

Tomco Techtips

TM

ISSUE 11

Troubleshooting Idle Solenoids

Although idle solenoids have been commonplace on Japanese carburetors for years, solenoid problems still confuse and frustrate experienced technicians. Unless you take a moment to review how an idle solenoid works, its symptoms may confuse you too!

Depending upon the system you are working on, the idle solenoid may also be called an anti-dieseling solenoid, a fuel shut off solenoid, a fuel cut off solenoid, or a slow fuel cut solenoid. Battery voltage powers the solenoid and the solenoid is hot whenever the ignition switch is on. Some solenoids, which have a single power feed wire, are grounded directly to the carburetor. But most solenoids are two-wire units: one wire is the power feed, the other is the ground. Usually, either the engine's electronic control unit (ECU) or a separate switch energizes the solenoid by grounding it.

Solenoid off, fuel off

A spring-loaded needle valve, which controls fuel flow through the idle circuit, slides into the end of the solenoid. When the solenoid is off, the spring pushes the needle valve inward, shutting off the idle circuit. When the solenoid is energized, it pulls the needle valve back and opens up the idle circuit again. Some technicians remember solenoid operation by remembering the phrase "solenoid off, fuel off".

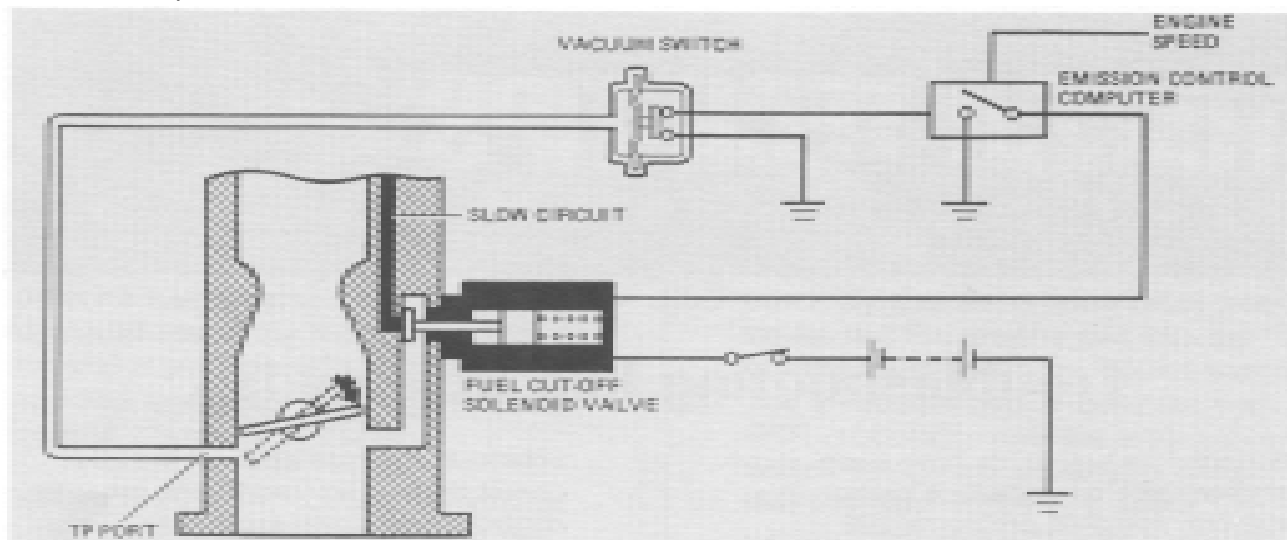
When the driver shuts off the ignition switch, the solenoid prevents the engine from

dieseling or running on. However, many technicians don't realize that the solenoid may also shut off the idle circuit during deceleration in order to control coast-down emissions. This prevents the engine from sucking fuel from the idle circuit during coast down and overrichening the mixture. Note that because some Japanese carburetors have more than one solenoid, you must refer to your shop manual to identify the idle solenoid.

Listen for click

The most common idle solenoid symptom is an engine that won't idle but will run above idle. When this happens, listen to the solenoid while a helper turns the ignition switch on and off. If the solenoid doesn't click every time he cycles the ignition switch, check for battery voltage at the solenoid with the key on. If you have power to the solenoid, replace the solenoid. If you don't have power, trace the circuit back to the ignition switch. Locate the problem, correct it, and retest the solenoid.

