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Fact or fiction: When you take good care of your customers, they come back for all of their auto repair and service needs. That's a fact. So, why aren't we paying closer attention to spark plugs? Consider these five reasons to help convince customers to replace their spark plugs on schedule.

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INDUSTRY NEWS

DIAGNOSTIC HELP

8 QUESTIONS TO ASK DURING DIAGNOSTIC SERVICE

ASTECH //
Online Contributor

When you are performing a repair, you want to know what's wrong with the vehicle before you start replacing parts. But how do you know your diagnosis is correct from the start?

Accurate diagnosis is critical to precise, timely and cost-effective repairs. You'd be surprised how many shops don't have access to up-to-date software or the training to diagnose vehicles correctly.

You don't want to be a shop that wastes time subletting diagnostics or repairs. It adds to the repair length and increases costs, both of which decrease profits and frustrate customers. Instead, ask yourself these eight questions to make sure you can provide highly accurate and timely diagnoses for your customers' cars.

1. Can your diagnostic service access original build data? There's a big difference between generic data and original build data when diagnosing vehicle faults. Accuracy is difficult to assure when manufacturer-specific trouble codes can mean very different

>> ASK CONTINUES ON PAGE 6

BREAKING NEWS

INDUSTRY COLLABORATION

TECHFORCE SUMMIT EMPHASIZES COLLECTIVE ACTION

To continue to build momentum for TechForce Foundation's FutureTech Success® campaign, 30 industry leaders gathered in January for the inaugural annual summit of the FutureTech Success National Leadership Cabinet. Participants ranged from the heads of national associations, such as ASE and SkillsUSA, to corporate CMOs and HR/technical recruiting executives, as well as upper-level executives from Nissan North America, Interstate Batteries, Universal Technical Institute and Manheim/Cox Automotive.

"Our campaign is focused on increasing the number of qualified technicians in North America, but we need the buy-in of the entire industry to be successful," said Jennifer Maher, CEO/Executive Director of TechForce. "And that is exactly what we have received from some of the industry's

>> SUMMIT CONTINUES ON PAGE 8

TRENDING

REGISTRATION OPEN FOR ASA ANNUAL MEETING

The Automotive Service Association opened online registration for its 2018 Annual Business Meeting, set for May 2-5 at Walt Disney World Swan & Dolphin Resort in Orlando.
MOTORAGE.COM/ORLANDO

AUTO CARE TESTIFIES IN SUPPORT OF WARRANTY PARTS NOTIFICATION

The Auto Care Association testified in February for passage of legislation that would ensure car owners are provided with warranty rights information when buying or leasing a vehicle.
MOTORAGE.COM/RIGHTS

AAPEX ANNOUNCES 2018 DATES

AAPEX 2018 will showcase the high-tech, $740 billion global automotive aftermarket industry during this year's event, Oct. 30-Nov. 1 at the Sands Expo in Las Vegas.
MOTORAGE.COM/AAPEX18

DENSO ACADEMY EXPANDS TRAINING

DENSO Products and Services Americas, Inc. has added three new training classes to its selection of instructor-led automotive repair courses through the DENSO Technical Training Program.
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LG, HONEYWELL DEMO CYBERSECURITY SOLUTION

Honeywell and LG Electronics will work together to develop a solution to address threats associated with the increase in vehicle connectivity technology.
MOTORAGE.COM/LG

PHOTO: SHUTTERSTOCK.COM /KURHAN

>> ASK CONTINUED FROM PAGE 4

things for each carmaker. Choose a diagnostic service that provides relevant results according to a vehicle's make and original build data.

2. Is the information legal and licensed? Carmakers often make their diagnostic software proprietary. Only properly licensed users receive up-to-date information, including new model releases and bulletins. Be sure your shop's diagnostic services come from a licensed provider that uses paid OEM subscriptions.

3. Is your shop using a licensed OEM version for vehicle programming? It's never a good idea to use a copycat service or product. Using software that's out of date or unlicensed can cause ECU problems after a reflash or reprogramming. Are you willing to chance compromising a customer's car with inadequate software?

4. How often are OEM updates performed on your diagnostic device? Some aftermarket scan devices add OEM updates in bulk batches, sometimes only twice per year. That can leave huge gaps in coverage, especially if you work on newer vehicles. Plus, those updates can cost your shop nearly $4,000 for the software alone, just to keep your software current. Choose a diagnostic provider that adds updates as they become available and for no extra charge.

5. Is OEM information downloaded when the diagnostic tool is connected? Cheap code readers and diagnostic tools simply scan for trouble codes and read live-stream data. That doesn't tell the whole story for an accurate diagnosis. If your diagnostic tool doesn't download the vehicle's OEM information, you could have missing or inaccurate data.

6. Does your device provide OEM recall and TSB information automatically? Recalls are prevalent on all makes and models, and technical service bulletins can lead you to required repairs quickly. A high-quality diagnostic tool or service should have the ability to provide recall notices and TSB information automatically, as soon as the device is connected. If it doesn't, reconsider your tool's quality.

7. Is the technician trained to scan and diagnose vehicles? Constantly changing technology and new vehicle features put technicians at a disadvantage. Staying current on diagnostics is nearly impossible while trying to remain productive, unless that's their job day in and day out. It can lead to mistakes or frustrating time delays. The best diagnostic services offer support and diagnosis by Master Technicians, both remotely and on-site.

8. Is there coverage if you encounter an issue? If there's a problem with the equipment or the scan data, you want to know someone has your back. Top-quality diagnostic services provide guaranteed support for their product and the vehicle you're working on so you can stay productive.

MITCHELL 1 MANAGEMENT WORKSHOP COMING TO SAN DIEGO

MOTOR AGE WIRE REPORTS //

Mitchell 1 will hold this year's first Shop Management Workshop, April 26-28 in San Diego, Calif. at the San Diego Marriott Mission Valley. The training is for shop management software users who want to learn more advanced capabilities, shortcuts and new features to run their businesses more efficiently.

The training session focuses on best practices and guides users through all levels of functionality of Mitchell 1 Manager™ SE and ShopKey Shop Management SE. Emphasis is on features in the 7.0 version of the software, but previous versions are also covered. Topics include program setup, inventory, reporting, scheduling, advanced transactions and aftermarket cataloging.

A practice lab equipped with computers and staffed by product specialists will be available throughout the event so attendees can practice and apply the skills they are learning in the training sessions.

The workshop will be led by John Dwulet, senior product manager for Mitchell 1's management software solutions, and Tim McDonnell, senior market manager for Manager SE. Attendees can expect lively discussions on how to use the management system to energize their business, increase profits and boost productivity.

"This advanced training turns existing shop management system customers into power users who get the most out of their software and business," said Dwulet. "The sessions will uncover strategies that attendees can use to compete successfully, maximize their maintenance and repair opportunities, and enhance their relationships with customers."

Adds McDonnell, "For the experienced Manager user, the workshop provides comprehensive training that increases the value of their shop's software investment. The interaction between attendees, sharing methods and tips is priceless."

Attendees can earn 30 AMI credits toward the Accredited Automotive Manager (AAM) designation by completing the workshop.

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>> SUMMIT CONTINUED FROM PAGE 4

strongest advocates and highest profile leaders.

"No one entity can fix the qualified technician shortage problem. We're so grateful to have the support, engagement and enthusiasm of leaders throughout the industry."

The Cabinet spent two days exploring ways to implement and activate the campaign within their own companies and associations, and brainstorming collaborative ideas around which the whole industry can unite.

"We must beat one, collective drum," said Maher, "that we are one of America's largest industries, and we need a strong, trained, viable workforce. For decades, students have been told there's only one road to success, and that's through a four-year degree. They've been led to believe that working with your hands and using one's natural tactile intelligence is a 'less-than-desirable pathway.' But it's simply not true, and America needs its skilled technicians to keep it rolling. Today's vehicle technician jobs are in high demand and provide a solid middle-class career path. It's time we stand up and rally together for our own talent pool."

Demonstrating the collective power of this initiative, competitors — Shell Lubricants and Valvoline, Advance Auto Parts and AutoZone, Nissan and General Motors — left their business cards at the door, pledging instead to unite behind the FutureTech Success initiative, aimed at helping to motivate, train and develop technicians.

During the summit, TechForce unveiled its revamped website, designed, built and managed by Autoshop Solutions. The new site includes the FutureTech Resource Hub, a one-stop-shop portal through which parents and future technicians can find after-school programs, clubs, events, technical schools, scholarships and trainings that help develop their skills and pathway to the technician profession. Additionally, the site includes the new Industry Hub (I-Hub) through which industry recruiters, managers, working technicians and educators can find helpful resources to support and connect with future technicians.

"Anyone — from interested students to companies wanting to recruit the best technicians — can find what they need on the website," Maher said. "Students and their parents can explore what the technician career is all about through our collection of videos, while companies can access and share the best practices to attract, develop, train, hire, recruit and retain technicians."

To kick off the summit, a joint luncheon was held for the members of the National Leadership Cabinet and members of the Arizona FutureTech Workforce Development Council. Having national leaders joined by their local counterparts raises the bar for technical education in Arizona. Together, the organizations ensure that middle- and high-school students create opportunities to connect STEM subjects to automotive and diesel technology; provide national resources, training aids and donations to programs and students in need; and ensure that industry is part of the solution in developing tomorrow's workforce of vehicle technicians.

Driving home the point was a "Connecting the Dots" theme emphasized by two of the Summit's kickoff luncheon speakers, who are both recipients of TechForce and FutureTech Success campaign efforts. Tony Camp, principal of Trevor Browne High School in Phoenix, said his school has benefitted from an auto shop makeover with the help of TechForce. Crist Morillon, an entry-level Telsa technician, shared her personal journey to becoming a technician, beginning with SkillsUSA, Phoenix's Metrotech High School, Universal Technical Institute, and now Tesla.

Both Camp and Morillon said TechForce is a bridge for the resources available throughout the industry in a way future technicians, parents, schools and employers can all find each other.

The Leadership Cabinet consists of industry entities including manufacturers, associations and celebrities. MA

REPUTATION REPAIR

Four quick tips to help keep your shop's online reviews in check

ROXANNE DOCHE // Contributing Editor

We live in a tech-savvy world where online reviews can be just as powerful, and possibly even more influential, than its traditional word-of-mouth counterpart. Within the span of a few keystrokes or swipes across a handheld screen, your shop's digital footprint is created. This can make or break your small business.

While glowing reviews are obviously the gateway to a positive online presence and good for driving a steady stream of customers to your door, negative reviews can potentially cause damage. One person's opinion, warranted or not, can adversely affect your new customer acquisition and sometimes even loyal customer retention.

However, there is a method to managing these reviews to help lessen and even prevent harm to your business's growth.

1. Stay one step ahead

Many shop owners assume that because they aren't listed on a review site, they don't need to worry about it. But the truth is, on many of these social platforms any user can add a listing — which means that customers can in fact leave reviews. It's extremely important for you to stay on top of your business listings and, if you haven't already, claim your listing. It's a necessary step so you can manage any review that is left for your shop.

It's also a good idea to have a marketing plan in place, even if it's just a basic one that includes an email

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schedule and a social media calendar. Add an action item in this plan to check your reviews regularly. This way, if any new reviews are added to your business's page, you will be ahead of the game. You want to be aware of any positive reviews as well as any negative reviews. While negative reviews will need to be handled carefully, positive reviews make great social media posts and quotes for your website.

There are also tools you can use that will alert you of your shop's online presence, like Google Alerts or Brand24. These alerts are triggered by keywords, so if you have a common word or phrase in your shop's name, you may receive some alerts that are unrelated to your business. At Management Success, many of our clients are often featured as community ambassadors or recognized for their involvement in charitable events. If this is the case in your shop, these alerts would notify you that your shop was mentioned in a local article. This can be a great marketing resource.

2. Act quickly

Once you are alerted to a negative review, act fast. Especially if it's a problem that has occurred within your shop, you will want to address it immediately. The more time that passes, the more detrimental it can be to your business and the harder it is to convince the reviewer to remove it.

I know that it is sometimes easier said than done because you take pride in the services that you provide, but you should try to not take any negative feedback about your shop too personally. Many times, the reviewer is stating an opinion and not a fact, so the negative review may not seem fair to you. Remove the emotional element and address the issue privately to ensure the best success.

3. Reach out to the reviewer

If a negative review is left on your business's page, you definitely do not want to ignore it. But you also do not want to respond publicly, if at all possible. This often creates a public exchange between you and the reviewer, which can actually make your situation worse.

YOUR DIGITAL FOOTPRINT IS A DIFFICULT PATH TO CONTROL. THE ONLINE UNIVERSE CAN BE A WONDERFUL RESOURCE WHEN USED RESPECTFULLY, BUT IT IS ALSO EASILY ABUSED. KEEP AN EYE ON YOUR ONLINE REPUTATION AND STAY PROACTIVE IN PROTECTING IT.

Many sites will allow you to send the reviewer a message. Use this as an opportunity to apologize to the customer and explain how you plan to resolve the situation. Keep your reply short and to the point. Empathize with how they are feeling, address their concerns and let them know you care enough to take action. Sometimes, it may even be necessary to offer compensation for any inconvenience caused. Don't become defensive or try too hard to over explain. If handled correctly and calmly, the reviewer will often remove a negative reveiw from the site.

If the reviewer does not remove the negative review, you may need to respond publicly. Briefly apologize and express your willingness to take action. If the reviewer continues to respond, tell them you would like to speak with them privately.

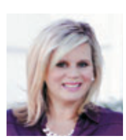
4. Keep providing great service

While it isn't always possible to "bury" unfavorable reviews, you can outshine the negative with more positive. Your shop is known for outstanding service and quality repairs. Do not let one unhappy customer rain on your parade. Let people know where they can review you by posting a sign on your service desk. You can make a game of it and offer a discount or raffle entries to those who share their satisfaction.

Your digital footprint is a difficult path to control. There is so much information that is readily available, literally in the click of a second. While the online universe can be a wonderful resource when used respectfully, it's also easily abused. Unfortunately, information can be fabricated and falsified. Review sites do their best to eliminate spam and false reviews, but they cannot catch everything.

Keep an eye on your business's online reputation and stay proactive in protecting it. Everything begins and ends with great service. If you continue to do the best job that you possibly can and your keep your customer's best interests in mind, you have already taken the first very important steps to ensure quality control going forward.

Every person and every shop will make a mistake at some point. Use this experience as an opportunity to improve. Responding to reviews can be a great way to learn from and build goodwill with your customers. MA



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Use a bad review to get the customers you wish you had

Hold your ground and don't let the 20 percent of haters hold you back

Do you want to have a mediocre 4-star or a mind-blowing 4.8-star average review rating? Will you put in the work to make that happen, or will you be mediocre like the shops out there that are fighting to stay alive? To get something you've never had, you must do something you've never done, so what will that be? Let's listen to ATI Instructor Nick Peyton explain how you can get the customers you really want.

Anyone can get a 4-star average review rating. It's easy — just show up, do things the same way they have been done for 20 years, and never push yourself to be the best. As the industry changes, most won't understand why they are getting left in the dust. Why are they dealing with the bottom 20 percent of the customers who fight over price, bring in their mud-covered used parts, and complain about you online? Are they attracting these people? Starbucks, which receives $22 billion in revenue annually, is the most expensive cup of coffee on the street, and they are never slow. It's not that they have the most amazing cup of coffee. What are they doing right?

5-star service comes first

To get an average 4.8 out of 5 or higher, you need to get a high volume of 5-star reviews. You will have to increase the quality of your service in the customers' eyes. A few examples: thank-you calls, courtesy checks and all the stuff most have heard before. However, the part that is usually missing is the customer's perception of your shop's value. Do your customers see the value in the products and services you offer? Bottled water is a $16 billion industry annually, and it's free out of the tap. People buy bottled water because they see value in it. What are you missing?

Some customers are not going to like the positive changes you make because they are not willing to pay for your quality. It is usually about 20 percent of your client base who cause 80 percent of your problems. And YES, they are going to complain when you make your service better, but these are the 20 percent who are already complaining, so what does it matter?

You have to believe in your shop, your team and yourself. If you listen to your bad customers, they will put you out of business. If you're going to be around in the future, it must be a profitable business first.

When you start making changes to your shop, you are going to see negative reviews first. This is a good thing. The bottom 20 percent will immediately post a 1-star or 2-star review to whichever review page they spread their negativity through. Haters say exactly what they need to say to keep the other customers like them away. A few examples: "These guys wanted to look over my whole car, and I just need brakes;" "I could not bring my own part;" "They would not sell me the part at the same price as I found on eBay." Remember, it is important to respond to all negative reviews in a positive way. Make sure you list how you prefer to be contacted. This shows the customers you want that you care, and you are trying to make them happy.

You have to hold your ground on offering the best, most amazing customer service in your area, and don't let the 20 percent of haters hold you back. If you do, this can backfire. Let me explain: you need to get 5-star reviews in the beginning to overcome the few hater reviews you will get while trying to make it better. When you have 20 5-star reviews about how you took the time, answered questions and took care of their car and their family — these reviews are the ones that attract the customer you want.

WHEN YOU START MAKING CHANGES TO YOUR SHOP, YOU ARE GOING TO SEE NEGATIVE REVIEWS FIRST.

Simply stay the best

As you get through this change, hold your line on your quality, pricing and culture. You will keep getting 5-star reviews and the 1-star customers will start finding a cheap shop with bad service. You must set the standard.

When I teach class, I tell every student that I want honest feedback. If we need to improve on something, let us know; please comment on anything we can do better. This is the only way for us to be the best. I will never get all five out of five stars because in the process of pushing the class to be the best, I will rub someone the wrong way. I would rather change 19 lives and have one student who just does not agree with me, than have 20 people who feel the class was ordinary. Trust me, it's hard to have someone walk out and take that in a positive way. But again, do you want to be the best or mediocre?

Look at your shop through the customer's eyes. In today's world, even if they are referred to you they will use Google to find your website and phone number — and check your reviews. The average consumer will click on the shop that has the highest reviews, and then click to read that shop's lowest reviews. Think about when you look at reviews online for a product you want to buy; you do this, don't you? You want potential customers to read "They would not put my used part on;" "they wanted to look over everything and build a plan for my car, such bad people." This will do a few GREAT things. The quality customer will laugh at those and say to themselves "We all know those people." Then they will check your 5-star reviews to see why people are coming to you. Your great customers will sell your services for you. Better yet, the customers who want to bring in their own part will read that and call someone else. If you keep dealing with customers who don't want to play by your rules, recommend a shop that will install their part, and let them put that shop out of business.

The best thing you can do is come at this from the other direction. Instead of arguing over customer-supplied parts, put up a sign that says: "In an effort to give our customers the best service, we do not install customer-supplied parts." Let them ask you why, and be able to explain. Remember when a customer gives you a great comment, ask them to post that in the review they give you online. Get your good customers to help you.

It's really simple. Treat people the way they want to be treated. Start by setting a good impression every time a customer comes in. Make sure the shop, bathrooms and customer waiting areas are clean. Everyone can fix a car. Talk to them about the repair like a neighbor. Show them what is wrong so they can start trusting you, and we can turn the perception of this industry around. Some consulting companies want to make this process sound complicated so you have to pay them to get the knowledge. It's not rocket science, and all of us at ATI want you to be the best shop in your area!

If you want to find out how the best shops consistently get Google reviews and need more help, then go to *www.ationlinetraining.com/2018-03* for a limited time. We will send you more quick tips on how to ask for reviews and get them. It takes around 90 seconds or less to get your customers to tell others how much they love you in a Google review. MA

CHRIS "CHUBBY" FREDERICK is the CEO and founder of the Automotive Training Institute. ATI's 115 associates train and coach more than 1,400 shop owners every week across North America to drive profits and dreams home to their families. This month's article was written with the help of Coach Nick Peyton. *chubby@autotraining.net*

Building shop management skills is a process

It must go beyond just another seminar or sales course

Shop operators are experiencing challenges like none ever seen before in our industry.

Consider the development of vehicle technology over the past five years. Consider the change in vehicle service intervals. Consider the cost of diagnostic equipment to even begin the process of entering and sustaining this profession. Consider the technical skill level required today to be on the shop floor. Consider the uninformed consumer who doesn't truly understand its complexity. Consider the change in vehicle sales mix with the dramatic increase of import vehicles and the decline of the North America brands. Consider the lack of larger facility space, which is needed for shops to hold more equipment than ever required before to meet complexities of vehicle service. Consider the longer period of time required to properly diagnose and service the vehicle to manufacturer recommended standards.

Shop business has changed drastically, yet it is not being acknowledged properly within the industry. Every level of the industry talks about the desire to drive more sales. The commodity side of the industry has the loudest voice and spends money on marketing that screams to shop owners "more activity" and "make more sales with our products and programs" and "be price competitive." The commodity side of the aftermarket does not understand how the shop business level has changed and the need to address real shop issues — productivity and client relationships.

Step back and consider the following: The manufacturer, warehouse distributor and part suppliers are in the commodity business, and they require volume sales of their products to survive. Their marketing displays their desired results. The service provider, however, is in the knowledge business and does not so much require the commodities to survive, but rather requires proper billed hours at the right rate to survive and prosper. Shop owners are not getting exposed to, or taught, how to ensure proper net income is achieved and retained, allowing them to grow and enjoy a rewarding professional career. Instead, shop owners are approached by the commodity side and sold on the idea to attend a presentation or seminar that preaches more sales, more vehicles to service, more activity. These are "motivational" talks only and do nothing to teach the shop owner proper business acumen and best business practices. The shop owner is never introduced to his/her own numbers and allowed to work with them and clearly understand what they mean. This is an absolute tragedy within our industry.

THE SHOP BUSINESS HAS CHANGED DRASTICALLY, YET IT IS NOT BEING ACKNOWLEDGED PROPERLY WITHIN THE INDUSTRY.

