

Electric Power System General Guidelines

1. Increase number of motor windings:

- Kv (Unloaded RPM) decreases
- Spin larger props slower
- Torque increases
- Efficiency increases
- Resistance (Ohms) increases
- Amperage decreases
- Performance (horsepower) decreases

Decrease number of motor windings:

- Kv (Unloaded RPM) increases
- Spin smaller props faster
- Torque decreases
- Efficiency decreases
- Resistance (Ohms) decreases
- Amperage increases
- Performance (horsepower) increases

2. For a given motor size, a higher Kv rating generally means:

- Spin smaller props faster
- Torque decreases
- Efficiency decreases
- Resistance (Ohms) decreases
- Amperage increases
- Performance (horsepower) increases

(Above are opposite for a lower Kv rating)

3. Increase number of battery cells (voltage):

- Amps increase

Decrease number of battery cells (voltage):

- Amps decrease

4. Increase propeller load (diameter and/or pitch):

- Amps increase

Decrease propeller load (diameter & pitch):

- Amps decrease

5. Speed Controller (SC)

- Efficiency is about 90-95%
- Efficiency is worst at part power – overheats SC
- SC is just like a switch at wide open throttle (WOT)

6. Motor efficiencies typically run about 85%

- Motor eff X SC eff = about 75% overall efficiency

7. Motor Gearboxes

- Lowering gear ratio increases Amps (higher load)
- Raising gear ratio decreases Amps (lower load)

8. Keep Battery to SC (direct current) leads short - - 7 inches maximum

9. JETI SC Timing Setting

- Soft (Low) - Less amps; less power; cooler running; longer flights
- Hard (High) – More Amps; more power; hotter running; shorter flights

9. Outrunner Motors Generally:

- Have higher Torque
- Spin larger props slower
- Are not generally used with Gearboxes
- Are wound to have a lower Kv

10. Inrunner Motors Generally:

- Have lower Torque
- Spin smaller props faster
- Are more commonly used with Gearboxes (but not always)
- Are wound to have a higher Kv

11. Lithium Packs – What they don't tell you.

An example from Flight Power Evolution 20 Packs:

- Evo 20 packs are rated at 20C continuous / 30C Burst
- The pack service life is considered over when it will charge up to 80% of its rated capacity (C)
- If discharged at 10C, the pack capacity will slowly deteriorate to 80% of capacity over about 200 charging cycles
- If discharged at 20C, the pack capacity will slowly deteriorate to 80% of capacity over about 50 charging cycles
- The “harder” you push (discharge) a pack, the shorter its service life will be.
- Charging on the Evo 20 packs can be done at 2.5C to get 90% of capacity in about 25 minutes. However a reduction in cycle life should be expected.

12. All lithium cells from all manufacturers lose capacity with use. The loss in capacity is related to the current drawn from the pack. When used at up to 5C, lithium cells can last for up to 1000 cycles. When used at the nominal discharge rate (12C or 20C), Shark Power lithium polymer cells will lose up to 10% of capacity after 100 cycles. It is suggested to consider buying packs with a good reserve of capacity for long service life.

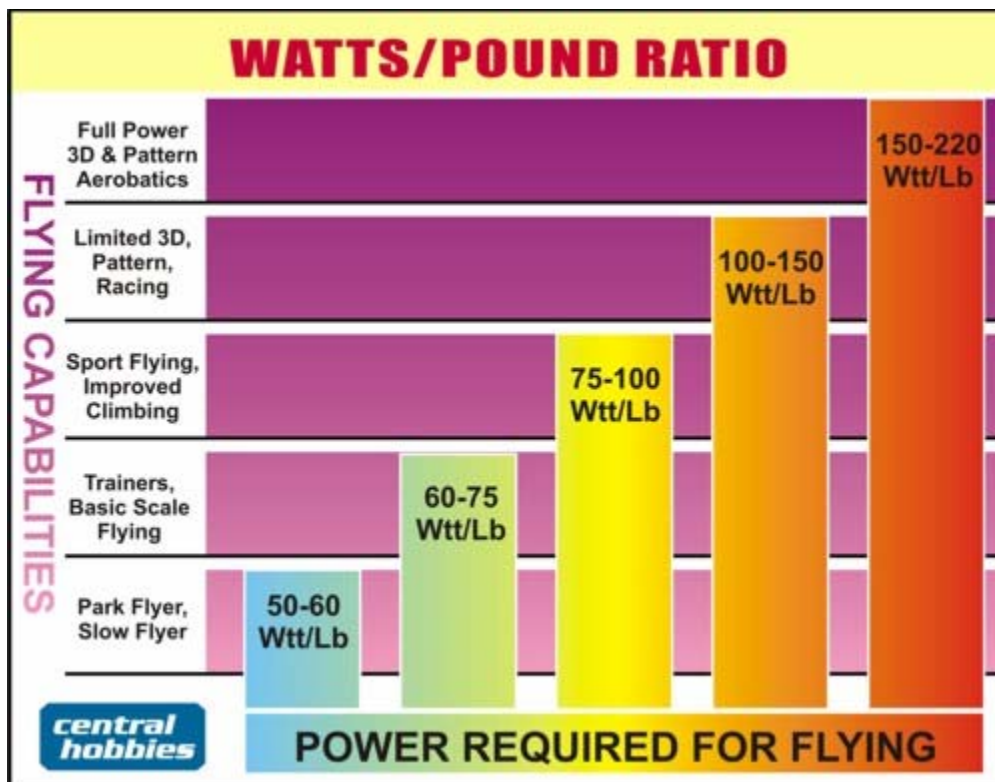
13. **General sizing of an electric motor versus a glow engine:**

Multiply the glow engine size (in cubic inches) by 1000 to get approximate electric motor watts equivalent.

