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September 2013

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Vol. 132, No. 9

Advancing the Automotive Service Professional Since 1899



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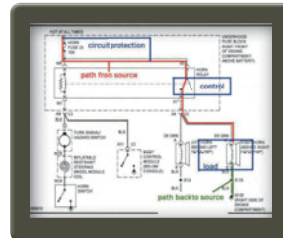
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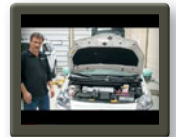
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KEEPING TIRES IN CHECK

BY TSCHANEN BRANDYBERRY | MANAGING EDITOR

6 Orange Electronic is expanding its facility and continuing to offer TPMS solutions in the U.S. Read more on this Taiwanese company in one part from our recent trip.

AMI TO HONOR 20TH CLASS OF GRADS IN 2014

6 The prestigious AAM designation will be presented in a ceremony in Detroit. No graduation ceremony is planned for 2013.

MITCHELL 1 NAMES WISC. YOUNG MAN TOP STUDENT

8 Kevin Borchert was honored as the Automotive Technology Outstanding Student for 2013.

NASTF CHOOSES ATE AS SITE OF SPRING MEETING

8 The spring meeting will precede ASA Northwest's training event, and will bring techs and OEM reps together.

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Ingersoll Rand is celebrating the 10th anniversary of its top-selling 2135Ti ½-inch Titanium Impactool.

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MITCHELL 1 SETS TRAINING

Mitchell 1 will host 2013's final Shop Management System Training Workshop, Oct. 3-5.

»» MOTORAGE.COM/MITCH1TRAINING

UNI-SELECT TAPS LEADERS

Uni-Select appointed Brent Windom as president and COO for its U.S. automotive business effective July 31.

»» AFTERMARKETBUSINESS.COM/USLEAD

PROGRAM GROUP RESTRUCTURES

Uni-Select Inc. is restructuring its U.S. operations by eliminating approximately 600 jobs and closing 48 stores and several distribution centers.

»» AFTERMARKETBUSINESS.COM/UNISEL

MAKING SOME ELBOW ROOM

After buying his dream shop, this owner was surprised to hear lack of space was its biggest problem.

»» ABRN.COM/ELBOWROOM

LEADERS DISCUSS ISSUES AT ABRN ROUNDTABLE

ABRN convened a panel of representatives from a variety of backgrounds to discuss key issues in collision repair industry

»» ABRN.COM/ROUNDTABLE

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Orange Chairman and CEO Aliber Hsu explains his company's offerings during a media briefing.

INTERNATIONAL BUSINESS

Keeping tires in check

TAICHUNG CITY, Taiwan — Orange Electronic serves TPMS needs around the globe, specifically in the United States, all from a modest three-floor facility.

But the company is growing, with more TPMS needs to meet as more regulations are being adopted worldwide. Chairman and CEO Aliber Hsu is focusing on getting the message of a need for regulations out, and the safety service Orange's TPMS sensors can provide.

"This is a necessary part," he notes, adding that it is not something that just the rich can afford to want. It is something that everyone needs to promote vehicle safety, better fuel economy and a cleaner environment. "This is a great time for us to focus."

Orange TPMS sensors and "trigger" relearn tools are available in the United States at NAPA and AutoZone.

The CEO touts two aspects that set his company apart. First is a wireless design that overcomes two problems — getting the signal out from under the tire and keeping the signal up with the speed of the vehicle. Second is a tool that will copy the ID number of a wheel's current TPMS sensor so that a technician can paste it onto the coding of a replacement sensor.

This makes training easier for technicians. Hsu adds that his company has worked with the Tire Industry Association (TIA) on providing training for techs.

You can read more about this Taiwan company and others at MotorAge.com/Taiwan.

— *Tschanen Brandyberry, managing editor*

BREAKING NEWS INDUSTRY WEEK

AMI TO HONOR 20TH CLASS OF GRADS IN 2014

The Automotive Management Institute (AMI) will honor its 20th class of Accredited Automotive Managers (AAMs) during Industry Week 2014, set for July 29 to Aug. 2, at the Cobo Center in Detroit.

The prestigious AAM is awarded to automotive service professionals after they successfully complete course work and earn 120 credits of management education. Graduates are recognized during a formal cap and gown ceremony, and more than 1,700 individuals have earned the AAM designation with approximately 100 new graduates each year.

Industry Week 2014 will co-locate several of the industry's key events, including the International Autobody

[AMI] CONTINUES / PAGE 8

Discussion is on-going in MotorAge.com forums

Photo: Tschanen Brandyberry



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KNOW HOW

[AMI]

CONTINUED FROM PAGE 6

Congress & Exposition (NACE), the Congress of Automotive Repair and Service (CARS), the Inter-Industry Conference on Auto Collision Repair (I-CAR) Conference, and the Collision Industry Conference (CIC) Meeting.

"Many events are planned for Industry Week 2014, giving our new graduates an exciting forum during which to be honored," said AMI Executive Director Toni Slaton, AAM. "Graduates will also have the oppor-

tunity to take in everything Industry Week will offer, including a premier trade show, meetings, conferences, networking and education essential to their business success."

"Many events are planned for Industry Week 2014, giving our new graduates an exciting forum during which to be honored," – Toni Slaton

As a result of the anticipated size and scope of the new Industry Week, AMI will not hold a graduation ceremony during the upcoming Automotive Service and Repair Week (ASRW) in October in Las Vegas. It will, however, offer more than 41 AMI-approved classes during ASRW, giving students an opportunity to earn credits toward the AAM and potentially graduate in July 2014.

For more information about the Institute, its curriculum, or EXCEL, contact AMI at (800) 272-7467 ext. 129, or visit the AMI website at www.amionline.org.

MITCHELL 1 NAMES WISCONSIN YOUNG MAN TOP STUDENT IN 2013

Kevin Borchert from Racine, Wis., was recently named the 2013 Mitchell 1 Automotive Technology Outstanding Student during the North American Council of Automotive Teachers (NACAT) conference in Quebec City, Quebec, Canada. Each year, Mitchell 1 recognizes one U.S. or Canadian high school senior for outstanding achievement in automotive technology and auto shop repair scholastics. Borchert received a \$2,500 scholarship, a check for \$500 and roundtrip airfare and accommodations for himself and a guest to attend the NACAT conference.

"Mitchell 1 is proud to recognize Kevin Borchert for his outstanding achievement and strong dedication to pursuing educational excellence in the automotive technology field," said Nick DiVerde, senior marketing director, Mitchell 1. "With Kevin's drive and enthusiasm for making a difference in the aftermarket,

we know he will one day accomplish his dreams."

To be eligible for the scholarship, applicants must be a current student majoring in automotive technology/auto shop repair course work and must meet the following criteria: be nominated by his/her NACAT instructor, maintain a minimum overall 3.0 GPA, have plans to attend (or already be enrolled in) an accredited college or university, and be a U.S. or Canadian citizen.

Borchert graduated from Case High School in Racine, Wis., in May 2012. He is currently enrolled in the automotive technician associate degree program at the Milwaukee Area Technical College and is expected to finish in October 2014. His ultimate career goal is to work as a professional technician at an aftermarket repair facility that installs and repairs performance equipment.

As an avid automobile enthusiast, Borchert tries to attend as many car shows as possible and especially likes vintage muscle cars. He also enjoys watching drag racing, road racing, NASCAR, Indy Car, truck pulls and tractor pulls. "I have been a car nut since I was three years old. I can't remember a time in my life when engines and performance automobiles have not occupied my entire existence," said Borchert.



Borchert

NASTF chooses ATE as site of spring meeting

NASTF and the Automotive Service Association Northwest (ASA Northwest) is pleased to announce that the NASTF Spring 2014 General Meeting is set to precede the Automotive Training Expo (ATE) on the afternoon of Thursday, March 20, 2014, near the Seattle/Tacoma airport in Washington.

"The NASTF Board of Directors was very excited to accept the invitation from ASA Northwest, the event

producer of ATE, to bring our Spring 2014 General Meeting to technicians in the Northwestern U.S.," explained Skip Potter, NASTF executive director. "NASTF wants to be where the techs are; and ATE is a perfect opportunity for us."

"ASA Northwest is looking forward to supporting NASTF at the 2014 Automotive Training Expo (ATE). ATE is the West Coast's largest automotive training venue, being held March 21 to 23, 2014, at the Doubletree Hilton Seattle Airport. We had almost 900 industry professionals at ATE 2013 with a record number of shop owners, managers, service advisors, techni-

cians, and auto instructors from high schools and colleges who attended three days of management and technical training," said Jeff Lovell, president/executive director of ASA Northwest. Additional details can be found at www.atetrainingexpo.com.

NASTF General Meetings provide a rare opportunity for aftermarket technicians and shop owners to interact directly with key service operations managers employed by the original equipment manufacturer (OEM) automakers. The NASTF General Meeting Planning Committee expects to release the Spring 2014 agenda and registration information in December.

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QUESTION OF THE MONTH



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SURVEY: Technician A says a pink-colored transmission fluid is evidence of overfilling and that the pink color is caused by aeration of the fluid. Technician B says pink-colored transmission fluid is caused by coolant mixing with the transmission fluid due to a leak in the transmission cooler. Who is correct?

- A. Technician A
- B. Technician B
- C. Both A and B
- D. Neither A nor B

Visit MotorAge.com/sep13survey to answer the question and register for our monthly drawing from Federated Auto Parts.



Building a winning team to better your bottom line

Breaking down what you expect is just the start of getting better numbers.

BY BOB SPITZ | WORKSHOP MEMBER

I was talking with a shop owner and he said to me, "I am having a hard time getting my crew, especially my service writer, to understand what I want. How do I get employees to be on the same page as me?"

Employee management is the trickiest part of a business. The reason most employees go off on a different direction from the owner is a lack of understanding of what you the owner is trying to accomplish. There is no agreement. Telling people what you want done and how to do things only works when the understanding is

already established. In other words, when the employee gets how their job is related to the overall plan. ...

One of your biggest barriers to training people is if the person you are attempting to train feels there is nothing to learn; they already know it all. You have to know how to handle this kind of person, and better yet know how to spot this kind of person before you hire them. You also need to know how to motive people to attend training. There are many ways of doing this, but beware of the person whom you can not motivate. ...

You have to break it all down. The only thing you ever have in an

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BEST OF THE BLOGS are articles written by bloggers on Motor Age's community pages

Mudlick Mail/Ackworth, Ga.

A call to action

Your customers are inundated with a slew of mail daily and standing out in the crowd isn't easy. Crafting a compelling call to action is critical. If you're not sure what a call to action is, it's the message that urges a customer to come into your shop.

Don't make them think too hard. Your message should be clear and concise. Consider these calls to action. The more direct you are, the more likely your customers are to respond favorably.

Distinguish yourself. You know what sets you apart from every other shop like yours on the planet, so say it.

Use action words. Words like call, buy, sell and visit are all things your customers can do. "Perhaps you could," is a request, not an actionable statement.

Creativity can play a very strong role in your call to action. Clever tends to win out, so if you can come up with something that solves an important problem, you're going to hit the winning equation.

Don't forget to add urgency. You need to convince your visitors to act quickly. If they don't feel the need to act right away, you may lose them.

Junius/Alabama

What will the market bear?

About 30 years ago, when I was doing some work at my dad's VW shop, I walked in a parts house I didn't usually patronize. I had graduated from high school one year behind this guy, so I figured he'd treat me right. I asked for a set of points for a '67 VW Bug. When the parts guy threw that set of points on the counter and told me they were \$3.11 I said, "Steve, you're getting rich

on these. And besides that the rubbing block on this set of points is plastic — good grief!"

He huffed at my remark and puffed that he didn't make more than 15 percent on anything he sold. "Well, if that's the case, you're buying them from the wrong place. I can buy a brand new set of OEM Bosch points for 65 cents at the BAP/GEON parts house in Dothan!" He sputtered and stammered and then said something very telling:

"That guy is ruining the parts business for everybody! He's selling those points for what I pay for them!" I found myself wondering if he knew he had just blown that 15 percent remark into the "lies and deceptions" column. I never went back to that parts store again.

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OCTOBER 9TH 2013
@ 8:00 PM

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the DCT450/470**

Join us for a look at this new transmission and learn how to properly service it.



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KEEPING
TIRES IN CHECK

TAIWAN AFTERMARKET

*One example of
Taiwan's exports.*

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Q+A WITH
MATT
CURRY

THE HYBRID SHOP CEO

*This shop owner is
expanding service.*

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THE
TRAINER
VIDEO

PETE MEIER

*Reading a wiring
diagram*

employee is willingness. In the case of a service writer, break down all the hats they are wearing and take one hat and work out step-by-step what you want them to know and do regarding that position.

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Building a winning team
In this first recording in the series "Building a Winning Team," Bob Spitz and Steve Ek of EK Automotive discuss the importance of attitude and tone in building a true team of professionals in your shop.

Tips for improving processes
First of the series — Tips on handling the customer from the phone call through the initial estimate process.

HEV TV: Hybrid A/C
AR&D's Dr. Mark Quarto hosts segments on HEV-TV on YouTube. In this, he shows the differences between an electric hybrid compressor and a conventional design.



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Noteworthy

comments from
MotorAge's online communities

Each month, we scan the Workshop, the *Motor Age* Facebook page and our Twitter feeds to see what you're saying. Comment today to be heard.

Fred Donaldson via Facebook:
Always great to hear of young adults with goals, and working towards them!

iCommett:
This was a really good video with both of you expressing good things to consider. I have been using highlighters on schematics for a long time now, but by George I went to your website and ordered your material "The Wiring Diagram Color Code Legend Poster and Marker Set" anyway. The chart may help others to see it and think

things thru a little bit more. Thanks again to both of you for the good work that you are doing.

David Chiffens via Facebook:
(Technician pay) still is way too low for most techs.

John Pawczuk via Facebook:
Our dishwasher's electronic panel quit functioning. I used the eraser trick on the connections inside the door and it worked like a charm!

Troy Peco via Facebook:
One of my students was at this event for automotive

service and it was great to see all these future automotive technicians. A great organization and a great tool for showing America the area it needs to spend more money on education.

AutoMobile:
Dealerships post adds all the time, especially ones like Ford who now require factory certified to perform any warranty work. It may do you well to do the same. Then instate a mentorship for the kids out of school with those experienced techs you hire.



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Q+A WITH MATT CURRY

CEO AND PRESIDENT, CURRY'S AUTO SERVICE AND THE HYBRID SHOP



THIS PAST TOP SHOP RECOGNIZED A NEED FOR HYBRID SERVICE AND TEAMED UP WITH SOME OF THE BEST.

BY JAMES E. GUYETTE | NEWS CORRESPONDENT

Named the 2010 *Motor Age* Top Shop, Curry's Auto Service in the Washington, D.C. area has partnered with Automotive Research and Design (AR&D) to form a new joint venture for hybrid vehicles called The Hybrid Shop.

The company is assembling a nationwide aftermarket dealer network. CEO and President Matt Curry talked about the program, in which he partnered with *Motor Age* contributor Dr. Mark Quarto.

MA: What are the basics of your Hybrid Shop battery repair program?

MC: We are offering The Hybrid Shop as a "fractional franchise," meaning it's a business within a business. We are establishing a network of top-end auto repair shops across North America with professionally trained and educated technicians to perform diagnostics, maintenance and repair of all hybrid vehicles. We offer a proprietary training program provided by AR&D and by Dr. Mark Quarto, a Ph.D., EE with 28 years of hybrid vehicle experience working as a lead technologist for GM. We also offer proprietary equipment that allows our dealers to "condition" hybrid batteries as an alternative to replacing them, saving our customers thousands of dollars

and our system is much better for the environment as it produces no waste. Through our exclusive system, we can restore up to 95 percent of a battery's original power, energy and capacity.

MA: What types of expertise does your team bring to this initiative?

MC: Dr. Mark Quarto is one of the country's foremost experts on hybrid vehicle technology. Chris Quarto is CEO of AR&D and has a MS degree and worked in corporate America and internationally for over 30 years in M&A, operations and other areas. My CMO, Judi Curry and I are serial entrepreneurs, have 10 auto repair shops in the Northern Virginia, D.C. area. We were named top shop by *Motor Age* Magazine in 2010 and Best of Northern Virginia by the readers of *Northern Virginia Magazine*. Curry's Auto Service made the *Inc.* 5000 Fastest Growing Companies three years in a row and *the Washington Business Journal's* Fastest 50 DC companies two years in a row. Judi and I deliver the branding and marketing expertise to The Hybrid Shop.

MA: What services are offered?

MC: Consumers who own hybrid vehicles can save thousands of dollars by having their hybrid batteries recondi-



tioned when the warranty is up instead of purchasing a new battery. Before conditioning the battery, The Hybrid Shop technicians will perform a comprehensive state-of-health check to determine if the battery needs to be serviced. If so, the \$499 charge will be applied toward battery conditioning. The Hybrid Shop at Curry's Auto Services offers a 12-month/12,000-mile warranty.

MA: How do you become a dealer?

MC: We are trying to get an elite network of dealers throughout North America. The cost is \$50,000, which includes four days of onsite training, one five-day SAE class, one battery Gen 3 charge discharge unit, ongoing marketing, operational, technical and sales support, POS kit and ongoing Internet marketing solutions. Our dealers get an exclusive territory in their area. *ZZ*

Photo: Mark Curry

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MIKE ROWE'S
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Mike Rowe struck some nerves in at SkillsUSA.

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MANAGEMENT



THE STATUS QUO **OR** TIME TO EXPAND?

MAKING THE MOVE TO A SECOND LOCATION IS A BIG DECISION. MAKE SURE YOU'RE PREPARED TO TAKE ON THE CHALLENGE.

BY **BRIAN CANNING** | CONTRIBUTOR

ONE OF the greatest and most obvious ways that the "American Dream" manifests itself is for some courageous man or woman to cast caution to the wind, go out on their own and start a new business. Never mind that after five years in most industries, half of these brave souls are out of business. The fact remains that the other half are surviving and maybe even thriving, contributing to the U.S. economy and employing millions upon millions of U.S. workers.

Small business truly is the engine that drives the U.S. economy and the automotive repair industry can be very proud of its contribution to this. An important consideration for many shop owners who survive those first five years is when or if we should look to expand.

The answer to that question is very complex. Certainly if your current shop is thriving and those key performance

indicators like sales, sales growth, profitability, production, retention and car count trends are strong and moving in the right direction, expansion is something I definitely would consider. And just as obviously, if those indicators are not where they should be or are trending in directions other than where they should be, I would not consider expansion, or at least not until we have our first house in order.

