

## **Tuning the 2017 Etec 850 for maximum HP with ethanol fuel**

When we certified the stock 2017 sleds for the AmSnow/DTR shootout, I suggested to all the dealers (D&D Powersports, Howard's Inc, CJ Motorsports, Sports Unlimited) that we run 10% ethanol fuel in the sleds to be equal.

Why run dreaded ethanol? Because it can add a certain amount of HP to any engine due to 1) its oxygen content and 2) its great cooling of intake air as it absorbs heat during vaporization—effectively increasing airflow and 3) higher octane. We've switched from non-ethanol to 10% (usually measures closer to 5%) ethanol fuel on many engines, usually with a small increase in HP. But what I've always failed to take into consideration is that ethanol/ air mixture burns @20% *slower* than gasoline/ air mixture (I had to Google that after this test session), causing peak cylinder pressure to occur later. At a 10% does this mean that the net burning velocity drops 2% (10% of 20%)? If one of you smart chemists understands this, please advise! Remember when, in 2003, (pre-Boondocker and Power Commander days) I was lamenting the fact on DTR that the pig rich early Firecat 700s were in dire need of reduced fuel flow. One smart DTR member emailed me and suggested a tiny orifice sized like a Mikuni 300 main jet in the fuel line would drop fuel pressure enough to reduce A/F ratio from 10.5/1 to 12.5/1 and that absolutely worked perfectly, bringing guinea pig Scott Norine's 03 F7 up from something like 128 to 140+ HP! So now we have this new issue of tuning various % ethanol fuel for max HP and some input from DTR members with ethanol tuning experience would be great.

When Mark and Scuba from CJ Motorsports came with the new Etec 850, they had a half tankful of 91 non-ethanol. My plan on this day was to test the engine (42 miles on the sled prior to dyno/ track shootout) on non ethanol, have Mark roll the timing around with the BUDS system, then add just enough E85 (acquired in warm weather--this time of year it becomes something like E65) to create 10% ethanol fuel and do it again.

On the 91 non ethanol in breakin mode, stock timing was optimal. Mark first advanced with no HP increase, then retarded timing and still no HP increase was indicated.

We estimated the gallons of fuel left in the Etec 850's tank, and I wound up doing a "heavy pour" (a term used by bartenders serving a good tipper) of E85 and brought the fuel in the tank up to 12% ethanol. Close enough!

Remember--this new engine was still in "breakin mode" which is said to add some fuel and oil, and retard the timing some. So the timing adjustments that we made with ethanol fuel will surely need revision after breakin!

### 2017 Etec 850, 12% ethanol, timing optimized

EngSpd RPM	STPPwr CHp	STPTrq Clb-ft	LamAF1 Ratio	AirInT degF	Baro_P InHga	STPCor Factor	SAECor Factor	SAEPwr CHp
6700	128.2	100.5	15.05	43.9	28.71	1.032	0.992	122.5
6750	129.6	100.9	14.90	43.9	28.71	1.032	0.992	123.9
6800	131.3	101.4	14.74	43.9	28.71	1.032	0.992	125.5
6850	133.2	102.2	14.56	43.9	28.71	1.032	0.992	127.3
6900	136.0	103.5	14.41	43.9	28.71	1.032	0.992	130.0
6950	138.3	104.5	14.36	43.9	28.71	1.032	0.992	132.2
7000	140.6	105.5	14.34	43.9	28.71	1.032	0.992	134.4
7050	142.9	106.4	14.33	43.9	28.71	1.032	0.992	136.6
7100	145.1	107.3	14.32	43.9	28.71	1.032	0.992	138.7
7150	147.5	108.4	14.30	43.9	28.71	1.032	0.992	141.0
7200	150.8	110.0	14.25	43.9	28.71	1.032	0.992	144.1
7250	153.3	111.0	14.21	43.9	28.71	1.032	0.992	146.5
7300	155.9	112.2	14.15	43.9	28.71	1.032	0.992	149.0
7350	158.1	113.0	14.08	43.9	28.71	1.032	0.992	151.1
7400	159.8	113.4	14.04	43.9	28.71	1.032	0.992	152.8
7450	161.4	113.8	13.99	43.9	28.71	1.032	0.992	154.2
7500	162.8	114.0	13.95	43.9	28.71	1.032	0.992	155.6
7550	164.2	114.3	13.94	43.9	28.71	1.032	0.992	157.0
7600	165.7	114.5	13.95	43.9	28.71	1.032	0.992	158.3
7650	167.0	114.6	13.95	43.9	28.71	1.032	0.992	159.6
7700	168.2	114.8	13.95	43.9	28.71	1.032	0.992	160.8
7750	169.4	114.8	13.96	43.9	28.71	1.032	0.992	161.9
7800	170.2	114.6	13.98	43.9	28.71	1.032	0.992	162.7
7850	170.8	114.3	14.01	43.9	28.71	1.032	0.992	163.2
7900	170.9	113.6	14.03	43.9	28.71	1.032	0.992	163.3
7950	170.3	112.5	14.03	43.9	28.71	1.032	0.992	162.7
8000	169.3	111.2	14.02	43.9	28.71	1.032	0.992	161.7
8050	167.6	109.3	14.00	43.9	28.71	1.032	0.992	160.0
8100	165.3	107.2	13.99	43.9	28.71	1.032	0.992	157.9
8150	163.4	105.3	13.97	43.9	28.71	1.032	0.992	156.0
8200	160.7	102.9	13.93	43.9	28.71	1.032	0.992	153.4
8250	157.2	100.1	13.88	43.9	28.71	1.032	0.992	150.0
8300	153.5	97.1	13.84	43.9	28.71	1.032	0.992	146.4

