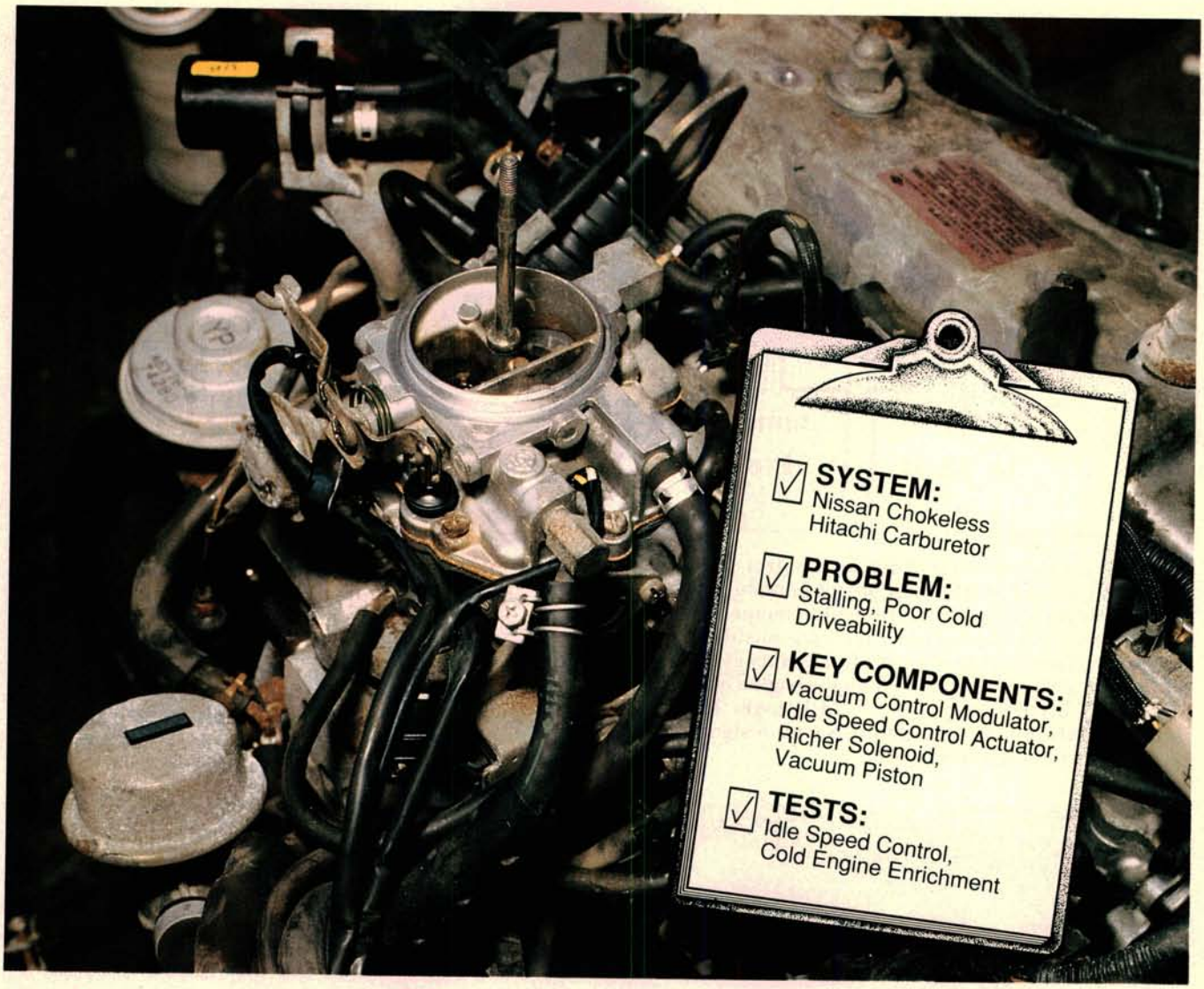


Nissan Chokeless Hitachi

PART ONE

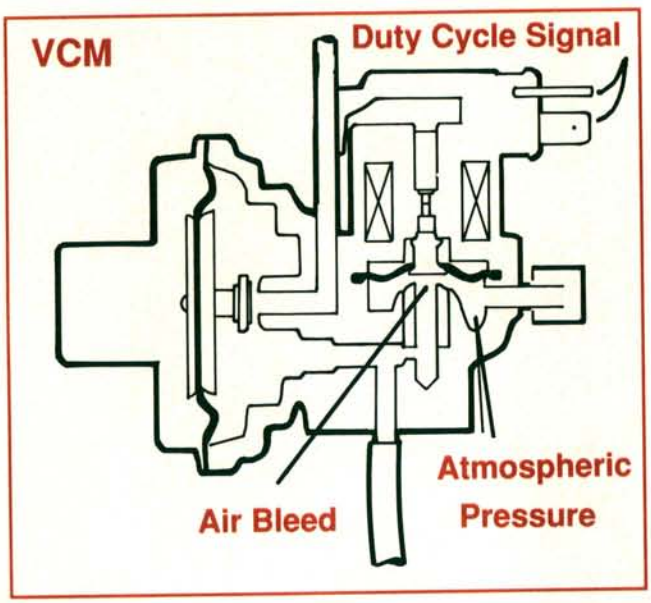
We took our first look at Nissan's chokeless Hitachi carburetor back in March and April of 1989. At that time, this unique carburetor had been out of production for nearly two years, and some of the over one million Sentras and Pulsars equipped with chokeless Hitachis were beginning to show up for service at independent shops around the country.

A couple of things have become apparent since then. Our newer readers may not have seen our 1989 articles. And nearly five years after the last carbureted Sentra or Pulsar rolled off the assembly line, the chokeless Hitachi continues to baffle some of the best minds in the business. A trip down Memory Lane seemed in order.

