

Trying to figure out the ETEC 800.....

In my recent Blog, I talked about some low altitude ETEC 800 owners reporting unusual reduction in horsepower after running hard for a while. I've surmised that Bombardier is using their precise exhaust valve control to *reduce* top end power as well as increase low and midrange RPM airflow and power. Why reduce top end power by partially lowering exhaust valves? It may help reduce exhaust emissions, or reduce dB from high power stock mufflers. And since the ETEC has very little unburned fuel exiting the exhaust ports to vaporize in the pipe (and help cool the exhaust system), there may be a need to prevent the pipe and muffler from becoming dangerously hot in their confined locations. Devoid of vaporizing wasted fuel, ETEC exhaust temperature coming out of the engine might be (guessing) 1300F, 1400F or even higher! And if held WOT long enough, the complete exhaust system could become cherry red hot from Y pipe to muffler outlet (steel becomes red at 1200F)! (read Kevin Cameron's pipe temp article in Volume5 #4 in the archives here). So how can Bombardier control pipe/ muffler temperature when it gets too high? Advancing the timing would reduce exhaust temp, but could also send the engine into detonation because of excessive combustion chamber pressures and temperatures. Adding fuel would reduce exhaust temperature and cool the muffler, but would also create unacceptable (in 2011) exhaust emissions. And surely, emissions testing must be done at maximum operating temperature.

The only thing left seems to be to reduce the volume of hot exhaust gas through the muffler. If the throttle bodies were controlled by the ECU ("drive by wire") then it would be simple to just close the throttle blades a bit even while the sled rider holds the throttle lever "to the bar". But since the sleds are still "drive by cable" then the only thing left may be to partially close the exhaust valves to let things cool down! Reduce airflow, reduce HP, and reduce BTUs entering the exhaust. High altitude ETEC triders don't seem to complain about this since mountain riders put way less BTUs through their exhausts.

Going back to our first dyno test session with Billy Howard's 2010 1/2 ETEC 800, I examined more closely the airflow of cool vs hot dyno tests. What I think was happening was we had a substantial airflow and HP reduction with the muffler hot—a much greater reduction than we should expect from the hot exhaust itself. The following WOT graph shows hot and cool comparison of airflow CFM, HP, and fuel flow lb/hr. Note that airflow of cool engine is higher from low RPM to 6300, then identical to hot from 6300-6700 (probably valves open halfway on both), then from 6700 to max revs we can assume that the hot exhaust temp readings causes the valves to *stay halfway open* instead of opening fully as it appears happens the cool (black line) engine! And perhaps, if muffler temp was even higher, the protective ECU may cause the exhaust valves to be closed even more, further reducing BTUs and HP even more than shown on the graph!

I'm quite confident that because airflow CFM cool and hot are identical from 6300-6700 (but cool engine power is higher there probably due to leaner fuel flow, and perhaps more advanced timing?), and that the airflow jumps suddenly at 6700 with the cool engine that exhaust valves must be controlling this top end power difference.

If that is the case, then maybe we can trick the ECU into thinking that the muffler is cooler than actual, and hold those valves wide open so we can enjoy all the horsepower for a longer period of time. But what are the possible consequences of running with overheated exhausts? Melted plastic? Burning plastic? It would seem unwise, once someone determines optimal muffler temp, to try to permanently fool the ECU if, indeed it may create unforeseen issues. But if, say, 750 degree F is max allowable temp before valves drop then maybe fooling the temp sensor by 100 degrees F or so might not be unreasonable. Then time at max power would be extended. I am told that the DynoPort ETEC 800 muffler has the exhaust temp probe mounted in a way that partially shields the probe from the exhaust gases, perhaps helping prolong the delivery of maximum power.

Obtaining accurate technical information on the ETEC system from Bombardier/Evinrude people has been so far difficult. But by measuring and testing on the dyno and in the field, we may be able to overcome whatever it is that is hindering field performance, but without compromising safety.

And we're still waiting for the electronic wizards at DynoJet and elsewhere to figure out, how to create additional fuel to support the additional airflow available from engine mods etc. And adding some extra fuel could drop those EGTs and keep exhaust system temperature low at the expense of higher emissions. "Off-road" use only, please! Damn the "greenies".

For now, this may be the "smoking gun" that can explain, at least partially, the drop in power that some ETEC 800 owners complain about.

2010 Etec 800 smoking gun?

Black "warm" muffler, Red "hot" muffler

