Cooling Towers

A cooling tower is equipment used to reduce the temperature of a water stream by extracting heat from water and emitting it to the atmosphere. Cooling towers make use of evaporation whereby some of the water is evaporated into a moving air stream and subsequently discharged into the atmosphere. As a result, the remainder of the water is cooled down significantly.

Cooling towers are able to lower the water temperatures more than devices that use only air to reject heat, like the radiator in a car, and are therefore more cost-effective and energy efficient. The makeup water source is provided to replenish water lost in evaporation. Hot water from the condenser is sent to the cooling tower. The water exits the cooling tower and is sent back to the exchanger or other unit to produce cooling

Classification of cooling Towers:

The cooling towers are mainly classified according to the method by which air is introduced into the tower. In order to make the study of towers more convenient there are some other criteria on which the cooling towers may be classified. These classifications are given here,

1) Classification on the basis of direction of air-to-water flow
2) Classification on the basis of air flow generation methods
3) Classification on the basis of Heat transfer methods

Classification on the Basis of Air Flow Generation Methods:

The natural draft cooling tower makes use of the difference in temperature between the ambient air and the hotter air inside the tower. As hot air moves upwards through the tower (because hot air rises), fresh cool air is drawn into the tower through an air inlet at the bottom. Due to the layout of the tower, no fan is required and there is almost no recirculation of hot air that could affect the performance

Mechanical Draft Cooling Towers:

Mechanical draft towers have large fans to force or draw air through circulated water. The water falls downwards over fill surfaces, which help increase the contact time between the water and the air - this helps maximize heat transfer between the two. Cooling rates of mechanical draft towers depend upon various parameters such as fan diameter and speed of operation, fills for system resistance etc

Forced Draft Cooling Tower

In the forced draft cooling tower, the hot water is sprayed at the top of the tower and air is forced by the blower from the bottom of the tower. The velocity of 120 m/ min is recommended with a flow of 100 to 130 m^3per min. per ton of refrigeration. These towers are available in counter flow arrangement.

Feed water heater:

In a steam engine, a device to heat the feed water up before it's fed into the boiler. The reason for doing this is that low-pressure exhaust steam, which can do little further work in expansion, is still fairly hot. This thermal energy would otherwise go to waste, so why not use it to heat the water going into the boiler up some? That way, less energy must be expended warming it up once it's in the boiler.

Feed water heaters can be divided into two major categories; direct, and indirect. A direct feed water heater mixes the hot exhaust steam directly with the cold feed water. The heat transfer is done directly. This is obviously the efficient way to go about it, but it has a problem; the steam may have impurities in it you don't want to go into the boiler, particularly lubricating oil from the cylinders or turbine that it was used to drive. Oil in the boiler water can cause foaming, which can render the sight glasses used to monitor boiler water level inaccurate.

The only disadvantage of a feed water heater is that by warming the feed water, it makes it impossible to use an injector to get that water into the boiler. Injectors require the feed water to be cold in order to work.

Re heater:

Power plant furnaces may have a reheater section containing tubes heated by hot flue gases outside the tubes. Exhaust steam from the high pressure turbine is rerouted to go inside the reheater tubes to pickup more energy to go drive intermediate or lower pressure turbines.

Air pre-heater:

Super heater and economizers generally cannot fully extract the heat from flue gases. Therefore, pre-heater are employed which recover some of the heat in the escaping gases. The function of an air pre-heater is to extract heat from the flue gases and give it to the air being supplied to furnace for coal combustion. This raises the furnace temperature and increases the thermal efficiency of the plant. Depending upon the method of transfer of heat from flue gases to air, air pre-heaters are divided into the following two classes.

a). Recuperative Type

b). Regenerative Type

The recuperative type air heater consists of a group of steel tubes. The flue gases are passed through the tubes while the air flows externally to the tubes. Thus heat of flue gases is transferred to air. The regenerative type air pre-heater consists of slowly moving drum made of corrugated metal plates. The flue gases flow continuously on one side of the drum and air on the other side. This action permits the transference of heat of flue gases to the air being supplied to the furnace for coal combustion.