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MAY 2017

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IN EVERY ISSUE

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SHOW FEATURES

LET NACE AUTOMECHANIKA BE YOUR MATCHMAKER

KRISTA MCNAMARA //
Content Channel Director

CHICAGO — Send your technicians to training and build your shop supplier network — all at one event. NACE Automechanika 2017 is offering matchmaking services between exhibitors and attendees of the 2017 show, happening July 26-29 in Chicago.

Unique to NACE Automechanika attendees, the service allows high-buying-power shops to connect with potential suppliers during the show. When you register to attend NACE Automechanika, simply check the box to indicate you are interested in matchmaking services, and via email you will be guided through the process, beginning this month. Three attendee webinars will also take place in May to further explain the offerings and how to best tailor it to your needs.

"Adding matchmaking to the list of unique offerings we are able to provide

>> MATCH CONTINUES ON PAGE 8

BREAKING NEWS

EVENT SUPPORT

OEMS TO FEATURE TRAINING, TECHNOLOGY IN COLISEUM FEATURE

NACE Automechanika 2017 announced the commitment of the industry's leading OE brands including Toyota, Fiat/Chrysler, BMW, Nissan, Honda and General Motors. As the largest U.S. tradeshow and training event for automotive service and collision repair shop owners and technicians, the OEs will join more than 600 exhibiting companies who will display their new innovations, products and services. This event is the largest U.S. tradeshow and training event for automotive service and collision repair shop owners and technicians taking place July 26–29, 2017 at McCormick Place West, Chicago.

With the OEs representing the driving force in automotive technology, NACE Automechanika is pleased to create a platform for this elite group to connect, train and network with the market.

>> OEMS CONTINUES ON PAGE 10

TRENDING

NACE AUTOMECHANIKA ONE-DAY EVENTS TRAIN HUNDREDS

The NACE Automechanika Commitment to Training completed three one-day training events in 2016, with more than 370 technicians receiving professional training.
MOTORAGE.COM/ONEDAYS

TRENDS, TECHNOLOGY TO BE FOCUS OF TRAINING AT NAMC

WIth four full days of training and education, NACE Automechanika Chicago, July 26-29, is a "must attend" for industry students, technicians, shop owners and educators.
MOTORAGE.COM/EDUCATE

A LOOK BACK: AUTOMECHANIKA CHICAGO MADE ITS 2015 DEBUT WITH QUALITY ATTENDANCE

Automechanika Chicago launched April 24-26, 2015, and welcomed nearly 6,000 attendees. More than 450 exhibitors from 23 companies were present, and more than 2,000 attended the 100+ training seminars.
MOTORAGE.COM/DEBUT

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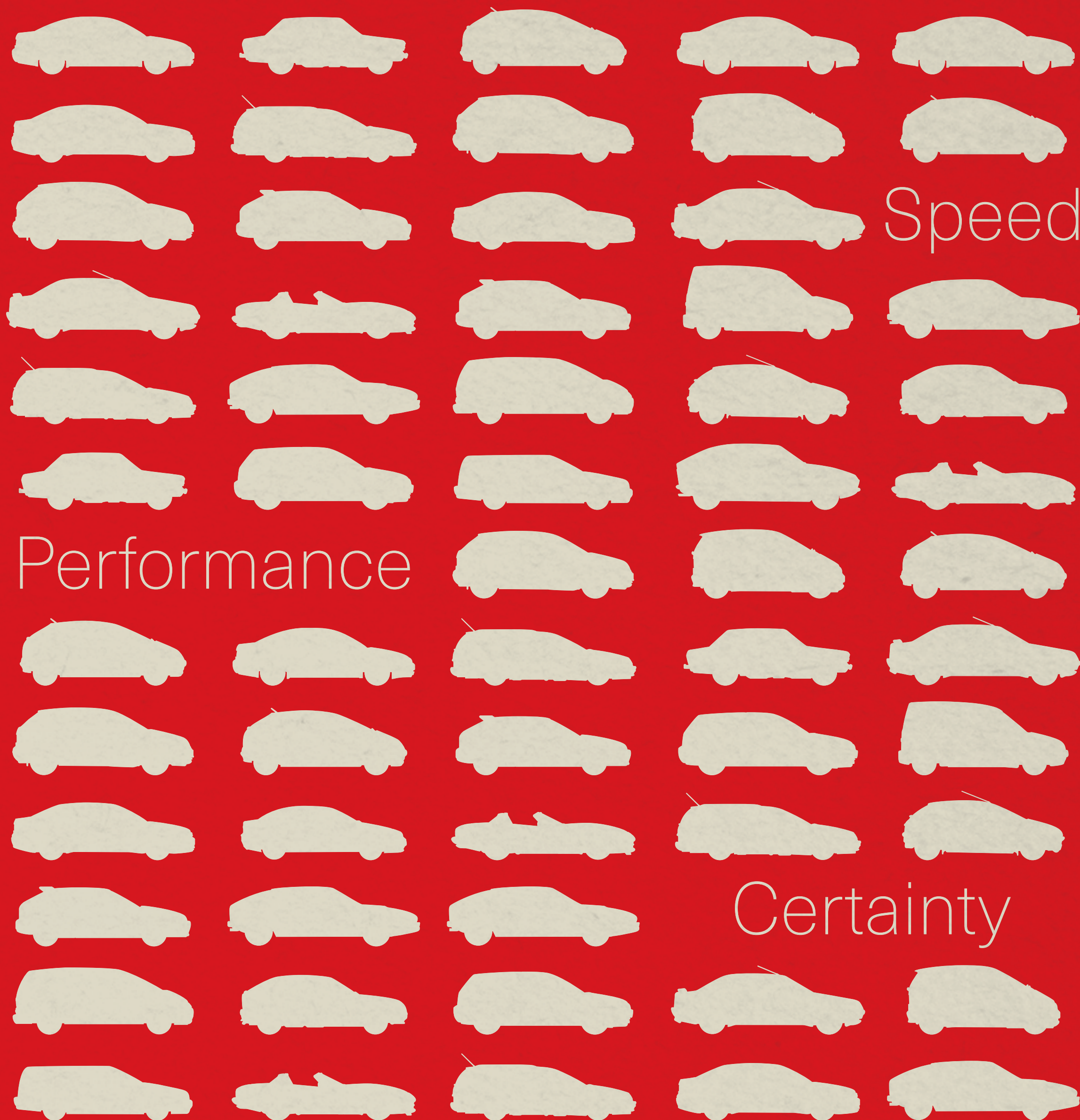

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TRAINING SCHOLARSHIP

NAMC SCHOLARSHIPS AWARDED AT 2017 TST BIG EVENT

PETE MEIER // Technical Editor

TARRYTOWN, NY — Two attendees of the 14th annual TST (Technicians Service Training) "Big Event" can now add a second training event to their schedule this year — NACE Automechanika 2017.

During the March 25 Big Event, which hosted 461 technicians, educators and shop owner from 19 different states and Canada, two winners were selected to receive TST/*Motor Age* NACE Automechanika scholarships. These scholarships cover the cost of travel and hotel stay, as well as providing some pocket money the recipients can use to purchase products on the trade show floor.

Robert Kenney, a technician at Gil's Garage Inc., in Burnt Hills, NY, was the first winner. Kenney said he hopes to attend NACE Automechanika and then bring what he has learned back to his shop to train other technicians and serve as a mentor.

The second winner, Joel Widrick, owner and technician at Widrick Truck & Diesel Service in Carthage, NY, said he was hoping to take two of his technicians with him to NACE Automechanika; the scholarship will help make that possible.

"Being able to team up with the UBM Community Engagement Program and provide these deserving technicians with scholarships thrills me," said G. Jerry Truglia, president of TST. "The need for training is so great in our industry. Having the opportunity to make sure more technicians and owners not only are able to get to the show, but also can share the ability with their employees is something that is incredible. I know they will really benefit from the training as well as having the entire trip covered."

To qualify, scholarship entrants had to meet one of the following criteria:

- Tech/shop owner who attended at least 4 training events in a 12-month period;
- Master ASE with L1 certification;
- Technician/shop owner at least 60 years old who attended three seminars/classes in a 12-month period;
- Tech with 5 years or less in the business with at least one ASE certification;
- Owner/service writer with any type of training;
- Technician/shop owner at least 40 years old who attended three training seminars/classes in the past 12 months;
- Any parts counterperson with any training in the past 12 months

TST's Big Event provided sessions from leading industry trainers, including NAPA's Tom Rayk, Wayne Colonna from ATSG and WORLDPAC's Mark Warren. Twenty five vendors also had booths. The program aims to help techs stay current with diagnostics and repair procedures. "With new vehicles being so technically advanced, it's now more important than any time before to stay updated so you and your business do not evaporate," Truglia said. MA

>> **MATCH** CONTINUED FROM PAGE 6

at NACE Automechanika Chicago is a huge benefit to all of the high-buying-power shops able to attend," says Jim Savas, VP and GM of the Automotive Group at UBM Advanstar, one of the show organizers. "Instead of having multiple suppliers call on you and disrupt your business several times in a week, you can meet with the companies you want to, on your schedule and not miss out on any training or co-located events during NACE Automechanika Chicago."

Shops and show exhibitors first complete a company profile to more clearly define their business, needs and wants. A matchmaking survey then matches exhibitors to shops based on a compatibility scoring process. Build your schedule by viewing recommended profiles and sending an invitation by simply clicking "schedule a meeting"in the matchmaking dashboard. The requested party can either accept or decline.

Manage your meetings in the digital dashboard so you have one less pamphlet or guide to carry, or print your full, final schedule before the event for easy reference for all company management or representatives attending.

The matchmaking process offers many benefits, including helping both attendees and exhibitors find the best matched participants for their needs, schedule meaningful meetings, maximize access to business opportunities, secure a full schedule for the show and ensure you make your valuable time count when attending NACE Automechanika.

Questions on the matchmaking process can be directed to NACEAutomechanika2017@poken.com. MA

The Facts on Friction

Scientists, engineers and athletes have all endeavored to reduce friction in one way or another. Because, ultimately, less friction means less wear and tear and better overall efficiency.

1

Find out how far back conquering friction dates and what the future of reduced-friction technology holds.

1. MAGLEV

How about eliminating friction altogether? Maglev trains use magnets that allow the trains to float above the tracks. The absence of friction in addition to streamlined aerodynamic designs allow these people movers to exceed speeds of more than 300 mph. Now that's forward thinking.

2. SLIPPERY SHOES

The sport of curling dates to 16th-century Scotland, where men slid rocks called "loafies" across ice-covered lochs to hit targets. Today, players wear a "gripping" shoe to push off and a low-friction coated "sliding" shoe so they can glide smoothly with their stones before releasing them. Curling has gained popularity as an Olympic sport and is now played in 35 countries.

2

3. WD-40 MULTI-USE PRODUCT

This legendary lubricant was invented by Rocket Chemical Company back in 1953. It actually took them 40 attempts to get their water-displacing formula to work, hence the name WD-40. Today, the blue-and-yellow can isn't only used for squeaky hinges, but for everything from preventing rust on saw blades to removing crayon from walls. Who knew?

4. AIR LUBRICATION

Big ships require a lot of energy to get where they're going. For better fuel efficiency, engineers are working on a concept called "air lubrication." The idea is to create a layer of air between the ship's hull and the water below to reduce friction. Even though it takes additional energy to pump air under a ship, some experts believe it could save 10-20 percent of the overall fuel expenditure for a typical large vessel. It's probably only a matter of time before everyone gets on board and starts using this new, innovative thinking.

4

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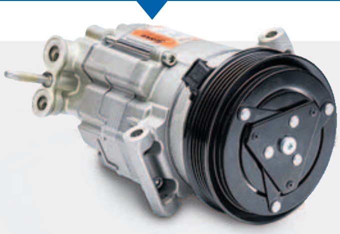

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INNOVATION STARTS WITH THE ORIGINAL

>> OEMS CONTINUED FROM PAGE 6

The OE Coliseum will feature each OE along with their respective, diverse range of innovative technologies for the automotive industry. In addition, to meet the increasing demand for education, the OEs will host several training sessions throughout the three-day event in the OE Training Theatre, located inside the OE Coliseum.

These trainings are provided at no cost to the attendees. Collision repair professionals will find the training especially fitting, as the free OEM education is a great addition to technical and managerial courses offered throughout NACE Automechanika Chicago. Automotive professionals can register now for a free expo pass, which grants them access to all training and demonstrations on the show floor, including I-CAR demonstrations, Scan-A-Palooza scan tool demos, The Spray Zone paint demos and the OE Coliseum.

"The OE Coliseum will arm shop owners and technicians with the knowledge to become better trained and more efficient. Bringing together this spectacular line-up of automotive manufacturer brands to help educate shops about future vehicle technology and repair needs demonstrates our commitment to the industry and fills a need in the marketplace for high-end training," states Bridget Ferris, NACE Automechanika Chicago Show Director.

The OE Coliseum is just one of several features at NACE Automechanika Chicago that showcases automotive innovations. Attendees, including distributors, shop owners and technicians will also have access to a number of other resources at the show.

GET A GLIMPSE AT THE NACE AUTOMECHANIKA SHOW FLOOR

Whether you are new to the event, or attended in 2015, NACE Automechanika 2017 has grown and developed from its inaugural show.

Need help visualizing the set up of the exhibition hall and want to check out where companies and show floor features — like the Scan Tool Stadium, Tool Alley and VIP Lounge — will be located?

Take a look at our floor plan, which will continue to be updated as the show gets closer. Visit ***MotorAge.com/floorplan***.

We hope to see you there!

ACCOMMODATIONS

CHICAGO HOTEL SPACE IS FILLING UP FAST

KRISTA MCNAMARA // Content Channel Director

NACE Automechanika 2017 may still be a couple months away, but hotel rooms are filling up fast!

NACE Automechanika 2017 has partnered with OnPeak to negotiate travel discounts and secure a number of reduced-rate hotel rooms to make your trip to Chicago as affordable as possible.

Although the event, happening July 26-29, still seems far off, make your travel arrangements today. The Hyatt Regency McCormick Place — adjacent to the event location at McCormick Place West — is already at 91 percent capacity! Four other partner hotels — Chicago Marriott Downtown Magnificent Mile; Fairmont Chicago Millennium Park; Hampton Inn Chicago Downtown, Magnificent Mile; and Hyatt Regency Chicago are all booked at least at one third capacity!

Haven't yet registered for NACE Automechanika? Sign up now at SearchAutoParts.com/NAMC2017register. You'll receive an email that will send you directly to the official show hotel booking page. Or you can visit it now at SearchAutoParts.com/NAMChotels.

As the event draws closer, attendees are from time to time subjected to improper solicitation from unaffiliated hotels or third-party housing agencies. Hotels listed on the above link are the sole event-approved Hotels for the event. The event organizers encourage attendees to book housing accommodations using the reservation phone numbers and/or links provided here.

You may advise them of any unauthorized solicitations via email to Rosa Yee at rosa.yee@ubm.com.

With more than 10,000 attendees and 600+ exhibitors expected for training, hotels are gearing up for a sold-out week. Numerous co-located events taking place during the week — including the Collision Industry Conference summer meeting, 16th annual MSO Symposium, Business Outlook Conference, Society of Collision Repair Specialists board meeting, National Auto Body Council board meeting and the Collision Repair Education Foundation annual golf fundraiser, among others — will also ensure lodging will book up fast.

NACE Automechanika aims to work as your unofficial travel agents, securing deep discounts without booking, change and cancellation fees; guaranteed flexibility to change your lodging plans if needed without penalty, a best rate pledge to ensure their partner rates remain the lowest, and all this while still allowing you to earn hotel rewards points for your stay.

And it isn't just your presence at the show that supports its success; when you book through the NACE Automechanika OnPeak site, commissions normally paid to travel sites go to support the show, lowering overall costs. Be sure to book today!

The deadline to book your hotel room and still receive discounted rates is July 5. MA

NACE AUTOMECHANIKA: A TRADE SHOW AND TRAVEL DESTINATION

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THE SOUL OF YOUR BUSINESS

Recognize and understand the basics of culture and your role in it

JEFF PEEVY // Contributing Editor

In our industry, we continue to see a growing awareness around the importance of business culture. This is an important step in any industry or business within it and especially for the leadership that guides it. If you are a business owner or manager, it is important that you recognize and understand the basics of business culture and your role in it. An increased awareness of culture helps us better understand each other and ultimately appreciate the diversity and wisdom that exists in the world.

There are many attempts to define culture, but for our industry, I always refer to the following by Marcia Connor and James Clawson: "Culture can be defined as a pattern of learned assumptions that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think and feel in relation to the problems of survival and integration." I refer to this definition of culture often, as I believe it helps define the accepted beliefs or learned assumptions that exist within businesses. Anyone who has worked in or done business in multiple repair businesses will experience different perspectives on how to approach it.

In the past, I have referenced studies I have been involved in where repair businesses had similar square footage, number of employees and equipment, yet output and profitability were very different. As my personal awareness of culture increased, it became clear that the differences within these businesses came down to their culture. These learned assumptions that exist within a business dictate everything about it, from its productivity and employee retention to whether everyone is optimistic and positive or negative — and the list goes on.

Business culture begins with leadership. The perspective and attitude leadership embodies becomes the framework from which the business'

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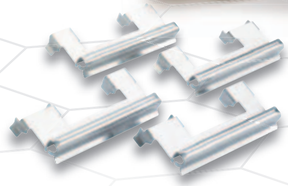

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culture lives. Over time, these assumed beliefs evolve and become more entrenched. As it becomes more defined and established, it has a greater influence on those working within it. If leadership fails to expose itself to other viewpoints, the culture continues to become more inward focused and ultimately more narrow in its overall understanding of what is going on outside their small world. In this case, the real danger in an ever-changing industry is that the business' ability to adapt decreases until those in it do not even recognize the change happening around them. I believe this has happened to the majority of repair businesses within our industry. Massive amounts of changes are happening every day, yet many continue to approach their business and their repairs the same, despite growing frustrations and shrinking margins. This group is culture blind and can't see the true reality of our industry because they have a business culture and fixed personal mindset that has established a different reality that has them placing the blame outside themselves and their businesses. David Luehr, *ABRN* contributor, well-known industry coach and author of the new book, "Secrets of America's Greatest Body Shops," calls this the victim zone. It is sad and frustrating to watch, and if you are starting to realize you may be in this category, begin to overcome it by getting out and networking with other positive people within the industry. Attend seminars and training and hire a coach who can bring an outside perspective into your business. Your awareness of how others are doing and thinking about many of the same things you are faced with will grow and so will you, your business and its bottom line.

