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KIA QUALITY CONNECTION
FALL 2018

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KIA QUALITY CONNECTION

View the Fall 2018 edition of the Kia Quality Connection now!
MotorAge.com/KQCFall18



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ESSENTIAL SCOPE TECHNIQUES

Don't miss the last live webinar of 2018! Pete Meier and G. Jerry Truglia return Nov. 17 at 6 p.m. EST for the live presentation of Essential Scope Techniques.



The DSO, or Digital Storage Oscilloscope, can be used to test nearly every system on the car – from basic electrical integrity tests to testing the mechanical condition of the engine.



In this PayPerView webinar, Pete and G. will show you a variety of essential testing techniques you can use immediately to improve your diagnostic efficiency and accuracy. Scopes that will be demonstrated include Snap-on, Pico, ATS and U-Scope, and tests demonstrated will include battery/charging systems, relative compression with and without an amp clamp, fuel system tests, ignition system tests and much, much more.

MOTORAGE.COM/DSOTECHNIQUE

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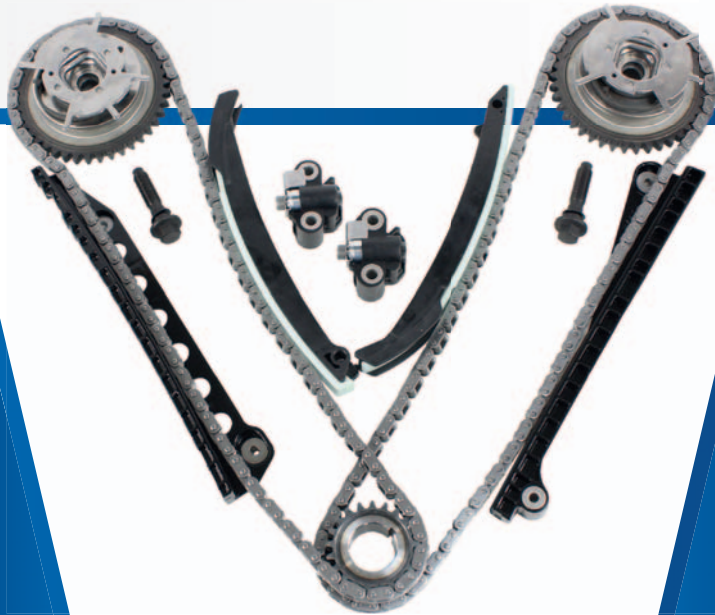
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BREAKING NEWS

SHOP MANAGEMENT

MANAGEMENT SUCCESS REBRANDS AS DRIVE

CHELSEA FREY //
Senior Associate Editor

➔ Management Success, an automotive, collision and truck repair consulting and training group, announced its rebranding as DRIVE at its SHOP OWNER'S EXPO in Pomona, Calif., last month.

DRIVE's CEO, Bill Kilpatrick, spoke to *ABRN* about the company's rebranding and future.

Why did your company decide to rebrand?

"Management Success has been a leading name in business consulting for 25 years. I took control of the company when Mike Lee passed away. Mike was a wonderful friend, and I deeply respect his knowledge of the industry and his wit. I came in with a background in technology, and I saw the opportunity to make changes.

>> DRIVE CONTINUES ON PAGE 6

RECRUITMENT

DEALER PARTNERS WITH COLLEGE TO TRAIN INMATES AS TECHS

MOTOR AGE WIRE REPORTS //

➔ A Virginia automotive dealer is joining with a local sheriff and community college to train non-violent offenders in the Norfolk City Jail as automotive technicians.

Dennis Ellmer, president of Priority Automotive, believes the new Priority Technical Training Center can help put a stop to the revolving door at the Norfolk City Jail while helping his 21 auto dealerships in Virginia and North Carolina answer a nationwide shortage of auto technicians.

"This may seem like an unlikely partnership, but it just makes perfect sense," said Ellmer, who was joined by Virginia Gov. Ralph Northam during a formal dedication ceremony in September. "Teaching non-violent offenders to make a good honest living is good for our communities, good for our law enforcement agencies, and good for Priority Automotive."

Built and funded entirely by Priority Automotive, the new training center features 12 repair bays and will train 15 non-violent offenders for careers in

>> TECHS CONTINUES ON PAGE 6

TRENDING

AIRTEX-ASC LAUNCHES NEW ENHANCED WEBSITE

The newly designed website at AirtexASC.com features increased product information and detailed technical support to help meet the needs of its customers.

MOTORAGE.COM/NEWWEB

ASCCA DEGREE PROGRAM IS FIRST OF ITS KIND

The Automotive Service Councils of California Degree Program at Cuyamaca College in El Cajon, Calif., aims to help the industry find qualified technicians.

MOTORAGE.COM/ASCCA

CRC INDUSTRIES, NAPA SUPPORT INTREPID FALLEN HEROES FUND

CRC and NAPA are partnering to fund a non-profit that serves U.S. military personnel suffering from Traumatic Brain Injury and Post-Traumatic Stress.

MOTORAGE.COM/IFHF

LIQUI MOLY PARTNERS WITH CHICAGO BULLS

The oil manufacturer's brand will have a significant presence at the United Center where the team plays, including logo placements on pole pads at both baskets, as well as on digital platforms.

MOTORAGE.COM/BULLS

MITCHELL 1 NAMES SWEEPSTAKES WINNER

Becky Hillig of Hillig Auto Center in Long Prairie, Minn., won the Fabulous Las Vegas Sweepstakes and an expense-paid trip to AAPEX and SEMA, which ran Oct. 30-Nov. 1 in Las Vegas.

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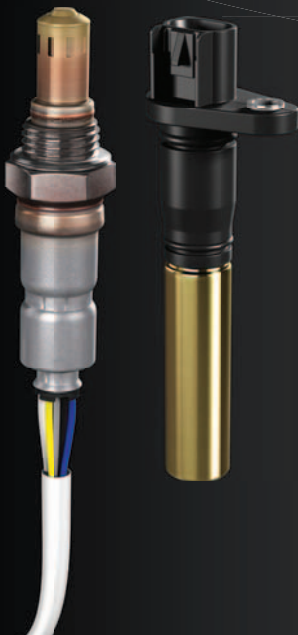


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>> **TECHS CONTINUED FROM PAGE 4**

automotive repair through a two-year certified program offered by Tidewater Community College.

Ellmer said he got the idea during a trip to Fiji, where he met a tour guide who earned a tourism degree while incarcerated in a local jail.

Priority is paying 100 percent of

the trainees' tuition, and will offer each trainee a full-time job with benefits once they finish the two-year program.

Norfolk Sheriff Joe Baron said it costs Norfolk taxpayers an average of \$26,000 to house a single offender for one year.

"What we know is more than 96 percent of our offenders are coming back to

our community," Baron said. "We also know former offenders are less likely to return to jail if they have gainful employment at the time of their release. By funding the cost to build the center and pay the trainees' tuition, what Priority is doing here is nothing short of life changing for these inmates. And great for the community." **MZ**

>> **DRIVE CONTINUED FROM PAGE 4**

The decision to rebrand is big. We are modernizing our content top to bottom. This impacts every service we offer."

What is unique about DRIVE and the history behind the rebrand?

"Years ago, I launched a software company that grew to 100 employees, and it was acquired by General Electric. Software development is in my blood. The technology company I have been incubating is now fully integrated with the automotive aftermarket. We have quadrupled the size of our development force."

How is DRIVE helping repair shops be successful in this rapidly changing industry?

"Rather than focusing on the day-to-day duties of a CEO, I am more comfortable spearheading research and development, pioneering new training techniques and coaching styles, plus seeing the future and staying in front of the technology curve. Every player in the automotive aftermarket, whether they are a huge parts vendor or a small independent garage, could have their game uprooted and batted down if they don't face the coming onslaught of technology. It is our duty to make certain

our clients succeed through the proper use of technology and business combined."

How will the rebrand benefit clients and shop owners?

"DRIVE solutions will provide shop owners more free time, financial stability, growth, succession and gives the modern shop owner an opportunity to create their life by design."



BILL KILPATRICK,
CEO OF DRIVE

In balancing the past and future of the company, how will DRIVE's offerings be expanded?

"You might be surprised about what we are keeping and what we are changing. We are a management services company. This foundation will not be diminished; it will be enhanced. Our clients are extended family to us. We know them well and we love them. DRIVE will always be committed to their success. We are closely partnering with industry influencers. You can expect to see more developments in 2019 than you have seen in our past 25 years." **MZ**

STUDY: CONSUMERS WANT DATA CONTROL

MOTOR AGE WIRE REPORTS //

More than 8 in 10 U.S. vehicle owners and lessees believe car owners should have full access to and control of their vehicle's data, including maintenance and repair information, according to a survey released by the Auto Care Association.

The survey, conducted by research firm Ipsos, found 86 percent of consum-

ers said vehicle owners should have access to driver and vehicle data — or telematics. Another 88 percent of consumers believe a vehicle's owner should decide who has access to this data.

There is continued debate over vehicle data. Vehicles continue to get "smarter" with telematic technologies that enable real-time, wireless transmission of driving behavior information. However, as technology

advances, OEMs are gaining exclusive access to vehicle data at the expense of consumers.

"Without the right to control where their data goes, car owners may face greater inconvenience, greater cost and fewer options for taking care of their vehicle," said Bill Hanvey, president and CEO of Auto Care Association. "These results should be a wake-up call to automakers." **MZ**

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What is a good service advisor worth?

This position drives your shop success — do you have the right person in place?

What is a great service advisor worth? Before we can put a value on this we need to define what a good or great service advisor is. I promise you, there are far more mediocre and even bad service advisors out there than good or great. How can this be? Because hiring and terminating employees is a hard thing to do, and it is easier to keep who you already have at the counter. Let's listen to a former multi-store operator and ATI coach, Paul Marsh, offer some suggestions on this topic.

Personality vs. technical ability

Personality is far more important than experience. I can teach a layperson most everything you would need to know to be a successful service advisor within 60 to 90 days on the job. What I can never teach, and no one can, is the right personality to be successful as a service advisor. What does the right personality look and sound like?

- You can hear them smiling over the phone. Their tone, energy and voice in-

flexion make the caller feel their call is important and their business would be appreciated, rather than feeling that the call is an unwelcome interruption.

- They are social butterflies! The kind of person you can take to a party where they do not know a soul and they are comfortable and happy to meet new people.
- They have a high need for recognition, which drives them to high performance.
- A high sense of urgency. They can't wait to do it all!

CONSIDER HIRING THE RIGHT PERSONALITY AND THEN TEACH THEM THE REST.

- Empathic — they can relate to the level of concern of others and make them feel at ease.
- MONEY MOTIVATED! They thrive in a pay-for-performance position and are focused on what it takes to maximize their income.

How many can say this describes your advisor? When I bring up a concern about their advisor, I have had own-

ers tell me things like, "He is not a people person" and, "Once you get to know her she is a good person." A phone call lasts minutes at best, so how can a customer get to know him or her enough to feel like your shop is the place to go? Indifference from the person a consumer deals with is one of the biggest reasons customers quit a business.

Frequency reports

In a recent coaches' meeting, we were reviewing "frequency reports." This is an invaluable tool to track the frequency of your customer visits and show how many are one-time, two-time, etc., returning customers. I was astonished to see that at a very successful shop, 53 percent of their customers came to the shop only once. This shop spends good money on their website, search engine optimization and ad words. But they are clearly NOT giving their customers a compelling reason to return. Their four- and five-time return customers accounted for over half their sales with hundreds of dollars more in ARO, but only single-digit percentages of their overall car count. If they could double their four- and five-time return rate, they would never need to spend a dime on ad words or social media. They would be rolling in the dough!

I cannot speak to this shop's advisors or customer experience, but I sure do question them. How do you lose more than half of your first-time customers and not think that something is wrong? What impact does a good service advisor have on return rates? They have almost complete control over it except for



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 Chris "Clay" Frederick, CEO

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the percentage of people who move, visitors to the area and other reasons that customers may not return.

It starts with the call prior to visiting. I cannot tell you how many times in my many years running multiple stores and districts that I have seen car count climb substantially within days of changing a store manager. The new manager answered the phone clearly and professionally, spoke with a smile, showed interest, invited the customer in, made it clear that their call was important and their business would be appreciated and all in all, gave the customer a compelling reason to come in.

A great service advisor greets the customer as soon as they walk in and shows warmth and professionalism that puts the customer at ease. The write-up process includes questions that clearly define the customer's concerns; and the customer feels a connection to the service advisor based on their urgency, professionalism and personality. A great service advisor is a great person who finds commonality quickly and makes others feel comfortable. You CANNOT teach this.

Great service advisors

A great service advisor has a process when contacting the customer about their vehicle that includes the customer in the conversation, paints visuals for the customer to understand, listens to the customer and gives options and advice on the vehicle's health. A great process starts with what is right with the vehicle, then the concern the customer brought the vehicle in for and other concerns or suggestions.

A great service advisor understands the importance of the "goodbye kiss." They take the time to go over all repairs and services and, when applicable, declined work. They answer any questions and make sure in words and in action that the customer knows their business is appreciated.

I hire personality above experience. When we run an ad, the early resumes we see are almost exclusively not who we hoped to hire. The underperformers and job hoppers are looking for work and the great employees are being taken care of. We need a service advisor, and we often settle for experience, as it is easier than training someone. STOP! Bad hires cost you as much as three times their pay in lost or unrealized revenue.


Consider hiring the right personality and teach them the rest. You do NOT need to be a tech to sell service and give customers a great experience. You do NOT! I am living proof of this. You can pay these people less to start, then help them grow into a great career and become a great long-term employee. They do not know at first whether a customer who came in for an oil change should or should not be expected to want to maintain their vehicle. You show, train and tell them what to do and they just do it. There are countless videos and resources to

teach anyone the fundamentals of how an automobile works.

What is a great service advisor worth? Every penny they earn!

Exceptional service advisor checklist

A great way to make sure your shop is providing the best experience to your customers is to use the Exceptional Customer Service Checklist. The function of the checklist is to make sure that we give the same "wow!" experience every time to every customer. You can use it to grade your service advisor and help them grow.

If you would like our Exceptional Customer Service Checklist, you can get it by going to www.ationlinetraining.com/2018-11 for a limited time. 



CHRIS "CHUBBY" FREDERICK is the CEO and founder of the Automotive Training Institute. ATI's 130 full-time associates train and coach more than 1,500 shop owners every week across North America to drive profits and dreams home to their families. Our full-time coaches have helped our members

earn over 1 BILLION DOLLARS in a return on their coaching investment since ATI was founded. This month's article was written with the help of ATI Coach Paul Marsh.

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Effective owners, managers use these three rules

Learn to evaluate the tasks that take up your time and determine what can go

First, acknowledge that the owner/manager of the shop is an actual position within the business and this position must be held accountable to the business just like any other role. Let's also acknowledge that we have a tendency to overcomplicate our day-to-day function as we examine every task, which in turn can lead to a stressed, unprofitable business.

Have you ever noticed that it appears the longer you are actually in business these days, the messier, more cluttered your personal day becomes? I hear from shop owners who have been in business more than five years things like, "I'm personally just too busy," or "there is so much that I must do," or "I've got so much on my plate."

This happens to every business owner/manager at some point in time, especially when the shop is understaffed, no matter how good the business seems to appear on the outside.

Concentrate first on obtaining the right staffing levels for the business from the back shop to the back office to the front counter. Bring those areas to the proper levels to ensure quality and service are in place for the shop clients.

Now you are ready to move on to effectively utilizing YOUR time properly.

Once staffing levels are right, start to deal with this too-busy situation by revisiting two important words that are repeated time and time again, but they are truly ignored by so many: "Slow down!!" This phrase is critical for you to work with to becoming effective in your position in the company.

Consider making a big sign with the below points and displaying it in your office where you are forced to view it constantly:

NOTHING SHOULD BE DONE IN MY BUSINESS BY ME UNLESS:

1. It makes a significant contribution to achieving worthwhile business goals;
2. It pays for itself in a reasonable and predictable time;
3. It can be explained simply and completely to those who-



NOW IS THE TIME TO FOCUS ON WHAT REALLY COUNTS — THAT IS, TO GET YOURSELF INTO A DAILY ROUTINE. IT WILL DRAMATICALLY MAKE A DIFFERENCE IN YOUR STRESS LEVELS AS WELL AS ENHANCE THE BUSINESS PROFITABILITY.

have to make it work.

Think about the clarity those three statements bring to the table.

"If it were only that simple," you say. Well, consider putting it to the test with everything you do. When you keep these three items top of mind and answer all three points honestly, it allows you to evaluate everything you personally handle and do in proper perspective to your particular function within the business. If what you are doing as an owner/manager doesn't fit those rules, then you either explain and delegate it to someone else to do and hold them accountable, or throw it out and don't waste your time with it.

Too many owners/managers get caught in the trap that they are the only ones who can perform a task properly for the business. I respectfully disagree. Every task in a business is trainable, but I believe a very big issue is simply that you must be willing to let go. When you finally let go and start trusting the people that you have on your team, your time is used to a greater value and benefit to your shop. Everyone wins when the owner or manager is effective at their position.

Consider that now is the time to focus on what really counts — that is, get yourself into a daily routine. Entering December and January traditionally frees up time for the owner or manager to get refocused. I recommend that this exercise becomes a main focus for you during these two months as it will dramatically make a difference in your stress levels as well as enhance the business profitability for 2019.

Maximizing your efforts to enhance your business profits — that's the purpose here, and after all, that's your job. **TL**

BOB GREENWOOD, AMAM, is president and CEO of Automotive Aftermarket E-Learning Centre Ltd. (AAEC), which provides business management resources for the automotive aftermarket. Bob has more than 36 years of business management experience and is one of 150 worldwide AMI-approved instructors.
greenwood@aaec.ca



HOW TO

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To guarantee any repair is estimated correctly, you've got to research OEM repair resources every time you write an estimate. Mike Anderson of Collision Advice points out that OEM repair procedures change regularly – in fact, it's not unheard of for some to change multiple times.. If you specialize in Toyota or Lexus repairs, that's where Toyota's Technical Information System (TIS) comes in. TIS is Toyota's singular resource that gives collision repair professionals all the details they need to restore a Toyota or Lexus to OEM specifications after an accident.

Because Anderson's a stickler for getting it right, he facilitated and recorded a webinar to help you navigate and improve your search results on the Toyota/Lexus TIS Website: <http://bit.ly/TISVideo>. In addition to a site overview, Anderson pinpoints two key features for collision repair professionals, Toyota Repair Manuals and Collision Repair Manuals. He also helps navigate vehicle build data, find cut and weld details and where to find specific

vehicle dimensions.

TIS has repair details for all 1990 and newer Toyota, Lexus, and Scion vehicles and is available to any repair facility for a daily, monthly or annual subscription. Toyota updates TIS regularly, so you have access to exactly what you need, when you need it. For more information check out TIS today at <https://techinfo.toyota.com>.




Wholesale Parts

Global initiative

Shop owners relocate from Argentina to join forces with U.S. franchise

ROBERT BRAVENDER // Contributing Editor

 Moving a great distance to set up a new business can be tough. Add that it's in another country with cultural differences and language barriers — not to mention reversed seasons going from the Southern to Northern Hemisphere — and it sounds daunting. But to business partners Mario Gonzalez and Sebastian Pacheco, it was definitely doable, particularly with the help of a franchisor.

Their story starts in Buenos Aires, Argentina, when Pacheco had his car serviced at Gonzalez's shop. "I've always loved cars," says Pacheco. "I used to work on the weekends on my car; for me it was a hobby at the beginning. Then I met Mario, first as a customer, then as a friend, and I started learning a lot about cars from him."

For the next five years Pacheco assisted Gonzalez in running the shop in Argentina's bustling capital, but saw greener pastures in the United States. "In our country we were always going through a difficult economy because of security situations," he explains, "so we started looking for a place where we could work in a better environment with more possibilities to grow, to have a better life."

To that end they focused their search on Florida. "We looked first at Miami, where we liked the kind of life," Pacheco comments. "Then we looked [on the Gulf Coast] at Venice, Tampa and Sarasota." Meanwhile they also found a franchise fit with Moran Family of Brands, based in Midlothian, Ill.

One of the nation's leading franchisors of general automotive repair since 1990, this company has assembled a variety of products and services through various brands. Perhaps their best known brand is Mr. Transmission, which is typically paired with Milex Complete Auto Care, covering the rest of the car.

Moran also has two aftermarket service divisions: SmartView Window Solutions, which provides window tinting, and Alta Mere, The Automotive Outfitters. Moran literature describes the latter as "high-tech automotive accessories and driver-safety products," such as "security and radar detection systems, remote starters and keyless entry, and hands-free bluetooth phone systems."

And while these brands are frequently licensed in various combinations, Pacheco and Gonzalez were the first franchisees in Moran's history to put all four together at one location. There was just one little hitch to that plan.

"When we signed the contract with (Moran), we hadn't yet



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Tampa, Fla. // www.tampamrtmilexaltamere.com

Sebastian Pacheco, Mario Gonzalez
Owners

> 1
Years in business

4,000
Total square footage of shop

1
No. of shops

3
No. of bays

secured the location," explains Pacheco. "At that point the options were Sarasota and Tampa. We started looking for a shop in the two places and (Tampa) was the best choice.

"We spent a month getting to know this area," he continues, "and we found a balance in Tampa between the quantity and kind of people that we could provide service to, and the quality of life that we could get there. We checked demographics; (Tampa) has people from almost all parts of the world: Europe, Russia, South America, Central America. The Latin community is a big one, but we focus on everybody who needs our services."

They eventually found a 4,000 square foot facility that had previously specialized in repairing German brands but had been empty for two years. "It was in really bad shape," says Pacheco, "so we re-did all the floors, changed some walls; it took two months to get it ready to open," which they did in June of 2018. Pacheco assumed the duties of general manager, dealing with vendors, interviewing new employees, as well as adver-

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tisement and marketing, while Gonzalez ran the shop.

“The idea was to be a one-stop shop for everything that your car needs,” Pacheco says. “At this time we’re not only thinking about maintaining all of these services, we’re thinking about adding more, like high-quality detailing (that includes) polishing and cleaning the car. That’s not something the franchisor does. We also paint small parts of the car, like the mirrors, door handles, but we’re not a full body shop — we only do some details so the car will look nicer. These are things we did in Argentina.”

Skill and ambition are about all Pacheco and Gonzalez brought from Argentina; everything else had to be built nearly from scratch. But for that they had help from Moran. “The company provided us with some vendors and also with training for each brand,” Pacheco explains. “We also spent a week with the owner of (another franchise) to learn about everything else. We worked there, met with customers, employees and learned how they managed the place.”

And Pacheco points out that they are still learning. “We are trying to learn how to present the services to the customer, how to manage the employees, and the way that people think — that was the main difference between here and Argentina,” he comments.

“It’s very difficult to buy a car in Argentina, so the people there take more care of their cars. Here people might only use a car to get from point A to point B, so we’re trying to educate people to ensure the cars not only work fine, but we also try to make the cars look nicer. We help them maintain their car so they won’t have to spend so much money on it.”

Thus, every part of their program, from Milex’s preventative maintenance, to SmartView’s interior-saving window tinting, to their own detailing services, all complement extending the use of a



customer’s car. However, Pacheco, who used to sell advertising for a Buenos Aires TV station, also utilizes the latter as a marketing tool.

“Every car that comes here, even if just an oil change, we do a complimentary detailing of the car,” he explains. “We leave the car looking better, so when the customer sees the car they’ll feel more comfortable. When we do bigger (tickets), we offer other complimentary services, like taking care of leather interiors.

“We think of that like an advertisement,” Pacheco points out, “because

that customer is going to tell a friend, and they’ll tell someone else, each time referring more people — because they get more than what they expected.”



ROBERT BRAVENDER

graduated from the University of Memphis with a bachelor’s degree in film and video production. He has edited magazines and produced shows for

numerous channels, including “Motorhead Garage” with longtime how-to guys Sam Memmolo and Dave Bowman.

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Massachusetts kicks off state data access debate

U.S. Senate considering AV legislation while U.S. DOT issues AV Guidelines 3.0

With no clear path established by Congress on autonomous vehicles, including data access, states are moving forward with legislation. In Massachusetts, Rep. Paul McMurtry (D) has introduced state legislation co-sponsored by Reps. John Lawn (D) and Joan Meschino (D) that seeks to “enhance, update and protect the 2013 Motor Vehicle Right to Repair Law and Consumer Rights.”

There are a number of important provisions in the proposed Massachusetts legislation, including definitions and additional mandates relative to the original Massachusetts Right to Repair legislation about five years ago.

1) “Mechanical Vehicle Data” — Any data in a vehicle related to the diagnosis, repair or maintenance of that vehicle.

2) “Telematics System” — Any technology that collects, stores or transmits a vehicle’s diagnostic or repair information such as a vehicle electronic system that collects and stores information and utilizes wireless communications to transfer that information electronically. Such systems include, but are not limited to, motor vehicle remote diagnostics, automatic airbag deployment and crash notification, navigation, stolen vehicle location, remote door unlock and transmitting emergency and vehicle location information to public safety answering points.

3) Access to vehicle onboard diagnostic systems shall be standardized and not require the use of any authorization by the manufacturer. Manufacturers may utilize an authorization system for access to vehicle networks and their onboard diagnostic systems that is standardized and is administered by an entity unaffiliated with a manufacturer.

