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ENDEAVOR BUSINESS MEDIA

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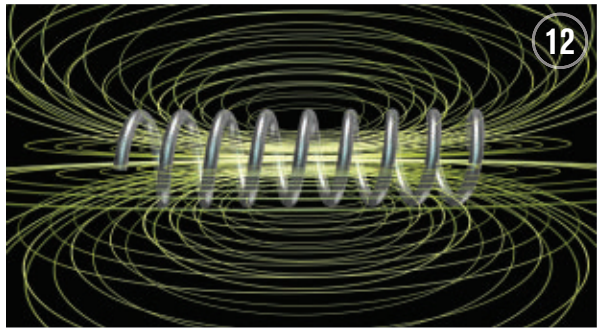
OPERATIONS

8 **HOW TO ADDRESS INFLATION IN YOUR SHOP**

It impacts your business much more than you may be aware.

RICK WHITE



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But spark plugs have a hard life and the stories they can share with a knowledgeable technician can help in the proper diagnosis of any driveability complaint. And that's a Service Done Right!

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LEGISLATION

HOUSE VEHICLE DATA ACCESS CAUCUS IS ESSENTIAL TO ADDRESS CRITICAL CONCERNS

MADI HAWKINS //
Contributing Editor

The ability to access vehicle data is essential to automotive repairers. As cars become more technologically advanced, vehicle data access issues only become more important. The issue of "right to repair" and vehicle data access continue to gain prominence in the national conversation and the legislative agenda.

In Sept. 2022, U.S. Congressman Earl "Buddy" Carter (R-Ga.), a member of the U.S. House of Representatives Energy and Commerce Committee, established the House Vehicle Data Access Caucus (VDA Caucus). In Feb. 2023, Carter joined with cosponsor Congressman Darren Soto (D-Fla.,) re-establishing the bipartisan House Vehicle Data Access Caucus for the 118th Congress. Both Congressmen Carter and Soto are members of the U.S. House Energy and Commerce Committee, which has jurisdiction over the vehicle data access issue.

The "Dear Colleague" letter stated:

"With tremendous advancements in technology over the last several years, vehicles are generating increasing amounts of data that can be accessed by a variety of sources ranging from in-vehicle ports to wireless transmission. As this vehicle data ecosystem evolves, there are growing questions about what data is accessible, to whom, and under what circumstances. Policy and practical issues that must be addressed include who "owns" or controls the vehicle data, who can expand or limit services offered, and who will ensure privacy and cybersecurity."

This caucus will be essential in addressing critical data-access concerns for all stakeholders. The Automotive Service Association (ASA) worked with other stakeholders in the American Alliance for Vehicle Owners Rights (AAVOR) in meetings with Congressman Carter's office on this issue.

In 2021, the Federal Trade Commission (FTC) released "Nixing the Fix: An FTC Report to Congress on Repair Restrictions". This report stressed the importance of preserving consumer choice for third-party aftermarket repairs. Since then, the U.S. Congress has held multiple committee hearings to discuss issues surrounding repair restrictions and data access, in the automotive industry and others.

The "Right to Repair" movement has a history dating back over 30 years, since the 1990 Clean Air Act Amendments required that original equipment manufacturers (OEMs) provide emissions information to independent repair shops. In 2014, some aftermarket organizations signed a Memorandum of Understanding (MOU) with the Alliance of Automobile Manufacturers (OEMs) that stated:

"A manufacturer of motor vehicles sold in the United States shall make available for purchase by owners of motor vehicles manufactured by such manufacturer and by independent repair facilities the same diagnostic and repair information, including repair technical updates, that such manufacturer makes available to its dealers through the manufacturers internet-based diagnostic and repair information system or other electronically accessible manufacturer's repair information system."

This MOU did not account for the mainstream adoption of telematics technology in most modern vehicles, which is where the vehicle data access debate picks up today. In 2020, in Massachusetts, voters passed a "Right to Repair" ballot initiative in a 75 to 25 percent vote that would have codified the right for consumers to choose where they get their vehicles repaired. However, a legal challenge by the automakers has delayed implementation. Other states, such as Maine, are attempting to follow in Massachusetts's lead with their own ballot initiatives.

In Aug. 2022, the California Air Resources Board (CARB) passed the Advanced Clean Cars II regulations. These regulations include a variety of initiatives to set California on the path to zero-emissions by 2035. Most notably for the vehicle data access debate and independent repair shops is the requirement that new zero-emission vehicles have a standardized data connector (such as an OBD-II port) and use standardized communication protocols.

The OBD-II port was originally intended as an access point for emissions information, as required by the 1990 Clean Air Act Amendments. There was concern from independent repair shops that new zero-emission vehicles would not have OBD-II ports since they do not have emissions data. Several states have already indicated that they would follow in California's footsteps in adopting the Advanced Clean Cars II regulations.

Vehicle data access will continue to be an important issue for independent repair shops, and it is important that their voice is heard as a stakeholder in this issue. The Automotive Service Association (ASA) asks shop owners to send a letter to their U.S. House of Representatives members encouraging them to join the newly established Vehicle Data Access Caucus. Send a letter to your representative here: https://www.votervoice.net/ASASHOP/Campaigns/97966/Respond.

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SCHOLARSHIPS

UNIVERSITY OF THE AFTERMARKET FOUNDATION ACCEPTING SCHOLARSHIP APPLICATIONS

The University of the Aftermarket Foundation (UAF) is now accepting scholarship applications through March 31 on its Aftermarket Scholarship Central websites at AutomotiveScholarships.com and HeavyDutyScholarships.com.

Hundreds of scholarships are available, including scholarships for automotive, heavy duty, or collision repair, as well as engineering, business, and IT/cybersecurity.

The scholarships will be awarded for the 2023-24 academic year to students enrolled in four-year and two-year colleges, as well as ASE/NATEF certified automotive, collision and heavy duty/diesel post-secondary programs.

In 2022, 461 scholarships totaling $731,350 were awarded.

Interested parties can text their name and email address to 720-903-2206 to receive information, reminders, and updates about the University of the Aftermarket Foundation scholarship program.

By completing a single application at automotivescholarships.com/apply-online, students will be considered for multiple scholarships for which they are eligible.

A complete list of scholarships offered by UAF and affiliated

industry organizations is featured on the websites with links to information outlining each organization's scholarship details, eligibility requirements and awards.

To be considered for as many scholarships as possible, UAF urges applicants to read the individual pages thoroughly to ensure they include the proper information required by each organization on their application.

MITCHELL 1 NOW ACCEPTING SCHOLARSHIP APPLICATIONS

Mitchell 1 announced it's now accepting applications for its annual Automotive Technology Scholarship,

Now through March 31, high school seniors and college students in the U.S. and Canada who are interested in pursuing a career in the automotive aftermarket can submit applications by visiting AutomotiveScholarships.com.

"We're pleased to offer the Mitchell 1 Automotive Technology Scholarship to a deserving student to help pave their way to a fulfilling career servicing or supplying parts for vehicle

maintenance and repair," said Nick DiVerde, senior marketing director, Mitchell 1. "The scholarship will help students pay for their tuition so they can achieve the skills they need to succeed in this rewarding field."

The recipient will receive a $2,500 scholarship, a check for $500, and roundtrip airfare and accommodations for the winner and a guest to attend the North American Council of Automotive Teachers (NACAT) conference to be held July 10-13, in Houston.

To be eligible, scholarship applicants must be a current student majoring in automotive technology / auto shop repair course work and meet the following criteria:

- Nomination from his/her NACAT instructor
- Minimum overall 3.0 grade point average
- Planning to attend an accredited college or university, or already enrolled in an accredited college or university
- A U.S. or Canadian citizen

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ADOBESTOCK

How to address inflation in your shop

It impacts your business much more than you may be aware.

BY RICK WHITE // Contributing Editor

It's darn near impossible to go anywhere and not run into a news segment, article, or conversation about inflation. Make no mistake: it is an issue that not only affects your grocery bill but is also having a much bigger impact on your business than you may be aware. The truth is that inflation impacts you, your business, your team, vendors, and clients.

Let's start with you because of your impact on every other group mentioned. The truth is that your attitude, beliefs, and expectations will affect everyone you encounter. If you're scared and worried about the repercussions inflation will have, it will infect your team, your clients, your vendors, and your business. However, if you are positively focused, determined, caring, and calm, you will be like a lighthouse to a ship tossed in the storm and bless the people around you who desperately need a break from the negativity.

Let's move on to your business. Why is your level of positivity and confidence a big deal? Because fear makes you shrink. You stop thinking about growth and start thinking about survival. You don't focus on helping your client; you're completely focused on keeping food on your table and not going out of business. This new focus causes you to expect less, do less, and get less, reinforcing your negative outlook, causing you to expect and do even less the next go-round. Before you know it, you're laying off your team and cutting expenses wherever you can. But it doesn't have to be this way. You showing up positive and certain makes all the difference. Yes, you will need to adapt to the current economic climate. Depending on the

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market you serve and the impact inflation is having on them, you may need to defer maintenance, break up repairs over time to help with budgeting, and should offer prime and subprime financing options. The key is that you still expect a "win, win, win" for your client, your team, and you.

Inflation quickly erodes profit, so make smart pricing decisions

As a business owner, you need to make smart decisions right now regarding pricing because inflation quickly erodes your profit. How? Your buying power is drastically affected by inflation. What cost you $100 in January 2019 now costs you $117.91 in December 2022! Inflation silently eats away at your profit if you're not paying attention. If you increased sales by 5 percent in 2022, you actually lost 3 – 4 percent in profit. If your profit falls within the 5 – 7 percent national average, you're hurting at 2 – 3 percent profit! If you had 10 percent growth in 2022, congratulations! (NOT!) Because you didn't grow. Your sales increase was due to inflation. It's critical that you maintain your profit margins. A great website to monitor inflation for your adjustments is https://data.bls.gov/cgi-bin/cpicalc.pl.

Let's talk about your team next. Not only is the doom and gloom of inflation and impending recession from the news shaking their emotional stability and foundation, but they also have a harder time making ends meet. Instead of focusing on performing quality repairs and taking amazing care of your clients, they're worried about how they will survive this downturn. It's important that you bring your positive mindset to work each day, reassuring them that everything's going to be okay. You should also be giving each one of your team a cost-of-living increase. Notice I didn't say "raise." Raises denote an increase based on performance. A cost-of-living increase is tied directly to the inflation rate, so they have the same buying power today as they did when you presented their wage plan to them. At the beginning of 2022, I recommended that my clients increase their labor rate by 10 percent and give each team member an 8 percent cost-of-living increase. Why is this important? When a member of your team is running out of money with month still left, many times, they start looking around to see what else is available that will pay more. We all know how hard it is to replace someone today, right?

Adjust your labor rate for inflation

Do you have a process to adjust your labor rate regularly for inflation? I have some shops that adjust their labor rate annually, semiannually, quarterly, and even monthly. The frequency isn't as important as the process. You don't have to worry about your parts when discussing inflation. I'll talk about that in just a bit.

The last group to consider is your vendors. As an industry, beating up your vendors and techs is common practice to make a profit. That needs to stop NOW! It's time to stop wasting 20 minutes shopping around for the cheapest part and instead, be loyal to the one vendor in your market that cares about the quality they sell and servicing their clients. That would be you. While you don't have to be concerned about having an inflation strategy for parts, your vendor does. Their buying power is eroding just like yours. Give them room to make a profit; it will serve everyone in the long run. When I had a shop, I told my primary parts vendor to charge me 10 percent more than any other shop with my volume, provided that I was the first delivery every time. He loved it, and so did I. Getting vehicles turned around more quickly was more important to me than a couple of bucks. I don't know about you, but I get tired of tripping over dollars to pick up pennies.

> "YOU SHOWING UP POSITIVE AND CERTAIN MAKES ALL THE DIFFERENCE."

You don't have to worry about having an inflation strategy for parts because you have a matrix you use to price your parts. When the cost of your parts goes up, your matrix ensures you're still making a profit. Fun fact: You make more money when you sell more expensive, better-quality parts!

Inflation is a moment in time that can be successfully navigated

Inflation is a moment in time that can be navigated with a positive mindset, a smart strategy, and a clear understanding of its impact on your business. By addressing your own beliefs and expectations, making informed pricing decisions, supporting your team, and maintaining a loyal relationship with your vendors, you can counteract the profit erosion caused by inflation and continue to grow and thrive, even during challenging times. For more information on when to give raises to your team, visit 180biz.com/raises and sign up for a popular webinar that walks through the seven triggers of a pay increase process. I believe the lesson buried within these times is that it's important to stay up to date on economic trends to adjust your strategies as needed. This will help ensure that your business is prepared for changes due to any economic climate and that your clients, teams, and vendors are taken care of and supported. With the right attitude and strategies, you can ensure that your business is ready to weather any storm and ultimately come out ahead.

RICK WHITE is a business-turnaround and exponential growth expert who helps auto repair shop owners go from struggling to stay open to being recognized as the go-to shops in their market. He helps business owners with average shops transform their shop into the shop of the year in the industry.

