No Spark

One look at the wet book of matches in our photo will tell you that none of those matches is likely to produce a spark. But suppose an engine won't start and we need to find out why. More than a short glance is required to make the correct diagnosis. Let's assume a quick check with a spark tester reveals that the engine isn't producing any spark. What now?

If you work on a single line of cars, your past experience may tell you that if the car in your stall has no spark, the chances are good that the igniter is to blame. A correct guess has the customer back on the road after a minimum amount of time spent on diagnosis.

But what if you're unfamiliar with the no-spark vehicle in question? There could be more than a dozen different reasons why the engine has no-spark. The following is a partial listing of some basic no-spark causes:

- No power or ground to the ECU
- Wiring harness damage or corrosion
- No power or ground to the crank angle sensor or Hall Effect sender
- Defective distributor cap
- Defective rotor
- Defective secondary ignition wires (especially the coil wire)
- Damaged spark plugs
- Carbon tracking on the ignition coil
- No signal from the ECU to the power transistor or igniter
- No signal from the crank angle sensor to the ECU
- Defective coil power transistor
- Defective igniter
- Defective distributor module
- Defective distributor pickup coil

With so many choices, random guessing and parts swapping can quickly become an expensive and time consuming proposition. A systematic approach is necessary to quickly eliminate the items on our list that aren't causing the no-start, so we can zero in on the actual cause.

Working with an accurate wiring diagram will greatly increase your chances of correctly diagnosing your no-spark and should also speed up the process. Let's look at some simple procedures that can be used with the appropriate wiring diagram to diagnose no-start conditions on a variety of import ignition systems.

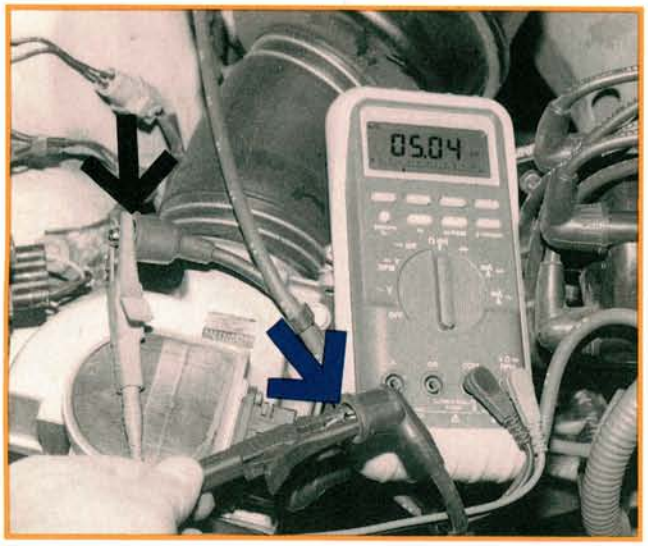
DRIVEABILITY CLINIC

1 Where to Start

Eliminate the easy stuff before wasting time on unnecessary diagnosis. No ignition system will work without power and ground. A fully charged battery is always helpful too. Consult a wiring diagram to make sure that all ignition related circuits have power when the ignition is on. Look for blown fuses, inoperative relays, or related wiring problems. More complex engine management systems may be protected by several fuses and relays, with scattered component locations.

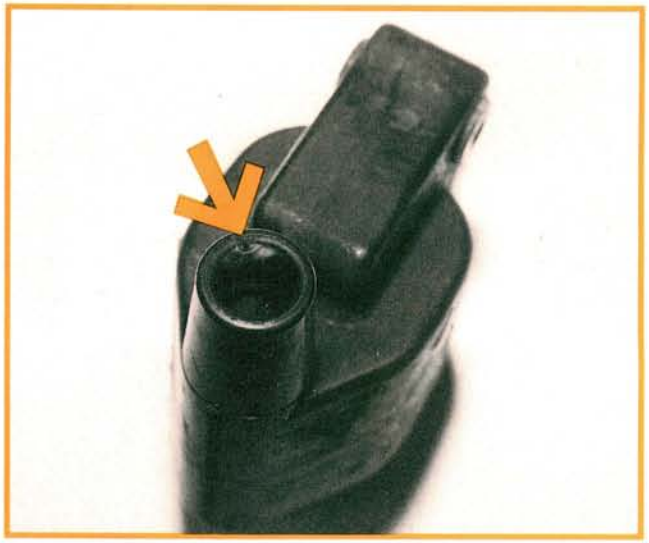
2 Spark Testing

Is the spark making it to the spark plugs? We'll start at the spark plugs and work backwards. Remove a spark plug wire at the plug and install a spark tester. Crank the engine while watching for spark at the spark tester. If the spark is strong, but the engine still won't start, check for fouled or damaged spark plugs. Make sure the spark is reaching all of the plugs. We're concentrating on no-spark, so we'll rule out low compression, fuel system problems, and incorrect valve timing as no-start causes.