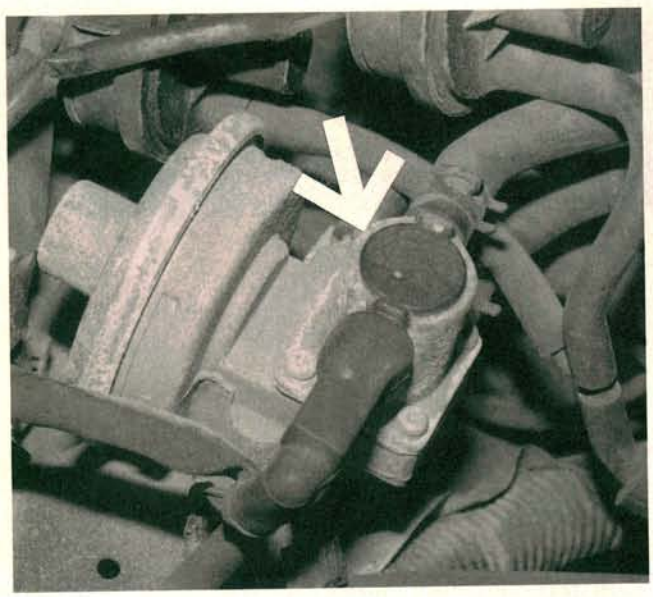
If you take a look at this carburetor, it won't take long to notice that it has no choke plate, fast idle linkage, fast idle cam, or choke pull off. New components take the place of these traditional carburetor parts. Parts like the Vacuum Control Modulator (VCM), Idle Speed Control Actuator (ISCA), and Richer Solenoid are directly controlled by the vehicle's ECU to help the engine deliver better performance, economy, and cleaner emissions, without the expense of a fuel injection system.

A new set of driveability problems and repair techniques came along with this new system, and this is where the confusion sets in for some technicians.