Take the concept of being culture blind. Many small businesses completely overlook their own culture and its strengths and weaknesses. It's easy to do, as most have their heads down, working hard every day in their businesses and feel they do not have the luxury of taking a step back to work *on* their business. To overcome culture blindness, one must be willing to take an honest assessment of themselves, their operation and their employees. Start by identifying what you say is important and compare it with your business' operational actions. You may claim customer service is important to you, but identify what you and your business are really doing to promote good, consistent customer service, resulting in real customer loyalty. Here is an example: If you want your business to know what your customers really want, what steps have you taken to ensure you and your staff are listening to what they are telling you? Listening skills are one of the most important skills anyone can have. In fact, it is often 60 percent of our daily activities, yet the *International Journal for Listening* reported only 2 percent of adults have formal listening skills training. How would your business compare?

Long-term employees are a window into the company's culture. As you walk through the journey of seeing your business' pattern of learned assumptions for what they really are, look at the staff who have been there the longest. They are likely comfortable with the culture and align with it. Are they positive or negative? Do they go above and beyond or do they do just enough to get by? Do they love to learn and share their knowledge or do they protect what they think they know and project themselves as knowing almost everything? I have seen technicians who would leave training classes excited about what they have learned, only to downplay it back at the shop because to admit you learned something, in that business' culture, would be admitting you did not know something. Compare that situation with a repair business that has a learning culture. The learning culture promotes the need to always be learning and encourages employees to share what they know and learn and likewise be open to what others can share. Training is seen as an opportunity to learn, not just an event one must complete to maintain good standing in a program that requires it. There are huge gains in the ROI of training and tools and equipment costs when the culture promotes learning and curiosity.

Identifying your business' true culture, including its strengths and weaknesses, is not easy but well worth it. It requires honesty and sincerity. To change the culture and strengthen your business also requires honest, sincere and effective communication. The open conversation with staff requires exposing the realities of the industry outside the business and how the business must champion change and adaptation to be successful. It requires laying out a plan with a commitment to keep anchoring it every day with an obsessed focus on the outcome. You will lose employees who refuse to change, but a strong business culture that values learning, sharing knowledge and improving the lives of its staff and customers will always do well. The healthier your culture becomes and is then showcased during employee recruitment, the better the candidate you will see show up at your door, as they are attracted to the culture and naturally align with it. As my friend, David Luehr says, "If cash is the lifeblood of a company, culture is its soul." MA

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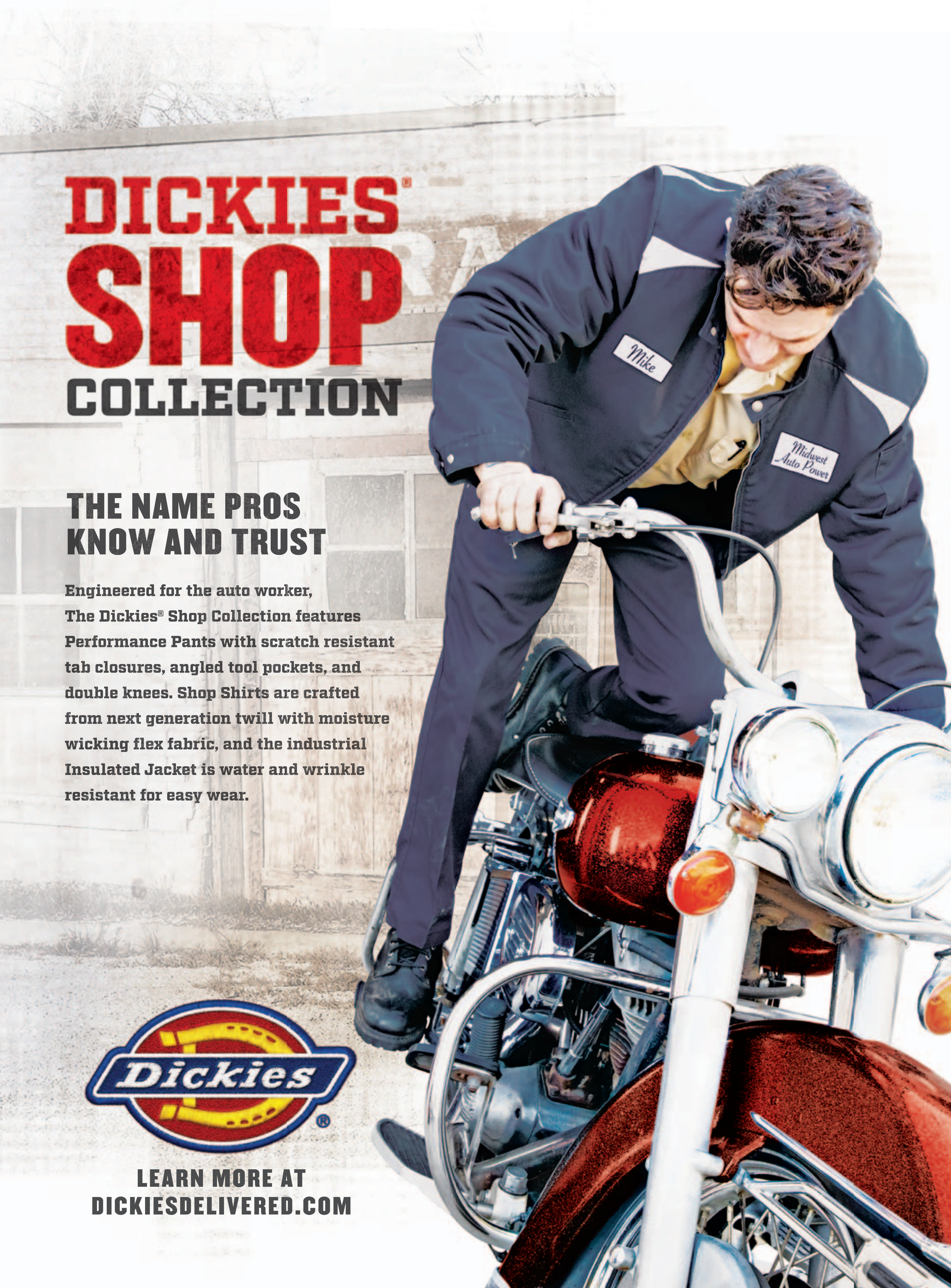
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TRAINING THE RIGHT WAY

From customers to technicians, understanding how someone thinks and learns is key.

DAVID ROGERS // Contributing Editor

Do you remember the first time you saw a colored wiring diagram? Those things are a beauty! Before those came along, technicians were left deciphering a spaghetti mess of wires, connecting 40 (or 400) different components and a harness. Trying to identify a single wire was a nightmare. When they added color, the whole game changed. Now you could see exactly where a single wire came from and where it went.

Training works the same way. When you don't fully grasp a concept, it's like looking at a black-and-white wiring diagram. Some people may get it, but no matter how long others look at that image, they only become more frustrated.

That's because people learn in different ways. Understanding how someone thinks can solve hours of frustration explaining the same thing over and over again with no results.

Finding the right way to teach someone, whether it's a technician or a customer, is like adding color to a wiring diagram. When you explain an idea the right way, you can see the lightbulb click over their head and – bam – there's color!

Multiple learning styles

Not everyone learns the same way. Some people can hear a concept once and master it. Other people need to see, read, touch and feel the concept in real life before the idea will click.

In other words, some people might pick up the concept of gravity by reading a textbook, but others will never grasp it until they see you drop an apple and watch it hit the ground.

I fall much more into the second group. When I don't understand something, I ask someone else to explain or show me how it works. You might prefer to tinker or listen to a podcast; we're all different.

It took years of reading articles, listening to advice and testing concepts

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in my shop before the significance of this finally sunk in with me. If everyone doesn't learn the same way, then I cannot expect the same results from each individual using only one method.

There are obvious applications of this throughout your shop — just consider your front counter. If you're advising every customer the same way, you're guaranteeing that some people are never going to understand what you're recommending and therefore, cannot make an informed decision They may buy, but chances are high they'll develop buyer's remorse and never come back. What's true of the customer at the front counter is absolutely true in the rest of the shop.

If you've ever felt like you can't find good employees, or that training your team is a waste of your time and money, you're not alone. It's a common belief among shop owners. But I'm here to tell you that teaching your employees in the way they learn best — coupled with measurement and accountability — can change the way you think about your team.

It doesn't end with training

Even the most tested and proven concepts will fail to take hold for two reasons.

The first, we've covered. I could hand you an article that explains how to grow your profits by $1,000 a day, but if you learn best by listening or tinkering, you'd never capture that money.

That's true whether we're talking about shop policies, like the inspection process you teach your techs, or whether we're talking outside training, like the class your service writer attends. Be sure to provide — or seek out — training that addresses multiple learning styles.

But just as important as the way in which we train is the way in which we hold our teams accountable for executing the things they've learned.

If you teach your techs how your shop inspects a vehicle, but you don't hold them accountable to do it every time, they'll absolutely go back to pencil whipping inspections, even when they fully understand the expectation and completely grasp the importance. Without accountability, they are likely to fall back on old ways.

IF EVERYONE DOESN'T LEARN THE SAME WAY, THEN I CANNOT EXPECT THE SAME RESULTS FROM EACH INDIVIDUAL USING ONLY ONE METHOD.

If your service writer learns the best way to advise at the front counter, if they fully understand how they can directly impact the shop's growth, but you don't hold them accountable to advise every customer that way each time, they'll go back to old habits.

Training doesn't happen in a vacuum. Even the best training will be useless unless you're willing to hold your team accountable to do what they've learned. You must measure daily, track daily and maintain accountability daily.

To bring this back full circle, the same goes for your customers at the front counter. After you're done educating in their learning style and they've made an informed decision about their vehicle, your job isn't done. That's why customer follow-up is so critical. When you offload your customer follow-up to an outside firm, you take away your chance to reinforce your education and address concerns.

No shortcuts

If there's a key takeaway here, it's that there are no shortcuts or magic words.

Educating your customers so they can make the right decisions takes patience and follow-through but leads to long-term relationships and bigger sales. Any trick or gimmick that pretends to shortcut this process will lead to burning trust with the customer.

Educating your employees so they execute takes patience, accountability and measurement, but leads to sustainable changes and growth. Trying to shortcut this process is what leads to feeling like training doesn't work or employees aren't worth the effort to train.

There is no easy button. Because people learn in multiple ways, you cannot shortcut the training process with a single tool or class — you need a system or a tool kit that incorporates all of the tools for success. Seek out programs that adapt and involve, find multiple ways to teach your customers and follow through to make sure the lessons are sticking.

With multiple tools in hand, you'll be able to maximize your effort so your customers and your technicians can make better decisions. You won't have to spend time explaining a concept over and over to someone who simply doesn't understand because you'll be able to approach it from multiple angles.

Training is a powerful tool. Understand the training you are providing your employees and the advisement you provide to customers, inside and out so you can hold employees accountable to those policies. Follow up with your customers to ensure they understand your advice or identify areas to improve.

Understanding how people learn empowers you to train and educate them more effectively. But it doesn't end there. Follow through and hold your team accountable to make sure the training sticks and adds real value to your business. MA

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HOW TO HOLD GREAT TEAM MEETINGS

Five steps to follow for effective production and continuous improvement business meetings

DAVID LUEHR // Contributing Editor

Do you hate meetings as much as most people? I don't blame you! I used to hate them too. I don't know anyone who likes to sit in a time-wasting meeting where one person talks on and on without a speck of constructive dialogue, going from one tangent to the next. However, once I learned how powerful a good meeting could be, I wanted to learn all I could to become great at conducting them.

If there is one thing that is worse than bad meetings, it is the level of communication in the automotive repair industry. Most involved in this business have never received any formal training on how to be a good communicator, leader or how to conduct an effective meeting. Communication could likely be the No. 1 problem I see in the shops I visit. It causes issues with every aspect of the business from quality, culture and process defects to customer satisfaction. If we are going to run a successful business — folks, I hate to tell you this — you are going to have to get good at running meetings!

Two types of meetings that are prevalent at successful repair shops are the morning production meeting and, in many high-performance shops, the periodic continuous improvement meeting. I will cover these two with you and give you a few pointers to make them not dreaded by your staff!

The morning production meeting

America's greatest repair shops hold a morning production meeting, sometimes referred to as a release meeting. These shops have successfully figured out how to make these meetings both quick and effective. For many of these shops, "quick" and "effective" were not words used to describe the meetings at first; trial and error, as well as a good dose of persistence, were needed to get

PHOTO: DAVID LUEHR

the meeting results they were after.

Many leaders who have attempted to implement a production meeting at their shops have either quickly abandoned the idea or they continue to run lengthy meetings with little or no benefit to the shop or the people attending. We'll discuss some of the factors that can make you successful at utilizing the morning production meeting, but first let's talk about who should attend them.

Production meeting attendance

Personally, I like to see the entire crew invited whenever possible. As much as I like keeping technicians working on cars, some of the best teams I have worked with invite all the techs and administration people together for either all or certain portions of the meeting. It's a great way for a service writer or customer service rep to gather accurate information they can use to update customers. Service writers will have confidence in a vehicle's repair status when he is talking directly to the technician who is assigned to the job. Some shops prefer to hold morning production meetings with only the administrative staff, using information someone previously gathered during one-on-one conversations with the technicians. This method is good, but does not capture the opportunity for team fellowship and the highest possible level of interactive communication. The valuable time taken by pulling techs out of their bays is wisely invested if greater communication and a solid daily game plan can be achieved in return.

Here are five tips for great production meetings.

1. Be prepared/Make it quick. Great meetings are held with a definite purpose in mind. Don't have meetings just to have meetings. Make sure the entire staff arrives on time and everyone is prepared to give their share of the input. For example, if your business has a parts manager, the parts manager needs to be prepared to answer any questions relative to the arrival status of any missing parts.

For a smaller shop, the morning production meeting should require about 10 minutes of time to complete with larger shops requiring about 15 minutes. If you are new to holding meetings, they may take a little longer at first, but don't despair — you will get better and more efficient as you get more skilled at facilitating the meetings.

2. Keep the meeting on track. Facilitating a meeting does take practice and skill. One reason so many shops fail with meetings is because they allow participants to take the meeting on a tangent. Nobody needs to hear about Bill's weekend; let's keep it on track by only talking about what needs to happen to get the cars to go home on time.

There are a couple trains of thought about which ROs to discuss during the meeting. Some shops only talk about the cars on the list to go home today and tomorrow, while other shops will hold discussions about all the vehicles in the production system. I am okay with either method as long as it is done efficiently.

3. Encourage everyone to contribute. Some shops just go through the motions. Don't just stand there in front of the staff and read your delivery list to them. You have to facilitate, not just bark out orders. Ask good questions of your technicians like, "John, the Audi Q7 is on the schedule to go home tomorrow. Is there anything you are aware of that could keep the Audi from going home tomorrow?" By asking questions like this, you are engaging them in a problem-solving manner that will get the results you want. Take advantage of this valuable time to solve problems together as a team. The minds of many can be much more powerful than one.

4. Share the numbers (Make it a game). A great way to keep people engaged in their jobs is by sharing numbers and making it a game. If you share

the company's sales, customer satisfaction scores and cycle time numbers with your team each morning, they will feel like an important part of the company. Get your people involved by making the mundane day-to-day business into a game where if everyone performs well, everyone gets rewarded. Use the morning meeting to quickly share the successes and opportunities for improvement in how the team is performing. Set realistic goals and then get everybody on board playing the game and winning.

5. Agree to actionable items. Possibly the most overlooked contributor to successful meetings is action. Don't ever finish a meeting without ensuring accountability towards the actions needed to execute the plan. I like to use a dry-erase board to write down critical tasks required to make cars go home on time and identify who is responsible for carrying out the tasks and by what deadline.

Continuous improvement meetings

One of the best ways I know for shop owners and managers to become respected leaders is through conducting periodic continuous improvement meetings. I recommend for most businesses to hold them at least once a month. For shops that are in the middle of major process implementations, more often would be best. A continuous improvement meeting (C.I. meeting) is an open forum for the shop's entire team to make suggestions, discuss problems and communicate in a safe and respectful manner. These meetings contain many benefits besides the obvious, which is to continuously improve the business' operational level. Some of these benefits include a greater sense of belonging to its members, a feeling of contribution to the success of the company, and as I mentioned, enhances respect for the shop's leaders.

Shops can choose an appropriate time that best suits the needs of the business, but I typically see these meetings held as a lunch or afterhours affair, which last for 60-90 minutes. Don't forget to supply lunch or dinner!

During the first few C.I. meetings you host (morning meetings too), don't be too discouraged if the team doesn't all want to contribute with helpful input. You will get a few people who have been conditioned over the years to keep their mouth shut, and may not trust management with open, honest communication. These people will usually come around after a few meetings when they are convinced it is both safe and productive to talk. Others will use this opportunity to create a gripe session. Leaders — be careful you don't allow the meetings to get too negative. The purpose of the meeting is to discuss problems and find solutions. Problems must be discussed; however, keep the team's focus on finding solutions in an objective, non-threatening way.

Similar to what I wrote about morning meetings, C.I. meetings also need to follow the same five rules to be effective.

