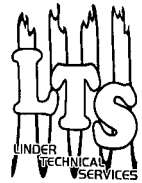


# Networking

Newsletter



## Tech Training By: Jim Linder

### You just never know???

One of my weaknesses as an automotive instructor is that I feel as if everyone understands a particular system after we have taught it to a few thousand groups etc. I automatically assume that after teaching about the operation of a particular system that all attending (and everyone else in the world) knows how the system works and we can move on. Well you know that is very untrue, but I still feel that way from time to time.

This case study of a very troublesome car comes from Bob Foote at Beck Service Center Indianapolis, Indiana and covers my above thoughts. The vehicle is a 1993 Pontiac w/a 3100 engine that will not start. Another shop had installed a new (rebuilt) engine that was built at a very reputable machine shop. After doing all the usual tests and "parts evaluations" (nice way to say replacement), Bob was called to look at the car.

The car had a no-spark condition at all times. Knowing that all electrical parts had been either switched or replaced with known good components, Bob hooked up his 5100 Vetronix scope to check the inputs and outputs from the ignition system and crank sensor. The picture below is what he found at the crank sensor output.



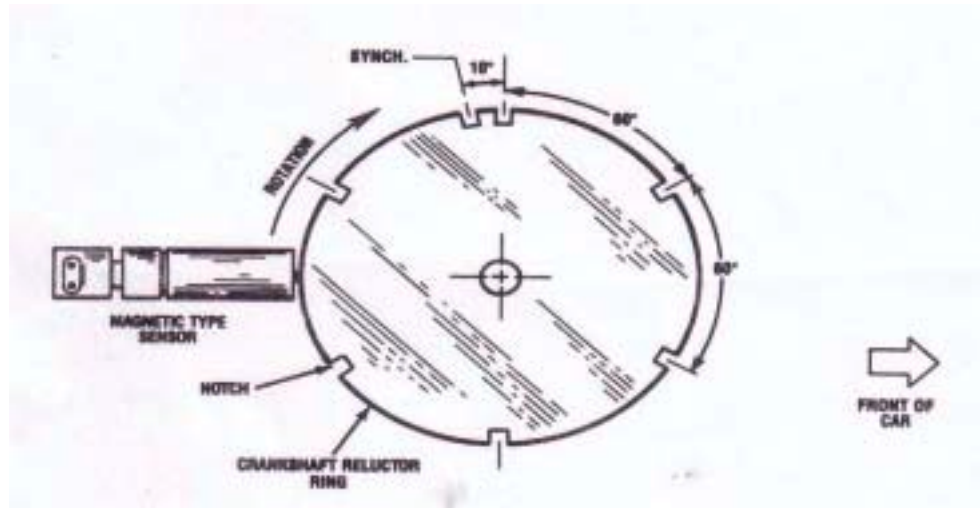
This picture shows the output of the magnetic crankshaft sensor. There appears to be an even signal and one signal every sixth cycle shows a slightly different signature. Knowing the car's history, Bob called us and discussed the above waveform knowing that this was not really a good waveform.

After some discussion I remembered a similar story from Mike and John out at Hobbs Automotive a few years ago. They had a similar signal to the one shown above on a no-start vehicle that they had in their shop.

Now for a brief review of this engine application in regards to what the sensor must do and how it works. The GM 2.0L, 2.3L, 2.5L, 2.8L and the 3.1L all use a machined wheel mounted on the crankshaft inside the oil pan. This wheel is called a reluctor. This reluctor is machined with a notch every 60 degrees (six notches for a six cylinder) and a double notch spaced 10 degrees apart for the number one cylinder sync. As the notch passes the sensor, a magnetic field in the sensor changes and a voltage signal is induced (per the above scope pattern) Magnetic sensor output varies with rpm. A typical value is 500mV at cranking speed up to 100 volts at high rpm. A minimum spec of 100-200mV at cranking speed is given by GM.

## Tech Training (Cont. from page 1)

The strategy for the 3100 engine is that the once the ECM sees the number one sync (double notch), it skips the first 60 degree notch and fires the 3-6 coil pack, skips the third 60 degree notch, sees the next one and fires the 2-5 coil pack, then skips the next 60 degree notch and fires the 1-4 coil pack. After the double notch signal is seen, the ECM must see a total revolution of the crank and starts firing of the ignition system 60 degrees ahead (needed for spark advance). This double notch is needed not only for ignition but also for E.S.T. (electronic spark timing), fuel injection and engine rpm signal by the ECM.



Now, back to Bob's problem. Bob knew that something was wrong with the waveform, but what could it be? All the parts had been replaced but the crankshaft, and the reality of the crankshaft being broken wasn't ever considered to be a possibility.

