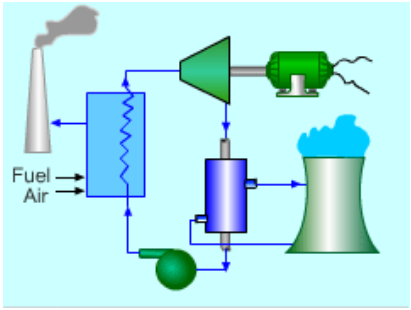

بسم الله الرحمن الرحيم

Thermal Power Stations



Lecture (8)

on

Schematic of a Thermal Power Plant

By

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Major Components of a Thermal Power Plant

3. Boiler

A boiler (or steam generator) is a closed vessel in which water, under pressure , is converted into steam. The heat is transferred to the boiler by all three modes of heat transfer i.e. conduction ,convection and radiation.

Major types of boilers are:

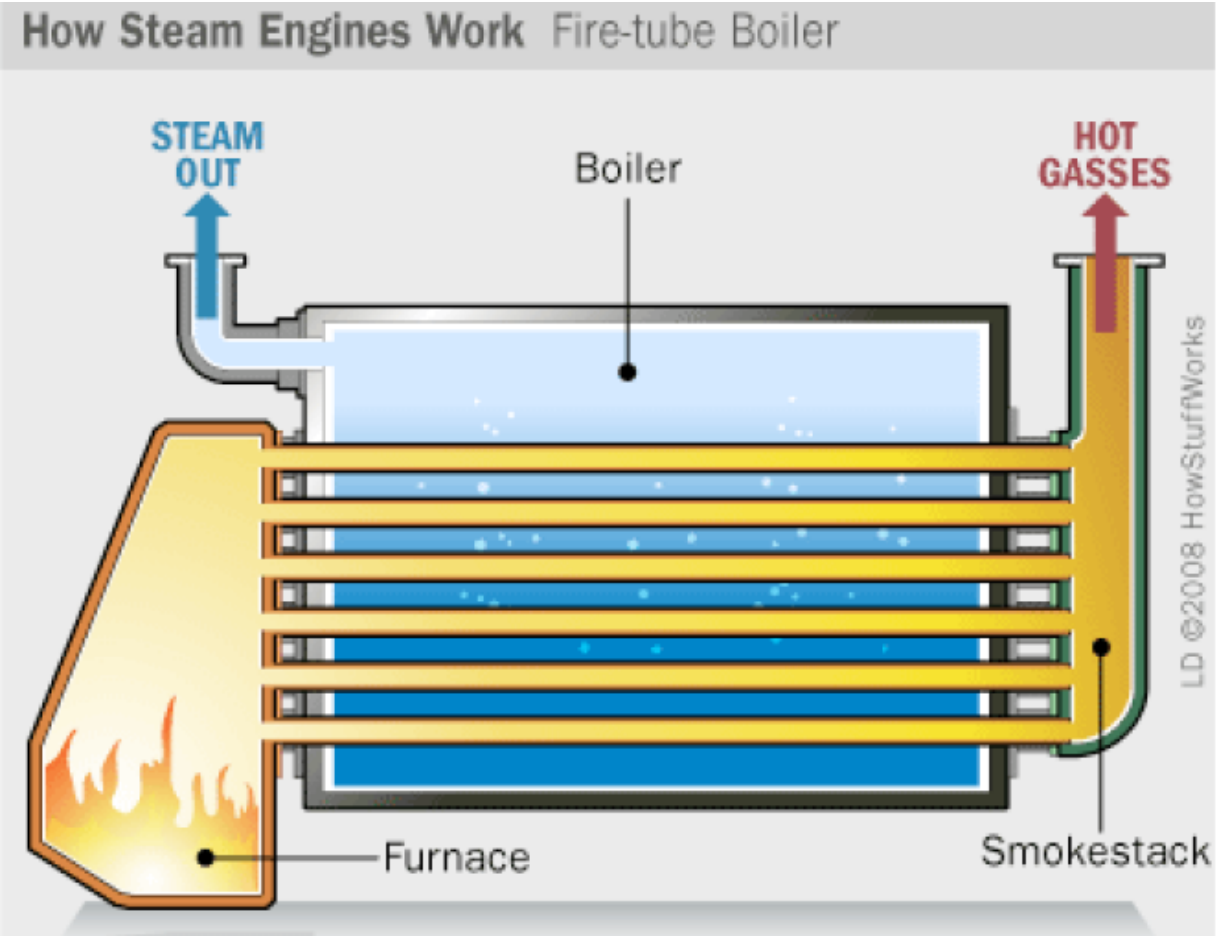
(i) Fire tube boiler

(ii) Water tube boiler

Major Components of a Thermal Power Plant

3. Boiler

Fire Tube Boiler



Major Components of a Thermal Power Plant

3. Boiler

Fire Tube Boiler

The boiler is named so because the production of combustion pass through the tubes which are surrounded by water.