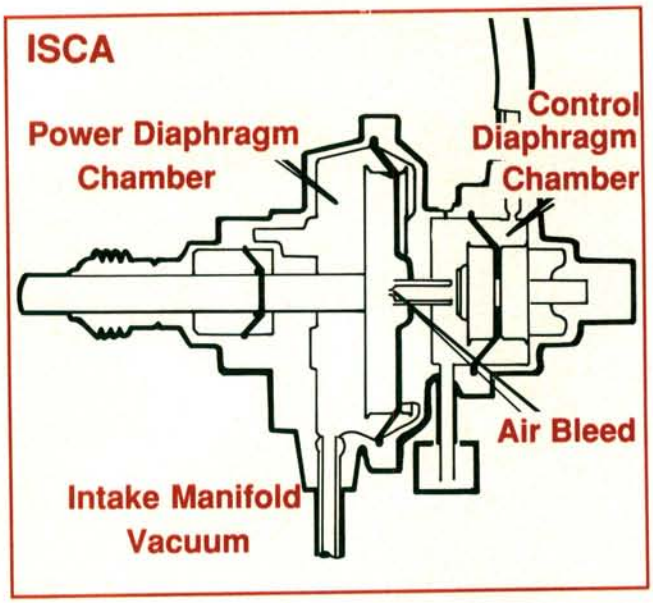
This month we'll concentrate on chokeless Hitachi driveability problems that usually occur when the engine is cold. Next month we'll look at problems that can affect warm engine operation.



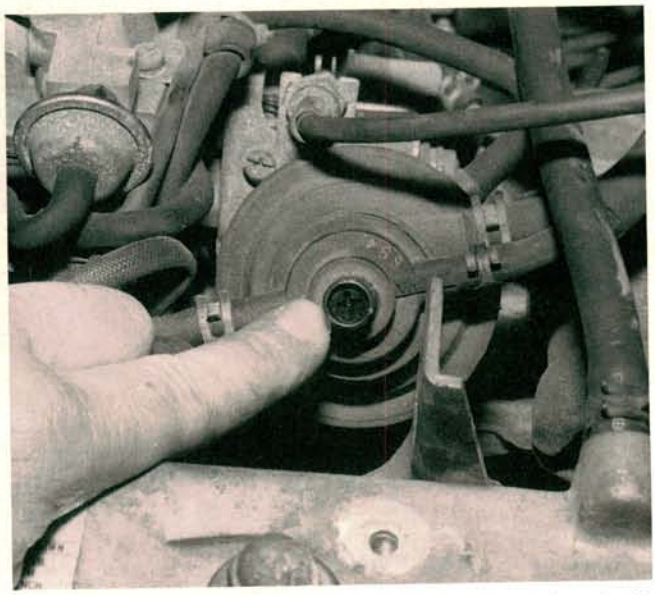
1 The ECU uses the Vacuum Control Modulator (VCM) and Idle Speed Control Actuator (ISCA) to control idle speed at all engine temperatures. A variable air bleed inside the VCM mixes outside air with manifold vacuum to translate the ECU's duty cycle signal into a control vacuum signal. When the engine is cold, the ECU's duty cycle signal to the VCM is high. The VCM translates this into a weak control vacuum signal to the ISCA to increase cold idle speed.



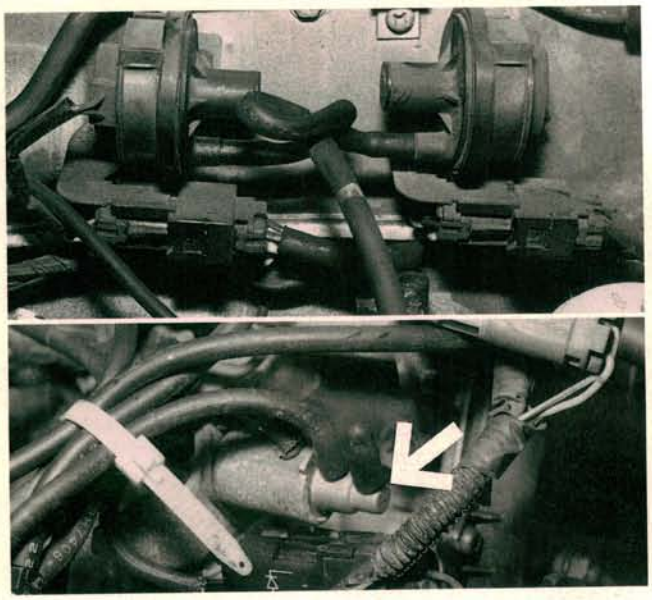
2 A stuck VCM can prevent the ECU from controlling idle speed. An air filter near the VCM must remove any dirt or water from the air before it enters the VCM to create the control vacuum signal. Weak filters caused moisture damage to early VCMs, making them stick. The ECU's duty cycle signal should make the VCM tick rapidly while the engine is running. Replace the VCM if it's stuck. Hitting a stuck VCM may revive it temporarily.