Consider that high percentage of shop owners who have high school-level education as their formal education. From there, they worked hard and achieved the designation of holding a technician license. They are knowledgeable about the vehicle and the best shops have a concerted effort in place to stay on top of this. However, one must ask, "Where were they taught to read a balance sheet? Where were they taught how to measure and manage their business? Where were they taught the difference between mark-up and gross profit? Where were they taught shop site efficiency and its effect on the bottom line? Where were they taught to manage gross profit and measure net profit? Where were they taught to create a shop team through personnel development? Where were they taught the costs of accounts receivable?"

The facts are that the average shop today is missing between $30,000 and $35,000 in net income per bay per year from a lack of management of current business coming through the door. Independent shops don't need more immediate vehicles to work on; they need to learn how to manage properly what they currently have. If their business was managed correctly through the process of learning to develop best business practices and measure and manage productivity instead of chasing activity, suppliers in this country would be getting paid in full each month and at better margins! The shop owner and staff would enjoy a professional personal income as well as have the cash to move his/her business forward.

Parts suppliers and warehouse dis-

tributors (WDs) tell me shop owners are not interested in business management. This is true based on the fact that suppliers and WDs sold seminars in the past and called them business management seminars, when they were, in fact, sales courses. This industry does not need another sales course. Those part suppliers and WDs failed their customers! The trust has been broken. They sold shop owners training focusing on sales techniques, making the shop busier through increased activity and selling more parts, forcing shop owners to work harder and not smarter. Sales of the shop went up, but net income did not. The credibility of these suppliers and WDs has to be rebuilt.

Many shop owners, as licensed technicians, are nervous about approaching the real issue of shop business management on their own. I've heard from them, "I will not understand; I wasn't that good in school at math and English." Or, "I'm a tech, not a pencil pusher;" "That's why I have a bookkeeper because business management is numbers and paperwork that bean counters have to understand." These reasons are seldom spoken to their supplier; instead, they say, "It is too expensive;" "I don't have time;" "I don't need another course;" "No one can show me something I don't already know;" or "That stuff isn't worth it anyway." To all shop owners clinging to these excuses, wake up and do the math — you bought yourself a job and you know it; your debt is out of proportion to the business; and your stress level has increased to undesirable levels, which is affecting your family relationship. Do you want to do something about it or not?

Understanding real shop business management is easier than you think; however, you must work with it because it has not been part of your daily activity in your shop throughout your career. If you are a shop owner and a technician, you can grasp and understand proper business management! However, the real question is do you want to learn? If you don't want to learn, then no one can help you. You should wind down your business and get out now while you can, as the next three to five years are going to be very challenging to say the least! If you do want to learn, then plan the time now and enroll in a proper business course that is independent-shop specific. I'm confident that if the course is the right one, you truly will enjoy it.

You did not create the current industry issues. This is just reality today. This business has changed, and if you are going to be in it, you must clearly understand the business management side of it. MA

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

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Shop owner strives to surround himself in business with like-minded people

ROBERT BRAVENDER // Contributing Editor

What you bring to the table is vital. Craig Walter became an independent when he took over Don's Auto Ade Tire & Auto Repair back in 2003, but the time he spent as a regional manager for Goodyear gave him insight into business philosophies and practices years before sharing such info became popular. In fact, he was frequently its source when working with various shops and dealerships.

Take the fairly recent trend of car care clinics — Walter recalls placing a newspaper ad back in 1977, which offered to hold clinics for women only. "I had that underlined," he notes. "It was an $8.50 ad that I answered for almost two years, and it turned into something great. (Clinics aren't) anything new.

"I started with Goodyear in '68 and worked for them for 25 years," states Walter. "I started out as a technician and worked my way up to store manager, then retail sales manager." Once he became the Regional Automotive Service Manager, Walter was involved in establishing Goodyear's training centers in the Chicagoland area, which included Warrenville, Ill., home to Don's Auto Ade.

"Don started the shop years ago when he was a parts guy," Walter explains. "As time went on, he got tired of doing that and got into auto repair, and that's when I met him in the late '70s."

But Don had a reputation with company reps — he didn't tolerate them. "He had a Goodyear sign up, but he wasn't selling Goodyear tires," chuckles Walter. "I stopped there several times, and of course he threw me out. By the third time he finally said he wasn't interested since we really didn't care about his business. I told him I did — that's why Goodyear sent me."

Don used the excuse that he didn't have enough room to stock tires. "So I told his guy behind the counter that I would come back Saturday," says Walter. "I cleaned up a storage room they had; the next week I told Don they now had space for 50 Goodyear tires. He started buying them." And eventually became a Goodyear dealer.

Having earned Don's respect, Walter began working more closely with the shop as the years went by. Then two things happened: Goodyear decided to get out of the auto repair market in the Chicago area, and Don decided to retire — an ideal time for Walter to buy the business. Still, the first few years weren't easy, especially after they moved to their current location. Ironically, it used to be a Goodyear franchise Walter had helped set up in 1988.

DON'S AUTO ADE

Warrenville, Illinois // www.donsautoade.com

Craig Walter Owner	**8** No. of bays
1 No. of shops	**$240** Average repair order
35 Years in business	**125** No. of customer vehicles per week
5 No. of employees	**$1.1 million** Annual gross revenue
6,000 Total square footage of shop	

"When we took that [building] over, it was about as low as it could be." he relates. Not only were all the lifts gone, but the previous tenants had a bad rep. "I thought, man, am I doing the wrong thing here? But if anybody can get this place going, it's me. The first two years here we kind of lost our butts, but none of my guys were out of work. Now we're hiring more people. It's just a matter of how you're going to run a store."

Today, Don's is an independent Goodyear dealer, with all the accreditation that entails.

"I've been doing this my whole life," notes Walter. "You surround yourself with good people and teach them the right way to handle clients — everybody in my store talks to customers,

PHOTOS: DON'S AUTO ADE

even tire people — and I don't see how anybody could lose a customer.

"I don't put a yellow line on the floor saying 'customers not allowed,'" he continues. "(I used to) ask dealers, 'what does that line mean to you? Are we stepping into a new country?' No, the service manager and mechanics just didn't want to be bothered with the guy who's going to spend $3,000 to fix his car. Liability? That's why they pay insurance. I walk customers through my shop every day. We're not going to let them go wander around by themselves, but we show them the situation, explain it to them."

A computer simulation program Walter uses through a smart TV also aids enlightenment. "Say someone wants to know where their timing belt is," he outlines. "I'm not only going to do that, but also show them the inside of the motor running and what it looks like when the belt breaks."

Naturally, Walter heard about this program through Goodyear; it costs him about $60 a month. "They've got new services coming out all the time. There's so much you can educate the customer with now. And when they go home, they feel so much better that they made their own decision, because it made sense to them."

However, before it makes sense to the client, it's got to make sense to the technician. As Walter sees it, theoretical knowledge helps with problem solving skills. "I recently bought a piece of equipment because it's user-friendly," he explains. "But when it tells you a car needs an oxygen sensor, that doesn't mean it actually does. These things are dialed into whatever that computer wants to see, and if it doesn't want to see it, you're going to have an engine light come on in two months and you've already taken $1,000 from the customer. The techs need to know the theories behind how these parts work together and what else may be wrong in the system — and be able to explain that to the customer."

For instance, one customer was getting all sorts of warning lights. "It got to the point where the car put itself into theft mode and wouldn't even start," Walter relates. His techs looked into the battery cable. "That cable was pretty intense. For one, it was 11 feet long and sprouted out in three different areas. You should have seen the corrosion growing inside this thing. If you don't have the theory behind it, you won't even know where to start on a problem like this."

Walter helps teach his staff, because what they bring to the table is vital.

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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Marketing your shop in the age of social media

INVEST 20 PERCENT OF YOUR AD BUDGET INTO THE CUSTOMER EXPERIENCE

BOB COOPER// Contributing Editor

Over the past 100-plus years, marketing strategies and the brands that were built were developed by two entities: the client and the ad agency. The client would tell the agency how they envisioned their brand, and the agency would develop the advertising campaigns that would create that very same image in the minds of the targeted consumers. The tobacco companies wanted to create brands that would cause a consumer to feel good when they used their products, and the ad agencies did a great job of achieving this objective. Volvo wanted to create a brand that reflected safety, and as we all know, just about every Volvo ad sends that very same message. After 100-plus years, that systematic method of brand creation is now dead. Not just for companies like the above, but for auto repair shops just like yours. Let me explain what has happened.

The ability to create a brand is no longer under the control of a product or service provider, nor the ad agencies. In today's world brands are now created by one entity more than any other, and that entity is social media. The way your shop is going to be perceived in your community is based on what is being said about you, your company and your employees on social media and review websites. You may believe that you provide a great service, and that your technicians are second to none. You may also invest a lot of your hard-earned money into advertising programs to try to get that message (brand) into the minds of your targeted customers. But in reality, if the chatter in social media says that you overcharge, or that you don't live up to promised completion times, then whether you like it or not, that will become your brand.

So here are my recommendations. First of all, accept the fact that social media is here to stay, and it is where your brand is going to be built. Secondly, you should create a plan that will have a positive impact on what is being said about you and your shop on social media sites. Obviously there are a number of things you can do, but nothing will ever trump extraordinary service. The reason companies like Nordstrom, Zappos shoes and Starbucks have such extraordinary reputations (brands) is because they deliver extraordinary service. I would strongly encourage you to review every customer touch point from fielding that first call through your customer follow-up calls, looking for ways to improve the entire customer experience.

Lastly, I am going to suggest you do something that your competitors would never dream of doing, and that is invest 20 percent of your ad budget into the customer experience. This means investing in the customer waiting area, your shuttle service, refreshments, extended warranties, customer follow-up and the plan you have in place for dealing with disgruntled customers.

The Marriott Corporation discovered that they were getting higher CSI scores from customers they dropped the ball with, yet the customer was pleased with the resolution, than from those who had flawless stays at the Marriott. The lesson they learned? When a mistake is made people typically don't expect a resolution that will make them smile, so when they are completely satisfied, they are pleasantly surprised. This is why the Marriott immediately allocated a good percentage of their training resources to dealing with customers who had a bad experience. Without question, you should do the same.

In closing, brands are no longer built on Wall Street, but in today's world they are being built each and every day on the web. I can only hope we all agree that social media is here to stay, so you need to invest in making the customer experience incredibly positive, because if you do, your customers will do what agencies used to do and create an extraordinary brand for you. MA

BOB COOPER is the president of Elite, a company that offers coaching and training from the industry's top shop owners.
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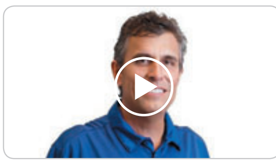

The importance of finding a work-life balance

MOTORAGE.COM/FindBalance

MECHANICAL MOMENT

FINDING A SIMPLE FIX FOR A NISSAN NO START

VEHICLE: 2013 Nissan Sentra, L-4-1.8L, Automatic Transmission

MILEAGE: 48,345

PROBLEM: The battery went dead overnight. The owner tried to jump start the vehicle, but the engine would not crank over. It was towed to the shop.

DETAILS: When it arrived at the shop, the malfunction indicator light was off and there were no DTCs on any modules. The Tech-Assist consultant advised the shop to unplug the battery for about five minutes to reboot the modules. After the reboot, the engine would crank and run with a jumper battery connected.

CONFIRMED REPAIR: The technician performed a full charging system test and found the battery to be defective. He replaced the battery and the problem was fixed.

NOTE: Losing power and/or being boosted will sometimes cause glitches in certain modules — rebooting them often fixes any issues.

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

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Tarrytown, New York

MARCH 21-24
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Omni Orlando Resort at ChampionsGate
Orlando, Florida

APRIL 14
ATI: Eight Essential Skills for Shop Success
Hotel to be determined
San Jose, California

MAY 2-6
ASA Annual Meeting and Conference
Walt Disney World Swan and Dolphin
Orlando, Florida

JULY 23-26
2018 ASE Instructor Conference
Embassy Suites
Friscoe, Texas

AUGUST 8-10
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THE MISSING BIRTH CERTIFICATE

THE F-150 with the ABS problem

WHAT DO YOU DO WHEN YOU THERE IS NO "AS BUILT" DATA PUBLISHED FOR A VEHICLE?

JAIME LAZARUS // Contributing Editor

Most of us have seen that vehicle that arrives at the shop with an indicator illuminated on the instrument cluster, but covered and hidden by some picture, postcard or a sticky note. In some rare cases, the customer is actually at the shop because that light is on and they are interested in getting the problem resolved (snicker)! The others, when questioned, will admit "that light's been on for some time" and they're really not concerned about it. Some may be curious and want to know what's causing it but have priorities reserved for their original complaint. Can you imagine, though — an employer requiring the vehicle problem to be addressed or else the vehicle cannot be driven?

Such was the case with a U.S. Forest Service truck, a 2007 Ford F-150. The anti-lock brake system (ABS) light was illuminated and therefore — according to state law — the vehicle had to get repaired before it could be driven again. There's a liability issue to consider. Should a crash have occurred and the driver knew beforehand that the anti-lock brake system may not operate as designed, the state could have been brought into litigation for negligence (or something else). So it's a set policy for their vehicles to be repaired, for the safety-related systems to be operating correctly and — in this case — for the ABS light to be extinguished before the truck is returned to service.

The vehicle was a "plain Jane" Ford truck. So basic was this truck that it had roll-down windows! This is the type of truck you see government agencies purchase by the hundreds at a time that are all identical. Because they are bought with taxpayer dollars, they usually have little to no convenience items and are only equipped with standard options. This truck's standard options included an anti-lock braking system, and it had a problem. The shop where it was towed analyzed the system and determined the ABS module needed to be replaced. The procedure for replacement of that module includes having to program it to that particular vehicle. I am the mobile technician they usually call for reprogramming services.

PHOTOS: JAIME LAZARUS

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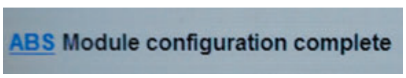
Simple job

When I was phoned ahead of time to estimate the cost to program that module, I had absolutely no idea what the job would actually entail until I completed the work on the vehicle. I quoted the shop's costs based on the labor time guide just as I usually do, but in this case the labor time guide made assumptions that did not apply to this job. Those were reasonable assumptions, and I had to believe there wouldn't be any problem finishing the task. I learned valuable lessons from what happened next! Do you ever work on government-owned vehicles? If so, have you ever tried to change your estimate after it was approved?

In my training classes, I instruct attendees to always look up the module replacement procedure before beginning the job. I'll admit I don't always practice what I preach. I will sometimes do module programming without reading any of the instructions published regarding the module replacement. My assumptions are based on experience — that it's going to be done the same way on the 101st module as it had been done on the last 100 I programmed before. What I preach is intended to save someone else some trouble or time based on lessons I've learned. This job humbled me because I should have listened to my own instructions! Question: At what point during the job should we research the proper way to do it?

WHEN ILLUMINATED, it is one reason this vehicle may NOT be driven.



IDS MESSAGE INDICATING PMI was successfully completed.

THE LOCATION is directly below the air filter housing, just rearward of the left headlamp.

Once the used module arrived at the shop's location, I received the call and scheduled a time to go there, install it and program it to the vehicle. When leaving my office, I remember jinxing myself by saying how simple this ought to be and estimated what time I would be returning that day. After all, I thought, I've done several of these using both new and used modules, and all of them in the past were finished in short order!

The procedure is typically straightforward. You begin by "inhaling" (that is, capturing information) data, turning the key off, installing your replacement module and turning your key back on to program the data into that module. This procedure is called Programmable Module Installation (PMI). Whether you're using a j2534 device or the Ford IDs software, the procedure is the same.

I went through the steps as I so often had done in the past. At the end of the programming event, it said everything went successfully. I didn't expect any problems. I cleared all codes when I was done and left the key in the off position for 30 seconds before starting it up again. Immediately upon starting the engine, the ABS light illuminated brightly as if to be thumbing its nose at me. "What the heck?" I thought. A quick look at ABS diagnostic trouble codes (DTCs) revealed a module configuration failure error code number B2477-00.

Maybe not...

Once again, before using any service information, I went back and made sure that I did everything the way I had done in the past. I made sure I correctly entered all of the information it asked for and when I completed the task, it gave me the same error message. Now, I thought, it was time to look at the service information. After all, as I've said before, when all else fails, RTFB (read that FINE book)! Afterwards, I reread it again because during the first time I didn't see anything different from what I had done! I started to scratch my head. I thought back to the comment I made

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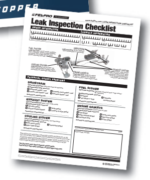

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COUNTERMATS (17.25"x12") AND POSTERS (29.5"x23")

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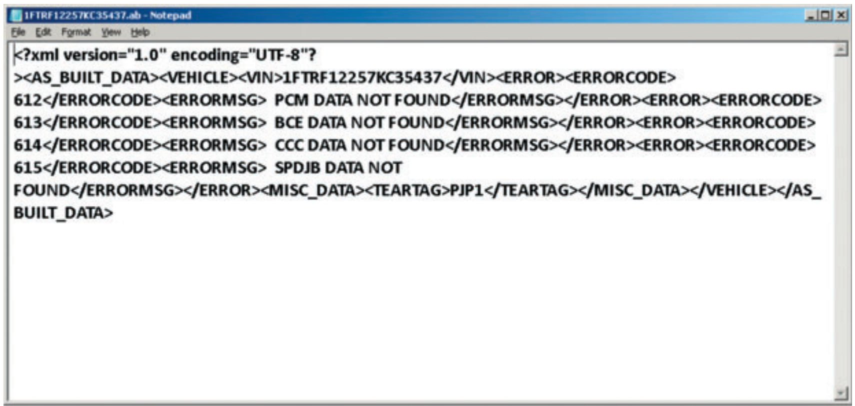
when leaving the office about how easy this was going to be.

There were many things running through my mind about why this error could occur. Now is when I read about the conditions necessary for the code to set. It was time to perform pinpoint testing. That means it's time to read voltage supplies and to test grounds. It was time to look at the data. It was time to look at the part number of the replacement module and make sure its application is correct. When all of that was as it should be, I reinstalled the original module to see whether it could be programmed either. Unfortunately, that module had internal faults, and because of this, I could not conclusively confirm whether the replacement module we were installing was faulty or not. Another module was ordered, this time from Ford. I wonder: are there times when you prefer to install a used module instead of a remanufactured or new?

I returned as soon as I was notified the new module had arrived. It wasn't actually new, but a remanufactured part. In my experience, I've found the Original Equipment (OE) remanufacturing process produces a more reliable component than a used part from a vehicle recycler. I went through the process and attempted PMI, but received a message that "configuration data could not be transferred from the original module. This module will require manual entry of configuration data." In other words, it was requiring As-Built data to be loaded into this module in order to configure it to the vehicle.

As-Built data could be considered the code engineers enter into a module to make it work right. Each module has a set of characters that must be entered in a unique order to configure it to a particular vehicle. Once done, that set of instructions makes that module work properly in that vehicle. Some say that As-Built data is the code used when the module was installed on the factory assembly line, hence the term "As-Built." In fact, when you enter As-Built data into a module today that happened to have been built many years ago, any updates that have occurred since are included in today's As-Built data code. I have yet to prove that statement false. Many times I will go back and try and do an update to a module that I programmed using As-Built data, and I will be shown a message that says no newer software is available.

I went to Motorcraftservice.com to download the As-Built data and found none was available, at all, for any module in this vehicle! I had never encountered such a thing! As-Built data was always displayed for every VIN that I had entered in the past. I requested the data through the link identified as "Click here if module data required is not available below." I also asked that they contact me as soon as possible once the As-Built data was provided on their site. An automated response indicated it "may take up to 48 hours to receive a reply" once I completed the request. For the second time, I left the shop with the truck in the same condition it was when I arrived. It is at this point in the process that I felt humiliated. Feeling confident that this will take no time at all jinxed me once again!



YOU CAN VIEW AND EDIT THE CONTENTS of the code that gets loaded into a module by using a text editor.

A few days later

Many times during each of the two following days I checked for any information but received no response from them. After the second day, I used the link at the bottom of the web page to contact Motorcraft about the problem. In my message to them I provided all kinds of contact information and explained the problem (again) in detail and that I had not received a reply. I received an almost immediate response saying the request for As-Built data was already "answered" on the day it was requested. I tried in vain to locate the "answer," even requested it re-sent, but it was never to be seen (and the As-Built data still was unpublished). I was getting frustrated that such a simple job was taking an extraordinary amount of time to complete.

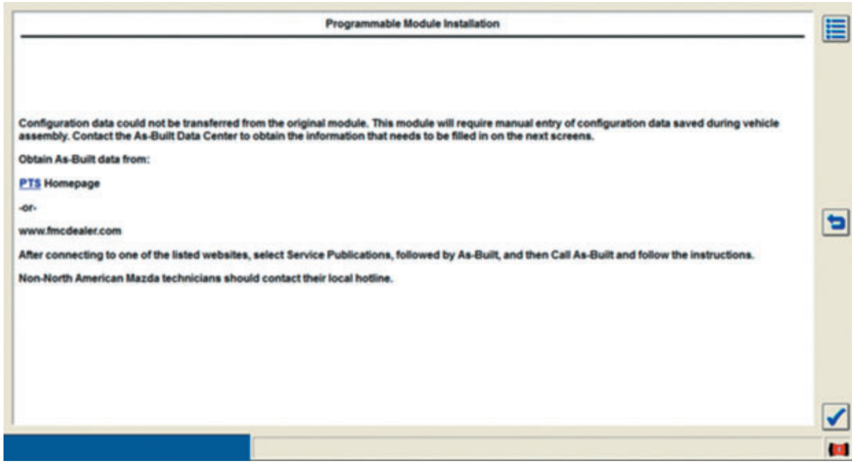
It was extremely frustrating to learn that Motorcraftservice.com had responded to my request for assistance the same day it was received. Unfortunately, I wasn't notified by them, their response was unavailable and it could not be accessed by anybody. No one had access to their response, and it's unknown to where they sent it. Lots of people who got involved in the situation could see that a response had been sent, but nobody could read what that response was.