1. Be prepared
2. Keep the meeting on track
3. Encourage everyone to contribute
4. Share the numbers (and progress being made)
5. Agree to actionable items

Integrity from leadership is really the key ingredient to making your meetings truly powerful. Leaders absolutely must act on the agreed-to items from the meetings. They must also be able to hold others accountable to perform the tasks they have agreed to and follow up regularly. So, you see, great meetings involve shop leaders to become…well, great leaders. MA

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What is wrong with people? Or is it just me?

Set expectations and lead your employees to get the best out of them

We all have our own opinion on the answer to the first question, but very few ever think they are the problem. When we started coaching shop owners, one of my favorite competitors told me he had no interest in coaching and he just wanted to train. When I asked why, he told me it was because the biggest problem is usually them, though you will never convince them of it. My first thought was that he has been doing this too long; however, I find myself guilty at times thinking everyone else is the problem, not me. I overheard one of our former shop owners and now ATI coach, Bobby Poist, tell a story to a group of new shop owners that you might be able to relate to:

A couple months ago I had a conversation with a shop owner. He was having problems with his service advisor and had decided to let him go. He searched for a few weeks and found a new service advisor. To quote his own words, “This guy is the greatest thing since sliced bread!”

Ironically, in a few weeks he was having similar problems with the new service advisor. He wasn’t following up with customers or selling maintenance packages. He had no desire to keep the shop busy and was having problems completing his day-to-day tasks. This made me think a little. Why did we start having problems with the new guy? How could he go bad so fast?

Ever wonder why your employees don’t do what you ask of them? You hire someone new and they start out OK. Then something happens and they start making all sorts of mistakes. You find yourself wondering, “What happened to the person I hired?” I thought they were amazing, and now they aren’t even the same person.

HOW CAN YOU HIRE SOMEONE AND LET THEM GO WITHOUT GUIDANCE? AN INABILITY TO LEAD IS USUALLY THE CAUSE OF HOW EMPLOYEES GO BAD.

I am confronted with this situation a lot. What I usually find is that the business owner is the problem. Seems hard to swallow, but it’s the truth. They are unable to set expectations, they avoid confrontation, and they expect others to lead their employees. This usually leads to good people getting let go and then moving on to be great in another organization. How can you hire someone and let them go without guidance? Then get mad when they don’t perform to your expectation levels? You may as well roll the dice and hope for a good employee. Unfortunately, this mentality only leads to failure. An inability to lead is usually the cause of how employees go bad. So, how do you fix this?

Create processes

Process is the key ingredient that makes a business successful. A process is a step-by-step guide on how something should be done. There are 11 steps to making a Big Mac, yet the process is so thorough that anyone can learn to make one in no time. What do you think would happen if someone negated the process and put all the condiments on the outside of the bun? It wouldn’t be a Big Mac. This process is utilized worldwide. Why can’t your processes be the same? Can you simplify the processes that will make your business successful?

Hire the right people

Know what you want: Envision the perfect employee. What does he/she look like? How do they dress? What traits do you expect? Who will be the person that represents your business? Statistics show that knowing what you want in advance will help you decide who will fit your mold.

Having a tough interview process will help to weed out the wrong employees. Get to know them. Ask them tough questions and let them talk. Most people will turn state’s evidence if they have enough time. Use hiring tools such as personality profiles and tests to help you determine the best candidates. Check their references. (Most potential employers won’t check references because of some fear that they might get sued.) As far as I know there are no laws that keep you from checking a potential employee’s work history.

Onboarding new employees

Every new employee should go through an orientation period. This will introduce them to how your business operates — how to open the shop, write up a customer, set a lift, perform a proper courtesy inspection, etc. Knowing how the business operates and understanding expectations are keys to your success. Everybody needs direction if they are to reach their potential.

Give feedback and progress reports. Have one-on-one meetings with your employees, and review expectations with them. A good leader will help employees succeed by holding them accountable. Set goals and recognize the good as well as the bad! One-on-one meetings and agreements not only hold employees accountable; they also help with important documentation if proof is ever needed.

Hold team meetings and recognize the wins your staff has accomplished. Try to focus on positives, which help everyone feel good. The saying "Negativity breeds negativity" comes to mind when most people think about meetings. Most shop owners and managers hold meetings when something is wrong. The problem with this is employees recognize a meeting as a beating. Once this mentality has been set, your employees will shut down.

Become a great leader

Businesses are most successful when the employees understand the owner's values. Ensure that everyone in your organization operates by them and you will be successful. If you find someone operating outside of your values and guidelines, it is your responsibility to counsel them. If they don't comply, you probably have the wrong person.

Hold people accountable. Talk about their performance when necessary. Waiting to handle an issue is the same as not doing anything at all. People will take advantage of you because they feel you won't do anything about it. Statistics show that employees are happier when they have direction and are accountable. If we both agree on something and I don't comply, it is your responsibility to hold me accountable. If you don't, then you are just as much to blame as I am.

Cultivate a take-ownership environment. One of the main complaints I hear from shop owners is that their employees won't give them feedback. They state everything is OK when asked, yet their actions prove otherwise. A great way to cultivate a take-ownership environment is to ask your employees for help. Discuss key issues you have and ask them to help you solve problems. The employee may not be able to help, but will appreciate your asking. If they can't offer feedback, you can turn the opportunity into a learning experience. The term "buy-in" comes from a person's ability to agree with a process and take ownership toward its success.

Allow praise to be praise. Don't praise an employee with a negative. "You did great here, but..." only leaves your employees feeling derailed and frustrated. When you recognize something good, mention it. Only the good thing — there is no need to cloud the situation with words like "but," or "if." A feel-good moment is a feel-good moment. When praise is used properly people will become more engaged. They will also be happier in their environment.

After many years in the automotive industry, I have seen a lot. I have worked with many great leaders, and many not-so-great leaders. The leaders that made me who I am today are the people who weren't afraid to outline their expectations. They held me accountable and praised me when I did a great job. They talked to me and recognized my strengths. They helped me develop my weaknesses so that they became my strengths.

Do you have what it takes to be the best of the best? Taking a long, hard look in the mirror could be just what you need to be successful. What can you do to help your employees become the best of the best? The key to their growth lies in your ability to take ownership and lead them to glory. Although this approach may seem painful, you might just eliminate the one obstacle keeping you from achieving your goals — you!

Test yourself

If you would like to see where your strengths and weaknesses are, simply go to *www.ationlinetraining.com/2017-05* to take the Business Owners' Evaluation Checklist.

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 Bobby Poist.
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Changing our industry from a trade to a profession

Voluntary professional accreditation could have immediate and immense benefit

Over the past number of years, discussions of professionalism and raising the bar for the aftermarket have been common. The trade days are over; we are now evolving into a true profession.

Consider a completely out-of-the-box idea: a professional accreditation for the independent shop. Such a concept would involve a system run by the industry and approved by state governments across the country. In a simple context it would be organized like the engineers' society, accountants' society, medical society or law society, only this membership would be on a voluntary basis.

DOES THIS GENERATION NOT HAVE A RESPONSIBILITY TO LEAVE BEHIND AN INDUSTRY SECTOR IN BETTER SHAPE THAN WHEN THEY ENTERED IT?

An accredited shop will have met a certain criteria established by a national association in technical expertise and business expertise and adhere to a standard of performance to the public. The "society" would be responsible for overseeing the standards and administrating the accreditation. All members of the society would pay annual dues to help finance the responsibility. Recognition for such accreditation would be public knowledge not only through the internet but through local articles and events praising such achievement and of course prominent signage within the shop site itself. In a short period of time, the public would come to recognize the difference in an accredited shop compared to a non-accredited shop. Think of it as recognizing the difference between a bookkeeper and a Chartered Public Accountant (CPA). There is a difference in competency, ability and depth of expertise.

This would be a substantial undertaking; however, the benefits to the aftermarket would be incredible. The sector would end up moving from a perception of a trade to the reality of a profession.

It makes sense for the industry through its national association, coupled with thorough participation of state shop associations, to gather authoritative representatives from the manufactures, warehouse distributors and jobber divisions and create a forum to discuss such a structure and how it could work. The foundation must be put together first. Committees must be established to do this. In time, the governments across the land must see and understand the structure being formed, followed with exposure to the education network. I believe the various automotive and technical colleges across the country would be ecstatic about getting involved with this concept.

The naysayers will shoot such a concept down stating, "Let free enterprise prevail." All accountants, lawyers and engineers are in the free enterprise arena; however, they have established professional standards of execution throughout their entire "business." Why can't the independent aftermarket sector do the same? The benefits to such a concept are enormous, such as improved image in the schooling system to attract the brightest students into a "profession" knowing they are entering a field that demands standards of professionalism. Public vehicle safety issues delivering reliable technical competency would now be properly addressed. Higher standards in executing to the public and improved public perception and image would all lead to higher personal incomes.

Let's face it — if it would be easy, everyone would say, "why not?" But the fact is this undertaking would be large, but it would set the groundwork for the next generation in the aftermarket to excel and prosper. Does this generation of aftermarket personnel not have a responsibility to leave behind an industry sector in better shape than what they had when they entered it? I believe we have a moral obligation to do just that.

Talk to your state shop association board of directors about forming a committee of volunteers prepared to put in the time and have them approach the national association and say, "Let's take this out for a spin and see what this concept has to offer. We are prepared to do our part and get involved. Let's get a two-day forum together and see what we can do." MA

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The soul of Mayberry

Shop maintains traditional values, neighborhood feel

ROBERT BRAVENDER // Contributing Editor

There will always be a Mayberry, somewhere. Andy Griffith's legendary TV series set in the fictional North Carolina town has come to symbolize Americana at its finest: gracious neighbors, honest store keeps, and loyal friends all engaged in the ethical treatment of all. And if Tal LaMountain's description of Williston Park, NY is even partially accurate, this little Long Island village is a close approximation.

"It's one of those towns where you can find generations of families still living here," LaMountain reports. "We joke that people never leave; they move from one block to the next. It suits us well."

LaMountain's shop is an institution in the town; Tal's Auto Service was started by his grandfather in 1952. Three generations have run it since then — with no need to change the name since it's always been run by someone named Tal. As the current Tal puts it, "we still have that neighborhood repair shop feel."

But a small, intimate town makes maintaining a good reputation much more vital, since a bad word can spread so quickly and completely. "The main thing with my grandparents, my parents and (now me) was always customer relations," LaMountain explains. "If that phone rings, you answer it. People walk into our office, we say hello, talk to them about how their kids are and how the car's running; it's just a friendly environment.

"Our main thing is that the customer must always have contact with us," says LaMountain. "They don't want to deal with the service manager or a secretary; they want the guy who's actually working on their car. (Customers) can have contact with all of our mechanics; if they want to see something, we'll walk them through. Nothing's hidden or behind closed doors."

And never turn a customer away, LaMountain notes. "Once you tell them you can't do something, you'll be shocked how many you'll lose." This requires treading the tricky line between being eager to please and one's ability to solve a problem. "You have to maintain an open mind and be able to at least tackle these problems, but be honest when you can't do it," he outlines.

"You have to be confident in what you can do and own up to what you can't. You can't fix everything," LaMountain reasons. "You can't be a hero all the time. But there's a solution: send it to somebody else who can take care of it. When you're honest with the customer, they're going to want you to find someone that can do it so they don't have to leave you."

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60 Years in business	**$350,000** Annual gross revenue
4 No. of employees	**ASE** Certifications held by the shop
5,000 Total square footage of shops	

In the meantime, learn everything you can. "Any Snap-On class, any MACs class, any Mapco class, any training that comes up, you go to it," LaMountain asserts. "Five or six years ago it was hybrids; you go to the classes anyway because you never know what you're going to run into."

Thus, Tal's services an incredibly wide variety of motors, from big diesels to 2-strokes. "Our tow trucks ran diesels and we had to learn how to fix them in order to keep them in service," recalls LaMountain. From there the list grew exponentially, from Cummins and Duramax to Mercedes and BMW, from Italian exotics to light equipment, like Kubota and Case.

LaMountain observes that diagnostics for the higher end

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autos isn't too bad these days if one uses a "middle-of-the-road" scanner. "Unfortunately, middle-of-the-road is still $8,000," he wryly remarks. "The days of a top-of-the-line scanner being $1,100 are gone."

The scanner updates alone cost $1,100, and LaMountain does them twice a year. "I used to wait out the updates, but now it's imperative that you do it," he maintains. "Say I bought a scanner that goes up through 2017. Mid-2017, do I really need to worry about an engine

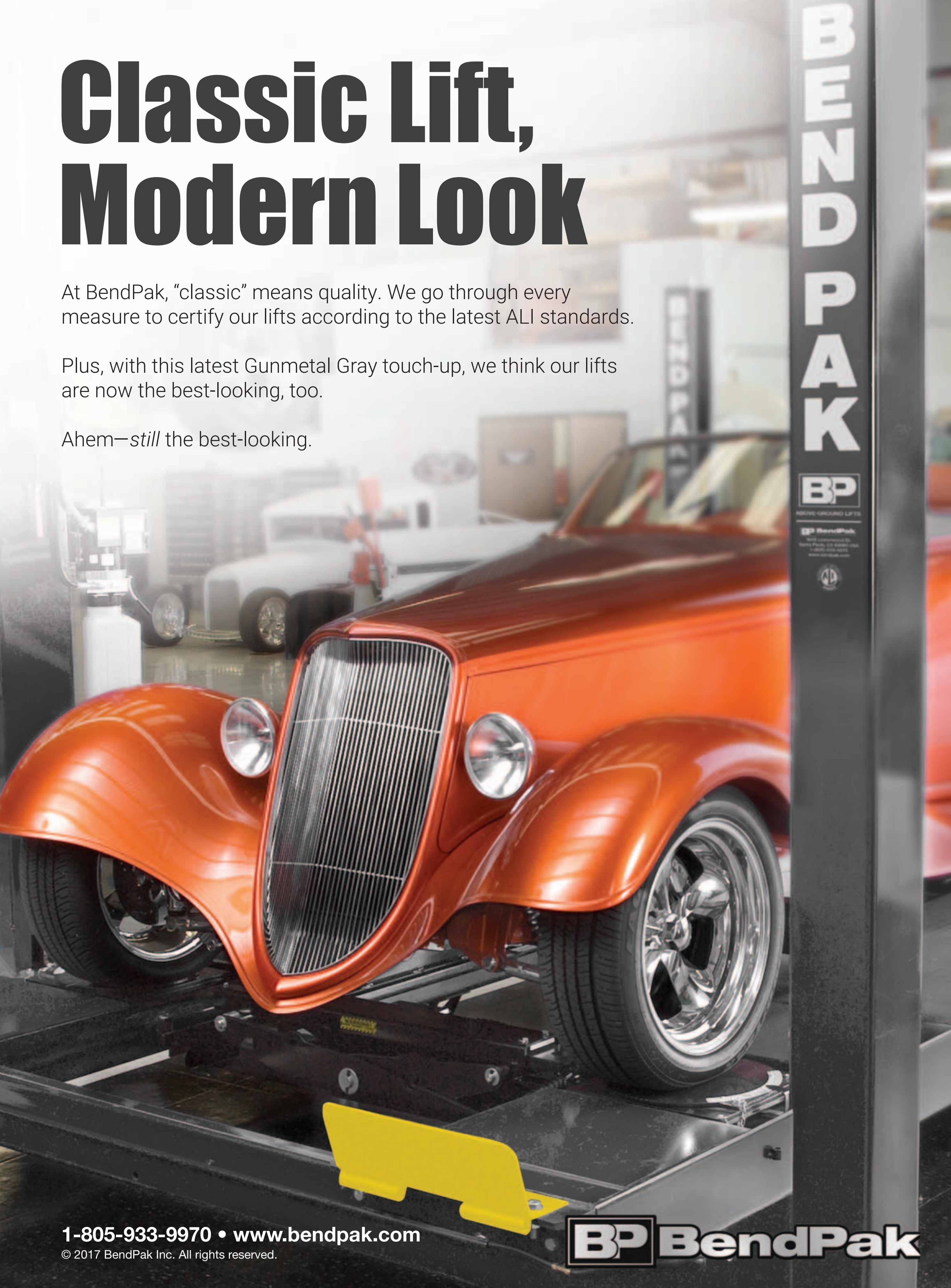
light because the car's warrantied? But when a customer comes in and they don't want to go back to the dealer, you at least want to be able to hook up to the car and tell them what the problem is and what they're up against."

And while their tow trucks are no longer on call, LaMountain will occasionally retrieve someone who is stuck. "I come in here regularly over the weekend just for somebody to drop a car off, and if there's a problem that I can take care of quickly, I'll do it," he confides. "Again, it's that small contact customers have with you; they feel like you're going above and beyond — but its part of the business."

Having worked fulltime in the shop since he was 17, LaMountain can also share lots of recollections with clientele. "It's amazing to see the generations of people coming through the door," he reveals. "I hear stories like 'my grandfather used to bring me here,' or 'you guys have been here forever.' The ones I like the most are when new people move into the house of an old customer who passed away, and his kids are telling them 'if you need a repair shop, that's the place to go.' Those caught me off guard the first few times, but it's a nice feeling."

It's almost as if you can hear someone whistling a tune…

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.
rbravender@comcast.net



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Improve from the inside out

BUILD A POSITIVE RELATIONSHIP WITH YOURSELF TO SEE PERSONAL DEVELOPMENT

MIKE JONES // Contributing Editor

I believe that our eyes have been taught to see what is pleasing and what is not. We look at people and make an assessment of their worth and value immediately based on the picture, the 1 percent visible to the human eye.

As a result, last year people spent over $12 billion undergoing surgical procedures to alter their 1 percent to create a more attractive picture, photoshopping their appearance to look more attractive to the human eye.

I have observed people meeting someone for the first time and telling them how beautiful they were just based on the 1 percent they can see.

What you see with the human eye may be deceiving. The outside does not always look as good as the inside. It is more valuable to get to know people from the inside out. If you come to know the inner beauty of the person, the outward picture has little value.

I have met people over the years that just because of the outward appearance, I would never have spent any time getting to know them.

