Nissan Chokeless Hitachi

PART ONE

By now we're all pretty familiar with feedback-type carburetors. Feedback carburetors offer precise fuel metering for better emission control without the cost of a complete fuel injection system. The reduced cost makes a feedback carburetor a natural for the economy end of the car market. It has its limitations, however.

Tightening emission standards have become increasingly difficult to meet with a carburetor, feedback or not. The feedback carburetor can't control the fuel mixture under all operating conditions like fuel injection can. Many manufacturers have started using fuel injection on even their most inexpensive cars, in spite of the added cost.

Nissan came up with a cross between a carburetor and fuel injection for 1984 Sentra and Pulsar models. It's still a carburetor, but it has many of the operating characteristics of fuel injection. The ECU has far more control over the carburetor than in a simple feedback system. This system was installed in over one million U.S. sold Sentras and Pulsars. It was replaced by single-point fuel injection on 1988 models.

One thing to keep in mind when working on this carburetor is that it's still just a carburetor. The most common problem with these carburetors is plain ordinary dirt. So if you get one that won't idle properly, don't automatically assume that something electronic has failed.

DUTY CYCLE TESTING

A duty cycle meter comes in handy for diagnosing dirt-obstructed fuel passages. An incorrectly adjusted idle mixture screw can also be detected by duty cycle testing. Attach the duty cycle meter to the terminals for the Air-Fuel Ratio (AFR) Solenoid at the carburetor connector. A dwell meter can be substituted for a duty cycle meter. Set the dwell meter on the four-cylinder four-cycle scale. Multiply all duty cycle percent readings by .9 to convert to dwell meter degree readings. Check for the following readings:

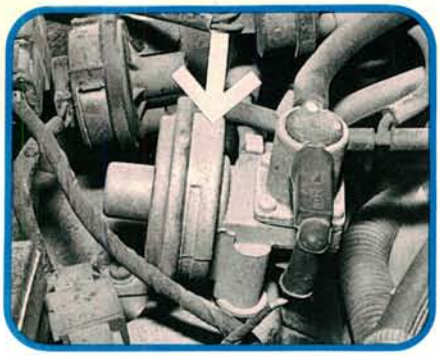
- A duty cycle reading of 0 percent at idle would indicate clogged idle passages.
- A 0 percent reading at 3000 RPM would indicate that the main metering passages are blocked.
- A warm engine should "clamp" at a duty cycle reading of 40 percent ± 5 percent at idle. A higher duty cycle reading indicates that the conventional part of the carburetor (idle mixture circuit) is delivering a rich mixture. The ECU tries to compensate by sending the Air-Fuel Ratio (AFR) Solenoid a lean signal.
- A duty cycle reading lower than 35 percent at idle would indicate that the idle mixture circuit is set too lean. The ECU tries to compensate by sending the AFR Solenoid a rich signal.

Because this carburetor isn't really like anything else that you've probably seen, we're going to spend some extra time with it. In this first installment, we'll outline basic operating principles of the system, component locations, and troubleshooting techniques. Next time we'll cover disassembly, cleaning, and adjustments.

—By Karl Seyfert

1

Idle speed at all engine temperatures is maintained by this diaphragm, called an Idle Speed Control Actuator (ISCA). The actuator's plunger extends to provide a fast idle during engine warmup. This screw is used for adjusting maximum fast idle speed. Don't use it to adjust warm idle speed.

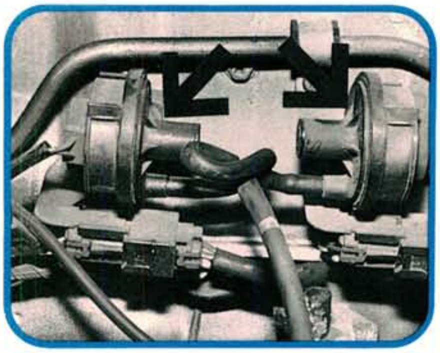


2

The ISCA is operated by a controlled vacuum signal which is sent by the Vacuum Control Modulator (VCM). The VCM receives a duty cycle signal from the ECM which it converts to a vacuum signal. Idle speed is adjusted for engine temperature as well as additional electrical, power steering, and A/C loads.

3

Early models experienced problems with VCM operation. Moisture drawn into the control system caused the VCM to stick. A normally operating VCM emits a rapid ticking noise while the engine is running. The early VCMs lacked this top vacuum port. The later style VCM can be installed on early models.



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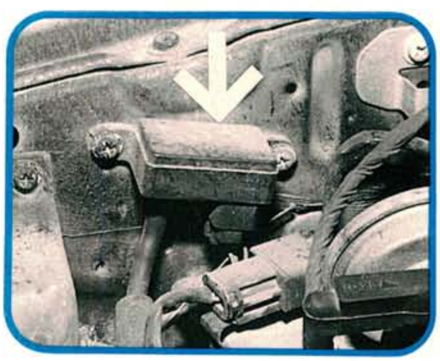
Two vacuum sensors monitor the VCM circuit. A drop in vacuum opens the sensors. This breaks the ground circuit to two vacuum cut solenoids on the intake manifold which open to prevent a runaway throttle. Double components are used for added safety. The sensors are mounted on the right strut tower on 1984-86 models.