Being a resourceful individual who

owns many different wrench sets for a reason, I used another tool to try to get the same information. This time, I logged into FordInstallerSupport.com, also known as the Professional Technician Society. It's the same site dealer technicians use. When I attempted to find the information, I saw it was unpublished there as well! This meant to me that the information was simply not available, maybe omitted. Since I hadn't heard anything from the other site, I then sent a request for assistance to this website as well.

I don't know how many days (yes, days) were spent trying to find a solution to the problem on my own, but there were many ways I attempted. For instance, I tried to install As-Built data for a very similar vehicle, but there were other error codes stored afterwards. I also contacted a good computer programmer friend of mine who helped me write some As-Built data, which would have been identical (with the exception of one character) to the one that was eventually supplied. I installed the file successfully, but thought about the liability (if that vehicle had gotten into a crash afterwards with that software that was loaded if it were not correct for it). I could have left myself open for a lot of liability and financial heartache, so I uninstalled the code I just flashed. It's unknown whether or not my NASTF SIR (Service Information Request) played any part in motivating someone at Ford to respond. It's anyone's guess, but this is one other resource I used. I could describe more ways, but I'm sure you get the idea.

About two weeks elapsed before I enlisted the assistance of the Ford parts distribution manager friend of mine from whom the latest module was purchased. He looked into the situation and came up with the same results. That information is unpublished and unavailable. He understood my frustrations, went up his chain of command and yet still came back empty-handed like I did. I'll say, without his intervention I seriously doubt I would have ever resolved the situation. With his help, though, enough people had gotten involved in the situation, and we finally got answers from an engineer who provided the data we needed. Question: How many coworkers, associates and people-in-the-know do you have in your network?



THE TECH MUST USE AS-BUILT DATA, but what to do if that isn't available?

How many cooks in the kitchen does it take to spoil the meal?

I am extremely grateful to the Architecture & System Design Supervisor for Ford Customer Service Division who contacted me personally! We discussed why so many problems occurred on this job and after our chat, he worked with me directly to resolve them. What was found is there were multiple requests for assistance, one from MotorcraftService.com and one from FordInstallerSupport.com, which for some reason went unanswered. It was suspected that since the first was supposedly "answered," that the second request could be ignored. Since no one could produce the actual answer, I never got the As-Built data needed to program the ABS module to this vehicle.

Some of the lessons I learned from this experience are:

1. Look up all of the information before estimating costs — EVERY TIME!
2. When the service information dictates a module has to be programmed a certain way, then make sure that you can finish the job once you get there (that the information required will be available — before you begin).
3. We need to have multiple avenues of resolving problems when it comes to programming vehicles, much the same way that we need to own multiple wrench sets. Having an established network of people in the know is critically important!
4. NEVER jinx yourself by forecasting how a job will go!

P.S. Kudos once again to Ford for caring enough to help me get one of their vehicles back on the road. A shout-out goes to Kevin Brady (Ford Motor Company) and to Dennis Boyle (Packer Norris Parts) who were both instrumental in resolving the problem. Thank you again gentlemen!

JAIME LAZARUS has regularly presented technical seminars since 1985. He recently taught instructors at the North American Council of Automotive Teachers conference and the NASCAR Technical Institute.
jlazarus1@cfl.rr.com

A HARD START 6.0 FORD

2005 FORD F-550, 4-wheel drive drivetrain with a manual transmission. The vehicle is powered with the 6.0L Diesel engine.

WHERE DO WE START WHEN CONFRONTED WITH A HARD START/NO START ON A DIESEL ENGINE?

ALBIN MOORE // Contributing Editor

Since the inception of the "electronic diesel" engine, the diagnostic path is a little different compared to an older mechanical engine, but the same questions must still be asked — is the engine cranking fast enough, is there proper compression in the cylinders, is the proper amount of fuel being injected into the cylinder and are the glow plugs working properly for the engine to start? In this article, I will lead you through the diagnostic process for a cranks/no start that I have used many times over the years.

Our example

Today in the shop is a 2005 F-550, with 77,000 miles on the odometer. The truck has a six-speed manual transmission with a four-wheel drive powertrain. Yes, this is a medium-duty truck, although the engine and transmission are the same as any 2005 F-250 that drives up and down the street. When being confronted with problems like this, whether you are working on a Ford or any other diesel engine, start with the basics and go from there.

The complaint on this vehicle is a no start. The owner states it started running rough and lost power. They stated the Check Engine light came on and he had cleared the codes with his pocket code reader. Don't you just love those dime-store tools that make the vehicle owners feel good? Well, in a case like this where the engine will crank but not start, any codes that might have been stored are not of much value to me anyway. While cranking, the engine will fire once in a while in an attempt to start and a little blue smoke comes from the exhaust, but that is about all that happens. At this point, I want to see some scan data while cranking to get a direction on this issue.

For no starts/hard start problems, I will always begin my testing with a scan tool. This is so I can gather a lot of information very quickly and since we are working on an electronic diesel, the information I need can be accessed very easily. I always take a look to see if there are any stored diagnostic trouble codes. In this case, there were no DTCs stored to aid in a direction. Since this is a Ford 6.0 HUEI (Hydraulic Unit Electronic Injector) engine, the scan tool

PHOTOS: ALBIN MOORE

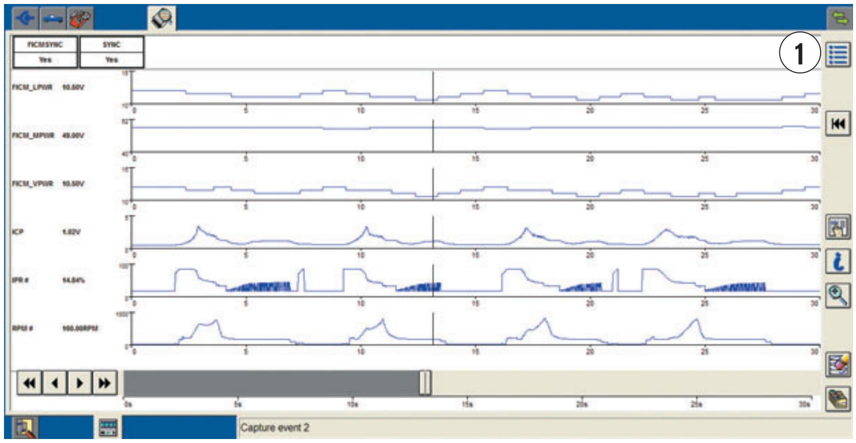
HERE'S A NEW SPIN

data needed will be the three voltages from the Fuel Injection Control Module (FICM), sync, FICM sync, Injector Control Pressure (ICP) voltage, RPM, Injector Pressure Regulator (IPR) percentage and fuel injector pulse width. With this information captured during cranking, I will know if I need to go look for a problem with the FICM, high-pressure oil system or fuel supply.

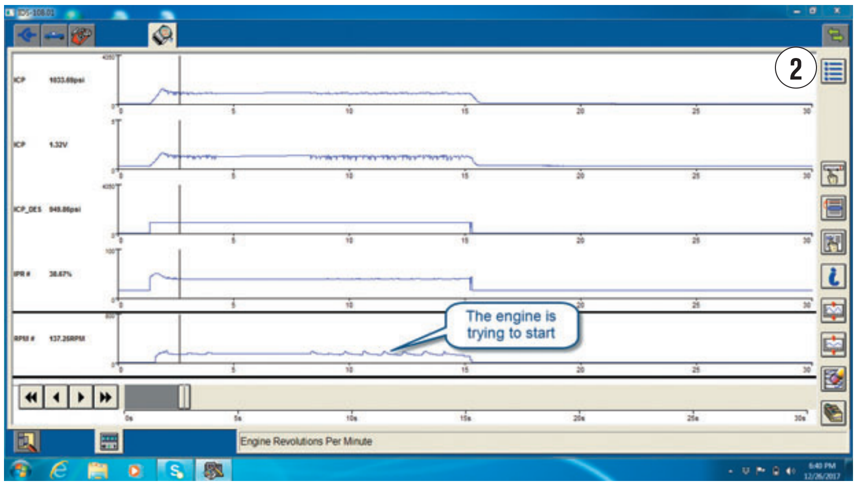
Before we get too far into this project, I want to take a minute and explain why I use the PIDs I use. “FICMlpwr” is the voltage to the module; it should be above 10 volts while cranking. “FICMmpwr” is FICM voltage to the injectors. This voltage should remain above 46V during cranking. “FICMvpwr” is vehicle power through the ignition switch. This should also remain above 10 volts when cranking. The RPM PID should be above 150 RPM (I like to see above 160), but this depends on the temperature of the engine. If the temperature is down to near 0˚F, your cranking will be slower.

The ICP voltage is very important. You should see 0.2 - 0.25 volts Key On Engine Off (KOEO), and when you start cranking, the voltage should climb up to around 4.5 volts if the engine doesn’t start. The injectors will not be pulsed until this voltage gets to 0.8 volts. The pressure PID is an inferred value, and it can read 2500 PSI when there is no pressure at all. That’s the reason for using the voltage PID instead. The IPR will start at 15 percent KOEO, and start climbing up to 85 percent on a long crank.

Last but not least is the Sync and FICM sync PIDs. This information tells you if the FICM module is properly synced with the PCM. If they both say “YES,” be assured there is a proper signal from both the CKP and the CMP sensors. By gathering this information during cranking, you have enough information to go to your next test.



SCAN DATA OF CRANKS/NO START. The engine will fire and then die. The problem is caused by compression being blown into the fuel rail. This starves the engine for fuel.



ZOOM IN ON THE CRANKS/NO START. Notice the ICP and IPR are normal for a running engine. This shows the high-pressure oil system is working correctly. This points to the problem being lack of fuel.

So let’s test

With the scan tool hooked up, I checked for any DTCs stored, then moved on to the KOEO injector buzz test. This will tell me if the FICM is capable of pulsing the injectors and checks the electrical circuits to the injectors. While the test is being performed, I should be able to hear a faint audible click from each injector as it is activated. In this case, about half the injectors clicked. I ran the test three times; the results were the same each time. As with all other tests, be sure and write down the results.

The next thing is to select the aforementioned data PIDs and give the engine a 15-second crank (Figure 1). By examining the data, I can see the ICP voltage was between 0.2 volts and 0.25 volts KOEO before the engine was cranked. Once the engine started cranking, the ICP voltage increased as it should, and the engine started and died. All three FICM voltages behaved as they should and the injectors were being pulsed. With this data, I know the high-pressure oil system is working properly. I can narrow the problem down to two areas: lack of fuel supply to the fuel injectors or all eight injector pintles are stuck and the injectors need to be replaced.

Before I start taking the engine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apart, I want one more data capture with the scan tool. In Figure 2, I have reduced the PIDs to only ICP pressure, ICP desired pressure, ICP voltage, IPR percentage and RPM. This data verifies the high-pressure oil system is working properly. The next step is to test for proper fuel supply.

Fuel supply testing

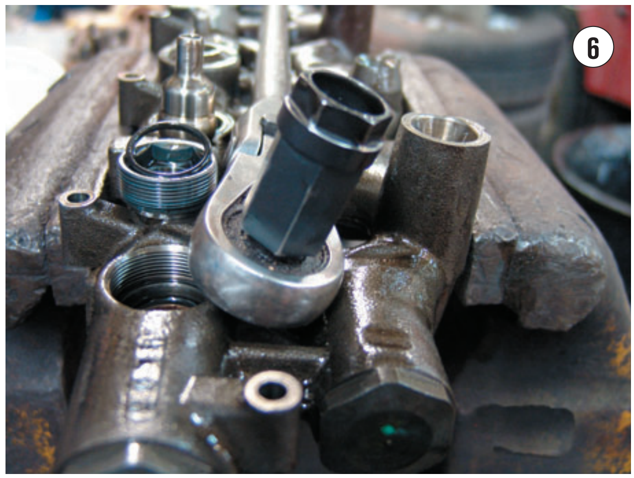
Because I am now looking for a fuel supply issue, I want to start testing the fuel supply. A quick way to verify fuel supply is to remove the top from the secondary fuel filter (Figure 3), then use the scan tool to turn the fuel pump on and see if fuel is being pumped into the fuel filter housing. This can also be done by just cycling the key, but it is easy to run the fuel filter over and cover the engine with fuel. In this case, there was a good volume of fuel to the filter.

You might ask why I didn't use a fuel pressure gauge to test the pressure. Well, all a pressure gauge will tell me is the static pressure, and to get this engine started, all that is needed is fuel supply. Once the engine is running, then the volume and pressure can be tested easily on a test drive. All I want now is to get this engine started. In this case, the filter housing filled

SECONDARY FUEL FILTER with the top removed. The top was removed to see if the electric fuel pump would pump fuel.

FUEL INJECTOR REMOVED FROM THE ENGINE. Notice the grease on the lower part of the injector. Injectors are supposed to be installed with motor oil to lubricate the seals. Using grease like this will plug up the fuel injectors.

THIS FUEL INJECTOR WAS NOT PROPERLY INSTALLED IN THE ENGINE. Either the injector bore was not properly cleaned, or the injector hold down bolt was not properly torqued. Notice the black soot on the tip of the injector. This is caused by compression being blown up alongside the injector.



HIGH-PRESSURE OIL RAIL with one of the injector high-pressure oil nipples removed. These nipples have a seal under them that very commonly leak.

with fuel in about three seconds, so I know the problem is not the fuel pump or a plugged fuel filter. By the way, the owner has already replaced the fuel filters. With a fuel supply to the filter, the next question I ask is whether or not the fuel is passing through the filter. All that is needed for this test is to crack one of the steel line fittings on the bottom front of the filter and turn the pump on. If fuel squirts out, you have fuel supply to the cylinder heads. Now the problem has been narrowed down to the fuel injectors.

There are a few other tests I could do, such as a balloon test. To perform this test, a balloon is hooked to the fuel supply lines that go to the cylinder heads and the engine is cranked. This test is looking for compression being blown back into the fuel rail in the cylinder head. This compression could come through a defective fuel injector or from an injector that is not properly tightened into the cylinder head. In this case, I opted to pull an injector out to see if I could find anything there. Since only half of the injectors clicked properly, these injectors were faulty and needed to be replaced anyway.

I decided to pull an injector from the right cylinder bank,

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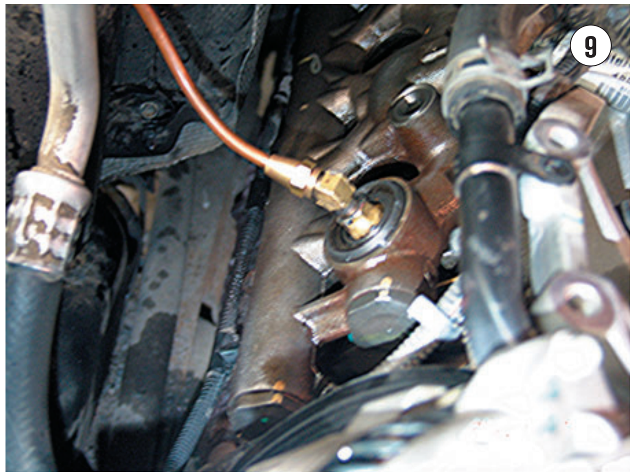
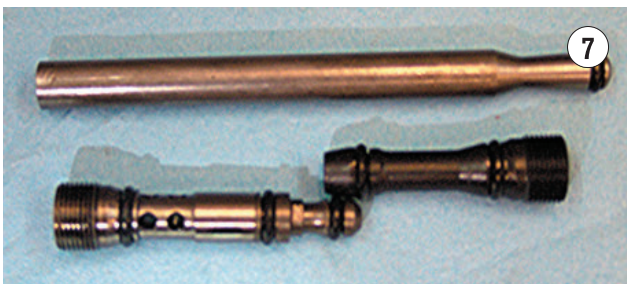


RIGHT CYLINDER BANK HIGH-PRESSURE OIL RAIL being air tested for leaks. Any time you have the high-pressure oil system apart, be sure and air test it before you put the valve back on.

since this is the easiest one to get the valve cover off of. When the first injector came out, I saw someone had installed the injectors by lubricating them with grease (Figure 4). When installing injectors, they need some lubricant on the O-ring seals, which should be motor oil. The grease that was used on these injectors can get into the fuel system and plug up the injectors. As I continued to remove injectors, I found the #7 injector hold-down bolt only finger tight. When the injector was removed, I could see why the engine would not run. The injector was not sealing in the cylinder head and was letting compression blow back into the fuel rail (Figure 5). This blows the fuel out of the fuel rail and in effect, starves the engine for fuel. This engine has all the hallmarks of being worked on by someone who was not very conscientious about their work.

Any time you have a high-pressure oil rail off, give the high-pressure nipples a sideways push with your finger. If you can move them easily, the O-rings that seal them need to be replaced. Figure 6 shows the tool used to remove the nipple balls. If these are leaking and are put back in the engine, it won't be long before the vehicle will be back or taken to another shop with a hard start problem when the engine is hot. There are a lot of places for high-pressure oil leaks in this engine.



STAND PIPE AND DUMMY PLUG REMOVED FROM THE ENGINE. The rubber seals on these are very common to leak. I recommend replacing these any time the fuel injectors are replaced.

FUEL INJECTORS AND ROCKER ARMS with the high-pressure oil rail removed.

As long as I am talking about oil leaks, there are two stand pipes and two dummy plugs on this engine (Figure 7). Make sure you look these over very carefully and make sure the seals are in good shape. Any time these are disturbed, it is a good idea to replace them to prevent leaks. Doing the job right the first time will save your customer money in the long run. Before you put the oil rail back on the engine (Figure 8), take a look at the seals in the top of the fuel injectors. If the seals on the ball/nipples have been leaking, there is a good chance the leaking oil has eroded these top injector seals, too. These seals can be replaced without replacing the injectors.

With the high-pressure oil rails installed on the engine, it is always a good idea to hook air pressure to the ICP sensor port and pressure test the system. All you need is a fitting to screw into the place the ICP sensor goes (Figure 9), turn the key on — which pulses the IPR at 15 percent — and hook up air pressure. If you have a tight system, you will only hear a small amount of air leaking through the IPR, which means the system is tight and no leaks. It is a good thing to always air test before you install the valve covers. This might save you a lot of time and a comeback. Any time you work on the 6.0 engine, or any diesel engine for that matter, be very particular and do the job right the first time. These engines are getting some age on them and are still a very profitable engine to work on. MA

ALBIN MOORE spent 21 years in logging before opening a shop in 1992 that specializes in drivability problem analysis. He is an ASE CMAT L1 technician with 40 years of analyzing and fixing mechanical and electrical issues.
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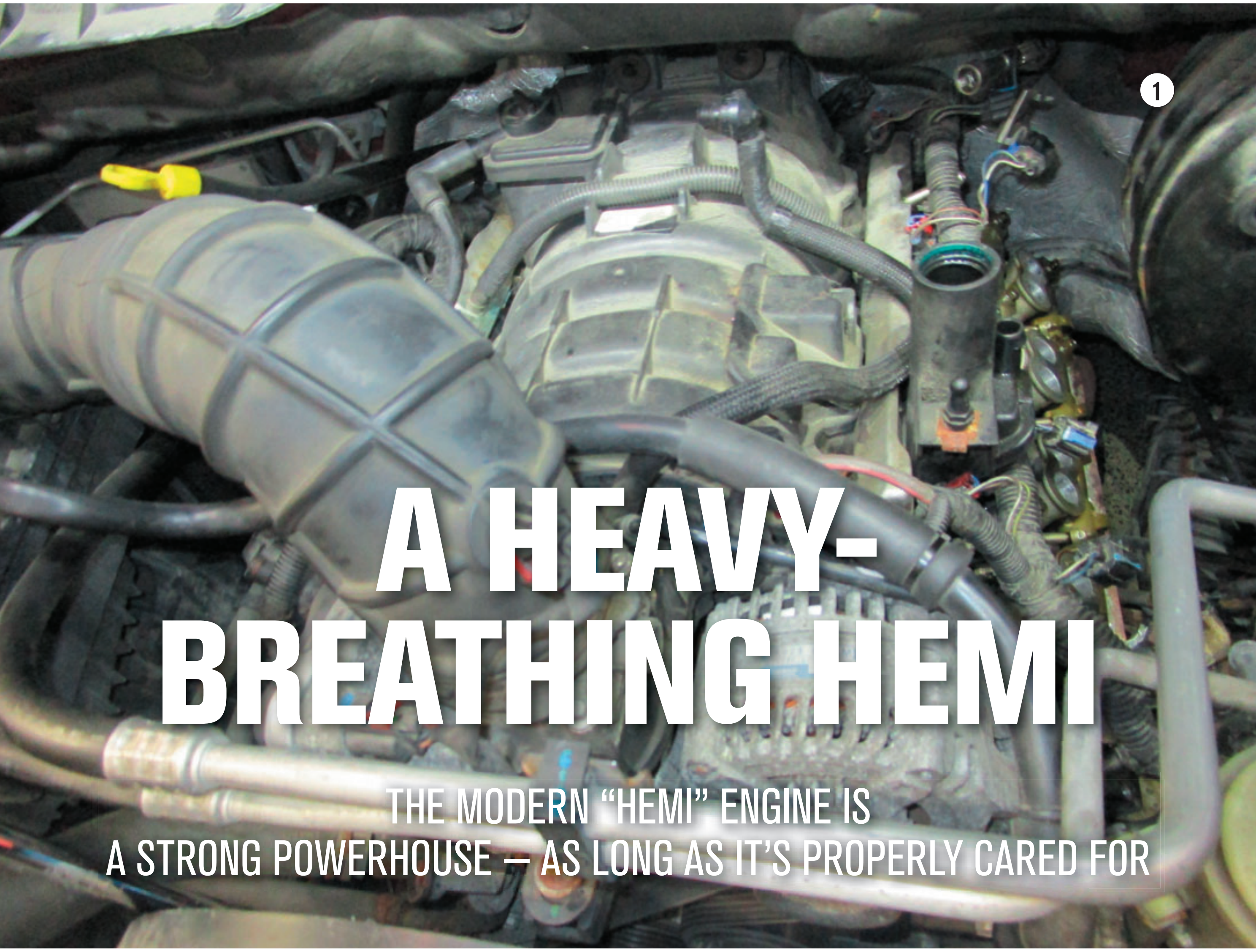

A HEAVY-BREATHING HEMI

THE MODERN "HEMI" ENGINE IS A STRONG POWERHOUSE — AS LONG AS IT'S PROPERLY CARED FOR

G. JERRY TRUGLIA //
Contributing Editor

In our shop we don't see many Chrysler cars, but we do see a bunch of Jeeps, minivans and Ram pickups. Most of the Ram pickups in our area are sold with the "Hemi" motor in them, so our chance of seeing one of them is going to be on the high side. One of the most important services that needs to be performed on this powerhouse of an engine is an oil and filter change. As we know, there are many vehicle owners who shop for the cheapest oil and filter change prices. Well, shopping for the cheapest oil and filter change usually is going to cost them in the long run. The old commercial from FRAM, "Pay me now or pay me later," really applies, especially with these engines. Before we dive into our case studies of heavy-breathing powerplants, we need a short history lesson of where the motor came from and the changes that make it today's Hemi engine.