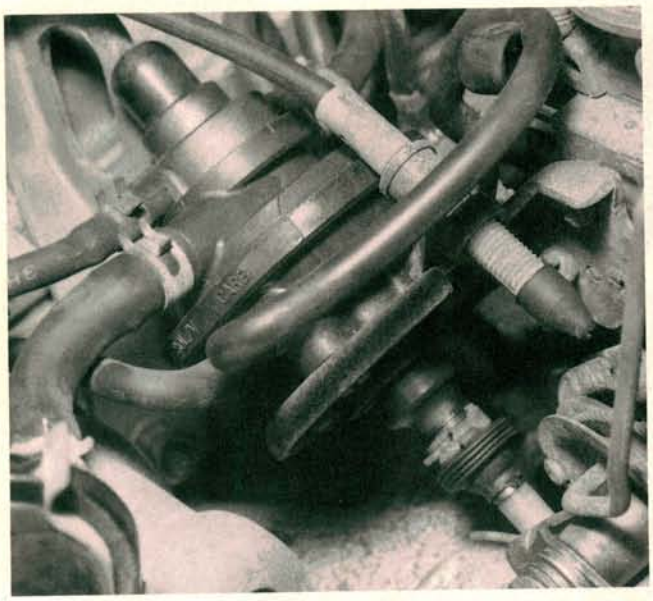
3 The ISCA has three chambers. The lower power diaphragm chamber and middle air chamber are connected by a variable air bleed passage. The VCM's control vacuum signal enters the ISCA upper control diaphragm chamber to adjust the amount of air that bleeds from the air chamber into the lower power diaphragm chamber. During cold operation, the VCM control vacuum signal is weak and very little air bleeds into the power diaphragm chamber. Strong manifold vacuum extends the ISCA push rod, raising the cold idle speed.



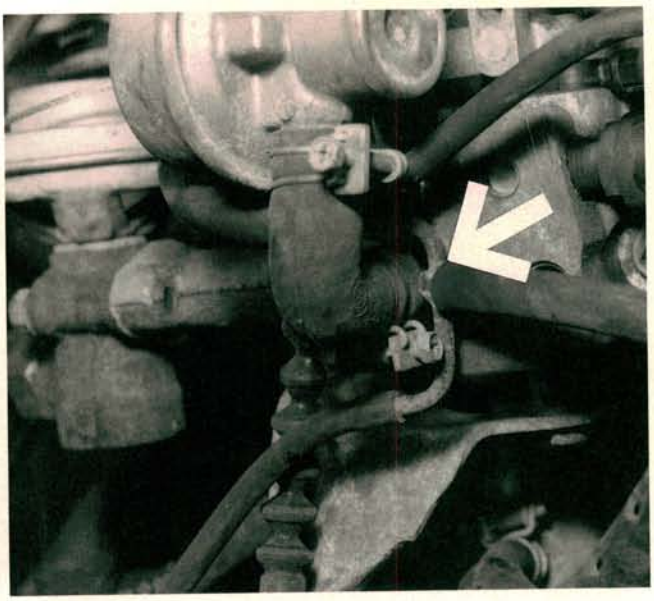
4 If the engine has no cold fast idle, your first inclination might be to look for an adjustment screw. I've seen several perfectly good ISCAs ruined by cranking on this adjustment screw or by turning the ISCA push rod. This adjustment screw and a smaller one on the carburetor linkage control maximum idle speeds. But they seldom need adjustment unless someone has gotten to them before you. We'll show you several more likely causes for no cold fast idle you should check first.



