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KNOW HOW

38 A LOGICAL PROCESS TO DIAGNOSIS

We need the proper training, tools, equipment and a logical diagnostic game plan

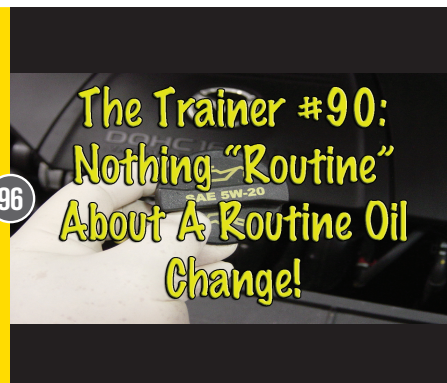
60 LOOKING BEYOND THE MIL AND THE DTC CAUSING IT

A 2010 Ford Flex with a DTC that proved to be a symptom, not the cause of the customer concern

**THE TRAINER:
NOTHING
ROUTINE
ABOUT A
ROUTINE
OIL CHANGE**

**The Trainer #90:
Nothing "Routine"
About A Routine Oil
Change!**

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TECH APPRENTICESHIPS: YOUR EMPLOYABILITY AND ROI SOLUTION

Apprenticeships can be the answer for shops to make money while teaching a new technician how to repair and maintain vehicles — and how to do things the way they are done in your shop. Pete McNeil, owner, and Jake Sorensen, lead tech, with McNeil's AutoCare in Sandy, Utah, created their own apprentice program now certified by the U.S. Department of Labor. Their plan can be a blueprint for your shop. From outlining how it makes money for your shop practically right from the start to how it helps bring in quality employees, Pete and Jake discuss in the webinar why younger people are not interested in auto repair; the not-so-secret roadmap for success; the new NAPA AutoCare Apprentice Program; barriers techs and employers have to overcome; and your shop's potential success rate.

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CONSUMER PRIVACY

HANVEY WARNS CONSUMERS ON VEHICLE DATA ACCESS, PRIVACY

MOTOR AGE WIRE REPORTS //

As part of the organization's continued efforts to ensure a consumer's right to access their car data, Bill Hanvey, president and CEO of Auto Care Association, penned an op-ed exploring the significant issues surrounding data collection and ownership in modern cars.

The op-ed was published by *The New York Times* as part of the outlet's "Privacy Project," which explores the modern discourse surrounding tech

data privacy for consumers.

Here is the article text:

Cars today are essentially smartphones with wheels. For drivers, this has meant many new features: automatic braking, turn-by-turn directions, infotainment. But for all the things we're getting out of our connected vehicles, carmakers are getting much, much more: They're constantly collecting data from our vehicles.

Today's cars are equipped with telematics, in the form of an always-on

>> DATA CONTINUES ON PAGE 5

BREAKING NEWS

INDUSTRY EVENTS

LEADERSHIP, TRAINING, TECHNOLOGY FOCUSES OF ASA MEETING

The Automotive Service Association (ASA) had a successful and exciting Annual Business Meeting & Conference April 30-May 2 at the Hurst Conference Center in the Dallas-Fort Worth, Texas community of Hurst.

With a focus on technology and training, ASA offered a variety of classes to bring service professionals up to speed on changes taking place in the industry.

The association also surprised attendees with the launch of ASA's mobile app. Available to download on iPhone and Android devices, the app was created by MobileSoft, a global leader in mobile app technology.

During the ASA Annual Meeting, ASA Executive Director Ray Fisher, AMAM, installed the 2019-2020 Board of Directors.

>> ASA CONTINUES ON PAGE 5

TRENDING

WOMEN IN AUTO CARE ACCEPTING NOMINATIONS

Women in Auto Care, a community of the Auto Care Association, are accepting nominations for the 2019 Women of the Year awards. Winners will be named at AAPEX.

MOTORAGE.COM/WOMEN19

EV MARKET FORECASTED AT \$2.6 TRILLION

The future is coming bright for electric vehicles, a market estimated to grow to \$2.6 trillion by 2030, according to IDTechEx. And some OEMs are in great danger.

MOTORAGE.COM/EV2030

TAKE A LOOK AT YOUR SHOP PAYROLL

Automotive consultant Vin Waterhouse details a strategy for your business based on today's changing models, and reveals changes that will catapult you to a more rewarding career.

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LEGISLATIVE SUMMIT SET FOR SEPTEMBER

The Auto Care Association announced that its Legislative Summit will take place Sept. 18-19 in Washington, DC, in conjunction with the 2019 Auto Care Association Fall Leadership Days.

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THE GROUP TRAINING ACADEMY ENHANCES OFFERINGS

New additions to The Group Training Academy include courses on hybrids, anti-theft systems, European schematics and new classes for shop owners and managers.

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>> DATA CONTINUED FROM PAGE 4

wireless transmitter that constantly sends vehicle performance and maintenance data to the manufacturer.

Cars not only know how much we weigh but also track how much weight we gain. They know how fast we drive, where we live, how many children we have — even financial information. Connect a phone to a car, and it knows who we call and who we text.

But who owns and, ultimately, controls that data? And what are carmakers doing with it?

The issue of ownership is murky. Drivers usually sign away their rights to data in a small-print clause buried in the ownership or lease agreement. We know our smartphones collect data, and we've come to accept an implicit contract: We trade personal information for convenience. With cars, we have no such expectation.

What carmakers are doing with the collected data isn't clear. We know they use it to improve car performance and safety. And we know they have the ability to sell it to third parties they might choose.

Debates around privacy often focus on companies like Facebook. But today's connected cars — and tomorrow's

autonomous vehicles — show how the commercial opportunities in collecting personal data are limitless.

The data on your driving habits — how fast you drive, how hard you brake, whether you always use your seatbelt — could be valuable to insurance companies. You may or may not choose to share your data with these services. But there's no opt-out feature for your car.

Carmakers use data to alert us when something needs repair or when our cars need to be taken in for service. What they don't tell us is that by controlling our data, they can limit where we get that repair or service done.

Because of the increasing complexity of cars and the Internet of Things, data is critical to repair and service. When carmakers control the data, they can choose which service centers receive our information.


There are more than 180,000 independent repair shops across the country; most have all the tools needed to work on today's connected and complex cars. But without access to car data, they're working blindfolded, unable to see the diagnostic information they need.

The solution is simple. The only per-

son who should control car data is the car owner (or lessee).

The idea that drivers don't control their own data flies in the face of what consumers want and expect. Nearly 90 percent of consumers believe vehicle owners should control who can see their vehicle's data. Currently they don't.

Digitization of the auto industry is, ultimately, a good thing. Today's connected cars are paving the way for autonomous vehicles and vehicle-to-vehicle communications, and eventually vehicle-to-infrastructure communications, making our roads safer. But unlike Alexa and Nest, consumers are unaware of the degree to which their own car collects and processes data.

It's clear, because of its value — as high as \$750 billion by 2030 — carmakers have no incentive to release control of the data collected from our vehicles. Policymakers, however, have the opportunity to give drivers control — not just so that they can keep their data private but also so that they can share it with the people they want to see it. This will let car owners maintain what they've had for a century: the right to decide who fixes their car. Read the full article at MotorAge.com/Hanvey. 

>> ASA CONTINUED FROM PAGE 4

They include:

Chairman: Bob Wills, AMAM, owner of Wills Auto Service in Battle Creek, Mich., begins a two-year term.

Chairman Elect: Fred Hules, AMAM, owner of Tech 1 Auto in Peoria, Ariz., and the former secretary/treasurer, moves into the chairman elect slot to begin a two-year term.

Secretary/Treasurer: Scott Benavidez, AAM, owner of Mr. B's Paint & Body Shop, Albuquerque, N.M., and the former Collision Division Director, moves into the secretary/treasurer role to begin a two-year term.

General Director: Elissa Larremore, owner of CBS 1 Collision, based in Shreveport, La., will continue her role as general director serving the second year of her two-year term.


General Director: Todd Black, AMAM, owner of Unlimited Service, Bellingham, Wash., will begin a two-year term in the general director role. Black was appointed last year for a one-year term as general director due to a board vacancy, and he was elected earlier this year.

Mechanical Division Director: Tom Piippo, AMAM, owner of Tri-County Motors, Rudyard, Mich., is serving his

second year of a two-year term as head of ASA's Mechanical Division.

Collision Division Director: Mike LeVasseur, director of business development, Caliber Collision, Clifton Heights, Pa., begins his new two-year term as director of the Collision Division after getting elected earlier this year.

Immediate Past Chairman: Roy Schnepfer, AAM, Butler's Collision, Roseville, Mich., begins his two-year term as past chairman.

Ray Fisher, AMAM, ASA president/executive director, also serves on the ASA Board of Directors in an ex-officio capacity. 



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MAXIMUM EXPOSURE

Learn how to use digital media to enhance traditional print marketing

TIM ROSS AND JON BUTTS // Contributing Editors

From your social media newsfeed to your office elevator, it seems that advertising is everywhere. Even the NBA is starting to sell advertising space on players' jerseys. We tell our clients that in this increasingly competitive marketing environment, they have to promote their shops in a variety of channels. And that often means adding digital media to the print marketing they've traditionally done.

Shop owners need to be where their customers are, and their customers are spending more time on their mobile phones, tablets and laptops. If they don't have a good, balanced online and offline presence — if they're just relying on the mailbox or digital strategies — they're losing out.

The shop owners we work with gain different benefits from different types of marketing. With direct mail, for instance, the whole idea — whether it's going to an existing customer or a new one — is getting into someone's home in a way that isn't possible with email or texts, which can be easily deleted. Historically, it has been a simple one-way communication: people get a postcard and it hopefully prompts a call to the number listed on the mailer or a visit to the auto repair shop.

With digital, it's different. For starters, it's a more interactive medium. Consumers can visit a website, fill out a form and

trigger a call from the shop. Digital also allows for campaign retargeting, which means that you can basically follow a customer electronically once they've visited your site and serve them ads based on what they've viewed. Retargeting provides another opportunity to re-engage with website visitors even after they've left your site.

Digital + print = Maximum exposure

While digital marketing and print marketing each offer their own advantages, the best way to maximize your advertising spend is to combine both methods. By leveraging both approaches, you'll be able to increase your exposure and hopefully, your response rate.

Digital and traditional marketing can work effectively in concert. Your direct mail campaigns, for example, can help drive customers to your digital channels. Our strategy when developing mailers for our clients is to include promotions that prospects can access by following a link that takes them to dedicated landing pages. Those links are trackable, so we cannot only use them to figure out if our direct mail campaigns are working, but we can also gather customer information based on who clicks on them and then use that data in our retargeting efforts. We can

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also design mailers to send prospects to the main website, the testimonials page (to build credibility) or a scheduling page. The key is to direct the customer to the page that will offer the best chance of conversion.

In the same vein, we can use mailers to encourage mobile communication between our clients and potential customers. For instance, we might design a postcard that offers customers a special bonus or gift if they text a code to a certain number. Once they take that action, they receive a text back with information on how to claim the promotion and also become opted-in for future promotional texts.

Even social media can help reinforce the messages you're promoting through a postcard campaign. A consumer could be scanning through their Facebook newsfeed and see an image of a check engine light, accompanied by a message stressing the importance of addressing warning lights in their car. Meanwhile, a postcard from your shop advertising a free warning light scan might be sitting on their coffee table. The multi-channel approach will ensure that your shop is front of mind the next time that customer requires any repair services.

In the long-term, you might find that print media is a great tool for acquisition, while digital media is a good strategy for retention since it's less expensive on a per-impression basis. Once a customer is in your database, social media, email marketing and text messaging will help you maintain brand awareness.

Targeting is key

One thing to remember with both types of marketing is to be targeted. Auto repair shops don't want to blast everyone in their database with an email reminding them to get an oil change. There will be some customers who need an oil change and will get one, but there will be others who were in last week for their oil change, so that message is irrelevant to them. And

if the new offer is cheaper than a previous one, a customer who may already have used a previous offer can get upset about the lower new offer and possibly unsubscribe to your emails. It's important to segment your customers and send them relevant messages at the relevant time in the most relevant way.

With direct mail, shop owners can use demographic research to target the best potential customers located closest to their business. On the digital side, geofencing allows shop owners to target customers in the spaces where they spend their time. You can send ads to a customer's mobile device based on their current location (say the area surrounding your shop) or a location (a competitor's shop) they recently visited. You can also take a direct mail list of addresses and add mobile ads to those same households. Another approach is to send a few mobile ads to a customer before they get a direct mailer, so you're planting the seed for the postcard that will eventually land in their mailbox.

New digital technologies worth a closer look

Marketers are still unlocking the power of mobile technology, so it pays to stay abreast of advertising trends on this platform.

The mobile wallet, for instance, takes mail-to-mobile marketing to a whole new level. Most mobile wallets allow users to save coupons and promotions conveniently on their phone. With this in mind, you could send an ad to someone physically near your location reminding them to use a coupon stored in their wallet. You could also offer special promotions for customers who pay for service with their mobile wallet.

The challenges of running an integrated campaign

Figuring out how to allocate budget for a combined marketing program can be

a tough task. A marketing partner can help with that, evaluating your current advertising spend and how it can be effectively split between digital and traditional marketing. What's most important is committing to an adequate marketing budget. That's not to say that you need a massive budget, but you will need to spend a certain amount each month to stay in the game. If you can't do that, it's tough to have an integrated marketing approach — to do both digital and traditional marketing. If you don't have a big marketing budget, you don't have to do both digital and traditional in the same month — you can alternate. It is more effective, however, to have both types of marketing running concurrently.

It's also important to stay consistent. A new marketing strategy may not yield immediate dividends but could deliver strong returns over the long term. It's crucial to give your campaigns time to work. You can always make adjustments if you're not reaching your anticipated goals.

Ultimately, it's important to avoid viewing marketing as a commodity. Direct mail isn't just putting ink on paper, and digital marketing isn't just putting a jpeg together and posting it wherever. You need experience and strategy to make sure marketing is done the right way. If it's not hitting the right people at the right time in the right way, it's not going to be effective. *TL*



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Sales is a full-contact sport every single day

Win the game with these three strategies

If you have been in the business any length of time, you know sales is not like riding a bike. Depending on how the front counter is feeling, that day's sales can fluctuate. I was listening to Coach Paul Marsh explain how to stop that fluctuation from happening, and he began by saying:

I am a football fan and one of the aspects I respect and appreciate the most is the dynamics and effects of a great coach. In the movie, *Any Given Sunday*, Al Pacino gives an epic speech to his team at halftime in the locker room. I've watched this scene countless times. I never get tired of hearing him build the enthusiasm and passion of his team. He sends his team back out on the field fired up and ready to win.

What I truly loved about the speech was his reference to the game being a "game of inches." It really is. You need 10 yards for a first down, which is 30 feet, which is 360 inches. Every inch really does count. Reverse it and every inch you allow on defense counts just as much. Don't believe me? Think back to those markers and chains being dragged out on the field. The tension building as they check to see if a team who went for it on fourth down keeps the ball or loses possession. Most of the time it is a matter of inches.

We operate in a world where our ultimate goal may be based on a yearly sales and profit goal. We can divide that goal into 12-month segments. Then into an average of 4.3 segments. Finally, into 5 or 6 segments depending on whether you are open 5 or 6 days a week. You can take that number down to an hourly

or per-minute sales goal — I think you get the point.

What I'm asking you to consider is that winning, for shop owners, is really a "Game of Contacts." Every contact is either pushing you forward towards your goal or pushing you away from it. There are countless contacts every day in your business. Each call, each in-store customer interaction and each time we talk to a technician — all are contacts. When you talk to a counter person, and receive part delivery house calls, these are also contacts. It even comes down to every piece of marketing or piece of info about your shop in print or on the web. Don't know where to begin? Take a page out of our play book for some easy wins.

WINNING, FOR SHOP OWNERS, IS REALLY A GAME OF CONTACTS. EVERY CONTACT IS EITHER PUSHING YOU FORWARD TOWARDS YOUR GOAL OR PUSHING YOU AWAY.

1. Start with your employees

Developing and improving your technicians and other employees involves many contacts and should be part of your game-winning strategy. Most often, they're the first interaction your shop will have with customers, so their well-being is important. How you greet them in the morning is a tone-setting contact. Do you grunt your hellos, or do you smile and set a positive tone and message to start their

workday off right? It's also important to seek their feedback. Do you have a daily meeting with them as a group or individuals to discuss the day and short- and long-term goals? Do you do weekly one-on-one meetings where you praise them for achievements, discuss performance and ask for their input and thoughts? Your employees should feel like they have a voice in your business and that their feedback is important.

Likewise, when your tech brings you a completed courtesy check, you should take the opportunity to coach them to make sure that they're maximizing your shop's sales potential. Be sure to take time to review and discuss their recommendations to cover what's present and what's missing. Also, make sure that your tech is promoting your shop culture properly along with those services.

2. Maximize customer interactions

As you may have guessed, there are many contacts throughout the customer sales process that present opportunities to increase sales.

When you answer the phone, that's a contact that presents an opportunity to make a great impression. Do you sound professional, happy and easy to connect with? Did you ask for and use their name throughout the conversation? Did you have to ask them to come in, or did your conversation give them a compelling reason to come in? Having an incredible phone conversation plays into the mindset of a shopper.

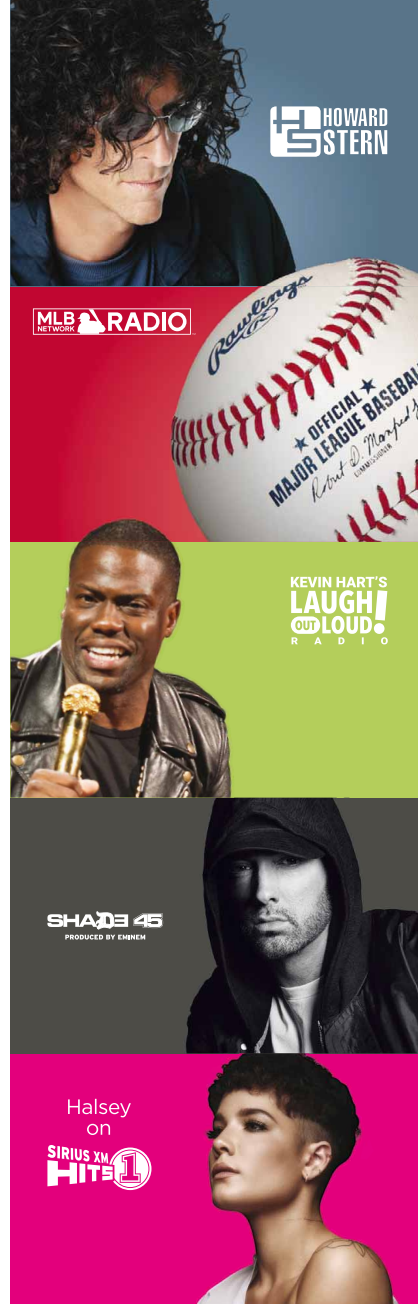
For customers that come in to drop off their car, you should have a process



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Ed Farrell - Dudley Automotive Services, Arlington, MA

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that ensures efficiency, builds relationships and reinforces their decision to bring their car to you. As Coach Geoff Berman says, “Everything speaks!” What does the appearance of your shop and property say? Do you offer complimen-

tary pick-up and drop-off service, or any other value-added services that fall outside of the key drop box?

Next, when you’re “contacting” a customer about the results of your courtesy check or about a concern they may have about their car’s condition, you should have a sales process designed to present all your findings in a way that sells the value of your recommendations. This process should help to paint a mental picture for the customer to help them understand why these services are needed and the importance of what you’re recommending.

Last, when the customer comes to your shop to pick up their car, make sure that you have a good closing process that reinforces your shop’s value and their investment. This process should also secure return visits by recommending their next check-up. And request good recommendations — thereby limiting the chance of receiving a bad online review. The last “contact” in the process should be closing out the customer’s bill with a smile and remembering to say thank you.

3. Work with your supplier connections

Finally, we come to the most underestimated contacts in the sale process — interactions with your suppliers. These relationships are rife with sales opportunities. For example, when the

parts driver comes to your shop, that’s an opportunity to promote your business. The parts driver most likely lives and works near your shop and owns a car. They probably live in a household with at least one other car and have nearby family and friends with cars. Another benefit is that they talk to managers and technicians from other shops that may be seeking employment elsewhere. Based on your current relationship, do you think your parts driver would recommend you as an employer?

There’s no time like the present to get started

There are so many “contacts” and related opportunities around your shop every day. They’re the “inches” that Pacino spoke of in *Any Given Sunday* and they’re as important as those big tickets we sell or great techs we hire. In fact, these opportunities can lead to even bigger tickets, better techs and better employees. It’s a game of contacts. Contacts that add up to the sum and total worth of your business.

To see if you are getting the most out of your “contacts,” try ATI’s Business Owners Evaluation Checklist. It’s a great tool to see where you stand with your vision for your shop and how well you’ve spread that vision to your team. Simply go to www.ationlinetraining.com/2019-6 for a limited time. **ZZ**

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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 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 former shop owner and ATI member, Coach Paul Marsh.
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Tackling the issue of continuous investment

Figuring out how to fund continuous education, software and equipment

Today's shop business is dramatically different than 10 years ago. The continuous investment in the business that is required today is enormous and many shops are getting financially behind because of it. The question now is how should we be approaching this issue?

Consider that today we are in a knowledge-based business. Consider today it is about managing productivity through "billed hours," which are the result of selling your knowledge. This billed hour measurement now plays a stronger role than ever in moving the business forward. Let's look at two examples and how to handle the solution:

- We require \$25,000 a year now for technician, service advisor and management training/development, so how do we fund this? Solution: take the total billed hours from the last 12 months and divide that total into \$25,000. If we billed out 4,500 hours over the last year, 25,000 divided by 4500 = 5.56. We raise our maintenance labor rate by \$6 and all our future education and personal development will be funded as long as the billed hours are in place. Put aside \$6 for every hour billed each week into a special account. Maybe label the account "Education/Development Fund" and that is where you draw your development funds from.

- We will require \$3,000 per month for new leases on diagnostic equipment. Take your average billed hours per month for the previous 12 months and divide it into the required lease fees per month. For example, we average 375 billed hours per month, so \$3,000

divided by 375 = 8. If 85 percent of our hours are maintenance and 15 percent are diagnostic, then we raise our maintenance rate by \$6.80 and our diagnostic by \$1.20 ($\$8 \times 85\% = \6.80) We are covered for all new diagnostic equipment leases as long as the average billed hours are in place.

As you can see, every new investment will be reflected through the labor rate and the labor rate adjustments will depend on the billed hours. The more efficient the shop is, the more billed hours it achieves and therefore the labor rate adjustment is not much compared to an inefficient shop that does not obtain the correct billed hours for the work coming through the door.

There are a couple of other considerations to be discussed on this topic as well.

1. Consider your labor rates and the dealership labor rates in your area as a starting point. For example, with GM dealers, there is no way you should be more than \$5 lower in your rate. You require more training, need more equipment and you need a more diversified staff with different knowledge levels as you work on all makes and models. I have clients that are now above the dealer rate and NEVER receive one complaint from their clients because they are excellent at what they do. It is all about competency today and competency is reflected in the labor rate. When you have the skill level in your shop, STOP selling yourself short. This is strictly a MANAGEMENT issue, not a marketplace issue.

2. Do you measure religiously (daily, weekly and monthly) the average

billed hours per RO? Are you where you should be, meaning for basic consumer work 2.5 billed hours per RO, mid-duty 4 to 6 hours and heavy duty 8 to 10 hours? Take your total labor sold in each category (maintenance, diagnostic, reflash) and divide it by your labor rate for that category to determine how many hours were sold. Take total hours sold and divide it by the number of ROs written to determine the average billed hours per RO. Now also examine your sales mix as, for example, if you are doing consumer vehicles and mid-duty (1 tonne, cube vans) then maybe your average in your shop should be 3.5 hours per RO. Calculate your average mix of vehicles. If you are not at the correct billed hours then you must examine your internal processes starting with vehicle inspections and how they are being handled and follow through from there on all other issues that affect productivity billings.