The Muscle Car era

Chrysler made their first engines with hemispherically-shaped combustion chambers in 1951, but these early motors ranged from 301 to 392 cubic inches. They were called the "Red Ram," "Firedome" and "Firepower," depending on brand, and horsepower peaked in 1958 with a dual four-barrel version of the 392 rated at 390 hp, which would soon be outperformed by a 413 Wedge.

When the 426 Hemi was introduced in 1964, it was strictly a racing engine. That same year, four Hemi-powered Mopars swept the Daytona 500, finishing 1-2-3-4. It caught the racing world by surprise, and prompted NASCAR to impose stricter production rules on

PHOTOS: G. JERRY TRUGLIA

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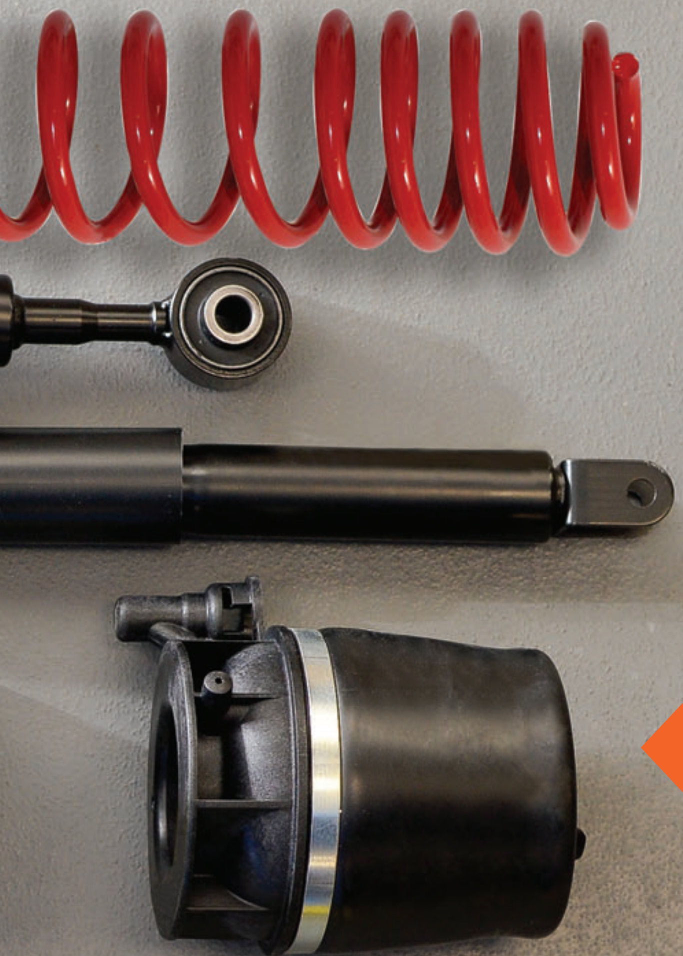

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Chrysler. Instead of producing a few blueprinted Hemi motors each production year, they would have to produce several thousand and sell them in street-legal cars. The street Hemi soon showed up in select 1966 Dodge and Plymouth models.

Today, it's a different story. Chrysler has their Dodge Challenger Demon 6.2L engine producing 840 horsepower that will clock a 0-to-60 mph run in 2.6 seconds. Since most of us won't be so lucky to work on or even drive one of the 6.2L Demons, it's time to get back to reality and concentrate on the Hemi that we are most likely to work on. The engine that I am referring to is the 5.7L Hemi, which is the most common, along with its sister 6.1L engine that is similar. Starting in 2003, the Hemi was used in the Dodge Ram 1500, 2500 and 3500 pickup trucks as well as their Dodge Durango, Chrysler 300C, Dodge Magnum R/T, Jeep Grand Cherokee, Dodge Charger R/T and Dodge Challenger R/T. The Hemi comes in different flavors, such as a straight-up standard engine, Variable Camshaft Timing (VCT) or Multi-Displacement System (MDS). Having owned a Chrysler 300C with the 5.7 Hemi that utilized the MDS, I can tell you that this engine can produce some ass-kicking horsepower. I maintained my 300C properly and changed the oil using the specified oil and had absolutely no problems with the engine, so my Hemi was breathing just fine. Now that we have covered some of the Hemi's history, let's move on to some real-world breathing problems.

A Hemi with a problem

Let me share our New York experience with Hemi breathing problems that we encountered in our shop. First is a 2009 Dodge Ram 1500 pickup, equipped with a 5.7 L Hemi and with 112,962 miles on the odometer. It came in with a concern of low power and performance. The vehicle owner said that she had always taken care of her Ram and had the oil changed every 3,000 miles. She proceeded to tell us that she had all the recommended work performed by her former technician.

We assured her that we would perform a thorough inspection of her vehicle to address her concerns. Since this Ram's check engine light was illuminated and there was the complaint of a performance problem, we explained the steps we would perform. These steps would include a complete vehicle scan, along with testing the engine's mechanical condition. I had Bill, my lead tech, scan the vehicle's computer system, where he discovered a P0305 (Cylinder 5 Misfire) that could be the result of a mechanical, ignition or fuel problem.

We started with the basics: checked all the fluids and performed a battery test, as well as a fuel and ignition system test. The results of our basic tests all received a passing grade so we proceeded to check the engine vacuum while cranking and at idle, followed by a relative compression test. The relative


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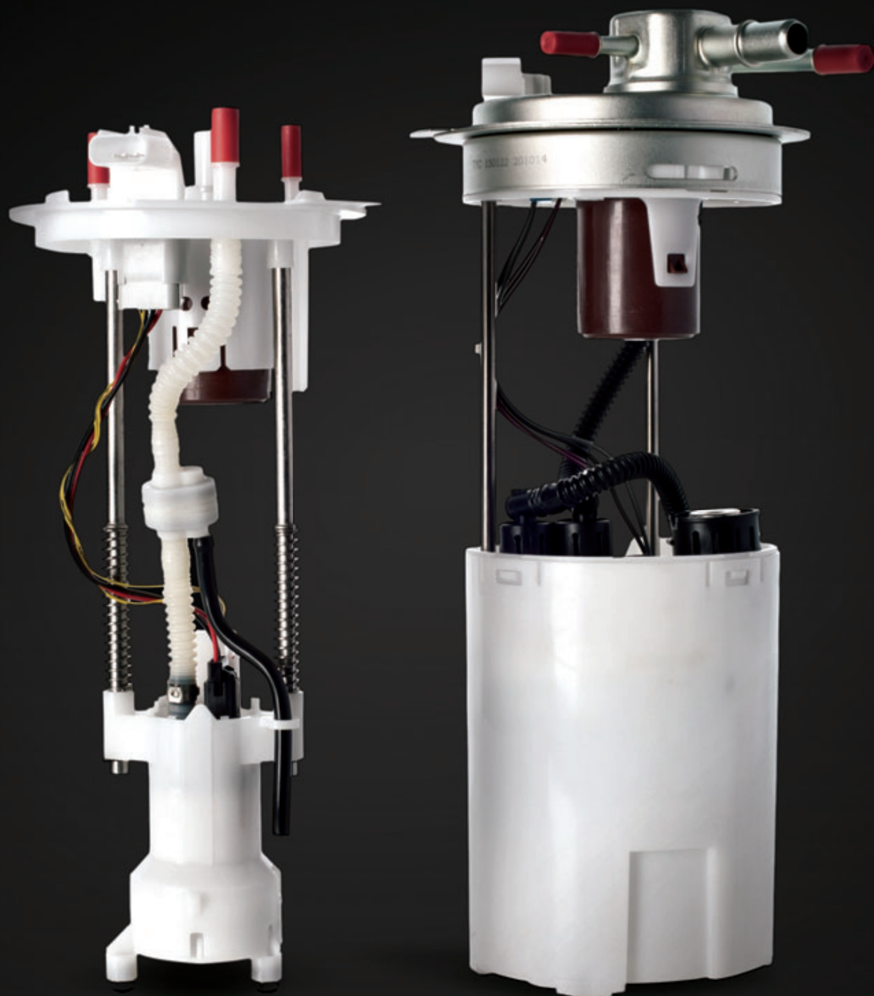
compression and idle vacuum test were surprising to both of us. Neither test revealed any signs of the problem that we expected them to reveal. We were now at the junction where we had to request more diagnostic time. With the extra approval time, we proceeded to remove the coils and spark plugs, and performed a conventional compression test. We explained that depending on the dry compression test results, we may have to perform a wet compression test, possibly followed by a cylinder leak down test.

Bill started the compression test on cylinder #5 since that was the cylinder that displayed the DTC. Bill used our usual procedure of four "bounces" of the compression gauge needle and recorded a compression reading of 225 psi. Bill thought that the reading was on the high side, so he looked up the recommended procedure in service information, finding that it was only three bounces of the needle on the compression gauge. The specification for the compression test was a reading of at least 100 psi with no more than a 25 percent difference from cylinder to cylinder. Bill retested with the recommended procedure only to discover about the same 225 psi reading. He moved on to cylinder #7 and found a very similar reading with the rest of the cylinders all about the same. Bill and I discussed the test results and thought that the compression readings were a bit high, and thought that carbon build up may be the cause of the misfire. We proceeded to take a closer look by using our inspection camera in cylinder #5 first,

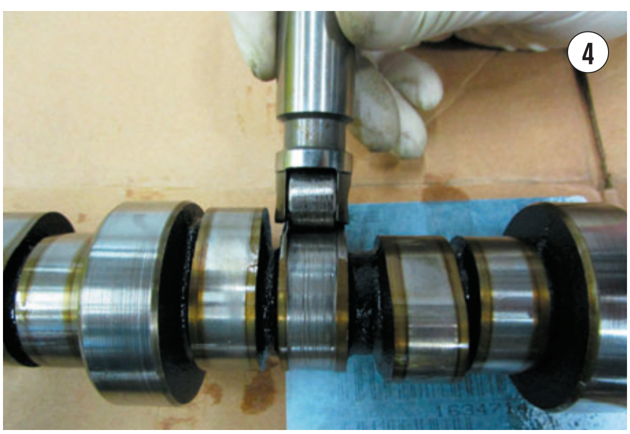


followed by a look in all the other cylinders. Our findings from our inspection camera test revealed heavy carbon buildup on the valves and pistons that we thought could be causing the misfire. At this point we recommended an engine decarb, since it was the easiest and cheapest way to go. We continued to explain that if there was not a significant improvement after the decarb, we would recommend removing the left side (Bank 2) valve cover.

The Ram owner thought about it and decided to have us perform the decarb. Bill performed the engine decarb and retested the compression, finding lower compression readings across the board. The road test of the pickup yielded better results and the Check Engine light stayed off. We explained to the customer that if the light illuminated again she needed to come right back in. Otherwise she should drive the truck for a couple of weeks before returning to us for a recheck. Well guess what, the Ram was back in within a week with the light once again illuminated. We connected our scan tool and found the same P0305 DTC.

The vehicle owner understood from what was previously explained to her about the Ram problem and the next steps we needed to perform. Since the DTC P0305 returned, Bill decided to go on a different path by utilizing our pressure transducers, comparing a good cylinder to the bad #5 cylinder. His findings revealed only a slight difference with running compression but enough for him to proceed without hesitation. Bill's next step was to remove the Bank 2 valve cover, providing us a good view of the rocker arm assembly. We thought that we would find something broken or loose on the #5 cylinder that would validate the misfire. After a thorough investigation of the rocker arms with the engine off, we found nothing abnormal. So, we decided to prepare the engine compartment for possible oil spills and started the engine up to see if there was any abnormality with the rocker arms.

Bingo! We found cylinder #5 exhaust valve rocker was not moving at the same rate as the others. As we ran the engine and



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looked even closer at the rest of the rocker arms, we noticed that there was something abnormal on cylinder #7 as well. With the difference we had uncovered, we were confident that there had to be a lifter or camshaft issue. We were fortunate that the Ram owner was still in the front office waiting for her elder mother to come pick her up so we had the opportunity to show her the problem. We explained with the engine running she would be able to compare the noticeable movement difference from a good and bad rocker arm. We told her that we would provide her with a detailed estimate, but we needed about four hours to disassemble the engine down to where we could physically see the problem. The coolant/antifreeze would have to be removed along with the intake plenum (Figure 1) and other associated parts before we could give her a complete estimate on how much it would be to repair.

Once Bill had the rocker assembly and intake removed, we knew it was going to be expensive. This Hemi was equipped with the Chrysler MDS cylinder deactivation system (Figure 2), so there could also be an issue with the MDS system causing a misfire problem. We had to make sure that the MDS solenoids were operating as designed to rule out any problems before moving on. The MDS system deactivates cylinders 1, 4, 6 and 7 during steady low speed cruise to save fuel. When the MDS system is activated, the engine goes into four-cylinder mode, providing better fuel economy. Since our main problem was in cylinder #5, we ruled out a problem with the MDS system. We still had to check and compare the conventional lifters and the MDS lifter to distinguish if there were any of them that may cause a future problem or the slight difference on the #7 cylinder. You don't want to perform a valve job and have it come back for a part that you should have replaced. For starters, the MDS system did not have any DTCs stored, so that was a good sign, but the solenoids still needed to be tested dynamically and the oil screens would need to be cleaned at the very least.

After the solenoids passed the dynamic test for proper operation and current draw, it was tear-down time. Bill contin-

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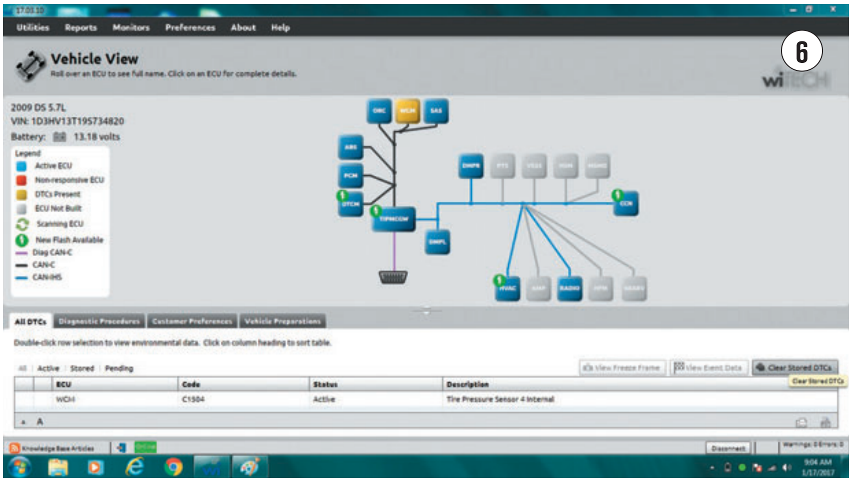


ued the tear down with the removal of the cylinder heads so he could remove and inspect all the lifters. Take a look at what he found on cylinder #5 (Figure 3). The lifter was worn down and had severe flat spots on it. We knew without even looking any further that the camshaft had to be replaced. We explained to the Ram owner the teardown procedure necessary for a proper inspection and that the repair was now going to be a bigger job than we had anticipated. The camshaft would have to be removed and replaced, along with the timing chain, camshaft and crankshaft gears and associated parts. The vehicle owner was impressed with the pictures and the detailed explanation of the problems we provided her, so she gave us the approval to repair this poor-breathing Ram.

When Bill had the motor torn down to the point where the camshaft was removed (Figure 4), he noticed that the oil pan was almost rusted through and would have to be replaced. This was a similar issue that we had encountered on many other Chryslers. As you can see from the picture, the camshaft was severely worn, causing the engine's heavy breathing and Check Engine light to illuminate. We called the Chrysler dealer and ordered all the parts we needed from the oil pan, thermostat, water pump, timing chain, gears, camshaft, lifters, gaskets and other associated parts. Once the parts arrived, we noticed something that we thought was odd. There was a $200 core charge on the old camshaft — the core price was higher than the new replacement. Bill and I compared the new parts to the ones we removed and took the comparison picture of the old and new camshafts (Figure 5) so the Ram owner could really see the difference. I brought the cylinder heads to the machine shop to be inspected and rebuilt, making sure we covered all our bases. The machine shop cleaned and decked the heads, along with replacing a few valves including those in cylinder #5. In the meantime, we cleaned and prepared the engine block for all the new components that were going to be installed.

Once the engine was fully assembled, we installed new factory spark plugs, specified oil and Mopar antifreeze, then proceeded to crank the engine over without allowing it to start. When the oil pressure reached an acceptable level, we started the engine. It was running great, with no noise, running nice and smooth, but we were not done yet. We still needed to perform another scan of all the computer systems to make sure that there were no misfires present or any other DTCs for that matter. The results of the Chrysler wiTech full system scan came up code free (Figure 6), but there were four computers that needed to be updated. Since we performed such an expensive repair, we decided not to leave the computers that needed updates without updating the software. We explained to the Ram owner that her truck should have all of its computers up to date to prevent any problems and would most likely fix a few issues the vehicle had as a result of the older software. One of the updates required was for the TIPM (Totally Integrated Power Module) that is the electrical command center that incorporates many relays and fuses. The other system that needed updated software was the HVAC system that the owner had issues with from time to time. There were also


8


9

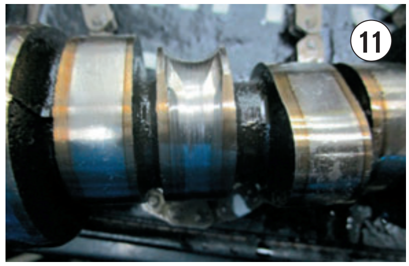
two other computers that needed updates as well. With the owner's approval we reprogrammed all the computers, assuring that all the Ram's computer systems would be up to date. Now this Ram was ready for a good road test, followed by another visual, fluid check and another complete computer scan. Since there were no leaks or computer-related problems, Bill drove the truck home to ensure that there were no issues before we returned the Ram to the vehicle owner. This Ram was now done and running great.

Another sick Ram

Our next sick Ram is a 2011 5.7 L Hemi with MDS that only had 67,208 miles on the clock. After we performed a complete vehicle scan that revealed two associated DTCs P0301(Cylinder #1 Misfire) and a P1411 (Cylinder #1 Reactivation Control Performance) that needed attention. We noticed that the engine was misfiring and running really bad, so we were going to continue our investigation of the vehicle. We located a few other clues, with one of them being an oil sticker on the windshield's left upper corner and an oil level that was full and clean.

This engine requires 5w20HD oil in order for the MDS system to operate properly. Proper oil weight and specified rating are one of the most important things that help prevent premature engine failure. After we ran a few tests, we concluded that the fuel, ignition and relative compression were all good. We suggested to the owner that we remove the valve cover on the driver side of the engine so we could observe cylinder #1 valvetrain movement. We knew from our previous experience with the relative compression test on the 2009 Ram that it did not reveal an engine problem, so we would not get fooled again. Take a look at the short video on our YouTube TST channel, "TSTSeminars" (www.youtube.com/watch?v=QD42t8F_jyI).


10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As you can see from the video, the No. 1 intake rocker arm barely moves, but the barely-moving rocker arm is enough to fool the relative compression test (Figure 7). I believe since some air was still allowed to enter the cylinder, the battery voltage drop (or current if done with an amp clamp) along with the engine cranking speed stayed about the same, thus fooling the relative compression test. Remember that this was the same test results that we encountered on the 2009 Hemi motor. If there is a problem that is not uncovered in the fuel or ignition system on the engine, I would strongly suggest that you perform a pressure-style compression test with either the compression gauge or pressure transducer. After we selected the right path to diagnose the problem, our next step was to write up an estimate and see if the Ram owner wanted to fix it. The owner agreed to this very expensive repair job and understood that we may uncover other problems. As we started the disassembly of the heads, we found that the engine cylinder heads had exhaust studs that were broken on both banks (Figure 8 and 9). This job was going to be a duplication of the 2009 Ram, so we knew what we had to do. Bill tackled this engine and care-


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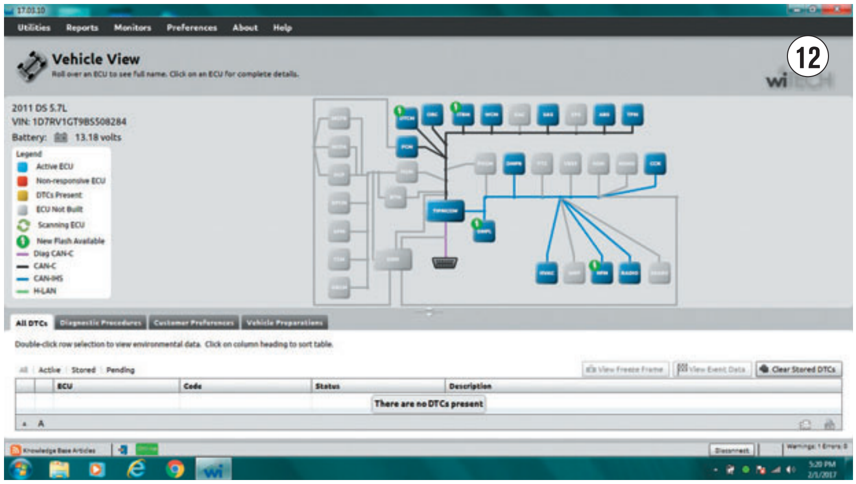
fully disassembled it in record time. The hardest part of the disassembly would be removing the lifters, timing cover, chain and gears because the oil pan would have to be removed. We had it down to a science since we made a pulley system out of a heavy duty pipe and ratchet straps (Figure 10) since our engine holder was not wide enough to handle the job. Our homemade engine holder would allow us full access to the oil pan removal and all the timing components that were needed to perform the repairs.



