1.6 GAS TURBINE POWER PLANT

In all power generating stations except solar power generating station employee alternator to generate electrical energy. An alternator is a rotating machine which can produce electricity only when it rotates. Hence there must be a prime mover which helps to turn the alternator. The primary arrangement of all power plants is to rotate the prime mover so that alternator can generate required electricity. In gas turbine power plant we use high pressure and temperature air instead of high pressure and temperature steam to rotate the turbine.

The fundamental working principle of a gas turbine power plant is same as that of a steam turbine power plant. The only difference is there that in steam turbine power plant we use compressed steam to rotate the turbine, but in gas turbine power plant we use compressed air to turn the turbine.

A gas turbine, also called a combustion turbine, is a type of continuous combustion, internal combustion engine. There are three main components:

1. An upstream rotating gas compressor;
2. A downstream turbine on the same shaft;
3. A combustion chamber or area, called a combustor, in between 1. and 2. above.

A fourth component is often used to increase efficiency (turboprop, turbofan), to convert power into mechanical or electric form (turboshaft, electric generator), or to achieve greater power to mass/volume ratio (afterburner).

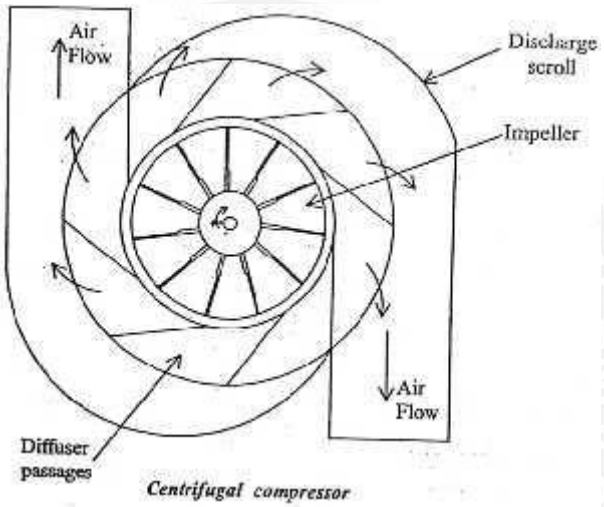
The basic operation of the gas turbine is a Brayton cycle with air as the working fluid. Fresh atmospheric air flows through the compressor that brings it to higher pressure. Energy is then added by spraying fuel into the air and igniting it so the combustion generates a high- temperature flow. This high-temperature high-pressure gas enters a turbine, where it expands down to the exhaust pressure, producing a shaft work output in the process. The turbine shaft work is used to drive the compressor; the energy that is not used for shaft work comes out in the exhaust gases that produce thrust. The purpose of the gas turbine determines the design so that the most desirable split of energy between the thrust and the shaft work is achieved. The fourth step of the Brayton cycle (cooling of the working fluid) is omitted, as gas turbines are open systems that do not use the same air again.Gas turbines are used to power aircraft, trains, ships, electrical generators, pumps, gas compressors, and tanks.

