WELLS Counter Point

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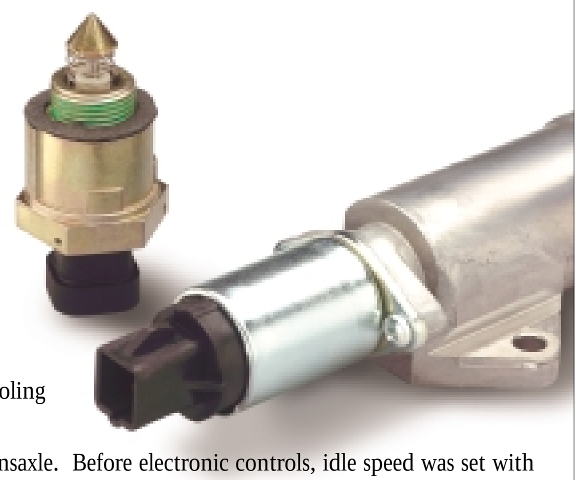
THE ELECTRONIC, DIAGNOSTIC AND DRIVEABILITY RESOURCE.

Idle-Speed Controls



The speed at which an engine idles is important because it affects idle quality, idle emissions, charging output, engine cooling and the automatic transmission or transaxle. Before electronic controls, idle speed was set with an adjustment screw on the carburetor or throttle linkage...

...but once it was set, it couldn't compensate for changes in engine loads. Turning on the A/C or other high-drain electrical accessories or using the power steering could lug down the engine. Idle speed would also vary as a cold engine warmed up, requiring careful adjustment of the choke and pull-off linkage.

Today, idle speed is automatically maintained within a preset RPM range for optimum driveability and emissions, regardless of engine temperature or parasitic loads. To accomplish this, two basic types of idle-speed-control actuators may be used: an idle-speed-control (ISC) motor (used on older feed-back carburetors), or an idle-air-control (IAC) bypass valve (used on throttle body and multiport fuel injection).

GM IDLE-SPEED-CONTROL MOTORS

On earlier General Motors carburetors that have idle-speed-control (ISC) motors, a small electric stepper motor is connected to the throttle linkage to regulate idle speed. The ISC motor receives its commands from the powertrain control module (PCM), which monitors engine RPM through distributor pickup reference pulses. The PCM maintains the desired idle speed by moving the ISC motor plunger in or out to change the throttle position. The PCM will also increase the throttle opening when the A/C compressor clutch is engaged and when the transmission is in drive, or when power steering is at maximum effort.

The ISC control circuit is only activated at idle when the throttle linkage closes a switch in the ISC motor housing called the idle-tracking or throttle switch, commonly referred to as the "nose" switch.

ISC DIAGNOSIS

Problems such as stalling, low idle speed, fast idle or an erratic idle can be symptoms of trouble in the ISC motor or control circuit. But be sure to rule out other possibilities first, such as a leaky EGR valve or vacuum leak (leaky vacuum hoses, leaks at the carburetor or intake manifold gaskets, or a leaky power-brake booster).

The operation of the ISC motor can be checked by switching on the A/C while the engine is idling and watching for the ISC motor to increase the throttle opening. When the ignition is turned off, the ISC plunger should also move to the fully-extended position on most applications.

If the ISC plunger does not move, the "nose" switch may not be closing and activating the ISC control circuit. You can check the status of the "nose" switch with a scan tool by watching for an "on" signal when the throttle closes. No change in switch status when the throttle opens and closes means the switch might be defective and the ISC motor might have to be replaced.

If the "nose" switch is working but the ISC plunger is not moving, you can check the motor by turning the key off, unplugging the connector on the back of the ISC motor and using a pair of fused jumper wires to power the motor (this may require re-adjusting the idle speed).

Grounding terminal "D" on the back of the ISC motor and applying battery voltage to terminal "C" should cause the plunger to fully retract (See Figure A). Reversing the connections (grounding "C" and supplying voltage to "D") should run the plunger all the way out. If nothing happens when you jump the ISC motor, the motor is defective and needs to be replaced. But if it works, the problem is in the wiring or ECM.