4) Commencing in model year 2020, vehicles that utilize a telematics system must be equipped with an inter-operable, standardized and open-access platform capable of securely communicating all mechanical vehicle data in a standardized format accessible by the vehicle owner or lessee through a



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mobile-based application and, upon the authorization of the vehicle owner, accessible by an independent repair facility or other entities for maintenance, diagnostics and repair. Authorization by the owner or lessee is required for access to mechanical vehicle data for the purposes of maintenance, diagnostics and repair.

5) Failure to comply with these requirements shall prohibit an OEM from selling new motor vehicles in the Commonwealth until the manufacturer has cured all problems and is in full compliance with this act.

No action will be considered on this Massachusetts legislation until 2019.

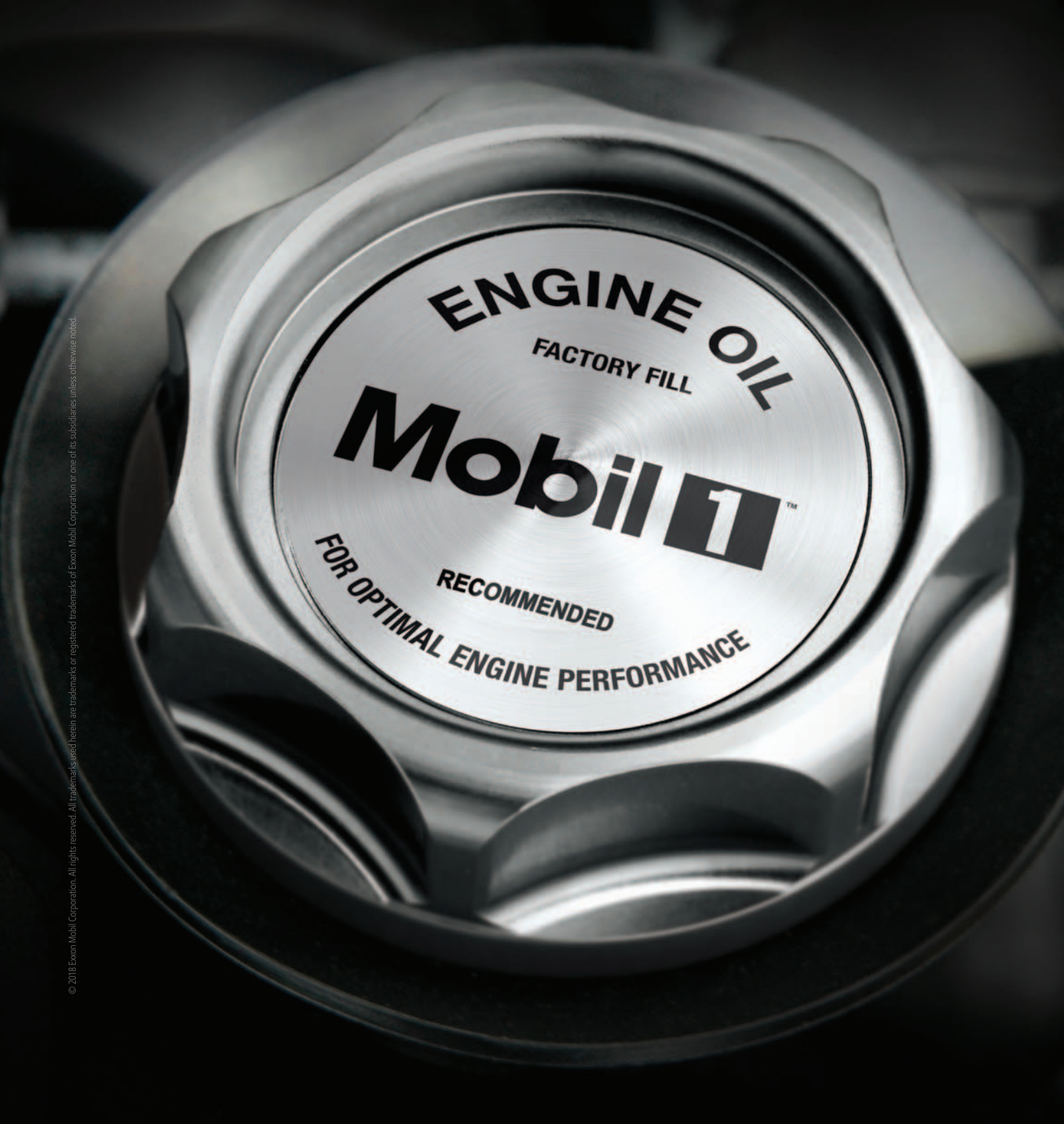
As previously reported, the U.S. Senate is waiting to consider autonomous vehicle legislation, the AV START Act, on the Senate floor. The bill has been held up over a few issues. Important to independent repairers is a requirement that the National Highway Traffic Safety Administration (NHTSA) establish a stakeholder workgroup to review data access and cybersecurity. The stakeholder group is to report back to Congress its findings.

Finally, federal regulators are continuing to issue guidelines for these new vehicle technologies. The Trump Administration released a set of guidelines that addressed the roles of states and the federal government in regulating these new vehicle technologies. Recently, U.S. Department of Transportation Secretary Elaine Chao released “Preparing for the Future of Transportation; Automated Vehicles 3.0.” These guidelines attempt to provide: New Multimodal Safety Guidance; Clarification of Policy and Roles; An Outline of How to Work with U.S. DOT as Automation Technology Evolves; and U.S. DOT’s Operating Administrations Commitment to Safety.

Review the DOT guidelines at www.transportation.gov/av.

ROBERT REDDING is the Automotive Service Association’s Washington, D.C. representative. He has served as a member of several federal and state advisory committees involved in the automotive industry. rredding@reddingfirm.com

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Give toxic relationships in your life an ultimatum

LIVE HOW YOU WANT TO LIVE – POSITIVELY – AND LET OTHERS HAVE THE POWER IN DECIDING IF THEY WANT TO CONTINUE DOWN THE PATH WITH YOU OR NOT.

MIKE JONES // Contributing Editor

Recently I coached a young executive, and she spoke of the challenges she faced being positive because of the relationship she had with her two siblings, their children and her mother. She lamented about how difficult it was to be positive around these people. They found the negative in almost everything and saw themselves as victims of circumstance. They chose to blame others for everything going wrong in their lives.

These family members mocked her for being positive and found a way every day to create something negative.

After participating in a group coaching series, she continued the effort to sustain her benefits and enrolled in our “1:1” coaching. Sustainability is key — unless you deliberately choose to practice new behaviors, you are destined to return to your comfort zone.

Sometimes sustainability is made more difficult or prevented due to the unnecessary baggage we refuse to let go of on our journey to change. This unnecessary baggage can be people, outdated beliefs or circumstances that have happened.

My coaching to this woman was that in order to live a purposeful, happy, joyous, rewarding, stimulating, positive life, we have to allow relationships that have passed their expiration date to move on. Some people feel obligated to remain in a decaying or dead relationship because of what others think they should do. You

may wait for someone else to change in order for the relationship to improve. And when the relationship does not improve, you feel like a victim. In this conversation, there are NO victims, only volunteers.

Positive and negative is a choice. Going back into relationships where you have been part of the negativity and are now choosing to focus on the positive can be a challenge. The others in the relationship get to choose if they want to be positive or negative. If they choose to remain negative, ask them to write down the benefits.

Over the years, the only reason I have heard for why a person will choose to be negative is because it is easier. At this point you need to make a choice: Tough or suffering?

Tough means not allowing that person to live in your space; however, it is OK to allow them to exist outside your space. Suffering means that you allow these relationships to live in your space and their choice negatively affects your world.

She asked the negative relatives to write down the benefits of being negative and you guessed it — they stated it was easier to be negative because there were fewer disappointments.

She needed to redefine these relationships to get to her outcome of a happy, positive life. She said she would have to choose suffering because blood was thicker than water.

Some of the people who are the closest to me have no blood relation to me at all. If I lived that truth — blood is thicker

than water — my life would have taken an entirely different course.

I made the choice to grow as a person focused on positive outcomes and committed to accept personal responsibility for everything going on in my life.

I have outgrown many relationships from blood relatives to lifelong friends because of my choice to live a positive, purposeful life. Just because someone is your sibling or even parent, it does not determine if they will be a value add to your choice to live your purpose. It takes a tremendous amount of courage to live your life outside of the expectations of others; however, when you do, you create new possibilities for others as well. They get to choose their fate. However, if their fate becomes yours, that is the result of your choice — not theirs.

Blood may be thicker than water, but that will not determine if I allow an individual to live in my space no matter what their relationship to me is. The reality you are experiencing is based on your choices and not the choices of anyone else. What choice will you make today to create the life that you want? *MJ*



MIKE JONES is the founder and president of Discover Leadership Training, a next-level leadership development solutions company in

Houston, Texas. He encourages others to create a better version of themselves by realizing their untapped potential.

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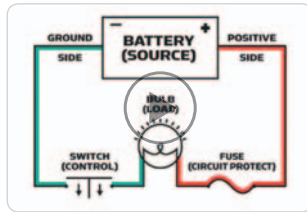


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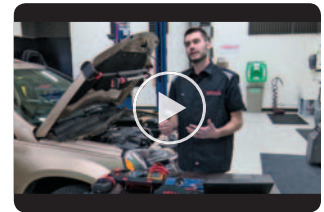
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MECHANICAL MOMENT

SERVICE REPAIR PROBLEMS AND SOLUTIONS THAT JUST MIGHT BENEFIT YOUR SHOP TECHNICIANS

GMC CANYON INTERMITTENT BRAKE LOCKUP

VEHICLE:

2005 GMC Canyon, 4WD, L5-3.5L, VIN 6, Automatic Transmission

MILEAGE: 198,003

PROBLEM:

This vehicle came into the shop with the antilock brake warning indicator on. The technician connected a scan tool and pulled the codes listed below. They test drove the vehicle and confirmed that the brakes would intermittently lockup.

C0221 – Right Front ABS Channel in Release Too Long

C0040 – Right Front Wheel Speed Sensor Circuit

DETAILS:

With the scan tool, the technician observed that the right front wheel speed sensor PID would drop out and the signal was erratic. After inspecting the right front wheel

speed sensor and the hub assembly, he found that the wheel hub was damaged.

CONFIRMED REPAIR:

The hub assembly was replaced, the DTCs cleared, and the vehicle test driven. No DTCs returned and the brakes operated normally.

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Orlando, Florida

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Anaheim, California

FEBRUARY 28-MARCH 3

VISION Hi-Tech Training and Expo
Overland Park Convention Center
Overland Park, Kansas

MARCH 20-23

ATI Super Conference
JW Marriott San Antonio
Hill Country Resort
San Antonio, Texas

MARCH 22-24

Automotive Training Expo (ATE)
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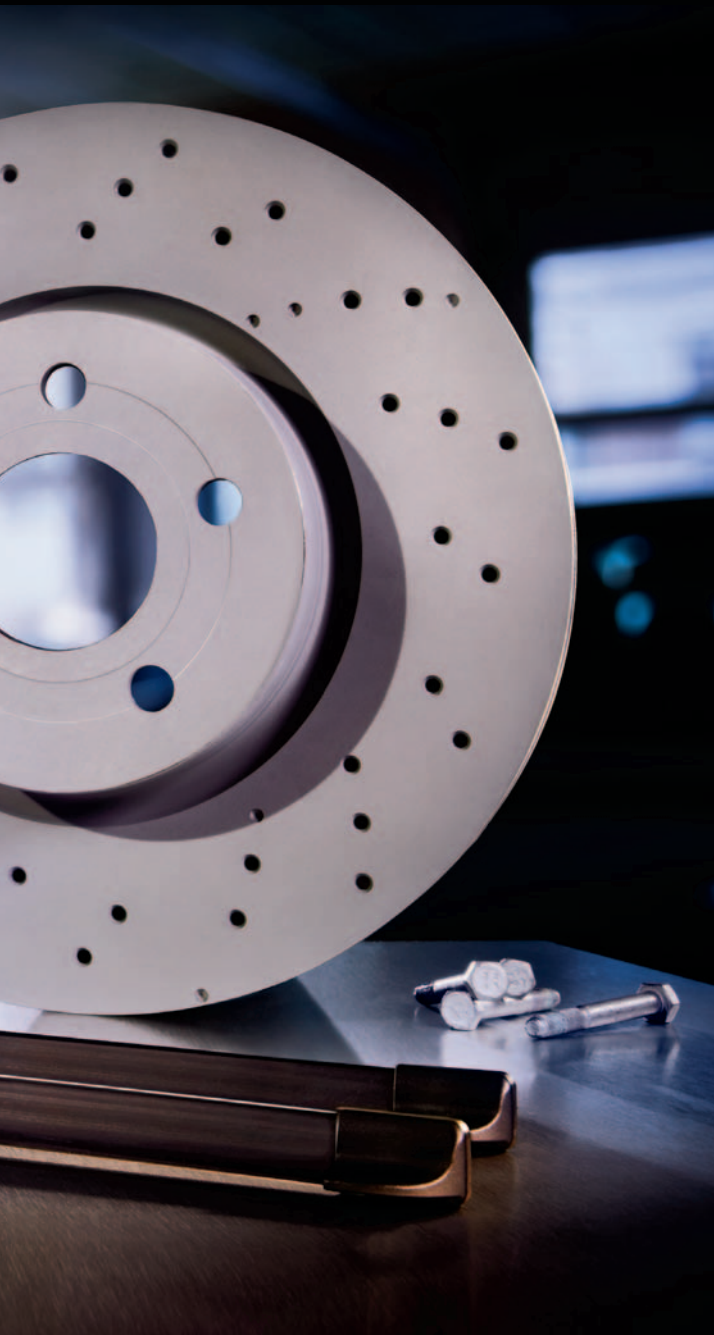
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G. JERRY TRUGLIA //

Contributing Editor

An everyday occurrence in our shop — and maybe yours as well — is routine service. The services that are performed most frequently at our shop are oil changes and tire-related service. Many of the vehicles our customers come in with are late-model vehicles that are driven a fair number of miles. With that being said, let's take a look at the No. 1 most common service, the oil change.

Before we get to the bay

But before we get too deep into the service, let me share with you what takes place first.

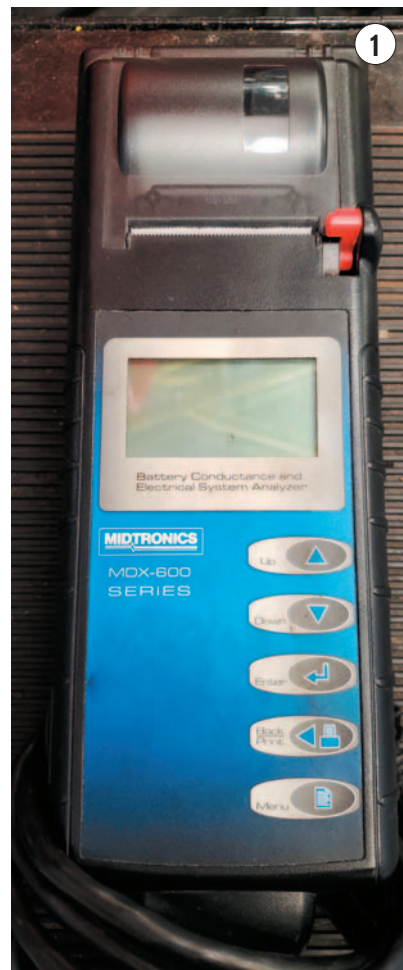
Everything starts at the front desk: the customer fills out the work order, followed by us writing down their requested service, and finally we have them sign the work order for approval. Many customers we encounter are either new to our shop or just purchased/leased a new vehicle and are in for a bit of a shock.

We find that many of them are not aware that this is “not their father's Oldsmobile.” Their new driving machine is not only more sophisticated, but is going to be more expensive to service. Many of them were using con-

ventional oil in their old clunker or think the oil change is going to be one of those \$19.95 specials, since they have seen an advertisement in the local paper or mailer. This brings us to the point where we have to explain that their motor has to use the proper rated synthetic motor oil. Many times, we must go into either ALLDATA or ProDemand to print out the specifications to justify the price. As we all know, today's oils are expensive and must be used for proper engine operation, mileage and warranty.

Some customers have an issue with the price since they were accustomed to paying so much less compared to what they must spend now. Once the front desk process is complete, we get a floor mat, take the keys and drive the vehicle to an open bay. We make sure we unlock the doors, have the driver or one window down and pop the hood. Our normal procedure for any service performed in our shop is to always check all the lights and take a look at the windshield wipers. There is nothing worse than receiving a call or visit from a customer with a vehicle that you just serviced having an issue with a burnt-out bulb or worn wiper that you did not make them aware of. Besides, it's a good way to make a few extra bucks and keep a customer satisfied.

After these checks are completed, we write down the mileage, inspection date,



year, make, VIN number and last but not least, the tire pressure specs, taken from the door pillar sticker. By recording all that information, we don't have to go crazy later guessing what year the car is, what engine it has or what the tire

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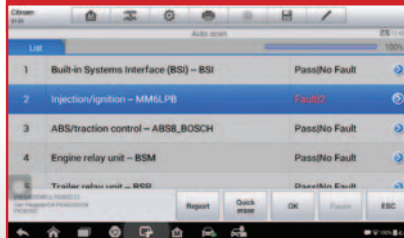
ADVANCED SERVICES



18 SERVICE FUNCTIONS



ALL SYSTEM DIAGNOSTICS



AUTOSCAN ALL MODULES

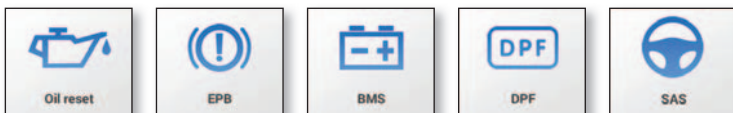


TPMS STATUS SCREEN



VIEW ALL SENSOR INFO

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pressure should be. The extra minute to record all the information saves time and allows us to look up the correct parts or information on the vehicle we are servicing. Once all the information is recorded in our shop management system, it's a breeze the next time the vehicle is in for service.

Under the hood, under the car

Next, we open the hood, give a good look-see for worn belts or anything that may look abnormal along with checking the oil level and writing down if it is dirty, low or overfilled. The oil cap is removed and placed next to the hood latch so it is not forgotten, as well as re-installed. That is followed by checking the transmission, power steering, brake fluid, battery (we may perform a test using our Midtronic (Figure 1) or Associated tester (Figure 2), fill up the washer fluid bottle and any fluid that was not up to the specified level.

Now the vehicle goes for an upward ride where we take a look underneath and note any leaks. If the vehicle has an under pan cover, it is removed, followed by removing the oil drain plug and oil filter. Note, if the engine has the oil filter on top of the engine, the filter would be removed first, so the oil can drain properly. While the oil is draining, the tire pressure is adjusted and possibly, depending on the service history of the vehicle and the condition of the tires, a rotation may be recommended or performed. The front and rear differentials as well as the transfer case (if equipped) are checked along with the condition of the fluid. We will sometimes suggest replacement of the fluid per the OE service requirements or fluid condition. When those two procedures are finished, the new filter will be installed, making sure that the filter base is clean and does not have any gaskets left on it. The same would apply for a top engine-mounted filter. If it's a cartridge-type rather than a

spin-on, we make sure that the oil ring gaskets are replaced and that the filter is torqued down to the proper specification using a torque wrench. The drain plug in some cases may need the plug washer replaced and if so, we would replace it. Many drain plugs need to be torqued to 25 Nm to prevent damage to both the drain plug and oil pan. To make matters worse, have you come across the special rubberized Audi/VW drain plug that you need a special removal tool for? It's a good idea if you work on those vehicles to purchase the correct tool and at least a couple replacement drain plugs.

No substitute for "right"

After the filter and drain plug are taken care of, the vehicle is let down and the correct oil specified for the engine is installed. Using the correct oil along with the proper level is a very important step. Today's engines are very expensive, and not using the correct oil, or under- or over-filling the crankcase can become a very costly repair.

In my shop, we prefer to use Pennzoil (Figure 3), LiquiMoly (Figure 4), Motul (Figure 5), Pentosin or in some cases the OE oil to ensure the proper oil for the application. We always make sure that the oil meets the required specifications for the engine it is going in. Before we pour the oil in the engine, we use one of our many special oil funnels to prevent any spills. After the oil is poured in, we leave the funnel in place with a rag on top of it and start the engine. The oil indicator, light or gauge is observed for proper operation and then the engine is shut off and the oil level is rechecked. If the vehicle does not have a dip stick, we follow the OEM procedure, usually using a scan tool, to make sure the oil temperature and level are correct. Once that procedure is completed, we make up an oil sticker and install it on the upper left-hand corner of the windshield.



We are not done yet; now comes the difficult part if you are not familiar with the vehicle you just changed the oil on. Since most new vehicles have an oil change, tire rotation or maintenance reset procedure, you have to either go through a dash or infotainment screen and perform the dance. Most vehicles are easy, but there are some Euros and other vehicles that are a real pain. On some vehicles, the reset can be performed with a scan tool or you can look it up in service information. There are also apps that provide reset information — Oil Reset Pro, Reset Oil and Pro Reset Oil Service, among others. So, an oil change that was once a quick, simple service has become a more difficult and time-consuming process.

Maintenance lamp reset — the easy to the difficult

The easy? GM has a procedure where you select “Info” until you see “Remain-

ing Oil Life,” and then press the “SEL” button until you see “Oil Life.” After a beep is heard, the Oil Life will be reset to 100 percent and you’re done. Now that’s nice and easy — the way it should be.

Now let’s turn the wheel to an oil reset that is on a difficult vehicle. On many early Mercedes Benz products, it’s like a game of spinning the wheel and

hoping you land on the right spot. Well, maybe it’s not that bad once you’ve done it a couple of times, but you don’t know it until you have done it. The following is an example of a Mercedes E class that uses the steering wheel control buttons that you need to know the proper procedure on. First, may I suggest that you make sure that the trunk lid, liftgate,



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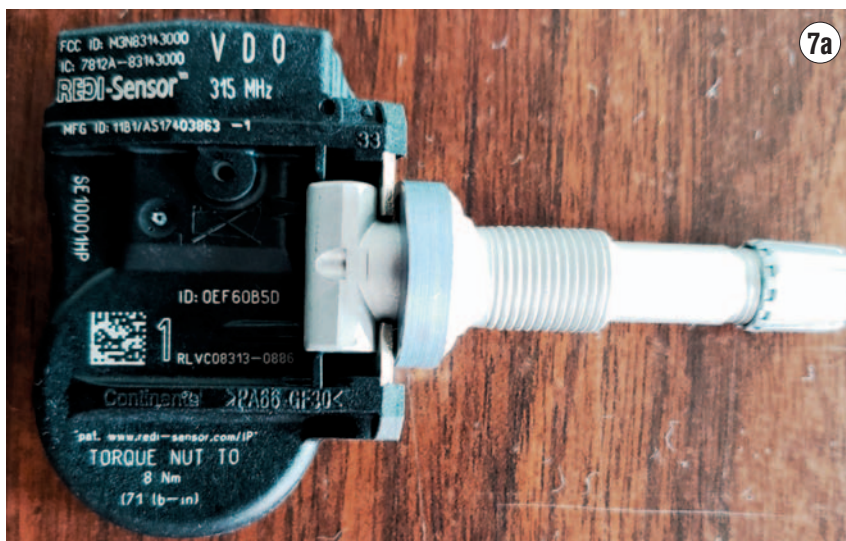
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hood and doors are closed in order for the procedure to work. Your next step is to make sure the ignition is in the on position, engine not running.

Now you're ready to press the Page In button that is located of the left side of the steering wheel until "Temperature" is displayed on the dash. This is followed by pressing the Reset button that is located to the left on the instrument cluster. The cluster should now display "UB 12.1" or so. Next, return to the left side of the steering wheel and press the down arrow. The Service Menu will now be displayed; get ready to switch to the right side of the steering wheel and press the - (Minus) button until "Confirmation" is highlighted. This is followed by going back to the Page In button on the left side of the steering wheel until you see "Full Service." Don't worry, you're almost done; press the Page In button again until you see "Service Confirmed." Now you can turn the ignition off and go back and see that the oil life is reset. It makes you wonder why any car company would make it so complicated. Thankfully, most of the newer vehicles are easier and many have the function to be reset right through the scan tool or oil reset tools.

On many of the higher-end, newer vehicles that we service, there is an extra step since the engine does not have an oil dip stick. So besides from just filling the oil up and checking the level on the dip stick, the engine operation temperature has to be up to the correct level. There is also a wait time before checking the oil level either on the vehicle display, or by a scan tool. I like using the scan tool since it allows easy access to changing the date, miles, light reset and oil level. Now this is not to say that we don't double check the oil level by using the vehicle's oil level display, since this is how the vehicle owner is going to check it. The procedure on a Porsche, for example, can vary from using the console



control knob or the steering wheel to display the oil level information. The display has the following: oil level OK, minimum oil level reached, oil level below minimum, oil level above maximum. The important thing on this vehicle is the eye candy display (Figure 6) that will indicate if the oil level is correct. It's a good idea to stay on the lower end of the oil level required amount. Pouring in just under the specified amount is the way to go since it's easier to pour more in than removing extra oil. Too much or too little oil can cause engine running issues or even damage. The extra time it takes to double check is well worth it when you're dealing with any vehicle — never mind this expensive engine.

