Synchronous Generators

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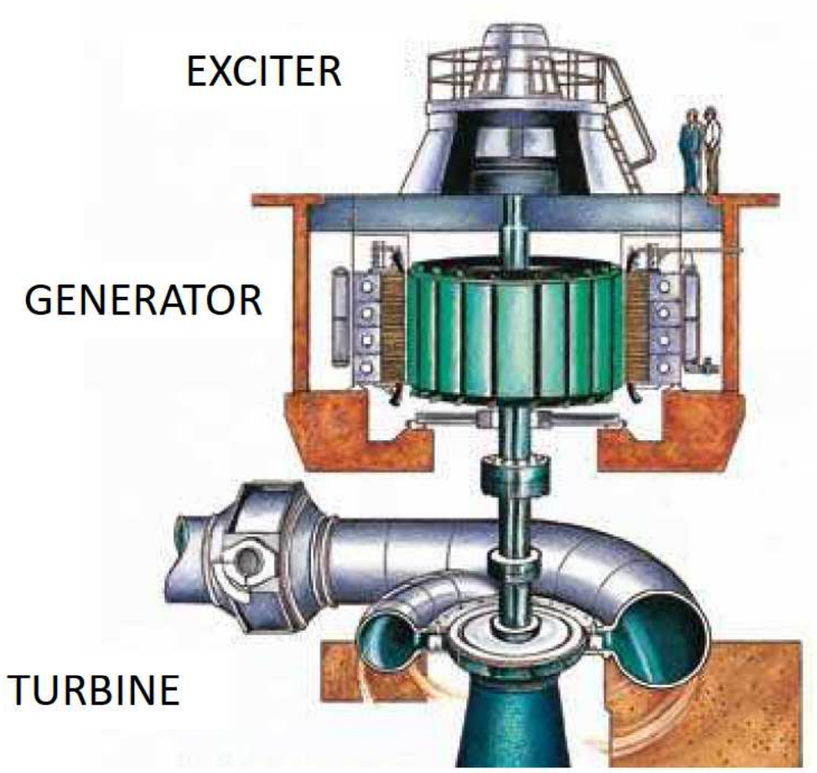
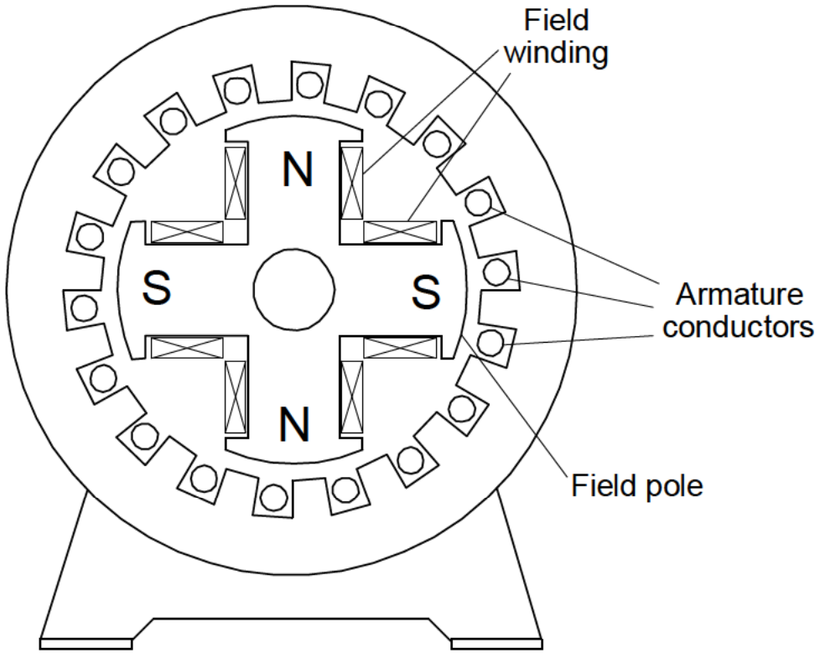


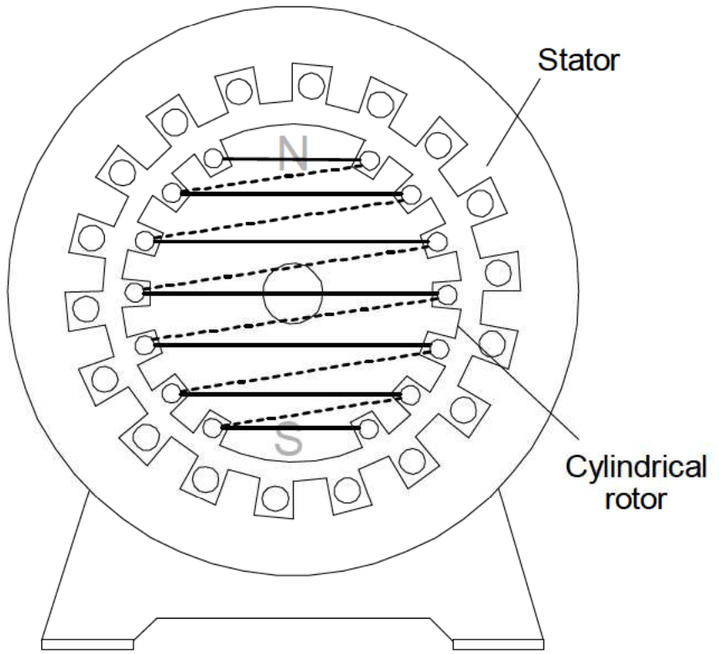
- Synchronous generator is the common type used in generating stations
- It runs at constant speed and generates constant frequency output
- The field poles are on the rotor side and the armature is on stator side
- The armature winding is placed in the slots on stator core
- Field poles are excited with a dc supply
- DC supply to the field poles are given through a pair of slip rings

