Alternating Current Electric Induction Motors

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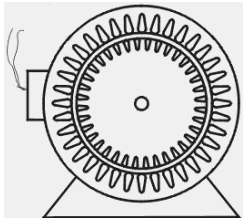
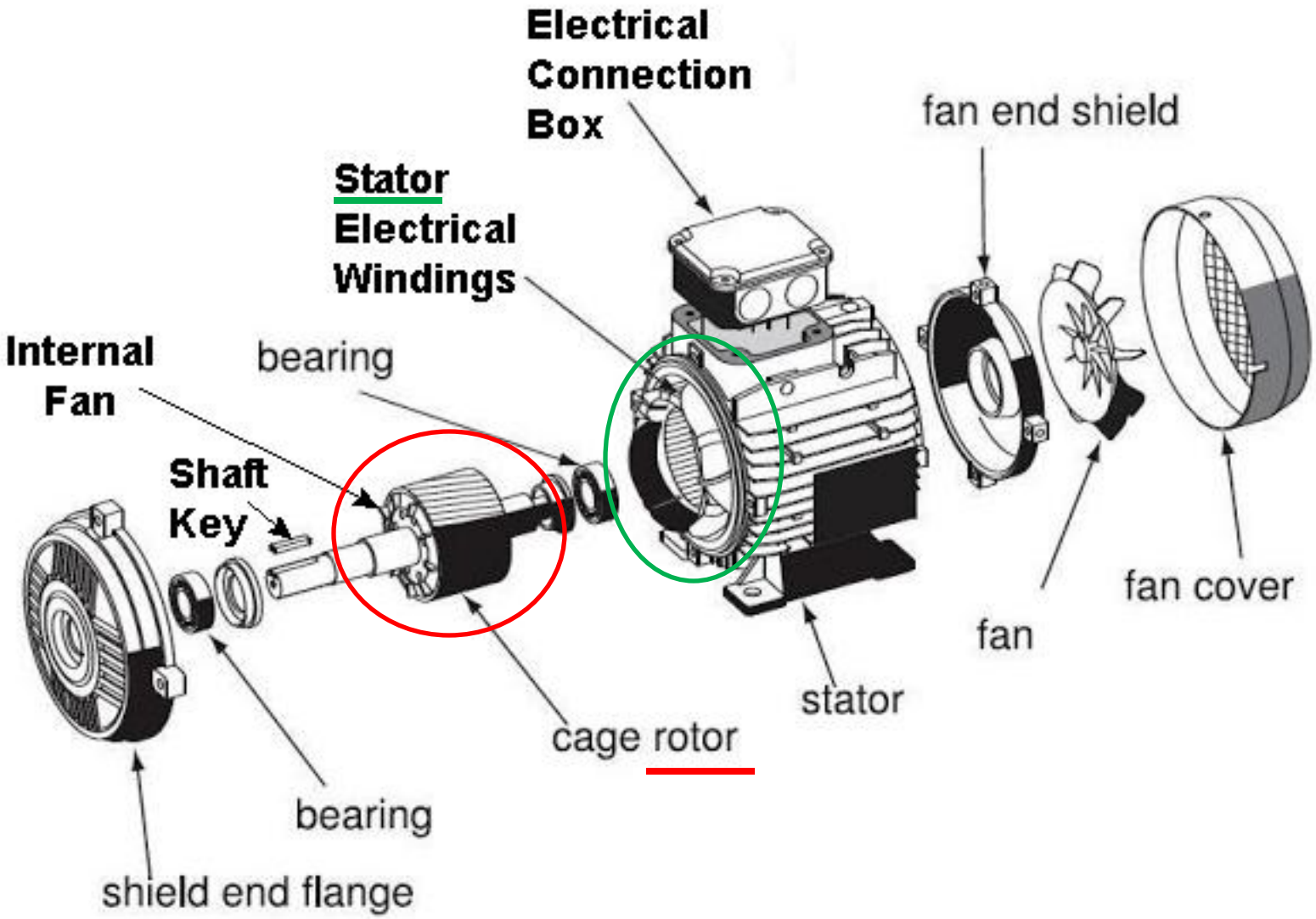
Home Metal Shop Club
08-09-2014

Types of Electric Motors

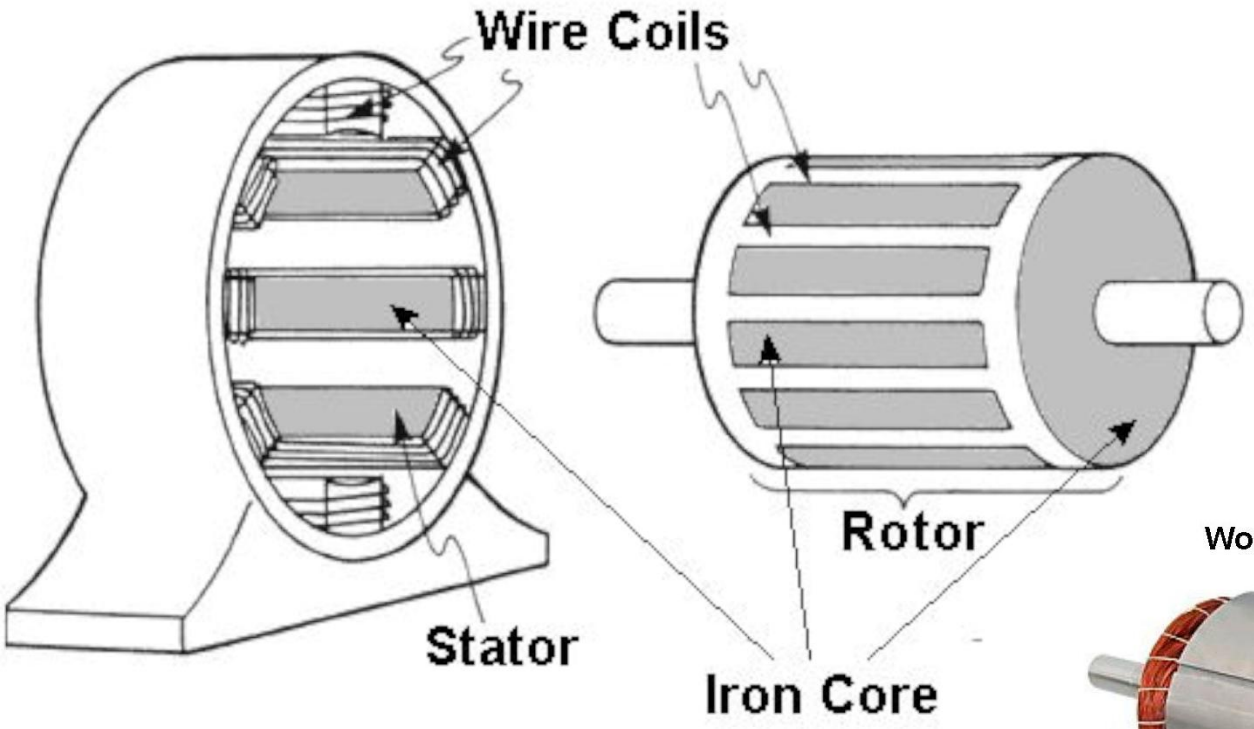


- DC Stator
  - PM Rotor
  - Communtator
- **AC Stator**
  - **Induction**
    - Hysteresis
    - 3-Phase
    - **Single Phase**
      - **Shaded Pole**
      - **Split Phase**
      - **Capacitor**
        - **Cap. Start**
        - **Cap. Run**
  - Slip Ring
    - Synchronous