Depending on whether the tube is vertical or horizontal the fire tube boiler is divided into two types:

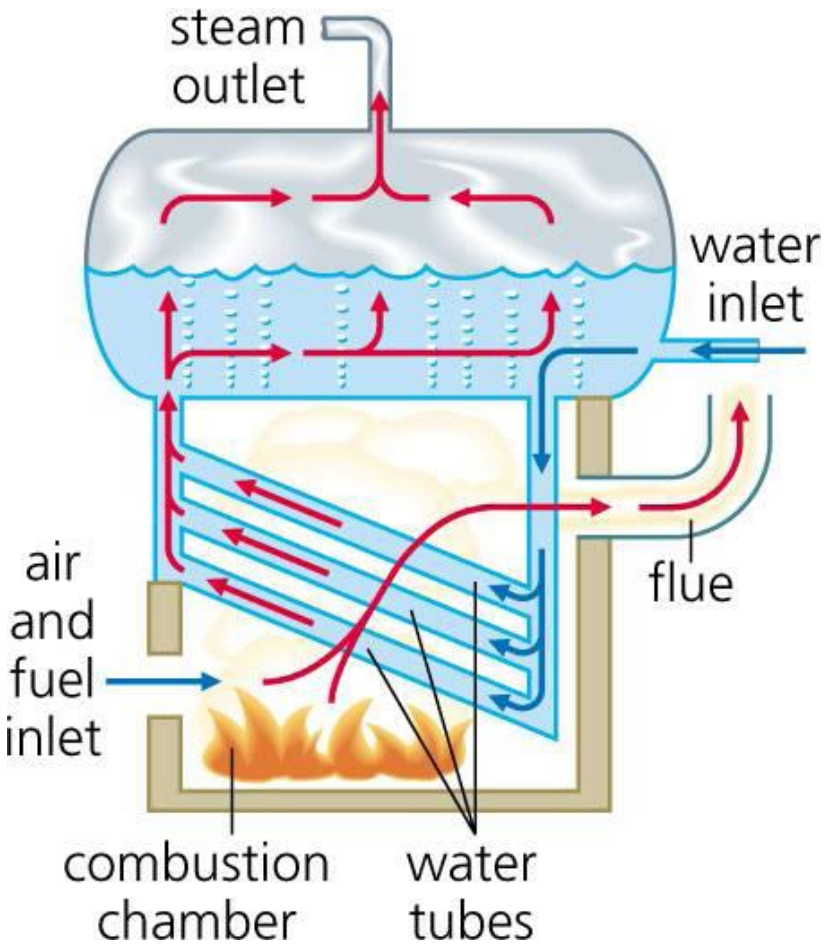
- Vertical tube boiler
- Horizontal tube boiler

A fire tube boiler is simple ,compact and rugged in construction. Its initial cost is low.

Major Components of a Thermal Power Plant

3. Boiler

Water Tube Boiler



Major Components of a Thermal Power Plant

3. Boiler

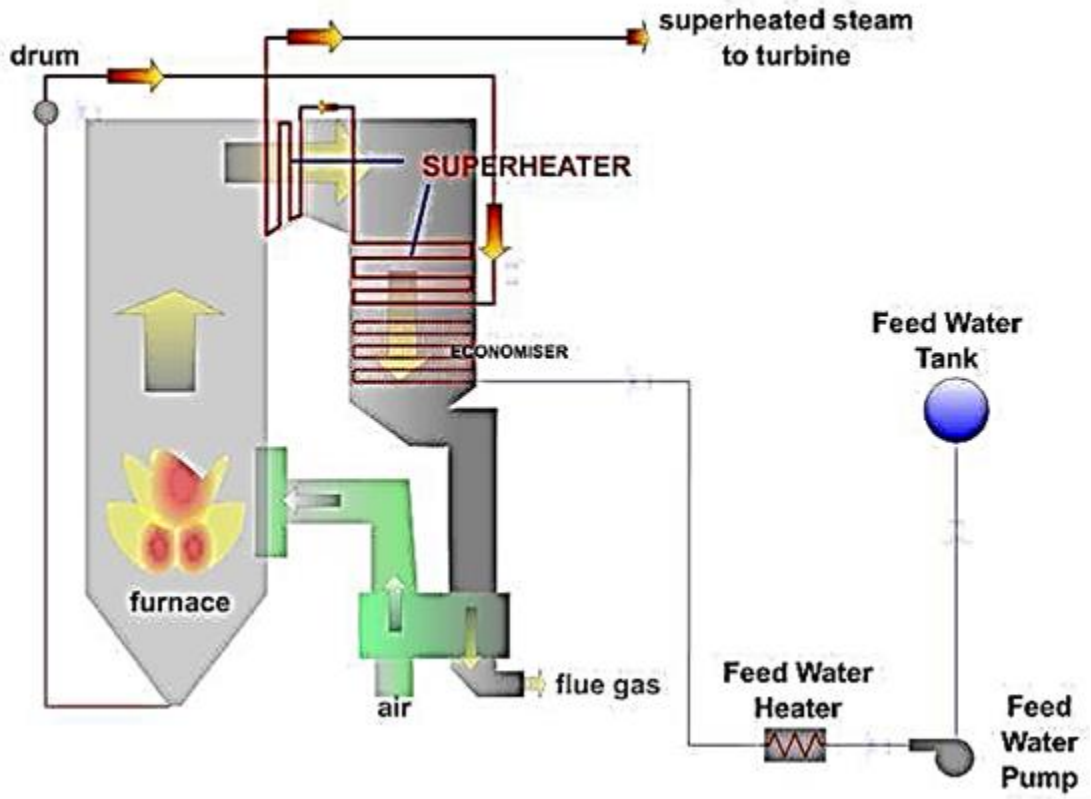
Water Tube Boiler

In this boiler, the water flows inside the tubes and hot gases flow outside the tube .

- Water tube boiler are classified as
- Vertical tube boiler
- Horizontal tube boiler
- Inclined tube boiler
- The circulation of water in the boiler is may be natural or forced.

Major Components of a Thermal Power Plant

4. Superheater and Reheaters



Major Components of a Thermal Power Plant

4. Superheater

- Super heated steam is that steam which contains more heat than the saturated steam at the same pressure. The additional heat provide more energy to the turbine hence power out put is more.
- The function of the super heater is to remove the last trash of moisture from the saturated steam.
- Superheated steam causes lesser erosion of the turbine blades and can be transmitted for longer distance with little heat loss.
- A superheater may be convention type, radiant type or combination.

