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TechNews

NISSAN

INFINITI

Are Your Brake Relines Up to Nissan & Infiniti Standards?

- Nissan & Infiniti Head Gasket Replacement
- How's That Fuel Pump?
- Nissan & Infiniti Ignition Service
- Performance
- Parts Department
- Dealer Listings

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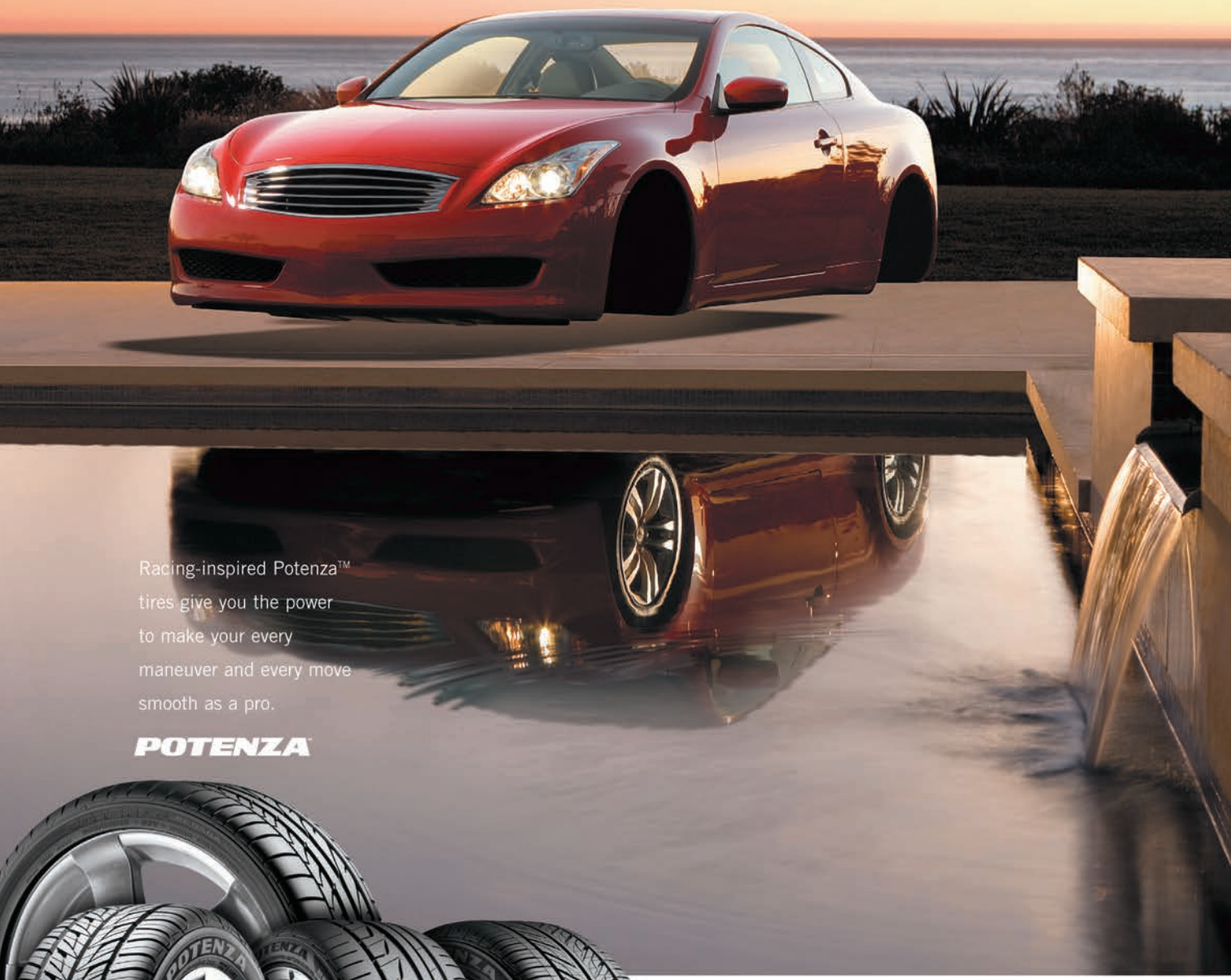

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Contents

Features

Departments

Welcome to Nissan & Infiniti TechNews

A Valuable Information Resource — Free!

Welcome to the premier issue of Nissan & Infiniti Tech News, the technical information magazine for independent shops that service and repair Nissan & Infiniti vehicles.

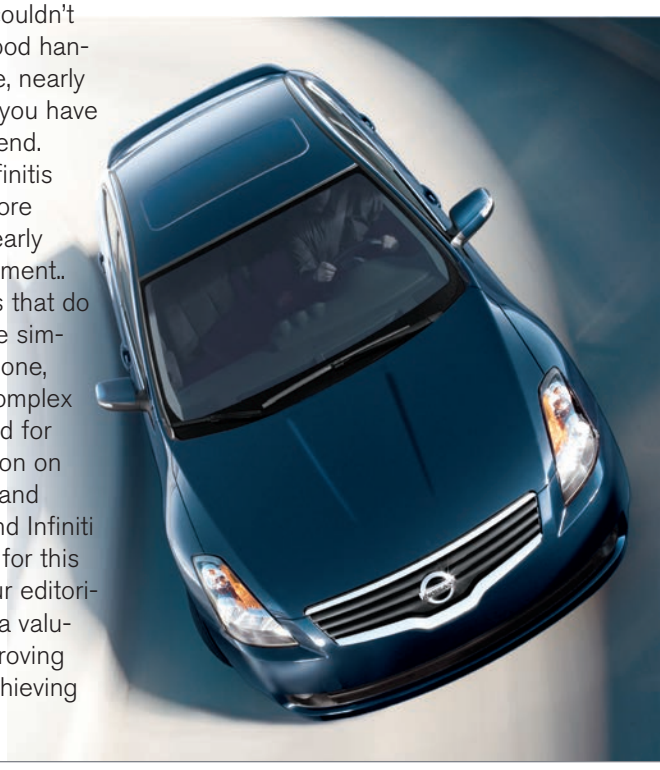
The good people at Nissan North America are providing this informative publication to you for free. Why? To help make sure you know the specific service information necessary to fix that Nissan or Infiniti vehicle right the first time, which will assure that the brand keeps its excellent reputation among motorists.

Speaking of reputation, if you think Nissan is a post-WWII phenomenon, you're way off. The company's history can be traced to 1911 when Masuijiro Hashimoto, an American trained engineer, founded the Kwaishinsha Motor Car Works, which evolved into the huge manufacturing concern we know today as Nissan. Its first car was the 10 horsepower DAT (an acronym from the first letters of the partners' family names, Den, Aoyama, and Takeuchi) runabout, but the company's small, rugged trucks made up most of its production. In 1958, Datsuns were exhibited at a car show in Los Angeles, prompting a comment in Business Week that qualifies as a world class example of poor forecasting: "With over 50 foreign car makers already on sale here, the Japanese auto industry isn't likely to carve out a big slice of the U.S. market for itself."

The company's reputation in North America grew steadily thereafter. The popularity of the "Z Car" was a big part of it, but the rest of this strong foundation was built on simple, efficient vehicles. The Datsun B 210 is good example. It was a strange looking car with ungainly proportions and odd honeycomb covers for its tiny wheels. Its horsepower and handling weren't exactly breathtaking, either. It was, however, as dependable and serviceable as anything ever seen, so technicians couldn't help liking it. Add to this good handling 510s and inexpensive, nearly indestructible pickups and you have a good beginning for a legend.

To say that Nissans & Infinitis have become fabulously more sophisticated since those early days is quite an understatement.. As with all other carmakers that do business in this country, the simplicity we loved so well is gone, supplanted by amazingly complex technology. Hence the need for accurate, specific information on how to maintain, diagnose and repair late model Nissan and Infiniti vehicles. One good source for this essential tool is NITN — our editorial team intends to make it a valuable ingredient in both improving your technical skills and achieving your business goals.

One more thing: Given the complexities of service on modern high-tech Nissan and Infiniti vehicles, it no longer makes any sense to risk using anything but the very best parts, namely the genuine Nissan &?Infiniti products available through your local dealer's parts department. After all, you certainly don't want to have installation problems, or, worse, have to do the job all over again because a non-O.E. part didn't fit, function or last like the real thing. Give it some thought from the point of view of work satisfaction, your reputation and keeping your customers happy and we believe you'll agree. |??



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Are Your Brake Relines Up to Nissan & Infiniti Standards?

What you need to know about how pad and rotor quality, and proper procedures, will assure that your customers stay happy.

The best thing you can do to avoid complaints about noise, pedal feel, poor performance, or premature wear is to use the pads that were designed for the vehicle. That means O.E. quality from your Nissan dealer.