After my 30 years in the people business, I can tell you that my wise grandmother was absolutely spot on when she said, "Do not judge a book by its cover."

A lot of people hire folks based on the 1 percent and quickly learn that was not a good hire. Many people get into relationships, based on the 1 percent they can see and come to learn over time, they have nothing in common with that person on a deeper level at all.

Here are my five tips to improve your attractiveness from the inside out:

1. Build a positive relationship with yourself. If you lose something or forget something, do not call yourself stupid or an idiot. Be your own best friend.

2. Build more trust in the relationship you have with yourself. We're almost halfway into the New Year and some of you made some promises on Jan. 1 that you have broken. If you practice breaking promises to yourself, you will develop a habit of breaking promises to others. Begin again right now and keep those promises small and on a short time cycle.

3. Challenge yourself to do something new today. Get out of your comfort zone. Read a book, eat new food, and talk to different people. Go explore and learn something new today.

4. Do something physical every day. It doesn't matter how long or what it is; however, it should be focused on getting heathier. There are people walking around that appear to be physically fit based on how skinny they are; however, the inside may not mirror the outside.

5. Invest in your own personal development. Buy a book, take a class, and get some professional coaching. The only way to get a return on the investment is by applying what you learned. I have had people recommend books and classes to me that they read or attended and shared how awesome they were and how much they benefitted from the book or the class. I took them at their word and read the book or attended the classes and came back and asked them, did you really read that book? Did you really attend that class? Because I gained things from the book or the class that was transformative for me, and I did not see an improvement in their inner attractiveness. Investing in you is the best investment you will ever make.

Beauty, awesomeness, happiness, incredibleness and creating the best version of you is an inside job.

"The stuff in the book — I can go back and play around and do hands-on work. Now I'll have stuff to train myself."
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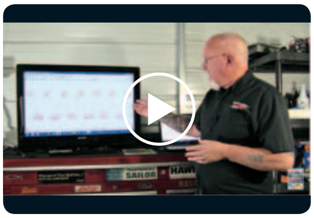

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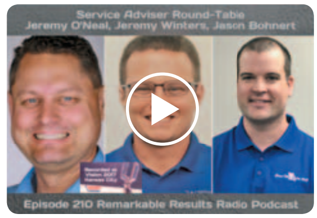

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SOCIAL INSIGHTS

HOW COLLISION AVOIDANCE SYSTEMS IMPACT BASIC SERVICE REPAIRS

Some of the technology used in collision avoidance systems is a limited version of autonomous vehicle technology. The most common type of these systems currently being implemented is automated cruise control. The number and complexity of these systems prevents this article from covering them all, but let's focus on a few main types of systems that may impact how your shop handles even "basic" services such as brakes, tires and alignments.

Motorage.com/avoidance

BATTERY TECHNOLOGY CHANGES ARE ON THE WAY AS VEHICLE ELECTRICAL DEMANDS INCREASE

Vehicle electrical systems are expanding and evolving to support a wider array of power-hungry technology and to help enable new types of hybrid and electric vehicles. Cars are brimming with new technologies, including advanced driver assistance systems (ADAS), cameras and sensors, semi-autonomous driving solutions, and others that are putting more strain on batteries and electrical systems. While full electric vehicles present some installation and safety challenges for installers when it comes to battery and electrical systems, big changes are underway for conventional vehicles and hybrids as well.

Motorage.com/demands

MASTERING ELECTRICAL DIAGNOSTICS WITH MULTIMETER TIPS AND TRICKS

Electrical problems, such as voltage drops, continue to be some of the most frequent and frustrating issues we face as technicians. This month we'll be continuing our dive into electrical diagnostics with practical multimeter tips and tricks!

Motorage.com/multitips

EMERGENCY MARKETING STRATEGIES FOR CAR COUNT LULLS

Most smart shop owners have a comprehensive marketing calendar that includes a balance of new customer acquisition efforts and tried and true customer retention efforts. I would bet for the most part your marketing strategy does a fair job of keeping your bays full. It is inevitable though, despite your best efforts, planning and management, that your shop will hit those brief periods where the schedule looks light and the fear of techs with no cars in the bays looms ever larger.

Motorage.com/lulls

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JULY 26-29
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ANOTHER A/C MILESTONE

AND SOME NEW EPA RULES, TOO!

FORD ALREADY CAME OUT with their first yf vehicle last spring when they started sending 2017 Escapes to U.S. dealers, but this year we saw them expand use of the gas into three more vehicles, the Focus, Fusion Energi and F-150.

STEVE SCHAEBER, Manager of Service Training, MACS // Contributing Editor

We've reached another milestone in the mobile A/C refrigerant timeline, and this time it's a big one: Jan. 1, 2017 was the drop-dead date set by the EU (European Union) for when vehicle manufacturers can no longer fill any new vehicle's A/C system with fluorinated refrigerants (or F-Gases) that have a GWP rating of more than 150. This totally knocks out R-134a as a player (with its relatively high 1,430 GWP), pretty much leaving OEMs with a choice between R-152a, R-744 (what we call carbon dioxide when it's used as a refrigerant) or R-1234yf, which is quickly becoming the new world standard.

If possible, car makers around the world would still like to employ just one universally accepted working fluid (the refrigerant), which is one reason why R-1234yf has so much support — that, along with its GWP of 1 and its similarities to R-134a, among others. All OEMs will build yf systems to meet the current EU and upcoming US and other world regulations, but it's not the only fluid in development right now.

Tata Motors in India is working on a "Secondary Loop" system with MAHLE Behr Troy (formerly Delphi Thermal Systems) and the Institute for Governance and Sustainable Development (IGSD) that uses R-152a (the same chemical used in those cans of computer dust off spray), and we expect to learn more about that as 2017 progresses.

But probably the most well known is Daimler's work on R-744 systems, which they have said will be available on certain vehicles for the 2017 model year. In fact, there were several meetings and discussions about the technology at the recent European Automotive A/C Convention in September 2016, including a demonstration of R-744 R/R/R machine technology on an actual vehicle.

R-1234yf in Philadelphia

In the meantime, here in the U.S. we continue to see more vehicles on the

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street using R-1234yf refrigerant, and, as expected, the 2017 model year has extended HFO's reach into several more models than ever before. In January, MACS attended the Philadelphia Auto Show to check out the new models, open 100+ hoods and see what the OEMs are doing with their A/C systems. We were not surprised to see more vehicles using the new refrigerant, but we really didn't expect to see as many as we did. I myself thought there would be some increased expansion within a few car lines, but we found it in close to half of the vehicles we saw on the floor. In fact, we calculated recent surveys at about 48 percent!

Several newcomers brought yf to the show, including brands like Subaru, Kia, Chevy and Buick. So far Subaru has only changed over their flagship Legacy sedan and Outback wagon, while Kia is using it in the Optima and Sportage. We also checked out FCA, and, as expected, almost every vehicle on display uses yf. This is not surprising, considering they changed over most products during the 2015 model year. There are still a few holdovers like Caravan and Patriot, but they are expected to be phased out of production soon.

PHOTO: STEVE SCHAEBER

CADILLAC BECAME THE FIRST US BRAND to use R-1234yf back in 2012, and now we've seen it in six of their models, including this 2017 XT5 crossover.

As for the GM brands, technicians know that when a change is made to one specific model, changes to their sisters are not far off. For example, MACS reported back in August about GMC putting yf in the Acadia, and now we're also seeing it in the Cadillac XT5. Same goes for the Chevy Silverado 1500 and GMC Sierra 1500 pickups, which both use yf, along with the Canyon and Colorado.

All but a few Honda vehicles are using yf, and that likely has to do with their refresh schedule. Those vehicles that have already been changed over are also on new platforms or on to their next generation (like the Gen2 Ridgeline). So while HR-V and Odyssey have yet to be changed, we expect that they're next on the list, and maybe we'll see them using yf at next year's show.

Although we were told back in 2015 that two of their vehicles would be using yf in the 2016 model year, we've

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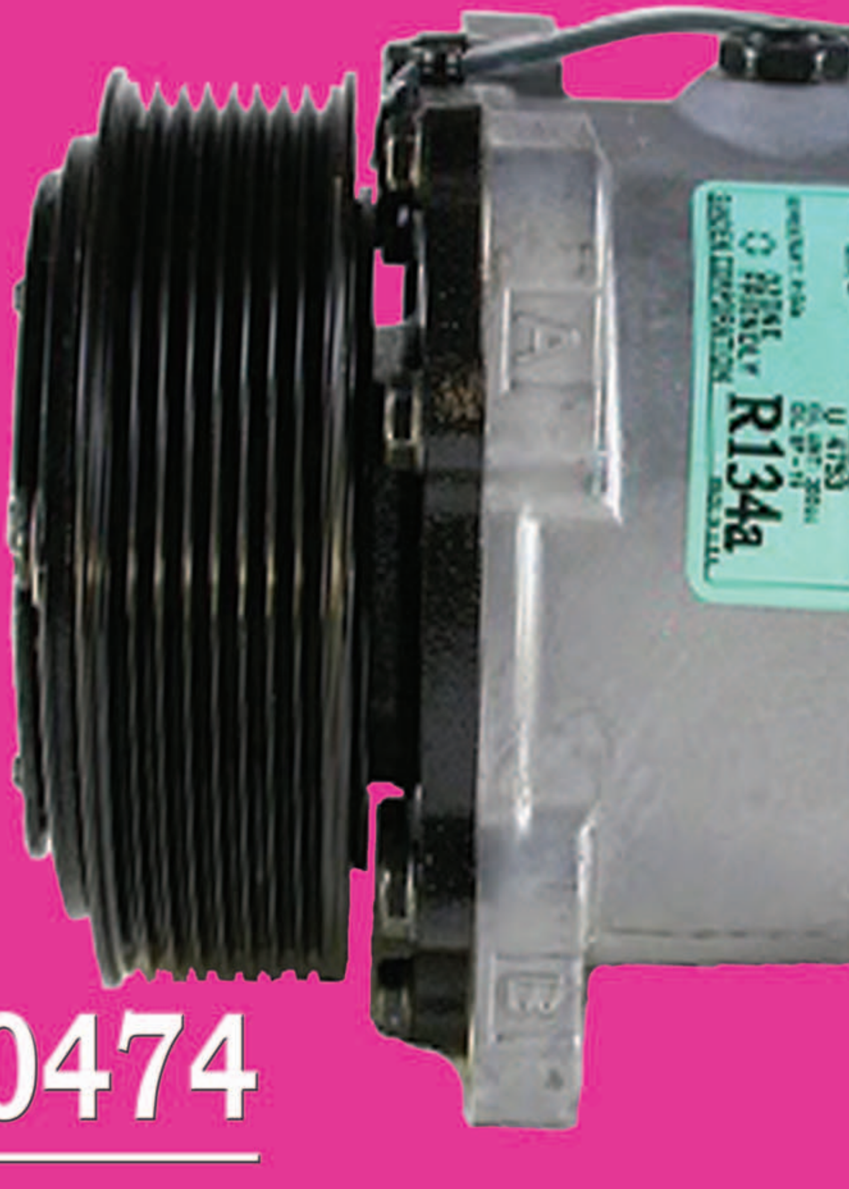

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only seen Toyota using it in the Tacoma pickup thus far. But inside sources tell MACS that a Lexus model is slated to get it next, and we'll just have to wait for its introduction, due sometime this spring.

New EPA rule allows R-1234yf in certain trucks

If you've been waiting to see R-1234yf in something larger than a half-ton pickup truck, you might not have to wait too much longer. A new EPA rule will soon allow manufacturers to use HFO refrigerant in certain medium and heavy duty vehicles, as long as they comply with certain regulations.

The rule lists HFO-1234yf as acceptable, subject to use conditions, for limited HD vehicle types, such as medium-duty passenger vehicles, HD pickup trucks and complete HD vans. In other words, it allows yf in medium- and heavy-duty vehicles with a Gross Vehicle Weight Rating (GVWR) of between 8,500 and 14,000 pounds (Classes 2b and 3). At this point it only applies to newly manufactured vehicles built with an air conditioning system designed to use it, but up until now only light-duty trucks, such as the 2016 Ram 1500, were allowed to use yf. They're considered to be "Class 2a" trucks, because they fall within a GVWR range of 6,001-8,500 pounds. We expect Class 2b trucks like the Ford F-250 to be next in line to get yf, as they're being put together on the same assembly line as their half-ton counterparts.

MANY OF THE GM SISTER CARS will change over to use yf at the same time, since they're being built on the same platforms and come off of the same assembly lines. Examples include the Chevy Silverado 1500/GMC Sierra 1500 (shown here), and Chevy Colorado/GMC Canyon pickup trucks.

PHOTO: STEVE SCHAEBER

It's being called "Rule No. 21" (part of EPA's SNAP program), and it does a lot more than just allow yf to be used in MD trucks. It also requires technician certification in order to purchase MAC refrigerants, as well as requiring the use of self-sealing valves in those small cans sold at auto parts and other big-box stores.

GET MACS CERTIFIED

Are the technicians in your shop MACS Certified? Visit www.macsw.org where you can learn how to become certified under Section 609 of the US Clean Air Act. While you're there, you can download a free copy of the MACS study manual.

We think this rule makes a lot of sense too, because there are only minor differences in the size and configuration of the A/C systems between these vehicles as compared to their smaller counterparts. In fact, many of the bodies and cabs used to build these trucks are the same; it's the chassis, frame and suspension that can really tell them apart. As an example, what are the main dif-

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ferences between the A/C system of a Ford F-150 pickup truck and an F-550 Super Duty? For 2013, the refrigerant charge amounts only differed by about 4 ounces, likely due to variations in components or heat load among the engines. Let's also compare two 2016 Chevys: The Silverado 1500's GVWR is 6,500-7,200 lbs, while the 2500HD is 9,300-9,900 lbs. The 2500HD can't use yf, even though they're built on the same assembly line with nearly identical A/C systems.

What can you expect for your shop? You might soon see some of the larger work trucks, work vans, utility bodies, plumber, bucket, stake, dump and other vocational trucks using the new refrigerant. Unless it gets into an accident that damages the A/C system, you probably won't have to work on the A/C system for a few years yet. So for right now, you'll want to stay on top of what's going on to learn about the new models coming out with the gas, the new tools and equipment you'll need to use, and other developments in the work truck A/C market. Also, most of this new rule applies to other industries besides MVAC, and you can learn more about it on EPA's website at www.epa.gov.

WE ALSO SAW what we think will be the first Volkswagen to use R-1234yf in the U.S., and that's the 2018 VW Atlas R-Line. This prototype was on display in Philadelphia, and while there was no J639 label to be found (there was actually no labeling on this particular vehicle, not even in the door jambs), the shape of the service ports are a dead giveaway that it uses yf.

PHOTO: STEVE SCHAEBER

New EPA rule restricts the sale of HFC refrigerants

Another part of this rule is expected to reduce emissions of hydrofluorocarbons (HFCs) such as R-134a. It affects Section 608 of the Clean Air Act, and it extends the Ozone Depleting Substance (ODS) sales restriction to HFCs and other non-exempt substitutes, with

MANUFACTURERS USING R-1234YF

Here's the most current list we've put together so far, showing which manufacturers are using R-1234yf refrigerant in production vehicles right now. Keep in mind that some of these may not be US-spec, available only in Europe or other parts of the world.

- BMW i3 Electric, i8 Electric
- Buick LaCrosse
- Cadillac ATS-V, CTS-V, CT6, Escalade, XT5, XTS
- Chevrolet Bolt EV, Camaro RS, Colorado LT Diesel, Malibu, Silverado 1500 LTZ & Z71, Spark EV, Suburban, Tahoe, Trax
- Chrysler 200, 300, Pacifica
- Citroën C4, Elysëe
- Dodge Challenger, Charger, Dart, Durango, Journey
- Fiat 500, 500L, 500X
- Ford Escape, F-150, Focus, Fusion, Fusion Energi, Transit
- GMC Acadia, Canyon SLT, Sierra 1500, Yukon XL, Denali
- Great Wall Motor – Voleex C30
- Honda Civic, CR-V, Fit EV, Pilot, Ridgeline
- Hyundai Santa Fe, i30
- Infinity Q50
- Jaguar F-Pace, F-Type, XE, XF, XJ, XJL
- Jeep Cherokee, Grand Cherokee, Renegade, Wrangler
- Kia Cadenza, Carenz, Cee'd2, Optima, Sorento, Sportage
- Land Rover Discovery, LR4, Range Rover
- Lexus GS450h
- Lincoln MKZ
- Mazda CX-5
- Mitsubishi Mirage
- Open Mokka
- Peugeot 301, 308
- Ram 1500
- Renault Zoe 3
- SAIC Motor – MG350 / Rover 350
- Subaru BRZ, Forrester, Impreza, Legacy, Outback, XV
- Tesla Model S
- Toyota GT86, Prius Plus, Tacoma, Yaris HSD

Still not every OEM selling in the US has made the change, and even though we checked every car they had on the floor, we could only find R-134a being used by brands such as Acura, Infinity, Mazda, Mitsubishi, Nissan and VW. It will be interesting to see who waits the longest, but as of right now EPA has set 2021 as the model year deadline after which R-134a will not be allowed in new light-duty vehicles.

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MACS TO HOST MOBILE A/C PAVILION AT NACE AUTOMECHANIKA 2017

Do you want to learn more about how mobile A/C works, what's going on in the industry and rules and regulations applicable to your shop, all while becoming certified to handle mobile A/C refrigerants? Then you'll want to see MACS at NACE Automechanika 2017! MACS will be hosting the Mobile A/C Pavilion where you can find manufacturers and distributors displaying A/C parts, components, supplies, tools and equipment.