Welcome to the new aftermarket, as this article is just one topic of so many that must be examined and realigned to work properly in today's shop business. The same old question must be asked: "Are you working IN the business or ON the business?" *MZ*



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.

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Most Favored Nation clauses are still an industry problem

They are harmful to both consumers and repairers

While the term Most Favored Nation (MFN) clause may appear to refer to some international trade agreement, these clauses do have an important meaning for the collision industry. MFN clauses, in direct repair agreements (DRP), between insurers and collision repair facilities guarantee an insurer that it will receive prices that are at least as favorable as those provided to other carriers doing business with the collision repair facility, for the same products or services. MFN clauses can, under certain circumstances, present competitive concerns. One instance is when the MFN clause is used by a dominant buyer of intermediate goods, raising other buyers' costs or foreclosing would-be competitors from accessing the market.

Insurer MFN Clause Example: Provider agrees that if it gives a bottom line discount, rebate or other estimate discount on the overall repair costs to any insurer, such discount constitutes an estimate and bill for repairs for purposes of this section. In that event, pricing provided to the insurer and its customers by Provider shall include the bottom line discount given to any other such insurer.

Examples of the negative impact of MFN Clauses

Collision shops: If the largest or a larger insurer insists on an MFN clause, shops are forced to make decisions as to whether to participate with other insurers that may have smaller market share but require higher discount(s). This could negatively impact the collision shop as well as limit the repair choices of the vehicle owner (consumer).

Consumers: Shops are pressured to reduce direct repair program participation with carriers that require discounts yet have a smaller market share. Consumers may not be allowed to have their vehicle repaired where they prefer to have it repaired. The cost to repair a vehicle could increase with smaller insurer discounts becoming problematic for collision repairers.



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Insurers: Smaller carriers, and some larger carriers that require discounts are at a disadvantage due to shops having to drop their programs in order to avoid the financial pressure of providing all these same discounts to an insurer(s) that is dominant in the marketplace.

The Obama Administration did not look favorably on MFN clauses relative to health care. Unfortunately, their interest did not include property and casualty. In 2012, Michigan prohibited the use and enforcement of MFN clauses in health insurer contracts. In the fall of 2012, the Federal Trade Commission (FTC) and the Antitrust Division of the U.S. Department of Justice held a joint public workshop on MFN clauses.

The Automotive Service Association (ASA) wrote the U.S. DOJ Assistant Attorney General for the Antitrust Division following the Workshop. In the letter, ASA stated: "An increasing number of our collision repair shop owners are faced with direct repair agreements, offered by insurance companies, which include Most Favored Nation (MFN) clauses. For the large majority of collision repairers, not participating in insurer direct repair programs is not a viable

option. The Department has raised concerns about MFN clauses in recent litigation as well as in testimony on Capitol Hill. ASA encourages the Department to continue to pursue the MFN clause issue. The anti-competitive nature of these clauses ensures both our members and consumers are at a disadvantage."

Although at least one major insurer has dropped the use of MFN clauses, they are still included in some insurer DRP agreements. Many repairers view these clauses as harmful to their businesses. This Administration and the new 116th Congress may want to take another look at the impact these MFN clauses have on consumers and repairers. *TR*

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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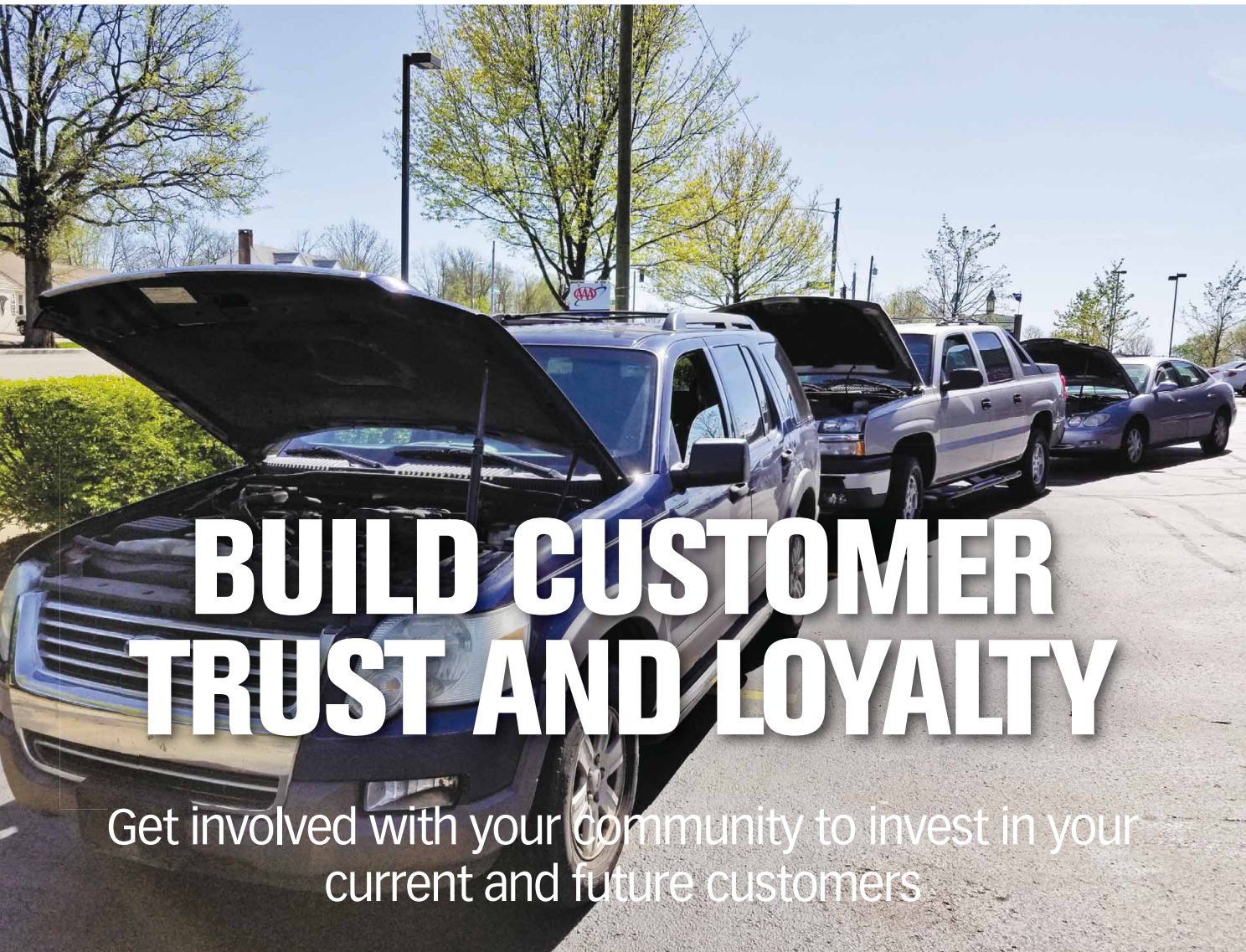


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TONY PFUELB // Contributing Editor

It is mind-blowing to think you can post a video online, and within minutes you can have thousands of views from all around the world. With social media growing more and more every second, anything can go viral. There are many great things I can do with my cell phone to keep our customer up to date with what is going on in our repair shop. We are addicted to social media, and we pick up our phones over 50 times a day to check in with the world. If you are not using social media

to grow your customer base, you should. You can use many different platforms to build customer trust from free vehicle inspections in your community to a call-in radio show or Facebook Live. It is also just as important to communicate with our customers face to face.

Getting your shop involved in your local community is a great way to build trust in your current and future customers. For example, I perform free car inspections for our local YMCA during their Health and Wellness Festival.

I found this was a great opportunity to meet future customers and introduce them to our shop. This off-site inspection creates a no-pressure environment where a potential customer can get to know about our shop and also have their car inspected in the process. When performing these inspections, I get a lot of questions pertaining to their vehicle. I make sure to take extra time when answering these questions, and show them examples on their car so they can understand. In an off-site environment

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I have the time to answer the customer's questions and show them examples on their vehicle.

A customer is more likely to approve repairs once they fully understand the need for the repair. This can be done through pictures, video or actually showing them on their vehicle. This will also help the service writers sell the repairs with little resistance or doubt. During the inspection, I talk to the customers as I would in a job interview. In reality, you are being interviewed for future business. There are many repair shops in our town, and I use this opportunity

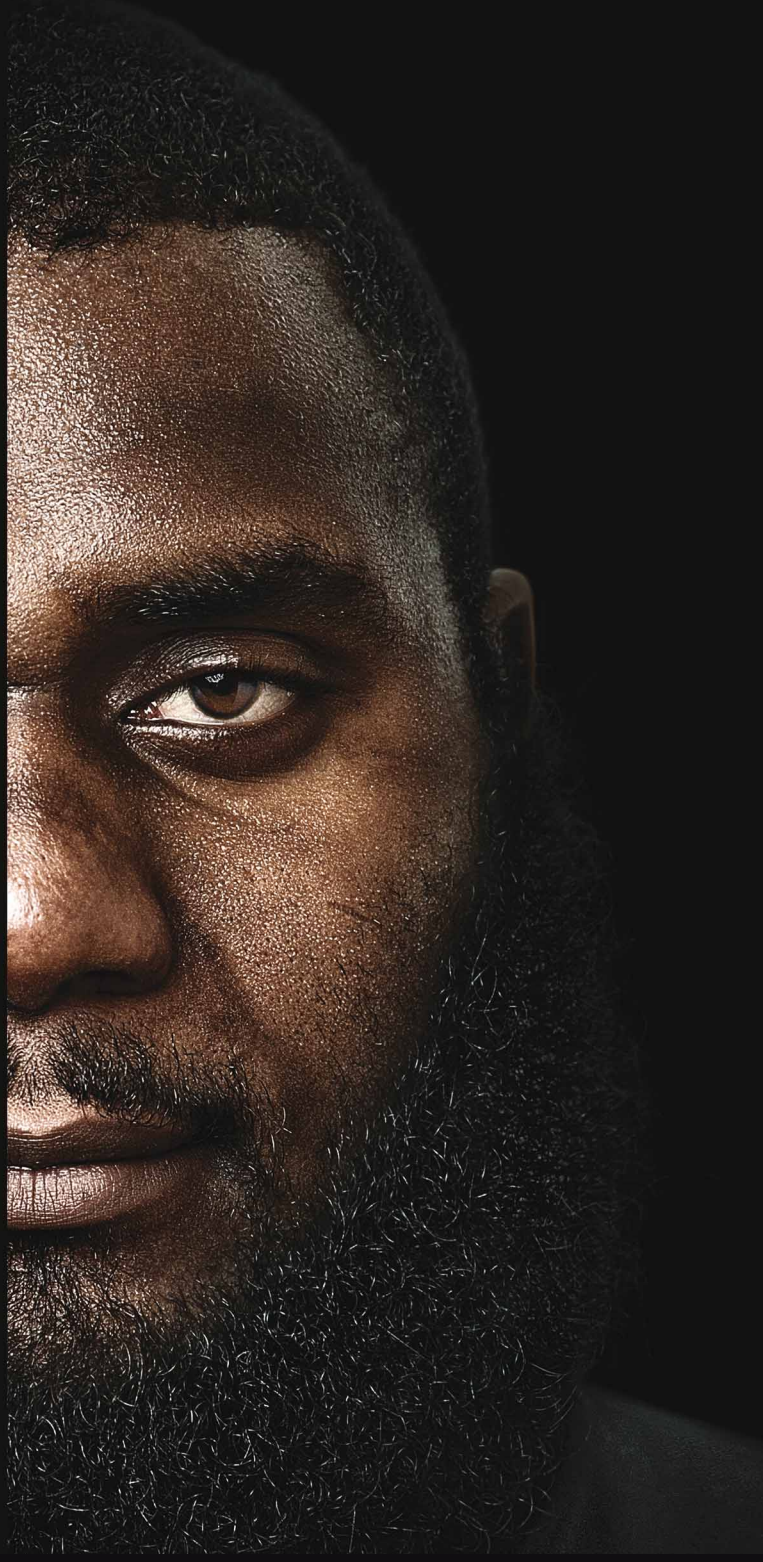
to introduce them to our shop.

I also volunteer my time at our high school vocational school. During car care month the vocational school provides auto inspections at no charge to the community. The students perform the inspections, and I make sure the students are being safe. I am also there to answer any questions the students or customers have. The students really appreciate and respect the time I volunteer to the school. I was once a student at the school and know how important the program is to the growth of the automotive industry. In order to protect and

prolong our industry, it is important to help educate the future technicians. In three years these students will be graduating, and we want our shop to be the first shop they apply to.

During these free car inspections, I don't check every single part or fluid on the car. I just do a basic under-the-hood inspection of the fluids and filters. In addition, I like to check the cranking battery voltage, tire pressure and tire wear. The local YMCA is just over one mile from our shop, so I use this opportunity to invite customer to stop by our shop to visit after the inspection is completed. If

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your shop wants to start a free vehicle inspection day it does not take much — just a few hand tools and a location. I like to bring some screw drivers, voltmeter, tire gauge and a tire depth gauge. If it is going to be a sunny day or chance of rain, it is nice to have a pop-up tent. I can perform these inspections by myself, but it is a lot faster to have a helper. When finding a location, I would recommend a place in your community that is close to your business. You want the people that are going to stop by to be in your target customer location. The first year doing inspections at the YMCA with no advertising, I only had six cars in three hours. The up side was four out of the six are now returning customers. This year with advertising and promotions our goal is to have around 50 vehicles.

I also teach a women's automotive class. I talk about the basics when it comes to car repair and maintenance. The one topic everyone enjoys is what to do when you are having a car problem. For example, when the battery light comes on or there's smoke from under the hood. I like these classes because it is a small group, and no one feels pressured or embarrassed to ask any questions. Most customers are afraid to ask questions at the shop because they feel the answer might cost them more money. I also talk about how they can maintain their

cars so they will last years longer. I will go into detail on how to change a flat tire, change your own oil, and what to do if your vehicle breaks down while traveling. It is always a fun time, and we all walk out of the class with a better understanding of our vehicle.

In 1998, our shop started a call-in radio show called Under The Hood on Saturday afternoons. In the two-hour programing I would answer car questions live. I would also have a topic to talk about if we didn't have a lot of calls. As our families and the shop have grown after eight years, I had to stop the radio show. Last year we brought back Under The Hood using Facebook Live. With Facebook Live we are able to answer our viewers' question and give them real-world visual examples.

If your shop is wanting to start a Facebook Live, I would recommend a weekly show. When starting a live event, it is not how many people watch it live, but the total views that week. I had a week when only two people watched the show live, but it had over 600 views of the video at the end of the week. You don't need any video editing skills or acting classes; you just need your smartphone. I find a topic to talk about for that week, and then at the end of the live cast answer any commented questions. I like to keep the videos around 15-20 minutes long. If you would like to up your video quality, you can pick up a phone stand, camera light and microphone all for under \$50 online. What we have experienced is that Facebook shares are just as effective as a customer's word-of-mouth referral.

If you are nervous about posting live online, don't worry. It is just like talking to a customer over the phone. I like to have an outline of that day's topic just in case I lose my train of thought. Make sure when filming to always look at the camera, and not the screen. I will try to post one video or picture a week on our Facebook page. I will post anything from failing water pumps to major engine repair. Some of most popular videos are the funny ones, like if you find an animal in the blower motor, or a gas tank held on by a ratchet strap. I always try to use our social media posts to show examples of real-world problems. Most customers don't know how a shop is run or what we see in a week.

In today's world, you are most likely to get a text response back from a customer rather than a phone call. What we have to remember in the automotive repair industry is that trust and loyalty have to be on a higher level than other industries. Technology is changing the way we run, manage and market our shop. We can't only focus on the new trends and forget about the personal face-to-face connections with our customers. **TL**

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DAVID ROGERS // Contributing Editor

Few auto repair shop managers or owners got into this industry to focus on marketing. We love cars. We love working on cars. Marketing is usually a necessary evil that we pay attention to but don't necessarily focus on.

This attitude has cost a lot of good shop owners their businesses. I've seen it first hand.

Even if you aren't a fan of marketing, you need to be as hands-on with it as possible for your shop to succeed. And,

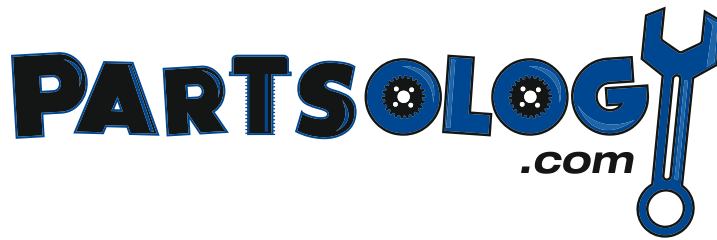
for your marketing to be successful, you need to pay close attention to the return on investment (ROI) with every ad buy you make. Your ROI needs to be as high as possible for you to maximize your marketing budget and get more customer bang for your buck!

Marketing vs. advertising: know the difference

The first thing you should know about marketing is that it's not the same thing as advertising. While all advertising is

part of marketing, not all marketing is tied into advertising. An easy way to differentiate marketing from advertising is that advertising is a sprint while marketing is more of a marathon. Or, to put it another way, advertising is a snack while marketing is a multi-course meal.

Marketing's menu includes a lot of elements, all relating to your shop's brand — hands down your most valuable commodity. Waiting room cleanliness, customer service procedures, community involvement — all these things shape



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the way you're perceived by the people who visit your shop and the people you want to be visiting your shop. It's a long-term game that requires discipline, persistence and vision.

For your long-term marketing to be successful it needs to be well-coordinated and rolled out in a strategic manner. "Piecemeal advertising," sending out bits and pieces of unintegrated collateral and one-off promotional offers, might help you get a few more cars in your bays for a week or so but it really doesn't work in the long-term, which is a lesson we learned the hard way more often than I'd care to admit.

Quality > quantity

While seeing more customers come through your doors might seem like it means that your marketing is working, that's not necessarily the case. Now more than ever, analytics and having a comprehensive understanding of the true results your marketing efforts are having are key to sustaining success.

Car count or clicks to your website are easy metrics to keep track of but, most of the time, the easiest metrics are just the tip of the iceberg in terms of marketing analytics. Beneath the surface is where you can determine the quality of your efforts instead of just the quantity they're producing as, again, quantity can be both misleading and superficial.

Having good marketing isn't just about attracting customers — it's about attracting good customers and retaining them. When you are selecting the advertising components you will be including in your marketing engine, you should have both internal and external concerns in mind.

All your advertisements should take your existing customers into consideration in addition to the new customers you're hoping to attract. Gaining a few new cars who aren't loyal to you and don't trust you yet simply isn't worth it

if you alienate your long-term clients by offering only new customers one-time discounts or anything to that effect.

Stay the course

Another important thing to remember when you're putting together a marketing plan is that you need to stick with it long enough to measure and evaluate your results. A shop owner I know recently decided to devote some money towards Google AdWords, which is a direct and relatively easy way to get more views on your website and more cars in your bays.

After seeing mediocre results for a couple of weeks, he abruptly decided to abandon the whole thing — just like that. We will never know how much AdWords would have helped him in the long-run in his market because he was overly-reactionary and didn't show any patience — a major no-no in the independent business marketing world.

Digital is definitely an important item on your shop's marketing menu. Your online presence is a lot more than just putting up a website and hoping people find it. You need to make sure the language on your site is written in a manner that is going to be found in search engines. You also need to have active social media platforms directing customers and potential customers towards your business.

So-called "old-fashioned" advertising channels are still relevant but, like AdWords, they need to be maintained and developed over time. We use direct mail at our shop for a very simple reason: it still works. We have been doing it for years and use a lot of the same language we were using when we first started targeting potential clients with "snail mail." If you just use direct mail as a one-off promotion, it's not going to work. You need to stick with it, refining your targeting, and expand your reach over time to find the right customers — customers loyal to your brand and not just the coupon chasers.

Consistency is key

Just like running your small business, perseverance is a big factor in your marketing plan's success. Your advertising is a big dish in your marketing feast, maybe even the main course, but it's not the entire meal. Consistent branding, effective messaging and compelling content are cornerstones of your shop's marketing plan and should be taken into consideration any time you place an ad or send out a special offer. Don't panic and send out a "free oil change" coupon just to get people through the door. This damages your brand and negatively affects your overall marketing plan.

While you can drive yourself nuts worrying about your effectiveness or ROI on a given advertising campaign, at the end of the day, marketing is all about results. If your business is growing in a meaningful and measurable way, your marketing is doing a good job. If you are not, it is not.

Truly understanding the multiple marketing metrics you have access to nowadays is increasingly tricky, which is why a lot of shops rely on professional marketing agencies to help achieve their goals and better comprehend their branding. This is why for those without a solid understanding of marketing and how to evaluate their efforts, it makes the most sense to focus on your expertise — running a shop and repairing cars — and let marketing experts handle your campaigns. *ZZ*



DAVID ROGERS is chief operating officer of Keller Bros. Inc., president of Auto Profit Masters and president of Shop 4D, the industry's first Artificial Intelligence

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Taking the high road

Shop focuses on repair details to ensure all are done correctly

ROBERT BRAVENDER // Contributing Editor

→ Seattle, 1984: three young men, two of them students at the University of Washington, were tasked with repairing a professor's Honda in a campus parking lot. It proved to be their entrance exam into professional automotive repair.

"The joke at the time was that we had earned the 'Doctor of Honda' degree," explains Fred Wilson. The only one of the trio who would actually earn a degree, Wilson, with his twin brother Tom and their friend Randy, took this as a sign — literally — naming their new shop Dr. Honda later that year.

"What we did for marketing was run around on bicycles and put little half sheet flyers on Honda windshields," Wilson recalls. "There were thousands of them in the neighborhood, because this was back in the day when they all came from Japan, and they came off the boat about a mile and half from the shop. The market was just flooded with them."

With Seattle being a port of entry for Asian imports, domestic makes had pretty much disappeared from the area by the 1980s. By the '90s the shop would expand into other lines, thus changing the shop's name to its current High Road Automotive, but still all-Asian.

"We just started taking in Toyotas and Subarus and learned about them the hard way — whether that was smart or not," Wilson laughs. "They're not that much different so it wasn't that hard, but occasionally we'd find we needed a special tool for this or that."

What they learned from these experiences was written down in what would become the shop's policy manual. Wilson's partners would eventually move on to other endeavors, but he carried on compiling knowledge. The shop now runs on carefully curated checklists and procedures. For example, most day-to-day tasks are now in their custom computer program.

"You cannot sign off that you're done with something until you've signed off the checklist," he explains. "It's basically a training device that's written into our software. Say you're doing a wheel bearing; the checklist is going to ask did you torque wheel lugs, are the ABS sensors properly installed — it's that level of detail, and each job has its own particulars. It's on software that we wrote and I've never seen anything like it anywhere else."

"It's not fly-by-your-pants anywhere," Wilson states. "If I see a tech doing things that aren't by the book, I may correct him right then, but I'm going to be nice and sweet about it, because



HIGH ROAD AUTOMOTIVE Seattle, Wash. // www.high-road.com	
Fred & Kathy Wilson Owners	6,500 Total square footage of shop
1 No. of shops	13 No. of bays
35 Years in business	55 No. of customer vehicles per week
8 No. of employees	\$1.6 million Annual gross revenue

I figure it's my fault; it's either in the book and I haven't trained it properly, or that setup wasn't covered in the book. One way or the other, I just jot down a note and we go change the book. Then we go back and change the technician."

High Road pairs younger techs with older ones as much as possible. "It's essentially an apprentice program," explains Wilson. "We pull in 20-somethings and set them next to a guy who's been here 10 years. They learn inspection first because our inspection stuff is crazily extensive; through that they learn the car's problems. Then they move on to oil changes, fluids — that way we work them organically up, and it can take two or three years."

Wilson goes on to explain that High Road's inspection and maintenance program is comprised of roughly three levels, although there are an infinite number of options between them. But any configuration would probably please a customer, since they're marketed on the shop's website as a 'car day at the spa.'

