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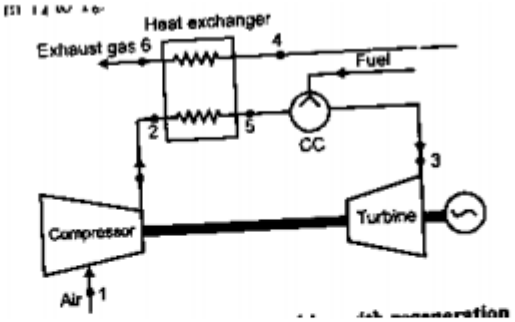
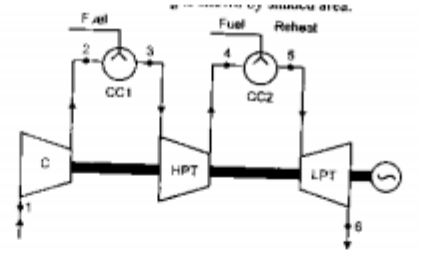
State the different methods used to improve thermal

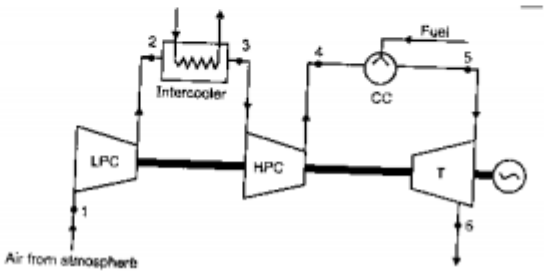
Methods to improve thermal efficiency of gas turbine 1) Regeneration – This is done by preheating the compressed air before entering to the combustion chamber with the turbine exhaust in a heat exchanger, thus saving fuel consumption.



(a) Reheating : The whole expansion in the turbine is achieved in two or more stages &reheating is done after each stage.



(a) Intercooling



Compare, closed cycle and open cycle gas turbine.....

Sr.no	Factors	Open cycle gas turbine	Closed cycle gas turbine
1.	**Pressure**	Lesser pressure	Higher pressure
2.	**Size of the plant for given**	Larger size	Reduced size
3.	**Output**	Lesser output	Greater output
4.	**Corrosion of turbine**	Corrosion takes place due to	No corrosion since there is
5.	**Working medium**	Loss of working medium	No loss of working medium.
6.	**Filtration of incoming air**	It may cause severe problem.	No filtration of air is required.
7.	**Part load efficiency**	Less part load efficiency	More part load efficiency
8.	**Thermal efficiency**	Less thermal efficiency	More thermal efficiency
9.	**Requirement of cooling**	No Requirement of cooling water	Larger amount of cooling
10.	**Weight of system for**	Less	More
11.	**Response to the changing**	Good response	Poor response
12.	**Fluid friction**	More Fluid friction	Less Fluid friction

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Give classification of air conditioning system.....

Air conditioning systems are classified as 1) Classification as to major function- i) Comfort air-conditioning - air conditioning in hotels, homes, offices etc. ii) Commercial air-conditioning- air conditioning for malls, super market etc ii) Industrial air-conditioning – air conditioning for processing, laboratories etc

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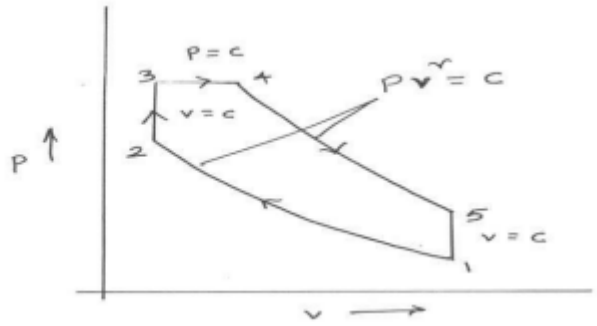
Draw P-V and T-S diagram for dual cycle. Name the processes involved in it.....