Major Components of a Thermal Power Plant

4. Superheater

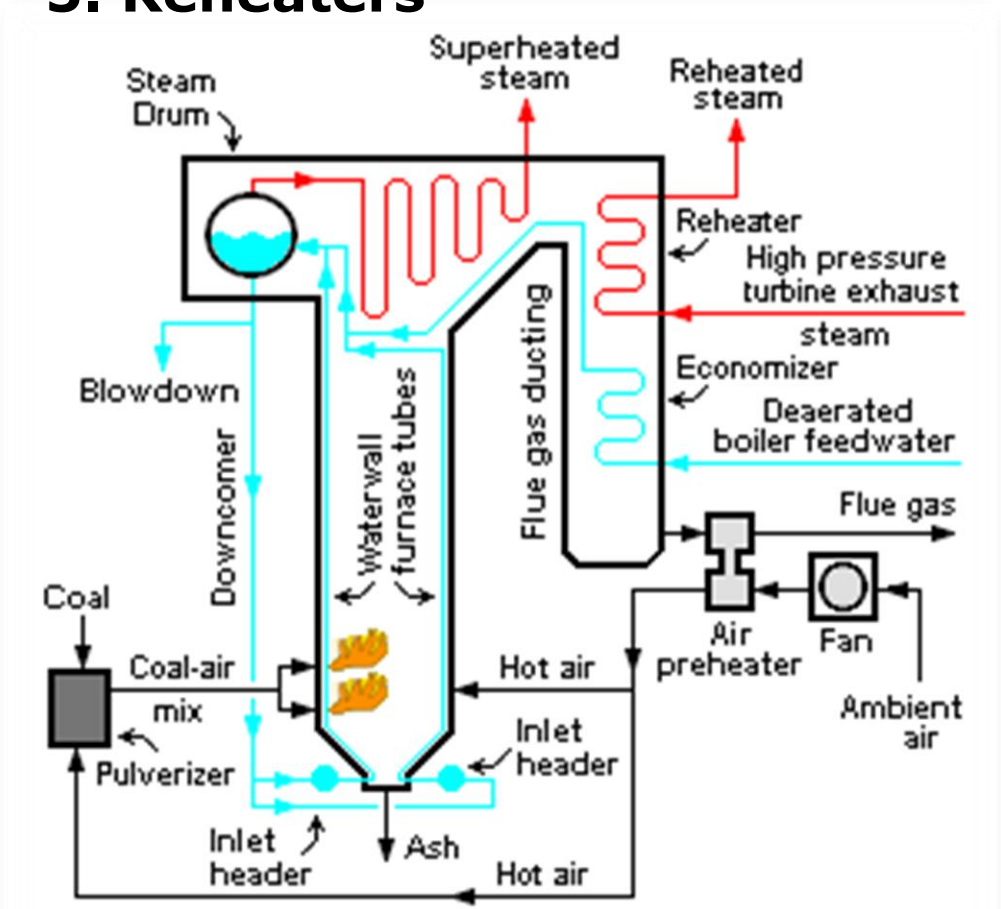
Major Components of a Thermal Power Plant

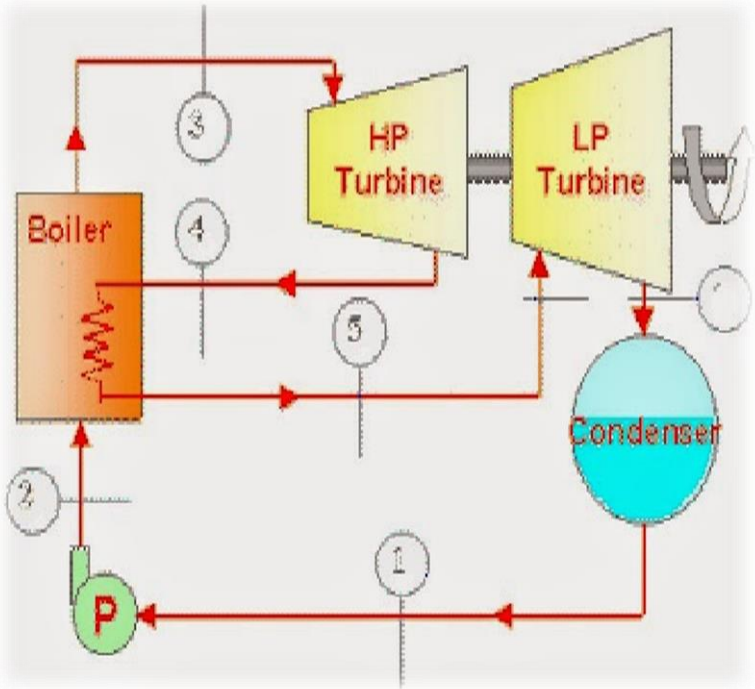
5. Reheaters

- In addition to superheater modern boiler has reheater also. The function of the reheater is to superheat the partly expanded steam from the turbine, this ensure that The steam remain dry through the last stage of the turbine.
- A reheater may be convention type, radiant type or combination.