5

Here's a quick check of the VCM system. Locate the small black air filter canister to the left of the carburetor atop the intake manifold. Place your hand over the opening at the back of the filter. The engine idle should race when you cover it. Look for damaged or blocked VCM hoses if it doesn't respond.



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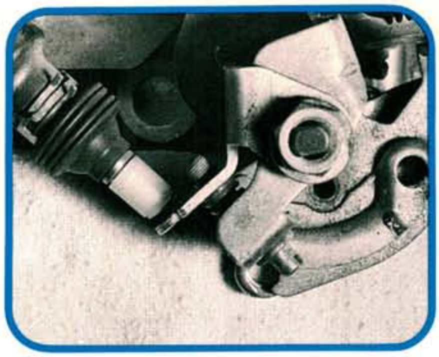
The Vacuum Sensor monitors manifold vacuum and converts the information into a varying voltage signal. The ECU reads the voltage signal and uses the information to help determine the proper air-fuel ratio. 1984-86 Vacuum Sensors are mounted on the right inner fender. It's on the firewall on '87 models.

7

The ECU monitors intake air temperature through this sensor mounted in the air cleaner assembly. A similar sensor mounted on the right rear side of the intake manifold measures coolant temperature. The ECU uses the information from both sensors to determine the correct air-fuel ratio under varying conditions.



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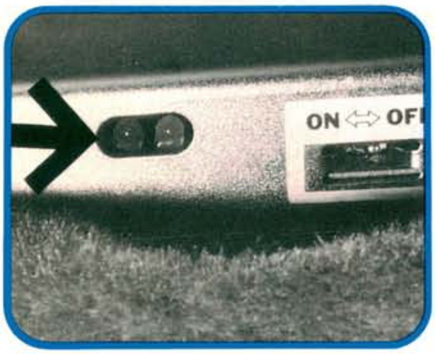
1986-7 models incorporated a "self-learning" feature in the ECU. The ECU monitors the operation of the engine and arrives at a normal set of values for any given situation. This prevents the ISCA from hunting for the perfect idle speed and allows it to respond more quickly by relying on this learned information.



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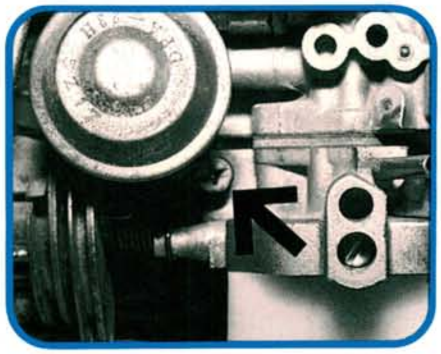
The ECU has limited self-diagnostic capabilities. With the micro-switch on, the LEDs show one of two fault codes. Each code indicates a problem in a separate group of circuits. Perform ECU pin tests on individual circuits to locate the faulty part or circuit. Solid red and green LEDs indicate normal operation.



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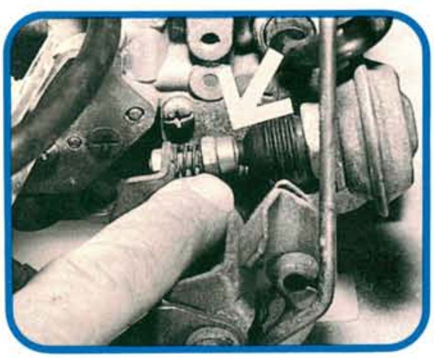
The base idle speed screw is on the left rear corner of the carburetor. It shouldn't require adjustment unless someone has already tampered with it. If the base idle is adjusted too high, the VCM will retract and stop controlling idle speed. If it's set too low, the engine may stall during quick deceleration.



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The carburetor dashpot (arrow) provides a cushion when the throttle is closed rapidly. This allows a more gradual transition between the leaner air-fuel ratios of cruising and the richer idle ratios. If the dashpot touch speed is too low, it may cause stalling during fast stops or deceleration.

12

Earlier carburetors used a Throttle Positioner (arrow) instead of the dashpot. The Throttle Positioner holds the throttle open slightly during engine starting. Once the engine starts, manifold vacuum retracts the Positioner and allows the engine to return to normal idle speed.

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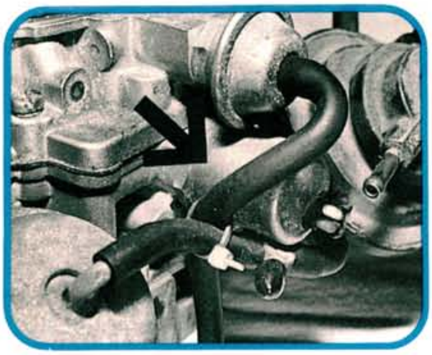

There's no choke plate, so how do we get a richer mixture during cold starts? The ECU sends a pulsed electrical signal to the Enrichment Solenoid (arrow) to provide additional fuel. The amount of enrichment tapers off as the signal from the water temperature sensor indicates the engine is warming up.