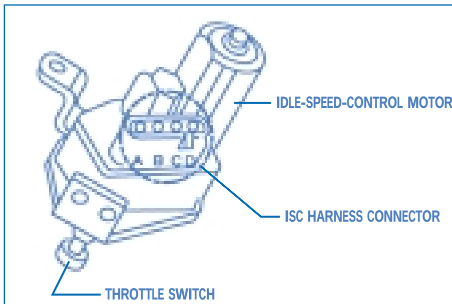


FIGURE A

Do not jump the ISC motor after the plunger reaches the fully-extended or retracted position

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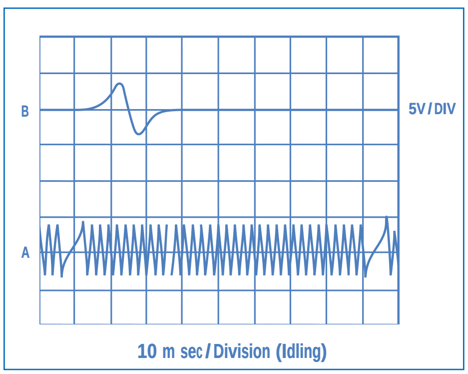
Fine Tuning

Fine Tuning *questions are answered by Jim Bates, WELLS' Technical Services Director.*

Q: "I have a 1995 Toyota Tercel that bucks and jerks under load at higher RPMs. Pulled codes and got a knock-sensor code. Replaced sensor and no more code but still have the same bucking and jerking problem. When it bucks, it loses spark and injector pulse. Everything checks out okay with the scanner on it while driving. This thing is giving me a headache and whiplash! Any ideas would be greatly appreciated."

Rick's Repair, Daytona Beach, FL

An intermittent crankshaft position signal may be causing the problem. In addition to the sensor itself, loose or corroded connectors or wiring could be the cause. The scope patterns shown below for the crankshaft position sensor (A) and the camshaft position sensor (B) are typical. Lightly tap on the sensor and wiggle the wiring harness and connectors while looking for an interruption in the signal.



Q: "I have a 1996 Ford Taurus 3.8L that will not start. There is spark, fuel pressure and injector pulse. But the strange thing is that it has all these things while the ignition switch is in the on position and the engine is not even being cranked! When this happens, the fuel injectors click, the ignition coil buzzes and so does the integrated-relay-control module (IRCM). I have replaced the ignition-control module but that didn't change anything. When I unplug the control-module harness connector, the coil stops buzzing but the injectors and the IRCM still do their thing. Have you ever heard of this kind of thing before?"

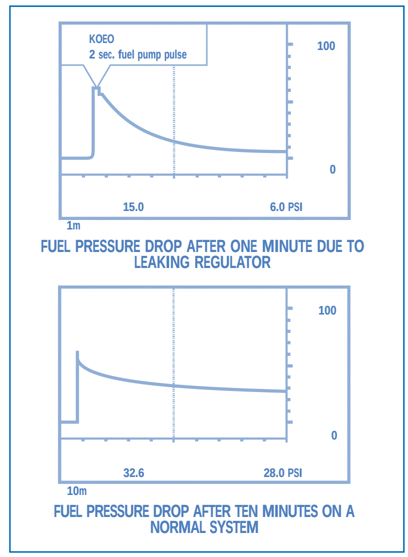
Mike Bolton, Dallas, TX

Actually Mike, I have seen this before. In each case, the problem turned out to be a bad ground connector located near the battery and was accompanied by a buzzing IRCM and clicking injectors. Repair of this connector and the associated ground connections will solve the problem.

Q: "I have a 1995 S10 Blazer with the 4.3L Vortec engine that has idle and acceleration problems. This engine only runs rich on one side, the even bank. This shows up in the secondary ignition pattern and on a cylinder balance test. Everything else looks Okay, but since this is a Vortec system, I'm not sure how the fuel injection assembly could only affect one bank of cylinders. Any thoughts on this?"