Tire rotation

This simple service is something that most of us do without thinking much about, but with almost every vehicle out there with TPMS installed (Figures 7a, 7b, 7c), the game has changed. When we rotate tires, first we check if the tires are different sizes, followed by if they are directional. Many vehicles have wider tires in the rear or directional tires that cannot be rotated the normal way. Directional tires have a one-way arrow on them that has to be installed only on the corresponding side of the vehicle that they are intended for. These type of tires have a specific tread pattern that were developed for the vehicle so it can handle better. A tire rotation with directional



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TECHNICAL TRAINING



tires can only go front to back or back to front on the same side. Different size tires like the ones on my Corvette can only be rotated side to side since the rear tires are wider than the front. On vehicles with front-wheel drive, move the front tires straight back on the same side and move the rear tires to the front on opposite sides. On the run-of-the-mill rear-wheel drive vehicle with the same size non-directional tires, they can easily be rotated. The front tires get moved

to the opposite side of the vehicle in the rear and the rear tires are moved straight to the front.

That's easy, but what about the spare? Let me tell you that if the vehicle does have a spare, you have to dig it out since many owners have their trunk loaded with stuff. Or if you live in the real world and deal with rust, spare tires that are installed under a vehicle are a bear to deal with. Besides, many vehicles have already replaced tires with



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different brand or style tires, so we don't usually have to rotate them. However, if the tire valve is accessible, we will inflate the tire to the proper pressure. Our next part of the rotation procedure is to look up the torque specification and select the proper torque stick (**Figure 8**) to get the wheel nut torque in spec. This is done before we lower the vehicle to the ground, followed by manually torquing all the wheels with our Snap-On torque wrench (**Figure 9**).

We are not done yet since TPMS has to be reset. The quickest way for us to perform this function lately is by using the Autel TS508 (**Figure 10**) that provides us a quick and easy way to reset the TPMS. This is to ensure that the vehicle owner has the correct tire pressure displayed on their information system. The relearn procedure varies by vehicle, but the tool provides us with step-by-step directions.

Let's take a look at a GMC Canyon TPMS relearn procedure that starts with



the ignition on and turning the headlight switch off to on four times within three seconds. If the procedure was performed as stated, the horn should make a double chirp that indicates the relearn mode is activated. On the Autel tool and most others, the TPMS tool will display a vehicle graphic that displays the tire you should start at. On a GMC Canyon, we start at the left front tire and use the tool to activate the sensor. In some cases, you may have to let air out of the tire or add air until you hear the horn beep before you move on to the right front, right rear and finally the left rear tire. Once the last tire is done, the horn should sound twice, indicating that the process was completed. Turn of the ignition and you're set to go.

Of course, on some vehicle — such as a Subaru Forester — you have to add a test drive at speeds over 19 mph for 10 minutes before the TPMS light goes off. If you recall, I wrote an article on a VW that was a real problem with adding a TPMS sensor (“Dealing with European Vehicle Drivability Issues,” September 2017). VW relearn procedures are usually automatic and reset just by driving the vehicle. However, the procedure is different if you have to replace one of the sensors. Audi/VW (**Figure 11**) has you start with the vehicle sitting 20 minutes

ignition off, no door or any activity on the vehicle. If anything is turned on or open, the system will not go into a new sensor learn mode. After the 20 minutes of wait time, the vehicle needs to go for a test drive above 16 mph and not over 64 mph for 7 minutes. Once the test drive is completed, the vehicle needs to be shut off and the tire pressure set to the recommended pressure. The parking brake needs to be set, and the ignition must be set to the on position, engine off. Once this step is achieved, hold the SET or ESP if it has one. The location varies from the console near the shifter to the glove box. On the VW Golf we had, the procedure was totally different since it did not have a SET or ESP button. We had to confirm that the tire pressure was correct and add a Tire Pressure Security Adaptation code in order to get the TPMS light off. To read more about this problem VW, go to MotorAge.com/problemVW. **ZZ**



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COUNTING THE COSTS

SAFETY IS NOT AN AFTERTHOUGHT. ARE YOU DOING ALL YOU CAN?

TONY MARTIN // Contributing Editor

The world of work has changed dramatically in recent years. One example of this change is workplace safety, which has risen to become a dominant concern in industry. Now, more than ever, businesses and organizations are committing tremendous resources to keeping their workers safe. This involves investments in policy development, equipment and training, but also implies a shift in workplace culture. Everyone is being asked to think differently, and while most are adjusting, others are clearly not.

While the bigger companies of the world have led the way on this front, small business is also changing its focus to improve safety for its workers. There are numerous reasons for this, but the primary catalyst is that we have gained an awareness of the true costs of workplace injuries. Where a

job-related injury was once viewed as an isolated expense on the company ledger, there is now broad recognition that the costs are much greater than we originally thought.

This dynamic has worked in the favor of the worker. Most companies now emphasize the idea of “look before you leap” and encourage their employees to take the time to assess risks before performing a task. At first glance, this would appear to hurt production, and therefore, our ability to make money. However, when looking at the bigger picture, it is clear that we will actually come out ahead when we limit expenses related to workplace injuries.

So what does it cost a company when someone gets hurt on the job? Most of us are aware of the direct costs, which are items like ambulance rides, hospital stays, surgeries, physical rehabilitation, prescriptions, etc. Direct costs also include Workers’ Compensation and related disability payments.



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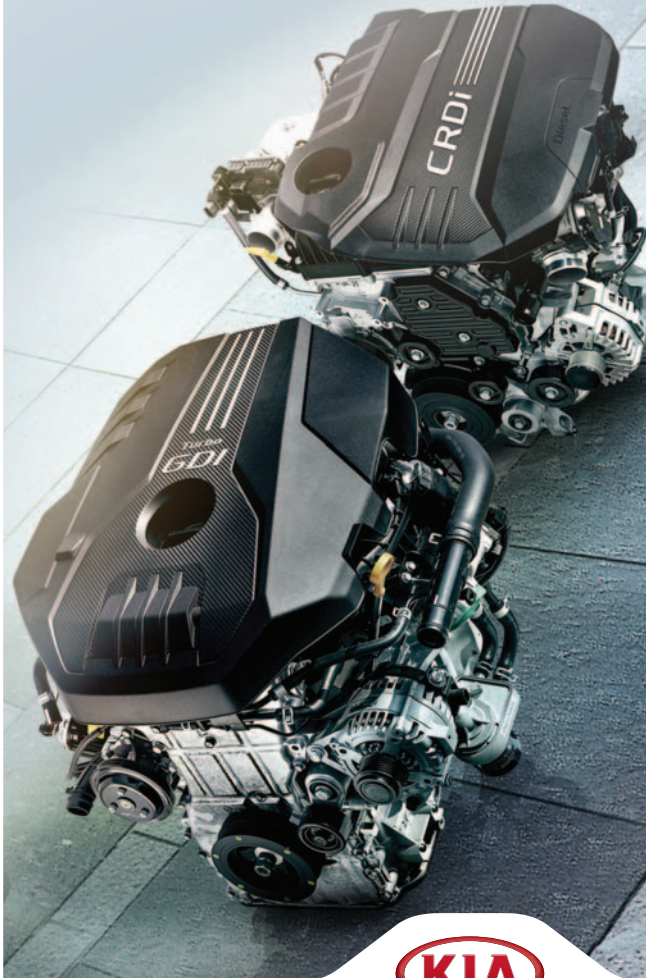
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TECHNICAL DRIVABILITY

These expenses can be mind-boggling in this day and age, but are often covered by insurance. We're not off the hook, however, because the direct costs of a workplace injury are only one piece of the puzzle. What many people fail to take into account are the hidden costs, also known as indirect costs. These are expenses that aren't covered by insurance and thus have a greater financial impact on a business.

Indirect costs

There is a long list of indirect costs related to a workplace injury. I refer to these as cascading liabilities, because each one has a negative effect on all the others. In other words, you can't incur one of these expenses without it causing other costs to increase. Here is a short list of the major indirect costs borne by a business when their workers get hurt:

Costs related to replacement workers — An injured employee typically cannot function fully in their job role, so the business either does without their services, or hires a replacement. If the business doesn't hire a replacement, it may forfeit any revenue the employee could have generated. Beyond that, extra workload distributed to the other employees could contribute to fatigue and increase the risk of another incident taking place. Keep in mind, however, that a replacement worker is no free lunch. There are costs related to the recruitment process, and there is always a learning curve for the new employee, even when they bring significant experience to the table.

Administrative overhead — A workplace injury triggers an avalanche of paperwork related to incident reporting, insurance claims, etc. This ties up resources on the part of administrative staff, who could otherwise be using their time to help generate revenue for the company.

Insurance cost increases — While the direct costs of a workplace injury are often covered by Workers' Compensation, the claim will likely result in increased premiums. Workers' Compensation premiums are typically based on a national survey that assesses the risk associated with the job duties of the employee. However, they can adjust up or down depending on a number of factors related to the business being covered. If the business takes steps to reduce the risk to its workers, the premiums may be reduced. However, injuries and associated claims will cause them to increase in a big way. To make matters worse, a premium increase will typically remain in effect for three years after the claim.

Increased regulatory oversight — Depending on the severity of the incident, regulatory agencies such as OSHA (Occupational Safety and Health Administration) could conduct an investigation on your premises. Citations and fines can be the result, and repeat visits are a possibility if the inspectors think your business could be a trouble spot.

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Loss of competitive ability — Any increase in overhead expenses for a company will reduce its ability to compete. In some cases, a poor safety record can cause a business to be disqualified from bidding for contracts with state and federal agencies, as well as many private concerns.

Erosion of company image — Workplace injuries and the associated bad press can make consumers think twice about purchasing products or services from your company. This can also make it more difficult to recruit new employees because people don't want to work for a company that has a poor safety record.

Adding it all up, the indirect costs of a workplace injury can be harmful for any company, but will have an even harsher impact on small businesses. Conservative estimates place the indirect costs of an injury at up to 4.5 times that of the direct costs. The crushing financial impact of a workplace injury clearly shows that investments in safety can pay back in very short order.

Societal attitudes

There are still many folks who believe that if you're working the way you should be, then it is reasonable to expect that you'll get hurt from time to time. A really good example of this is the condition of a workman's hands. Lots of people won't believe that you work as an automotive technician unless your hands are torn up. In fact, you may be made to feel that you are either lying or you're a complete slacker if you don't have cracked nails, swollen knuckles, or even missing parts of fingers. These attitudes are an indicator that society hasn't fully embraced the notion that all injuries are preventable, and that we shouldn't be making peace with anyone getting hurt on the job.

The question is: why wouldn't the employees want to follow the rules?

There is no simple answer to this question. In some cases, the worker believes that taking risks in the name of production makes them a better employee. This attitude could have been passed down to them by previous generations, who lived at a time where production was the only real concern. Posturing may also be a factor if the workplace culture is dominated by those wanting to show the world that real men have a high risk tolerance. What is troubling about these mindsets is the assumption that they will be the only ones affected if they get injured in a workplace incident.

In any case, those who engage in unsafe work practices are not seeing the bigger picture. You may have gotten away with dangerous shortcuts in the past, and now you've reached the point where they are standard practice. Getting yourself hurt isn't a matter of if — it's only a matter of when. And when you do get hurt, you won't be the only one who pays the price.

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Wipers: ●●●●●●●●●●
Horn / Interior Lights: ●●●●●●●●●●

UNDERHOOD

Oil Condition: ●●●●●●●●●●
Transmission Fluid: ●●●●●●●●●●
Power Steering / Brake Fluid: ●●●●●●●●●●
Coolant / Antifreeze: ●●●●●●●●●●
Air Filter: ●●●●●●●●●●
Cabin Filter: ●●●●●●●●●●
Belts: ●●●●●●●●●●

UNDER VEHICLE

Brake Lines / Brake Hoses /
Brake Cables / Fuel Line: ●●●●●●●●●●
Suspension & Steering: ●●●●●●●●●●
Driveline (Axles / CV Shaft): ●●●●●●●●●●
Rear Differential Fluid Level & Condition: ●●●●●●●●●●
Exhaust System / Shocks & Struts: ●●●●●●●●●●

TIRES

TREAD DEPTH: ● 7/32" or greater ● 3/32" to 6/32" ● 2/32" or less
LF ●●●●●●●●●● RF ●●●●●●●●●● /32
LR ●●●●●●●●●● RR ●●●●●●●●●● /32

Wear Pattern/ Damage: LF ●●●●●●●●●● RF ●●●●●●●●●●
LR ●●●●●●●●●● RR ●●●●●●●●●●

Air Pressure: Based on Mileage and Wear:
Alignment:
Balance:
Rotation:
New Tire:

BRAKES

BRAKE PADS / SHOES: LF ●●●●●●●●●● RF ●●●●●●●●●●
LR ●●●●●●●●●● RR ●●●●●●●●●●

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On a personal level

Just like your employer, you will incur direct and indirect costs if you get injured. However, while it will cost your company a lot of money, they will write a check and be more or less done with it. You and your family could potentially pay for the rest of your lives.

Your direct costs due to an injury are easy to quantify. Basically, these are expenses that leave less money in your pocket than what you would have made if you weren't injured. First off, your income isn't going to be anywhere near what you are making while you're at work. You may have yourself fooled into thinking that Workers' Compensation is a free lunch, but it's time to set the record straight on that. The reality is that Workers' Compensation typically pays 60 percent to 80 percent of your base pay (no overtime or bonuses included). This number would be roughly the same if you were receiving long-term disability payments. I encourage you to do this calculation, then think carefully about how your bills will be paid if this is what you'll have to live on.

Another angle on direct costs that we should discuss is that a workplace injury could leave your employer in a compromised financial position. That being said, this could impact you directly by limiting your employer's ability to grant pay raises and bonuses. Taken one step further, it could also lead to layoffs if the company's business is negatively impacted.

Medical expenses of a workplace injury are often fully covered by Workers' Compensation. However, if you get hurt away from work, you will be subject to deductibles and copays when you file a health insurance claim (assuming you have health insurance). It is also possible for your claim to be rejected, forcing you to engage in an appeal that may involve legal representation.

Now that we've discussed your direct costs if you get hurt in a workplace incident, it's time to look at some of your indirect costs. These oftentimes are expenses that you can't put a dollar value on; in other words, they're priceless! And, just like indirect costs for your employer, these are the ones that will have the biggest impact on you and your family.

Loss of quality time — There are all sorts of activities that you enjoy with friends and family when you are away from work. Many of these are physical in nature, such as sports and outdoor endeavors, and you may not be able to participate in these at the same level (or at all) if you are disabled due to a workplace injury. Think carefully about this; how much enjoyment do you derive from being able to recreate with those who are closest to you? It is an understatement to say that watching from the sidelines isn't the same.

Physical pain and suffering — There are many minor injuries that heal up and don't seem to have a lasting impact in terms of physical pain. However, a serious injury can leave the worker with chronic pain and the potential to develop a dependence on painkillers. If you know someone who is suffering from an addiction to opiates or other controlled substances, you can testify to the misery that they — and those who are closest to them — endure.

Alienation — A workplace injury can leave you with a lot of spare time. Too much time on your hands can lead to your mind wandering to places it shouldn't go, and one of those places is self-accusation. You are your own worst critic, and your self-esteem tends to take a pounding when you aren't earning your living the way you feel you should. This directly impacts your relationships with your loved ones and friends, only magnifying the suffering

you are experiencing.

Take care of yourself

I would suggest that those who assume inappropriate risk in the workplace haven't thought very carefully about the ramifications. To quote a famous phrase, "It isn't about you." Dangerous shortcuts or negligence that takes place in the name of getting a job done right away could lead to terrible consequences for your family and your coworkers. You can make simple changes in your work practices that will help you, your family, and friends prosper. Here is a short list of items that you might consider:

1. Discipline yourself to wear the appropriate PPE during the workday. This includes safety glasses, hard-toe boots with metatarsal guards, gloves and face shields.
2. Don't make peace with malfunctioning equipment, especially when safety is involved. For example, are you willing to work underneath an automotive lift if the safety catches are inoperative?
3. Don't walk by safety issues, such as slippery floors, without doing something about them.
4. Think carefully before lifting heavy objects. Is there a safe way to lift it by hand, or is it time to put a jack or hoist to work?

I encourage you to do the right thing and think beyond yourself when you are making critical safety decisions at work. You won't regret taking the time to do it right when you enter your retirement years injury-free! **ZZ**



TONY MARTIN is the author of "Tuning In to Safety," a book written to help workers get their priorities straight in regards to safety. Tony works in the mining industry in Fairbanks, Alaska. He is a qualified Heavy Duty Equipment Mechanic and former post-secondary level educator.

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SURVIVING THE TOUGH ONES

FEEL LIKE THROWING UP YOUR HANDS IN FRUSTRATION WHEN YOU'RE FACED WITH TOUGH DIAGNOSTIC CHALLENGES? YOU'RE NOT ALONE!

JAIME LAZARUS // Contributing Editor

Seriously, the reasons why I don't want to perform the replacement of mechanical devices is two-fold; first, I get bored easily — so the tasks I perform become “tedious boredom” when all I'm doing is trying to get them done faster than the last time I did the same thing and secondly, I'm no longer physically able to do what I used to be able to do. Maybe it's because I did what I did when I was able to — with disregard for how I'd eventually PAY for doing them in the future — that my body has fallen apart. It's as good a guess as any. So, it's diagnostics and ONLY diagnostics for me now and in my future, sanity be damned!

There have been many people credited with coining the phrase: “The definition of insanity is repeating the same mistakes and expecting different results.” There are many variations of that often-repeated statement and they all seem to apply most appropriately when we are diagnosing problem vehicles! How many times have you thought “Did I miss something in my diagnosis?” It's that question I kept repeating re-

cently while I was diagnosing a 2005 Chrysler 300 LX with a 5.7L Hemi, AWD and 80,985 miles on the odometer. Have you ever had to re-do the diagnostics you performed previously because a problem is still present?

Starting with the customer's notes

As was the case with this vehicle, we aren't always fortunate enough to be able to review repair history. Jeff and Katie had purchased the vehicle five months before bringing it to Gary's shop. They said it had only recently developed the symptoms regularly when at first, they were happening only sporadically. As described by a written note left in their vehicle, the symptoms included “drives rough — jumpy — all the time, worse when wet.” They went on to describe them further by writing “does sometimes cut out when stopped. Not running on all cylinders. Spark plugs replaced 2 months ago — problem is worse.” Lastly, they wrote, “Get random misfire errors.” I just love customers' notes. Don't you?

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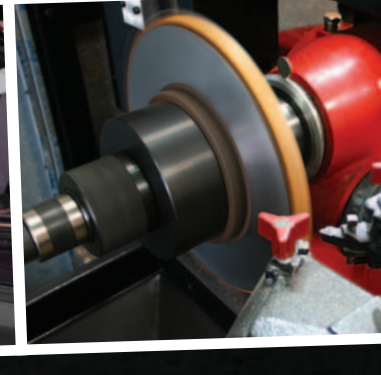
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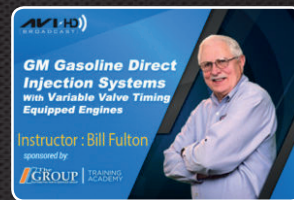
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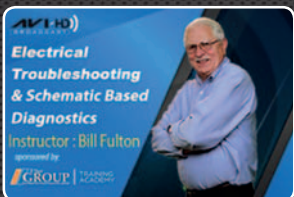
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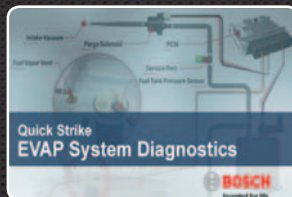
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Do you ever get the feeling someone has been working on a car, recently, like right before the customer brought it to



2005 LX HEMI EMBLEM

YOU? That's the way I interpreted what was written. Is that what you thought, too? My curiosity was peaked around HOW the customer knew there were misfire codes. Also, I had to believe the REASON the spark plugs were replaced was to (guessingly) resolve the misfire(s) because the cause could not be determined. Obviously that work made things worse (or did it?). Did rainy weather have an effect before the spark plug replacement or did this operation create a new problem? I also wondered

WHO replaced them (a professional or amateur?). Lastly, what was meant by "sometimes cut out when stopped?" It was my responsibility to determine the causes of these complaints.

I preach about the need for your first step to be a visual inspection, which is where I started on this vehicle. Until this one, I'd never worked on a 4WD Chrysler product that didn't have "33 inch Mud-ders" and wasn't extensively modified for off-road use only! This was a new one to me, so I was particularly observant!

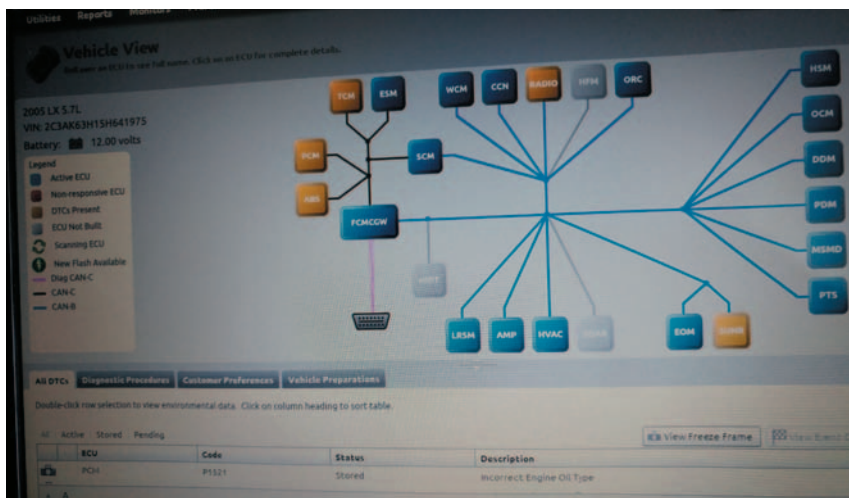
The first thing I noticed was a much-labored starter when cranking the engine. There was a noticeable "starter drag," but the engine did eventually start. Once running, a light tapping sound was heard, which went away after a few seconds. The lead tech and I went out for a test drive. We noticed a loud "rubbing" noise, similar to a tire rubbing the inside wheel well as we backed into the parking lot to leave. It went away as we took off. No misfires were detected while driving the vehicle "normally," and all systems operated as designed as long as we drove in that manner. But this car's got a Hemi!



2005 CHRYSLER 300 (LX) - THE VEHICLE

Radical! But not in a good way.

When traffic permitted, we tested how well the Hemi performed. Yes, tested. Hard. It was when the transmission was about to shift into second gear (and again later when it was ready to shift into third and when shifting into fourth) that there was what can only be described as a radical event. It was as if the engine's controller suddenly forgot how to do so. There were backfires out of the exhaust. There were backfires under the hood. There was bucking and jerking. There was almost a loss of vehicle control every time we put the car to this "test." It was violent. It was engine load-related we agreed, since it didn't matter what gear we were in, what speed we were going, etc. I decided to record as much



I BEGIN SCAN DIAGNOSTICS with a complete vehicle network test whenever I can. Chrysler's wiTECH software displays the vehicle network graphically and indicates which modules have DTCs, have updates available and more.

as I could with the scanner (wiTECH) but under such conditions, it's difficult at best to capture events like these let alone hang onto the laptop! We made it back to the shop without a law enforcement escort.

The engine sounded "louder" than it should be, as if there was a modified air intake, each time we accelerated. Sure enough, it had been modified, but not like you're thinking. There was no air filter installed, and the air filter box lid, to which the air snorkel attaches, was



LOCATED CLOSE TO WHERE the battery is mounted in the trunk are two of six main body grounds.

not clamped down tightly. There was no sign of where the air filter might be. Does this information make you think (like I did) that the spark plugs might not have been replaced by a professional? My visual observations revealed no more surprises.

It was because of the owners saying the misfire condition was more promi-

nent in wet weather that I immediately suspected a secondary ignition insulation violation had occurred. In simpler terms, I thought a plug wire or boot was leaking. I have a mixture of salt water in a spray bottle that I prominently labeled "Ignition Insulation Test Fluid" that works very well. When sprayed on ignition components while the en-



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gine's running, it reveals the leaking secondary components with ease! Unfortunately, in this case, the engine continued running as smoothly as the engineers had intended no matter how much I sprayed on it. I began to get perplexed. Wouldn't you? I hosed down the mess I made on top of the engine and moved on.

A look in the trunk

Having a nagging feeling that I'd better begin my next diagnostic step with a Battery/Starter/Charging system test, I grabbed my Pico, a battery load tester and a battery conductance tester. I opened the trunk to find an exposed battery compartment. Usually there's a spare tire cover and a spare tire to move before you can even get to the battery! All the obstacles were missing. I also witnessed a lot of corrosion on both of the body grounds that are located closest to the battery. I imagined I was going to find excessive voltage drops on



THERE IS ONE GROUND LOCATED on the rear of each cylinder head.

all kinds of power supply and ground circuits to modules (but I was still in "information gathering" mode).

At Gary's shop, we used every test we could to confirm our suspicions. On more than one occasion he had learned one test might give a "passing" result while another might not. I had one test fail, another was "borderline" and the third test indicated the battery should be recharged and re-tested. But Gary wasn't too worried here. His intuition was that we were not addressing the customer's primary complaint(s) despite finding something that wasn't quite "right." I had to agree with him. This information would be used at a later date, though.