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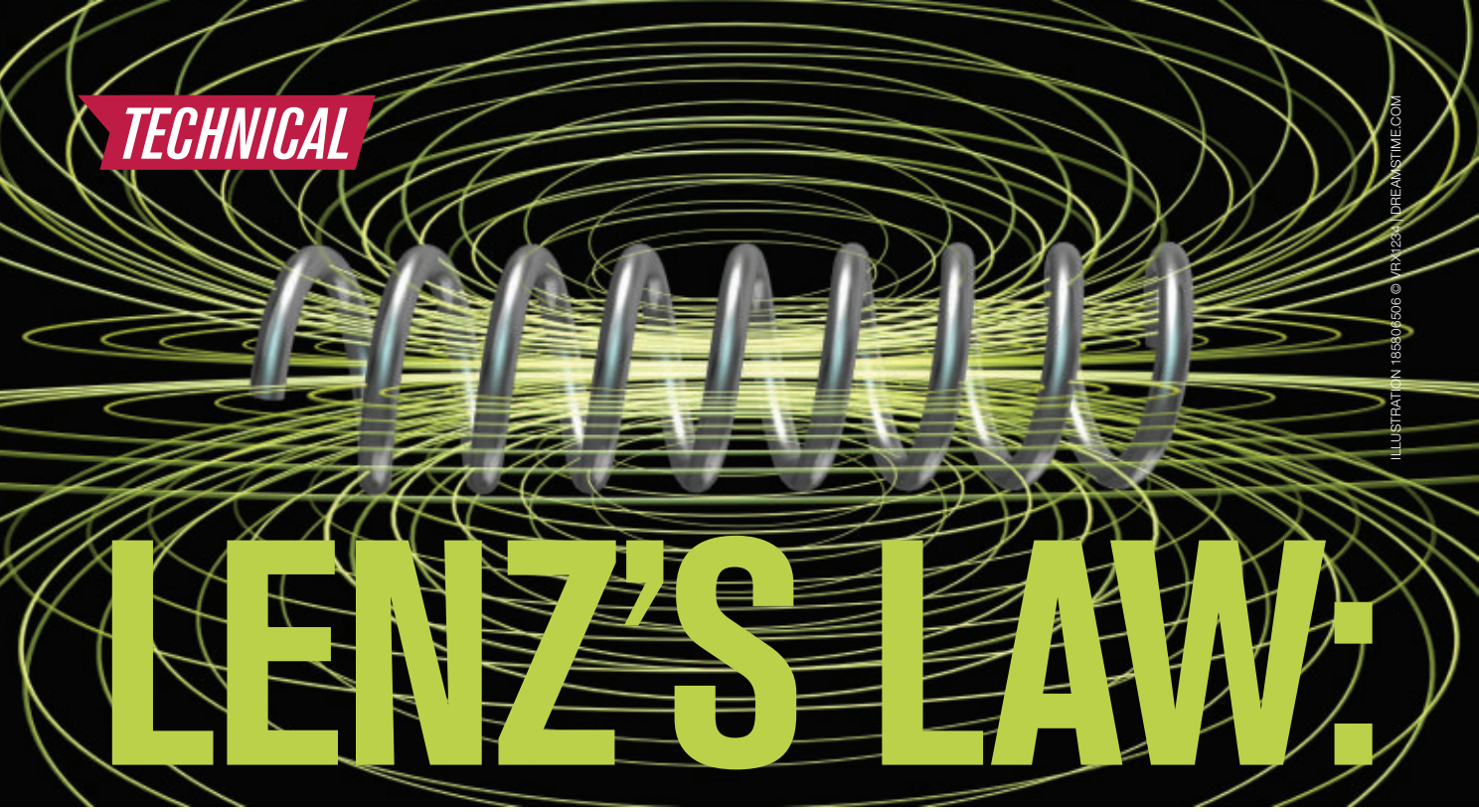

LENZ'S LAW:

THE ANATOMY OF THE CURRENT WAVEFORM

I USED TO BELIEVE THAT ELECTRICAL THEORY WAS FOR BOOKWORMS, NOT TECHNICIANS. BUT I DISCOVERED ITS ROLE IN LOGICAL DIAGNOSTICS IS INDEED CRUCIAL.

BY BRANDON STECKLER // Technical Editor

Just as Ohm's law basically demonstrates how amperage (current flow), voltage (electrical pressure), and resistance (opposition to current flow) all relate to each other, It's Lenz's law that allows us to view the functionality of the components in the electrical circuit. Just because a command was given doesn't mean a function was carried out. If you don't believe me, simply instruct your child to clean his or her room, and you'll quickly realize a command doesn't always produce the intended goal.

Back in the 1800s, a physicist named Emil Lenz discovered that as current flows through a circuit, a magnetic field is created around that circuit. This magnetic field hinders the flow of electrical current. It was this observation that led to what we know as Lenz's law.

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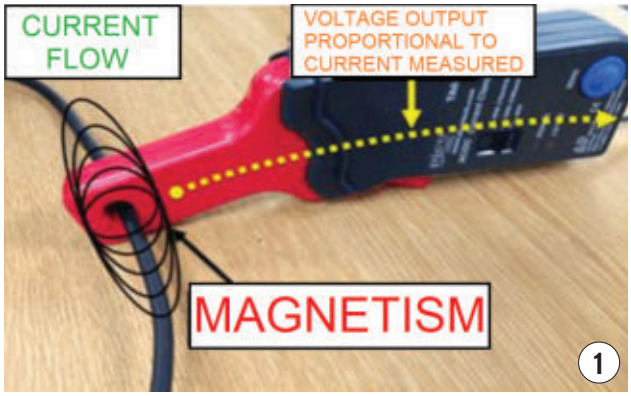
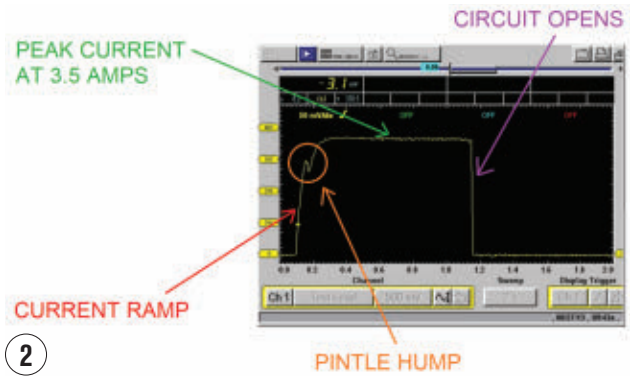


THE CURRENT PROBE encompasses the circuit, measures the intensity of the magnetic field and outputs a voltage corelating to that magnetic field's intensity. Magnetism is proportional to current flow.



THIS KNOWN-GOOD A/C COMPRESSOR CLUTCH CURRENT WAVEFORM exhibits anticipated characteristics like peak current value, a current ramp and pintle hump. This data equates to a complete circuit, proper current flow, and clutch engagement.

Laws create rules and anticipation

What's important about laws of physics like Lenz's law is that it governs how the characteristics of electricity exhibit when a circuit is energized and functioning properly. As mentioned above, as electrical current flows through a circuit, the magnetism created as a result limits the ability of the current to flow.

When implementing a digital storage oscilloscope (DSO or lab scope) in combination with a current probe, we can see the effects of current flow changing over time. This occurs because the current probe (when encompassing a conductor of an energized circuit) is designed to measure the magnetic field created around the conductor **(Figure 1)**. The key is the magnetic field is proportional to the amount of current flowing (more current = more magnetism).

The current probe will output a small voltage that is proportional to the amount of measured magnetism. The end result: The current probe will output a voltage that correlates with the measured amount of current. Just as an ECU correlates a sensor's signal voltage input to a physical quantity such as temperature, angle, or pressure.

In use with a scope, this of course offers a visual representation of the circuit's functionality. We can see not only the command being given but also the response of the circuit activity by way of how the current is flowing through the circuit (or not properly flowing through the circuit).

Why is this important for diagnostic purposes? As diagnosticians, we can "see" the effects of the circuit's behavior through the eyes of the scope/amp probe. We can do so without disassembly, and equally as fascinating, we can do so remotely. Since the current flow is the same anywhere in a series circuit, we can obtain a current signature from an amp probe anywhere in that series circuit (more on this in a future article). We can capture this information easily and efficiently without disassembly. It's truly a game-changer in the world of diagnostics, especially considering how challenging it has become to gain access to certain components in today's tighter vehicle configurations.

Below are examples of common automotive actuators we as technicians encounter on just about every single vehicle we are challenged with. Regardless of what the manufacturers name these devices, it's the operation of these devices that remains the same in almost all vehicles. We cannot change physics, so why not learn to anticipate the signatures produced by these devices' circuits when they are in operation?

Solenoid current signatures

Call it what you will:

- Solenoid/relay
- Evap purge valve/vent valve
- Fuel injector
- A/C compressor clutch field coil

All these devices are basically the same, and so are their operating characteristics. These are inductive devices, meaning when electrical current is flowing through the conductor, magnetism is created. However, this conductor is wound many times over, making it an "inductor." The significance of the inductor is that each coil winding of the conductor amplifies the magnetic field strength more and more. We capitalize on the strength of magnetism to create physical movement.

We can all relate to this by simply holding two magnets near one another. If the poles of the magnets are opposite, the magnets tend to pull each other together. However, the opposite is true if the poles are alike. They will repel/push away from one another. It's this physical trait that allows all the above devices to do what they do when an electrical current is flowing through them.

The first characteristic one should notice in the scope current signature is that the current doesn't shoot straight up but instead appears to ramp in over time. This is Lenz's law at play **(Figure 2)**. As the circuit is energized and the electrical

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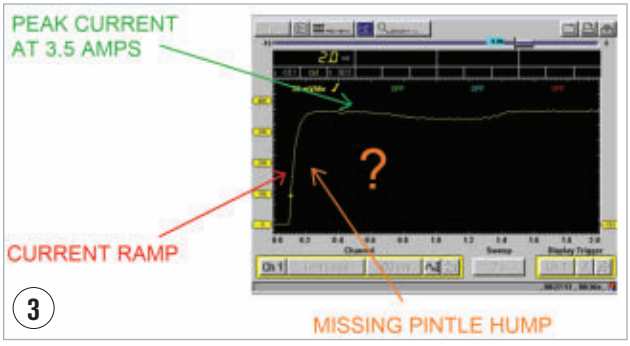
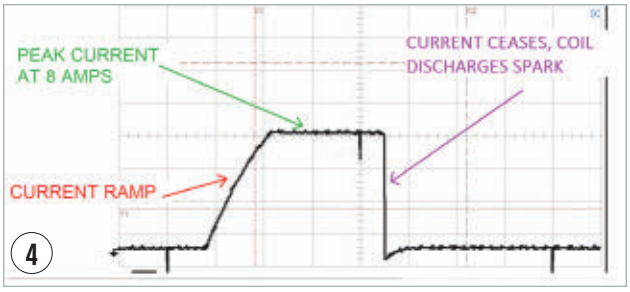


THIS FAULTED A/C CLUTCH CURRENT WAVEFORM'S PEAK CURRENT is adequate (indicating no circuit fault), but the missing pintle hump means the clutch did not engage. The air gap is too wide for the magnetic field to overcome.



THIS HEALTHY, GRADUAL IGNITION COIL CURRENT RAMP displayed allows the coil's magnetic field to output a spark when it collapses.

current begins to flow, the windings of the solenoid's inductor begin to dwell and take on the electrical energy, which creates magnetism.

Remembering that magnetism hinders current flow, the solenoid's windings initially take on a lot of energy. As the solenoid windings dwell, the rate of magnetism created begins to dwindle as the solenoid windings become more and more saturated (just as you become less hungry as you continue to eat more of the meal on your plate). It is for this reason the current flow increases over time.

The second significant characteristic is the actual peak current value. This is governed by Ohm's law (the relationship between voltage, amperage, and resistance). If the total current flow (highest amplitude of the current signature) has reached the amplitude expected, it only makes sense that the available voltage supply and ground supply are not compromised and the resistance value of the solenoid and the rest of the circuit must be proper. Any change in voltage/ground supply or resistance anywhere in that circuit would alter the current being detected by the amp probe and reduce the amplitude of the signature displayed on the scope screen (It wouldn't have reached the 3.5A displayed).

The third significant characteristic is what we commonly call the "pintle hump." The current flowing through the inductor and creating the magnetism is what creates the purpose of the device known as the solenoid. The magnetism is strong enough to pull a spring-loaded pintle valve off its seat against spring pressure. This would be the point where a relay clicks and the injector delivers fuel, or an A/C compressor clutch engages (in this example).

Magnetism creates the physical shuttling of the pintle. As the pintle moves, it too creates a disturbance in the current flowing in the circuit. This is described through another law of physics (Faraday's law), which will be discussed in another article.

As the pintle moves within the magnetic field of the inductor windings, the voltage its movement creates counters the current/magnetism created in those same windings. This countervoltage opposes current flow.

As a result of the countervoltage, the momentary reduction in the current flowing creates the pintle hump in the signature on the scope screen. The physical movement of the pintle is being witnessed (confirming the relay clicked, the injector opened, or the compressor clutch engaged). Equally as important is if the anticipated pintle hump is missing, it infers that the device didn't function as intended, and more time to investigate why is justified **(Figure 3)**.

From this same capture, we can see that the peak current flow is the same as when the device functioned normally in the previous capture. This indicates no electrical fault present (same 3.5A measured) but likely one mechanical in nature, preventing the pintle from shuttling (this A/C clutch had an excessive air gap issue).

Step-up transformer signatures

The job of the step-up transformer is to take an input voltage such as source/battery voltage) and step it up to a higher voltage value. We've seen this device for nearly 100 years as the ignition coil. The coil is a necessary device because it can produce enough electrical potential to jump the spark plug's gap within the pressurized combustion chamber.

Very similar to what was described above for the solenoid current signature, the ignition coil signature also displays as a ramp and for the same reasons described by Lenz's law **(Figure 4)**. Magnetism and electricity are very closely related. As the ignition coil takes on energy and the current signature ramps up, the magnetism is generated over time (in this case, several milliseconds). However, when the ignition coil dwell ceases, this is when the coil discharges and a spark is output. The resulting ignition firing event correlates with that point of the coil current ramp.