Tom's Towing Service, Memphis, TN

In cases like this, it is common for a leak to occur in the housing that holds the fuel injector and pressure regulator. Depending on where the leak is, it can affect one side of the engine more that the other. Since all of the plumbing is inside the intake plenum, a fuel-pressure leak-down test would be one way to verify a leak. After running the engine (or just the fuel pump) and shutting it off, the fuel pressure should hold for quite a long time. If there is a leak, the pressure will drop off immediately.



FUEL PRESSURE DROP AFTER ONE MINUTE DUE TO LEAKING REGULATOR

FUEL PRESSURE DROP AFTER TEN MINUTES ON A NORMAL SYSTEM

Please send your questions to: *Jim Bates c/o WELLS Manufacturing Corp., P.O. Box 70, Fond du Lac, WI 54936-0070 or e-mail him at technical@wellsmfgcorp.com. We'll send you a WELLS shirt if your question is published. So please include your shirt size with your question.*

Quality Points

WELLS Makes MAF Sensors More Durable

WELLS has developed design improvements for 10 mass airflow (MAF) sensors for 1985 to 1989 General Motors applications that eliminate the most common cause of sensor failure on these vehicles: circuitry contamination.

The troublesome OEM MAF sensors on these vehicles have their main circuit board mounted in the airstream. This provides additional cooling, but also exposes the components to environmental contamination that will eat through the protective epoxy coating. This can result in declining accuracy of MAF output signals and outright sensor failure.

In the redesigned WELLS MAF sensor, the electronics are relocated out of harm's way. The main circuitry is safely mounted on a substrate adhered to an aluminum heat-sinking plate, sealed inside an environment-proof housing. The only components exposed to the airstream are the heater element and thermistor. In addition, WELLS also uses a more rugged and compact circuit design with fewer interconnections.

The OEM sensor, by comparison, has outdated wire bonding and chip resistors on separate substrates. That's why WELLS MAF sensors outlast and outperform the OEM sensors.

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Idle-Speed Controls

because doing so may overload and damage the motor. Many ISC motors burn out because the plunger is running at the fully-extended or retracted position. This could be the result of a vacuum leak, fuel problem, overadvanced or retarded ignition timing or plunger misadjustment. The computer continues to supply voltage to the ISC motor in an attempt to regulate the idle speed, but because the motor is all the way in or out, it can't go any further, overheats and burns out. Also, do not connect voltage across ISC motor terminals "A" and "B," as doing so can damage the "nose" switch.

A shorted ISC control circuit will set a code 35 in the computer's memory. This code can also be triggered on some models by a shorted "nose" switch. A "false" code 35 can sometimes be set by a misadjusted or sticking throttle position sensor (TPS). This tricks the onboard diagnostics into thinking the throttle is open when it really isn't. An air leak in the hose to the vacuum differential sensor on some early 2.5L engines can also cause the same condition.

If you get a code 35, turn the ignition off and unplug the connector on the back of the ISC motor. Connect an ohmmeter between terminals "A" and "B" (the top two terminals), then open the throttle and note the resistance. Less than 10 ohms means the motor is shorted and needs to be replaced. If the reading is over 10 ohms, check for voltage between terminals "A" and "B" in the harness connector. "A" is ground and "B" is the computer-control circuit. If the reading is at least six volts, check the operation and adjustment of the TPS. If the TPS is okay, the fault is most likely in the ECM.

If the reading between connector terminals "A" and "B" is less than six volts, check the voltage drop between terminal "A" and ground, then check the voltage drop between terminal "B" and terminal #8 at the ECM. If the wiring is okay, the problem is in the ECM.

IDLE-AIR-CONTROL VALVES

General Motors idle-air-control (IAC) valves are used on both throttle body and multiport fuel-injected engines to regulate idle speed. Chrysler calls it an automatic-idle-speed (AIS) motor, while Ford refers to it as a throttle air-bypass solenoid (AIR B).