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to customers about money, ever, if I can help it. I've got two service advisors to do that."

Technical expertise has become something of a language barrier for Wilson. As the shop's Ballard location transitioned from being a fishing village on Puget Sound to part of the Northwest's burgeoning tech industry corridor, newer residents were noticeably less knowledgeable on cars. Bottom line? "My customers are machinery-challenged," laughs Wilson.

On the other hand, "everything in marketing here, even word of mouth, is electronic," he explains. "The most important thing to maintain here is your Yelp! rating. You also have to have an excellent website or they'll laugh you off the face of the earth. It's weird, because you're in this place where everybody is connected to everybody, they can quickly find out your online reputation. They live on their phones; everything we send the clients has to be adaptable to be seen on a phone. That's how high-tech this place is."

The days of dropping flyers on windshields are long gone. *MZ*

"The simplest is where we're only going to look at straight safety," he notes, "Are brakes falling off, tires bald, ball joints worn out? At the medium level we'll look at those safety items plus a year, pointing out those things that are kind of worn. Then the 'white glove' — a full bumper-to-bumper, nitty-gritty inspection, noting things like if the foot pedals are wore out. We don't have that many customers who want that level, but they're out there. You get a list and you pick what you want.

"We have always been team-based on our tech crew," Wilson points out. "One guy will work on a car and if it's getting behind, we'll put another technician on it because they're paid hourly. We've never

done flat rate so there's no grand incentive." Under this system technicians also don't specialize in any one brand.

"I'm a student of people and psychology," he muses. "I'm actually more interested in that than management techniques; I change how I manage based on that." Having done some management training — with plans to do more — he's keenly aware that technicians should distance themselves from their former job to become owner/managers. However, Wilson doesn't feel he can.

"I am the technical expert," he emphasizes. "There's nobody else here with a degree in mechanical engineering; they're all going to come to me. What I did do on the profit side is I don't talk



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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Report No.: A0000014193

Full vehicle systems AI inspection report
This report is created by
LAUNCH ROXIE

Vehicle Information

VIN: 1FTWV31P85E951635
Vehicle manufacturer/model: Ford/F-350
Year of manufacture: 2005
Mileage: 235971 KM

Inspection organization

Name: LaunchTechUSA
Address: 1820 S Milliken Ave Ontario CA
Contact Number: 0 5624631580
SN: 88750001920
Time and date of inspection: 10/06/2018 11:58:57
Inspection Location: 9 2485 Arisawa Dr, Corona, CA 92879, USA

Inspection result

There are 2 issues for Power system:

1. On-Board Diagnostic (OBD) Systems Readiness Test Incomplete
2. Too Low ICP - Engine Cranking

There are 2 issues for Safety and Security system:

1. CAN Communication Bus Error - Reception Error
2. FR Wheel Speed Sensor Input Circuit Fault

There are 7 issues for Vehicle body system:

1. Brake On/Off Switch Circuit Fault
2. Transfer Case 2WD (Two Wheel Drive) Solenoid Circuit Open Or Short To Ground
3. Ignition Run/Accessory Circuit Fault
4. Transmission Transfer Case 4WD (Four Wheel Drive) Solenoid Circuit Fault
5. Ignition Key In Circuit Error
6. CAN Communication Bus Error - Reception Error
7. Ignition Switch Circuit Open

Inspections are normal for Power system

1. TCM (Transmission Control Module)

Inspections are normal for Safety and Security system

1. PAM (Parking Aid Module)
2. TBC (Trailer Brake Control Module)
3. PCM (Powertrain Control Module)
4. VSM (Vehicle Security Module)

Professional Report

GEM (Generic Electronic Module)	Abnormal 1
ABS (Anti-Lock Braking System)	Abnormal 2
IC (Instrument Cluster)	Abnormal 2
PAM (Parking Aid Module)	Normal
PCM (Powertrain Control Module)	Abnormal 2
TBC (Trailer Brake Control Module)	Normal
TCM (Transmission Control Module)	Normal
RCM (Restraint Control Module)	Normal
VSM (Vehicle Security Module)	Normal

- PRE & POST REPORT -
WILL AUTOMATICALLY SEND UP TO 5 EMAIL ADDRESSES

Advanced Driver-Assistance Systems: What we've learned

THE OPPORTUNITY IS HUGE, PROCESS IS CRITICAL AND TOOLS AND TRAINING MATTER

CHRIS CHESNEY // Contributing Editor

Several years ago, our CTI and WTI research and development team began an intensive search for truth with respect to Advanced Driver-Assistance Systems, or ADAS. While we continue to gather data from real calibration and ADAS failure issues, I want to share with you what we know and don't know in regards to ADAS.

The business opportunity is enormous and opens up three potential opportunities for shop owners. First is the Mobile Technician, who is typically at the front of the line with new technologies. The challenge for them is space, and the slope of the floor they have available also presents a challenge. The second opportunity is a progressive shop owner who has available space or builds said space for a local ADAS calibration center. In a similar vein is the third opportunity, which is a series of regional/local ADAS or technology centers that handle ADAS and other advanced technology services/issues for the local service centers. The key is the skill set of the technician and the discipline to keep them focused on ADAS so they can become proficient and profitable. Calibration setup is critical but time consuming if you're paying flat rate, which opens the door for potential mistakes.


Process is the next critical element of ADAS service and calibration. Today's service information is massive in scale, but it also contains a treasure trove of

answers. Some will simply tell you to RTM (Read the Manual), but that in itself is nearly impossible. It requires creating and implementing a technical reading strategy that allows you to find the answers to your questions quickly.

Next let's focus on tools such as scan tools and targets. Our goal is to find the truth with respect to what it takes to do ADAS; what we've found is most of the quality aftermarket tools do a great job of calibration. Some are tied to their own target system, but you can implement either OEM or another target supplier product and the results are the same. Remember, the tool does not calibrate the technology, it simply makes the request. However, there are systems where you'll be asked to validate or enter correction factors into the scan tool that are shared with the controller to complete the calibration successfully. If the aftermarket tool does not allow this or skips that step, then the calibration will be inaccurate. But is that a fatal flaw? Our opinion at this point is not necessarily.

By now you recognize there are two types of calibration: static and dynamic. Static requires targets to be placed precisely in relation to the vehicle so the controller can compensate for lens quality in a camera, for instance, or to validate the radar sensor can see the radar target. Many have said that if you don't calibrate the technology perfectly using OE tools and targets, then you run the chance of getting sued. I agree, but with this caveat: if all you do is static cali-

bration and do not test drive the vehicle under the conditions prescribed by the technology provider/OEM, then you only did half the job and yes, you might get sued. The other half of the service is the dynamic calibration. Static calibrations are required to verify the technology is pointed in the right direction both horizontally and vertically so the controller can adjust for lens quality in the case of cameras, or recognize blockage such as incorrect paint, bumper stickers laid over the radar sensor, etc. Once the vehicle is driven, the controller can gather enough data from each sensor then aggregate all the data so it can effectively recognize the real targets, accurately and on time. This dynamic calibration or learning is needed BEFORE the controller decides to activate collision avoidance or automated braking, blind spot warnings, or pull on the steering wheel to keep in their lane.

We will keep researching to ensure we fully understand this new frontier. We will share our learnings with you in our training programs, and we will continue to work with the OEMs to bring the enable criteria for dynamic calibrations to your service information systems so you can find it, understand it and use it to protect your customers and you. 

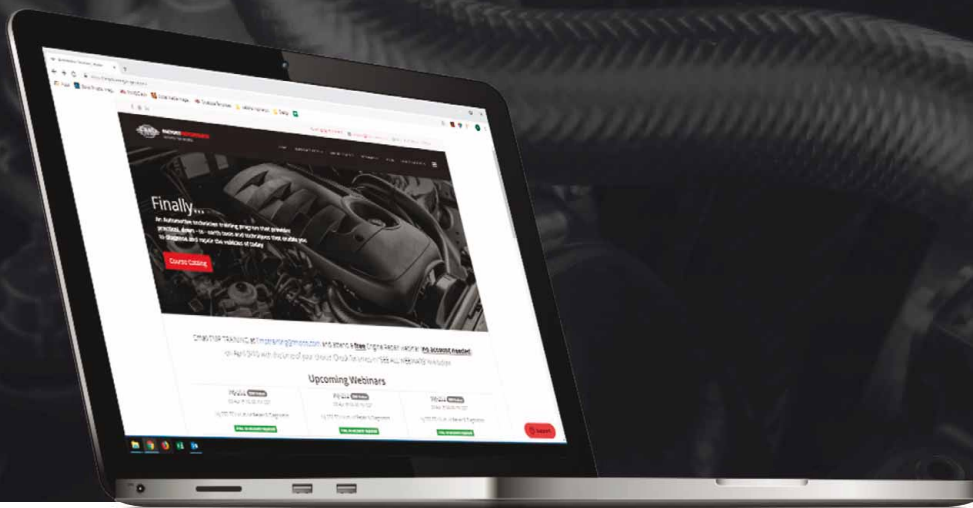


CHRIS CHESNEY is the Senior Director of Customer Training for Carquest Technical Institute (CTI) and Advance Professional.
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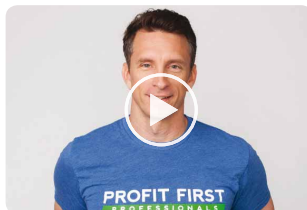
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MECHANICAL MOMENT

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

NEON STUCK IN SECOND GEAR — DTC P0750

VEHICLE: 2004 Dodge Neon, L4-2.0L, VIN C, Automatic Transmission

MILEAGE: 176,335

PROBLEM: The vehicle will not shift and is stuck in second gear. The MIL is on.

DETAILS: When the tech connected a scan tool, he found a DTC P0750 (LR Solenoid Circuit). The first step was to check the fluid level and condition. It was full and looked/smelled normal. Next, he tested the resistance of the solenoid pack. They were all in specifications so he tested for power and grounds to the solenoid pack. He found that the solenoid pack red wire was intermittently getting power. After looking at the wiring diagram, he tested the power and ground circuits for the transmission control relay. The circuits tested good so the relay was determined to be faulty.

CONFIRMED REPAIR: He replaced

the transmission control relay, cleared the code and test drove the vehicle. The transmission shifted correctly again and the MIL remained off.

This tech tip and others come from ALLDATA Tech-Assist, a diagnostics hotline of ASE-certified Master Technicians.

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Chandler, Arizona

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SkillsUSA and National Leadership and
Skills Conference
Kentucky Exposition Center
Louisville, Kentucky

JULY 30-AUGUST 2

Association of Diesel Specialists
International Convention & Tradeshow
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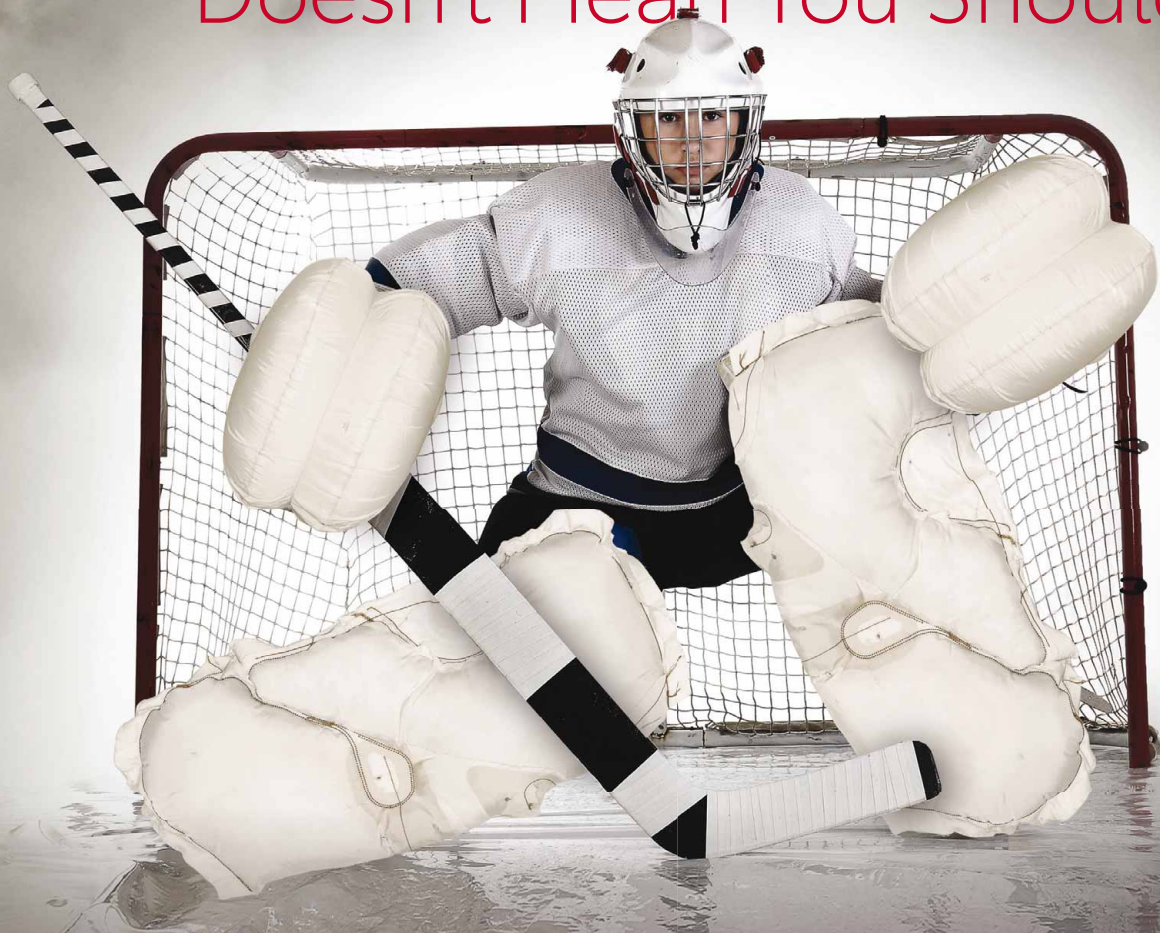
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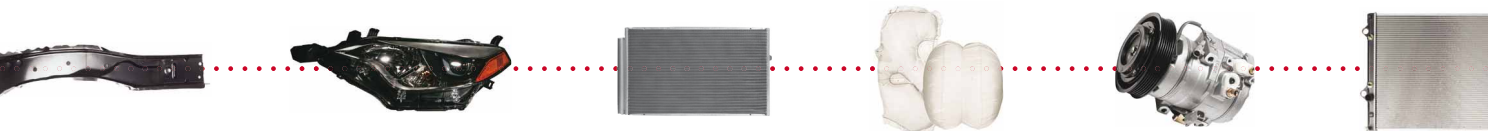


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REFINING YOUR GAME PLAN — A LOGICAL PROCESS TO DIAGNOSIS

WITH VEHICLES BECOMING MORE AND MORE COMPLEX, WE NEED TO HAVE THE PROPER TRAINING, TOOLS, EQUIPMENT AND A LOGICAL DIAGNOSTIC GAME PLAN

G. JERRY TRUGLIA // Contributing Editor

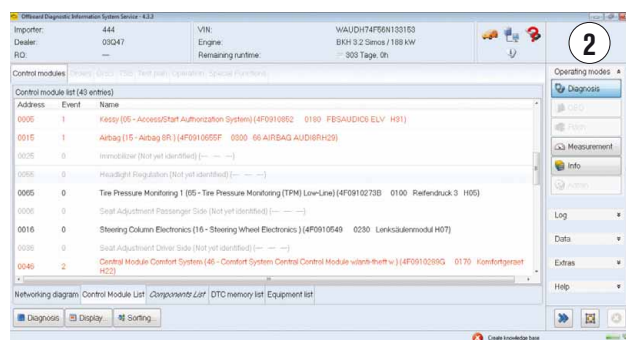
If you have been reading my articles the past 10+ years, you know that I always emphasize having a Game Plan. The New England Patriots would not have won the Super Bowl again if they did not have a plan. We're not a football team, but we are a team of professionals who keep America running. With vehicles becoming more and more complex, we need to have the proper training, tools, equipment and game plan. In this article, I will take you through a couple real life case studies that hopefully assist you in diagnosing problem vehicles.

First up — An ailing Audi

Our first case study that came in was from a customer who had recently purchased a 2006 Audi A6 3.2L from his uncle's used car lot. However, this well detailed Audi had to be towed in due to a no crank or start condition.

Sometimes Audi models can be a real challenge to diagnose and get running if you don't have the proper training and scan tool such as Ross Tech or ODIS. After questioning the vehicle owner (who unfortunately did not yield much information), it was time to move on and use our best tools. The tools that I am referring to are the tools are the same you've heard me preach on before — the tools that God provided us with: our brain, eyes, ears, nose and hands. As a result of using those tools we found that the steering wheel and column may have been compromised.

The battery and starter checked out fine. Having had previous experience with a similar problem on Audi and VW, we suspected an issue with the Access / Start module. The results from the ODIS scan tool confirmed our suspicions of a problem relating to the steering column, yielding a large list of DTCs. One of the DTCs that had to be dealt with first was



the 0005 Access/Start Authorization System.

This DTC prevents an engine crank/start condition because it brings down the CAN BUS (**Figure 1**) and shuts down other modules. The Authorization Module is integrated with the immobilizer and steering wheel lock mechanism that is mounted to the steering column. Our experience with this issue has shown us that the module is a common problem that causes no response from the ignition key or start button. The module's job is to look for the key or transponder that manages unlocking and locking the steering wheel. It also activates the relay's terminal 15 that supplies power to the other modules in the vehicle. If an issue is detected with any of the module compo-

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nents, such as the actuator motor, sensing micro switches, relay, or other electrical connections, the system will throw a DTC and not operate.

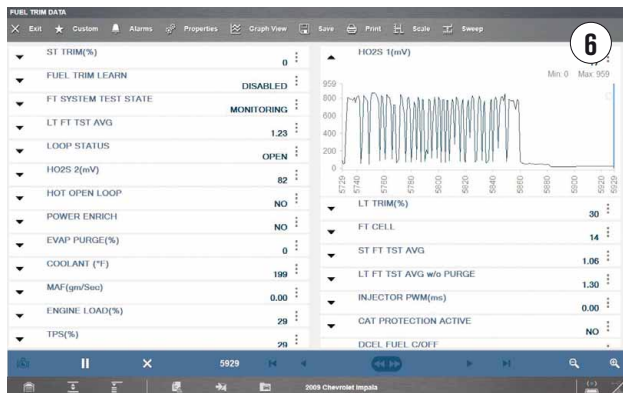
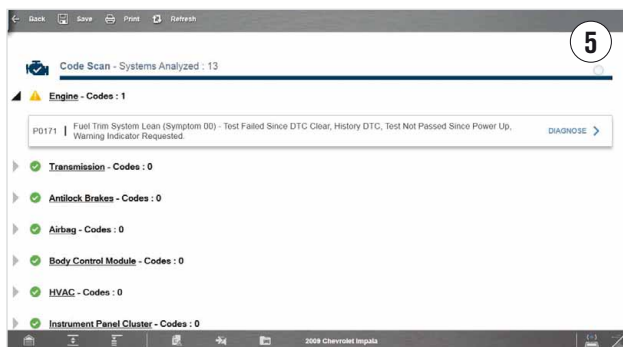
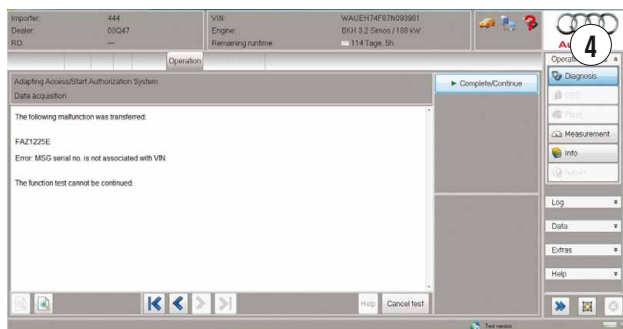
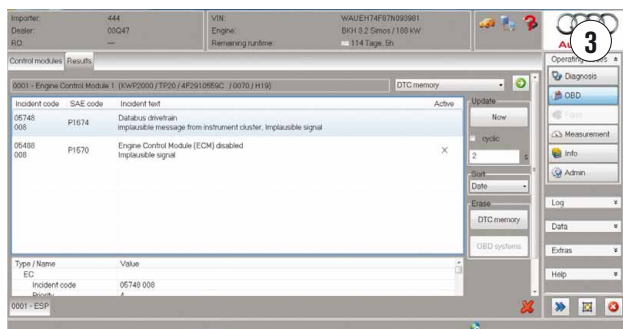
The Audi dealers only sell the complete steering column to repair this problem, but that's not the only way to fix this problem. For one, the module can be removed without completely taking down the steering column. Now it was time to contact the vehicle owner and explain the repair options so he could choose the path of repair that works best for him. This was followed by providing the Audi owner with pictures and other printed information (**Figure 2**) on his no crank/start condition. In this case we explained that the engine no crank/start condition was due to a “no com” (communication) problem on the CAN BUS. We continued with an explanation of the different repair options: either replacing the complete steering column or just removing the Access/Start module and sending it out for repair.

The difference in pricing is significant. A new steering column from Audi goes for \$1,700, while the other option is about half the price. After our explanation to the vehicle owner and the used car lot uncle, they decided that cheaper was better. However, their choice came with one big surprise! They decided to tow the Audi back to the used car lot shop. So, they used us to diagnose the problem and chose a cheaper alternative by performing the physical repair at the used car lot.

We invoiced the Audi owner for the diagnosis while they prepared to have the vehicle towed. After seeing the damage they previously inflicted to the steering column, we suspected that they would encounter problems and be back again. The used car lot apparently proceeded to remove the module and, as we suggested, sent it to Speedosolutions.com. When a module is at Speedosolutions.com they check the circuits, cleared out data and format the module so it mimics a new one. After the used car lot shop received the reconditioned module, they installed it but encountered the same no crank/start condition.

They decided that they were in over their head and called us, asking if they could tow the vehicle back to our shop and get it running. Bill explained that there would be another diagnostic fee along with a programming fee to get the Audi running. Once the vehicle arrived, we looked it over, paying special attention to the steering column area. Bill noticed that the used car lot did not follow directions of only removing the module. Instead, they totally removed the steering column. As a result of their removal process of the steering column, there was more noticeable damage — including a “click” noise from the steering wheel that was due to a damaged clock spring.

Bill called the used car lot to inform them what we uncovered before proceeding to do anything on the Audi. Their response was don't worry about the damage — just get the Audi running. Since they gave us our marching orders, we



proceeded first with a full vehicle scan. The results of the scan uncovered (**Figure 3**) the following DTCs: P1674 Databus Drivetrain Implausible Message from Instrumental Cluster and FAZ1225E error with serial number (**Figure 4**), Error: MSG serial no. is not associated with VIN.

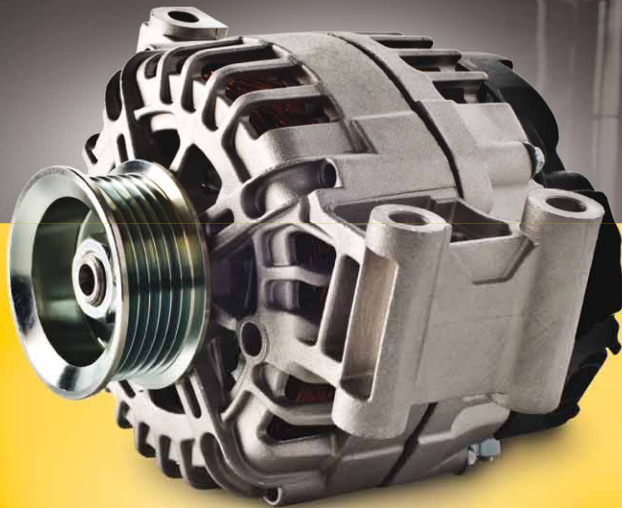
Our next step was to try and clear the DTCs then insert the

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correct VIN in the module. After the programming process was completed the engine came to life and ran well. We followed that up with another complete scan of all the vehicle system making sure there were no other issues. It is always good practice to make sure all vehicle modules are clear of DTCs before returning the vehicle back to the owner. With the Audi now starting and running it was time to collect our diagnostic and programming fees and return the vehicle to the customer.