3 Secondary Wiring

Is there spark at the ignition coil? If so, something between the coil and the spark plug may be interrupting the spark delivery. Damaged secondary ignition wiring may be introducing extra resistance into the circuit. Many manufacturers specify a maximum allowable resistance for any secondary ignition wire. When this resistance gets too high, the spark looks for easier paths to ground. Check for external wire damage, then wet the wiring and crank the engine while watching for stray sparks.



4 Damaged Ignition Coils

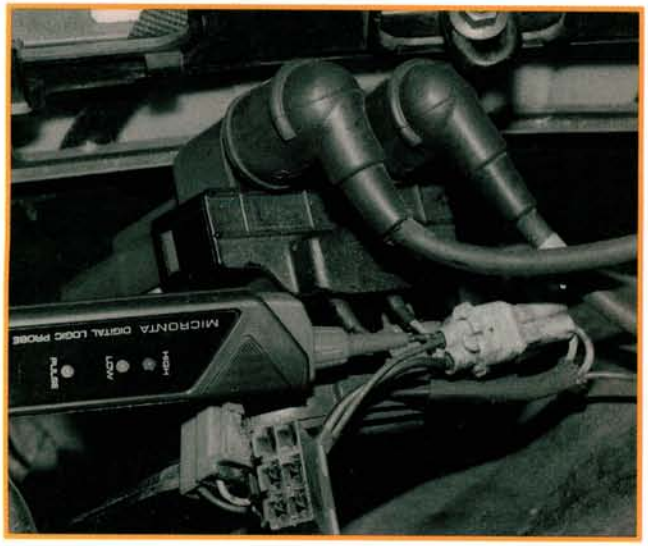
High wiring resistance may cause the spark to look for a ground somewhere in the secondary system before it reaches the spark plug. The damaged coil tower on this molded coil from a dual coil Nissan 200 SX ignition system was hidden under the coil wire boot. The engine started every time, as long as the weather was dry. Rainy weather, combined with high secondary resistance produced an intermittent no-start. The spark snuck around the wire boot to ground on the coil mounting bracket.

5 Damaged Distributor Caps or Rotors

Damaged distributor caps or rotors can also prevent the spark from completing its appointed rounds. We've all seen carbon tracks inside distributor caps. These usually kill the spark to one or more spark plug, or send it to the wrong plug at the wrong time. However, a damaged distributor rotor may also kill the spark before it reaches the distributor. The top side of this Mazda 323 rotor has burned through, allowing the spark to reach ground at the distributor shaft.

6 Coil Output

The diagnostic path can lead in several different directions from here. If there's no spark at the coil, check the coil positive terminal for battery voltage with the ignition on. Now attach a logic probe to the coil negative terminal. A high-low signal while cranking tells us the igniter or power transistor is switching the coil's ground supply off and on. If this signal is good but there's no spark, compare the coil primary and secondary resistance to the manufacturer's specifications.

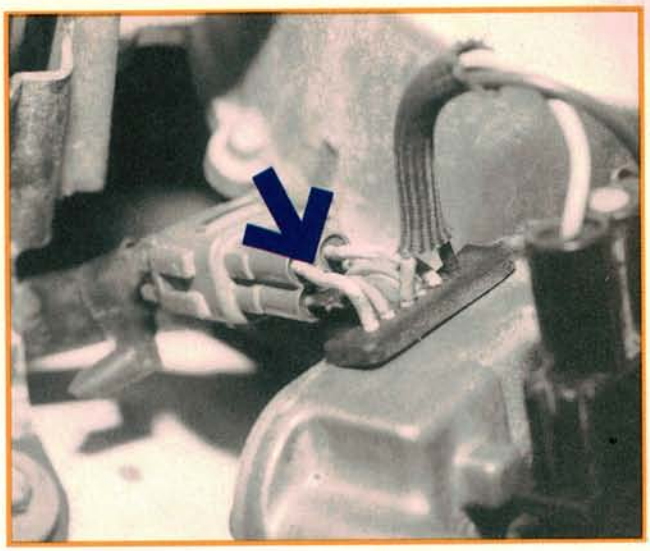


7 Coil Control

There are many ways to switch the negative side of the coil off and on. Most are more complicated than a set of ignition points. This Toyota igniter serves as a middle man between the coil and the ECU and amplifies the ECU's signal to fire the coil. Attach a logic probe to the ECU trigger signal lead. The logic probe should show the ECU's trigger signal while cranking. If there is a signal, we'll need to check the igniter next. No signal means the trouble is further up the line.