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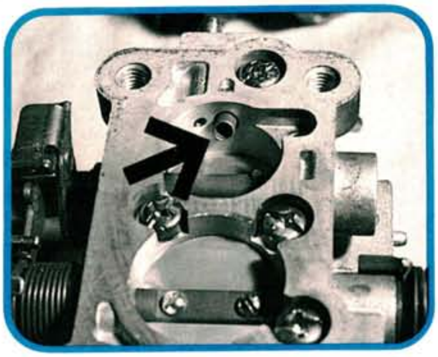

Fuel passes from the Enrichment Solenoid to this opening (arrow) below the secondary throttle plate. A leaking Enrichment Solenoid can be difficult to diagnose since the fuel is dumped below the throttle plate. Dirt in the solenoid or a damaged O-ring may cause the solenoid to leak fuel.

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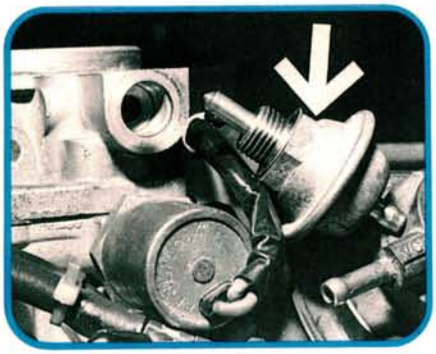

Further enrichment is provided during cranking by the Vacuum Piston (arrow). Engine vacuum is low during cranking and the Vacuum Piston closes. This blocks the air bleed for the Enrichment Solenoid passages. Once the engine starts, vacuum pulls the piston open to expose the air bleed.

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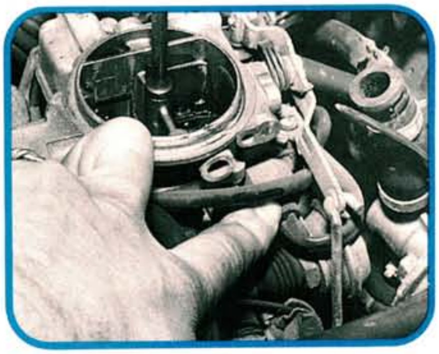

The Anti-diesel Solenoid has more to do than its name implies. During closed throttle deceleration above 2000 RPM, the ECU interrupts power to the Anti-diesel Solenoid to reduce hydrocarbon emissions. Just because it clicks when you turn on the ignition, don't assume that it's good.

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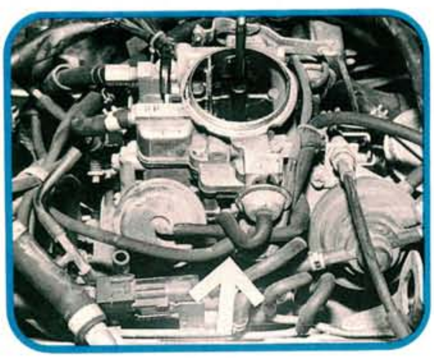
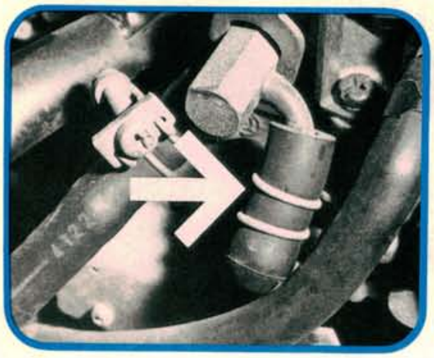


A fuel mixture heater is mounted below the carburetor (take my word for it, it's there) to help atomize the fuel during cold operation. The heater is under ECU control and is a Positive Temperature Coefficient type. Its resistance to current flow increases as temperature rises to prevent burnout.

18

Watch for chafed vacuum hoses (arrow) at the back of the carburetor. Vacuum leaks will affect VCM operation. Carbon deposits in the vacuum ports at the rear of the intake manifold will also change VCM operation. The system must receive full manifold vacuum for proper operation.



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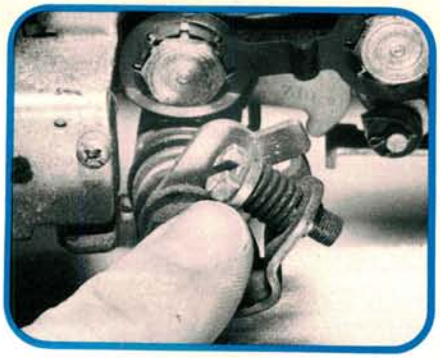
1984 and early '85 models with a fuel return line at the carburetor had hot restart fuel starvation problems. A factory kit containing fuel hoses and a new fuel pump to convert to a non-fuel return carburetor setup (shown) is available. Later models eliminated the return fitting at the carburetor completely.



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The most sensitive adjustment on the carburetor is the Throttle Switch. The ECU uses the signal from the Throttle Switch to determine when to shift the carburetor between the lean cruising fuel mixture and the richer idle mixture. A misadjusted Throttle Switch will cause an off-idle hesitation.