



Frank Massey, Autoinform

Common Rail Diagnostics

The efficient and complete combustion of an oil based fuel is fraught with problems. It's pretty much certain that additives, rather than thermal emission control, will dominate the current and near future diesel development. Autoinform's Frank Massey describes the basics of his common rail diagnostic procedures.

Piezo injectors have revolutionised the fuel delivery process, in both petrol and diesel systems, however cost and in-service problems are directing manufacturers to abandon these uses. Improvements in power delivery and emissions, coupled with ever smaller petrol power plants, producing remarkable economy per mile, must surely lead to the demise in small to medium diesel powered vehicles.

This has directed our attention to the next generation of training programmes in 2015 towards subjects covering, twin charge, direct petrol injection and lean burn technologies. The CRD systems will however concentrate our efforts for the foreseeable future.

A recent repair illustrates what can be a difficult situation if not diagnosed and handled effectively. A **Nissan Pathfinder** was presented to us for diagnosis and repair. The vehicle would not start, and when cranked, it did however for a couple of seconds give the impression it would start. The vehicle employed a DENSO CR system, a system in which we have considerable experience.

The first step of course is serial evaluation, a hard DTC for EGR linear position error was the only indication of a problem. The next check was the generation of correct rail pressure, this as always, involves the evaluation using our Picoscope. The two vital parameters of common rail functionality are pressure against time, and to measure that you need a scope. The rail pressure sensor default value is 1 volt KOEO (key on engine off). During cranking the voltage reached 2.5 volts in less than 1 second, confirming excellent hydraulic functionality. Next, once again focusing on electronic functionality, I monitored the current path through the injector circuits, no problems here with 18 amps and no loss of injector triggering events. Given that correct fuel is delivered at the correct time and pressure, then all that's required for a diesel to run is a mechanically efficient engine. In an attempt to confirm this, I decided to inject easy start into the air intake. It didn't run, in fact pressure was diverting back out of the inlet tract! This suggested the possibility of a blocked exhaust or a, valve timing error.

We conducted a little research and discovered a recall relating to valve timing issues. Unsure how to continue at this point, and considering cost implications, we advised our customer. We were considering dropping the exhaust just before the catalyst, anticipating a blocked exhaust as the most likely cause. However despite not starting, there was some pressure coming out of the exhaust pipe.

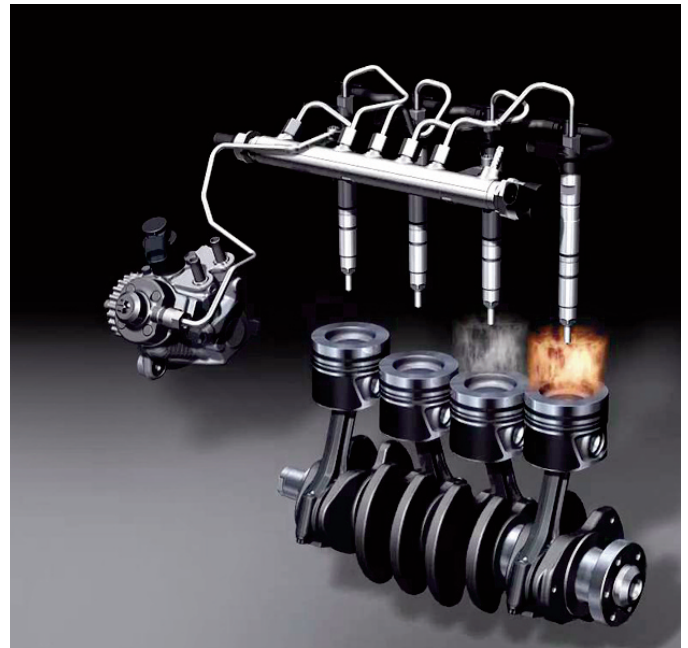
To assist the escape of possible back pressure, the EGR circuit was removed, and it was discovered that the EGR valve was completely off its seat in the fully open position. Surely this would not prevent starting?

Given the DTC and evidence in hand, we advised replacing the EGR valve. The next issue was cost. The EGR valve was very expensive. Replacing the valve was straight forward enough, the vehicle started and ran normally so all ended well. I must say I was surprised such a fault created a no start condition, and added as a consequence of this experience another layer in our evaluation process. I am often quoted as saying common rail diagnosis is straight forward, upon reflection, I think its time to concede otherwise.

Another recent experience involves a **2002 Laguna 1.9 CR** with high mileage, but in reasonably original condition. Suffering from very poor crank start problems, otherwise drivability was not bad.

Lots of DTCs, probably man made, a couple of spare parts in the glove box, including a can of easy start, here we go again!

Rail pressure on a Bosch volume controlled system should reach 1.6v very quickly, with start capability anything over 1



volt from the rail pressure sensor. 1.3 volts represents approx. 300bar pressure. Injection can commence around 120 bar, so what was the problem?

The Pico trace demonstrated a very slow rise time and a voltage value just under 1 volt, with a nominal value of 0.5v, suggesting a low pressure priming, pressure generation or leakage problem. Once started the pressure was fine except the control duty cycle of the volume regulation valve was excessive, more open than normal. I checked the rail safety valve for leakage, then conducted an injector back leakage test. The No 2 (French 3) injector was leaking very badly. Given the cost of good replacement injectors, the owner declined the repair.

This brings me full circle to my introduction and technology changes. Unless cars are regularly maintained to correct specifications with quality parts, they will cost more to repair or become scrap value prematurely. We, as repairers, have to invest ever more money into capital resources and keep abreast of vehicle development, invest in training and software platforms.