

Heat and the Harley®

With the EPA mandates on Mother Harley®, our beloved V-Twins are running leaner and leaner, making them run hotter and hotter. I've heard many complaints over the years about the unbearable heat rising off the V-Twin when riding slow, or stuck in traffic. Let's face it; it is a problem, and adding a Trike kit places more load on your V-Twin, exacerbating the problem. However, there are a few things we can do about it.

As most of you are aware, there is a "Harley-Tax" that just about every HD owner pays sooner or later. This "tax" is the "pipes and air cleaner" modifications commonly done. We all want that "Harley rumble." That potato, potato, potato sound, not present on today's new bikes and Trikes. Putting on a new exhaust system or at least a set of "performance" mufflers is the first step, followed closely by a change in the restrictive air box and filter. Performing these tasks will make the motor a better air pump, more air in, more air out, but something must be done with the fuel mixture or it will be even leaner than before, creating more heat. On bikes earlier than 2007, you have several choices. The infamous Dealer Stage-1 download, where the bike's ECU is flashed, giving it a new "Map" or fuel curve, if you will. This usually runs about \$150, and is done at the dealer only. It's a one time shot, no further adjustments possible (without another \$150 flash) Other options are one of the many available aftermarket tuners, such as the venerable Power Commander, Fuel Pak, Rev-Tech DFO, and a host of others. The advantages of these aftermarket tuners is that they allow you to make changes in the future, either with a laptop via a USB connection, or with buttons on the faceplate of the device. You actually have the same choices on 2007 and newer bikes too, but it really is not mandatory, unless you want your motor to run cooler, that is.

On the 2007 and newer H-D's, two O₂ sensors are used, one in each pipe. When pipes and air cleaner modifications are made, the ECU's on these 2007 and newer bikes can actually self-tune to compensate for those changes, and return the motor to a 14.7:1 AFR, as mandated by the EPA.

Now, I'm going to get off track here just a bit to explain air-fuel ratios and what stoichiometric means. "Stoichiometry" is derived from the Greek word *stoikheion*, meaning element and *metron*, meaning measure. A Stoichiometric fuel mixture for gasoline is 14.7 parts of air to 1 part of fuel. This mixture is theoretically the perfect air fuel ratio, in which there is exactly enough air to burn all of the fuel. That's what EPA is mandating, and it sounds just perfect. I mean after all, there is exactly the right amount of air to burn ALL the fuel, so what's wrong with that? Well, quite frankly, several things when dealing like we are here with an air cooled motor. In an air cooled motor, there are no radiators, water jackets, fans, thermostats, etc. to maintain the motor at a constant temperature, necessitating the need for a variable fuel mixture to keep the heat down, and keep away from the great engine destroyer called detonation. So, 14.7:1 is "stoich" with lower numbers like 13.7:1 being richer and higher numbers like 15.7 being leaner.

What does my air cooled V-Twin need? Typically we need a mixture of about 11.5 to 12.5 at cold start (first 30-40 seconds) At idle we'll want 12.8 to 13.5, and 13 to

14.5 at part throttle cruise. At wide open throttle a mixture of 12.5 to 12.8 will keep the heat way down (more fuel = more cooling of the cylinder heads) and keep the motor out of detonation. Is this legal in an emissions controlled motor? No, it's not, but the motor will run a lot better, last a lot longer, run cooler, and still give decent fuel mileage.

So what can be done to combat the heat? There are several things, all legal, BTW. First, if your Harley® is Delphi fuel injected, there is a three phase heat management system built into the software. All F.I. bikes have a temperature probe in the front cylinder head. This thermistor type sensor sends temperature information along the data buss to the ECU. In Phase 1, if the ECU sees engine temperature above 300 degrees F., while the bike is either moving, or standing still, it will reduce idle speed. Theory being that a lower idle has less sparks, producing less heat. In Phase 2, if the ECU sees an engine temperature that is still climbing from Phase 1, it will richen up the AFR. Richer mixture has a cooling affect. In Phase 3, if the ECU sees that the temperature is still going up, and the bike is sitting still, it will go ahead and skip-pulse the injectors, not delivering fuel on each intake stroke. Again, limiting combustion and producing less heat. Phase 3 is only active when the bike is sitting still. These 3 Phases pass from one to another without pause, and you may not even feel or notice it.

Additionally, Harley® has another download for 2007 and later touring bikes called EITMS, or Engine Idle Temperature Management System. This download shuts off fuel to the rear cylinder if ALL of the following conditions are met: High Engine Temperature; Engine must be at Idle speed; Bike must not be moving; Clutch lever must be pulled in, or transmission in neutral. When all of those conditions are met, the rear cylinder will stop firing until one of the conditions above are no longer met. When the engine is in EITMS mode, a difference in exhaust sound and or a unique exhaust odor may be noticed, both of which are considered normal. This one is free from your dealer. Each bike (by VIN) is entitled to have EITMS activated and deactivated once without charge. See HD Service Bulletin M-1191.