For all truly professional shops, avoiding customer comebacks is a top priority when selecting replacement brake pads and rotors. One of the leading causes of comebacks is brake squeal, something the use of genuine Nissan or Infiniti parts minimizes while providing effective braking performance. Aftermarket pads may look like a bargain, and may even stop the car adequately, but few are extensively tested for a specific Nissan or Infiniti model. In the "black magic" world of brake friction recipes, rotor materials, and caliper design, a lack of part-to-vehicle matching will often result in brake noise that's objectionable to a significant percentage of your customers along with premature wear, not to mention poor performance. Here's why.

The trick with brake squeal often isn't actually eliminating it, but having it occur at a frequency that's so high human ears can't hear it. The way this is done is by selecting unique combinations of rotor material, pad material, shims, retainers, and lubricants. Even with all this, a set of brand new brakes properly installed and functioning may be silent most of the time, but may squeak a little on limited occasions, such as a cold, damp morning.

Why do brakes squeal?

Brake squeal is a high-frequency vibration of the brake pad and rotor -- the energy is being released as sound waves. Typically, squeal is produced during low- to mid-level applications of the brake. It can be caused by a number of factors:

- Pad lining material
- Pad shims not installed at reline
- Glazed pads or rotors
- Inadequate piston retraction causing dragging (which also leads to glazing)
- Misaligned caliper or bracket
- Calipers with bent floating pins, or inadequate lubrication of the pins, not allowing the caliper to properly float
- Lack of a bevel on the pad leading edge
- Proper application of grease at specific locations

What are they actually made of?

The quest for the ideal friction material has been sort of like a drawn out version of Thomas Edison's search for a suitable light bulb filament. All kinds of things have been tried for over a hundred years. The spoon brakes used on the first cars usually had wooden blocks, but they were sometimes supplemented with a leather lining. Band type brakes were either metal to metal, or used wood or leather, too. The earliest drum stoppers (invented by Louis Renault in 1903) had iron shoes against steel, then some strange materials were used, such as the walrus hide linings of the English Wolseley.

The science of formulating brake friction materials has become so sophisticated that the traditional labels and definitions are becoming meaningless. For example, "organic" used to refer to asbestos linings, but now is sometimes used to describe materials that are either semi-metallic, or ceramic. Also, neither semi-met nor ceramic is perfectly accurate for most modern formulas because one may contain a certain percentage of the other, and some amount of several other different materials.

"We use O.E. pad applications in everything we service. Why? It minimizes or eliminates noise problems. There may be warranty issues to consider as well. We want to do the best job possible for our customers. "

Scott Destemper, Alpine Automotive

What's really in brake pad material? There may be Kevlar, steel, or fiberglass strands as a replacement for asbestos fibers, resin to glue it all together, iron, brass or copper dust, particles or strands, lubricants, some form of clay (if the pads are ceramic), and other "top secret" materials. There may be 15-20 different ingredients in all. The different materials perform differently.

When Nissan/Infiniti brake engineers specify a certain formula for a particular model, they have numerous goals in mind such as exceptional stopping performance, long service life, low noise potential, as little dusting as possible, and rotor longevity.

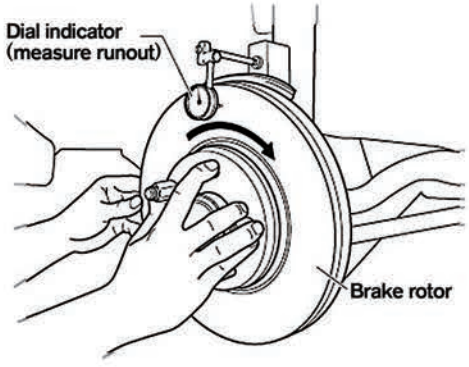
While technicians may try to choose pads of a certain composition or reputation to address specific situations, chances are that there will be unintended consequences. The majority of customers seeking brake service simply want brakes that work the way they did when their Nissan or Infiniti was new and a lack of objectionable noise. Techs can guess which pad will appeal to a particular customer, or by going with O.E. pads, minimize the chance for objections in all categories.

The other side of the coin

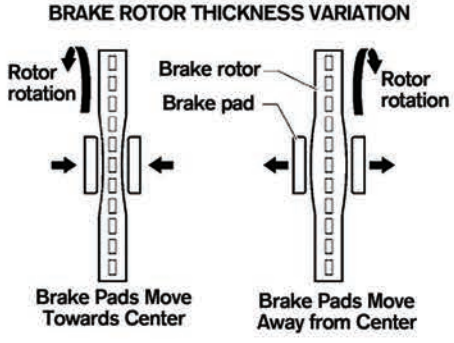
Where rotors are concerned, some other high-performance vehicle makers consider them sacrificial and so employ very aggressive, abrasive friction materials. This means that the discs wear out at about the same rate as the pads. Other drawbacks may include increased pedal effort, a "grinding" pedal feel, and possibly noise.

Nissan/Infiniti has a much more practical philosophy that your customers will appreciate. By using advanced brake design and very careful attention to the subtleties of friction formulation, the company has achieved excellent stopping performance and rotor life.

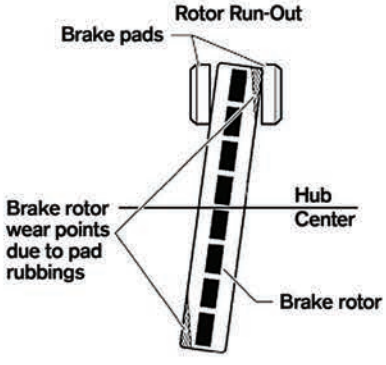
Of course, there are frequently cases where new rotors are required, especially in vehicles that tow heavy trailers or are driven aggressively in city traffic. You may be able to eliminate problems such as DTV (Disc Thickness Variation) or deep grooving with your brake lathe, but since Nissan/Infiniti makes new O.E. rotors available at such a reasonable price it often makes



If runout is beyond specifications, check for mounting errors before you machine or replace the rotor.

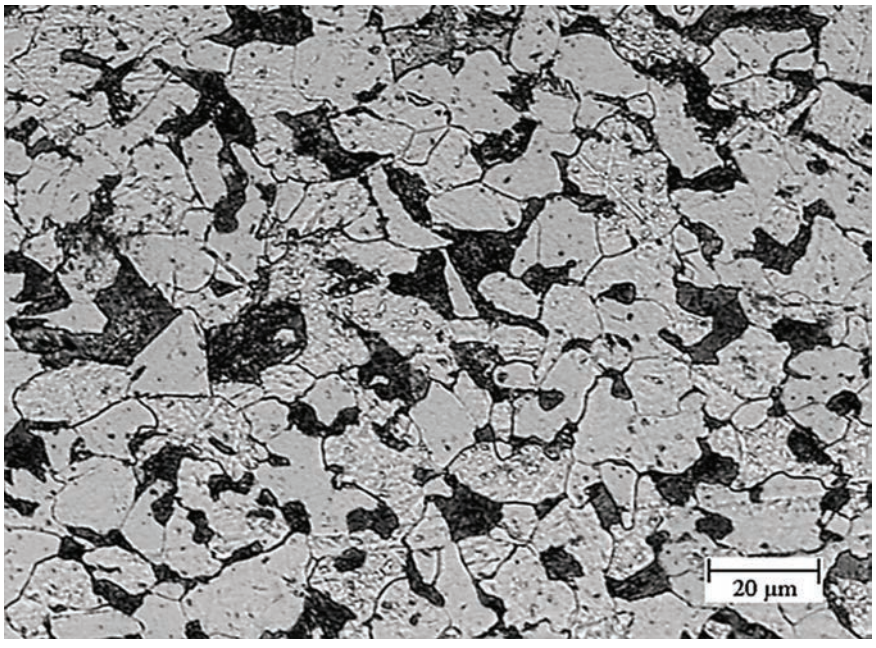


Disc Thickness Variation causes pedal pulsation as the “fat” spots pass between the pads.



Runout makes the rotor wear unevenly as high spots hit the friction material.

The idea of replacing rotors is all fine and good, but how can you be sure you’re not buying trouble? Only by insisting on O.E. quality from your Nissan dealer’s parts department.



Unless you're a metallurgist, how will you know whether or not those non-O.E. rotors have a cast iron composition that's up to Nissan's standards?

sense to replace them. In fact, there is a trend going on among repair shops to do just that and to use their lathes less and less.

There is one caveat, though. Many aftermarket replacement rotors simply do not match the quality of O.E. specimens in either manufacturing or materials. If you're not a metallurgist and don't have X-ray capabilities, how can you tell what you're getting? We've seen cases where off-brands weighed several pounds less than the originals. That can contribute to the warpage that can result in DTV, pedal pulsation, and a reputation-damaging comeback. If you're going to put on new rotors, choose only O.E. from your local dealer's parts department for quality and tight run-out specifications.