Sometimes, a customer will tell you that the engine idles okay but runs on after he shuts off the ignition. If this solenoid flunks the click test, you can bet that instead of replacing a bad solenoid, someone simply removed its needle valve. The person who shortcut the repair may or may not have warned the customer that although the engine would idle, it would also diesel when he shut it off.



Check throttle switch

The less-common but more confusing and frustrating solenoid symptoms are light-throttle surging or lean misfire. During light-throttle driving, the throttle blade may be open just far enough to draw fuel from the idle and off-idle (transitions) circuits -- without pulling fuel from the main circuit. Therefore, if the idle solenoid shuts off the idle fuel during part-throttle driving, the engine will buck, surge, hesitate, or stall.

The ECU operates the idle solenoid based on RPM and inputs from devices such as a throttle switch or idle switch, a clutch switch and/or neutral switch, a coolant switch, and a vacuum switch. Experience has shown that a worn or misadjusted throttle/idle switch is the most common cause of light-throttle idle solenoid trouble. The throttle switch is mounted on the carburetor. Although this switch does wear out, it also falls prey to unskilled hands that disturb the factory switch adjustment.

Whenever a light-throttle surging problem occurs on a Japanese carburetor, check throttle switch operation and adjustment before you blame the carburetor itself. When the engine's shut off, you can usually hear this switch click as you open the throttle very slowly. If you don't hear it click, check for a sticking or severely misadjusted switch. Sometimes, a thorough lubrication is all it takes to get a balky switch working smoothly again. To be thorough, open and close the switch while you spray it with lubricant.

Following the procedure outlined in your

shop manual, always check that there is continuity through the switch when its contacts are supposed to be closed. The switch contacts could be severely worn or gross misadjustment may prevent them from closing at all. A misadjusted idle speed screw or throttle positioner could also prevent the switch from closing.

Finally, check that the throttle switch opens at the correct RPM. Typically, the manual instructs you to check the switch's input terminals to the ECU. The voltage at these ECU terminals should change from one reading to another within a specified RPM range. If it doesn't, you adjust the switch by turning its adjustment screw or else carefully bending a piece of linkage until the switch opens at the correct RPM. Always check the switch's opening point several times. If the switch is working smoothly, it will always open at the same RPM.

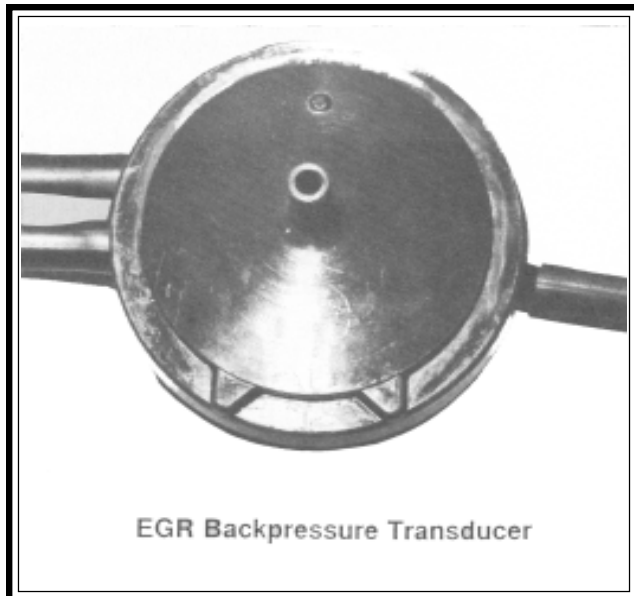
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Never soak a throttle switch in cold-dip carburetor cleaner.

Testing EGR Backpressure Transducers

EGR backpressure transducers are nothing new. Stand-alone EGR transducers first appeared in the earlier 1970s on domestic engines. Later on, newer domestic EGR valves designs eliminated the stand-alone transducer.

But today, nearly any Toyota, Lexus, Suzuki and many Mazda engines still have a separate EGR transducer (refer to the accompanying photograph). Shop manuals may call this transducer and EGR vacuum modulator valve. Although this transducer works basically the same way a domestic unit does, many technicians overlook it when they troubleshoot a Japanese EGR system. Then they replace the EGR valve for a problem that is actually rooted in the transducer.



