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ANALYSIS OF THERMAL POWER STATION LOSSES

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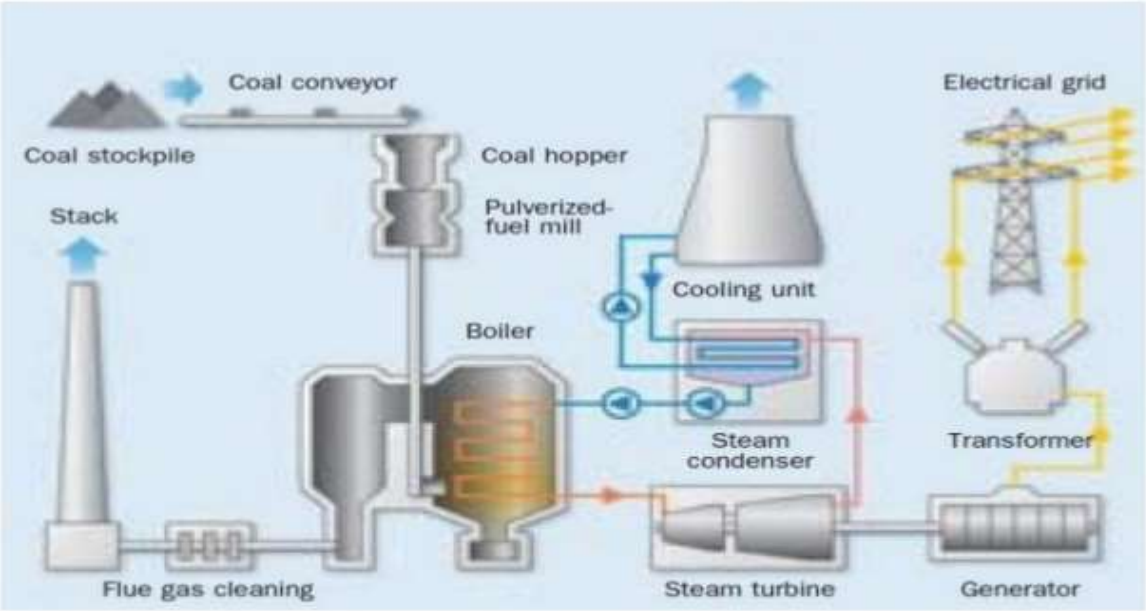
INTRODUCTION

Thermal power plant is a power plant that will convert thermal energy into electrical energy. Turbine in most parts of the world is powered by water is heated, turns into the room and a steam turbine rotates the electric generator. Although turbine vapor is condensed in a condenser and is used to heat; This is called the Rankine cycle is caused by the position of the biggest changes heat in the construction of thermal power plants, fossil fuels dominate, although nuclear energy and solar energy is also used. Because like using energy sources such forms of thermal energy is converted into electrical energy. Some thermal plants are also designed to make thermal energy for the purpose of power generation, district heating or Desalination of water