Your part

The evolution in lining material has made rotor finish much more critical than it used to be. Some experts say that getting this right will eliminate 80% of noise comebacks. Smoothness is the rule. Where 80 100 RMS was once considered correct, now 40 60 RMS is recommended. In other words, in cases where you are turning the rotors on your lathe and are finishing up with a non directional swirl, use 120 to 150 grit paper instead of the traditional 80.

One brake expert tells us that some people get confused about this because new rotors come with a directional finish. "What's important is the fineness of the finish," he says. "New rotors will probably be in the 30 40 RMS range, which is hard to achieve with the average shop lathe. Adding that non- directional finish with an abrasive is a means to an end."

Speaking of brake lathes, the on-car type is an excellent choice for several good reasons. First, it eliminates the possibility of rotor mounting errors that can result in runout. While runout itself won't cause pedal pulsation or "judder," it leads to disc thickness variation (DTV), which certainly does manifest itself as that distressing condition. Runout causes the rotor to wear unevenly as it hits those abrasive pads in one spot on each side every revolution of the wheel. The contact areas will end up thinner than the rest of the disc. Any lack of parallelism between the two sides of a rotor is the direct cause of pulsation -- the fat places knock the pads and piston back, and that little column of fluid transmits this movement to the pedal.

Second, avoiding the dreaded squeal is often considered another justification for the purchase of this equipment. An exec for a company that makes on-car lathes tells us, "Noise comes from vibration. If you can get all the thickness variation, runout, and taper out of a rotor, you can be pretty sure it won't be the cause of noise."

Finally, an on-car lathe is by far the best way to deal with vehicles that have rotors that require major surgery for removal.

Nissan & Infiniti Head Gasket Replacement

Is it a blown gasket? Or, something else? Here's how to be sure, and procedures that will avoid comebacks.

Although other head gasket types are sometimes used in Nissan & Infiniti engines, expanded graphite is the most common.

It would be an unusual Nissan or Infiniti customer who comes in seeking head gasket replacement. More often, he or she will arrive at your shop asking for a cure for overheating, coolant loss, steam at the tailpipe, or misfiring issues. A head gasket may fail to seal between two cylinders, or between a cylinder and a coolant passage, because of high mileage, which necessarily entails many, many heating/cooling cycles, a serious overheating incident due to carelessness on the owner's part, the use of an antifreeze that's not approved by Nissan/Infiniti, or improper assembly during an engine overhaul.

The key to accurate diagnosis lies in ruling out other possible causes of these problems and confirming that the head gasket is indeed at fault by at least two different methods so that you can be absolutely confident head gasket replacement will cure the problem(s). Also, adopting a few "best practices" in head gasket replacement will insure against reputation-damaging "comebacks."

Head gaskets became an especially big challenge when aluminum heads were used with some iron blocks (called "bi-metallic" engines). Aluminum expands and contracts at a different rate from that of the block as it heats up and cools down. Even properly bolted down, this difference in expansion rates, may cause "scrubbing" of the gasket. Newer, and better, gaskets became mandatory to handle this.

Even with later Nissan and Infiniti engines that have aluminum blocks, there is still a lot of squirming going on in the head/block seam. So, gaskets have had to evolve. Although Nissan/Infiniti has employed several types of head gaskets over the years, the most common variety in use today is expanded graphite, which is extremely heat resistant, very conformable to waves, pits, and dents in the sealing surfaces, and has excellent torque retention. It's a natural lubricant, too, which helps it survive the scrubbing action present due to varying expansion rates.

While many will last a lifetime, some percentage will fail and allow combustion gases to escape, or coolant to seep into a cylinder, especially if a vehicle is allowed to run low on coolant and overheat. Pre-ignition or "pinging" is another leading cause of head gasket failure.

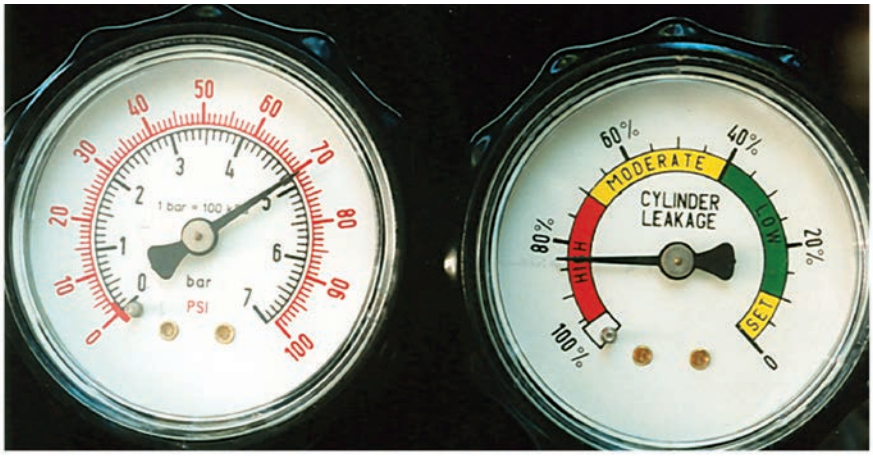
One possible cause of premature head gasket problems is the use of the wrong antifreeze. Use only the type recommended by Nissan, ideally the O.E. formula.

Replacing a head gasket that doesn't solve the customer's problem is an expensive proposition for both the customer and the independent Nissan/Infiniti shop that performs the work. The first "look see" at a potential head gasket failure is usually a compression test. One low cylinder, or a pair of adjacent, low cylinders is one indication. But a good tech will get confirmation with a second, or even third technique before pulling the head off.

Ruling out other possible causes.

A good second step is a leakdown test. A cylinder with a leakdown rate of greater than 20% is suspect. The value of the leakdown test is in confirming that you don't have a burned or otherwise damaged valve allowing pressure to escape the cylinder, or worn rings. However a leakdown test doesn't do much for actually verifying a head gasket leak. If you want to see if there is a leak from the head gasket, apply shop air to the cylinder and see if coolant bubbles appear in the radiator neck.

Pressure testing the cooling system is another method techs should use. Again, not so much for identifying a head gasket failure as for ruling out other possible causes of overheating. Sometimes the failure will only occur when the engine is hot. In that case, remove the radiator cap, warm the engine up, then install the pressure tester to check for leaks. In general, all cooling system faults, drippy hoses, loose clamps, clogged radiators, worn impellers and other faults need to be cured or ruled out before diagnosing a head gasket as a cause of an overheating problem.



A cylinder leakdown test can tell you more than you've found out from a compression test. Listen for escaping air, look for bubbles.

Other techniques for identifying cylinder-to-water jacket leaks include filling the cooling system to the neck of the filler, and watching for pressure pulses as the engine is cranked over. All that compression inside each cylinder will perform a better test than even a pressure tester. Again, the engine may need to be warm. Another technique is to place a heavy plastic bag over the radiator neck and secure it with a rubber band. If it inflates rapidly, compression or combustion pressure is getting into the cooling system. If it doesn't blow up, punch a small hole in it and use your gas analyzer to "sniff" for exhaust gases. Be extremely careful to only sniff gas and not let coolant erupt or splash onto the analyzer head, which may damage it.

A technician who specializes in Nissan/Infiniti gave us a valuable insight into identifying small leaks, saying, "I find with a slight head gasket leak, one that doesn't leak a lot, or all the time, the heater will intermittently quit putting out hot air before the vehicle starts to seriously overheat. The lack of heat is what brings the customer into the shop. I had one vehicle that would only act up once every few weeks and I never could get a positive test for a combustion leak.
Imagine it blowing a little combustion gas into the cooling system and forming an air bubble that impeded coolant flow to the heater core."

Physical inspection shouldn't be overlooked. The brown color of water in the oil, or the "chocolate milkshake" color and consistency of oil in the coolant is unmistakable. A vehicle with a starting problem, white smoke, or misfire in the mornings may be leaking coolant into a cylinder. Allowing it to sit overnight, and borescoping the spark plug holes for fluid is a quick and easy test. Any cylinder experiencing coolant leakage will be too clean, completely lacking in carbon buildup, and the spark plug will be too clean as well. Pulling the 02 sensor and putting a clean rag over the hole before cranking may show coolant leakage getting blown out. If a vehicle has been blowing white smoke, plan on replacing the 02 sensor(s) since most antifreeze formulas contain silicates, which can contaminate the sensor.

If any appreciable amount of coolant has been passing through a cylinder or two because of a leaky head gasket, there is a good chance that the O2 sensor(s) has become contaminated and will only send a "lazy" signal.

By this point, the technician has probably ruled out or repaired other potential causes and has at least two confirmations of a head gasket leak, or cracked head, and can proceed with pulling the head. Before removal, use a beam or dial-type torque wrench to give each head bolt a quick check to see if any are significantly looser than the rest; this also may help pinpoint the problem. Or each bolt can be loosened one full turn, and then re-tightened to see what the torque value is/was.

Make sure the engine has come down to room temperature before actually removing the head. Otherwise, the casting may warp as it cools without the rigid support of the block.