Owning and running a business can be very rewarding, but it also can be a huge challenge. Not all, but a very large majority of the shop owners I have known and worked with over the years tend to work in their business not on it and spend little or no time developing business plans. They tend to show up to work early, work late and spend little or no time planning their next moves or monitoring and managing their business performance. They are embedded in the day-to-day running of their business and most typically do not have the time (or inclination) to take care of the business of the business. I only mention this because as challenging and



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“IF WE ARE BOTH BUSY, PRODUCTIVE, PROFITABLE AND HAVE A GREAT STAFF IN OUR EXISTING OPERATION, WOULDN'T IT BE REASONABLE TO EXPECT WE COULD ACHIEVE SIMILAR THINGS IN A NEW OPERATION? MAYBE, MAYBE NOT.”

BRIAN CANNING [CONTRIBUTOR]

complex as running one shop is, running two or more shops is more complex. If you have thoughts of expansion, you need to remember this.

Two Different Shops

I have a great former client who owns and operates a premier multi-store tire and automotive repair business centered around Charlotte, N.C. This company is first class in everything it does and somehow operates a dozen or so beautiful, modern, high-end facilities while retaining a genuine family owned business atmosphere. They are a very visible fixture in the community. Expansion for them is a science, with a time-tested strategy that relies on an intense market survey, precise planning and flawless execution. There are no half-cocked, ego-driven decisions being made here; they go at expansion with their eyes wide open and very aware of market potential long before they break ground.

Expansion for them is nothing more or less than their corporate evolution, having started out on this journey back in the early 1960s. Each of their stores is a profit center in and of itself and as they have grown and prospered, they have developed a process toward expansion that allows them to go into a market with reasonable expectations for a return on investment.

They have a very structured and disciplined approach to expansion, backed up by 50-plus years of experience, that has seen them go from being a very small fish in a very big pond to being a very big fish in a pond that is seeming to shrink. I have no doubt that as long as this incredible business owner would choose to grow and expand; he will do so successfully and very much to the benefit of his customers, his would be customers and his many staff members.

I have another former client and friend who operates a high end



European shop in Spokane, Wash. I would tell you honestly that this is the best run stand-alone shop I have ever seen or been associated with, enjoying high sales, high profitability and strong reliable car count week after week, month after month and year after year. Their secret, in this very tough sector

of the automotive repair market, is providing their customers with incredible customer service every time they are in.

This is a shop that reasonably could look at expansion, with great prospects for success, but that has instead put major effort into making its existing shop as good as it can possibly be and not seriously looked at expansion. It has explored opening an oil service facility across the street and even opened a detail shop as an extension and enhancement to their existing business, but expansion just has not been a priority.

I have no doubt that if this incredible owner decided to branch out and expand beyond his one existing facility, he would be successful but there is a lot to be said for making your existing operation as good as it can be. Certainly his customers have benefited from his efforts along these lines, as have his staff and community. Thirty-five years of practice have made them nearly perfect.

Both of these former clients are successful, both are dedicated to their customers and both are very profitable. One designed his business with expansion in mind and is very structured and methodical in those efforts. The other works very hard to make his one shop as good as it could possibly be, with continuing and ongoing efforts to perfect the business. His net operating profit, productivity, customer satisfaction and retention all underscore the quality of his effort. For one, expansion is part of the game plan. For the other, it is certainly a possibility, just not yet.

Over the years, I have seen and worked with any number of shop owners who wanted to expand. Every one of these owners had their own reasons for wanting to expand; some very sound business reasons, some little more than ego but in every case you start with where we are today with our existing operation and explore the risks and opportunities presented by expansion.

If we are profit starved now, there is little reason to believe that adding a second or third location will alleviate that strain. If we have trouble staffing our existing shop or suffer unacceptably low car count in our current operation, why would there be a different expectation in our new shop? By the very same token, if we are both busy, productive, profitable and have a great staff in our existing operation, wouldn't it be reasonable to expect we could achieve similar things in a new operation? Maybe, maybe not.

According to University of Tennessee research, as of 2012, the top three reasons for start-up business failure were incompetence, unbalanced experience or lack of management experience, and a lack of experience in lines of goods and services sold. These accounted for 87 percent of start-up failures.

The same research showed that the leading management mistakes were going into business for the wrong reasons, poor advice from family and friends, being in the wrong place at the wrong time, getting worn-out and/or underestimating the time requirements, family pressure on time and money commitments, pride, lack of market awareness, falling in love with the product/business (lost objectivity), a lack of financial responsibility and awareness and a lack of a clear focus.

The specific pitfalls in these many failures were emotional pricing (way too low or way too high), living too high for the business, nonpayment of taxes, no knowledge of pricing, lack of planning (duh!), no knowledge of financing, no experience in record-keeping, poor credit granting practices, expansion too rapid, inadequate borrowing prac-

tices, carrying inadequate inventory, no knowledge of suppliers and a final big one, a wasted advertising budget. None of these goes away or is diminished by expansion, and if anything, they are magnified. You do not want to be one of these statistics.

“A great many automotive repair shops survive and even prosper because the owner is there and focused... If you were to expand, who would be the new you?”

A great many automotive repair shops survive and even prosper because the owner is there and focused on the details of the day to day, but, with expansion comes the need to delegate and rely on others to get the job done. If you were to expand, who would be the new you?

Several important considerations before committing to expansion:

- What are the current and mid-term economic trends in your market area
- What is the state of business in your current shop (sales, profits, productivity, staffing)?
- Who will be the new you when we add that second or third location?
- Why now?
- What are the driving reasons behind your expansion?
- What is a reasonable return on your investment in time, energy and money expended?
- What is the benefit of expansion?
- What are the risks associated with expansion?
- Are you gambling everything (your current shop, your future livelihood) on expansion?

You need to consider all of this before you think about expansion, but if you have the answers and account for them in your planning, expansion might be the right decision. Don't let your ego skew your answers to these important questions.

America's promise is in the opportunity that is out there for all of us. Expansion can be a huge opportunity and it can also be a huge risk.

Take an honest and critical look before you take that leap and to have a plan and a road map for your journey. You are likely to make a misstep from time to time and get lost from time to time, but a plan and a road map will keep you on task and keep you on course. Make your American reality even be better than your American dream. Expansion might be a path worth exploring. *TM*



BRIAN CANNING
CONTRIBUTOR

Brian Canning is 30-year veteran of the automotive repair industry. He has been a leadership coach, Goodyear service manager, retail sales manager for a distributor, run a large fleet operation and headed a large multi-state sales territory for an independent manufacturer of automotive parts.

✉ Email Brian at brimarc@hotmail.com

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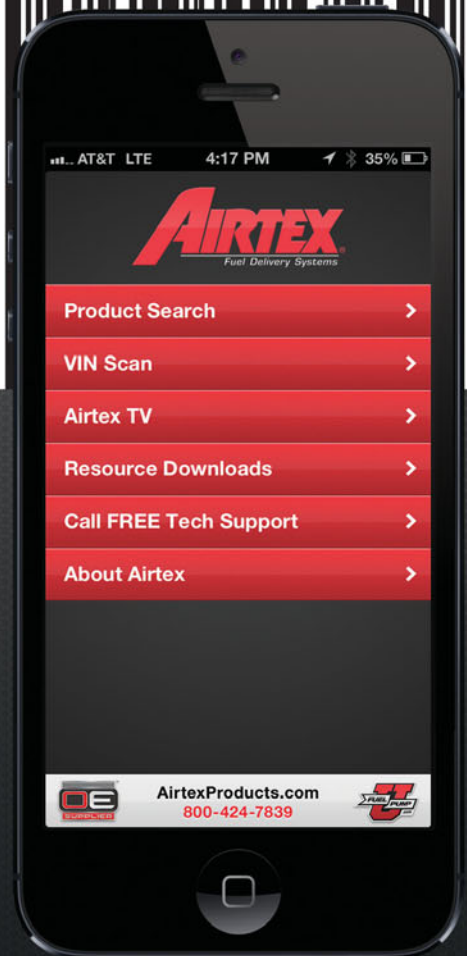
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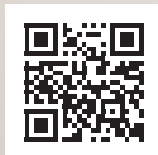
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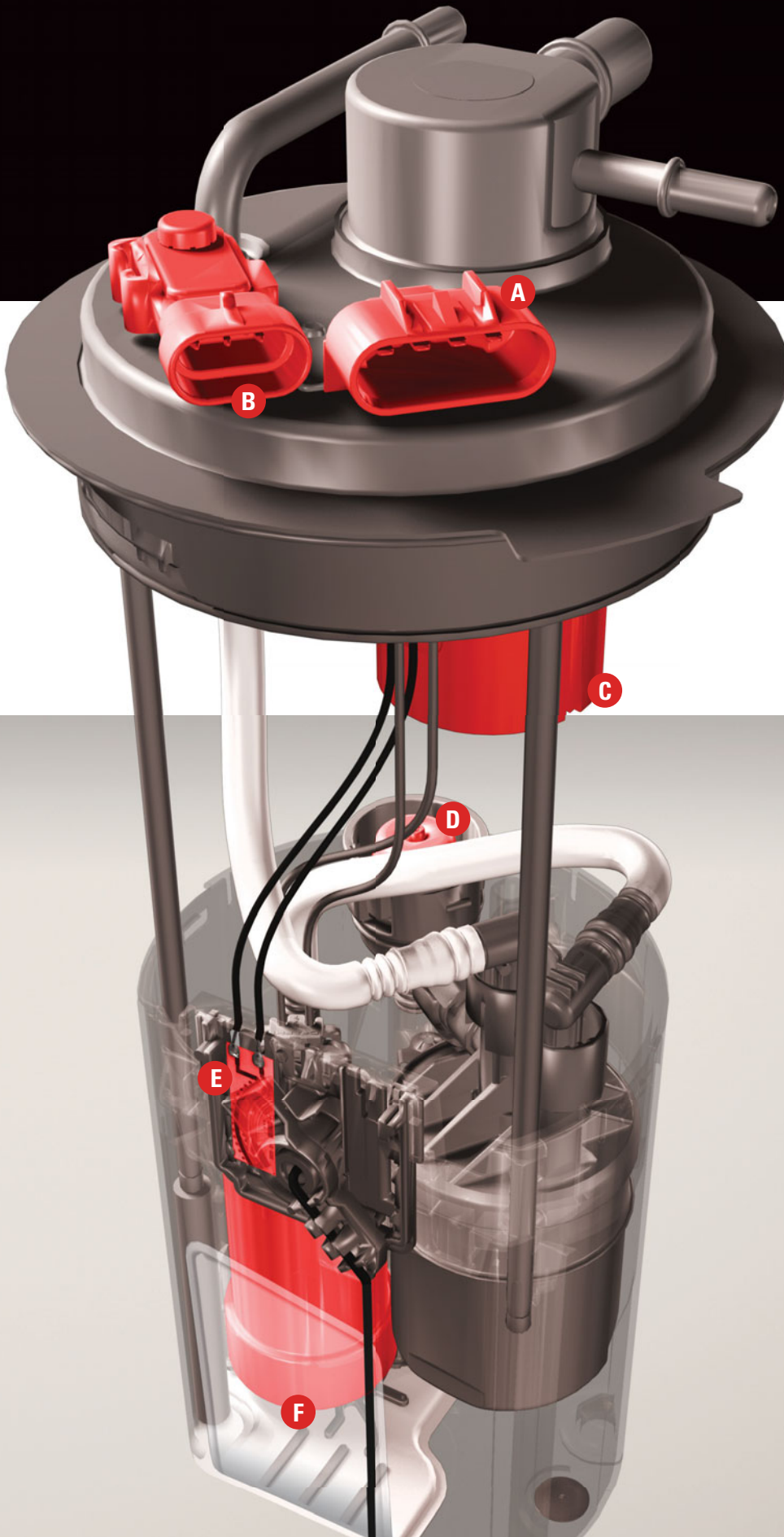
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WHEN IT COMES TO BEING THE BEST SHOP, IS PRODUCTIVITY OR EFFICIENCY MORE IMPORTANT?

BY CHRIS "CHUBBY" FREDERICK | CONTRIBUTOR



WHEN MOST of us started in the automotive repair business, we had a dream we were trying to achieve. It might have been spending more time with the family or with our hobbies. It might have been to earn more money to provide a better life, or we simply felt we could do it better than most. Whatever your dream was, the No. 1 dream wrecker I have witnessed in my 40-some years watching shop owners has been on the labor side of the business.

If you can succeed with productivity and efficiency, you will be much closer to your dreams coming true. This month, let's listen to a lesson from our instructor on this subject, Randy Somers, while he explains to owners and service managers how to improve the labor side of your shop.

Many of us in the automotive profession have multiple names to describe

virtually the same thing. For instance, a customer could have a check engine light on or a drivability concern and we could perform an engine diagnostic or a checkout, an engine analysis or a test; we might even "pull codes." Some of you might remember when we would scope the car. These terms used in different ways essentially mean the same thing to us. Productivity and efficiency are terms that frequently are used in different situations to describe the same thing.

Many shop owners measure productivity of techs something like this: "My techs seem busy all day." Busy doesn't always equate to being productive. Sometimes efficiency is expressed in these terms: "My tech is very efficient; he cleans all his tools after every job." While that could be one interpretation of efficiency, it isn't the definition we are using here. Productivity, or lack of it, is an issue many people face in the day-to-day world of owning a shop.

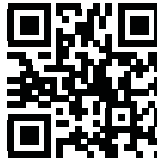
Over the years, I have heard owners saying things like "I don't know what's wrong, everyone seems to be busy and nobody is goofing off. We must need more cars."


In order to be profitable and offer customers great service with the WOW factor, a shop needs to be truly productive and efficient. Here are a few simple steps to follow to get you well on your way.

The Difference

First we must define the terms. To me, technician efficiency is measured in this way: If I give a technician a one-hour job that he or she does in one-half hour, then that tech is 200 percent efficient. My experience in automotive is that most technicians are efficient. When you give them a one-hour job, they are usually done in one hour, sometimes even less. Productivity is a measure of how many of those efficient jobs get stacked on top of each other in an eight-hour day to make eight hours of labor sales or more. Keeping that thought in mind, we should always be 100 percent productive or more than 100 percent if our technicians are more than 100 percent efficient. So why aren't we?

The second step is to determine where we are in terms of productivity versus where we should be in productivity, which is different again from where we could be. To measure your overall team productivity, you need to



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TechTalk

BY FEDERATED AUTO PARTS

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“IS IT HARDER TO MAKE A GOOD PROFIT ON PARTS OR LABOR? ANSWER: LABOR. IT MOVES, TAKES DAYS OFF, GETS SICK AND HAS A CELL PHONE.”

CHRIS “CHUBBY” FREDERICK [ATI CEO]

take the total labor hours produced in any given time period divided by the total hours of floor time or actual clock hours worked in the same time period. If I have 90 hours of billed labor in a week and my techs have 120 hours of actual time worked (3 techs x 40 hours), I would be 75 percent productive.

Realistic versus Achievable

The third step would be to determine what a realistic and achievable goal for productivity is. Being 75 percent productive, is that a good number or not? I can tell you that it is above the industry average. Is 75 percent a good number or not though, that is a different question altogether. I would never shoot for the average. No one ever wakes up in the morning and says “Wow, I hope I have an average day today.”

People usually don't fail because they set the bar too high; but because they set the bar low and achieve their goal. In order to know if 75 percent productive is good or not, you need to know what you are capable of producing. In the above example, it would be easy to say that if my techs work 120 hours then I would expect 120 hours. If I set the bar high, I might even expect 120 percent productivity or 144 hours of labor in a 120-hour week. This is achievable but probably not sustainable.

I think that 90 percent is a good target for productivity. It is realistic, attainable and sustainable. Once we reach 90 percent productivity, I would recommend adding another tech and making



them 90 percent productive as well. If we agree that 90 percent productivity is a good target or goal, we have to ask ourselves, 90 percent of what? Ninety percent of 120 hours of floor time would be 108 hours produced. That works if we assume all techs are capable of producing 40 hours in a 40-hour week.

Is a typical A level technician capable of producing 40 hours in a 40-hour week? I think so. Is a typical B level technician capable of producing 40 hours of labor in a 40-hour week? I think so. Is a general service tech capable of 40 hours in a 40-hour week? Eh... Maybe 20 is a more realistic number in this example. So do I really have the capability to produce 120 hours in 120 hours worked, or am I staffed to produce 100 hours in a 120-hour week? If that is the case, then that would make 90 percent productivity 90 hours billed, not 108.

Diagnosis the Problem

The last step will be to figure out exactly where the problem lies if your technicians aren't at least 90 percent productive. It is easy to blame “those dang technicians” when productivity is low. The problem is that — as the above definition shows — efficiency is more

of a technician issue, not productivity. Low productivity is more a front counter function than a technician concern.

So now it's “those dang service writers' fault.” While that might be satisfying to say from time to time, it isn't always true either. In order to fix productivity, we need to determine what is stopping us from being productive. Let's examine some of the many things that get in the way of productivity.

Technician efficiency could be a cause of low productivity, so what hinders efficiency in technicians? Technician skill level could stand in the way of our being productive. Are we dispatching the correct skill level work to the correctly skilled technicians? Do we have a training issue or even a retraining issue? Are technicians being pulled on and off of vehicles and that prevents them from being productive? It can make your head spin trying to decipher all the reasons that could prevent us from being both efficient and productive.

In order to be productive and efficient we need to define, measure and manage. In order to get on the road to productivity and profitability, we first need to measure in order to manage. The productivity worksheet is the first step on that road. Go to www.ationlinetraining.com/2013-9 and print it out. Fill in your technicians' times for one week, and follow the suggestions for managing your way to the life of your dreams. Remember this is a limited time offer. **ZZ**



Chris “Chubby” Frederick is the CEO and founder of the Automotive Training Institute. ATI's 108 associates train and coach more than 1,150 shop owners every week across North America to drive profits and dreams home to their families. Our associates love helping shop owners who have had the same struggle as many of them have had, and who are looking for the same answers — and in some cases looking for a lifeline. This month's article was written with the help of our ATI Instructor and Coach Randy Somers.