Major Components of a Thermal Power Plant

5. Reheaters





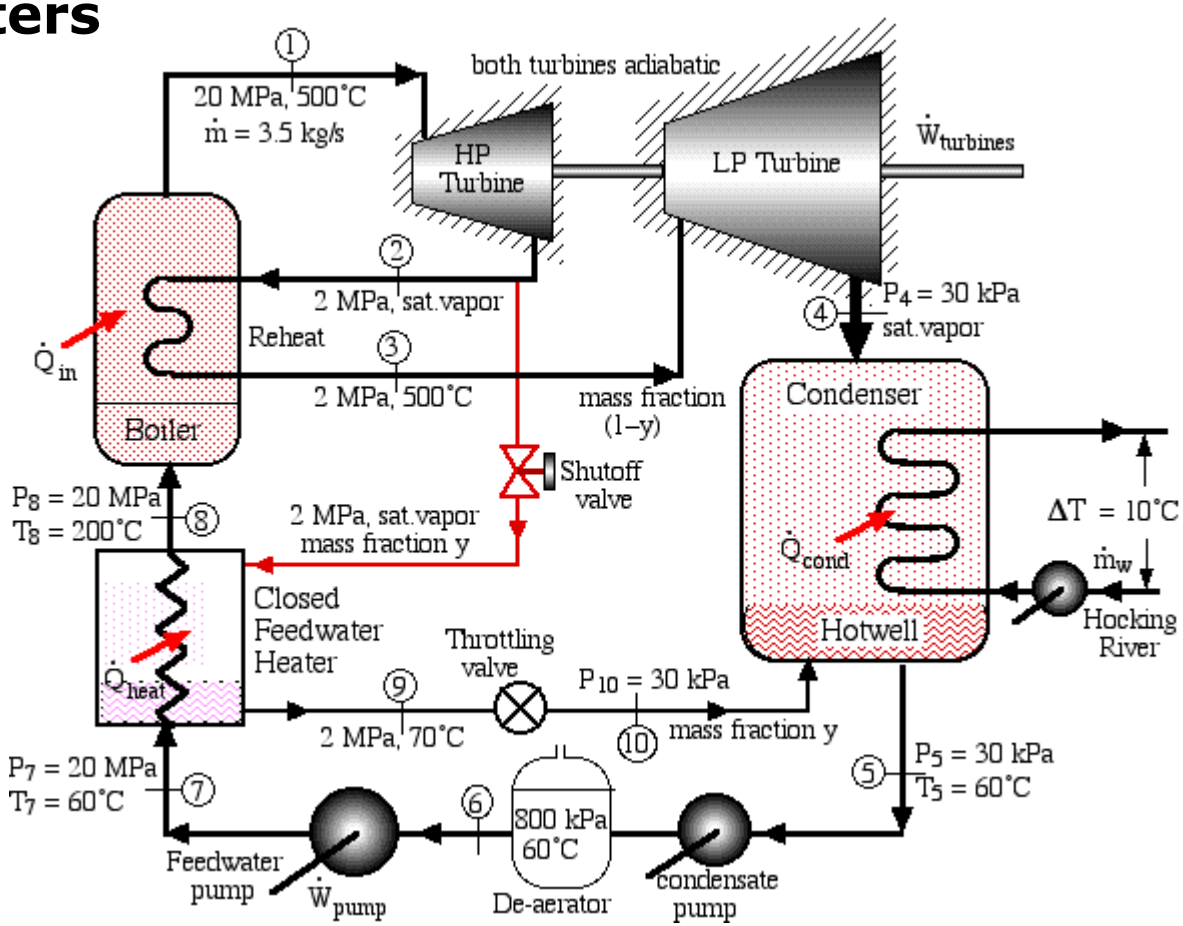
Major Components of a Thermal Power Plant

5. Feed Water Heaters

- Feed Water heating improve overall efficiency.
- The dissolved oxygen which would otherwise cause boiler corrosion are removed in the feed water heater.
- Thermal stresses due to cold water entering the boiler drum are avoided.
- Quantity of steam produced by the boiler is increased.
- Some other impurities carried by steam and condensate, due to corrosion in boiler and condenser, are precipitated outside the boiler.

