

Cyclone 360-watt motor with internal controller, timing study

CW rotation, with 1.5 degree timing advance

Full Throttle	Power (Drain Brain)	Power (PowerTap)	Efficiency
	75	0	0.0%
	135	51	37.8%
	180	98	54.4%
	230	126	54.8%
	260	164	63.1%
	310	205	66.1%
	340	230	67.6%
	360	254	70.5%
	400	286	71.5%
	480	345	71.9%
	535	383	71.6%
	550	385	70.0%
	565	385	68.1%
	610	400	65.6%
	620	411	66.3%
	620	415	66.9%
	675	420	62.2%

CW rotation, with 1.5 degree timing advance

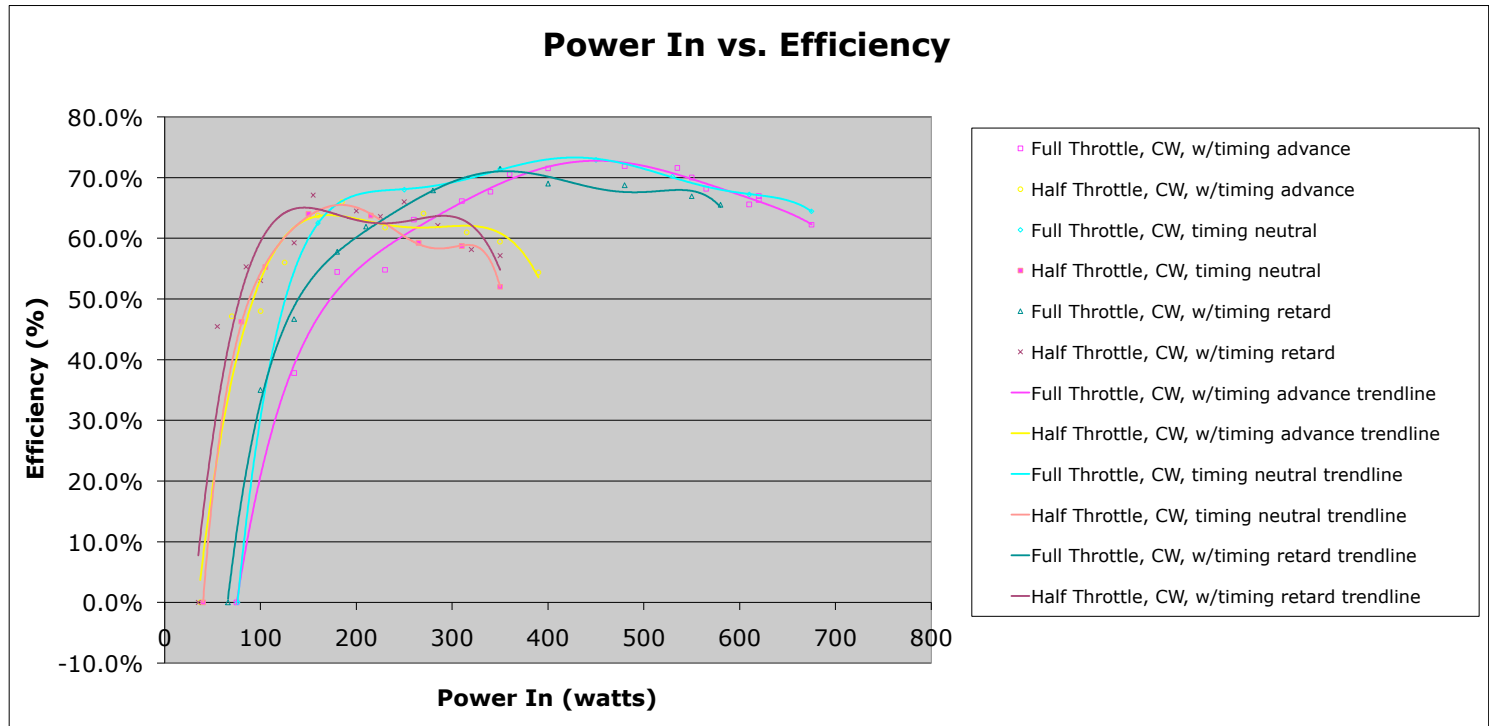
Half Throttle	Power (Drain Brain)	Power (PowerTap)	Efficiency
	37	0	0.0%
	70	33	47.1%
	100	48	48.0%
	125	70	56.0%
	160	102	63.8%
	185	122	65.9%
	230	142	61.7%
	270	173	64.1%
	315	192	61.0%
	350	208	59.4%
	390	212	54.4%

CW rotation, with 1.5 degree timing retard

Full Throttle	Power (Drain Brain)	Power (PowerTap)	Efficiency
	66	0	0.0%
	100	35	35.0%
	135	63	46.7%
	180	104	57.8%
	210	130	61.9%
	280	190	67.9%
	350	250	71.4%
	400	276	69.0%
	480	330	68.8%
	550	368	66.9%
	580	380	65.5%

CW rotation, with 1.5 degree timing retard

Half Throttle	Power (Drain Brain)	Power (PowerTap)	Efficiency
	35	0	0.0%
	55	25	45.5%
	85	47	55.3%
	100	53	53.0%
	135	80	59.3%
	155	104	67.1%
	200	129	64.5%
	225	143	63.6%
	250	165	66.0%
	285	177	62.1%
	320	186	58.1%
	350	200	57.1%



Notes: The curves should generally be concave downward. Variation from this is no doubt due to errors in my measurement equipment.
 Efficiency was measured by comparing energy drawn from the battery according to a Cycle Analyst and comparing that to energy sent to the rear wheel of the bicycle as read from a PowerTap hub.
 Motor power passes through a 9.33:1 planetary gearbox and a standard bicycle chain and 14t - 52t sprocket on a left crank.
 Torque then passes through the bottom bracket to a 51t chainring and then directly to a 34t sprocket on the rear wheel.
 Efficiency of the two-stage chain and sprocket drive is probably around 88%, so actual motor/controller efficiency is about 13% greater.