E-mail Chubby at cfrederick@autotraining.net

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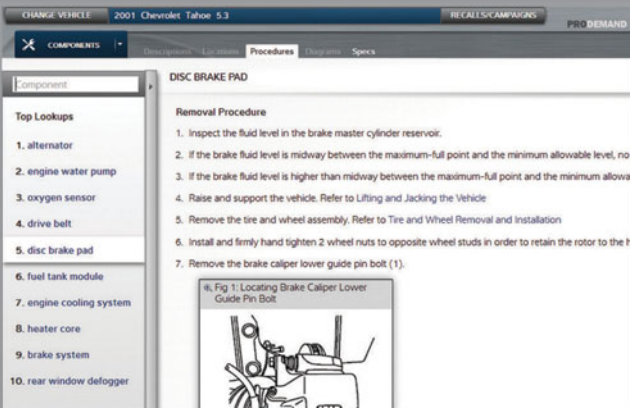


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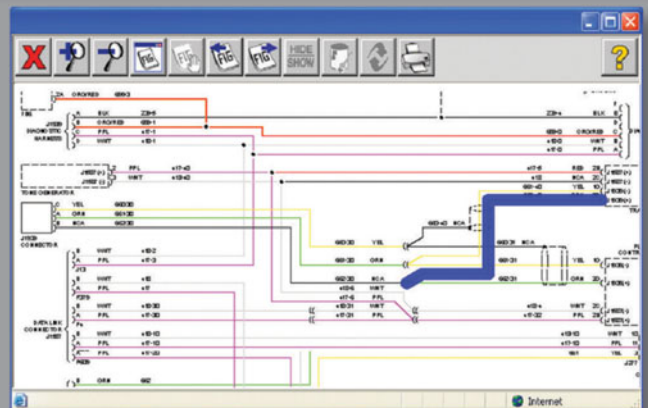
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KEEPING EMPLOYEES IN THE LOOP

YOUR MARKETING PLAN CAN SUCCEED ONLY IF YOUR STAFF KNOWS WHAT IT SHOULD OFFER.

BY **TIM ROSS** | CONTRIBUTOR



EVER try to redeem a coupon at a restaurant and encounter a server completely in the dark about the offer? Even when all ends well, that situation often can leave you with a bad impression of the employee, the establishment's management or sometimes both. Unfortunately, it's not all that unusual for business owners in a variety of industries to fail to inform their employ-

ees about their marketing efforts.

I help shop owners execute marketing campaigns on a daily basis, and I find that very few involve their staffs in the planning process. Instead, employees typically find out about new offers and promotions after a marketing program already has been launched. There are serious ramifications to this approach. Your customers might receive poor service. Uninformed

employees could make your business appear disorganized and less credible.



Employee morale also might suffer because your staff could end up feeling neglected and out of the loop.

The simple solution to these problems is to engage your employees in marketing efforts from the very beginning. Having staff buy in from the start will help you maximize the effectiveness of your advertising and marketing campaigns.

My suggestion is to create a communications plan to inform your employees about your marketing program. When developing your plan you'll need to answer the following questions:

- What is the best way to spread the word about your plans?
- What are the goals of your marketing campaign?
- How will you prepare staff to respond to leads and business generated by your campaign?

The Vehicle

Determining which vehicle to use to communicate information about your promotions can be a challenge. While

some employees read their emails religiously, others might check their inboxes infrequently. Newsletters are nice, but there's also no guarantee they'll get read. I prefer a personal touch and recommend hosting weekly staff meetings where you can share vital information about your marketing efforts and other key initiatives. Make these meetings mandatory and try to schedule them at a time when the majority of your staff can attend.

These forums offer the opportunity not only to disseminate information verbally, but also to show your employees the marketing pieces you'll be using, so they can become more familiar with what offers are being advertised. Make sure you also keep copies of your most recent flyers, postcards or other materials at the front counter or posted somewhere where employees can easily access them.

If staff meetings aren't feasible because of time or scheduling constraints, consider utilizing another vehicle that will provide the most convenience for employees. Maybe hav-

ing managers pass along information on a one-on-one basis would be more effective in some cases. Some companies also have developed intranets or microsites where employees can find updates and crucial information about new programs.

The Message

Simply informing your staff about an offer or promotion isn't enough. Employees need to understand what you expect your offers and promotions to accomplish. That means you'll need to have the goals for your campaign clearly outlined. Your staff, particularly your front counter personnel, will need to know if your aim is to attract new clients, drive sales or increase brand awareness.

For example, if your goal is expand the audience of customers who receive your offers and updates, you'll need your front desk staff to make it a priority to obtain email addresses from customers. To drive sales, you could lure customers in with a discounted oil change and then have your front



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desk managers promote a free vehicle inspection that could reveal other needed repairs. Walk your employees through the logic behind the offer and the anticipated end result.

The Preparation

How many times have you heard coaches of professional sports teams blame losses on poor preparation? Even with the most talented players and a clever game planning, teams can fall prey to failure without practice. The same holds true in business.

You might have a great marketing plan and a wonderful staff, but if your team hasn't received the right training, the chances of success are slim. Having an ongoing training program helps prepare employees to handle the inquiries and potential sales calls that might be generated by your campaign. Your program should equip employees with solid phone skills and offer guidance about how to not only respond to leads, but also how to turn those leads into sales.

You also should teach technicians how to prioritize jobs if your offers result in an onslaught of new business. Instead of fixing cars based on the order those cars arrived, they should service automobiles based on when they need to be delivered. That might mean placing a longer repair job on hold to take care of an oil change, but that strategy will allow your shop to service more cars in a more efficient fashion.

It's also key to train your employees on the right questions to ask. Tracking the success of your campaigns can be tricky, but with practice, your employees can help eliminate some of the guesswork. For example, some customers come in for service but don't bring a postcard with them. In those cases, it's crucial for employees to ask how a customer heard about your shop.

It's also important to prepare your employees for potential issues that might arise. It's not unusual for customers to try to take advantage of

offers that don't apply to their vehicle (i.e. an import owner attempting to use an offer geared for domestic cars), but if employees are trained to handle those situations, the better the chance for a positive outcome.

Finally, don't forget to ask your staff about feedback on your marketing efforts. Because they are on the front lines, they can offer valuable information about which offers were most popular, what kind of customers you attracted and how to improve future marketing programs. **ZZ**

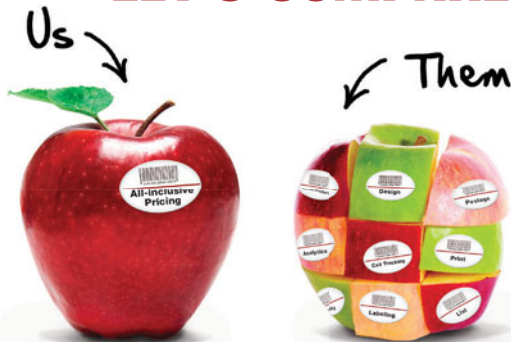


TIM ROSS
CONTRIBUTOR

Tim Ross is president of Mudlick Mail, a provider of direct mail services for the automotive service industry. He has been with Mudlick Mail since 2008.

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OPERATIONS

SHOP PROFILE

A snapshot of one of the industry's leading shops

ADVANCED AUTO PRO'S / GREELEY, COLO.



Greeley's Progeny

What one man envisioned centuries ago is coming true still with this shop.

BY **ROBERT BRAVENDER** | CONTRIBUTOR

Horace Greeley was a master communicator. A legendary newspaper editor of the 19th Century and an ardent abolitionist, he founded the New York Tribune (published until 1966), arguably coined the phrase "Go west young man" (he might have cribbed it from someone else) and was famous enough to have a city in Colorado named for him (along with cities in three other states).

Located on the plains of northern Colorado, Greeley also is home to Advanced Auto Pro's Inc., a repair shop Rick Bilger founded in 1994. One of his ancestors might have listened to ol' Horace, because his family has a long history in the area and the industry, the latter going back to his grandfather. Bilger himself started working on cars when he was 13 and opened his own shop when he was 21 — and promptly failed.

"I shouldn't have been my own accountant," he admits. So Bilger went to work at area dealerships for the next 10 years before making another try in 1994, this time with success.

"It matters what you call success," he cautions. "Somebody making a living in a lean-to was not what I was after."

Like the town's namesake, Bilger had come to value communication. Based on past experiences at dealers, he needed to create a clear conduit between himself and his customers.

"It seemed like every other day there was somebody screaming at someone at the counter," Bilger recalls. "Sometimes I would walk up front and hear a service advisor explaining a repair that I was doing, and it would make me cringe; it wasn't even what I told them. That's not what I wanted."

Now there's always discussion with the staff on how to explain things, without getting too technical.

"We've never been ones that wouldn't bring the customer back into the shop and show them exactly what's been going on, answer any questions

AT A GLANCE

Advanced Auto Pro's Inc.

Shop name

Rick Bilger

Owner

Greeley, Colo.

Location

1

Number of locations

19

Years in business

7

Total number of employees

4

Number of technicians

4,980 square feet

Shop size

9

Number of bays

82

Average vehicles per week

\$262

Average weekly repair ticket

\$1.1 million

Annual gross revenue

BBB, ASE Blue Seal, AAA, AYES

Shop affiliations

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they have," says Bilger. "If you asked any of the people who work for me what

Photos: Advanced Auto Pro's

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3

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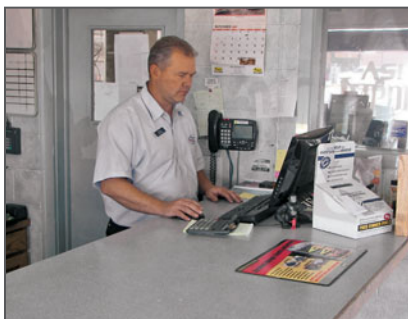


Master L1 Technician Marc DuBois makes sure the customer knows what was done on this vehicle by carefully documenting all of his observations.

our shop is about, it's communications. That's all we talk about."

The advent of digital photography and videos certainly has helped in this respect, and just recently the company subscribed to a service that allows them to send photos to customers via their phones.

"Then they can call us back and discuss (the problem)," explains Bilger. "Again, that's something new and exciting, but it also fits right into what we've been trying to do all along. The last couple of years have been amazing. It really augments our approach. Every time I find something that can more easily and clearly explain what



Service Manager Steve Lapp works to make sure all of the written communications with customers are clear and easy to understand.

we're recommending to our customers, it just flows right in."

Of course such technology can be a double-edged sword. With print declining in some areas and broadcast not always bringing the people in, right now marketing strategies are up for grabs. Shifting paradigms appear to point to the Internet, but no one seems to have mastered it yet.

"Not that the Internet isn't useful or unnecessary, it's just so hard to grasp," Bilger concludes. "You almost have to do a little bit of everything and track, track, track, because it's a moving target. There's just so many ways of getting that information on the Internet."

Case in point: Several years ago Bilger was on Colorado's ASA board and was privy to one of its panel studies. "We had a little cross section of people, and we asked them how they chose their last shop. There was a lady who was about 60; a professional man about 40-some; and a young woman in her 20s, also a professional. The older lady definitely said that she found hers with the phone book; the professional said he Googled it; the one that got me was the young woman — she used the GPS on her phone. That really was shocking to me."

It used to be simple: one phone book; one, maybe two newspapers; a local ra-

dio station; and of course direct mail, though Bilger still relies on the latter.

"I'm still getting results better than the phone book. Every year the phone book gets less and less reliable, but I won't get out it completely, because I only track return on investment and I'm getting new customers who are spending money, and it's more than the amount than I'm putting out," he says. "I don't really care as long as that return on investment is working."

However once his shop gets a customer in the door, there's the still-reliable reward program for loyalty. As a member of their Car Care Club, clients get \$500 worth of service and discounts for only \$89.95. Another level of service is a VIP club where, according to the shop's publicity, "our best clients can budget for car maintenance and repairs by prepaying monthly for service and receiving up to a 20 percent discount on all repairs."

"We sort of created the program from scratch, but with ideas from other shop owners around the country," Bilger reports. "I really do try to get ahold of people who are like-minded. If I can get an idea, I will certainly implement it, no doubt about that."

Echoing some of the ideas of Greeley himself, Bilger and Advanced Auto Pros are perhaps part of the publisher's cultural legacy.

"(The industry's) way more transparent now," Bilger discloses. "You might as well open up the front door, because you have to be very aware of answering every question and making sure people feel good about what they're doing, because they're going to complain very publicly if you don't — which I've always been fine with doing, and I think that is why we have remained viable." ■



ROBERT BRAVENDER
CONTRIBUTOR

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.

Email Robert at rbravender@comcast.net

TECHNOLOGY

THE NUTS AND BOLTS OF AUTOMOTIVE REPAIR



IN THIS SECTION

- 44** Electrical
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THE FOURTH STATE

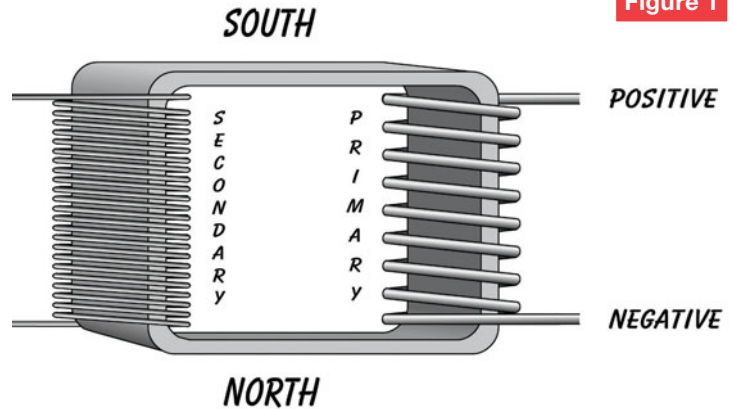


Figure 1

There typically are 100 windings in the secondary coil for every single winding in the primary.

GAINING A UNIVERSAL INSIGHT INTO THE DIAGNOSIS OF AUTOMOTIVE IGNITION SYSTEMS.

BY **BERNIE THOMPSON** | CONTRIBUTING EDITOR

Did you know that a fourth state of matter powers the spark ignition internal combustion engine (ICE) and it can be used for engine diagnosis as well? So one might ask, what is this fourth state of matter any way? We commonly think of matter existing in three states: solids, liquids or gases, but there is another state called plasma. Plasma, while the most common state of matter in the universe, is sparse here on Earth.

Creation of plasma on earth requires high levels of naturally occurring or man-made energy, and this plasma is the result of heating a gas in which the particles become charged and the molecules or atoms are ionized. An ion is an atom that has lost or gained an electron, thus changing it from a neutrally charged particle to a charged particle. When a gas is super heated, large numbers of ions are formed, which forms plasma. Because of the large number of charge carriers present, it becomes electrically conductive. Plasma has unique properties that differ from sol-

ids, liquids or gases, and therefore it is considered to be a distinct state of matter.

In the spark ignition internal combustion engine, the plasma becomes a major player in igniting the air/fuel charge within the combustion chamber. It does this not by electric flow through the hydrocarbons, but by the intense heat from the plasma. This heat puts enough thermal pressure on the hydrocarbons that the hydrocarbon chains break, thus igniting the air/fuel charge. Because plasma can be created naturally or by man, the question at hand is how is plasma produced in the combustion chamber?

This plasma is not naturally occurring, but is man-made, and it is produced by the step-up transformer known in the automotive industry as the ignition coil. The step-up transformer uses the principle of electromagnetic induction, which occurs when a magnetic field is changing, moving or varying across a conductor. This change in the magnetic field will create a potential or voltage within the conductor. This potential is

caused by the changing magnetic field forcing electrons of the conductor to move from one atom to another atom; thus creating a difference between positively and negatively charged atoms. This difference is potential or voltage.

The step-up transformer uses a low-voltage, high-current pole to create a high-voltage, low-current pole. This is done by using two different coils or windings of wire. The first coil is the secondary as shown in Figure 1. The primary is wound around a core for magnetic amplification. In newer transformers, this core will be made of many plates of a ferrous metal, usually a soft iron, layered or laminated together. This

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“THE PRIMARY WINDING USES LARGER DIAMETER WIRE WITH FEWER WINDINGS. THIS ALLOWS THE PRIMARY TO HAVE A VERY LOW RESISTANCE VALUE. THE SECONDARY USES SMALL DIAMETER WIRE WITH MANY MORE WINDINGS, WHICH ALLOWS THE SECONDARY TO HAVE A HIGH RESISTANCE VALUE.”

BERNIE THOMPSON [CONTRIBUTING EDITOR]

gives better amplification than a solid core. The primary winding uses larger diameter wire with fewer windings. This allows the primary to have a very low resistance value. The secondary uses small diameter wire with many more windings, which allows the secondary to have a high resistance value. The automotive coil usually is wound approximately 1 to 100, in other words, for every 1 winding of the primary the secondary has 100 windings. The primary winding usually has 1 to 4 ohms of resistance, whereas the secondary winding usually has 8,000 ohms to 16,000 ohms of resistance.

The waveform that is produced on an oscilloscope from the automotive step-up transformer is shown in Figures 2 and 3 where the primary and the secondary are electromagnetically coupled so anything that affects either winding

is mirrored in the other winding. The automotive step-up transformer works by controlling the primary circuit by either completing the primary circuit or opening the primary circuit. Once this circuit is completed as seen at point C, Figure 2, current flows through the primary conductor that in turn creates a magnetic field around the conductor, and the laminated soft iron core amplifies this magnetic field. As the current increases, the magnetic field also increases.

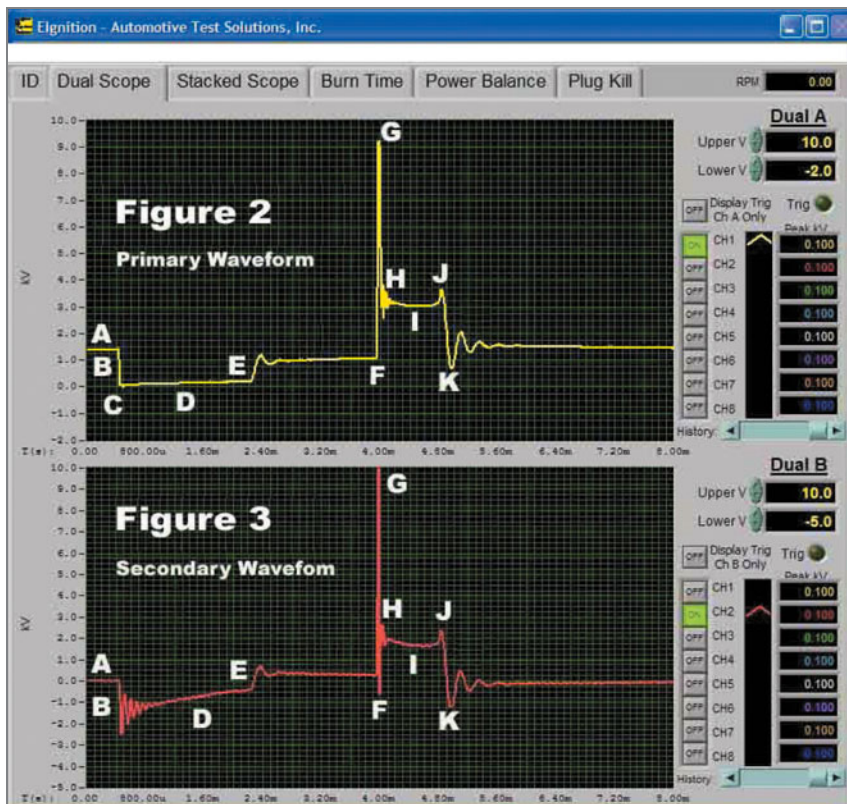
Because the secondary winding is wound very close to the primary winding, the magnetic field from the primary winding moves or changes through the secondary winding. This changing of the magnetic field through the secondary winding induces voltage in the secondary winding as can be seen as ringing as seen at point B, Figure 3.

