LINDER TECHNICAL SERVICES

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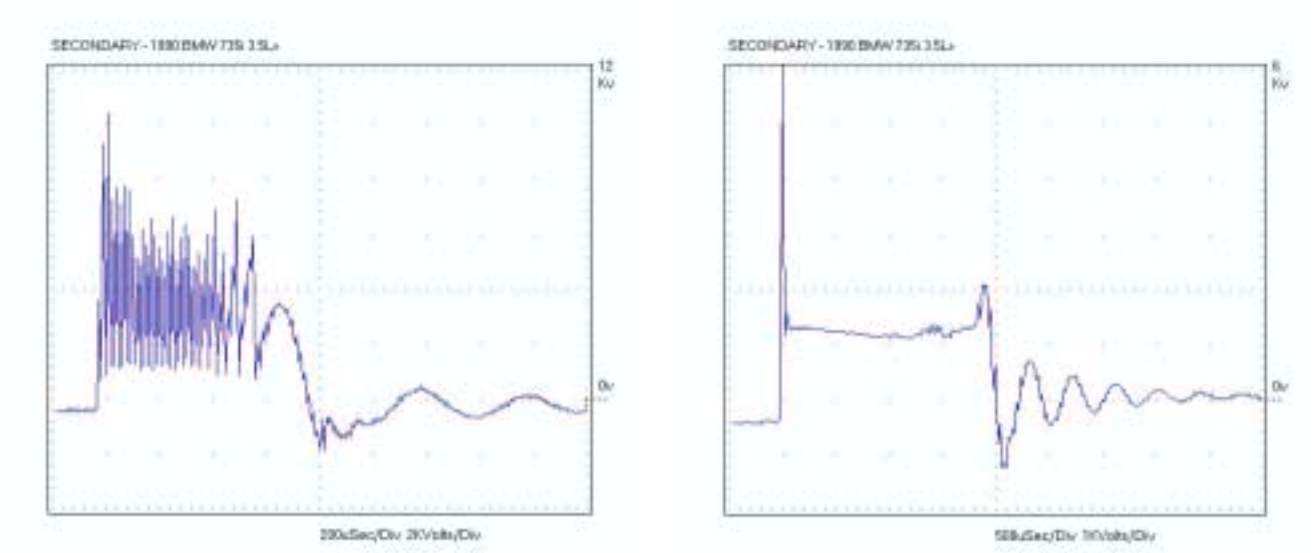
Networking

Newsletter

Tech Training

On-Car Injector Service
Some do----some don't!

This case study comes from our West coast friend, Brad Peterson. The vehicle is a 1990 BMW 735i with the 3.5L engine and 135,000 miles. The car misses intermittently at idle, but smoothes out under load. Testing shows a problem in # 2 cylinder. Idle vacuum was 14 inches before injector cleaning and 17 inches after cleaning.



The picture on the left shows turbulence created by poor fuel injector spray under idle conditions. The right picture shows the same cylinder after a total fuel injection service has been performed on the vehicle.

Note: This example has been discussed on the I-ATN technical Discussion channel. Many opinions have been voiced. Some say they believe this to be a defective plug wire or spark plug and others say a valve is being held open with carbon causing this unwanted turbulance. The only thing we know for sure from Brad Peterson's example is that :

- The vehicle did have an idle misfire and rough idle.
- The problem cylinder was identified by a scope secondary check.
- Injector cleaning did in fact clean up the waveform.

The bottom line is that the service technician didn't spend all day on this vehicle, followed a procedure and got the car out of the bay. Also, the customer complaint is now gone! Enough for any shop ?