Types of Construction

Salient Pole type

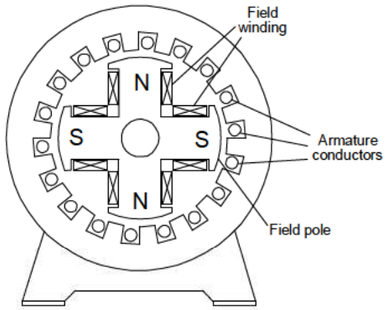


Cylindrical Rotor type

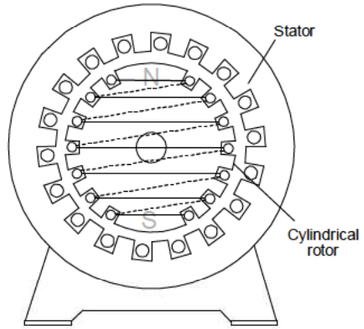


Types of Construction

Salient Pole type



Cylindrical Rotor type

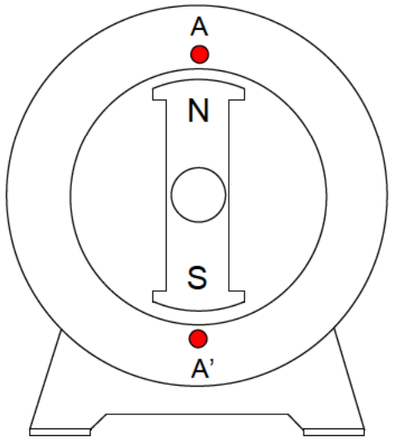


Why Armature on Stator?

- Power in the field system is much less compared to the generated power, which is easily handled by the slip rings.
- When the armature is on the stator side, generated power is directly taken out without the help of slip rings.

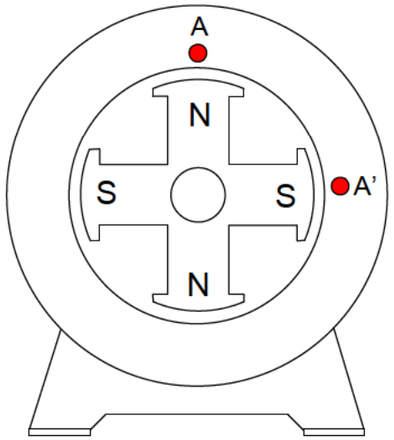
Relation between Speed and Frequency

2 Pole



1 revolution per second (*RPS*) makes 1 Hertz

4 Pole



1 revolution per second (*RPS*) makes 2 Hertz

General case

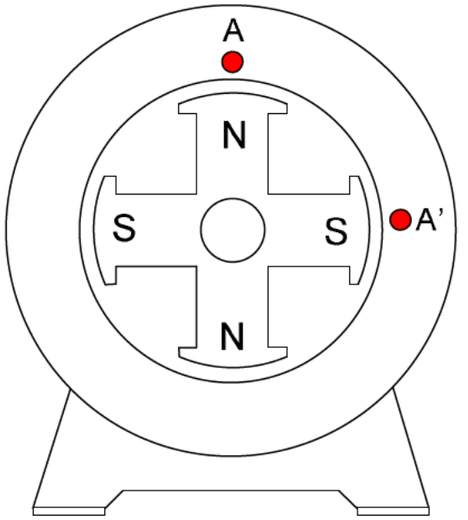
$$RPS = \frac{2f}{P}$$

where f is the freuency
and P is the number of poles

$$RPM,\ N = \frac{120f}{P}$$

Synchronous Speed (Derivation)

- Synchronous speed is the speed at which the generator should run to produce a constant frequency



$$\text{Number of cycles per revolution} = \frac{P}{2}$$

$$\text{Revolution per second} = \frac{N}{60}$$

$$\text{Cycles per second} = \frac{P \times N}{2 \times 60} \quad \Rightarrow \quad f = \frac{P \times N}{2 \times 60}$$

$$RPM, \; N = \frac{120 f}{P}$$

f - freuency

P - number of poles

N - speed in RPM