

EGR Troubleshooting

Modified from <http://easyautodiagnostics.com/gm/4.3L-5.0L-5.7L/egr-valve-tests-1> for Isuzu, specifically my 1999 Vehicross.

This type of EGR Valve has made the auto repair industry and GM a ton of money over the years, since it's prone to carbon blockage. Well the good news is that this is an EGR Valve and EGR Valve System that is very easy to test and diagnose... and this article will walk you through the entire diagnostic/troubleshooting process.

Common EGR System Symptoms

This is not the most definitive list on the subject, but does cover the majority of symptoms I've seen on this type of EGR Valve Setup:

- EGR valve fault codes that light up the CHECK ENGINE LIGHT (CEL) on your instrument cluster.
- EGR valve fault codes:
 - P0401 EGR System Flow Insufficient.
 - P0403 EGR Solenoid Circuit.
 - P0404 EGR System Performance.
 - P0405 EGR Pintle Position Circuit Low Voltage.
 - P1404 EGR Valve Stuck Open.
 - P1406 EGR Valve Pintle Position.
- Rough idle.
- Really bad gas mileage.
- Lack of power as you accelerate the vehicle down the road.
- Truck seems to run ok above 30 miles and hour but once you come to an idle, the engine barely stays running.
- Vehicle runs great.. just the annoying check engine light is on with one of the above diagnostic trouble codes stored in the PCM's memory.

When something goes wrong with the EGR System... you usually see one of the following:

- Chunks of carbon blocking the EGR Valve's Pintle from fully seating in its seat.
 - Now, as you may already know, exhaust gas cannot recirculate back into the engine at engine idle. If this happens, well the engine is gonna' idle rough and/or stall. exhaust gas recirculation is normally only permitted at hard acceleration or when the vehicle is already cruising at 30 mph or above and the vehicle is accelerated.
 - When a piece of carbon blocks the EGR Pintle from seating, you get one of the following diagnostic trouble codes: P1404 or P1406.
- The EGR passages inside the intake manifold get clogged with carbon.
 - When this happens, you'll get a diagnostic trouble codes P0401.

This article will help you to diagnose all of the above DTCs, since it covers how to test the EGR Solenoid (which I call the Pintle Motor), the EGR Pintle Position Sensor and carbon blockages (the EGR Solenoid and Pintle Position Sensor all are inside and part of the EGR valve itself).

What tools do I need?

Here's what you'll need:

1. A multimeter.
2. An OBDII CEL code reader (optional, but you probably want to know what specific code you're troubleshooting)
3. A set of wire-piercing probes (optional, but this is the easiest and the most effective way of getting at the signals without cutting wires). I used this set:

http://www.amazon.com/gp/product/B00KHC62HQ?psc=1&redirect=true&ref_=od_aui_detailpages00

Circuit Description of the EGR Valve



The connector on the EGR Valve has 5 wires and normally the letters A through E are stamped on the EGR valve itself (but not always). I'll be using these same letters in all of the photos in the image viewer so that you'll know what wire to test. Below are the circuit descriptions:

- Circuit labeled A: EGR Valve Control (provided by the PCM). Yellow wire.
- Circuit labeled B: Sensor Ground (provided by the PCM). Green wire.
- Circuit labeled C: EGR Pintle Position Signal. Yellow wire with red stripe.
- Circuit labeled D: 5 Volt Reference (provided by the PCM). Red wire.
- Circuit labeled E: 12 Volt Power Source. Black wire with yellow stripe.

Test 1: Check the EGR Pintle Voltage

The most common problem on this type of GM EGR Valve setup is carbon blocking the EGR Pintle from fully extending and preventing exhaust gas flow into the intake manifold or blockage inside the intake manifold's plenum.

The EGR Valve can go bad, but not very often. So the very first thing you need to do is to see if the EGR code that's lighting up the check engine light (CEL) or the rough idle your car is experiencing is due to a bad EGR Pintle position sensor.

If you got EGR Valve DTC P0403, you can skip this test and start with the next test.

We need a good and logical starting point for our tests, so first you'll check the EGR Pintle Position with a multimeter and depending on the result of this test, you'll know where to go from there.

- With your multimeter in Volts DC.
- With the red multimeter test lead and an appropriate tool (like a Wire-Piercing Probe), probe the circuit labeled with the letter C (the middle yellow wire with the red stripe).
- Connect the black lead of the multimeter to engine ground (like the black battery terminal).
- Turn the Key to the On position.
- Your multimeter should display a voltage reading between .6 to .9 Volts DC.

Did your multimeter display this voltage?

- If your multimeter displayed .6 to .9 Volts DC, so far so good. The pintle could still be bad, we'll check for this in Test 5, but if it has a normal voltage here, it's not stuck.
- If your multimeter displays a DC voltage above .9 Volts, this is an indication that a piece or pieces of carbon are blocking the EGR Valve's pintle from fully seating.
- If your multimeter did not display any voltage or a very low voltage, re-check all of your connections and redo the test. If still no voltage or a voltage way lower than the .9 Volts specified, then this confirms the EGR P0405 (EGR Pintle Position Low Voltage) diagnostic trouble code. This low or non-existent voltage output is usually due to the 5 Volt Reference Voltage (that powers the Pintle position sensor inside the EGR Valve) is missing. So, to check for this is Test 3.

