Summer 2017 | Volume 10 | Issue 2

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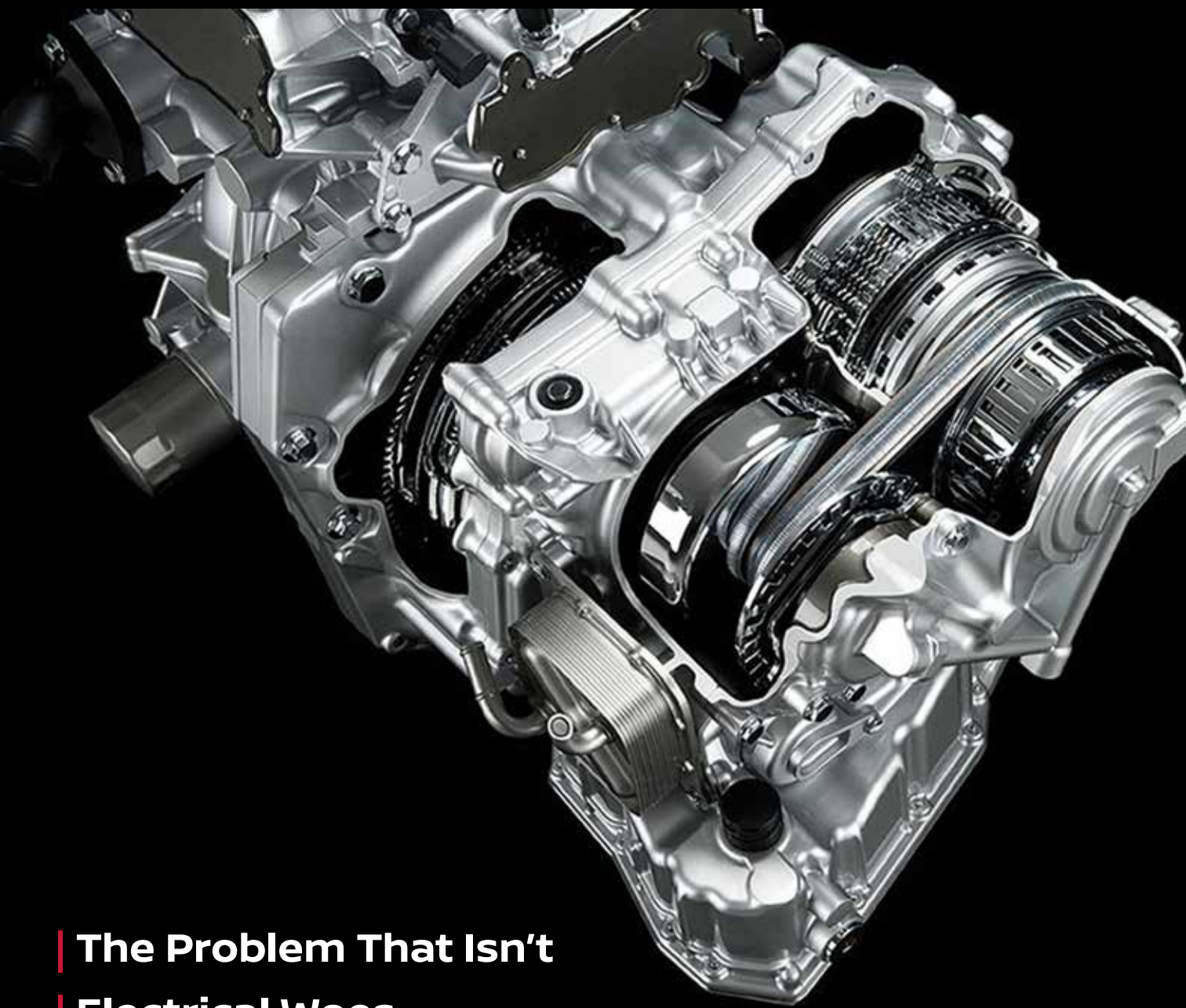

The Problem That Isn't

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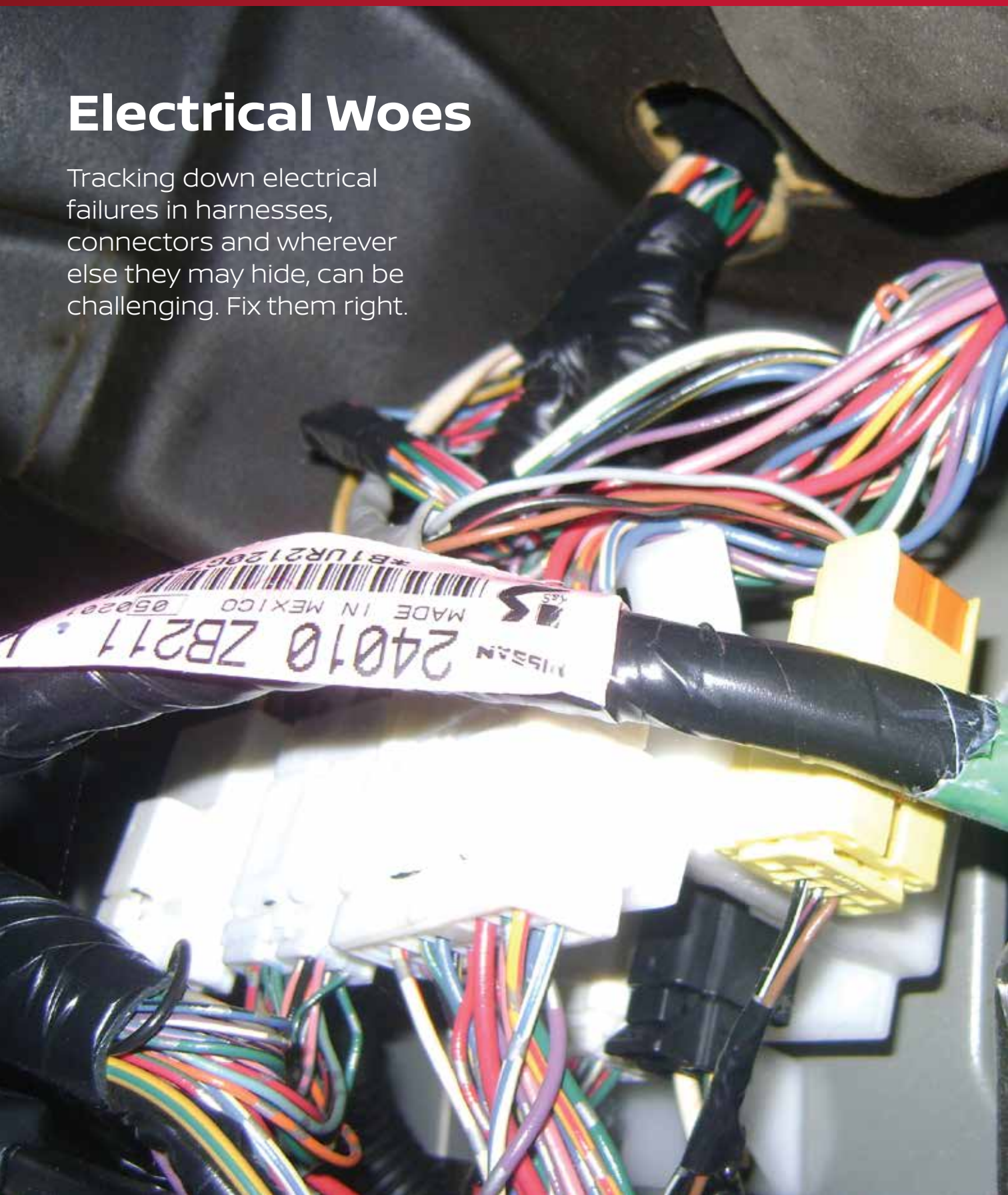
Contents

Features

Electrical Woes

Tracking down electrical failures in harnesses, connectors and wherever else they may hide, can be challenging. Fix them right.



Every technician that has been on the job for more than a week has found himself beating his head against the wall because of some mysterious electrical fault that just doesn't make any sense. Even the aged master tech that awes everyone with his almost magical way of identifying a problem by the sound of a small tick or chirp, will still lament not becoming an accountant when facing a broken wire somewhere in the dash harness.

From intermittent radio reception, to headlights that flash with the turn signals, electricity can be the root of some of the most fascinating and mentally taxing issues a technician can face. With the increasing complexity of today's cars, getting a solid foundation in electrical diagnostics will make you a more valuable technician.

A good place to start is by getting a better understanding of what makes electricity so difficult to understand. Although we don't yet understand everything about electricity, we know it has some basic rules it has to follow. We can use analogies about how electricity flows like water in a hose. This helps with the basics but will leave you confused with some deeper problems like RFI (radio frequency interference), and CAN BUS wiring.

The vast majority of electrical problems will be caused by a failed part that can be changed. When they're not, then they will fall into one of two categories; either a circuit is making contact where it shouldn't, or it's not making contact where it should.

Experience is the best teacher as always. The more you work with electricity the better you will understand it. You might even consider time spent on the diagnosis as a benefit, like extra time spent in class. However time is money, so let's see if we can "illuminate" some of the more mysterious problems. The idea is to come to the correct solution and repair as quickly as possible. The bi-directional nature of electricity, intermittent contact, added resistance, poor grounds and using the wrong tool for the diagnostic procedure can all combine to suck up your time and leave you with a headache.

Opposite Page: Somewhere in this tangled mess is an electrical gremlin that is poised to ruin your day. Time to get your wiring diagram out and track him down.

Bi-directional flow

A common frustration in diagnosing electrical problems is not fully understanding that electricity can flow both directions in most cases. This can become a particular problem if there is a short between adjacent wires in a harness or connector.

A wire that should have no voltage with the key off, for example, may be shorted to a wire with power all the time. The electricity can flow backwards, through that circuit and back to a shared source like the ignition switch, energizing all other circuits on that leg of the ignition switch.

Removing fuses to identify a parasitic draw may identify the wrong circuit in this situation, since the circuit being disconnected might be fed backwards through the branch at the ignition switch. This can lead the technician to guess and change out an ignition switch only to discover that the problem still remains.