If the head is going to a machine shop, cleaning and surface checking should be done there. Otherwise, these critical details are your responsibility. Make sure you remove all of the old gasket shellac, carbon, and corrosion. Be careful not to make any deep gouges or take off any metal in

Applying an aggressive "zip" disk to the head is NOT recommended. Not only can it make dents and waves much faster than you might expect, it will contaminate the engine with abrasives that may damage bearing surfaces.

the process. Gasket engineers have told us that savage cleaning procedures, such as using sanding disks or wire brushes on a drill, can cause unsealable unevenness almost instantly. The same goes for those aggressive "zip" disks, which can possibly contaminate the engine with abrasives that may destroy bearings. So, use proper gasket scrapers and your favorite solvents.

Well and truly flat

Check for warpage using a straightedge and feeler gauges lengthwise and crosswise. The traditional rule of thumb says if you can slip a .006 in. gauge between the head and the straightedge anywhere over its entire length, or a .002 in. gauge in any six inch span, the casting is too wavy to guarantee a decent seal.

But that may not be good enough anymore. For example, at least one of the major gasket makers has tightened its recommendations. For a V6 or three cylinder head, it's now .003 in. over the whole length, for a V8 or four cylinder it's .004, and for an in-line six .006 (come to think of it, that's easy to remember because the thousandths are the same as the number of cylinders). Max deviation from flatness across the width remains .002, and there should be no "sudden irregularities" exceeding .001 in any three inch diameter. By the way, this is the sum of the values for both head and deck.

But flatness isn't the only sealing surface consideration. The level of smoothness or "tooth" is also important. If it's too rough, the gasket won't be able to fill up the scratches. For years, people said that if it's too smooth there won't be enough bite for a good grip, so there'll be unwanted movement in the sandwich. A gasket engineer has since told us, however, that that's not a real concern because he's never seen a case where a mirror-like finish caused a problem.

If you suspect that the head is cracked, you can see if dye testing will reveal the fissure, but it would be better to send the casting to a machine shop that's equipped to do pressure testing.

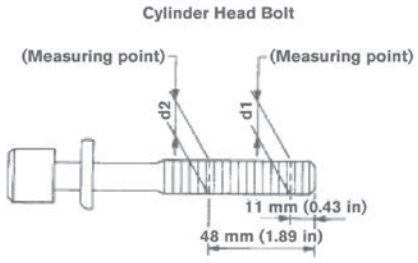
We'd better address the question of supplementary sealants. If the gasket has graphite faces, don't apply any sealer as it'll soften that carefully manufactured surface. Metal faces should receive an even coat of a suitable chemical sealer.

Nail it down

Clamping force on the gasket must be exactly right, which not only requires that the recommended head bolt tightening procedures be used, but also that the threads and the bolts themselves be given proper consideration.

First, make sure the bolt holes in the block are clean and free of fluid (hydraulic pressure can actually cause cracks). Blow them out, and perhaps clean them with a rifle brush or a thread chaser.

Since most Nissan and Infiniti engines are designed to use the "plastic zone" or "torque-to-yield" tightening technique, you must measure the head bolts to be sure



Never reuse "plastic zone" or "torque-to -yield" head bolts without comparing the diameters of the threads at the points shown. If the difference is larger than the specification, get new bolts or risk twisting one off and ruining your schedule.

they have not stretched too much to be safely reused -- a snapped bolt would be a disaster both financially and time wise. Subtract the head bolt diameter measurement taken near the top of the threads from that taken near the end of the bolt. On an Altima 3.5L V6, for example, those points would be 48 mm and 11 mm from the end of the bolt, respectively. If the difference exceeds the published limit, which will typically be on the order of 0.11 mm (0.0043 in.), replace the bolts with new ones.

If the bolts are to be reused, clean them with a wire brush, then coat the threads with engine oil.

On certain Nissan and Infiniti engines, head bolts need to be replaced every time they are removed.

Nissan's service engineers know what procedures will produce the proper clamping force on a head gasket , and provide graphics to help techs understand the process, such as the one shown on the right. Follow the instructions to the letter.

Nissan particulars

Late-model Nissan and Infiniti engines continue the company's legacy of durability and dependability. Your job is to make sure these characteristics are retained after you've made repairs, and that means adhering to Nissan's specific procedures. The company's service engineers know what works, so resorting to short cuts or half-baked methods is asking for a damaged reputation.

We'll provide a couple of examples of the particulars of head gasket replacement:

- On the 2000 Maxima 3L V6 (VQ30DE), make sure to rotate the crankshaft until #1 piston is 240 deg. BTDC of its compression stroke before installing the heads or piston/valve interference will occur.
- On the 2000 Sentra 1.8L (QG18DE), a bead of RTV Silicone Sealant (Part Number 999MP-A7007) must be applied to the seam at the front of the head gasket. The major bolts should be angle torqued in this sequence: 22 ft. lbs., 43 ft. lbs., loosen completely, 22 ft. lbs., then an additional rotation of 50-55 deg. The small bolts at the front (11-14) should be tightened to 56-74 in. lbs. Use the proper order, of course.

Obviously, we can't give the details for every year and model Nissan and Infiniti engine, but the above should illustrate that you must look up the specific instructions for each to assure against catastrophe.

Install the cylinder heads on the cylinder block. Tighten the cylinder head bolts in five steps in the order shown.

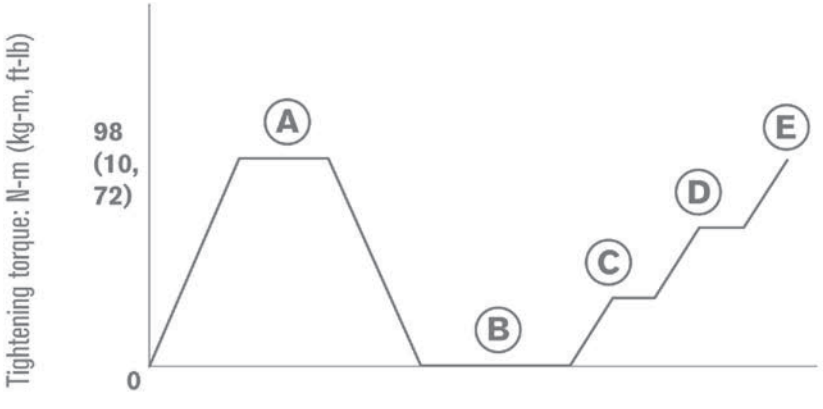
Step A: 98 N-m (10 kg-m, 72 ft-lb)

Step B: 0 N-m Loosen in the reverse order of tightening

Step C: 39.2 N-m (4.0 kg-m, 29 ft-lb)

Step D: 90° degrees clockwise

Step E: 90° degrees clockwise



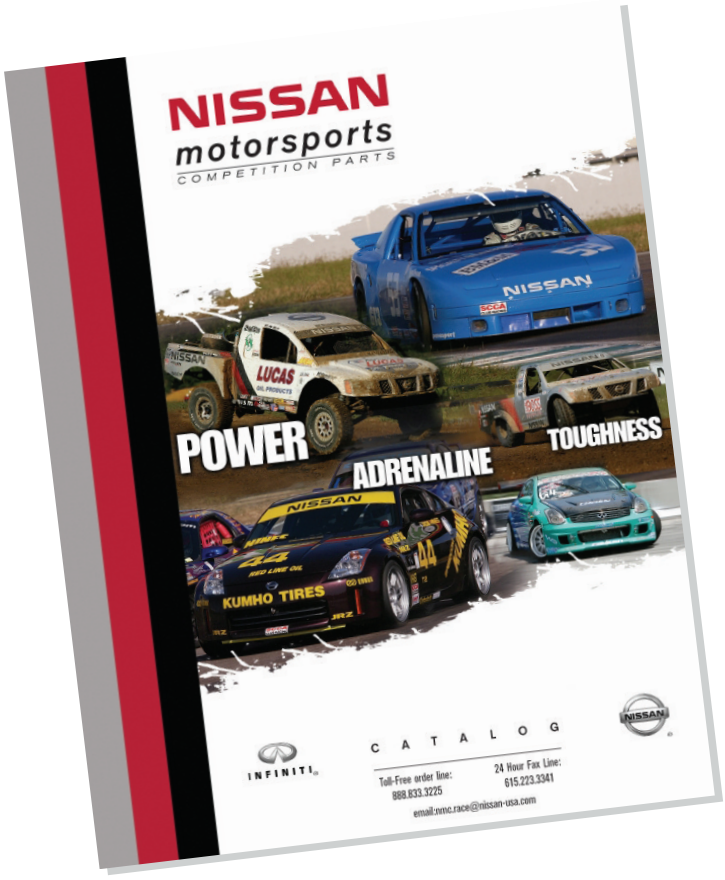
Nissan performance

Nissan Motorsports Announces New Catalog and Racer Support Program

NASHVILLE, Tenn. (July 29, 2008)

- Nissan Motorsports has announced a new, revised Competition Parts catalog and Racer Support Program. "Nissan has always believed in creating a partnership between the company and the dedicated teams who compete in our vehicles," said Nissan Motorsports Marketing and Operations Senior Manager Ron Stukenberg.

