



EEE 411

Power Station Engineering

DIESEL & GAS TURBINE POWER PLANT

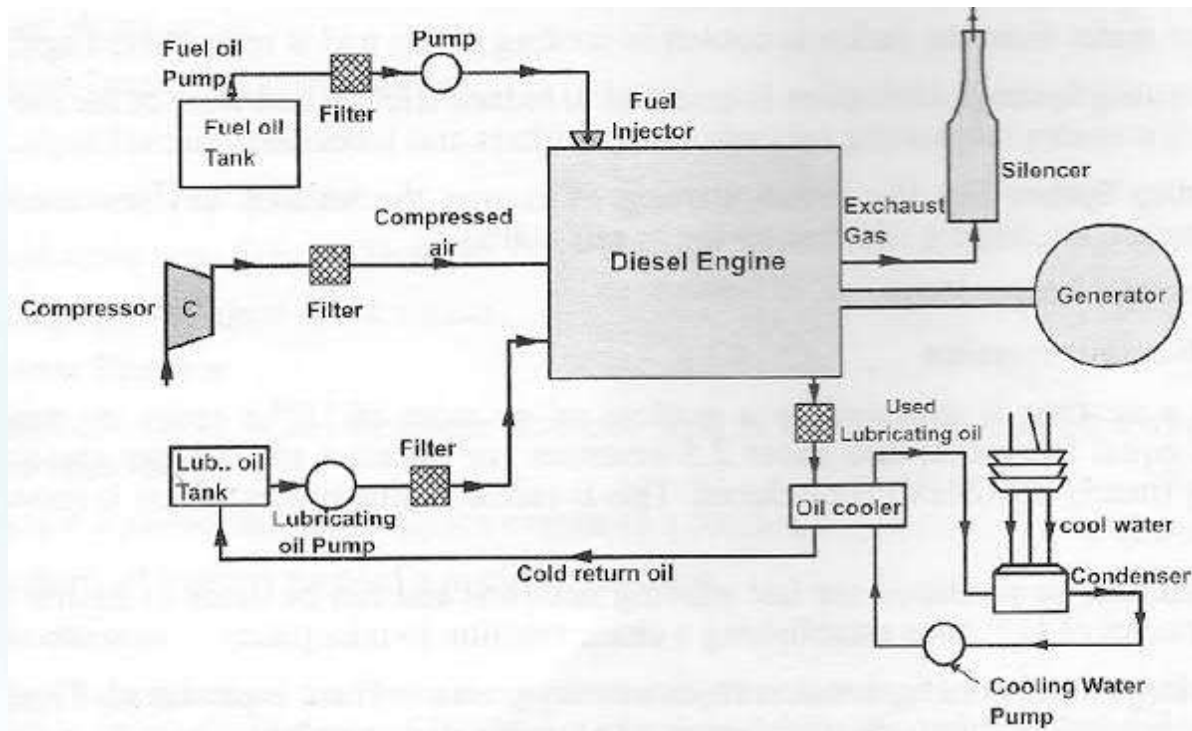
Diesel Power Plant

2

- *A generating station in which diesel engine is used as the prime mover for the generation of electrical energy is known as **diesel power station**.*
- Such power stations are only used to produce small power.
- Diesel power stations are finding favor at places where demand of power is less, sufficient quantity of coal and water is not available and the transportation facilities are inadequate.
- These plants are also used as standby sets for continuity of supply to important points such as hospitals, radio stations, cinema houses and telephone exchanges.

Schematic Diagram of Diesel Power Plant

3



Advantages

- The design and layout of the plant are quite simple.
- It occupies less space as the number and size of the auxiliaries is small.
- It can be located at any place.
- It can be started quickly and can pick up load in a short time.
- There are no standby losses.
- It requires less quantity of water for cooling
- The overall cost is much less than that of steam power station of the same capacity.
- The thermal efficiency of the plant is higher than that of a steam power station.
- It requires less operating staff.

Disadvantages

5

- The plant has high running charges as the fuel (*i.e.* , diesel) used is costly.
- The plant does not work satisfactorily under overload conditions for a longer period.
- The plant can only generate small power.
- The cost of lubrication is generally high.
- The maintenance charges are generally high.

Example 2.14. *A diesel power station has fuel consumption of 0.28 kg per kWh, the calorific value of fuel being 10,000 kcal/kg. Determine (i) the overall efficiency, and (ii) efficiency of the engine if alternator efficiency is 95%.*

Example 2.15. A diesel power station has the following data :

Fuel consumption/day = 1000 kg

Units generated/day = 4000 kWh

Calorific value of fuel = 10,000 kcal/kg

Alternator efficiency = 96%

Engine mech. efficiency = 95%

Estimate (i) specific fuel consumption, (ii) overall efficiency, and (iii) thermal efficiency of engine.