Major Components of a Thermal Power Plant

5. Feed Water Heaters



Major Components of a Thermal Power Plant

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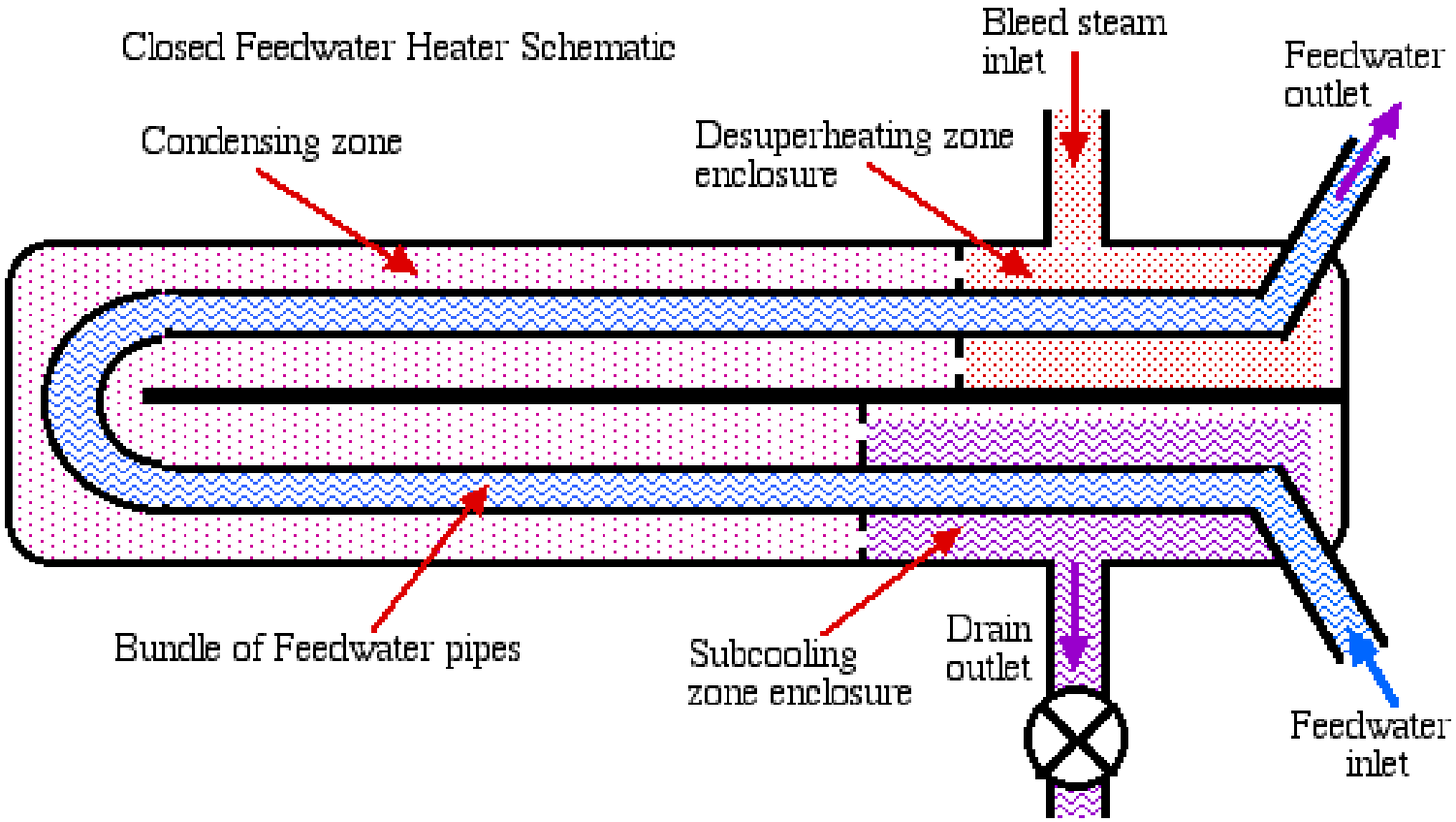
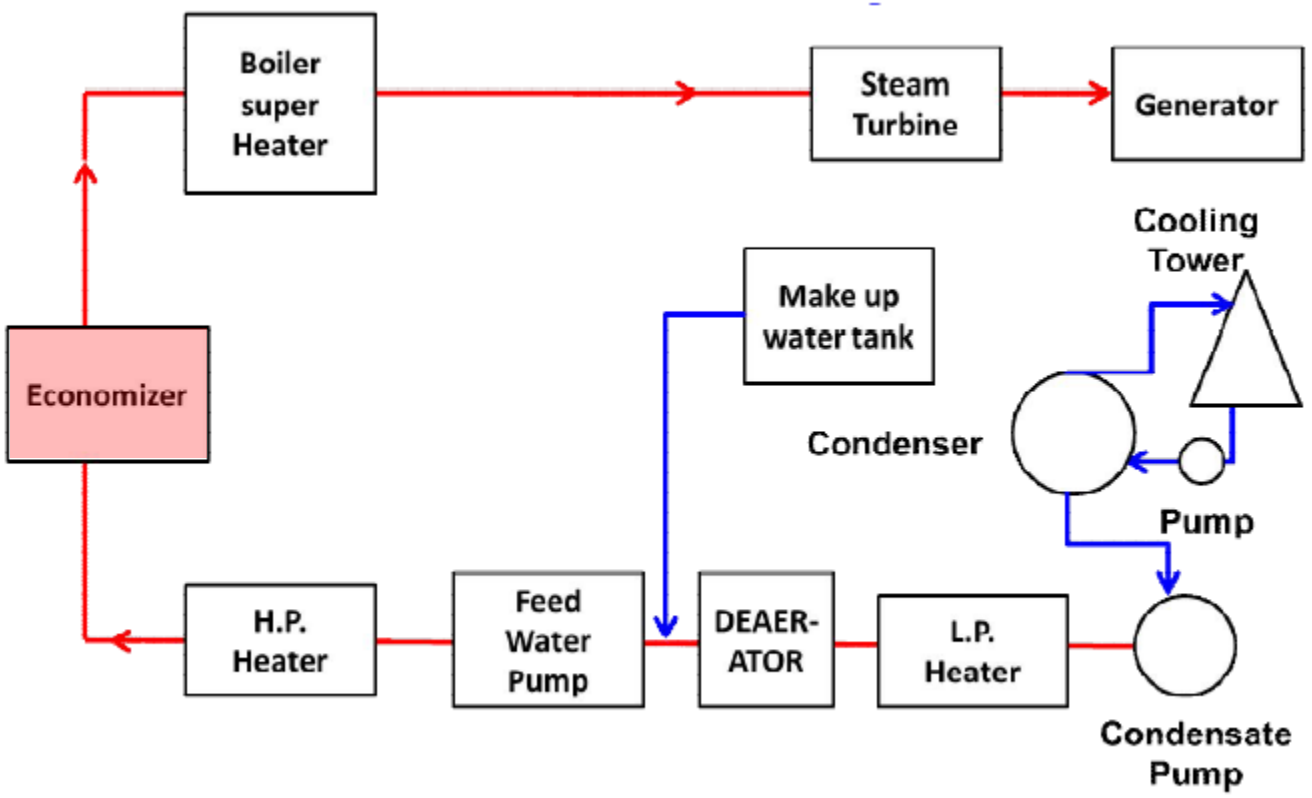