The IAC valve opens a small bypass circuit that allows air to flow around the throttle. Increasing the volume of air that's allowed to bypass the throttle increases idle speed, while reducing the bypass airflow decreases idle speed (See Figure B).

The IAC valve is controlled by the engine's computer. The computer monitors idle speed by measuring the time between pulses from the ignition module or crankshaft sensor when the throttle position sensor or throttle switch signals the computer that the throttle is closed.

If idle speed is out of range, the computer commands the IAC valve to either increase or decrease the bypass air flow. Additional sensor inputs from the coolant sensor, brake switch and vehicle speed sensor may also be used to adjust idle speed according to various operating conditions. Idle speed may also be increased when the A/C compressor is engaged, the alternator is charging above a certain voltage, the automatic transmission is in gear, or power steering loads are high.

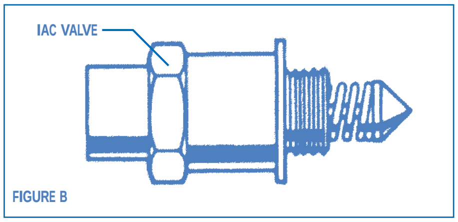

FIGURE B

IDLE-AIR CONTROL-VALVE DIAGNOSIS

A common condition is an idle-air bypass valve that's fully extended (closed). This is often a symptom of an air leak downstream of the throttle, such as a leaky throttle-body base gasket, intake manifold gasket, vacuum circuits, injector O-rings, etc. The computer has closed the bypass circuit in an attempt to compensate for the unmetered air leak that is affecting idle speed.

Incorrect idle speed (too high) also can be caused by a shorted A/C compressor clutch wire or defective power steering pressure-sensor circuit. A code 35 on a GM application indicates a problem in the idle-air control circuit. To troubleshoot the problem, disconnect the IAC motor, then start the engine to see if the idle speed increases considerably. Turn the engine off, reconnect IAC and start the engine again. This time the idle speed should return to approximately the previous RPM. If it does, the problem is not the IAC circuit or motor. Check for vacuum leaks or other problems that would affect idle speed.

If the idle speed does not change when the IAC is unplugged, and/or does not decrease after reconnecting the unit, use a test light to check the IAC wiring circuits while the key is on. The test light should glow when connected between terminals A and B and terminals C and D if the PCM and wiring are okay (indicating the problem is in the IAC motor). If the test light fails to glow on either circuit, the fault is in the wiring or PCM.

On Ford throttle-body Central Fuel Injection (CFI) applications, a solenoid or vacuum diaphragm is used to open the throttle linkage along with an idle-air bypass valve. Ford also uses idle-air bypass on its multipoint injection applications. Codes 12, 13, 16, 17 and 19 all indicate idle speed is out of spec (too high or too low). Codes 47 and 48 indicate a fuel-mixture problem which could be caused by an air leak. The diagnostic procedure when any of these codes are found is to turn the engine off, unplug the ISC bypass air-solenoid connector, then restart the engine to see if the idle RPM drops. No change would indicate a problem in the solenoid, wiring or EEC processor.

A Ford ISC solenoid can be checked by measuring its resistance. A reading of between 7.0 to 13.0 ohms would be normal. Also check for shorts between both ISC solenoid terminals and the case.

If the ISC checks out okay, check for battery voltage between the ISC connector terminals while the key is on. Voltage should also vary when the engine is running. No voltage indicates a wiring or EEC processor problem.

With Chrysler, a code 25 means there's a problem in the AIS motor-driver circuit. The AIS driver circuit can be checked by a scan tool actuator tests. When the actuator display shows a code 03, the AIS motor should cycle one step open and one step closed every four seconds. You can remove the AIS from the throttle body to see if the valve pintle is moving in and out, or simply listen for the motor to buzz.