In this faulted capture, although the peak current value is roughly the same, we can see that the coil ramp is relatively

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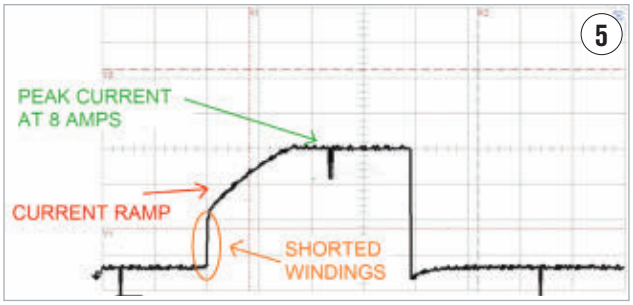
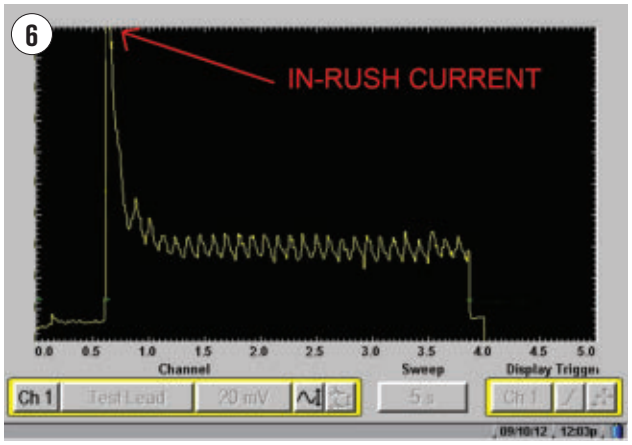


THIS STEEP COIL RAMP is evidence of shorted primary-coil windings. Less magnetic field is created, which results in less coil output. The cylinder may misfire under certain conditions.



THIS DC BRUSHED MOTOR CURRENT WAVEFORM has a ton of diagnostic data. Information about the starter motor, related circuitry, engine speed, and engine cylinder health can all be derived from this one capture.

steep when compared to the known-good capture of Figure 4 **(Figure 5)**. As you are aware, the current trace displays current over time. This steep rise indicates an increase in coil current (due to a shorted inductor winding).

It's logical to question why a misfire may be experienced with a coil shorted in this manner. Let's think this through:

A shorted coil causes an increase in current flow (less resistance).

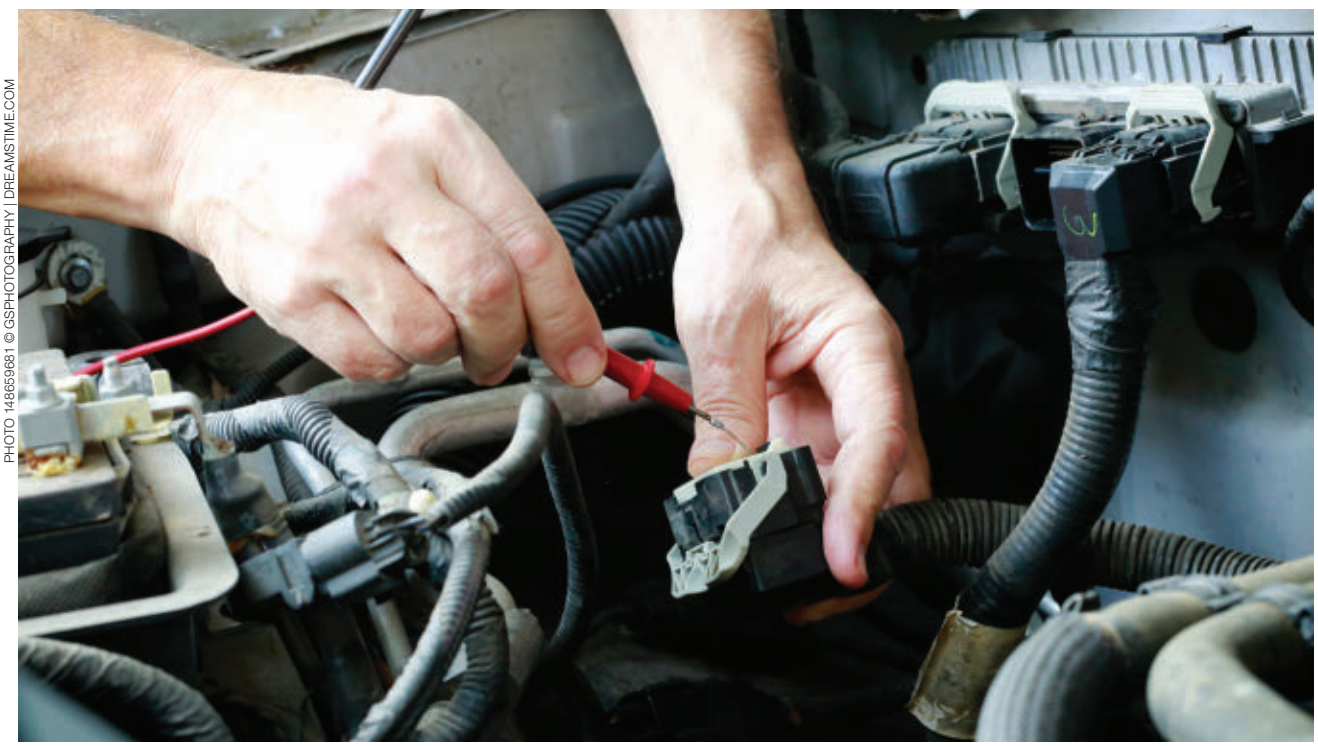
An increase in the current flow should yield an increase in magnetism. This should increase coil output, but it does not; why?

When the windings of the inductor are shorted, the path for electrical current bypasses several of the windings. Of course, this reduces resistance and increases current, but there is less magnetism due to fewer energized windings; this results in less coil output. If coil output is reduced to the point that an adequate spark event cannot be sustained, a misfire will occur.

DC motor signatures

Like the other two devices described above, the DC motor is also an inductive device. The same principles apply because it is the magnetism created around the armature of the motor that opposes the magnetism from the permanent magnets surrounding the armature (causing repulsion). We can monitor the operation of a DC motor with a scope and current probe in the same fashion.

As can be seen in the current trace, the initial high-am-



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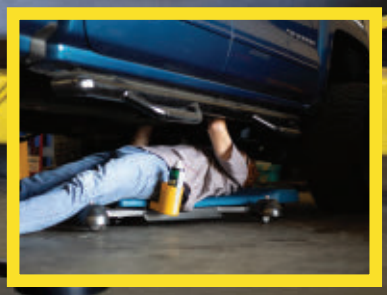
WORK MEETS COMFORT



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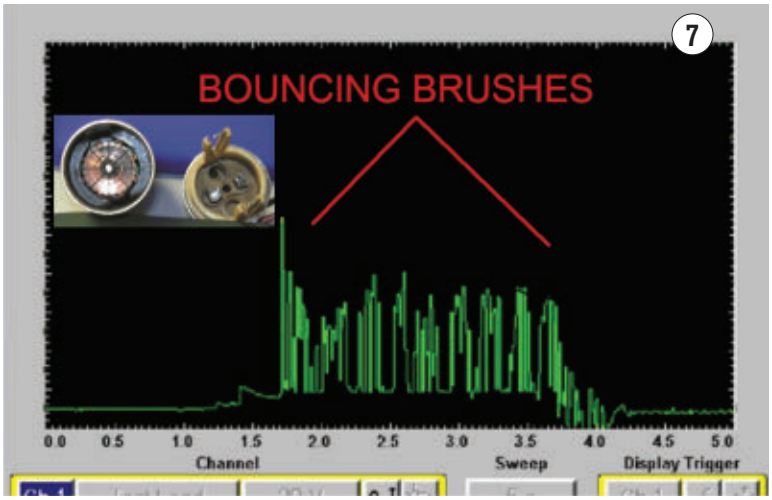
plitude spike is what is referred to as inrush current **(Figure 6)**. By now, you should be familiar with why this occurs. Upon energizing the DC motor circuit, the current rushes into the windings. As the windings begin to dwell and take on energy, a magnetic field is created, that opposes the permanent magnets and causes the motor to spin.

The rotating armature creates its own counter-voltage (like the moving pintle of a solenoid). As the armature spins faster, more counter voltage opposes the initial current flow and creates the reduction of current flow seen in figure 6. Although there is more diagnostic value in this capture (as it can also be used preliminarily for engine health analysis), this will not be discussed in this article.

Being able to recognize these characteristics and understand the principles of DC motor operation will allow us to recognize when faults are present, preventing operation or allowing intermittent symptoms to surface.

Seen here is another current signature of a starter motor (DC motor). However, this one displays a fault. The symptom exhibited is an intermittent very slow engine cranking condition **(Figure 7)**. The telltale characteristic of the failure exhibits as rapid changes in current flow. This is visible even when the symptom isn't present.

The significance is in the design of the DC motor. Spring-loaded brushes contact commutator bars that allow current to flow through the rotating armature. As these brushes age and wear, the contact area of the brushes and bars degrades. If poor contact is made, the current flowing through the armature is reduced, and (you guessed it) so, too, is magnetism. This is what causes the intermittent slow-cranking condition the customer complains about.



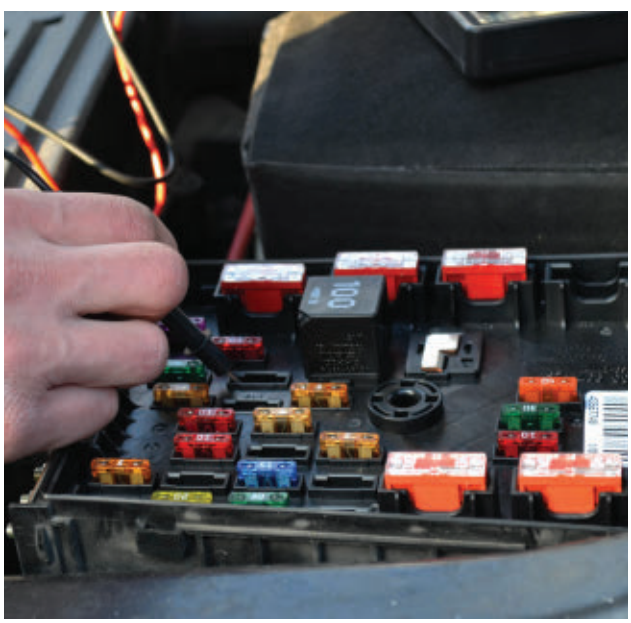
THIS INTERMITTENT SLOW-CRANKING ENGINE was easily diagnosed from this capture, displaying poor current flow due to a brush/commutator bar contact issue.

The significance is the symptom exhibited mimics that which is created from a dead battery, but it's the results of the test that tell us what truly is deficient in the circuit. Finding success in implementing such testing techniques takes the appropriate tooling and a lot of practice. However, it would all be a game of memorization without an understanding of the physical laws at play in the captured signatures we rely on for answers.

The voltage in a circuit designed to perform work (actuator circuits) is simply the command to operate. It's the current that tells the story about the circuit's functionality. Invest in a scope and current probe and watch your diagnostic success increase many times over.

Being able to see a circuit's functionality is a game-changer. It takes our diagnostic skillset to the next level. Regardless of how often your diagnoses are correct, without being able to prove component functionality you are indeed guessing.

These tools and testing techniques will take the guesswork out of typical diagnostics and propel your success and confidence in the work bay forward. The best part is all the vehicles we encounter basically function the same. The data doesn't lie!



BRANDON STECKLER is the technical editor of *Motor Age* magazine. He holds multiple ASE certifications. He is an active instructor and provides telephone and live technical support, as well as private training, for technicians all across the world.

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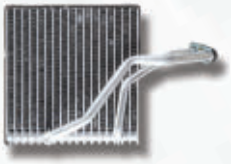

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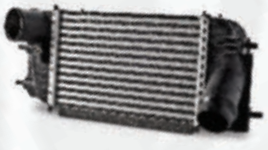

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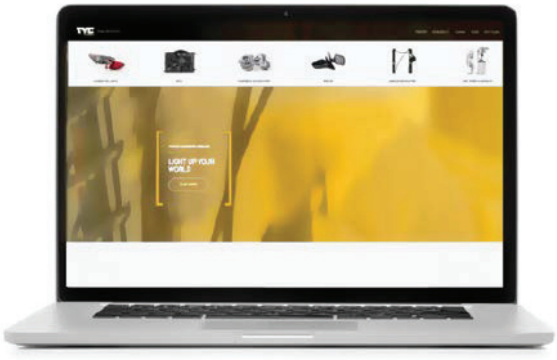

Is your shop ready for a service EVolution?

The auto industry is investing more than $1 trillion into shifting new vehicle production from internal combustion power to electric. Forecasters estimate EVs could account for up to one third of the North American market by 2029. And with dozens of electric models from domestic and import brands already on the road, chances are good that if you haven't yet had an EV in your shop, you will soon enough. Investing in technical training and equipment will ensure you're ready when the time comes.

How to lift

Most EVs are designed with their high-voltage batteries under the vehicle. The battery packs are large – taking up most of the undercarriage – and heavy. As a result, the OEM-recommended lifting points are often on the far edges of the vehicle frame.

To safely lift an EV, you'll need a vehicle lift with sufficient rated capacity and the capability to engage with the lifting points. Leading equipment manufacturer BendPak, Inc. has re-engineered its two-post lifts to meet the challenges of EV service.

The new BendPak AP Series two-post lifts feature a patent-pending swing arm design that offers greater extension and retraction than ever to reach even the most difficult lifting points. And their low profile means you can access both in-close and far-out lifting points without damaging vehicle ground effects.

For extra strength and peace of mind, BendPak strategically increased the high-strength steel used in critical load-holding components and invented an Automatic Swing Arm Restraint System (ASARS) designed to prevent dangerous, unplanned movement of the lift arms. ASARS offers twice as much holding grip as traditional systems and can withstand more than 2,000 pounds of side force if an improperly spotted vehicle shifts during service.

AP Series lifts are the most customizable, versatile two-post lifts BendPak has ever made, providing excellent return on investment. They offer the convenience of wide or narrow installation and their BI-METRIC swing arms enable a single lift to be used for both symmetric and asymmetric lifting. A choice of heights can accommodate cars, SUVs and even high-roof cargo vans — regardless of powertrain.

How to lower

To ergonomically remove a high-voltage battery pack, you'll want to invest in a lifting table. BendPak's new Mobi-EVS™ EV battery pack and powertrain lifting system makes it easy to lift, lower and position high-voltage batteries, as well as internal combustion engines, transmissions, fuel tanks, transaxle assemblies and more. Its compact design and easy-glide swivel casters let this space-saving scissor lift move effortlessly throughout the shop.