PARTS OF THERMAL POWER PLANT

1) Boiler
2) Turbine
3) Electric Generator
4) Evaporator

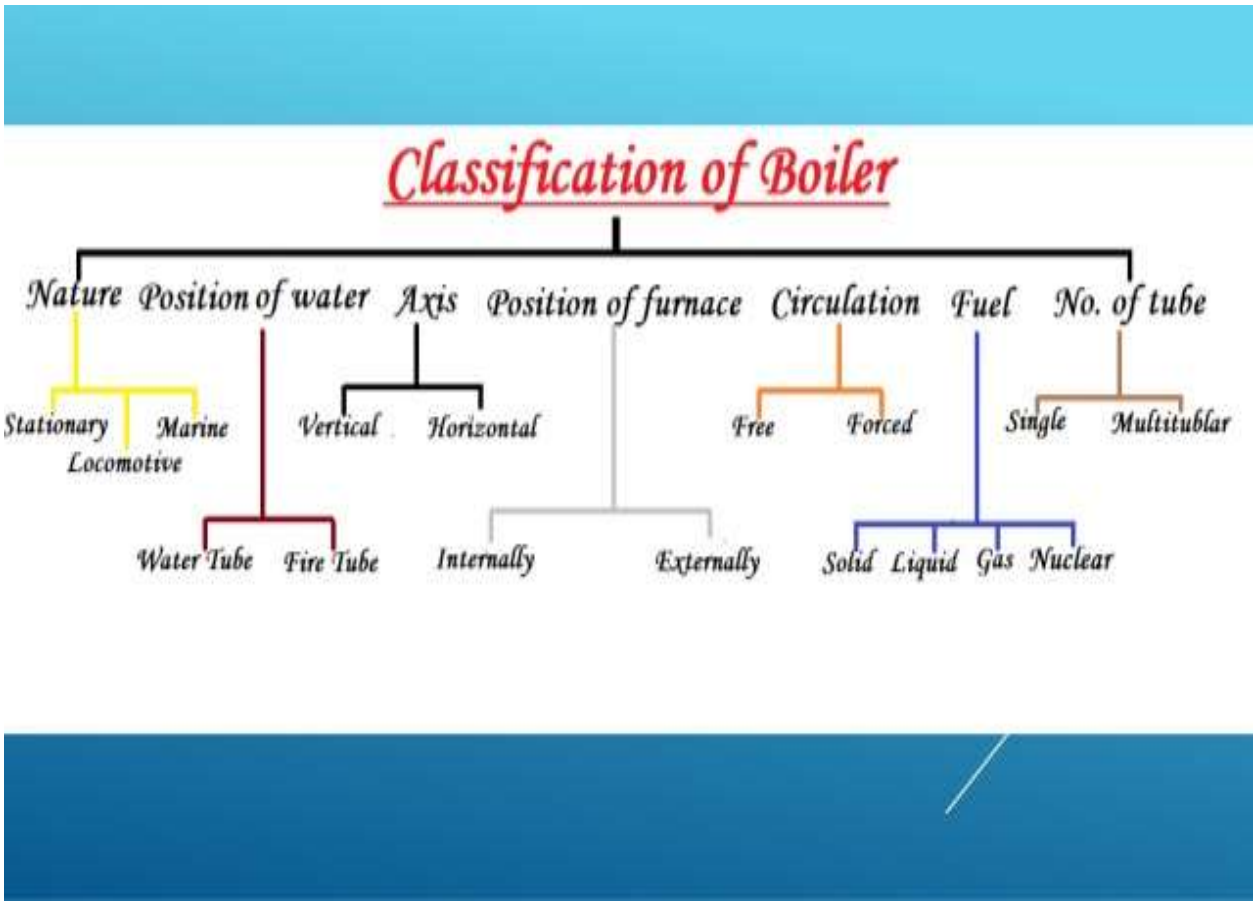
LAYOUT OF THERMAL POWER PLANT



Boiler

A boiler is a closed vessel in which water or other fluid is heated. The fluid does not necessarily boil. The heated or vaporized fluid exits the boiler for use in various heating processes or applications, including water heating, central heating, boiler, power generation, cooking and sanitation.

CLASSIFICATION OF BOILER



TURBINE

Introduction

A turbine (from the Latin turbo, a vortex, related to the Greek word for "turbulence") is a rotating mechanical device that extracts energy from a fluid flow and converts it into useful work. The work produced by a turbine can be used to generate electrical energy when combined with a generator or producing thrust, as in the case of jet engines. A turbine is a turbo machine with at least one moving part called a rotor assembly, which is a shaft or drum with blades attached. The moving fluid acts on the blades so that they move and impart rotational energy to the rotor. The first examples of turbines are windmills and hydraulic wheels.

Steam Turbine Efficiencies

The followings efficiencies of impulse and as well as reaction steam turbine are important from subject point of view :

1) Diagram or bald efficiency: -It is the ratio of the work done on the blades to the energy supplied to the blades.

Let V=Absolute velocity of inlet steam in m/s

M=mass of steam supplied in kg/s.