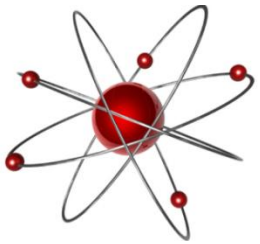
Parts of an Induction Electric Motor



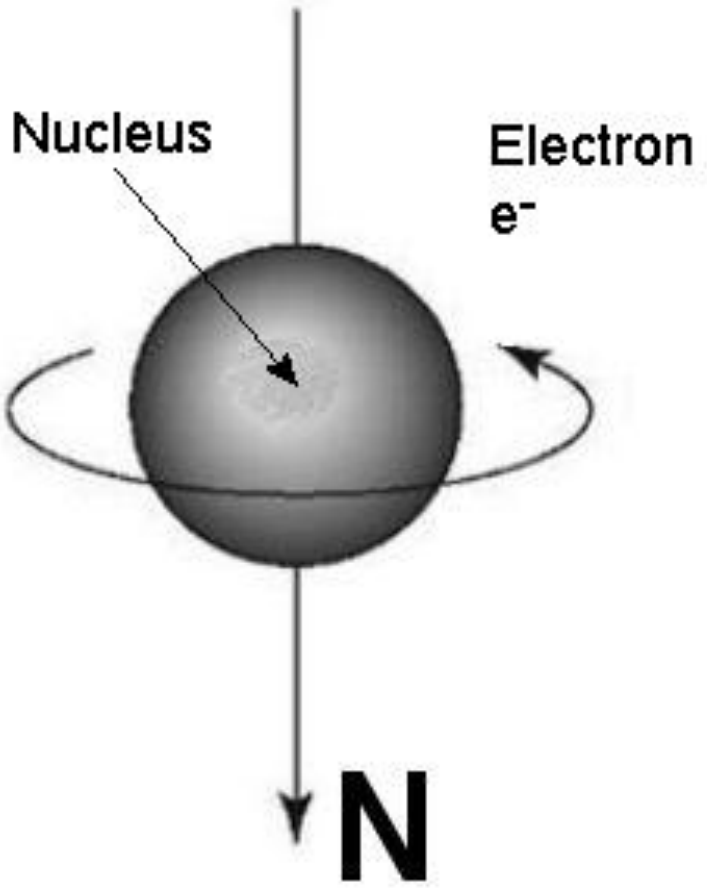
Coils and Magnetic Core

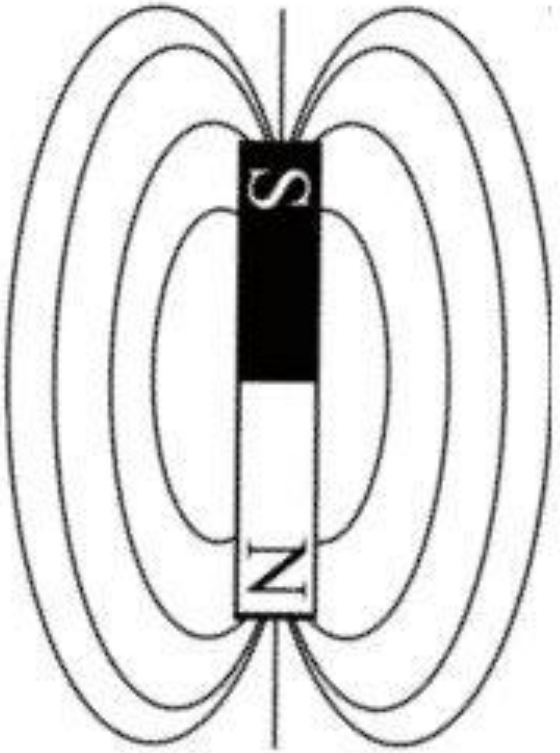


Wound Core Rotor

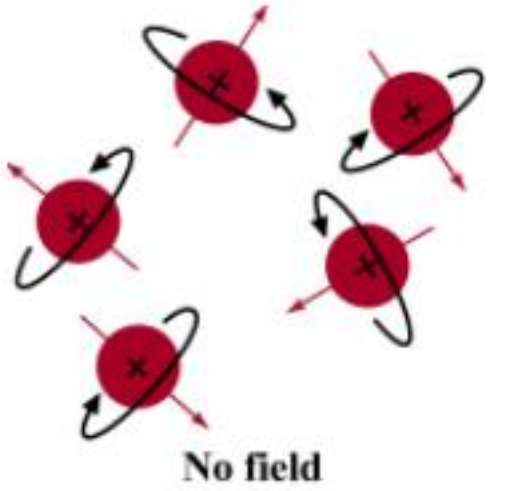


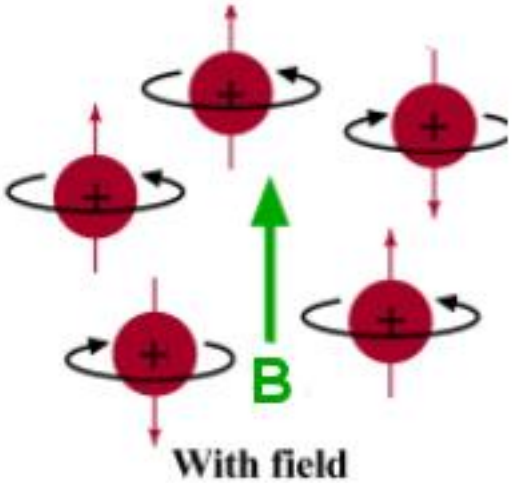
Why are some Substances Magnetic ?

