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NEBRASKA PUBLIC POWER DISTRICT

MAGNETIC FIELDS, MAGNETIC FORCES, FARADAY'S LAW

MOTOR BASICS

CONCEPT One of the important applications of electromagnetism is the electric motor. An electric motor is a device converting electrical energy into mechanical energy (generally a torque). The conversion is usually obtained through the generation of a magnetic field by means of a current flowing into one or more coils. The electric motor works on the principle of magnetic effects of current. The principle is when a rectangular coil is placed in a magnetic field and current is passed through it, the coil rotates because of the torque producing forces acting on the coil. When a conductor such as a wire is carrying a current, it experiences a force in a magnetic field. Scientists call this the "motor effect".

EXAMPLES

Magnetism is the force used by motors to create rotation.

A **magnetic field** (B) is produced any time an electric current is passed through a wire.

The magnetic field around a singular straight wire is not very strong, however, a stronger field can be created by coiling the wire. An even stronger field can be produced by coiling wire around a piece of special steel called "**electrical steel**" and creating an **electromagnet**.

Coil "groups" laid in slots in electromagnetic material forms the stator of an industrial motor.

The poles of an electro-magnetic coil change polarity when the direction of current flow changes. This is caused by a **split ring commutator**.

When an **electric current** starts to flow through a wire, it creates a **temporary magnetic field** all around the wire. If you place the wire near a **permanent magnet**, the **temporary magnetic field** created by current flow interacts with the **permanent magnet's field**.

When two magnets placed near one another they either attract or repel.

The temporary magnetism around the wire attracts or repels the permanent magnetism from the **electromagnet**.

APPLICATION

Wind turbines are becoming increasingly more important in the state of Nebraska energy production arena. Wind energy is produced by generators that essentially are working motors running in reverse. Nebraska has an excellent "energy source" such as the wind and we are capturing its potential with the research and development of windfarms across our state.

Make sure it measures up

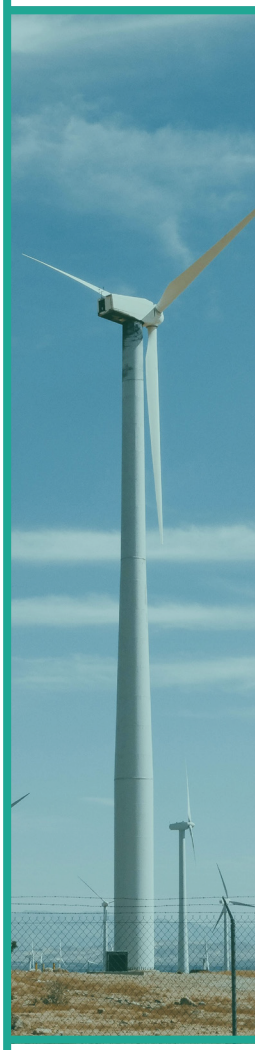
BACKGROUND

Danish Physicist Hans Orsted was the first to discover that a magnetic field was produced by the flow of electric current.

American physicist Joseph Henry discovered electromagnetic inductance and built the first electromagnetic motor.

The principle of an induction motor is to induce magnetic forces into the rotor of the motor. Torque is a force applied at a distance from and perpendicular to a rotational axis in the motor. Hence causing the rotor to spin.

Some electrical power generators can be driven by humans such as a hand crank or a bicycle wheel to generate electricity. Wind turbines and Hydroelectrical plants can also generate electricity. A generator is a motor running backwards.



FIVE KEY COMPONENTS THAT MAKE UP YOUR INDUSTRIAL ELECTRIC MOTOR

1) The Rotor. The rotor is the moving part of your electric motor.
2) The Stator (Stator Core). The stator is the stationary part of your motor's electromagnetic circuit and usually consists of either windings or permanent magnets. The stator core is made up of many thin metal sheets, called laminations.
3) The Bearings. The rotor in an electric motor is supported by bearings, which allow it to turn on its axis. The bearings are supported by the motor housing. The motor shaft extends through the bearings to the outside of the motor, where a load is applied.
4) The Windings. Windings are wires that are laid in coils, usually wrapped around a laminated soft iron magnetic core to form magnetic poles when energized with current.
5) The Commutator. The commutator is a mechanism used by a motor to switch the input of most DC motors.