After my discussion with Bob, I remembered (getting harder these days...rbg) that the vehicle that was at Hobbs Automotive years ago with this similar problem had a new oil pan installed before it was towed to the repair shop as a no start. It seems as if the customer had hit a curb at speed and caved in the oil pan. The wreck had closed up the double notch on the crank wheel! After hearing this story, Bob left and had the oil pan removed from the engine to find that the double notch wasn't closed up it was totally broken off the engine! Check out the picture below:



WOW! It seems that the crankshaft had become damaged somehow during the rebuild and no one had noticed the damage.

The engine was removed and another crankshaft was installed and engine started right up. The waveform signature of the good signal is shown on page 4.

## Fuel Injection Service Update from the “Wizard”



### Injector Terminal Fretting?

Recently we had a set G.M. Multec II injectors sent to us out of a 2001, 5.3L Silverado, where the customer thought the injectors might be shorting out. He asked if we had seen this before because it was the first time he had run into this problem with this type of injector. I told him that we see a lot of the of the Multec II injectors clog at the discharge tip, but so far, I haven't seen any of them short out. When we got the injectors we started our testing with an ohmmeter. Ohm testing showed very little resistance difference between the injectors. Next we put the injectors on the current load bench. Our current load test results proved that all the injectors were within specification and the injectors held up during repeated loading of the coil windings. They all flowed close to spec and a visual inspection of the discharge tips concluded that they were all fairly clean.

I called the customer to discuss more about the vehicle and see if any additional info could be given to help us determine what was going on. He couldn't remember what code(s) it had be he thought it was a PO200 or PO300 something. Not much help to us, but it was some direction. Researching the PO200 code (Injector Circuit Fault), I came across a term I remembered reading about sometime ago, “terminal fretting”.

“Fretting” is the rubbing motion that occurs between two surfaces. “Fretting corrosion” is the build up of insulating, oxidized debris that forms on the electrical connection. Vibration of the engine, injectors and harness movement are contributors to the fretting motion. Fretting corrosion is microscopic and nearly impossible to see. If the oxides create enough resistance in the circuit, insufficient current will be available at the injector to open it properly. This condition may come and go as vibration moves the contact points. G.M. recommends that if you suspect this condition you remove the electrical connectors and apply a small amount (about the size of a BB) of dielectric grease.

I called the customer to discuss what I had read with him. He said he had not searched for information because he knew if he sent the injectors to us we would find out what was going on. He asked if we would go ahead and clean them since they were here. We did and sent them back. Meanwhile, the customer did as instructed and applied dielectric grease to each terminal. We're happy to say that the car was returned to its' owner and has been running great ever since!



Don't forget, the deadline to register for LTS Tech day is August 1, 2004! You won't want to miss a day of training with John Thornton, Dave Hobbs and Scot Manna. We're looking forward to seeing you there! Any questions, call Michele at 888-809-3835 or e-mail to [michele347@juno.com](mailto:michele347@juno.com)

For more information on LTS Tech Day, refer to the May 2004 newsletter, or go to our web site at: [www.lindertech.com](http://www.lindertech.com) and click on the “Tech Day” link from the home page.

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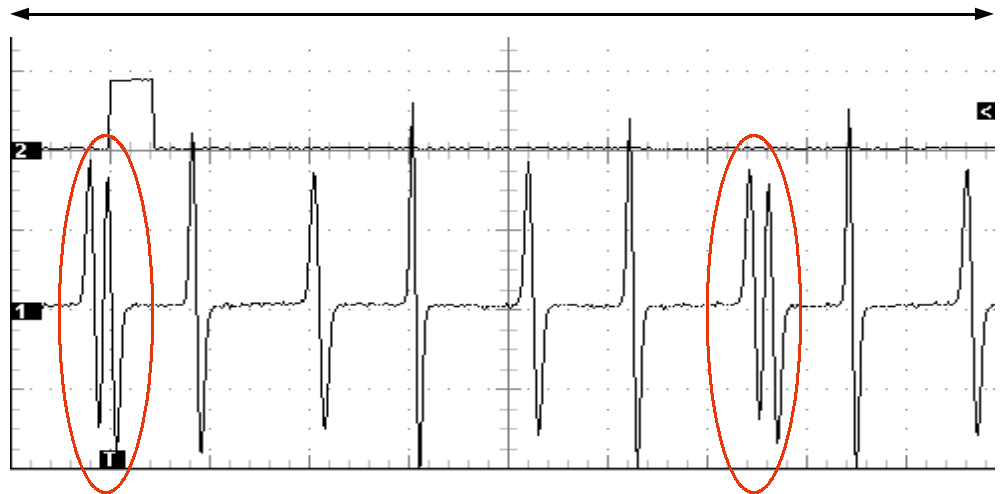
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## Tech Training (Cont. from page 4)



Note that the double notch is shown for proper triggering of injection and ignition and proper spark timing may now occur. I realize this is a rare, obscure problem, but it is the third time I've heard of this happening which means it can and does happen. I complement Bob on knowing the signal was wrong and for taking the time to look for the answer! This would have been very difficult (if not impossible) to diagnose without a lab scope!!

Jim Linder