The Mobi-EVS delivers wireless, rechargeable electric/hydraulic operation which improves operator efficiency by eliminating the need for a manual hand crank or foot pump. Its twin-cylinder design provides maximum load stability for lifting and lowering, while an automatic safety lock system secures up to a massive 4,000 pounds at working heights up to 75". The Mobi-EVS also comes standard with an impact-resistant UHMW protective cover on the lift table, to protect against wear and tear.

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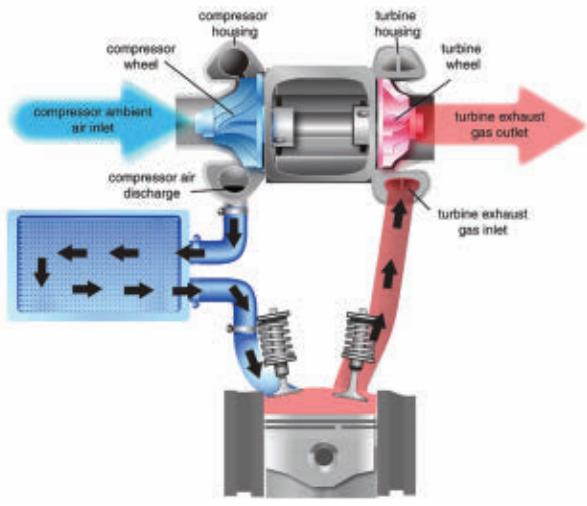
A Closer Look: Turbochargers

In an effort to increase fuel efficiency, maintain performance and reduce emissions, vehicle manufacturers are adding turbocharged engines to their lineups at a significant rate. Over the next five years, the turbo service market will continue to experience substantial growth.



What Causes a Turbocharger to Malfunction?

Symptoms of a malfunctioning turbocharger include loss of power, excess smoke (in diesel applications), high fuel consumption, overheating, increased exhaust temperature, and oil leaks from the turbo. Debris or a leak in the ductwork can damage or block the intake or exhaust systems, impacting turbo performance.

A whistling noise under the hood (different from normal turbo spooling) could be caused by a boost leak or inadequate turbo clearances. A rotor assembly that has seized up or is difficult to rotate might be caused by degradation of the oil. Clearances that are out of specification may be associated with a lubricating oil issue.

If the turbo has been damaged by foreign material, there will be clear evidence that on the turbine or compressor housings. Damaged blades indicate that the turbo needs to be replaced. Metal in the intake tubes may indicate a damaged engine.

Common Trouble Codes

Two typical diagnostic trouble codes for turbos include P0299 (underboost) and P0234 (overboost). An underboost code could be due to a wastegate that's stuck in the open position or a leak between the compressor and throttle. Causes of overboost include a wastegate that's stuck in the closed position, a wastegate vent solenoid that's stuck in the vent position, and leaking or disconnected control hoses.

Replacing a Faulty Turbo

If the determination has been made that the turbo is faulty, you'll need to install a new one. Remember to check for low oil, dirt ingress, and oil contamination with coolant. Ensure that the air ductwork is sealed and perfectly clean, there is proper lubrication and cooling at the turbo, and fresh engine oil is bled through the turbo. A new, quality air filter should be installed on the vehicle.

When selecting a replacement turbocharger, remember that quality matters. Standard® offers a complete line of 100% ALL-NEW (not remanufactured) premium Turbocharger Kits. Standard's New, No-Core Turbocharger Kits are available for gas, diesel, domestic and import vehicles.

Complete Turbo Kits

Standard® Turbocharger Kits include the hardware and gaskets needed for a complete turbo repair.

Standard® Turbochargers are engineered to ensure each performs with precision for the application it is replacing. As a quality-plus offering, each Standard® new Turbo Kit includes everything needed for installation, including a factory gasket kit and new hardware. Each New Turbocharger is also protected by a 3-year/36,000-mile limited warranty and carries no core charge – no core returns! Standard® also offers a drop-ship program on all Turbocharger Kits to help you get your customer's vehicle back on the road quickly.

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For more information on diagnosing and replacing these components, search "Turbo" on the StandardBrand YouTube channel or visit **StandardTurbos.com**.

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HELPING YOUR CUSTOMER MAINTAIN HIS OR HER VEHICLE IS A RESPONSIBILITY THAT GOES BEYOND POTENTIAL PROFIT.

BY ROY DENNIS RIPPLE // Contributing Editor

As automotive technicians, there are three targets we try to hit when we service a vehicle:

- Fix it right the first time, on time
- Fix it most cost-effectively
- Get paid appropriately

But a fourth objective seems to get lost in the shuffle, which is our responsibility to the vehicle owner. In most

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cases, a person only communicates with his or her vehicle through the technician. We are translators, speaking both automobile and human. You could even say we're bilingual.

Therefore, the customer must depend on us to keep their vehicle running safely and efficiently. For most people, this means keeping their life running safely and efficiently. A person's vehicle usually makes the top-two list of the most important non-living things in their life. When it goes bad, so does their world. This makes it our responsibility to offer the customer a comprehensive report on the condition of their vehicle, along with recommendations of how to best handle any present or pending issues.

When I was a kid, I read an article (yes, there were printing presses way back then) entitled "The Auto Mechanic, America's Unsung Hero." The article considered what would happen if all the automotive technicians went on strike, compared to other tradesmen like plumbers and electricians. The author inferred that soon the trucks would stop trucking, and the work vans would stop working, leaving the plumbers and the electricians "pulling a little red wagon filled with tools." The author's outlook was slightly extreme, but you get the point. What we do is important, and along with it comes great responsibility.

The journey to a car's reliability and longevity starts with maintenance. A schedule of recommended maintenance intervals is available from all manufacturers. Unfortunately, many car owners see the owner's manual as an object that gets in the way when searching the glove box for napkins. It's up to us to study the maintenance schedule and recommend the applicable services. It is not always easy for the customer to understand the importance of performing scheduled maintenance and the consequences of ignoring these services. Here's a list of maintenance items and the things a car owner and the tech should know:

TRANSMISSION FLUID EXCHANGE

During the initial transmission break-in, the transmission fluid becomes contaminated with metal and clutch material particles. The filter captures most of this debris, but some particles are suspended in the fluid. This can lead to premature wear of transmission components. The dumping of debris into the transmission fluid continues throughout the life of the transmission but is more prevalent during break-in. Because of this, the first transmission fluid exchange is crucial.

Automatic transmissions run at very high hot temperatures. Transmission fluid breaks down over time due to these high temperatures, causing transmission slippage and premature transmission wear.

Beware of the customer who requests a transmission fluid exchange. Quite often he or she is experiencing a transmission concern, and a transmission fluid exchange will not fix it. Always road-test the vehicle before changing the transmission fluid. Verify there aren't any transmission issues you could get blamed for later ("Ever since you replaced my transmission fluid").

COOLANT EXCHANGE

Antifreeze has a high boiling point and a low freezing point, and it remains stable during rapidly changing engine operating temperatures. Antifreeze conducts heat very well, making it ideal for removing heat from the engine and transferring it to the atmosphere through the radiator. Antifreeze has low viscosity, making it easy to pump, and it aids in lubricating the water pump. Antifreeze loses all these properties with age.

Electrolysis occurs when electrical current flows through the cooling system. Electrolysis causes quick deterioration of cooling system components. The water pump, radiator, heater core, hoses, and the engine can all fall victim to coolant deterioration. The chances of this happening are much greater with old antifreeze. The coolant should be replaced at the first sign of cooling

system component failure and proper maintenance intervals.

BRAKE FLUID EXCHANGE

The most crucial property of brake fluid is that it maintains a stable viscosity and compressibility throughout its entire operating temperature range, from very cold to very hot. The negative property of brake fluid is that it's hygroscopic, which means it absorbs water.

Water in brake fluid significantly lowers its boiling point. The dry boiling point of DOT 3 is 401 degrees F. The wet boiling point (defined by the temperature at which the fluid boils after absorbing 3.7 percent water by volume) is 285 degrees F. That is a big difference. Since brake fluid temperatures at the calipers can easily exceed 200 degrees F, this could be a problem.

The fact that water freezes also tends to complicate things a bit. Water-contaminated brake fluid turns dark, damaging master cylinders, wheel cylinders, calipers, and hydraulic control units (HCUs). Notice how dark the contaminated brake fluid is **(Figure 1)**. A pressure bleeder connected to the master cylinder is the best way to flush the brake system **(Figure 2)**.

DIFFERENTIAL OIL EXCHANGE

During regular differential operation, gears mesh at high speeds, high torque, and high temperatures. This causes metal to contaminate the fluid, especially during break-in. Limited slip differentials use clutches that release clutch material into the fluid.

All differentials are vented. The vent must be open to the atmosphere as an escape route to prevent pressure build-up from the hot fluid. But this also allows a passageway for environmental hazards such as dirt and water to enter the differential housing.

Differential fluid exchange intervals are dependent on operating conditions. High loads like towing or off-road use dramatically decrease the time between differential fluid exchanges.

SPARK PLUG REPLACEMENT

Spark plugs don't last forever because they work so hard. Depending on the situation, they can be asked to fire well over 1,500 times per minute into a combustion chamber that can easily reach temperatures of 4,500 degrees F.

Most manufacturers specify spark plug replacement intervals of 90,000 to 100,000 miles, and shorter for heavy-duty usage. Older, lower-mileage engines are also candidates for a fresh set of spark plugs. The guy who putts around town, rarely reaching full engine operating temperature for long, plays havoc on spark plugs. The longer an engine is in cold enrichment mode, the longer the spark plugs are firing into a cold, rich mixture. Spark plugs need time to burn away that nonsense while firing into a clean (near 14.7:1 air/fuel ratio) combustion chamber.

I suggest you recommend a spark plug replacement on any vehicle over seven years old with original plugs, regardless of miles. Replacing spark plugs will most likely increase fuel economy and performance. You can say this to a customer with confidence.

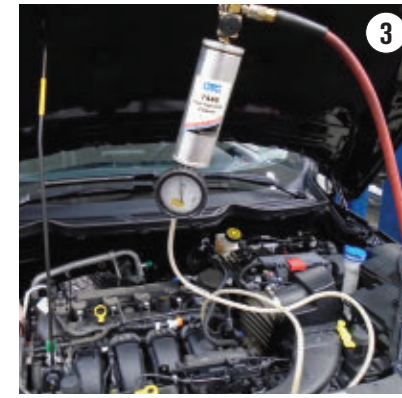
FUEL INJECTOR AND INDUCTION SYSTEM SERVICE

Most of you remember that gummy, varnish-like goo that would build up inside carburetors. We have no reason to believe that the same deposits aren't manifesting inside fuel injectors. The spray holes at the end of an injector are very small, and the armature and the needle need to move freely without sticking. Deposits are the reason for most of the fuel injectors we replace that are clicking but not properly delivering fuel.

A sound fuel injector cleaning system pushes cleaning solvent (at the system's correct operating pressure) directly through the injectors, bypassing the rest of the fuel delivery system. Cleaning the injectors should increase fuel economy and performance. Ensure the engine is at operating temperature before performing a fuel induction ser-

BRAKE FLUID that has absorbed water becomes dark and murky. It should be changed before it damages hydraulic brake components.

BRAKE PRESSURE BLEEDER hooked up to a master cylinder reservoir. A pressure bleeder is the best way to replace the brake fluid.



FUEL INDUCTION CLEANER attached to the fuel rail and set to factory fuel pressure.

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vice **(Figure 3)**. The air/fuel mixture ratio while running a cleaner is much leaner than on gasoline, so a cold engine doesn't run well on it.

Most manufacturers do not suggest performing a fuel induction service on a turbocharged engine. Their studies have shown that turbochargers can be damaged by small pieces of carbon dislodged from the combustion chamber by the cleaner.

POWER STEERING FLUID EXCHANGE

That silvery substance you see floating in the power steering fluid is from the inside of the aluminum rack and pinion steering gear assembly. The rotary valve turning inside the housing and the piston moving from end to end create metallic mud in the fluid. This is why it's not uncommon to replace a power steering pump due to steering gear failure. Replacing the fluid will surely increase the life of both components.

THROTTLE BODY SERVICE

Because of the positive crankcase ventilation (PCV) system, sludge on the throttle plates is unavoidable. Manufacturers have been coating throttle plates and throttle body housings with a non-stick substance, so the sludge won't stick. This doesn't seem to be working well; the sludge still sticks. Throttle body sludge messes with the throttle position sensor (TPS) signal because it keeps the throttle plates from closing to the position the powertrain control module (PCM) recognizes as idle. This can cause a surge at idle. If the sludge is extreme, it can cause the throttle plate to stick during acceleration, especially when cold **(Figure 4)**. This is more than enough to change the TPS signal at idle and to block a portion of the idle intake air.

So here is the conundrum. The manufacturer says not to clean the throttle body because the cleaner removes the protective coating that's supposed to keep the throttle body from sludging up. However, there are times when the only way to fix a driveability issue is to clean the throttle plates or replace the throttle body. My call.... if it's sludged, it must be cleaned.

THROTTLE BODY SLUDGE blocks idle air and possibly changes the TPS value at idle.

DO NOT RECOMMEND A BATTERY SERVICE when you see this. A new cable and possibly a battery replacement are needed to fix this one.

BUILD DATE STAMPED on the sidewall of a tire. This tire was manufactured during the 27th week of 2021.

THIS ROTTING AND CRACKING is why you should look past the tire tread and scrutinize the entire tire.

BATTERY SERVICE

The battery service is relatively basic. I load-test the battery, clean the terminals and the battery posts, and spray some protectants on the terminals. Here are some things to consider.

Dirt on the top of the battery can drain it of its charge. This oily crud is a conductor, allowing current flow between the two battery posts. So, cleaning the battery should be part of your service. Load-testing a battery is not enough. Perform a thorough visual inspection of the battery.

I have seen many cracked, leaking batteries pass the load test. Check the seams for seepage and the sides for bulging. Batteries are the leading cause of "no-starts." The vehicle owner needs to know if there is a problem.

When you see a terminal covered in corrosion, spray the corrosion away and inspect the integrity of the terminal and the cable before selling the customer a battery service. Sometimes you'll find the remnant of what used to be a healthy terminal underneath all that corrosion **(Figure 5)**.

