

# Brushless DC Motors (BLDC)

Brushless DC motor is a rotating electric machine that converts electrical energy into mechanical power. It works on direct-current electricity. Similar to a generic DC motor, a brushless DC motor has both a rotor and a stator. In a standard DC motor the armature conductors will rotate and the magnetic field comprising the stator remains physically static. But in a brushless DC motor, the roles of the conductor and the magnetic field are reversed. Here the conductors remain stationary and the magnetic field rotates. Due to this feature a brushless DC motor is equivalent to a reversed DC commutator motor. In this armature remains static and the magnets rotate.

### Construction Characteristics

Unlike DC motors with brushes, brushless DC motors have electronically controlled commutation system. They have powerful switching transistors to supply electric power to the motor.

### Principle of Operation

In a DC motor, a rotating torque is produced when the polarity of the magnetic field in which the conductors are placed gets reversed. In a general DC motor, the polarity reversal of the magnetic field is achieved by the commutator and the brushes arrangement. In the brushless DC motor, there are no brushes to achieve polarity reversal. Power transistors switching in synchronization with the rotor position perform it.

In a brushless DC motor, sensors are used to detect the position of the rotor at any instant. Rectangular voltage pulses that fluctuate in accordance with the rotor position drive a brushless DC motor.

The rotor magnet generates the rotor flux that on interaction with the stator flux produces the rotating torque. Brushless DC motors have three-phase stator. Fluctuating voltage strokes are appropriately applied to this three phase winding system of the stator in such a way that the phase angle between the rotor flux and the stator flux is nearly 90 degrees.

This 90 degrees phase difference between the rotor flux and the stator flux ensures generation of maximum torque.

## Brushless DC Motors

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### Special Characteristics of Brushless DC Motors

- Equivalent to a standard DC motor turned inside out.
  - Construction is similar to a multi-phase AC motor.

### Advantages of Brushless DC Motors

- Like a DC motor good control is possible.
  - Low noise
  - Low electro magnetic interference
  - High speeds are possible
  - Highly reliable even at higher speeds
  - Highly durable. Brush wear is less.
  - High efficiency

### Limitations of Brushless DC Motors

- Construction is somewhat complex with multiple fields and delicate magnets.
  - Require advanced electronic speed controllers to run
  - Total system cost is higher.

### Applications

- Ceiling fans
  - PC fans
  - Air conditioning
  - Refrigerator
  - Washing machines
  - Blowers
  - Industrial and automotive applications

### Types

There are two major types of brushless DC motors. They are:

- Stepper Motor
- Reluctance Motor

### Brushless DC Motors Vs AC Motors

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Brushless DC motors are identical in construction to an AC motor. But controller implementation in BLDC motors is different and that is what that makes BLDC a DC motor. In AC motors sinusoidal current is supplied to each of the two legs with appropriate phase difference. But in BLDC motors, electronic controllers are used to feed full positive and negative current to two phases at a time. The major implication of this feature is that BLDC are very suitable for logic controllers and battery power sources that operate on DC. So BLDC are widely used in computers, cars etc.