The battery tests also led me to perform voltage drop tests because the battery was located in the trunk (and we all know where the starter's battery cable terminates). There was over two volts difference between the battery positive post and the starter's threaded stud to which the positive battery cable is attached! Gary said, "I'll make note of it," and asked me to continue to diagnose the misfire complaint. I suspected that with so much corrosion noticed at so many locations, that it might have an influence in an ECU's performance. I had to prove it to Gary though, grumbling about that under my breath! I'm the guy who likes to fix problems identified and then see if the customer's complaints are resolved. Gary's not from Missouri but he might as well have been with his insistence on "show me!"

What the ECUs are seeing

I then scanned the vehicle's systems. On all vehicles, I prefer to perform a complete network DTC test before I do anything else. My reasons are many — which include the possibility that more than one module may point to the same failure, that maybe there's a network fault that interrupts communication throughout the vehicle (which may be causing the customer

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ON BOTH SIDES OF THE VEHICLE, rearward of each headlamp, are located main body grounds.

complaint) and of course, I use that information as a baseline to help me throughout the whole diagnostic process. There are more reasons. Maybe there are some reasons you have that I didn't mention?

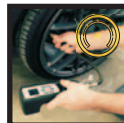
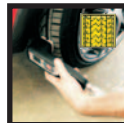
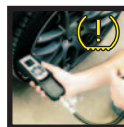
Of the 11 codes found in the 21 modules reporting on the network, all were "Stored" (History) DTCs except one, a P0420 — Pending — Catalyst Efficiency (Bank 1). Because stored DTCs could have occurred as far back as when the vehicle was being assembled, we cannot grace them with much importance during our initial evaluation. If you happen to see DTCs like this vehicle had stored, a P0315 (No Crank Sensor Learned) and a P0339 (Crankshaft Position Sensor Intermittent) and then couple them with the customer's complaints, then it might be easy to suspect the CKP (Crankshaft Position Sensor) was the culprit.

Gary found one at a dealership and had it installed before I knew what happened! I would have preferred to have scoped it to prove it was faulty but Gary owns the shop and made the executive decision to "just try it" and see if the vehicle ran differently. He said the part was cheaper than the time he'd have had to pay me to scope it (again, his call). Unfortunately, it didn't change how the vehicle ran.

I performed almost every test I could, including power supplies and ground circuit(s) voltage drop testing. There were two bi-directional tests, which gave me errors when attempting to perform them. These failures led us to condemn the PCM (Powertrain Control Module) due to suspected failure of inter-

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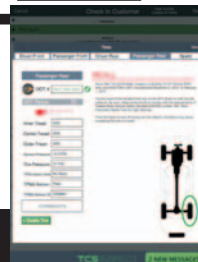
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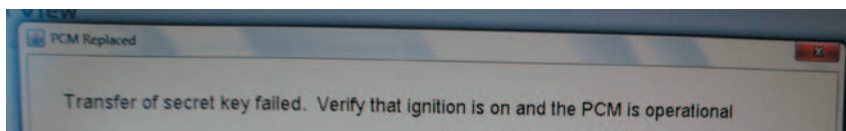
nal components. The theory was if the PCM couldn't properly run these tests, it might be improperly calculating what's needed under a heavy load. A "Chrysler Reman" was ordered from the dealer, installed and attempts were made to program it to the vehicle. After several failed attempts, pinpoint tests were (re) done, yet resulted in no problems found. Eventually the module cooperated, it "let" me program it and perform all the set-up routines that were required. A test drive revealed the violent, radical way it had been performing was now not present. "Hooray," we cheered, until it just shut off for no reason!

We coasted to the side of the road. It restarted and without incident, we got back to the shop. It was then that Gary allowed his tech to clean the SIX major ground points and the starter terminal connections in hopes one or more of them may have caused the stalling. For several hours after, we let the car run in the service bay. It would still stall randomly, while nothing was being done to it, several times per hour. Could this symptom be what the owners described as "does sometimes cut out when stop?"

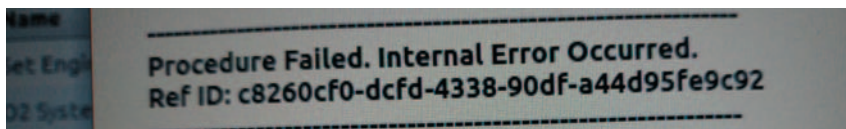
Frustration builds

I'm sure you can imagine the testing that took place in the days that followed. Yes, days. Running the same tests I'd run before. Nothing was proving faulty, though. Finally, out of desperation, we chose to order (from the disbelieving dealership) another PCM. The new one programmed properly on the first attempt, was set-up in no time at all and it resolved every drivability complaint the owners had! It finally ran like a Hemi was meant to run.

Have you ever noticed how we interpret what a customer describes, but it can also be interpreted in many different ways? It became obvious our owners Jeff and Katie were trying to help me diagnose their complaints by using terms they thought I'd understand. I, however,



ONE OF THE PCM BI-DIRECTIONAL TESTS FAILED and wiTECH displayed this error message.



THE FIRST REPLACEMENT PCM was difficult to program, routinely delivering error messages like this one.



WITECH DISPLAYED THE REPLACEMENT PCM wasn't operational immediately after installing it. It took almost a minute before it was recognized on the network!

use those same terms to describe other types of engine running conditions than what was being experienced. I gave them kudos for trying. The "sometimes cut out when stopped" complaint was separate from the "Drives rough — jumpy — all the time, worse when wet" complaint. Also, we can now assume the "Not running on all cylinders" complaint was derived from some other mechanic sharing his or her thoughts about how it drove. It was early in my diagnosis that Gary asked me to chat with the owners. That was a wise decision because there was a lot we didn't know about the car, and a lot they didn't know about it either. For instance, Jeff had no idea how long they'd driven the car without an air filter. Communication is a critical element in accurate diagnoses.

Gary's astute business instincts —



I'VE SEEN BETTER LOOKING, higher quality PCMs from aftermarket suppliers.

to stay focused on the customer complaints — could have almost driven me nuts! I routinely found one problem on the vehicle after another. However,

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ONCE A "GOOD" PCM was installed, programmed and all the set-up procedures performed the DTCs were cleared vehicle-wide.

rather than calling the customer with each problem that I discovered, he had me resolve their complaints first. Without annoying them, without generating suspicions of "selling" work and without seeming incompetent, in the end he made many more sales on the vehicle. He first addressed their needs then, after earning their respect (and building up their confidence in his shop's capabilities), it was a lot easier to address their next-most pressing needs, like their battery, etc. Oh, and that loud "rubbing" noise heard while backing? That was due to incompatible fluid in the transfer case. Yes, he serviced that as well.

It is a reality we must live with. To confirm our suspicions of what is wrong with a vehicle we must perform certain tests, most times repeatedly, and look to see if the results are the same. These techniques just happen to be similar to the statement "doing the same things over and over expecting different results is the definition of insanity." That's just crazy, isn't it?

P.S. — Both PCMs bought from the dealership arrived in boxes that had several labels on top of each other, had mispositioned labels on the PCM itself and looked as if the cases were sand blasted. I'd seen better looking units come from after-market suppliers, which evokes my question "From where did the dealership source these modules?" *TZ*



JAIME LAZARUS has regularly presented technical seminars since 1985. He recently taught instructors at the North American Council of Automotive Teachers conference and the NASCAR Technical Institute.
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VANESSA ATWELL //
Contributing Editor

One evening seven years ago, after a particularly rough day working at the head office of a Japanese vehicle manufacturer, I scanned the online job postings and noticed an ad from a remote, arctic mine site that sounded

similar to the job I was doing at the time.

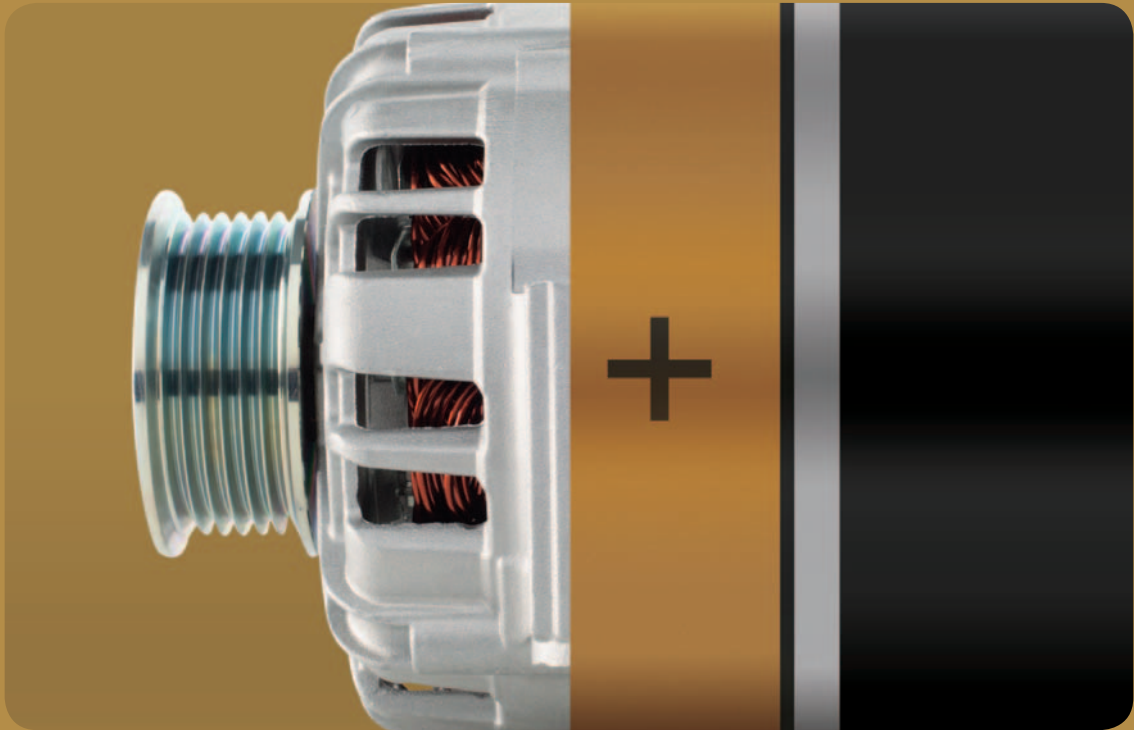
I submitted a resume I had on file along with a generic cover letter, clicked “submit” and didn’t think anything else about it, chalking it up to a mental escape after a tough day. Six weeks later I got an email offer to fly to a tiny, remote northern town for an interview and six months after that I was working at the site in some of the harshest conditions

on the planet — seriously.

Conditions on site are so harsh we don’t even order parts for “arctic” or “extreme cold” conditions because they’re never suitable for the environment we work in — we’d just have to take them off and make up our own stuff that can handle the job. And the parts we do order can take months to get to site. There’s no parts store on the corner —

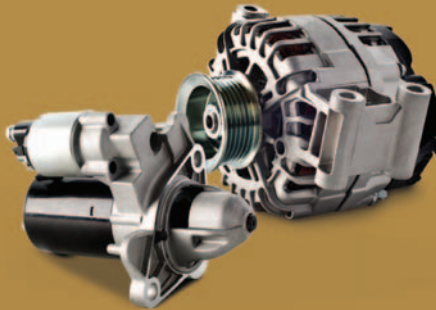


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DURING THE WINTER there's maybe an hour or two of daylight — and yes, it's brutally cold, down to -80F at times. The trucks and buses need to run at that temperature because they're considered shelters.

there's not even a road 10 months out of the year until the ice road gets built. Parts are flown in based on priority and can often get bumped for groceries or other, higher priority parts. It's not uncommon to get techs flying in to site to bring parts up in their personal luggage and to patch up vehicles in the meantime so they're safe to drive.

And not only that, since the pick-up trucks and buses on site are used as emergency shelters as well as for transportation and protection against curious or aggressive wildlife, the vehicles simply have to work because someone could freeze to death (or, in theory, get eaten) if they don't. This is even more important when you have to live and work with the people counting on you to keep their protective-shelter-transportation working, and you kind of like having them around.

Not only do the vehicles have to run reliably, oil or coolant leaks from the vehicles are simply not acceptable because any and all leaks have to be reported to the government agencies and the company can be fined or shut down if they don't. In addition, any contaminated soil needs to be flown off site and disposed of at huge expense. Ugh.

Perhaps the biggest difference, though, is how important the company's safety record is and how this affects their ability to keep operating. Thus, there's an unbelievable amount



USUALLY THE ONLY WAY TO GET SUPPLIES to site is to fly them in, but for two months in the winter they're driven up on an ice road.

of pressure to work safely and keep the workplace clean — more than I've ever seen anywhere, including the Japanese manufacturer. The company is fanatic about safety and shortcuts or unsafe acts typically get a person banned from site for good.

Aside from these differences though, the methods used to keep vehicles running in these harsh, remote conditions are similar to the ones used everywhere — pay attention to details, be ready for common repairs and listen to the customers.

But I'll give them all the credit — techs working in this harsh environment definitely know how to keep vehicles running and overcome tough repair challenges while keeping the costs reasonable. And since many of the challenges we face up here are faced by techs all over the country, here are a few

tips from the frozen north that may help make any repair go smoothly when conditions are tough, resources are scarce and the vehicle simply has to work.

Common problems

Techs on site are split into two groups: the heavy-equipment techs who keep the large equipment and heavy-duty units working, and the light-vehicle technicians who keep literally anything else with an engine that can be moved or dragged across the site operating.

Mostly these are Ford 4x4 diesel trucks with crew cabs, but there are also school buses, highway trucks, firetrucks, ambulances, pumps, small engines, man-carriers, snowmobiles, ATVs, boats, portable heaters, geotechnical equipment, elevated work platforms and light plants — and just about anything else you'd imagine on a worksite that's cold and dark nine

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months of the year.

That said, easily the most common problems fleet-wide are diesel pick-up trucks with no-start conditions and DEF/regeneration system issues.

No-starts on site tend to happen to people who aren't used to plugging in a vehicle when it gets cold, or when the block heater's cord itself goes bad (which is surprisingly common). The fixes are similar to what they are in less extreme conditions — charge and test the batteries, replace and repair components as necessary and verify that the block heater and cord are operational so the problem doesn't happen again. It's usually a quick and easy repair.

Regeneration system issues are also incredibly common since vehicles idle so much on site, up to 24 hours a day in the winter.

And, just like everywhere else in the country, regen issues tend to happen at the worst possible time and in the worst locations (on ramps, on blast patterns and in the middle of nowhere). The fix is the same as ever: add fluid if required, perform a manual regen and reprogram the system if required — it's just much colder outside when these fixes happen.

A few cost-saving and fuel-saving “no-idle” initiatives have been introduced in the past, which then typically result in an increase in no-start conditions as the trucks freeze up after being shut off (and even the occasional engine replacement when people kept trying to start a frozen truck with no oil pressure), so the initiatives tend to get scrapped for a while until a new group tries introducing them again, with inevitably similar outcomes. Unfortunately, it's just not a good idea to shut off a truck overnight when it's -80°F outside.

And, as with most other places, attempts to remove and clean the DPF filter aren't always successful, so the filters need to be replaced. It's tough to



KEEPING THE SHOP CLEAN is just the beginning. Trash is meticulously sorted to keep hazardous materials out of the landfill and incinerator. And working safely is absolutely critical because it's a long way to the nearest hospital. (The sock monkey is in the photo because it made my family back home laugh.)

explain the large cost involved. No one wants to hear how much those things go for, even mining companies with planned maintenance budgets!

No doubt the system causes aggravation, but it's nice to be able to breathe and the law says they have to be installed on vehicles so, like techs everywhere else, we work with the systems and fix them when they go bad. Some things are the same everywhere.

Modifications and damage

Most of the trucks on site have been heavily modified for the harsh conditions they operate in, and like many modified vehicles, this can cause problems when the companies that do the modifications off site aren't aware of what they're drilling into.

One time several pickups were down at the same time, waiting for the same part (the auxiliary radiator) to arrive because they'd all been punctured

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Technology

with a screw used to hold a bracket for a bolt-on system during the installation process. The parts took months to arrive, and people were going nuts because there were no trucks available. (It's not OK to operate a leaking unit because of the environmental issues involved, so the trucks were parked until they could be fixed.)

It was taking forever for the parts to arrive — no amount of money or begging could get them to show up any quicker. And it was not fun explaining the problem over and over again.

So, in order to get the trucks back in use (since so many trucks were down), one tech brought tubes of a stop-leak product to site and ran it through the cooling systems on the various trucks.

It worked great, and it got the fleet back in action until the parts finally arrived and the units were fixed permanently.

No matter where you are, no one wants to have a unit down because the parts aren't going to be available for a while.

Diagnosing and repairing computerized systems

Diagnosing electronic problems when it's bitterly cold outside can also be challenging — but it needs to be done.

As is true everywhere else, the most important thing is to start by making sure the battery is good. Even if the battery is slightly undercharged, it can cause drivability problems so this critical step is done as one of the first diagnostic steps every time.

Another tip that may help is to print off the entire wiring schematic for a problematic system (not just the little section involved) and then use highlighters to trace circuits all the way through from power to ground. It sounds simple, but it really helps when there are many circuits involved in a system that share a common splice or junction box.



FRONT OF THE ACCOMMODATIONS BUILDING and one of the few places smoking is allowed. The butts need to be disposed of in the bins so they don't attract wildlife.



KEEPING THIS TRUCK RUNNING in the extreme cold isn't an easy job, but peoples' lives depend on doing it well.

And also like everywhere else, swapping parts among units to help diagnosis problems can save time and verify suspicions about what's causing a problem — ordering the wrong parts can keep the unit down far longer than it needs to be. That's one good thing about having so many similar vehicles in the same place; finding a known good part isn't too difficult.

Finally, just like everywhere else,

the pickup trucks used on site occasionally need to be reprogrammed to repair concerns, and it can really be a challenge on site since the satellite internet connection is slow and intermittent and sometimes birds build nests in there and then can't be disturbed. What tends to help is doing the reprogramming on nightshift when there are fewer people using the internet connection, and being careful to set



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everything up carefully so the job will be successful on the first attempt. No matter where you are in the country, attention to detail is important when things get difficult or challenging.

Safety

However, of all the challenges I encountered when I started working at the site, easily the toughest thing to get used to was how fanatic management was (and is) about working safely.

Every shift starts with a safety meeting and everyone is expected to willingly participate with a positive attitude. This is not optional. Before any job starts, technicians list any possible hazards or problems that could happen during the task, and they do this again if anything changes during the job that affects the initial assessment. Any hazards are discussed and eliminated or managed before the job begins. No exceptions.

The typical nicks and cuts that techs tend to get (and that I always got) are considered unacceptable on site and count against the department's record — all of which took getting used to because I'd never experienced anything like it.

Honestly, after a while I got used to it and now I'm actually very happy about it.

While not every shop in the country shares this attitude, it's well worth remembering that this job can indeed be dangerous and one bad choice can affect your ability to earn money or enjoy your life and the things you like to do.

Taking a few minutes to understand hazards in the work area and what can go wrong during a job, and then taking steps to eliminate the risk is well worth it. Along those lines, realizing when a repair isn't going well and then taking a few deep breaths or a few steps away to regroup before losing your mind can make a huge difference to the repair and your safety. It's tough to stay calm in the moment when things are



VIEW FROM THE FRONT OF CAMP AT LUNCH TIME. The sun only comes up a little bit in the winter, and barely sets at all in the summer (which makes it tough to sleep on nightshift).



SPRING THAW

not going right and are quickly getting worse, but making the effort to regroup and step away for a break can be all it takes to change course and get things back under control without breaking anything or getting hurt. No matter where you're working, it's not fun getting hurt on the job and it's definitely no fun breaking things.

Whether I like it or not, working on site has changed the way I think about doing a job, and I don't think that's going to change any time soon. Working up here has definitely had an impact on me, and I think, overall, it's a good one.

Conclusion

Working at a remote arctic mine site definitely has its challenges, but overall it's a great experience in a gorgeous part of the world, and it's even kind of fun — which was exactly what I was hoping for when I applied so many years ago after a rough day at the office. It's nice when the people around you genuinely ap-

preciate the value of a good mechanic, even though it's tough to explain to those same people why a repair sometimes isn't going well.

Overall, the same things that keep trucks running well at -80F are the same things that keep any vehicle running well anywhere — attention to detail, understanding common problems and listening to the customer. And even though it takes some getting used to, working safely is definitely a good idea, as is understanding why the people around you are trying to work safely and what's important to them at home.

Because no matter where work is, it's nice to get home healthy and even happy at the end of the day. Some things are the same everywhere. *TL*

VANESSA ATWELL is a Master Technician for two major manufacturers and has also worked on the bench of an independent shop. She has developed and delivered training for both vehicle manufacturers and independents, and helped develop government training and regulations standards.

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IS THE CURRENT PATH CLEAN?

YOU HEAR TECHS ALL THE TIME TALKING ABOUT TESTING “POWER AND GROUNDS.” BUT WHAT DOES THAT REALLY REFER TO — AND HOW DO YOU PERFORM THESE TESTS CORRECTLY?

PETE MEIER // Technical Editor

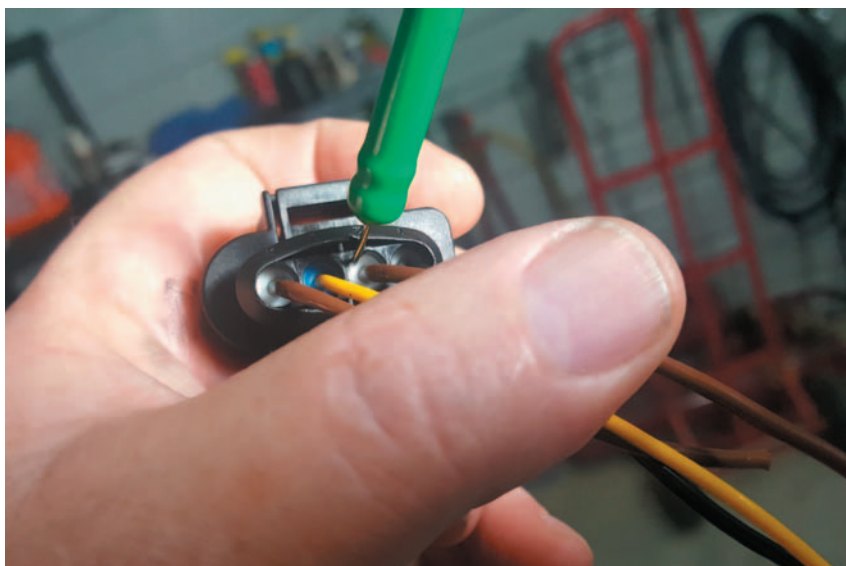
I struggled with the concept of voltage drop testing until a contest held by my last employer embarrassed me enough to go home and do what was necessary to learn the technique. As a result, I found myself solving more electrical concerns for our customers, and that didn't go unnoticed by my boss. It didn't take long for him to refer other techs in the shop to me when they were stumped by an electrical gremlin. While I certainly didn't mind, I also didn't want to do their work for them. After all, we were all on flat rate.

And didn't a wise man once say something about teaching a man to fish?

One instance that really stands out in my mind for some reason was a GMC blower motor that didn't want to run at full speed. The tech working on the concern had ordered and installed a replacement blower motor only to have the new one act the same way. That's when he came to me for help.

“Did you test power and ground to the blower motor?” I asked. He assured me he had, but I was curious on exactly how he had performed the tests. So I asked him to show me.

Grabbing his test light, he disconnected the connector from the blower motor, turned the ignition key “on” and switched the blower motor control to “high.” He grounded his test light to a



THIS IS WHY MANY OEMS do not want you to backprobe. If you damage the weather seal, corrosion will not be far behind.

nearby screw head under the dash and placed the probe end of the test light in the connector socket bringing power to the motor. It lit up brightly. I didn't really need to see him do anything more. I knew he had failed to test the power circuit correctly, and I was willing to bet he hadn't tested the ground side any more effectively.

Do you know why?

This particular job happened a long time ago, yet I still meet and hear stories from technicians who are making this same mistake every day. One foundational fact about testing for voltage drop is that the circuit **MUST** be “on” with current

flowing. By disconnecting the connector from the blower motor, the tech was doing nothing more than measuring OCV (Open Circuit Voltage).

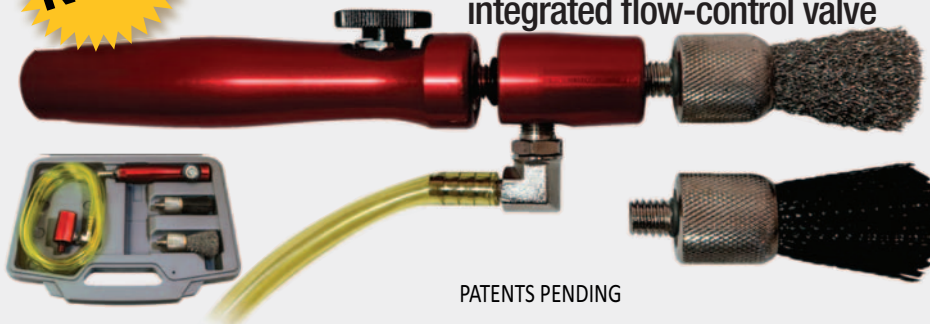
I went back to my bay and grabbed my PowerProbe, a tool I used frequently for electrical testing on most circuits. Another foundational rule is to always reference your meter to the battery so you can be assured of testing the entire circuit path. The other side of that rule is to get your measurement lead as close to the circuit load (in this case, the blower motor) as possible for the same reason. It is important to remember that you are only measuring the voltage potential (or lack thereof) between

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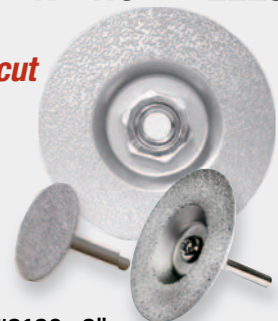
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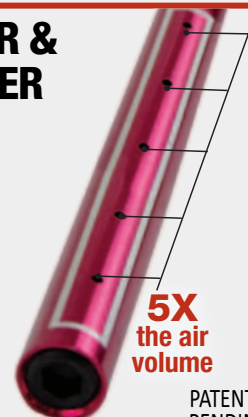
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PATENTS PENDING

the two leads of your tool.