The primary winding has ringing as well, but the current flowing through the primary circuit dampens this ringing. The primary winding will continue to build the magnetic field around itself until the primary winding is saturated as can be seen at point E. This saturation point is dependent on a combination of the wire diameter, the number of turns, the distance between the turns and the applied voltage to the circuit.

Once the primary winding is saturated, the current path is broken by the points or ignition module, as can be seen at point F. Because the stored magnetic energy in the primary winding is the same as the electric potential and the electric current flow is shut off by opening the circuit, the primary magnetic field now falls back into the primary conductor in order to try to maintain the current flow within the conductor. Because the electric circuit is open due to the points or ignition module, the current path for the collapsing primary magnetic field would not be present.

This, in turn, would slow down the collapsing magnetic field and would not allow very much electromagnetic induction to take place because the faster the magnetic field changes, the more electromagnetic induction takes place. In order to allow a current path to be established for the collapsing primary magnetic field, an alternate circuit through the condenser or capacitor is used.

The condenser or capacitor allows the primary circuit to be completed if the electrical field is moving rapidly. The primary magnetic field being allowed to collapse through the condenser or capacitor at a fast rate allows this magnetic field to fall rapidly across the secondary winding, which creates electromagnetic induction in the secondary winding. This induced voltage puts electrical pressure on the electrons within the secondary winding, which causes the electrons to move. The voltage is amplified, because there are a greater number of secondary wind-



The primary capture shown at top is nearly a perfect mirror image of the same coil's secondary capture.

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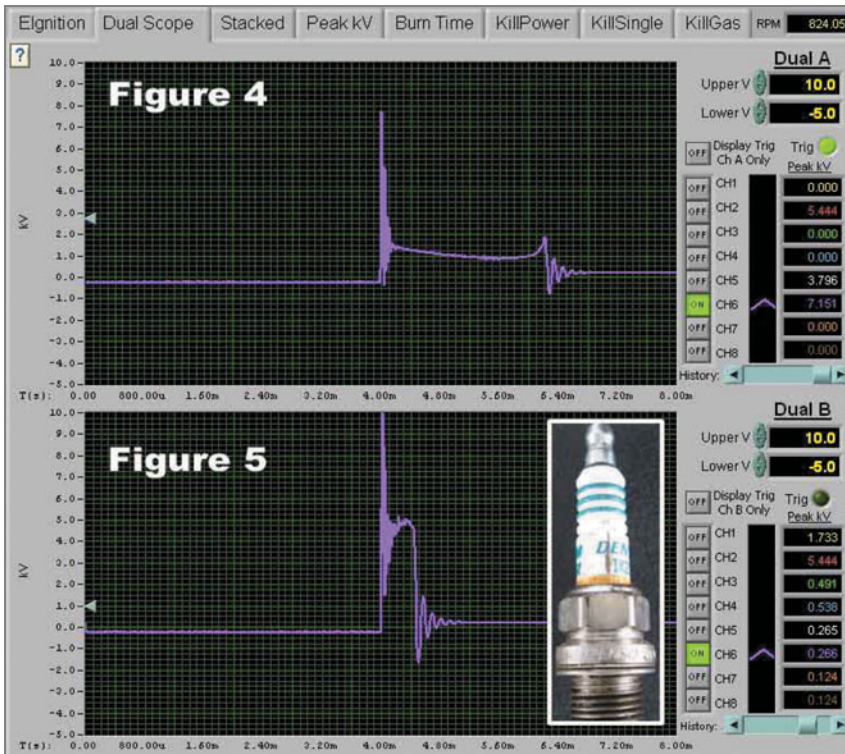
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Understanding the physical process of getting electricity to cross an open spark plug gap can speed up any drivability diagnosis.

ings than the primary winding. This allows the vehicle's 12-volt battery to be amplified and produce up to 50,000 volts from the step-up transformer.

The step-up transformer produces a high energy state of greater than 20,000 volts and contains it within the transformer. However this high energy state will want to move to a lower energy state outside of the transformer. A conductor, such as an ignition wire that connects the secondary winding to the spark plug, is used. The high energy pushes the electrons down the ignition wire to the spark plug where there is an open circuit present between the spark plug electrodes. This high voltage produced from the step-up transformer will push low energy into the gap of the spark plug electrodes known as a corona discharge.

The corona discharge is an electrical path that is not strong enough to form a conductive region and yet is not high enough to cause electrical breakdown or arcing. This corona will allow electrons to start to flow across the spark plug electrodes. This forms early ionization of the spark plug electrodes. As the energy across the spark plug electrodes increases, electrical breakdown occurs as seen at point G. The electrical breakdown is the energy that is required to

overcome the overall resistance within the secondary circuit, which should be approximately 10,000 to 20,000 volts. During breakdown, the electrons are

ripped off of the atoms that are within the spark plug electrodes. These atoms and molecules are accelerated by the electric field and start to hit each other. These molecular hits or collisions create energy exchanges that produce heat. As the areas where the electrons are flowing across the spark plug electrodes have greater numbers of collisions, each collision generates heat so the heat intensifies with a greater current flow.

At some point, the gas (nitrogen, oxygen and hydrocarbons) across the spark plug electrodes is super heated and a plasma channel is produced. Plasma is a super heated ionized gas containing about equal numbers of positive ions and electrons. The plasma is conductive so that when the plasma is created the resistance across the spark plug electrodes is reduced as seen at point H. The creation of the plasma channel is the difference of point G where breakdown occurred, and point H where the breakdown was super heated creating plasma, which is conductive and lowers the resistance. It is important to note on an oscilloscope that the voltage changes show resistance changes occurring within a circuit.

When diagnosing the engine using point G of the ignition waveform, it



A lack of fuel alters the composition of the plasma channel.

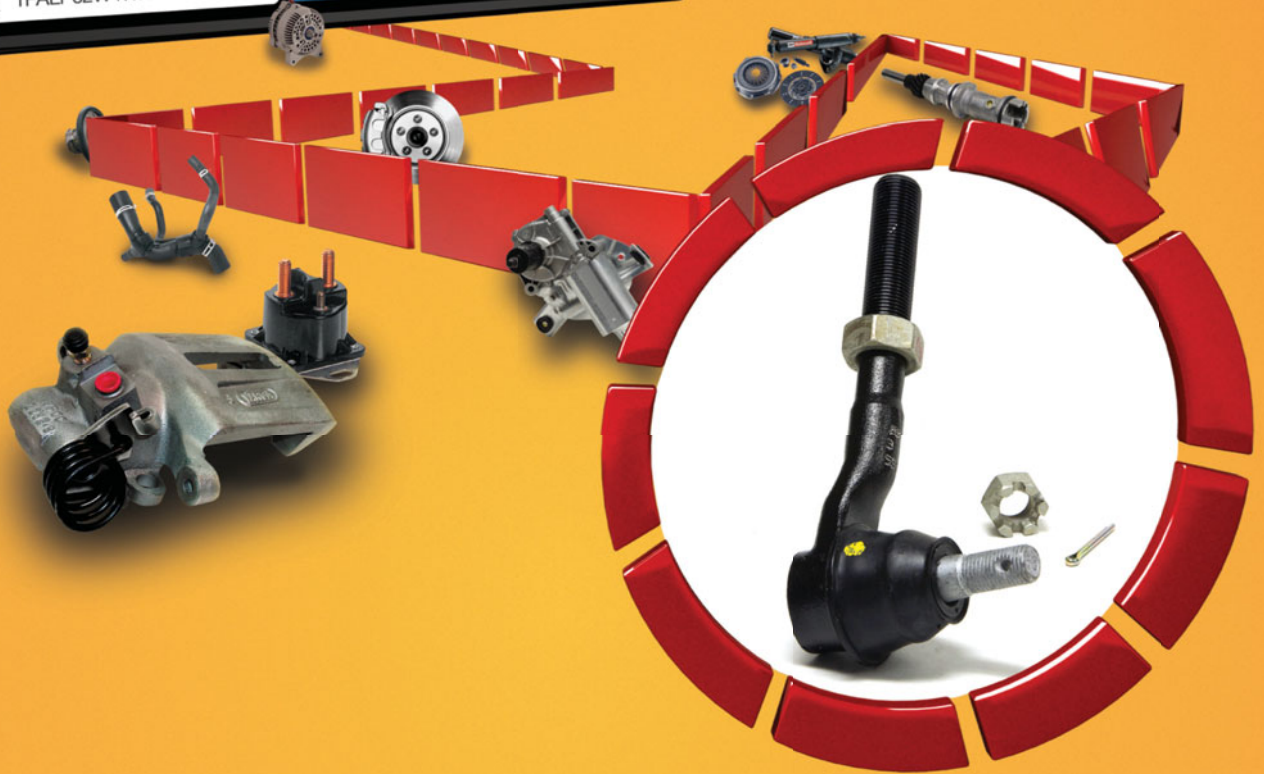
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can be very hard to determine whether there is a problem, due to point G's normal range moving between 10,000 volts and 20,000 volts. If the point at G is greater than 20,000 volts, this indicates there is a problem with the resistance of the secondary circuit. A much better indicator of a problem than point G is the point of plasma at H. This point will be very steady and should be between 1,500 volts and 2,000 volts depending on the size of the spark plug gap.

Because the plasma is created by the number of ion collisions, which is proportional to the amount of current flowing, resistance is the only thing that will move this point up or down. If the resistance moves up and the current goes down the resulting smaller plasma channel is less conductive, whereas if the resistance moves down and the current moves up, the larger plasma channel is more conductive.

Ringling will occur after the point of plasma, which is where the vertical fire line and the horizontal burn line meet. The ringling is the energy changing between electrical energy and magnetic energy. Just like when a bell is struck, the ringling from the bell is loud when first struck and diminishes. The harder it is to ionize the spark plug electrodes, the larger this ringling will be. Point I is the plasma channel (what is referred to in the automotive industry as burn time) that was established during breakdown.

The gases that were contained within the combustion chamber are what results in the plasma. In other words, the plasma will contain atmospheric gas, which is approximately 79 percent nitrogen, 21 percent oxygen and other gases which can be present including hydrocarbons (gasoline), exhaust gases (EGR) and positive crankcase ventilation (PCV) gases. The conductivity of the plasma will change depending on what gases are contained within the plasma channel. This means that the voltage shown on the oscilloscope of the burn line will be proportional to the resistance of the plasma channel.

The point at J is where the plasma is breaking down. Because the plasma is



composed of an equal number of positive ions and electrons, when the electron flow starts to decrease due to a limited reservoir contained in the step-up transformer, the positive ions and electrons become unbalanced allowing the plasma channel to break down. This break down changes the conductivity within the plasma and creates more resistance, which causes an increase in voltage.

The point at K indicates the amount of energy that still is remaining in the step-up transformer. The first negative oscillation is the most important one and this point should be about -1,000 volts to -2,000 volts. At the point the electron flow ends across the spark plug electrodes, the energy that did not leave the transformer must be dissipated.

The step-up transformer accomplishes this by ringling the energy. This ringling or oscillation is caused by the change in energy between electrical and magnetic, which the step-up transformer is very good at creating. The larger the voltage change and the more oscillations within the ringling, the more energy is left in the ignition coil. If there are no rings, the energy of the ignition coil was totally dissipated. This ringling can be used to see how much energy was used or not used during the ignition coil discharge.

Now let us analyze the ignition waveforms that are seen in Figures 4 and 5. This engine ran with an intermittent misfire and Figure 4 shows where there was not a misfire present and Figure 5 shows where a misfire occurred. In Figure 4, the ignition waveform is normal. The breakdown voltage is at 8,000 volts, the point of plasma is at 1,500 volts, the burn time is over 2ms, and the energy left in the coil is -1,000 volts. Now let us analyze the waveform in Figure 5, which indicates that the breakdown voltage is over 10,000 volts, the point of plasma is at 4,500 volts, the burn time is about .6ms, and the energy left in the coil is -1,500 volts.

When analyzing ignition waveforms it is very important to check the Time to Tail. The Time to Tail shows the time the transformer had to discharge the

energy and how much energy was still remaining in the transformer. In this case the burn time is only .6ms and the energy remaining in the transformer is only -1,500 volts. With only .6ms of time to discharge the energy that was contained in the transformer, it would not have enough time to dissipate the energy to -1,500 volts.

If the spark had ionized across the spark plug electrodes with only .6ms of burn time, the energy left within the transformer would be over -5,000 volts. There are physical conditions that determine how much energy can travel through the plasma channel created across the sparkplug electrodes. If the time that the transformer has to ionize the spark plug electrodes is limited, then the amount of energy dissipated in this time is limited, so a large amount of the energy will remain in the transformer. This energy will have to be dissipated with the ringling of the transformer.

“The step up transformer accomplishes this by ringling the energy. This ringling or oscillation is caused by the change in energy between electrical and magnetic, which the step up transformer is very good at creating”

If the burn time is limited and the energy that is still remaining in the transformer is low, then the spark did not go across the spark plug electrodes but went elsewhere. It is necessary to check the point of plasma in order to determine where the spark went.

Because the plasma is at 4,500 volts, this indicates that the spark did not ionize, but took a carbon path. Carbon is a conductor that changes the resistance. This is why the point of plasma is so high, and the energy contained within the transformer is totally drained. How the burn voltage is formed will show what type of material the carbon trace is on. As can be seen in Figure 5, the carbon trace

is down the side of the spark plug between the D and the E.

When a carbon trace has been made on the spark plug, the spark plug boot will have a carbon path as well. The carbon trace in the spark plug boot will look like a squiggly light gray line which indicates that the spark plug and spark plug boot will need to be replaced.

Now let us analyze the ignition waveforms in Figures 6 and 7. This engine ran with an intermittent misfire. Figure 6 shows where there was not a misfire present and Figure 7 shows where a misfire occurred. In Figures 6 and 7, the throttle is snapped to about 50 percent in order to load the ignition system. With more air volume in the combustion chamber, more pressure can be produced and it is far harder to ionize a gas that is under pressure. This loads the ignition discharge in order to locate problem areas.

In Figure 6, the ignition waveform is normal with a snapped throttle opening. The breakdown voltage is at 10,000 volts, the point of plasma is at 1,500 volts, the burn time is 1.2ms, and

the energy left in the coil is -1,700 volts. Now let us analyze the waveform in Figure 7 which shows the breakdown voltage over 14,000 volts, the point of plasma is at 1,800 volts, the burn time is about .5ms, and the energy left in the coil is -8,500 volts. The Time to Tail is .5ms of burn time and the energy left in the transformer is -8,500 volts. This shows that the spark did ionize across the spark plug electrodes; however, the burn time voltage increases rapidly to 17,000 volts.

Because the plasma channel sets this voltage, a high resistance is indicated. This resistance is created by what the composition of the plasma gas is. In this case, it shows a lack of hydrocarbons contained within the plasma channel. This lean air/ fuel charge changes the plasma composition, which, with the lack of carbon, creates low conductance within the plasma channel and creating a high burn voltage.

With this additional resistance, the transformer could not discharge the energy contained within it and therefore, the energy had to be dissipated

by the transformer. This is indicated by the negative going tail, which is quite high at -8.5k volts. This intermittent misfire was diagnosed as caused by dirty fuel injectors that resulted in low levels of fuel in the air/gas mixture.

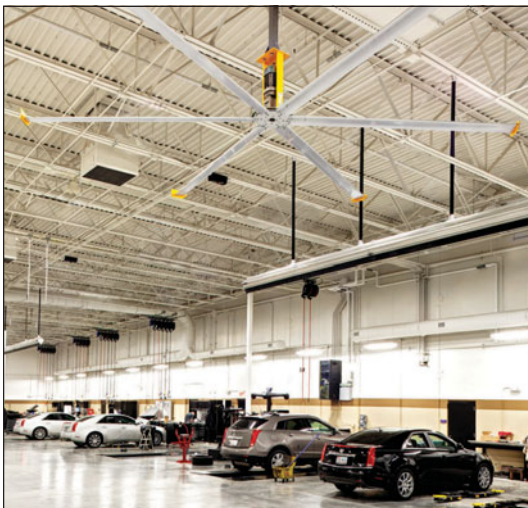
The vast amounts of intergalactic plasma in the universe are not very important to you when repairing a vehicle in your bay. However, the fourth state of matter within the combustion chamber is. With this understanding, a very fast and accurate diagnosis can be made in your service bay. *LTZ*



BERNIE THOMPSON
CONTRIBUTING
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Bernie Thompson is an automotive diagnostician and trainer, and co-founder of Automotive Test Solutions in Albuquerque, N.M. He is an expert at diagnostics and repair strategy and designs award winning diagnostic tools and software for the automotive industry.

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Placing the voltmeter leads across to two exposed legs of the fuse allows you to measure the voltage drop. A voltage reading here indicates that there is current flowing in the circuit.

PARASITIC BATTERY DRAIN

MAKING A TOUGH JOB A LITTLE EASIER TO TACKLE.

BY MICHAEL MILLER | CONTRIBUTING EDITOR

Let's face it, parasitic battery drains suck, and I'm not only referring to voltage. Locating the source of the draw also can suck up a lot of time. A couple of decades ago, a test light and a fuse puller were pretty much all that was required to track down a problematic circuit that was causing a continuous amperage draw on a vehicle's battery. Now with the technological evolution of automotive electronics and its encompassed networks, the archaic methods previously used to detect parasitic draws can derail your diagnostics before you even get started. While diagnosing parasitic draws probably never will be on your list of favorite work orders, encompassing the techniques here hopefully will make narrowing them down a more efficient process.