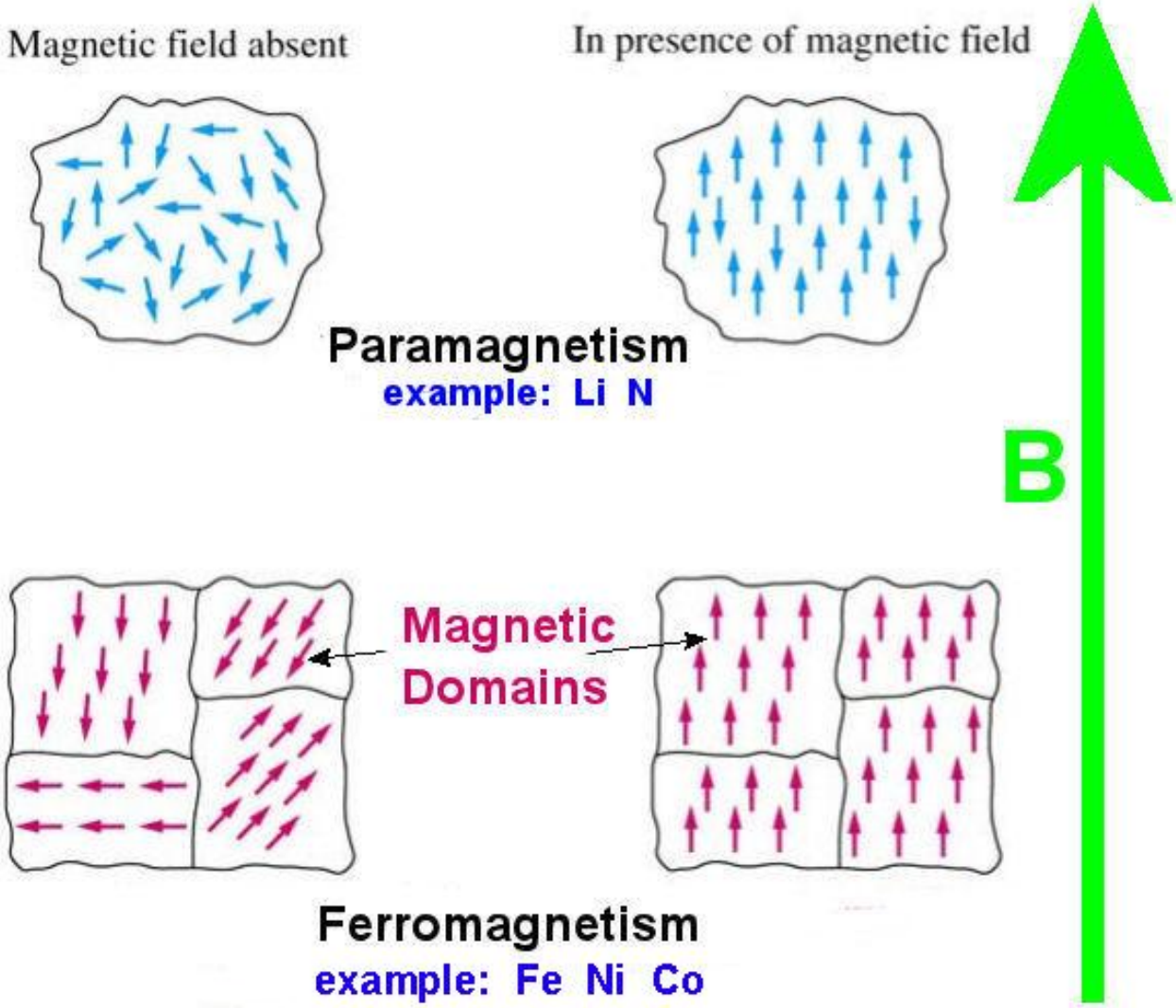




Induced Magnetism

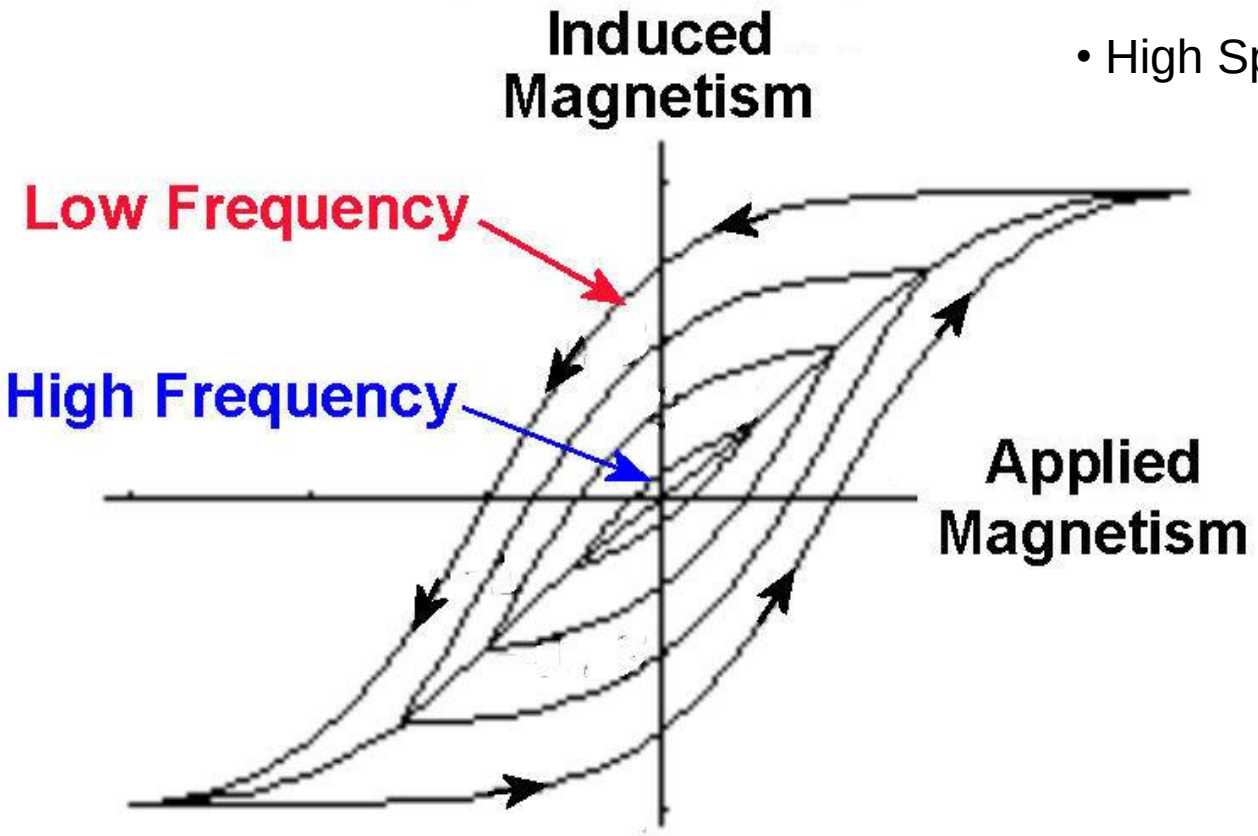




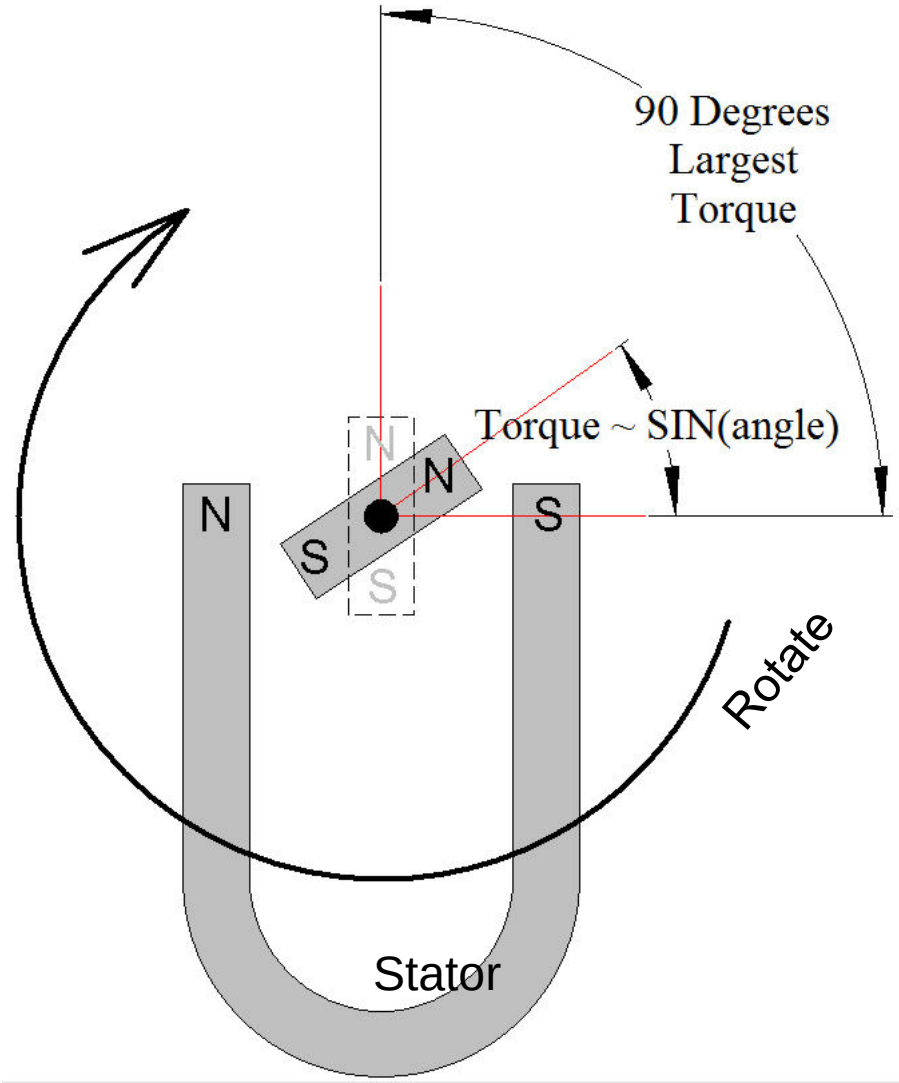


Retentively (Remanence) - Hysteresis

- Build-Up Lags Application
- Magnetism is Remembered
- High Speed Reduction



Magnetic Drag

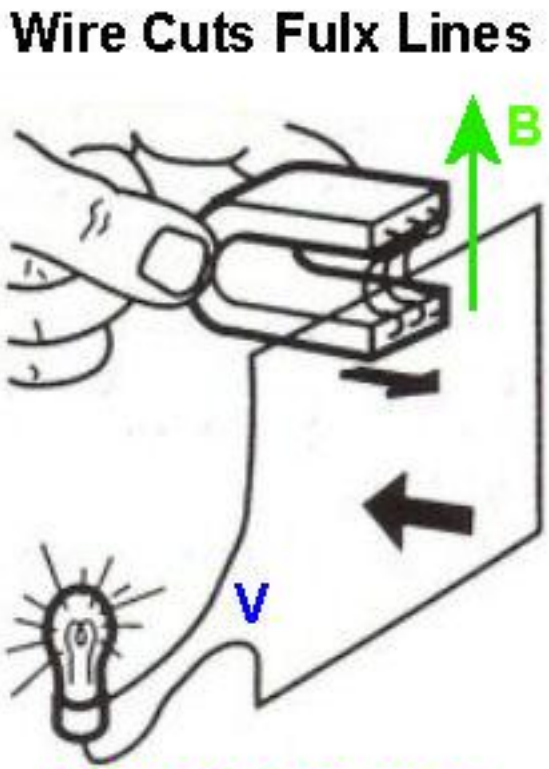


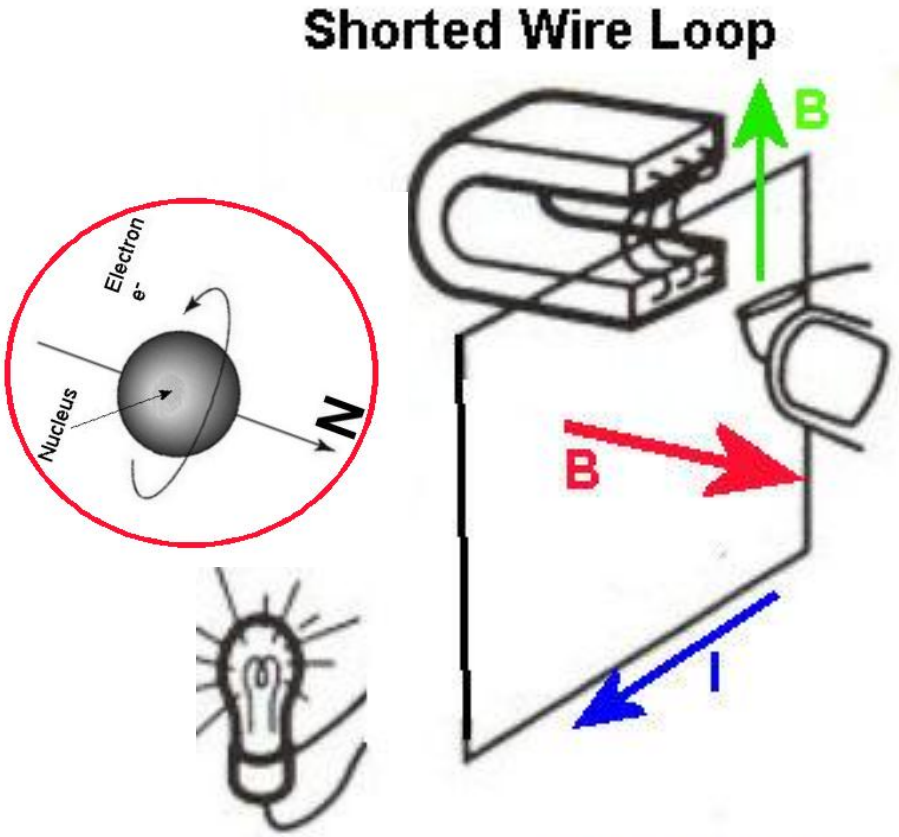
Magnets like to align North to South.