SAVE THE TIRES

It's common practice to take measurements of the tires' tread when servicing a vehicle. If the tread is low, inform the

customer that they need tires. Besides tread depth, we should also be looking at the other things that the tires have to tell us.

Right alongside tire depth in the order of importance is tire age. In time, tires start to dry rot. You can see the cracking on the sidewalls and inside the treads. When the rubber rots, it becomes hard. This means you can have a tire with limited traction even with a tread depth of 8/32".

The tire production date is located on the sidewall after the DOT number, manufacturing plant, and brand digits. The production date is represented as a four-digit number. The last two numbers are the year of production, and the first two represent the week. So, a production date of 2721 means the tire was produced in the 27th week of 2021 **(Figure 6)**. Most manufacturers recommend replacing tires over six years old. I have seen many tires cracking at four years old, so use your discretion **(Figure 7)**.

Uneven tire wear means that something is not right. We all know the signs of wheel alignment issues. Out-of-spec camber causes inside or outside wear, and a misaligned toe angle can cause the tires to feather. Loose steering and suspension parts can cause similar tire wear, so check the front end.

An overloaded vehicle can cause front tire wear due to the front suspension being lifted as the rear is sagging. This is a common problem with drivers loading their 1/2-ton pickups as if they are 3/4-ton pickups. When you see uneven tire wear, find the cause and inform the customer. Sometimes it's as simple as incorrect tire pressures, but the customer needs to know. Tires are not cheap; save the tires.

EMBRACE YOUR ROLE AS A TRUSTED AND DEPENDABLE SERVICE PROVIDER

Being an automotive technician is an honorable occupation that commands respect and makes you someone who is always in demand. Ask anyone who has been stuck on the side of the road. You are near the top of the list of people most folks need to trust and depend on. Being responsible for keeping a person's vehicle safe and reliable is a noble vocation. Embrace it.

ROY DENNIS RIPPLE is a Ford Senior Master Technician and an ASE Master Technician with more than 30 years' experience in the automotive industry. As an automotive journalist, he is the recipient of a 2020 Azbees Award and a 2020 Tabbies Award. Ripple is currently working full-time as the shop foreman at a Ford dealership. He lives in New Jersey with his wife, three dogs, and two motorcycles. He can be reached at *ripkrypton@gmail.com*.

TECHNICAL

BREATHE EASIER

CABIN AIR FILTERS PROVIDE FRESH AIR FOR DRIVERS AND PASSENGERS WHILE REDUCING STRESS ON HVAC SYSTEMS.

BY EDWIN BETANCOURT // Contributing Editor

In recent years, as part of a greater focus on health and safety, more people have been giving thought to the quality of the air they are breathing. Pollutants, pollen, and odors can all have a major impact on our health, as well as the comfort and enjoyment of our personal spaces. Many individuals and businesses have chosen to purchase air filters or filtration systems to help reduce the number of particulates in their spaces and to provide fresher and cleaner air. Shop owners can help do the same for drivers in their vehicles by replacing cabin air filters regularly.

As people spend more time behind the wheel or as a passenger in vehicles, a clean and properly operating cabin air filter is extremely important. By identifying when a cabin air filter needs replacing, shop owners have an excellent opportunity to help improve the comfort and health of their customers, capitalize on a preventive maintenance step, and improve the overall performance of a vehicle's HVAC system.

Pungent pollutants

Just like oil and fuel filters help keep contaminants out of the liquids that are crucial to healthy engine performance, cabin air filters keep particles out of the air inside the vehicle cabin. Cabin air filters remove pollen, pollutants, dust, soot, and exhaust gases from the air entering the vehicle. The filters also help reduce unpleasant odors from bacteria and fungi. Some cabin air filters include active carbon formulations that can capture particles as small as 0.01 to 2 micrometers (microns).

Showing a vehicle owner the side-by-side difference be-

ON THE ROAD

tween a brand-new cabin air filter and the dirty one removed from their vehicle can clearly demonstrate that the air inside their vehicle is not as clean as they may want it to be.

An ounce of prevention

Most shop owners know that the easiest way to prevent problems in the future is by being proactive. If a vehicle is about to embark on a long road trip or is entering a heavy driving season, preventive maintenance is the best way to keep it running smoothly and out of the shop. In addition to an oil change, wiper replacement, and tire rotation, shop owners can educate drivers on the advantages of replacing their cabin air filter.

Not only does a new filter help keep the air inside the vehicle free of pollutants, but it also helps reduce the overall strain on the HVAC system. As the cabin air filter becomes clogged, the vehicle's HVAC system is forced to work harder, reducing the efficiency of the heating and cooling systems that keep the vehicle comfortable. When the HVAC system is stressed, it also affects the driver's ability to see clearly out of the vehicle as the HVAC system works harder to clear window condensation. All of this extra effort can lead to potential problems for the blower motor, as it works harder to circulate the air.

Explaining to a customer how the efficacy of their heating and air conditioning system can be negatively affected by an old cabin air filter is a simple way to increase service opportunities.

The season is here

With the spring and summer driving seasons approaching, there will be an increase in the amount of pollen in the air, exhaust gases on the roadways, and the need for efficient air conditioning to keep vehicles comfortable for drivers. Many

"NOT ONLY DOES A NEW FILTER HELP KEEP THE AIR INSIDE THE VEHICLE FREE OF POLLUTANTS, BUT IT ALSO HELPS REDUCE THE OVERALL STRAIN ON THE HVAC SYSTEM."

vehicle manufacturers recommend replacing cabin air filters every 10,000 - 30,000 miles, but others see the replacement as a seasonal need. As drivers take longer trips and spend more time inside of their vehicles, they can become more aware of the quality of the air and the performance of their HVAC systems.

Shop owners should also be aware that the region in which they live can have an impact on how frequently a cabin air filter needs to be replaced. Vehicles that spend more time driving in urban areas are subjected to more exhaust gases and pollutants, while vehicles that drive in rural areas are more likely to be affected by dust. Both can lead to the need to replace the cabin air filter ahead of manufacturer intervals.

Whether the air inside the vehicle is becoming stale, or the vehicle owner complains of a weak HVAC system, shop owners should be aware that a clean cabin air filter is a key component of keeping both their customer and the vehicle healthy and running smoothly. MA

EDWIN BETANCOURT is an associate productmanager for Continental's Automotive Aftermarket business, North America. Betancourt joined Continental in 2022, having previously spent over a decade as an automotive technician, assistant foreman, and trainer. He holds a BA in Business Administration and Marketing from DeSales University, an Associates in Arts in Business Administration from Lehigh Carbon Community College, and multiple certifications in automotive technology from the Universal Technical Institute.

PHOTO CREDIT: WILL ADD DREAMSTIME INFO IF WE USE THIS

FAILING TO PLAN COULD BE PLANNING TO FAIL

WHEN IT COMES TO DIAGNOSTICS IN THE REAL-WORLD, NOT HAVING A GAME PLAN IN PLACE MEANS SHOOTING FROM THE HIP. THAT ALMOST NEVER ENDS WELL.

BY CHRIS FARLEY // Contributing Editor

Being an efficient mobile technician means seeing a plan through, and it is very rewarding. I get to see a lot of strange issues and problems that some days make me question my career choice. Luckily, I love what I do and when I finally figure out those tough issues, I get that rush/high that carries me through. That said, I also get called out on many issues that are easily diagnosed with basic testing, research, or understanding of the systems in question.

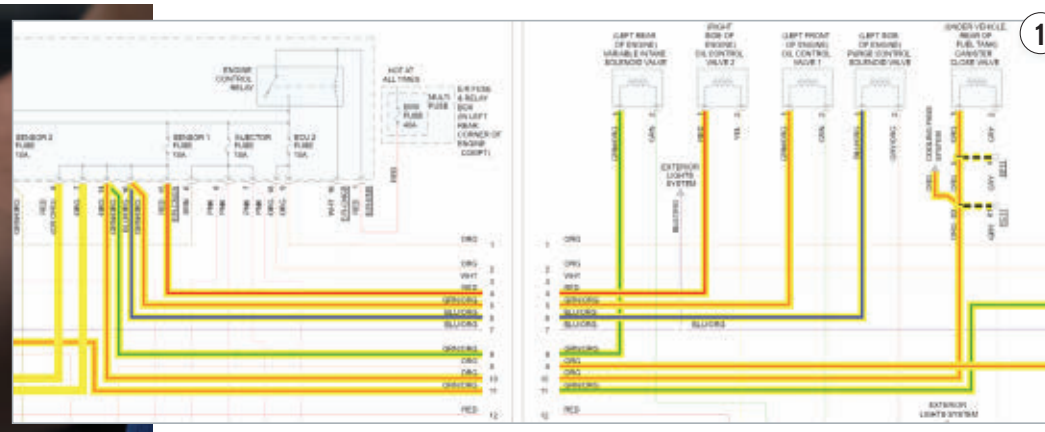
Now, in my early days (in the bays), I had my share of misdiagnosed vehicles, and I do still make mistakes (just a lot fewer and farther in between). Like some of my current customers, I, too, had a pile of tickets to get through and have made those rash decisions to save time. Many times, it meant I had skipped over the basics and moved further down the diagnostic process than necessary (sometimes influenced by previous problems I had seen or "silver bullets" I had read).

My position now does not allow me the opportunity to make those mistakes because if I misdiagnose now, I am not only putting my reputation on the line; I am also putting my customer's reputation on the line. I have learned to develop a solid path with every diagnosis and to never knowingly skip over the basics (even if I have been told they were previously tested and verified).

Unbelievably, I still have customers who have no information systems available in the shop. Furthermore, the extent of their scan tools is a simple code reader. I also deal with body shop techs who are experts in their craft, but when it comes to wiring or communication systems, they are about as skilled as I would be in the art of repairing a body panel.

On the path to greatness

Following a consistent path to approaching diagnostics is critical. Regardless of the problem, you start every job by taking the same steps (so you do



IN THIS PICTURE, you can see that all the related systems were fed power from the same Sensor 1 fuse.

not miss basic faults or end up taking the wrong turn at the fork in the road). My process may not work for you, but I have found it to work best for me and it maximizes my time. So, take something from it to add to yours, or just find what works for you and go with that.

After I get a description of the problem from the customer, I connect my scan tool and perform a full vehicle scan. I do this even if the problem I am there to fix seems like it would not require a scan (because you may get an open-circuit code or have a new component installed that needs to be set up/configured to work in the vehicle). You may find a code in another module that could influence the problem you are there to look at, or even a completely different issue that the customer is unaware of. Also, never forget the "ever since you" situations. Be wise and save your scans and document your findings. This may be a lifesaver in the future.

While my vehicle scan is running, I perform my visual inspection looking for new components, and recent mechanical/collision repairs (especially those less-than-proper repairs, like an air inlet hose wrapped in duct tape, or vacuum port held on with a glob of epoxy).

I also like to perform a quick battery test. Low battery voltage causes so many communication codes and issues with no-starts because immobilizer systems (and other modules) can lose their configuration during a low-voltage start attempt. Adequate voltage is what allows computers to maintain their memory.

When my scan is done, I review my results and go to repair info for circuit description, operation, and diagrams. I pull up code set criteria and TSBs (Technical Service Bulletins) and review some sites for common failures. I have been an independent/aftermarket tech my entire career, so I work on all models. I may think I understand how a system works (because I've dealt with that system so many times on other vehicles). But in different vehicles, that same system may operate differently, which could cause a misdiagnosis.

Having a full understanding of the system/components in question will allow you to develop a targeted approach with "go/no-go" tests to get quick, accurate results. These steps can take anywhere from 10 to 30 minutes, but the time spent doing this could save minutes, hours, or even days (as you will see in the following case studies). These were not difficult issues to diagnose, but they are presented to show how solid processes and understanding save time and prevent misdiagnosis.

Does it need an ECM or not?

We will start with an easy one. This one came from a small local shop that has a very old-school mentality. It has limited scan tool abilities and no information system. It does mostly large mechanical repairs and powertrain replacements.

I was called in to look at a 2013 Hyundai Elantra for a list of codes. This shop owner remembers the early days of computers in vehicles that would set multiple, random codes and would often lead to a diagnosis of a failed module. When I see a list of codes, I think of voltage or ground issues, because a module can only function if it

has what it needs to work (including, but not limited to, proper voltage and ground supply).

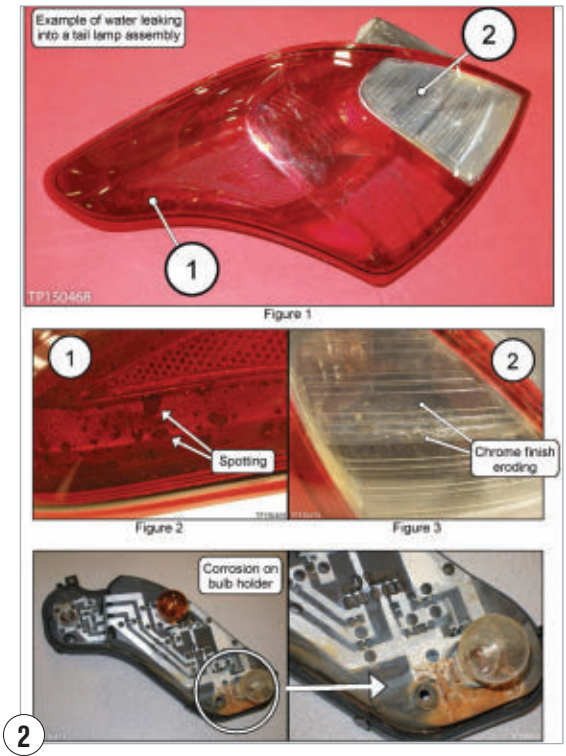
I started my process and found multiple sensors have already been replaced. I suspect the only reason I was not there to program a "new" module was because of the price of a new Hyundai ECM. The scan showed a list of codes as described. I saw codes for HO2 sensors, the purge solenoid, and the vent solenoid, as well as codes for intake/exhaust valve control solenoids. They were all circuit codes, and a quick review showed they share a common power source **(Figure 1)**.