EGR Backpressure Transducer

Regulate EGR operation

A backpressure transducer improves driveability by regulating EGR operation according to engine load. It does this by sensing exhaust gas backpressure and adjusting the amount of vacuum that goes to the EGR valve diaphragm.

The EGR transducer, which is spliced into the carburetor-to-EGR valve vacuum hose, has a spring-loaded bleed valve inside it. This bleed valve leaks off the vacuum signal to the EGR valve. Therefore, the farther the bleed opens, the weaker the vacuum signal to the EGR valve and the less EGR flow the engine receives. Naturally, closing the bleed valve creates the strongest vacuum signal and maximum EGR flow.

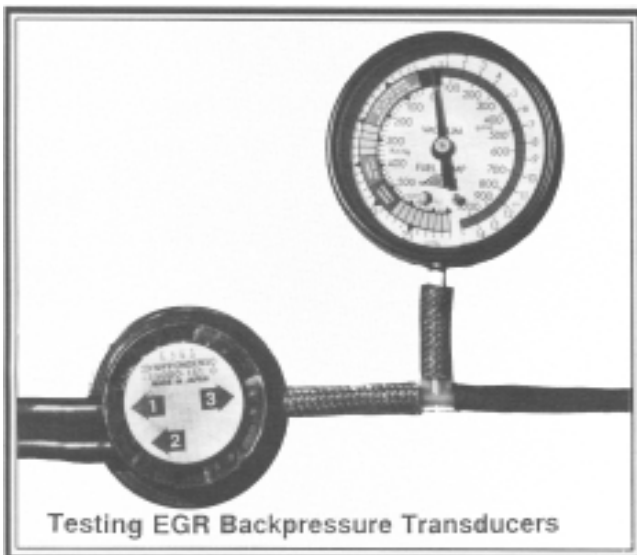
The transducer senses exhaust backpressure through a hose connected to the bottom of the transducer. This backpressure operates the bleed valve. Under lighter engine loads, exhaust backpressure is relatively weak, so the spring loaded bleed valve remains open and weakens the EGR vacuum signal. As engine load increases, exhaust backpressure increases, closes the bleed valve, and strengthens the EGR vacuum signal.

A typical domestic EGR backpressure transducer only has one vacuum supply hose, but this Japanese unit has two. One hose feeds a ported vacuum signal to the modulator port that's usually marked P or 2. The other supply hose feeds venturi vacuum to the modulator marked R or 1. Under certain engine loads, the second vacuum signal boosts or helps the first one operate the EGR valve.

Check hoses first

Whenever you check an EGR problem and you see an EGR vacuum modulator on the engine, be sure its vacuum hoses are routed correctly before you proceed. If someone has reversed the vacuum supply hoses at the modulator, the modulator will open the EGR valve too soon and make the engine hesitate, stumble, or surge.

Testing the EGR modulator is similar to testing a domestic unit. With the engine warmed up and idling, there should be no vacuum at the modulator's outlet port (usually marked Q or 3). When you rev the engine to about 2000 RPM, you should see a vacuum reading at the outlet port. If you don't see a vacuum reading, check for a clogged exhaust port before you condemn



the modulator. A clogged port would prevent exhaust backpressure from closing the modulator's bleed valve. Meanwhile, a partially restricted port--or a substantial reduction in exhaust backpressure--may upset the modulator's calibration and weaken the vacuum signal to the EGR valve. This would reduce EGR flow and could

cause the engine to ping.

Suppose the hoses are routed correctly and everything tests good so far but the engine still has an off-idle stumble or low-speed surge. Tee a vacuum gauge between the EGR modulator and the EGR valve. Watch the gauge while you road test the car. When you see a vacuum reading with just a tiny bit of gas pedal movement, the modulator is usually bad.

Remember that a restricted exhaust system could increase backpressure enough to trick the modulator into opening the EGR valve too soon. During your road test, note how the car performs during heavy-throttle and wide-open throttle driving. Perform the vacuum gauge test for a restricted exhaust. Depending upon how the customer drives a car with a restricted exhaust, he may only notice the off-idle hesitation or low-speed surge!

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