Unplugging the connector on the ignition switch before condemning it can reveal the error. This example is a bit extreme, but understanding the bi-directional nature of electricity is a must in order to understand and perform advanced wiring diagnostics.

In the example above, stopping at the first fuse that reduces the draw can lead you astray. Take an extra minute or two and go through the rest of the fuses to insure the one you suspect is the only circuit causing a draw.

Intermittent contact

Without good solid electrical contact your wiring system just will not work reliably, yet the slightest glancing touch of a bare wire to ground can cause instant failure. Both sides of this equation must be considered when chasing an intermittent fault.

Fortunately modern ECMs will often indicate if the signal is too high or too low and sometimes even tell you there is a short to power or ground. Unfortunately not all systems are monitored by a control module, and a short to ground inside a sensor looks very similar to a short to ground in the wire harness. This is why it's important to follow all the steps in the factory prescribed diagnostic chain when it suggests disconnecting the ECM connector and testing the harness for shorts and opens.

Doing a wiggle test, that is, shaking the harnesses while the system is on, is going to be your first go-to test for intermittent contact. Pay special attention for places where a harness goes around a sharp corner or where a missing harness anchor lets the harness rub. Even a rodent having chewed on the wire insulation can lead to intermittent contact that will set a fault code or blow a fuse.

Added resistance

Added resistance in a circuit has been the cause of many gray hairs and thrown wrenches. You might be assuming you have a sensor failure or mechanical failure while looking at the data stream from various engine sensors, but can you trust the information you're seeing? Added resistance in a circuit will often cause erroneous readings in the ECM.

There are several ways this can happen — loose or corroded connectors, burnt or hot wires, or even some fluid leaks can raise resistance in a circuit. When condemning a sensor or system, it's a good idea to verify outside of the ECM that the problem actually exists.

For example a P0128 code indicates that the engine isn't heating up enough and may need a thermostat. Verifying the actual temperature of the cooling system with an infra-red temperature gun can save you the time of installing a thermostat only to find that the ECT PID was incorrect due to a corroded connector or failing sensor. As a rule of thumb, if you can change your data stream by moving a harness or connector, something is wrong.

Back probing the MAF signal gives us info directly from the sensor. If the voltage differs from the data stream on the scanner, we know we have a resistance problem in the wire harness or ECM connection. If we can change the data by moving the harness we know where the problem is.

In case you're not familiar with the expression "PID," it stands for Parameter IDentification. This refers to the individual data streams from the ECM reporting the information received from various sensors within the vehicle.

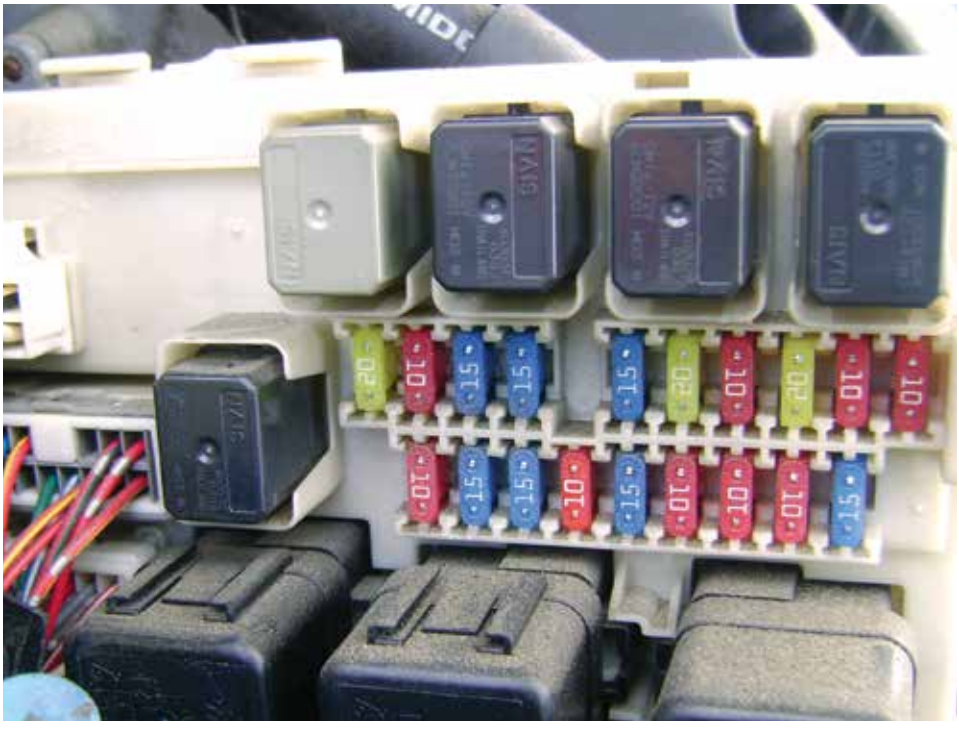
A wire doesn't have to be completely open to cause significant diagnostic issues. Back probing a sensor connector is a great way to verify a sensor failure, but don't neglect disconnecting the connector to check for corrosion, loose terminals, or fluid contamination. Any one of these can trick you into changing a perfectly good sensor only to find that the problem still remains. Should you find a damaged or corroded connector, replace it. Pigtails (assembled connectors with terminals and short leads) are readily available from the parts department for most connectors with fewer than 5 pins, and a few are available with more. For bigger failed connectors, like ECM or fuse box connectors, replacing the entire harness may be in order.

Poor Grounds

Some of the most interesting and laughably ridiculous failures stem from poor grounding. A very common example of this failure is running lights that flash with the opposite turn signal. When looking at the circuit diagram, the circuits may seem completely separate. In the vehicle they can share the same bolt grounding them to the body or frame. Should that bolt get rusty it may no longer have a solid grounding connection.

This brings us right back to the bi-directional nature of electricity. If the turn signal can't ground through the ground wire, it may find a path to ground through the shared ground in the running light bulb. It can then power the running light circuit backwards and finally ground at another running light ground point.

Although drawn out, this example gives a clearer idea of what can happen when a shared ground fails. These kind of failures are often very difficult to pin down; measuring the resistance of the ground side of the circuit with a voltage drop test will often point out a bad ground.



Parasitic draw problems will bring us right to the fuse block. Pull every fuse, one at a time, and record which ones reduce your excess draw. If it's more than one, look at the diagrams for what they have in common, especially the "power distribution" diagram.

This is even more critical when suspecting a faulty module, like a ECM. One ground with high resistance can skew all the input information for the ECM.

Before replacing any module it is a good idea to test each power and ground circuit, especially if the module displays an internal error. Even if a poor ground connection isn't the direct cause of the symptom, the added stress on the system could still be

the root cause, leading to another failure in the near future. When repairing a rusty ground, solder a new ring terminal and wire brush the mounting location. Clean rust from grounding locations, and then protect them with dielectric grease to prevent future corrosion. A solid ground point must be clean.

The Right Tool

Using the right test equipment for a particular failure isn't as simple as it used to be. Where we once used probing test lights and analog multi-meters for most problems, we now have a wide range of tools that are far more accurate and safer.

The test light is seldom used in modern vehicles and many tool boxes don't even carry one. Using an old fashioned test light on a modern computer controlled engine is not only dangerous for the ECM, but also doesn't usually give any useful information. Should a test light be connected to ground and probe a powered wire from the ECM, the amperage draw of the bulb in the test light may far exceed the capacity of that specific driver in the ECM. The result is irreversible and the need for a replacement ECM.

Even if the circuit you are intending to test can easily handle the load, a simple mistake in wire identification may have you damaging another circuit. The proper tool is a high impedance digital volt/ohm meter. Not only is the DVOM safe for any ECM circuit; it will actually give you useful information like actual voltage and resistance.

The graphing multi-meter is a wonderful time-saving tool. Often a circuit failure will happen faster than the DVOM can react. You connect your wires properly and have the correct voltage or resistance reading, yet the circuit is still setting a DTC. The answer is to use a graphing digital multi-meter.

By actually graphing out the voltage or resistance readings, you can see momentary drop-outs or spikes in the voltage that you would never see watching a numerical display on a DVOM. The perfect example is the 5V reference signal. A completely open circuit will be easily seen by either tool, but many small or intermittent drop-outs may require a graphing multi-meter to see.

Connecting a graphing digital multi-meter to an inductive amp probe, you can watch the amperage fluctuations of any DC motor. In a fuel pump or blower motor, for example, you can see irregularities in the pattern that can reveal a potential failure. This is extremely helpful when diagnosing intermittent failure situations when an electric motor is working when it comes into the shop.

Another example would be a suspected starter motor. Excessive amperage spikes or drop-outs can point to a failing starter even if it seems to be working OK. And as an added bonus, the amperage will fluctuate with the compression in each cylinder, in effect, giving you a kind of cylinder balance compression test. If every 6th peak is lower

This Quest has been crippled by rust. After cleaning the mounting and replacing the terminal on the wire, it's time to check the rest of the grounds on the van for the same problem.

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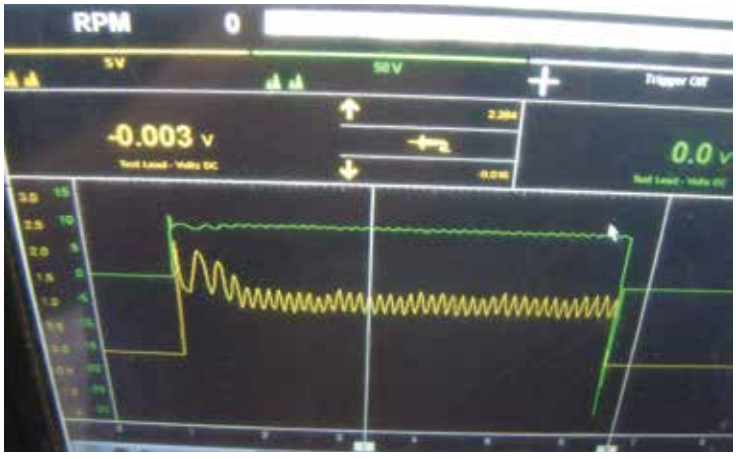
than the rest in a 6 cylinder engine, you might suspect one of your cylinders has weak compression.