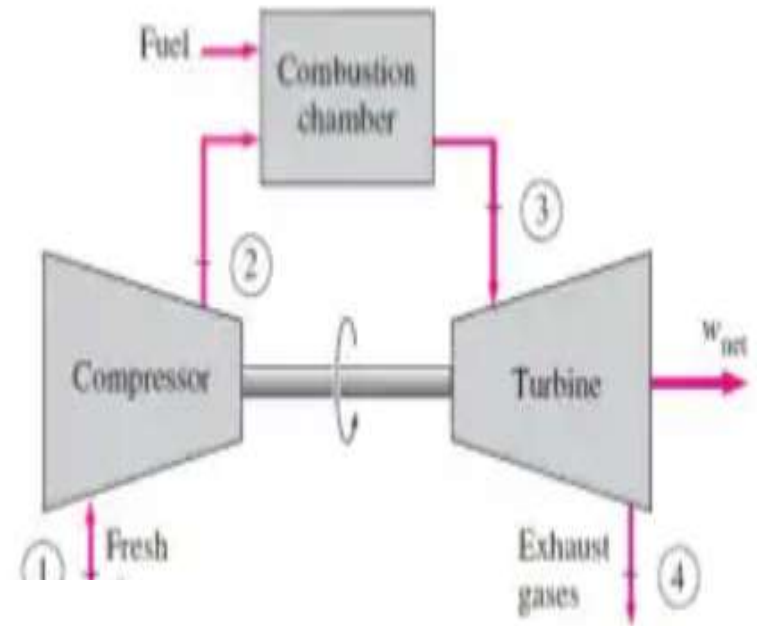
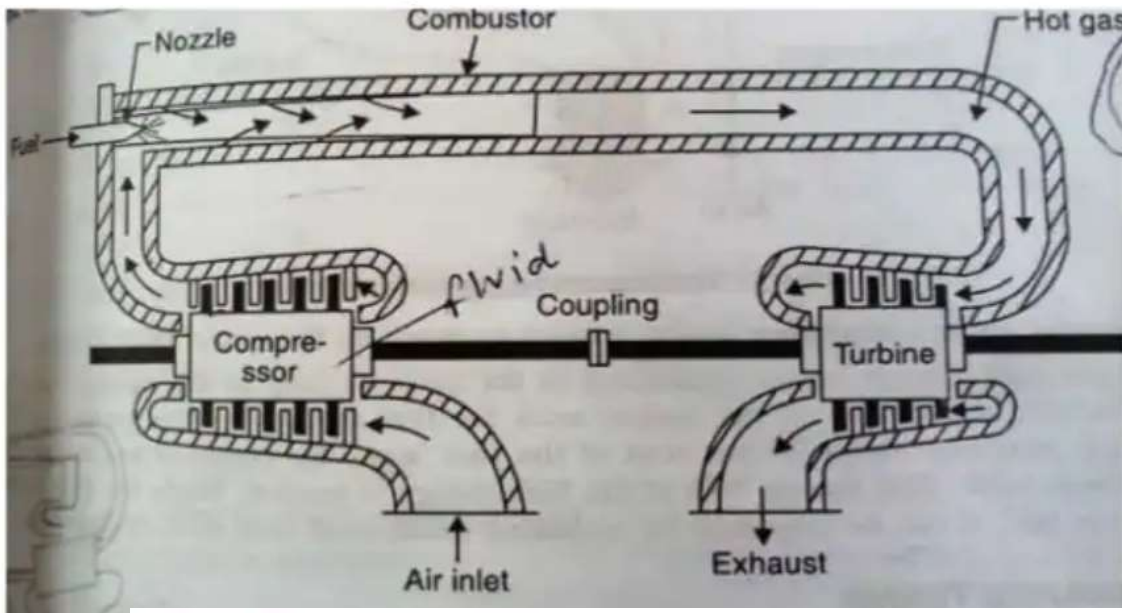
Example 2.16. *A diesel engine power plant has one 700 kW and two 500 kW generating units. The fuel consumption is 0.28 kg per kWh and the calorific value of fuel oil is 10200 kcal/kg. Estimate (i) the fuel oil required for a month of 30 days and (ii) overall efficiency. Plant capacity factor = 40%.*

Gas Turbine Power Plant

6

- *A generating station which employs gas turbine as the prime mover for the generation of electrical energy is known as a gas turbine power plant*