MACS will also be presenting three different mobile A/C training classes that you won't want to miss! The MACS 2017 Mobile A/C Update covers a variety of service information, tools and equipment, diagnostic techniques and industry current events, including an update on regulations and what's going on with the new refrigerant R-1234yf that you've been hearing so much about.
Register today at *MotorAge.com/mobileac.*

Whether you're new to A/C or have years of experience, you'll want to check out MACS Mobile A/C Service Best Practices. Servicing mobile A/C systems has become more complicated in recent years as vehicle and equipment OEMs continue to build more modern and complex systems. This class will help service technicians to better understand component design and integration, testing and replacement, along with recommended best service practices to get the job done right the first time.
Register today at *MotorAge.com/acpractices.*

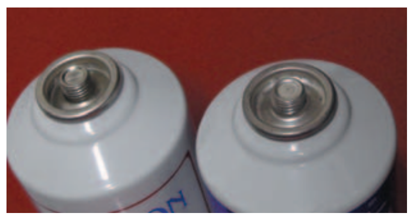
Are you and your technicians certified to handle mobile A/C refrigerants? Has it been many years since you took the MACS exam? You can become certified at NACE Automechanika with MACS! Section 609 Certification is a requirement of all mobile A/C service technicians by the U.S. EPA under the Clean Air Act of 1990. The goal of this program is to provide information to technicians about safely handling automotive refrigerants along with applicable rules & regulations. Following classroom instruction, attendees will take the 609 test on-site the same day (additional $20 fee applies).
Register today at *MotorAge.com/609certification.*

the exception of small cans containing two pounds or less of (primarily) HFC-134a for servicing motor vehicle air conditioners. These small cans can continue to be sold without technician certification so long as they have a self-sealing valve to reduce leakage. This is something new to most of the U.S., but not California. The Golden State has had self-sealing cans since 2010 when CARB (the California Air Resources Board) first required their use. It also applies to other non-ozone depleting substitutes such as R-1234yf, which should be available in small cans later this year.

Most of the EPA rules and regulations that apply to automotive technicians come from Section 609 of the US Clean Air Act of 1990, but others also affect us in the shop. One in particular is Section 608, which although it's commonly thought to affect only HVAC/R technicians (those who work on commercial, industrial and residential A/C units, refrigerators and freezers), also applies to the mobile A/C community because it contains the bulk of EPA's "refrigerant management program."

So what do these changes mean to mobile A/C technicians, shops and shop owners? Probably the biggest is that technicians will need to be certified under Section 609 through a program like MACS if they are going to purchase refrigerant. Prior to this rulemaking, a MACS certification was only required for purchases of CFC refrigerants like R-12, but starting on January 1, 2018, you'll also need one if you want to buy R-134a or the new HFO refrigerant, R-1234yf. MA

BEGINNING ON JANUARY 1, 2018 technicians will need to show their Section 609 Certification card if they want to purchase mobile A/C refrigerants, including R-12, R-134a and R-1234yf.



PHOTOS: STEVE SCHAEBER

WITH THE EXCEPTION OF CALIFORNIA, small cans of refrigerant are sold without self-sealing valves in the U.S. This new EPA rule changes that, requiring the use of self-sealing cans across the U.S.

STEVE SCHAEBER is the Manager of Service Training for the Mobile Air Conditioning Society (MACS) Worldwide and Technical Editor of ACTION™ Magazine.
steve@macsw.org

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PLASTIC PARTS LIKE THIS one seem doomed to fail, and when such a large amount of coolant is flowing through a passage like this, old fittings are like a ticking bomb where the engine is concerned. If this happened in Atlanta during rush-hour traffic on a 100-degree day, it'd be nasty.

IT MAKES A DIFFERENCE AND IS A GREAT UPSELL

RICHARD MCCUISTIAN // Contributing Editor

I've heard people say that they don't think they need an oil change because the car still runs good. And those people are totally oblivious to the coolant that carries away engine heat.

Then there are those who care a lot about their cars but know very little about things under the hood.

A customer recently came to me with her Buick smoking and making strange noises. She said she had seen the oil light come on and so she added oil. I pulled the dipstick and we found that it was about five quarts overfilled. When I asked her why it had so much oil in it, she said she didn't know anything about the dipstick — she just figured she needed to add oil until she could see through the filler cap hole that it was full.

But there are some drivers who are car-conscious enough to check and change the oil regularly, and they'll even check the rest of their fluids, but too many don't ever think of replacing the coolant or doing anything else to the cooling system until it springs a leak or an overheating episode happens. Oil changes happen regularly. Coolant changes every 60,000 miles tend to be forgotten. It's sort of like the transmission — some folks don't consider doing anything to it until it starts having problems. And a neglected cooling system tends to develop a few problems that can't be easily dealt with, and some of

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Ranger

SOME CUSTOMERS DON'T WORRY about their cooling system until this needle makes its way into the red or a "Check Gauges" light pops on.

WE FLUSHED THIS IMPALA (left) four different times before we got this play doh under control. Every time we did an oil change for a while, we found this clogging crud. We finally replaced the radiator.

the fallout from such lassitude is more or less permanent. Flakes of rust shred water pump seals, heater cores and radiator fins, and used-up coolant stops protecting the metal parts. I've repaired overheating problems in some cases by just replacing old coolant.

From our side of the service aisle, it's a foregone conclusion that cooling system service makes a LOT of difference, and it's a great (and necessary) upsell on vehicles that are in need. Checking the vehicle's maintenance record and schedule is a legitimate practice too (if there is one). If you follow the manufacturer recommendations at the intervals they publish, it pays off in the long run for the customer as well as the shop. It's a win-win, but you must sell it!

Plastic parts that fail

To save weight, car manufacturers have been making lots of things out of plastic for decades now, and many of these plastic parts carry hot coolant, which in many cases has been a tremendous repair boon for those of us who wrench for a living. How many shops could fill the back of a pickup with plastic coolant-carrying parts we've replaced over the past six months?

A lady came to me with a high-mileage Honda Accord and asked what I would do to reduce the likelihood of mileage-related unscheduled maintenance. One of the several suggestions was that we replace the radiator and the coolant along with it. Why? Well, most of us have seen more than a few engines destroyed because of an old radiator that cracked on the highway, dumped the coolant and led to a meltdown. Then there are those radiators that leak from the rubber seal between the core and the tanks. That happens even on lower-mileage platforms, and sometimes it happens with replacement radiators if they're cheapies.

And there are those crummy plastic elbows GM used to pipe coolant through the belt tensioner on turn-of-the century 3.8L platforms, but good metal replacements are now available for those. There are also the plastic intake manifolds that like to split and plastic and silicone manifold gaskets that die every day and start dumping coolant everywhere. Most of us have also replaced leaking plastic thermostat housings on Ford Explorers and those annoying plastic 2.7L water outlets (the one that comes with the ECT sensor in it).

If you put a heater core in a mid-2000s Nissan Pathfinder, you may find that underhood heater hose manifold and pipe assembly brittle to the point of fragility, and since it includes an electric water pump, it's about $250.

The point is that there's nothing wrong with upselling items like this to protect a customer from catastrophic breakdowns. Again, changing failure-prone plastic parts on familiar platforms that are high mileage helps protect the customer from later loss. Simply servicing the cooling system might not totally prevent plastic part failures, so on a failure-prone part that doesn't cost a lot and isn't hard to change, selling one is a good idea, even if it's the plastic intake manifold on a Lincoln or a Crown Victoria. Those like to leak in various places as well. But be careful to buy good parts. We've had to replace radiators a second time because the first replacement part started leaking at the tank/core joints after only a few thousand miles.

We replaced one plastic radiator on a 2005 Caravan (it seems like we work on a lot of those) that wound up with a percolating coolant issue after we replaced the radiator, and it turned out that the neck of the radiator was built just a bit out of spec — even with the right radiator cap installed there was almost no spring tension applied, and so the coolant wasn't under pressure, and it would be boiling whenever she stopped the vehicle. You could remove the cap with a thumb and a forefinger. The radiator cap's bottom seal didn't even have a signature mark where it had been pressed against that inside lip. Experimentally, I took another new cap I had, removed the gasket, and worked it onto the new radiator cap, stacking the gaskets to apply more pressure, and the percolation stopped. The radiator still had to be replaced with another one.

RUST ATTACKS PARTS FROM THE INSIDE OUT in a very big way. It clogs radiators and can erode an expansion plug that, on the outside, looks just fine. We replaced all the expansion plugs in a 1998 Taurus while we had the transmission out and washed enough rust out of the block to fill a large coffee can. And it wasn't even overheating.

A GOOD COOLING SYSTEM MACHINE is a good tool to have on hand. On rusty systems we'll push a lot of clear water through before finally shoving the 50/50 in there.

GROUND CIRCUITS — PART 2

Part 2 continues a series of online-exclusive electrical circuit articles that focus on the ground side of the circuit. Read it at ***MotorAge.com/circuitspart2.*** Missed Part 1? Check out ***MotorAge.com/circuitspart1.***

The cap debate

Certainly one of the more interesting issues I've run into more than once over the past several years is in regard to brand new radiator caps with dangly vent valves. If I pull a radiator cap off an older system and see a dangling vent valve, I'm replacing it. But when the new Stant cap comes with a dangly valve, I get sort of bothered, and I make the parts guy find one with the same part number that has a tight vent valve. And he always can, it seems. When he combs his inventory, some of the same part number caps will have dangly valves and some won't. That in and of itself is troubling, but Stant calls these danglies

THIS PATHFINDER seemed to be full of coolant and was running 195 degrees on the scan tool, but we had no cabin heat until we jacked it up and poured another ¾ gallon of coolant in. Where there are bleeders, it's best to use them, though, but use a hose to keep coolant off the belts. The Pathfinder doesn't have any.

"partial pressure" caps.

In a "partial pressure" cap, the vent valve is free-hanging by design – there is no spring to close it, just a small weight to make it dangle. It is supposed to close only when system pressure rises high enough to cause coolant flow volume that can overcome the weight of the valve and push it shut. Thus, in these systems, the cooling system isn't pressurized until it gets hot enough to put sudden pressure on the cap. At that point, the sudden pressure/flow that hits the cap is supposed to push the vent valve closed and then pressure increases in the cooling system. Why do this? Well, they say the system doesn't need to be under pressure until it becomes necessary to raise the boiling point of the coolant. Supposedly, this is easier on the solder joints and other "weaker" places where building pressure can cause leaks, and I'm not a college-trained engineer, but my question would be that if those joints can't take the pressure early on, will they even be able to handle the pressure after it rises? This is a peculiar strategy to me.

This debate may not be worth having, but I don't like replacing one dangly vented cap with another one, if you know what I mean. Caps are cheap, though, and replacing the cap is typically a good idea.

Most of today's cooling surge-tank type systems don't have that kind of

CODES DECODED

A P0128 code basically means the engine is running a bit cooler than the PCM is programmed to accept. The P0125 code usually means a thermostat is needed, but on some Toyota platforms it can mean the O_2 sensor heater isn't working and closed loop isn't happening soon enough or at all, and you may not get an O_2 heater code. If you're working on a Camry that seems to be running warm enough but still throws a P0125, look at the O_2 heater. The problem is that some new thermostats open too soon. I sometimes had to replace one, two or even three times when I was at the Ford dealer to get one that would get warm enough.

radiator cap anyway, but there are multiplied thousands of vehicles on the road that do.

Much ado about coolant

With all due respect, we've seen more problems with Dex-Cool than any other coolant. That orange liquid loves to turn to orange mud on systems that haven't been serviced according to the book, and it's very difficult to get that junk out of a system once it's there. We've used all manner of methods (including "CLR") to try and get rid of that stuff, but it usually takes repeated services over time to make it happen.

THIS WILL TOSS A P0128 IN SHORT ORDER, but the 'stat isn't always stuck open — sometimes the spring just gets weak and lets it open too soon. It's a good idea to replace it when doing a comprehensive service. Thermostats are no longer packaged with a gasket — probably because a few numbers fit many different platforms and the gaskets are different.

We worked on one 2006 Impala that, when you removed the filler cap, had what looked like modeling clay clogging the filler neck. We flushed and flushed that one and eventually replaced the radiator before we finally got it clean enough to be trouble-free. Green coolant went back in, and we finally got just about all of that stuff out, but periodically some of it will break loose and make an appearance when we're servicing that one.

On my personal vehicles, I follow the maintenance guide on everything from oil changes to coolant exchanges. I have a 2007 Taurus and a 2007 F-150, both of which use Motorcraft Gold, and when I replaced it in both vehicles at the required interval, the coolant I was pushing out looked as good as what I was putting in. Personally, I like the Motorcraft gold coolant best of all, but Ford has moved on to other formulas and colors now.

We presently use a Robinair coolant exchanger that works well, and before I exchange the coolant on a nasty one I like to push about 15 quarts of water through before shoving the coolant in, but it works best when you remove the thermostat instead of letting the pressure push it open, and replace the 'stat when you're done.

Hoses and stuff

Anywhere there has been oil seepage that attacks a rubber coolant hose, those hoses tend to get soft, flabby and unreliable. And don't we all love those OEM spring clamps that can be so annoying, especially when one of the ears snaps off on one that feeds the heater core and those connections are way down there almost out of reach? Be careful of hoses that are

SOME COOLING SYSTEM ISSUES ARE EASY TO SPOT (like the hose) and some aren't. That hose could have burst while I was standing there and produced some debilitating burns. Pay attention when under the hood of a hot one! We didn't see this weedy stuff clogging the radiator until we dismounted the radiator and looked in between it and the condenser. How this stuff gets through the condenser is pretty incredible, but I've seen this.

dissolving from the inside out, because they'll look good right up until they spring a pinhole leak. You can usually squeeze the hoses with a practiced hand and catch this early, though.

Unserviced cooling systems (or systems that have been filled for a while with nothing but water) may have cavitated water pump reaction services and partially dissolved impellers, so if you know the cooling system is full and you don't have good heat, check for good flow. If the impeller is plastic with an aluminum hub, sometimes those get loose on the shaft and cause similar issues. To check for flow, we pull the hoses off the heater core and put a clear hose from the local hardware store between the inlet and outlet heater core hoses to see what's going on. It's a neat way to find bad water pumps and clogged passages, because you can watch the flow happen. You can connect a water hose to the heater core and check for flow through as well while you're at it.

Pressure testing is a good thing to do, but you need a really good pressure tester, and I despise those that have the stupid one-size-fits-all rubber cone, because they tend to blow out and make a mess. I want a set that has a cap to fit most every system.

Bleeding the cooling system is an all-important task — always turn on the heater. If it was working before but it isn't working after the fill, you may need to do extraordinary things to get the air out. On a 2005 Pathfinder we just finished (heater core, heater pipe manifold, etc.), we had to jack the front of it up at a very steep angle and add coolant to get all the air out. Initially, one of these will seem full and won't usually be overheating, but we had no cabin heat until we raised the front of it and poured in another half-gallon of coolant. Watch for that. Nissan Quest is similar — raise it up in the front, put a funnel full of coolant mix on the radiator neck, and slap the throttle a few times. On the ones with old fashioned radiator caps, I use a doctored cap with the spring and seat removed so that it seals only around the top of the neck, and as the engine heats up, that lets the system drink from the degas bottle and get rid of its air very easily, but you have to keep an eye on the coolant level in the degas bottle.

Vehicles with the thermostat in the lower hose are obviously easier to bleed than those that have it in the upper hose, because the block tends to fill through the open top hose. I first saw that setup on VW Rabbits and some of the old 2.8L Ford V6s back in the day, but it's everywhere now. On some platforms I like to fill the block through a heater hose, which bypasses the thermostat. Always check for shop manual procedures on unfamiliar platforms. MA

THE PLASTIC RESERVOIRS, when really rust-stained, should be replaced, because you can't see the coolant level in one like that. The round ones like the VW one like to burst and leak, and I knew of one 2006 Power Stroke diesel that was destroyed because the owner wouldn't come off of $45 to replace a leaking degas bottle.

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RICHARD MCCUISTIAN is an ASE-certified Master Auto Technician and was a professional mechanic for more than 25 years. Richard is now an auto mechanics instructor at LBW Community College/MacArthur Campus in Opp, Ala.
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FINDING THE LEAK

ONE OF YOUR FIRST CHECKS is to determine whether there is dye in the system. Take off the low-side service port cap and look for dye residue with a leak detection flashlight.

WITH SYSTEM CHARGES GETTING EVER SMALLER, FINDING AND REPAIRING LEAKS IN THE AIR CONDITIONING SYSTEM TAKES ON A WHOLE NEW IMPORTANCE.

TONY MARTIN // Contributing Editor

The daily work routine of the automotive technician is mostly taken up with fixing leaks. Think about this for a moment: When we work on cars, we are spending the lion's share of our time finding leaks and then repairing them. This could be air, vacuum, coolant, oil or even electricity. Obviously, the better we are at pinpointing leaks, the better we serve our customers and the more money we can make.

Mobile air conditioning systems operate by circulating refrigerant through a sealed system and will stop working if the refrigerant leaks out. Generally speaking, these systems work very reliably so long as the refrigerant stays put. However, the majority of the problems we see are related to refrigerant leaks, and these can often be challenging to locate. There are multiple techniques for finding A/C leaks, and each has its own merits and pitfalls. Having said that, you will probably want to have several of them in your diagnostic toolbox to stay ahead of the game. Again, increased expertise in finding refrigerant leaks will help your customers stay cool and put more money in your pocket.

The A/C service season is coming

PHOTO: TONY MARTIN


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up fast, and many of us haven't had to deal with an air conditioning performance concern in several months. We may be a little rusty with the basic rules of refrigerant leak detection, and a review of technologies and techniques may be helpful to get us off to a good start. If your shop does air conditioning repair, having your technicians go over the information in this article could flatten the learning curve and get you off to a great start on a profitable summer A/C service season.

Getting underway

Let's say that you are an automotive technician and the first A/C performance concern of the season has appeared in your bay. You suspect that the system is low on refrigerant, and you will need to locate and repair one or more leaks. One of your first questions should be: Is there dye in the system? Look for a sticker in the engine compartment that indicates that dye has been installed. If you don't find a sticker, take the cap off the low-side service port and shine your leak detection flashlight over it. Glowing dye residue inside the port changes your whole approach, because now you can go directly to inspecting the system with your flashlight.