Not too long ago when a customer had a concern about their vehicle's

battery going dead after sitting overnight or after a few days, the first step was to disconnect one of the battery cables and install a test light in series between the cable and the battery post. The glow emitted from the filament was relative to the amount of current being consumed by the vehicle's electrical system. Common causes were glove box lights remaining on or sticking brake light switches. Tracking them down was as simple as going to the fuse box (don't forget to trip the door ajar switch so the dome light doesn't stay on) and pulling fuses one by one, until the test light glow diminished. Then finding out what circuits were powered by that fuse and eliminating them one by one.

Just by doing the first step, disconnecting the battery cable, on a modern vehicle can completely nullify your diagnostics. On most vehicles, removing battery power from modules on a



network reboots them and that may have even fixed the problem without you knowing it, not to mention erased clues that could have helped with your diagnostics.

Start with the Source

Sometimes when looking for the source of the parasitic draw, we overlook the source of voltage itself: the battery. Uncountable hours have been wasted without first testing the battery. First, the battery needs to be adequately charged. Too low of a voltage might cause modules to flake out and your test results will be inaccurate. Also, don't forget to measure for any drain caused by corrosion on top of the battery, referred to as case drain. Because the corrosion is conductive, it creates

Photos: Michael Miller



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an electrical path for current to flow from the negative post to the positive post. To check, place the negative end of a digital multimeter (DMM) on the negative post of the battery and place the positive lead on the case of the battery. If your meter reads even half a volt, the battery needs to be cleaned. Also, while you're at the battery, don't forget to measure voltage drop between the battery post and its respective



The top of the battery case itself can be a cause of the parasitic drain due to corrosion. Here there was nearly 8 volts constantly draining the battery.



One the best ways to prevent loss of power when installing an DMM in series with the battery cable.



By supplying power at the DLC, you avoid the acrobatics required to try and hold the jump box clamps on the battery terminal and clamp while simultaneously installing an ammeter in series between the two.

terminal while starting the engine. Too much resistance here can prevent a battery from charging properly, not to mention increase the amount of current needed to start the vehicle.

Not Just for Check Engine Lights

The first step I do when checking for parasitic draws, at least if the battery has not been completely drained since it was brought in, is attach a scan tool and checking for codes. I'm not looking for powertrain codes, but I don't dismiss any that are present as they also might be a clue. I am looking for Loss of Communication or UXXXX codes. The reason is a large amount of modules have their own power and ground circuits, but rely on another module or an ignition switch input signal to wake up or power down.

When a module stays awake and keeps talking, also known as a babbling node, it also will keep sending out state-of-health messages to other modules. When other modules are powered down and do not respond, the babbling node module sets Loss of Communication codes for the modules it is looking to receive messages from but didn't. Depending on what type of network and which module is the babbling node, several modules might stay awake and create a large parasitic draw.

When the bus is still active, there usually will be a draw of 1 amp or more. A tip to keep in mind is that on most vehicles modules will power down more quickly when the vehicle is put in the locked position with the key removed, rather than just turning off the ignition and closing the doors. Also keep in mind that some modules will stay awake when the key is in the ignition, or in the case of a proximity key, even when it is near the vehicle.

Testing Without Disconnecting the Battery

There are a couple of methods described in a previous *Motor Age* The Trainer video (May 2013) on how to avoid losing power to a vehicle while installing



a DMM in series with the negative battery cable and post. Attaching a jump box to the corresponding battery cables and disconnecting the negative cable while installing a digital ammeter in series is one way. The only problem is you need to be careful about knocking off the

jumper box clamp while removing the cable from the battery. Some manufacturers recommend trying to hold a multimeter probe on the negative battery terminal and the other on the negative battery post while removing the clamp while maintaining continuous contact with the probes.

I think this sounds more like a challenge on a reality game show than a diagnostic procedure as you need three sets of hands to accomplish this successfully. My favorite method is using an OBDII connector with a power point adaptor that plugs into the outlet on the jump box. They are fairly inexpensive (most are available for less than \$17), and you don't have worry about knocking off the clamp while trying to remove the battery cable and installing the ammeter. There also are jump boxes available designed specifically for saving computer memory with the OBDII connector made to it. Forget about using the old 9-volt battery-style memory saver that plugs into the cigarette lighter. It's power is not sufficient for modern vehicles and many modules "Keep Alive" power feeds are not shared by the same circuits.

What About Using an Amp Clamp?

That would negate removing the battery cables at all. In my experience, low amp probes have too small of a jaw opening to fit around a battery cable. The amp clamps that do fit around the cable seem to be too unstable and the readings that were displayed were not accurate when compared to the same vehicle while using an ammeter in series with the negative battery cable.

Getting Started

After the computer memory saver method has been put into place, dis-



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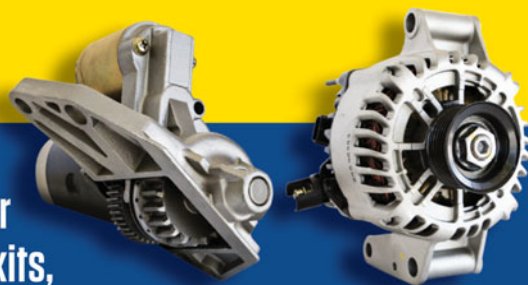
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connect the negative battery cable and install the black lead DMM lead to the negative battery post and the red lead to the negative battery cable. Depending on your meter, it is usually a good idea to set the readings to amps first, and then switch to milliamps after you determine the current draw is not too large. While it is best to check manufacturer specifications for the vehicle you are working on, most manufactures allow up to a 50mA normal draw.

Another item to keep in mind is the time required for modules to power down. While some turn off with the ignition switch position signal, others remained powered up for varying lengths of time. Some manufacturers recommend waiting 20 minutes, while another recommends waiting up to one hour. This is another area where it is best to consult service information for appropriate times.

As a side note, if your meter has an "Auto-Off" feature that times out and shuts off the meter, make sure you disable it or you will be starting over from the beginning. Open all doors/trunks/hoods/liftgates and trip the switches so they appear closed to the module(s) in charge of monitoring them. This makes it much easier to access multiple fuse boxes, modules and components without disturbing the sleeping bus.

During the interview with the customer, have your service consultant ask some specific questions that might help you to focus on smaller or specific areas that might be the cause of the parasitic drain. Some questions to ask are:

- How many hours does the vehicle remain parked before the battery is discharged?
- How often is the vehicle used?
- How many miles was the vehicle driven before the vehicle was shut off?
- Was the vehicle locked or unlocked when parked?
- Where any activities taking place before shutting off the vehicle, such as watching a DVD, charging a cell phone, using the auxiliary port, using a Bluetooth device or using the navigation system.
- Has there been any recent work performed or accessories installed? (Aftermarket alarms and stereos are common sources of key off battery drains.)



The ammeter is installed in series between the negative battery post and the negative battery terminal.



When beginning your diagnosis, a good place to start is a visual inspection for aftermarket accessory installations such as alarms and stereos.



These Acupuncture Probes available from AES wave (05-762) make measuring voltage drop across the top of a fuse an easy task because of their fine point.

Using Voltage Drop

Another way to track down the offending circuit is by performing a voltage drop test across a fuse. Keep in mind that each type of fuse will have different resistances, so it is best to consult the fuse manufacturers' specifications for cold resistances. A fuse's resistance is going to be measured in milliohms (0.001 ohms). Keep this in mind when using Ohm's Law to determine the amperage draw on the circuit. A set of backprobes attached to the end of a

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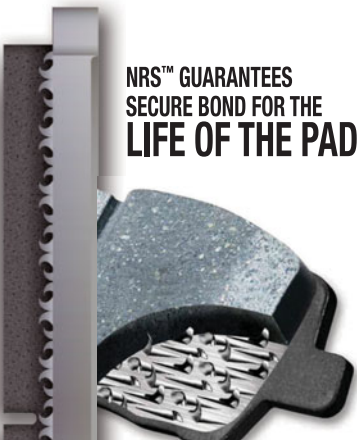


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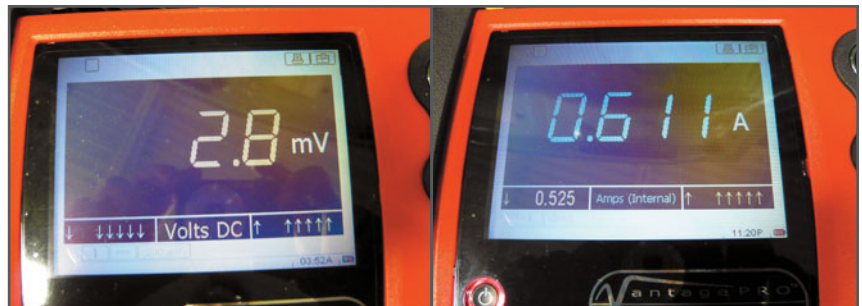
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(left) Here is the reading taken on a Mini 15 amp fuse when the dome light was turned on. (Right) The same reading in milliamps is found when using an ammeter installed in series between the negative battery terminal and clamp as when using voltage drop across the fuse and Ohm's Law.

meter works best to get on to the two exposed legs of the fuse.

On J-Case type fuses, you will need to pop off the clear protective cap to access the fuse legs for testing. The theory is that if a fuse is showing a voltage drop, current must be flowing across it. Therefore, that is very likely the circuit that is running the battery down. Keep in mind when measuring voltage drop across fuses that the type of fuse and the manufacturer will change the resistance factor. For example, a 20 amp rated Mini Fuse has a cold resistance of 3.21 milliohms (0.00321 ohms) and a standard 20 amp ATO Blade fuse has a cold resistance of 3.38 milliohms (0.00338 ohms). A 20 amp Maxi Fuse has a cold resistance of 3.10 milliohms (0.0031 ohms), while a 20 amp J-Case fuse has a cold resistance value of 4.29 milliohms (0.00429 ohms).

Here's an example to clarify a bit. An ammeter is installed in series with the negative battery cable. After waiting for the modules to power down, a reading of 10mA is observed on the ammeter. Reaching through the window and turning on the dome light, a reading of 611 mA (0.611 Amps) is displayed. This method involved disconnecting the battery and installing an ammeter between the battery terminal and cable clamp. A 15 Amp Mini-fuse protects the power feed to the dome light.

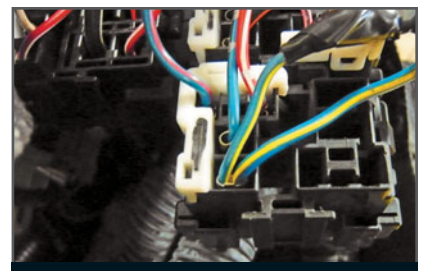
According to the chart, the cold resistance of the fuse is 4.58 milliohms. Placing the voltmeter leads across the top of the fuse shows a voltage drop of 2.8 millivolts. Using Ohm's Law (volts/ohms = amps), I can fill in the fields and come up with 0.0028 volts / 0.00458 ohms = 0.611 amps, which is the same amperage that was measured when

disconnecting the battery cable and installing an ammeter. There occasionally will be a slight variation between the numbers on the ammeter and the results of using the voltage drop across the fuse depending on the accuracy of the DMM and the manufacturer of the fuse. However, it should not exceed 1/100th of an amp.

For simplicity's sake, a less cluttered math equation can be used since volts, amps and ohms are generally all in "milli" or thousandths of their respective value when dealing with parasitic draws. So the same equation would look like this: 2.8mV / 4.58mohms = .611A (611mA).

Divide and Conquer

So now you have narrowed down the offending circuit, but what do you do when the fuse powers more than a single circuit or component? Divide and conquer. Combining the method of checking voltage drop across a fuse and separating each leg of the circuit, a draw can be more precisely isolated. Locate the splice point in the circuit powered by the fuse with the exces-



In situations like this, when two or more wires are powered by the same fuse, you need to isolate which one is the problem.



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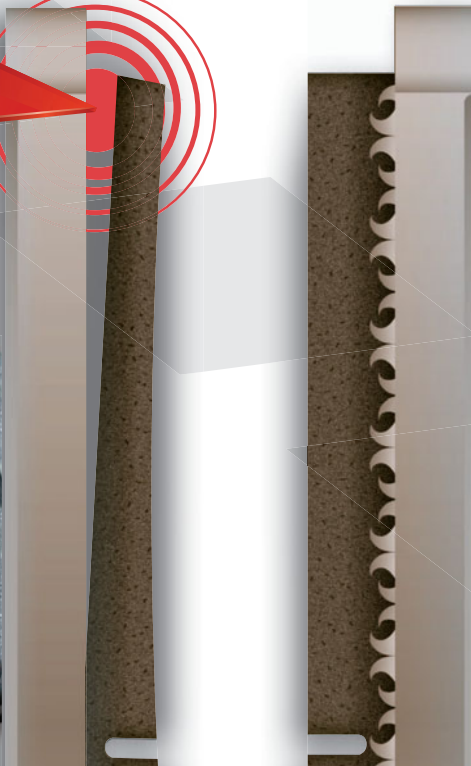
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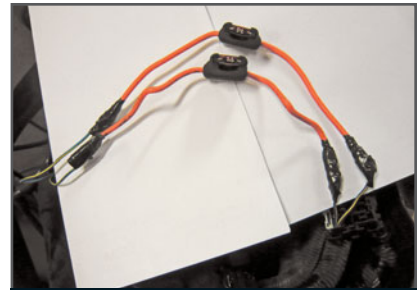
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sive voltage drop. Cut each leg coming from the splice and install another fuse from the splice and install another fuse of the same amperage rating.

I have a couple of inline fuse holders available for a few dollars each at a local parts store that I install at the splice in the circuit temporarily to determine which one of the legs is staying awake and also, which component is causing the battery drain. This method also can be used when there is an excessive load in a system causing

a fuse to blow. Instead of unplugging multiple components one at a time and test driving to see which ones are not causing the fuse to blow, the offending circuit can be narrowed down in one step. By separating each leg, and installing an individual fuse on each, only the one that has the overcurrent will blow.

However while looking for a parasitic draw, it gives you an opportunity to narrow the possibilities and stop



By installing an inline fuse holder in series with each leg of the circuit, you can use the voltage drop method to determine which leg to follow. This also works great when tracking down a short which blows a fuse as the specific leg with the defective component or shorted wire can be isolated.

trying to unplug everything powered by a particular fuse. There is really no easy method to try to keep the circuit powered up when doing this, unfortunately in this case, power will need to be removed and the process of waiting for modules to time out will have to be repeated.

Conclusion

Another area we cannot overlook when dealing with battery drains is Technical Service Bulletins (TSBs). Checking before delving headfirst can save you hours of frustration.

Hopefully some of these techniques will come in handy the next time your routed a vehicle that has a complaint about the battery going dead after sitting for a short period. The automotive technology we encounter on a daily basis has evolved drastically over the last decade, so it only stands to reason that the approaches we take to repairing them must also. *MM*

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Michael Miller lives and works in Las Vegas. He is an ASE certified World Class Technician with more than 50 current certifications. He holds a degree in mechanical engineering and is currently completing a second degree in automotive technology.

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Connecting your scope to most circuits is no different than connecting your DVOM, but you'll get a lot more information from the scope.

BLOW THE DUST OFF OF THAT SCOPE AND UNLOCK ITS DIAGNOSTIC POWER.

BY PETE MEIER | TECHNICAL EDITOR

Every month, we produce short (15 to 30 minute) videos on a variety of technical topics. Our June video focused on basic uses of the digital storage oscilloscope (DSO) in an attempt to encourage those of you who have one gathering dust in a corner of your shop to break it out and use it. Judging by the response, many of you are doing just that and have asked us for more scope-related information. Rest assured, we will be adding more material to our video library soon.

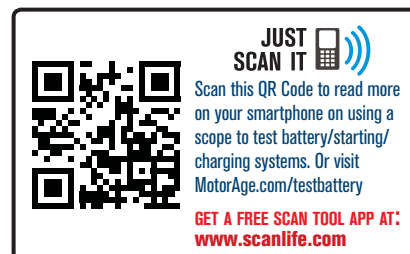
In the meantime, I thought it appropriate to offer a print primer on scopes and their use as a diagnostic tool. I'm no power user, just an average guy like the rest of you, and if I can make use of this time saving diagnostic tool, I know you can too.

Why Use a Scope?

The very first scope I ever used was one of those big box engine analyzers

you might recall from the mid-1970s. It was an analog scope, using a cathode-ray tube display, and the neon green trace you saw on its screen was in real-time with no capacity to store the information for later viewing or analysis. It typically was used to check secondary ignition patterns and had some neat features. You could show all eight cylinders at the same time in series (the parade pattern), stack them on top of one another (the raster pattern) or look at one cylinder at a time. This made spotting anomalies in the patterns easy to do and techs with even a rudimentary amount of training could pick out problems in the ignition system after a few minutes of viewing.

In the early 1980s, the DSO was born. This new style of scope used an analog to digital converter (ADC) to convert the real-time analog input signal to a digital form that could be stored indefinitely with no degradation in the quality of the signal attributes and



later displayed on a variety of screens. Fluke was (and still is) a popular choice for early automotive techs that began experimenting with the use of these scopes as a diagnostic tool.

Some of the distinct advantages offered by the early DSOs were the ability to freeze a capture on the screen, to store that image in a permanent library either in the tool or on a personal PC and the ability to share that image with other techs. And with the birth of the International Automotive Technicians Forum on something new called the "Internet," experimenters were able to share their notes with others around the world and not just with those in their hometown.

The majority of the DSOs offered for sale as automotive tools today are more than capable enough of capturing the signals you want and display

Photos: Pete Meier

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NUMBERED LEADS



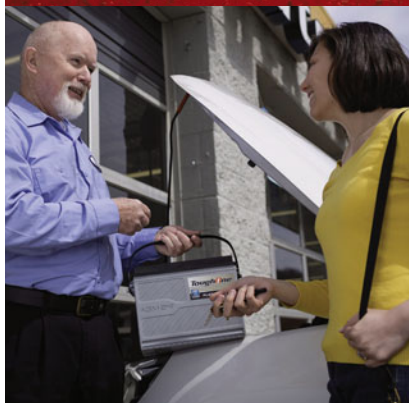
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them with a resolution that almost mirrors on the older analog displays. And with the accessories that have been adapted and developed for automotive diagnostics, our scopes can rise to nearly any diagnostic challenge you care to throw at it.

Want to monitor current in a circuit over time, looking for that intermittent cause of the battery drain you've been trying to nail down for the last month? A scope can do that. Want to be sure an input sensor signal is reliable? A scope can do that. Want to see if transmission line pressure changes in synch with the variable commands received by the linear solenoid controlling it? A scope can do that. All that, and a whole lot more.