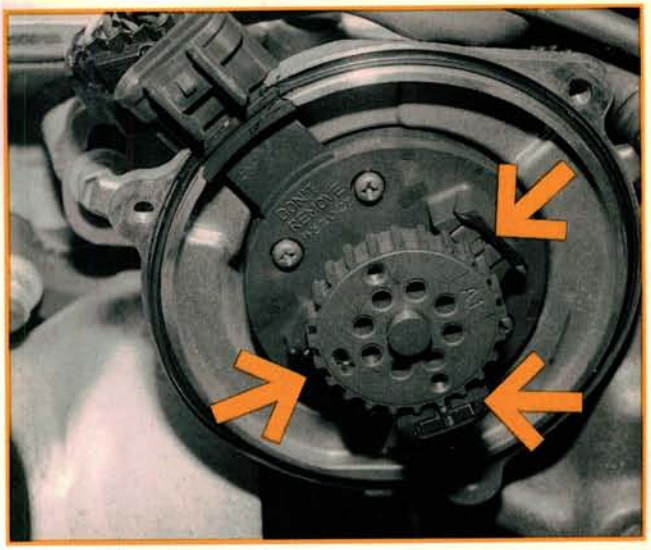
8 Igniter Testing

When you get this far, many trouble charts tell you to "try another igniter." That's great if your parts supplier will "loan" you an igniter to try. Some igniter designs can be safely tested by using a 1.5 volt dry cell battery to simulate the signal from the ECU or distributor pickup coil. Ground the battery lead, then briefly attach the positive lead to the igniter's input signal wire with the ignition on. A good igniter should fire the coil, producing a spark at the spark tester.



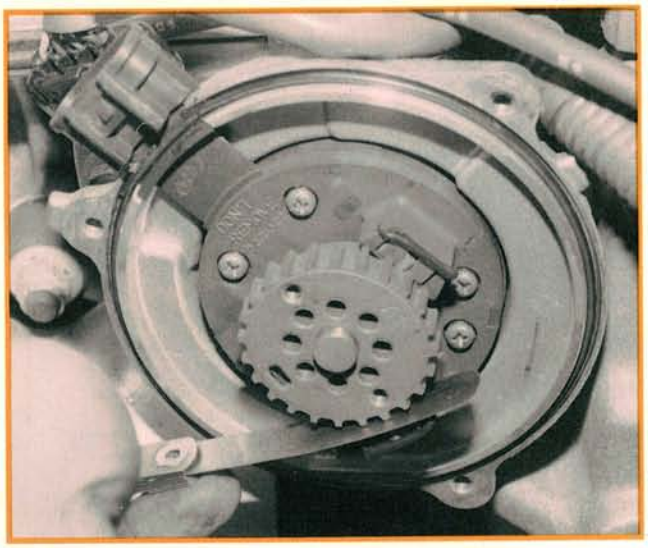
9 Trigger Signals

Let's backtrack a couple of steps. If there was no trigger signal to the igniter, the problem is further upstream. On ECU controlled ignitions, check for a signal to the igniter at the ECU terminal while cranking. A good signal here points to a wiring problem between the ECU and the igniter. If no signal is leaving the ECU, we need to dig deeper. Is the ECU not triggering the igniter because it hasn't received the necessary information, or does the ECU have an internal problem?