Even with these modern tools it's still possible and even common to damage the wiring system with sloppy testing techniques. When testing wires it is tempting to use the sharp electrodes that come with the DVOM to pierce the wire casing and take your reading. Often this will result in a damaged wire, either by breaking the copper strands in the wire or by allowing future water intrusion through the hole in the casing.

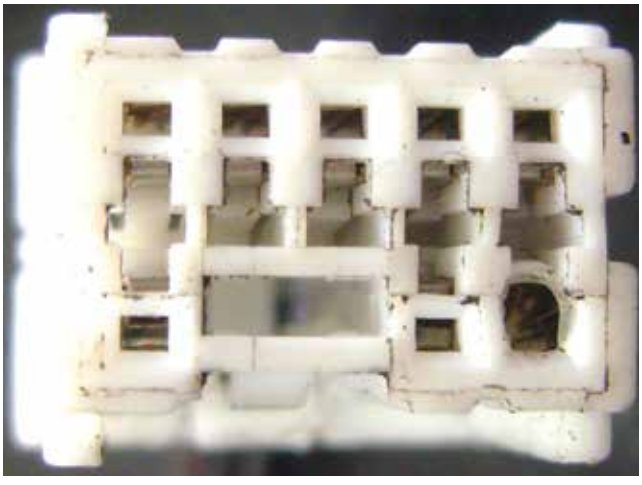


The green trace is the voltage on the trigger wire for the starter solenoid and the yellow trace is the amperage of the starter. With a stable pattern, this is what you want to see in a starter test. Can you tell how many cylinders this engine has?

Another common mistake is to unplug a connector and probe directly into the female side of the connector. This will typically give you an accurate reading but will often damage the connector by spreading the terminal end, making a poor connection when the connector is plugged back in. It may seem nit picky, but causing an electrical fault while trying to find another fault will make your job much harder.

A better way to test the wiring is to back probe the connector with a metal pin. With an inexpensive box of T-pins from the local fabric store you can safely and quickly test almost any connector by pushing a pin between the wire and seal on the back of the connector. Making sure to push the pin in far enough to make contact with the back of the terminal, it is much less likely to damage the wire or connector and doesn't usually have to be removed until all of your testing is done, allowing for quick switching back and forth between connections. This method also allows testing with the connector plugged in for voltage drop tests and, with extreme caution, supplying external voltage or ground.

Using T-pins and jumper wires with alligator clips allows for easy and safe testing of almost any circuit, so long as you make sure the pins don't stick out far enough to make contact with a grounded surface. When back probing more than one wire in a connector it is also important to be sure the pins don't touch each other unless you are sure you want them to.



This connector was damaged by an eager young technician. By forcing a DVOM test lead into the face of the connector he confirmed a low resistance ground but added more work in having to replace the connector he damaged.

An example of when you would short the pins would be with an ECT sensor that is reporting an unreasonably low temperature. By briefly touching the pins together and observing the ECT PID you can quickly eliminate or confirm faulty wiring in the harness. If the temperature reading spikes high you know the ECM is reading the low resistance of the shorted pins, simulating a

By back probing this EVAP purge solenoid and bending one of the T-pins we can safely monitor the voltage with the engine running and the solenoid in use. This will help to identify intermittent failures as we can test while power braking or even driving down the road.

very high engine temperature. This would confirm that the wires to that point are good and your problem is somewhere downstream of your test point, in the sensor or in the business side of the connector.

Electrical wiring in an automobile is vulnerable to many different failures. Each kind of failure tends to have a specific location where you're likely to find the problem. With a little logic and testing, finding the issue doesn't have to be a "needle in a haystack" kind of search.

If you've confirmed an open in a wire, a good place to start looking for it is any place that moves. Door jambs, trunk lids and seat tracks are some of the more obvious examples, but also observing how the engine harness moves as the engine strains against its mounts can give you a place to look for a damaged wire. A broken motor mount makes it even more likely that a harness would fail when it moves more than it typically would.

Should you find a break in a wire at a point in the harness that flexes, don't splice the wire together where it broke. A better idea is to cut a section of the damaged wire out and make two splices, one well before and one well after the flexing point. A rigid soldered repair is more likely to fail while flexing than a fresh piece of wire. Also, if one wire in a harness at a flexing point has failed, inspect the neighboring wires for fatigue and a possible future failure. When several wires have failed it might be prudent to change the whole harness to be safe.

Above all else, be patient. When you find yourself getting frustrated, stop and think. Check for TSBs, look at the diagrams again, and use a highlighter. Nothing ruins your day worse than realizing you've just spent two hours chasing the wrong wire because of a simple misreading of the diagram.

Confirm your repair and take a second to figure out why the failure happened. Wires don't spontaneously break and connectors don't corrode by themselves. If you did find a damaged wire or connector, ask yourself "How did this happen?" Often you will find another circuit with the same problem. Electrical diagnosis gives you plenty of ways to mess up, so don't take it personally. It's not worth the gray hair.

Feature

The Great Oil Change Debate

Mechanics all know how important regular oil changes are to the longevity and reliability of an engine. But why is there so much consumer confusion surrounding the frequency of oil changes? This article will discuss Nissan's official stance with respect to oil changes, as well as why it is important to refer to the owner's manual or service manual for oil change interval recommendations.

For such a fundamental part of vehicle maintenance, there is much more confusion surrounding the humble oil change than any other aspect of car repairs. We as mechanics know how important the regular oil change is, but do we realize how much research and development goes into the service interval recommendation?

This article will explore the repeating question of "Why" we change oil. It will give Nissan technicians the confidence to best respond to a common customer question that ultimately has no single answer.

The purpose and science of modern engine oil

Let's start at square one. The primary role of engine oil is to reduce engine wear caused by heat. Heat is generated from friction between every moving internal engine component,

At a microscopic level, even polished aluminum has asperities. The top image is the two lubricated objects separated by hydrodynamic oil flow; the lower is when the two objects touch, and are grinding against each other's boundary.

and from the combustion events. The secondary role of engine oil is to resist its own degradation over its service life so as to best perform its primary duty.

In order to appreciate the research and testing Nissan performs on its vehicles, we should understand what science goes behind engine oil. To reduce heat from friction, engine oil functions as a lubricant. A less obvious statement would be that engine oil provides hydrodynamic lubrication and boundary lubrication.

Hydrodynamic lubrication is ideal because the lubricated surfaces are completely separated by flowing oil, and only a little heat is generated from internal friction of the oil itself. Boundary lubrication is a last resort for when the microscopic irregularities of the two surfaces come into contact. Their contact creates more heat from friction, and also results in material wear as the asperities (the peaks of the irregularities) grind together and become suspended in the engine oil.

Nissan engineers determine the point engine oil change intervals need to be established. Nissan also determines the correct viscosity for their engines. Viscosity is the measurement of a liquid's resistance to flow and its ability to support a load. If the oil viscosity is too high, it will not flow easily between the two lubricated engine parts causing drag – literally the same concept as air resistance. This wastes power and efficiency. If the oil viscosity is too low, the oil film cannot bear the load between the two forces, and the two lubricated engine parts will come into contact, causing wear.

Viscosity is affected by pressure and will shear under high stress. A simplified way to visualize shearing is to smudge a drop of water on the table. The single drop shears into many smaller droplets, and now the

table is dry between them. When a rocker arm presses on a valve shim, the oil will be squeezed and some molecules will shear. When the shearing force stops, the sheared molecules may not return to the oil chain. Over time, viscosity will decrease. Resistance to shearing is a characteristic of oil chemistry.

Viscosity is temperature dependent. At lower temperatures, the viscosity is higher. Less flow means less oil film coverage, and therefore an increased amount of reliance on boundary lubrication.

Furthermore, heat will transfer from the lubricated surfaces into the engine oil as it makes contact. Nissan engineers have determined with rigorous testing the best way for their recommended oil to flow and for heat to be exchanged.

Therefore, without the correct viscosity, the engine oil will not flow as intended to the needed components, nor will it support the intended load forces between the lubricated components. This is why the single most important thing for engine longevity is to match the Nissan-recommended oil grade.

Why does oil viscosity matter? Because it does most of the protection work.

The official Nissan oil change interval

Understanding the chemistry behind engine oil illuminates the importance of the oil and the role regular service intervals perform. Nissan has tested their branded oils with their engines for millions of miles, monitoring the rate of deterioration with scientific rigor and professional testing. The official intervals are published with these considerations in mind.

It is important to check the official oil change interval for every Nissan vehicle you work on. Also, you should ask the customer a few questions about their driving habits to determine the severity of the vehicle's usage. Ultimately, there is no one simple interval recommendation for every single customer. The customer can find information about maintenance for their car in the owner's manual.

Free oil change with every engine replacement! Infrequent driving coupled with a coolant leak from the cylinder head gasket resulted in this oil gelling.

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Nissan service manual or owner's manual Maintenance section includes information about how to recommend maintenance as well as how to perform it. You gain access to each manual with a subscription to www.nissan-techinfo.com. As a repair tech, it will be your responsibility to research the official Nissan recommendations. There will be a table to indicate recommended mileage and time frame for each relevant service item. You will also discover important information about specific fluid requirements, capacities, and methods to determine their condition.