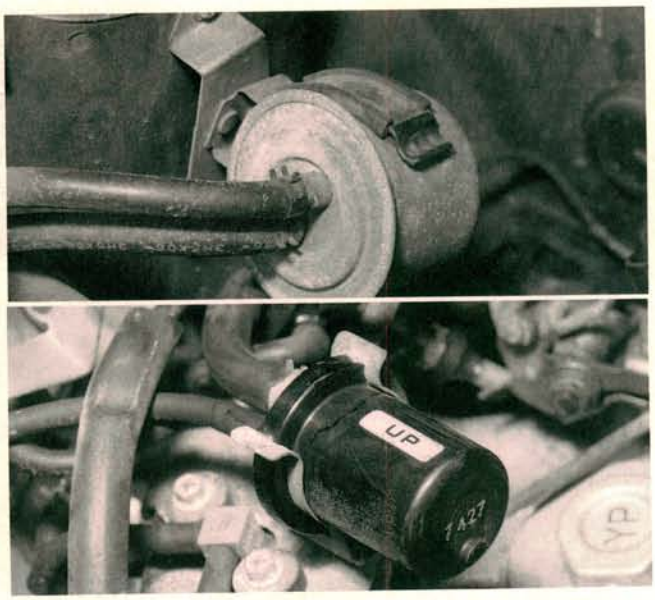
5 We know a low control vacuum signal from the VCM causes a fast idle. What if there were no VCM control vacuum signal? Strong manifold vacuum would fully extend the ISCA push rod and we'd have a runaway throttle. To keep this from happening, two vacuum switches monitor the VCM control vacuum signal. When control vacuum drops below a set limit, two vacuum cut solenoids vent the manifold vacuum in the ISCA's lower power diaphragm chamber, and the push rod retracts. There's two of everything for an added measure of safety.



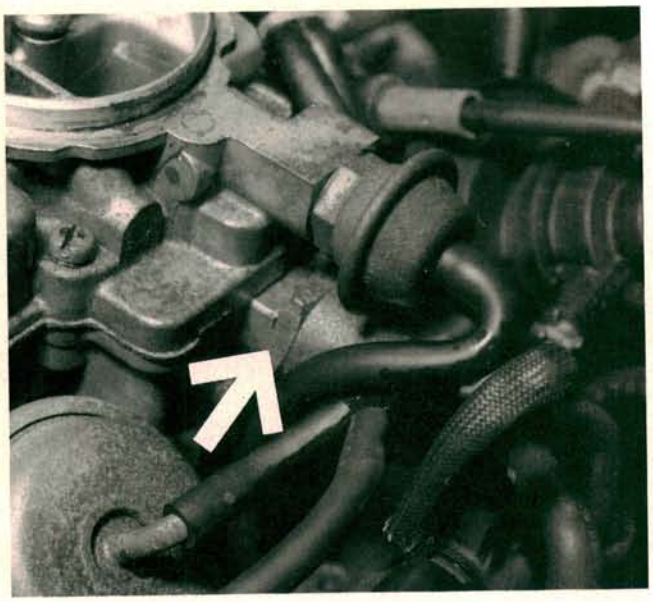
6 If the VCM control vacuum signal drops low enough to open the vacuum sensors, look for broken or disconnected vacuum hoses between the VCM and the ISCA, or between the ISCA and the vacuum switches. An internal ISCA diaphragm failure is a third, but less likely possibility. The vacuum switches provide the ground to the vacuum cut solenoids and are wired in series. A break in the switch wiring or a failure of either vacuum switch will also open the vacuum cut solenoids.



