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Engine Tuning For Emissions Testing

By Mike Perkins
BMW CCA Technical Advisor
Owner - Bavarian Machine Specialties

In our world today, your new generation BMW engine is controlled by a sophisticated motronic engine management system. The idea of a tune up seems somewhat outdated. In the past, a tune up consisted of replacing spark plugs and filters, adjusting valves, timing, fuel mixture and engine idle speed. It is important to understand that although most of these operations are no longer necessary on new BMW models, "tuning" is still the key to engine performance.

Although the definition of a tune up has certainly changed, the need for a well tuned engine has not. As of January 1, we have taken our first steps forward toward real emissions testing. Regretfully, the motorist choice emissions testing program is a watered down version of the failed I/M 240 program. Still your car will be required to pass an actual tail pipe exhaust analysis at idle and 2000 rpm.

Engine performance is the operative word when discussing a tune up on a modern BMW. When a customer brings their car in and asks for a tune up, I have learned that usually they mean the car is in actuality suffering from a performance symptom. The car may have a cold start or a surging problem, but they have been trained to believe "it needs a tune up". In fact, all that may be wrong is a faulty coolant temperature sensor. In one sense, the tune up may be less involved than in the past, but in another, it is more complicated than ever before. There is a greater need for all components in the system to work together flawlessly. Sensors, actuators, spark coils, injectors, wiring connections, mass meters, variable cam timing, hydraulic lifters, closed loop O_2 systems, dual catalytic convertor systems, self diagnostic control units and vacuum air leaks are just the beginning of what should be considered when a BMW is not running properly. One sensor or wiring contact with slightly too much resistance can upset the entire balance of an otherwise perfect engine. Finding and repairing the glitch in the engine management system of a modern BMW is usually dependent on two basic elements; expertise and proper equipment. Without theses two important components, effective diagnostic procedures are futile. Fortunately, these systems while more complicated, are also more reliable.

Having conveyed all this about the complexity of today's BMW management system, I would like to emphasize one more item that is of paramount importance and is a common ailment to all BMW's. With fuel injection, even if all the components of the engine management system are functioning perfectly, the engine can still lack performance or perhaps even fail an emissions test. The most commonly encountered problem is with poor performance from the fuel injectors. You cannot and must not underestimate the impact of fuel injector volume and spray pattern quality on driveability. The diagnosis of "clogged" or "dirty" injectors are terms that can be somewhat misleading. The problem is caused not by dirt, but rather by a buildup of fuel varnish in the injector nozzle. The olefins (heavy waxy substances) in gasoline form deposits that gradually build up and restrict the injector. Although injector clogging is not as prevalent as it once was, thanks to the addition of improved detergents and other additives in gasoline, the situation still exists at a high rate. Bosch has even designed injectors to resist varnish build up. It is interesting to note that even though failing injectors will have a terrible impact on engine running, a fault code will not typically be set until the last stages of clogging. This fault code is never from the actual injector, but from the oxygen sensor that can no longer compensate for the extreme running abnormalities.

Generally speaking, there are two approaches to restoring injector performance. On the car and off the car cleaning. I have utilized both approaches and come to the conclusion that the only effective operation is an

to the fact that the injectors have to be removed from the engine, but it offers several important advantages. In this procedure, the injectors can actually be observed during operation for an accurate spray pattern. An ultrasonic bath is also used to dislodge deposits in the nozzle and body of the injector that normally resist chemical cleaning. As an aside, it is interesting to note that Bosch does not approve the use of chemicals to clean injectors such as that utilized in the on the car method. Additionally, the cleaning bench allows for back flushing of the injectors and a set of injectors can actually be flowed and matched for a particular engine.

I have spent many hours on the flow bench and have discovered several interesting facts concerning the importance of fuel injector performance and the consequences on emissions output. My recommendation to anyone struggling with an engine that otherwise "checks out" but still has a running problem is to have the injectors tested. This might just save you a lot of time and expense, not to mention an inspection sticker.