Testing the fuse revealed it was blown. Installing a new fuse resolved the issue, and I then cleared the codes. Keep in mind that something caused this fuse to blow. Measuring the current in the circuit, I could see no issues. So, I informed the customer to drive the car for a while, but there was a good chance that one of the components already replaced was likely the issue that caused the fuse to blow.

The hesitating Versa

I was initially called upon to program/set up a used transmission on a 2014 Nissan Versa. I arrived to find a dead battery (which is something I see way too often as a mobile tech), so there were no fault codes stored. I proceeded to perform the requested tasks.

Some Nissan CVT transmissions have calibration data for the solenoids stored in the control valve body of the transmission. So, when you replace the unit, the files need to be loaded into the replacement transmission control module to allow proper operation and control of the transmission. Once that is done, it is required/advised (depending on the unit being used or rebuilt, to keep a warranty) to update the software in the TCM to the newest available level. This customer opted for the update as well, even though it was a used unit. After performing the procedures, I took a quick test drive and verified the vehicle was operating properly at that time.



THESE ARE THE ATTACHED PHOTOS for Nissan TSB #NTB15-082. Water ingress is causing electrical faults.

About one month later I was called in to perform the same procedure (but this time on a remanufactured unit from the dealer). When I asked what happened with the other unit, I was told it was bad from the start. Now in hindsight, I could have asked more questions and pushed a little harder, but here I was a little guilty of being biased because of all the Nissan CVT failures I had seen. I performed the requested tasks and moved along.

The following week I got a call from… (guess who?) … You got it, from the same transmission shop, and guess what? They had received a badly remanufactured unit and somehow convinced the dealer to send them another one. I then called "shenanigans."

When I got to the shop, I told them I was only there to set up the latest unit, but If I had the whole story, I could diagnose the problem with the vehicle. I was told the diagnostic guy was off that day, but I did get all the work orders with the notes. I saw the original complaint of hesitation and check engine light with a P0705 stored. The notes said they followed the diagnostic flow chart, which led to the transmission needing to be replaced.

At this point, I cleared the old files and loaded the new ones into the TCM and performed the required steps. I then started the diagnostic process. I test-drove the vehicle, and I got the code to set. I scanned for DTCs and found P0705 "transmission range sensor A circuit." With a quick check of repair information, I got the criteria and description of the code. With a quick check for any TSBs or common issues, I located TSB #15-082: 2012-2014 VERSA SEDAN; HESITATION ON ACCELERATION AND/OR DTC P0705 (**Figure 2**).

This TSB advised looking for indications of moisture in the taillight causing corrosion of the circuit board. The TSB also states that if corrosion is found, replace the tail lamp assembly and not the CVT assembly. One more thing…before testing, I pulled a wiring diagram for the transmission system. I want to say here that I've been an aftermarket/independent tech my whole life, so the redrawn diagrams are my comfort zone (which can create a problem now and then, so I usually check the OEM (Original Equipment Manufacturer) diagrams as well). The ALLDATA information system I'm using offers both styles of wiring diagrams.

First, a visual inspection of the taillights indicated a new right-side unit,

TEXA

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- WiFi - BT Compatible

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- 20lb Tank In Cabinet
- Android Touchscreen
- Full Auto Functions
- WiFi - BT Compatible

KONFORT 750R

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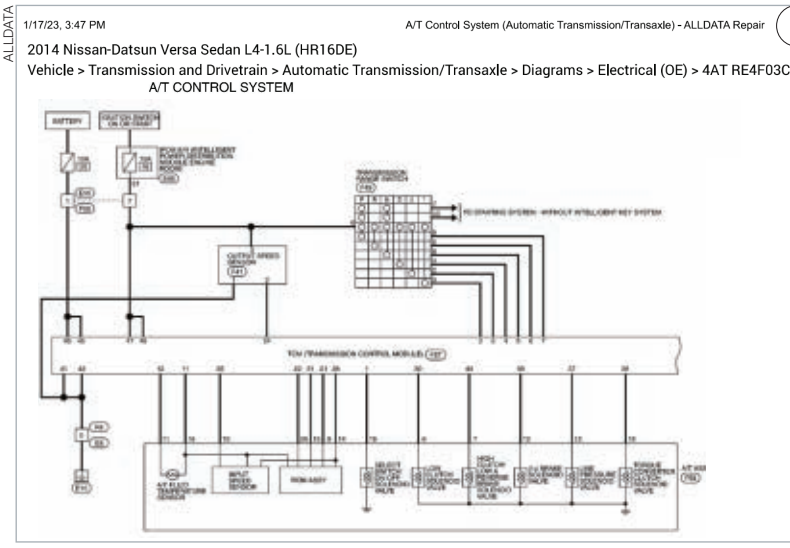
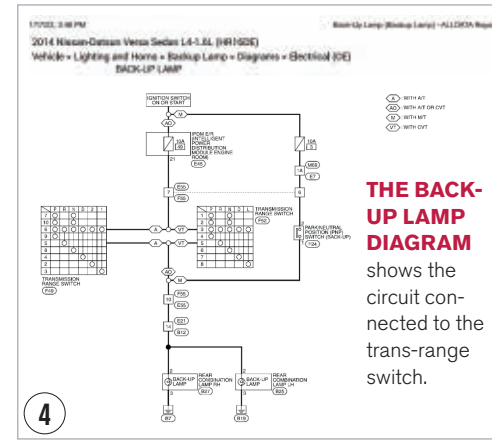


3 **TRANS RANGE SWITCH DIAGRAM** does not show that the circuit also supplies backup lamps.



THE BACK-UP LAMP DIAGRAM shows the circuit connected to the trans-range switch.

4

but the left side was old and showed signs of water intrusion. I removed the back cover to inspect the board and to no surprise, there was corrosion across the circuits. Although I had the exact description of everything in the bulletin, I was not ready to pull the trigger and say, "this is it." After all, there have been four transmissions in this vehicle up to this point, so I need to verify this truly is the cause.

The transmission circuit diagrams do not show the connection, but if you look at the backup light circuit, it shows that the circuit between the range sensor and the TCM also feeds the backup lights **(Figures 3+4)**.

On this vehicle, battery voltage comes into the transmission range switch. As gear range selection is made, that voltage is sent through the corresponding pin to the TCM to indicate the gear selected. The description of the code says, "two or more range signals say 'on' (show voltage) simultaneously."

If I disconnected the range switch, there should have been no voltage present on the wiring going to the TCM. But, with lights on and the foot on the brake, voltage was present on the reverse wire. If I disconnected the taillight, the voltage would be gone. We now had a confirmed diagnosis, and when I told the service manager, he said, "Huh, that would explain why the parts department asked me if there was water in the taillights when I ordered the second unit. I didn't look but I just told him, 'No'."

The total time for diagnosis (including the research/testing) was between 20-30 minutes. I know some techs are fast, but I am sure that the time I spent researching was a lot faster than swapping the transmission, (even including the time for a third visit to the shop for the same issue).

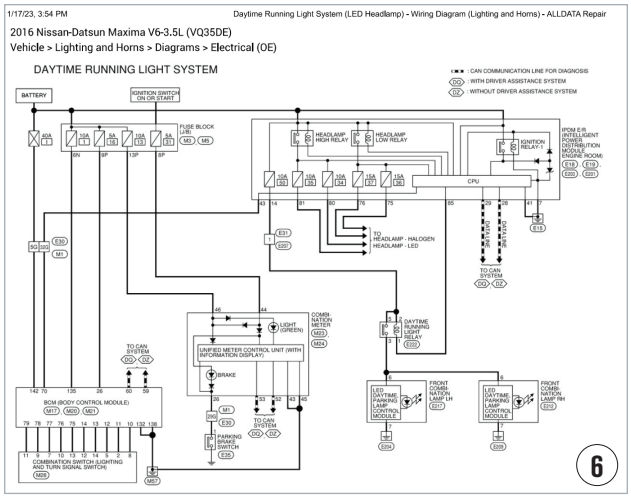
The flashing Maxima

My last case study was a 2016 Nissan Maxima at a collision shop. The vehicle was previously released to the customer and had returned with a low beam out along with the complaint of the DRLs (daytime running lights) flashing like a strobe when you turn the vehicle off.

The shop determined the aftermarket headlamp was faulty and thought it could also fix the flashing light complaint (well, they were half-right). The low beam worked, but the lights were still flashing. So, they called me in to

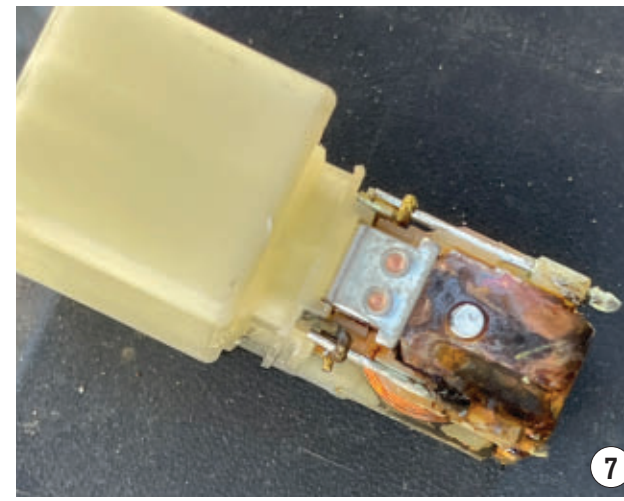
5 **LUCKILY, THE BUMPER WAS OFF**, allowing easy access to the relay for testing (which was not mounted to where it was supposed to be). It was hanging underneath the right headlight and collecting rain water.

ALLDATA



DISPLAYED HERE ARE THE CIRCUITS IN QUESTION and how they relate to the fault exhibited.

ALLDATA



THE CASE OF THE RELAY WAS CRUSTED with rust and a large deposit of the black burnt substance, the root cause of the fault.

look. They called me on Friday afternoon, so I did not get there until Monday after the car had sat in a heated shop for the weekend with the battery disconnected.

Once the battery was connected, we saw one flash of the lights, and all was then good. So, now the problem had become an intermittent issue, which is what we all "love" to hear. The shop couldn't let the customer take the car with the potential of it happening again. Was there a possibility that the battery disconnection had reset the module, and all is good now? I guess I've seen stranger problems fixed by battery resets, but I'm not OK with taking that chance right now.

So, I began the diagnostic process. The vehicle was already apart, so access to the wiring was a non-issue **(Figure 5)**. I scanned the vehicle, and the only code I retrieved was for a trans shudder (big surprise). I checked TSBs and common faults with no luck. I pulled the wiring diagrams and began my testing.

The DRLs are powered through a relay that has voltage supplied via a fuse in the IPDM (intelligent power distribution module). That relay is controlled with a ground that also comes from the IPDM **(Figure 6)**. When the relay is activated, it provides voltage to the lights on both sides.

So, what can cause the lights to come on and flicker? The chance of it being a wire intermittently and repeatedly shorting (while the vehicle is turned off and sitting still) is highly unlikely. At this time, the shop manager stopped over to see what I had found so far. I explained the situation and operation and he concluded that it must be the IPDM (since that sits on the side the deer hit). I advised him that it was a possibility that it was causing the issue, but I was not ready to call anything conclusively until I had evidence.

My next step was to locate the relay. The bracket the relay is fastened to had been left unbolted and was hanging upside-down (the light bulb in my head began to flicker). I removed the cover of the relay box, and I removed the relay. I inspected the terminals, and everything looked clean. I removed the case of the relay itself for inspection. Rust and a black, burnt substance on the relay contacts and inside the relay's case were present **(Figure 7)**. The substance was moist to the touch as well.

What I believe happened is the bracket was left unbolted and water had gotten in the relay. Between the water and rusted relay assembly, I believe the voltage was arcing across the contacts and causing the issue. I advised the manager and tech of what I had found and told them to replace the relay and make sure they mounted the bracket properly (so as not to allow water to gather in the relay again).

As you can see in these examples, there is time spent preparing before testing. Understanding how the circuits work (so you can prepare for the proper tests) could prevent wasted time. This might only save you a few minutes in certain circumstances, but it could also be a few hours or even several days in other scenarios, not to mention the amount of money spent on unnecessary parts and the labor to install them. Remember, it's not only your reputation as a tech that is in question but also the business you represent.

CHRIS FARLEY is a 25+ year veteran of the industry and is currently the owner and operator of Automedic LLCs, a mobile programming & diagnostic business servicing both auto body and repair shops in central NJ.

DREAMSTIME

PREDICTIVE MAINTENANCE BRINGS REVENUE OPPORTUNITIES

BY JOHN BURKHAUSER // Contributing Editor

Maintaining any machine or device is proven to help it provide a long and mostly issue-free life. And like many things in this day and age, maintenance itself has become more complicated. In this article we will discuss the different types of maintenance along with the best ways to monitor and document each vehicle for maximum return on investment and use.

There are three basic maintenance approaches that companies may take — each with pros and cons:

- Reactive maintenance (sometimes referred to as corrective maintenance)
- Preventive maintenance
- Predictive maintenance

Reactive maintenance

Reactive maintenance is basically waiting for the vehicle to actually break down before addressing any wear or issues. Hence why it is sometimes called corrective maintenance, since you only address the failed items. The hope is that the repairs will cost less than any maintenance that could have taken place. I've seen some fleets approach maintenance this way, retiring vehicles just before the original factory warranty expires.

The pros to reactive maintenance are that there are no costs or planning needed up front. Only when the item fails is when the cost and process to restore it to working condition are put into place.

The cons of being reactive can include additional costs

FOR THE WEAR HISTORY TO WORK in helping predict future vehicle needs, it needs to document everything, even newly installed brake pads (green). Documenting the pads' condition as good, fair (yellow), or bad (red) can also help in limiting your shop's liability, since you can always refer back to previous inspections if a question arises.

that result from the failure, such as towing, lost time, or additional damage that can result from the failure.

Preventive maintenance

The next level of maintenance is preventive. The idea here is that regularly scheduled checks and maintenance are performed in the hope of avoiding down time for the vehicle.