Process 1-2 : Isentropic compression

Process 2-3: Partial Heat addition at constant volume

Process 3-4 : Partial Heat addition at constant pressure

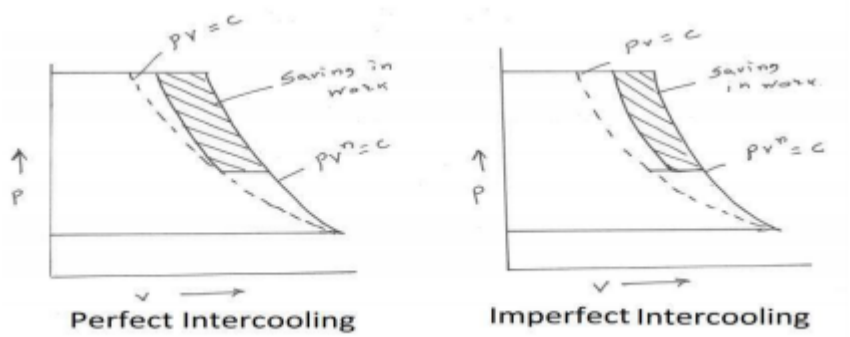
Process 4-5 : Isentropic expansion

Process 5-1: Heat rejection at constant volume

Define perfect and imperfect inter-cooling in air compressor and show it by graph also....

Perfect cooling: In this process the temperature of air after passing out of intercooler is same as that of temperature of air before compression in LP cylinder. The respective figure is shown.

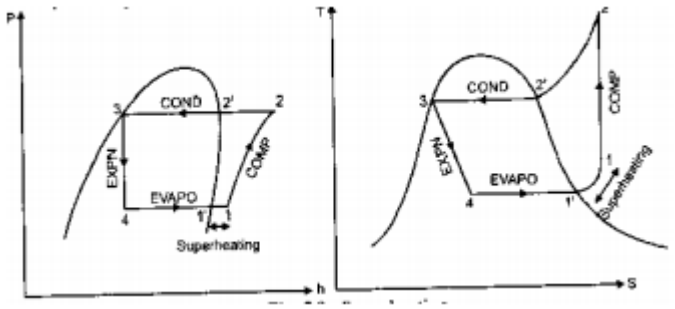
Imperfect cooling: In this process the temperature of air after passing out of intercooler is between the temperature of air before & after compression in LP cylinder. The respective figure is shown.



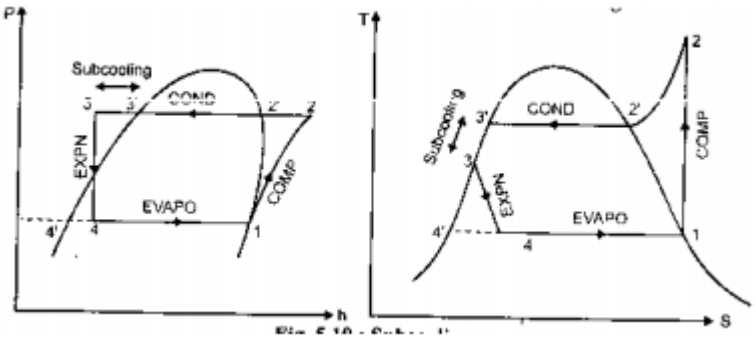
Represent subcooling and superheating on P-h and T-S

diagram....

Superheating

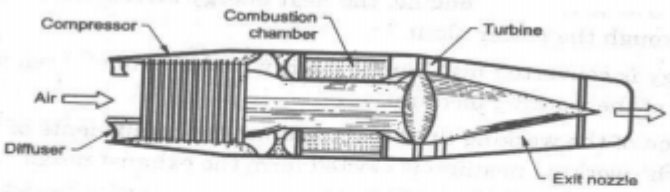


Due to superheating suction temperature of compressor increases , increasing compressor power but it also increases the refrigerating effect therefore COP of system remains more or less constant. The superheating is not done to increase the refrigerating effect or COP but it is done to increase the life of compressor.



Explain construction and working of turbojet with neat labelled sketch.