Why oil should be changed

Pay attention to customers who drive less than average. Check the service manual or owner's manual for recommended timetables for oil changes, typically every six months. This is true even for vehicles that have not traveled many miles. Here's why:

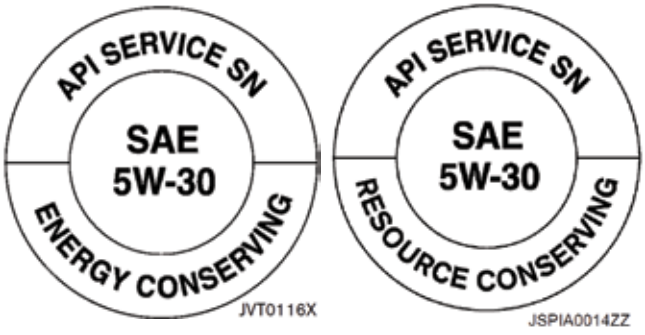
Moisture build-up from infrequent driving can create gelling from emulsification (think salad dressing). Cars that aren't driven for sufficient duration at full operational temperature means that water inside the crankcase is never vaporized and vented. Plus, without heat expansion, piston rings never seal perfectly, allowing ambient dust particles and fuel to blow-by and contaminate the oil.

Fuel contamination is a serious consideration. After about 1500 miles in an average engine, there may be as much as 3 percent fuel in the oil! Infrequently driven cars will have richer mixtures and higher moisture content, resulting in rapid oil degradation despite low mileage.

Use Nissan filters because they fit properly, seal and won't leak. They also have high quality filtration capability, and an anti-drainback valve to provide oil pressure faster during startup.

Choosing the correct oil: The API Donut

Nissan service manual or owners' manual refer to the required oil using a registered mark from the American Petroleum Institute (API).

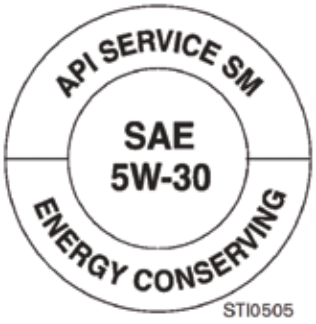


Can you spot the difference between these two requirements? They are different oils.

Use what's recommended. Who has done more research: Nissan or the salesman at the auto show tent?

The engine oil industry is more strictly regulated than aftermarket parts suppliers. Engine oils that pass controlled testing can display the API's "donut" certification stamp.

All genuine Nissan motor oils are API certified. However, not all API certified oils can work in all Nissan engines. This is because not all API certified grades are equal. Currently, oils with the API "SN" certification are the highest standard. Even if the viscosity is correct, an oil that is API "SM" should not be used in a vehicle that calls for API "SN."



The SM designation is obsolete; you can use SN oil in this engine.

Making things a bit more confusing, the designation "Energy Conserving" is not the same as "Resource Conserving." Resource Conserving oils are a special sub-type of API-SN oils that have been engineered with less of the additives that shorten the lifespan of catalytic converters and oxygen sensors. Failure to use Resource Conserving oils in cars that call for them may shorten the lifespan of expensive emissions control components.

The best interest of the driver

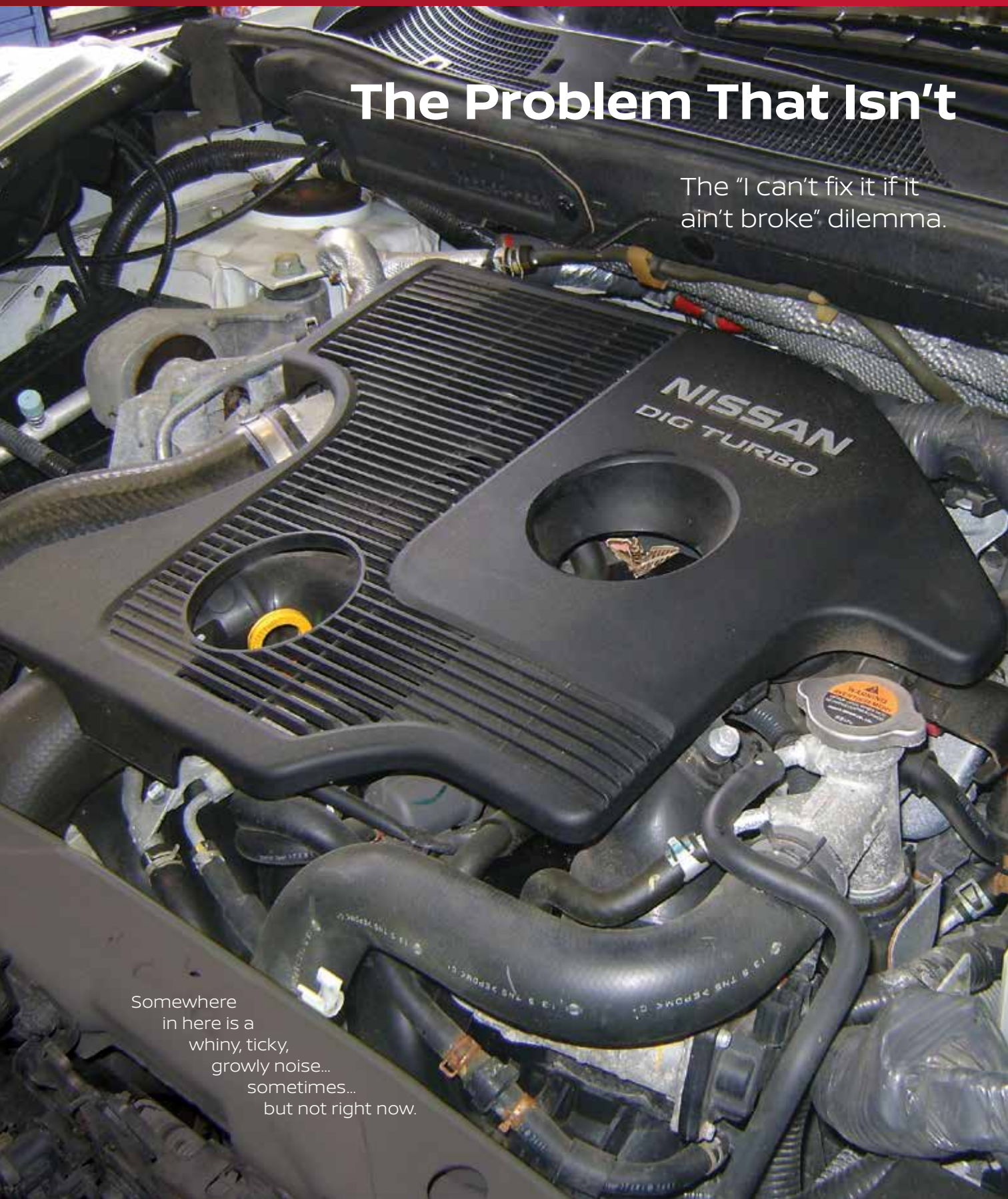
Consumer advocate groups and some state governments have enacted measures to try to protect motorists from predatory oil change recommendations. The spirit of these laws is to prevent a quick lube joint or similar unscrupulous shop from unnecessarily changing oil before it nears the end of service life. This wastes oil resources, risks spillage into the environment, and costs customers money. The federal government has published that as little as 50-100 ppm concentration of oil can cause a water treatment process to fail, and that 1 gallon of oil can contaminate 1,000,000 gallons of fresh water.

With all of this in mind, it's clear that Nissan engineers know what's best for their cars and their engines based on how the vehicle is used. For this reason, motorists and technicians alike should refer to the car's service manual or owner's manual for appropriate oil change intervals, with special attention paid to how the vehicle is used.

By following the Nissan official intervals, you will protect your customers' investment as well as the environment.

The Problem That Isn't

The "I can't fix it if it ain't broke" dilemma.



Somewhere
in here is a
whiny, ticky,
growly noise...
sometimes...
but not right now.

What can we do when the customer's complaint doesn't show itself? Let's look into the intermittent issues, hidden faults and the misunderstandings that plague our industry.

Automotive diagnostics are hard enough. Trying to find a small EVAP leak or a module that is causing a communication code can be frustrating to say the least. Then it gets worse. A customer comes in terrified that her car won't start, yet she drove it in and it hasn't had a problem for over a week. Of course, the car starts every time in the shop. Or worse yet, a very sensitive customer insists that his new car has something wrong with the engine, because it makes a lot more noise than his last car. Is something wrong or is it just different? When a problem refuses to show itself you may be tempted to throw in the towel, but don't give up too quickly. There are techniques you may be able to use to find a solution.

There are some possibilities to consider with any diagnostic job that comes through the door:

- The problem is real, and present, and you can find it and solve it.
- The problem is real but not present, so you have to figure out how to make it misbehave.
- And the last, most unpleasant option; there is nothing wrong and you are wasting your time.

This last situation should be extraordinarily rare and will usually involve the owner's not understanding how some feature of their car works. Think about the "shifting" complaints when CVTs were first introduced. Good communication with your customer will help to prevent most simple misunderstandings.

The first step in any diagnostic procedure is to record the mileage, because your service writer will need that information later and you may forget. But immediately after that you need to verify the customer complaint. How you go about that will depend on the nature of the complaint. Keep an open mind when listening to the customer's concerns. A very small misunderstanding about what is actually concerning them can make a big difference in where you will look for the problem. Words like clunk, click, bang and stall may mean something completely different to the customer than what you think it means. Getting them to tell the whole story will give you context as to what the words mean to them.

A very common area of confusion is in vibration diagnostics. Even if you feel or hear a vibration that concerns you it may not be the same one that the customer is concerned about. TSB NTB12-020 is one of the broadest TSBs put out by Nissan. It applies to all Nissan vehicles and basically consists of a checklist for the customer to fill out that will help you pin down what they are feeling.

Short of actually riding with the customer this may be your best bet in getting to the heart of their concern. If you have the opportunity, you should absolutely take a drive with the customer. Not only will it give you a much better understanding of what their concern is, but it will also give them more confidence in you as a technician. People appreciate that you care enough to take the time to really understand their problem.

Noise diagnostics is really in the same field, as you will seldom have a noise without an accompanying vibration and vice versa. Just listening for any noise may get you into a repair that isn't what the customer was actually worried about. If a person has been driving their car for years they may not notice a wheel bearing that has been slowly getting louder over the years, but will be very aware of a new buzz in their stereo system. Although you know the wheel bearing is much more important

and must be brought to their attention, it's important to be sure and address the customer's concern first. You may fix the bearing and still have an angry customer because of a buzzing radio.