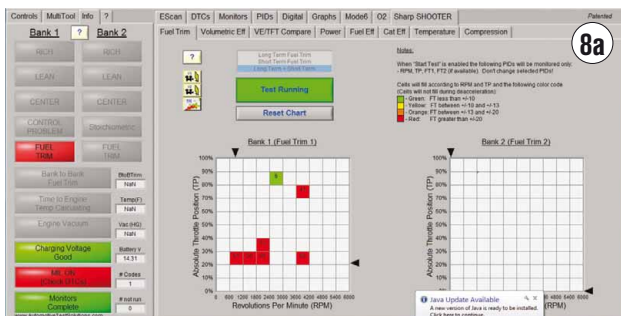
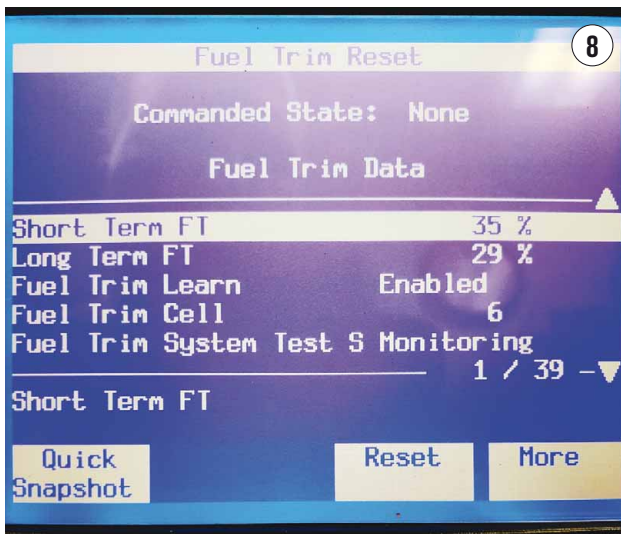
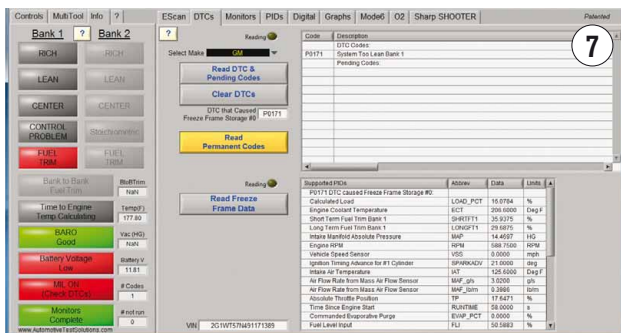
Next — A weak Chevy

A 2009 Chevy Impala 3.9L 54K came in with a complaint of low power, poor stopping and the Check Engine light illuminated. The customer told us this only happened after her son was driving over 95 mph with the police in pursuit!

She said that her son had to make a rather quick stop as the police had blockaded the road ahead. After absorbing what the vehicle owner provided us with, we concluded that a good visual and mechanical inspection was the first place to start. My tech, Franklin, was given the job and thought he would take the vehicle for a short test drive. After Franklin started the engine up and discovered that it was barely idling along with the brakes feeling bad, he thought that a test drive was out of the question. The vehicle was barely driven from the front of our shop into his bay.

As Franklin was driving the vehicle into the bay, he noticed that it was very difficult to stop. He thought that the poor idling and stopping could be caused by a massive vacuum leak resulting from a very lean condition. He decided to connect the Snap On Zeus scan tool since it performs a full vehicle system scan rather quickly. As a result of the Zeus scan (Figure 5), he found all of the vehicle systems to be DTC free except for the engine, which had a DTC P0171 stored. Take a look at the scan data (Figure 6) that Franklin uncovered as the engine stalled from a high rpm. Anything stick out as being a problem?

For one, the O₂ voltage was switching as the engine rpms were raised up but were down to zero near idle. The next important PID data was LTFT reporting +30, and it was captured in fuel cell 14 at a high rpm. Normally if this was a vacuum leak at idle, the Fuel Trim cell number would be a 0 to 6 number rather than anything higher. His thinking at this was point was that the engine may be starving for fuel since one of the major complaints was low power. Franklin proceeded to test the fuel pump current waveform at the fuel pump relay, pins 30 and 87, and found the current ramping waveform was normal at 6 amps. He followed that by performing a fuel volume test with our MAC/MityVac fuel pressure and volume tester. The results of the fuel pressure test were a perfect pressure of 62 psi and a volume reading of 0.5 gallons per minute without any bubbles or fuel discoloration in the sight glass. Now he could rule out a



fuel delivery problem and concentrate on finding out what was causing such a huge command of 30 percent LTFT.

His next step was to remove the Zeus and install the EScan, since it provides more in-depth information on driveability problems. The EScan data revealed the same DTC P0171 (Figure 7) with the very important Freeze Frame data. The Freeze Frame data is like a snap shot picture of when the engine acted up and threw the DTC. In this case, we can see that the engine was hot, not moving since mph are 0, MAP at 14 HG, MAF 3.2 lower than the 1 gram per liter at idle and rpm at 588, STFT 35% and LTFT 29%. This information warrants further investigation that led Franklin to the EScan Sharp Shooter Fuel Trim

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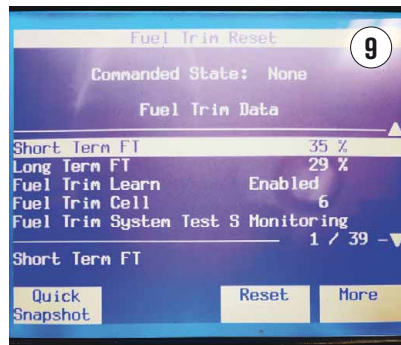
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data (**Figure 8**). He could now view the trim data in a graphic format rather than just as a static number. The fuel trim numbers were high at the low rpms and a bit higher on the chart than idle, since the engine would stall out at a normal idle speed. We noticed at this point that the high numbers were not just at idle but up at a 70 percent throttle and about 4000 rpms. Normally, if the numbers are high on the low end of the scale and high all the way through the rpm and absolute throttle ranges, it's a MAF problem.

But hold on — we have an engine that will not run at idle. This made us think that there had to be a massive vacuum leak. Franklin began to unplug all the engine vacuum lines and sealed them to see if there was any difference. He removed the PCV valve and noticed a slight difference, so he installed a new AC Delco PCV that resulted in the engine to somewhat idle, but the LTFT was still high (**Figure 9**).

At this point we thought that the next logical area for such a large leak was at the intake manifold. I took out our leak detection tool that consists of a Coleman propane bottle, valve assembly and flow tube. With the valve fully opened for maximum propane flow, we checked for leaks. In the past, we had come across some intake manifolds on these engines that had gasket issues as well as a PCV valve problems. Working as a team, we checked all intake areas and came up empty, no detectable vacuum leaks anywhere on the engine. The next thing we tried was flowing propane to an open vacuum port and found that the engine was able to idle better. With that result, we confirmed that there had to be a leak somewhere, since adding propane allowed the engine to idle better and the fuel pump passed pressure and volume test.

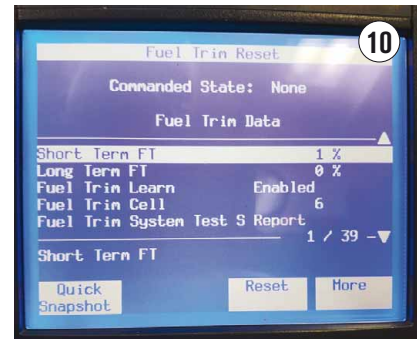
Our next step was to shut the engine down and connect a smoke machine. Unfortunately, the smoke test



did not reveal any leaks. Coming up empty-handed we thought it had to be something that we were overlooking. I carefully thought about a couple of GM police cars that I had worked on right after 9/11. Those engines had a similar issue that resulted in a vacuum leak that were also difficult to locate. The problem with those vehicles was that the power booster diaphragm was defective, causing the high fuel trim readings. I mentioned that to Franklin and had him smoke the power booster to check for escaping smoke. The test yielded no leaks, so we were still no further along locating the leak.

Franklin called me back over to get me up to speed and brainstorm our next move. Thinking how there was a possibility of hydrocarbons being in the brake booster diaphragm if the filter diaphragm was leaking, there was a good possibility of the smoke being consumed and not being visible. We switched from shop air to CO₂ on the smoke machine and tested for leaks using the Bullyseye leak tester. The testing along with using CO₂ uncovered the leak in the power booster.

As we depressed the brake pedal, we noticed that the leak would be worse or nonexistent at times. I assume the reason for the different reading was that the power booster diaphragm was flexing, causing the leak to be worse or better depending how it flexed. We blocked off the power booster to confirm our finding then ordered a new booster. Frank-



lin removed the old power booster and install the new one that resulted in a normal engine idle.

With the engine now running normal, Franklin connected the GM Tech 2 and reset the Adaptive Fuel Trim. The Adaptive Fuel Trim resets (**Figure 10**) the fuel trim so the engine will not continue to add a high commanded rate of fuel. Remember that after any Fuel Trim repair an Adaptive Fuel Trim reset is needed to get the engine fuel delivery commands back in a normal operating range. This is an important step that is commonly overlooked that can cause other problems such as a P0420 to pop up. The rich condition caused by a command that has not been reset can take a borderline converter and push it over the edge. After the repair, the fuel trim reset, along with a good test drive it was time to recheck the vehicle for DTCs and fuel trim readings. Since the Tech 2 was left connected for the fuel trim reset, it was taken along for the test drive and used to recheck the vehicle when it was returned to the shop. The LTFT readings were now back to normal along with a stable idle and good brakes. **ZZ**



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THE EVOLUTION OF ONBOARD DIAGNOSTICS

THE SOCIETY OF AUTOMOTIVE ENGINEERS (SAE) HAS REVISED ITS J-2012 STANDARD TO REFLECT THE NEW CLASSIFICATION OF DTCS. UNDERSTANDING HOW THIS CAN HELP YOUR DIAGNOSTIC STRATEGY IS WORTH EXPLORING.

DAVE MACHOLZ // Contributing Editor

Perhaps you have seen manufacturers that are utilizing 7-digit DTCs? Or perhaps a DTC that doesn't seem to make sense numerically (think "P0A7F"). Some of these diagnostic trouble codes look nothing like what we have grown accustomed to seeing over the last 20 years. With this in mind, the Society of Automotive Engineers (SAE) has revised its J-2012 standard to reflect the new classification of DTCs. Understanding how this can help technicians is worth exploring.

With an evolving list of new technologies found on today's automobiles, the amount of data and diagnostic information available to technicians has grown. While many technicians and shop owners are overwhelmed by the learning curve of new technology, there is a distinct advantage to more information. Think about no-code diagnostics, for example. Why are they so hard for technicians to fix? Simply, because there is limited data to base our diagnostic strategy upon. With more data at our fingertips, one could argue that

DTC	P030000	Random/Multiple Cylinder Misfire Detected
DTC	P030027	Random/Multiple Cylinder Misfire Detected (Emission) Signal Rate of Change Above Threshold
DTC	P030085	Random / Multiple Cylinder Misfire Detected (Over Temperature) Signal Above Allowable Range

SEVEN-DIGIT DTCS such as these Toyota Tundra misfire codes provide an added layer of diagnostic data.

diagnostics are perhaps getting easier and not harder.

There are several organizations that work alongside automotive manufacturers and engineers to establish best practices, protocols and, ultimately, standards for our industry. The International Organization for Standardization (ISO), the Institute of Electrical and Electronic Engineers (IEEE) and the Society of Automotive Engineers (SAE) are organizations that technicians should be familiar with, as much of the technology we work with on a daily basis is designed in conjunction with and in consultation of their published standards. These organizations are responsible for the standardized practices we have become accustomed to such as an OBD-II connector that is within a reasonable



SOCIETY OF AUTOMOTIVE ENGINEERS MEMBERSHIP is a must for the serious technicians.

distance of the driver's seat, under the dash. The standards published by SAE are publicly available and can be found through the SAE website at www.sae.org. There is a considerable cost to purchasing these documents; however, SAE offers discounts to its members. SAE offers memberships on an annual and lifetime basis and working technicians should consider

joining to stay on the cutting edge of technology. Another approach to accessing SAE documents is through your public library, community college or university library, as many often subscribe to electronic SAE databases and make them available with a library card or student ID. SAE standards are a wealth of information for technicians, and I have personally spent many-a-night combing through them while preparing for articles or classes given at the college or through WorldPac.

Leveling the playing field

In the 1990s, SAE created a standards document to align the naming of diagnostic trouble codes across manufacturer platforms. This naming convention is why we all know that a "P0420" is a catalyst efficiency code and why a "P0300" is a random/multiple misfire, regardless of the vehicle nameplate. The J-2012 standard has been updated over time to reflect new and emerging issues with the naming and classification of DTCs but started as a simple way of cataloguing and standardizing the data across manufacturers.

You are likely familiar with some of these naming conventions and are most likely aware that for many years the three-digit codes we have all come to know are preceded by an alpha-numeric prefix. Such as "Px," "Bx," "Cx" or "Ux." SAE and ISO are responsible for the fact that these represent:

P: Powertrain

B: Body

C: Chassis

U: Network

As an example: B0, B1, B2, B3, C0, C1, C2, C3, P0, P1, P2, P3 and U0, U1, U2, U3

In the early SAE J-2012 publication, a DTC's second digit represented the following:

0: ISO/SAE controlled – This meant these codes were specifically defined by ISO and SAE and have become what we know as "generic" DTCs

1: Manufacturer Controlled – Up to the manufacturer to define within the context of the SAE/ISO standard

2: Manufacturer Controlled— Up to the manufacturer to define within the context of the SAE/ISO standard

3: Reserved by document – This meant SAE had the foresight that they would eventually have more codes that would need to be added as technology progressed.

The third digit (second letter or number) in the DTC sequence provided a classification for the DTC type within the Powertrain Control Module:

0: Fuel and Air Metering and Auxiliary Emission Controls

1: Fuel and Air Metering

2: Fuel and Air Metering

3: Ignition System or Misfire

4: Auxiliary Emission Controls

5: Vehicle Speed, Idle Control and Auxiliary Inputs

6: Computer and Auxiliary Outputs

7, 8, 9: Transmission

A: Hybrid Propulsion

B, C, D, E, F: Reserved for future publication of DTCs (Planning for the future).

SAE J-2012 also provided four basic categories of DTCs as well as definitions for each:

General Circuit/Open – Fixed Value or no response from the system where specific high or low detection is not feasible or can be used in conjunction with circuit high and low codes where all three circuit conditions can be detected.



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Range Performance Problem

— Circuit is in the normal operating range, but not correct for the current operating conditions. It may be used to indicate stuck or skewed values indicating poor performance of a circuit, component or system.

Circuit Low — Circuit voltage, frequency or other characteristic measured at the control module input terminal or pin that is below the normal operating range.

Circuit High — Circuit voltage, frequency or other characteristic measured at the control module input terminal or pin that is above the normal operating range.

Understanding these naming conventions as well as DTC classifications makes the identification of system errors easier to diagnose.

As an example, if we are looking at issues with DTCs related to engine coolant temperature we can easily differentiate between a circuit low or high code in which we are looking for an electrical or electronic issue and a range/performance code where we are more likely looking for a mechanical problem such as a stuck thermostat.

When you take a step back from

this information for a second and realize there are only four general classifications for codes, diagnosis is really simplified.

Evolving to meet emerging tech

SAE J-2012 has been updated throughout the years as vehicles have become progressively more complex. As microcontrollers improve and continue to come down in price, their capabilities and storage capacity have greatly improved. With new technologies such as advanced driving assist, autonomous driving and vehicle electrification being introduced, the need for a redesign of the J-2012 standards was needed.

The sheer amount of new diagnostic trouble codes available as a result of technology has essentially created a naming problem for SAE.

In 2016, SAE re-published J-2012 as well as a new digital annex, or Excel spreadsheet, known as J-2012DA. According to SAE, the digital annex will need to be updated frequently to accommodate the new codes being created by manufacturers as new technologies emerge. This new naming convention has also made the original naming conventions somewhat obsolete, and a standard for naming has given way to new varieties of alphanumeric combinations.

The image shows two membership options side-by-side. The left card is for 'Professional Membership' at \$110, listing benefits like staying on top of industry developments, continuing learning, and saving on SAE programs. The right card is for 'Student Membership' at \$30, listing benefits like getting a career started with SAE resources, building a network, and learning from industry experts. Both cards have a 'Select to Join' button at the bottom.

SAE HAS MULTIPLE MEMBERSHIP LEVELS for professionals and students and is a tax-deductible investment in your professional growth.

The screenshot shows the SAE International website. At the top is the SAE logo and navigation links for Standards, Publications, News, Attend, Learn, Participate, and Donate. Below this is a 'Standards Collections' section with three main cards: 'AeroPaks' (8,000+ aerospace standards), 'JPaks' (2,000+ ground vehicle standards), and 'TechSelect' (100,000 technical papers). A fourth card for 'SAE MOBILUS' is highlighted in blue, describing it as a source for feature-rich access to authoritative engineering standards, news, and insights.

SAE'S LIBRARY OF STANDARDS is a wealth of information for professional technicians seeking to raise their level of knowledge.

One of the specific areas that the new standard specifies is a two-digit identifier at the end of the DTC that essentially creates a seven-digit diagnostic trouble code. The technical advances of microcontrollers found on vehicles has allowed manufacturers to more precisely specify a problem that it has self-diagnosed and provide additional information to aid in the repair of the problem.

For example, on a 2019 Toyota Tacoma a P0300 “random multiple misfire” code becomes three different codes:

P030000 – Random/Multiple Cylinder Misfire Detected

P030027 – Random/Multiple Cylinder Misfire Detected (Emission) Signal Rate of Change Above Threshold

P030028 – Random/Multiple Misfire (Over Temperature) Signal Rate Above Allowable Range

These new seven-digit DTCs provide an added layer of information for the technician as the detection capabilities of the microcontroller has improved. In the example above, not only is the crankshaft position sensor detecting a variation in crankshaft speed, but it is also utilizing a software algorithm to determine the estimated weighted moving average (EWMA) of the crank and its perceived effect on emissions and catalyst damage. This allows Toyota to go further than the P0300 by adding two digits that specifically categorize a code within the code, so to speak. The wealth of information this provides for diagnostic purposes allows the technician an

additional set of diagnostic data.

To summarize, the complexity of vehicle electronics and microcontrollers has numerically exceeded general code definitions and created a need for new naming conventions. The disadvantage to technicians is we will no longer be able to recognize many codes as we used to, such

as a P0171 or P0400. However, we will gain a deeper understanding of the circuit, component or system at fault through data enriched information supported by seven-digit DTCs. While some might complain about the complexity of our new automobiles, we should welcome the additional data that is now available. *TM*



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DAVE MACHOLZ is an instructor for the Toyota T-TEN, Honda PACT and general automotive programs at Suffolk County Community College in

Selden, N.Y. He is an ASE CMAT and L1 technician and holds a New York State teaching certification in vehicle repair.

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A LACK OF DRIVE

A 2002 ACURA RSX WITH NO 4TH GEAR PROVIDES REAL-WORLD LESSONS IN DIAGNOSING TRANSMISSION CONCERNS FROM A DRIVABILITY GUY'S PERSPECTIVE

SCOT MANNA // Contributing Editor

My career as a diagnostic technician has spanned over 40 years, and I can say with certainty that I am still learning. What keeps any good diagnostic tech moving forward is the fact that there is always something new to learn and the quest for knowledge is what separates the average technician from the industry leaders. The best learning experiences I have been involved in is when I venture outside the typical comfort zones of familiar engine problems and into jobs that are not in my so-called wheelhouse.

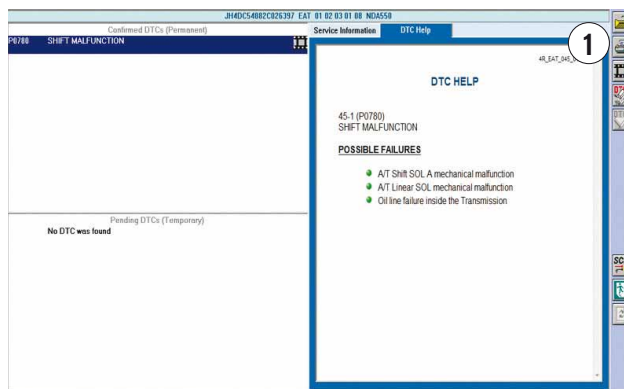
The featured vehicle in this month's article is one such example.

Applying drivability tactics to transmission concerns

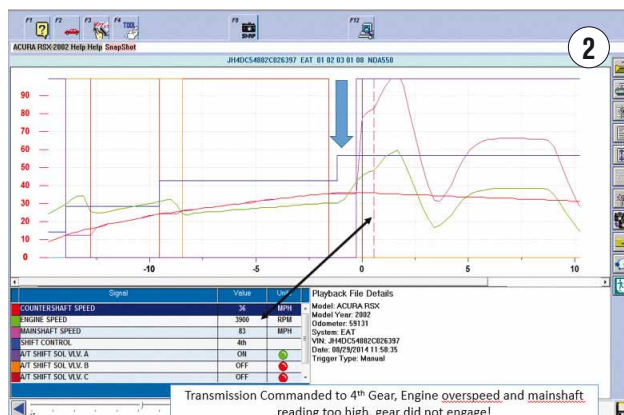
I am by all admissions not a transmission expert, but I have been involved in repairing many transmission-related problems. As a matter of fact, one of my better customers is a local transmission shop that sends me many vehicles that have transmission problems that turn out to be electrical in nature. This 2002 Acura RSX is one such example.

The transmission shop wants to know if I can test the computer to determine if it is working properly. They have rebuilt the trans, but the original problem remains. This 4-cylinder, 5-speed automatic Acura has a problem of going into neutral at the 4th gear shift. The shifting is normal from 1st to 2nd, and 2nd to 3rd, but when attempting to go into 4th the engine revs way up and no engagement into 4th gear occurs. Sometimes the transmission will shift into 5th gear if the driver keeps on the gas.

When I first took a look at the vehicle, I connected the Honda HDS scan tool and pulled codes, which are displayed in **Figure 1**. The factory scan tool has a split-screen look with the module data appearing in the left-hand screen and scan tool help or service information displayed on the right side if you have a current Honda/Acura website subscription active. The DTC help displayed seems to point to a mechanical problem inside the transmission. Nothing about the P0780



CODE SCREEN of transmission code stored in Acura RSX. The possible failures all point towards a mechanical problem.



HDS RECORDING SHOWING RPM and transmission Main Shaft speed climbing instead of dropping when the 4th gear shift takes place.

Position	Gear position	Shift solenoid valves				
		A	B	C	D	E
D, D3, M	Shifting from N position	OFF	ON	ON	OFF	OFF
	Stays in 1st	ON	ON	ON	OFF	OFF
	Shifting gears between 1st and 2nd	OFF	ON	ON	OFF	OFF
	Stays in 2nd	OFF	ON	OFF	ON	OFF or ON
D, M	Shifting gears between 2nd and 3rd	OFF	ON	ON	ON	OFF or ON
	Stays in 3rd	OFF	OFF	ON	OFF	OFF or ON
	Shifting gears between 3rd and 4th	OFF	OFF	OFF	OFF	OFF or ON
	Stays in 4th	ON	OFF	OFF	OFF	OFF or ON
B	Shifting gears between 4th and 5th	ON	OFF	OFF	ON	OFF or ON
	Stays in 5th	ON	OFF	OFF	ON	OFF or ON
	Shifting from P and N position	OFF	OFF	OFF	OFF	OFF

ACURA RSX shift solenoid application charts.

