## 2019 Polaris 850 Patriot early pipe testing

A few 850 Patriot owners report substandard performance compare with most others, something we documented with the 800 HO Polaris engines. Complaints by some include "fading" horsepower after extended periods of time at WOT.

I went back and reviewed the 130+ dyno tests I performed on the early production 850 Patriot engine last fall—breaking the engine in (we picked up 8-10 HP loading the engine very hard for the first 30-40 dyno tests and then taking it out of breakin mode) and later on experimenting with leaned out fuel flow by reprogramming the Yellow ECU to think it had Red injectors (Red injectors have @3% *higher* flow rate meaning the pulse width is 3% narrower). This is fine for WOT operation on 92+ octane pump gas. But the problem with doing that in the field is that it also leans out the already-lean midrange part throttle. This can lead to bogging and lean misfire (leaner than 17/1) while cruising. So tuning top end fuel is best accomplished with Power Commander V's.

But in reviewing the many back to back to back (B/B/B) WOT sweep tests I did on that new engine, it never once faded from overheated pipe or muffler. In most cases, HP *increased* after the first cool pipe test. The first test with pipe temp lowest, the ECU leans out fuel flow some to hasten bringing the tuned pipe temp up to optimal at 1000F+. And when the pipe is the coolest, airflow is the highest hence the leaner A/F on test one. As the tuned pipe temperature rises, expanding gases begin to restrict airflow through the engine, further enrichening the mixture as fuel flow rises at the same time. The following are two graphs showing B/B/B tests with the engine fully instrumented and monitored by Digital Wrench.



Then I went back to the Sports Unlimited 850 Patriot DTR/ AmSnow Shootout sled data, broken in on their hydraulic track loader dyno. We did our first three B/B/B tests during the dyno certification and this one lost HP on each subsequent sweep test as follows. This engine performed great at the Shootout—but those are 1000' blasts with plenty of pipe/ engine cooldown time in the snow on the return before the second pass.





Last week Rob Schooping who's been resurrecting HTG working out of his garage at home, tried to help out Pete Nixon who owns an 850 Patriot with 600 hard miles on it that was slower than the others-even on the first hit. So Rob "trail ported" the cylinder which would increase airflow and lean out mixture. We didn't instrument the engine with airflow and fuel flow meters—only monitored A/F ratio and deto and pipe temp on our Digital Wrench. We also had a stock pipe mod from SSI and a preproduction stamped pipe from BMP to try. Rob was disappointed in the stock pipe HP (nearly 170 HP), and the fact that it, too, laid down on the second B/B test (we didn't bother with a third). But was this engine low on stock HP? Were the rings still not seated properly? It's difficult to do an "A-B" test on an engine like this without knowing exactly what "A" was. We tried leaning the trail mod out with a PCV and we picked up some detonation so we left that stock. And I still have the "broken in" 850 ECU left here by Polaris after that first test session, just to see if that first sled had less protect-me tuning in it, and the HP still faded after test one. But then we tested the SSI pipe mod and BMP stamped pipe-both added about 8 HP with good torque and broad overrev (especially the SSI stock pipe mod), but fell flat on test two. Both pipes measured about 3.75 PSI average pipe internal pressure usually optimal and repeatable on aftermarket pipes. Where the stock pipe lost about 2 HP on test two, both aftermarket pipes lost much more than that with backpressure climbing only to a still-typically optimal 4 PSI! While the HP drop was more significant with the aftermarket pipes, both maintained more HP than stock even on test two.







Both the SSI pipe mod and the BMP pipe are fitted with internal stingers. The BMP pipe's stinger is removable and we did not try it this time with the stinger removed. The internal stinger does much more than act as a "choke" in the tuned pipe outlet—it's effectively punching a "cookie cutter" hole in the soundwave, causing more sound energy to be returned to the closing exhaust port. This improves the supercharging effect, packing more A/F mixture back into the cylinder. That's why pipes without internal stingers are louder due to more sound wave energy being funneled out the back of the pipe. On engines with less than optimal stock pipes (like the F7 Firecats) the internal stingered SSI/ BMP F7 pipe mod will *increase* measured airflow, which in the case of the F7 increases operating compression and makes the engine much more powerful even on long runs. But on engines with optimal non-internal stinger pipes it may increase operating compression too much, creating deto and or slowing the engines down. It's always a balancing act worth evaluating.

So the unanswered question is, why did our early production 850 Patriot hold, and even gain HP at elevated pipe and muffler temps? It wasn't in the ECU. Testing will continue by DTR and others trying to home in on (not "hone in on") the reason for the HP fade on just some 850 engines. Stay tuned for more.