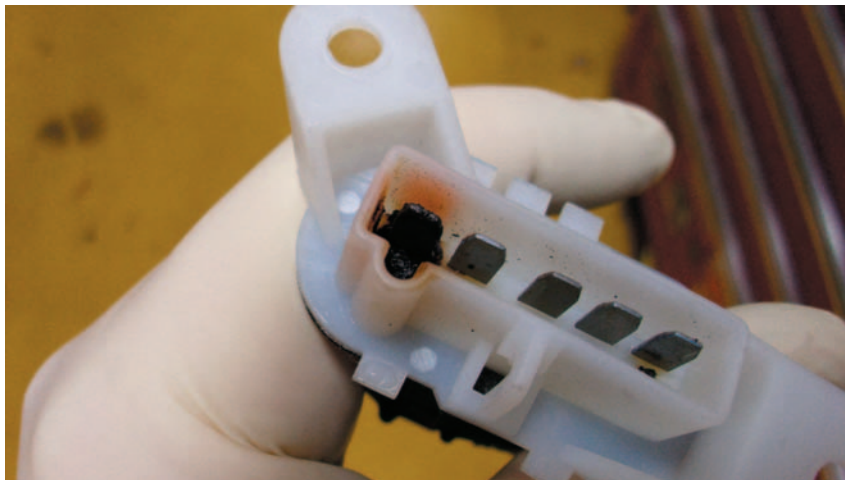
I plugged the blower motor connector back in and wasn't surprised to hear it spinning much more slowly than it should. I gently probed the power feed wire right at the connector and measured less than 6V. That's a far cry from the 12V+ I should be seeing! I explained to the technician I was helping that the reading was telling us there was an unwanted resistance somewhere between the connector and the battery positive cable connection.

Reviewing the schematic he had printed out, I explained that we needed to backtrack on the power side of the circuit, heading back to the battery. Once our meter reading returned to normal (on the power side using the PowerProbe, that would mean seeing the full system voltage) and then heading back toward the load until the reading went bad again, eventually closing the gap on the fault kind of like two baseball players with a runner trapped between them. The easiest way to do that would be to break the wiring path into easy segments and the first to present itself on the truck was the connector at the firewall, bringing the power in from the underhood junction box to the interior cab.

Measuring the same wire on the cab side of the firewall gave us the same reading we had at the blower motor, so we knew the problem had to be on the underhood side of the wiring. Moving to the other side of the same connector, the PowerProbe showed 12.3V — or normal. Disconnecting the plug (with some effort, I might add) revealed the problem. A loose connection created extra resistance in the circuit. That extra resistance also resulted in a hot spot that burned the contact, adding to the problem, and melted the connector, making it difficult to separate. A replacement connector was ordered and installed, the old blower motor was reinstalled and the concern was corrected.



PIERCING A WIRE FOR TEST PURPOSES also has its disadvantages. The biggest is forgetting to seal the hole you made with your tool.



DAMAGED OR POORLY FITTING CONNECTIONS in the harness plugs is an increasingly common cause of electrical issues. Mike Miller offers tips on finding these problems in his own article, "When the problem is terminal," on page 72.

Before you replace that ECU

An ECU, no matter what system or systems it's in charge of, is still an electrical "load" first. And like any other, it has to have a clean supply of voltage and a clean path to ground to function. Often, an ECU has more than one of each and ALL need to be tested and verified before the ECU itself is condemned. And while you can do it the same way as we did the blower motor, it's not as efficient.

An easier way is to disconnect the ECU, identify the harness side connector pins supplying the grounds and power feeds (both "hot at all times" and those that may require a certain key position) and then install a substitute load for testing.

The first step I like to take after identifying what does what is to use my PowerProbe (or test light) to identify which power feeds are "hot at all times."

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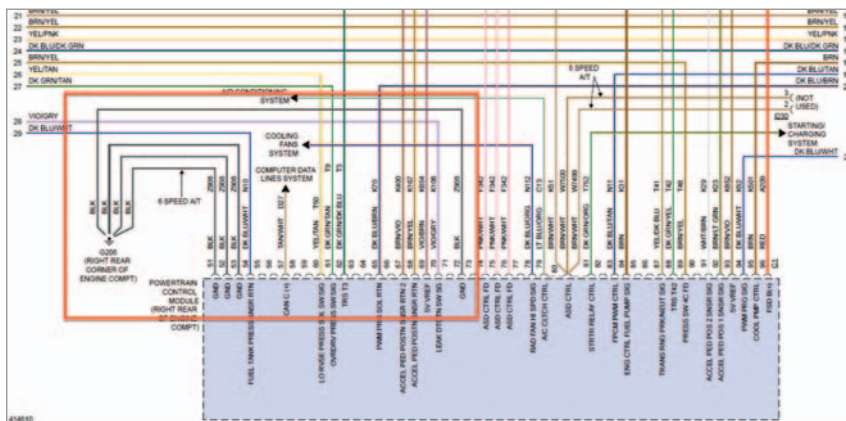
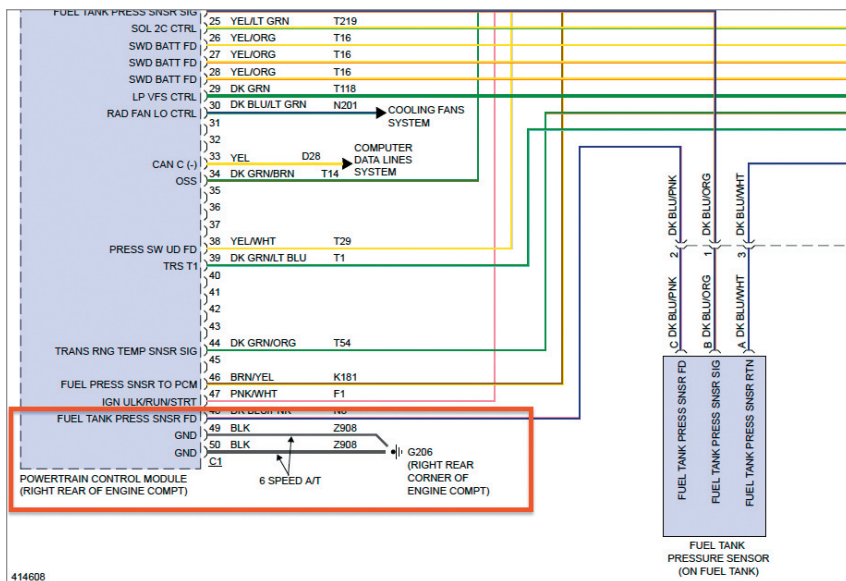
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With one identified, I use my connector test kit to select a lead that will fit the connector properly and install it on the power feed I've located. I then add a second test lead to the first ground connection I want to test. To these two leads, I attach my substitute load — typically a light bulb of one kind or another.

I used to use a headlight bulb exclusively, but after I shared that in one of my Trainer series videos (The Trainer #74 — MotorAge.com/feb18trainer), some readers shared their concern of exposing the ECU wiring to excessively high current draw. And while I never had a problem with that, it did get me to thinking. The whole purpose of testing this way is to uncover the presence of unwanted resistance elsewhere in the circuit. If the applied available voltage will be consumed proportionally to all the resistances in the circuit path, doesn't it make sense to use a substitute load that will mimic the normal current load of the ECU? So now I look at the fuses protecting the ECU I'm testing and choose a substitute load accordingly. The 55-watt headlight I use draws roughly 5 amps and fits most of my needs just fine.

With the substitute load connected and lit, I measure voltage drop on both the power side and the ground side but not at the load connections. To avoid reading any drop that I added in making those connections, I measure at the point where my leads are plugged into the ECU harness connector. The meter connections are simple — DVOM set to the Millivolt scale, negative meter lead on the positive battery post and the positive meter lead on the power side connection as described. If the drop is over 0.50V, the meter will typically read "OL" or provide some other over-limit warning. Then I move the negative meter lead to the ground post at the battery and the positive meter lead to the ground connection and repeat the test. If either fails, I know what side



PINPOINTING THE POWER AND GROUND FEEDS for an ECU may require you to look at more than one page. Be sure you identify and test them all.

of the circuit I need to start backtracking on. If the first ground point passes, I move the connector and test lead to the next ground pin and test it, moving through all the grounds until I've checked them all.

If all the grounds pass, I pick one and use it as the ground point for my substitute load and begin checking any remaining power feeds going to the ECU. The schematic will tell me if the feeds are "hot at all times" or what position the key must be on to complete the circuit.

Ever increasingly complex electronics are changing the aftermarket repair landscape. If you aren't comfortable

with electrical troubleshooting techniques, you need to get comfortable — and soon. Hope this helped you get on your way! *TM*



PETE MEIER is an ASE certified Master Technician with over 35 years of practical experience as a technician and educator, covering a wide variety of makes and models. He began writing for *Motor Age* as a contributor in 2006 and joined the magazine fulltime as Technical Editor in 2010. Pete believes in the mission of the magazine to "advance the automotive professional" and provides resources to working techs around the country through print, social media and YouTube.
pete.meier@ubm.com

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WHEN THE PROBLEM IS TERMINAL

ISSUES WITH ELECTRICAL CONNECTIONS ARE BECOMING MORE COMMONPLACE, AND THE SYMPTOMS THEY CREATE MAY MIMIC FAILED COMPONENTS — THAT HAVEN'T FAILED.

MICHAEL MILLER // Contributing Editor

When we think of failures, we often think in terms of components since most of the time that is what ends up being replaced, especially with ignition problems and crank no-starts. Oftentimes we overlook or never consider something that is becoming more common: the terminal contact inside of the connector to a component. The intermittent nature of terminal connection problems make them extremely hard to diagnose since they often occur so fast and also so randomly. One technique is to use an oscilloscope to help pick out quick glitches in a circuit that would be hard to locate with other testing methods.

2013 Dodge Durango

The first vehicle is a 2013 Dodge Durango with a 5.7L engine and 52K miles on the odometer. It was towed in with a complaint of a crank/no start. The customer stated the vehicle has been running rough and had low power before it stalled. When I went outside to try to start the Durango, it started right up. Like most technicians have experienced with a vehicle that was towed in and as most technicians would, I instinctively thought that a fuel pump was going out. Something else I noticed was that I could not shift out of park, but after



THIS IS A PICTURE OF THE 2013 DODGE DURANGO with a 5.7L engine

repeatedly pressing the brake pedal the shift interlock released, so I could move the vehicle.

When I went to pull the Durango inside, it died out while making a turn. I noticed a long crank before it restarted, then after about 20 feet it stalled again and this time it would not restart. After getting some help to push the vehicle in my bay, you guessed it — it started up and idled fine. OK, let's scan the vehicle for codes and take a look at some data before testing the fuel pump. I found a stored code P0627 Fuel Pump Relay Circuit, which seemed in tune with the stall and long crank that followed afterwards. Also stored was a P0571 Brake Switch Performance code, which explained why I had difficulty shifting out of park.

Shortly after the vehicle was inside, the service writer came with some information that the customer had shared with them. The customer informed us

that the vehicle had been brought to the dealership earlier in week to have a fuel pump relay recall performed. They only had it back for a day when the stalling started occurring intermittently and then last time it stalled, it would not restart, only crank. We were also informed that prior to being at the dealership for the fuel pump relay recall repair, they did not experience any problems.

On these vehicles, the fuel pump relay is integral to the Totally Integrated Power Module (TIPM) and is not serviceable separately. It appears that the fuel pump relay is problematic and a recall had been issued for this vehicle. Safety Recall R09/NHTSA 15V-115 addresses this problem, but instead of replacing the entire TIPM assembly, the repair is to rewire some of the TIPM circuits and add an external fuel pump relay.

After getting this information, I focused in on the fuel pump relay to find

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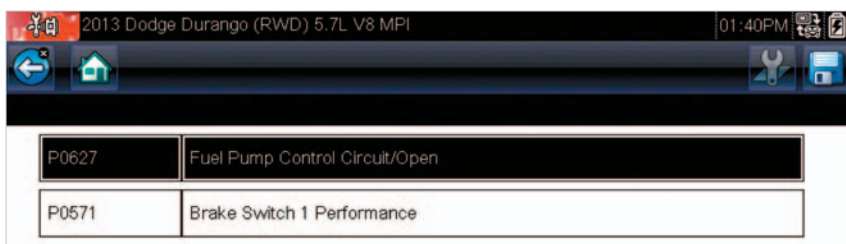


PARTS
ELITE

out if anything during the repair was left loose. I printed a copy of the recall repair instructions so I could familiarize myself with the procedure and hopefully narrow down the number of circuits to test. The connectors of the TIPM are secured by a flip-type lock to hold them in place so there was little chance of them not being pushed in fully. Most of the repair consisted of cutting and splicing wires of the fuel pump circuit going to the TIPM into the harness supplied for mounting the fuel pump relay remotely from the module. The repair passed a visual inspection, so I attached my oscilloscope to each of the relay circuits to determine if one of them was causing a loss of voltage to the vehicle's fuel pump or if I need to look elsewhere.

The location of the relay on the fender made an easy point to attach my scope leads to get direction on what is and is not working as designed. Just a heads up, if you open the hood on any of these vehicles that were affected and there is a single relay attached to the right corner of the engine bay held in by a push clip, the recall has already been performed on that particular vehicle. By attaching to the fuel pump relay I could monitor whether the PCM was commanding the relay on and also what the output voltage to the fuel pump was when the vehicle was either cranked or running. It so happened that when cranking the Durango this time it started and kept idling. As seen on the scope capture, the green and red traces showed a lot of drop outs, which corresponded to the PCM control circuit commanding fuel pump relay on and off and the output from the relay to the fuel pump, respectively. The rapid on/off of these two signals continued until the vehicle stalled out.

Reviewing the capture, I found that the green trace, which is the relay command from the PCM, was dropping out



A GOOD FIRST STEP IS retrieve Diagnostic Trouble Codes (DTCs) that give some direction in deciding where to begin testing.



THE FUEL PUMP RELAY was originally an integral part of the TIPM, but when the safety recall has been performed, it is visibly mounted on the right front of the engine compartment.



SINCE THE RELAY IS MOUNTED REMOTELY, it made an easy test point to start looking for a problem related to the DTC and no start concern.

first, following closely by the red trace, which is the voltage output of the relay to the fuel pump.

Reviewing the procedure to install the external fuel pump relay, I found that the relay command signal was spliced into a pink wire with a green

tracer, which goes to Pin 38 of a 40-pin connector at the TIPM. Lifting up the TIPM and inspecting the wiring did not reveal anything loose. The brass splice band and solder joint where the relay wiring attached to the original TIPM wiring also showed good. Inspecting



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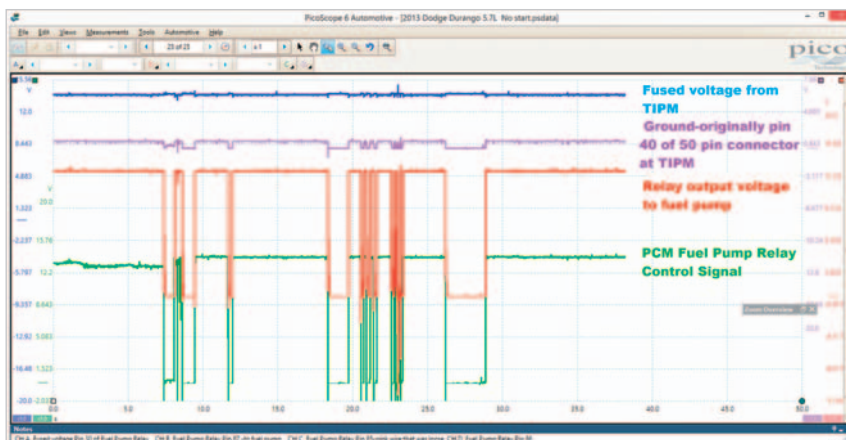
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the pin fit in the connector revealed something else. After the technician removed the terminal lock from the 40-pin connector, he must have used an incorrect tool to push the terminal out of its cavity because the terminal was spread and there was no grab felt at all during the pin drag test. As seen in the picture, the terminal flopped around when inserted over the mating male pin. This was the poor connection that was causing the vehicle to stall out when driving or when slight movement of harness existed.

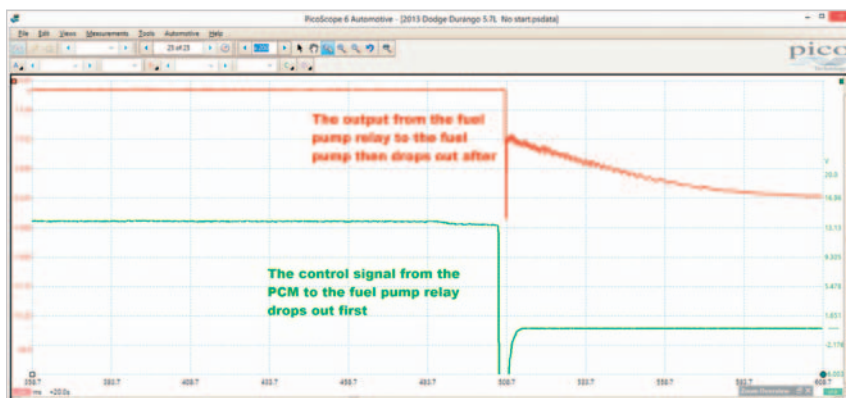
Since the external fuel pump relay and related wiring alterations were made during a safety recall, we did not perform the repair on the terminal. The customer and dealer were contacted and informed of what we found, and the vehicle was towed back to the dealership for repair. The customer was also advised of the problem with the brake switch input being the cause for having difficulty shifting out of park.

2005 Chevrolet Aveo

The next example is a 2005 Chevy Aveo with a 1.6L (L91) 4-cylinder engine and 89K miles. I was asked by the tech to look at this vehicle before he proceeded with any further diagnostics. The vehicle was brought to us for an intermittent misfire that was especially noticeable on acceleration. The original tech performed a scan for codes and a P0302 Misfire Cylinder 2 and P0303 Misfire Cylinder 3 were in history. While loading the engine on a test drive, the misfire was evident. As part of his visual inspection, he removed the spark plugs and noticed that they were worn out and in desperate need of replacement, so new ones were installed as a starting point; however, the misfire still persisted while driving. So with the scan tool attached during the test drive watching misfires, he noticed that both cylinders 2 and 3 were still the ones



MONITORING EACH CIRCUIT OF THE FUEL PUMP RELAY, it didn't take long to find a problem in the relay control circuit.



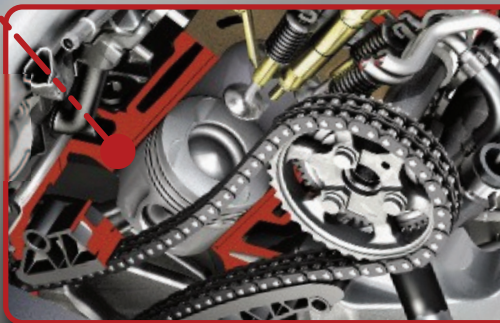
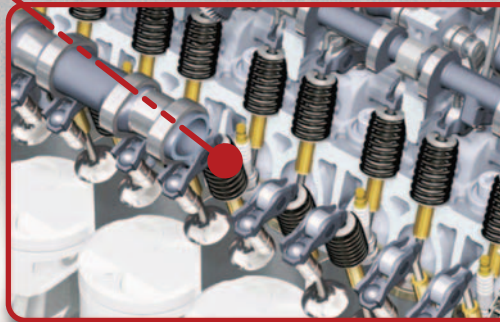
ZOOMING IN ON THE CAPTURE we can see that the control circuit from the PCM is losing its signal, which in turn is causing the fuel pump relay to open and causing a loss of voltage supplied to the fuel pump.



A CLOSE UP of the spread-open terminal connector causing a poor connection at the TIPM



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showing a misfire. Since coils are a very common ignition system failure component, especially under load, it was the next logical assumption. Normally he would have swapped coils if this was a COP (Coil on Plug) system, but since this vehicle utilizes a one-piece dual coil pack for all four cylinders, this technique would not help on this vehicle. This is a waste spark system that uses one coil for a pair of cylinders and fires both the event cylinder that is on its compression stroke as well as its companion cylinder, also known as the waste cylinder, which is on its exhaust stroke. Most of the voltage in this series circuit is used by the cylinder firing the plug on the compression stroke due to the higher pressure in that cylinder. The waste spark cylinder has less resistance due to the lower cylinder pressure of the exhaust stroke.

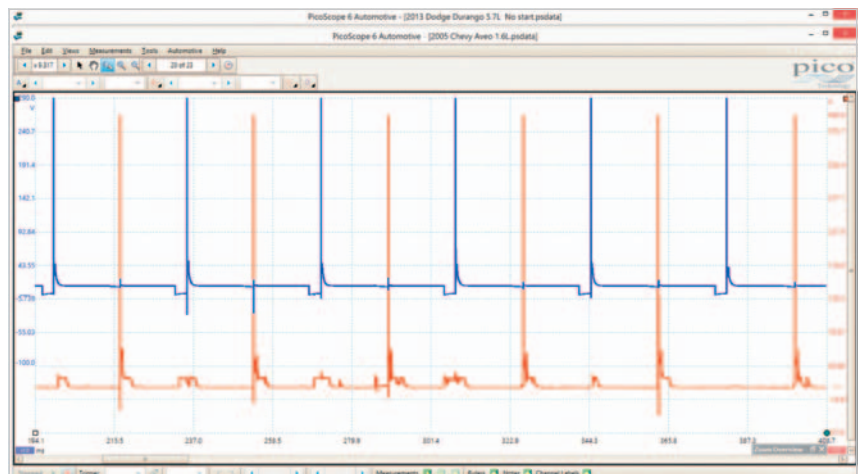
Due to the seat-of-the-pants feel we develop as techs, an ignition misfire has a characteristic feel that hints to us it is spark related. Going by his gut instinct, the spark plug wires were the only option left that could cause this type of misfire. A new set of spark plug wires were ordered and installed. Confident that this would repair the concern, the vehicle was test driven once again but much to his disappointment, the same symptoms remained.

It was at this point where I was asked to assist with the diagnosis. A visual under the hood shows everything was installed properly and the spark plug cables were routed correctly. I attached the scan tool to monitor misfires and go for a test drive. Sure enough, under a moderate to hard acceleration, the misfire occurs only on cylinders 2 and 3 along with a large jerk from worn-out engine and transmission mounts.

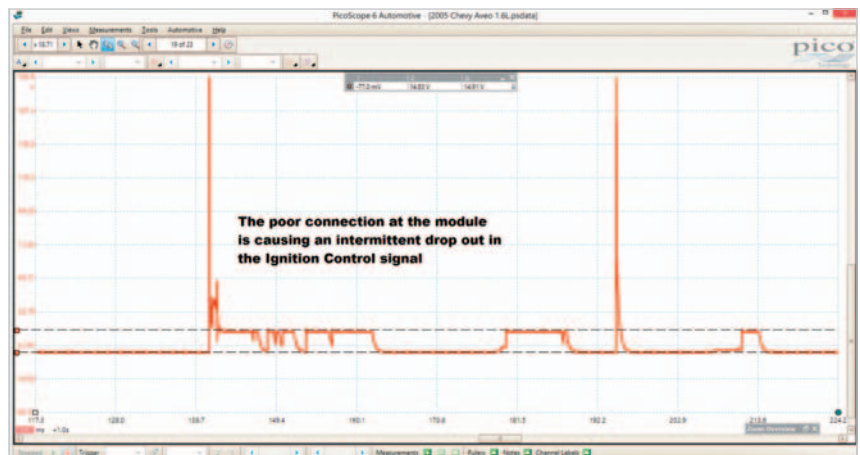
As I pulled back into the shop I was immediately asked by the tech if I thought it was ignition related. It did feel like an ignition misfire, but I really



THIS IS HOW LOOSELY THE TERMINAL fit onto the mating male pin at the TIPM. A correctly fitting terminal will not wiggle and exhibit a drag when sliding on the mating pin.



THE BLUE TRACE SHOWS THE IGNITION CONTROL CIRCUIT for the non-misfiring cylinders (1 and 4) while the red trace shows the ignition control circuit for misfiring cylinders (2 and 3).



A CLOSE UP LOOK at the drop outs in the ignition control circuit for the misfiring cylinders.



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WHEN ATTEMPTING TO PERFORM A PIN DRAG TEST at the connector for the ignition module, the terminal pushed out of the back side of the connector.