"At Nissan Motorsports, our goal is to make available a full selection of high-quality track-ready components and make them easy to access. We also want to provide a support structure for those dedicated teams who use our components."



The revised 120-page Nissan Motorsports catalog is now available and engineered to allow Nissan, Infiniti and Datsun competition drivers find and purchase parts with ease. The catalog features a revised look and includes several new products and features. An electronic version of the catalog is also available at www.nissan4parts.com.

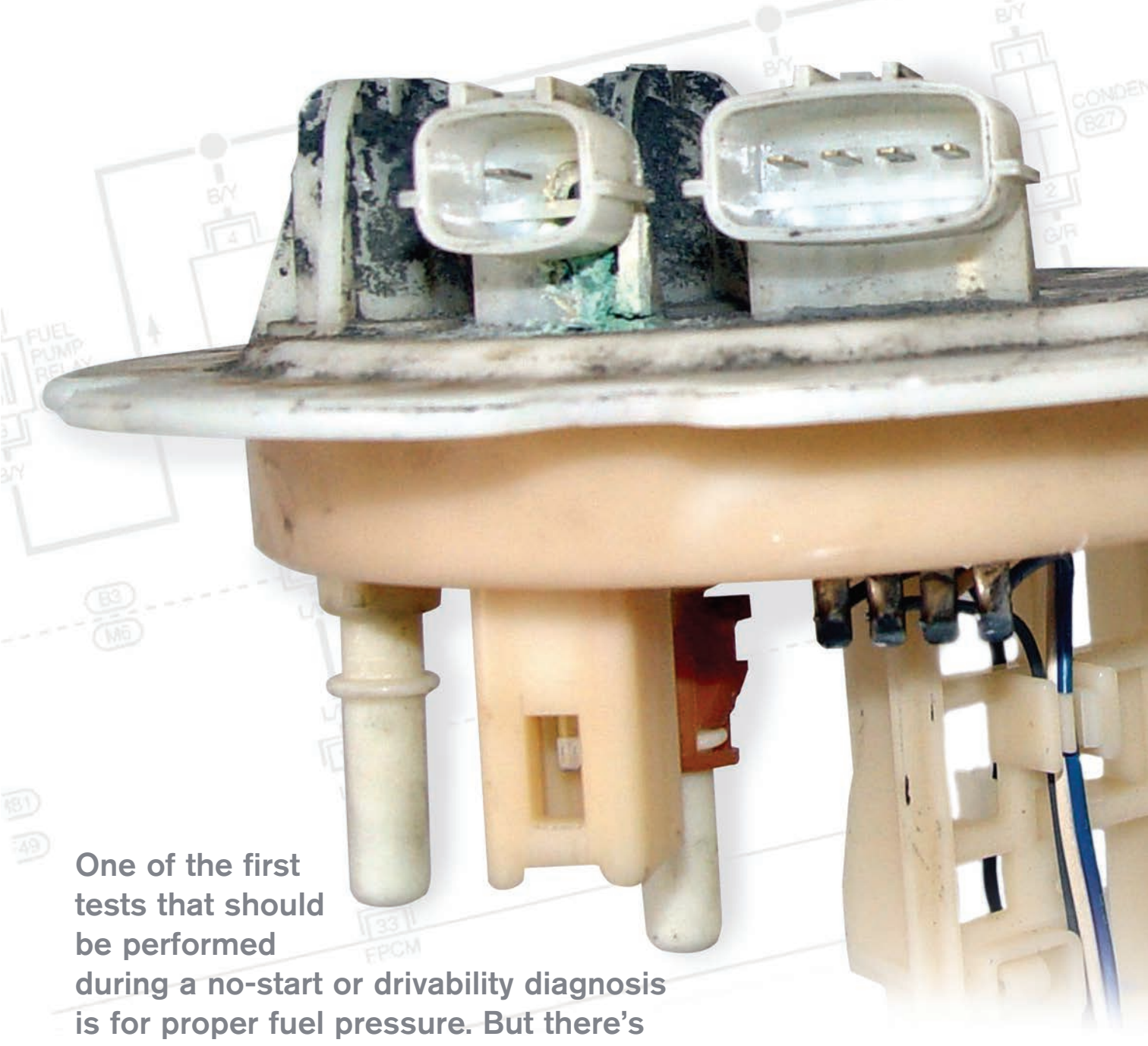
The Racer Support Program is available to teams in multiple competition series and with multiple sanctioning bodies. Some of the series are: Sports Car Club of America (SCCA) Road Racing and Solo, Grand Am KONI Challenge Series and Rolex Sports Car Series, Lucas Oil World Series of Off-Road Racing (WSORR), Championship Off-Road Racing (CORR), NOPI Drag Racing Association (NDRA), the Formula Drift Championship and others.

"We always look forward to competitive success in all Motorsports venues." said Stukenberg. "Nissan has a record total of 88 SCCA National Runoffs National Championships, well ahead of every other manufacturer, and we're looking to add more championships all the time."

To be eligible for the Racer Support Program racers must be registered with Nissan Motorsports and must display official current "Nissan" logo and "NISMO" (Nissan Motorsports, International) die-cuts on designated areas of the car or truck during all race events. The drivers' race suits must also display a current Nissan patch on the upper chest.

For more information on the Racer Support Program, or to order the catalog, contact Nissan Motorsports at 888 833-3225 or nmc.race@nissan-usa.com.

How's That Fuel Pump?



One of the first tests that should be performed during a no-start or drivability diagnosis is for proper fuel pressure. But there's more than just pressure to think about.

Have you checked the fuel pressure? When we discuss a symptom that a vehicle is exhibiting, this is one of the first questions we have to answer. It would be disheartening to perform all sorts of time-consuming scoping of ignition waveforms, sensor specifications and voltage readings of signals only to find the culprit was a problem with fuel pressure. In the age of OBD II diagnostics, CAN communication among modules and pulse-width modulated signals, we often overlook the most basic tests such as that for fuel pressure. But there is so much more we can test about a fuel pump. Also, there are many more factors we have to think about besides the pump that affect the fuel supply to the injection system. Let's see what some of those problems might be.

Under pressure

As long as they have been called Nissans, they have used a fuel pump mounted inside the tank (not true with the previous Datsun nameplate). Of course, Infiniti vehicles have always had it there. The pumps these days are mounted in "fuel pump modules." These include the pump assembly, level sensor and supply and return lines. They also may include the pressure regulator on "returnless" systems.

Going back to "Fuel Supply 101," the function of a fuel pump is to draw gasoline from the tank and send it through lines to the injection system mounted in the air intake manifold. A fuel pressure regulator makes sure that an adequate and consistent supply of fuel is available at the injectors. It keeps the fuel at the specified psi even if engine demand increases or decreases. It does this by maintaining spring pressure on a diaphragm against which the excess pressure from the pump pushes (the supply pressure from the pump is always higher than the required pressure). Most pumps are capable of putting out double the operating pressure. The 80 or so psi hits the diaphragm and forces a bypass valve open to allow the excess pressure to return to the tank, thus keeping the pressure at the specified level.

Fuel rail-mounted pressure regulators are often vacuum-assisted. Manifold vacuum is applied to the spring pressure side of the regulator. This pulls up on the diaphragm and lowers fuel pressure slightly. While under acceleration manifold vacuum drops, which allows fuel pressure to increase. This additional fuel is helpful in high-demand situations.

Keeping in mind exactly how EFI operates will provide you with more ways of testing it, and allow you to arrive at accurate diagnoses, especially in those hard-to-find intermittent problems.

Tapping in

Nissan/Infiniti does not typically provide a Schrader valve on their fuel rails for checking fuel pressure. Also, the rail on the V6 is underneath the upper intake plenum, so it is difficult to get to. Tapping into the feed line from the fuel filter is the right way to connect your gauge. Nissan/Infiniti uses a flange-style fitting starting in about 1999, so make sure you have the necessary adapters from fuel pump kit J-44321, available at your local Nissan/Infiniti parts counter.

Always remember to play it safe and reduce pressure before disconnecting any fuel line. This can be achieved by using the Consult II, going into "Work Support" and selecting "Fuel Pressure Release." Or, you can remove the fuel pump fuse, run the engine until it stalls, then crank it two or three times. Just don't forget to put the fuse back when you're done connecting your gauges.

Pressure can be checked with the fuel pump relay jumped and the engine not running, or by simply running the engine. Of course, with the engine running manifold vacuum is applied to the regulator so pressure will be 5 to 10 psi lower than with the engine off. If monitoring fuel pressure while driving, have someone else at the wheel for safety's sake. Watch pressure carefully. Nissan and Infiniti provide fuel pressure specs with and without vacuum applied to the regulator. Under acceleration, fuel pressure should increase. If under hard load you see the pressure dropping you can suspect that something is going wrong with fuel volume.