We'll assume you don't see any signs of dye in the system. You don't have to install it right now — just be sure that you get it done before you return the car to the customer. Be sure to use a high-quality dye that meets SAE J2297 standards. It pays to take some precautions at this point, because it is easy to make a mess when connecting to the service port due to pressure in the A/C system. Cover the coupler with a rag during this process to prevent splatter and extra work cleaning up after the fact.

WITH THE SENSITIVITY SWITCH ON HIGH, keep the probe ¼" from the work, and move it slowly — about 1-2 inches per second. Remember that antifreeze, Loctite and windshield washer fluid can cause false alarms.

Approximately ⅛ ounce of dye concentrate will work for anything from passenger cars to a heavy-duty truck. Don't overdo it; one trigger stroke on most injectors will get the job done. Don't assign the cost of the dye to your shop materials fees! Put a separate line item on your invoice for the dye you install in your customer's vehicle. Take some time to fill out a sticker indicating that there is dye in the system and install it in the engine compartment. Obviously, this is not going to help you with finding the leak right now because it will take some time for the dye to circulate with the refrigerant oil and make its way through the leaky joint. Having said that, your next step will be to get out your electronic leak detector and go over the entire system slowly and carefully.

A QUALITY ELECTRONIC LEAK DETECTOR will pay back dividends. Remember that these require periodic maintenance, so follow the instructions in the operator's manual.

Electronic leak detection should be done in the shop with any fans turned off that could cause air movement around the area you are testing. Turn on the detector and let it warm up for a minute or two. Turn the sensitivity switch to HIGH, and place the sensor probe about ¼" from the possible leak source. Slowly move the detector underneath the connections and lines you are checking at a rate of about 1 to 2 inches per second. When the detector beeping rate increases, pull it away for a moment to extinguish the alarm, then place it back near the same area to verify the leak. To pinpoint the location of a larger leak, turn the sensitivity switch to LOW and retest. When you locate a leak, continue on and inspect the remainder of the system. It is always a possibility that you have more than one leak to deal with.

Thomas Parker of Inficon Inc. shares some tips for improving your results when using electronic leak detectors. First, be aware that false alarms can be caused by windshield washer fluid, antifreeze and Loctite, so be sure to avoid these fluids when leak testing. The technician should also be aware that the filtering software in some detectors is more effective than others, so spending extra money on a quality detector can pay dividends. Also, keep in mind that all electronic leak detectors require maintenance, so be sure to follow through on the instructions in your unit's operator manual.

PHOTOS: INFICON

Live and let dye

One disadvantage with electronic detectors is that they will not detect leaks that only take place during vehicle operation. This is where leak detection dye excels, because it is dissolved in the system oil and will travel with the leaking refrigerant where it can be detected when the vehicle is in the shop. It can also be effective for locating leaks in areas that are visible but cannot be accessed by an electronic detector.

IF THE SYSTEM DOESN'T HAVE leak detection dye installed, be sure to inject 1/8 ounce of dye concentrate before returning the car to the customer.

WHEN INSPECTING FOR DYE LEAKS on an A/C system, start at the compressor discharge and carefully make your way through the entire system. When you get back to the compressor inlet, be sure to inspect the input shaft seal.

If the system had dye in it when it came to you, you can immediately perform an inspection using a leak detection flashlight. The large, awkward lamps that were once the industry standard are a thing of the past. Compact, lightweight flashlights are now the norm, and these are typically battery powered for ease of use. Keep in mind that there are a number of types of leak detection flashlights available. John Duerr of Tracer Products offers the following tips for choosing a flashlight for refrigerant leak detection:

1. Fractional vs. single LED — the type of LEDs that are placed in the lamp are indicative of how much power is in the lamp. Fractional LEDs are a set of several small LEDs, while a single LED has 1 powerful lamp. Traditionally, single LED lamps are more powerful and have a better fluorescent response than fractional LED lamps.

2. Dye absorption — there are three primary types of light used in UV fluorescent leak detection. However, each has a different wavelength and is absorbed differently by UV fluorescent dye.

a. UV (365 nM) is responsive to all dyes.

b. Violet (400 nM) is compatible with all A/C and coolant dye, and some fluid dyes.

c. Blue (450 nM) is compatible with all dyes with the exception of extended life coolant dyes.

3. Beam profile — how wide the useful light projects on to a surface. A strong flashlight will have a consistent beam, while a weaker flashlight will become dimmer towards the edges of the beam profile.

4. Construction — flashlights need to be designed to withstand use in extreme heat without failure.

For best results, always wear fluorescence-enhancing safety glasses when using a leak detection flashlight. This will help highlight any glowing dye as well as protect your eyes from UV radiation. It goes without saying that fluorescent leak detection works best in low-light conditions, so ideally the vehicle will be indoors with the shop lights turned down.

Start at the A/C compressor discharge port and thoroughly inspect all fittings and lines as you follow the path of the refrigerant through the system. Be methodical, thoroughly inspecting each component before moving on. If you find a leak, make a note of its location, then con-

VERIFYING EVAPORATOR CORE LEAKS

So you've inspected the components in the system that are reasonably accessible, and you have yet to find a leak. This is where it can get challenging, because it is possible that you have a leaky evaporator to deal with. You don't want to be guessing in this situation, because it is often a labor-intensive process to remove and replace an evaporator in most vehicles. What can be done to increase our accuracy in diagnosing evaporator leaks?

Jeff Prickett of Stride Tool recommends that you stress the A/C system to help verify an evaporator leak. Leave the vehicle doors open and run the engine with the A/C in MAX COLD and the blower on HIGH. After 15-20 minutes, shut the engine off and place a piece of white paper on the floor beneath the evaporator drain. As the evaporator thaws out, condensed water will flow into the evaporator drain and then on to the paper underneath. Direct your leak detection flashlight onto the paper to reveal dye that has been carried with the water. You will be amazed at how any dye that is present becomes that much more visible with the white paper as a background.

ONCE ALL REPAIRS ARE COMPLETE, be sure to clean up your work with an approved dye remover.

PHOTOS: SPECTRONICS

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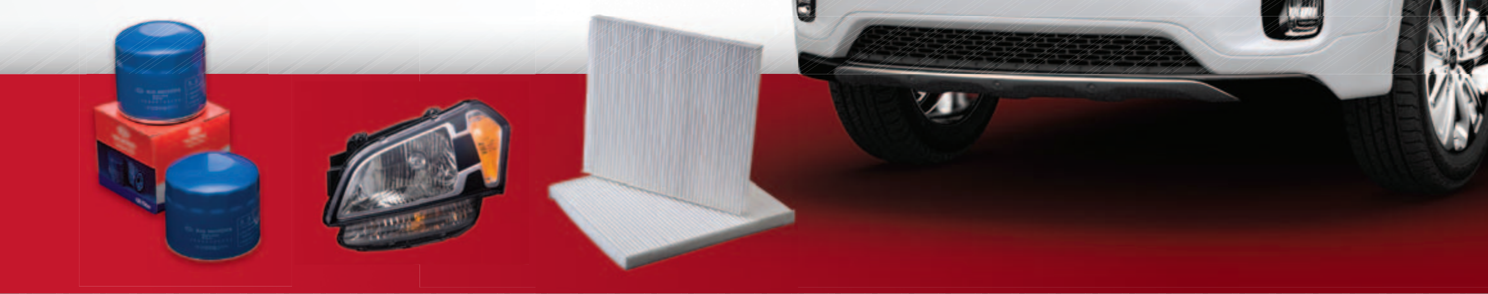

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tinue inspecting the system in search of other leaks. Follow the lines until you make your way back to the compressor inlet. While you are there, don't forget to assess the condition of the compressor shaft seal.

When you find leaks and make the associated repairs, be sure to use an approved cleaning solution to remove all the dye from the leak sites. This will help the next technician (possibly you) from being misled when performing future A/C leak repairs on the vehicle.

CARBON DIOXIDE WORKS VERY WELL FOR A/C LEAK DETECTION because it is a smaller molecule than the refrigerant and will leak more easily. Start by recovering the refrigerant from the system, then charging it with CO_2.

Tough cases

Slow refrigerant leaks that are not detectable with dye or an electronic detector will require another approach. Your next step could be to replace the refrigerant in the system with a substitute gas and then test for leaks. The idea is to use a gas that has a smaller molecule than that of the refrigerant, so it will leak more freely than the original. The substitute gas must also be harmless in terms of flammability and its effect on system materials.

One approach is to recover the refrigerant from the system and then fill it with nitrogen. The technician then closes the valves to seal the system and listens for leaks with an ultrasonic listening tool. This can work for large leaks, but will be less effective for the slow leaks that cause us the most grief.

AFTER FINDING THE GENERAL LOCATION of the leak with the electronic detector, spray it with the Leak Seeker foam. The pink foam will turn yellow at the exact location.

What works best is to use a gas that can be detected with an electronic gas detector. Having said that, the two top candidates for substitute gases are forming gas and carbon dioxide.

According to Bernie Thompson of Automotive Test Solutions, carbon dioxide has some compelling advantages for A/C leak detection. While it is a small molecule and will leak more readily than refrigerant, it is also heavier than air and will fall from a leak rather than dissipating. This helps concentrate the leaking gas and makes it easier to detect using electronic means. Automotive Test Solutions' Bullseye Leak Detector system uses an electronic CO_2 detector as a first step to find the general location of a leak, but then pinpoints the leak using a specially-formulated foam. The pink Leak Seeker foam is sprayed on to the general area of the leak, which turns yellow and produces bubbles when it makes contact with carbon dioxide. FYI - the Bullseye system can be used to detect leaks of all kinds, including slow leaks on tires, EVAP leaks, and head gaskets. This versatility can be very useful to any shop that does general automotive repairs.

The bottom line

Slow refrigerant leaks are often the bane of the A/C service professional. While there are numerous technologies available for A/C leak detection, you will be best served by using more than one to get the job done. It goes without saying that you shouldn't go cheap. Buy the best tools available and provide the training to your technicians so they can use them properly.

There are cascading benefits that will be realized with increased competence in locating A/C refrigerant leaks. Finding and fixing slow leaks reduces comebacks, making for happier customers and more business coming your way by word of mouth. Your technicians will also gain on-the-job satisfaction, with more flagged hours and fewer comebacks. This all adds up to increased profits as your customers stay cool through the hot summer months! MA

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PHOTOS: AUTOMOTIVE TEST SOLUTIONS

APPLYING LOGIC TO THE DIAGNOSTIC PROCESS

SOLVING ANY DIAGNOSTIC CONCERN REQUIRES A PROCESS. WHAT'S YOURS?

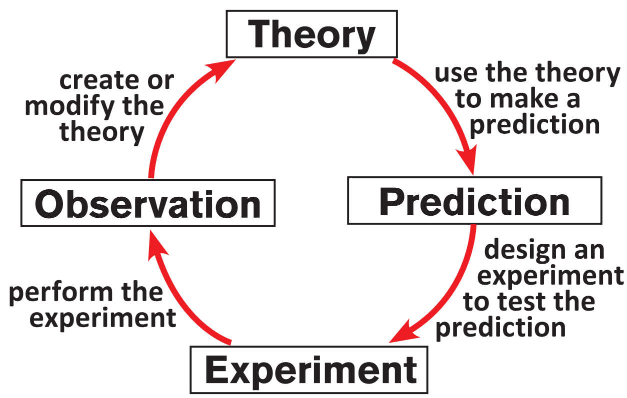
ERIC ZIEGLER // Contributing Editor

How many times have you run into a situation like this? The vehicle that is in your bay has been to a couple of shops and still has problems. Maybe it has an issue that stubbornly hasn't yet manifested itself. Or perhaps you have very little firsthand knowledge of the system or vehicle you are working on and/or you have never had the "privilege" of working on one. I think if most of us are being honest, we would admit these situations are presenting themselves more and more frequently. So what do you do? How do you proceed at this point? Do you have a set plan of attack (POA) in place or a process that will help guide you through these increasingly tough "diags?"

The diagnostic process has to start at the service desk. The questions of who, what, where, when and how need to be part of the original, or triage, process. The customer is oftentimes the best source of information about the problems with his/her vehicle. They operate it numerous times a week in many different conditions and usually know its many quirks and where and when the problems arise. Our job as technicians is to be the diagnostic detective and put all the pieces together to come up with the "why."

So what's your POA

Do you use Google or some internet "silver bullet" site? Will you use the results of that search to start replacing parts? Unfortunately, there has been a trend in our industry to do just that! I get calls or emails from time to time seeking advice on diagnostics. When I ask questions like "what have you tested?" or "what do you know?" I usually get responses like, "we replaced this," or "Google said to put this part in." I actually don't have issues with Google searches or pay diagnostic sites — both have



a place in the diagnostic process — but use the results to gain some direction and do some testing.

I always try to have a logical approach to diagnostics whenever I am working on something that I have very little firsthand knowledge or experience in working on. I am always harkened back to elementary school science class, when I was first introduced to the Scientific Method, a four-part process that involved the following steps with a focus on how we can apply them to our logical diagnostics (as seen in the illustration above):

1. **Form a hypothesis** — Oftentimes we have an idea or silver bullet or TSB that we think may be the cause of our problem. For example, a 2002 Malibu with 200,000 on the odometer is towed in with a crank-no start condition. Based upon your experience, pattern failures and internet searches, you think or surmise that possibly the fuel pump may have died. This is your hypothesis.

2. **Design an experiment** — Based upon your hypothesis, design an experiment to test or prove or disprove what

PHOTOS: ERIC ZIEGLER

you think is the cause. In the example where we suspect a fuel delivery issue, maybe the experiment we design to test the fuel delivery system is to place a fuel pressure gauge on the fuel rail test port.

3. **Analyze the results of your experiment** — Using the 2002 Malibu, let's say I have fuel pressure that is in spec and yet the vehicle still doesn't start. How do I know if the fuel is reaching the cylinders? Make note of the results and design another experiment as to how to test that.

4. **Modify your hypothesis based on the results. Design another "experiment" if needed** — The above example may seem a little simple, but I believe it illustrates a logical plan that we as techs use regularly, possibly without necessarily realizing that we are employing a logical diagnostic method. I would implore you to use the same method to diagnose systems that you may not have "time in type" in. We test the no-start fuel delivery system in a logical path like muscle memory, yet if we are confronted with a network no-communication issue, we are often challenged on how to proceed.

Another method someone showed me a few years ago was to try to put ideas on paper and do some brainstorming. Try this sometime: take a piece of paper and divide it into four squares:

In the upper left corner, label it "things I know," and list them. Maybe the vehicle is a no start (NS), yet it has spark. Make a note of that.

In the upper right corner, label it "things I don't know," and list them. Do I have adequate fuel pressure? Does the injector and spark plug fire at the correct time?

In the lower left corner, label it "things I want to know," and list them. So say I have fuel and spark yet the engine still doesn't start. Is the fuel reaching the cylinders? Is the engine mechanically in time?

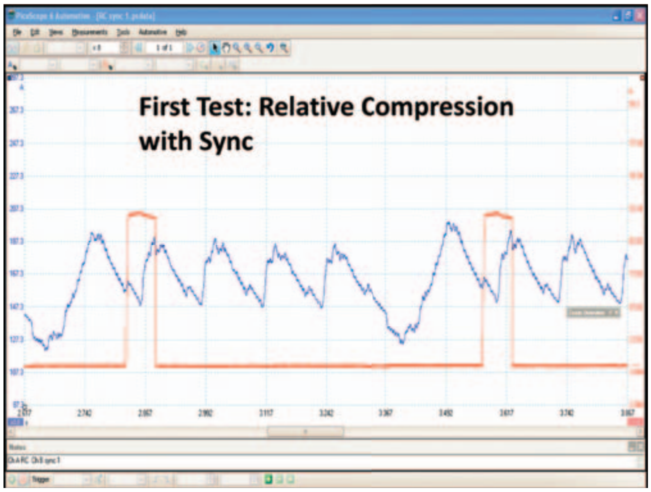
In the lower right corner, label it "design the experiment," and list ways you could prove the thing you want to know.

This is a brainstorming technique that makes techs critically think and put to paper a logical plan of attack. Another great piece of advice I picked up from a fellow *Motor Age* contributor that I call the "Manna Mantra" is to "do the extra test." In other words, if you think you have proved or verified something, find an additional way to prove it to yourself. This will make you a better tech and is a great way to cross check your results.

The "flat rate" test drive

I believe that a logical POA should start simple and have the ability to garner the most information with the least amount of effort. This, in my opinion, always starts with a scan tool and test drive. Systematically leverage the information in the scan tool. Look at and record codes, both current and historical. Don't necessarily limit yourself to the enhanced side; use the OBD II generic data to check for pending codes and take a look at the Mode $06 data, if applicable. Make note of the PCM calibration, too. There are times when calibration updates have been issued to correct drivability issues. It's hard to tell if the module needs to be recalibrated if you don't know what calibration is in the module. None of these tests are time consuming. It is merely using the scan tool to its fullest ability and having a logical progression or POA. After recording any codes and freeze-frame data and comparing that to the customer's "what, when and how" description, a systematic test drive while recording a snapshot or movie can usually give you a "go/no go" of the fuel system and the engine's ability to breathe. This is sometimes referred to as the "flat rate" test drive.

Too often I see techs test drive cars for drivability issues without having a scan tool hooked up, or if they do, they do not have a snapshot set up to record the test drive. This is a classic case of not leveraging technology to your benefit. Most quality modern scan tools have large recording buffers and have made great leaps in graphing scan data. Set the PIDs up in the data stream to include those needed to do a Volumetric Efficiency (VE) calculation and include O_2 sensors and Fuel Trim (FT) to get an idea of engine fueling. Next, take the vehicle out and drive it with a couple of wide open throttles (WOT) through a 1-2 shift while recording a scanner movie.



