

Q. Which are two types of alternators?

→ The two types of alternator are

- Salient pole rotor
- Cylindrical rotor.

- Salient pole rotor has projected poles out of the from the surface. The airgap is non-uniform so this operates at low speed & also have large diameter & small axial length. The prime movers used are hydraulic turbines or diesel engines.

- Cylindrical rotor - does not have projected poles so the airgap between stator & rotor is uniform. Number of poles are less. It operates at high speed. diameter is small but axial length is more. The prime movers used are steam turbines.

Q. Differentiate between salient pole rotor & cylindrical rotor of synchronous machine.

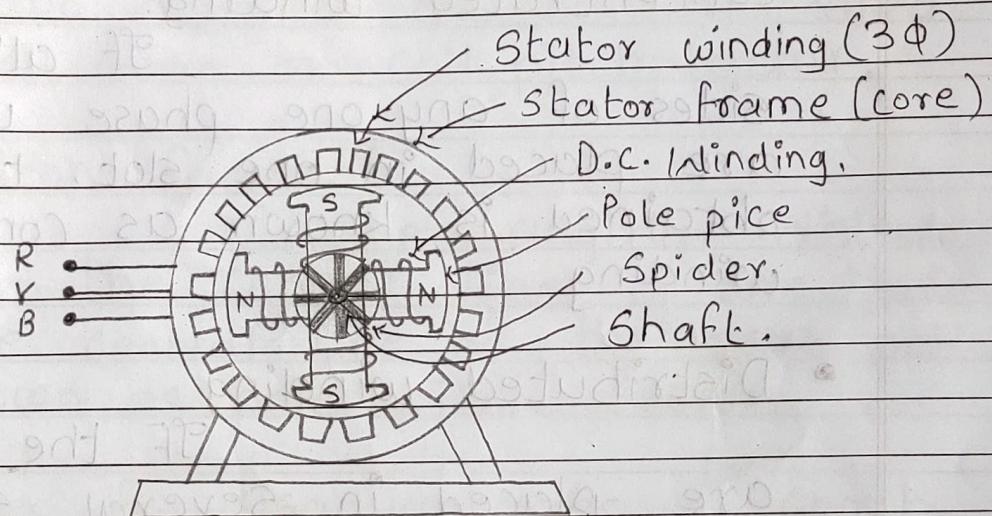
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Salient pole rotor

Cylindrical rotor.

- | | |
|---|---|
| <ul style="list-style-type: none"> • Salient pole rotor has poles which are projected out from surface. • The air-gap between stator & rotor is non-uniform. • The salient pole rotor has more number of poles. • Operate at low speed. • They have large diameter & small axial length. • The prime mover used are water turbines. | <ul style="list-style-type: none"> • Cylindrical rotor does not have poles that are projected. • The air-gap between the stator & rotor is uniform. • The cylindrical rotor has less number of poles. • Operate at high speed. • They have small diameter & large axial length. • The prime movers used are steam turbines. |
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Q. Explain construction of 3Φ Alternator with diagram.



- Stator frame :-

Stator frame is the laminated stamped core which has slots for stator windings.

- Stator winding :-

This winding is placed in the stator slots & it carries armature current through it.

- D.C. Winding :-

This winding is placed on pole piece. It generates constant flux which is then cut by stator winding.

- Spider :-

It is the support for pole piece to hold & rotate on shaft.

- Shaft :-

It is the rotating part connected with prime mover.

Q. Define the following:



- Concentrated winding.

If all the coil

sides of any one phase under one pole are placed in one slot, the winding obtained is known as concentrated winding.

- Distributed winding

If the conductors

are placed in several slots under one pole, then the winding is known as distributed winding.

- Full pitch winding

When the two coil

sides forming a complete coil of a winding are 180 electrical degrees apart, the winding is known as full pitch winding.

- Short pitch winding

When the two coil

sides forming a complete coil of a winding are less than 180 electrical degrees apart, the winding is known as short pitch winding.

- Coil span factor

The distance between

the two sides of a coil is called
the coil span or coil pitch factor.

- Pole pitch factor,

The angular distance
between the central line of one pole
to the central line of the next pole
is known as pole pitch factor.

Q. Advantages & disadvantages of short
pitch winding.



- Advantages

- The amount of copper needed for connections is less as compared to the full pitch winding.
- Generated EMF can be made to approximate to a sin wave more easily.