Another test is that of "dead head" pressure. Here, you clamp off the return line from the pressure regulator back to the tank. As mentioned earlier, almost all pumps put out just about double the regulated pressure. By blocking the return line you can see the maximum pressure the pump is capable of producing, which should be almost double the engine-running pressure. If the psi does not increase significantly, then you may have a weak pump. We recommend that you do not leave the return line blocked for very long. Only perform this test long enough to read the gauge.

Fuel volume is another helpful test. Remove the fuel feed line

and safely run the fuel into a measuring container. Crank the engine for 15 seconds and measure the quantity of fuel delivered. You should get about a pint. If you prefer, you can jump the pump relay with the key on -- expect about one quart in 30 seconds. Restrictions in the system such as a collapsed fuel strainer in the tank or a clogged fuel filter can reduce fuel volume and cause drivability problems.

Don't just throw in a pump

There are other factors involved in fuel pump performance than just the condition of the pump itself. Fuel pumps are electro-mechanical devices that rely on proper power and ground to function. If there is a problem with either, you could install several fuel pumps and still not have the necessary pressure or volume. So, you should perform electrical tests on the system, such as monitoring voltages to the pump.

This can be tricky since the pump is not always easy to get to. You can check voltage at the relay or fuse, but it could drop across connectors after the relay. You need to verify proper voltage at the pump, which will probably require removal of the pump. Luckily, Nissan and Infiniti have typically installed a fuel pump inspection cover either underneath the rear seat, or in the trunk, which makes life much easier. You can check voltage at the top of the fuel pump module and verify the ground without having to drop the tank. If you find a problem with voltage drop between the fuel pump module and the fuel pump inside the tank, you may need to replace the unit as an assembly. It makes sense to always do an amp draw test, which can let you know if the pump is working too hard (a clogged filter or a blocked return line, perhaps?), or is on the way out. Most Nissan and Infiniti fuel pumps draw about 5 to 5.5 amps. This can easily be checked with an ammeter between the switched contacts of the fuel pump relay, or at the fuel pump fuse. Most quality digital multi-meters (DMMs)

You can measure voltage at the pump control module, which is mounted in the trunk. In this case, the relay is providing 13.8 volts and the module is grounding the pump completely to get maximum output.

If fuel pressure is not up to spec, it doesn't necessarily mean the pump is bad. In this assembly, you can see green copper oxide corrosion forming in the wiring to the pump, which causes high resistance and poor pump performance.

can measure safely up to 10 amps, so this shouldn't be a problem. Keep in mind that when you start the vehicle the "in-rush" created by the pump starting up will increase amp draw until it settles down into its true operating amperage.

Additional fuel pump controls

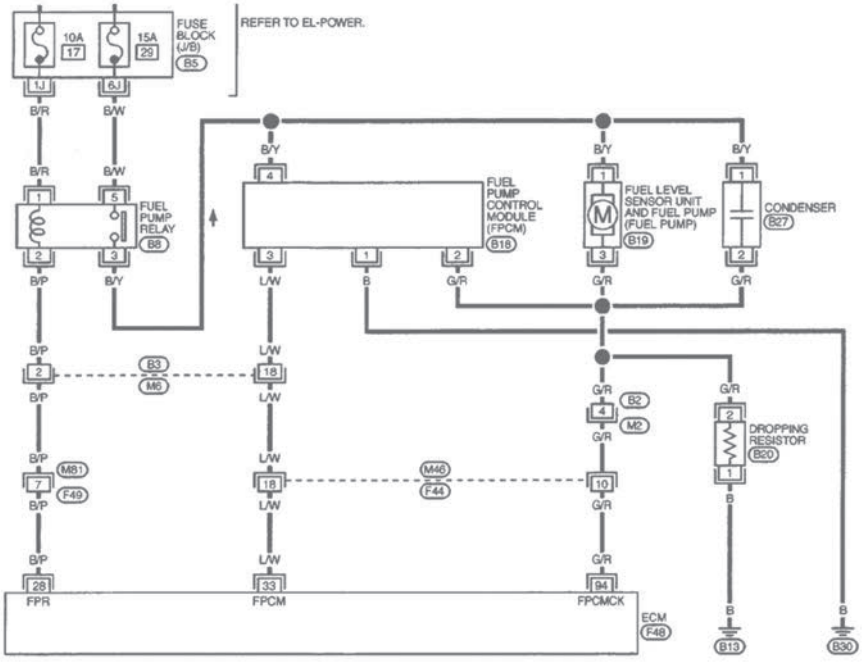
Nissan/Infiniti has also incorporated an additional control of the fuel pump. Under low-load situations, the engineers felt that the pump didn't need to be operated at full power. So, they installed a dropping resistor in the ground side of the pump wiring. This reduces the voltage through the pump for low demand situations to about 9 volts. The addition of a fuel pump control unit can also ground the pump directly in higher demand situations, bypassing the dropping resistor and producing full fuel pump operation. You can bypass the relay and send full battery voltage to the pump by placing a jumper wire between the fuel pump ground and the ground of the module. So, if you see slightly lower pressure and volume numbers on some Nissan and Infiniti vehicles.

Finally . . .

remember that the control module may be reducing voltage to the pump.

With the sensitivity of computerized fuel injection systems, something as simple as incorrect fuel pressure can cause everything from an illuminated MIL to a drivability concern. If your tests point to a worn-out pump as the cause of the problem, replace it with a genuine Nissan/Infiniti O.E. pump, which was not only designed to work with the control module, but will also have predicable pressure and amp draw specifications. Its long life is another benefit that customers will appreciate.

You don't need access to the fuel pump to check its amp draw. An inductive ammeter and a loop of wire installed in place of the fuse works fine. Or, you can use a scope and a low current probe.



Here is a wiring diagram of a fuel pump control module on a 2000 Nissan Maxima. The module receives a signal from the PCM. Depending on this signal, the module either grounds the fuel pump directly, or allows it to ground through the dropping resistor only.

Nissan/Infiniti Parts Department

Clean Cabin Air and Good Profits

As you know, most Nissan vehicles have a feature that helps keep the interior environment healthy and comfortable. It's your job to inform them and recommend regular filter replacement, which is a profitable job.

The idea of filtering the air that ventilates a vehicle's interior isn't new. In fact, Nash introduced the "Weather Eye" system in 1938 (that's 70 years ago!), one of the features of which was filtration. Very little happened along those lines for many decades, but the concept came alive again in the 1990s. In fact, various Nissan and Infiniti cars and SUVs have had cabin filters for over a dozen years.

The air filter removes unwanted particles such as mold, bacteria, pollen, tobacco smoke residue and dust from the vehicle's HVAC system. It also minimizes the bad odors associated with such contaminants. In addition, it helps minimize odors associated with driving: exhaust fumes; environmental and industrial pollution and others (ever drive past a dead skunk or a hog farm?).

Nissan owners require clean air in their vehicles. Replacing the cabin air filter routinely helps keep interior air as clean as possible.

The trouble is that most motorists don't have a clue that their cars even have this great feature. So, it's your responsibility to educate them so that they can have the benefits they deserve. You will also see a good profit on replacement. Use the Owner's Manual as a sales tool.

Also, many models were delivered with a filter-capable HVAC system, but with no filter actually installed. An original-equipment-design air filter kit is available from your local Nissan/Infiniti dealer's parts department for upgrading these systems.

Choked off

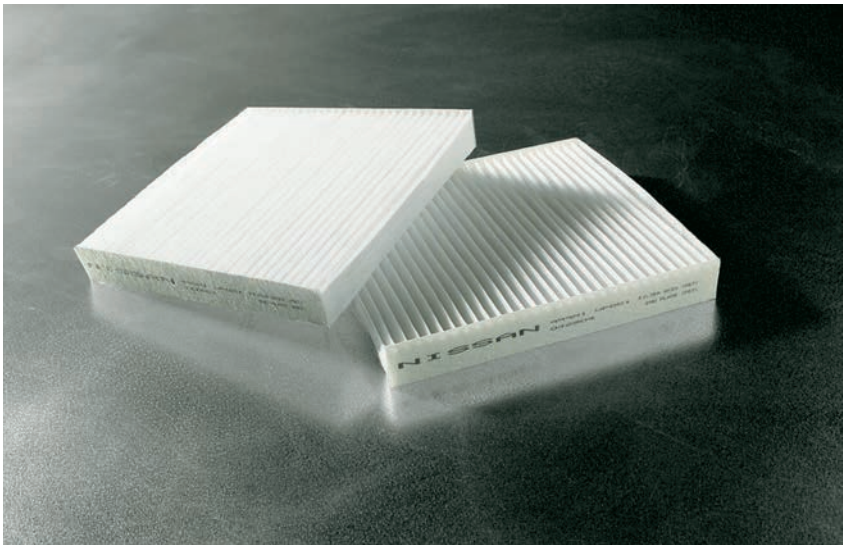
The cabin air filter, just like the engine air filter, needs to be changed regularly. Clogged or restricted filters reduce the airflow from the vents resulting in poor circulation. Symptoms include inadequate heating or cooling, inefficient windshield defrosting, or bad odors. The evaporator may even freeze up, stopping flow at the vents.