Major Components of a Thermal Power Plant

5. Feed Water Heaters

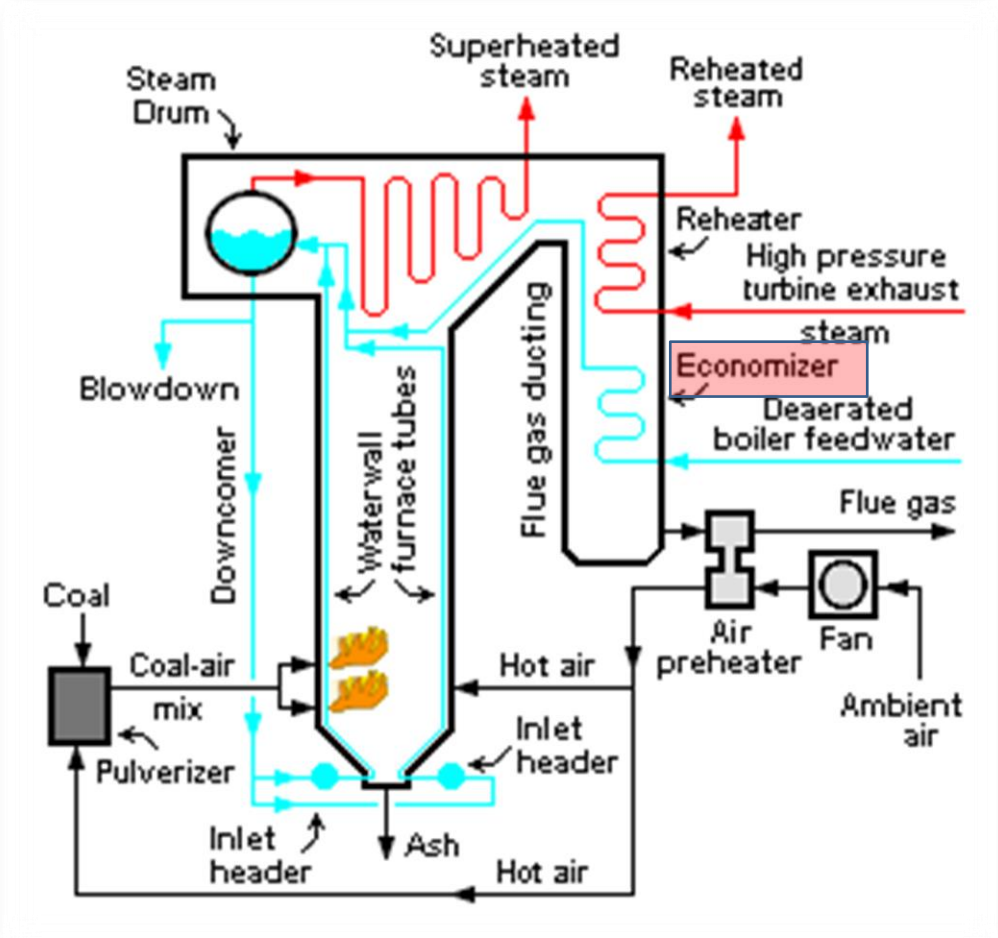
Major Components of a Thermal Power Plant

6. Economizer



Major Components of a Thermal Power Plant

6. Economizer



Major Components of a Thermal Power Plant

6. Economizer

- Boilers are provided with economizer and air pre-heaters to recover heat from the flue gases. An increase of about 20% in boiler efficiency is achieved by providing both economizer and air pre-heaters.
- Economizer alone gives only 8% efficiency increase. The feed water from the high pressure heaters enters the economizer and picks up heat from the flue gases after the low temperature superheater.
- Economizer can be classified as an inline or staggered arrangement based on the type of tube arrangement.

Major Components of a Thermal Power Plant

7. Air Preheaters

After the flue gases leave economizer, some further heat can be extracted from them and is used to heat the incoming air for combustion.

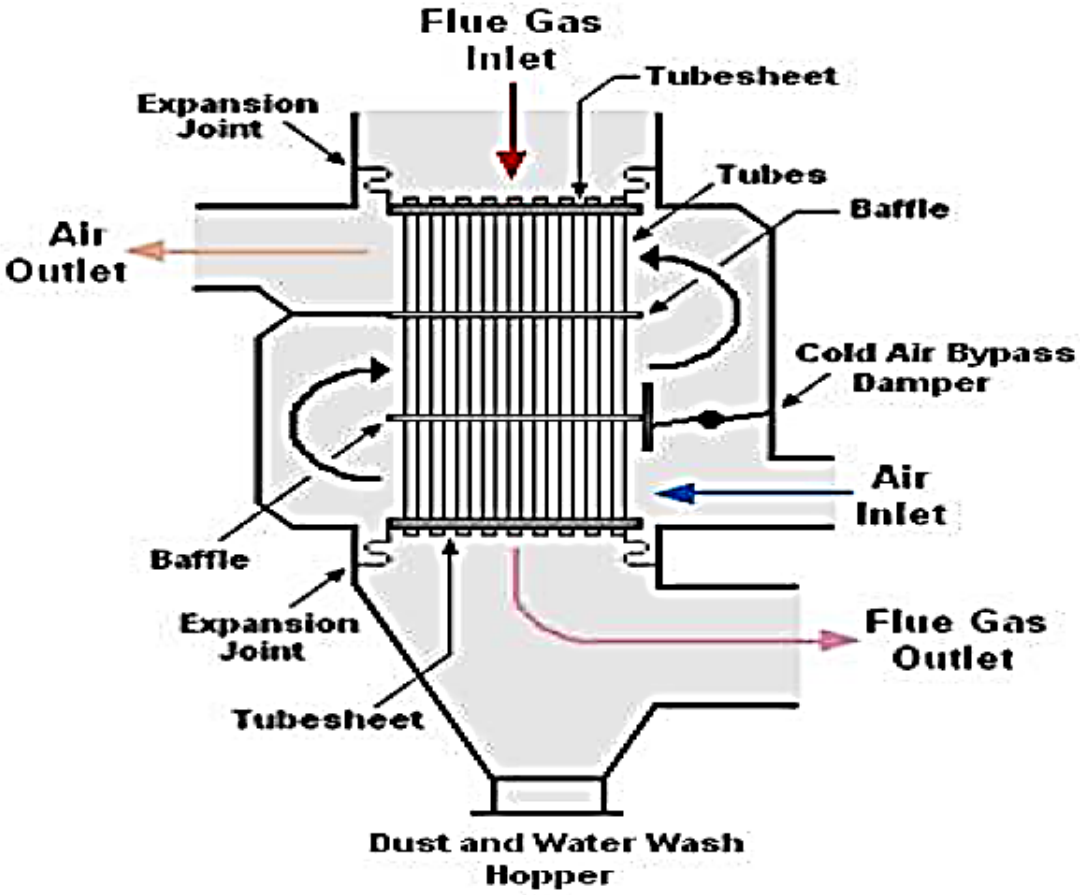
Air preheaters may be of following types:

