forced draft tower and induced draft tower.

**Forced draft towers:** It can be seen from Figure 3 that it has one or more fans located at the tower bottom to push air into tower.

Advantages:

- (a) A part of the velocity head of air thrown by the blower is converted to pressure head on entering into the tower. It makes energy efficient than induced draft.
- (b) Less susceptible to vibrations as fans are installed near the ground.

Disadvantages:

- (a) Air flow through the packing may not be uniform
- (b) Some of the warm and humid air may be recirculated back. Recirculation rate becomes low if the wind velocity is high. It is not popular except for small capacities.

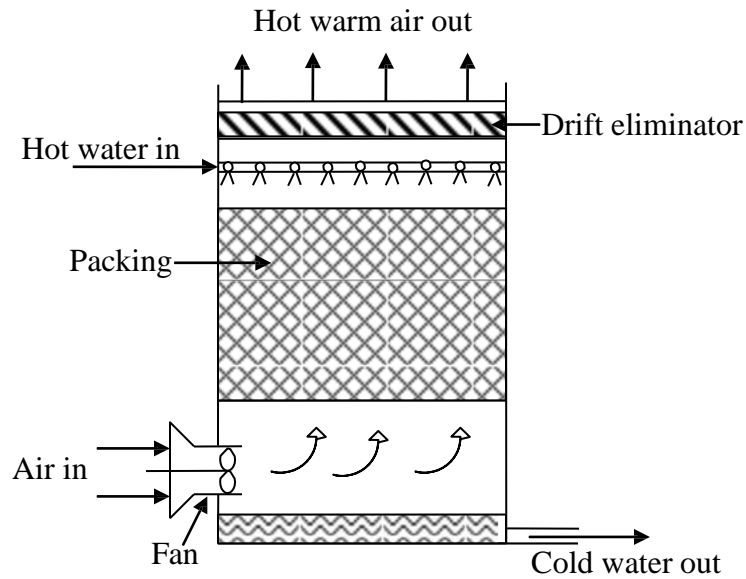


Figure 3: Schematic of forced draft towers.

**Induced draft towers:** One or more fans are installed at the top of the tower. Depending on the air inlet and flow pattern, induced draft towers are of two types, cross-flow and counter flow towers.

***Major advantages of countercurrent induced draft cooling tower***

- (a) Relatively dry air contacts the coldest water at the bottom of the cooling tower
- (b) Humid air is in contact with the warm water and hence maximum average driving force prevails for both heat and mass transfer.

***Disadvantage of induced draft towers compared to forced draft towers***

It consumes more horse power.

Cross-flow induced draft cooling tower requires less motor horse power than countercurrent induced draft cooling towers.

**(D) Cross-current and counter-current**

Cross-flow induced draft cooling tower supplies horizontal air flow along the packed height and requires less motor horse power than the counter-flow type. Additional 'cells' may be added to raise the capacity. The schematic of induced draft counter-flow and cross-flow cooling towers are presented in Figure 4 and Figure 5, respectively.

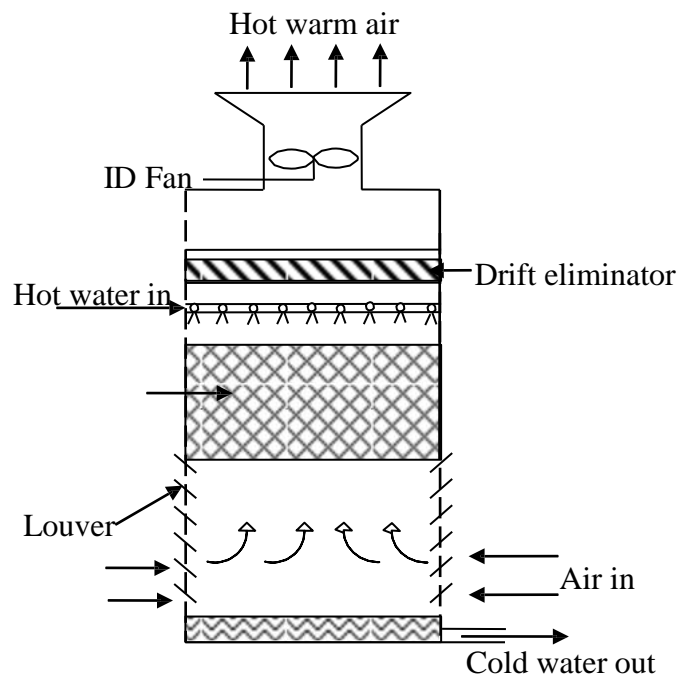


Figure 4: Schematic of mechanical draft counter-flow tower.

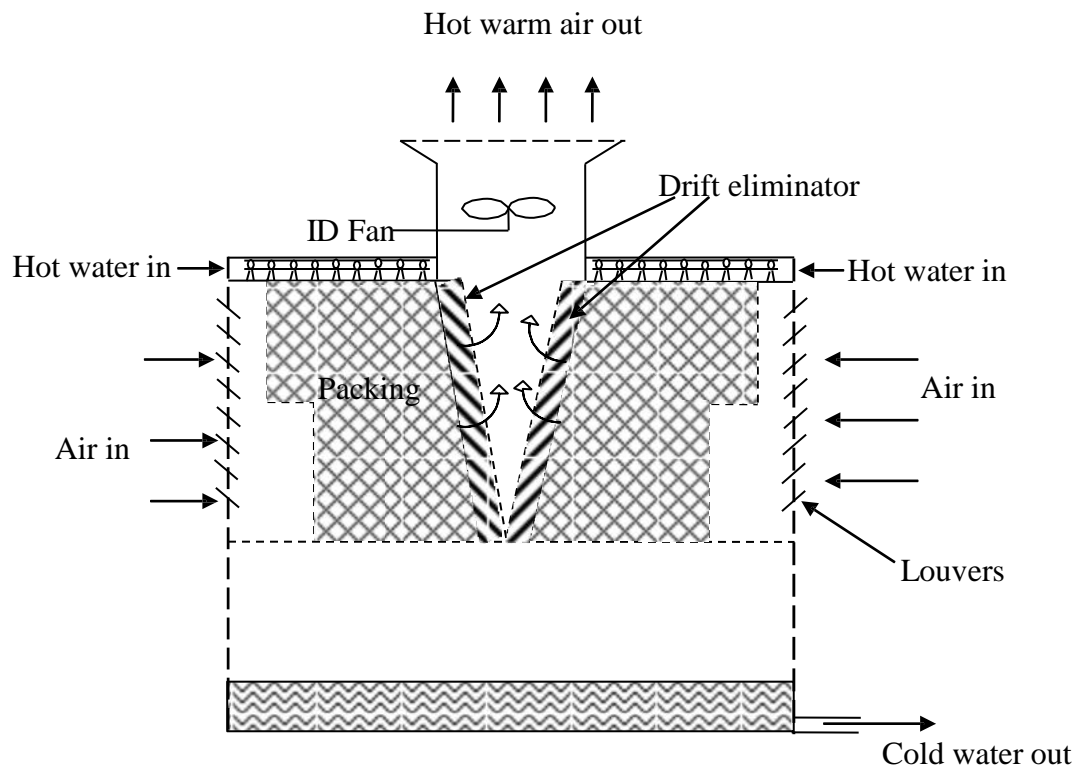


Figure 5: Schematic of mechanical draft cross-flow tower.