It is employed for boilers of medium pressure range. Here a number of vertical tubes made of cast iron are connected to common headers at the bottom and top. Feed water flow into the bottom header and then through the vertical tubes flow out from the top header. Hot flue gases escaping from the boiler are directed to flow across the outside surface of tubes thus indirectly heating the feed water flowing inside. To avoid deposit of soot over the tube surface, tubular scrapers are fitted over the tubes. These are operated by chain and pulley system and while moving up and down slowly scrap the soot over the wall of tubes and so increase the heat transfer rate. An internal tube economizer is fitted inside the boiler and is an integral part of it.

Advantages of Economizer

1. Stresses produced in the boiler material due to temperature difference of boiler material and feed water are reduced because of increase in feed water temperature.

2. Evaporative capacity of boiler increases as less heat will be required to generate steam if feed water temperature is already high due to preheating.

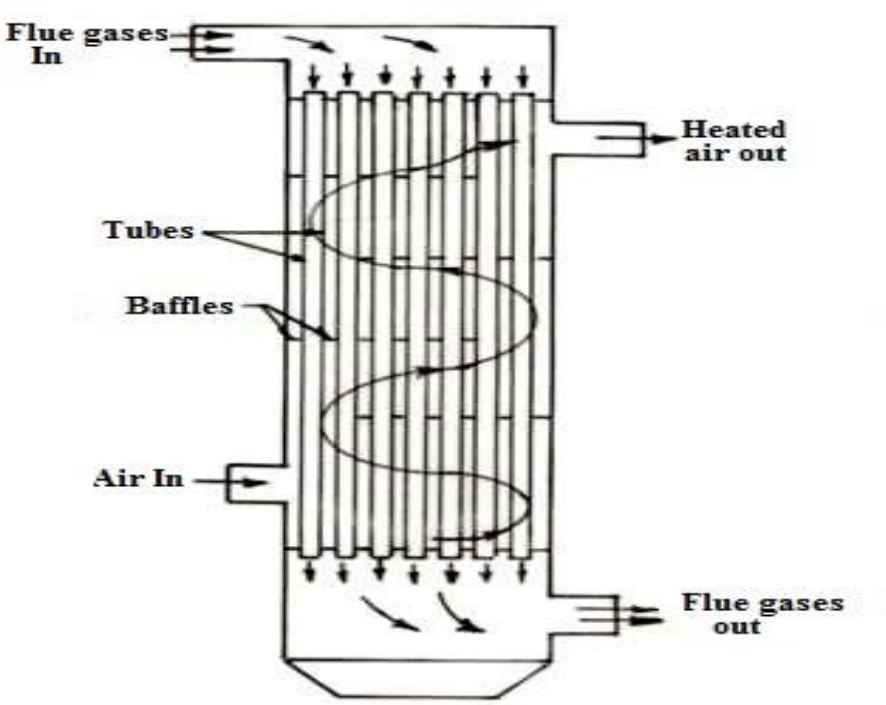
3. Overall efficiency of boiler increases because of more steam produced per kg of fuel burnt.

Air Pre-heater

Air Pre-heater (Tubular Type)

Function

The function of air pre-heater is to further utilize the heat of flue gases after coming out of economizer to preheat the air used in furnace or oil burner.



Construction

It is a plate type or tubular type or storage heat exchanger, in which flue gases pass through the tubes on one side of plate and air pass on other side. In storage type a rotor fitted with mesh or matrix alternatively come in the passage of flue gases and air thus exchanging heat.

Super heater

The function of super heater is to increase the temperature of steam beyond its saturation temperature. It is a type of heat exchanger. Hot flue gases coming out of burner are first directed through super heater before the boiler. The main advantage of superheating of steam comes in power plants, where steam is expanded through a turbine. But in a processing industry superheating is required only to avoid condensation in pipes. Thus super heater has less advantage or use in a processing industry and many times not used but not always.

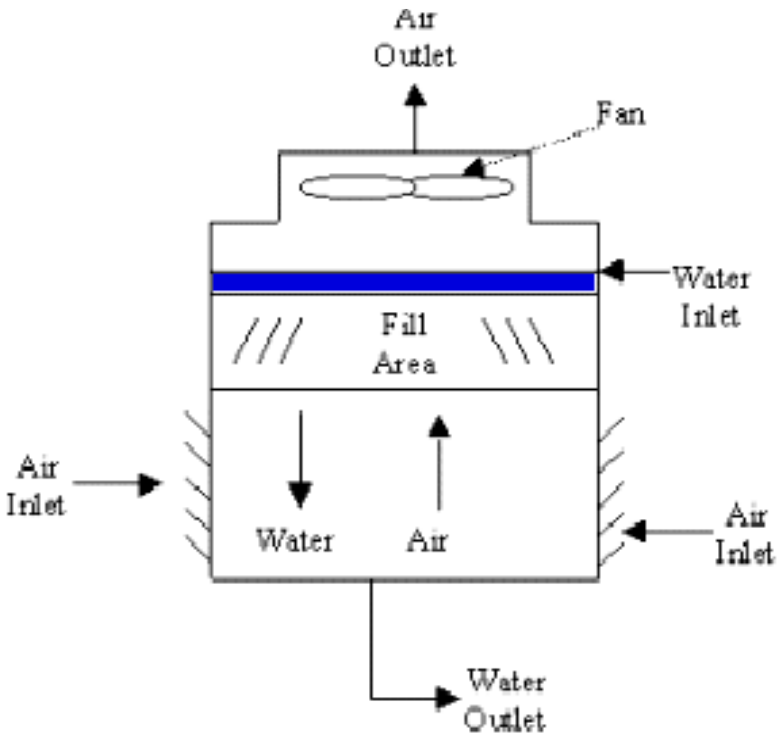
Cooling Towers

• Cooling towers fall into two main sub-divisions: natural draft and mechanical draft. Natural draft designs use very large concrete chimneys to introduce air through the media.