THE LOCKING TANG OF THE TERMINAL was bent and flattened, allowing it to back out of the connector and thus cause an intermittent circuit problem.

needed to dig a little deeper before I could be absolutely sure. I pulled up a wiring diagram of the ignition system and then started to get my oscilloscope out. I think that most good diagnostic techs have a set routine they perform to isolate problems when diagnosing vehicles and by sticking to that regimen they cannot only prove what is not working correctly but also — and just as important — what is working correctly.

I like to try to find some commonality when I see multiple trouble codes to see if a single problem can be causing all of them. Looking at the wiring diagram for the ignition system I find that both cylinders that are misfiring also happen to be on the same coil of the dual coil assembly. The ignition coil module has a three-wire connector with Pin B receiving voltage in Run and Start through the 15 amp DIS/Injector Fuse. Pin A is Ignition Coil 2 and 3 Control, while Pin C is Ignition Coil 1 and 4 Control. The Powertrain Control Module (PCM) controls the dwell of both ignition control circuits. Even though the ignition coil assembly is new, it is the one item that both misfiring cylinders have in common. So with the scope attached to the ignition coil, I go for a test drive and record my findings.

Without even needing to pull out of the parking lot I get enough misfires to

determine if I am headed in the right direction. Sure enough I notice something occurring on the voltage trace of Pin A of the Ignition Control Module signal, which is the ignition control for cylinders 2 and 3. The pattern has a lot of drop outs and while the voltage signal for Pin C, which controls the ignition timing for cylinders 1 and 4, looks normal. Now I can narrow it down to something in the ignition control circuit that is causing the signal to drop out. The downward saw-tooth pattern noticed during the signal drop is caused by an intermittent open in the ignition control signal.

With the vehicle in the bay, I performed a wiggle test on the harness to try to duplicate the loaded driving conditions and found that when moving the section near the connector of the ignition coil module, the engine misfired heavily. Inspection of the harness revealed no breaks in the wiring, but when removing the connector of the ignition coil module and attempting to perform a pin drag test on the Pin A for cylinders 2 and 3, the wire pushed out of the connector.

The locking tab of the terminal was bent as to allow it to slip out of the connector. I'm not sure if someone tried to remove the terminal at one time or as noted earlier, the powertrain mounts were broken and allowed the

engine to jump when loaded, which may have caused damage to the locking tab. When the engine moved and the harness flexed, it allowed the terminal to have a poor connection with the mating male terminal and lose signal, causing misfires for the corresponding cylinders. When the harness was relaxed during idle and cruise conditions, the connection was good enough that no misfires occurred.

Repairing the locking tab of the terminal fixed the misfiring concern, but the customer declined replacing the powertrain mounts even knowing that it could lead to repeat failures of the harness and its connectors.

Finding either of these failures without the use of a scope would have been a much more lengthy and involved process, especially with the number of circuits on a modern vehicle. By narrowing down a fault to a particular circuit, the diagnosis can be performed more efficiently without unnecessarily replacing components. *MM*



MICHAEL MILLER lives and works in Las Vegas. He is an ASE certified World Class Technician with more than 50 current certifications. He holds a degree in mechanical engineering and is currently completing a second degree in automotive technology.
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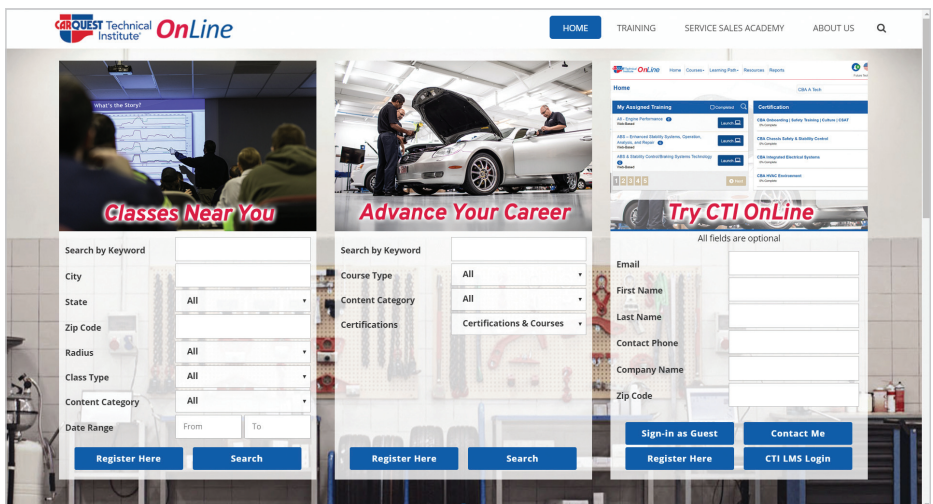
Certify your team for long-term success

One of the most talked about topics in shops today is the acquisition and retention of talent to help grow and sustain your team. Faced with an aging workforce, while also preparing for the tidal wave of technology changing our industry, you can't afford to wait until it gets here to build the teams and skills needed to service your customers. That is why Carquest Technical Institute and Worldpac Training Institute are partnering to create the most comprehensive automotive education program in the industry. One

particular of this partnership is a new Learning Management System (LMS) designed to guide our shop owner partners in growing and retaining talent.

Currently, the CTI OnLine platform provides typical elements found in an LMS, including online content and the ability to register and track classroom records. Any technician, service advisor or shop owner who has attended a CTI event can find their record on CTI OnLine, and soon all WTI students will be able to access their transcripts as well. However, the traditional model of accessing online and classroom content is being totally remodeled. Instead of selling classes or online course packages, our primary goal is to sell and deliver certifications.

A certification is defined as a credential that is earned to show an individual has knowledge of a specific skill. The CTI-WTI OnLine platform will offer a series of Certifications that emulate the National Automotive Service Task Force career path framework. For each job role a technician holds during the course of



their career, we will offer a certification path that includes online and classroom content, ensuring the student has both the knowledge and necessary skill to warrant being awarded each certification. Coupled with ASE certifications, this new structure and trackable/reportable program will allow a shop owner to create accountability in their organization's learning paths. The structure of these certifications alternatively gives a shop owner the ability to grow a team that enables them to provide the services their customers require. At the end of the day, it's all designed for them.

How do you find out more? First, visit the new portal for CTI-WTI at www.CTIOnLine.com; please note the new branding for this new partnership has not been finalized as of this article's creation, so keep your eye on this publication for announcements. On the new CTI-WTI portal, you'll find three ways to search for information. First, you can search for classroom events using our new search tool. Use keywords such as a topic or instructor coupled with a state

or zip code filter to find a class near you. Next, you can use our new LMS online training Guest registration that gives you the ability to create a guest credential that allows you to experience our very robust online content. Finally, you can search for Certifications that meet your need with details about the courses and content as well as the expected amount of time it will take to complete.

Our industry is advancing rapidly, and you can't afford to go looking for talent when you need it. You must have that talent on your team, growing and preparing for new opportunities BEFORE you need them. CTI-WTI is your best source of help to get prepared.



Yes, brakes can really be environmentally friendly

BOB PETERS // Chief Engineer of Friction, Akebono Brake Corporation

Recently, technological innovations in the automotive industry have dazzled imaginations and have begun to change transportation forever. Likewise, we've seen a huge push to make autos more environmentally friendly than ever before. Electric vehicles, lightweighting and fuel efficiency have nabbed headlines, but in the world of brake systems, we're also doing our part by using more environmentally friendly materials.

For decades, copper was used in brake pads for its durability and heat resistance to help make braking smoother. Eventually, however, environmental organizations discovered that every time a driver stepped on the brakes, microscopic levels of copper-containing brake dust were being sent into the air, only to settle on city streets, parking lots and roofs. When it rained, the debris flowed into the surrounding watershed. In trace amounts the effects were negligible, but



in high-traffic, urbanized areas, copper levels from pad debris, combined with industrial waste, elevated copper levels to concerning levels.

Something had to be done. Many years ago, I had the privilege of joining the aptly named Brake Pad Partnership, a cooperation between the auto industry, brake pad manufacturers, environmental groups, storm water agencies and coastal cities. To combat copper entering the environment via brake dust, the states of California and Washington enacted legislation mandating that copper be reduced to less than 0.5 percent in brake pads by 2025.

Fortunately, at Akebono Brake Corporation, we were already ahead of curve. In fact, Akebono was the first to market with fully compliant, copper-free ceramic brake pads. As it stands today, Akebono has all but eliminated the need for copper in its brake pad formulations.

So how did we eliminate copper without reducing quality, when there is

no simple substitute for copper? After many months of development, Akebono formulators created a proprietary compound formula that's just as good — or better — than the ceramic brake pads of yesteryear.

The results have been better than even we could imagine. Today, the ceramic brake pads we provide to automakers maintain all the same benefits of traditional ceramic pads — durability, quietness, heat dissipation, less abrasion on brake rotors — but without using high copper levels or abrasive ferrous metals in its place.

Akebono customers can expect that same level of OE quality, dependability and “environmentally-friendly” low-copper in our Pro-ACT[®], EURO[®] and Performance[®] Ultra-Premium aftermarket brake pad lines.

Learn more at akebonobrakes.com.

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DPF forced regeneration

The Diesel Particulate Filter, DPF for short, is an emission control device standard on 2009 and newer diesel-fuel burning vehicles that collects toxic soot particles preventing them from escaping into the air. Over time this soot builds in the filter. The DPF system is designed to automatically regenerate the filter by using engine heat to burn the soot to smaller particulates.

The DPF system works as follows. Over the life and use of the vehicle, soot builds in the filter, constricting air flow and increasing pressure before the filter. A sensor monitors the level of soot buildup within the filter by measuring air pressure before the filter and after. When significant pressure is detected, the Powertrain Control Module (PCM) initiates DPF Regeneration.

If the vehicle is unable to regenerate the filter during regular vehicle use, it may display a DPF service message to prompt the driver to operate the vehicle for a specific time and speed. Some vehicles have a DPF switch that initiates a regeneration while the vehicle is parked. Some vehicles use an active regeneration system by which fuel or an additive is used to increase the temperature and burn down the soot.

However, these regeneration procedures can fail, particularly if the filter is too dirty and has been neglected for an extended time. A clogged filter will quickly result in poor fuel economy, crippled engine power and sometimes severe engine damage.

Autel's TS608 is a perfect tool for high-volume maintenance

service shops. In addition to its dedicated TPMS functionality, this wireless Android-based touchscreen tablet with all system fault detection, provides a comprehensive service menu that includes forced DPF regeneration capability.

Before attempting a forced regen, select AutoScan to scan the vehicle for engine codes. A forced regen cannot occur while codes are present. After codes are addressed and the vehicle is re-scanned, tap on the Service Menu on the Home Screen or select the icon on the bottom toolbar. Tap the DPF/SCR icon. Though the Selective Catalytic Reduction (SCR) does have a filter, it rarely requires maintenance.

Next, initiate the forced regeneration on the vehicle. The instructions vary by vehicle, so take care to follow the directions displayed. The vehicle will then proceed to perform the regeneration itself, raising and the lowering the engine rpms needed to clear the filter. A forced regen can take from 20 to 40 minutes, depending on the amount of congestion within the filter. The tablet will display a message once the regen has been completed. The engine will return to normal rpms, and the exhaust should be noticeably clearer than before the procedure. The DPF light can be reset in the previous initial DPF service menu.

Though the importance of regular vehicle service cannot be overemphasized to any of your shop customers, those driving diesel vehicles must be especially advised to not ignore the DPF service dash light.



AUTEL®

FAQs: How to replace a hybrid battery

As hybrid vehicles have grown in popularity, and vehicles from the early 2000s are now of an age where repairs are necessary, there is a profitable opportunity for independent repair shops to service these vehicles — in particular, the battery.

CARDONE's Technical Training team has conducted many hybrid technology clinics across the country for technicians looking to offer hybrid battery replacement at their shops. These techs have posed some great questions that we will share here. For context, it would be helpful for you to scan the QR code below to watch our video on how to safely remove the 2004-2009 Toyota Prius Gen 2 Battery.

With the replacement of the new battery, is there a program procedure to link it to the car, or is it plug and play? Always consult the vehicle manufacturer service information for software updates and/or TSBs.

Will my mileage drop when the car is older with high miles? My 2011 Prius has 165,000 miles. Yes, all batteries degrade with time.

Do hot environments degrade a battery over time? Southeast U.S. has internal temperatures on cars reaching 160 degrees F on up. Extreme temperatures will contribute to electrical performance degradation.

Where is the typical fan motor located? The location varies. On the Gen 2 Prius, it is on the rear right behind the trim panel. On the Gen 3 Prius, it's attached to the end of the HV Battery.

Is it necessary to use orange safety cones in the work bay to alarm other technicians that HV battery repair is being done? Yes. Safety first!

If an auxiliary battery is connected without the key in the slot and an immobilizer code sets, is there a

recommended procedure for clearing said code? It will set a code. Follow the service information procedures for the code or codes set

Can the safety plugs go bad? How can you check? There is a 125A fuse inside the safety plug, and on the slider, there are two contacts for enabling & disabling the HV system. These can be checked with an ohm meter for continuity and visually inspected for damage or corrosion.

Do presets disappear when 12 v battery is disconnected? Yes. In some vehicles, you can use a "memory saver" to avoid losing radio and some body controlled systems options, but this varies by vehicle.

Should we leave the key fob in for the entire time during the unpowering and removal process? That is not necessary. The key fob should be in the slot before reconnecting the 12V battery.

Are leakage and corrosion still problems in late-model Toyotas? The first generation of Panasonic prismatic modules was more common in the first generation of these batteries. We attribute the problem in part to overheating, causing the electrolyte to expand, build pressure and leak. Improvements in ventilation and cooling fan maintenance have helped in reducing the corrosion.

Are you supposed to disconnect the 12v battery prior to removing the high voltage battery? Yes, the 12V battery should be disconnected to avoid the accidental attempt to power up the system with the HV service plug discon-

nected and set codes for the interlock system and/or the immobilizer. Other codes can be set depending on the vehicle and options.

When installing a battery, are there any reprogramming of the battery control module or reset procedures needed for the new battery and electronics to work properly? There are no reset procedures needed for the HV battery ECU. It is recommended to use a Keep Alive Memory strategy for radio stations or car seat memory. The express down/up function must be relearned, and there may be other relearns needed for other components depending on the vehicle model.

Should you use an anti-corrosion grease on the battery terminals? Anti-corrosion grease or any coating will attract dirt and may contain metals like copper, or lithium that may react in an unintended way, causing codes. The battery terminals should be clean and dry.



Scan this code to view a detailed How-to Video on how to safely replace a 2004-2009 Toyota Prius Gen 2 Battery

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WE BUILD IT BETTER

Keeping the hybrids cool.

Over 95 percent of the hybrid vehicles on the road today in North America depend on air cooled technology to keep their batteries in good shape and delivering the necessary performance. This cooling is typically provided by an electric cooling fan. But unlike your humble HVAC motor, a hybrid vehicle battery cooling fan is a much more sophisticated and harder working component — operating almost continuously while the vehicle is in use. So, it makes sense that servicing and replacing the battery cooling fan is not only highly recommended but also a very important step in maintaining optimum battery health and service life.



REPLACING THE HYBRID VEHICLE BATTERY COOLING FAN HELPS MAINTAIN OPTIMUM BATTERY LIFE.

A typical hybrid battery pack begins to weaken after five years in service. Battery life can also be reduced by extreme swings in exterior climate and temperatures. All of these factors can significantly affect the fuel economy and overall performance of the vehicle.

Here are some obvious symptoms to look for while diagnosing a failing hybrid battery:

- Hesitation on acceleration
- Diminished operating range
- Internal combustion engine (ICE) running more often or at unexpected times
- Unusual engine noises

Check the SOC for telltales

The driver may also notice a drop in the battery “State of Charge” (SOC) condition bars after little or no vehicle usage. For example, the hybrid vehicle is parked with full SOC bars showing. However, upon returning to the vehicle, the driver sees only one bar remaining in the SOC. This is an indication of an underlying issue with the hybrid battery.



Keep interiors clean and free from contaminants

Since the cooling fan is located within the rear of the vehicle, the overall vehicle interior conditions are important. Contaminants such as dirt or dust can create issues, while fur and dander from pets can clog up the air flow and contribute to cooling system failure. It is important to keep the interior clean to prevent contaminants from being drawn into the cooling system.

Many of these issues can be avoided with good vehicle maintenance and cooling fan replacement.

Repair tip: Do not bench test a hybrid cooling fan motor because it requires special tools to generate a signal at the factory specified voltage. Using a 12-volt source, such as a battery charger, is not recommended.

These helpful tips are brought to you as a courtesy of Continental, a leading manufacturer of VDO aftermarket hybrid battery cooling fans, engine cooling fan assemblies, and HVAC motors.

For more information, check out our hybrid battery cooling fan replacement video at: <http://vdousa.com/hybrid> or contact: salessupport-us@vdo.com.

VDO

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Tips & tricks for troubleshooting integrated brake controllers

The past few years have seen a lot of changes regarding Integrated Brake Controllers (ITBC), and the standards are still unclear when it comes to the challenges these new systems bring. Shops working on domestic and foreign light-duty pick-up trucks and SUVs need to be able to answer their customer's questions quickly and accurately. Most of the time it's as simple as establishing the connection and showing real-time output. But only now have new products been introduced to properly troubleshoot ITBC.

Nowadays, vehicles are being manufactured with dash-mounted ITBC. Like Aftermarket Brake Controllers, ITBC work in unison with the vehicle's speed and brake pressure sensors. Tied into the vehicle's computer system, they sense if the trailer is connected by detecting load from the trailer electric brakes. If there's no load, no power is sent to the trailer brake magnets when the brake pedal is actuated. The driver can limit the max amount of power to the trailer brakes, but depending on the vehicle manufacturer, this isn't always straight forward. It's also a common misconception that newer systems will actuate the brakes just like previous systems. This can cause major safety issues when you're driving down the road with a fully loaded trailer, not realizing the ITBC never detected the trailer.

So far, to help a customer verify the vehicle is connecting properly, you would need to have a trailer present. Most shops don't have a trailer for this, and the ones that do still don't have the tools necessary to verify the brake controller output and timing are indeed functioning properly. The only tool on the market that can solve these problems is IPA's #9107A



Electric Brake Force Meter with Dynamic Load Simulation and Circuit Testing. Not only does it make the diagnostic process fast and easy, but it simulates a trailer for one-man, in-cab diagnostics. No more customers arguing their new truck doesn't register a trailer. No more techs unsure if they should follow one manufacturer's reading or another. No more shops sending customers away with unsafe vehicles because they don't have the means to diagnose the problem.

This tool is already being adopted by dealerships across the country, setting the standard for vehicle/trailer brake controller testing. Just plug the 25-ft cable into a vehicle's 7-way spade connector, then sit in the cab with the hand-held meter and start the vehicle. A "Trailer Connected" (or similar) indicator should appear on the console. If you get a "Trailer Not Connected" indicator, or no indicator appears at all, the controller is faulty or the wiring/grounds are suspect and should be cleaned/replaced. Once a connection has been established, you can read real-time brake force output and

test all truck-side tow circuits. You can even do a test drive with the unit connected to ensure the gain settings reflect the actual output at the connector.

The #9107A is a must-have diagnostic tool for techs, fleets, and rental companies dealing with brake controller equipped vehicles. The universal applications work with most all integrated and aftermarket brake controllers on vehicles with 7-way spade connections.

IPA is a family-owned, USA manufacturer of tools and equipment dedicated to producing industry-leading solutions for truck/trailer diagnostics and maintenance. For more information on the #9107A Electric Brake Force Meter and other IPA products, contact your professional tool distributor or visit www.ipatools.com.

IPA
FUTURE NOW

New PurolatorBOSS® Premium Cabin Air Filter with Febreze Freshness offers maximum protection & odor elimination

According to the AAA Foundation for Traffic Safety, the average American spends almost 300 hours driving every year. That's a lot of time spent breathing contaminated air that circulates within a vehicle's cabin. Billions of harmful pollutants, allergens, contaminants and fine dust particles can make their way inside the cabin. Contaminants from the road, construction, farming, manufacturing or pollen infiltrate the air that your customers, and everyone else riding in their car, breathes.

Today, 80 percent of all cars on the road and 95 percent of new vehicles rolling off the assembly line are equipped with a cabin air filter. While there continues to be excellent organic growth within the category, cabin air filters are still one of the most under-performed maintenance items on a vehicle. And, unlike typical cabin air filters, the new PurolatorBOSS® Premium Cabin Air Filter with Febreze Freshness is designed with triple layered protection. This powerful combination blocks and controls odors and prevents mold and bacteria growth — all while blocking most fine dust particles and allergens — to ensure a more pleasant driving experience for your customers.

Nearly 75 percent of all vehicle climate control problems are caused by a blocked cabin air filter. Unlike other cabin air filter types, PurolatorBOSS Premium Cabin Air Filters provide maximum efficiency while optimizing airflow through a vehicle's HVAC system so the A/C, heater and defroster units function properly.

Poor quality air can make you tired and irritates your eyes and respiratory tract. And, while over 35 million Americans suffer from symptoms related to airborne allergens, a PurolatorBOSS Cabin Air Filter can make their in-car experience more pleasant by eliminating fine pollutants like road dust, dirt,



pollen and other allergens from entering the cabin.

Essentially, a cabin air filter is to a car what a furnace filter is to a house. While it's best practice to replace furnace filters periodically for optimum performance, the same holds true for a cabin air filter. We recommend replacing the cabin air filter every 12 months or 12,000 miles to keep the quality of air inside the cabin smelling fresh and clean.

With added-value features that many customers will be willing to pay for and easy installation in 15 minutes or less, a PurolatorBOSS Premium Cabin Air Filter with Febreze Freshness makes this filter replacement a service worth pursuing.

Purolator offers a variety of air, cabin air and oil filters. Find the right filter for your automotive needs at www.pureoil.com.



"FEBREZE FRESHNESS" is a registered trademark of The Procter & Gamble Company, Cincinnati, OH, used under license by MANN+HUMMEL Purolator Filters, LLC.

Include battery testing in your vehicle inspection

LARRY HAMMER // Technical Services,
Mighty Distributing System

If testing the battery is not a part of your vehicle inspection...it should be. A heads-up notice on a failing battery can save your customer a lot of grief.

During a recent oil and filter change, a technician performed a complimentary battery check that reflected a battery that was in need of replacement. When the lady contacted her husband, accompanied by a printout showing the condition of the battery, he decided not to have it replaced, since the vehicle had been starting perfectly.

Days later and 100 miles away from home, the lady encountered a no start condition due to a dead battery. She had an SUV full of kids, and the weather was scorching hot, but not as hot as the verbal exchange between the stranded lady and her husband. The cost of the battery replacement had now escalated, as a service call was now required.

With no warning

In the past, a warning symptom such as a change in the cranking speed of the engine made it obvious that the battery should be tested. But today's systems often function normally until the next starting event and then totally fail. Heat is a major contributor to battery failure. Gassing occurs within the battery, promoting a loss of electrolyte, plate corrosion and internal shorts. Often, newer vehicles will have an insulation wrap around the battery to shield it from intense underhood temperatures, which is a major cause of battery failure. Cold conditions also contribute to battery failure, as in-

creased amperage is necessary to start a cold engine with a thick oil viscosity. In addition, a battery is less efficient at cold temperatures.

Sulfation

Sulfation of the plates occurs when the battery is allowed to sit for extended periods of time in a discharged state. When the battery state of charge is below 80 percent, sulfation can occur in a two-week period. In this low state of charge, lead sulfate will form on the battery plates. This contamination insulates the plates' reactive material, resulting in a reduced capacity and the ability of the battery to accept a charge. A battery in this condition can be permanently damaged in a two-month period.

When diagnosing an electrical related problem, always start with the source of power first. That would be the battery. Low voltage or a voltage drop can create some major challenges, especially with the myriad of electronics and accessory components on today's vehicles.

Battery drain

Due to parasitic current drains, which are necessary to keep computer and accessory memories alive, a vehicle that has been parked for 2-3 weeks can result in a low voltage condition that can present some difficult challenges for the technician diagnosing an electrical complaint. Short trip driven vehicles equipped with a maze of electronics often encounter battery failure due to the battery never becoming fully charged, resulting in sulfation. Often, more energy is taken from the battery than the alternator can replenish during these driving conditions.



THE TECH HAD URGED THE MAN TO INSTALL A NEW BATTERY BUT HE 'KNEW BETTER' AND TURNED HIM DOWN.

Summary: Make battery testing a part of your vehicle inspection. Provide the customer a printout reflecting the condition of their battery. Today's battery testers will identify a soon-to-fail battery before it becomes a major difficult-to-diagnose issue or leaves the customer stranded.

In addition to a no-start symptom, low battery voltage can create some difficult-to-diagnose symptoms, especially in those applications with numerous electronic systems and creature comforts. For some interesting troubleshooting tips involving low voltage and electrical interference symptoms, review Mighty Tech Tip #163 "Battery Facts." To access Mighty Tech Tips, go to www.mightyautoparts.com and select Tech Central: Tech Library: Tech Tips.



Are you ready to repair ADAS?

You've probably already seen vehicle features like adaptive cruise control, parking assist sensors and blind spot indicators in your auto repair shop. All of these technologies (and many more) fall into the new category of vehicle systems known as ADAS — Advanced Driver-Assistance Systems. If you haven't encountered ADAS yet, you will soon as the latest generation of vehicles makes its way into the aftermarket for service and repair.