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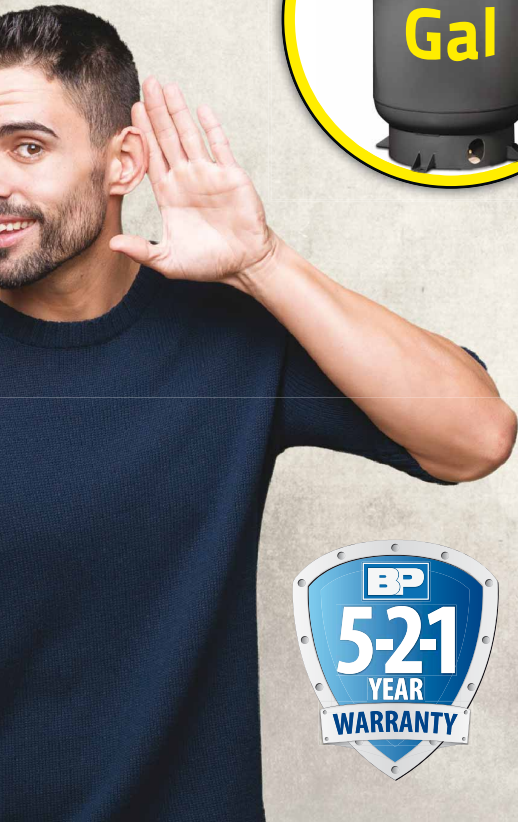
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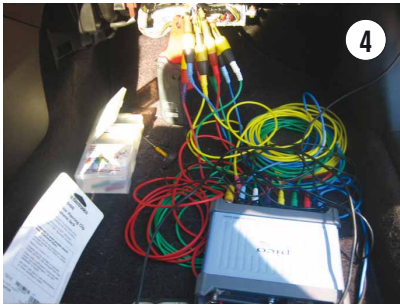


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code seems to mention anything concerning an electrical fault as a possible cause. While I would not call the three possible causes listed as a comprehensive list, it does seem to suggest that the code set criteria is most likely caused by a mechanical issue in the transmission.

Keep in mind that any solenoid is an electro-mechanical device, meaning it can fail either electrically (open, shorted or high resistance coil) or mechanically, (stuck or frozen armature preventing mechanical movement). The first two items mentioned state a mechanical problem with shift solenoid A or Linear solenoid B, so the circuits inside the PCM that monitor electrical function are not reporting a problem. Codes P0753, P0758, P0763, P0768 and P0773 are circuit codes for shift solenoids A through E and none of these codes are present. Code P0780 is described in service information as a “mechanical problem in hydraulic control system”, so I think I’m simply going to have to verify electrical circuit integrity and send the car back to the trans shop. They always think there must be a “bad” wire somewhere. Only testing will tell.

Let the game begin!

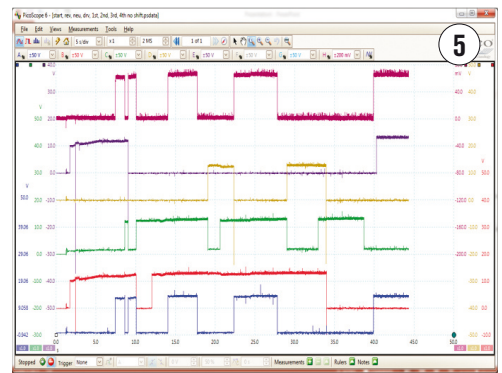
The Acura is road tested with the scan tool connected and the following recording is captured. The problem is seen in **Figure 2**, when the 4th gear

shift occurs, the engine RPM and Main Shaft speed flares way up once 4th gear is commanded, 4th gear has not engaged. While the scan tool can show solenoid commands, it cannot verify proper circuit operation, such as voltage levels and solenoid movement, that a scope can uncover. Testing will continue with a lab scope.

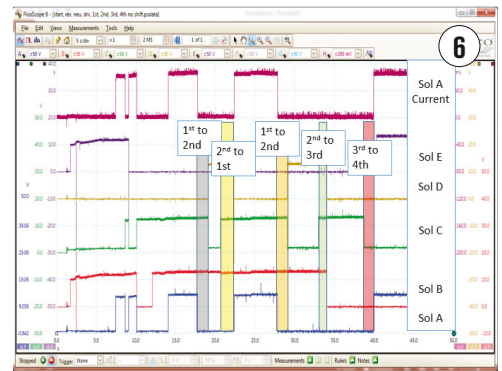
Because I am not familiar with this transmission’s operation, it is necessary to do some research into the operation and electrical control of the transmission, so I can check the operation of the PCM. Service information states the transmission shifts into 4th gear by turning off Shift solenoid C and turning on Shift solenoid A as shown in the shift chart in **Figure 3**. This seems to point to shift solenoid A as the major player in completing a shift into 4th gear.

With this information, I decide to connect my Pico 8-channel scope to all the shift solenoids, Linear solenoids A and B, and the last channel to shift solenoid A with a current probe. With the current probe connected I will be able to confirm that shift solenoid A does indeed move by observing if a “pintle hump” is present when current flows though the solenoid.

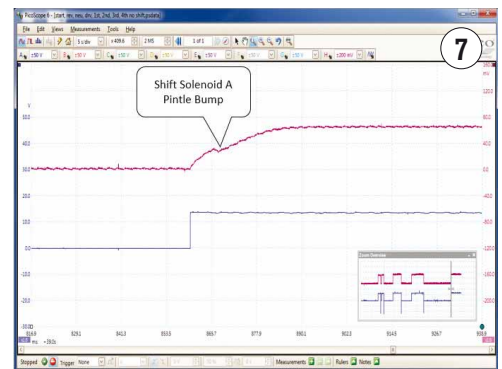
I will point out here that the shift solenoids for this transmission are feed-side switched, not ground-side controlled like many domestic applications. The PCM supplies 12 volts through a High-Side Driver to turn a shift solenoid On. My scope connections can be seen in **Figure 4**. The linear solenoids control the hydraulic pressure that is supplied to the actual



PICO SCOPE CAPTURE with all 5 shift solenoids, top waveform is shift solenoid A current.



LABELS ARE ADDED to illustrate each gear change during the scope capture.



CLOSE UP ZOOM OF shift solenoid A voltage and current with pintle bump pointed out.

clutch packs through a high rate duty cycle control, which can control the apply rate of the clutch pack and hence shift feel. The shift solenoids control hydraulic pressure to the shift valves inside the valve body, which in turn control shift timing.

With the scope connected and a slow time-base of 5 seconds per divi-

sion, the Acura is test driven through the 4 shift points and all 4 shift events are captured on one screen. Once back at the shop, the pattern is analyzed. It is clear the PCM turns off shift solenoid C and then turns on shift solenoid A when 4th gear is commanded and the current probe confirms that there was pintle movement from shift solenoid A. The linear solenoid waveforms have been removed for clearer analysis of the shift solenoids. **Figure 5** shows the whole test drive, **Figure 6** adds labels to each waveform and highlights the shift points, and **Figure 7** is a close-up view of shift solenoid A voltage and current when commanded on. The current probe clearly shows there is a pintle bump that indicated the shift solenoid did indeed stroke and eliminates the possibility that the shift solenoid is mechanically stuck or jammed.

PCM OK — So what else?

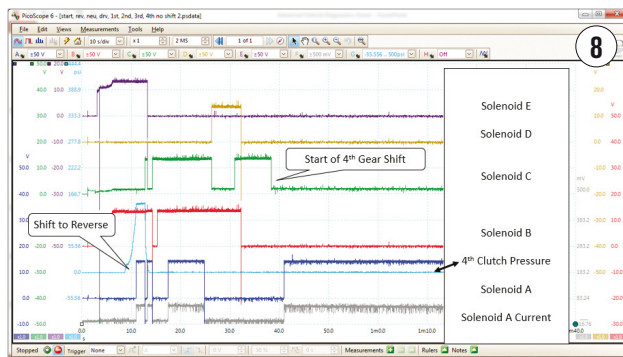
After reviewing the waveform, I concluded the PCM was doing its job and the problem must lie inside the transmission since there are no clutches or bands held applied by any electrical component. The shift solenoids are being operated as designed and I did not see why a different computer would change anything.

The transmission shop picked up the car and went through the trans again, but found nothing wrong. They returned the car to me for another look. This time I connected the scope like before but added a Pico pressure transducer to the 4th clutch pressure port on the front of the transmission. I road tested the car on my lift and watched to see if pressure was applied to the 4th clutch circuit. The 4th clutch is applied in both reverse and 4th gear. To my surprise, the pressure transducer confirmed the 4th clutch received pressure in reverse but not during 4th gear apply as seen in **Figure 8**.

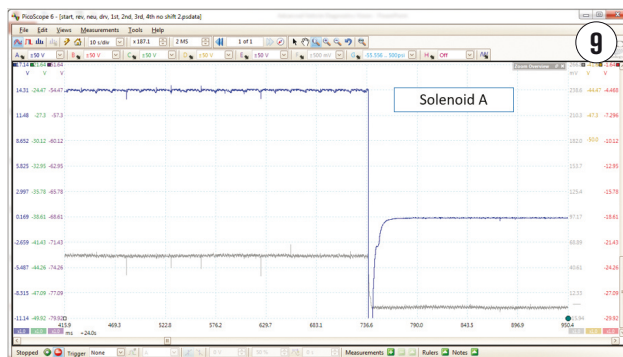
Wondering if something could be blocked in the valve body, I told the transmission shop what I found and if they knew if a valve body restriction was possible. They did not believe this could occur and did not want to take the transmission out again. It was decided to try a different PCM as a last hope. I did not think this was going to cure this issue, but I was dead wrong. After installing a used PCM the Acura shifted flawlessly! I could not explain the reason so I connected my scope for a third time to capture a known good waveform. This is when the problem was finally determined. Once the waveforms were compared, a subtle difference stood out.

The “aha!” moment

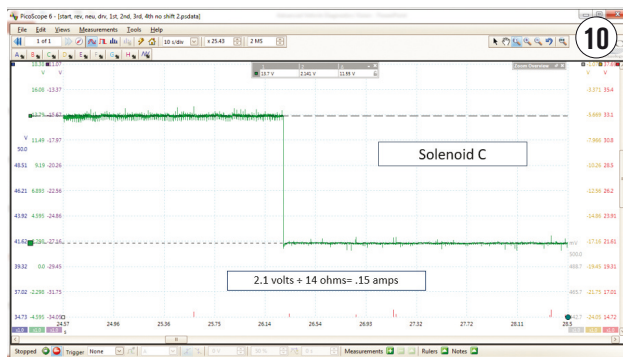
While I was mostly looking at shift solenoid A operation, I did not pay much attention to shift solenoid C or the downward spikes that were present on most of the solenoid turn off points. Once I zoomed in on the solenoid turn off commands,



THIS WAVEFORM CAPTURE from the second look at the Acura shows the pressure applied to the 4th clutch when in reverse. This is the third trace up from the bottom and the pressure is close to 150 PSI.



SHIFT SOLENOID A TURN-OFF EVENT showing the downward spike created by the abrupt halt of current flow and the induced voltage produced in the solenoid windings.



SOLENOID C VOLTAGE TRACE when commanded off. The voltage stays at 2.1 volts above ground meaning there is about 150 milliamps of current flow.

I noticed an interesting problem. Just as a ground-controlled solenoid creates an upward spike when commanded off, these High-Side Driver solenoids produce a downward spike when turned off due to magnetic induction in the coil. **Figure 9** shows a close up of shift solenoid A as it is commanded off. The spike, as well as another pintle closing bump, can clearly be seen. These spikes could be seen on each solenoid turn-off event except solenoid C.

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And that is where troubleshooting a transmission-related complaint gets cloudy. Many of the inputs used by the TCM (Transmission Control Module) are shared with the ECM (Engine Control Module). Many of the same foundational factors that can result in engine performance complaints can also lead to transmission performance complaints. And some drivability problems can mimic



transmission problems – and vice versa! Is your customer's concern over shift quality really a fault of the transmission?

Regardless of the concern, one basic truth remains. By following a logical diagnostic process, you can solve your customer's problem!

Learn what to do before you

even start troubleshooting the concern, how to check transmission performance with your scan tool, and what you absolutely need to do after you've made any major changes in the transmission or it's related systems. Watch this episode of "The Trainer" at MotorAge.com/jul18trainer.

When I looked at solenoid C, the waveform voltage did not return to zero volts but instead hung around 2.1 volts and no downward spike was present. This meant there is leakage across the transistor driver and some current is still flowing!

With 2.1 volts applied to a 14-ohm solenoid, there is about 150 milliamps of current flow (ohm's law). While I can see this electrical problem and I know that the car is fixed, I still don't know why this could keep the 4th gear shift from occurring. I will need to go back to service information and determine how the hydraulic system works. Fortunately, my Mitchell 1 repair information system had detailed descriptions

of how the transmission hydraulic circuit operated. The current flow through the HSD for shift solenoid C prevents the solenoid from returning to its off position, which keeps fluid pressure applied to shift valve C.

If hydraulic pressure is not removed from shift valve C, it cannot return to its home position and uncover the pressure apply port 5G. Linear solenoid B supplies 56 pressure to shift valve C and is then connected to the 5G port and routed to shift valve B and becomes 4th clutch pressure 40, which is sent to the 4th clutch. Similar to a restriction, when the shift valve C does not stroke back to the right, the 5G port cannot connect to circuit 56 pressure

from linear solenoid B.

This Acura was a great learning experience for me and has made me pay greater attention to circuits controlled by high-side drivers when I scope test any system using them. Keep in mind that many Chrysler engine control systems use HSDs, so you may encounter a similar condition somewhere down the road. For now, I feel better knowing I have restored my lack of drive. *TL*



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LOOKING BEYOND THE MIL AND THE DTC CAUSING IT

THIS IS THE STORY OF A 2010 FORD FLEX WITH A P0133 DTC. WHILE NOT A MAJOR FAULT, THE REAL LESSON WAS LEARNED WHEN THE DTC PROVED TO BE A SYMPTOM AND NOT THE CAUSE OF THE CUSTOMER CONCERN.

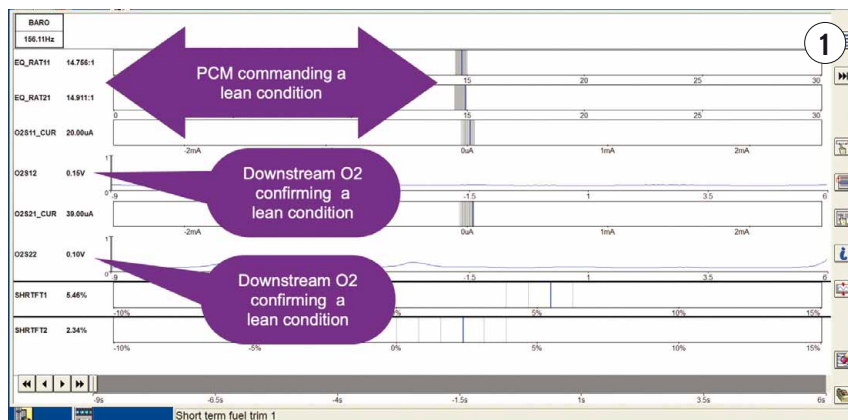
MARK DEKOSTER // Contributing Editor

My brother-in-law is great at detailing cars and is a bit of a DIY person when it comes to working on cars. A recent experience he had with his car, a 2010 Ford Flex, points to why a DIY or an inexperienced technician can get off in the weeds when relying on just a scan tool, the PCM and lack of product knowledge.

From the beginning

Here's the back story, and let me first apologize for not having actual screen shots from a scan tool showing what I saw when I looked at his car. I will post a few images showing what you want to look for on a scan tool when analyzing a similar concern.

My brother-in-law's Flex had an illuminated MIL. He took it to a local parts store and had the free scan done. They reported to him that the vehicle had a P0133 (O₂ Circuit Slow Response) and needed a new Wide Band O₂ sensor and quoted him a price. As you know, Wide Band sensors are not inexpensive, and he decided that he would call me,



THIS CAPTURE SHOWS THE PCM COMMANDING a slightly lean condition at idle. It is commanding an A/F ratio varying from 14.6 to 14.9. The downstream O₂s confirm that the engine is running lean as they are showing voltage around .15mV.

knowing I had a Ford IDS and could scan and check out his vehicle.

He called and brought the car over, and I first confirmed that the MIL was on.

I have written about this in the past and I discuss this in every training class that I do; I recommend that you have a consistent process for dealing with every car that you work on. I call what I do my Five-Step process. (Yes, it is based on the OE's processes.) Briefly, the five steps are:

1. Confirm the concern
2. Visual inspection

3. Check TSBs
4. Non-intrusive test procedures (Test before you touch)
5. Network test

It doesn't make much difference in which order you do steps 2-5, and 4 and 5 are often done at the same time simply by connecting a scan tool and reading codes.

Tech Tip: Most late-model vehicles use the same network for scan tools as they do for module-to-module communication. If the scan tool talks to the vehicle, the network is likely OK.

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I connected IDS and scanned for codes and sure enough there was a P0133. Typically, my next step is to go to Service Publications to look up the code. Some of you who know how the IDS works know that a description of the code shows on the screen. I don't try to memorize codes, and I suggest that you don't either. The reason for that is that in the OE's description of the code is information about how the code set and possible concerns.

OK, you're all saying that I probably figured this out easily because I was a Technical Trainer for Ford and have experience with looking at Fords and possible concerns; that's true. While I did not have experience with this particular code, I do look for additional information while connected to the car during initial non-intrusive checks. I will note certain PIDs and how they react over different operating conditions.

Tech Tip: Check fuel trims at idle, low load, medium load and high loads.

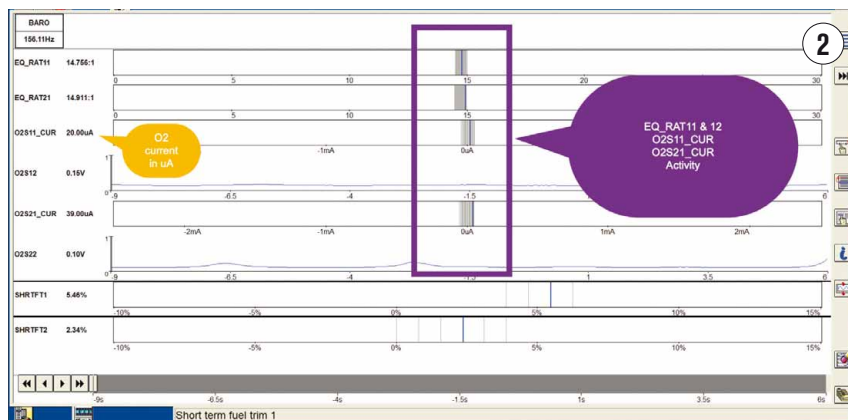
If there are codes, I will look at Freeze Frame.

Tech Tip: Even if there are no hard codes with an MIL, if there is/are pending code(s) there will also be freeze-frame data related to those codes that may assist in determining the cause of the concern.

What doesn't fit?

Freeze-frame data on this code was particularly interesting, as I noticed that it set at idle. That is somewhat unusual. Generally speaking, a lot of OEs do not program the PCM to detect concerns at idle. As long as I was sitting in the front seat with the scan tool, I thought I would gather more information through Datalogger.

On Ford's IDS, Datalogger is the option for looking at PIDs. In Datalogger, you have several options as the PIDs are arranged by the Powertrain Control engineers into blocks that they would want to look at when scanning



THIS CAPTURE SHOWS THE WIDE BAND SENSORS SWITCHING rich-lean in the gray trace. Somewhat harder to see on this is the STFTs switching. These are PIDs to monitor to confirm operation of the sensors.

a vehicle, such as fuel system, ignition, and others depending on the year and model of the Ford you're working on.

What I want to see in every case are the Long and Short Fuel Trims, Wide Band O₂ sensors current flow, Downstream O₂s and MAF information. Based on symptoms, I will pick and choose additional PIDs to view. As data stream came online, the first thing I noticed was STFT was +29 percent and the upstream Wide Band sensors were not switching.

As you may know, under normal operation the PCM will modify fuel injector pulse width to increase and decrease fuel. We see this by watching STFT switch and then watch to see if Narrow Band sensors switch rich-lean (**Figure 1**). We can watch that on a scan tool and see what the PCM is doing to try to create a stoichiometric mixture. To see this on a Wide Band sensor, we want to look at the current flow to the sensor.

When looking at a Wide Band sensor, it appears that the sensor is not switching with voltage holding steady. Actually, it is switching — it is just switching much faster than the narrow band sensors do, and we can see that two ways. First, as with narrow band sensors, by looking at STFT, if short-term trim is switching plus minus then

the sensor is working.

Tech Tip: Working doesn't mean there is no problem with it, it just means it is working.

The second way we can tell is by monitoring current flow to the sensor. If those PIDs are available on your scan tool, what you should see is current flow switching back and forth as the Wide Band sensor pumps exhaust in and oxygen out.

Look at this screen shot of the IDS (**Figure 2**). The blue line represents current and the light gray is a historical trace of the current switching. What we want to see is equal amount of gray on each side of "0."

STFT threshold exceeded

Back to our Flex — +29 percent is beyond the threshold to set a code and in this case, the car did. One could argue that it should have set a P0172 or P0174 and I don't disagree with the thought, but the engineers programmed the PCM to set the P0133 code in this situation.

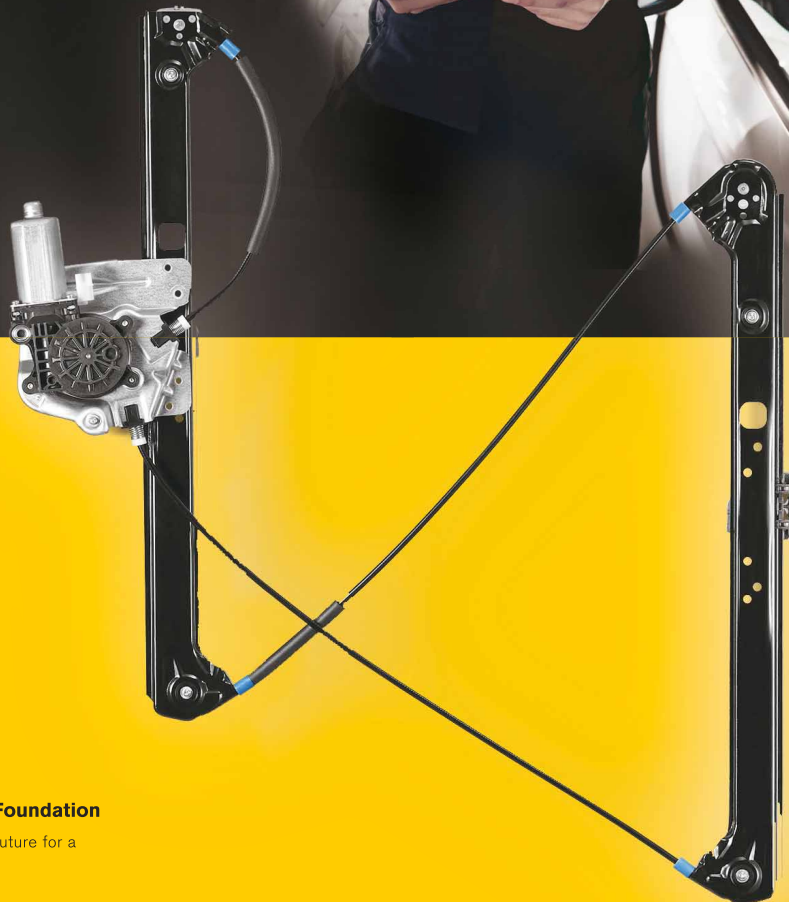
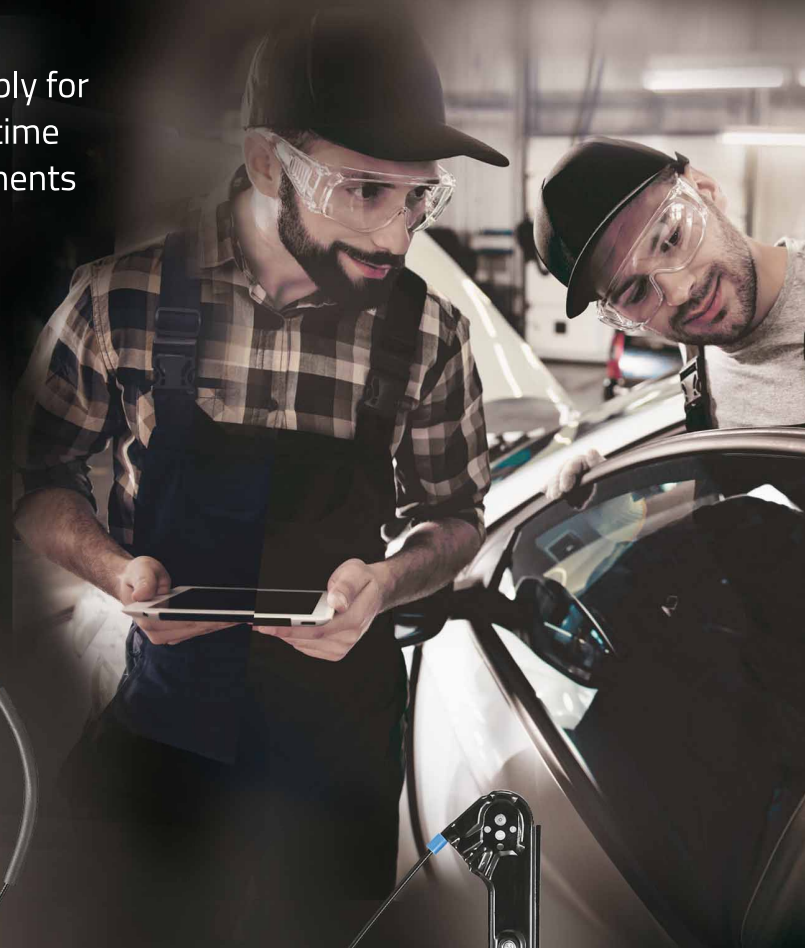
Plus 29 percent STFT suggests that the vehicle is running very lean if the HO₂S is not the cause but a symptom. What we need to answer at this point is to determine if the vehicle is very lean, or just at least thinks it's very lean. In

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other words, is this lack of switching caused by a faulty sensor or a symptom of another concern? Before we throw parts at this vehicle, we want to gather more information.