Analysis from the "Sleuth", Michele Winn

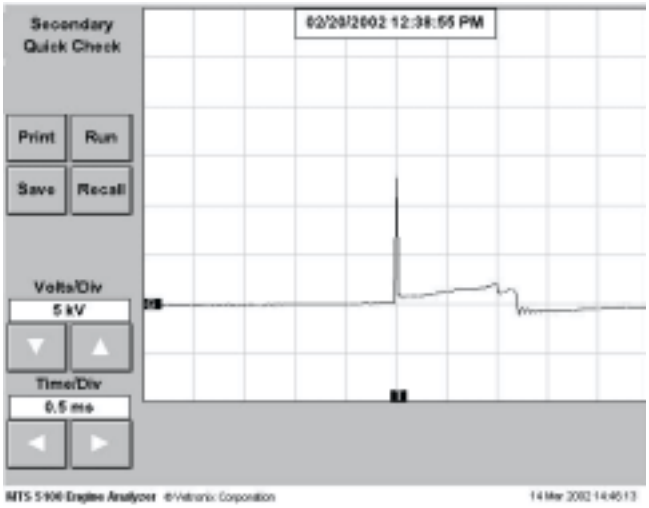
For those who have been reading our newsletters for a long time, you may remember several case studies in the past that I used to prove a point about flow charts. They are good to use when you're working on a system or vehicle that is not familiar to you. However, if you follow them blindly, you can wind up in a heap of trouble!

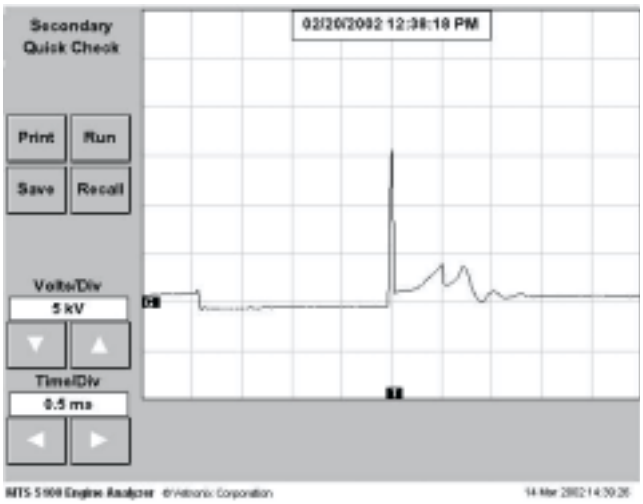
This month's case study is a 1996 Ford Windstar with 100,000+ miles. The customer complains that the check engine light comes on and flashes while driving. It runs rough and misses under load. The vehicle had been to another shop twice previously. The last time he was told that they did not have the equipment to fix the problem and he would need to take the van elsewhere. Of course, before they decided they couldn't fix the problem, they installed new plugs and wires.

The customer needed a ride back to work, so we took his van and I let him drive. As soon as he took off, I could feel a misfire and a lack of power. The check engine light came on almost immediately and started flashing. I almost laughed out loud when the customer remarked that the van seemed to be running pretty good. I also thought it was amusing how hard he mashed on the gas pedal every time he took off from a stoplight. (I guess the flashing orange light on the dash isn't a huge concern to some customers since he told me this problem had been going on for over a year!)

When I got back to the shop, I used the NGS scanner to retrieve codes. It pulled up a PO304 (cylinder #4 misfire). Remember, the previous shop already put plugs and wires on the vehicle, but I was still curious about the condition of the #4 plug. I was very happy to find that cylinder #4 was located on the front bank, passenger's side, so I removed it for inspection. Sure enough, the plug was new. No signs of fuel-fouling, no cracks, nothing unusual. It looked like it had been firing like it should. I didn't see any difference between the #4 plug and the #3 plug, but I also wasn't sure how many miles were on them.

Next, I hooked the Vetronix 5100 scope to the ignition to check and see if I could see anything on the pattern. Remember, this only occurs under light load (in drive around 1800-2200rpm). The picture on the left is cylinder #4 at idle with no misfire. The picture on the right is cylinder #4 under light load, with misfire occurring.





Analysis from the "Sleuth", Michele Winn (cont.)