In a scan tool engine-running test-mode #70, which checks the throttle-body minimum air flow, depressing and holding the proper scan tool button should close the AIS bypass circuit. At the same time, ignition timing and fuel mixture are fixed. Idle speed should increase to about 1300 to 1500 RPM. If it does not match specifications, minimum air flow through the throttle body is incorrect.

On late-model vehicles with OBD II, the following codes may indicate a problem with the idle-air-control system:

- P0506 — idle too low
- P0507 — idle too high
- P1508 — idle-air-control stuck closed
- P1509 — idle-air-control stuck open
- P1599 — engine stall detected

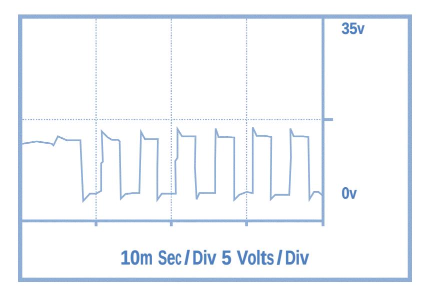

FIGURE C

When installing a new GM IAC or Chrysler AIS motor, the pintle must not extend more than a certain distance from the motor housing. The specs vary, so check the manual. Chrysler says one inch (24.50 mm) is the limit, while some GM allow up to 28 mm on some units and 32 mm on others. If the pintle is overextended, it can be retracted by either pushing it in (GM) or by connecting it to its wiring harness and using actuator test #03 to move it in (Chrysler).

Digital Storage Oscilloscope (DSOs) can also be used to view IAC wave forms. A typical GM is illustrated above (Figure C).

WELLS

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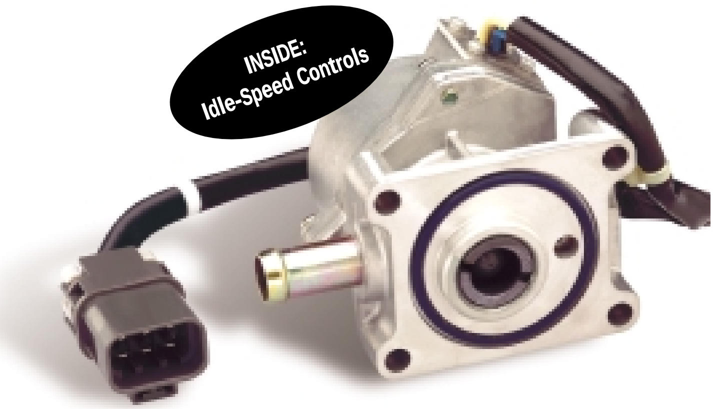
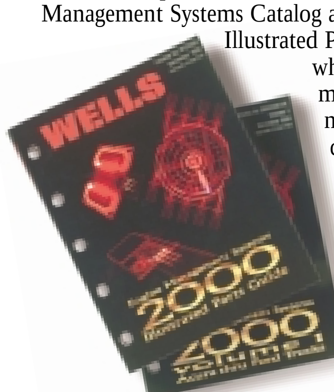


Hot off the Wire

WELLS Publishes Catalog, Parts Guide

WELLS has published its extensive 2000 Engine Management Systems Catalog and 2000 Illustrated Parts Guide, which incorporate more than 2,400 new part numbers covering through model year 2000 vehicle applications.



The 2,598-page catalog has been divided into two volumes for easier storage and use. Volume 1 covers Acura through Ford trucks, while Volume 2 covers Geo through Yugo. Both volumes also feature expanded Gold Program listings, as well as information on WELLS' QS-9000 certification.

The fully-illustrated parts guide contains 941 pages of detailed information and new categories, some of which include:

- Top Dead Center (TDC) sensors for Mercedes and BMW
- Windshield-washer fluid-level sensors for Ford
- Chrysler transmission speed sensors

An alpha locator program indicates the size of each product box. This allows for improved utilization of shelf space, which maximizes return on investment through better inventory management.

For information on obtaining copies of the publications, contact your nearest WELLS distributor or representative. In recent years, WELLS catalogs have won numerous awards from the National Catalog Managers Association.

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