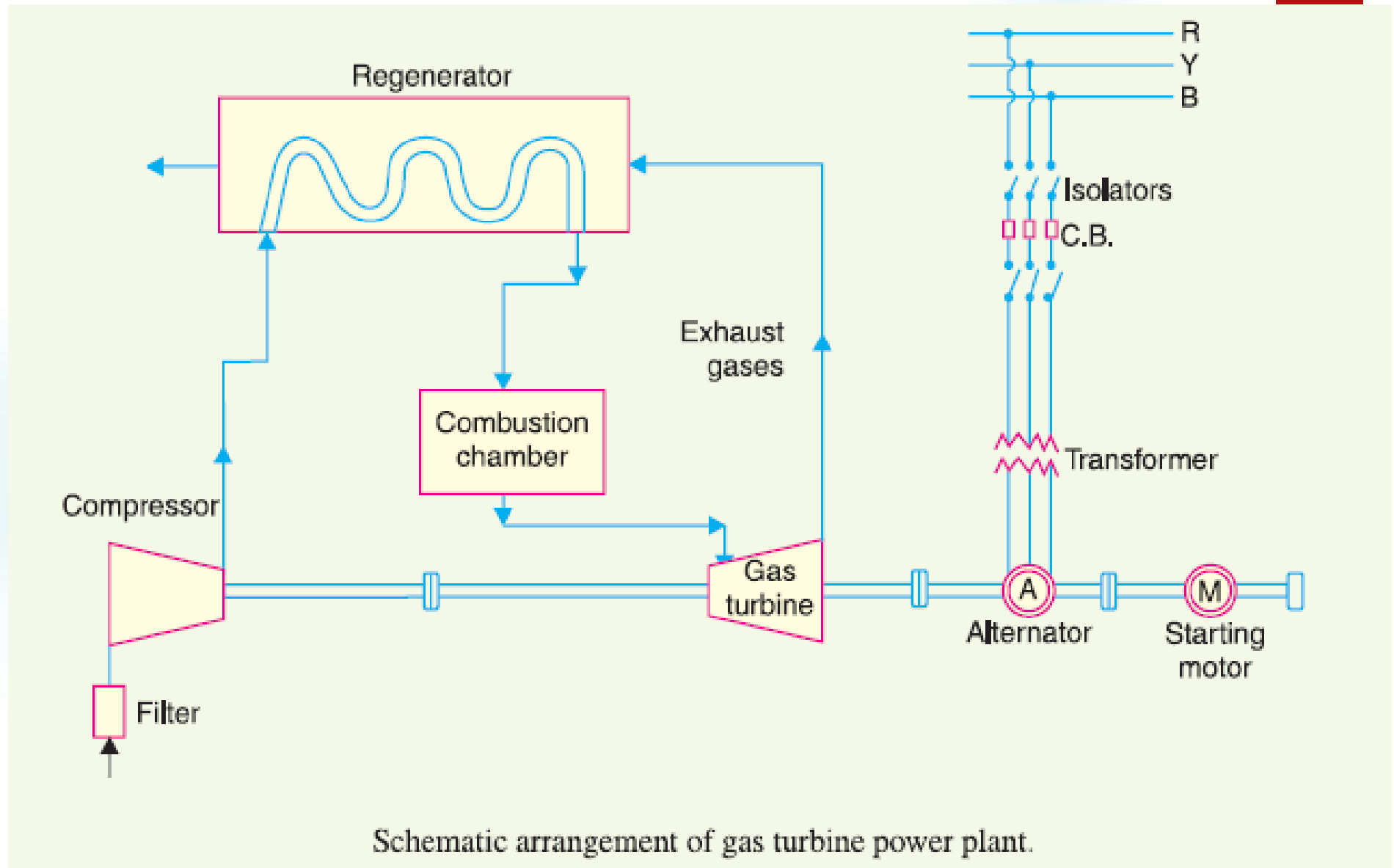
Simple Gas Turbine



Working principle :

- Air is compressed(squeezed) to high pressure by a compressor.
- Then fuel and compressed air are mixed in a combustion chamber and ignited.
- Hot gases are given off, which spin the turbine wheels.
- Gas turbines burn fuels such as oil, natural gas and pulverized(powdered) coal.
- Gas turbines have three main parts:
 - i) Air compressor
 - ii) Combustion chamber
 - iii) Turbine

Schematic Diagram of Gas Turbine Power Plant



Advantages

- It is simple in design as compared to steam power station since no boilers and their auxiliaries are required
- It is much smaller in size as compared to steam power station of the same capacity.
- The initial and operating costs are much lower than that of equivalent steam power station.
- It requires comparatively less water as no condenser is used.
- The maintenance charges are quite small.
- Gas turbines are much simpler in construction and operation than steam turbines.
- It can be started quickly from cold conditions.

Disadvantage

- For starting the unit, power is required from some external source.
- Since a greater part of power developed by the turbine is used in driving the compressor, the net output is low.
- The overall efficiency of such plants is low (about 20%) because the exhaust gases from the turbine contain sufficient heat.
- The temperature of combustion chamber is quite high (3000 F) so that its life is comparatively reduced.