Where this becomes more difficult is if your service writer doesn't know to ask the right questions. They may hand you a work order that states, "Customer hears a humming noise." Being a focused technician you, of course, go for a test drive. An exhaust leak may get your attention, all the while not realizing the customer has, for the first time, noticed a faint road noise from the tires due to a new road surface in his neighborhood. The questionnaire from the TSB may help eliminate such mistakes.

These examples are fine if the vehicle has an actual problem. Often people will be concerned about noises that are part of the normal operation of the vehicle. Being familiar with normal sounds comes with time and experience. Just because you can hear something doesn't mean it has failed. There has been a recurring issue with CVT transmissions being replaced from technicians hearing noise and condemning the transmission. TSB NTB16-109 addresses this and applies to any Nissan with a CVT transmission. There are a number of examples in the TSB of common noises that a CVT will make, and how to differentiate between CVT noises and other front end noises. The moral of this story is you need to know what the car is supposed to sound like.

VEHICLE VIBRATION DIAGNOSTIC WORKSHEET

Service Advisor:

Please review this short form with the customer to best communicate and understand the vehicle vibration the customer is experiencing.

GENERAL INFORMATION

Where do you feel the vibration? (Please check all that apply.)

- ❑ Steering wheel
- ❑ Seat
- ❑ Shift lever
- ❑ Floor
- ❑ Body
- ❑ Other:

At what speed(s) do you feel the vibration?

- ❑ Only at _____ mph (input multiple speeds if necessary)
- ❑ Between _____ mph and _____ mph

On what road surface(s) do you feel the vibration? (Please check all that apply.)

- ❑ Only on rough roads
- ❑ On any road surface
- ❑ Only on very smooth roads
- ❑ Only on highway expansion joints

When do you feel the vibration? (Please check all that apply.)

- ❑ All the time
- ❑ Not sure
- ❑ Only driving after vehicle has been
- ❑ Other:

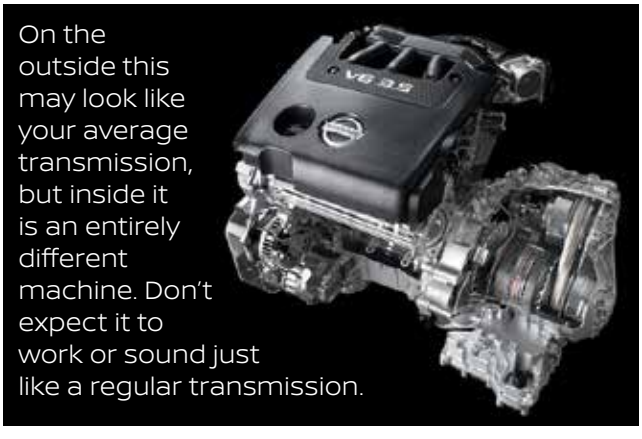
Print page 2 of TSB NTB12-020 and ask your service writer to use it when a customer has a noise or vibration complaint.

Comparing a CVT transmission to a non-CVT transmission, in regards to noise, can lead to a serious misdiagnosis.

Although noise and vibrations are very common examples of difficult-to-define problems, intermittent failures can also cause big headaches. Let's examine an example of a customer that may complain that their 2009 Altima will not start and the customer has diagnosed it to be a failed starter. You may be tempted to just change the starter. Go through all the variables first.

Does this customer know what he's doing in "diagnosing" a failed starter? Does he even know where the starter is? If his vehicle has the option of a push button starting system, how confident is he that it isn't a problem with the vehicle's security system?

Rust on the rotors means this car hasn't been driven in a long while. If nothing is obviously broken you may want to put some miles on it before you try to diagnose suspension noises.



On the outside this may look like your average transmission, but inside it is an entirely different machine. Don't expect it to work or sound just like a regular transmission.

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Regardless of whether the customer is qualified to make any diagnosis, it will still be bad customer service to change a part if it's not the problem. Although the cost of a proper diagnosis may make the customer wince, it's really the best way to protect the customer and yourself. The cost of diagnosing after a new starter doesn't fix the problem will make him wince much harder.

So you've got the customer's OK to diagnose the no-crank situation. The car is now in your service bay and starting every time. This is the beginning of the first step in diagnostics. Verify the complaint. Just because the vehicle isn't failing to start doesn't mean it isn't having a problem that you can identify. Testing the various systems involved in engaging the starter motor may reveal your culprit.

A graphing multimeter and an inductive amp probe clamped onto the battery cable going to the starter may reveal irregularities in the cranking pattern that would indicate a starter nearing failure. Checking the steering lock for proper operation may also lead you to your solution as these have known issues and happen to control the starter function. In today's age of aftermarket modifications, looking for an aftermarket alarm or remote start system may lead you to your solution.

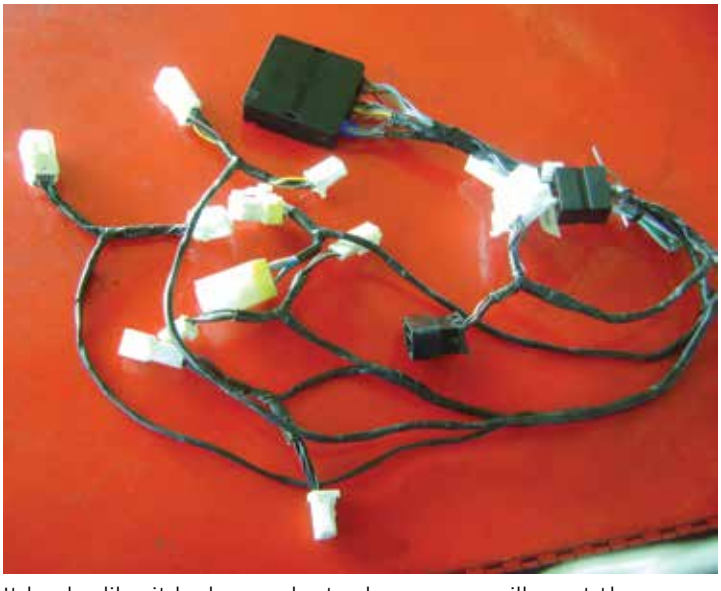
Intermittent failures can be very frustrating but even worse than that is the customer's insistence that their car has a certain failure every time they drive. And yet, it won't misbehave when you go for a test drive. Driving with the customer will often reveal some very weird habits that you may not even consider.

A great example of this is a driver who has developed the habit of braking with the left foot, or more specifically, resting their left foot on the brake pedal while driving. With the ECM-controlled throttle body the car will not allow proper acceleration if it senses the brake pedal is engaged.

Nissan has addressed this in a TSB: NTB14-107, "Check if the driver is resting their left foot on the brake pedal while accelerating. Advise the customer not to rest their foot on the brake while accelerating." Of course the same problem could be caused by any situation in which the ECM sees the signal that the brake pedal is engaged, but driver error is an easy one to miss as it won't be reproduced on your test drive unless you take a ride with the customer.

Since 1996 and the implementation of OBDII, ECMs have been monitoring vehicles' systems for anything that might increase their output of harmful emissions. And certain markets have requirements that vehicles must pass periodic emissions tests. The government has left it up to each state as to how they will enforce their emissions standards, but a common theme in all of them is the vehicle will have to pass all of the OBDII monitors. The idea is that normal driving on surface streets and the highway will allow the vehicle to test all of its systems.

A fairly common way cars fail is when they don't complete the monitors for some



It looks like it belongs, but a keen eye will spot the aftermarket device. Wired in with the push button start on a 2009 Altima, this device was causing a very intermittent no crank. What's worse is that the customer bought the car used and never even knew it was there.

reason. Of course it could be something simple, like the customer thought he could cheat the system and clear his codes right before taking the test, or perhaps the car was parked for 6 months before the test and had a dead battery.

This can be a frustrating problem to diagnose because, in a certain sense, there isn't a problem. The vehicle runs well and there are no warning lights on the dash. A customer can drive for years with the monitors incomplete without any idea there's a problem until they fail inspection.

Getting a vehicle to pass all the monitors is fairly straightforward. System readiness test (SRT) drive patterns are the absolute shortest route to passing the monitors. The standard is different for each manufacturer of course. It's also different for most models. There is a lovely TSB, NTB98-018g, that covers all 1996 and 1997 Nissan models as well as some good information about general procedures for newer cars. For example, a drive cycle will complete much faster if you have less than half a tank of fuel since the EVAP monitor runs slower on a full tank. The TSB also lists each 1996 and 1997 vehicle by the last 5 digits of the ECM part number and gives a graphic and text description of what the SRT will look like as well as how many trips are required.

If the computer uses logic to control the throttle and the driver doesn't, the vehicle might not work the way the customer expects it to.