1. Plate type
2. Tubular type
3. Regenerative type

Cooling of flue gases by 20°C increase the efficiency of the plant by 1%.

Major Components of a Thermal Power Plant

7. Air Preheaters



Major Components of a Thermal Power Plant

8. Deaerators

A deaerator is a device that is widely used for the removal of oxygen and other dissolved gases from the feedwater to steam-generating boilers.

In particular, dissolved oxygen in boiler feedwaters will cause serious corrosion damage in steam systems by attaching to the walls of metal piping and other metallic equipment and forming oxides (rust).

There are two basic types of deaerators,

1. the tray-type an
2. the spray-type

Major Components of a Thermal Power Plant

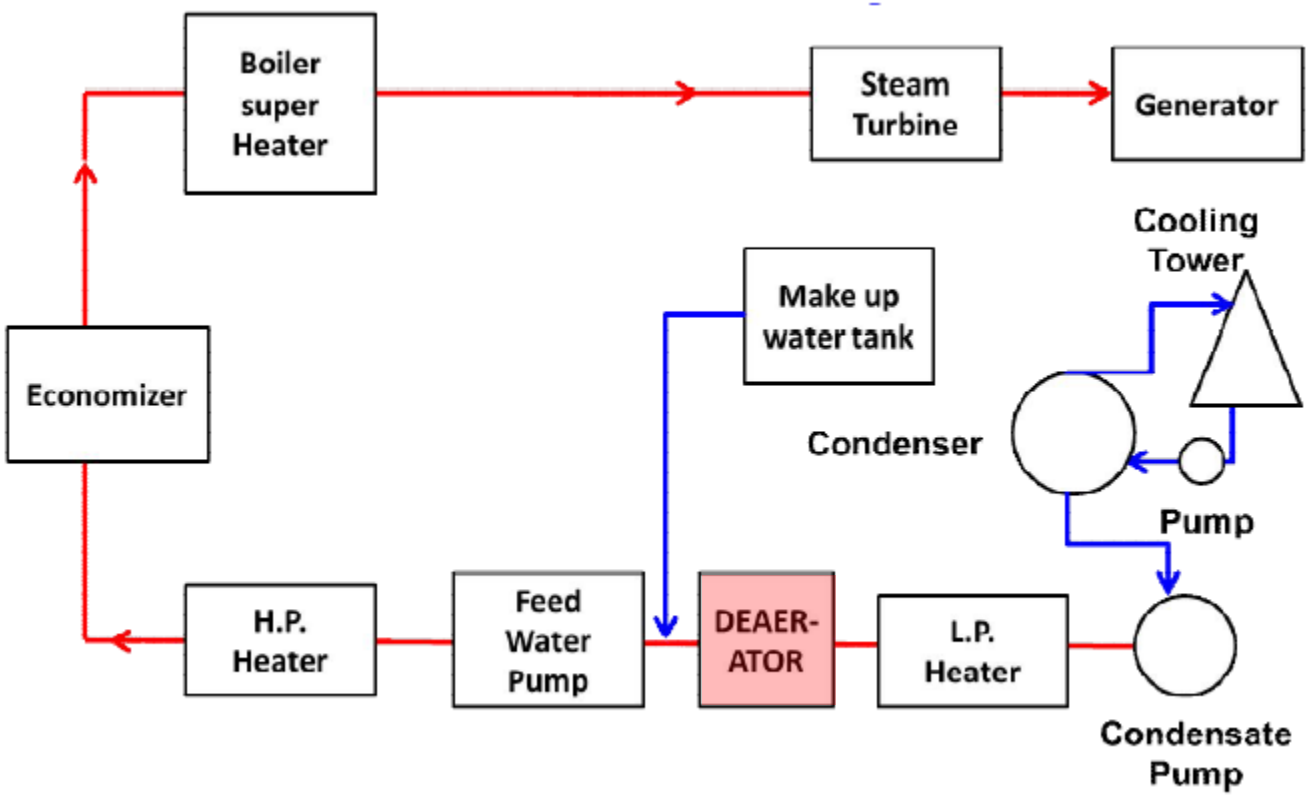
8. Deaerators

The tray-type (also called the cascade-type) includes a vertical domed deaeration section mounted on top of a horizontal cylindrical vessel which serves as the deaerated boiler feedwater storage tank.