Important information to know about this engine is that it has the same VCT (Variable Cam Timing) camshaft phaser set up as the 2009 Ram Hemi. The lifters must be removed first and carefully inspected, besides keeping them in order since there are different ones used between the MDS and non MDS cylinders. The lifters for cylinders 1, 4, 6 & 7 are for the MDS cylinders that have two holes on the side of the lifter that are used as latching pins. Another super important fact is that the camshaft has a non-serviceable bearing, so if they are damaged, the complete engine block must be replaced. Lucky for the Ram owner, the camshaft bearings were in good shape, so we were able to replace the camshaft and lifters without any extra cost.

When Bill removed the camshaft and lifter (Figure 11), the problem was obvious. As Bill removed the oil pan, he found that it was starting to rust, so we recommended that it be sanded down and painted with Rust-Oleum. We applied multiple coats of paint to the oil pan assuring that there would not be any rust-through issues in the near future. Bill prepared to install the camshaft and timing components as I applied prelube and prepared the new lifters for installation. After the heads, intake and other components were torqued down, oil, antifreeze and all the fluid would be installed and checked before we cranked it over. After a few long cranks with the fuel and spark disabled, we reconnected them, and the Hemi fired right up. The engine was purring like a kitten, and just needed to idle for a while so we could make sure that the engine was producing proper heat and not leaking any fluids. As the engine was running, we performed a complete vehicle scan with the Chrysler wiTech to make sure there were no problems. Since there were no leaks and no other issues we decided to shut the engine down and perform a few computer updates (Figure 12) and recheck all the fluids. The Hemi was now breathing as it should, along with developing the power that this engine is capable of supplying. After a few more successful road tests and computer scans the Ram was ready to go.

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VOLUMETRIC TURBOCHARGED ENGINES

VE HAS BEEN A VALUABLE DIAGNOSTIC TOOL ON NORMALLY ASPIRATED ENGINES. CAN IT BE ADAPTED FOR USE ON THE NEWER TURBO POWERPLANTS?

SCOTT SHOTTON // Contributing Editor

Volumetric efficiency, or "VE," is a measurement of how well a pump can move a liquid or gas compared to its physical limitations. If one were to perform an internet search, the results would include things like oil drilling platforms, hydraulic rams and more. Automotive technicians have also been using this measurement for many years to diagnose engine breathing problems. After all, isn't an engine just an air pump?

Two years ago, I penned an article "Asthmatic Engines," (March 2016) on this very topic. However, its subject matter pertained to naturally aspirated engines. The technique lends itself well to these engines and assists in quick and efficient diagnosis of engine performance issues and some MIL (Malfunction Indicator Lamp) illumination complaints. With the increasing popularity of turbocharged applications in the last decade or so, there needs to be some adaption of this technique in order to use it correctly on a forced induction engine. Let's do a quick review of volumetric efficiency as it pertains to naturally aspirated vehicles.

1

Name	Value	Range	Unit
Calculated Load Value	96.5	0...100	%
Intake Manifold Absolute Pressure	171	0.00...36.98	kPa
Engine RPM	3196	0...7000	rpm
Air Flow Rate from Mass Air Flow Sensor	89	0.00...1.44	g/s
Absolute Load Value	163.1	0...25700	%

SCAN DATA CAPTURED from a known good turbocharged vehicle.

VE review

VE is calculated using three basic inputs: engine displacement, engine RPM and measured airflow. With these three pieces of information, we can calculate how much air the engine should pump at the given RPM and compare that number to the amount of air that was actually measured entering the engine. The VE calculator is recommended and outputs the value in a percentage. The higher the percentage, the better the flow and vice versa. If we want to be a little more precise, some calculators allow us to enter information that affects air density, such as barometric pressure, air temperature and even humidity. A general rule of thumb is a VE number of 75 percent or higher is acceptable, but this number will vary with different engine applications. An OHV V6 engine may be only 75 percent to 80 percent when it is functioning to the best of its ability, while a DOHC inline 4-cylinder engine (with better airflow) may be more like 80 percent to 95 percent.

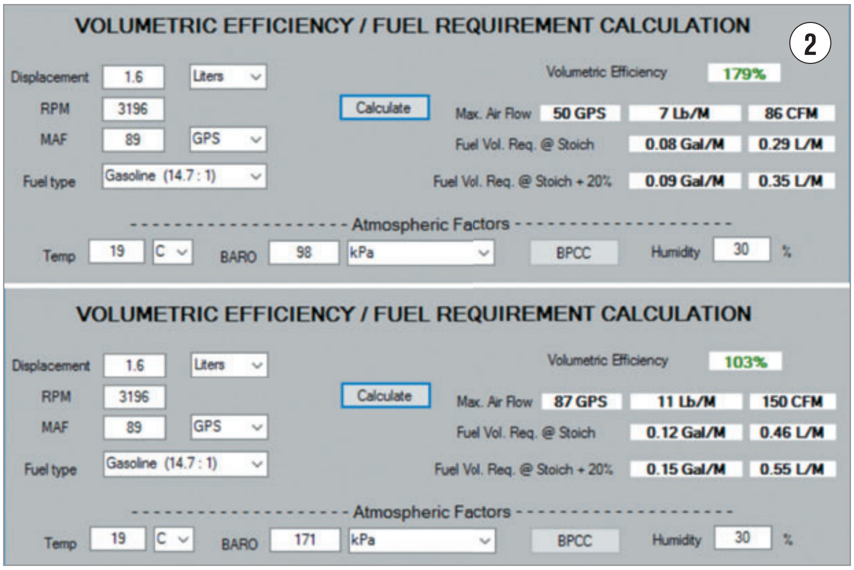
Once the VE number is obtained, and a few extra data PIDs (Parameter Identifiers) are observed, a diagnostic direction can be quickly chosen. For example, if a vehicle has low VE while the throttle is wide open and the oxygen sensor reads very lean, the fault is more than likely an air metering issue. On the flip side, if a vehicle has a good VE number and the oxygen sensor still reads very lean during wide open throttle, then the fault is most likely a fuel delivery issue. For more detail on this

PHOTOS: SCOTT SHOTTON

technique as it pertains to naturally aspired engines, refer back to the March 2016 issue of *Motor Age*.

Introducing turbochargers

With the addition of turbochargers, we now have to account for air being forced into the engine above and beyond what the engine alone would normally flow. The results are VE numbers in excess of 100 percent. One of the problems that these high numbers present is "how high is known good?" Without knowing what good is, we cannot make a good diagnostic decision using the VE value. Some applications may yield a VE number somewhere around 125 percent, while other applications may push 300 percent. With this wide of a range, we have to make some adjustments to our calculations to level the playing field. Once we do this, we can use the values to make some diagnostic decisions and move our way down a logical diagnostic path.



TOP — RAW VE DATA NOT ADJUSTED FOR BOOST. Bottom — Boost numbers entered to get adjusted VE.

The additional data PID that is required to accomplish this on a boosted engine is boost pressure or intake manifold pressure. Air temperature is also a desired addition to the equation, but is not necessary. The only tool, besides a scan tool, that is required to calculate a VE number on a forced induction engine is a VE calculator that allows a boost pressure or barometric pressure input. Most calculators that I have seen do not provide this option, so they cannot be used for this task regardless of how well they may work on a naturally aspirated application.

If it can be obtained, desired boost or a published maximum boost specification would be beneficial to the process. If this information is available, it can be compared to the maximum boost achieved during a test drive and the result can be an additional piece of information used during diagnosis.

Calculating VE

In a way, calculating VE this way is kind of like tricking the calculator a bit. What I mean is that during wide-open throttle on a naturally aspirated engine, we have barometric pressure in the intake manifold. A general barometric pressure is ei-

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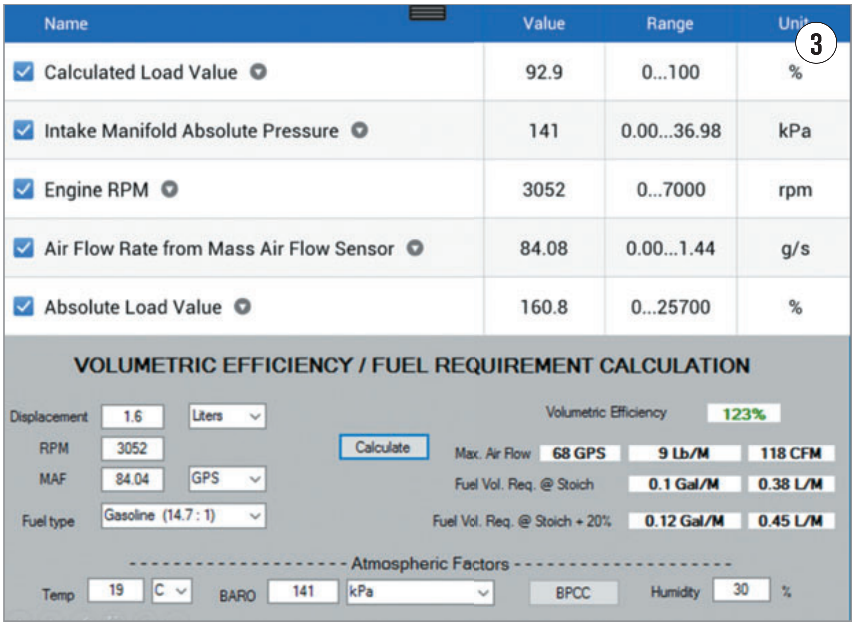
ther built into the calculator behind the scenes or input by the technician and is required for the calculation whether it can be seen or not. On a turbocharged engine, the vehicle may be operating at the same barometric pressure as its non-turbo counterpart, but is there still barometric pressure in the intake manifold when it is floored? Not if the turbo is boosting it. So let's lie to the calculator and tell it what the boost pressure is instead of the barometric pressure. After all, boosted or not, the intake manifold pressure is what the calculation actually requires, so it does not matter which label the calculator assigns to it, boost or BARO. We will need to perform this calculation twice. First, the calculation will be performed using the barometric pressure, and we will label this value "VE." Second, the calculation is repeated with the actual boost pressure instead of the barometric pressure. The second value will be labeled "Adjusted VE."

A note on conversion and baseline pressure

Some vehicles, or scan tools, may display information in different units of measure. These situations may require some conversion. For example, one vehicle may display approximately 99 kPa (kiloPascals) for barometric pressure and 34 kPa while idling. Another vehicle may display 29.4 inHg (inches/mercury) of barometric pressure and 10.1 inHg while the engine is idling. The first vehicle may be easier to grasp because 100 kPa is one atmosphere and the engine creates vacuum, hence the lower kPa number, while idling. The second example could appear as a good barometric pressure, but have poor engine vacuum at idle or 10.1 inHg while a standard specification of 18 – 21 inHg is expected. In all actuality, if we were to connect a vacuum gauge to this engine we would read 19.3 inHg, well within the acceptable range. In this case, 10.1



WITH A BOOST LEAK, the adjusted VE number is higher than normal because not all of the measured air is making it into the engine.

inHg is 19.3 inHg less than our BARO of 29.4 inHg. These readings are a result of the scan tool displaying absolute pressure instead of gauge pressure/vacuum. How the vehicle and scan tool display this pressure information, as well as the units of measure supported by the VE calculator being used, need to be understood and converted correctly for the VE number to mean anything at all.

Known good calculation

Performing a VE calculation on a boosted engine is not much different than doing so on other engines. A known good 2012 Mini Cooper S with a 1.6 liter turbocharged engine will be used to illustrate the technique. In addition, the procedure will be done using an aftermarket scan tool using only global OBDII data. A recording of a wide-open throttle test drive has been made and data PIDs are observed at the engine's highest boost (Figure 1). There are two data PIDs not included in the image: a BARO (Barometric Pressure) of 98 kPa and an IAT (Intake Air Temperature) of 19 degrees Celsius.

First, a non-adjusted calculation (top of Figure 2) is made by inputting engine displacement, engine RPM, MAF reading, IAT and BARO. Boost numbers will be entered later. In this case, the actual VE of the engine is 179 percent. For the second, or adjusted, calculation, the actual boost pressure will be substituted for the barometric pressure (bottom of Figure 2.) The new adjusted VE calculation is 103 percent. This adjusted number is a much better way to determine if the engine is breathing properly. Since different boosted applications are all over the board when it comes to the raw numbers, the adjusted number actually means something to the technician regardless of application, since it can be compared to a general good specification of 90 percent to 100 percent. However, care must be used in a low-boost situation since this number is a good indication of VE under current boost, not desired boost.

You may have noticed that the calculated load and the absolute load PIDs were also included in the screen capture. On this vehicle, the absolute load PID was very close to our raw VE num-

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Name	Value	Range	Unit
Calculated Load Value	55.3	0...100	%
Intake Manifold Absolute Pressure	103	0.00...36.98	kPa
Engine RPM	3078	0...7000	rpm
Air Flow Rate from Mass Air Flow Sensor	45.36	0.00...1.44	g/s
Absolute Load Value	94.5	0...25700	%

THE CALCULATED LOAD VALUE may suggest this engine cannot breathe when in fact it is breathing fine — it is just lacking boost.

ber, and the calculated load PID is very close to our adjusted VE calculation. I would like to say these PIDs can be substituted for our calculations, but when failures occur, these numbers can stray from the actual calculations. In a nutshell, these PIDs should be used with a little caution.

While diagnosing breathing problems, another data PID that we need to observe is fuel trim. It is important to observe these values during closed loop operation, which will most likely not be at peak boost, rather a bit before the peak boost in the recording. For the known good vehicle, the fuel trim numbers were normal.

The next step is to determine how this information is useful for diagnosing a failure. To accomplish this, a few broken cars will be used for comparison and to observe how different faults affect data and VE.

Leaking boost

When a vehicle has a boost leak, or a leak between the outlet of the compressor and the intake valves, the scan data will change. All of the air entering the turbocharger passes through the MAF sensor and is reported to the PCM. However, some of the air is forced out of the boost leak while the remainder is forced into the engine. This will cause the PCM to over fuel the engine and the VE number to be falsely elevated. Basically, too much air is measured, too much fuel is injected and too much airflow gets entered into our calculation.

The result of a boost leak (Figure 3) can now be spotted with VE and a scan tool due to high adjusted VE and the resulting negative fuel trim numbers. For the sake of full disclosure, the scan tool capture in this case is actually the same vehicle used earlier in the article for our known good before a boost leak repair had been performed. It should also be noted that the load PIDs did not change very much and is a perfect example of what was mentioned before — use the load PIDs with caution.

Air metering

A vehicle with an air metering issue, such as a faulty MAF sensor or broken turbocharger inlet tube, will exhibit different behavior. In the case of false, or pirate air as it is sometimes called, the MAF sensor does not measure all of the air entering the turbocharger. Extra unmetered air is drawn in through the leak, and the MAF sensor reports an incorrect value to the PCM. In the case of a faulty MAF sensor, the results will be the same as long as the MAF sensor is under measuring the air. These metering issues will affect the VE and the adjusted VE measurements since the MAF signal is an input for the calculation as well. Both values will be lower than normal. In addition, much like their naturally aspirated counterparts, fuel trim numbers will be positive to

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compensate for the unmeasured air that is entering the engine.

No boost

The next example (Figure 4) is taken from a 2011 Mini Cooper Convertible with the same 1.6 liter turbocharged engine. The test drive is performed, and it is confirmed that the vehicle has very low power. It should be obvious that the engine definitely has lower-than-normal load values. However, our VE calculation yields a value of 95 percent, and the adjusted VE is calculated to be 90 percent.

VE and adjusted VE numbers that are very close together, and in the good range of 90 percent to 100 percent, are a good indicator that the engine can breathe to its full capacity, but it just is not being boosted. Remember, if a VE and adjusted VE calculation both have BARO/Boost pressure inputs that are nearly the same, both calculations will be as well. Additionally, even though the air flowing through the engine is not the desired amount, it is still being metered correctly, so the resulting fuel trim numbers will be normal.

5

Comparison of data to known good values.	Boost Leak	Air Metering	No Boost	Exhaust Restriction
VE (raw)	OK	↓	↓	↓
VE Adj.	↑	↓	OK	↓
Fuel Trim	↓	↑	OK	OK

THIS CHART ILLUSTRATES that each different breathing fault causes unique data behavior.

Restricted exhaust

Exhaust restrictions can have unusual effects on turbocharged engines. An exhaust restriction affects the engine's ability to exhale as well as slowing the turbocharger's turbine due to the reduced exhaust flow. Basically, an exhaust restriction will cause both the raw VE number and adjusted VE number to be low due to the fact that the engine cannot breathe correctly. However, since the reduced airflow is still being measured correctly by the MAF sensor, the engine will still be fueled correctly and the fuel trim numbers will remain near normal.

Diagnostic application

All of the information that we have covered is useless unless we can apply it to our diagnostics. To view what has been covered so far, let us look at all of the data in chart form. The chart (Figure 5) allows us to visualize the relationships, and more importantly the differences, between the four faults that have been discussed.

Using only three pieces of data, all of the faults exhibit different results. For example, a wide-open throttle test drive that yields a low VE value, a low adjusted VE value and positive fuel trim numbers would indicate high potential for an air metering issue. These results do not match any of the other faults on the chart. The next logical diagnostic step would be to inspect the air ducting between the MAF sensor and the turbocharger air inlet as well as testing the MAF sensor itself. If the same test drive were to yield different results, the chart would be consulted and the appropriate next step would be performed.

Parting thoughts

Only four faults were covered here, and we technicians know there are more possibilities: restricted intakes, PCV issues and more. We also know that there are always vehicles that are the exception to the rule. If the chart works the majority of the time, then it has served its purpose. If it does not find the fault with a vehicle quickly, then the worst thing we have to do is perform more testing to isolate the issue. MA

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YOU WIN SOME, LOSE SOME

MY FRIENDS AND FAMILY KEEP ME BUSY IN THE SHOP. OFTEN IT'S NORMAL MAINTENANCE WORK, BUT OCCASIONALLY I GET A REAL CHALLENGE.

PETE MEIER // Technical Editor

I've been working on my own vehicles since I first started turning a wrench. Not because I wanted to — it was a simple matter of economics. I couldn't afford to pay someone else to do it for me. For the last 20-odd years, I've had to work in the dirt driveway of my current place of residence, but was blessed a year or so ago with the chance to build a real garage next to my house, complete with a two-post lift (a gift from a very good friend)!

I refer to my shop as the "*Motor Age* Garage" in honor of the column that has been a staple of this magazine for as long as I can remember. Writing for that column was my first role as a new contributor to the magazine, and it's where we start our newbies to this day. By the way, we've got some great young talent to introduce you to!

In addition to making life easier maintaining my own cars, it also provides me with the means to produce the videos you see on our YouTube channel and has opened up a variety of opportunities to share topics that I couldn't before. On the other side of the coin, it opens me up to a lot of requests for help from my youngest son and his friends. I've done everything from oil changes to evaporator core replacements (Ford F-150, full dash removal) and soon, I'll have his Chevy truck in for a valve "tick" that I suspect may be a wiped camshaft. Oh, the joy…

THE BIRTH OF THE SHOP, where all the magic happens!

I'll admit, there are times when I don't feel like working on a car but I then find myself enjoying the work, getting greasy and beat up again. And I'm keenly aware that, in order for me to do my job here, I have to stay "in the trenches" as much as I can. After all, I can't tell you guys to continue your education and skill development if I don't!

Anyway, I recently had a project in the shop that I thought might be of interest to you. It starts with my very favorite customer — my wife.

The shuddering Scion

My better half owns a 2014 Scion tC that is her pride and joy. She's gone full tilt with it — installing a TRD (Toyota Racing Development) exhaust, leather interior, custom lighting and more. When she cleans it up, she'll spend a solid 3-4 hours making it look as good as it did when it first rolled off of the showroom floor. And she is just as picky when it comes to maintaining it mechanically.

The car has just over 37,000 miles on it and recently displayed a new behavior that my beloved finds truly annoying. She works at the local hos-

PHOTOS: PETE MEIER

THE WIFE'S 2014 SCION TC, with a little TRD added.

pital and leaves the house when it's still dark. One recent (and also our first "cold") morning, she headed off to work as she normally does but on the way there, experienced a severe "shudder" when she came to a full stop. The vibration was enough to cause a loud "tapping" noise that could be heard in the cabin and was strongly felt in the steering wheel. Whatever was causing the condition, it wasn't something the ECM was concerned with — the MIL light remained off.

When she returned home later that day, I met her in the garage to see what the car was doing. Of course, I couldn't duplicate the problem and after reviewing the scan tool data, could find no clues as to what the problem might be. So I told my spouse I would check it the next morning, and she could take my vehicle to work instead.

The following day I went out to the garage and started the car up. Following the same route she takes to work, I tried to duplicate the problem, but again, without success. The only difference between my drive to work and hers was the temperature. It doesn't stay cold long in central Florida!

Waiting for the chill

A few days later, the weather forecast called for another cold night. Here was my chance! Or so I hoped.

I have an exterior/interior thermometer I use for A/C work, and I first recorded the air temperature in the shop. It was reading a chilly 41°F, which matched up with the ECT (Engine Coolant Temperature) and IAT (Intake Air Temperature) readings on my scan tool. I started the car and it dutifully went into its cold start mode, keeping the idle high as the engine warmed up. I decided to monitor the ECT, IAT and engine RPM along with STFT (Short Term Fuel Trim) and LTFT (Long Term Fuel Trim) as I retraced my wife's commute.