- Due to elimination of high frequency harmonics, eddy current & hysteresis losses are reduced.

- Disadvantage

- The total voltage around coils is reduced. To compensate it more number of turns & therefore more copper required.

Q. Why parallel operation of alternators is needed.

→ Parallel operation of alternators is needed due to the following reasons.

- Continuity of supply:- When one alternator is taken out of service for its scheduled maintenance & inspection.

- Efficiency:- During the periods of light load, one or more alternators may be shut down so running one will operate at full-load.

- Breakdown:- In case of major breakdown the supply is carried by the parallel alternator.

- Load growth:- In order to meet the increasing future demand of load.

- Economy:- Operating cost & cost of energy generated are less in parallel operation.

Q. Conditions required for parallel operation of alternators?

→ Conditions required for parallel operation of alternators are as following.

- Busbar voltage & incoming alternator voltage should be equal.

- Phase sequence of busbar & incoming alternator should be same.

- Frequency of generated voltage & incoming voltage should be same & constant.

Q. What is mean by synchronizing of alternator.

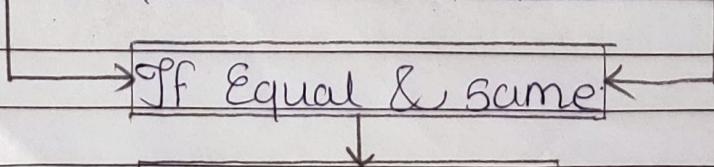
→ The process of connecting two alternators or an alternator & an infinite bus-bar system in parallel is known as synchronizing.

Alternator 1

Alternator 2

- Frequency
- Voltage
- Phase Sequence

- Frequency
- Voltage
- Phase Sequence



Synchronization
is possible.

Q. What is armature reaction in an alternator.

→ The main field flux in the an alternator is produced by the rotor field poles. When the alternator is loaded, the armature currents are set-up which produces the armature flux. This armature flux reacts with main flux & modifies it. This modified magnitude depends on type of load.

Q. Write down voltage drops in alternator when it is loaded.

→ Voltage drops in alternators when it is loaded are as following.

- V_{tg} drop due to armature resistance
- V_{tg} drop due to armature leakage reactance
- V_{tg} drop due to armature reaction

Q. Explain different starting methods of synchronous motor.

→ The following are the different methods to start a synchronous motor.

- Using Poney Motors:-

A small motor is connected at the end of shaft which is used till motor reaches the synchronous speed.

- Using clumper winding:-

Damper winding is provided while manufacturing of motor which helps motor to reach sub-synchronous speed.

- As a slip-ring induction motor:-

The motor is started as induction motor by adding rotor resistance using slip-rings.

- Using small DC machine coupled to it.

Q. Explain hunting in Synchronous motor, with their causes & effects.

→ Hunting is the phenomenon of oscillation of the rotor about its steady state position or equilibrium state in a synchronous motor. Hence, hunting means a momentary fluctuation in the rotor speed of a synchronous motor.

- Causes of hunting
 - Sudden change of mechanical load.
 - Sudden change in field current
 - Cyclic variation of the load torque.
- Effects of hunting
 - It may lead to loss of synchronism
 - Resonance may take place
 - Large mechanical stresses

