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XJLovers

FAQs

Rich Fuel Mixture on EFI Systems

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This information pertains to the Jaguar XJ6 Ser II-III models with the fuel injected 4.2 engine. However, in a broader sense, many of the items mentioned apply to other fuel injected models as well.

A slightly over-rich mixture may well go unnoticed until your car fails an emissions test or for some other reason has been checked with an exhaust gas analyzer. However, many owners are plagued with a gross over-rich condition which often appears suddenly and is manifested by black exhaust smoke, fouled spark plugs, and a "chuffing" engine. This article is intended to address grossly over-rich running problems. Here we go...

COOLANT TEMP SENSOR: This is a common culprit. The main purpose of this sensor is to "tell" the ECU that the engine is cold so that a richer mixture, required with a cold motor, will be provided. In this sense it is similar in intent to an automatic choke on a carbureted engine. As the motor warms up the influence of this sensor is gradually reduced and at about 180°F or so it no longer is really part of the mixture control picture.

However, skewed readings from a tired sensor can tell the ECU that the engine is till cold when, in fact, it is fully warmed up. In such instances the ECU dutifully continues to command a rich mixture which the warm engine cannot tolerate....and then you have the black smoke and chuffing.

I might add that hesitation and poor running on a cold or cool-ish engine can be caused by a coolant temp sensor that is "skewed hot", telling the ECU that the engine is warmed up when, in fact, it is not. The ECU in these cases is commanding a too-lean mixutre.

The sensor can be checked with an ohm meter. Of course, as the temperature increases, you are looking for a smooth transistion. You may find a lazy sensor giving skewed readings or one that is just flat dead and gives a fixed reading.

Here's more info on testing: <http://www.jag-lovers.org/xjlovers/xjfaq/testcts.htm>

Don't forget to check the connector. A disconnected temp sensor will result in a "full rich" command. A dirty and/or loose connection will do nearly the same.

These sensors are inexpensive (\$25 or so) and easy to replace (10 minutes) so diagnosis by substitution is not too hateful in this case. Many owners carry a spare.

On the 4.2 engine this sensor is on the water rail in the #3 position from the front.

FUEL PRESSURE REGULATOR: This vacuum operated device, as the name implies, controls fuel pressure according to engine demand. It can cause serious mixture problems regardless of engine temperature.

The fuel pump is capable of producing 80-100 psi of fuel pressure but the engine is designed to run with much less....usually no more than 36 psi. Excessive pressure literally pushes extra fuel into the engine when the injectors open. A fuel pressure test will verify that the regulator is doing the job as intended.

It is also possible for the diaphram inside the regulator to rupture. In this case raw fuel will be drawn through the vacuum hose and deposited directly into the inlet manifold.

The regulator is easily recognizable. It is a small cannister-type device, mounted on the fuel rail, has a vacuum tube and a fuel hose.

Going hand-in hand with the pressure regulator is the fuel temperature switch. These were not used on the early cars so you may not have one. Some early cars were retro-fitted, however, as part of a "hot start kit".

The idea of this sensor is to sense fuel temperature and, if too hot (170°F or so, I think), allows full fuel pressure in the rail to alleviate vapor lock. Were this switch to fail, or for any other reason the regulator was cut off from the vacuum supply, full fuel pressure would be present at all times and an over-rich mixture would result. You can eliminate this switch as a possible problem by simply bypassing it with vacuum hose.

OXYGEN SENSOR: This device monitors oxygen content in the exhaust and sends its readings to the ECU to trim the fuel mixture. Information on testing the sensor can be found here: <http://www.jag-lovers.org/xjlovers/xjfaq/o2.htm>

FUEL INJECTORS: The fuel injectors are designed to spray a precisely metered amount of fuel into the combustion chambers. With age and mileage, however, the internal seals degrade and may result in a drip-drip-drip of unmetered fuel into the engine. The only way to check this is to actually remove the injectors, pressurize the fuel line, and simply see if they drip fuel. You can check them individually or collectively, if you remove them with the fuel rail as an assembly. The same principle applies to the cold start injector.

COLD START CIRCUIT: Aside from the possibility of a dripping cold start injector this circuit is unlikely to cause a rich-running problem. Contrary to common belief, the circuit is operational *only* when the starter motor is engaged, as it gets voltage directly from the starter circuit. Unless the wiring is really fouled up in a most peculiar way, the circuit is deactivated as soon as the key is released from the "start" position. So, the cold start system may well cause a starting problem, but it's unlikely to create a *running* problem.

FUEL CHANGEOVER SYSTEM: If the fuel changeover malfunctions there is a possibility that one tank may become overfull. If this happens, excess fuel can be drawn into the fuel vapor canister (in front of the right front tire) and, from there, is drawn by engine vacuum directly into the engine. A fuel drip in the area of the front wheel is an obvious indicator. For diagnosis, the vacuum line from the canister to the air inlet tract can be removed and checked for signs of raw fuel. Checking the changeover system is covered here: <http://www.jag-lovers.org/xjlovers/xjfaq/fuelchangeover.htm>

AIR FLOW METER: The "AFM" is the principle player in mixture control. It has an air intake flap which, as it opens further and further, mechanically controls a resistance "wiper" which, in turn, controls injector pulse width (the amount of time the injectors remain open) via the ECU. The AFM can be responsible for a variety of problems but is not high on the list of likely culprits in diagnosing a rich-running problem. For most DIY types, diagnosis by substitution is the most common plan of action.

ELECTRONIC CONTROL UNIT: The "ECU" is the brain of the fuel injection system. Taking information from the sensors and AFM, it controls mixture by varying the injector pulse. These are remarkably reliable and replacement should only be considered when other causes are ruled out. Diagnosis of a faulty ECU is generally by substitution. If the ECU is suspect, first carefully remove the connector, inspect the contact pins, and re-seat the connector a couple times. This will often clear the pins of any corrosion which may have developed.

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