Nissan/Infiniti recommends that the cabin filter be changed annually, or every 15,000 miles, whichever comes first, or more frequently in dusty conditions.

Whenever you replace a filter, don't forget to affix the caution information and service reminder label to the inside lip of the glove box, or to the driver's door pillar. It will help remind the customer to have the cabin air filter checked and build business for you.

Genuine Nissan/Infiniti cabin filters take out over 90% of particles over three microns. For even better air purification, or to address odor problems, ask your dealer about the availability of premium charcoal filters for the model in question.

Maintaining the air filtration system is a "win-win" situation for both you and your customer. They continue to receive the benefits of clean air, better heat and air conditioning efficiency; and you get an additional boost to your work orders.



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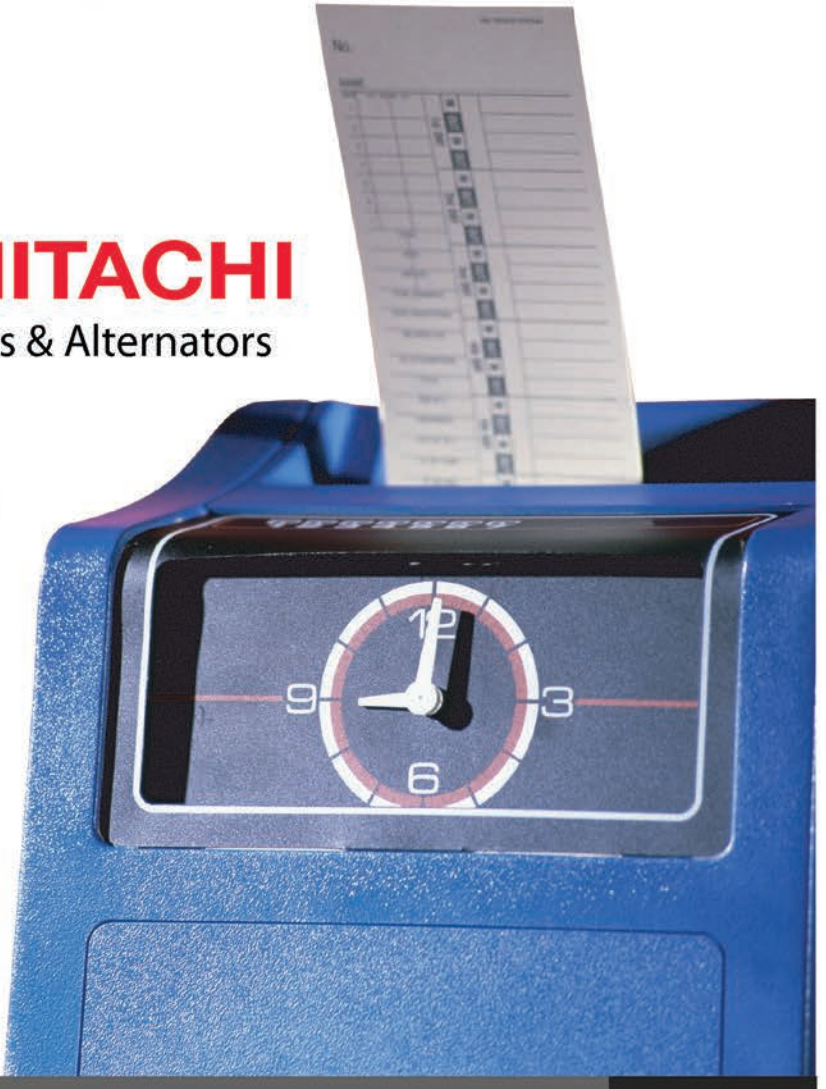

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Nissan & Infiniti Ignition System Service

Here's how to keep them dependable.

In pre-COP systems, the secondary components that handled high voltage were vulnerable, so they needed to be replaced periodically.

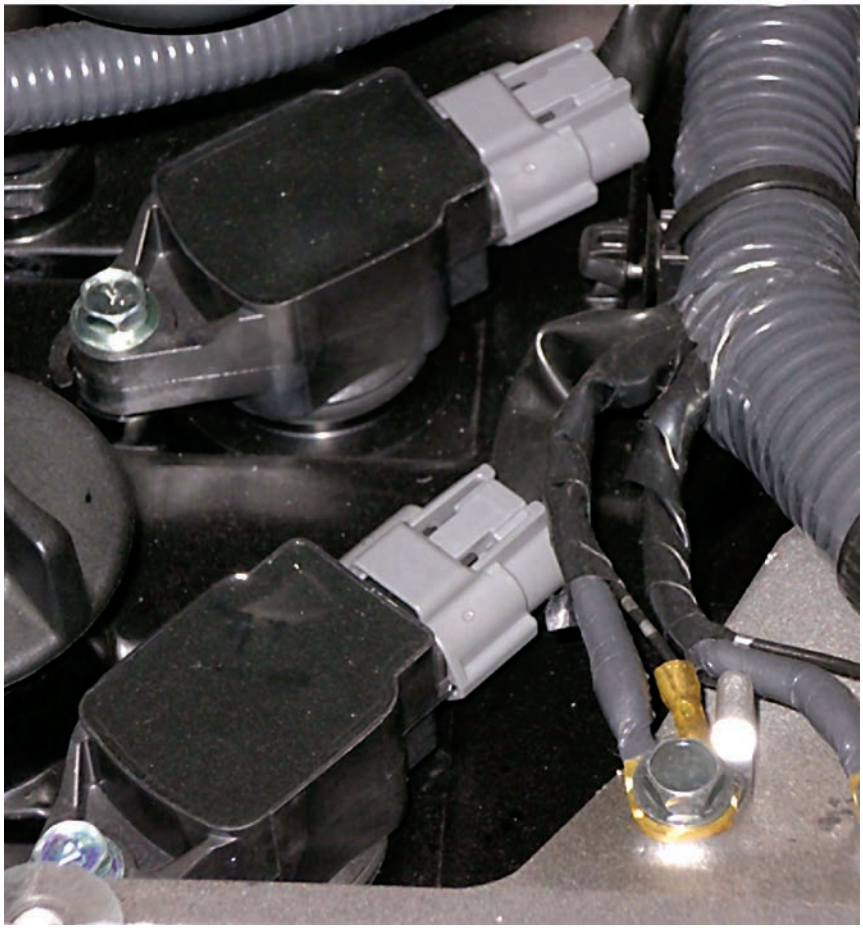
Historically, automotive ignition systems needed more maintenance than just about anything else on the car. Not only would the points, plugs and condenser need to be replaced frequently, but to assure good performance the ignition timing had to be reset between tune-ups because as the points' rubbing block wore, spark was retarded. Also, the distributor cap, rotor, coil and spark plug wires were all subject to various kinds of damage, such as carbon tracking, so were routinely replaced.

Today, of course, everything is different, and the term "tune-up" has become an anachronism. On the other hand, ignition systems are vastly more sophisticated, so everything involved has to be in nearly perfect condition or you can expect driveability, performance and ignition problems, and diagnosis has definitely gone high-tech.

The purpose of the ignition system is to ignite the compressed air/fuel mixture at the instant that will generate the maximum power and the minimum amount of emissions. Spark timing is determined by a table of data inside the electronic control module (ECM), which looks at engine rpm, load, temperature, etc. Feedback from a knock sensor will cause the ECM to retard the timing to prevent engine damage. Timing may also be retarded while the engine is being cranked both to make it easier to crank and to prevent kickback.

Traffic COP

The ECM utilizes crankshaft and camshaft position sensors to know where the engine is in the firing order and when a particular piston is approaching top dead center (TDC). Distributors, rotors, and spark plug wires have mostly been replaced by Coil-On-Plug (COP) technology, which Nissan was one of the first to employ.



When the time is right to fire the spark, the ECM will send a signal to an ignitor circuit within the COP. The ECM monitors the current flowing to the coil during the dwell period and can detect an open or shorted coil. An ignitor is little more than a power transistor with some added circuitry to limit the maximum current flow through the primary side of the coil. Turning the transistor off causes electrical current to stop flowing through the coil, and a spark is generated as the magnetic field of the coil collapses, producing high voltage in the secondary, which is connected directly to the spark plug itself. The actual power for the coils is supplied through the ignition relay; the ECM simply switches it on and off using the transistor in the ignitor circuit much like a normally-closed relay.

Nissan was one of the first carmakers to use Coil-On-Plug technology, which eliminates many of the components that were prone to problems.