Q. Explain operation of a synchronous motor, with increase in load.

→ When the load on a synchronous motor is increased, then

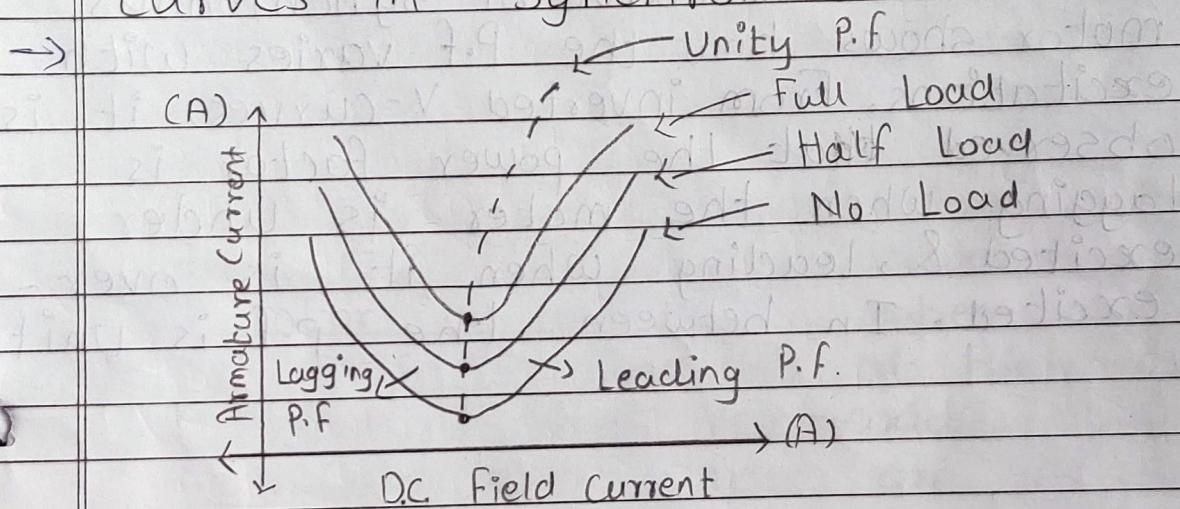
- The motor continues to run at synchronous speed.
- The torque angle (θ) increases
- The magnitude of the excitation V_{fg} remains same
- The armature current (I_a) drawn from the supply increases.

Q. Write down effects of change in excitation on Synchronous motor.

→ Effect of change in excitation on Synchronous motor are as following

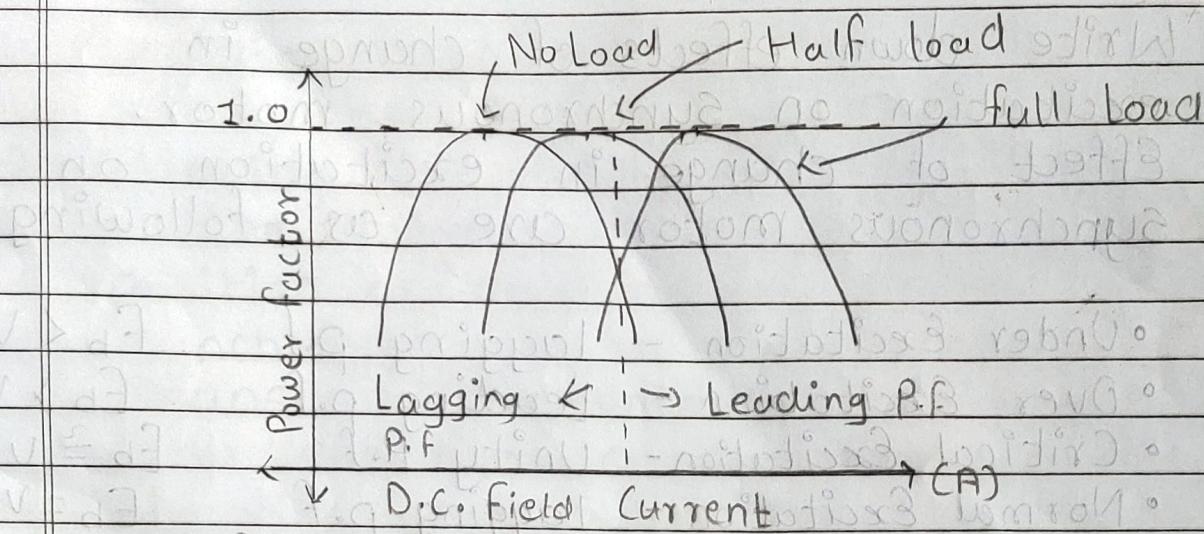
- Under Excitation - Lagging p.f $E_b < V$
- Over Excitation - Leading p.f $E_b > V$
- Critical Excitation - Unity P.F $E_b \approx V$
- Normal Excitation - Lagging p.f $E_b = V$

Q. Draw & Explain V & inverted V curves in Synchronous motor.



V curve of Synchronous motor

From V-curve it is observed that the armature current has large values both for low & high values of excitation. It has minimum value corresponding to the unity p.f.



Inverted V-curve of Synchronous Motor.

The inverted V-curve of synchronous motor shows how the P.f varies with excitations. From inverted V-curves, it is observed that the power factor is Lagging when the motor is under excited & leading when it is over-excited. In between, the p.f is unity.