Basic Settings

Today's DSOs are available in a variety of platforms: handheld independent units, as an accessory module built in to your scan tool platform and as PC-based platforms that use a USB interface. No matter the platform, they all perform a similar task and differ primarily in how the basic settings are adjusted.

Scopes take an input signal and trace it over time, producing a graph of that changing signal that allows you to see much more than you can using a multimeter or scan tool. There are two axes — one vertical and one horizontal — the DSO uses to plot that signal for viewing, and you can adjust both of them to suit the type of signal you are trying to view. Each axis is divided into units, the value of which is determined by the user, just like the graphs we made in junior high math class.

For the sake of remaining on the same page, let's start using the lingo of the scope user. When two scope users are comparing notes, they refer to the signal they've established on the screen as a capture. If that capture is displayed to show just the portion relevant to the system we are monitoring, the screen view is called a waveform or pattern. For example, I can capture several seconds of a cam sensor signal on my screen. A complete cycle of the cam sensor signal displayed, though, would be the sensor's waveform.

The vertical axis is the voltage scale and the horizontal axis is the time scale, each having divisions of measurement. The total time displayed on the screen is referred to as a sweep. For example,



These older scope models are still found on sites like eBay and at very reasonable prices.



This old UEI scope was the first scope I ever personally owned and was a very capable tool.

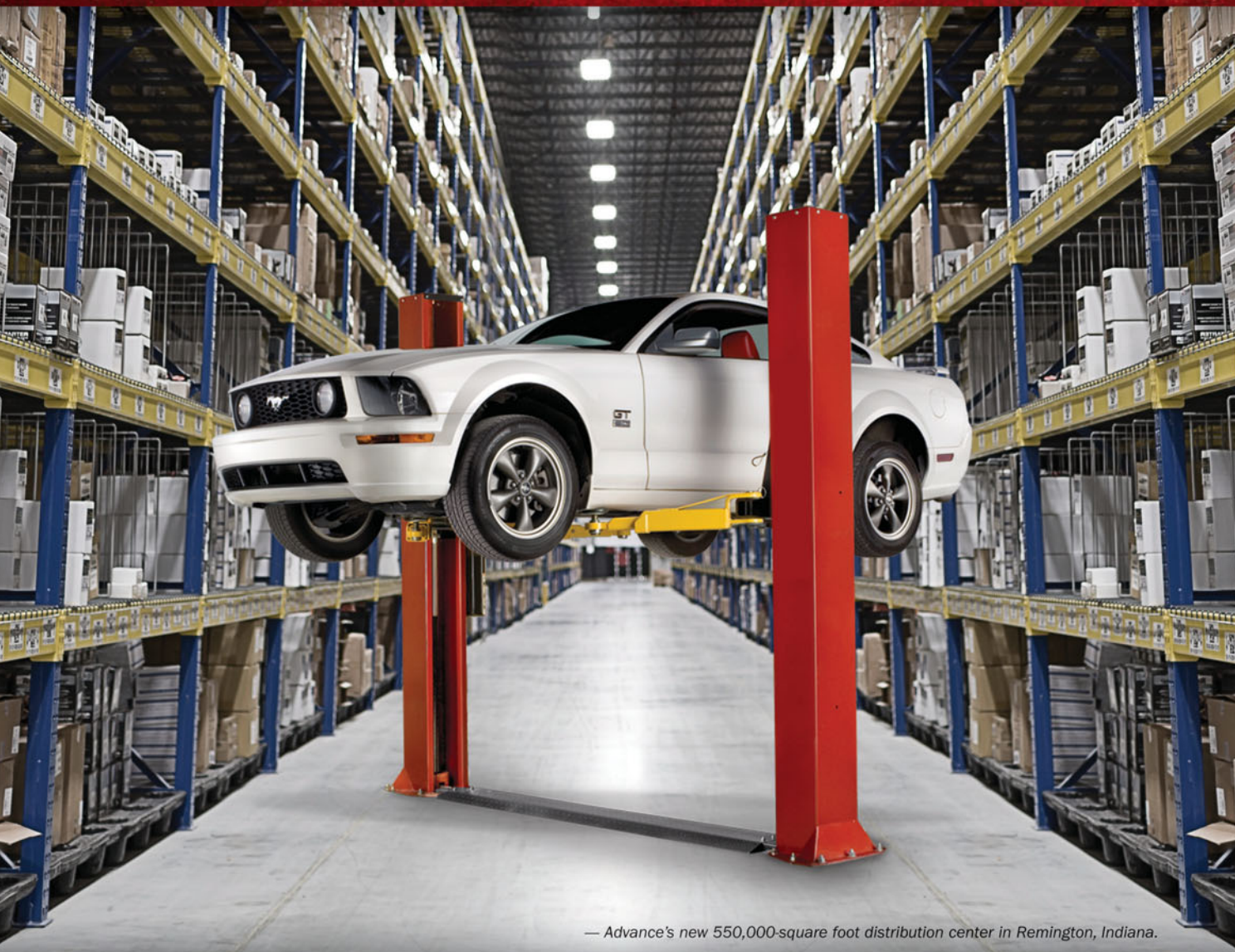


Make a habit of setting up your scope every morning and connecting to as many "known good" cars as you can. If you grab your DVOM, stop and grab the scope instead.

if you've set the time divisions to one second each and there are 10 divisions on your scope's screen, scope users would call that a single 10-second sweep. Your scope's settings control for both of the axis might be based on divisions or sweep or both.

The voltage scale typically should be set to allow your captured signal to take up most, but not all, of the screen. If you're measuring a Throttle Position Sensor (TPS) signal, for example, with a range of 0.0 to 5.0 volts, adjust your scope to 0.10 volt per division (with the typical 10 divisions that gives you a range of 0 to 10 volts) or choose the sweep that best fits (-10 to +10 volts on my Pico).

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
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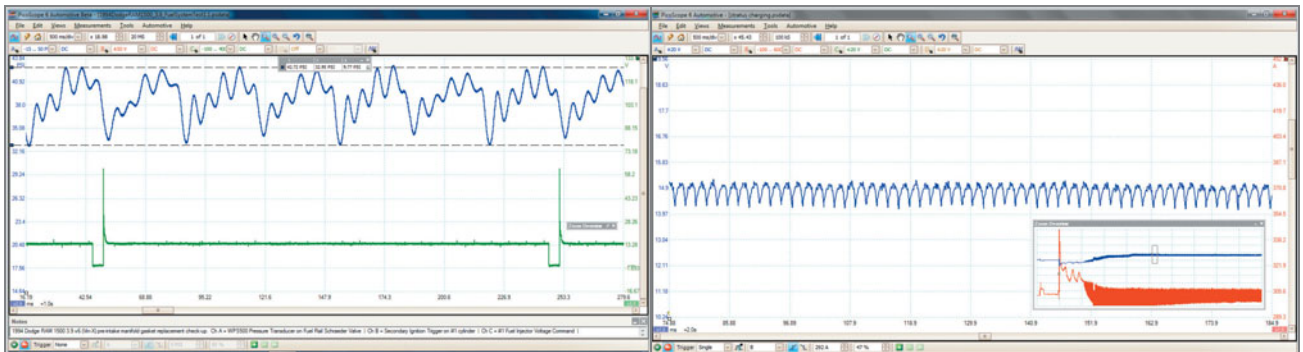
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(Left) The injector (green) was used as a reference for this fuel pressure (blue) capture. Notice that the pressure drops are uniform. How many cylinders does the engine have? (Right) You can see from the little window how much I've zoomed in on the saved pattern. This is excessive AC ripple, and the reason for the failed battery.

The time scale is where the real power of a scope comes into play. With many of the newer DSOs, it is possible to set up sweeps that last minutes, even hours. The user then has the option to use the Zoom features on the tool to expand the capture and look at the same data in microseconds with almost no loss in resolution. Personally, I've never come close to exceeding the capabilities of a scope and I tend to prefer to adjust my time settings to allow me to view the signal I'm trying to capture in real-time. I'll start with a sweep larger than I expect I'll need and then make adjustments to the time divisions until the waveform is set the way I want.

Another setting you'll need to master on your scope is the trigger setting. The trigger is the set point you establish that tells the scope when to start tracing the waveform on the screen. Some adjustments you can make to your trigger point include the time it starts on the screen, the voltage level that needs to be achieved, and whether

that voltage level should be detected as the signal voltage rises or falls. Using a trigger allows you to set up the scope to capture a signal anomaly (scope users call that a glitch) or stabilize a running pattern on the screen for easier viewing and comparison.

Blow the Dust Off

There's no better way to learn how to use a scope than to actually drag it out of your toolbox and use it on every "known good" car that comes into your bay. In our video, we show you how to use it to conduct a battery/starting/charging system test and that's a good thing for a few reasons. One, it gives you the motivation to turn it on every morning when you come into work so it's ready when you are. Two, performing this simple test will be of real value to both you and your customer, so it's not a waste of time. And three, it provides you with practice in setting up and using the controls on your particular scope. For more information on this

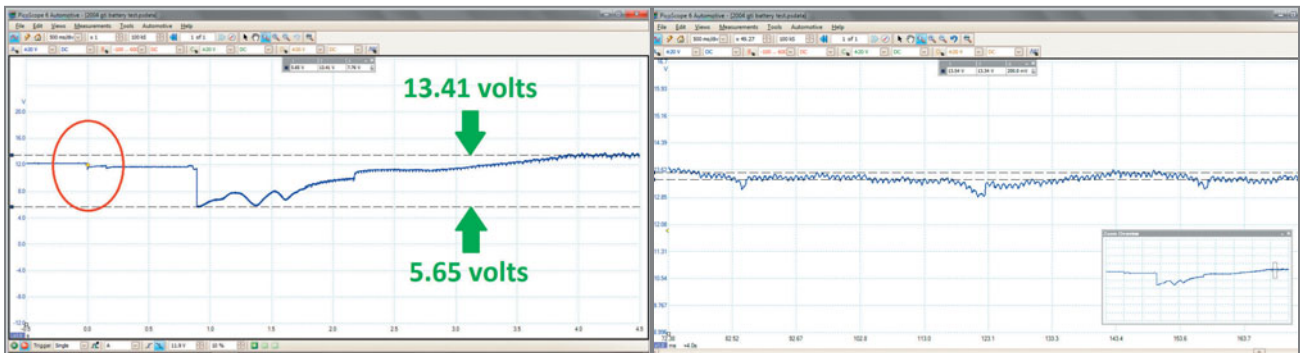
test, check out the June video in the AutoPro Workshop or the *Motor Age* YouTube channel. You can also read a great article by Albin Moore on the topic online at MotorAge.com.

And while we aren't going to go into that test in detail here, I do want you to start learning your scope by connecting channel one to the battery the same way you would if you were going to measure its voltage using your multimeter (DMM).

Wait a minute? What's a channel?

Another powerful aspect of the scope is its ability to trace more than one signal at a time. Each input is a channel, and there are scopes offering anywhere from one to as many as eight channels.

For a long time, I relied on two, but I must admit I like the fact that I have four now. The advantage is being able to compare apples to apples by monitoring multiple, but similar, signals at the same time. An ignition system immediately comes to mind. It also can be an advantage when you want



(Left) In this image, notice first where I have the trigger (yellow diamond highlighted). I also can check in-rush voltage and charging voltage. Add a high current clamp to a second channel and perform this simple test on every car you bring in. (Right) Compare this to the "known bad" image. Same amount of zoom on the voltage pattern but in this case, the AC ripple is under spec and OK.

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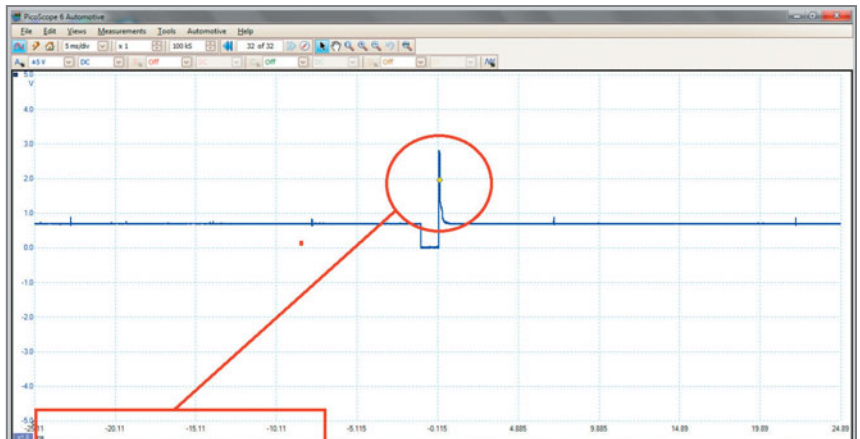
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This is the trigger, or the set point I've established telling the scope when to start drawing the trace.

to compare one signal to another or see if they are in sync as would be the case with a Crankshaft Position Sensor (CKP) and a Camshaft Position Sensor (CMP). A third use is for "if/then" testing. For example, if the Engine Control Module (ECM) completes the ground path for the fuel pump relay, does current flow through the pump circuit?

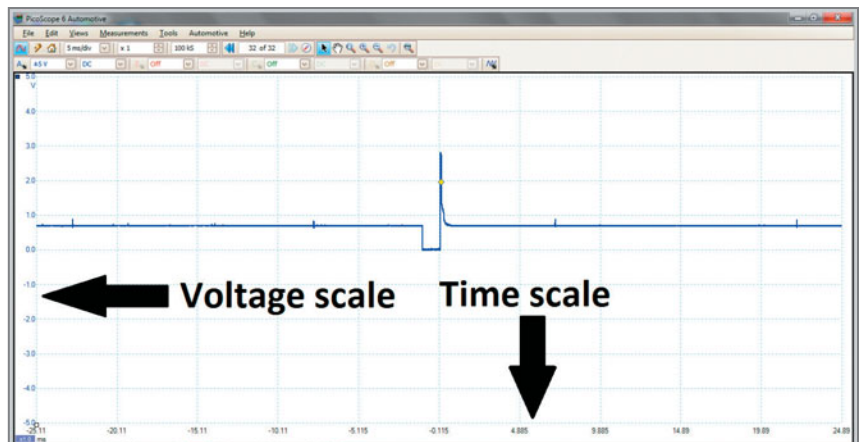
I'm sure you can see more diagnostic possibilities.

Back to the battery. Most voltage measurements you'll make with your scope will have you connect in the same way you would if you had chosen to use your DMM instead. In fact, there will be cases where the DMM is enough to get the job done but if you make a habit of using your scope instead (at least during the first few months), you'll see where using the scope allowed you to see something that you would have missed with the meter alone.

Set your voltage divisions based on the test you are making. The battery voltage shouldn't exceed 20 volts, should it? Or go less than 0.0 volt? Set your scope accordingly.

Adjusting the time divisions is next. Adjust your scope to record a 20 second sweep. If you have to set your scope's time scale by divisions, simply divide the number of divisions into 20. For example, my Pico has 10 divisions, so I'll select a time base that will be close to two seconds each from its dropdown menu. The scope module built into the Snap-on Verus®, on the other hand, allows you to select the time scale base by total sweep time.

As a quick side note, both have accessory menus that change the scaling on the voltage scale to correspond with a variety of accessories like pressure transducers and current clamps. If your scope doesn't have



There are two axes on a scope: time and voltage. Both can be set by the user to view nearly any electrical signal you want. With accessories, you can also view current, temperature and pressure changes.

this feature, or you're using an accessory that doesn't match up with the scale choice, just remember that all of the available accessories are converting their inputs to a voltage signal your scope can read and there should be a chart offered with that accessory telling the end user what the "xxxx" (pressure, temperature, current) to voltage relationship is.

For this battery test, I want to set the trigger to start capturing the battery voltage input after I've reached in and started the car and I want it to stop after the single sweep is completed. I do this on the Pico by selecting a single trigger starting one time division in from the beginning of the screen. Now to set the voltage level of the trigger.

I want the scope to begin its capture just after I turn the key on but before I actually start the car. What happens to battery voltage when you turn the key on? It drops, right? So I'm going to choose a voltage mark that is less than OCV but more than what I expect the voltage to drop to on start-up. Then I'm going to use the scope's trigger settings to tell the scope to look at OCV and start its trace when it sees that level drop to the marker I've established.

Make sense?

Now I'll start the scope and then start the car. Once enough time has passed for the scope to complete its capture, I'll shut the car off and take a look at the pattern on the screen. From this first capture, I can check battery OCV, system in-rush voltage and charging system voltage. Do you have a similar pattern on your scope?

There is more to see.

Using the Zoom function, I'm going to take a closer look at the charging system voltage portion of the pattern. By zooming in from a two second per division time base to a 10 millisecond per division time base, I'll be able to see the condition of the alternator's diodes. This waveform is the A/C ripple that you've probably measured with electronic testers in the past. If



Read more about other creative ways you can use a scope in performing diagnostics
MotorAge.com/creativescope


you can't zoom in with your scope, simply readjust your time settings. Add a high current amp clamp to a second channel to measure starter current draw and charging amperage. You'll get good practice with your scope while providing a valuable service to your customer.

Additional Daily Tests

Any test you make with your digital voltmeter can be made with your scope. Lead placement is the same for any voltage test you want to make. The power of the scope is the ability to see the changes in voltage as the component operates in a way you'll never see with a meter alone. This takes voltage drop testing to a whole new level. Imagine looking at the voltage drop over a groundside module driver? Or being able to actually measure how long it takes for a driver to turn on or off?

CAUTION: Be sure to know the voltage input limits of your scope. Some circuits (injector and primary ignition, for example) can produce flyback voltages that can harm your tool.

With accessories, you can expand your scope's (and your own.) diagnostic capabilities. Check the pressure drop across the fuel injectors with a pressure transducer. Inspect the electrical health of a fuel pump in seconds with a low amp clamp. The uses of a scope are only limited by the imagination of its user. Yes, there is a learning curve to becoming proficient with it. Yes, it will take some investment of time and training.

Didn't every skill you've mastered so far? 



PETE MEIER
 TECHNICAL EDITOR

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

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DIAGNOSING BMW DMTL / LDP EVAP SYSTEM

With smoke applied, it didn't take long to find the cause of this BMW's leak.

FRUSTRATION CAN GIVE WAY TO ELATION ONCE YOU SPEAK THE LINGO OF BMW EVAP.