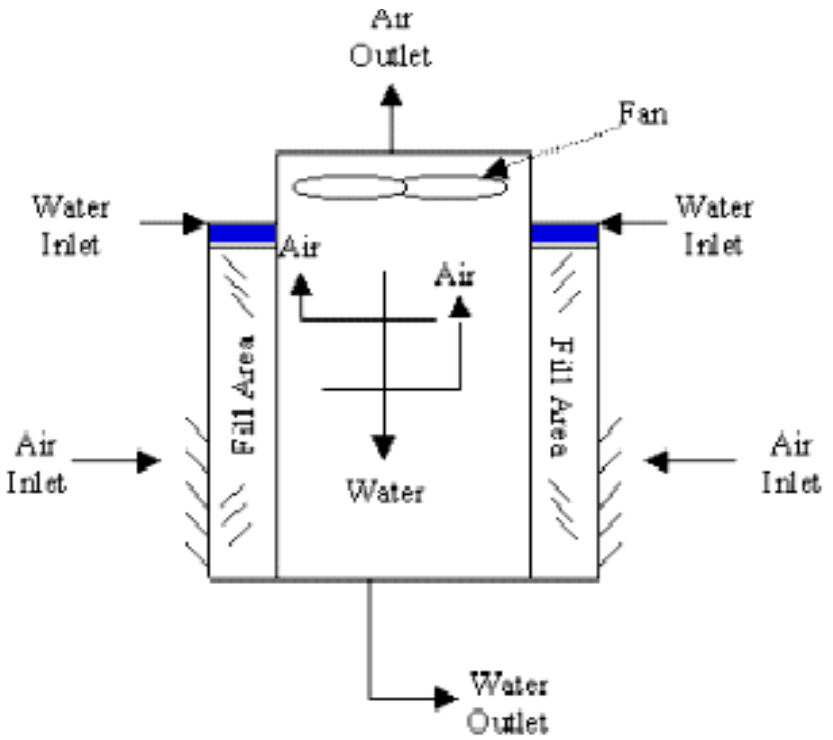
• Mechanical draft cooling towers are much more widely used. These towers utilize large fans to force air through circulated water. The water falls downward over fill surfaces which help increase the contact time between the water and the air. This helps maximize heat transfer between the two.

• Heat is transferred from water drops to the surrounding air by the transfer of sensible and latent heat

Types of Mechanical Draft Towers



Counter Flow Tower



Cross Flow Tower

COOLING TOWER BASICS

Basic of Cooling Tower:- Water flow rate. Approach (difference between outlet water & wet bulb temperature) Range (difference between inlet & outlet temperature). Hot water temperature (HWT). Cold water temperature (CWT). Wet bulb temperature (WBT). Liquid to air ratio (L/G).

• What factor affecting for CT performance:- Inadequate or excess water flow. Inadequate or excess air flow. Type, quality & spacing of fills. Type of drift eliminators. Type & spacing of nozzles. Motor rating, Fan & Gear box type.

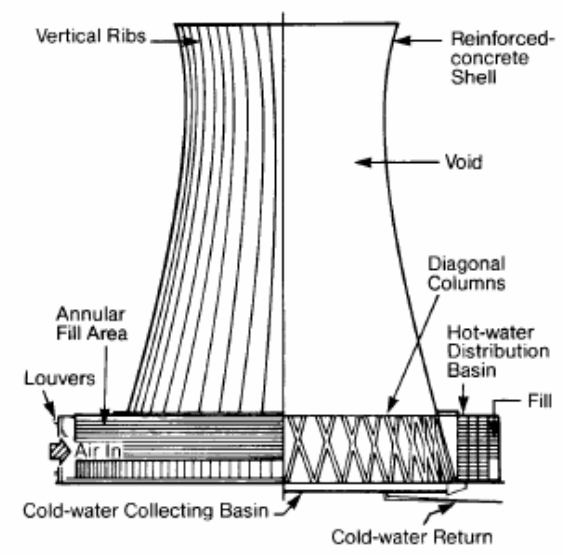


Figure 2. Cross flow natural draft cooling tower

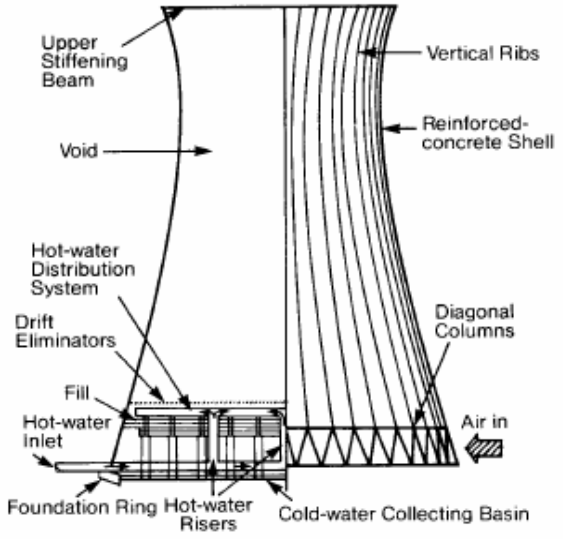


Figure 3. Counter flow natural draft cooling tower

Types of Mechanical Draft Cooling towers

•Counter flow induced draft

•Counter flow forced draft

•Cross flow induced draft

Cross flow induced draft towers

Hot water enters at the top and passes over the fill.

•Air is introduced at the side, either on one side (single flow tower) OR opposite sides (double flow tower)