The spray-type consists only of a horizontal (or vertical) cylindrical vessel which serves as both the deaeration section and the boiler feedwater storage tank.by 1%.

Major Components of a Thermal Power Plant

8. Deaerators



Major Components of a Thermal Power Plant

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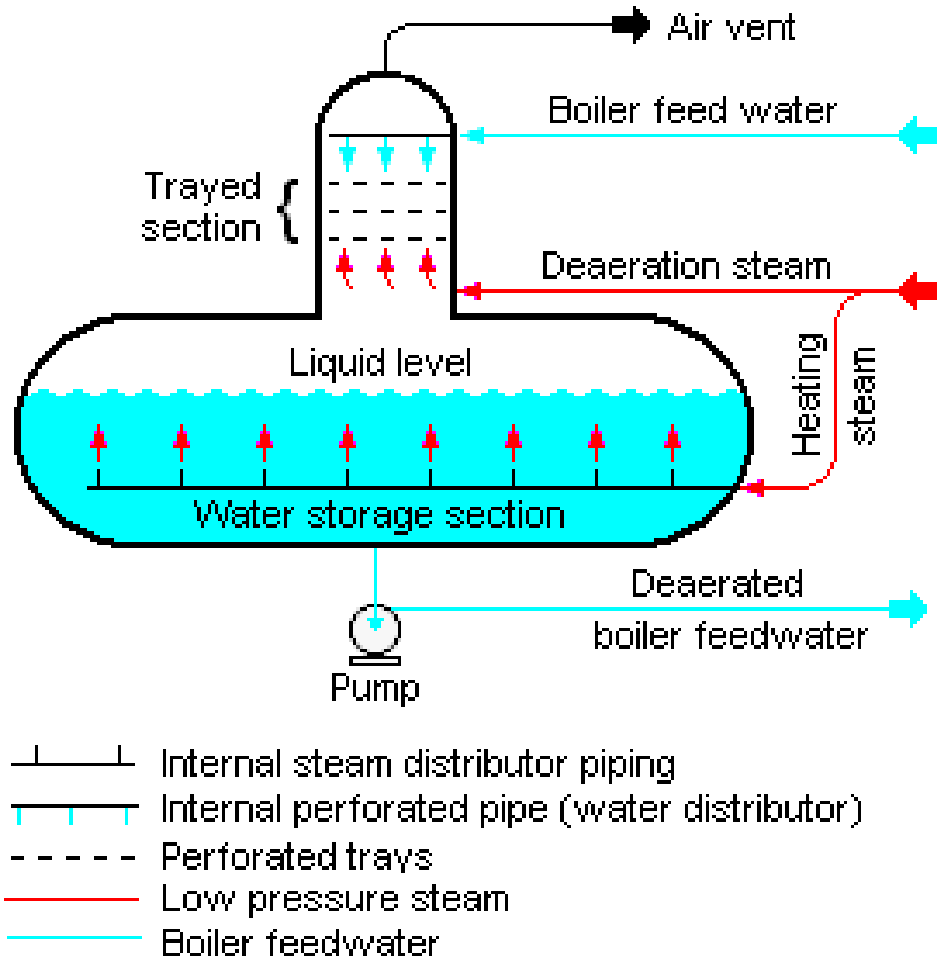

Major Components of a Thermal Power Plant

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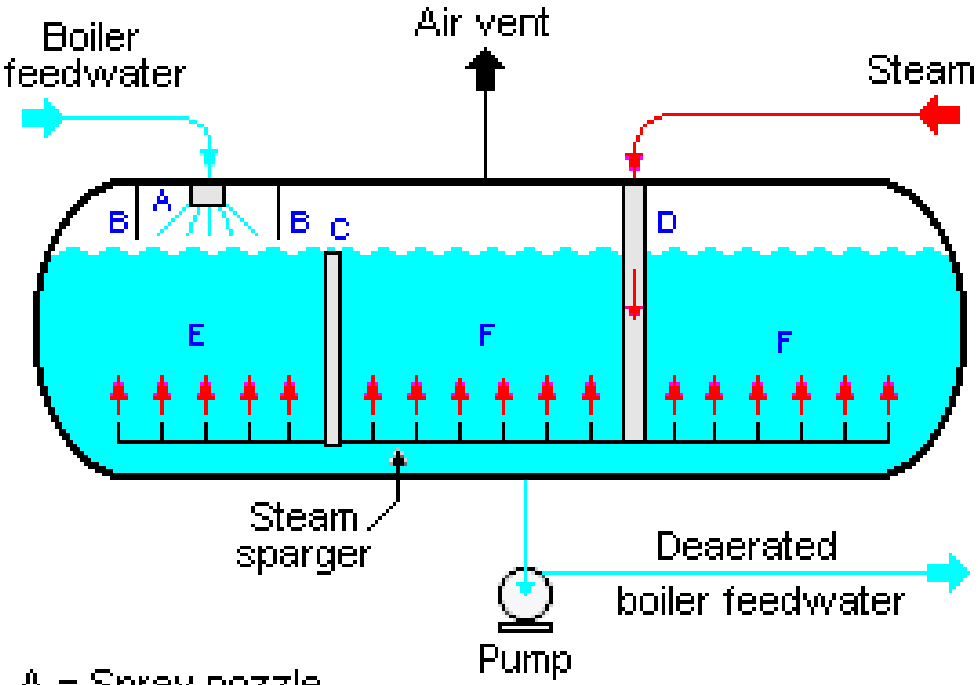

A = Spray nozzle
B = Spray nozzle shroud
C = Baffle
D = Steam supply pipe
E = Preheating section
F = Deaeration section


Thank You