ADAS is a complex system of cameras, radar systems, sensors and control modules. The control modules use a variety of technologies to help interpret the signals received to deliver ADAS features. In addition to the more "common" components like those mentioned above, you might also see more "unusual" ones like a yaw/acceleration sensor, pedestrian impact detection sensor or forward looking radar module. Many of the components are precisely calibrated to ensure the control modules are interpreting the proper information. And it's easier than you might think for them to go "out of calibration."

Impact of ADAS

ADAS is impacting even common jobs that you may have in your bays right now. For example, consider the wheel alignment — usually a pretty straightforward job, right? Well, maybe not always anymore. On most vehicles equipped with ADAS features, calibrations will need to be performed after that alignment. Let's say that a 2016 Audi A8 Quattro equipped with Adaptive Cruise Control and Lane Change Assist System comes to your shop needing a four-wheel alignment and adjustment of the rear thrust angle. The ADAS features on this vehicle add 2.2 hours of labor time for calibration to the 1.8 hours already assumed for the alignment.

Components	Jobs Requiring Calibration
cruise control module	-
cruise control sensor	replace cruise control sensor perform wheel alignment
cruise control systems	-
lane change assistance module	-
lane change assistance system	-
lane recognition systems	-
outside view camera	calibrate outside view camera perform wheel alignment replace outside view camera
park assist indicator	-
park assist sensor	replace park assist sensor
park assist switch/button	-
parking aid module	-
parking aid systems	-
power steering pump	-
steering control module	-

Calibration routines can vary widely by manufacturer. Some are as easy as printing targets on your own printer and placing them in areas in the shop. Others require targets attached to fixed mounts on an aligner or stand-alone frame with specific level floor specs to ensure the calibration will be accurate. One of the challenges is having enough space in the bay to accommodate these calibrations.

Several feet of unobstructed space are needed around the vehicle: in front, behind and to the sides. Any object in this space could cause an inaccurate or incomplete calibration. For instance, almost 40 feet from the back bumper to the front camera target is needed to do a front camera calibration on a Honda Odyssey.

What happens if the calibrations are not done correctly? There likely will be no indication — no MIL illuminated, etc. But while the vehicle is driving, the "field of view" can be slightly shifted. With even a 2 degree alteration on a forward-facing radar module, the focus at 60 feet ahead of the car won't even be in the car's same lane. That can lead to potentially deadly consequences from unanticipated be-

haviors of the adaptive cruise, pedestrian detection and other features.

ADAS repair information

Having a repair information resource that consolidates all the information related to the ADAS features on a vehicle can help technicians understand, diagnose and repair these complex systems.

For example, ProDemand, the auto repair information software from Mitchell 1, streamlines the search process and delivers all the ADAS information together in a single location. So, techs have a full picture of all ADAS features and the specific components contributing to the operation of those ADAS features. ProDemand also lets techs know at a glance if the components associated with the ADAS feature will require calibration, special tools like targets, or a scan tool to complete the job.

Whatever repair information resources you use in your shop, ADAS-equipped vehicles are coming. Are you ready?



Corrosion-resistant coils from NGK — The Ignition Specialist™

Many Chrysler, Dodge and Jeep original equipment ignition coils are made with zinc-plated steel secondary winding terminal connections that can be prone to corrosion. These corroded coils can reduce engine performance and fuel economy. That's why NGK manufactures ignition coils for these applications with brass secondary winding terminal connections. And with an added insulating dielectric grease, NGK's coils better resist corrosion, optimizing engine performance and improving fuel efficiency.

NGK coils are manufactured to OE standards for durability and operational performance. Developed in an ISO 17025 accredited lab, NGK offers more than 490 ignition coil part numbers, covering over 96 percent of domestic and import vehicles on the road today in North America.

NGK is the largest supplier and manufacturer of spark plugs, coils and other ignition products for domestic and import vehicles in North America. With over 50 years of automotive expertise, NGK's family of automotive products is

driven by extreme dedication to innovation, performance and quality.

To learn more about NGK ignition products, visit ngksparkplugs.com.



THE IGNITION SPECIALIST™



Hybrid battery cooling system repair

Hybrids and electric vehicles (EVs) should be treated with caution when it comes to service, repair and of course, diagnostics. And while the same applies to any vehicle, with EVs and Hybrids there are added dangers.

A Toyota Auris hybrid arrived with the Hybrid Warning Light illuminated. The vehicle had been converted for covert surveillance with sensitive recording devices spread throughout the cabin.

The DTC fault code P0A82-123 was extracted from the Hybrid Control Unit (HCU) with 123 being the INF (information) code.

Access to an OEM Scan tool allowed for interpretation of the INF code to reveal "Occurrence order 1". This indicated P0A82 was the initial code that illuminated the hybrid warning light, and provided immense value where multiple fault codes are stored.

The DTC P0A82 referred to "Hybrid Battery Cooling Fan Performance error".

This indicated a problem with the cooling fan control circuit responsible for cooling the high voltage (HV) battery. Understanding the operation of the system is essential when diagnosing recorded faults, and in this case the speed of the battery cooling fan is controlled in a loop fashion by the HCU. A command signal from the HCU is delivered to the cooling fan to increase or decrease fan speed, depending on battery temperature. A feedback signal from the cooling fan is sent to the Battery Control Module (BCM), where this value is converted into serial data and returned to the HCU, completing the loop.

An initial inspection revealed the cooling fan to be running continuously at high speed, which had been difficult to detect amongst the surveillance equipment.

In order to access all the relevant components for BCM circuit evaluation via the HV battery cover, the hybrid system is required to be shutdown using the following procedure:

1. Ignition off and key secured at least 2 meters away from the vehicle.
2. 12 V Battery negative terminal disconnected.
3. Signage placed about the vehicle indicating "Caution, HV testing in progress"
4. Approved safety gloves checked for leakage and worn, prior to Step 5.
5. HV Service Plug (Isolator) removed from HV battery pack and secured away from vehicle.
6. Wait 10 minutes for HV capacitors to discharge.
7. With safety gloves on remove the inverter cover (engine bay) and measure all HV terminals for the presence of any voltage (AC and DC) using the appropriate HV tester or HV probe with PicoScope.

Note: No Voltage should be present at any HV terminal under the inverter cover.

8. Refit the inverter cover.
9. The HV system is now shutdown and it is safe to continue with diagnosis.

Testing the cooling fan circuit required the 12 V battery to be reconnected and the ignition switched on, with the Hybrid system still isolated. This is normal procedure and generated additional DTCs, (these were erased on completion of the repair).

Note: Switching the ignition on with the HV Service Plug removed does not activate the HV system.

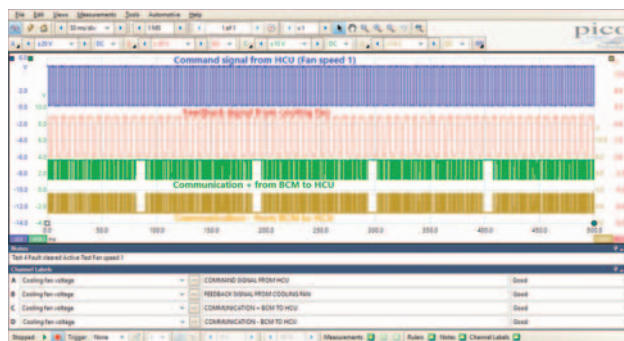
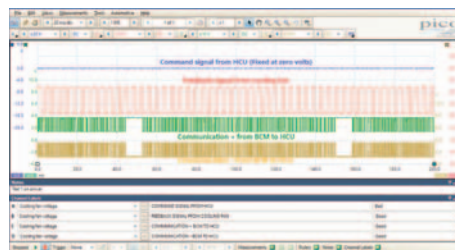
With the ignition on, PicoScope was connected to the command and feedback signals (CH A and B) along with the serial communication signal (CH C and D) within the cooling fan circuit.

Immediately we could see the command signal fixed at 0 V instead of the required PWM signal.

A continuity test of the command signal wire revealed a short circuit to chassis ground at one of the surveillance camera mounting bolts, resulting in a default max fan speed to ensure sufficient HV battery cooling.

With the short circuit repaired, full closed loop control of the battery cooling fan was restored and confirmed using the component test function of the scan tool.

With the short circuit repaired, full closed loop control of the battery cooling fan was restored and confirmed using the component test function of the scan tool.



PICO TECHNOLOGY
 800-591-2796
www.picoauto.com



Hub installation guide

SKF offers this technical tip that addresses installing the following hub units in the specified applications:

BR930772 Nissan Rogue (08-13) Nissan Sentra w/2.7L (07-12)	BR930888 Nissan Juke (11-17) Nissan Leaf (11-12)	BR930684 Nissan Sentra w/2.0L (07-12)	BR930880 Subaru BRZ (13-17) Scion FR-S (13-16) Toyota 86 (2017)	BR930872 Nissan Leaf (13-17) Nissan Sentra (13-17) Nissan NV200 (13-17)
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Installation guidelines

Prior to removal of the old hub assembly, be sure the ABS wheel speed sensor is removed (fig. 1). Sometimes it is helpful to use rust penetrant in and around the ABS wheel speed sensor to aid in removal. **WARNING:** If the ABS wheel speed sensor is not removed, damage can occur to this sensor during removal of the old hub assembly or during installation of the new hub assembly. Damage can also occur to the metal protective cap on the new hub assembly if the ABS sensor is not removed.

The ABS wheel speed sensor head sits in-between the protective cover and the ABS encoder ring built into the seal on the back of the hub assembly (fig. 2).

Also, be sure that the old protective cap is not still stuck in the knuckle after removing the old hub assembly. At times, the protective cap becomes dislodged from the hub assembly during removal. **WARNING:** If the old protective cap is left in place, damage will occur to the ABS sensor and new hub assembly (fig. 3).

SKF offers a web-based training and rewards program

SKF now offers the SKF Parts Xperience, a web-based training and rewards program designed to help automotive and truck technicians boost productivity and stay up-to-date on the latest vehicle technologies. Technicians can sign up for the program by visiting www.skfpartsexperience.com.

The SKF Parts Xperience program is designed to help technicians more easily engage with SKF products, learn more about installation and maintenance best practices, and manage reward points based on product purchases and installation. The new program makes it easy for users to tally points simply by scanning a box label barcode from their mobile device or by entering a part number online. Additionally, every time a user completes a training module, they'll be automatically rewarded with points. As users accrue reward points, they'll be able to redeem them for a wide array of merchandise.

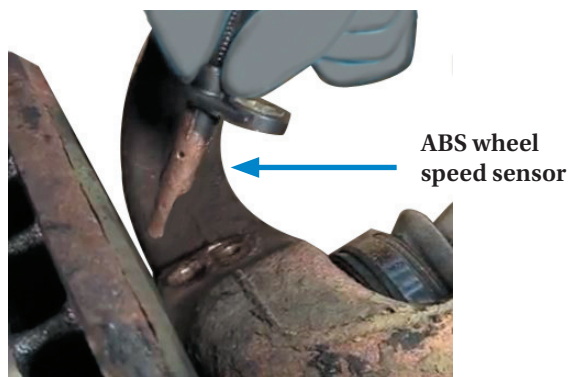


Fig. 1

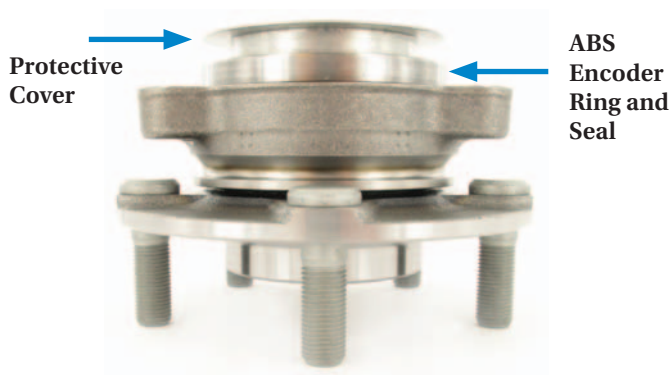


Fig. 2

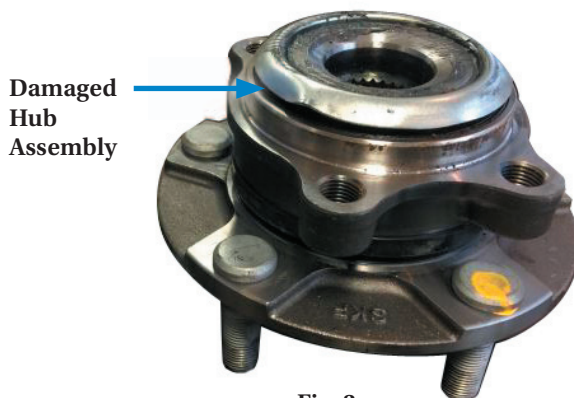


Fig. 3

Intelligent diagnostics strategies

The diagnostic strategies of old aren't relevant or effective in the modern repair scenario. When a vehicle pulls into the bay, technicians are likely to encounter multiple interdependent fault codes, hundreds of live data points, graphs, flow charts and diagrams. With too much information, the challenge is to find and follow the right clues to a solution.

The same computer and information technologies that add complexity to vehicles are enabling improved diagnostic strategies that simplify and reduce time spent in diagnosis and repair.

Regardless of the technology and system being diagnosed, air, fuel, spark, amperage, voltage and grounds are critical to making automobiles perform properly. ZEUS[™] with Intelligent Diagnostics software has revolutionized the process and made it more efficient, bringing together the tests and information related to a diagnostic trouble code (DTC) to one place.

Intelligent Diagnostics can be used whenever a code is present and includes smart shortcuts to take technicians to information related to that code:

- Technical service bulletins (TSB) recalls
- Scanner data, including custom data lists, along with smart data that automatically configures the display to show PIDs relevant to the fault code
- Functional tests and resets
- Guided component tests
- SureTrack[™] real fixes, tips and top repair charts

Intelligent Diagnostics and a step-by-step diagnostic process allows technicians to get through their diagnostic workload.

Step 1: Check for codes. Diagnostic trouble codes are the first and best



source of clues to narrow the search. Once it's known if there's a code, go to step two and use the code or symptom to determine a likely cause. Identifying a code opens the possibilities of putting Intelligent Diagnostics to best use.

Step 2: Smart data filters unrelated PIDS so technicians only see what's relevant to the code. It also automatically sets PID triggers, which flag PID red or blue, out of limits or within limits

Step 3: Search factory technical service bulletins. Intelligent diagnostics narrows down TSBs to those for that code. TSBs are a time saver with OEM experience on failures after a vehicle has been on the road for a while. They're a great companion to fault codes and SureTrack. Most technicians use a good repair information system like ShopKey[™] Pro or ProDemand[™] for TSB access. Intelligent Diagnostics takes users to the TSB related to the DTC they're investigating.

Step 4: Check SureTrack for real world answers. SureTrack takes the clues: vehicles, code and symptom and shows the most common parts used

to repair similar vehicle and problems. This is based on experience from millions of successful repair orders, so we see the actual parts used to complete the repair.

Step 5: Use functional tests or component tests to pinpoint and verify the problem. Using Intelligent Diagnostics, FastTrack Guided Tests display the information, relevant to the code, showing what to test, how to connect and what results to look for. Directly testing the suspected component is the best way to verify a component before replacement.

This diagnostic process may vary depending on workflow and the job at hand. Intelligent Diagnostics saves time and provides a confident solution on many repairs.

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TECHNICAL TRAINING

WORLDPAAC Training Institute (WTI) offers carline specific advanced technical training, business management solutions and exclusive Smart Groups designed explicitly for independent repair shop professionals. Always developed and taught by experienced instructors, WTI training keeps you ahead of the learning curve to ensure your business remains competitive and profitable. View the complete class listing at the website below.

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WATER PUMP SERVICE – NOT JUST A “BOLT ON” REPAIR

THE ORIGINAL WATER PUMP LASTED YEARS AND THOUSANDS OF MILES. WHY DID YOUR REPLACEMENT ONLY LAST SIX MONTHS?

PETE MEIER // Technical Editor

It's easy to blame the part when a job goes sour and results in a comeback. But if you ask the companies that make these replacement components (whether it's a water pump, alternator or air conditioning compressor), they'll tell you that there is nothing wrong with the part that was returned under warranty. And they should know — they are often the same company that made the part the car came with from the factory.

According to the big manufacturers, the most common cause of parts return is error on the part of the technician. And that brings us to this edition of The Trainer!

Water pump service is one of those routine jobs that many of us have done thousands of times. But replacing the pump on a 1983 Ford is not the same as replacing one on a 2016 BMW — or even a 2016 Ford! Paying attention to a few details before, during and after the replacement can make the difference in a job that lasts a lifetime or one that lasts until the end of the service drive.



This month, with the help of the experts at DAYCO, we'll share tips on identifying and correcting the causes of water pump failure, share the finer

points to consider when replacing a water pump, and how to ensure that the new pump has every chance possible at a long and healthy life. **MZ**

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HOW TO SERVICE GDI

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ASSURING BSD COMMUNICATION

Post collision, proper rear harness installation is key



Genuine Parts

Once again, Kia receives high accolades

Kia has continued its streak of receiving important industry recognitions. For the fourth consecutive year, Kia was recognized as the number one non-premium brand in Initial Quality by J.D. Power in the 2018 Initial Quality Study (IQS), with the lowest rate of reported problems. Also, for the second year in a row, Kia has been acknowledged as one of the most trusted non-luxury automotive brands in the annual Trusted Automotive Brands Study (TABS) conducted by AMCI Global.

With regard to the J.D. Power IQS, Kia maintained its leadership position with segment-leading performances for the Sorento, Highest Ranked Midsize SUV in Initial Quality and for the Rio, Highest Ranked Small Car in Initial Quality.

“Ranking number one among all mass market brands in Initial Quality for four consecutive years leaves no doubt as to the world-class quality and craftsmanship instilled in every car and SUV that Kia builds,” said Michael Cole, Chief Operating Officer and EVP, Kia Motors America (KMA). “With two segment winners the evidence of Kia’s progression and focus on the ownership experience is overwhelming.”

The annual report analyzed responses from 75,712 respondents with regard to



The 2018 Kia Rio lead the small car segment.

240 vehicle models across 26 segments. Vehicles were evaluated on driving experience, engine and transmission performance and a broad range of quality issues reported by vehicle owners.

The TABS recognition underscores the importance of customer trust in a brand because it is one of the key factors leading to brand loyalty and a customer’s decision to repurchase that brand’s products. Now in its second year, TABS again shows that trust accounts for more than 50 percent of a consumer’s decision to recommend or repurchase a vehicle from an automotive brand.

“Building trust is never easy. It takes years of delivering great vehicles and standing behind those vehicles...” said William (Bill) Peffer, Vice President, Sales Operations, KMA. “It’s an honor for Kia to have

ranked as one of the most trusted non-luxury automotive brands two years running.”

Ian Beavis, chief strategy officer, AMCI Global, said the TABS recognition puts Kia “solidly in the top tier of the industry in terms of trust.”

That said, we hope that we have earned your trust as well and are committed to keep earning it everyday.

Kia Motors America, Inc.

All trademarks and tradenames are the property of their respective owners. 2019 K900 shown with optional features. Some features may vary. Expected fall 2018 in limited quantities in select markets.

Disclaimer: The Kia Brand, Sorento, and Rio received the lowest rate of reported problems among mass market brands, midsize SUVs and small cars, respectively, in the J.D. Power 2018 U.S. Initial Quality Studies of new vehicle owners’ experience with their own vehicle after 90 days of ownership. Visit jdpower.com/awards.

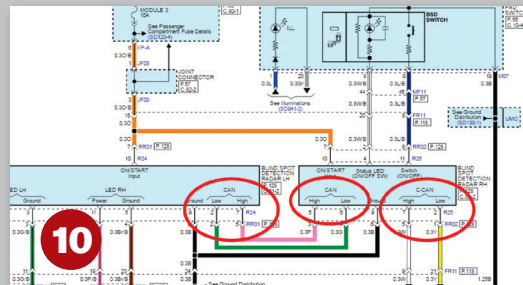
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If it's not in the right box, it's not genuine.



Genuine Parts

From starters to alternators, oil filters to spark plugs, there is no substitute for genuine. The only way to assure that you are getting Genuine Kia parts, backed by the Kia Warranty, is to order them from your local Authorized Kia Dealer. Contact your local Kia dealer for assistance and delivery of the parts you need.


*Genuine Kia replacement parts (except battery) sold by Authorized Kia Dealer under warranty are covered for the greater of (1) the duration of the New Vehicle Limited Warranty or (2) the first 12 months from the date of installation or 12,000 miles, whichever comes first. Labor charges not included when not installed by an Authorized Kia Dealer. Warranty is limited. See Kia's Replacement Parts and Accessories Limited Warranty for further details.

TURBO
GDI

How to service GDI

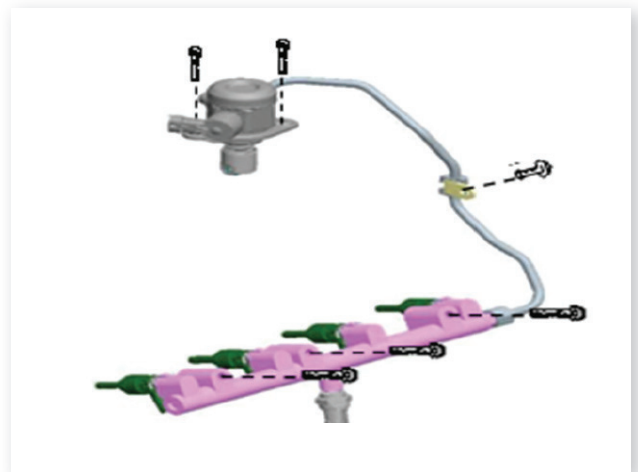
Special procedures should be followed

Special service information for all Kia vehicles equipped with Gasoline Direct Injection (GDI) engines is provided in this article.

 In GDI engines, highly pressurized gasoline is injected via a common fuel rail and injectors that deliver fuel directly into the combustion chamber of each cylinder. In comparison, in a conventional Multi-Point Fuel Injection (MPI) engine, the gasoline is injected into the intake port of each cylinder at a relatively low pressure. Due to high fuel pressure in a GDI system, servicing the GDI system requires special attention and handling procedures.

The following aspects of the Kia GDI fuel system are outlined in this article:

- Fuel Pressure Specification
- High Pressure Fuel System Tightening Torque
- SST For Tightening High Pressure Fuel Pipe Flare Nuts
- High Pressure Fuel System Residual Pressure Warning
- High Pressure Fuel Pump Installation
- High Pressure Fuel Pipe Installation
- Delivery Pipe and Injector Installation



Warning: Whenever the high pressure fuel pump, fuel pipe, delivery pipe, or injector is removed immediately after shutting off the engine, an injury may be caused by the release of highly pressurized fuel. Therefore, release the residual pressure in the high pressure fuel line by referring to the “Residual Fuel Pressure Release Procedure” outlined on page 6 before removing any high pressure fuel system components.

SERVICE PROCEDURE

Fuel Pressure Specification Comparison

MPI (Theta-2.0L/2.4L)	GDI (Theta-2.0/2.4L)
43-64 psi (3.0~4.5 kgf/cm ²) (Regulated by Fuel Pressure Regulator)	569-2133 psi (40~150 kgf/cm ²) (High Pressure Fuel Line)

Notice: The GDI high pressure fuel system operates at considerably higher fuel pressures than the conventional MPI fuel system.

High Pressure Fuel System Tightening Torque

Caution: When installing the high pressure fuel pump, fuel pipe, or the delivery pipe, be sure to follow the tightening torque specifications listed in the table below using a torque wrench.


Failure to do so may cause damage to fuel line connections and may result in fuel leaks.

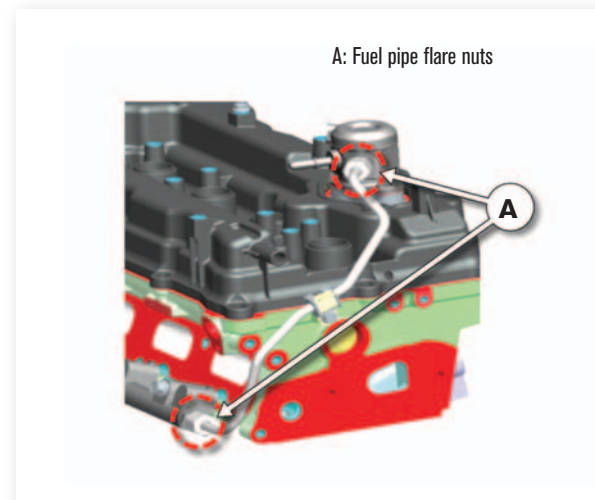
- Fully tighten the fasteners by hand without using a tool. During this time, check for proper positioning of the fittings and components.
- Afterwards, completely tighten to the specified torque using a torque wrench.
- If the fasteners are not tightened in a straight line with the mating bolt holes or fittings, a fuel leak may result due to misalignment, broken fasteners or damaged threads.