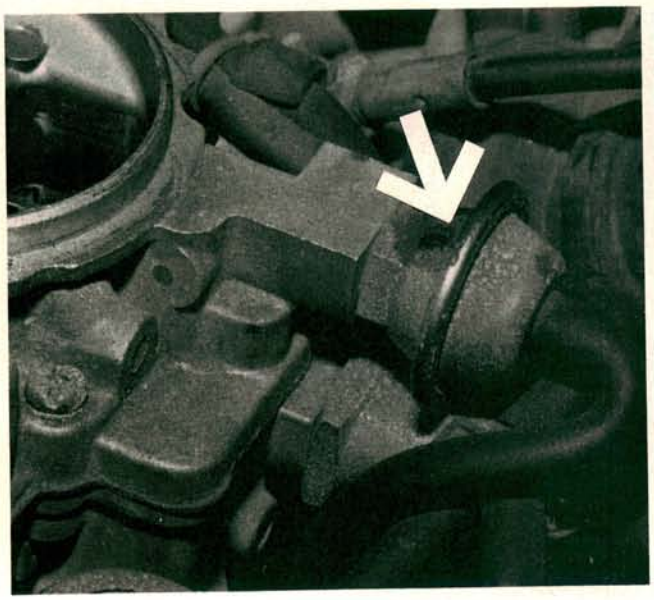
7 The whole idle speed control system runs on vacuum, so a strong manifold vacuum supply is a must. The VCM gets its manifold vacuum from a vacuum port at the back of the intake manifold, below the carburetor. The vacuum port is also near the EGR valve, which may clog the port with carbon. A low manifold vacuum supply to the VCM, caused by a clogged port or leaking vacuum hose, will weaken the VCM's control vacuum signal to the ISCA. This will cause a high or hunting idle after engine warm up.



8 You'll see opposite effects if either the VCM or ISCA air filters get clogged. A clogged VCM air filter causes a high VCM control vacuum signal to the ISCA. This retracts the ISCA push rod, slowing hot and cold idle speeds. A clogged ISCA air filter causes a high idle at all times. Outside air must pass through the ISCA's internal air bleed to weaken the manifold vacuum signal and retract the ISCA push rod. Test the system after removing the filter hoses if you suspect a clogged filter.



9 There's no choke plate to limit the supply of air during cold operation, so extra fuel must be added instead. Based on information from the coolant sensor, the ECU sends a varying duty cycle signal to the Richer Solenoid. When the Richer Solenoid needle opens, fuel flows from the bowl to an opening below the secondary throttle plate. A failed Richer Solenoid can cause cold engine stalling. A leaking solenoid needle will cause a rich mixture after warmup.



10 The Vacuum Piston does the job of a choke unloader on a conventional carburetor. Low manifold vacuum during cranking lets the Vacuum Piston extend, blocking an air bleed between the bowl and the Richer Solenoid to allow full enrichment. Full enrichment isn't needed after the engine starts. Higher manifold vacuum opens the Vacuum Piston, exposing the air bleed to limit enrichment and emulsify the fuel. Vacuum Piston failure will cause an over-rich mixture during warmup.

Cold Driveability Quick Checks

- Make sure the VCM is ticking when the engine is running. No tick - no fast idle. Moisture may enter the VCM and cause the internal solenoid to stick. If the VCM is working, removing its harness connector should make the idle speed drop. Tapping on a stuck VCM may revive it temporarily. The external adjustment screw on the side of the VCM vacuum chamber is factory set and does not require periodic readjustment.

- A more effective VCM air filter and revised VCM were introduced on later models to cure VCM sticking problems. A "VCM kit" containing the new VCM, air filter, and assorted hoses and brackets is available to convert an older idle speed control system.

- One of the most common chokeless Hitachi complaints is no fast idle when cold. Before you begin your diagnosis, make sure the base idle screw next to the throttle linkage hasn't already been turned up to mask this problem. A base idle speed that's too fast will cause other warm idle speed control problems we'll discuss next month.