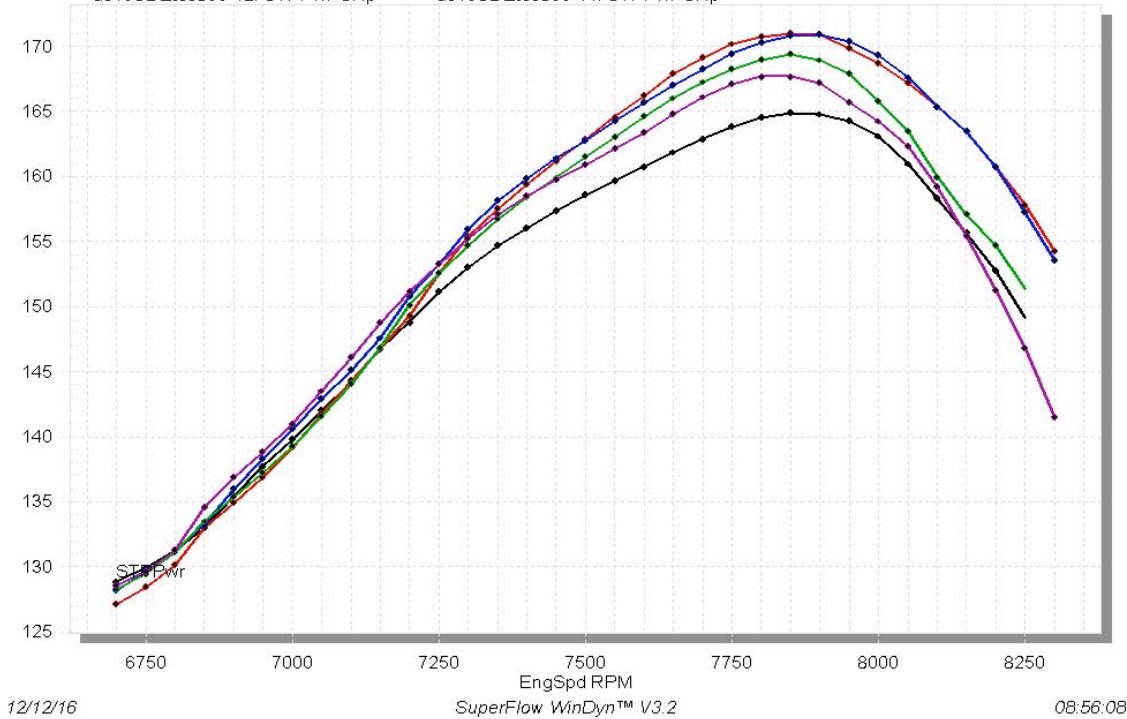
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Note that the 3 degree timing added test added midrange HP, and lost overrev HP with almost identical peak HP, so IN BREAKIN MODE 2.5 degrees added was optimal. But with typical 5% ethanol fuel, when breakin mode is gone, it's likely that one, maybe 1.5 degrees added from stock will be optimal. When we get one out of breakin we need to try this again. Next time we will have the sled fully instrumented with fuel and airflow meters affixed, seeing what sort of increase airflow comes with the reduced charge temperature.

### Etec 850 with 12% ethanol fuel timing adjustments

Black 0, Purple +1, Green +2, Blue +2.5, Red +3

as16SDEtec850-9: STPPwr-CHp      as16SDEtec850-14: STPPwr-CHp      as16SDEtec850-13: STPPwr-CHp  
as16SDEtec850-12: STPPwr-CHp      as16SDEtec850-11: STPPwr-CHp



12/12/16

SuperFlow WinDyn™ V3.2

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