Turbo-Jet Engine :



Turbo-jet engine

The turbojet engine consists of an open cycle gas turbine engine (compressor, combustion chamber and turbine) with an entrance air diffuser added in front of the compressor and an exit nozzle added rear end or aft of the turbine.

In this unit no propeller is provided. The diffuser of a turbojet engine must provide the greatest possible pressure rise by slowing the incoming air and converting its kinetic energy into pressure.

The shape, area and location of the actual air inlet in an aeroplane is highly important. Variable area entrance diffusers are being developed for new aircraft in order to maintain high diffuser efficiency for both high and low speed operation. The atmospheric air enters the compressor through the front opening.

The compressor compresses the air to the required pressure and discharges it into combustion chamber. The fuel is injected into the combustion chamber at constant pressure.

The gases leaving the combustion chamber expand in turbine, which produces sufficient power to run the compressor and exhaust to atmospheric through nozzle, which produces propulsive thrust to drive the unit.

The major advantages of the use of axial flow compressor is capable of multistaging and small frontal area, out weight its sensitivity and fragility. Therefore it is the current choice for use in turbojet engine of high thrust output.

A pneumatic rock drill requires 10 kg/min of air at 6 bar pressure....

Q5. (b)

Indicated Power $= \frac{n}{n-1} P_1 V_1 \left[\left(\frac{P_2}{P_1} \right)^{\frac{n-1}{n}} - 1 \right]$

$= \frac{n}{n-1} mRT_1 \left[\left(\frac{P_2}{P_1} \right)^{\frac{n-1}{n}} - 1 \right]$

$= \frac{1.25}{1.25-1} \times \frac{10}{60} \times 0.287 \times 300 \left[(6)^{\frac{0.25}{1.25}} - 1 \right]$

$= \underline{30.852 \text{ KW}}$ (2 marks)

Assuming mechanical efficiency as 80%.

Power required to drive compressor $= \frac{30.852}{0.8}$

$= \underline{38.565 \text{ KW}}$ (2 marks)

Isothermal Power $= P_1 V_1 \log_e P_2/P_1$

$= mRT_1 \log_e P_2/P_1$

$= \frac{10}{60} \times 0.287 \times 300 \times \log_e 6/1$

$= \underline{25.71 \text{ KW}}$ (2 marks)

Isothermal efficiency $= \frac{\text{Isothermal Power}}{\text{Indicated Power}}$

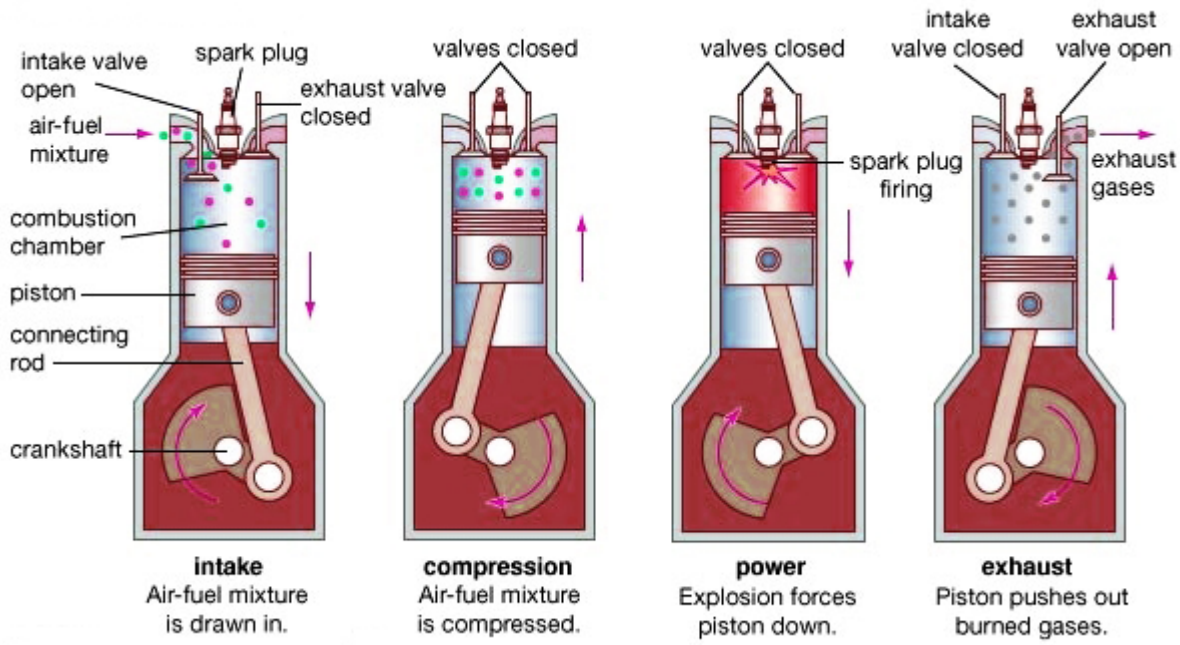
$= \frac{25.71}{30.852} = \underline{83.35\%}$