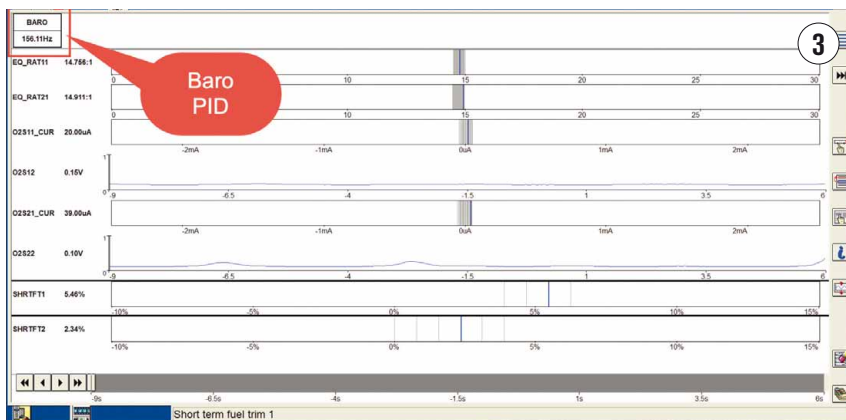
What can cause a very lean condition at idle? Remember, I had not looked up the definition of the code in service publications to see what Ford had to say about the code, how it sets and things to check.

The first thing that came to my mind for this lean condition was a vacuum leak. The car did not run as if it was running out of fuel, the other likely cause of a lean condition. I can check for a vacuum leak by increasing engine speed and watching HO₂S and fuel trims. A vacuum leak will show positive fuel trims at idle and as rpm increases the fuel trims will go towards 0 percent — all you have to do is simply increase engine rpm and watch trims. I pressed the gas pedal and as rpm came up, STFT started moving towards zero percent. As I continued to accelerate, the Wide Band sensors started switching, which I could see in STFT and the current flow to the sensors.

Vacuum leak I thought, BUT product knowledge also came into play at this point. A must-view PID when doing drivability work on a Ford is the MAF frequency PID.

Another Tech Tip: Ford has used MAF sensors for many years. When they started making the Turbo-charged EcoBoost engines they went from MAF to MAP sensors and back to speed density systems. Now some EcoBoost engines have MAP, some have MAF, and some may have both.

Ford MAF sensors create a frequency based on altitude of the vehicle. In the PCED, Powertrain Control — Emissions Diagnosis manual, in the Pinpoint tests they show a chart of what this PID should read based on the altitude of the vehicle and Barometric



THE BARO PID IS A MUST VIEW when doing Ford drivability. This image is showing 156.11Hz, which is a good reading for the altitude and weather on the day this image was captured.

Pressure. Grand Rapids, Mich., where I live, is about 500 ft. above sea level or a frequency of 157-159Hz depending on barometric pressure. Most of the techs just consider 157 or higher to be normal (Figure 3).

BARO low?

My brother's Flex was reading 155Hz; what does that mean?

One of two concerns: a bad MAF or a contaminated MAF. The key is to look at anything beyond 3Hz from normal for your region of the country as a cause for concern. The most common cause of a low reading MAF is one that is contaminated.

Tech Tip: The default setting for the MAF after a KAM reset or if the battery is replaced is 149.7Hz. That is normal for Denver. Denver is 5000 ft. above sea level. Most of the country is 5,000 ft. or less and that is the value that they set to give relearn a reasonable starting point. If you see 149.7 after every key cycle, the MAF is faulty or fuse is blown, unless you live in Denver.

Official Ford literature tells us that MAF relearn occurs during WOT. My experience is that many will relearn constantly above 50 percent load. In other words, you can watch it change as you drive at speed on an expressway.

Ford has recently recommended

that if you think you have a contaminated sensor that you should clean it, clear KAM, and road test to see if contamination was the cause of the concern. If it is "fixed" then you should replace the sensor.

Cleaning a sensor is one of those hot-button topics, I have talked to technicians across the country and found some that simply clean the MAF as regular maintenance. I have found others who will clean for analysis, but then replace. The OEs are concerned that you will use a cleaner that will degrade the surface of the MAF sensing resistors and create a concern. Because the MAF is a primary sensor for engine fueling, they are not quick to want you to create a condition that could result in repeat concerns by damaging the component.

What did we do? I suggested that we clean the MAF and see what happens. We did and with a clean MAF, the frequency returned to 158Hz, the O₂s switched and STFT was switching plus-minus 3 percent. I cleared codes and we monitored operation over the next few days to see if the Wide Band sensors had been damaged by the PCM adding excess fuel to compensate for incorrect air readings.

I had a head start on many of you because of my Ford background; let's look



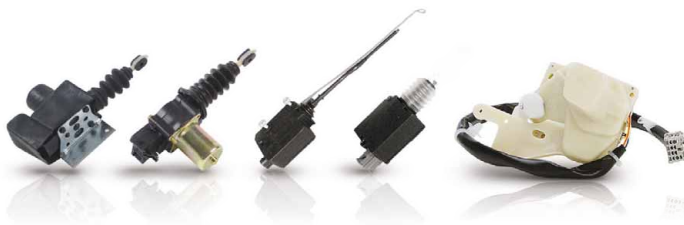
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at how it might have gone if I wasn't a Ford expert and relied on my five-step procedure.

Following the five steps

First, the confirmation of the MIL — that's easy. Simply start the vehicle and watch the dash lamps. The next step can be any one of the remaining four. In this case, I'm sitting in the car as if I was outside of the shop and walked out with a scan tool, so let's go to step four and do some initial non-intrusive testing by connecting a scan tool and checking for codes.

This vehicle had a MIL, there was a DTC and Freeze-frame data. While IDS will give a brief description of the code, it doesn't give possible causes nor details of what might have caused the concern. That is why I recommend that you look up codes in service publications. How do you as a non-Ford tech know to look farther versus trusting the code to show the cause? Step 3, TSBs and Service Publications.

I prefer factory information and consulted Ford's PTS website. On PTS I can input the VIN and the DTC and it will look up any applicable service messages and TSBs. None were there, so the next step is into the PCED to find the code.

A P0133 is defined as this: "The powertrain control module (PCM) monitors oxygen sensor response time by commanding a calibrated fuel control routine. This routine sets a calibrated limit to produce a predictable oxygen sensor signal amplitude. For vehicles with universal heated oxygen sensors (HO₂S), the test fails if the oxygen sensor signal does not reach the predicted amplitude within a predetermined response time."

In my case the real interesting part of this are the six possible causes:

- Contaminated HO₂S
- Exhaust Leaks
- Incorrect fueling

- Mass air flow (MAF) sensor
- Deteriorating HO₂S
- Inlet air leaks

Out of the six possibilities you will note, as I did, that only two of the causes of this code are a bad sensor. The fourth possible concern is the MAF sensor. Do you understand MAF systems well enough to know why a MAF sensor could be causing the problem?

You could Google or YouTube search for Ford MAF issues, keeping in mind that there is a lot of misinformation on both platforms. We're already in the Ford PCED. Go to the pinpoint test for analysis of the MAF and see what it shows for specifications. You can also find information on operation of the system in the first section of the PCED (**Figure 4**) and in publications provided by Ford called OBD II Model Year Summary. These are available at no charge.

Why does a contaminated MAF skew fuel trims? The MAF lets the PCM know how much air is entering the engine. The PCM then determines a pulse width from that information to get the HO₂S to switch at a stoichiometric ratio. If the sensor wire is contaminated it will typically under report air flow at some operating conditions and over report air flow at others.

In this case, the MAF was under-reporting the amount of air entering the engine at idle. The PCM fuel strategy was too lean based on reported air flow, so it began to add fuel and added to the point of exceeding the limits of the Wide Band sensor to switch. It did this long enough to trigger setting a fault code.

What would have happened if my brother-in-law had simply replaced the sensor? The concern was not fixed. The code would come back, maybe within a few days, maybe within a week or so, with the MIL on and the same P0133

Front UEGO Slow Response Test

The UEGO is also tested functionally. The response rate is evaluated by entering a special 0.5Hz: 1.5 Hz wave, fuel control routine. This routine drives the air/fuel ratio around stoichiometry at a calibratable frequency and magnitude, producing predictable oxygen sensor signal amplitude. A slow sensor will show reduced amplitude, measured as a line length. Oxygen sensor signal line length below a minimum threshold indicates a slow sensor malfunction (P0133 Bank 1, P0153 Bank 2). If the calibrated frequency was not obtained while running the test because of excessive purge vapors, etc., the test will be run again until the correct frequency is obtained.

UEGO "Response Rate" Operation:	
DTCs	P0133 (slow response Bank 1), P0153 (slow response Bank 2)
Monitor execution	once per driving cycle
Monitor Sequence	> 30 seconds time in lack of movement test, > 30 seconds time in lack of switch test
Sensors OK	EOT, IAT, MAF, VSS, TP, ETC, FRP, DPFE EGR, VCT, VMVEVMV, CVS, FTP, CKP, CMP, ignition coils, injectors, no misfire DTCs, no system failures affecting fuel, no EVAP gross leak failure, UEGO heaters OK, no "lack of switching" malfunction, no "lack of movement" malfunction, no UEGO circuit malfunction, no UEGO FAOS monitor malfunction
Monitoring Duration	4-12 seconds

BESIDES THE FORD PCED, you can also find information about emissions codes and how they set in OBDII Model Year Summary books that Ford publishes every year and offers at no charge on their PTS web portal. This image is from the 2010MY Summary and describes the process that the PCM goes through to set a P0133. These summaries are valuable resources to learn how the PCM is programmed to find concerns and what faults may keep the PCM from doing its job.

code. This is a case of the code being a symptom of the concern.

What about a code for a bad MAF? The data being sent to the PCM from the MAF was rational. It was wrong, but it was rational. Therefore, the PCM reacted to a concern it actually created. Perhaps, we'll get to a point when the PCM can determine with 100 percent accuracy what is wrong; they're much better than they used to be. Until they program a PCM to be 100 percent accurate, there will be a need for qualified technicians to see past the code and confirm the root cause.

Until then, fixing the vehicle right the first time requires due diligence on analyzing the concern by using the five-step analysis process, understanding system operation and using service publications. This will help you find the root cause and correctly repair the vehicle. **TLZ**



MARK DEKOSTER has been fixing or teaching people how to fix cars for over 30 years. He has been a tech, trainer for Snap-on and Ford Motor Company, and currently is an associate professor at Ferris State University. He is the lead instructor in The Automotive Management Degree Program.

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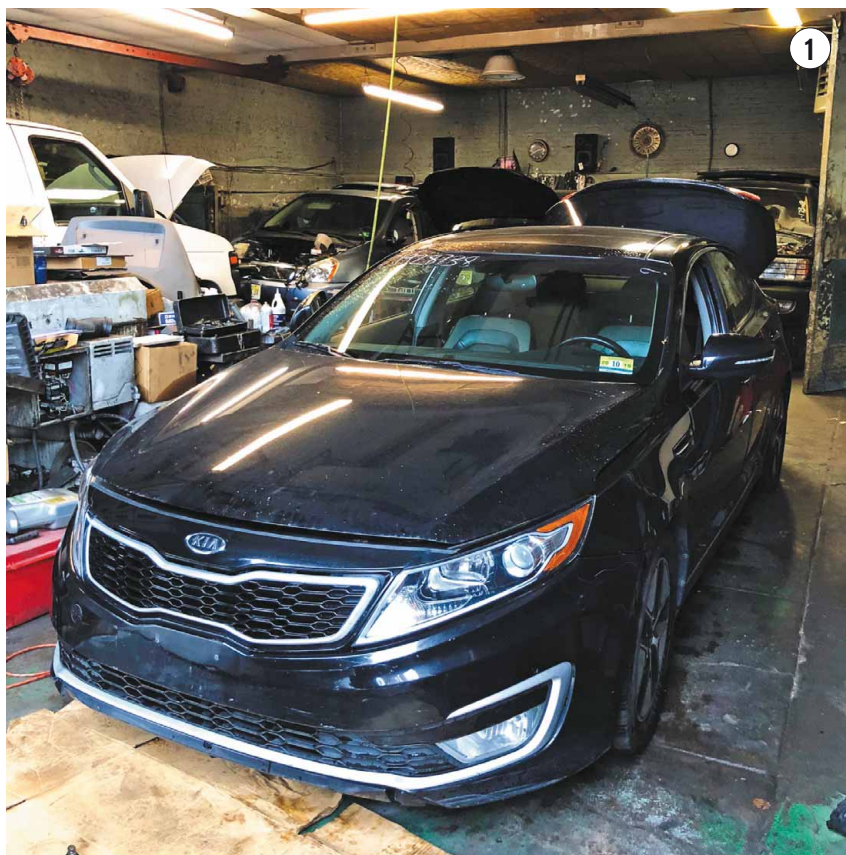
JOHN ANELLO // Contributing Editor

There was a local repair shop that had an oil change go wrong on a 2011 Kia Optima with a 2.4 L engine (**Figure 1**). The shop mechanic had an easy task of simply replacing the oil filter and removing and reinstalling a drain plug to drain and refill the engine with oil. The oil filter was installed properly, and the correct oil type and quantity was put in the engine, but the drain plug was never secured with a wrench and only hand tightened. Somewhere in the thought process, the mechanic forgot to tighten the plug with a wrench and allowed the vehicle to go down the road with a loose drain plug.

Over time and enough road vibration, the drain plug worked its way loose and the oil started to drain from the engine. The driver of the vehicle noticed the oil light come on, but proceeded to drive to get to a public destination off the roadway. Some drivers would just pull over, shut the engine off and call for roadside assistance but there are others who will not, and this sealed the fate of this vehicle. The vehicle was driven too far on oil starvation, and the engine seized.

Back at the shop

The car was towed back to the shop that serviced it to find out what happened to



the vehicle. The shop owner was not a happy camper because he discovered that the drain plug was missing and all the oil drained out, leaving behind a seized engine. He confronted his mechanic to educate him about why it is so important to always go over your service repairs and that he would now be partially responsible on some labor involved without pay. Hopefully, this would con-

DTC	
Erase All DTC	Freeze Frame
DTC Status	Erase Selective DTC
Current DTC	
Hist/Pend DTC P0336	Description Crankshaft Position Sensor "A" Circuit Range/Performance

dition his mechanic to be more aware down the road. To keep operating costs down and not go through insurance, the shop mechanic was instructed to pull the engine so it could be sent to an engine shop for repairs.

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Once the engine arrived at the engine shop, they pulled the oil pan to discover a damaged crankshaft and bearings. Luckily, the cylinder walls were not scored and most of the damage was lower end. The engine shop recommended a replacement crankshaft, main bearings, rod bearings and an oil pump. The repair shop decided to go ahead with the repairs, as it would be less costly than purchasing a used engine.

After about two weeks, the engine repairs were completed, and the repair shop drove there to pick up the engine. Once the engine arrived back at the shop, the mechanic was eager to get the engine back into the vehicle and out of his life. After a full day to install the engine, it fired up and ran. It did not crank over instantly, but it did run without any noises or signs of upper engine issues. As the vehicle ran in the bay, the Check Engine light came on, so the mechanic hooked up a scan tool to retrieve any codes to see if he left anything unplugged or not fully seated in the install process.

Whose mistake is it?

The code he pulled was a P0336 for “Crank Position Sensor Circuit Range Performance” (Figure 2). The vehicle never had this issue before, so maybe something happened in the engine repair process. The engine was running, so the crankshaft sensor had to be working or maybe it had a glitch in it that the ECM did not like, because the wiring to the sensor seemed OK. The shop did not have a scope, so they were just using old-school tactics and a scan tool to figure this issue out. The shop decided to replace the crankshaft sensor with a new one and when this did not work, they put blame on the engine shop thinking that they did not set up the valve timing properly.

The repair shop sent the entire vehicle back to the engine shop to have them resolve the issue. The timing chain and gears were checked and everything seemed in order. It was at this point I was called by the engine shop to get a second opinion.

The REAL cause

When I arrived at the shop, I was given the whole story of events, and I decided the best place to start was to hook up my 8-trace scope and look at the crank and cam sensors to make



sense of it all. I placed my yellow lead on the crank sensor, red lead on the intake cam sensor and my green lead on the exhaust cam sensor (Figure 3).



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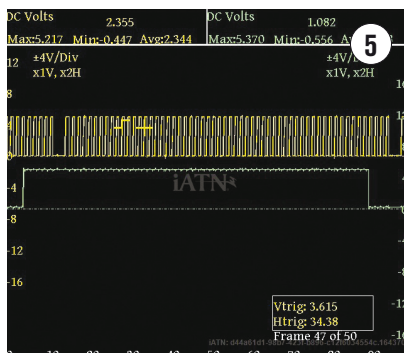
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The signal patterns seemed fine with good signal amplitude and no dropouts (Figure 4), but I needed a good known pattern to compare it to. If you don't have a good known car to hook

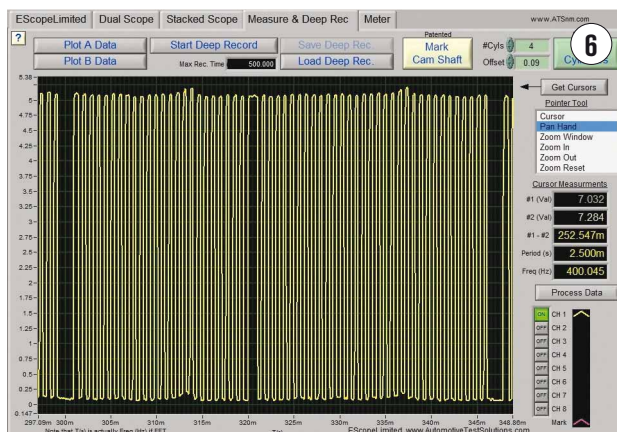


up to, it's always a good idea to head to the internet to see if you can tap into someone's waveform library. One great place is IATN, if you have a membership, to access information. I logged onto their site and sure enough I was able to find a crank to intake cam correlation waveform (Figure 5). The pattern seemed similar to the vehicle I was working on and the crank to intake cam correlation was identical, indicating a non-timing gear issue. But what caught my eye was the crankshaft pattern.

When I zoomed into my crank pattern (Figure 6), I counted 57 teeth between the synch gaps with an extra open gap, but the good known pattern did not have this extra open gap and showed 58 teeth between the synch gaps. This indicated that there might be an issue with the crankshaft that was installed in the engine. I asked the engine shop if they had another crankshaft for this car in their huge inventory and they were able to produce one (Figure 7). You could see that this crankshaft definitely had 58 teeth between the synch gaps incorporated into the crank trigger wheel, but with no extra gap. It was now a wait and see once they removed the oil pan for inspection.

Later in the week I drove back to the engine shop to see what they found. Apparently, someone had dropped the crankshaft they installed and caused damage to one of the teeth on the trigger wheel (Figure 8). I was totally taken aback by how someone could drop a crankshaft and not take the time to inspect it thoroughly for any damage they might have caused. The trigger wheel was not a solid gear, but rather a thin plate with teeth on its exterior edge. When the crankshaft was dropped it bent one tooth inward towards the crankshaft and the crankshaft sensor was unable to create a consistent magnetic field once it crossed its path. This created the extra gap in the crankshaft pattern that the ECM was unhappy with. The P0336 was more of a performance code than it was a circuit code and a scope would be the only option to use to actually see what was going on.

Once the second new crankshaft was installed, the vehicle was test driven by the engine repair shop to make sure there



were no other issues with the vehicle. They wanted to make sure there wasn't a check engine light coming on, because the last thing they needed was another comeback to bite into any profits that were left. They stood behind their work, and the engine shop had to eat the labor to not only pull the engine but also to disassemble the engine to replace the crankshaft a second time. This vehicle was not a money maker for anyone involved, and it only started out as a simple oil change. The only thing that came out of all of this was a valuable lesson to be learned. The vehicle was finally delivered to the repair shop and after their final inspection it was delivered back to its owner who was inconvenienced long enough without a vehicle. The owner did not request a loaner so that was a good thing, but you really need to unravel how this happens in our industry.

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Report No.: A0000014193

Full vehicle systems AI inspection report
This report is created by
LAUNCH ROXIE

Vehicle Information

VIN: 1FTWWG1P85E851636
Vehicle manufacturer/model: Ford/F-350
Year of manufacture: 2005
Mileage: 235271 KM

Inspection organization

Name: LaunchTechUSA
Address: 1820 S Milliken Ave Ontario CA
Contact Number: ☎ 5624631580
SW: 585750001053
Time and date of inspection: 10/09/2018 11:58:57
Inspection Location: 📍 2495 Arroyo Dr, Corona, CA 92679, USA

Inspection result

There are 2 issues for Power system:

- 1 On-Board Diagnostic (OBD) Systems Readiness Test Incomplete
- 2 Too Low ICP - Engine Cranking

There are 2 issues for Safety and Security system:

- 1 CAN Communication Bus Error - Reception Error
- 2 FR Wheel Speed Sensor Input Circuit Fault

There are 7 issues for Vehicle body system:

- 1 Brake Drive/ Switch Circuit Fault
- 2 Transfer Case 2WD (Two Wheel Drive) Solenoid Circuit Open Or Short To Ground
- 3 Ignition Run/Accessory Circuit Fault
- 4 Transmission Transfer Case 4WD (Four Wheel Drive) Solenoid Circuit Fault
- 5 Ignition Key In Circuit Error
- 6 CAN Communication Bus Error - Reception Error
- 7 Ignition Switch Circuit Open

Inspections are normal for Power system

- 1 TCM (Transmission Control Module)

Inspections are normal for Safety and Security system

- 1 PAM (Parking Aid Module)
- 2 TBC (Trailer Brake Control Module)
- 3 TCM (Transmission Control Module)
- 4 VSM (Vehicle Security Module)

Professional Report

Module	Status
GEM (Generic Electronic Module)	Abnormal 1
ABS (Anti-Lock Braking System)	Abnormal 2
IC (Instrument Cluster)	Abnormal 1
PAM (Parking Aid Module)	Normal
PCM (Powertrain Control Module)	Abnormal 2
TBC (Trailer Brake Control Module)	Normal
TCM (Transmission Control Module)	Normal
RCM (Restraint Control Module)	Normal
VSM (Vehicle Security Module)	Normal

- PRE & POST REPORT -
WILL AUTOMATICALLY SEND UP TO 5 EMAIL ADDRESSES



We are in such a great rush to beat the clock and get these cars in and out for the demands put on us from our customers. Then mix this with the constant distractions in our lives or in the shop. I have seen many people working in bays actually plugged into headphones while working, and it just amazes me how they can tune themselves out by doing so. I have always promoted the 5-sense diagnostics of hearing, feeling, seeing, smelling and tasting while working on cars. I'm not promoting tasting, but I can tell you over the 43 years working on cars I know what a few fluids taste like. It's helped in a few cases.