WHEN DEALING WITH DRIVABILITY ISSUES, one of the first tests I make is the relative compression test with sync.

An aggressive WOT acceleration of most vehicles with traditional O_2 sensors should cause the upstream sensors to go full rich, easily making 800-900mv. Think about this: WOT is usually when the engine requires the greatest amount of fuel to enter the cylinders. Basically the PCM sees the load increase via several inputs and

Lean Code Cheat Sheet

Suspect Condition	Fuel Trims (Total Correction)			Fuel Trim Notes:	Load PID/ VE(@WOT)	Possible driveability characteristics
	Idle	2500 RPM	Loaded			
Vacuum Leak	Positive	Closer to Normal	Normal	Trims get better as RPM and Load increase	Normal	May have poor idle especially cold/open loop. Normal driving conditions could appear OK.
Low fuel Volume	Normal or Positive	Positive	Positive	Trims can start normal or positive, but get worse as RPM, and especially load, increase. Degree of positive depends on how poor the fuel volume is.	Normal	May have low power, worse at WOT. May have starting problems such as a long crank time.
Air Metering	Close to Normal	Positive	More Positive	Trims can start negative, normal or positive but get worse as RPM and load increase	Poor	May have low power, worse at WOT
Wrong fuel (too much ethanol)	Positive	Positive	Positive	Trims will be equally positive under all conditions.	Normal	May have starting issues. Runs worse in open loop.

commands a full rich or "all hands on deck" fuel strategy. If you see the upstream oxygen sensors "latch" or flat-line rich, what logical deduction can you usually make in regard to the vehicle's ability to fuel the engine? What does that tell you about the fuel pump, fuel filter (if applicable) and the PCM control of the injectors? If the O_2's latch full rich is reaching 800-900 mv on WOT acceleration, I usually can remove fuel delivery as the cause of my drivability concern. I can list it in my "what do I know" column of my cheat sheet.

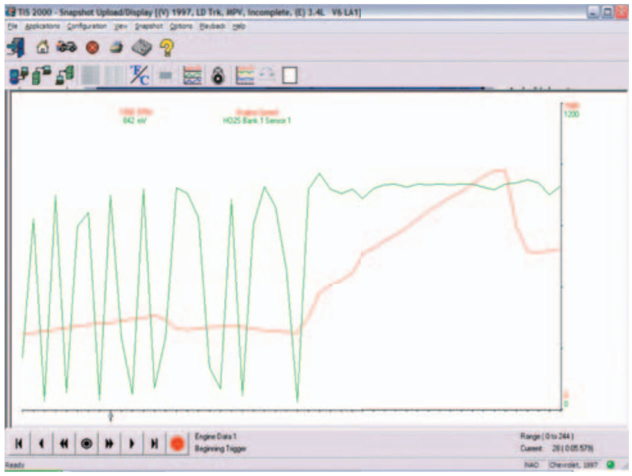
Furthermore, if I set up the scan tool's data PID list to make sure I have FT, O_2, Load, Loop Status, IAT, RPM, MAF (grams/second), I can gain a lot of insight as to the engine's ability to fuel and breathe. If I have driven the vehicle in a manner that captured a couple WOT accelerations through a 1-2 shift and recorded a snapshot movie, I can calculate my VE (MAF-equipped vehicles only) when I return to the shop and analyze my data. VE is a measure of the engine's ability to flow air. A simple VE calculation can give an idea of the engine's ability to flow air in and out. This usually is an indication that we don't have any restrictions in either the intake or the exhaust, causing a drivability problem. VE testing is a discussion in itself and *Motor Age* contributor Scott Shotton covered it in "Asthmatic engines," March 2016. Googling "VE calculator" nets some free online calculators as well as apps for phones and tablets.

If the VE calculates low, I must ask myself if this is a calculation error or if the VE is actually low. The MAF reading is one of the most essential inputs and is coupled with RPM for the VE calculation. A skewed MAF reading could cause my VE to calculate low. It's the old "garbage in equals garbage out" theory. A rule of thumb I sometimes use is the 40x rule. Most of us have heard about or use the 1 gram per sec of airflow per liter of displacement for engines of 3 liters, which are usually pretty close. The 40x rule of thumb is that in a healthy breathing engine you should be able to achieve 40 times the displacement in liters of the engine on WOT. In other words, a 5.3 liter engine should be capable of producing over 200 grams/second of airflow at WOT (5.3 x 40 = 212 g/sec).

Fuel Trim

Fuel Trim should also make the list of things we want to know on our PID list for out flat rater test drive snapshot movie. This is especially true if you are chasing a low power or a lean for rich code. Fuel trim (FT) is the PCM's correction to the Injector Pulse Width (IPW) in closed loop based on the PCM's inputs, such as the O_2 and other engine sensors. I like to think of it as a "if /then" correction. For example, if the PCM senses that the engine is leaner than the PCM wants to see it, then it will make a positive correction to the IPW and show it as positive FT numbers.

Conversely, if the PCM detects the engine is richer than the



ONE OF THE THINGS I look for is proper response of the oxygen sensor.

PCM wants to see, then it will subtract fuel from the engine by decreasing the IPW, resulting in negative FT numbers. A couple of important things to note regarding use of Fuel Trim: the engine must be in closed loop, FT should be checked at idle, at 2000 rpm with no load and 2000-2500 rpm with a load. Be sure to look and note your Loop Status PID. Moreover, using the scan tool's ability to graph will aid in your diagnosis immensely and help you "see" the if/then decisions or correlations between the PCM's inputs and outputs. A cheat sheet can be used (see page 70) for locating lean issues by "plugging in" the characteristics that you deduced from your test drive movie, VE calculation and FTs.

Mechanical concerns

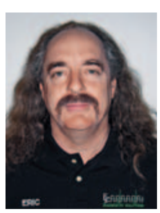
Engine mechanical issues are always something best found out early in the diagnostic process. There is nothing worse for a tech or shop than to find out that there is an engine mechanical issue causing the misfire after calling ignition or fuel delivery components and selling and replacing parts. Diagnosing the cause of engine misfires can be challenging for some. I believe that you have to have a logical and systematic POA for engine mechanical testing to help guide you.

Part of having a good POA is to have one in place already and have one that will work on a large variety of vehicles you service. It would not do you a lot of good to have a test technique for checking the mechanical integrity of an engine if we had to have a separate test technique for each OE. While each OE engine design does have different characteristics, most four-stroke internal combustion engines share some commonality, like compression in the cylinders, that must be relative to one another and that the spark plug generally fires BTDC compression. We can use these universals to create a POA or test technique to use a "relative compression" test measuring starter cranking current using a high-current probe and a DSO to infer engine cylinder compression "relative" to one another. This test has been outlined many times in this publication and has proven to be an accurate and time-saving test over conventional compression testing. Speaking of a logic approach and progression, it is one of the first tests I perform if I break out the scope on a drivability issue. Couple it with an ignition sync and possibly a vacuum transducer like a Pico WPS 500 or a FLS sensor, and I now know a great deal about the mechanical integrity and spark plug firing relative to piston position. This is a great "go/no go" test that in relative short order I can take engine mechanical off the list of possibilities causing my drivability problem.

In summary, there has been and continues to be a paradigm shift in the technologies of modern vehicles. No one can possibly stay up on the servicing of all of these systems. Does this mean we refuse to work on them or run for the doors? No! Does it mean we use Google and the internet to diagnose and replace parts based solely on that search? No!

What I think it illustrates is the need to use a logical approach and leverage the technologies available to us to come to a successful outcome. Always get as much information from the customer, harness your scan tool's power, use the flat-rate test while recording a movie and use the scientific method and the four-corner piece of paper brainstorming technique. These will hopefully give you the ability to design the experiment to verify what you want to know. Do the extra test! It will help you to better understand how things work and helps to cross check your results. It will make you a better tech in the long run.

"Rules of thumb" are generalities; there are always exceptions. The point is to have a simple, systematic and repeatable POA that you execute every time you drive a vehicle. By using the scan tool's ability to record the event and analyzing the recorded data, you can garner a great deal of information with a minimal amount of effort. This is just having good diagnostic technique and then applying a little logical deduction to it. Remember — there has never been a scan tool, lab scope or five-gas analyzer that ever fixed a vehicle without your cognitive input. You and your ability to reason are what make it all happen. The most powerful diagnostic tool in your arsenal does not reside in or on top of your toolbox — it rests on top of your shoulders! MA



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'TIS THE SEASON

ARE YOU PREPARED FOR THIS YEAR'S A/C SEASON?

PETE MEIER // Technical Editor

In 2005, I entered a contest sponsored by the Mobile Air Conditioning Society (MACS) and CarQuest. The aim of the contest was to find the "A/C Technician of the Year," and I was lucky enough to have won that first competition. But that was a long 12 years ago — and oh my, has the A/C service segment changed!

For that reason, I am reverting to my now primary function of connecting our readers with those who are experts in their fields. Elsewhere in this issue, you'll find an A/C industry update contributed by Steve Schaeber, the MACS Director of Training, and I encourage you to read what he has to share. It seems like only yesterday we were reporting on the advent of a new refrigerant and the impacts that it would have on technicians and shop owners alike. "Yesterday," my friends, is the key word here. R1234yf has arrived, and it may show up in your bays this summer. Steve has some wisdom to share on that topic and will also glance into the crystal ball to share with you what may be coming up next.

Some A/C tips of my own

While Steve will enlighten you on the new stuff, I think it's important to review some of the old stuff that still applies, no matter what kind of refrigerant system you're servicing. I've been attending the annual MACS training event and trade show for over a decade now and still see some fundamental issues that seem to persist.

One of them is the need to check for sealant before you attempt to service the customer's vehicle. More specifically, you want to know if there are any substances in the system that will harden or solidify when exposed to air or moisture. Draw this into your Recovery/Recycle/Recharge (RRR) machine unknowingly, and you could find your

PHOTOS: PETE MEIER

THE MACS EVENT provided great training opportunities to attendees, including this session with Peter Orlando.

shop without a machine as you wait for the parts or repair person to come unclog it. The only tester I know of is produced and offered by Neutronics, the same company that makes refrigerant identifiers. One new note that I saw at this year's show was a recovery system that now allows you to recover vehicles with known contaminants so you can properly dispose of them. With multiple refrigerants out there and increasing issues with counterfeits entering the market, it seems to me to make good sense to have this equipment handy if your shop does a lot of air conditioning work.

Which leads me to another step that should be taken before you decide to take on an air conditioning repair — the need to perform an identification test of the gas that is in the car you plan to service. The introduction of gas other than what is supposed to be there need not be done on purpose, either. While I was attending the show, I met an instructor who recently purchased 30 30# cans of R134a from a reputable supplier, only to find that they were all counterfeit and useless. Oh, did I mention you need to check your new supply as well? Could be a good idea to do that, too. If you intend to work on R1234yf systems, you'll find that performing an ID check is not an option but a required step — a good thought considering the cost of the refrigerant. Last thing you want to do is contaminate $1,200 worth of shop supply.

MOST OF THE majors had their latest machines on display, including those for use with R1234yf.

How about certification? I mean the EPA Section 609 certification you are required to have in your pocket if you do anything to the refrigerant circuit. While the certification doesn't expire, there have been several updates to the way things are done, so I encourage you to recertify if your card is more than 5 years old. It doesn't cost that much, and there are a few sources you can contact for the certification, including MACS and ASE. If you're attending the NACE Automechanika Chicago 2017 show, July 26-29, you can take the newest Section 609 session offered by MACS while you're there.

The last area I want to hit on is one you've heard me preach before. Make sure you read up on the system operation and testing procedures before you start condemning parts. There have been new strategies added to boost efficiency in the name of higher fuel economy numbers, and they may impact the results of your traditional testing methods. Regular contributor Eric

NEUTRONICS FEATURED their newest refrigerant identifier at the MACS trade show.

THIS UNIT IS for recovery only and is ideal for recovering contaminated charges from customers' vehicles.

Ziegler offers some thoughts on following a logical diagnostic approach in this month's issue, and while its focus is on drivability issues, the process applies to any troubleshooting scenario.

It's almost here!

It's hard to believe that NACE Automechanika Chicago is only a few months away. I remember the excitement and nervousness I had when we first held Automechanika back in 2015. We had worked hard to set up what we thought would be an exceptional training program for our attendees, and I vividly remember standing at the base of the stairs leading to the training hall that first morning, ready to welcome and assist those who came.

After the first morning session, we knew that we had hit the mark. Techs, shop owners and educators from around the country let me know that the class sessions were all they had expected and more. I also learned very quickly that most of those who came had never been to a national training event before — and wouldn't have been able to come to this one if it hadn't been offered at no cost. I was also very pleased to see a younger crowd than what I was used to seeing at other events. Again, a testament I think to our decision to offer the training at no cost, choosing instead to seek the monetary support needed from corporate sponsors.

Building on that success has been no easy task. There were mistakes made, and those who attended in 2015 were very helpful in telling us what they liked and what they thought needed improvement. And we listened. Our 2017 event, coming this July, will be bigger than ever, both on the training side and the tradeshow side. We planned big, too, so there is plenty of room for those who want to take advantage of this unique opportunity to learn — from the best independent instructors in the business, from the best aftermarket training organizations in the business and most importantly, from one another.

Our magazine is dedicated to "advancing the automotive service professional," and our training event at McCormick Place is the crown jewel of our efforts. And on July 26, I'll be standing at the base of the stairs, waiting to welcome you! MA

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DIAGNOSTIC DIVERSION

"NEW" DOES NOT ALWAYS MEAN "GOOD," AS THIS SHOP LEARNED

JOHN ANELLO // Contributing Editor

I was called to a shop with a complaint of a check engine light on a 2004 Jeep Wrangler with a 4.0L having about 61,000 miles on it (Figure 1). This vehicle belonged to one of the mechanics at the shop, and he had recently experienced an engine shutdown with a no-start condition. A well-known problem on this Jeep engine is the crankshaft sensor fails, resulting in an engine stall. The shop mechanic found this to be the problem on his engine as well and replaced it. About a week later he experienced a check engine light on with a Code P0340. This code directed him to a possible failure of the cam sensor. He then purchased a new camshaft sensor from the dealer, along with a new camshaft trigger wheel and shaft assembly (Figure 2). He made sure to index the shaft housing and position the trigger wheel in the same position that the old one was in. It will be important to properly align the camshaft sensor to the crankshaft sensor. If the camshaft trigger wheel is not properly orientated, it could result in a cam sensor code being set.

The shop mechanic took the Jeep for a test ride; however, the check engine light came back on. It's frustrating enough when you're working on a customer's car, but when it's your own vehicle it always becomes a personal challenge. When the mechanic returned to the shop, he proceeded to check the wiring from the cam sensor to the ECM. He did not see any issues such as a short or open circuit in the cam sensor harness. Upon not finding a wiring problem with the camshaft sensor circuit, the only alternative was the ECU, which is expensive, so he was reluctant to throw this in the mix. At this point, he decided to call me in to get a second opinion.

2, 4 or more?

When I arrived at the shop I hooked up a generic scan tool to verify the trouble code the Jeep had set. The ECM had stored a DTC P0340, thus indicating that the ECM was not happy with the cam signal (Figure 3). This code has many different scenarios that can set the fault. The sensor could be inoperative, the signal could be corrupt by noise, or the crankshaft to camshaft timing could be out of synchronization. The only way to accurately tell what is occurring is to display all the signals involved on a multi-trace scope.

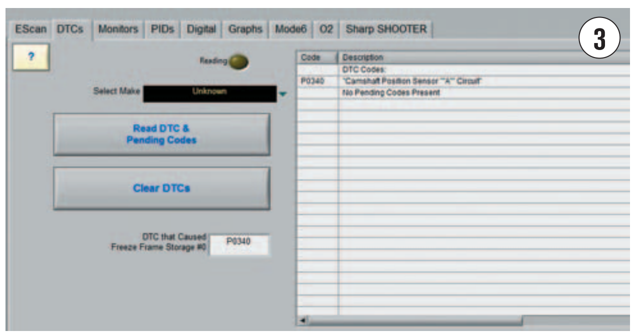
The shop did not have a scope, but the mechanic was willing to look over my shoulder to get a crash course on how to set up a scope and put together a game plan of what to view. About 20 years ago I started out with a two-trace Fluke 98 scope. This scope was complicated and had a long uphill learning curve. I learned how to use the scope by connecting to know good components. This allowed me to become familiar with the scope settings such as time, voltage and triggers. I then learned how to stabilize the voltage waveform on the scope display with triggers. I also learned the hard way that using triggers can hide an intermittent problem. When using the trigger, the last trigger event will be displayed on the scope. If the trigger is not there and the display shows a waveform, it looks like the waveform is still present even though it is not. In order to become better at using a scope, I took a few scope classes. Once I felt comfortable using a two-trace scope, I needed to move to the next level. There were many four-trace scopes hitting the market back then, and I needed to view more signals at one time on the same screen to enhance my diagnostics.

I acquired a few different four-trace scopes and mastered them along the way, but as time moved forward there was an increasing need to watch more than four signals at once. Vehicles were getting more complex and engine management systems were moving to multiple ignition coils and multiple cam sensors. I needed to go to the next level and purchased an eight-trace scope. It seems like the levels of moving forward never end, but it is what you need to do in order to keep on the cutting edge of automotive technology. You don't want to stand still as the advances in the industry surpass you. There are many technicians that are happy where they are, but you need to embrace the technology and the equipment that handles it better.

There is a need for an eight-trace scope, especially if you didn't want to waste time constantly moving your leads around. And once you move your leads around, you always wonder what you may have missed. You don't want to have limitations to what you can view on a screen, and an eight-trace scope will help you to build visual associations with many computer signals within the controller you are testing. This in turn will visually teach you how the ECU driver circuits react to input sensors. This is how you learn system strategies to help build your diagnostic routines. You want to have the ability to look at eight coil primary voltage patterns or even eight injector voltage patterns parading on a screen. This cannot be accomplished with a four-trace scope.