The Nissan Consult II not only allows you to access DTCs, but also gives you the capability of disabling cylinders, which is a great diagnostic help.

Killing cylinders with the Consult II

Using the Consult II, a technician can disable one cylinder at a time to determine cylinder balance or "contribution." A sufficiently serious misfire will set a DTC; a potentially cat-damaging misfire will cause the MIL not just to illuminate, but to flash. The challenge comes with a very slight misfire, one not occurring frequently enough to set a misfire code. Often a coil just beginning to fail will cause a P1320 to set. The customer may come in with complaints of a "stumble" or "fishbite" along with the MIL.

Using a clamp-on current probe, Nissan and Infiniti techs can identify the problematic coil by watching the current "ramp" of all six ignitors. A current flow of less than 7.5 amps will often point to the troublesome coil. That number isn't hard and fast; looking at the scope pattern is the trick. If one "ramp" or "waveform" is noticeably lower than the rest, or deformed (as if the ignitor's power transistor is fried), there's the problem. Measuring several good vehicles before having to diagnose a problem one will help the tech in learning to "read" current ramp waveforms. Note that a piece of white tape around the bundle of wires leading from the ECM to the coils provides an ideal location to put the amp clamp. If you're not fluent using an oscilloscope, this is the perfect diagnostic situation in which to learn. Simply adjust the timebase and gain on your scope until you've got a reasonably sized and scaled image, and identify the coil waveform that's noticeably different from the rest.

Attached to the crankshaft (on some engines, the flywheel) is a toothed ring that allows the crank position sensor (CKP) to tell where the engine is relative to TDC. A double-wide tooth creates a sync pulse that tells the ECM, "I'm at the top now." Regular teeth give the

ECM the ability to determine how far the crank has rotated, how fast, and whether it is accelerating or decelerating. This last point is important. Each time a piston fires, the engine accelerates slightly. An engine idling at 800 rpm is actually running at speeds between (approximately) 775 and 825 rpm, speeding up when a piston fires, slowing down before the next one fires. If the signal from the crank sensor fails to show the expected acceleration, the usual cause is a misfire; one cylinder not making its normal contribution.

Measuring the flywheel's acceleration or lack of acceleration has to be done carefully, however, since a vehicle being driven off-road can, because of bumps and holes, cause false readings. Newer vehicles are less prone to this problem than older ones, the ECM software having been improved over the years. Misfires occurring while the engine is decelerating in fuel cutoff mode "don't count" either.

A crank sensor can't do it all. As with any four-stroke engine, at top dead center, the #1 piston could be either on a compression or an exhaust stroke, and the ECM has no way of knowing which. This is where the cam position sensor (CMP) comes in. Since the cams are driven at half the speed of the crankshaft, a sensor on the camshaft provides the additional information the ECM needs to tell whether a particular piston is on a compression stroke or an exhaust stroke.

Singing solo

When the engine is first started, the ECM doesn't know where any of the pistons are, or where to send a spark.. The engine must rotate one or two times for the ECM to see the sync pulse from the crank sensor and get an internal phase-locked loop in sync. Think of it as the ECM electronically "humming along" with the crank sensor. If the crankshaft suddenly "falls behind," as it does in a misfire situation, the ECM notices its lovely duet has suddenly become a solo act and it will set a code.

But that's not the only synchronization that needs to happen. While the engine is being cranked the ECM needs to synchronize the signal coming from the camshaft position sensor with the crank sensor to determine which piston will be the next to reach TDC on a compression stroke, so it can send a spark to that cylinder, and have the engine actually fire up and run.. Before it does this, the ECM performs a sort of relevancy check. If the signals are too far out of whack, indicating, perhaps, a stretched timing chain, a P0350 DTC may be set.

Cam and crank sensors work the way most automotive sensors do, with a toothed ring sporting either one double-wide tooth or a double wide (Arkansas) gap for sync, a magnet, and a Hall effect sensor that can detect presence of tooth or gap. How can and do these sensors go wrong? For starters, heat may cause them to fail. Or, they may break down physically and allow oil to seep in.

Since the crank sensor is such a critical component, you should probably think twice before installing anything but an OEM replacement.

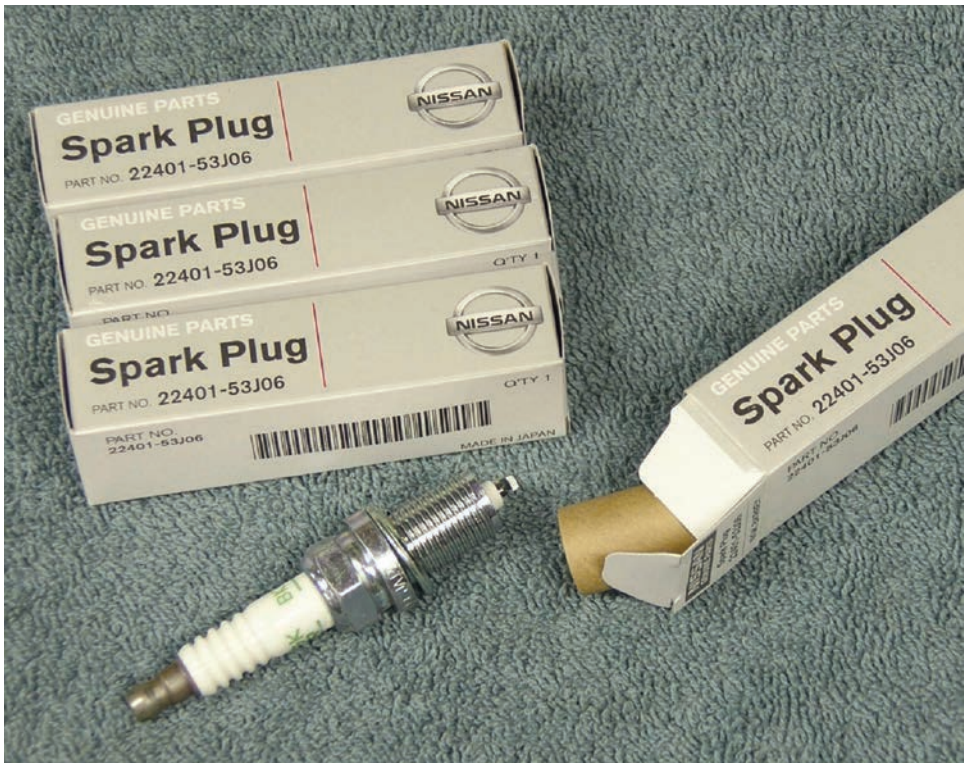
Scope and DMM

There are a number of checks a Nissan or Infiniti tech can make on cam and crank position sensors. The best is using an oscilloscope to view the output waveform, especially when there's a concern over whether or not a sensor is intermittent. Far less reliable, but quick and easy, is a resistance check of the sensor, using a DMM. Resistance specs can be found in the Nissan/Infiniti TIS system, although with Hall effect devices, all you're usually doing is ruling out shorts and opens. Measuring the AC amplitude with a voltmeter isn't generally advised with Hall effect CKP and CMP sensors.

What happens if the CMP signal is lost while the engine is running, say, due to an intermittently open connection? The ECM won't know when to fire the spark. The ECM may be humming along, but after a second or two the engine itself may have sped up or slowed down to where a spark arrived too early, and engine damage could result from kickback. Far too early could cause a backfire through the intake manifold, and damage the MAF.

In contrast, if the crank position sensor CKP drops out, it doesn't have to be quite as big a deal. Misfire detection gets lost. However, the ECM can continue running on CMP information alone. A DTC gets set because if the signal doesn't come back, the owner won't be able to restart the car after turning it off. A recent Nissan TSB calls for a software update that ensures that the engine doesn't stall in the event of a temporary CKP dropout.

Older Nissans with breakerless (optical disc) systems built into the distributor generally have only one type of failure: Oil contamination. If the PCV system on the vehicle isn't adequately maintained excessive crankcase pressure can force oil up into the distributor and foul the disc. Cleaning occasionally works. Otherwise, distributor replacement is required as the disc is not designed for R&R. You should check for other "common" distributor problems like moisture intrusion and carbon tracking as well.



To avoid misfire codes and other possible issues, spark plugs should be original equipment specification. You can be sure of that if you go OEM.

Aftermarket parts problem

Driveability issues (hesitation, stalling, misfires) may be caused by some aftermarket parts, or by consumer installation. Today's ignition systems are electrically "tuned" including the length of spark plug wires, sensor impedance, coil resistance, etc. Even use of some aftermarket spark plugs can result in misfires and codes getting set, especially on supercharged engines. Some aftermarket COPs may sometimes set a P1320 right out of the box. A recent posting on iATN described a tech who installed two full sets of aftermarket coils (12) and continued getting a P1320; current ramping (as described above) and replacement of the questionable coils with OEM Nissan parts immediately cured the problem. Once again, the cost of a comeback far exceeds the few dollars that might be saved on a non-OEM ignition part.

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