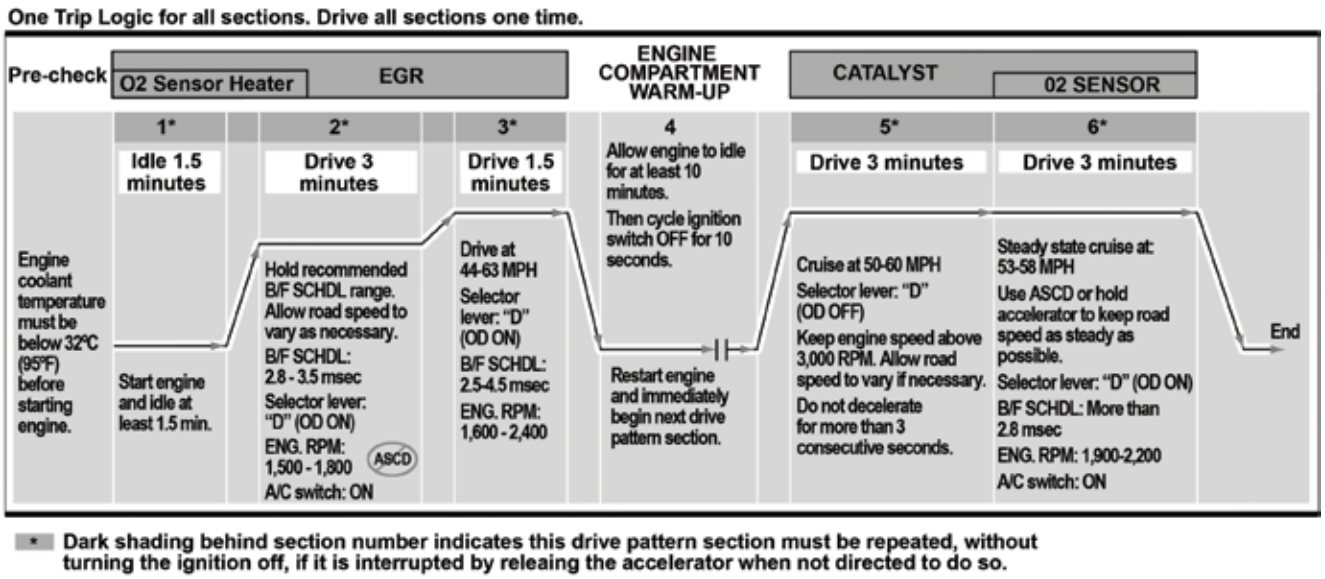
If you are trying to get a vehicle to complete all its monitors, be sure to take a quick look at your data stream before you start. For example fuel trims near or over 10 (positive or negative) may not have set a code yet, but clearly indicate that something isn't working the way it should. MAP, MAF, ECT, IAT, and the rest of the common PIDs should be looked at to see if something is out of place.

If it's 80 degrees F outside and the data stream for your IAT is at -20 you will have a problem soon even if a code hasn't set yet. Unfortunately most drive cycles are going to take you about half an hour. When you factor in that many will require two trips, it doesn't leave much time in the standard one-hour diagnostic time to figure out a problem if you do find one. Making sure your customer is aware of this diagnostic time ahead of time can save an uncomfortable conversation later.

Once in a while you will come across a vehicle that never seems to have completed its monitors. Be aware that loss of battery voltage will cause this to happen. Running a vehicle through its SRT only to have the customer take it home and fail the next day would be very disheartening. It is a good idea to be sure you know why it did not have its monitors complete.

Customers don't always use their vehicles in the most logical ways. Some drivers are very well versed in jump starting their car as they have a tendency to leave the lights on or the doors open, killing the battery overnight. If you don't know why the monitors are incomplete ask the customer if they have had a dead battery recently and stress the importance of trying to keep that from happening. Vehicles that are going to be parked for long periods of time may benefit from having a trickle charger installed to prevent battery drain.

When you have a case with an intermittent problem that isn't presenting itself it can be



This pattern will lead you to the quickest completion of the OBDII monitors for a 1996 Pathfinder. Finding a road where you can drive these speeds for the time required is another matter.

tempting to tell the customer, "It will have to get worse before we will be able to diagnose it," and send them on their way. Giving the customer more confidence may be better customer service. If you aren't hearing the noise or feeling the shimmy the customer is complaining about it can feel like you are wasting your time. From the customer's perspective they might be worried that they are going to break down on the highway and have a nervous breakdown right there in front of the whole world. But they are bringing it to you, the expert, to try and prevent that from happening.

Taking a few minutes to inspect the rest of the vehicle, especially the safety equipment (brakes, steering, suspension and fluids) will go a long way in giving them confidence that you aren't just brushing them off. Even from a strictly business perspective, sensitive customers are much better than apathetic customers who drive their car into the ground then want you to fix the absolute minimum to get them back on the road. Maybe this perspective can make this kind of frustrating job a little better.

You may be noticing a trend here. TSBs are excellent places to look when a problem, or lack thereof, has you stumped. There usually will be a solution; the question is, do you have

Customers may not be concerned about the things they should be concerned about. Having to frequently jump start their car because of a loose and corroded battery terminal wasn't important until it caused them to fail their emissions inspection.

the time to find it? Today's Nissans have more technology than ever before. Be patient and open-minded. The brake noise and flashing brake light will sometimes be a parking brake left on, and the dash light not working will sometimes be the dimmer switch turned all the way down. Just roll with it and keep an eye out for something serious. You never know when the next intermittent shimmy might be a tie rod end about to fall off.

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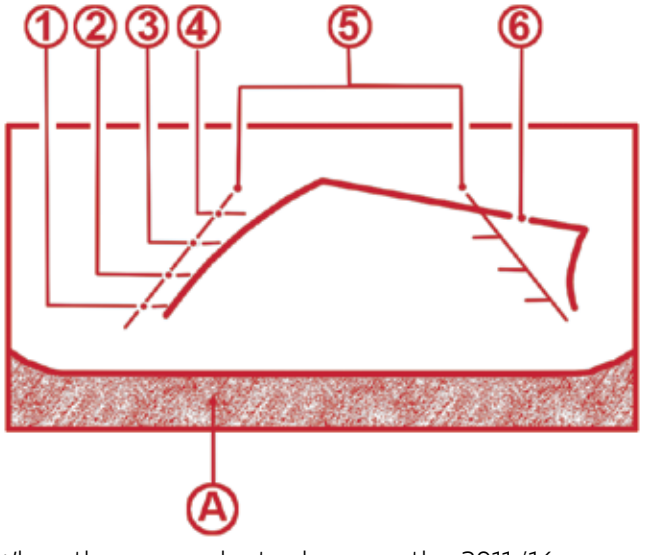
Backup Magic:
Repairing the Nissan RearView Monitor

The camera in the Nissan RearView Monitor system is used to help drivers with backup maneuvers. Here are a few tips for diagnosing problems and restoring system functionality.

The Nissan RearView Monitor is a single camera system that gives the driver an in-dash view of what is directly behind the vehicle. The following description and all repair procedures mentioned in this article apply only to the 2011-14 Murano Z51, unless otherwise noted. Other Nissan models and build years may include rear view monitor systems that feature different camera and control technologies, and require different diagnostic and repair procedures. Refer to your Nissan repair manual for application-specific information for the vehicle you are repairing.

How It Works

When the transmission is shifted into reverse, the rear view camera in the 2011-14 Murano Z51 receives power from, and is operated according to, commands generated by the AV (audio visual) Control Unit. The rear view camera sends its images to the AV Control Unit.



When the gear selector lever on the 2011-'14 Murano Z51 is in Reverse, the Nissan RearView Monitor system displays predicted course lines (6) showing the direction the vehicle will travel, based on how the steering wheel is positioned. Guiding lines indicate the vehicle width (5) and distances to objects with reference to the vehicle body line (A). Green lines mark distances of ten (4) and seven feet (3), a yellow line (2) warns that the vehicle is within three feet, and a red line (1) indicates there is only a 1.5 foot space remaining between the vehicle and an object behind it.

The AV Control Unit then generates fixed guide lines and predictive course lines in red, green or yellow, and overlays them onto the rear view images. It sends this combined visual to the in-dash display unit. The fixed guide lines give the driver a backwards-facing view, showing in real time exactly where the vehicle is relative to objects immediately behind it. The predictive course lines project where the vehicle is headed based on input to the AV Control Unit from the steering angle sensor.

The AV Control Unit is connected via CAN communication to the ECM and the rear camera and in-dash display unit.

When the transmission is in reverse, lines of different colors on the monitor indicate the distance from objects behind the vehicle. Using the familiar green, yellow and red colors of a traffic light, the lines start at ten feet away and give an increasing sense of urgency as the vehicle's predicted travel path puts it closer to nearby objects. A red line screams "Hey! You're only 1.5 feet away!"

It doesn't actually scream at you, of course. Perhaps that is one reason for the system's immense popularity. Unlike your significant other or co-worker in the passenger seat, checking the rear view mirror and not-so-secretly applying the brakes, Nissan's RearView Monitor helps you back up without passing judgment on your maneuvering skills.

A Proud History

Nissan's Infiniti luxury division was the first to incorporate backup camera technology in a production vehicle for the North American market. The company introduced its RearView Monitor system at the 2000 New

York International Auto Show, with North American market launch in March 2001 as optional equipment on the 2002 Q45 sedan.

RearView Monitor technology is now a standard feature on select vehicles across the Nissan line, and is available on every Nissan model. The technology is popular with safety-conscious consumers, and thanks to cell phones, the size and cost of high-resolution cameras has come down significantly since 2002. The only thing needed for the rapid spread of on-vehicle cameras to non-luxury models was a way to display the images. Thus today, on almost any Nissan model that is equipped with an in-dash screen for navigation and entertainment systems, a RearView Monitor camera is either standard or optional.

Rear Collision Likely Affects RearView Monitor Performance

The camera is always housed in the rear liftgate (tailgate) or decklid, depending on the vehicle model. Any collision that affects the alignment of the liftgate or decklid will likely alter the direction or angle in which the camera is pointed, destroying the accuracy of rear view imaging information provided to the driver.

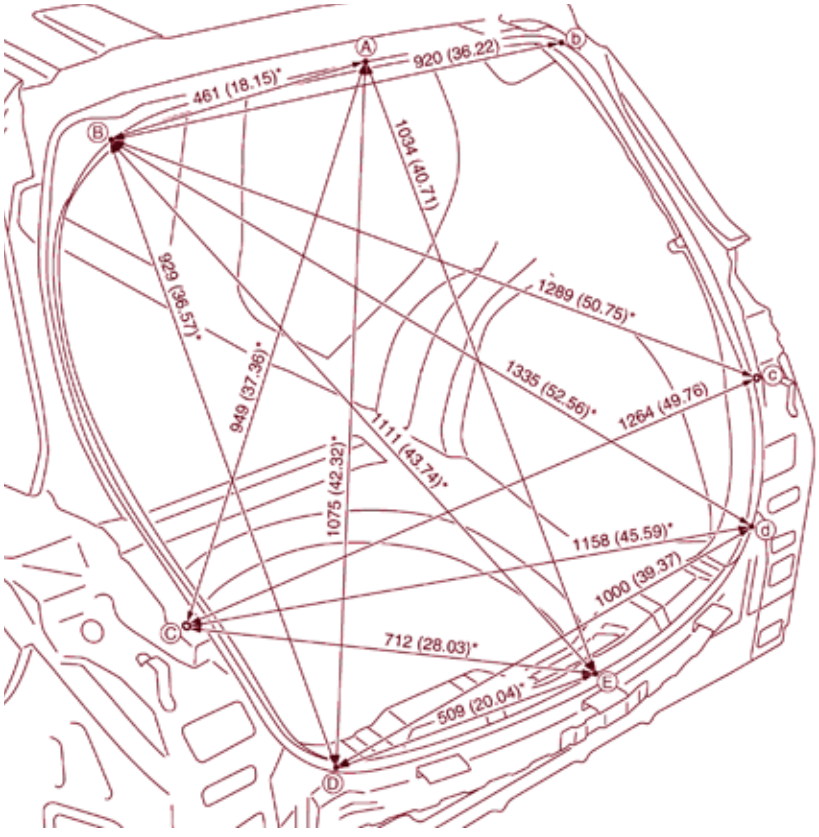
Additionally, any wiring fault or damage to control modules for the audio visual system, of which the backup camera technology is a part, can cause performance problems with the RearView Monitor.