Max torque is when perpendicular.

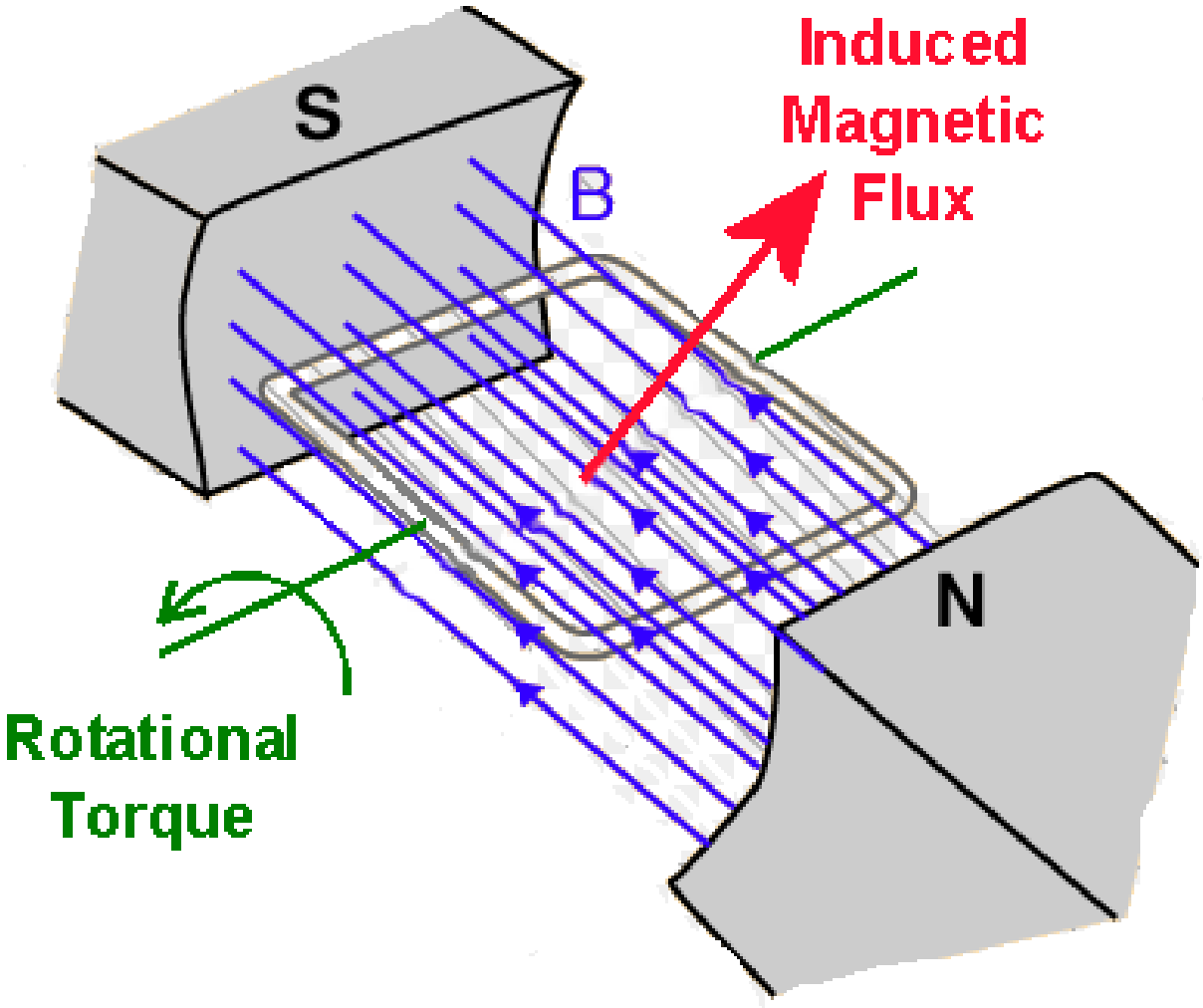
Rotate one and the other follows.