Sure, I can see in the scope patterns that there is a problem, but what's causing it? I checked a few more basic things like fuel pressure and vacuum leaks and I reluctantly decided to consult the flow chart. Here is a summary of the steps:

1. **Check for other codes and repair first.** The PO304 is my only code, so I moved on.
2. **Connect scan tool and record DPFE value with key on, engine off. Now start engine, allow it to idle and record the DPFE reading. The two values should be within .15V.** I chose to graph the sensor using EASE and found the KOEO and idle values were identical.
3. **Check injector resistance.** This vehicle uses Bosch injectors that rarely have resistance problems, so I will admit that I skipped this test. However, I would likely see a resistance problem on the next test.
4. **Check injector driver signal.** They recommend using a test light and a breakout box. That seemed like a lot more work that I wanted to get into, so I decided to check the signal with a current probe and found everything was fine. If I would have had a shorted injector, it would have shown up as a sharp vertical rise at the beginning of the current ramp, rather than a gradual upward slope.
5. **Check fuel pressure.** The spec is: KOEO, 35-45psi and 30-40 at idle. I checked fuel pressure earlier and was reading 38psi KOEO and 33psi at idle. No problem here.
6. **Check to see that the fuel system holds pressure**……..yep!
7. **Check injectors for proper flow rate and leakage.** To me, the only way to check proper injector flow rate is to remove them from the vehicle and give them to Doug to check on the flow bench. I know some of you are wondering why I couldn't use my Matco fuel injector pulser and pulse each injector and record fuel pressure drop. My question to you is: what is the spec? How much should they drop? Sure, if they all drop 10psi and one doesn't drop at all, you've got a problem, but what if they all drop 3psi? Is that acceptable? Is that too much or too little? Doug published an article in a past ASA AutoInc. magazine dealing with the subject or fuel injector operation confirmation. To view the complete article, you can go to this link: http://www.asashop.org/autoinc/dec2000/mech.htm or if you do not have internet access, you can contact me at 888-809-3835 and request a copy.
8. **Check for vacuum leaks.** I also checked for vacuum leaks earlier with the smoke machine hooked into the vacuum line to the brake booster. No leaks found.
9. **Check EVAP system.** Inspect canister for fuel saturation.
10. Steps 10-13 were all related to different components of the EVAP system. At this point I became very skeptical that this flow chart was ever going to help me fix this problem. I abandoned ship and decided to check for TSB's. I immediately found this:

Article #98-25-5: MIL Illuminated/Trouble Codes PO300 thru PO306, 3.8L.

Here are the details: The MIL may illuminate and diagnostic trouble codes PO300 through PO306 may be stored in memory. This may be caused by any of the following conditions:

—Fouled, cracked or incorrectly gapped spark plugs (remember, I already looked at them)
—Low compression
—Vacuum leak (the smoke machine didn't find anything)
—Faulty injector (very unlikely, but still a possibility)
—PCM calibration (Oh, I may be on to something!)
—Plugged EGR orifice(s) in each primary port of the lower intake manifold.

There is diagnostic information available at the end of the TSB to help determine the exact cause of the problem, so I chose to go thru those steps. In next month's newsletter I will go thru the remaining diagnostic steps, explain the problem and the fix. Meanwhile, what do you think the problem is???

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Spotlight on Greg Manker

LTS has grown by leaps and bounds in the last few years. Along with the growth came the need for new employees. Back in October, we introduced Terry (our all-purpose handy man) and Hiedi (part-time receptionist and technical writer. Greg Manker is another one of our new employees that we may have neglected to introduce to you. Greg is a member of the Indy Hi-Winders Car Club, drives a hot rod to work every day and loves all types of racing (as long as a Chevy wins!) Greg started working part-time with Doug in the fuel injection room in September of last year and went full-time just before Christmas. He likes to learn new things and catches on very quickly. Now, when Doug is unavailable, Greg is handling injector phone calls and taking orders. We can assure you that he is perfectly capable of answering your questions and getting what you need. So the next time Doug isn't available, don't worry if a new voice takes your call. You're in good hands! Greg has proven to be a huge asset to the fuel injection portion of our business and we are glad to have him! The next time you call in, please introduce yourself to Greg and make him feel welcome!