COMPONENTS OF GAS TURBINE POWER PLANT

1. Compressor
2. Combustion chamber
3. Gas Turbine
4. Intercoolers and Regenerators

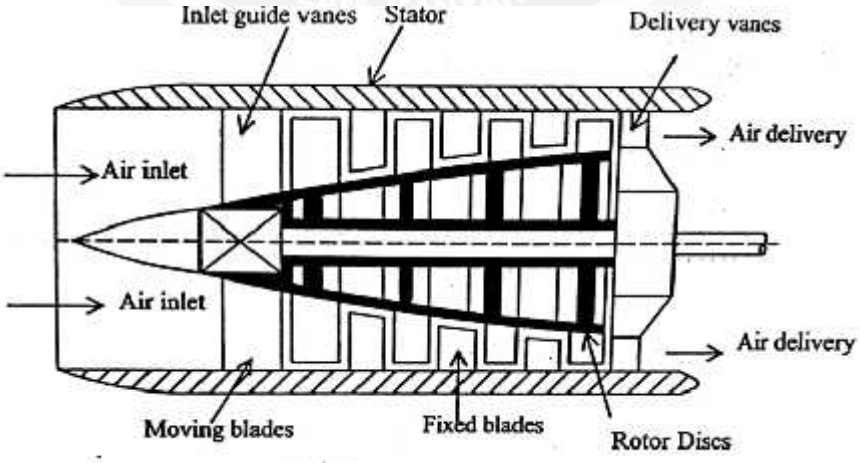
COMPRESSOR

Centrifugal compressor



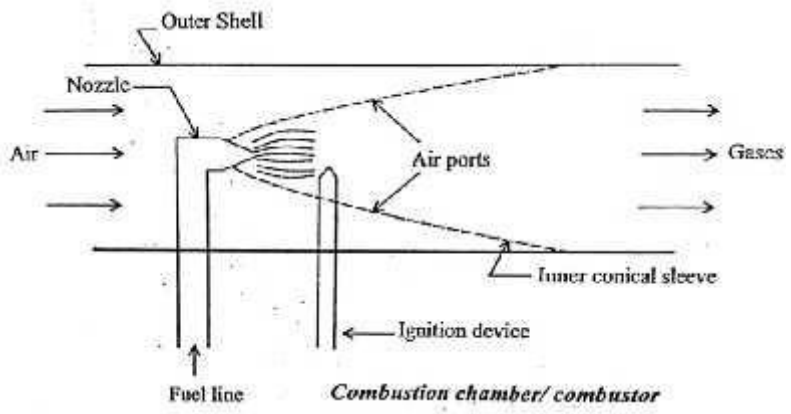
Centrifugal compressor

Axial Flow Compressor



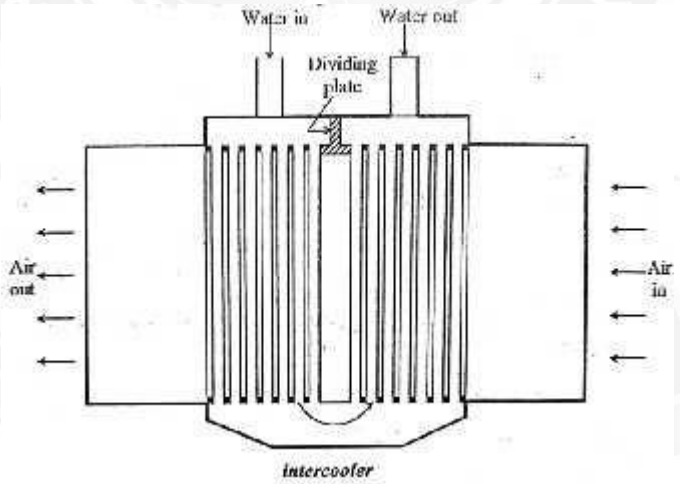
Axial flow compressor

COMBUSTION CHAMBER

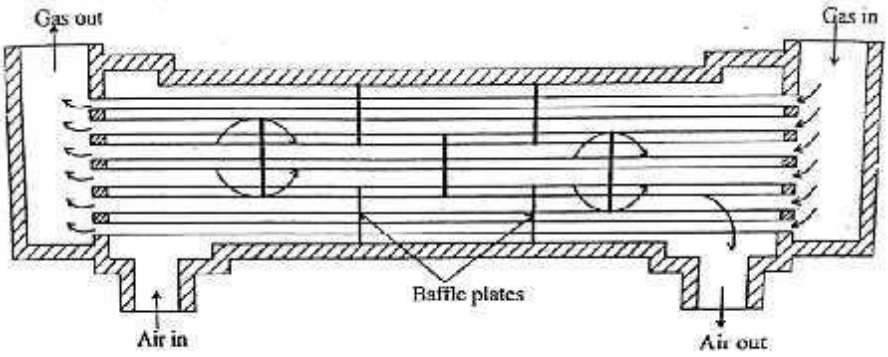


Combustion chamber/ combustor

.INTERCOOLER AND REGULATOR



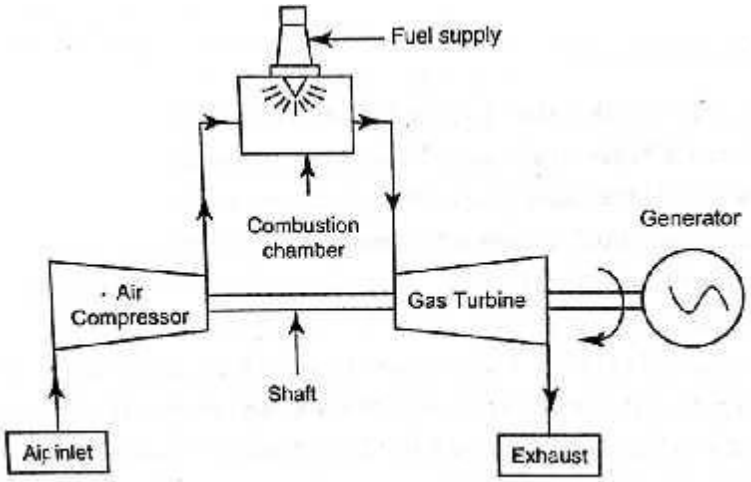
intercooler



Regenerator

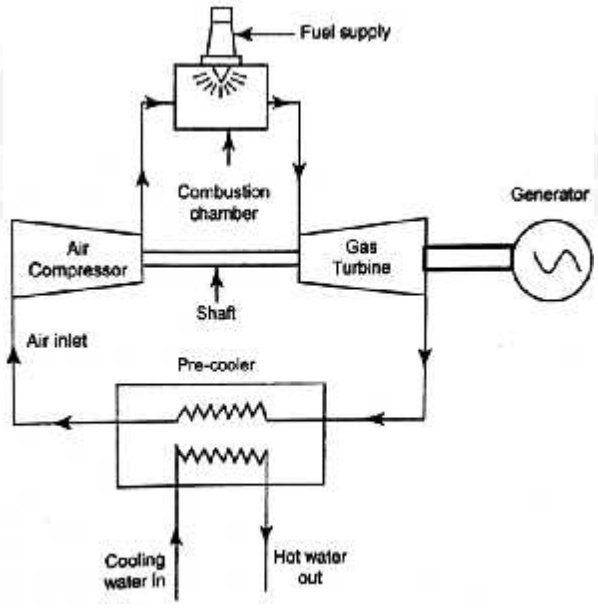
WORKING OF GAS TURBINE POWER PLANT

Open cycle gas turbine power plant



Open cycle gas turbine

Closed cycle gas power plant



Closed cycle gas turbine

Advantages of gas turbine power plants

1. Construction wise a gas turbine power plant is much simpler than a steam turbine power plant.
2. The size of a gas turbine power plant is smaller than that of a steam turbine power plant.
3. A **gas turbine power plant** does not have any boiler like component, and hence, the accessories associated with the boiler are absent here.
4. It does not deal with steam hence it does not require any condenser hence no cooling tower like structure is needed here.
5. As design and construction wise gas turbine power plants are much more straightforward and smaller, the capital cost and running cost are quite less than that of an equivalent steam turbine power plant.
6. The constant loss is quite smaller in gas turbine power plant compared to a steam turbine power plant because in the steam turbine power plant boiler has to run continuously even when the system does not supply load to the grid.
7. A gas turbine power plant can more instantly be started than an equivalent steam turbine power plant.

Disadvantage

1. The mechanical energy created in the turbine is also utilised to run the air compressor. Since a major portion of mechanical energy created in the turbine is

utilised to run the air compressor the overall efficiency of gas turbine power plant is not as high as an equivalent steam turbine power plant.

2. Not only have that, the exhaust gases in gas turbine power plant curries significant heat from the furnace. This also causes the efficiency of the system low further.
3. To start power plant pre-compressed is required. So before actual starting of the turbine air should be pre-compressed which requires an auxiliary power supply for starting a gas turbine power plant. Once the plant is started there is no more need of supplying external power but at starting point external power is essential.
4. The temperature of the furnace is quite high in a gas turbine power plant. This makes the system lifespan smaller than that of an equivalent steam turbine power plant.
5. Because of its lower efficiency, a gas turbine power plant cannot be utilised for commercial production of electricity instead it is normally used to supply auxiliary power to other conventional power plants such as hydroelectric power plant.