A few minutes into the drive, the ECT had reached normal operating temperature and the idle speed had settled down. As soon as the car came to its next full stop, I could feel the vibration and hear the tapping noise that my wife had mentioned. The engine rpm appeared to be lower than it should be, hovering around 620 rpm.

Specification in Neutral is 680-780 for this car, so I shifted into Park to check. Yep, that was OK and at the higher idle, the vibration and noise were gone and the engine was running smoothly. Stepping on the brake and putting the car back into Drive immediately brought the rpm down to 620, and adding the headlights dropped it even further to 580-590. That had to be too low! A quick look at the trims, though, showed perfect fuel control with both numbers staying under +/- 4 percent.

Next, I applied the parking brake and released the pressure on the brake pedal. The rpm increased to 670-680 and the engine condition was gone. That seemed like a more normal loaded idle speed to me, and I was surprised that applying the brake pedal would result in that much of a change. After all, the transmission was already loaded. What possible difference could the brake application make? And why only under "cold" weather conditions?

I think I got it!

I admit, I was at a momentary block in my thinking. I turned to some talented techs that hang out on Facebook and got some ideas from them, and I also talked to the shop lead at my local Toyota dealer. He wasn't too optimistic about my finding a solution, though, sharing that this was a common complaint that, to date, they have been unable to solve!

One great idea that came out of the discussions was to consider the impact the brake booster may have on the engine. The vacuum booster could be leaking and doing so only when the brake pedal was in a certain position, the shop foreman shared. He told me that he had found several similar issues when troubleshooting P0171 (System Lean) problems for his customers.

It made sense, so I thought I'd try it. I disconnected the vacuum feed to the booster and closed off the line at both ends and went back out for another test drive. And I'd like to report that the complaint had been resolved.

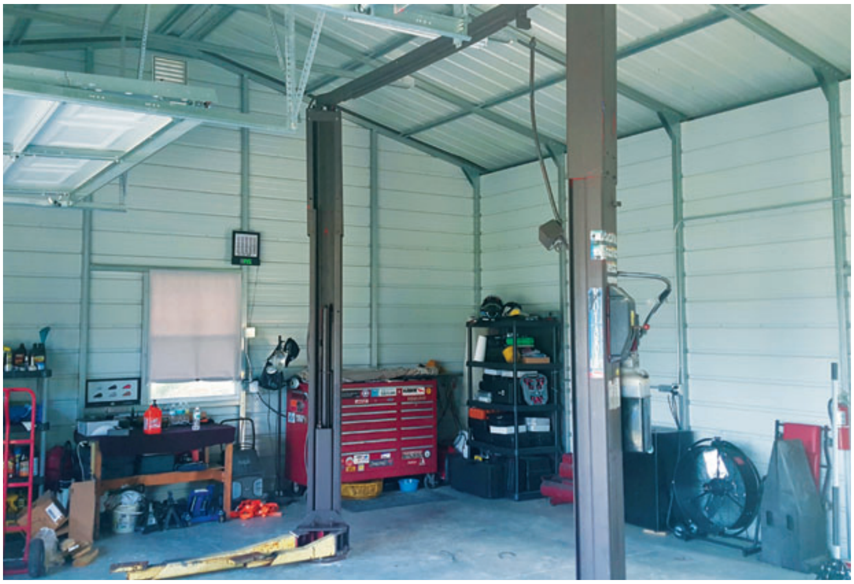
I'd like to, but I can't…

The problem was still there; the vibration, the accompanying noise, and the unusual drop in rpm with the brake applied. I did identify one additional factor, though. The rpm would not drop any lower than 580. I mean, I could get the rpm to drop lower by adding load, but the ECM would recover and bring it back to that minimum. However, I'm convinced that the ECM's "minimum" was too low for the car. What else could it be?

A COKED THROTTLE BODY can cause idle issues, but this one was not that bad. I cleaned it anyway.

I should add, before your emails start, that I did clean the throttle body (it was a little dirty, but not badly coked) and performed an induction cleaning (setting a P0304 in the process — a possible clue?). I also performed the idle relearn procedure using the Toyota method and the aftermarket method many of my FB friends suggested. The problem is still not resolved. And, of course, I checked for any related Technical Service Bulletins, but found nothing that helped.

But, faithful readers, I'm not done yet. My next step is to research every system that uses the brake pedal position sensor as an input. I'm also going to do some more in-depth engine inspections to see if the problem may be related to any weakness in an individual cylinder or in the Variable Valve Timing (VVT) system. I'm not ready to give up quite yet. I — and I can't believe I'm saying this — only hope the cold weather remains around long enough for me to verify any fix I make! And I'll be sure to let you know what I find out in a future Tech Corner column.



IT WAS GREAT HAVING a concrete floor to work on. Adding a lift, though, makes life so much easier!

PETE MEIER is an ASE certified Master Technician and sponsoring member of iATN. He has over 35 years practical experience as a technician and educator, covering a wide variety of makes and models. His primary goal is to bring working techs the information they need.
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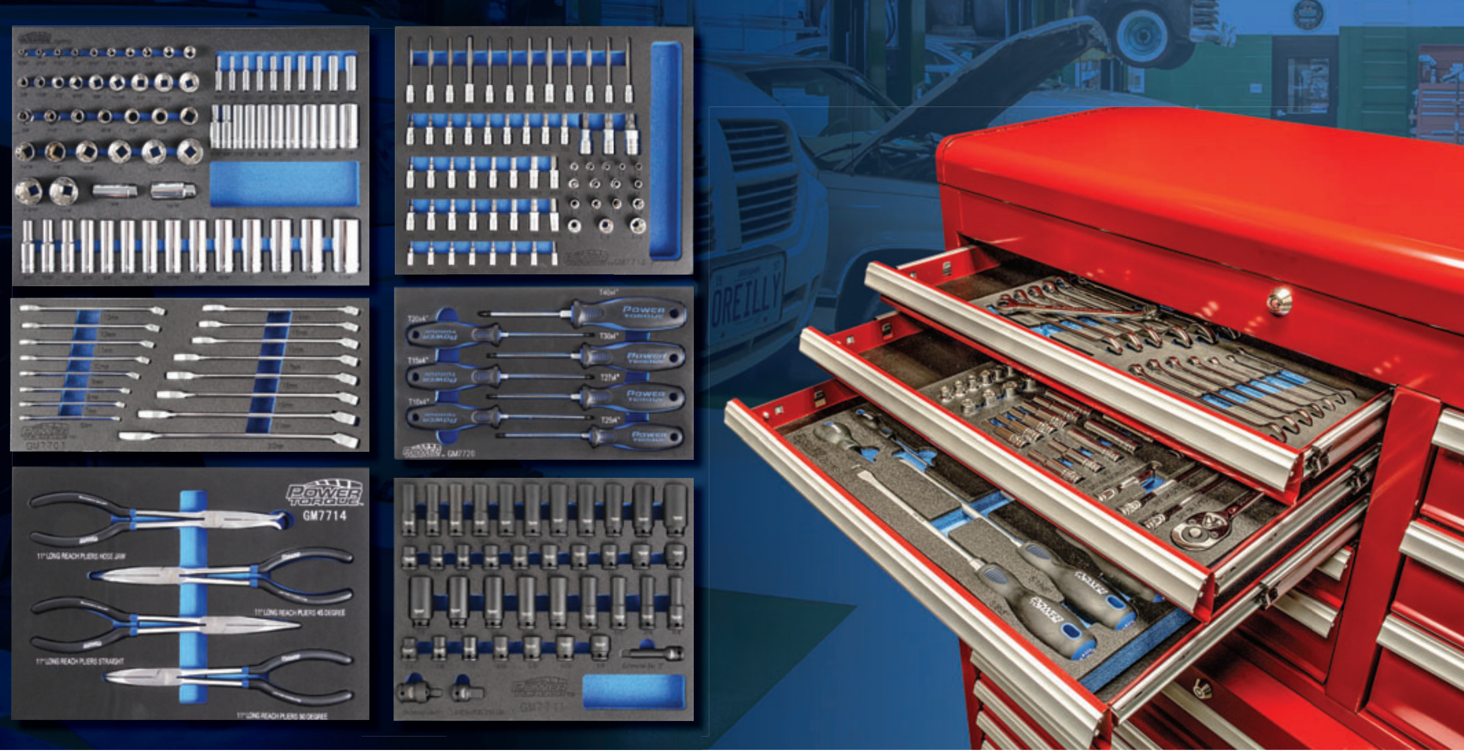


ADV 1257

A LUMBERING LINCOLN

THIS 2007 NAVIGATOR HAD A MISFIRE. FOLLOW ALONG TO SEE IF YOU WOULD HAVE TAKEN THESE SAME DIAGNOSTIC STEPS.

MICHAEL MILLER // Contributing Editor

When a vehicle shows up with a misfire, the first though that comes to mind is something ignition related, like a spark plug or an ignition coil, because they are such common failures. If that is not the cause, then it's on to something in the fuel system like a clogged fuel injector or a fuel supply problem. Even though this is not the best approach, it is the one most technicians follow due to previous repairs with the usual suspects. While a good percentage of the time they are able to repair a vehicle with this course of action, when a problem occurs outside of the realm of these common items, the next diagnostic steps become unclear. Even when performing the correct steps, interpretation of the results can be misleading. This vehicle was one of those cases.

The patient history

The vehicle is a 2007 Lincoln Navigator with a 5.4L 3-valve Triton engine and 82,810 miles. This SUV was in approximately a week ago for a misfire concern under acceleration during the time the transmission shifts between third and fourth gear. The technician determined that the misfire was due to failing ignition coils, and eight new Motorcraft coils were installed. The technician test drove the vehicle under the same conditions that revealed the problem and found that no further misfires were present. The customer was relieved to find that the vehicle did not have a transmission problem; it was easy to see why they thought that, since the misfire occurred just as the transmission was performing an upshift. The vehicle was returned to the customer. All seemed fine until eight days later.

The vehicle returned with an almost constant misfire that was present at idle and while driving it into the shop. After a visual inspection for a coil connector that may have fallen off, the technician grabbed a scan tool and retrieved a code P0305 (Misfire Cylinder 5). He again inspected the connector by pulling it off, checking the pins on both the connector and coil and reinstalling it, but to no avail. He then swapped coils between cylinder #5 and #6 and found that the misfire remained on cylinder #5. Staying with the original plan of "Misfire = Ignition Problem," he attempted to remove the spark plug from cylinder #5. Anyone who has replaced spark plugs on one of these engines knows what I mean when I said "attempted." The threaded portion of the spark plug and the body came out, but the rest of the metal shell remained frozen inside the combustion chamber. The spark plug was extracted without any incident, and a new Motorcraft spark plug was installed. I inspected the spark plug and could not find any signs of carbon tracking or damage to the nose of the plug other than what was caused by the extraction tool during removal.

THE VEHICLE IN QUESTION IS A 2007 LINCOLN NAVIGATOR with a 5.4L V8 with three valves per cylinder.

Misfire equals something else

The misfire remained without any change in intensity, and I did suggest to the technician to verify the spark plug was actually firing before reinstalling it into the cylinder head. So, if it's not ignition, it has to be fuel, right? (If Misfire ≠ Ignition, then Misfire = Fuel Problem). The fuel injectors on these engines are fairly easy to swap with only a couple of bolts holding down each side of the fuel rail, so the injectors between cylinders #5 and #6 were swapped and the fuel rail tightened back down. Of course, the engine still had the misfire when restarted, but the technician was confident that it had moved to cylinder #6. So he cleared the code and was going to test drive it to let the code prove that the misfire followed the fuel injector. Because the misfire was pretty severe, I offered to let him use my Ford IDS and its power balance test to show a graph of each cylinder and its misfire

PHOTOS: MICHAEL MILLER

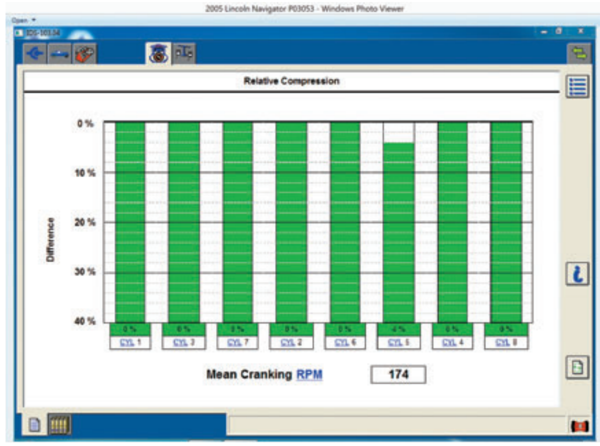
history. Much to his amazement, cylinder #5 was still the only cylinder misfiring. He has ruled out spark and fuel, so the only thing left is compression, right?

Unfortunately, Ford does not list an actual specification for compression, but rather a Min/Max range between cylinders. After the dilemma with removing the first spark plug, he was not going to remove the other seven to perform a traditional compression test. But he did test cranking compression on cylinder #5. He stated the result was 190 psi, so compression was good. At this point, he threw his hands up and asked the service writer to send the vehicle to me.

It's got to be something

One of the great benefits of the Ford IDS scan tool is the power balance test, but caution must be used since there has been a time or two when the wrong cylinder has been identified as the one misfiring. The misfire monitoring is a strategy that is learned, unlike a circuit code for a problem with an injector or ignition coil. There can be variances in the tooth spacing of the crankshaft reluctor, so these characteristics must be learned to enable the misfire monitor. This is usually done after the Keep Alive Memory (KAM) has been cleared and is accomplished by performing a few decelerations from 60 mph to 40 mph without braking. The fuel is cut to the engine, so no combustion takes place during the learning process, eliminating that variable from the calculation. There should also be a code P0315 (Unable to Learn Profile) if the vehicle was not able to learn the profile correction. That code was not present, but that does not guarantee that cylinder #5 was the one misfiring.

I have chased an incorrectly identified misfiring cylinder before, and it was a frustrating learning experience. A simple way to verify that the correct cylinder is being identified is to create another misfire or two on different cylinders from the one identified and verify that those cylinders are correctly identified also. I perform this by watching the power balance test and unplugging a coil on a different number cylinder and verifying it is correctly shown on the test. An injector would have the same effect if it is easier to access than the ignition coil. Needless to say, cylinder #5 was the one with the misfire, so that eliminated that possibility.



AN EASY FIRST TEST TO PERFORM with the Ford IDS scan tool is a relative compression test. While cylinder #5 is slightly lower than the other cylinders, it did not provide conclusive evidence that an internal engine problem existed.

Another test that should be performed on any vehicle with a misfire before delving too deep is a relative compression test. While I usually perform this test with an oscilloscope, a current clamp, and sync it with the cylinder #1 ignition coil, the Ford IDS has a built-in test that can be performed by depressing the throttle fully to the floor (to prevent fueling during the test) and cranking the engine for 10 seconds.

What I did find when performing this test initially was that cylinder #5 had 4 percent lower compression than the other cylinders, indicating the possibility of a mechanical engine problem, but it seemed too small of a difference for this scenario. However, since the cylinder was misfiring, not to mention a fuel injector swap between cylinders, there was also the possibility of a cylinder wall that has partially washed down from excessive fueling.

Even though the previous technician swapped the ignition coil and fuel injector from cylinder #6, that didn't mean that there wasn't an issue with the signals from the Powertrain Control Module (PCM) or wiring to the fuel injector or ignition coil for that cylinder. I attached a scope to both the fuel injector and ignition coil of cylinder #5 and found that both were receiving the correct voltage signal and were operating as designed. At this point I am satisfied that there is some type of mechanical problem affecting only cylinder #5.

THIS IS A COMMON PROBLEM that occurs when trying to remove spark plugs on this type of engine. While the threaded portion separates from the cylinder head, the shell of the spark plug remains seized in the combustion chamber and special tooling is required to remove it.

Cranking compression isn't the whole story

An easy test to perform without removing anything other than the vacuum hose is to perform a cranking vacuum test with a First Look Sensor (FLS). I installed the FLS into the hose going to the vacuum brake booster and synced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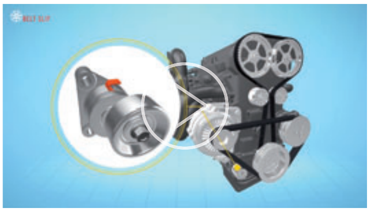
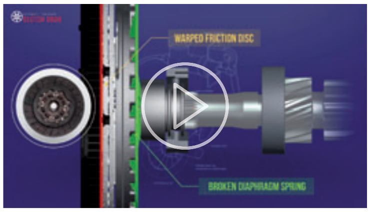
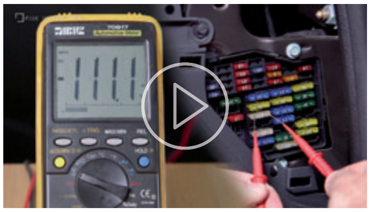
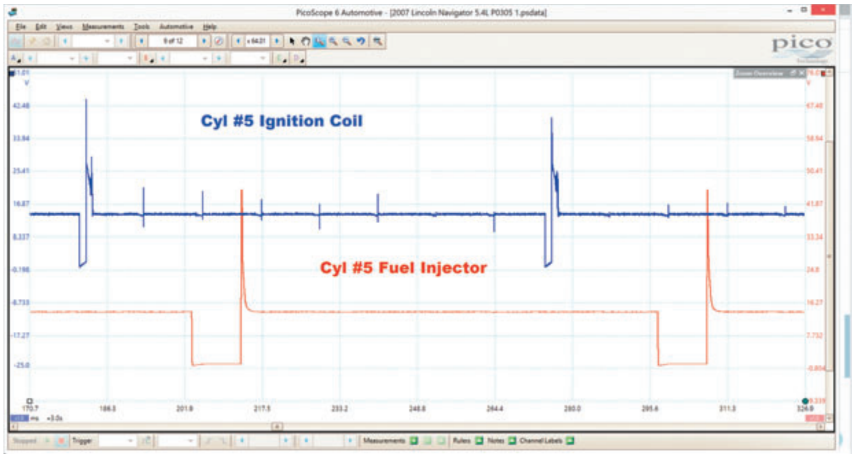



WARPED FRICTION DISC
BROKEN DIAPHRAGM SPRING

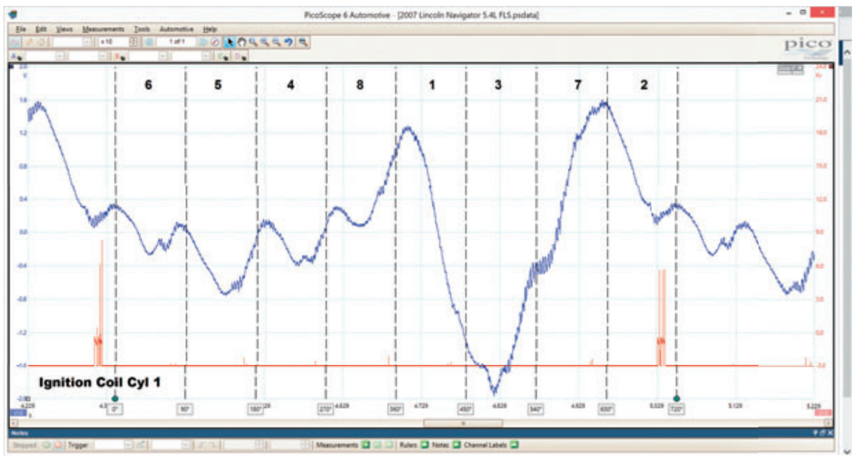


to the cylinder #1 ignition coil. The FLS measures changes in pressure, so this means that each time an intake valve opens, a downward hump or "pull" is indicated in the waveform. An engine in good condition will produce a consistent and relatively even pull for each cylinder in the firing order, since each cylinder should be drawing the same amount of air and each intake valve should be open for the same amount of time, but when an engine has a problem, the steady repeatable pattern will become erratic. This is where the sync comes in. By triggering off a known-good cylinder and using the rotational rulers of the scope, it is possible to divide the period between ignition firings into eight evenly spaced divisions with each representing an individual cylinder. Keep in mind that the intake stroke for the cylinder that has the ignition sync occurs about 360° before the intake stroke. The firing order for this engine is 1-3-7-2-6-5-4-8. Looking at the capture, there is definitely a problem, but it is not something that most can pick out unless they are very familiar with FLS pattern recognition. The pull for cylinder #5 looks fine; however, where the intake pulls for cylinders #3 and #7 should be, there are actually pushes or upward pulses. One of the reasons behind this type of a pattern is that if the intake side of cylinder #5 is not sealing, it can leak cylinder pressure back into the intake manifold (where the FLS is connected to) and disrupt the normal balance between cylinders. However, I am not confident enough in my abilities to make the call just yet, so a little more testing needs to be performed first.

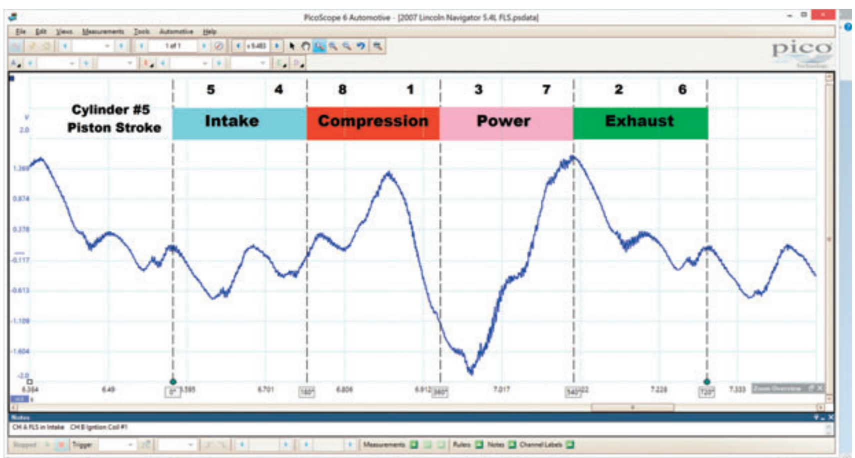
Since the other technician had already broken the original spark plug while trying to remove it and installed a replacement, I was not hesitant to remove the new plug and install a compression hose attached to a pressure transducer for my next test. If that was



WHILE THE OTHER TECHNICIAN ALREADY SWAPPED the ignition coil and fuel injector from cylinder #5 without any change in the misfire for that cylinder, I needed to verify that the actual signals, which activated the ignition coil and fuel injector, were present since even a known good component will not work correctly without the proper signals.