Electricity & Magnetism - Induction

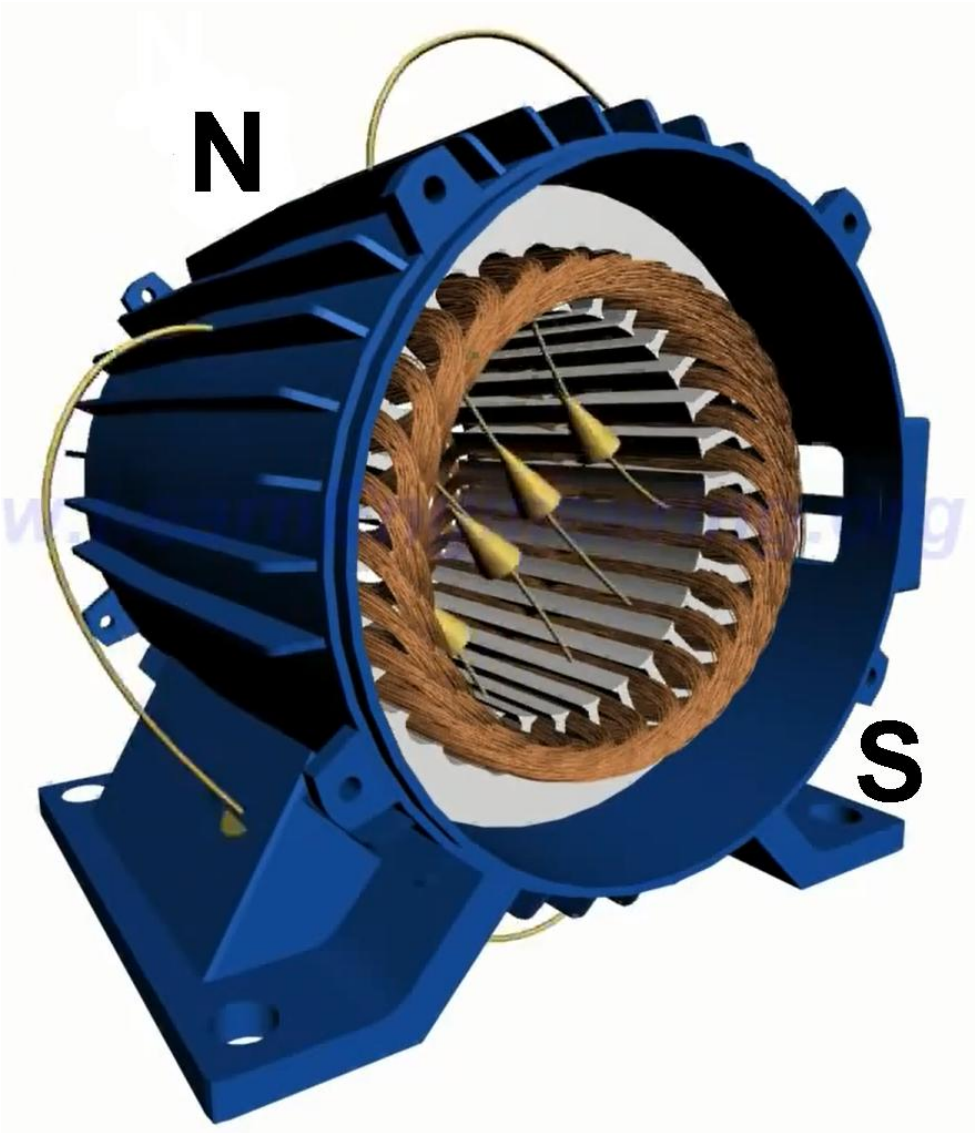




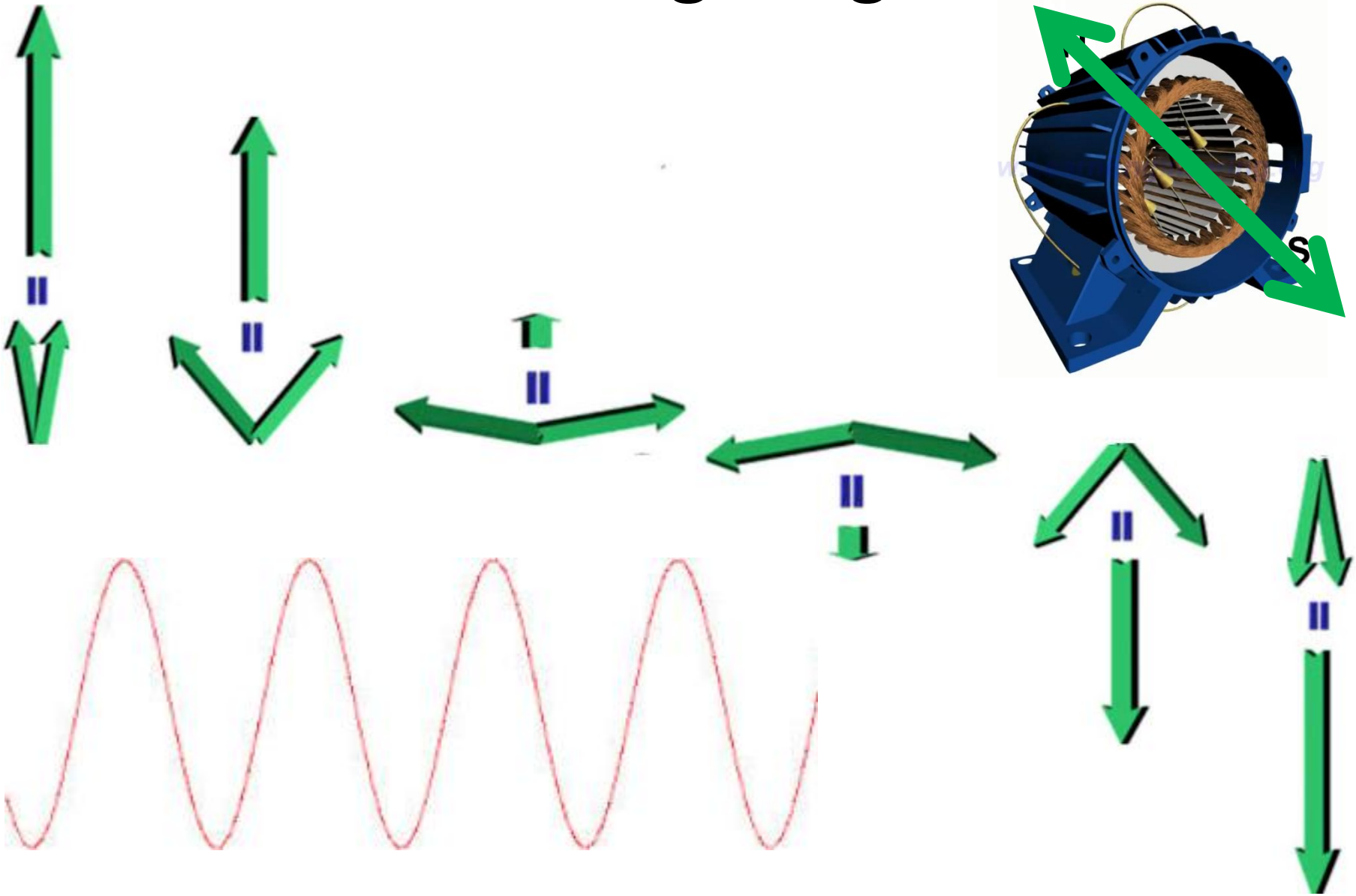
Induced Magnetic Torque



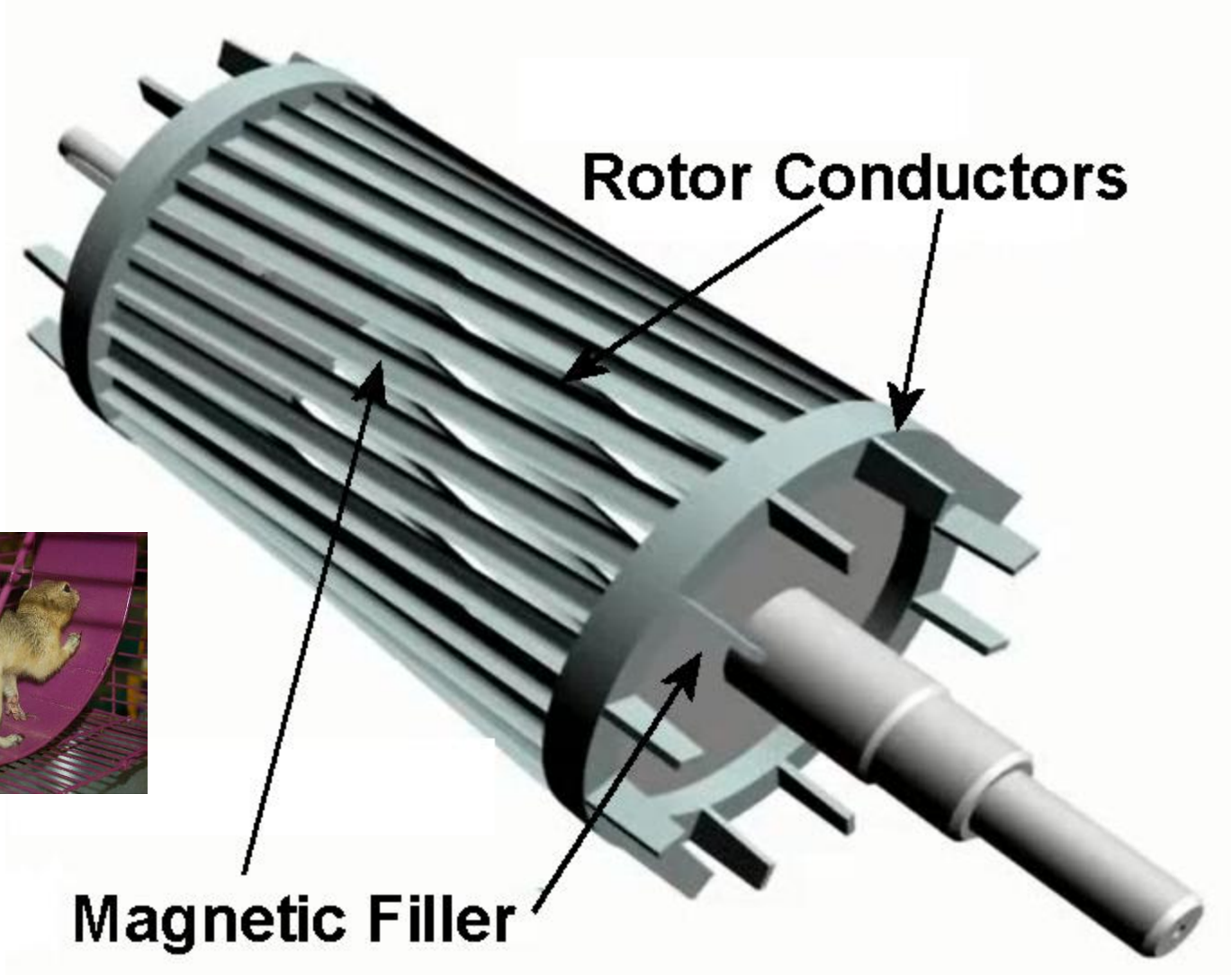
Stator Magnetic Field



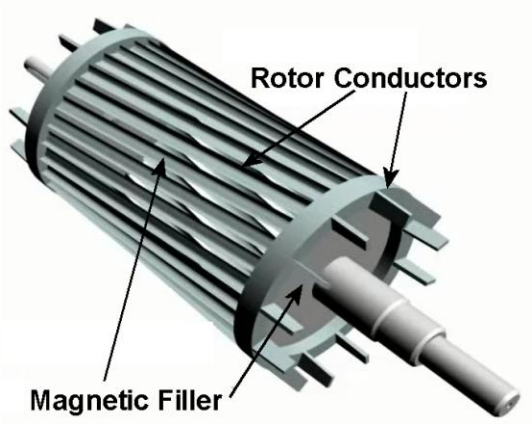
Double Revolving Magnetic Field



Squirrel Cage Rotor Construction



Preferential Rotation

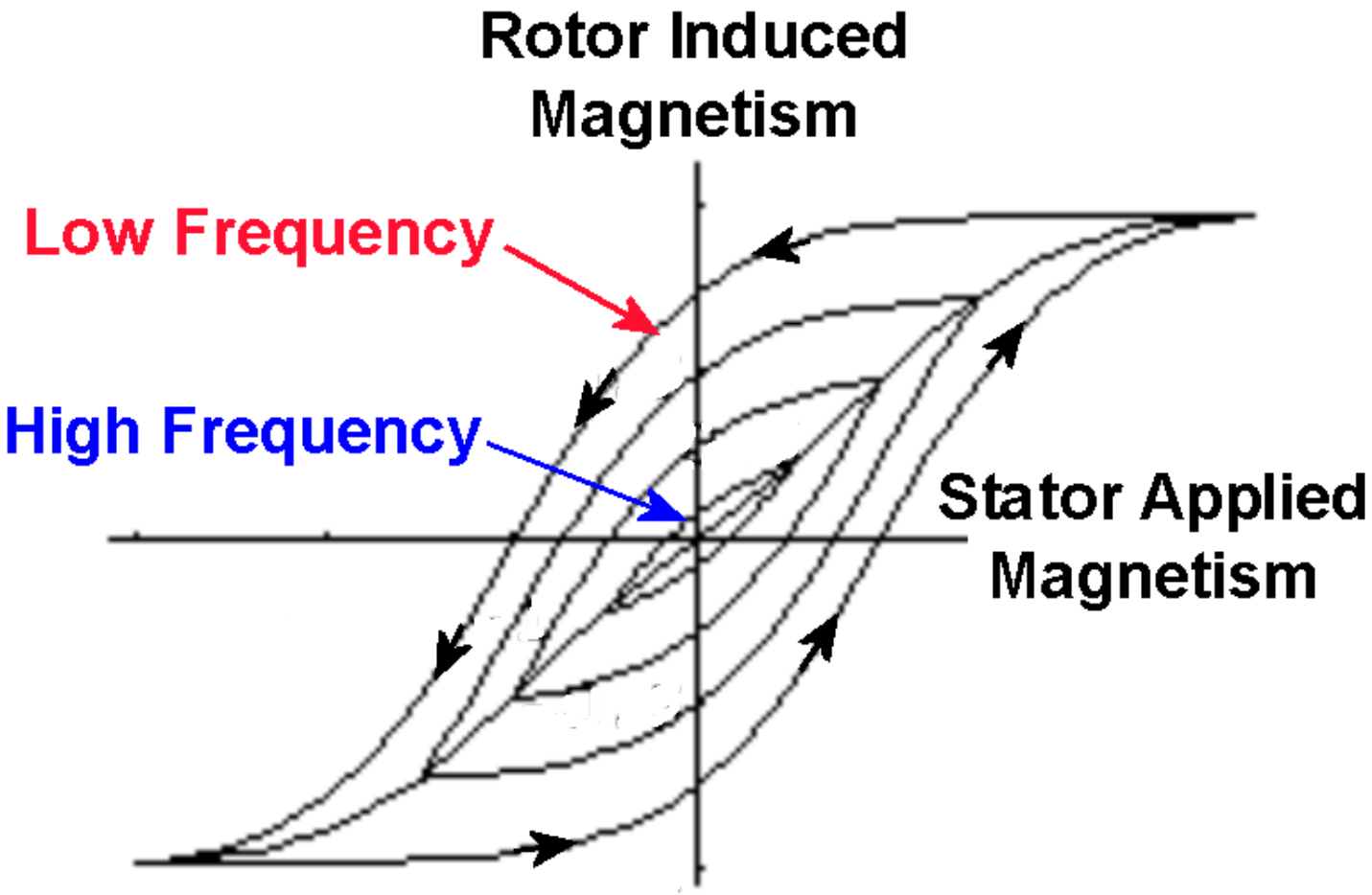


- Two Counter Rotating Magnetic Fields
