



SNS COLLEGE OF TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING



19MEB203 - THERMAL ENGINEERING

UNIT-IV AIR COMPRESSOR

TWO MARK QUESTION:

1. What is meant by single acting compressor?

In a single acting compressor, the suction, compression and delivery of air takes place on one side of the piston.

2. What is meant by double acting compressor?

In a double acting reciprocating compressor, the suction, compression and delivery of air takes place on both side of the piston.

3. What is meant by single stage compressor?

In a single stage compressor, the compression of air from the initial pressure to the final pressure is carried out in one cylinder only.

4. What is meant by multi stage compressor?

In a multi stage compressor, the compression of air from the initial pressure to the final pressure is carried out in more than one cylinder.

5. Indicate the applications of reciprocating compressors in industries.

Pneumatic brakes. Pneumatic drills.

Pneumatic jacks Pneumatic lifts.

Spray painting Shop cleaning.

Injection fuel in diesel engine.

Supercharging internal combustion engines.

Refrigeration and air conditioning systems.

6. Classification of air compressor.

1. Based on number of stages

- Single stage
- Multi stage

2. Based on moving parts

- Reciprocating compressor
- Rotary compressor

3. Based on the number of cylinders

- Single cylinder
- Multi cylinder

4. Based on the method of cooling

- Air cooled
- Water cooled

5. Based on pressure developed

- Low pressure (blowers)
- Medium pressure (single stage)
- High pressure (multi stage)

6. Based on action

- Single acting
- Double acting

7. What are the advantages of multi-stage air compressor?

- Saving in work is obtained
- There is little chance of lubrication trouble as the maximum temperature is reduced.
- It improves the volumetric efficiency.
- Leakage loss is reduced considerably.

- It provides more uniform torque and thus smaller sized flywheel is required.
- Cheaper material may be used for construction as the operating temperatures are lower.
- Lighter cylinders.

8. What is meant by volumetric efficiency and mechanical efficiency?

VOLUMETRIC EFFICIENCY: is defined as the ratio of volume of free air sucked into the compressor per cycle to the stroke volume of the cylinder.

$$\eta_{\text{vol}} = \text{Volume of free air taken per cycle} / \text{stroke volume of the cylinder}$$

MECHANICAL EFFICIENCY: is defined as the ratio between brake power to the indicated power.

$$\eta_{\text{mech}} = \text{Brake power} / \text{Indicated power.}$$

9. Define isothermal compression efficiency and isentropic efficiency.

ISOTHERMAL COMPRESSION EFFICIENCY: is defined as the ratio between isothermal work to the actual work of the compressor.

$$\eta_{\text{iso}} = \text{isothermal work} / \text{Actual work}$$

ISENTROPIC EFFICIENCY: is the ratio of the isentropic power to the brake power required to drive the compressor

$$\text{Isothermal efficiency} = \text{Isentropic power} / \text{Actual brake power.}$$

10. What is meant by free air delivered?

The free air delivered is the actual volume delivered at the stated pressure reduced to intake pressure and temperature and expressed in m³/min.

11. Define Swept volume.

It is the volume of air sucked by the compressor during its suction stroke. Mathematically, the swept volume or displacement of a single acting air compressor is given by,

$$V_s = \frac{\Pi}{4} \times D^2 \times L$$

D = Diameter of cylinder bore, and

L = Length of piston stroke.

12. Define clearance ratio.

Clearance ratio is defined as the ratio of clearance volume to swept volume (or) stroke volume

$$C = V_c / V_s$$

V_c = Clearance volume

V_s = Swept volume

13. Name the methods adopted for increasing isothermal efficiency of reciprocating air compressor.

Isothermal efficiency is increased by perfect inter cooling.

14. Why clearance is necessary and what is its effect on the performance of reciprocating compressor?

When the piston reaches top dead center in the cylinder, there is a dead space between piston top and cylinder head. This space is known as clearance space and the volume occupied by this space is known as clearance volume.

15. What is compression ratio?

Compression ratio is defined as the ratio between total volume and clearance volume.

Compression ratio = Total volume / clearance volume

16. Give the expression for work done for a multistage compressor with perfect inter cooling.

$$I.P = N \frac{n}{n-1} P_1 V_a \left[\left(\frac{P_{N+1}}{P_1} \right)^{\frac{n-1}{Nn}} - 1 \right] \frac{RPM}{60}$$

17. What are the factors that affect the volumetric efficiency of a reciprocating compressor?

- Clearance volume
- Compression ratio

18. Name the compression process in which work done is minimum in a reciprocating air compressor.

Isothermal compression

19. Discuss the effect of clearance upon the performance of an air compressor.

The volumetric efficiency of air compressor increase with decrease in clearance of the compressor.

20. What is the difference between complete or perfect inter cooling and incomplete inter cooling.

PERFECT INTER COOLING:

When the temperature of air leaving the intercooler is equal to the original atmospheric air temperature then inter cooling is known as perfect inter cooling.

IMPERFECT INTER COOLING:

When the temperature of air leaving the intercooler is more than original atmospheric air temperatures then inter cooling is known as imperfect inter cooling.

21. What are types of air compressor?

- Roots blower compressor
- Vane blower compressor
- Centrifugal blower compressor
- Axial flow compressor

22. Comparison of reciprocating and rotary air compressor?

S.No	Reciprocating Air Compressor	Rotary Air Compressors
1.	The maximum delivery pressure may be as high as 1000 bar.	The maximum delivery pressure is 10 bar only.
2.	The maximum free air discharge is about 300 m ³ /min.	The maximum free air discharge is as high as 3000 m ³ /min.
3.	They are suitable for low discharge of air at very high pressure.	They are suitable for large discharge of air at low pressure.

4.	The speed of air compressor is low.	The speed of air compressor is high.
5.	The air supply is intermittent.	The air supply is continuous.
6.	The size of air compressor is large for the given discharge.	The size of air compressor is small for the given discharge.
7.	The balancing is a major problem.	There is no balancing problem.
8.	The lubricating system is complicated.	The lubricating system is simple.
9.	The air delivered is less clean, as it comes in contact with the lubricating oil.	The air delivered is more clean ,as it does not comes in contact with the lubricating oil.
10.	Isothermal Efficiency is used for all sorts of calculation.	Iisentropic Efficiency is used for all sorts of calculation.

23. Comparison between centrifugal and axial flow compressor.

S. No.	Centrifugal Compressors	Axial Flow Compressors
1.	The flow of air is perpendicular to the axis of compressor	The flow of air is parallel to the axis of compressor
2.	It has low manufacturing and running cost.	It has high manufacturing and running cost.
3.	It requires low starting torque.	It requires high starting torque.
4.	It is not suitable for multi- staging	It is suitable for multi- staging
5.	It requires large frontal area for a given rate of flow.	It requires less frontal area for a given rate of flow. It makes the compressor suitable for air crafts.