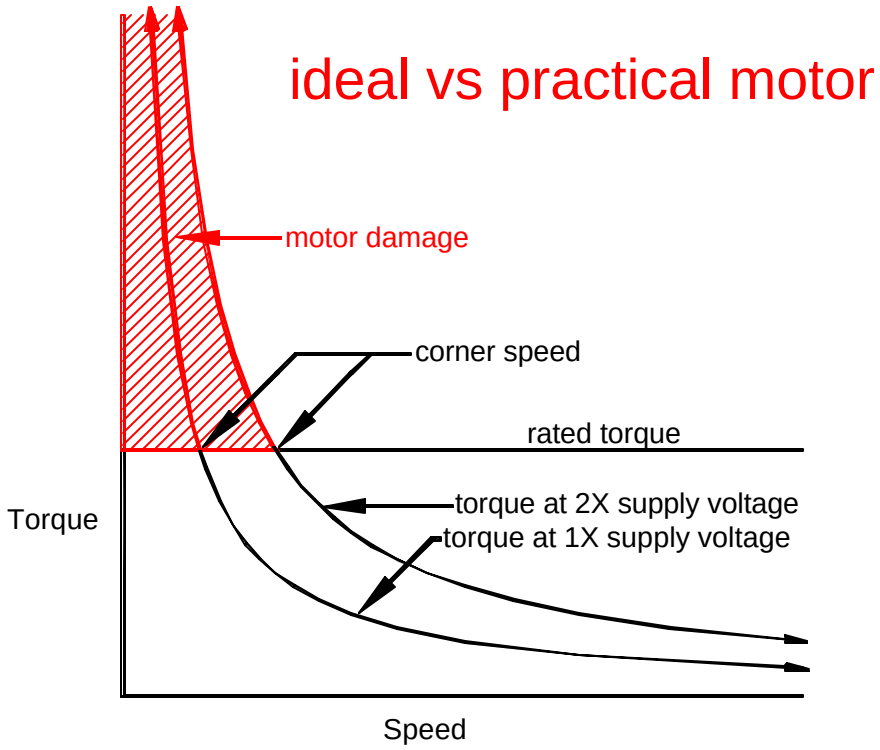
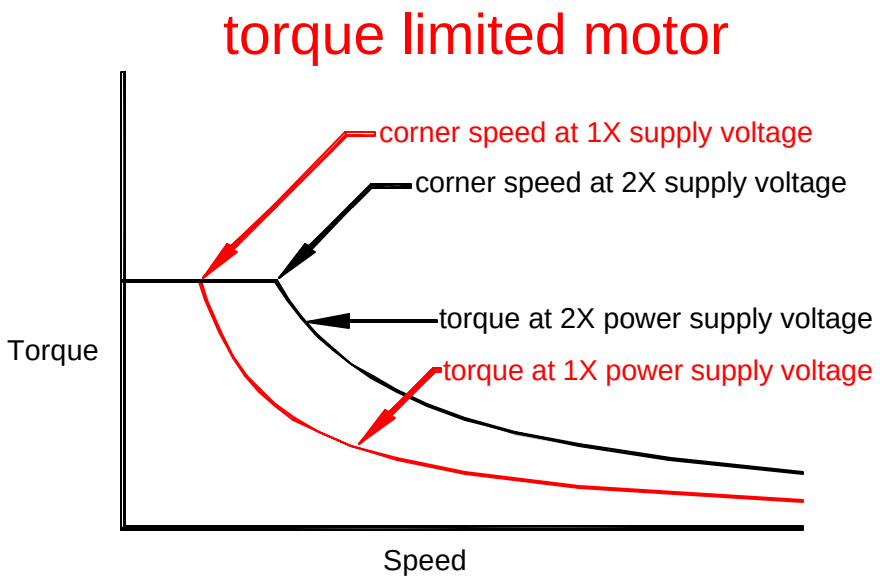
SPEED-TORQUE CURVE BASICS

In the previous section it was shown that motor torque varies inversely with speed. This then is the motor's natural speed-torque curve. Below a certain speed, called the corner speed, current would rise above the motor's rated current, ultimately to destructive levels as the motor's speed is reduced further. **Fig. 1**

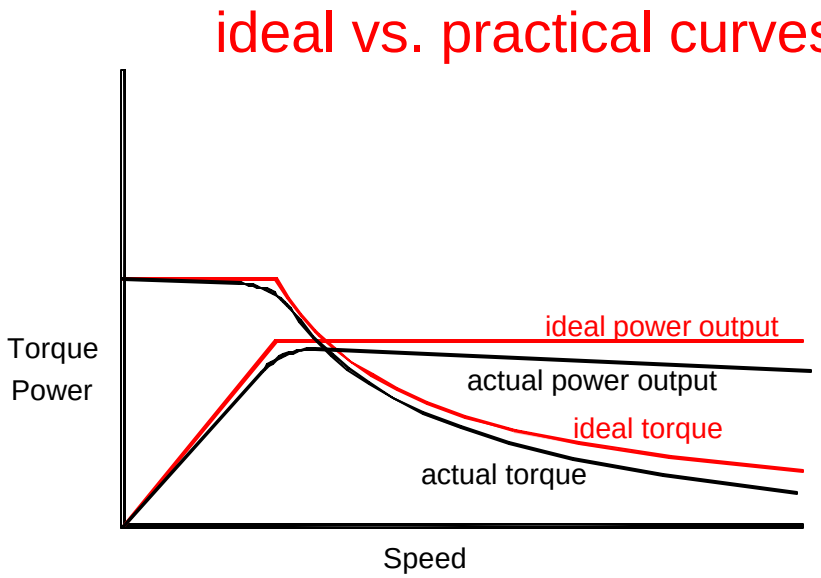


To prevent this, the drive must be set to limit the motor current to its rated value. Because torque is proportional to current, motor torque is constant from zero speed to the corner speed. Above the corner speed, motor current is limited by the motor's inductive reactance.



The result now is a two-part speed-torque curve which features constant torque from zero speed until it intersects the motor's natural load line, called the corner speed, beyond which the motor is in the constant power region.

A real step motor has losses that modify the ideal speed-torque curve. The most important effect is the contribution of detent torque. Detent torque is usually specified in the motor data sheet. It is always a loss when the motor is turning and the power consumed to overcome it is proportional to speed. In other words, the faster the motor turns the greater the detent torque contributes power loss at the motor's output shaft. This power loss is proportional to speed and must be subtracted from the ideal, flat output power curve past the corner speed. This now constitutes a practical speed-torque curve. **Fig. 14**



Notice how power output decreases with speed because of the constant-torque loss due to detent torque and other losses. The same effect causes a slight decrease in torque with speed in the constant torque region as well. Finally, there is a rounding of the torque curve at the corner speed because the drive gradually transitions from being a current source to being a voltage source. The drive limits current to the motor below the corner speed and thus is a current source. Above the corner speed, the motor's inductive reactance limits current and the drive becomes a voltage source as it applies all of the power supply voltage to the motor.