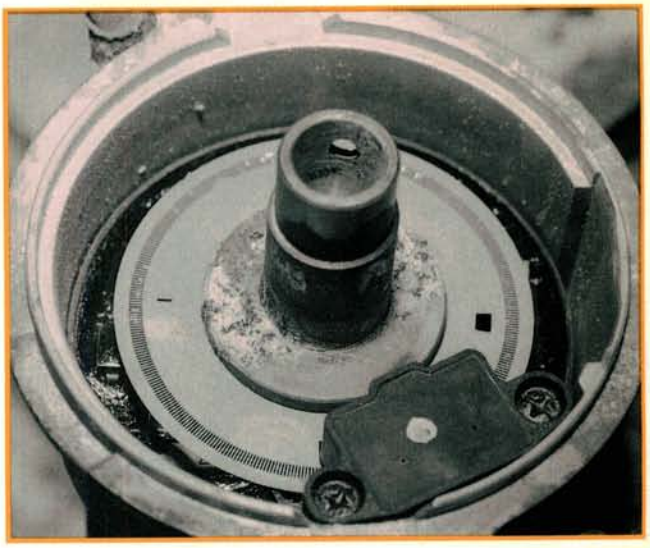
10 Trigger Types

ECU controlled ignition systems use a variety of inputs to help the ECU decide when to fire the coil. If any of these inputs is missing or doesn't look right to the ECU, the ECU may shut down the ignition. This Toyota distributor has inputs in the distributor, the NE, G1, and G2 pickup coils. The notched reluctor produces an inductive pickup signal. To check for internal damage, we measured the resistance of each coil and compared the results to factory specifications.



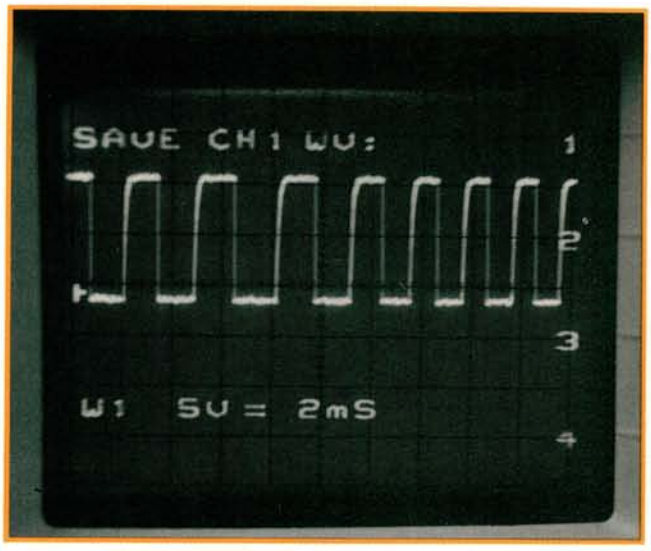
11 Air Gap

Although air gap isn't adjustable on this distributor, it's still worth checking. To prevent magnetic damage to the pickup coils, use a brass feeler gauge to make the air gap measurement. A gap beyond the recommended 0.2 mm (0.008 in) will weaken the inductive signal to the ECU and may reduce secondary spark voltage. A gap wider than 0.4 mm (0.016 in) on Toyota IIA systems can lower the available secondary voltage by as much as 3-5000 volts and reduce spark efficiency.



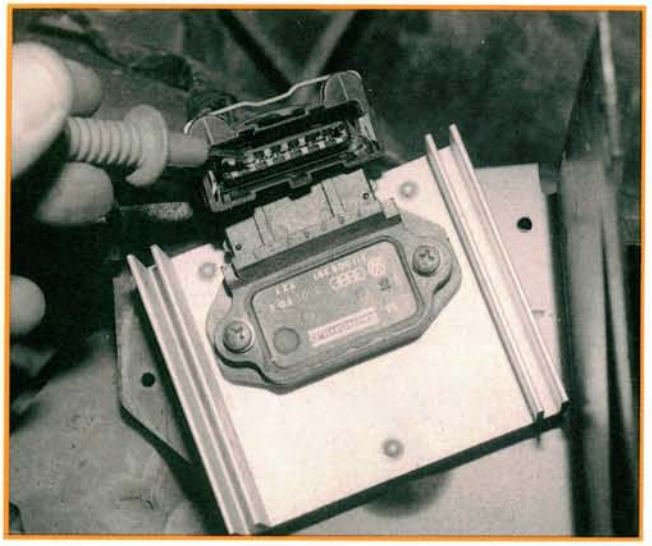
12 Other Sensor Designs

The shutter wheel crank angle sensor used by Nissan, Subaru, and other Japanese manufacturers has been a source of consternation for many technicians. A pair of LEDs on one side of the wheel shine through the moving shutter slots. A pair of photo diodes on the other side of the wheel pick up the light. Using reference voltage and ground from the ECU, the sensor indicates crankshaft position by sending two separate square wave signals to the ECU. This unit is not repairable or adjustable.