Test 2: 12v Solenoid Circuit

The EGR Valve has a Solenoid, that when commanded On by the PCM, it opens the EGR's Pintle to let Exhaust Gas circulate back into the engine.

If the EGR Solenoid does not get power (10 to 12 Volts) or the Solenoid is bad, the PCM will set a P0403 DTC. So, this test will check to see if this part of the EGR Valve is getting power.

- Set the multimeter in Volts DC mode
- Probe the wire E (black wire with yellow stripe) with red multimeter lead
- Connect the black multimeter lead to a good ground point on the engine or to the battery negative terminal.
- Turn the Key to the On position.
- The multimeter should read within a couple of volts of 12 (mine read 13.9v).

Did the multimeter read around 12 volts?

- If the multimeter registered around 12 volts, then the power circuit is OK. The solenoid may still be bad, we'll check for that in Test 8.
- If the multimeter didn't register around 12 volts, there is something wrong with the circuit. Without proper voltage, the EGR Valve will not function. You have a problem with your electrics, repair the fault in this circuit before continuing.

Test 3: 5v Reference Circuit

You're going to verify that the PCM (Powertrain Control Module=Fuel Injection Computer) is providing the EGR Valve's Pintle position sensor with 5 Volts. It's with this voltage that the EGR Valve Pintle Position Sensor can create a return signal to the PCM.

This test can be done with the connector connected or disconnected from the EGR Valve.

- Set the multimeter in Volts DC mode.
- Probe the red wire labeled with the letter D with red multimeter lead
- Connect the black multimeter lead to a good ground point on the engine or to the battery negative terminal.
- Turn the Key to the On position.
- The multimeter should read 4.5 to 6 volts.

Did the multimeter read 4.5 to 6 volts?

- If the multimeter registered around 5v, then the 5 Volt Reference circuit is OK. Go on to the next test.
- If the multimeter did not register 5 Volts, there is something wrong with the circuit or the PCM could be fried (although this would be a very very rare occurrence). Without these 5 Volts, the EGR Valve's Pintle position sensor will not function. Repair the fault in this circuit before continuing.

Test 4: Verifying the Ground Circuit

The wire labeled with the letter B is the circuit that provides the sensor ground path for the 5 Volt Reference voltage that the PCM sends the EGR Pintle Position Sensor in the Valve.

This sensor ground is provided by the PCM within the PCM (so be careful and don't short this bad boy to power or you'll fry the PCM). In this test step, you're going to verify that this circuit is OK and working.

1. Set the multimeter in Volts DC mode.
2. Probe the green wire labeled with the letter B with black multimeter lead (see photos in image viewer).
3. Connect the red multimeter lead to the battery positive terminal.
4. The multimeter should read within a couple of volts of 12v.

Did the multimeter read around 12v?

- If the multimeter reads about 12 volts, then the sensor ground circuit is Ok and doing its job. If you have done all of the prior tests successfully, and you are experiencing a P0405 DTC, this means that the EGR Valve's Pintle Position Sensor is bad. Replace the EGR valve.
- If the multimeter did not register around 12 Volts, there's something wrong with the circuit. Without this Sensor Ground Circuit functioning, the EGR Valve's Pintle position sensor will not be able to create its position signal. This usually means a short between the PCM and the EGR's connector or a BAD PCM (although a bad PCM is rare). Although testing these two things is beyond the scope of this article... you at least have eliminated the EGR valve itself as bad and now know where you need to focus your diagnostic on.

Test 5: Verifying the EGR Signal

This test step will verify that the EGR Pintle position sensor within the EGR valve is working correctly. We'll do this by physically moving the EGR Pintle by hand with a multimeter still connected to the EGR Pintle Position Signal wire.

The EGR Valve has to be removed from the vehicle to perform this test, so take care that the EGR Valve is not hot (and if it is, take whatever precautions not to burn your fingers or hands).

- Remove the EGR Valve from its base.
- The EGR Valve, although removed from its base, must remain connected to its connector for this test.
- With the multimeter in DC Volts mode, attach the red multimeter lead of the multimeter to the yellow wire with red stripe C circuit of the EGR Valve connector.
- Connect the Black lead of the multimeter to a good ground point on the engine or the battery negative terminal.
- Turn the Key to ON.
- With a small screw-driver, push on the EGR Pintle to move it up into the EGR Valve and then release it. While you're doing this, watch the multimeter. The multimeter should display a smooth increasing voltage reading as you push the EGR Pintle up into the EGR valve. The maximum attainable voltage, with the EGR Valve's Pintle fully pressed into the EGR Valve, will be about 4.5 Volts DC when pressed all the way in.
- Release the pintle. The voltage reading should return to the original value, you recorded in test 1 (.6 to .9 Volts), in a smooth decreasing voltage reading as you slowly release the EGR Valve's Pintle back to its fully seated position.