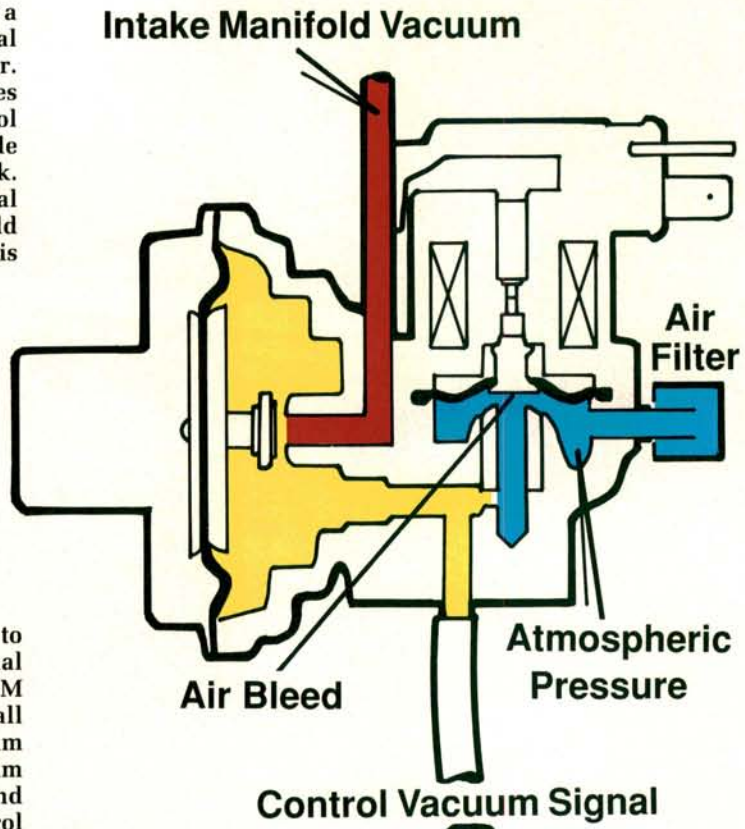
- The last Nissans equipped with a chokeless Hitachi will soon be five years old. Collapsed or leaking vacuum hoses caused by engine heat, oil leaks, or other hazards aren't unusual and can throw the idle speed control system into a tailspin. A quick visual hose inspection will often reveal the problem without spending a lot of diagnostic time.

- For a quick idle speed control check, clamp your hand over the small opening at the back of the ISCA air filter on the intake manifold. This cuts off the supply of bleed air to the middle ISCA chamber, and should cause the idle speed to rise sharply and stay there until you remove your hand. If the idle speed doesn't rise, the vacuum cut solenoids have probably opened because the system is in fail-safe mode. Start looking for vacuum leaks or anything else that could cause low VCM control vacuum. Fail-safe component or wiring failures could also be to blame.

