General Motor Knowledge
Part 30

Motor Performance Curves

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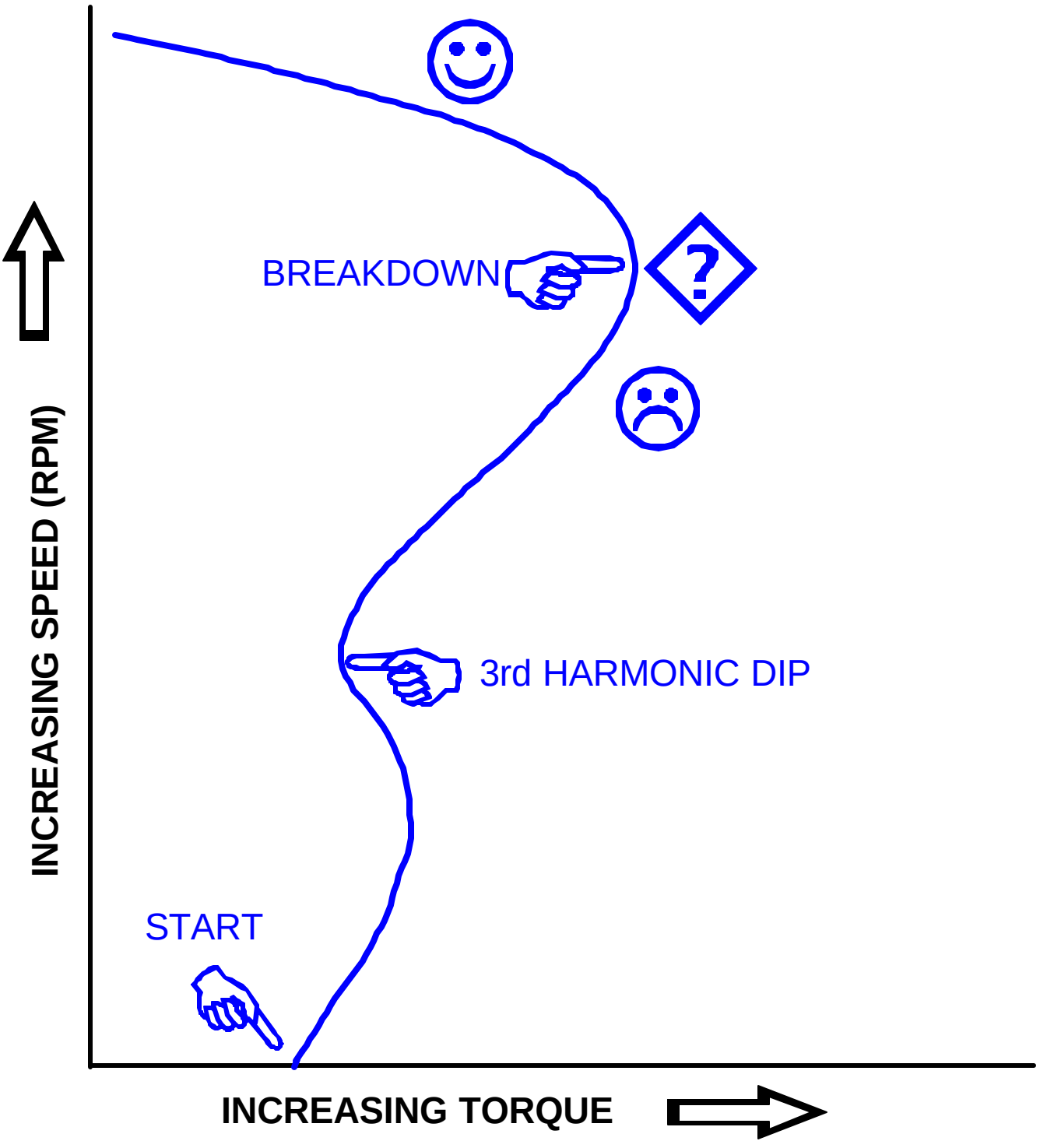
A motor performance curve is a picture showing the relationship between inputs and outputs. Let's choose motor speed in revolutions per minute (RPM) as a reference point and look at torque. Torque is a measure of the force a motor can develope to turn something.

Begin in the lower left corner of the picture. Draw a line of increasing speed up the page. This line begins at 0 RPM and extends to the synchronous or maximum speed, 1,800 RPM for a 4-pole motor. If the motor is not energized and RPM is zero, torque is also equal to zero. The lower left corner of our picture becomes RPM = 0 and TORQUE = 0. Speed increases up the page so we will choose torque increasing across the page to the right.

Turn the motor on. Torque is developed in the rotor but the rotor has not started to turn yet. "Starting" torque is available to start the rotor turning and to accelerate it up to some operating speed. As speed increases, torque is affected by the various harmonics. Most noteable is the third harmonic. This harmonic is centered at one third the synchronous speed or 600 RPM. It's negative most effect is seen as a dip in torque at about 750 RPM. This is the infamous "third harmonic dip". Torque will continue to increase as speed increases until a speed of maximum torque is reached. This is often refered to as "breakdown' torque. From this point upward as speed increases torque will decrease. At synchronous speed, torque will equal to zero.

The most desireable operating speeds are between synchronous and breakdown. If the motor load is greater than breakdown torque, the rotor stops turning because no more torque can be developed.


INCREASING SPEED (RPM)
BREAKDOWN
?
3rd HARMONIC DIP
START
INCREASING TORQUE