Did the EGR pintle cause the multimeter to increase to 4.5v when pressed, and return to .6 to .9v when released?

- If the multimeter registered a smooth and progressive voltage reading when the EGR Valve's Pintle was pushed into the Valve and the multimeter's voltage reading returns to its previous (seated Pintle) reading as the EGR Valve Pintle was slowly released to its seated position, then the EGR valve is working correctly.
- If the multimeter did not register a smooth and progressive voltage reading when the EGR Valve's Pintle was pushed into the Valve and the multimeter return to its previous (seated Pintle) reading when the EGR Valve Pintle was slowly released to its seated position, then the EGR valve is bad. Replace the EGR valve with a new one.

Test 6: Check EGR for Carbon Blockage

The next step is to remove the EGR Valve from its base on the intake manifold . Once you have the EGR Valve removed, it's time to visually check that the EGR Valve Pintle is not held open by pieces of carbon and that the orifices of the EGR Valve base are not blocked by carbon.

- Visually inspect the EGR valve for blockage

Is there carbon blockage?

- If both the EGR Pintle and EGR Base orifices are blocked with carbon, then remove the carbon deposits and verify that the EGR Pintle can now completely seat. This cleaning should solve your EGR fault code and/or rough idle condition. Re-install the EGR Valve, clear the EGR valve fault codes (that were lighting up the check engine light [CEL]), and road test the vehicle to see if the problem has been solved.
- If only the EGR Pintle was blocked with pieces of carbon from fully seating on its seat, this will cause a rough idle and/or engine stall condition. Removing these pieces will solve the issue. Re-install the EGR Valve, clear the EGR valve fault codes (that were lighting up the check engine light [CEL]), and road test the vehicle to see if the problem has been solved.
- If only the EGR Base orifices were blocked and/or closed off with carbon, cleaning and removing the carbon will renew the flow of exhaust gas into the engine (per PCM command) and your P0401 code should be solved. Re-install the EGR Valve, clear the EGR valve fault codes (that were lighting up the check engine light [CEL]), and road test the vehicle to see if the problem has been solved.
- If the EGR Pintle and EGR Base orifices are NOT blocked with carbon, then go on to the next test.

Test 7: Check EGR Passages for Blockage

There are 2 EGR passages, one going from the engine exhaust into the EGR valve, and one going from the valve into the engine to recirculate the exhaust gas. If either of these are clogged, they can cause the EGR system to throw a DTC.

- Start the engine with the EGR valve removed
- If the engine idles high and rough this indicates that the EGR was working, turn off the engine immediately. Optionally, during this short startup time, you can have a friend hold his finger up to the two holes which go into and out of the EGR valve (take caution if the engine is hot). You should have forceful exhaust coming out of the larger rear hole, and good suction from the smaller hole in the front.

Was the engine idle higher and rougher than without the EGR installed? Did you get forceful exhaust and suction from the large and small holes respectively?

- If the vehicle started like normal, or there is not forceful exhaust and/or suction, then there is a blocked passage. Clear the passage with a round wire brush and/or trombone cleaner using carb cleaner or Seafoam spray.
- If there is rough idle and good exhaust & suction, and you no longer have codes returning after everything is reassembled and OBD is cleared, then the EGR is working and your passages are not blocked.
- If there is rough idle and good exhaust & suction, but P0401 recurs after reassembly and clearing OBD... then you likely have a pneumatic leak / lack of vacuum connected to the EGR loop.
 - Check/replace your EGR valve gasket and ensure the EGR is fitted tightly with no leaks
 - Thoroughly inspect and repair any leaks in pneumatic hoses going to the engine block. Connection points, bends and joins are particularly vulnerable to leaks, and cracks can often be on the side of a hose that is not readily viewable.
 - Check/replace your manifold gasket
 - A malfunctioning throttle positioning sensor (TPS) or positive crankcase ventilation (PCV) valve or vapor canister purge solenoid (part #2N1001) can in some cases cause enough of a difference in measured pressure to cause the P0401 to persist.

Test 8: Solenoid Resistance

This test must be done with the EGR valve at room temperature. Why? Well the specs I'm providing for you are with the EGR Valve at room temperature... so keep this in mind when doing this test.

- Place your multimeter in Ohms mode (Ω).
- Disconnect the EGR's electrical connector.
- With the multimeter leads, measure the resistance across the EGR Valve pins that connect to wires labeled with the letter A (yellow wire) and the letter E (black wire with yellow stripe).
- If the EGR Solenoid is OK, your multimeter should read 8 to 9 Ohms.

Did the multimeter read 8 to 9 ohms?

- If the multimeter registered the indicated Ohms this result tells you that the EGR Solenoid is OK. If you are experiencing P0403, this leaves two possibilities for the code: A problem in the wire labeled with letter A (between the EGR connector and the PCM connector) or the PCM is bad (although this is very rare). Testing the two above conditions are beyond the scope of this article, but now at least you know what your next steps are.
- If the multimeter did not register the indicated Ohms This result tells you that the EGR Solenoid is fried. Replacing the EGR Valve will solve the DTC P0403.