

# TYPES OF MOTORS

## INTRODUCTION:

### What is a motor ?

- A motor is a device that converts electrical power into mechanical power



- A motor generates rotational motion.
- Conventional motors use chemical or electromagnetic and electric PE.
- ie: Car engines (motors) burn gasoline to turn wheels.

### Rotational motion has two components:

1. TORQUE
2. SPEED

Torque is the force of the rotation.

Speed is the rate of rotation.

## FUNDAMENTAL MOTOR BASICS:

- The greater the load on the motor, the greater resistance it applies on the circuit
- To overcome the resistance of the motor, the current, or amount of electrons, is increased
- However, resistance converts electric energy to heat, thus leading to overheating of motors
- Today's lesson: Don't overload your motor! It makes magic smoke, and magic smoke = BAD!

### Physics Review

- Torque is the rotational force
- Torque = Force X Radius
- Power = Force (N) X Velocity (m/s)
- Power = Torque (N-m) X Angular Velocity (Rad/Sec)
- Electrical Power = Voltage X Current

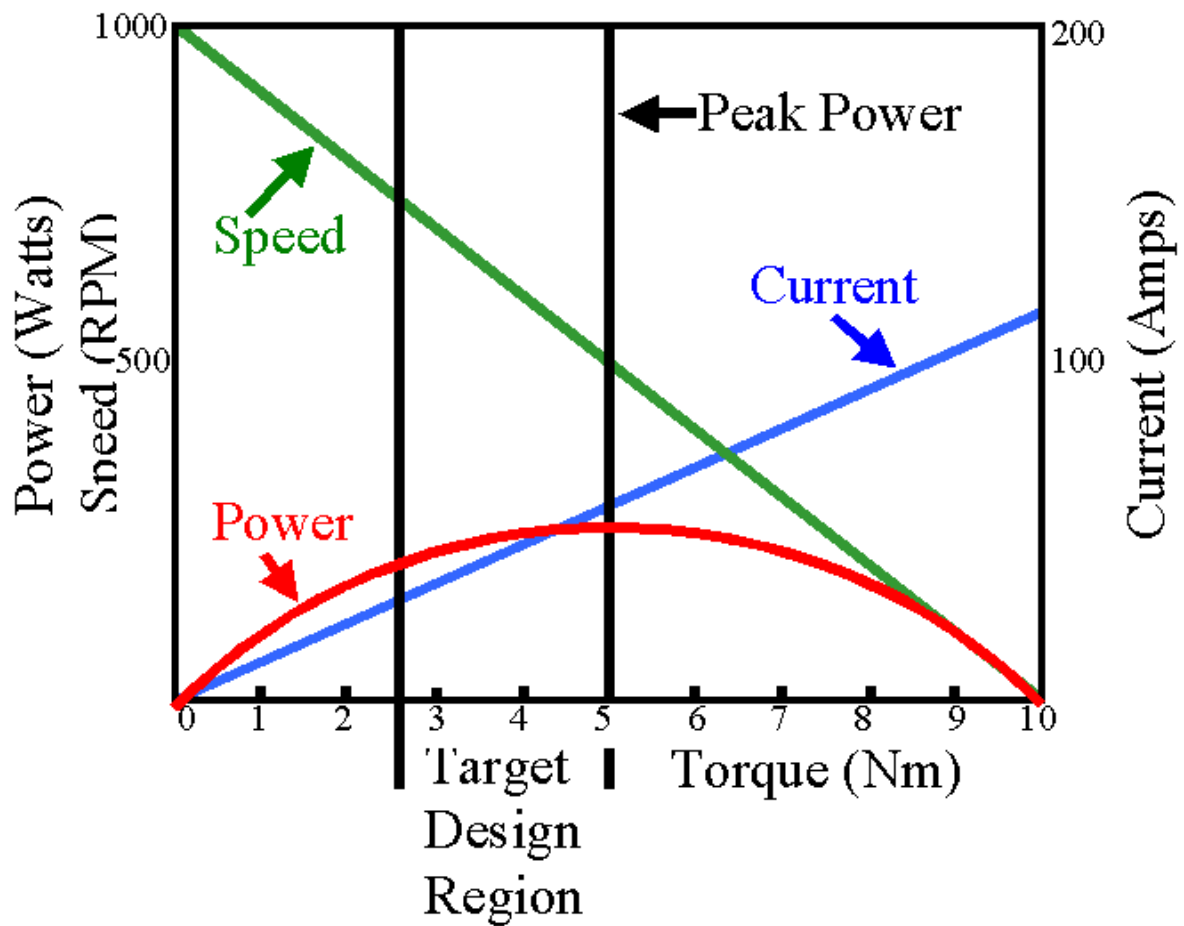
## Motor Characteristics:

- Free Speed: How fast the motor spins when not under a load
- Free Current: How much current the motor is drawing when it is under no load
- Stall Torque: How much resistance is needed to fully stop the motor from turning (stalling)
- Stall Current: How much current the motors draw when it is stalled

Electric motors behave with certain characteristics.

- Speed vs. Torque: The harder the motor is pushing, the slower it gets.
- Current vs. Torque: When the motor is pushed really hard, current get higher and higher.

Power vs. Torque: Power = Torque X angular velocity. When motor power approach near zero, or at least not maximum, the extra electric power actually turned into heat. Maximum power happens at the peak of curve, when torque pushing the motor is  $\frac{1}{2}$  stall torque, and when speed is  $\frac{1}{2}$  free speed



#### DIFFERENT MOTORS:

- Chipahua/CIM Motor
- Window Motor
- Van Door Motor
- Fisher-Price/Mabuchi Motor
- Globe Motor
- Yes, Van Door Motors are the motors that make your Van Door move!
- And Yes, Window Motors are the motors that make your car window move up and down!

#### Chipahua or CIM

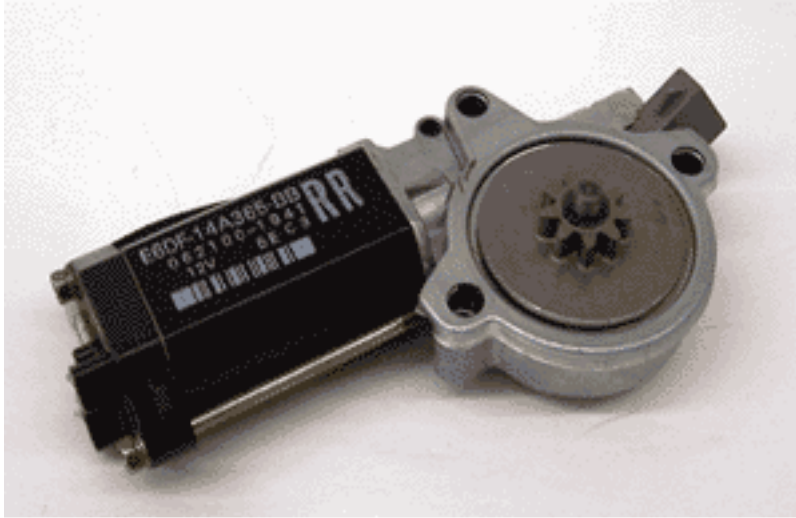
- 343 Watts of power



- 252.98 ft-lb/sec stall torque
- 5310 free load rpm
- Efficiency does not reduce much w/ heat
- Useful for prolonged running (drivetrains)
- Most commonly used

## Window

- 22 Watts of power
- 16.22 ft-lb/sec stall torque
- 90 free load rpm
- Gearbox does not back drive
- Useful for attaining and maintaining a position (arms)



## CONCLUSION:

- Keep these in mind:
  - Ease of mounting
  - Size
  - Power output of the motor
  - Stall torque
  - Free load rpm
  - Effects of prolonged use
  - Limited # of motors per year
  - Efficiency
  - Does it Back drive?
  - Is it the best motor for the job?