HERE IS THE CAPTURE USING THE FIRST LOOK SENSOR in the intake while synced to the cylinder #1 ignition coil. Note that the intake pull for cylinder #1 starts approximately 360 degrees from when the ignition coil fires.



HERE IS THE SAME CAPTURE WITH THE RELATIVE PISTON STROKE position of cylinder #5. Notice how the symptom of a leaking intake valve does not show up during the intake pull of cylinder #5, but the effect it has on the other cylinder's intake pulls depending on where the cylinder #5 piston stroke position is during their intake valve opening.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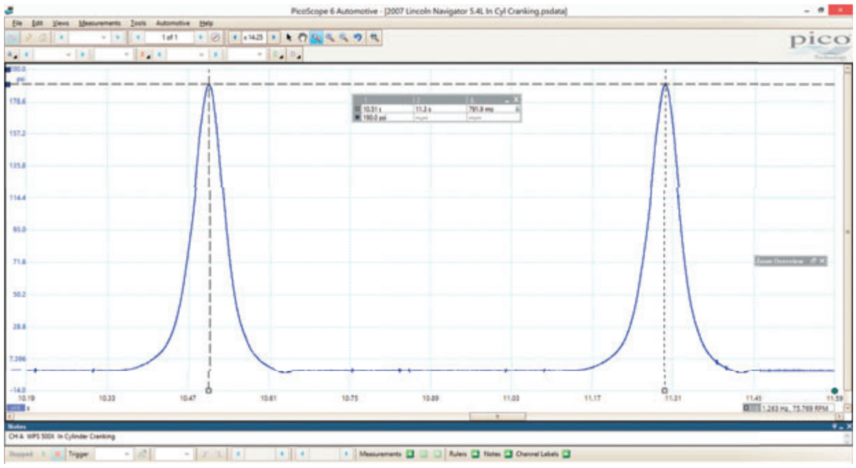
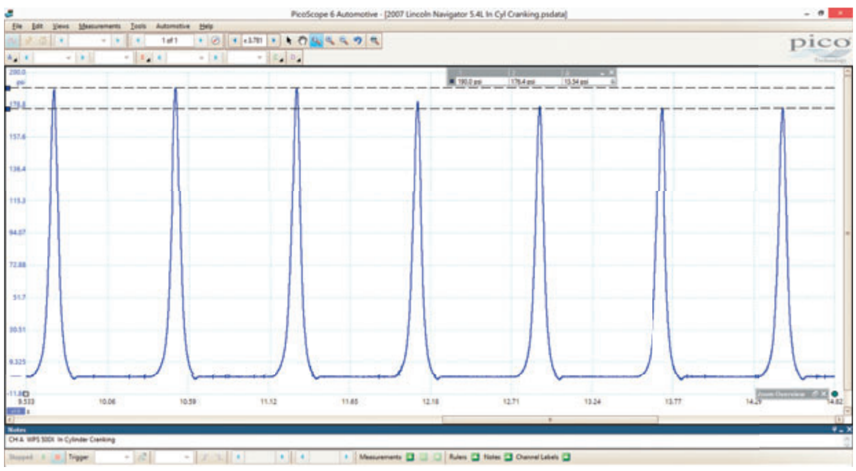
not the case on this type of engine, I would have opted for different testing methods rather than risking removing and possibly breaking the spark plug unless absolutely necessary. With the pressure transducer installed and the injectors disabled, I performed a cranking compression test, and I was a bit confused by the results. I know the previous technician also performed a test with a mechanical gauge, and I also came up with the same results — 190 psi of cranking compression and did not notice any discernable indications of a mechanical failure. However, is 190 psi of compression good? Is it high? Is it low? Remember, Ford does not list a min/max specification, only a range between what the highest and lowest cylinders can vary by. Based on what happened with the first plug that was removed, I am definitely not going to remove more spark plugs to perform comparison compression tests. Something interesting to point out is that as the cranking compression test continued, a decrease in pressure occurred by almost 14 psi as shown in the capture. The next test to perform, especially since the pressure transducer and compression hose are already installed, is a running compression test.

A look inside

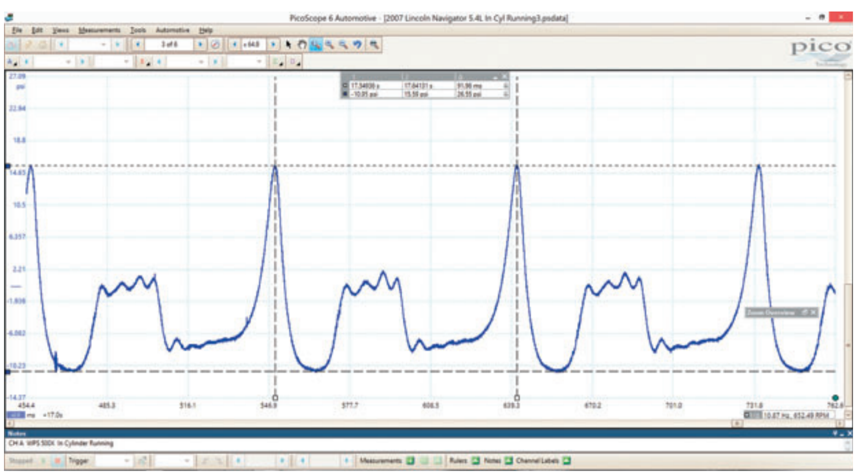
For the previous technician and several others, this is an overlooked test that reveals a lot of information. This is a dynamic test compared to the cranking compression test; some performance and tuning shops use this test to determine how well a particular cylinder is contributing to the engine. The test is performed with the fuel disabled to the cylinder being tested, which on this vehicle was as simple as unplugging the injector and running the engine at idle. The pressure of a good cylinder should be approximately one-third to one-half of the cranking compression test result. A throttle snap is also recommended during a



THE CRANKING COMPRESSION RESULTS found while using the Pico WPS-500X pressure transducer matched what the previous technician found using a mechanical gauge.



WHILE THERE ARE NO DEFINITE SPECIFICATIONS listed for compression of this vehicle, 190psi would normally be a very good number on most vehicles. However, after a few more revolutions, the number started dropping.



THE RUNNING COMPRESSION TEST IS WHERE THE PROBLEM IS REVEALED. Normally the compression would be between one-third and one-half of the cranking compression reading, but here it does not even reach 16psi.

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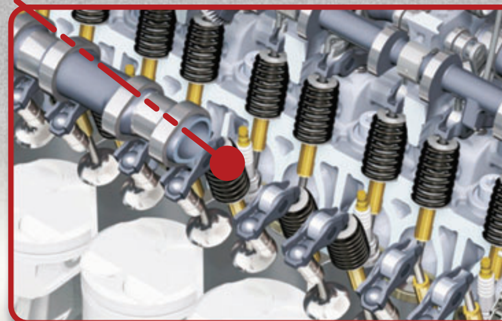

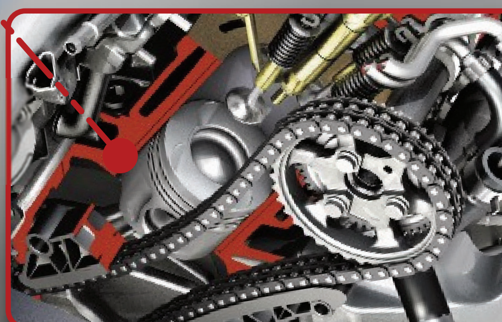

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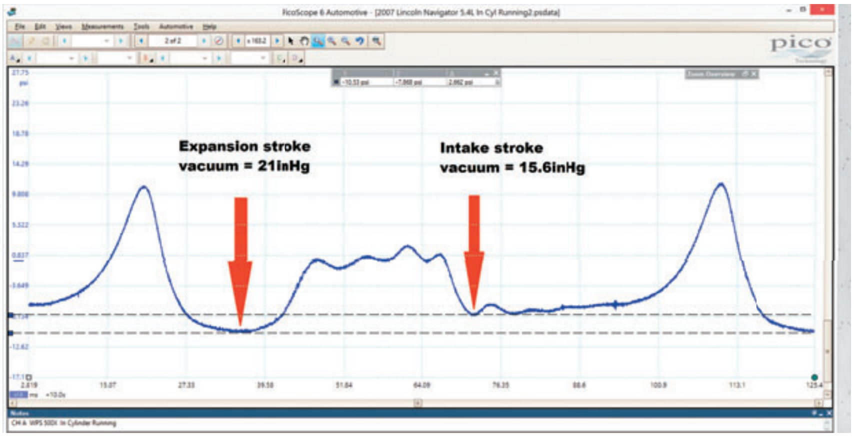


WHILE THE VACUUM ACHIEVED on the expansion stroke appears good at 21inHg, the vacuum reached during the intake stroke is around 15inHg, indicating an intake valve is not sealing.

running compression test, which should be approximately 80 percent of cranking compression results for that cylinder; however, when using an in-cylinder pressure transducer instead of a conventional compression gauge, it is not uncommon to see a higher reading than on the original cranking compression test. So, starting the engine and reading the test results showed a startling discovery — the running compression for cylinder #5 was only around 16 psi, a lot less than the 63-95 psi that would be expected and a snap throttle only increased to 70 psi. On a healthy cylinder, this would have been 150 psi or higher, but it was under half of that number. A good amount of the time when snap throttle results are lower than expected but the running compression is normal, the problem lies in the intake side of the system, and if they are higher, it points to the exhaust side, sometimes a restriction. This, however, showed very low running and snap throttle results. So now we know we definitely have an internal engine mechanical problem on cylinder #5, which is going to be intake related. This is also gathered from looking at the vacuum achieved on the expansion stroke and intake stroke. Usually both vacuum pockets are in the vicinity of a normal engine vacuum and are even with each other. When the expansion stroke vacuum is relatively good and the intake stroke vacuum is low, it generally points to an intake valve not sealing. The reason the expansion stroke vacuum is relatively good is because when the intake valve is leaking, it is open to the intake manifold where a vacuum already exists. An important point to remember that I was taught in pressure transducer training class is that the camshaft lobe opens the valve, but the valve spring closes the valve and keeps it closed.

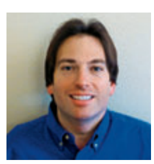
Going by these observations, a phone call was made to the customer and approval was given to remove the Bank #2 valve cover for further inspection. With the valve cover on the driver side removed, the test results were confirmed. One of the two intake valve springs for cylinder #5 was broken, which was the cause of the misfire.

An old-school style technique was used to hold the valve in place while changing the spring. Some small nylon rope was fed into the spark plug hole while the piston was at the bottom of the cylinder and then the crankshaft was rotated to compress the rope against the face of the valve, which worked perfectly. The rocker arm pops out and back in without any bolts, but a specific type of valve spring compressor was needed due to space constraints.

Once everything was reassembled, the Navigator idled and drove smoothly without any further misfire complaints. With ignition being such a common cause of misfires, it can sometimes be hard to step back and consider basic mechanical failures, especially with modern engine reliability. However, with the increased amount of labor required to remove engine covers and components for inspection, old-style tests can be performed with new tools and techniques to help isolate problems before teardown. MA

WITH THE DRIVER-SIDE VALVE COVER REMOVED, a broken spring for one of the two intake valves of cylinder #5 is found.

THE CAUSE OF THE MISFIRE, a broken intake valve spring on cylinder #5.



MICHAEL MILLER lives and works in Las Vegas. He is an ASE certified World Class Technician. He holds degrees in both Mechanical Engineering and Automotive Technology.
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Programs and services to grow your business

Advance Professional supports its professional customers with a full suite of business services and programs designed to help shops improve operations, recruit and retain customers, and drive sales.

Advance offers the aftermarket's most robust, specialized training program through Carquest Technical Institute (CTI) and Worldpac Training Institute (WTI). More than 80 instructors lead regional and destination training events and instructor-led courses are coupled with online training bundles for flexible training options that help any technician, service writer or shop owner stay up-to-date with the latest vehicle technologies and business strategies.

Marketing programs from Advance like TECHNET also provide innovative ways to help independent repair facilities attract, retain and connect with customers in new communication channels. TECHNET membership provides access to tools that help the independent business owner deliver a better customer experience and grow and compete in today's environment, while maintaining their own shop identity.

Premium quality. Proven reliability. Best-in-class national brands. World-class coverage dedicated to the professional technician.

Advance Professional offers recognized OE, premium, and professional grade products – designed and rigorously tested so professional customers can service and repair vehicles on time, the first time. Advance chooses suppliers that adhere to international quality standards and social accountability practices such as Carquest, MOOG, Wearever, Dorman, ToughOne, BWD, Intermotor, Monroe, Walker, Interstate Batteries, Gates and Dayco.

Advance offers more than 900,000 parts and products for foreign and domestic vehicles. Recent product assortment upgrades include an exclusive partnership with Interstate Batteries, with Interstate products available this summer, an upgrade to engine management parts offerings, including 02 sensors and belts, and an industry leading brake program offering with 99 percent coverage on foreign and domestic brake pads and rotors. And with the largest delivery fleet in the industry, professional customers can trust they'll receive the right part at the right time for their business.

The right part at the right time

Advance recently completed the rollout of cross banner visibility, a program that allows the company to serve and deliver professional customers with a greater breadth and depth of quality parts available in-market. Cross banner visibility enables shop owners, technicians and Advance Professional team members to view and order parts from Advance, Carquest and Worldpac through one single catalog.

As of October 7, 2017, Advance operated 5,074 stores, including Autopart International locations, and 129 Worldpac branches and served approximately 1,250 independently owned Carquest branded stores in the United States, Puerto Rico, the U.S. Virgin Islands and Canada.

For more information about quality parts, training or other programs from Advance Professional, visit pro.advancecommercial.com or contact your local Advance, Carquest, Worldpac or Autopart International delivery location.

Advance Professional

ADVANCE PROFESSIONAL
1-877-280-5965
pro.AdvanceCommercial.com

Yes, brakes can really be environmentally friendly

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

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

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

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

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

So how did we eliminate copper without reducing quality, when there is no simple substitute for copper? After many months of development, Akebono formulators created a proprietary compound formula that's just as good–or better–than the ceramic brake pads of yesteryear.

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

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

Learn more at akebonobrakes.com.

akebono
BRAKE EXPERTS

AKEBONO
PROACT®
ULTRA-PREMIUM BRAKE PADS

AKEBONO
EURO®
ULTRA-PREMIUM BRAKE PADS

AKEBONO
PERFORMANCE®
ULTRA-PREMIUM BRAKE PADS

HOT TOPICS

Section 609 certification and requirements

Technicians servicing Motor Vehicle Air Conditioning systems (MVACs) are required to be certified on Section 609 of the Clean Air Act, which directs the Environmental Protection Agency (EPA) to establish service standards. The requirements prevent the release of refrigerants during the servicing of MVACs and requires recycling for used refrigerants.

Technicians who purchase refrigerant in quantities of two pounds or more must be Section 609 certified and must be able to show their credential at the time of purchase. The certification is required for those recovering R-12, R134a and R-1234yf refrigerant. Section 609 certification is applicable for applications including passenger cars and trucks, heavy-duty trucks, buses, farm tractors, off-road equipment, and passenger military vehicles.

Section 609 certification programs are specifically designed to cover MVAC refrigerant recovery, recycling and charging equipment and procedures in accordance with SAE Standards and regulatory requirements. To become certified, technicians must pass a test demonstrating their knowledge of the use of refrigerant recovery/recycling equipment, the EPA's regulatory requirements, the importance of refrigerant containment and the effects of ozone depletion and environmental change.

Robinair, in partnership with MACS Worldwide (the Mobile Air Conditioning Society) is offering multiple online webinars and in-person training forums nationwide to help technicians learn more about A/C service and industry changes and become Section 609 certified. The automotive A/C training courses are often free of charge and helps technicians stay up-to-date on system service needs for R-134a and R-1234yf. The Section 609 course includes instructor-led training; technicians must purchase the official certification test from MACS.

R-1234yf refrigerant will also be a key trending topic of the training course as it continues to gain popularity among vehicle manufacturers. Automakers receive emissions credits for using R-1234yf, so aftermarket technicians will soon see an increase in vehicles using the refrigerant. Section 609 certification will be crucial as R-1234yf replaces the current industry-standard R-134a.

The training is also in compliance with SAE Standard J2845, which requires that technicians be trained to recognize which refrigerant is being handled, how to handle it safely and be equipped with the essential information, proper equipment and tools, which are unique to these refrigerants.

Once achieved, Section 609 is a lifetime certification with no requirement for recertification. Technicians can register for the Robinair and MACS Worldwide forums and Section 609 certification by calling 215-631-7020 x 0 or by registering online at www.macsw.org.

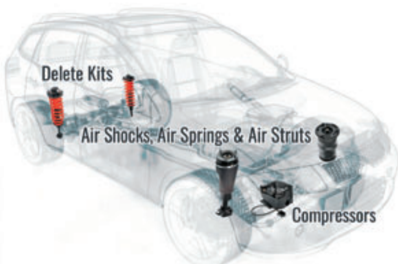
ROBINAIR

HOT TOPICS

Big changes to active air suspension aftermarket!

Between 2018-2020, the number of vehicles with Active Air Suspension systems is expected to increase by 30% to over 33 million

More and more cars on the road today are using air suspension systems to improve ride, handling, load capacity and aerodynamics for fuel efficiency.



Dorman Products now has a complete line of Air Suspension solutions

Offering innovative air compressors, air shocks, air struts, and air springs, and two types of delete (conversion) kits – all with comprehensive coverage.

All Dorman products are made with 100% new parts

No more hassle, cost, or availability issues from dealing with reman or cores.

OE Air Suspension Compressors have known failures

When there is a leak in an air suspension system, OE Compressors will continue to run until the point of failure and burnout. They can also fail from moisture intrusion at connector points.

Dorman fixed OE Compressor problems

The exclusive Dorman Products OE FIX Air Suspension Compressor (949-099) features thermal protection software to prevent motor burnout plus an additional protective membrane to improve weather resistance. Plus 100% new parts and the most included accessories in the Aftermarket.

More installation accessories included than anyone else

Dorman gives you the most accessories in the Aftermarket, delivering both convenience and value to your shop.

Exhaustively tested air shocks, air springs, and air struts

Life cycle testing over 2 million cycles (equivalent to 10 years average service) over a temperature range of -40F to 135F to help ensure quality

Dorman has 2 types of conversion (delete) kits for all budgets

Full, 4-corner, tuned-ride delete kits with replacement components at each corner designed to work in concert with one other for a high quality, level ride with precise handling. Plus budget-friendly partial kits for rear/front-only conversions that just remove the failed air components.

For more information about the Dorman Active Air Suspension line and to view coverage, visit DormanProducts.com/Air

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Fax: 215-712-5891
www.DormanProducts.com/Air
news@DormanProducts.com

Idemitsu lubricants: From OEM to consumer

Over 25 years ago, Apollo America was founded as a full subsidiary of Idemitsu Kosan, to support business in the U.S. with a major OEM manufacturer and to provide innovative and quality lubricant solutions to U.S. companies. The company draws its foundation from the rich lubricants history and company values set forth by Idemitsu Kosan founder Sazo Idemitsu. The name of the company was changed in 2006 to Idemitsu Lubricants America (ILA) to unify the Idemitsu name around the world.

While ILA takes great pride in its Japanese heritage, ILA products are produced at its state of the art blending and packaging facility located in Jeffersonville, IN. This location allows access and transportation from three major highways, rail, air and resources provided by the Ohio River. These capabilities play an integral role in the expansion of ILA business to other OEM factory fill and private label opportunities, and to also introduce consumer products in both the industrial and automotive aftermarket industries.

Idemitsu brand

Idemitsu offers nine Automatic Transmission Fluids (ATF) and a Continuously Variable Transmission (CVTF) fluid. They are application specific, and OEM equivalent in quality. The formulations are exclusively designed to meet the needs of specific Asian vehicle transmission applications. Each high quality ATF or CVTF product is unique in its ability to meet requirements for viscosity, oxidation prevention, friction durability, aeration control and wear protection.

"Not all vehicles are the same. Your vehicle came off the factory line with a specific ATF or CVTF, so why would you choose to use a multi-vehicle automatic transmission fluid that may or may not meet your transmission's exact needs?" said Tom Braun, ILA Aftermarket Oil Director.

Designed to meet OEM stringent performance and protection requirements, fully synthetic Idemitsu brand engine oils are engineered using advanced wear-control and superior additive chemistry for better protection. Idemitsu engine oils are available in 0W-20, 5W-20 and 5W-30 viscosities in 1-quart and 5-quart bottles. Rounding out the Idemitsu product line is Power Steering fluid and PAG – air conditioning compressor oil.

ZEPRO premium engine oils

Taking advantage of the development of OE approved oils for factory fill and dealer service, Idemitsu's research and development team has used these same efforts to bring the Idemitsu ZEPRO product line to the consumer market. These premium fully synthetic oils are available in: ZEPRO Eco Medalist 0W-16, 0W20 with Advanced Molybdenum, 0W-20 dexos1™ approved, ZEPRO Touring 5W-30 dexos1™ approved, and ZEPRO Euro Spec 5W40. All ZEPRO products are come in 1-quart and 5-quart containers.

Idemitsu and ZEPRO products are currently available through warehouse distributors, retail partners and online. To support the growth of the brand in the market ILA recently launched a consumer website that allows visitors to find the right Idemitsu product for their vehicle based on Year, Make, Model, and Engine. For more information visit idemitsulubrcants.com com and follow ILA on Instagram, Facebook and Twitter @idemitsulubes.

IDEMITSU

Lubricant solutions since 1911.