BY "G" JERRY TRUGLIA | CONTRIBUTING EDITOR

Not everyone understands EVAP systems, especially if they have to diagnose and repair one on a BMW. We understand that you might have some anticipation about working on different EVAP systems since manufacturers use so many different parts and names for their components. Be assured that in this article we will provide a solid overview of the different systems that will make your diagnostic routine easier.

Because there are only three types of evaporative emissions (EVAP) systems used, it won't be that difficult to understand. The three systems are vacuum, pressure and natural vacuum and are defined by the method used for leak detection. In the following paragraphs we will provide a brief description of each before we move specifically into the BMW Diagnostic Module Tank Leakage (DMTL)/Leak Detection Pump (LDP) EVAP system.

Before we move on to the system descriptions, we need to address the common misnomer that an EVAP problem is "just a gas cap." According to SAE paper No. 1999-01-1463 the gas cap is to blame only a quarter of the time for an EVAP diagnostic trouble code (DTC). So, if you are in the habit of sending motorists with an EVAP-related DTC on their way after a quick twist of the fuel cap, expect that they will come back with the same problem they originally showed up with. Better to learn how to pin-point the real cause of EVAP issues.

EVAP System Theory

Because we are limited to the length of this article we are going to cover only generic principals of EVAP systems. The following will provide EVAP theory essentials, so that you know enough to be able to make educated judgments during your diagnosis.



The EVAP system prevents hydrocarbon (HC) vapors from the fuel system from escaping into the atmosphere. On a vehicle with its engine off, the fuel in the tank starts to evaporate. Vapors travel through the vent hoses/tubes to be stored in the charcoal canister. When the engine is started, vapors are drawn/sucked into the intake and burned during combustion.

Most systems consist of a purge solenoid, charcoal canister, pressure/vacuum gas cap, fuel tank pressure (FTP) sensor and vent solenoid or valve. Any problem with these or associated parts (fuel filler neck, gas tank, associated rubber lines, etc.) will prevent proper operation of the EVAP system.

EVAP steadily has grown more complicated now that vehicles are mandated to have ever more efficient systems that prevent fuel vapors escaping to

Photos: "G" Jerry Truglia

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the atmosphere. The demands placed on the EVAP system have increased in an effort to reduce HC vapors.

The Engine Control Module (ECM) is in charge of both the operation and testing of the EVAP system. It checks the system's ability to purge HC vapors that are stored in the charcoal canister, and checks the system for leaks as small as 0.010 inch up to 0.040 inch. These tests fall under the "non-continuous" monitors, meaning that the system is tested only once during a given drive cycle. Codes set are "two trip" codes, meaning that faults discovered must be confirmed before the ECM commands the Malfunction Indicator Lamp (MIL) on.

In addition, many EVAP monitors have very specific enabling criteria that can make it difficult to run a monitor manually. This includes factors like how long the car has been idle (cold soak time), the amount of fuel in the tank (usually needs to be between ¼ and ¾ full), and others that you should be aware of when troubleshooting

EVAP system problems. Because Mode \$06 has a listing of the specific tests used by the ECM, it can be a helpful tool in your troubleshooting of intermittent EVAP faults and for verification of the final repair.

Here are a few other EVAP system basics to remember when you begin your testing:

- The Canister Purge Valve is normally CLOSED.
- The Canister Vent Valve is normally OPEN and needs to be closed for leak testing. Global OBDII Mode 8 will perform this function on some models, and you might be able to use your scan tool's bi-directional features for those that don't.
- The service port Schrader valve has reverse threads (on systems that use service ports).

Read more on some general BMW service tips that can save you time during your day.
MotorAge.com/bmwtips

▪ Fuel soaked charcoal canisters equal a bad liquid fuel separator.

There are different names for this component but it still has to do the same job, allowing only fuel vapors to enter the charcoal canister. If the canister becomes fuel soaked

you will need to blow out the lines in a well-ventilated area with an inert gas (not air) besides replacing the liquid fuel separator and charcoal canister.

▪ Line and hoses are the No. 1 areas that need to be checked for leaks.

▪ Vent and purge solenoids need to be energized to the open/closed or closed/open positions at least 10 times. We have experienced that just simply testing the solenoids by open and closing them a couple of times might prevent you from finding a defective valve that is sticking mid-way. Try using your



The EVAP system on this BMW shares similarities with the Chrysler LDP system. This car came in with code set for a major leak.

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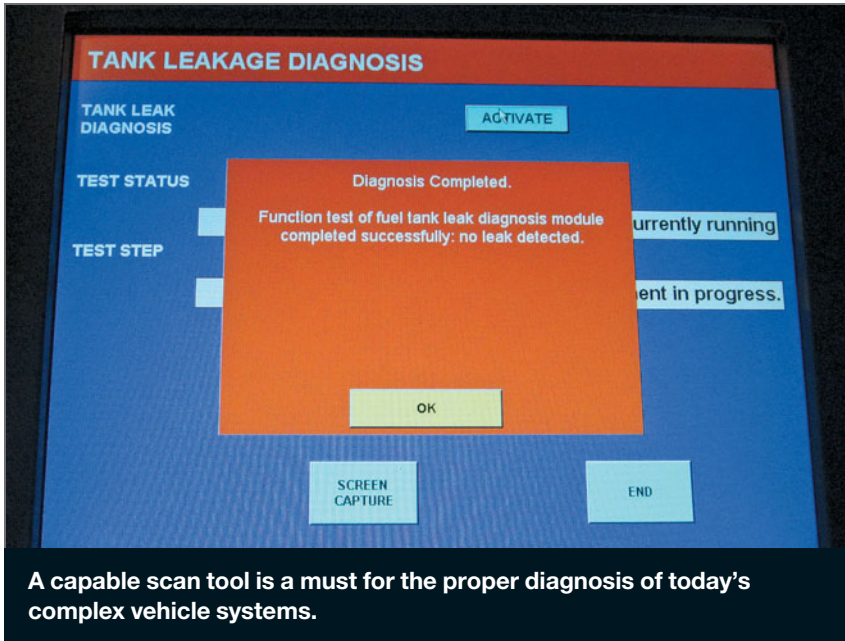


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cycling the LDP solenoid and watching the LDP switch. Once pressure (7.5 in H₂O) is built up in the system, the diaphragm will be seated upwards against spring pressure. The PCM knows this since it is monitoring the LDP switch. So, the PCM compares LDP switch position against LDP solenoid cycling time to determine if leakage is present.

When manually checking for leak, the vent valve must be closed. Closing of the vent valve requires that the LDP solenoid be energized and that a vacuum source be applied to the LDP solenoid. This will enable the LDP diaphragm to stroke upwards, thereby allowing the vent valve spring to close the vent valve.

If the pump runs a short time before reaching pressure it is assumed that there is a blockage and only part of the system is pressurized.

Now let's take a look at a system that uses a strategy called "natural vacuum leak detection."

Ford Engine Off Natural Vacuum (EONV) uses similar components to what it used on conventional engine vacuum systems. The difference is that instead of using engine vacuum, natural vacuum (or pressure) created inside the fuel system is used to test the system for leaks, after the engine is shut down.

Here's how it works.

1. When the engine is shut down and the ignition is switched off, the canister vent remains open to allow tank and

scan tools bi-directional control or use a Power Probe to exercise the valve to uncover one that sticks.

The Three EVAP Systems

EVAP systems can be distinguished by how the ECM performs the leak test. It is interesting to note that many systems use some form of vacuum decay method for self-tests, while most of us tend to use some form of pressure test for our troubleshooting. As with other systems, EVAP leaks might be missed relying on pressure testing alone.

The first one we'll overview are systems that use engine vacuum as the source vacuum for testing system integrity. GM, Ford and many imports use measurements from sensors giving feedback concerning the vapor management or purge control valve, solenoid-operated canister vent and fuel tank pressure sensor. They self-test in the following order:

1. Purge valve is closed and the canister vent valve is open. No engine vacuum is reaching the canister and with the canister vent open system pressure equals atmospheric pressure.

2. Purge valve is opened and the canister vent is closed. This should increase EVAP system pressure by 6 to 8 inches of water.

3. Purge valve and canister vent remain closed while the PCM monitors how long the system retains sufficient vacuum.

Next is an overview of how the

Chrysler Leak Detection Pump (LDP) EVAP system works and how to test it. This information is very similar to the BMW system that uses a DMTL.

The purge solenoid is normally closed, grounded by the PCM. The feed side comes from a Key On Engine Off (KOEO) fused circuit. The PCM energizes the solenoid to purge fuel vapors from the canister and to lower tank pressure. The LDP's vent valve is incorporated in the unit and is normally open. It supplies air to the charcoal canister.

The PCM checks for EVAP leaks first by de-energizing the Purge solenoid (normally closed), and then rapidly



Notice the location of the charcoal canister. It wouldn't be too hard to accidentally damage it if you weren't careful lifting the vehicle.

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Locating leaks in system lines and connections is much easier when you use one of the several capable testers on the market designed for the task.

atmospheric pressures to equalize. This is no different than other EVAP systems.

The PCM monitors system pressure via the Fuel Tank Pressure Transducer (FTPT). If the EVAP system pressure is 1.5 inHg or more, the PCM assumes that fuel in the system is generating a

lot of fuel vapor pressure and very volatile. The PCM knows that excess pressure (volatile fuel) makes the test unreliable and aborts the test. Remember, the canister vent is open. If the system can generate a positive pressure with the vent open, it's assumed that the

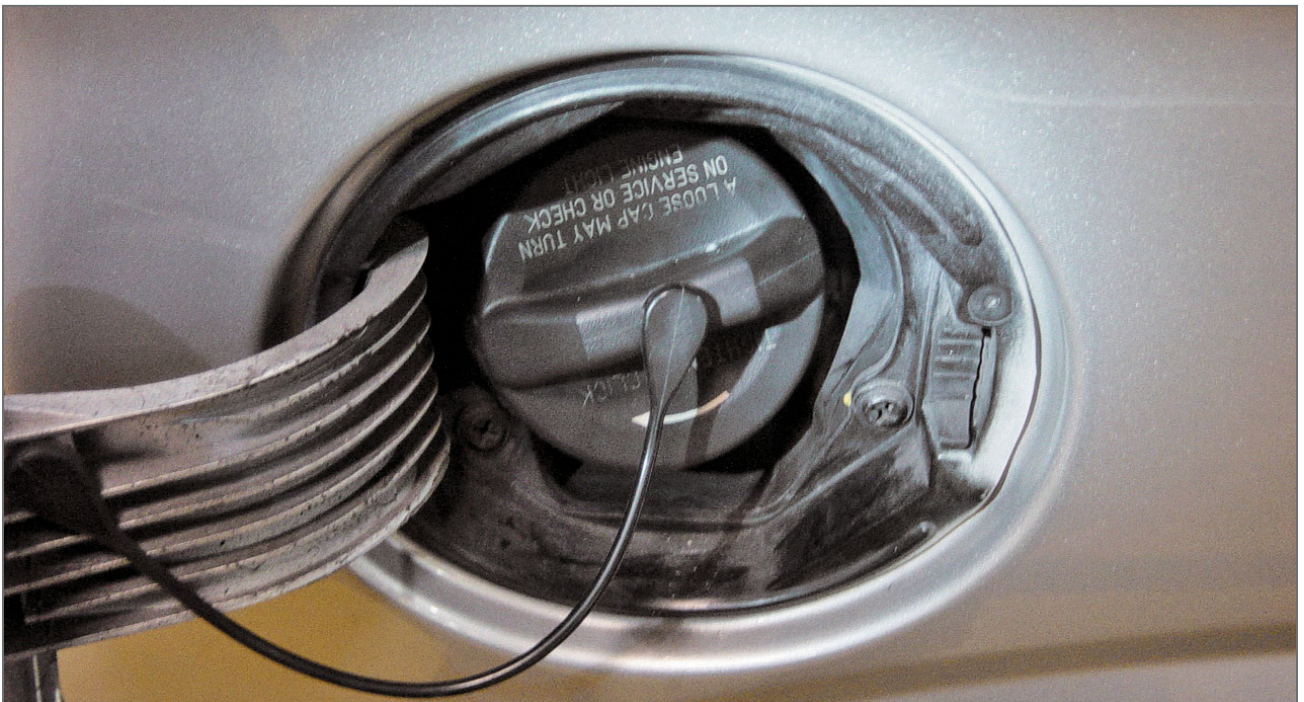
fuel is very volatile, creating pressure faster than the system can vent it.

2. The canister vent closes. Since the Vapor Management Valve (VMV) or purge valve is already closed, the system should be sealed. The micro-processor continues to look at feedback from the Fuel Tank Pressure sensor. If the EVAP system is leak-free, pressure should change. EVAP system pressure is monitored. If the system has a leak, pressure will change very little or not at all. If a large enough change in pressure is measured (either a positive pressure or vacuum), it is assumed that the system is leak-free, and the test passes. The amount of change required for a pass depends in part on ambient temperature and fuel level.

3. If a positive pressure is recorded, but it is not high enough for a pass, the first test is repeated. The canister vent opens again to vent excess pressure from the system.

BMW DMTL System

Now with the three system explanations out of the way let's move on to the BMW DMTL/LDP system. Since BMWs don't have many problems with EVAP other than a few gas cap and DMTL/LDP problems it not that difficult of a



Leaking gas caps make up only about 23 percent of the total causes for system leaks. Leave it alone until you've verified it's the problem.



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diagnosis or repair. It's always a good idea to check for Technical Service Bulletins (TSBs) and check resources such as AllData, Identifix and iATN.

“When manually checking for leaks, the vent valve must be closed. Closing of the vent valve requires that the LDP solenoid be energized and that a vacuum source be applied to the LDP solenoid.”

BMW started using the DMTL/LDP back in 1998 so it's far from being a new EVAP system. The components in the system includes the purge valve, liquid vapor separator/rollover valve,

charcoal canister, fuel tank, ORVR (On-Board Refueling Vapor Recovery), gas cap, DMTL/LDP that includes a vent valve and filter. The system utilizes the DMTL/LDP to vent the fuel through its internal vent solenoid and also is used to pressurize the system while checking for leaks. The DMTL/LDP contains a spring loaded diaphragm which moves up and down by a solenoid that controls engine vacuum. When the DMTL/LDP is in this mode, the diaphragm produces a small amount of air pressure that is used to test for leaks.

The next step is the normally open vent solenoid is closed so the pump can generate the proper pressure along with keeping the purge closed. As you can see there is nothing different from the other systems that we presented before in this article. The pump works by pulling in filtered air and then pumps the air through the charcoal canister.

If the filter is clogged, the system will not be able to achieve the proper pressure and a DTC will ensue. For the system to achieve a good pressure, the

DME (BMW's term for the ECM) pulses a vacuum controlled solenoid as the pump is operating. The DME monitors the diaphragm movement via the DMTL/LDP reed valve's feedback and compares it to stored DME vacuum solenoid frequency.

As the pump operates, the frequency of the diaphragm will slow down while the DME monitors the reed valve signal. The diagnosis of the system is monitored by the DME when it activates the DMTL and looks for the following:

1. The DMTL is activated as air is pumped through a restrictor orifice 0.3937 inch = 1.0 mm (0.040 inch leak) or 0.01969 inch = 0.5 mm (0.020 inch leak) that causes the pump motor to draw a specific amount of amperage.
2. Next the solenoid valve is energized which seals the system, delivering air pressure to the complete EVAP system. *Note: This is an important step. Changes in amperage readings are used for EVAP system diagnostics.
3. Large leak in the system is diagnosed when there is no amperage draw.
4. Small leak in the system is diagnosed when the amperage draw is the same as the orifice size.
5. No leak is when the amperage is higher than the specific range of the restrictor orifice size.
6. All of the above test results for amperage draw are checked in 45 to 270 seconds. A reminder once again that the BMW EVAP system is not all that different from the Chrysler LDP system. This same basic information can be used for all LDP pumps.

I hope that after reading this article, you'll have a better understanding of EVAP systems in general and feel more confident in diagnosing and repairing all the EVAP system problems you might come across. *JT*

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TRYING NEW WAYS OF LOOKING AT OLD PROBLEMS

THIS MONTH, WE OFFER A BUFFET OF TECH STORIES AND TIPS TO FILL YOUR PLATE.

BY "G" JERRY TRUGLIA | CONTRIBUTING EDITOR

Ever wish you could actually see if there was a restriction in a radiator or condenser? You can, if you use a thermal imaging camera.

The one we've been playing with lately is from General Tool and Instruments. Of the thermal imaging equipment on the market, this tool falls right in the middle of price range and features, and will do nearly anything you ask of it in the service bay. Take a look at the A/C condenser image I took below on the right.

In this image, you actually can see the flow paths through the coils as a bright yellow. Compare that color to

the scale you see at the right of the image to get an idea of how hot it actually is. This is with the compressor on, so heated refrigerant from the evaporator is now entering the condenser to pass that heat load on to the outside air. Flow restrictions would be seen as darker areas in the flow path. (Note: The dark area running horizontally across the image is part of the power steering cooler on this car and not an indication of a problem in the condenser.)

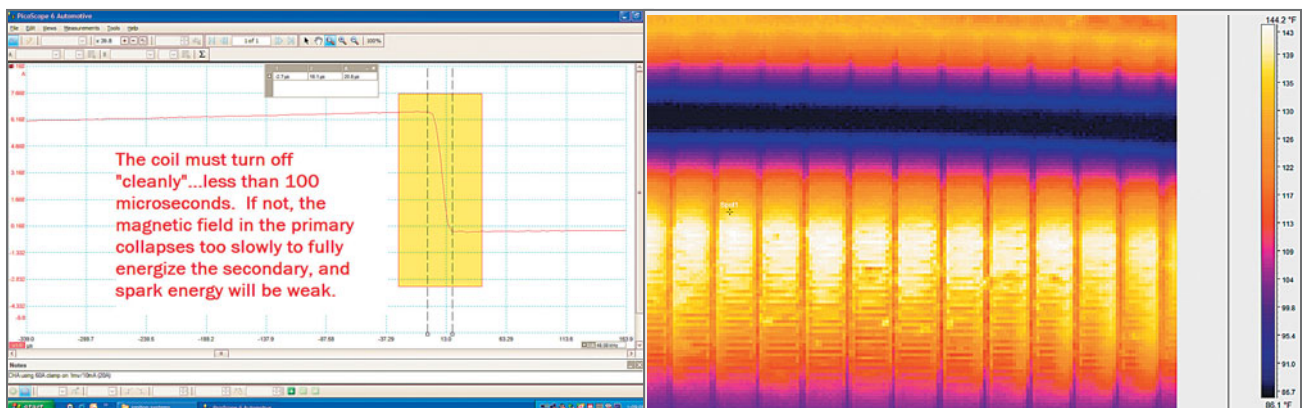
There is a learning curve to using thermal imaging as a diagnostic tool, but just imagine the possibilities! How much easier would it be to identify a misfiring cylinder, a dragging brake or failed hub bearing, just to name a few?