The Right Stuff

Repairs to a liftgate or decklid that contains a rearview camera require precision alignment of the repaired or replaced component. Aftermarket or recycled liftgates may have differences in build specifications that result in issues with camera alignment and performance.

Non-symmetric shape, variations in size due to less stringent aftermarket production tolerances, and fitment issues with hinges

The backup camera is housed in the rear liftgate or decklid, depending on the Nissan model and year. Shown here is the liftgate of a 2013 Murano.



For collision repairs, detailed specifications and measurement information for liftgates, decklids, and other components are available in the Nissan service manual section "BRM" (Body Repair Manual).

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and other mounting hardware are just a few of the causes of difficulty in achieving a proper alignment of the liftgate.

For all of these reasons, repair or replacement of liftgate or decklid components should only be performed with Genuine Nissan replacement parts.

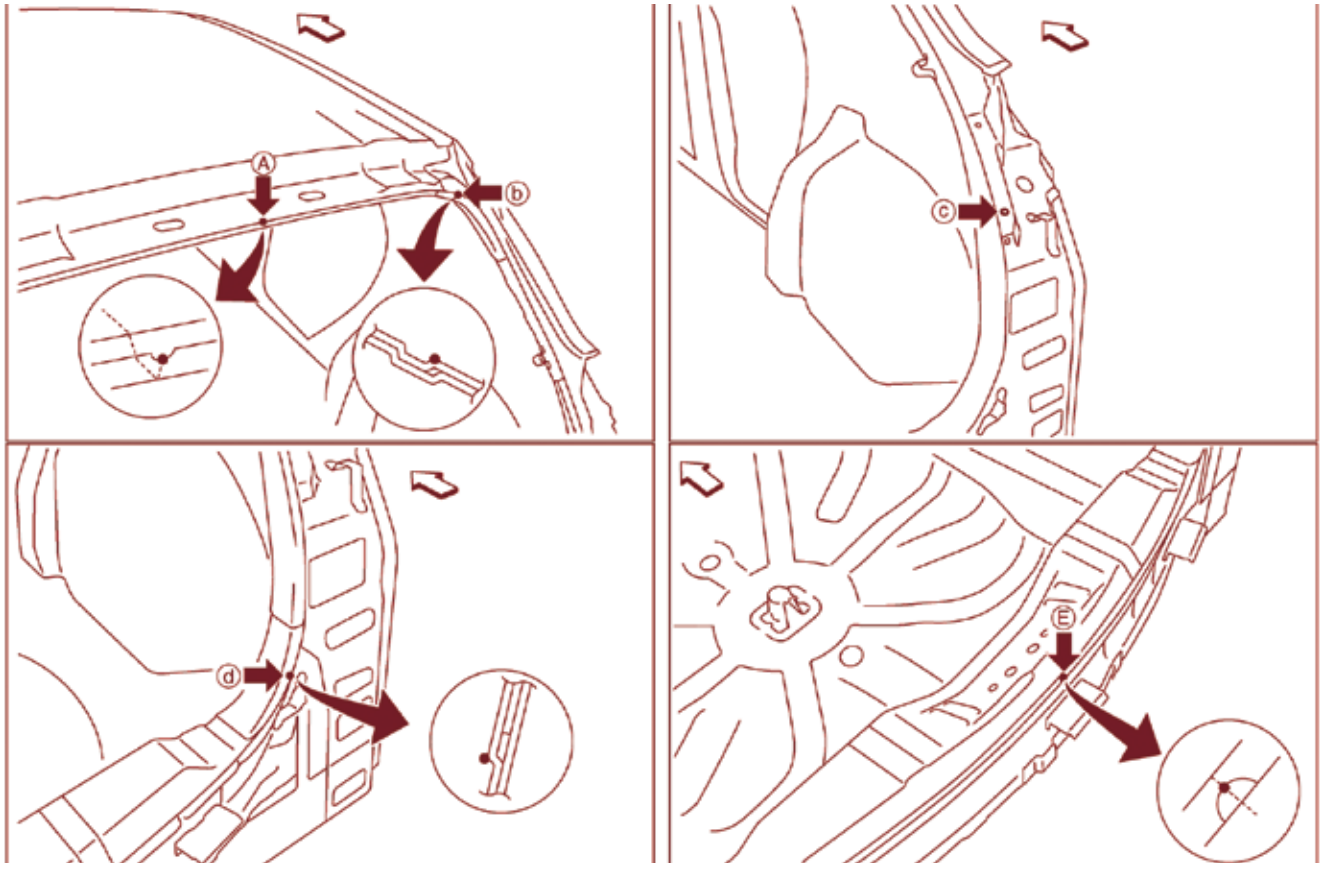
It is important to note that the inner and outer panels of the liftgate in the 2011-14 Murano are made of polypropylene. You cannot use a hammer and dolly to work the camera housing into the proper alignment.

Some non-OE liftgates may come without pre-drilled holes for camera installation. This forces the body shop to cut the opening, introducing potential measurement or placement error, not to mention requiring time-consuming extra labor. When collision repairs are necessary, Nissan North America strongly recommends that any repairs use Genuine Nissan replacement parts designed for the specific Nissan vehicle being repaired.

A Key Post-repair Step

Because the control module must know not only the direction and angle of the camera, but also its input and output specifications and communication protocols, the camera must be re-initialized and calibrated any time a related wiring harness has been disconnected. Even if you disconnect the camera's wiring harness only to move it for access to some other component, or to protect it from welding heat or some other nearby repair operation, you must re-calibrate the system in order to restore its functionality.

Nissan has issued a Collision Position Statement (NPSB-16-600, June 20, 2016) making post-repair calibration mandatory after

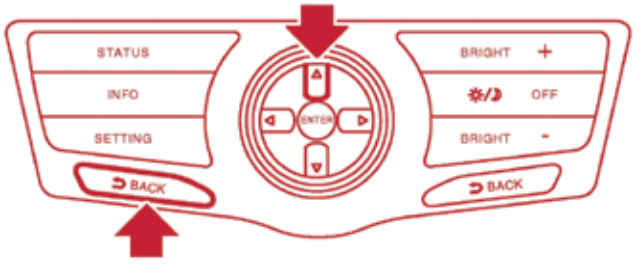


The Genuine Nissan replacement liftgate is designed to fit perfectly at several required measurement points, including the roof indent marking the horizontal center (A), the rear pillar main joggle (B), the vertical center in the rear pillar (C), the rear fender brace joggle (D), and the horizontal center positioning mark in the upper rear panel (E) above the bumper.

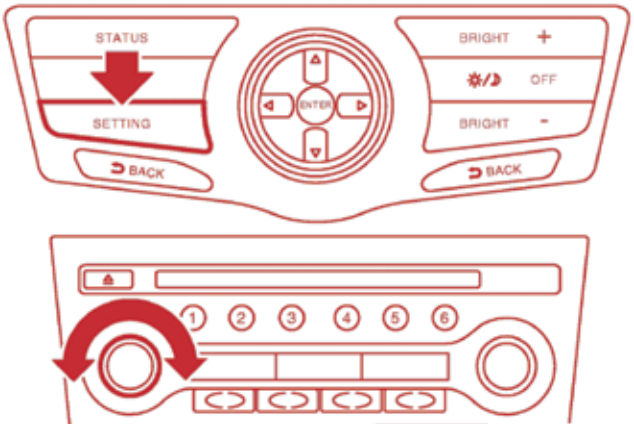
removal or replacement of any camera or the part in which it is mounted, including a liftgate, decklid, front grille or door mirror. If you're not sure whether the vehicle you are repairing has a rear view camera, check the Nissan service manual section "AV" (Audio, Visual & Navigation System) for further information.

Multifunction Switch Diagnosis

Before we condemn the RearView Monitor system in the 2011 Murano Z51, let's perform the Multifunction Switch diagnosis. On the in-dash control panel, press the "BACK" switch and the "UP" switch within ten seconds of turning the ignition switch from OFF to ACC and hold them for three seconds or more. A buzzer will sound, all of the indicators on the panel will illuminate, and an automated system self-diagnosis begins. Press each button on the multifunction switch to check its continuity. If the switch is functioning normally, a buzzer will sound with each press.



Make sure the dash controls are working. Turn the ignition switch from OFF to ACC, then simultaneously press the "BACK" and "UP" switches and hold both for three seconds. Next, press each button on the Multifunction Switch to check its continuity.



Manually diagnose communication functionality between the AV Control Unit and the backup camera by pressing the SETTING button while rotating the volume control 40 clicks or more in either direction.