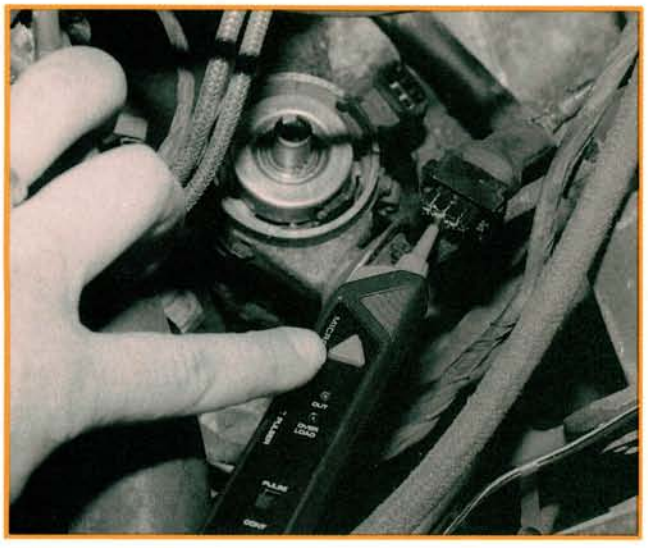
13 Testing

The crank angle sensor electronics may function normally when cold, but fail after the engine reaches operating temperature. Don't think the customer is crazy if the car will start after being towed. Attach a logic probe or oscilloscope to either of the crank angle sensor's output terminals, then start the engine. One square wave signals each degree of crankshaft rotation, while the second signal indicates actual crankshaft position by switching as each piston reaches TDC.



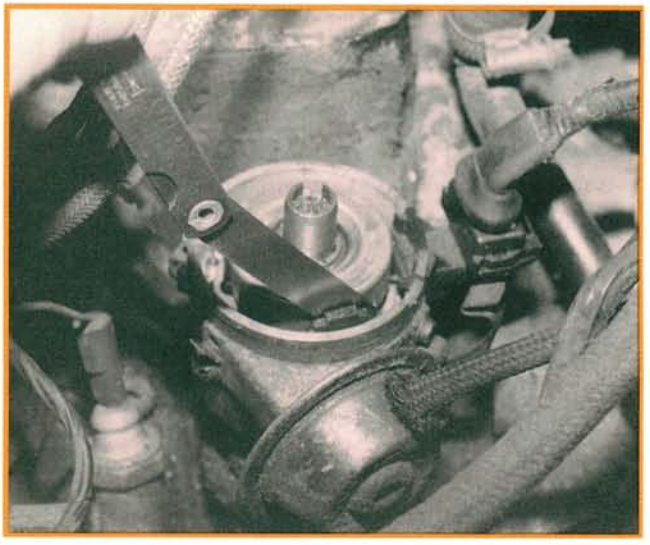
14 Hall Effect Ignitions

Many European manufacturers favor ignition systems using Hall Effect crank position sensors. While we can't cover every variation of the Hall Effect system, we will give you no-spark troubleshooting tips. Locate the ignition control unit, then check for a minimum of 5 volts at terminal 4 with the ignition ON. Also check for a ground at terminal 2. Now remove the harness connector at the distributor. Check for 5 volts at terminal 3 with the ignition ON, and a good ground at terminal 1.



15 Hall Sender Testing (Method One)

To test everything but the Hall sensor, we'll use a logic pulser to simulate the sensor's signal. The Hall sensor's harness connector center terminal carries the signal to the ignition control unit. Attach the logic pulser tip to the center terminal. Attach a spark tester to the coil wire, turn the ignition ON, then trigger the pulser in CONTINUOUS mode. Spark at the spark tester means the Hall sender is bad. No spark means the problem is further upstream (ignition control unit, digital idle stabilizer, knock sensor).



16 Hall Sender Testing (Method Two)

Use a feeler gauge to test the Hall sender if you don't have a logic pulser. Reconnect the harness connector at the distributor and make sure the ignition control unit is also reconnected. Rotate the distributor shaft until a shutter wheel opening is centered over the Hall sensor. Turn the ignition on, then slide a feeler gauge into the opening in the Hall sender. Now pull the feeler gauge out. If the spark tester sparks, the Hall sender is good. If there's still no spark, check the ignition control unit or wiring.