

JACKAROO TIP

Turbo Diesel - Black smoke exhaust

The turbo diesel 4JX1 Jackaroo may emit a black smoke exhaust in some circumstances. Usually it will occur when the engine is cold or warm but has not reached full operating temperature and when under load. Also it may occur when fully warm and at high revs at full throttle, say, when overtaking at 100 kph.

The ECM (Electronic Control Module) which adjusts the timing of the fuel injection pulse and hence the amount of fuel injected, monitors many sensors from the engine. These include: engine revs, injector rail oil pressure, water coolant temperature, air temperature, fuel temperature, inlet manifold pressure etc. When the engine is cold the ECM creates a rich mixture to produce maximum power and stop stalling. As the engine warms up so the output of these sensors vary. If some of these sensors are slow to act or are slightly out of original calibration so the mixture may remain slightly richer than that needed for maximum power or best fuel economy. This results in the black smoke.

If the engine lubricating oil is too heavy then it may not flow through fast enough to the injectors prior to the electrical pulse and the fuel may not be sufficiently atomised and not burn fully leading to unburnt fuel and black smoke. As the engine warms up so the oil flows easier and the fuel is better atomised. See Tip 16 (Choice of Oil Turbo Diesel) for comments on choice of engine oil. A leaking injector may also allow extra fuel into a cylinder.

If the air cleaner is blocked then the turbo may not be able to produce the required air pressure at the inlet manifold and again there is a possibility of a rich mixture. Also, if the injectors have been replaced and the ECM has not been calibrated correctly then there is a possibility of incorrect mixture - either lean or rich.

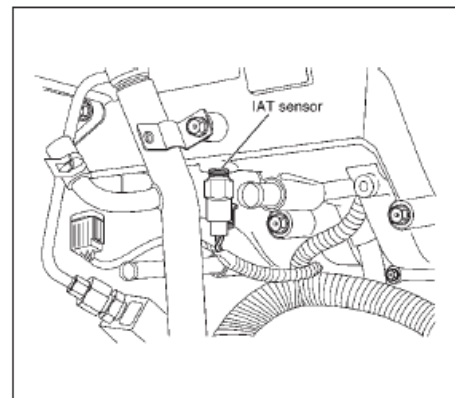
Over time the throttle butterfly may become bled up and be slow to operate. This will upset the mixture. See Tip 15 (Throttle Position Sensor TPS - Turbo Diesel).

Another problem leading to incorrect mixture is the failure of some of the hoses connecting the pressure and vacuum sensors at the inlet manifold. These should be inspected to ensure that the hoses have not hardened and fractured where they connect to the manifold and sensors. They are located under the manifold towards the front and a mirror might be useful for inspection. If hardened then they should be replaced. Note that there are two diameter sizes of vacuum hose used. The EGR (Exhaust Gas Recirculation) piston may seize and should be checked to confirm that the diaphragm is OK and that the shaft is clean and moves easily.

If no fault codes have been displayed on the Check Engine light or the Tech 2, then we could assume that all sensors are operating within tolerance. So unless there is access to a facility to measure the characteristics of all sensors against the original specification, replacement of a particular sensor might be of doubtful benefit unless it is determined as a possible cause through an appropriate diagnosis.

Intake Air Temperature Sensor

A crucial sensor that is often found to cause a rich mixture, is the Intake Air Temperature Sensor (IAT). This is located on the lower part of the inlet manifold as shown. Over time, the inside of inlet manifold builds up with oil and carbon, this will gradually coat the IAT and reduce its effectiveness to measure the air temperature, particularly as the IAT is on the lowest side. Thus, when a cold engine starts, the IAT takes time to recognise the increase in air temperature and continues to report "cold air" to the ECM and a rich mixture is maintained. Usually, there will NOT be a fault code. Removing the air hose



between the intercooler and the throttle body may provide an indication of the possibility of oil and carbon build up in the inlet manifold. If the throttle butterfly and its mounts are covered with oil and soot then the inside of the manifold and the IAT is almost certainly covered. A partial cure for a dirty IAT is to remove and clean it but this will not be a full cure. The best solution is to remove the manifold from the head and clean it using suitable degreasing solvents. Maybe pouring some volatile solvent in through the throttle throat and leaving overnight may be a benefit but it is essential that no liquids enter the cylinder bores as the hydraulic effect may damage the engine. Alternatively, some proprietary engine *tuneup/carburettor cleaners* may be poured into the throttle while the engine is running but it would probably take many litres over time to remove the build up of oil and carbon.

If there is black/blue smoke at **all** times and the turbo is noisy then there is reason to suspect failure of the turbo. This may be checked by removing and inspecting the air hoses into and out of the turbo. If they are coated with heavy oil deposits then the turbo has probably failed (or is soon to fail) and is running at reduced pressure, possibly producing a rich mixture although the reduced manifold pressure will be recognised by the ECM and the mixture altered. It may also be pumping engine lubricating oil into the inlet manifold which will result in some **blue** smoke.

Finally it is instructive to note that original road tests of the Jackaroo reported black smoke under some driving conditions!

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