Preventive maintenance pros are that the vehicle has scheduled downtime that can be worked around for minimal interruption of its use. Failure costs are reduced due to catching developing issues before they damage other systems and parts. Because service and checks are scheduled along with previous wear data being available, this helps enable the vehicle to operate as best as it can for a long time.

Cons to preventive maintenance include the need to adhere to monitoring vehicle operations and a set schedule which can be overbearing for the shop if many vehicles are involved. These schedules need to be based on a number of methods for determining when a vehicle needs to return. These methods are time, use, and vehicle condition. Combining these three for best results can be difficult and complicated.

Additionally, preventive maintenance cannot eliminate all possible vehicle breakdowns, though it will lower the number of them. So, in a way, reactive maintenance is a part of any preventive maintenance plan.

Predictive maintenance

The next level of maintenance is predictive. The idea here is to gather as much information as possible to predict when the vehicle is going to need service or repair. The information used can include live data from vehicles, input from inspections, and recording of vehicle wear history for comparison. Parts requirements can also be known in advance, decreasing waiting times during service having been pre-ordered based on the data.

Pros of predictive maintenance are that it reduces the time required to maintain a vehicle, saving time out of service including time worked on, and reduces parts costs and availability issues. When used properly, predictive maintenance can greatly reduce loss due to breakdowns.

Some of the cons of predictive maintenance include the overall cost and complexity of the system, which can include artificial intelligence software, vehicle monitoring devices and even specialists that may be needed to interpret the data. In other words, many of these predictive systems would only benefit large fleet operations.

With this understanding of the three approaches to maintenance that can be used with fleets, we can put together a system that works for your shop and any fleets that you may service. The best part is that these same ideas can be applied to your individual customers in a similar manner, which results in them returning on a regular basis and helping you boost your bottom line and customer satisfaction at the same time.

Action plan

Though the intervals have extended further and further, the oil change is still the main service that gets done on vehicles. Drivers and fleets understand the importance of fresh oil in their vehicles. Even with the extended intervals, the oil change is still the most frequent service vehicles get done. So why not use this fact as a foundation for the vehicle's other needs?

Using digital software that tracks a vehicle's mileage and time on the road, in addition to knowing the OEM or oil type requirements, we can calculate the average miles driven per day and predict when we expect the next oil change to be due. The next appointment can be automatically added to the shop calendar when the reminder sticker is printed. At the same time, a recommendation is posted in the management system.

With the same printing step, the software sets up a text reminder that is sent automatically to the fleet manager or driver prompting them that the next service is coming due in a week. Plans can be made to get the service done with little or no effect on the vehicle's availability.

An advanced scheduling option is also available to take advantage of the miles driven per day calculations. Other items that have recurring intervals for service can also be connected to the oil change. For example, if a vehicle is getting the yearly Pennsylvania safety inspection done with the oil change, the next appointment and automatic text reminder for next year's inspection will be set.

MEASURE TIRES ACROSS THE TREAD and write the measurement in 32nds in chalk on the tread. Each subsequent inspection will show the number(s) going down, counting down till "retirement".

Digital inspections

Digital inspections can also be part of this simple form of predictive maintenance. Each time a vehicle is in for service, its condition should be documented in pictures, video, and text. The first time a vehicle is in, a baseline inspection should be performed. The idea here is to document the vehicle completely as it is. Each inspection that occurs after this inspection will refer to the baseline inspection, showing the amount of wear that has occurred since it was done. I call this documentation a "wear history."

For example, by using pictures, video, and descriptions, the wear history will show tread depth of the tires decrease over time. It doesn't matter if the tread depth is measured in 32nds of an inch or in millimeters; the measurements will decrease, counting down to "retirement" or when it's time to replace the tires.

Based on the digital inspection pictures and measurements, the time of tire replacement can be predicted with a fair amount of accuracy. Being able to show this wear across inspections can also help prepare the fleet for the upcoming replacement.

Document everything

A wear history can apply to other items such as brakes and even oil leaks. During an inspection a seep can be documented. During each inspection afterward, the leak can be checked to see if it was getting worse, progressing to being wet and even dripping and requiring attention.

For the wear history to work in helping predict future vehicle needs, it needs to document everything, even newly installed brake pads, for example. Note that also documenting the vehicle condition whether it is good, fair, or bad can also help in limiting your shop's liability since you can always refer back to previous inspections if a question arises.

Recording the life cycle of parts requires the customer or fleet to return to your shop for subsequent inspections. Returning customers have a higher level of trust in your shop and therefore are more likely to buy more.

Sending copies of the vehicle inspections to the fleet manager can also result in a predictive maintenance type behavior. Before sending a vehicle to your shop based on earlier recommendations and reminders, the manager can look over the previous inspections and determine, based on the wear history, that the tires will need to be replaced on the next visit. Knowing this, they can reach out to your shop in advance so you can get the proper tire type in stock if you don't already have them — saving both your shop and the vehicle down time waiting on them to arrive the day of the service.

Following the same suggestions and steps mentioned above, this predictive type of maintenance can be applied to your regular customers with the same results. Get repeat customers with oil changes and other services based on their actual driving habits. With digital inspections, document their vehicle's vital components during each visit, building a wear history that will help you use a predictive type of maintenance program to prepare them for needed future work.

JOHN BURKHAUSER is an auto repair specialist with over 30 years of experience. He has expertise ranging from A Level and ASE Certified Master Technician to shop foreman, advisor and shop manager, to automotive trade school instructor and writer.

LOSE A BATTLE TO WIN THE WAR?

PHOTO 28962887 © KELPFISH | DREAMSTIME.COM

OFTEN, THE TAKEAWAY FROM A CHALLENGING DIAGNOSIS CAN'T BE LEARNED FROM A BOOK, AND THAT IS PRICELESS TO A DIAGNOSTICIAN.

BY BRANDON STECKLER // Technical Editor

WELCOME BACK TO ANOTHER EDITION OF "THE DATA DOESN'T LIE," A REGULAR FEATURE IN WHICH I POSE A PUZZLING CASE STUDY, FOLLOWED BY THE ANSWERS TO THE PREVIOUS ISSUE'S PUZZLE.

Just last month, I found myself neck deep in a 1994 Ford Ranger. For 16 hours of my life, this vehicle left me scratching my head. It presented with one symptom, was repaired, and couldn't leave because it had a seemingly unrelated new symptom.

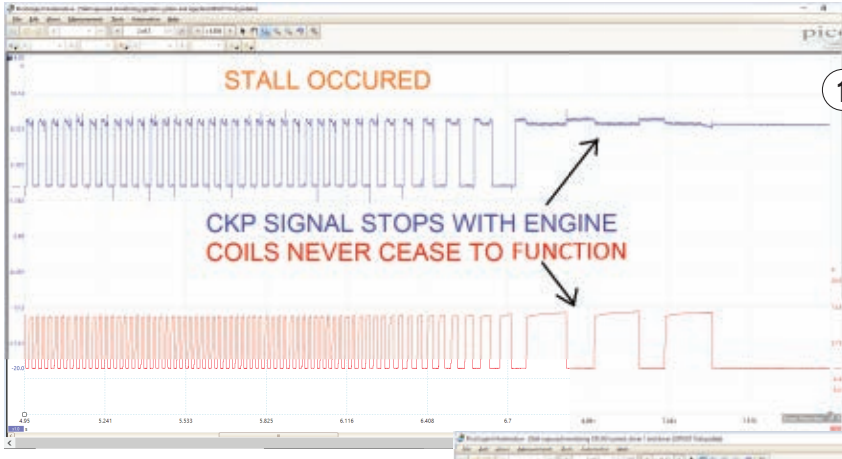
The vehicle was towed to a shop as a "crank/no-start" situation. My good friend and knowledgeable tech, Lee, determined the cause was a lack of spark (no coil operation). Lee replaced the crankshaft position sensor (CKP) and ignition control module (ICM) to remedy the situation.

He also got the OK to replace the timing belt because of its age. After he installed the new timing belt, CKP, and ICM, the vehicle was then started without the accessory drive belt installed (Lee simply wanted to verify proper timing belt installation before committing to fully reassembling the engine.) The engine started immediately and idled smoothly. The engine was shut off and reassembly was complete. However, upon restarting the engine, it would barely idle before coming to a stop within a second or two.

Retracing our steps

Aware that the drive belt was not installed during the successful engine start, Lee strategized to remove the belt once again and reattempt an engine start. With the belt removed, the engine started and idled smoothly.

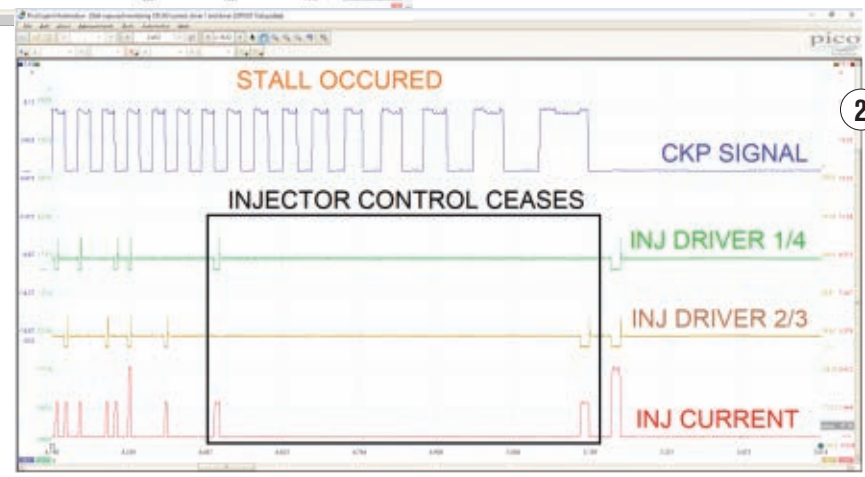
After inspecting the accessory drive pulleys for binding, he found no issue. The drive belt was reinstalled and this time, the alternator was unplugged. A successful engine start and smooth idle followed. He installed a replacement al-



1

DATA CAPTURED IN THIS FASHION is known as action/reaction testing, and it tells a story. The blue CKP trace displays the engine stalling. However, the red ignition coil ramps are still present. Together, this indicates that the stall did not occur from a loss of spark.

SIMILAR TO FIGURE 1, this also tells a story. The injector pulses disappeared, and the engine stalled as a result. This is visible in the current waveform and voltage signatures as well.



2

ternator and battery, yet the same start/stall remained. This is when I was called in for a second opinion.

After hearing the saga, I started and idled the engine successfully with the alternator disabled. Simply remating the alternator's connector caused an almost immediate stall. I thought it was best to verify there was no charging system issue (such as excessive AC ripple or excessive voltage drop). It seemed logical, as the fault only occurs when the alternator was charging. To my surprise, the alternator was performing properly, and full system voltage was available across the battery posts. I proved this further by once again disabling the alternator and substituting a clean smart-charger power source, only to have the stall occur similarly.

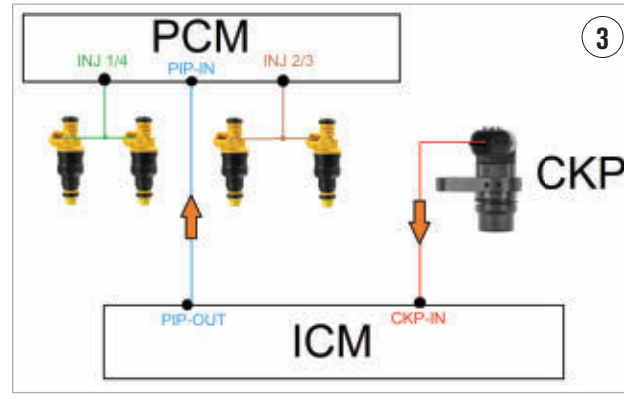
Where do we go from here?

At times we have faced symptoms with no diagnostic direction. These are the times I ask myself about the nature of the symptom. In this case, I'm speaking of the stall. For a stall of this nature to occur, something must be missing from the equation (is it a loss of spark or a loss of fuel?).

Although I have many different tools in my arsenal, this time I chose to use my lab scope and amp probe from Pico. I chose to monitor the work being performed. More specifically, I was looking for when the work stopped being performed. The engine was either losing spark, losing injector pulse, or a combination of both; the amp probe/scope will tell us that definitively and lead us to the next test.

Although the ignition coil operation always remained **(Figure 1)**, the injector coil current ramps were disappearing **(Figure 2)**. On a separate scope channel, I monitored the control of the injector circuits (measured directly at the PCM connector). This proved the circuits remained intact (no loss of voltage supply to the injectors) but also proved the PCM stopped providing the controlled path to ground for the injectors. On the blue channel, the CKP signal remained intact. This input is used by the PCM to drive the injectors. From this perspective, the PCM should have had what it needed to drive the injectors.

After verifying that the PCM was supplied with adequate battery voltage,



3

ALWAYS REFERENCE WIRING DIAGRAMS BEFORE TESTING. This vehicle's configuration is not typical. The CKP sensor doesn't report to the PCM directly. It first is sent to the ICM and used to control the timing and duration of the ignition coils. It is then sent to PCM from ICM for rpm input and control of the fuel injectors.

ground, and ignition voltage and had a healthy reference voltage output, the PCM was condemned. To my dismay, after two replacement PCMs (one used and one remanufactured) the fault remained.

Now, it's 'personal'

On occasion, I get egg on my face. But the key is I never walk away with egg on my face. I simply wipe it off. Walking away at this point would yield nothing but sleepless nights. More importantly, if I ever encountered this same issue again, I'd be no better off than I was the first time I had my rear-end handed to me. I was determined to find out the fault.

At this point, I had retraced my steps at least three times, coming up with the same "faulty PCM" diagnosis (which is possible but extremely unlikely). After much research about this vehicle's strategies and system configuration, I scrutinized a wiring diagram. To avoid any complications, I have access to many different sources of service information. However, this time I chose to use ALLDATA. For simplification, I redrew the diagram **(Figure 3)**. Although there had not been a loss of spark on this truck, the CKP signal is not sent directly to the PCM. It is first received by the ICM, used to fire the ignition coils, and relayed to the PCM for injector drive/RPM input.

