

Gas turbines

Objectives: At the end of this lesson you shall be able to

- describe gas turbines
- state stages of turbine
- compare the gas turbine and diesel engine.

Gas turbine

A gas turbine Fig 1 is a continuous combustion, internal combustion engine. There are three main components:

- 1 Gas compressor
- 2 Turbine on the same shaft
- 3 Combustion chamber

Some attachments used to increase efficiency, and also to convert power into mechanical or electrical form.

The basic operation of the gas turbine is a Brayton cycle. 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 and pressure. This high-temperature high-pressure gas enters a turbine, where it expands. This producing a shaft work output in the process.

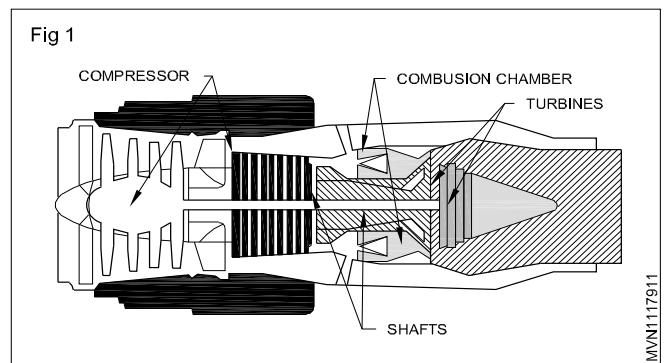
The turbine shaft work is used to drive the compressor. The energy that can also be (not used for shaft work comes out in the exhaust gases) produce thrust which is used to push aircraft. The purpose of the gas turbine determines the design so that the most desirable split of energy between

the thrust and the shaft work is achieved. Separate cooling system not required as gas turbines are open systems that do not use the same air again.

Gas turbines are used to power aircraft, trains, ships, electrical generator, pumps, gas compressors, and military war tanks.

Stages in turbine

The two primary parts of turbine stage are the stator nozzle and the turbine rotor blades. The stage consists of a ring of fixed blades followed by the rotor blade ring.



Gas Turbine	Diesel Engine
Large power achieved by relatively small size	Less power generated with occupying more space
High efficiency	Low efficiency
Simple design	Complicated in design
High revolution	Low revolution
High torque	Low torque
Needs very less maintenance suitable for stationary only	Needs very frequent maintenance suitable for both stationary and mobile.
Needs to have more safety conscious (More hazardous)	Less hazardous

Compression between single stage and two stage turbine engine

Single stage turbine	Two stage turbine
1 Low power achieved more than engine	Larger power achieved in greater than single stage
2 Torque developed high	Torque is balanced
3 Only one turbine connected to engine	Two turbo chargers of different sized kept in series
4 Constant pressure	High pressure & constant pressure
5 Lesser degree and bones is less than 20 bar	Require high degree of super charge map 25 to 30 ohm
6 Speed in controlled	Better speed control
7 Bearing life less compared	Longer bearing life
8 Vibration controlled	Reduced vibration & load users
9 Investment less compared to 2 stage	Investment is cost