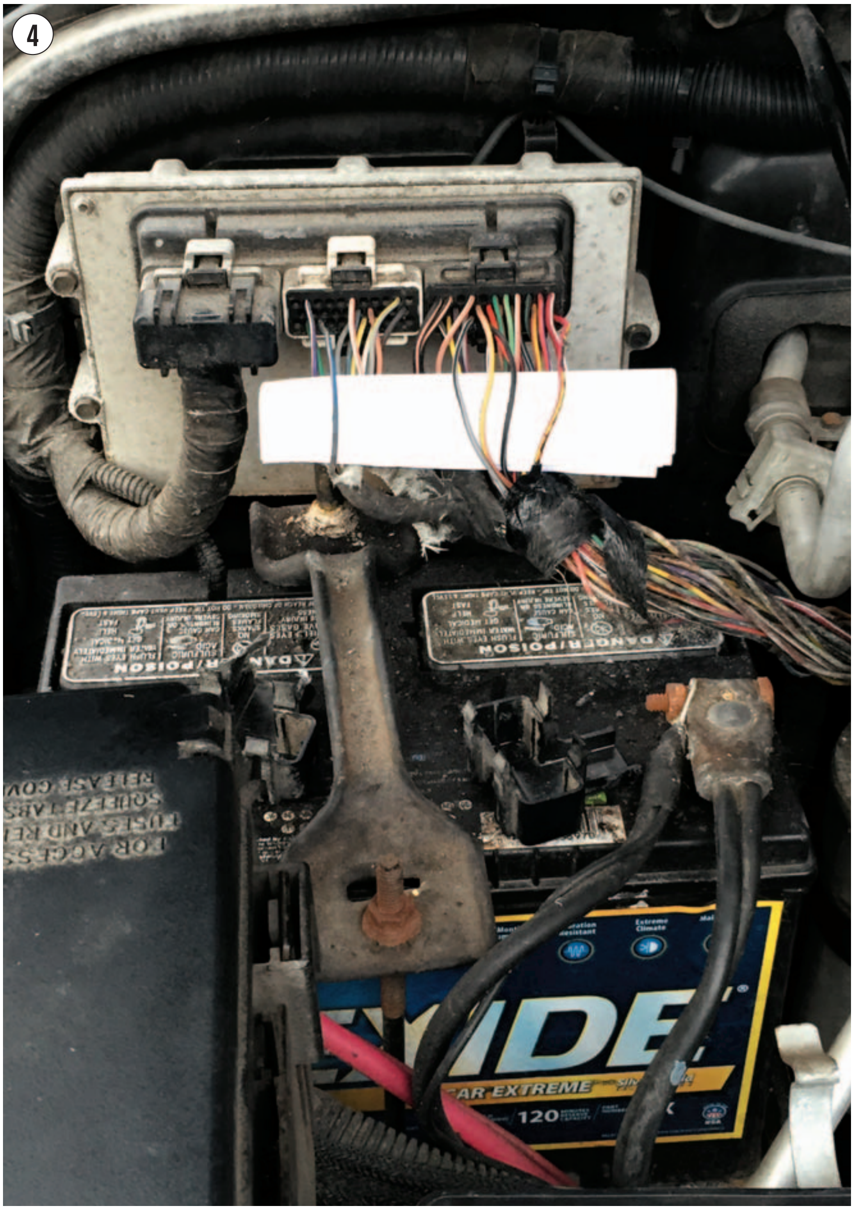
Time to test

The cam sensor on this Jeep is a three-wire Hall Effect sensor that has a power reference, a ground reference, and a 5-volt signal line that's toggled to ground. The configuration and speed



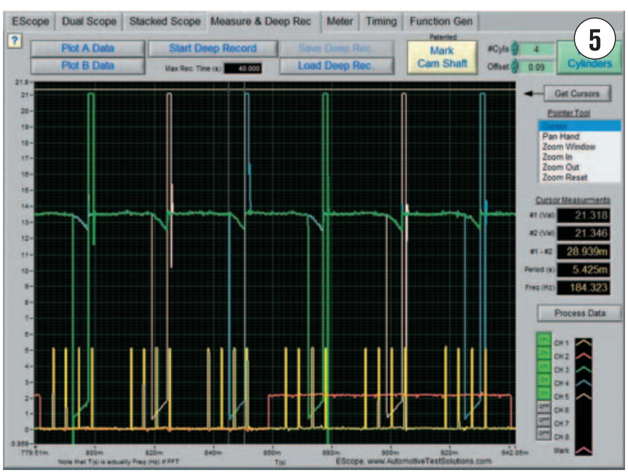
of the trigger wheel will determine the pattern and frequency of the signal you view on the screen. As part of my game plan I decided to use five traces of my eight-trace scope to view the cam and crank sensors and the three ignition coil drivers. This would allow me to check the integrity of the sensors and make sure the coils were being triggered correctly. It is always best to test the circuits directly at the ECM to ensure that you are testing the complete circuits involved. Testing any circuit at the component does not always guarantee that the circuit is not open from the ECM to the component.

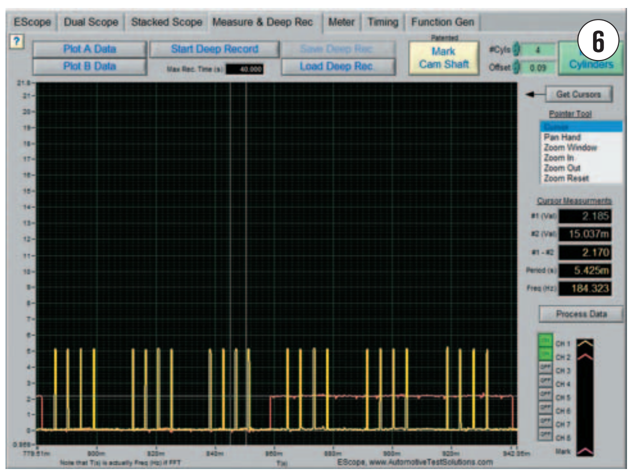
I went to my information system and pulled up a wiring diagram of the vehicle. I then located the circuits I wanted to test and found their pin locations at the ECM to attach my test leads (Figure 4). I hooked up my yellow lead to the crank



sensor, red lead to the cam sensor and my green/blue/white leads to the coil drivers. When I started the engine, I could see six primary patterns within one cam signal as it transitioned from high to low state (Figure 5). It is important to check the frequency of the coil primary to determine how many coil firings occur in one camshaft revolution. If all coils are fired correctly it is a direct result of whether the vehicle has a proper cam sensor to crank sensor correlation. There are some systems that may drop out coil primary and fuel injector commands if cam-to-crank correlation deviates more than a few degrees and in other cases there could be a hard or no-start condition.

The coil primary saturation times were about 5.4 mS., and the primary patterns seemed very consistent. What I had to do now was to hone in on the cam/crank patterns. I deselected the coil primary patterns and focused on the cam and crank signal waveforms (Figure 6). The crank sensor patterns were in packs of four paraded transitions from high to low, and three sets of the packs were equidistant within one transition of the cam sensor. The patterns were in proper orientation with one another based on my experience of viewing many good patterns on these 4.0 liter Jeep engines. The one thing that did catch my eye was that the cam





signal was not meeting its low to high transition properly. The cam sensor was being fed a 5-volt reference voltage, so the signal line should have been toggling from 0 to 5 volts, keeping within its 10 percent threshold. If this signal never went above 4.5 volts, the ECM would still see this as a low transition. The cam signal was not going above 2.1 volts, yet it was producing a frequency pattern. This was an indication that there was a current path to ground. When the camshaft sensor is at 5 volts, it is in an open circuit condition. Source voltage is always present to the point of the open circuit, which in this case is the camshaft sensor. You need to first understand that when a trigger wheel travels through the Hall Effect sensor and blocks the magnet from acting on the Hall Effect sensing device, the signal line will be high or in an open circuit condition. When the trigger wheel travels out of the Hall Effect sensor and exposes the magnet to act on the Hall Effect sensor, the signal line will be low or pulled to ground, which produces a current path so that a voltage drop can occur. I simply created this effect by removing the cam sensor and passing a razor blade through the Hall Effect assembly (Figure 7). I set my scope up to only view the cam sensor waveform pattern and watched the scope pattern as the cam sensor signal line transitioned from 0 volts to 2.1 volts. I then left the razor blade in place to block the magnet from acting on the Hall Effect sensing device. While the razor blade was in place, I proceeded to unplug the cam sensor connector. The scope pattern of the cam signal transitioned from 2.1 volts to 5 volts (Figure 8). This vehicle had a defective brand new cam sensor from the dealer. The sensor was not allowing the signal to transition above 2.1 volts due to a current path to ground, but did allow it to transition low near 0.1 volts when the resistance of the circuit changed.

New doesn't always mean good

The shop at this point ran to get another cam sensor from the dealer up the street. To my surprise, the dealer took the old sensor back and gave him another sensor without any questions. There has always been a policy with most parts counters to not accept returns on electrical parts, but I guess this depends on the relationship you have with the person at the parts counter. When the mechanic returned, he installed the second new sensor. Luckily it was easy to install, and I proceeded to take another look at the scope patterns of the cam and crank sensors (Figure 9). The signal patterns were now running true, the cam sensor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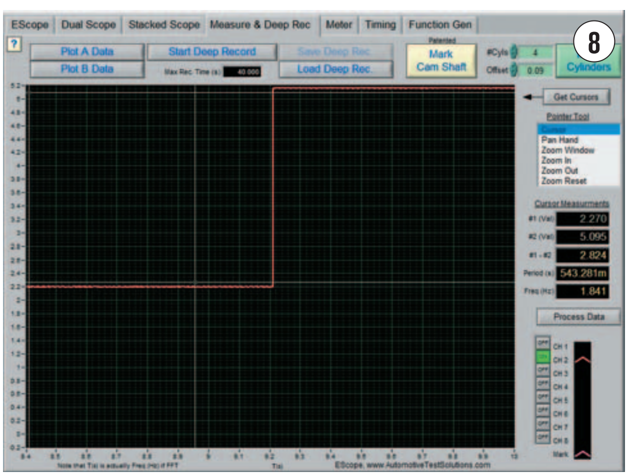

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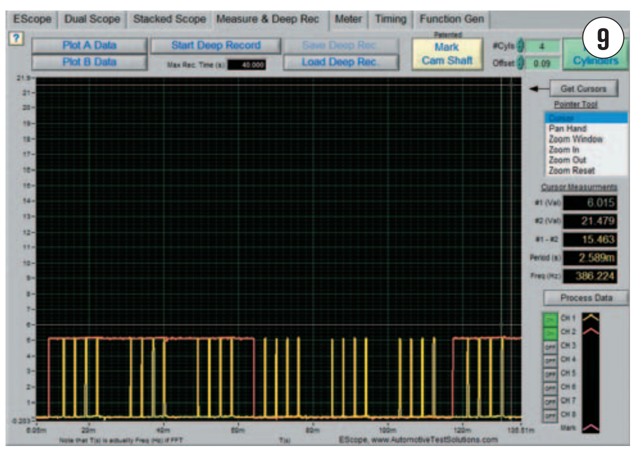
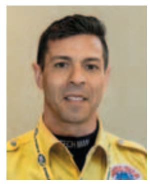


9

was toggling between 0 and 5 volts, the check engine light was off and there was no pending code P0340 in memory.

The garage mechanic was in total denial and disbelief. He could not accept the fact that he went the sure route to buy a genuine Jeep part only to have it create another problem that would need to be solved. This is not uncommon in the field, and I see brand new defective parts all the time. It's hard enough to go through the diagnostic process just to pinpoint a problem, but it is worse when you purchase a brand new defective part that has you second-guess yourself. When this occurs, you can end up with the same or similar problem that may take you down another path. This can be quite confusing because you feel that you have still not resolved the initial problem. It is important to have the equipment necessary to properly diagnose your customer's vehicles and possess an understanding of how to use the equipment. A picture is worth a thousand words, but a scope displaying a waveform to properly diagnose the vehicle in your service bay is priceless. I service over one thousand shops, and I recommend to each and every one of them that in order to repair modern vehicles, they will need a scope.

It is so important that you test with accurate methods so you know that your test results are valid. This will allow you to never second-guess yourself. If you know how to properly test a component and understand its strategy of operation, then it will allow you to validate whether your findings were correct or whether you're dealing with a defective or incorrect part for the vehicle. We now live in a world where the repair technician is not only responsible for accurately diagnosing the problem, but is also responsible for the quality of the parts they install. There is no guarantee that a manufacturer has quality control of parts they manufacture. The true technician is the one who will take nothing for granted and is keen enough to weed out the bad items that he purchases to do a job. My only hope is that this story hits home with many of my fellow technicians and that you take the proper steps not to fall in the trap of "Diagnostic Diversion." MA



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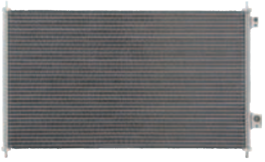

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INTEGRATED WINDOW CONTROL ASSEMBLIES

Newly released from Dorman is an Integrated Window Control Assembly (IWCA) fitting 2011-2016 Chevy Cruzes (part #748-974). This window regulator and smart motor assembly offers a convenient plug-and-play replacement featuring a printed circuit board with microcontroller and embedded software designed to restore all original advanced window functions such as anti-pinch, auto up/down, global open and more.

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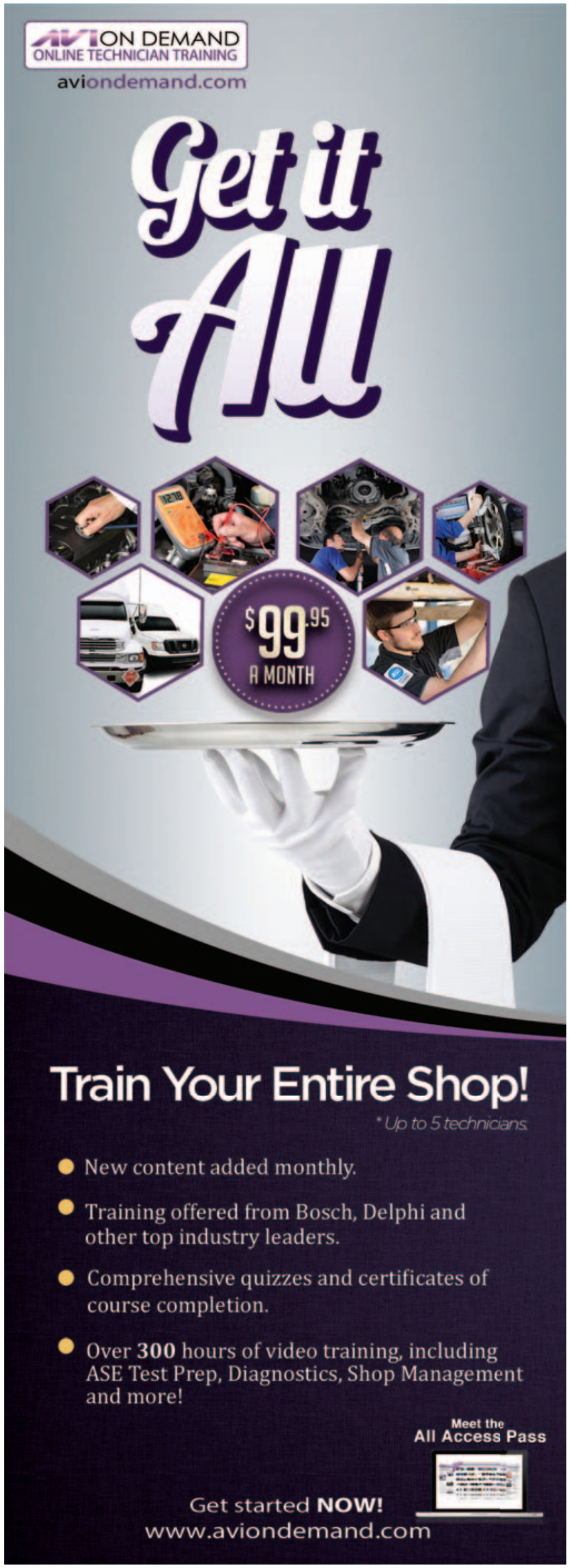
AD INDEX

AD INDEX

PRODUCTS



A FUEL TRIM PRIMER

UNDERSTAND WHAT IMPACTS THESE NUMBERS TO SOLVE A VARIETY OF DTC CONCERNS

PETE MEIER // Technical Editor

Most technicians understand the concept of fuel correction and what we mean by "closed loop" operation, but just in case...

Fuel control is the concept of maintaining the proper mixture of fuel and air in the cylinder for efficient combustion. Incoming air is measured (directly or indirectly) by the Engine Control Module (ECM) and then the ECM chooses how long to open the injectors in order to add the proper amount of fuel to that air charge. The original injection time is based (in part) on the known flow of fuel through the injector, but that original number is not perfect.

So a feedback sensor is used to tell the ECM how it did. These are the conventional oxygen sensor or the wideband oxygen sensor. Based on this feedback, the ECM adjusts the next injection event by increasing or decreasing the injector on time as appropriate. This process is continuous and results in the Short-Term Fuel Trim (STFT) numbers you see on your scan tool.

Ideally, the ECM will adjust the on time to cause the STFT to swing from a positive number to a negative number with each adjustment, with an average approaching zero. If the adjustments the ECM has made are insufficient to do that, the ECM "learns" a more permanent correction called Long-Term Fuel Trim and adds that factor to its internal calculations. If the total amount of correction (STFT + LTFT) exceeds a programmed threshold, the ECM will record a "system lean" or "system rich" DTC and turn on the Check Engine light.

But do you really understand the diagnostic advantages these Parameter Identifiers (PIDs) have to offer? To the knowing eye, the trims can point to the cause of that lean or rich system DTC. They can also be helpful in determining the cause of a misfire or even identify a clogged exhaust.

Watch this month's edition of The Trainer to learn more! MA

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