- Rotor Rotates in the Direction of One of the Fields
- High Frequency and Low frequency Currents induced
- Retentively (Hysteresis Drag) favors Low Frequency Current
- Inductance of Rotor Coil Chokes-Off High Frequency Induced Current

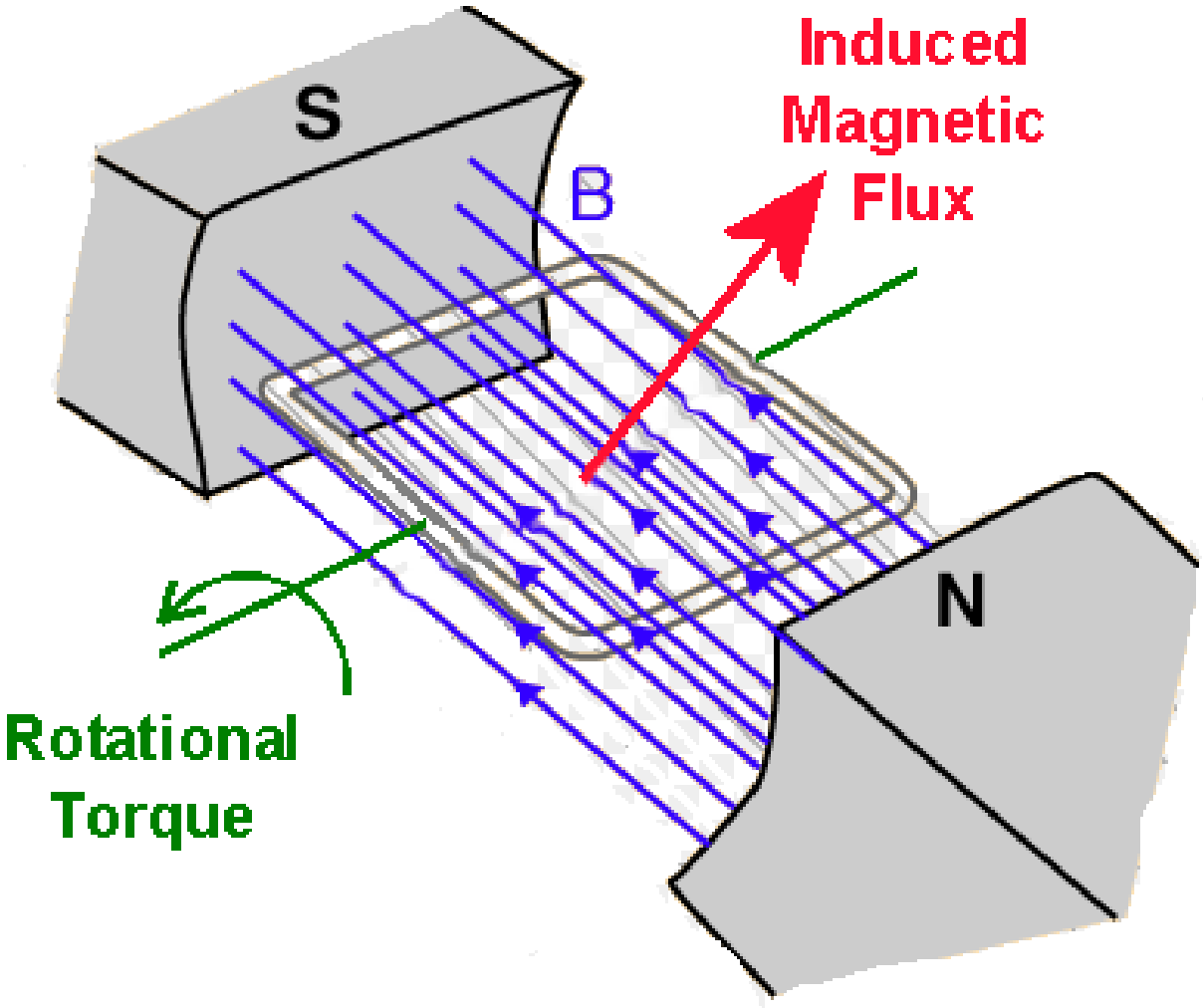
Hysteresis Magnetic Drag

Rotor magnetism build-up lags stator magnetism.

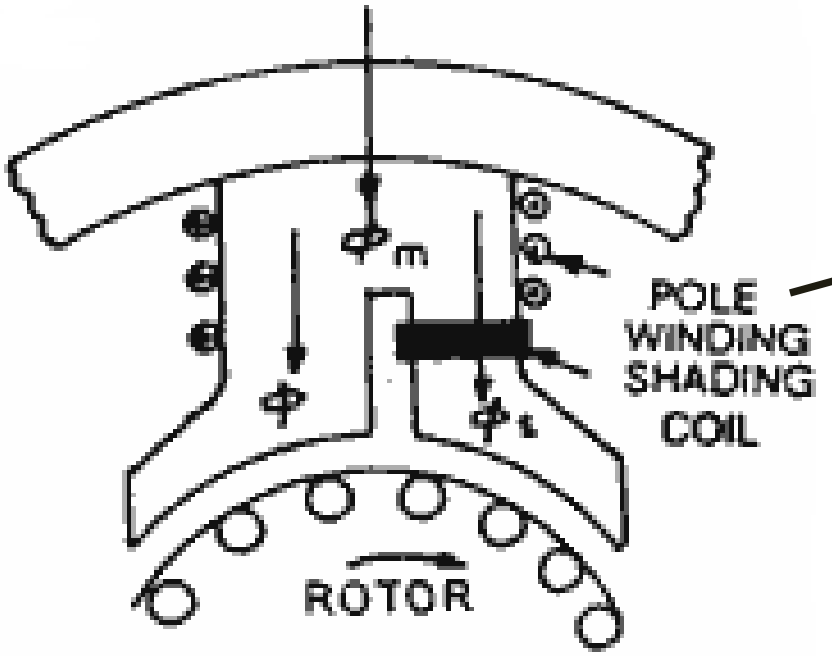
Rotor magnetism is reduced for higher frequency.



