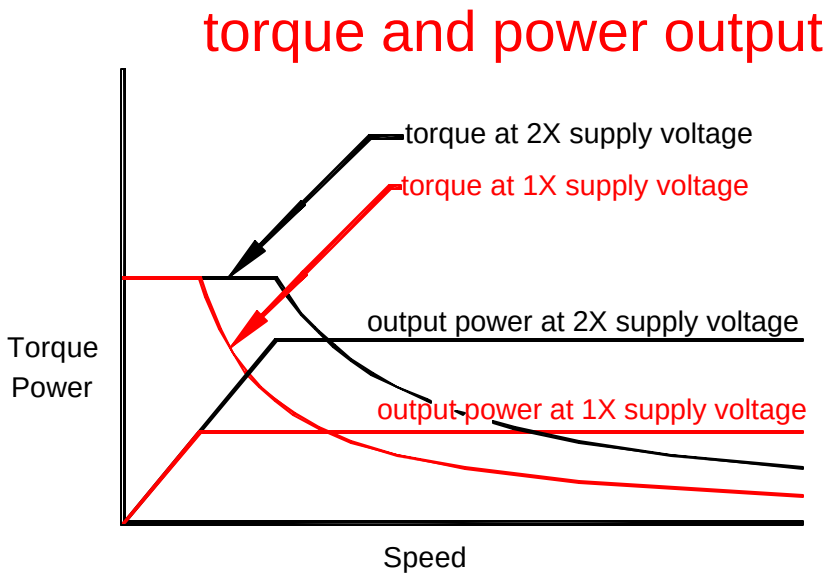
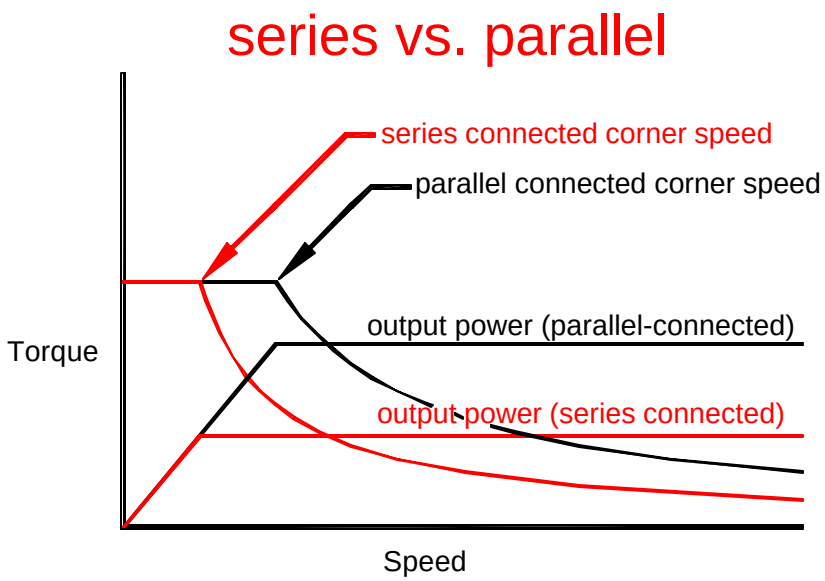
MOTOR POWER BASICS

The motor power output (speed times torque) is determined by the power supply voltage and the motor's inductance. The motor's output power is proportional to the power supply voltage divided by the square root of the motor inductance.

If one changes the power supply voltage, then a new family of speed-torque curves result. As an example, if the power supply voltage is doubled then a new curve is generated; the curve now has twice the torque at any given speed in region 2. Since power equals torque times speed, the motor now generates twice as much power as well. **Fig. 15**



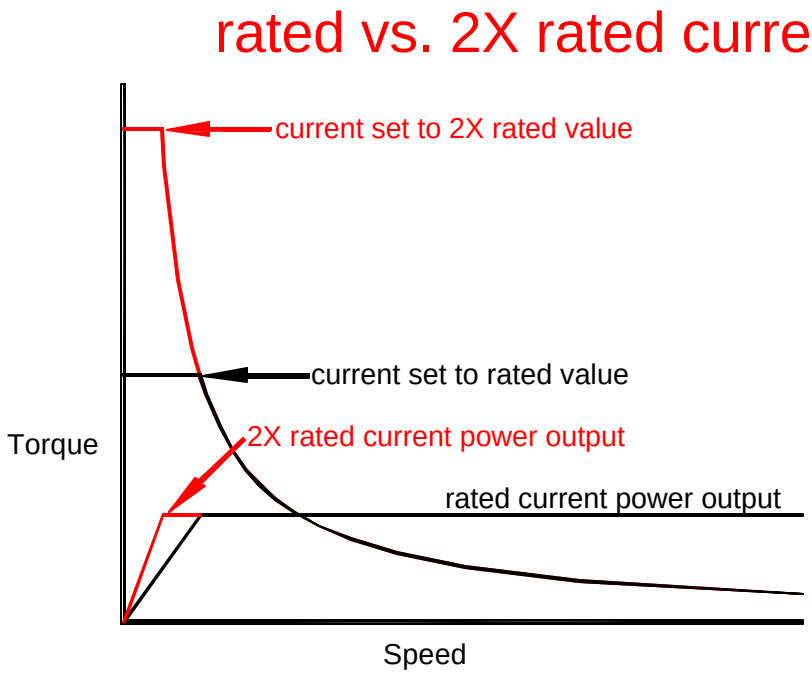
The following graph shows the effect of rewiring the motor from full-winding to half-winding while keeping the same power supply voltage.



This shows a half winding connected motor delivers twice as much power as a full winding connection at a given power supply voltage. This is because full-winding inductance is four times higher than the half-winding inductance.

Also note from the previous graph that motor output power doubles when the power supply voltage is doubled for either series or parallel-wired motors. Notice that a parallel-connected motor delivers performance identical to a series-connected motor running at twice the power supply voltage.

The next figure shows the effect of setting the motor current to twice the rated value. This abuses the motor because it will dissipate 4 times as much heat as setting the current to its proper value. The actual increase in low-speed torque is considerably less than double because magnetic saturation of the motor iron.



What can be seen is there is no increase of power output; the motor simply reaches its maximum power at a lower speed, all at the great expense of a four-fold increase in motor heating.

It is recommended the motor current always be set at the rated value also to get the best microstep smoothness. Setting the current higher degrades the linearity of motor and causes microstep bunching and attendant low-speed vibration.

What comes with increased motor power with increased power supply voltage is increased motor heating; this heating increases more rapidly than output power and ultimately sets the maximum output power from the motor. That is to say, the limiting factor in how much power a motor can deliver is ultimately determined by how much heat it can safely dissipate.