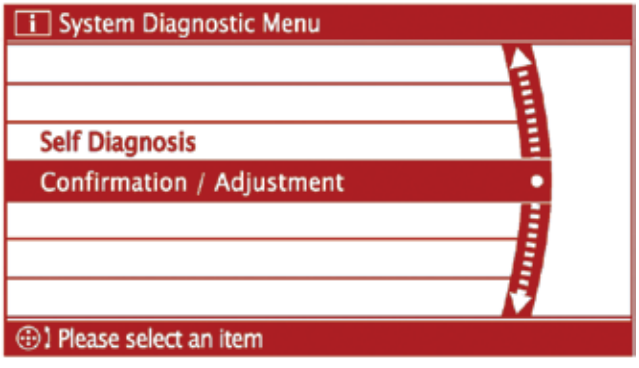
Note that the Hazard and Disk Eject switches cannot be checked in this way. Cancel the test by turning the ignition OFF.

A manual diagnostic procedure, called "Confirmation/Adjustment Mode" offers a more detailed assessment of individual components in the AV system, including the rear view camera.

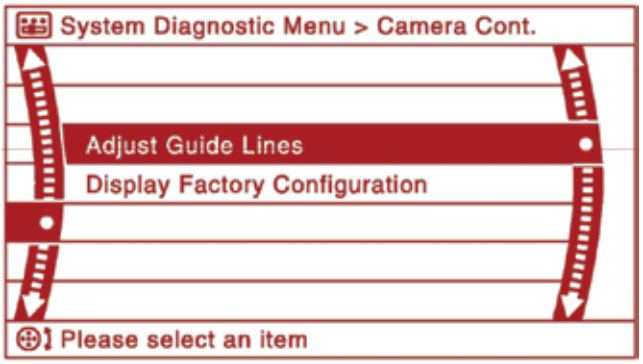
To begin manually checking that there is communication capability between the rear view camera and the AV Control Unit, start the engine and turn the audio system OFF. While pressing the "SETTING" button, turn the volume control clockwise or counterclockwise for 40 clicks or more.

The system diagnostic menu screen is displayed. Select "Confirmation/Adjustment." In this mode, you can check the factory configuration data relating to the rear view camera, adjust positioning of the guide lines that the AV Control Unit positions over images from the camera, and review any system error history.

Once in Confirmation/Adjustment mode, scroll down the screen to select the "Adjust Guide Lines" or "Display Factory Configuration" switches.



Use "Confirmation/Adjustment" mode in the system diagnostic menu to confirm the factory configuration of the backup camera, or to make adjustments as needed to restore RearView Monitor display functionality.



Select "Adjust Guide Lines" to change the positioning of guide lines as they appear on the in-dash monitor.

See your Nissan service manual AV & Navigation System section for additional details about using the AV Control Unit "Self Diagnosis" and "Confirmation/Adjustment" diagnostic modes. For example, you can adjust the appearance of colors on your in-dash display over a wide range beyond basic red, green, and blue and, of course, black and white. Just use the Nissan Color Spectrum and Gradation functions in the Display Diagnosis main screen.

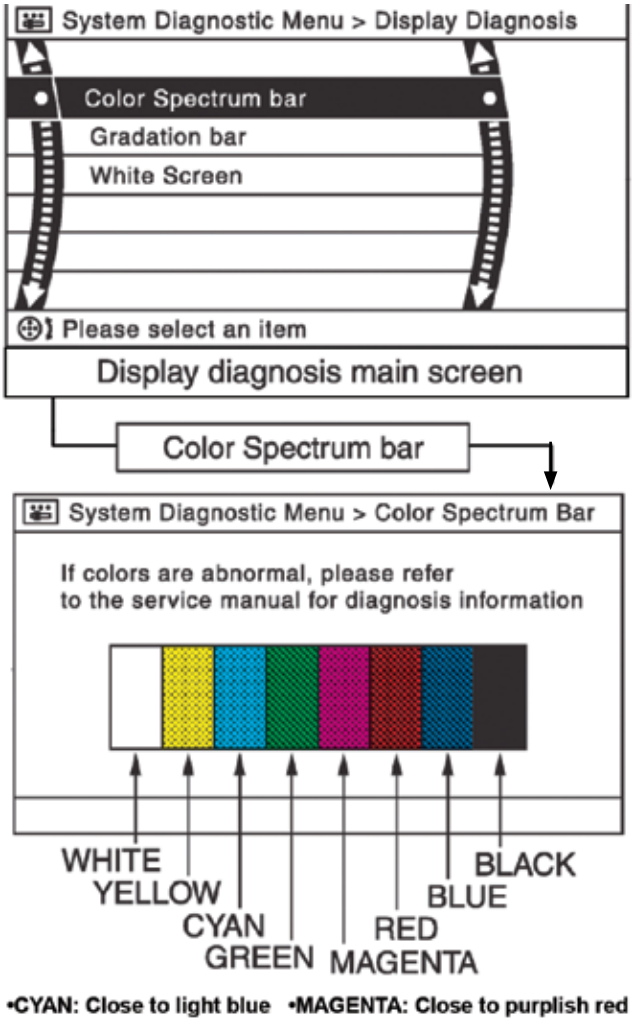
Diagnose the AV Control Unit Using CONSULT III Plus

Because the automated self-diagnosis mode is a switch operation, it cannot start if any malfunction occurs in the CAN communication circuit between the AV Control Unit and the multifunction switch. If the on-board diagnosis menu does not appear, if the in-dash screen does not display anything, or if the multifunction switch does not function, then you should perform a diagnosis using your CONSULT III Plus tool.

If there is a fault with the AV Control Unit, CONSULT III Plus will display trouble code U1200, U1216 or U1310. Refer to the Nissan service manual section AV for diagnostic procedures.

Save Existing AV Control Unit Specifications — Before Removal

In addition to diagnosis and error history, CONSULT III Plus can identify the AV Control Unit part number, save the exact AV system specifications for the vehicle, and write the specifications to the new unit if the AV Control must be replaced. This is of critical importance because the replacement AV Control Unit is shipped without current vehicle specifications.



Use the Color Spectrum, Gradation, and White Screen functions in the Display Diagnosis main screen to adjust the appearance of colors in the in-dash display.

If you remove the existing AV Control Unit before saving its specifications and part I.D. number information, the vehicle will not recognize the replacement control unit. You need the AV Control Unit part number and vehicle specifications downloaded from the existing control unit and stored in CONSULT III Plus in order to configure the replacement unit. Without this data, you will not be able to initialize the replacement camera, and will thus not restore functionality to the RearView Monitor system.

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On Camera

Checking the camera itself is pretty straightforward. If it is receiving the right amount of power from the AV Control Unit and not working, replace it.

First, check continuity between the wiring harness connectors of the AV Control Unit (connector M173, terminal 73) and the rear view camera (connector D192, terminal 1). If there is continuity, you're good. Next check between the AV Control Unit and ground. There should be no continuity. If you get a different result for either test, repair or replace the appropriate harness.

If the harnesses are OK, check the voltage supply to the camera. First, connect the AV Control Unit connector and the rear view camera connector. Turn the ignition ON. Put the transmission in Reverse. Check the voltage between the AV Control Unit harness (connector M173, terminal 73) and ground. If you don't see 6.0 V, replace the AV Control Unit.

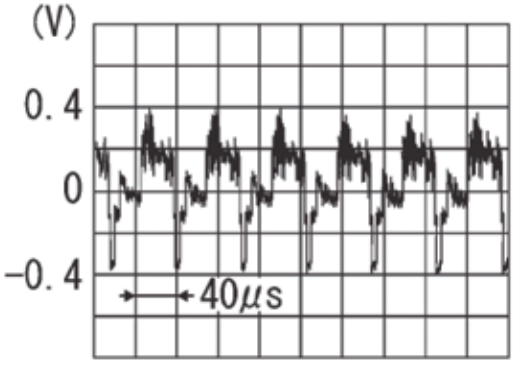
If you see the correct voltage on the ground side, check the camera image circuit. Turn the ignition OFF and disconnect the AV Control Unit connector and rear view camera connector. Make sure there is continuity between the control unit (connector M173, terminal 62), and the camera (connector D192, terminal 3). Then check to see that there is no continuity between the AV Control Unit and ground. If either continuity check shows the incorrect result, repair or replace the appropriate connector or harness.

If all of the above checks out, suspect the camera itself. Re-connect the AV Control Unit connector and rear view camera connector, turn the ignition ON, and set the shift lever in Reverse. Check the signal between the AV Control Unit harness connector (M173, terminal 62) and ground. The voltage should fluctuate quickly between 0.4 and -0.4 V. If not, replace the rear view camera.

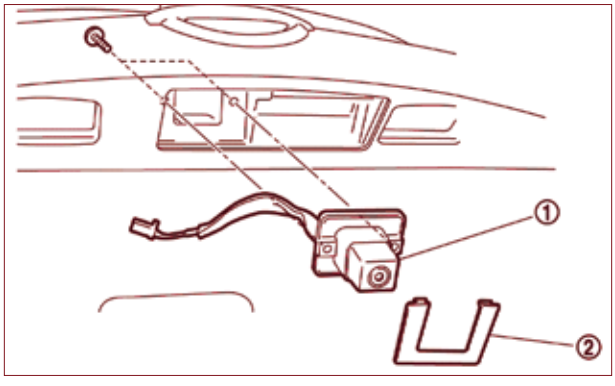
Installation is a bit more involved, although not difficult. In addition to physically mounting the camera, you must also lay out guide lines on the ground behind the vehicle and duplicate their position in the virtual image on the in-dash display. Using the "Confirmation/Adjustment" mode in the display unit, align the lines in the display with the guide lines on the ground, and press "OK" to save the settings to the AV Control Unit. Refer to the AV section of the Nissan service manual for the vehicle you are repairing for the exact "RearView Camera" installation procedure details.

After all repairs are completed, scan again for trouble codes. This will detect any new codes that have been set as a by-product of the repair procedures themselves. It will also confirm that problems identified in pre-repair planning have been properly repaired and that all vehicle systems are communicating as specified.

Now, smile for the camera.



Reference values measured between the AV Control Unit terminal 62 (red wire) and ground, with the ignition on, in a 2011 Murano Z51 with base audio and color display installed should range between 0.4 and -0.4 V.



The rear view camera in the 2011 Murano liftgate is easily removed.

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