Induced Current Yields Torque

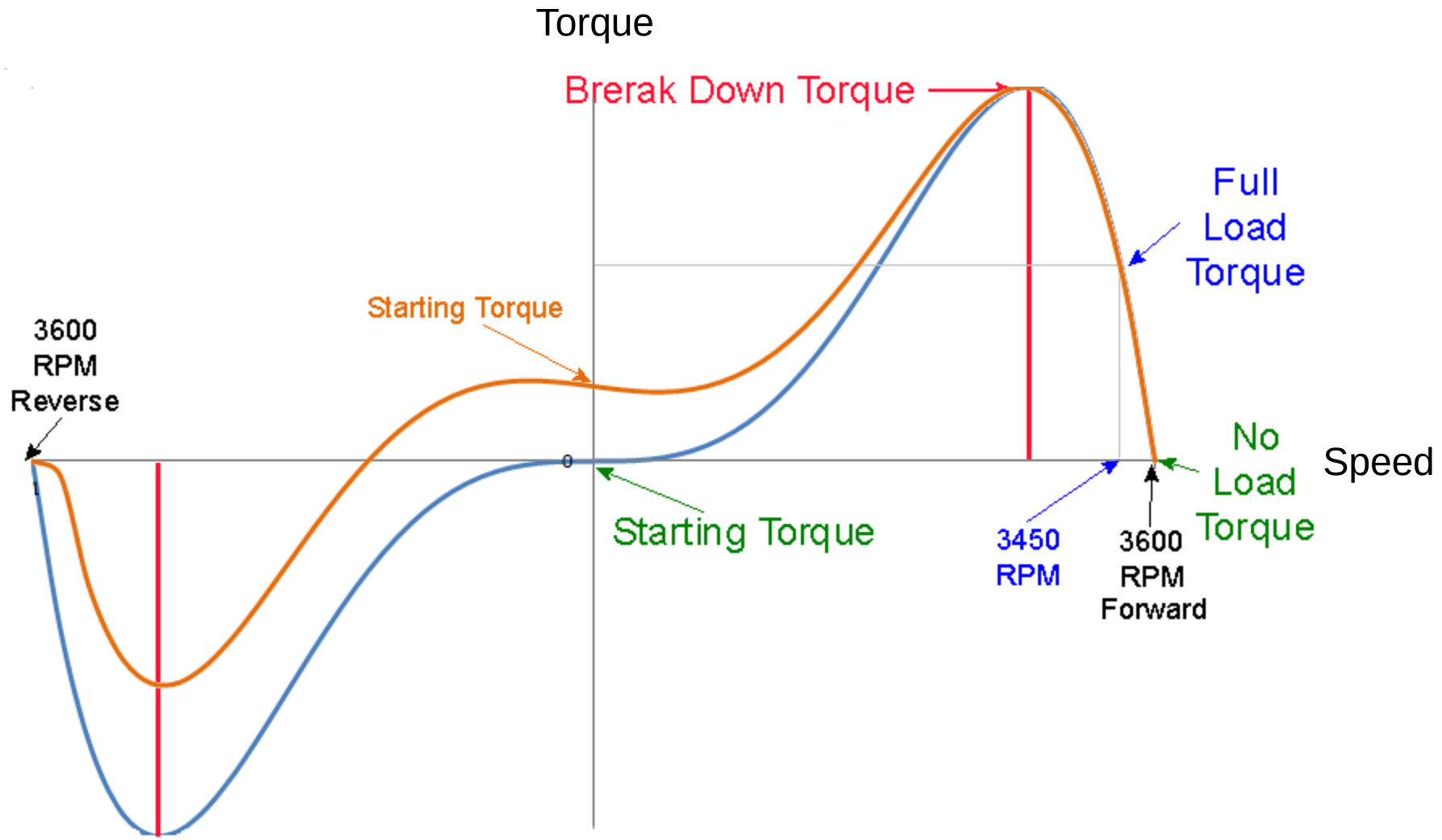


Shaded Pole Motor

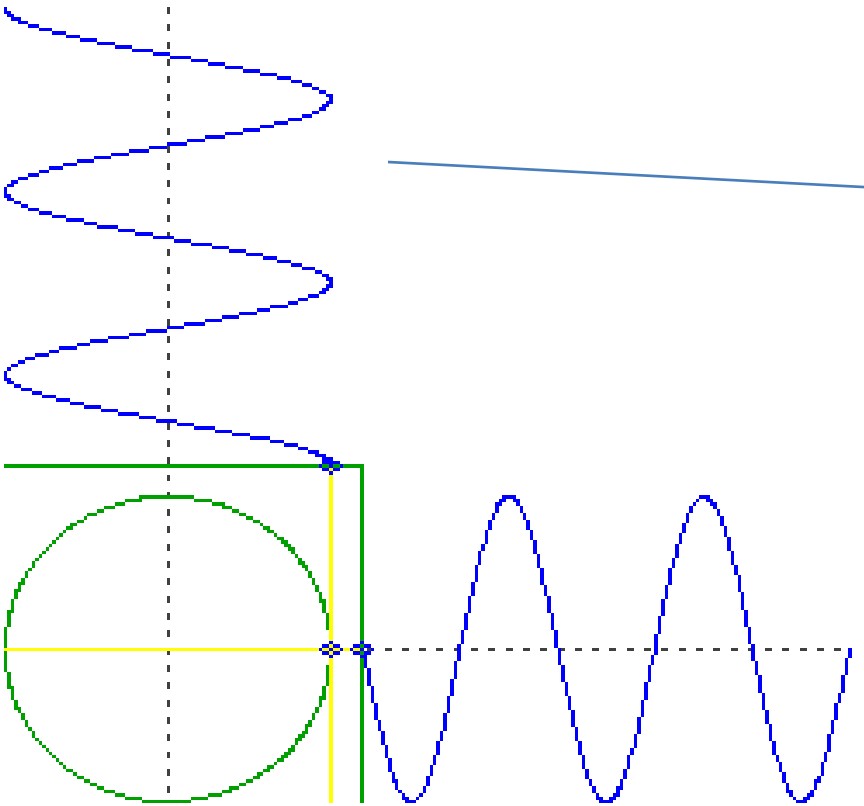


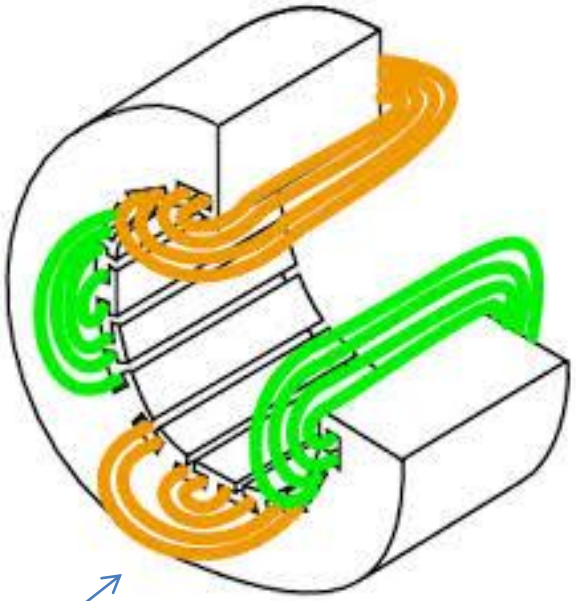
Shading one side of a pole delays the magnetic buildup, and thereby, creating a moving magnetic field