The vital other four senses are so crucial when working on and diagnosing cars. Use your eyes to look at vehicles and components for anything that's not right that should be brought to your attention. Use your hearing to hone in on any noises that may not seem normal that can alert you to a problem. Use your nose to smell for anything unusual like antifreeze leaks, burnt components, batteries overcharging or even a gas leak. Use your hands or body to feel for that miss in the engine or for the proper latching of a simple connector. The most important of all is staying focused

TRAINING IS ALWAYS A SHOP FOCUS

In this latest Remarkable Results podcast with Carm Capriotto, he speaks with Kevin Fitzpatrick, Vice President of Autologic; Steven Zack, Automotive Technical Instructor for Bosch; and Matt Fanslow, Shop Manager/Diagnostician of Riverside Auto Repair.

This episode reiterates the importance of training at all levels in the shop. The panelists also discuss keeping up with ADAS and calibration technology and changes, adapting to technician changes that are constant in the industry and the amount of good training available, among others.

Trainings and big events are available for technicians whether it is in the classroom or online. The panelists elaborate and advise on the challenges and the steps to advancement. They say there is no shortage of good training and that partnering with vendors who support training is a must. Listen at MotorAge.com/trainingsupport.

on what you're doing so your mind is connected to the vehicle so we don't forget to do a simple task like making sure we tightened a drain plug. I am sure that this story will hit home with many readers out there and my only hope is that we put our phones down in the shop and adhere to the old rules of yesteryear. *TL*

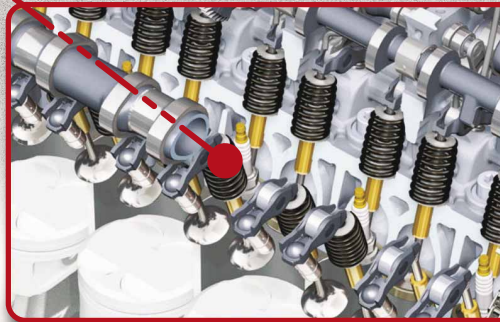


JOHN ANELLO owns Auto Tech on Wheels in northern New Jersey, which is a mobile diagnostic service for 1,700 shops, providing technical assistance and remote programming. He is also a nationally known trainer.

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IS IT TIME?

ARE WE, AS PROFESSIONAL AUTOMOTIVE TECHNICIANS, EVOLVING FAST ENOUGH TO KEEP PAGE WITH THE VEHICLES WE'RE CHARGED WITH SERVICING AND REPAIRING?

PETE MEIER // Technical Editor

Recently, there was an interesting discussion hosted by Remarkable Results' founder, Carm Capriotto, featuring Scott Brown (Diagnostic Network), Jorge Menchu (AESWave), Matt Fanslow (Riverside Automotive) and Justin Morgan (LMV Bavarian). The podcast was entitled "RR 414: Elevating Our Industry's Definition of Mechanic/Technician" and you can listen to it for yourself on Carm's site at www.RemarkableResults.biz.

There were several points raised by the panel that caught my attention. One was how we evolved from being "mechanics" to "technicians." More importantly, is the term "technician" adequate to describe to the curious onlooker what it is that we do for a living? According to Menchu, today's competent diagnostic tech should be thought of as an "automotive scientific investigator and a diagnostic reverse engineer." That's quite a mouthful and may be a bit awkward when used to describe to someone you just met what it is, exactly, that you do.

But to his point, and to the point of the other commentators, the average consumer today still looks at us and thinks of us no differently than the "mechanics" of 50 years ago. And why shouldn't they, I thought? It is an unfortunate reality that there are many in our business who aren't qualified to change the oil in a lawn mower, let alone attempt to repair any of the complex systems on an automobile. And every time



ERIC ZIEGLER PRESENTS to a full house at the 2019 VISION conference.

they leave a consumer with an improper fix and a deflated wallet, our image and overall reputation takes a hit.

Is it time?

That's when a comment made by Brown resonated with me. He related auto repair to aviation repair. Aviation technicians must be certified and licensed. Every repair or service they perform has to be recorded in the aircraft's logs. And, as a side observation, if there is a required service that needs to be performed, that aircraft isn't going anywhere until it is. As someone who flies fairly often, I'm pretty happy about that.

Now consider this — recalls issued by the OEMs are at record levels, yet the National Highway Traffic Safety Administration (NHTSA) estimates that 30 percent of the recalled repairs are not completed. Add this little trivia fact to the equation. According to the most recent data I could find, only 15 states require annual or periodic vehicle safety inspec-

tions. That means the roads are full of vehicles that could potentially cause injury to the occupants or those around them. That is my family and yours!

If we were to follow the template used in aviation, I think that would go a long way to accomplishing several things. One, we would all be safer on the road. Two, our professional stature would rise as those unable or unwilling to earn certification found other lines of work. Three, our value in the eyes of the consumer would rise.

On the negative side, costs to maintain and own a vehicle would increase even more. But aren't they already? Isn't that one reason that many of your customers aren't maintaining their cars the way they know they should — the way you've advised them they should? Is it a cost that would force some to give up vehicle ownership? Many already are. Is the cost we charge versus value we deliver more perception than reality on the part of the consumer? I wonder.

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A different perspective?

Recently, the washer in my home died in mid-wash. For the average individual, this means calling out a repairman or buying a new washer. In a hurry to get it fixed, I made a call to a local repair service and found out that they billed a flat \$65 fee just to come out and look at it — their “diag charge.” The cost to repair would be determined after he or she had a chance to investigate the cause. The fee would be due and payable regardless of whether or not I approved the repair.

Of course, I did my own homework and testing and fixed it myself. Appliance repair isn't rocket science. But it did make me think. How many consumers don't blink an eye to pay a professional to fix their appliances, repair their plumbing, or get the porch light working again — yet roll their eyes at the diag or repair fees we charge?

I'd argue that they don't consider us as “professionals.” And that needs to change sooner rather than later.

But that's not at the heart of what I wanted to discuss today. The aircraft technician must be licensed and certified. And I, for one, think it's time our industry followed suit. The only way to weed out those who need to be weeded out and to provide the consumer with some assurance that the person they are entrusting their vehicle to is qualified to do the job is to require licensing and certification.

And one requirement that will need to be included in this process is one of continuing education. Top technicians and shop owners already know the value and importance of ongoing training, but too many others are still relying on techniques and methods learned decades ago. Those processes may have worked just fine on Fred Flintstone's car, but they are not going to carry over to the Jetson's family sedan. As advanced driver safety systems continue to be added as standard equipment and new



EXHIBITORS COMPLETE THEIR last-minute preparations prior to the opening of the VISION trade show, held at the Overland Park Convention Center.



IT WAS STANDING ROOM only at this year's Big Event.



ATTENDEES AT THE BIG EVENT interacted with exhibitors during breaks.

technologies continue to emerge, the safety and well-being of our customers demands we stay up to date.

Don't wait!

To those of you who attend live training, whether it's an evening at the local Holi-

day Inn attending a seminar offered by one of the industry's numerous training providers or it's an all-out week of intensive immersion at a national event, thank you! You are setting the standard that I hope your co-workers and peers will see and emulate.

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To those shop owners who encourage — even demand — your technicians continue their personal growth, thank you! You are showing those who don't that developing a culture that sets that high standard only leads to increased profit and revenue. Why? Because your team is the only one in town that could actually FIX the problem.

Earlier this year, there were several opportunities to attend some fast-paced training around the country. It was my privilege to attend two of them — the VISION HiTech Training and Expo and the Technicians Service Training (TST) "Big Event."

When it comes to setting standards, Sheri Hamilton and the team at the Midwest Auto Care Alliance (MWACA) continuously raise the bar, hosting the annual VISION conference every March in Overland Park, Kan-

sas. The event draws technicians not just from the United States, but from all around the globe. This year's event also boasted a stellar lineup of classes hosted by the best independent trainers and aftermarket corporate training departments the industry has to offer. So much so, that remote campuses had to be opened to accommodate it all!


And while training is at the center of the VISION universe, it's the orbiting activities that sets this event apart from others. Of course, there is the almost standard trade show component for attendees to enjoy, but there is so much more. There are also formal opportunities to network with your peers and enjoy some entertainment to give those brain cells a break and there are even more informal opportunities to do the same. It's not unusual to pass by the Sheraton's lobby bar and see attendees

still at it in the wee hours of the morning. If you've never attended VISION, put this event on your bucket list.

The TST Big Event is another that is setting new standards for training events. Under the leadership of G. Jerry Truglia, the event has grown to a current attendance of nearly 700 in the past few years.

The structure of the event is unique. It is a single-day event that starts with a breakfast buffet for those attending. A good breakfast, a few cups of coffee and perhaps a good energy drink are almost mandatory to prepare the mind for the day to come! Attendees are in one big hall and the speakers rotate during the day. This year, the audience had the opportunity to learn from Kris Lewis, Vin Waterhouse, John Anello and John Thornton.

One brilliant innovation this event is becoming known for is the use of tablets rather than paper to distribute handouts and other materials to the guests. Another unique feature of the Big Event are the drawings held in between sessions for donated prizes including tools valued in the thousands of dollars, all thanks to corporate sponsors' support of TST's mission. If you live anywhere close to Tarrytown, New York, this is another of those events to add to your bucket list.

I'll look forward to seeing you at one, or both, next year! 



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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.

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Autel's MaxiVideo MV500 Display Tablet and Digital Inspection Scope unit features a five-inch color touchscreen Android-tablet and a detachable, wireless digital inspection scope with 8.5-millimeter cable with dual cameras to enable automotive technicians to inspect out of reach and poorly lit vehicle and engine parts. The 8.5mm camera cable probe includes front and side cameras, providing an expansive view with adjustable 40 lumens LED light. Perform zoom and lighting adjustments, start recording or take snapshots with one hand directly from the detachable inspection video scope. The 40-inch waterproof semi-rigid flexible cable provides visual access to difficult to reach areas of the vehicles, particularly engine parts. The video scope offers about three hours of continuous use on a rechargeable battery and functions while attached to or detached from the tablet, even as far away as 100 feet. The scope, with 2.8 hours of continuous use, can record, playback, and save high-resolution JPG images and H.264 videos at 1280x720 resolution. The tablet features advanced editing features and, in addition to performing all camera operations, can display in color or black and white and in optional camera views: front camera, side camera or both camera views. The MV500 tablet offers a 1280x720 resolution, a fast 1.6 GHz Cortex-A9 quad-core processor, 16 GB solid state drive and operates on Android's renowned KitKat operating system. Additional image or video storage is available by adding an SD card; the tablet supports up to a 32GB SD card. The tablet offers a USB 2.0 port for image and video PC uploads and an HDMI



Type A port for external image and video display. The unit's collapsible stand allows for hands-free viewing at 30, 60 and 90 degrees. The tablet features a 5-megapixel rear camera and speaker and microphone ports perfect for annotation. The tablet offers 3.5 hours of continuous use on a rechargeable battery. Purchase includes the MV500 tablet, video scope, USB cord, HDMI cable, magnet and mirror inspection cable attachments, user manual, and protective carrying case. Additional applications besides automotive use include HVAC and refrigeration and electrical inspections. The MV500 is warrantied for a year.

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The Parts Plus Car Care Center program focuses on five key elements to drive shop success:

Communications: Materials that have been designed to assist shops in communication, what repairs are needed and why, enabling consumers to make better buying decisions.

Marketing Programs: There's a wide range of marketing programs for our Parts Plus Car Care Centers to choose from. Each one designed to meet specific business needs and grow market share.

Business Support: Programs created to enhance the professionalism of each shop, attracting more customers and projecting a professional appearance.



Training: With the ever-changing automobile technology and business climate, it is imperative that repair shops not only keep up to date with the latest advancements, but also the latest business practices.

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TPMS warning light tells more than one tale

According to Sean Lannoo, Continental TPMS Technical Training Specialist and a TIA Certified Automotive Tire Service Instructor, when a customer's TPMS Telltale/MIL comes on, it can signal a variety of TPMS service issues. So, the best approach is to check the light first and determine the nature of the issue before dismounting any tires or servicing any sensors. By troubleshooting the problem up front, you will be able to identify exactly what type of TPMS service is needed, and in turn save you and your customer a lot of hassles and frustration.

Solid vs flashing light

A TPMS warning light that illuminates solid and remains solid usually means that one or more of the tires has low air pressure and needs to be inflated to the correct placard pressure.

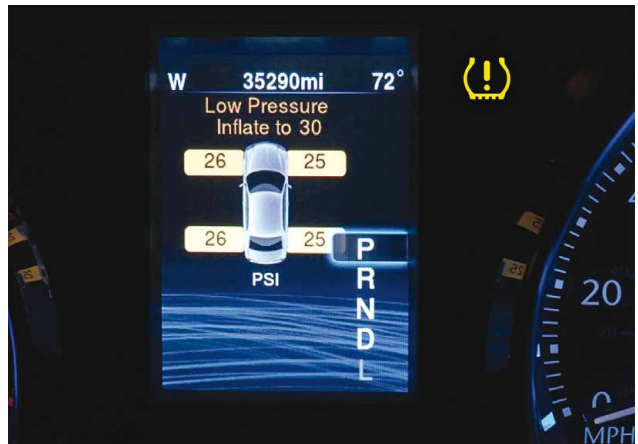
However, a light that flashes for 60-90 seconds and then illuminates solid is signaling that there is a problem with the TPMS system. It is very likely that one or more of the sensors are not communicating with the vehicle. This can be caused by a variety of issues. The flashing light can mean the sensor is damaged, missing, or has a dead battery and needs to be replaced. It can also mean that an incorrect sensor is installed in the tire.

To make sure you service the TPMS system properly, you need to troubleshoot these potential issues until you find the culprit.

Here are some additional tips to keep in mind when your customer comes in for service:

1. Check the Telltale/MIL every time a customer's vehicle enters your service bay and document the presence of any illuminated or blinking light before performing any work.
2. Don't forget to inspect the spare if it is equipped with a TPMS sensor.
3. While servicing TPMS, visually inspect stems, hex nut, seal, and cap. The recommended best practice is to replace with a new service kit.
4. Always inform the customer of the benefits of TPMS, regardless of whether it presents a sales opportunity or not.
5. Make sure you have a reliable resource you can go to for replacement Sensors, Service Kits, and Relearn procedures for any vehicle. For more information, visit: www.redi-sensor.com.

Continental also offers a free, tech support hot line at 800-265-1818, which you can call for quick, expert help whenever you need it.



A solid TPMS telltale indicates low tire pressure.



A flashing TPMS light can indicate several issues that need to be checked.

These helpful tips are brought to you as a courtesy of Continental, manufacturer of the VDO REDI-Sensor™ Multi-application TPMS Sensors and one of the industry's leading innovators of complete Tire Pressure Monitoring Systems, sensors, and service parts.

Continental 

VDO and REDI-Sensor - Trademarks of the Continental Corporation

How to conduct a voltage drop test on a fuel pump

Insufficient pressure and flow are indications that a fuel pump is underperforming, but that doesn't necessarily mean that it is failing. Low voltage or a bad connection or ground will cause a pump to underperform, producing the same test results as if the pump were bad.

Before replacing any fuel pump based on pressure and flow test results, always follow the vehicle manufacturer's recommended procedure for testing all electrical connections and the electrical system charge. A minor issue such as a loose ground can cause many problems that resemble more serious malfunctions.

Let's explore how to do a voltage drop test from the power side, and then from the ground side, too. We always put safety first, so be sure you are wearing safety glasses. Do NOT probe the vehicle electrical harness connector with DMM leads. Doing this can damage the terminals in the harness, creating the potential for an overheated fuel pump connector due to excessive electrical resistance. Always use the proper test probe to perform electrical tests.

To do the test from the power side, you'll need a DMM — that's a digital multimeter. You'll need access to the fuel pump connector and battery.

Take the multimeter and set it to twenty volts D-C scale, or D-C if your

multimeter has auto-ranging capabilities.

Now connect the multimeter positive probe to the battery positive terminal. With the fuel pump wire harness connected to the fuel pump, connect the multimeter negative probe to the power feed wire at the fuel pump connector.

Turn the ignition to the "on" position. Keep in mind that the pump will only run for about two seconds while the relay is in prime position, or until it gets an RPM signal. The reading should be less than 0.2 volts. If the reading is greater, check for resistance in the power supply circuit for the fuel pump.

Now, to do the test from the ground side, the process is very similar. You will again set the multimeter to 20 volts D-C scale, or D-C if your multimeter has auto-ranging capabilities.

This time you will connect the multimeter positive probe to the ground terminal of the fuel pump connector. Make sure the fuel pump wire harness is connected to the fuel pump. Then connect the DMM's negative probe to the battery negative terminal.

Turn the ignition to the "on" position. Again, keep in mind that the pump will only run for about two seconds while the relay is in prime position, or until it gets an RPM signal. Your reading should be less than 0.2 volts D-C. If it's greater than that, check for resistance in the ground supply circuit for the fuel pump.

And that's how you do a voltage drop



test. It is important to remember that loose connections produce resistance, which produces heat. If you replace an in-tank fuel pump assembly, make sure you check the terminal fit (for retention) on the wires that connect the vehicle harness to the actual fuel pump. Loose terminals / pig-tails should be replaced to prevent comebacks.

For a video demonstration, go to <https://www.youtube.com/DelphiAutoParts>

And for more helpful information on our full product line, go to www.Delphi-Aftermarket.com

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The importance of starting and charging system ground circuits

Real estate professionals often like to say, “The 3 most important things in real estate are location, location, and location.”

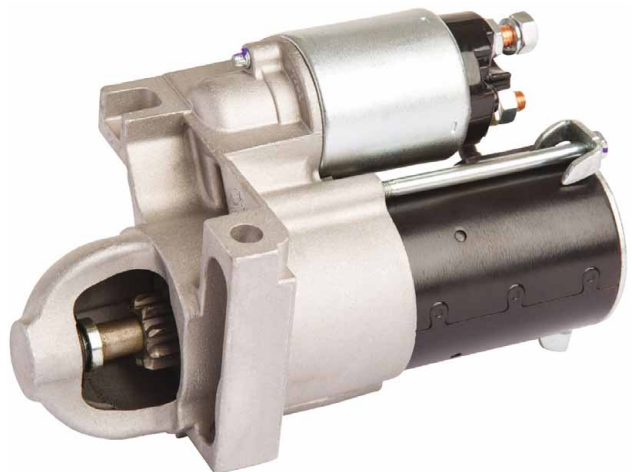
When it comes to vehicle starting and charging system problems and other vehicle electrical system problems, it could be said that the 3 most important things are grounds, grounds, and grounds. The ground or negative side of any electrical circuit is just as important and critical as the positive side of the circuit.

The performance and operation of any electrical circuit and the components within that circuit will be greatly affected by problems on the ground portion of that circuit. For example, problems on the ground side of the starting and charging system will often result in no-crank conditions, slow or sluggish cranking, no-charge or low charge conditions, overcharge conditions, and can cause premature failure of replacement starters and alternators. Therefore, it is critical to verify the condition of all of the vehicle ground circuits whenever there are starting or charging system problems on a vehicle.

This should start with a careful and complete visual inspection of the main ground cable from the battery negative connection to the cable terminating connection at the engine or chassis, depending on the vehicle. Next, a good visual inspection should be performed on the accessory or auxiliary grounds. These wires are typically smaller and shorter in diameter from the battery negative terminal to the vehicle body or chassis. Carefully inspect any ground straps from the engine to the body or engine to the chassis. Try to get your eyes and hands on all of these various ground connections and wires to inspect for loose connections, corrosion, oxidation and rust, frayed or broken wires, damaged connectors, evidence of overheating or arcing, and connections that may have been inadvertently left off or damaged during previous repairs.

If no obvious visual problems are detected, perform a voltage drop test on these ground circuits to locate excessive resistance in the circuits. The advantage of the voltage drop test is that the test is performed on a live circuit with current flowing; it is a “load test” of the circuit. The voltage drop test can often locate problems which cannot be easily seen during the visual inspection.

Using the steps listed above can help you find and prevent future electrical problems.



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Diagnosing engine coolant leaks

By **LARRY HAMMER**, Technical Services,
Mighty Distributing System

When most think of engine coolant (antifreeze), it is in relation to its freeze-point protection with little consideration of its ability to provide lubrication and protection from system corrosion.

Unfortunately, engine coolant normally does not receive any attention until one of the following scenarios occurs: 1) The engine overheats. 2) Freeze-point protection for winter is not sufficient. 3) Coolant is spilling, weeping or seeping from the engine or cooling system components. 4) A water pump or hose is replaced. However, other conditions must be considered before these symptoms occur. For example, once the corrosion inhibitors in the coolant break down, the system can encounter corrosion, promoting holes forming in the cooling system components, resulting in leaks, rust deposits or scale forming in the radiator tubes, thereby restricting coolant flow, resulting in engine overheating. Cooling system maintenance is imperative. It can save the customer much frustration and unnecessary expense.

Electrolysis

Deteriorated coolant is usually our first consideration when diagnosing leaking radiator tubes; however, electrolysis must also be considered. Electrolysis is a condition that occurs when electrical current flows through the engine coolant, promoting a deterioration of the system much like that of extreme corrosion resulting from worn out or contaminated coolant. Electrolysis is becoming a common occurrence with the new vehicle designs due to the use of lightweight metals, ungrounded plastic radiator tanks and a myriad of electrical

accessories and systems. Many of the accessories are consumer add-ons and are not properly grounded. Electrolysis occurs when current takes the path of least resistance and seeks a ground through the coolant. The coolant becomes electrically charged and becomes an electrolyte, thus consuming soft metals such as aluminum radiators and heater cores. Testing for electrolysis can be performed with a digital voltmeter set on the 12 Volt DC scale. Attach the negative lead of the voltmeter to the negative post of the battery and the positive lead should be placed in the coolant, but not allowed to make contact with the filler neck or radiator core. Two readings should be taken, one with the engine off and the other with the engine running at 2,000 rpm, with all electrical accessories on. A voltage reading in excess of 0.3 volts confirms electrical leakage into the cooling system. If the condition is present, perform a complete coolant exchange and re-test. If the condition is still present, a thorough ground inspection must be performed. For additional information concerning pinpointing the source of the electrical leakage refer to Mighty Tech Tip #137 Cooling Systems, available on our website.

Excessive thermocycles

Here's a different twist in cooling system troubleshooting. GM advises that the presence of a coolant smell or leakage may occur at the radiator on 2014-2016 Trucks and SUVs equipped with a 4.3L, 5.3L or 6.2L engine. Specific ap-



**LET ME PUT IT THIS WAY, BUDDY...
KNOW WHAT'S NO LONGER "COOL" ABOUT YOUR CAR?
IT'S YOUR ENTIRE COOLING SYSTEM.**

plications and Production Plant Codes are reflected in GM TSB PI1513D. The radiator should be inspected where the tubes attach to the headers. The presence of leakage may be the result of excessive thermocycles in the cooling system due to excessive cycling of the thermostat. This condition prompts fatigue in the tubes resulting in cracks and leakage where the tubes attach to the radiator headers. GM offers a revised thermostat and housing to eliminate the excessive cycling. If you identify the described leakage condition, do not replace the radiator without installing the revised thermostat or the condition will repeat itself.



www.mightyautoparts.com

Get to the fix faster with help from your tech community

If you've ever hit the wall when diagnosing a vehicle, you know the value of having a community of professional auto repair technicians close at hand to help get you on the correct path to a solution.