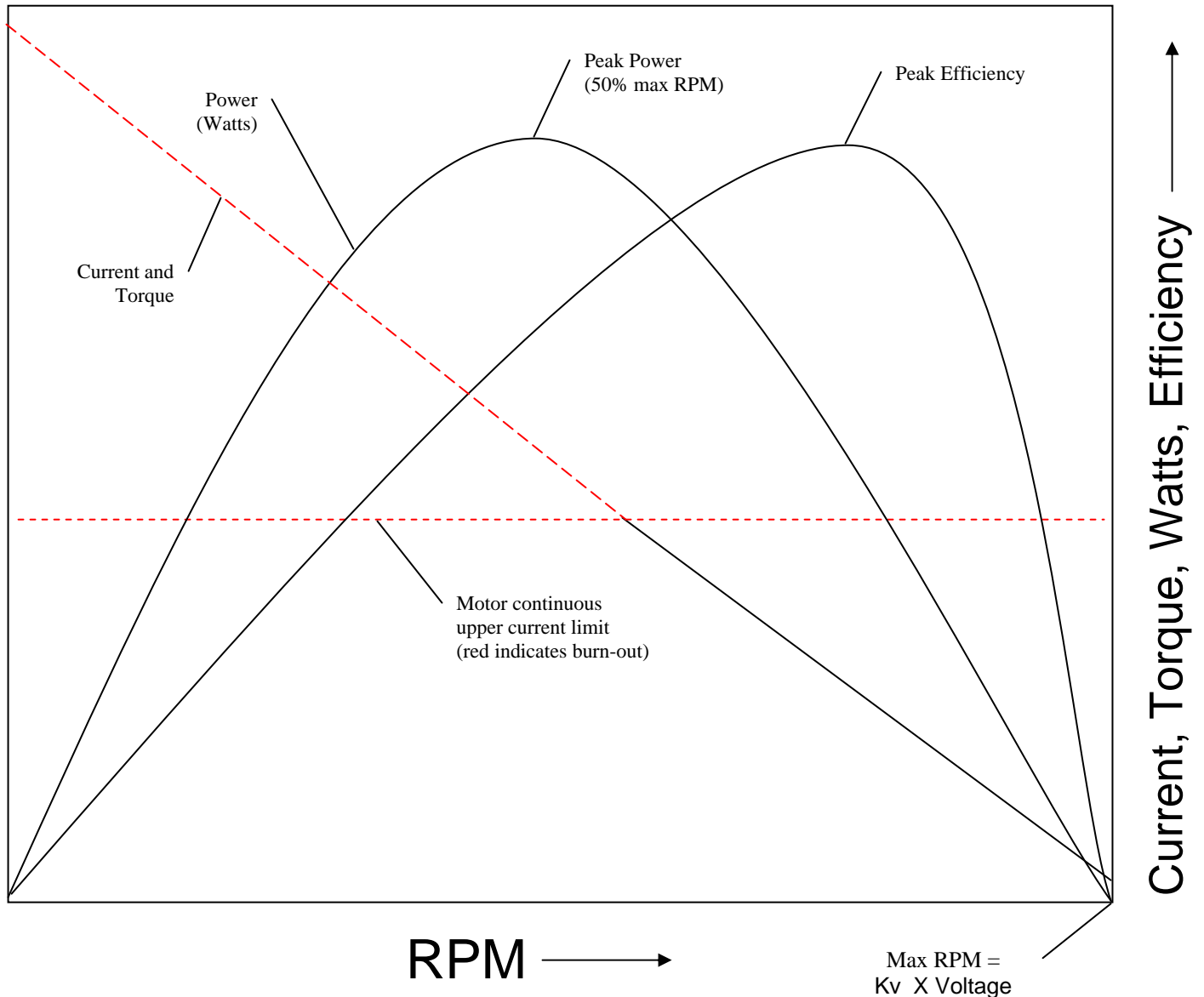
Glow Cubic Inches	Electric Watts
0.1	100
0.2	200
0.3	300
0.4	400
0.5	500
0.6	600
0.7	700
0.8	800
0.9	900
1.0	1000
1.1	1100
1.2	1200

etc.

14. **Another way to look at electric power required:**



TYPICAL ELECTRIC MOTOR POWER CURVES



1. With adequate cool-down periods and proper cooling airflow, most motors can be run above the motor continuous upper current limit only for short bursts (5 – 10 seconds).
2. Upper current limit can be set by the motor, speed controller, or battery. Exceeding the system' upper current limit results in bad smells, smoke, and/or fire.
3. To find a motor's maximum RPM, multiply the motor's Kv times the input voltage.
4. Peak power happens at one-half the maximum RPM.
5. For a given input voltage, as the motor is loaded, the RPM drops, and the current and torque rise.
6. Peak efficiency happens at generally higher RPMs with correspondingly lower propeller loads.