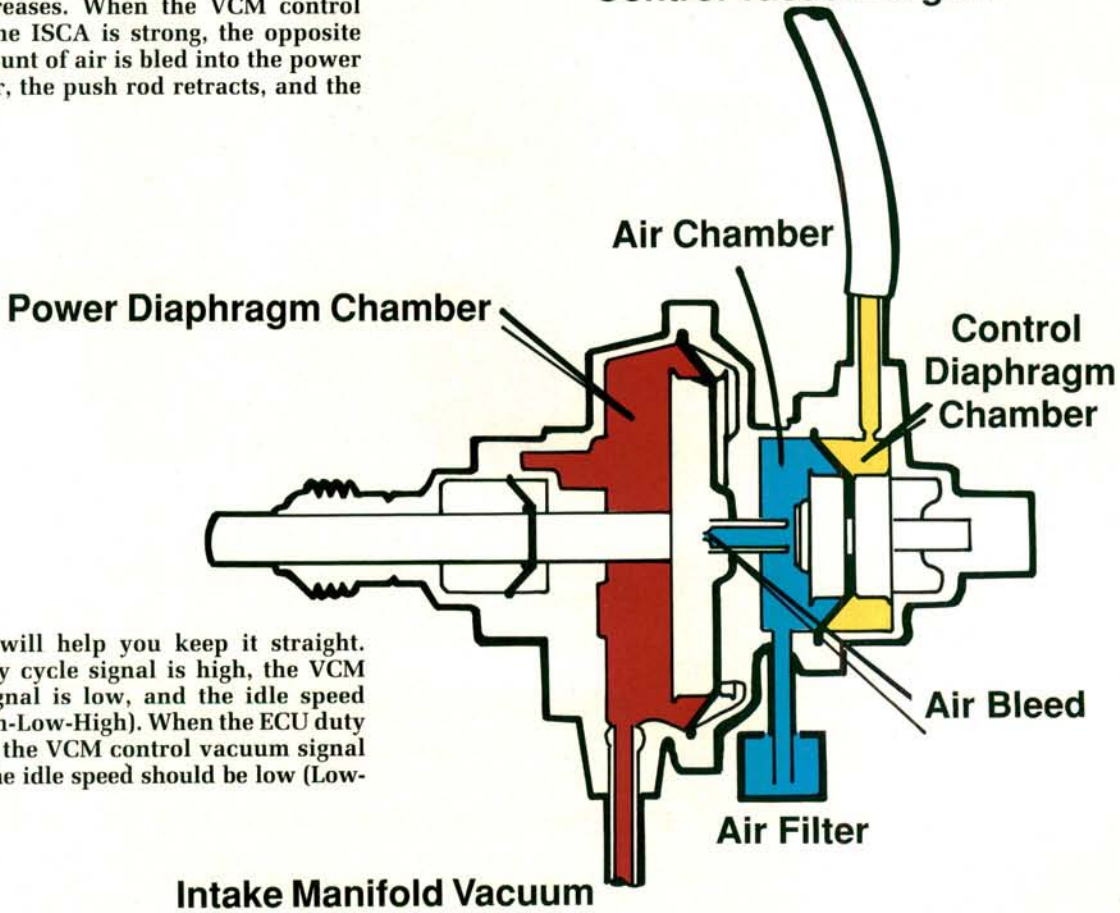
- Abnormally high or low idle speeds may be caused by clogged ISCA and VCM air filters. There's no recommended replacement interval for these small plastic filters, apparently they weren't expected to clog. If the idle speed stays high even after engine warmup, disconnect the ISCA air filter hose and retest. If the engine has no fast idle at any engine temperature, disconnect the VCM air filter hose and retest.

Idle Speed Control Basics

When the engine is cold, the ECU sends the VCM a high duty cycle signal. The high duty cycle signal keeps the VCM's internal air bleed open longer. Outside air is drawn through the filter and mixes with manifold vacuum to create the VCM control vacuum signal. The air bleed lets in lots of outside air, so the control vacuum signal to the ISCA is weak. When the engine is warm, the ECU duty cycle signal is low. The VCM mixes less outside air with manifold vacuum, and the VCM control vacuum signal is stronger.



The ISCA uses the VCM control vacuum signal to adjust the idle speed, also using a variable internal air bleed. When the ISCA receives a weak VCM control vacuum signal, it responds by mixing a small amount of outside air with intake manifold vacuum in the lower chamber. The strong manifold vacuum in the lower chamber extends the ISCA push rod and the idle speed increases. When the VCM control vacuum signal to the ISCA is strong, the opposite occurs. A large amount of air is bled into the power diaphragm chamber, the push rod retracts, and the idle speed drops.



Two simple rules will help you keep it straight. When the ECU duty cycle signal is high, the VCM control vacuum signal is low, and the idle speed should be high (High-Low-High). When the ECU duty cycle signal is low, the VCM control vacuum signal will be high, and the idle speed should be low (Low-High-Low).