Energy supplied to the blade per second,

=mv2/2 j/s

We know that work done on the blades per second

=m(vw+vw1)vb j/s

Diagram or blade efficiency ,

=2(vW+vw1)Vb/v2

We know that kinetic energy at inlet per second =mv2/2 j/s

Kinetic energy at outlet per second =mv12/2j/s

Workdone on the blades per second =loss of kinetic energy

= m/2 (v2-v1) J/s

And power developed p=m(v2-v21)/2 watts

Blading efficiency =v2-v12/v2

2) Gross or Stage efficiency :- It is the ratio of work done on the blades of steam to the total energy supplied per stage of steam.

Let h1=Enthalpy before expansion through the nozzle of steam

h2=Enthalpy heat of steam after expansion through the nozzle in steam

Enthalpy or heat drop in the nozzle ring of impulse wheel ,

hd= h1-h2

total energy supplied per stage =1000hd/kg of steam

gross or stage efficiency , = (vw+vw1)vb/1000(h1-h2)

3)Nozzle efficiency ;- It is ratio of energy supplied to the blades of steam to the total energy supplied per stage per kg of steam .

We know that energy supplied to the blades of steam

$=v^2/2$in joules

And Nozzle efficiency $=v^2/2000h_d$

ELECTRIC GENERATOR

In electricity generation, a generator is a device that converts mechanical energy to electrical energy for use in an external circuit. Sources of mechanical energy include steam turbines, gas turbines, water turbines, internal combustion engines and even hand cranks.

EVAPORATOR

An evaporator is used to convert the liquid form of an instrument into its gaseous form. The liquid is dried in a gas, or evaporated. The solution containing the desired product is fed in evaporator and passes through the heat source. Converts water to vapor in the applied heat solution. Vapor is removed from the remaining solution and now the condensed solution is tightened or removed in the second evaporator. Evaporator, as a machine, usually has four sections. The heating section is in the heating section, which can be different, steam is fed in this section.

ANALYSIS OF HEAT LOSSES

We know that the efficiency of a boiler is the ratio of heat utilized in producing steam to the heat liberated in the furnace. Also the heat utilized is always less than thr heat liberated in the furnace.The difference of heat liberated in the furnace and heat utilized in producing steam is known as heat lost in boiler.

1) Heat losses in dry flue gases:
   Heat lost to dry flue gases per kg of fuel
   $=m_g \times c_{pg}(t_g - t_b)$
   M_g= Mass of dry flue gases per kg of fuel
   C_{pg}= Mean specific heat of dry flue gases
   T_g= Temperature of flue gases leaving chimney and
   T_b= Temperature of boiler room
   This loss is maximum in a boiler.
2) Heat lost in moisture present in the fuel:
   It is assume that the moisture is converted into superheated steam at atmospheric pressure1.013 bar
   $=m_m(h_{sup}-h_b)=m_m[h_g+c_p(t_g-t)-h_b]$

$=m_m[\ 2676+c_p(t_g-100)-h_b$
Where,
m_m= Mass of moisture
Cp= Mean specific heat
Tg= temperature off flue gases leaving chimney
Tb= temperature of boiler
H_b= enthalpy of water

3) Heat lost to steam formed by combustion of hydrogen per kg of fuel
   Let, H_2= mass of hydrogen
   Mass of steam formed $ms=9H_2$
   Then the heat lost to steam
   $=9H_2[2676+cp(t_g-100)-t_b]$
4) Heat lost due to unburntcarbon in ashpit $=m_1xc_1$
5) Heat loss due to incomplete combustion of carbon to CO
   Heat lost due to incomplete combustion= m_2c_2
   M_2= mass of carbon mono oxide
   C_2= calorific value
6) Heat lost due to radiation:
   There is no direct method for finding the heat lost due to radiation this loss is calculated by subtracting the heat utilized in raising stream and heat losses from a heat supplied.

CONCLUSION

Losses of power plant is observed in different processes which directly affects the use of efficient force developed as the above study clarifies reduce power in each single stage. The criteria directly related to the efficiency is that in order to increase the total plant (Boiler, turbine, evaporator, etc) efficiencyby applying heavy insulation tubes to eliminate the vapor pressure drop probabilities from the steam generator to the turbine, with passage of solid fuel (coal) from the preheater (which acquire heat energy from hot flue gases present in the flue) for removing moisture from raw fuel, collecting the crude fuel remains in the well efras utilize the unused energy of the supplied fuel.

REFRENCE(S)-

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