In this configuration, an issue with the ICM could skew the CKP signal to the PCM ("PIP" signal in Figure 3). So, at this point, although I didn't see an issue with the signal at the PCM, I was still highly suspicious of the ICM being faulty and creating a skewed PIP signal that would allow the PCM to drop the injector control and cause the engine to stall.

The data doesn't lie

With all the information in front of us, I was faced with deciding on how to proceed and/or how to advise Lee of the proper repair. Here are some bullet points of what we know to be factual, and I will ask all you diligent readers for your input:

- A stall occurs each time the alternator is charging
- The stall is due to loss of injector control (from the PCM)
- CKP signal ("PIP-IN") appears healthy both before and after alternator charges
- No loss of spark occurs (ICM appears to function normally)

Given this information, what would you recommend doing next?

1) Replace PCM

2) Overlay new circuitry for fuel injectors

3) Replace ICM

4) Attempt to locate known-good scope captures in technician forums

Check out the April issue for the answer!

SOLVED: (Feb. 2023 *Motor Age*) 1999 Ford F350 V10 timing fault on one bank

What would you recommend John do next, given the data bullet points in last month's challenge?

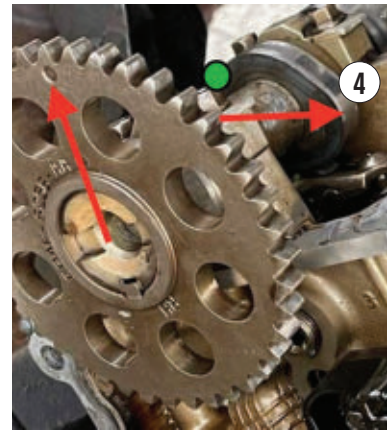
1) Reassemble the engine and start fresh
2) Measure cam lobe peaks with a degree wheel
3) Remove the cylinder head for machine work
4) Replace PCM due to logic-processing error

For those of you who chose answer #2, congratulations! After careful inspection and some research, it was learned the camshafts are each two pieces, swaged together with a tight interference fit. Bank #1 camshaft's front half became disassociated with the back half (Figure 4).

After closer inspection, the cam bearing surface showed damage from a lack of lubrication. It's likely the cam seized, and the timing chain twisted the camshaft apart. This explains why we had a bank #1 fault and why the timing marks were still aligned with no obvious damage to the keyways. Because the camshaft was out of phase by 180 degrees (360 crankshaft degrees), both banks of the engine were then on the same fire cycle (two cylinders on top-dead-center compression simultaneously).

Answers #1, #3, and #4 are incorrect. There is no reason to reassemble the engine. The data from the relative compression capture proves the engine-mechanical fault. The cylinder head doesn't require removal because the fault is timing-component related. The PCM doesn't require replacement because the data collected supports an issue with the engine.

The beauty of a logical diagnostic approach carried out by following the collected data means no guesswork or unnecessarily replaced components. Science drives the analysis, and the data doesn't lie.



DISPLAYED IS THE CAMSHAFT FOR BANK #1. The red arrow on the cam lobe indexes the apex, or tallest point. The green dot represents where the apex should be with the timing gear at about the 12 o'clock position. The cam lobe is almost exactly 180 degrees out of phase (360 crankshaft degrees).

BRANDON STECKLER is the technical editor of *Motor Age* magazine. He holds multiple ASE certifications. He is an active instructor and provides telephone and live technical support, as well as private training, for technicians all across the world.

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The Thexton Extended Back Probe Spoons, No. 914X, are designed to access electrical circuits from the rear of the connector to prevent piercing wires and possibly damaging the circuit. The 914X is ideal when space is limited for back probing. The additional foot of lead wire offers flexibility and assures a good connection with voltmeter. Made in the U.S.A.

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Raybestos added new friction, rotor and hydraulic coverage to its family of brake components. Sixty-four new part numbers add to the Element3 line, R-line, and specialty coverage line of Raybestos brake products for late-model domestic and foreign cars, pickups, and luxury vehicles. To learn more about new part numbers and their applications, customers should contact their First Brands Group representative.

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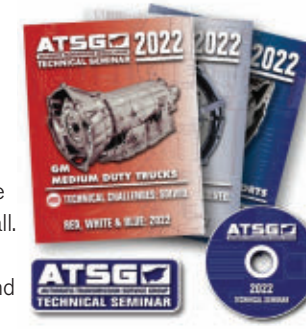
COVERS EVERYTHING ATSG HAS LEARNED IN THE PAST YEAR



ATSG's 2022 Seminar Book Set and DVD covers everything ATSG has learned in the past year from being on the front lines and taking tech calls everyday. Our techs with a combined 300+ years of transmission experience are ready to tackle any transmission problem, big or small. The 2022 Seminar Book Set includes three books that focus on GM & Medium Duty Trucks, Ford & Chrysler, and Imports. You are sure to find what you need in the 2022 Seminar Book Set. PLUS get an included DVD and free shipping!

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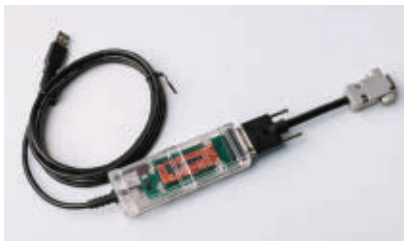

DETECTS INTERMITTENT OPEN-CIRCUIT AND SHORT-CIRCUIT FAULTS

The PhysiCAN SnS GRIP Tester from Sital Technology is a portable USB board that is based on the company's patented Safe and Secure (SnS) technology for CAN bus data buses. Detects and locates intermittent open-circuit and short-circuit faults in cables, connectors, bus terminators, and connected ECUs. The PhysiCAN comes with an app, a graphical user interface (GUI) tool, for real-time CAN bus physical layer fault monitoring and cybersecurity.

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REPAIRS WHEEL STUDS SAFELY AND CHIP-FREE

The GEDORE Thread Reset Tool, No. 3435644, is designed to repair wheel studs safely and chip free. The tool can be used universally on wheel bolts with M12 x 1.5 and M14 x 1.5. According to the company, repairs are done in just 30 seconds and will not weaken the thread. The thread becomes chipless by rolling (forming, pressing, embossing) back to its original geometry. No material is removed and the strength of the wheel bolts are fully retained. Use with a standard hex socket with reversible ratchet.

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THREE LIGHTS IN ONE

The NextLED Undercar Light, No. NT-6648, is designed to work in low-profile situations. With its compact design, it allows users to place it under any vehicle or crawl space. The unit is equipped with three lights: a 500 lm white LED flood light that measures 10" in diameter to grant wide and clear vision, a 18" flexible shaft detailing light (zoomable) to allow users to check on tighter space, and a UV light to help detect leakage. Its detailing light and flood light/UV light can be turned on at the same time, making it ideal for multi-tasking.

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HAS A LIFTING CAPACITY OF 6,000 LBS

The BADLAND 3 Ton Off-Road Jack from Harbor Freight is ideal for lifting mid-size trucks, SUVs, ATVs, and UTVs. The jack features a lifting capacity of 6,000 lbs and dual piston Rapid Pump technology to lift vehicles quickly and efficiently. Built for durability and rugged conditions, the jack has solid steel axles with sealed ball bearings for smooth operation, 7-1/16" thick aluminum side plates, and stainless-steel hardware. A rear axle wheel lock keeps the jack in place while working on a vehicle, and a locking adjustable height extension includes a rubber pad to protect against marring. Meets or exceeds ASME/PASE.

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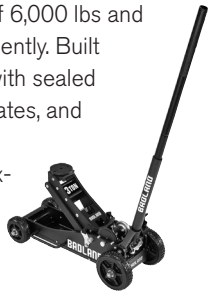

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THE TRAINER #135: DEALING WITH NO-CODE DRIVEABILITY CONCERNS

TROUBLESHOOTING DRIVEABILITY CUSTOMER CONCERNS WHEN NO CODE IS RECORDED BY THE ECM CAN BE CHALLENGING.

PETE MEIER // Creative Director, Technical

Troubleshooting driveability customer concerns when no code is recorded by the ECM can be challenging. It can be made less so if you follow a few simple guidelines!

First, follow a logical diagnostic process. My personal process is to consider every system and component "suspect" until proven otherwise. Never assume that the problem can't be caused by something until you do - or you'll find later that that is exactly what's causing the issue!

Another important component of this approach is to begin with generalized tests in order to eliminate as many possible problems as you can, as quickly as you can. It helps to remember that driveability is impacted by only four problems: improper combustion or engine sealing; volumetric efficiency; a weak or inconsistent spark; or inadequate fuel delivery or an improper spray pattern.

I like to begin my diagnosis with a relative compression test, followed by a volumetric efficiency test, a test of the engine's ability to breathe.

The list of possibilities is getting smaller and smaller. Next is the ignition system.

If I've identified a specific cylinder as a problem, the simplest ignition test is made by using an oldie but a goodie - the spark checker. But if I want to dive deeper into the ignition system, I want to see the ignition event and for that I'll need the scope. The actual testing method you'll need is based on the ignition system design you're dealing with. To actually see the spark event, for example, on some COP designs, you'll need a COP paddle probe or accessory secondary leads you can install between the coil and the plug. As a side note, if there is an intermittent sealing issue, this is one of only two methods I can think of that will help you spot it!

Last is fuel. I say "last," because this can be the most challenging to troubleshoot. Any imbalance between cylinders can cause a driveability issue. The key here is to remember that it is the quantity of fuel that is important, as well as delivering it at the right time AND with the right spray pattern.

The Autel MS-919 I use in this month's edition of The Trainer is a diagnostic tool that combines the top three tools that I typically use when performing a diagnosis: a scan tool, a multimeter, and a digital storage oscilloscope. Scan the QR code to watch the video!

How do *you* plan to service EV battery packs?

The BendPak EV2400SL is a push-around full-rise scissor lift table that is perfectly suited for EV battery pack replacement. With its compact design, this space-saving scissor lift can be easily transported anywhere in the workplace, making it ideal for multi-bay facilities or workplaces with confined areas. To learn more visit **www.bendpak.com/EVLIFT**.

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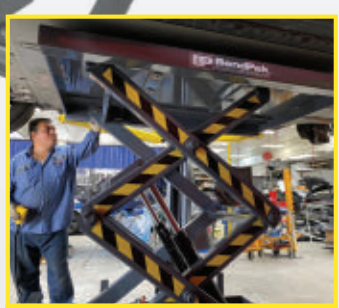

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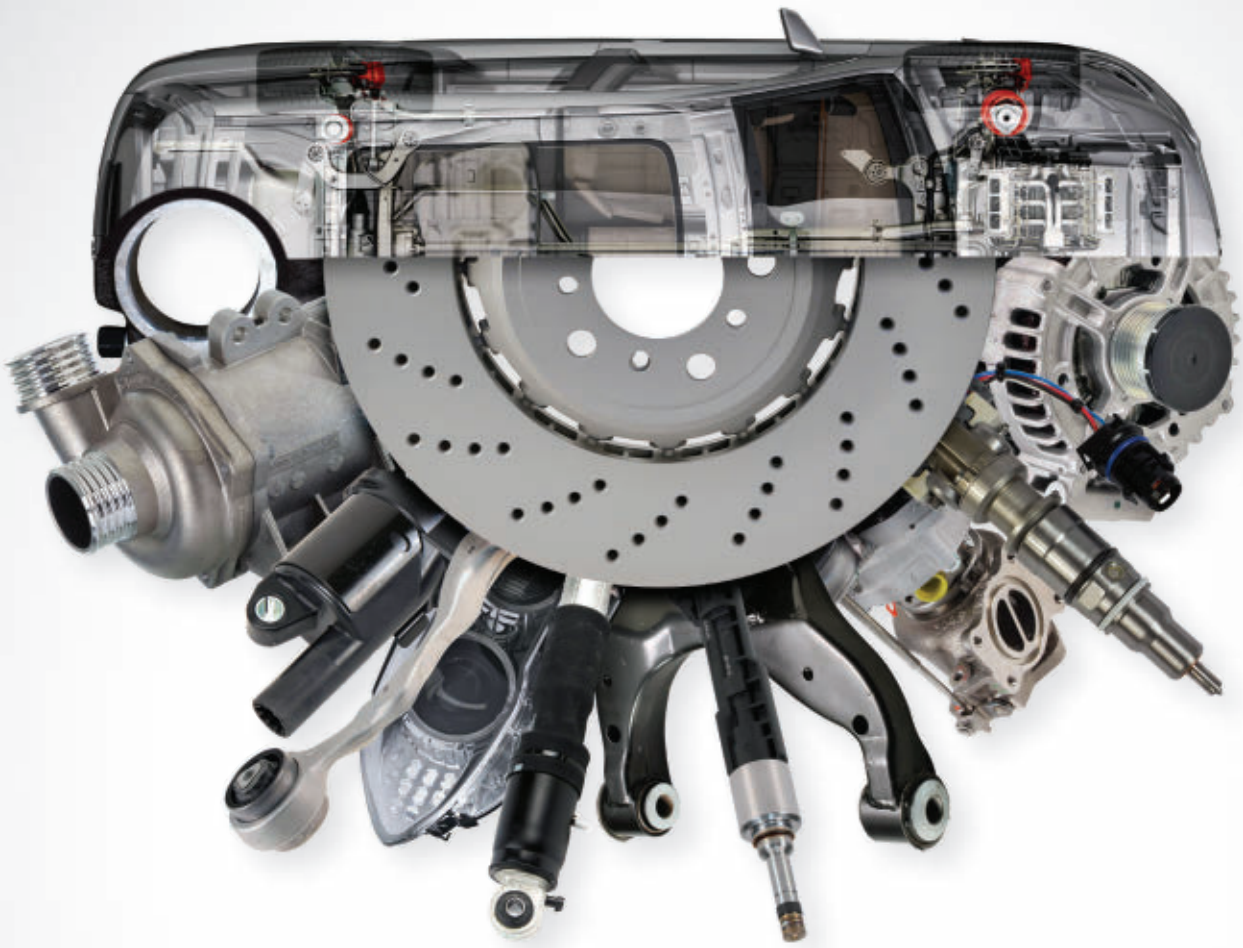

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