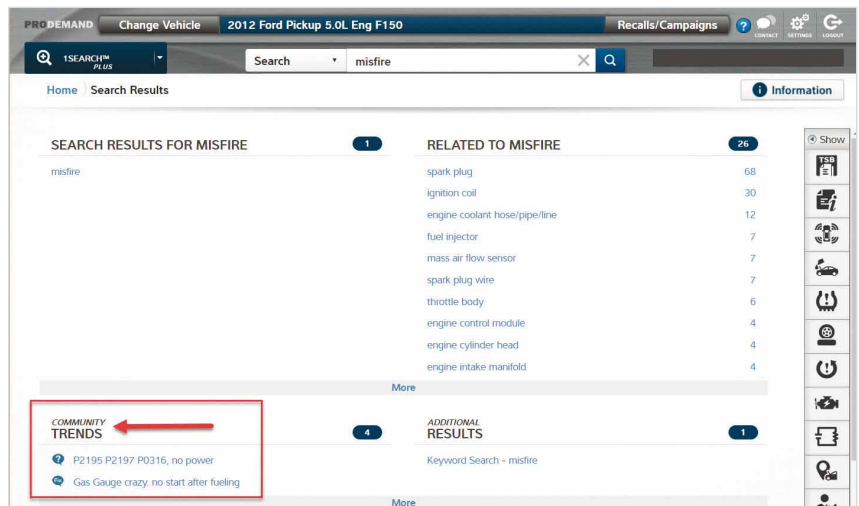
In an online community, you can type your question and with a click of your mouse instantly send it to an entire community of experienced technicians. Chances are good that you will receive answers and ideas within a few minutes that will help get you over the hump and back to fixing the vehicle.

For more than 10 years, Mitchell 1 has offered an active community of professional techs as part of its repair information system. The community is now integrated inside the ProDemand[®] repair and diagnostic information software as the SureTrack Community.

Community of professionals

SureTrack Community members contribute answers and help their peers with tricky vehicle issues. This information comes straight from the bay and is an invaluable resource for techs of all experience levels. In fact, the information is an integral part of the results returned when a user searches the ProDemand system for a code, symptom or component. Techs have immediate access to insights from community members along with the OEM and SureTrack real-world information delivered in a single lookup.

Technicians can participate in the Community as individual members, even if they access ProDemand through the auto repair shop where they work. Threads that are related to the current selected vehicle are presented first, so techs see only topics related to the vehicle in their bay.



Community "Trends" and tips are returned with OEM and SureTrack results after a search in ProDemand. Here the user searched for "misfire" on the 2012 Ford Pickup.

If they would like to view community threads for all vehicles, it's easy to toggle to All Vehicles.

The Community is included as part of the SureTrack[®] diagnostic module in ProDemand. SureTrack helps you build a diagnostic strategy by providing real world information including Real Fixes, probable components at fault, guided component tests and much more. This information is available right alongside ProDemand's comprehensive OEM information, so technicians don't have to search multiple databases with multiple logins and subscriptions to find the data they need.

Community highlights

Ask the Expert — Techs with specialized professional skills, knowledge and experience can register as an "expert" and share their knowledge with others in the community. Members who ask questions validate the experts' responses by rating their answers, and all members can indicate whether a "Best Answer" solved a similar

problem they have faced. If it did, the answer is recorded as a "Fixed It."

Leaderboard — The top community members are displayed in the leaderboard. Members are awarded points for answering questions as well as for how many "Best Answers" and "Good Answers" they have contributed. Those who gain the most points for the current time period are recognized at the top of the leaderboard.

My Activity — The My Activity page helps members keep track of their individual participation and activity in the Community.

Read more about SureTrack and the Community in the Mitchell 1 Shop Connection Blogs: mitchell1.com/shopconnection.



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Fleet brakes that work as hard as you do.

When it comes to keeping fleet vehicles on the road, time, money and even lives are at stake. That's why we created NAPA Fleet brakes from the ground up — designed to last longer and perform better on more than 90 percent of fleet vehicles.

More longevity. More performance.

As a rule, the longer a part lasts, the better. But longevity isn't the only marker of a good product. There's also performance to consider.

The truth is, NAPA Fleet brakes hit longevity and performance right in the sweet spot.

According to industry-standard SAE Safety Testing, NAPA Fleet brake pads and rotors last an average of two times longer than the competition. All thanks to special pad and rotor formulations that, when used together, stand up to the intense heat and friction service vehicles endure day in and day out. As a result, technicians experience more time between maintenance intervals and drivers benefit from more uptime — making project managers, accounts and business owners especially happy.

More safety qualifications than any other brand.

Imagine you're behind the wheel hauling a massive backhoe from a construction site, driving the morning rounds in a school bus or taking a police cruiser in pursuit from 80 mph to zero in a matter of seconds. You wouldn't want your vehicle equipped with just any normal brakes.

According to the tests, NAPA Fleet brakes are anything but normal.

After submitting NAPA Fleet brakes to rigorous research and development processes and safety tests, we've collected more safety qualifications than any other aftermarket brand. Our brakes even exceed the requirements of the Emergency Vehicle Operations Course — an industry benchmarking test where NAPA Fleet brakes passed with flying colors on performance and longevity, wear, and noise reduction.

Support you need to get the job done.

When it comes time to switch to NAPA Fleet brakes, we know you can't be left with a vehicle sitting on the lot waiting for parts. Time is money. That's why NAPA offers world-class training and technical support to all our fleet customers. And with more than 6,000 NAPA AUTO PARTS Stores and 16,000 NAPA



AutoCare Centers nationwide, the parts and advice you need are never far away.

Don't settle for anything less.

When your business or organization depends on a well-maintained fleet, there's no better choice than the performance, longevity and service that come with NAPA Fleet brakes. Because while keeping a fleet of vehicles running longer and stronger is your job, it's our business.

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Diagnostics on MRE style ABS sensor

By **STEVE SMITH**

I wanted to write something about diagnostics on MRE style ABS sensors following the ABS diagnosis in a forum topic that can be found at MotorAge.com/Pico.

I am not sure if this technique is already in use, (I haven't used it before) but I thought it was worth sharing.

Given that the MRE style ABS sensors predominately result in a current flow of approximately 5 to 15 mA, we ended up in a discussion of how one could use a by-pass technique to qualify the wiring harness and the ABS ECU from the point of view of "feed and return" in a sensor.

At the point of ignition-on (vehicle is stationary) the current flow through these ABS sensors will be in one of two states: high/low or 5/15 mA.

The idea is that if we can simulate this current flow, perhaps we can by-pass an MRE ABS speed sensor.

On the screenshot below, I had momentarily shorted together the ABS sensor wires, with the ignition on and the vehicle stationary, while I was monitoring the sensor supply voltage and the current flow.



With no short and the ignition on, the ABS light extinguishes as normal. At the point of the short circuit, the current flow increases to 70 mA and the ABS warning light illuminates to indicate a fault.

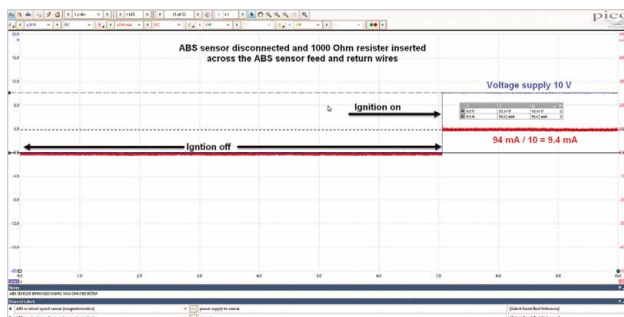
Note: The waveform indicates 704 mA, as I used a breakout lead wrapped 10 times through the jaws of a current clamp to improve vertical resolution and capture the mA values. See this technique at MotorAge.com/PicoCaseStudy.

Notice how the supply voltage drops to 0 V while the ABS sensor wires are shorted together.

This is because the supply voltage passes through a resistor or an elaborate control circuit, within the ABS controller, that prevents high current flow in the event of a short to sensor ground. However, 70 mA is permitted to flow to allow the ABS controller to determine the style of fault: ABS Sensor wiring short circuit.

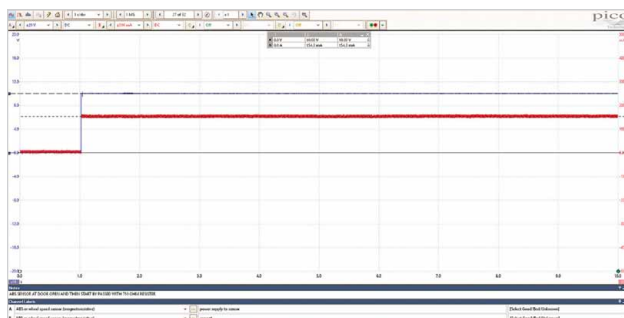
If we have a supply voltage of 10 V, how can we obtain and simulate 5 to 15 mA, using Ohm's law?

With a 1000 Ohm resistor we have $10\text{ V} / 1000\text{ Ohm} = 0.01\text{ mA}$ (10 mA). In the screenshot below, we had the ABS sensor disconnected and a 1000 ohm resistor inserted between the ABS feed and the return wires.



With the 1000 Ohm resistor inserted and the ignition turned on (vehicle is still stationary), the ABS warning light extinguished as normal. It would appear the ABS controller was happy with approximately 10 mA current flow.

In an attempt to fine-tune this procedure, we replaced the 1000 Ohm resistor with a 750 Ohm resistor (see screenshot below). The current flow increased to approximately 15 mA. Again, with the ignition turned on (and the vehicle stationary) the ABS warning light extinguished as normal. It would appear the ABS controller is also happy with approximately 15 mA current flow.



If nothing else, I think this highlights another rapid test we can carry out to confirm the integrity of the ABS sensor wiring and the ABS Controller's internal "feed and return" circuitry.

A point to note is that the ABS system on the vehicle under test, a 2013 BMW 320 d F31, would activate the ABS controller at the point of "driver's door open," before ignition-on.

I guess this is some form of preparation state, readying for a seamless start up and go.

SKF Flange kit offers solution for worn-out wheel bearing

Tech tip addresses 2007-2013 Jeep Compass and Patriot as well as 2007-2012 Dodge Caliber

SKF Flange kit BR930558K offers a solution when a worn out bearing needs replacement on 2007-2013 Jeep Compass and Patriot as well as 2007-2012 Dodge Caliber.

When replacing a worn-out wheel bearing, the wheel flange is often overlooked as the source of the bearing failure. Flanges that are bent or cracked will cause additional load to the bearing. SKF recommends doing a visual inspection and runout check of the wheel flange.

Damage to the wheel flange can also occur during removal. This can occur when the inner ring of the bearing is still attached to the flange after removal. In order to remove the inner ring, it needs to be cut off the wheel flange or pressed off. The cutting process can create scarring and jeopardize the integrity of the flange. The best process is replacement with a new bearing and wheel flange.

Currently, OEMs only offer an expensive option that comes with a knuckle assembly and backing plate. SKF offers a professional replacement kit that saves potential comebacks, time and cost. Only the necessary wear parts are included for replacement. The kit includes a wheel flange, wheel bearing, retaining clip and axle nut.

A premium hub bearing kit in the aftermarket

To avoid the risk of purchasing various replacement parts individually and from different suppliers, consider choosing the SKF all-in-one hub flange kit. The kit includes all the parts needed for a hub reassembly, including a cartridge-style wheel bearing, c-clip, axle nut, seals and hub flange. Engineered to meet rigorous OE specifications, SKF's premium parts are designed to fit and work properly the first time.

SKF YouTube channel offers in-depth technical videos

The SKF Vehicle Service



OEM KNUCKLE ASSEMBLY

Market YouTube channel offers a number of in-depth product and technical training videos designed to provide users with the information they need to conduct vehicle maintenance and repairs. Visit www.skfpartsinfo.tv to see more technical training videos or follow us on Twitter @skfpartsinfo.



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Dan-Am Air[®] aluminum air piping system

Clean air requirements are more critical than ever. Air tools, blow driers, HVLP spray guns, and supplied air respirators may require more air volume and better air quality than in the past. Not only does clean air effect equipment performance, but it is also critical for paint coatings performance. Dan-Am Air's aluminum air-lines along with SATA's filtration system can solve all of these issues.

The Dan-Am Air system is reusable and easily adaptable to any space, not only ensuring safe, clean air for your team, but also increasing your shop's efficiency and improving your bottom line.

Three-stage filtration

SATA filtration is available in two sizes, which can flow up to 129 cfm at 90psi—an exceptional amount of air for a single filtration unit, Gravenhof says, “if your shop is equipped with multiple booths, you have the option of a single SATA filter to maintain, as opposed to a filtration unit at each booth. Fewer filter cartridges to maintain equals fewer dollars spent.”

The SATA three-stage filtration system is simple: The first stage is the water separator, removing the larger moisture droplets and particles down to 5 microns from the air; next is the fine filter which removes particles down to 0.01 micron; and, finally, there is the activated charcoal filter stage removing hydrocarbons, oil vapors and odors to give you perfectly clean air for breathing and spraying.

High-quality materials

The system's airlines are made of powder-coated, aircraft-grade, extruded aluminum.

Aluminum's biggest advantage? Easy

to install, modular and reusable, lightweight, corrosion resistant, and guaranteed not to leak. Dan-Am Air fittings are constructed of a reinforced Nylon composite material, with a double Nitrile seal. The manifolds and ball valves are nickel plated solid brass, and all threaded connectors are high grade steel. Dan-Am Air can be easily adapted to your current system with the variety of threaded connection options available.

Modular design

“Compared to a more typical airlines system, ours is reusable,” Gravenhof says. “You can put a system up, and take it down and put it back together very easily. It's modular, and can be easily added on to or changed if need be.”

Designed with simplicity in mind, DAA allows you to do-it-yourself. Measure, cut, de-burr, then simply “Press-to-Connect”. The direct result being lower installation times and costs.

The “Press-to-Connect” subject tends to be the most misunderstood instruction in the DAA system. We have all been taught since we were young to first loosen a given item, put it together, and then tighten it. That is NOT the recommended installation procedure for DAA fittings. DO NOT loosen fitting caps before installation. It's as simple as pushing the fitting onto the pipe until it is fully inserted.

Creating efficiency, saving money

With high air volume demands and efficiency requirements, many of the major paint company training centers across the U.S. utilize the benefits of DanAm



Air and SATA Filtration in their facilities.

“The cost of a reusable and versatile system like Dan-Am Air can pay off quickly,” Gravenhof says. “It's a simple, effective system, with a do-it-yourself installation option. It saves time. It saves energy. It ultimately saves money.”

www.danamair.com

800-533-8016

A fresh start for a dirty Tesla

New technologies are evolving the art of servicing vehicles, thus creating new opportunities. One opportunity that has surfaced is regarding the air quality inside both electric and motor vehicles. Air quality is degraded by the presence of unwanted contaminants that accumulate and live in the ducting & condenser box of A/C and heater systems. These contaminants cause foul smelling odors produced by health threatening mold, mildew, and fungus deposits growing in cabin air systems.

There are ways to “fix” the problem — from complex, expensive and temporary to inexpensive, easy, and effective. Many of the products used are simple perfumes that temporarily mask the bad odor but do nothing to truly fix the problem at its source. Once the “perfume” loses its masking odor you are back at square one. Other products that are more effective (often expensive and not “perfume”) are difficult to apply and may require disassembling the dash and spraying different chemicals through the system and then following up with a rinse. These chemicals can potentially cause the vent control systems to stick and still do not prevent the return of the same contamination that caused the problem. This is a solution used by some OEM dealerships and is very costly and time-consuming but does not correct the root cause: organic contamination.

A more efficient and cost-effective method involves delivering a cleansing /disinfectant foam such as LUBEGARD® Evaporator & Heater Foam Cleaner directly to the area of active contamination. This foam cleaner is easily introduced into the “smelly” system using an application tube that is inserted into the evaporator box or heater (normal source of problem) by way of the drain

tube. All vehicles have a drain that allows condensation to escape the system. This condensation is the medium that allows the contaminants to grow in your heater or A/C; dark plus damp equals growth. If the drain is plugged, the application tube will clear it, allowing the water to now leave the system properly. Once the tube is inserted fully through the drain line, the can of disinfecting foam can be discharged into the evaporator box or heater enclosure. The foam fills the system and begins to expand touching the contaminated nooks and crannies. It takes about 15 minutes for the foam to collapse down and turn into a liquid as the foam bubbles implode, scour the A/C condenser coils and flow out the drain tube, taking the bad smell and contaminants with it. Simple, easy, effective, and usually performed while you are servicing another system on the vehicle. This is the most opportune time to sell and perform this service, because the vehicle will already be in your possession and the A/C drain line will be easily accessible.

When the vehicle is returned to the owner, not only has the driveline been serviced but the “environment” for the owner has been restored. Most vehicle owners (especially those with children) are grateful that there is a safe, economical solution for the problem. Health conscious vehicle owners will also appreciate peace of mind knowing the air they breathe is free of respiratory threatening contamination. Because the problem returns in time (hot or humid climates will need service more often) it creates the opportunity to not only maintain the mechanical health of the vehicle, but the health and well-being of its owner. It creates a pattern of repeat business because they now know how and where to get the problem “fixed.”



It's amazing how your nose can create a new opportunity because you decided to assume a new responsibility — taking care of your customer like you take care of their vehicle. LUBEGARD® Evaporator Heater & Foam Cleaner is just another tool in your arsenal.

Selling points for Kool-It Foam Evaporator Cleaner:

- *Removes bad odors caused by organic contaminants (mold, mildew, fungus) growing in A/C and heater systems on new vehicles including electrical driven vehicles like Tesla.

- *Removes harmful organic contaminants from traditional and new electric driven A/C and heater systems.

- *Protects health and improves sense of well-being for vehicle owner and their passengers.

- *Easiest add on service to sell and perform when performing routine maintenance on customer vehicles.

- *Easy to use with no special equipment or vehicle modification required.

- *Instant gratification when used, bad smells are gone immediately.

- *Removes the smell of smoke from tobacco use.

Color-coded UV leak detection dyes

Vehicles on the road today are around 11.5 years old. Quality improvements to materials, design, and manufacturing have greatly increased vehicle service life. Since 2006, car owners have held on to their vehicles two years longer before disposing of them. Car owners are also taking better care of their vehicles because they want to sell or have trade-in value when they're ready for their next car purchase.

Now there are more than 250 million light vehicles on U.S. roads. About 120 million of these vehicles are between 6-14 years old. Overall, the U.S. is adding more cars on the road but not scrapping older vehicles. New vehicle registrations outpaced scrappage by more than 42%. That means more cars on the road today are older and are more likely to have fluid leaks due to wear-and-tear.

Tracerline's ultraviolet leak detection method utilizes fluorescent technology to detect the smallest fluid leaks. Because leaks can happen anywhere, it is sometimes very difficult to find all leaks even within the same vehicle system.

The Tracerline TP-8692 UV Multi-Colored Fluid Dye Kit provides a mechanic with a complete set of dyes that fluoresce brightly when exposed to ultraviolet light. The kit includes three color-coded dyes for petroleum and synthetic-based fluids: white dye, yellow dye, and blue dye (red dye is available separately). The kit also includes a specially designed green fluorescent dye for conventional coolant. By offering a kit with color-coded dyes, a technician can quickly isolate and identify multiple leaks in all vehicle systems.

To use the kit's contents, add the appropriate dye to the system(s) being serviced. Run the system for ten minutes to let the dye circulate. Inspect the system

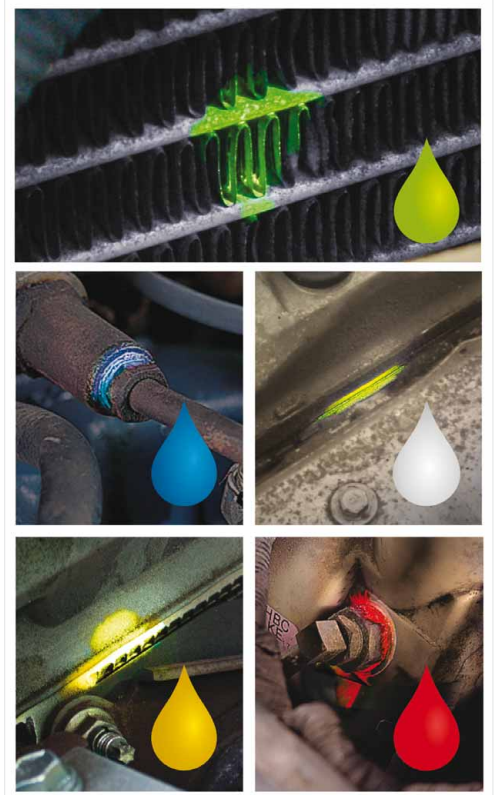
with the TP-8695, the powerful ultraviolet LED leak detection flashlight included in the kit. The TP-8695 has a range of 20 feet and can easily detect leak areas in a vehicle's system. Leak areas with escaping dye will fluoresce brightly when exposed to ultraviolet light.

One of the greatest benefits of the UV Multi-Colored Fluid Dye Kit is that it offers leak detection for all automotive systems — including coolant, brake, transmission, oil, fuel, and all other vital vehicle systems. In a single service call, a technician can scan all automotive systems easily.

Other methods of leak detection require suboptimal visual inspection, pressure differential testing, and measurements elapsing over a long period of time. These methods of leak detection are often imperfect and do not provide leak detection results in a timely manner. When time, money, and customer satisfaction are at risk, technicians need a safe and easy leak detection tool for all fluid-based vehicle systems.

According to the Automotive Service Association, 5% of all fatal motor vehicle accidents are caused by poor vehicle maintenance. About 25% of all mechanical failure can be eliminated by implementing a preventative maintenance plan and following up with regular vehicle checkups.

In an American Automotive Association study, it was found that that about 1/3 of Americans are unable to pay for unexpected vehicle repairs. The average cost for an unexpected repair was at least \$600 dollars. Repairs can easily run into the thousands of dollars de-



pending on the system being serviced. It was found that the most common vehicle breakdowns could be avoided with proper maintenance — saving the vehicle owner significant amounts of money.

By implementing a preventative maintenance plan with a set of color-coded UV leak detection dyes, car owners and businesses can reduce vehicle breakdowns and greatly extend the service life of their vehicles.

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PETE MEIER // Technical Editor

As with everything else automotive, the routine oil change has evolved. Back in the "old days" we changed the engine's life blood every three months or 3,000 miles. Filters were relatively similar and the choices for oil viscosity were pretty much limited to 10w30 or 10w40. But even with that much attention, engines of the day were considered close to the end of their useful life when the odometer broke six digits.

Today, drain intervals can exceed 15,000 miles, filters can be spin-on or cartridge, and the oil choices begin at 0w16 and work their way up from there. And engines are lasting two to four times longer than they did 30-40 years ago.

Ever wonder what changed?

Everything on the automobile is engineered, including the maintenance services required to protect the engine. The oil change intervals specified by the OEMs are based on a number of factors and it's increasingly important to understand what those factors are so you, as a professional technician, can help your customer make the right



choices in oil and filter selection.

So join me as I discuss some of the factors the OEMs consider when establishing their service recommendations, why a "one size fits all" approach to oil won't work, what to look for and what

to avoid when selecting a replacement filter, and why extending the service interval outside of that OEM limit could be a bad idea.

All of that and more is in the June edition of "The Trainer!"

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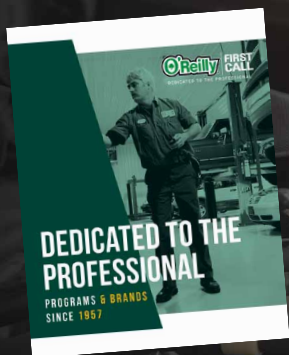
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