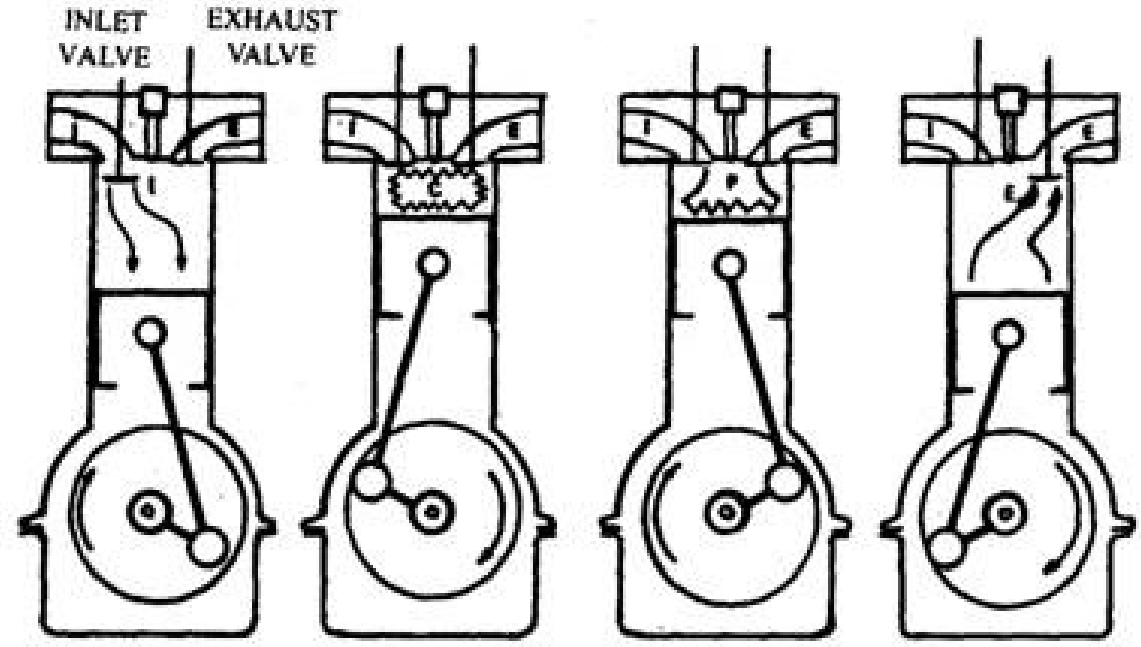
Explain construction and working of ice plant with neat sketch.

The main cycle used for ice plant is vapor compression cycle with ammonia as the refrigerant in primary circuit and brine solution in secondary circuit. Brine solution takes heat from water in secondary circuit and delivers the heat to ammonia in primary circuit. Thus, the indirect method of cooling is used in ice plant. In secondary circuit brine is cooled in evaporator and then it is circulated around the can which contains water. The heat is extracted from the water in the can and is given to the brine.

With neat sketches explain the working principle of four stroke spark ignition engine.

Four stroke spark ignition engine working principle





Pages

1
2
3
4
5
6

7
8
9
next ›
last »