Next on the list, oil monitoring and control. First and foremost, we must recognize that the oil in your air-cooled V-twin has cooling functions as well as the obvious lubrication duties. As such, it is really the lifeblood of your Harley®. How hot



is hot for oil temperature? Surely, oil temperatures in excess of 250 degrees are detrimental and will cause severe damage to your motor over the long run, if left unchecked. No oil Temperature gauge? A stock Harley® does not come with an oil temperature gauge, so the first thing you should do is add one. The easiest one is a “dipstick” type, which is similar to a meat thermometer, with the probe suspended in to

oil tank. Both Harley® and the aftermarket have several varieties available. For touring models with the ‘batwing’ fairing, you can replace that (pretty much useless) ‘Air Temperature’ gauge with an oil temperature gauge. Again, both Harley® and the aftermarket make kits for this. Now you are armed with some real time knowledge and will be able to make informed decisions on what else may be necessary. A good engine oil temperature is 200 to 240 degrees. Water condensation and acids tend to build-up in the oil if the temperature is consistently below 180 deg. F, and oil viscosity becomes marginal above 300 deg. F. The former statement is why I never start my V-twin unless I intend to ride it long enough to get the oil temperature up above 180, long enough to burn the condensation out of the oil.



The next logical addition is an oil cooler, period. I'm a firm believer that all air-cooled engines require an oil cooler. Not just some wimpy 5 or 6 row job either, but rather a 10 row ‘turbulated’ type oil cooler with an integrated thermostat which will by-pass the oil cooler until the temperature is above the 180 degree mark. It was very pleasing to see that mother Harley® put a factory installed oil cooler on the new Tri-Glide!



Next, more oil! That's right, more oil. At 4 quarts total (including the filter) there is not enough ‘cooling’ time in the oil pan. Sure,



the oil cooler core will hold a few extra ounces, but we need

something like a quart extra to really do the job. Toward that end, I have run extra oil in the frames on some bikes, and even in the crash bars, but Baker Drivetrain has recently come up with a better mousetrap, the “Plus 1” oil pan for touring models. It's not cheap, and it is time consuming to install (the swing arm shaft has to be partially removed) but it is well worth the extra time and expense. In the stock oil pan, the pickup and return are

located within 2 inches of each other, causing some swirling effect, and not allowing the hot oil to remain in the pan long enough to cool. The Baker Plus 1 was tested and shown to reduce oil temperatures by a full 10 degrees on an 80-degree day. The 10° reduction (a conservative measurement) in engine operating temperature on an 80 degree day certainly helps – especially if you’ve done anything to your bike to make it run warmer like motor hop-ups, blocking the motor’s air circulation, pulling extra weight, or sitting idle on hot asphalt in stop and go traffic on a hot summer day. Parade duty or gridlocked traffic? You’ll need this! The Plus 1 keeps overall oil temperature oil cooler by designing some common sense into something simple. First, it allows more oil to be stored in the system. The extra quart adds 20% more oil that has to warm up, taking longer to get to peak temperature and keep the peak temperature lower overall. Next, the feed and return ports are on opposite ends of the pan as opposed to being next to each other. Additionally, the overheated oil is forced to mix and cool as it travels from one end to the other, with cast in baffles. Finally, yet importantly, the “Plus 1” pan has cast in cooling fins on the bottom, which add additional surface area for the heat dissipation.



Ok, what’s next? A cooling fan to keep that precious air flowing between the cylinders when stopped on a hot day, doing parade duty, and other low speed operations. Harley® makes a fan kit, as well as the aftermarket. These are basically 12 Volt “box fans,” similar to a computer cooling fan, but heavy-duty, as they do move huge amounts of air. The one I have moves 200CFM of air @130MPH. (Similar to a leaf blower) The fan sits in place of the horn normally mounted on

the left side between the cylinders. You have to relocate your horn, but both Harley® and the aftermarket have you covered on that as well. The idea is to start the fan prior to any possible overheat situation. If you are moving along at anything above a brisk running speed, leave the fan turned off. When you find yourself close to being stuck in traffic, flip the fan on for that period of time, and turn it off when you are rolling again. The one shown here on my Trike is from LeNale Engineering.

What else? I’m sure I may have missed a few, but here’s one you may not have considered. The “Diamond Heads” Company in Las Vegas has been issued a Patent on their exclusive cooling fin cutting technology. Sure, you’ve seen cylinders and heads cut this way on TV from some of the big-time chopper builders, but Diamond Heads fin cutting actually does improve cooling. The way it works is that each cut not only increases fin area, but also the cuts are made in such a way that turbulence is created

across the fins, forcing air into the cylinder and head surfaces. Diamond Heads reports that testing has shown that Diamond Heads cool 12% faster than un-cut pieces. Here's a sample of their work. They are truly the "King of Bling."



Here's another one for heat reduction. While these deflectors do not do anything to actually reduce heat, they do lessen the heat on the riders legs. Many riders complain about the heat on their thighs. Once again Harley® and the aftermarket have come up with heat shields, which install under the seat, and attempt to direct engine heat away from the rider. Most are called "Saddle Shields" or "Air Deflectors." Several styles, shapes and colors are available. Again, these air deflectors are standard equipment on the new Tri-Glide.

I've covered a lot of additional parts and expense here, and you may or may not need all of these items, but please do yourself and your bike a favor, and at least install an oil temperature gauge and oil cooler, you'll be miles ahead.



Ride safe, ride sober, and ride free!

Dave Bickford TRI 11719

“Ultraboy”