HIGH PRESSURE FUEL SYSTEM TIGHTENING TORQUE		
	Theta-2.0L turbo GDI	Theta-2.4L GDI
1. Fuel Pump	9.4~10.8 lbs.-ft. (12.7~14.7 Nm)	9.4~10.8 lbs.-ft. (12.7~14.7 Nm)
2. Fuel Pipe Flair Nut	19.5~23.9 lbs.-ft. (26.5~32.4 Nm)	19.5~23.9 lbs.-ft. (26.5~32.4 Nm)
3. Clamp	72~8.7 lbs.-ft. (9.8~11.8 Nm)	72~8.7 lbs.-ft. (9.8~11.8 Nm)
4. Delivery Pipe	13.7~174 lbs.-ft. (18.6~23.5 Nm)	13.7~174 lbs.-ft. (18.6~23.5 Nm)

SST for High Pressure Fuel Pipe Flare Nuts

Tool Name/No.
Torque Wrench Socket (09314-3Q100)
Figure

Using Tool

Tightening flare nuts on both ends of the fuel pipe



» TSBs may be updated from time to time. Please refer to TSB ENG148 at www.kiatechinfo.com for the latest procedures.

» All images are for illustration purposes only.

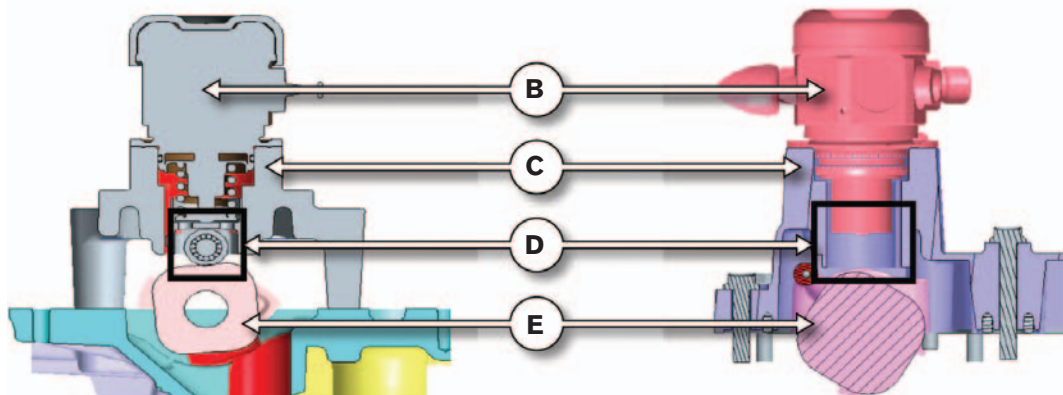
Residual Fuel Pressure Release Procedure

Wear safety glasses and fuel resistant gloves.

- Turn the ignition off and disconnect the battery negative cable.
- Remove the fuel pump relay and the electrical connector to the high pressure fuel pump.
- Reconnect the battery negative cable.
- Run the engine for about 20 seconds to lower the pressure in both the high or low pressure lines. The engine may shut off within the 20-second period. If not, turn the engine off.
- Proceed with the service or repair. Use rags to cover opening and catch spills when opening up either fuel line.
- Reinstall/reconnect all components in reverse order of removal. Start engine and confirm proper operation, and make sure there are no fuel leaks.
- After completing, clear DTC(s) using GDS scan tool (the procedure described above will cause DTC to set).

High Pressure Fuel Pump Installation

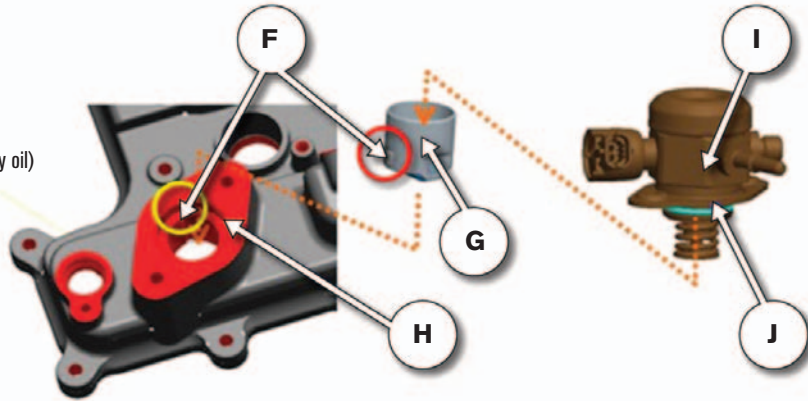
Before installing the high pressure fuel pump, be sure to place the fuel pump drive cam to the flat part of the lobe (as shown below) by rotating the crankshaft. If the drive cam for the fuel pump is not placed in the lowest position during installation, the fuel pump may be positioned improperly, which may result in fuel pump piston damage, broken bolt, damaged threads, damaged o-ring, etc.



B: Fuel pump, C: Adapter Bracket (Cylinder Head Cover), D: Roller Tappet, E: Fuel pump Drive Cam

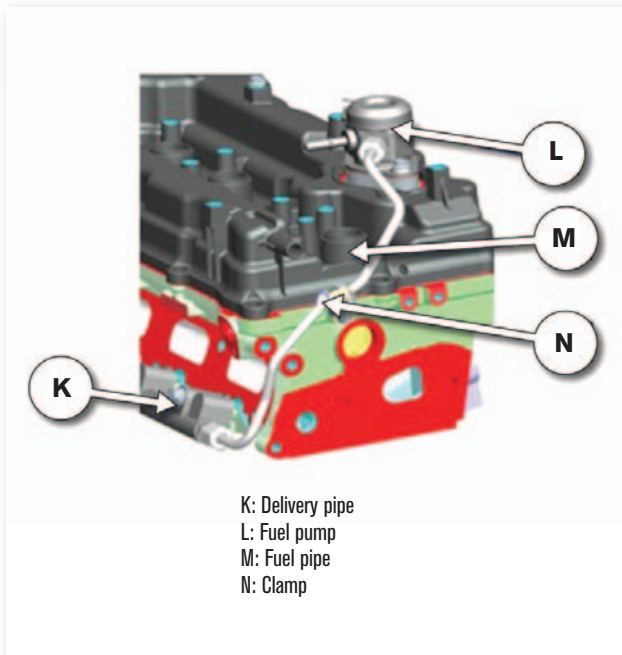
- During a repair requiring fuel pump removal, cover the exposed fuel pump mounting hole in the adapter bracket to prevent any foreign substance or debris contamination.
- Do not reuse the fuel pump mounting bolts. Once a fuel pump is removed, the removed bolts must be replaced with new ones.
- When installing the fuel pump mounting bolts, hand-thread the fasteners first, then gradually tighten 1/2 turn at a time to the specified torque while alternating between the two bolts in several cycles using a torque wrench. Failure to follow this procedure will cause misalignment to the assembly due to internal spring tension of the fuel pump and can result in damage to the adapter bracket.
- Do not drop the fuel pump. External impacts may damage the internal components of the fuel pump. If this has occurred, confirm proper operation through performance tests prior to reuse.
- Before installing the fuel pump into the adapter bracket, be sure to apply clean engine oil evenly over the entire surface of the O-ring, roller tappet, and fuel pump mounting hole. When installing the fuel pump, align the protrusion on the roller tappet to the groove in the fuel pump mounting hole.

- F: Align protrusion to groove
- G: Roller tappet (Apply oil)
- H: Fuel pump mounting hole (Apply oil)
- I: Fuel pump
- J: O-ring (Apply oil)



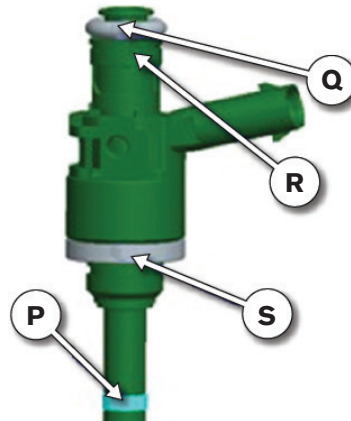
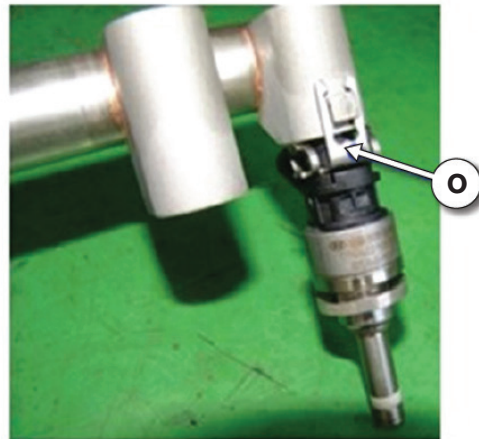
High Pressure Fuel Pump Installation

- Do not reuse the fuel pipe. Once the fuel pipe is removed, it must be replaced with a new one.
- There are protective caps on both ends of the replacement fuel pipe to prevent foreign substances from entering into the fuel pipe. Remove the caps prior to installing the fuel pipe to the fuel pump and the delivery pipe.
- Refer to the “High Pressure Fuel System Tightening Torque” chart on page 5 to properly install the high pressure fuel pipe.




Delivery Pipe and Injector Installation

- Do not reuse the delivery pipe mounting bolts. Once the delivery pipe is removed, the bolts must be replaced with new ones.
- Do not reuse the injector retaining clip, O-ring, backup ring, washer seal or combustion seal ring. Once an injector is removed, the five components must be replaced with new ones.



- O: Injector Retaining Clip
 - P: Injector Combustion Seal Ring
 - Q: Injector O-Ring
 - R: Injector Backup Ring
 - S: Injector Washer Seal
- Note: Items P, Q, and R are supplied in a single kit.

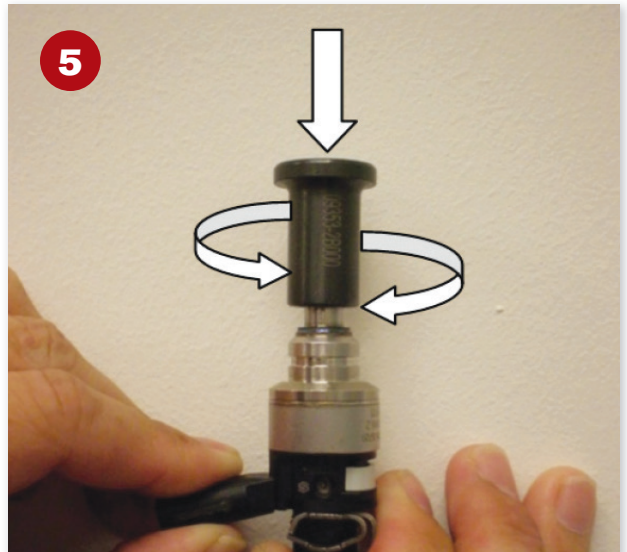
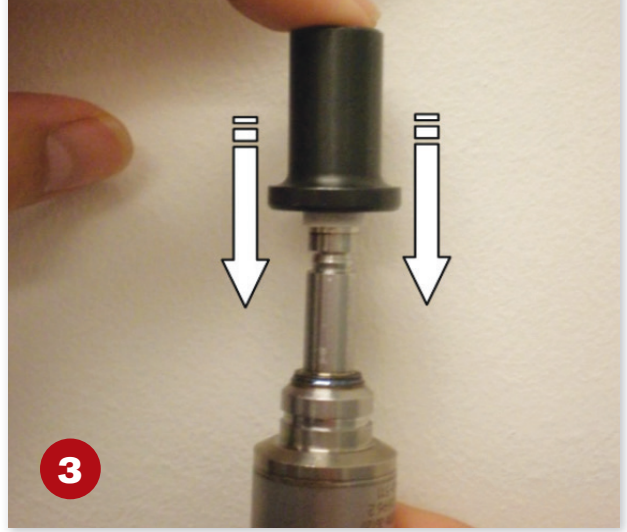
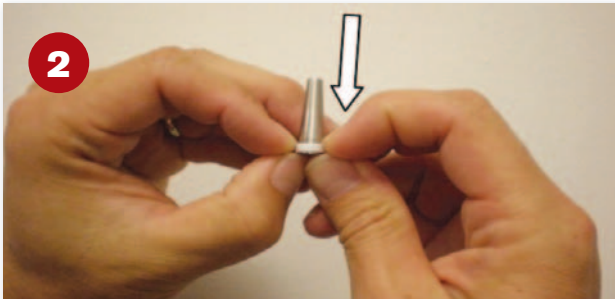
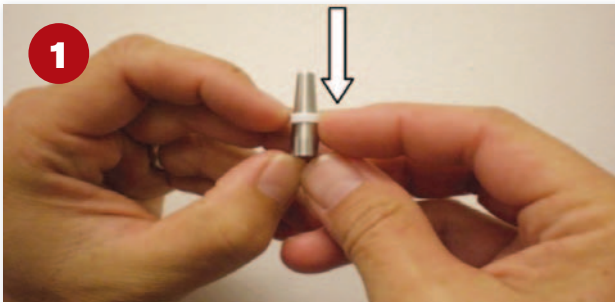
When installing the combustion seal ring onto the injector, use the SST 09353-2B000 (as shown below) and refer to the instructions below.

Tool Name/No.
Injector Combustion Seal Ring Installer
Tool Number
09353-2B000
Components
 <p>1. Sizing Tool, 2. Guide, 3. Pushing Tool</p>

Injector Combustion Seal Installation Procedure

1. Place the combustion seal on the cone and pull downward on the seal as indicated in the photo.

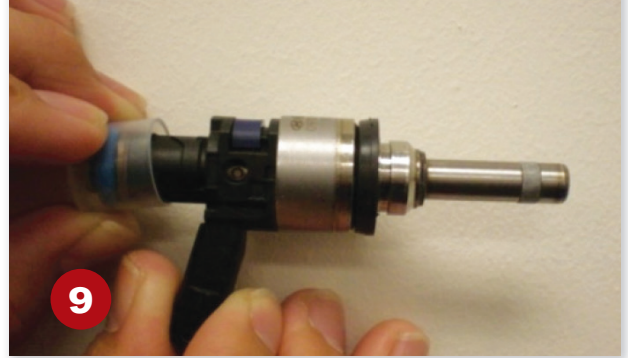
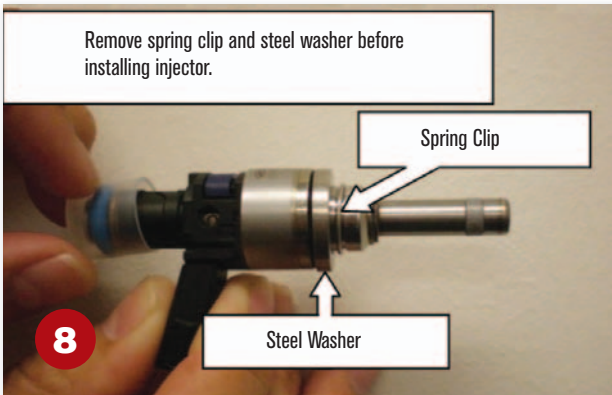
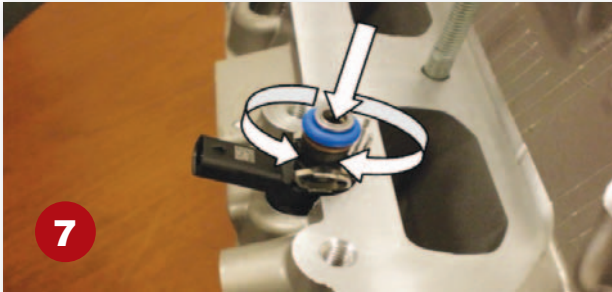
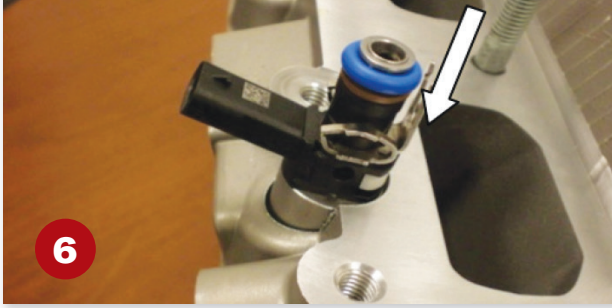
Notice: Your finger will work better for installing the combustion seal over the cone.



2. Pull the seal downward until it is near the bottom of the cone as shown in the photo.

3. Place the cone (with seal) on the end of the injector. Then place the sizing tool (09353-2B000) over the cone. Make sure the tool flange is toward the seal as shown. Press down on the tool to work the seal over the injector and into the groove.

4. Because the seal will stretch as it goes over the end of the injector, it will be a bit oversized after installation. By letting the injector and seal set for a few minutes, the seal may reduce in size. Inspect the seal for damage before continuing.



5. Place the resizing tool (flange up) over the seal. Twist the tool slightly while pushing down over the seal. This should reduce the size of the seal. *Be careful not to apply engine oil on the combustion seal ring.*

6. Place injector into the head as shown.

7. Twist slightly while pressing the injector into position in the head. This should complete the resizing of the seal. Remove the injector and inspect the seal before completing the injector installation process.

8. If the injector comes with a protective steel washer held in place by a spring clip, both will have to be removed before installation.

9. Install the washer seal onto injector with the rubber side (stepped) toward the injector.

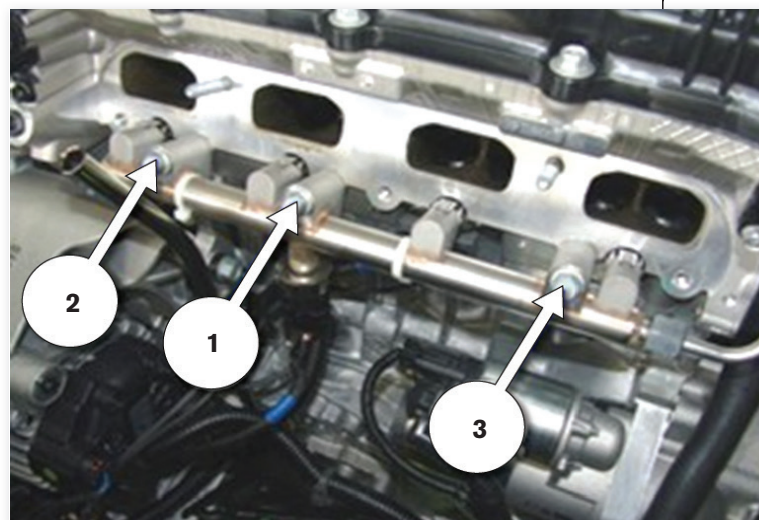
10. The stepped rubber side of the seal goes towards the injector.

11. The flat washer side of the seal goes towards the head. Before installing the injectors into the delivery pipe, be sure to apply clean engine oil evenly over the entire surface of the injector o-ring. *Be careful not to apply engine oil on the combustion seal ring.*

Avoid dropping the fuel pipe (including injectors) or bumping it into any hard objects since damage to the internal components may occur. If necessary, visually inspect and confirm proper operation with performance tests prior to reuse.

Before installing the injector into the cylinder head, clean the injector hole and avoid contaminants from entering inside the injector hole. When installing the injector, avoid bumping the injector tip into any of the surrounding components since the tip may become damaged from the impact.


When fastening the three fuel delivery pipe mounting bolts, fully hand-tighten first, and then tighten in the proper sequence (see photo above) in several cycles up to the specified torque. The delivery pipe should move less than 1/8 inch (approx. 3mm), whenever each bolt is tightened. **KIA**

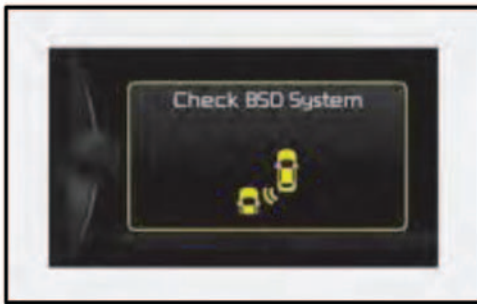


» TSBs may be updated from time to time. Please refer to TSB ENG148 at www.kiatechinfo.com for the latest procedures.

Assuring BSD communication

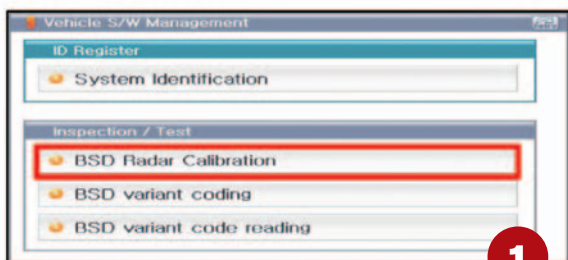
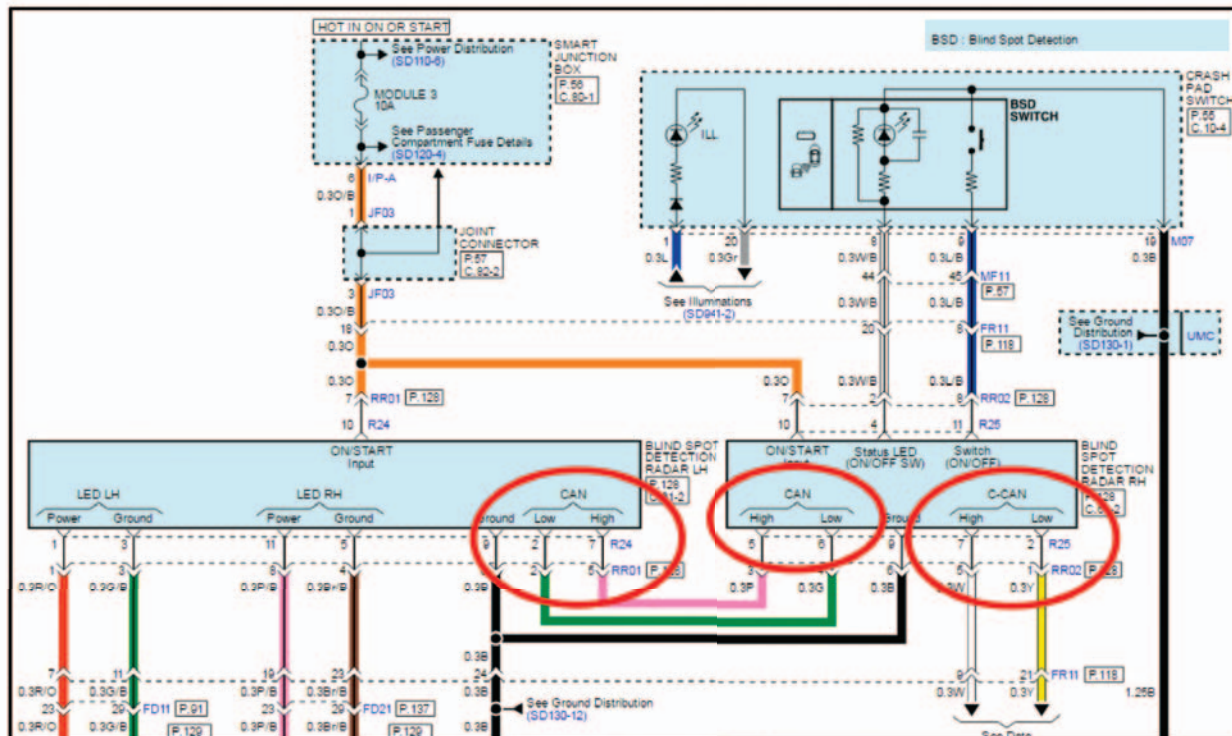
Post collision, proper rear harness installation is key

 This article provides information relating to the vehicles listed in the chart below when equipped with Blind Spot Detection* (BSD), which may exhibit a “Check BSD System” message and no communication with the BSD system after collision repairs. This concern is commonly caused if the rear bumper harness is installed backwards.



Model	Year	BSD Master Location
Optima (QF)	2014-2015MY	Right
Sorento (XM)	2014-2015MY	Left
Cadenza (VG)	2014-2016MY	Right
Cadenza (YG)	2017-2018MY	Left
Niro (PHEV)	2017-2018MY	N/A (No Master/Slave)

*Blind Spot Detection is not a substitute for safe driving, and may not detect all objects behind or around vehicle. Always drive safely and use caution.



[BSD Radar Calibration]

This function sets BSD Radar after replacement.

This calibration procedure will clear any 'Missing Calibration' DTCs which allows the Radar Sensors to go through the Self Alignment Procedure. The Sensors continually self-align while the vehicle is driven. It may take up to 30 seconds.

It will not allow cancellation of the process.

Press OK below to continue.



The master BSD module, located at either side of the rear bumper (refer to table at left), is the only BSD module that communicates on the C-CAN. The slave module (opposing side of bumper) communicates to the master module via local network CAN. The master and slave module connectors are physically identical and may be mistakenly swapped.

Note: Niro (PHEV) does not have a master/slave. Both modules communicate on the C-CAN.

To confirm correct installation of the harness, verify the pin location is correct for the left or right side module, which can be found on the Kia Global Information System (KGIS). See the diagram above.

It is important to note that the BSD system may be adjusted and calibration must be performed after any rear collision repairs. Failure to do so can result in improper BSD system operation. Refer to SST060 for more details.

1. Using a KDS/GDS, select “BSD Radar Calibration” in the BSD System.
2. Perform the “BSD Radar Calibration” procedure according to the KDS screen.
3. Once the procedure is complete, test drive the vehicle at speeds above 20mph to verify proper operation of the BSD system. **KIA**

▶ Pitstop Technical Operations may be updated from time to time. Please refer to PS464 at www.kiatechinfo.com for the latest procedures.

▶ All images are for illustration purposes only.

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Genuine Parts



Genuine Parts

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