Torque – Speed Curve

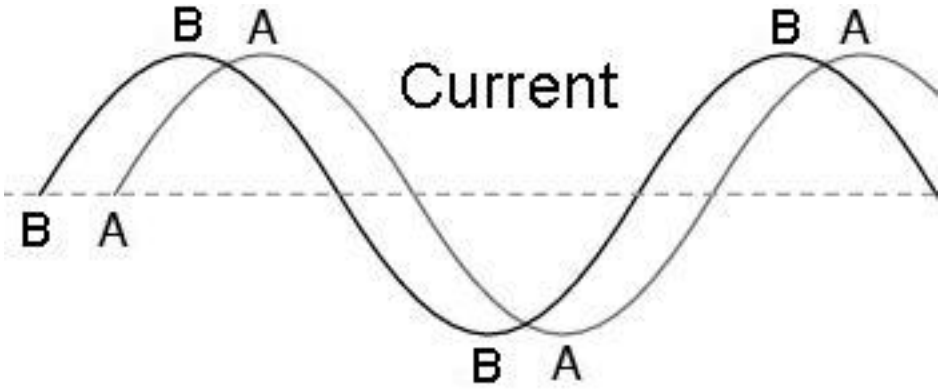


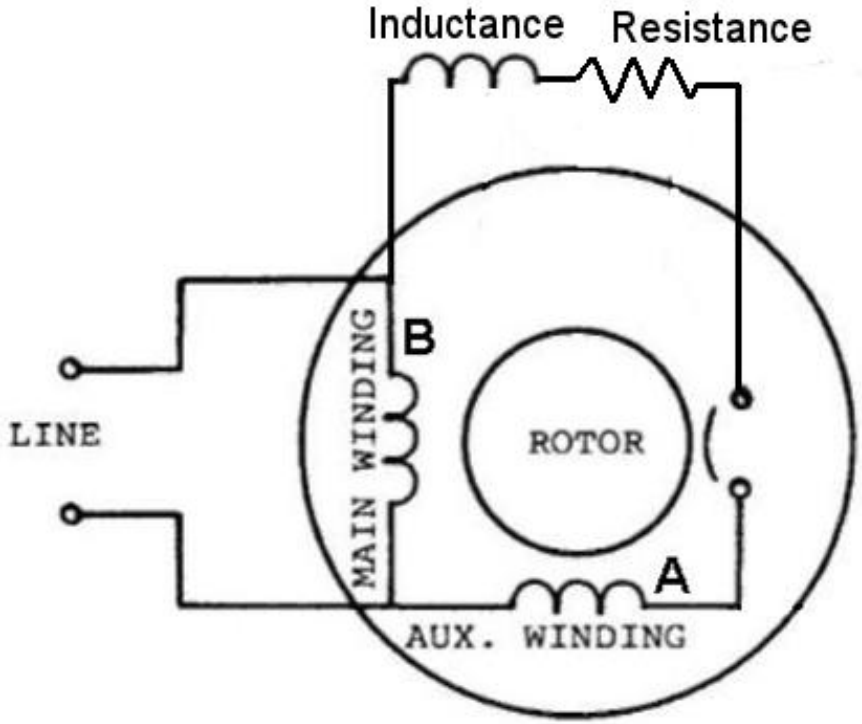
Quadrature Magnetic Coils





Split Phase Motor Starting



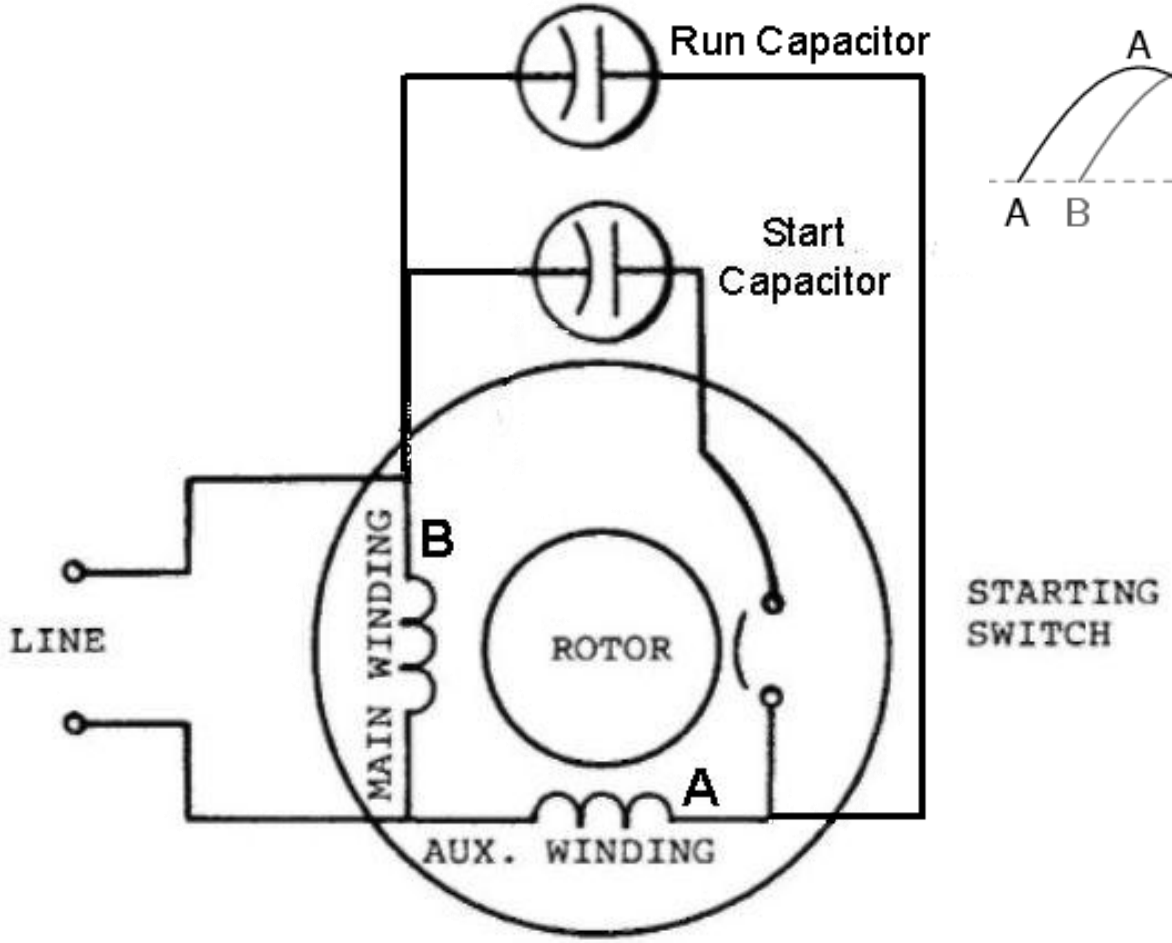


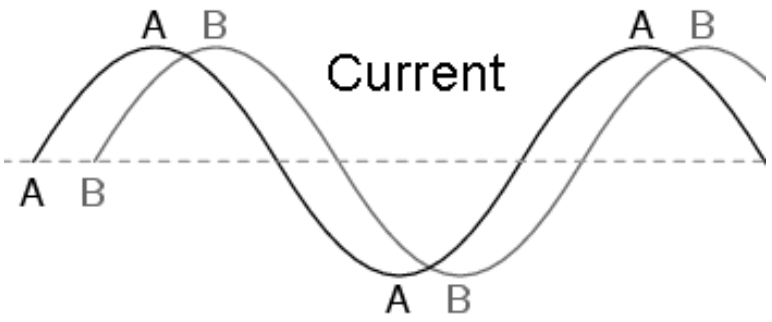
Main Winding Current "B"

Leads

Start Winding Current "A"

Capacitor Start and Run



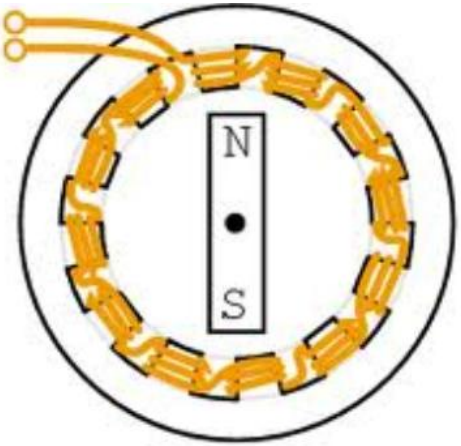


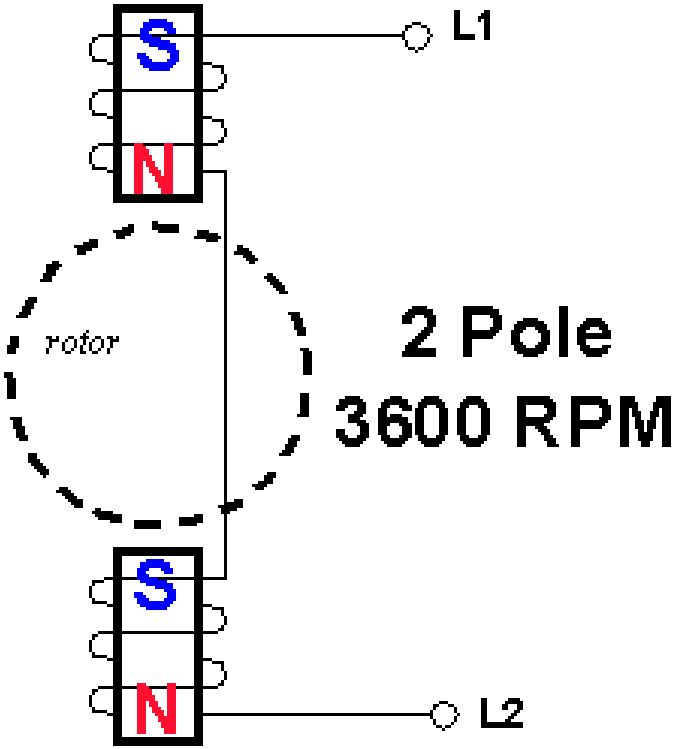
Start Winding Current "A"

Leads

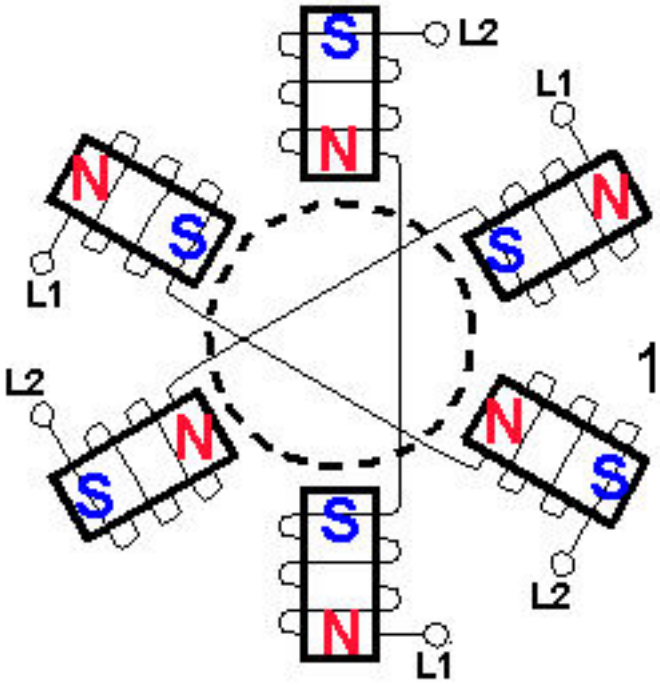
Main Winding Current "B"

RPM vs. Poles





2 Pole
3600 RPM



6 Pole
1200 RPM

FIN