HOT TOPICS

Reinventing the wheel with diamond

Grinding wheels that break and deteriorate quickly are dangerous and useless in a professional shop. Diamond technology is leading the innovation behind several new, time-saving products with faster grinding and cutting, as well as fewer sparks and odor than conventional grinding wheels. IPA® offers a full line of industrial, diamond products for any shop's need.

Working with difficult and tight materials

Standard-type grinding wheels are made of abrasive materials that are simply glued together. These wheels often break apart or become smaller the longer they are used. Diamond has seen some use in various cutting tools; however, adapting diamond to grinding wheels poses quite a challenge due to their shape and high speed. Therefore, an innovative, core bonding technology was invented to apply diamond to the wheel with a permanent bond. This allows diamond abrasive to be attached to a cutting edge, grinding surface and top side for unparalleled versatility without the typical failures seen from standard-type grinding wheels.

Lasts longer

Diamond is 20-60X harder than the usual materials used, and when core bonded to a stamped steel wheel, will help maintain the wheels size and shape. A close inspection of a diamond grinding wheel surface reveals it is comprised of thousands of small diamonds. As the wheel is used, the diamonds wear down very slowly and their edges fracture. On a microscopic level, when a diamond edge fractures, it leaves a jagged and new abrasive edge. These diamond grinding wheels will last a minimum of 20X (2,000%) to 60X (6,000%) longer than traditional wheels.

Variable high-speed operation

Because of the bonding technology, diamond grinding wheels will grind and cut faster with less sparks, debris and odor. Furthermore, the innovative design of IPA®'s diamond grinding wheels provides abrasive material on the cutting edge and topside for increased versatility and tight-access grinding/cutting.

Strength means safety and savings

Diamond grinding wheels are not only safer to use than standard grinding wheels, but due to their long life they also save additional costs by limiting downtime and interruptions to work flow. For example: Let's assume the diamond grinding wheel lasts 40X longer than a competing wheel. Throughout the life of that one wheel, that's 40 less times the user must stop working, find a new wheel, find a wrench, screw on a new wheel and then re-acclimate to the work at hand. Additionally, as stated in Newton's first law of motion: An object at rest stays at rest and an object in motion stays in motion with the same speed and in the same direction. Applying this principle to human workplace dynamics, a diamond grinding wheel has the potential to prevent an average of 40 additional interruptions which result in a cumulative loss of productivity. These new wheels are truly a game changer with immediate benefits.

IPA® FUTURE NOW®

INNOVATIVE PRODUCTS OF AMERICA®
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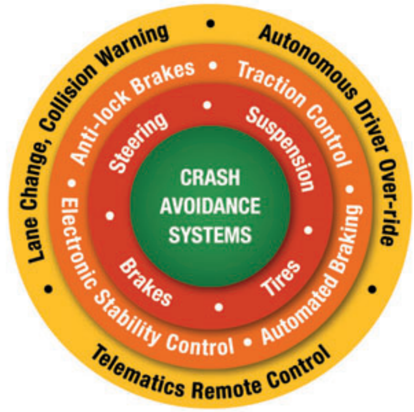
www.ipatools.com

HOT TOPICS

Crash Avoidance Systems require maintenance



Your customer's vehicle and its Crash Avoidance Systems capability may be at risk unless you help them make good ride control (maintenance) choices. That's correct: Shocks, struts, steering, suspension, brakes & tires are the most critical components of a vehicle's Computerized Crash Avoidance System!

TV commercials and new vehicle salespeople would have you and the motorist believing that just because a vehicle has all the latest high-tech, fancy name features that it's nearly Crash-Proof. What they don't tell you is that it only works well (if) you maintain the designed performance of its ride control components. That's when a parts professional can really help the motorist… Stay in Control.

A computer system like Electronic Stability or Traction Control can't actually stop a vehicle, it can't change lanes quickly and it can't help grip the road. Only the tires, brakes, shocks & struts and ride control components can! Computerized controls can only observe how a vehicle is behaving and make decisions about how to correct a bad driving situation. Electronics and computer software can't actually correct the problem nor avoid an accident by itself. The parts you recommend are what make the difference between it working well, or not.

So, are shocks & struts important to Crash Avoidance? Of course they are because they control the vehicle's springs, which in turn controls body movements like pitch, roll & yaw. When too much spring movement occurs due to shock & strut wear the steering becomes unresponsive which causes under & over-steer problems as well as reduced tire to road contact. As a vehicle begins to lose control, Crash Avoidance kicks in and tries to keep the vehicle in control by applying brakes, slowing engine speed and in some models it changes transmission, cruise control & steering functions.

You may be surprised to learn that National Highway Traffic Safety statistics show that most vehicle accidents occur to vehicles that are 4 to 8 years old. Virtually all vehicles in that age range are equipped with Crash Avoidance Systems, but they're still involved in the most collisions. That's where you, the parts professional, can help your customers: by helping them understand the importance of ride control maintenance parts like shocks & struts that help keep Crash Avoidance working at its best.

KYB is one of the world's largest suppliers of shocks & struts to new vehicle manufacturers and are original equipment on many of the world's top selling vehicles. The importance of Crash Avoidance is why all KYB shock & struts have original equipment quality and are specifically calibrated to help restore a vehicle's designed performance.

Helping the motorist stay in control is an auto care industry shared responsibility. The more you know and share with the customer, the safer we all drive!

KYB®
World Class Shocks & Struts

OEA
Original Equipment for the Aftermarket®

KYB | www.kyb.com

HOT TOPICS

What is it like to be the best of the best?

With the largest network of auto repair centers in the country, it's no surprise that NAPA AutoCare Centers are what comes to mind when motorists' think of quality installed parts and superior repair servicing.

Since the program began in 1984, over 16,000 NAPA AutoCare Members have chosen to partner with us because we continually provide their automotive or heavy-duty repair business with the most integrated and value-driven programs, discounts and tools available.

Members' drive more new and repeat business like ever before with nationally recognized consumer facing, Sales Driver promotions. They also provide more ways to help their customers through an expensive repair with the NAPA EasyPay - consumer financing program.

NAPA AutoCare Centers emanate professionalism and trust while revitalizing their businesses through the NAPA PROimage program. In fact, those who complete a PROimage redesign of their shop exterior typically see an average increase of 27 percent in their business profits within 6 months.

Hiring the best talent is simple as a NAPA AutoCare member. All members are able to easily post open and available positions directly from the NAPA AutoCare Talent Network. This resource directly collects interested and capable candidates and provides them with exactly what they need to find and apply for your position quickly and easily. There are over 12,000 members who've joined the NAPA AutoCare Talent Network and are finding their careers faster than they ever thought possible!

Staying at the forefront of technology and innovation, the NAPA AutoCare Member program contains the best mix of digital based service offerings available in the market. These include: the NAPA AutoCare App, Digital Menu Board, Digital Vehicle Inspection, NAPA Service Assistant, and leading shop management tool – NAPA TRACS.

Through these programs, NAPA AutoCare is committed to helping member partners lead their competitors in performing diagnostic services, sharing dynamic educational resources, providing convenient communication options and much more!

Being a NAPA AutoCare Center means you're one of the best of the best in your market.

Learn more today and change your business forever.

Visit: http://www.napaautocare.com/features-benefits.aspx to get started.

NAPA AUTOCARE CENTER

NAPA AUTOCARE | *www.napaautocare.com*

HOT TOPICS

Raybestos rotors and calipers provide best defense against the elements

Raybestos® RPT Rust Prevention Technology™ coated rotors and plated calipers provide protection against the harshest elements, including snow, salt and rain, inhibiting corrosion and rust, making them ideal for vehicles in all weather conditions.

Aggressive ice and snow melt chemicals used in colder parts of North America, as well as humidity in warmer climates, can accelerate rotor corrosion. Over time, this corrosion builds under brake friction layers, causing the friction materials to rust jack. RPT Rust Prevention Technology coated rotors use a propriety finishing technology to evenly coat each rotor's entire surface, including the cooling vanes. The full Grey Fusion 4.0™ coating helps resist corrosion and significantly delays rust-induced performance issues. Open-wheel designs on modern vehicles leave brake parts, particularly rotors, more exposed to the elements. If a rotor is uncoated, corrosion and red rust begin to form immediately.

RPT rotors are qualified by industry standard test procedure ASTM-B117 and SAE Standard G3000 qualified for structural integrity and maximum service life.

RPT Rust Prevention Technology plated brake calipers are premium quality, remanufactured calipers that function and fit like OE. They are friction ready and engineered for safe, leak-free operation. A proprietary zinc electroplating process helps prevent rust and provides protection for all kinds of weather. The plated brake calipers maintain their high-quality appearance and deliver continued functionality throughout their extended service life.

Strict testing criteria guarantees RPT calipers provide trouble-free installation and optimal performance in demanding driving conditions. They undergo a rigorous remanufacturing process to ensure they not only meet or exceed OE standards, but that they also adhere to global industry standards including SAE J1603, QC/T 592-2013, ASTM B117 and JASO C448. All recovered components are thoroughly cleaned, checked for wear and straightness, and zinc electroplated. The seals, boots, bleeder screws and O-rings are replaced with new materials.

For more information on Raybestos RPT Rust Prevention Technology rotors and calipers, or the complete line of quality brake products, including disc pads and shoes, rotors and drums, master cylinders, wheel cylinders, calipers, hoses, cables and hardware, visit www.Raybestos.com.

Raybestos® The best in brakes®

RAYBESTOS
4400 Prime Parkway
McHenry, IL 60050
815-363-9000
www.raybestos.com

HOT TOPICS

Dan-Am Air® Advanced Aluminum Air Pipe System

Today's 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 needed in the past. Not only does clean air effect equipment performance, but it is also critical for paint coatings performance. Dan-Am Air, along with SATA filtration can solve all of these issues.

Dan-Am Air is lightweight, aircraft grade, powder coated aluminum, which provides clean, dry air up to 232 psi. The reinforced composite Nylon fittings have dual seals, which rest on un-scraped pipe, providing a leak free guarantee. Our Press-to-Connect fittings feature a full bore design for turbulence free air delivery. This quick, instant connection eliminates the need to thread, solder or glue, accounting for far less installation times than traditional copper or black pipe.

We also stock a large array of threaded connectors and adapters, allowing Dan-Am Air to be integrated into existing systems without compromising performance, making DAA perfect for upgrade or expansion projects.

Designed with simplicity in mind, DAA allows you to do-it-yourself. Measure, cut, de-burr, then simply Press-to-Connect, equaling lower installation times and cost. All fittings arrive pre-torqued for immediate assembly and pressurization, as well as being interchangeable, allowing for ease of future addition or expansion. "This "Press-to-Connect" subject tends to be the most misunderstood instructions in the DAA system. We have all been taught since we were young, to loosen a given item, put it together, then tighten it back up, right? That is wrong with Dan-Am Air. DO NOT loosen fitting caps before installation. It really is as simple as push the fitting onto the pipe until it bottoms out. Done. Stop. Move on. The only reason to loosen a fitting cap, is to remove the fitting from the pipe. Loosening the cap relieves the pressure on the grip ring, allowing you to gently back out the pipe. To reuse any given fitting, simply re-torque the fitting cap to factory specs (line the arrows up, see figure 1), and "Press-to-Connect. As each cap is individual to its fitting, the arrows are either solid, or hollow respectively. Fitting caps are NOT interchangeable.

FIGURE 1

DAA also allows you to take your investment with you in the case of relocation, as all components are reusable.

Product design and support is readily available from Dan-Am Company. They also have all products on hand and ready to ship, as well as in-house support for quotes and general information.

Dan-Am Co., is the Exclusive Importer of SATA Products for the US and Puerto Rico. Anywhere you can purchase SATA Products, also has access to our Dan-Am lines as well, including Dan-Am Air.

Please visit our Website at www.dan-amair.com, as well as our Facebook page www.facebook.com/danamaluminumair-line for recent install pics, comments etc. Both of these have proven to be valuable resources for customers to understand exactly what can be accomplished with SATA and Dan-Am Air combined.

DanAmAir®

BRAD GRAVENHOF has been in the automotive industry for over 30 years and serves as DanAm Company's Sales and Technical DanAm Air Specialist.

HOT TOPICS

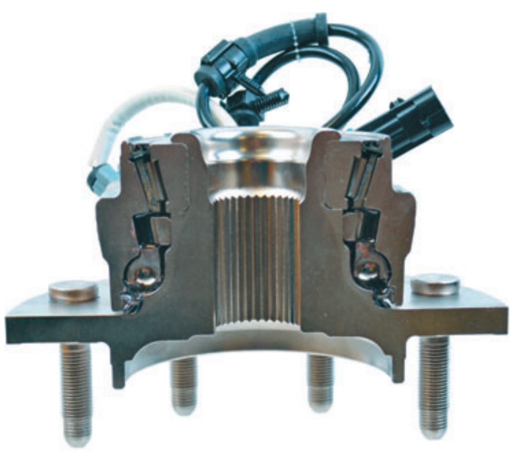
SKF – A hub of innovation

With the continued demand to create safer and more reliable vehicles, manufacturers are looking for any edge that can strengthen components and how they perform. SKF continues to build on its history as a pioneer in the development of the first, second, third and fourth generation wheel end hub bearing units.

Today, SKF continues its ongoing partnerships with original equipment manufacturers to develop a new level of performance, reliability, safety and comfort for today's vehicles.

The next generation of wheel end technology

SKF's X-Tracker hub bearing unit provides precision handling and braking characteristics, ultimately delivering improved handling and comfort. The SKF X-Tracker Hybrid hub bearing unit is designed to provide increased performance to pickup truck and SUV applications. Combining the strengths of the ball and tapered roller hub units, the hybrid hub bearing unit offers less rotor and flange deflection which helps withstand harsh off-road environments.



SKF hub bearing kits – everything you need in one box

SKF's hub bearing kit is designed to save time by providing everything an automotive technician needs to replace a press-in style hub bearing, including a cartridge-style wheel bearing, C-clip, axle nut, seals and the only premium hub flange in the aftermarket that meets 100 percent OE Specification. SKF's hub bearing kit reduces the chance of customer returns by providing quality parts designed to fit and work properly together, eliminating the hassle of sourcing separate parts, sometimes from separate suppliers.

Comprehensive line of U-joints from SKF

Building on our industry-leading expertise in bearing and seal technology, SKF offers a premium line of U-joints with broad application coverage, which includes an industry leading range of the high performance Brute Force line. The line offers more part numbers for broader coverage of automotive, truck, agricultural and industrial applications. Additionally, improved cataloging with key specification information creates easier parts identification.

SKF
890 North State Street, Suite 200
Elgin, IL 60123
800-323-8024
www.vsm.skf.com

HOT TOPICS

The aftermarket's next big repair opportunity

Last year, the National Highway Traffic Safety Administration (NHTSA) released a study that confirmed what many already suspected: the main reason for rear-end collisions is driver inattention. And yet the prevalence of driver inattention is still surprising. In a separate NHTSA study from 2007, researchers discovered that nearly 50 percent of two-vehicle crashes are rear-end crashes, and that drivers were inattentive to the upcoming traffic nearly 90 percent of the time. In yet another study, the National Transportation Safety Board (NTSB) determined that inattentive drivers played a critical role in nine serious crashes investigated between 2012-2014.

Fortunately, there's a silver lining to this problem. As early as 1995, the NTSB has been encouraging the development and adoption of automotive technology that prevents and mitigates such crashes. Today, the efforts of the NTSB and others have helped make the Advanced Driver Assistance System (ADAS) one of the fastest-growing automotive technologies over the past decade. In 2015, ten major vehicle manufacturers committed to making autonomous emergency braking a standard feature on all new vehicles. Just three years later, many ADAS components are now widely available on late-model and new vehicles, and will continue to be the premiere safety feature for the future.

Coming to a bay near you

As ADAS technologies become more common on vehicles, repair opportunities will grow. Moving forward, it will be imperative for shops and technicians to be ready to service these repairs when they arrive in their bays, especially considering that many ADAS parts are expensive, generate profit, and can be damaged by even minor collisions.

For example, blind spot detection sensors notify drivers to obstacles in their blind spots. Typically located on both corners of the rear bumper, the sensors tend to be damaged by minor rear-end collisions and even inaccurate parking. Cruise control distance sensors measure the distance to the leading vehicle to drive both the adaptive cruise control system and emergency braking system. Because the sensors are located in the front of the vehicle (usually behind the lower radiator grill), they're easily damaged by minor impact to the front of the vehicle. Lane departure sensor cameras notify drivers if the vehicle leaves a lane without a turn signal activated. Typically located on top of the windshield between the rearview mirror and windshield, the cameras can be damaged by both extreme sun load and objects that hit the windshield in the location point.

Standard's ADAS expansion

In order to provide professional technicians with the coverage and quality they need to take advantage of the growing ADAS repair opportunity, Standard is committed to aggressively expanding its line of ADAS categories. In January, Standard announced an expansion of 36 ADAS components including 18 Blind Spot Detection Sensors, 13 Cruise Control Distance Sensors, and 5 Lane Departure System Cameras. The release provides coverage for all major domestic and Japanese manufacturers including Ford, GM, Chrysler, Toyota, Honda, and Nissan. Standard's ADAS expansion adds to its existing line of 50+ Park Assist Sensors and will continue throughout 2018. In addition to providing high-quality parts, Standard is proud to offer training for ADAS repairs. Later this year, Standard Pro Training will debut its "Driver Assist System Overview" on-demand class available at standardbrandtraining.com.

STANDARD MOTOR PRODUCTS, INC.
StandardBrand.com

STANDARD®

FUEL PUMPS

Carquest Fuel Pumps, available exclusively from Advance Professional and Carquest, are performance-tested premium fuel pumps that ensure long life through quiet and precise operation. Designed with upgrades to meet or exceed OE specifications, Carquest Fuel Pumps use a superior carbon commutator and turbine technology to improve durability, enhance performance and reduce vibration noise. For more information on quality Carquest parts, call your local Advance Auto Parts or Carquest delivery location.

WWW.CARQUEST.COM

HEAVY DUTY CATALOG

The new Stant® Heavy Duty Catalog offers customers a complete line of innovative products for the heavy-duty, diesel, agriculture, small engine, marine and aerospace markets. The catalog features thermostats, fuel caps and radiator and oil caps for a wide variety of applications such as light-duty and heavy-duty on-road diesel engines and trucks, off-highway heavy-duty equipment, diesel engines for all horsepower ranges, construction equipment and agricultural engines and equipment.

WWW.STANT.COM

TIRE INSPECTION TOOL

Bartec announces the Tech200Pro, which is designed to work with your existing point-of-sale system, or Bartec's Service Center System, and as a result, making it easy, fast and accurate to inform customers of their tire's condition. The first tool to combine tread depth, TPMS and digital pressure measuring, the Tech200Pro captures the right safety information. The Tech200Pro is set up for a specific make, model and year by simply accepting the vehicle lookup from your point of sale.

WWW.BARTECUSA.COM

SHOP CARTS

Monster's new seven-drawer, fully assembled cart comes in three different colors (part no. MST3507XG) green with black trim, (part no. MST3507XMB) matte black and (part no. MST3507XTG) textured gray. These professional carts are designed with a large 15.6" tall-top storage compartment providing more space, gas struts for stability and a locking mechanism to keep your tools secure.

MONSTERAUTOTOOLS.BLOGSPOT.COM

HIGH CARBON BRAKE DISCS

Textar, the world's leading manufacturer of OE brake pads, offers a range of German-engineered, high-carbon brake discs for European applications. Engineers have developed a brake disc to ensure ultimate braking performance, and the brake discs are available at WORLDPAC.

WWW.WORLDPAC.COM

TIRE CHANGERS

The new line of Hofmann® smartSpeed™ tire changers are not only easy to operate, but shops will experience a new level of productivity when they use one of these performance-enhancing tire changers. Exclusive to Hofmann, the patented smartSpeed technology included on the tire changers optimizes the torque applied to the wheel and automatically sets the maximum rotation speed of the wheel accordingly.

US.HOFMANN-EQUIPMENT.COM/EN/

WHEEL BALANCER

The Road Force® Elite from Hunter is the fastest diagnostic wheel balancer on the market and performs both a traditional balance and Road Force Measurement® in less time than it takes to complete a conventional balance. Hunter's patented vision system determines wheel dimensions and wheel runout measurements on the Road Force Elite to save time, eliminate data entry errors, ensure accuracy and enhance ease of use. The vision system also completes a 3D scan of the wheel.

WWW.HUNTER.COM

HEADLAMPS

NAPA NIGHTVISION™ Headlamps work on over 99 percent of the vehicles in operation since 1958 and provide whiter, brighter light for improved depth perception and contrast. So, when you go with NAPA NIGHTVISION Brilliant capsules, you'll get industry-leading brightness that'll outperform any OE parts. Plus, each comes with a three-year warranty, which means you can buy with confidence.

WWW.NAPAONLINE.COM

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PRODUCTS

WHAT IS YOUR SCAN TOOL PROCESS?

WE DEAL WITH DRIVABILITY COMPLAINTS EVERY DAY AND THE SCAN TOOL IS A GO-TO TOOL FOR SUCCESSFULLY DIAGNOSING THEM. BUT DO YOU HAVE A PROCESS IN PLACE TO KEEP YOUR RESULTS CONSISTENT?

PETE MEIER // Technical Editor

MOTORAGE.COM/mar18trainer

I've known techs who have used a shop's high-end scan tools for nothing more than pulling codes, and I've known techs who could solve the mysteries of life using only the data they could access with a basic Global OBD II tool. One of the keys to the success of the latter group was the use of a standard routine that they applied to every case — at least in the beginning of their overall diagnostic process.

By following a standard process, you can minimize the time spent on the diagnosis and minimize the chances that you'll miss something important. The whole idea is to start off with a routine approach that will help highlight the problem area and draw it out into the open where you can examine it more closely.

The process involves the selection of specific data Parameter Identifiers (PIDs) and performing a test drive using a set route and following a specific set of steps.

In this edition of The Trainer, I'll show you how to set up your scan tool and test route and then take you through a few test runs, after which we'll analyze the data and determine our diagnostic "next steps." MA

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