Contributing editor Tony Martin recently wrote an excellent feature on thermal imaging for the May 2013 issue. Check out MotorAge.com to read it if you haven't already.

Weak Spark?

When we're diagnosing the cause of a weak spark, we often look at a few general, but common, issues like worn secondary wires or bad spark plugs. But have you ever found a weak spark caused by a bad switch?

By switch, I mean driver, the electronic switch typically found in an ignition control module or engine control module, depending on which type of control governs the current flow through the primary windings of the



(Left) This is the magnified view of the primary coil's current pattern, which is used to measure exactly how long it took to turn the current off. Too long of results in a weak spark usually is caused by a failed driver in the control module in charge. (Right) The thermal imaging camera captures the heat flowing from the condenser with the compressor engaged and can aid in locating restrictions to refrigerant flow.

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Using an on-car brake lathe is one way to ensure that the pads ride true to the rotor surface.

ignition coil. A weak or faulty driver that does not turn off the circuit cleanly and quickly causes the magnetic field to collapse inefficiently, producing a weaker spark than normal.

You can see this in the current ramp of the ignition primary coil. Simply use your scope's zoom function to blow up the ramp's turn off and measure the time it took for the ramp to start its downward slope to the point it actually completed it. Anything over 100 microseconds indicates a problem with the driver.

Brake Comebacks

By Craig Truglia, TST member

Most likely after purchasing new rotors from your local part store you have seen a label that states, "No machining required," or the rotor is "finished and balanced." Do you believe when you read those labels that it's OK to just install the rotor and continue on with the brake job? Only if you want to do the job again.

Always clean the rotor mounting surface and perform a rotor run out test to make sure the installed rotor passes specifications. If the rotor/mounting surface is not correct and run out exceeds the specifications, it will allow the rotor to pass through the new brake pads unevenly. This results in wear on some areas of the rotor as the inner and outer pads lightly come into contact with it. Soon, the abnormal wear begins to result in brake squeal

and shortly thereafter your customer might experience the dreaded "pedal pulsation of doom."

One way to make sure that the rotor runs true to the caliper and pads is to perform the resurfacing using an on-car brake lathe. But no matter how you choose to machine worn rotors, don't forget to clean the new surface by using hot soapy water. Wiping the surface clean with a paper towel or very clean rag should follow.

You might be wondering why we did not suggest using brake clean after machining. Studies have shown that the aerosol propellant (a refrigerant) in brake cleaner can cause small metal particles to freeze to the rotor surface grooves. The frozen metal particles can cause a hot spot to develop that results in rotor surface problems along with unusual brake pad wear. On the other hand, hot water opens up the rotor's surface and makes it easier to brush those small particles away.

A brake job is not complete without cleaning all the brake hardware and lubricating the pins and contact points. To complete a professional job, make sure to properly bleed the brake system and then take the car out to seat the new pads to the freshly machined and cleaned rotor. The "30/30/30" rule is the easiest way to bed in new pads. Make 30 full stops using moderate pressure from 30 mph, allowing at least 30 seconds between each stop to avoid overheating the friction material. Remember that the vehicle is a 3,000-pound missile that has to stop when the driver says so. Cutting corners to save a few bucks is no way to perform a brake job, and it's never a good idea to compromise quality and safety.

For more on how to perform a professional brake service and reduce your comebacks in the process, watch the *Motor Age*/TST webinar (sponsored by Wagner Brakes) in the AutoPro Workshop or either YouTube channel.

BMW's VANOS Tips

By Pierre Respaut,

TST vice president

This 1994 BMW 325i came in with a complaint of a loud rattling noise from the engine along with an occasional power loss. While test driving the vehicle, I noticed a slight misfire when

the engine was cold but didn't hear any strange noises. Once the engine was at operating temperature I started to notice a small rattle that was coming from the front upper timing chain area.

A corresponding timing retard on the front bank of cylinders was also noticed while monitoring the scan data. After the engine was running for a while, I started to hear a loud rattle that developed in the same area. Now it was becoming obvious that there was a problem with the VANOS (BMW's variable valve timing system) unit. I removed the valve cover to inspect the area where the noise was coming from.

There was a big mess along with gummy deposits from an engine that was obviously neglected. After cleaning away some of the sludge, I noticed gear scoring on the engagement gear where it exits the unit. There also was slight wear on the thrust washers from the intake cam chain sprocket. I continued to clean the gummy deposits and replaced the VANOS unit, thrust washer and related gasket. The engine now ran quiet with no timing intervention.

The bottom line here is, when you have a performance complaint without symptoms, look for a sticky VANOS. The VANOS assembly is sensitive to lubrication problems. Tell your customers to make sure they change their oil regularly and use the correct oil and filter.

If you are going to take this repair job on you will need some special tools. The flywheel will need to be locked at TDC using a rod that inserts through the block under the started motor – that is hidden by the fuel filter. The cams will need to be locked by a jig tool as well as the intake cam gear that has to be turned fully clockwise before the VANOS unit is inserted. *TM*



G. JERRY TRUGLIA
CONTRIBUTING
EDITOR

G. Jerry Truglia, president of Technicians Service Training, has been in the auto repair business for a long time as a tech, shop owner and nationally recognized trainer/author. He founded TST to bring affordable training to his fellow techs and shop owners.

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HOW FOREIGN IS DOMESTIC?

IS THERE REALLY THAT MUCH DIFFERENCE BETWEEN MAKES?

BY **ALBIN MOORE** | CONTRIBUTING EDITOR

I can remember back in the late 1960s, my wife and I were taking a cross-country trip in our Toyota car. I needed a little service on the car, so I stopped at a small independent shop. I was told they didn't work on any of that "import junk."

Opening the hood of my Toyota wasn't much different than opening the hood of my Ford pickup. Both engines had a distributor with ignition points, both engines had a carburetor sitting on top of them, there was a mechanical fuel pump on the side of each engine and a manual transmission fastened

between the engine and differential, which was mounted in the rear of the vehicle. Was the problem the animosity of the import vehicle coming to the shop, since yes, it was different than the Ford vehicles because it used a totally different set of tools to turn the nuts and bolts that held it together? Maybe the problem with the Toyota was this was some kind of new kid on the block and it was just plain different. Or was it the starting of the technology change that was scaring the shop owner away from bringing my Toyota into the shop?

Any time I am in a different part of the country, I like to drive around to see what the area is like and especially to check out other auto repair shops. Many times I see "foreign and domestic" on the sign along with the shop name. What does this mean? Is it saying that the shop is not afraid of any vehicle coming to the shop no matter its origin? Does it mean the shop is properly equipped to work on any vehicle on the road, no matter if it was built in North America, Asia or Europe, or is it just saying, "Bring it in and we'll give it a shot?" Twenty years ago I would take in heavy trucks, cars, light trucks, tractors and farm machinery, without ever the thought of being properly equipped to complete the repair to the machine. Today, I am a little more selective on the jobs I take. There are

some jobs that I just don't feel qualified to attempt. Maybe this was because 20 years ago things were simpler. There were no computers involved in most of the things that came to my shop, and the problems that I fixed were purely mechanical or electrical in nature. Whatever the reason was, today I have no problem turning some jobs away from the shop, since today I am not equipped to work on everything.

Quite often I read articles where shop owners are advised to specialize in one or a few different makes of vehicles. I have known over the years several different shop owners that did this and were very successful. I also remember working with my wife while organizing training events in our local area. My wife spent a lot of time on the phone calling the different shops and telling them about the training. At times I would get a kick out of the excuses that were used to not attend the training. The best one that sticks in my mind was, "We only work on Ford vehicles in our shop and



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our tech knows everything there is to know about Ford vehicles.” The class that was being offered was a class on Mazda fuel systems. I thought this rather comical, since this shop worked on a lot of Mazda vehicles. Thinking back, three or four years later this shop was out of business. Technology kept marching on and left this shop behind.

So what does all this have to do with domestic vehicles? The domestic vehicle of today has components that are manufactured in many different countries. Some of the domestic branded vehicles are not even assembled in North America. On the flip side, many

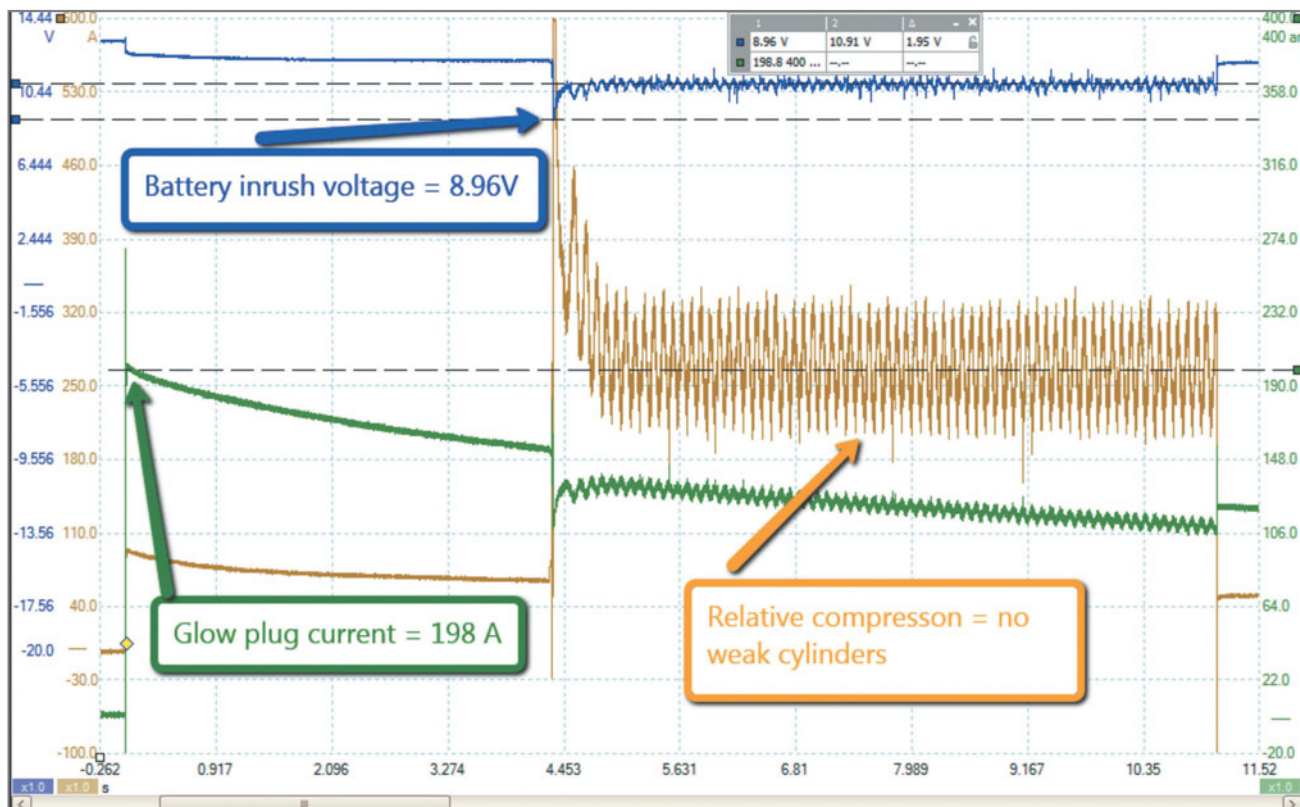
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of the import vehicles have parts that are made in many different countries, but many of these vehicles are assembled in factories right here in the U.S. and Canada.

Looking back several years, I guess my view of the “domestic vehicle” has changed. On the outside the vehicle of today is truly a global vehicle no matter where they are built. But on the inside, things can be a lot different. For most shops this is where the kink is. With so many different types of electronic systems on the different makes of vehicles, the cost of letting everything with wheels come through the doors can be quite daunting.

No matter the vehicle origin, is it profitable to stay up-to-date with both tooling and training to do everything on all vehicles? If we stick with the emission related end of the vehicle, most problems can be taken care of with global OBDII technology. But once we step over the line to body control, anti-lock brakes and airbag work, we delve into a whole new world of adventure. Very few of these systems are common between makes, and some are not even common between different models and years of the vehicle. Is it profitable to tool up for complete coverage for these types of jobs?

My shop is remotely located in small town America, one of those small, out of the way sleepy towns where farm tractors are as common on Main Street as are cars. I have been in business here for 20 years and have seen many changes to our industry. Along with



Labscope test of the glow plugs, battery condition and relative compression. Because this is a hard start cold and the engine has a misfire, the technician needs to know if the glow plugs are working, the batteries are capable of supplying the needed power to the starter and if there are any cylinders with low compression. A current probe is hooked to the power wire of the glow plug relay, another current probe is hooked to a negative battery cable and voltage leads are hooked to the posts on one battery. When the key was turned on the glow plug current shows over 190 amps, when the starter is turned on, the inrush voltage at the battery did not drop below 8.5 volts and the current pulses from each cylinder coming to compression are relatively the same. This test narrows the problem down to a fuel injector problem.

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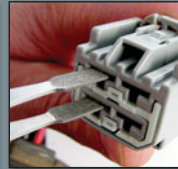
Deutsch/Cannon



ABS Sensor



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FUSE SAVER® MASTER KIT #8016

- Chase down short circuits without blowing fuses
- 5-30 amp breaker handles



6-PC. RELAY BYPASS SWITCH MASTER KIT #9038

- Energize a fuel pump with the push of a switch





This is a 1999 Nissan Quest with 149,000 miles, automatic transmission and powered with the 3.3 V6 engine. The complaint is engine overheat.

these changes I have had to make many changes to be able to stay in business, including in the diagnostic tooling and training departments. The world of problem diagnosis fascinates me, so I have moved my business in that direction. Electrical and drivability problem analysis is what I love to do. This work brings all kinds of problems to the shop, some foreign, some domestic. The last few weeks have seen Ford (Mazda), Mercury (Nissan), Pontiac (Toyota) and Chevrolet (Isuzu), all with problems, all needing some problem analysis before any more work can be done.

First the Ford

The first problem vehicle is a 2000 F250 powered with the 7.3 Powerstroke diesel engine. The complaint is the engine will not start in cold weather if the electric engine heater is not plugged in and the engine does not have as much power as it used to have. Looking at the odometer, I found it had 349,000 miles registered.

When I start on a problem like this, I first want to know if the batteries are producing enough power to turn the engine fast enough, if the glow plugs working properly and if the fuel injectors capable of injecting fuel into the combustion chambers. The first test is to hook up a scan tool, pull any stored

codes that might be present and then do the Key On Engine Off (KOEO) electrical injector buzz test. This will verify the electrical integrity of the injectors, the capability of the injector driver module to pulse the injectors and by

listening, the technician can hear the injectors being operated.

The next test is to verify proper glow plug operation, relative compression and proper cranking voltage. By hooking a current probe around the power feed wire to the glow plug relay, a high amp current probe around one negative battery cable and hooking a voltage probe to one battery, these three things can be tested with a labscope all at the same time. With this one simple test, I will have enough information to either stop here or move on.

When the key is turned on and the glow plugs come on, I want to see 180 to 192 amps of current draw to the glow plugs. When the engine is cranked, I will look at the minimum inrush voltage (the lowest voltage when the starter contacts close). This inrush voltage should not fall below 8.5 volts (see related article www.motorage.com/magscope). The relative compression test will tell me if the engine has any cylinders with low compression. The KOEO electrical buzz test found injectors Nos. 1, 5 and 8 did not buzz. Because there were no electrical circuit codes stored, this tells me that three of the fuel injectors have



The engine has an overheating problem and will push coolant from the radiator to the overflow bottle. Testing the cooling system with the blue block tester fluid found no air bubbles and the blue fluid did not turn yellow. The rubber glove is fastened around the radiator filler neck, the engine started and ran. After about 5 minutes with the engine at 2,500 rpm, the glove quickly inflated. I have found this is one of several great ways to get to the bottom of a combustion leak problem.

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The combustion leak problem is caused by the failed head gaskets. One cylinder on each head had the fire rings broken in the head gaskets. This engine had been rebuilt three years ago and still had all of the heat tabs intact. The heat tabs proved the engine had not been run hot enough to boil the coolant. There was no cylinder head warpage, only the fire ring damage to the head gaskets.

a problem with the hydraulic part of the injector.

Now to test the glow plugs and batteries. With the labscope hooked to the glow plug feed wire, one battery negative cable and battery voltage, the key is turned to the run position for a few seconds, then the engine cranked. The glow plug and battery test proved out fine. Now I have a good direction about the low power and hard start problem, I suspect this engine needs a set of fuel injectors.

There is one more test that needs to be done: the cylinder contribution test. The engine was started and brought up to operating temperature and the scan tool was used to perform the cylinder contribution test. This test stored a diagnostic trouble code (DTC) for cylinder 8 contribution. While the engine was running, there is an audible misfire from one cylinder.

The results of the testing found there were no problems with the batteries or the glow plugs. The hard start problem is caused by the hydraulic portion of the fuel injectors being stuck and not allowing the injectors to work. By having the electric engine heater plugged in, the injectors will stay warm and the engine will start.

There is a Ford term for this problem. This is known as “stiction,” and was fixed with eight new fuel injectors.

The Nissan Next

The next vehicle is a 1999 Nissan Quest (this same vehicle could be badged as a Mercury Villager). The odometer shows 149,000 miles, the engine is the 3.3 liter V6 with an automatic transmission. This vehicle came to the shop with an overheating problem. When the vehicle was driven to the shop, the electric cooling fans were running on high speed and blowing cold air through the radiator. Removing the radiator cap found the radiator full of coolant. Reaching into the passenger compartment, I could feel the heater blowing warm air. Checking the coolant temp gauge found the needle was in the “hot” position.


“When I start on a problem like this, I first want to know if the batteries are producing enough power to turn the engine fast enough, if the glow plugs working properly and if the fuel injectors capable of injecting fuel into the combustion chambers.”

This tells me that the water pump is pumping coolant, but it is not circulating through the radiator. The problem lies with the stuck thermostat. The thermostat was removed and tested and found to be stuck in the closed position. (I always love it when I am able to find the problem this easy.) A new thermostat was fitted to the engine and an airlift tool was used to vacuum fill the cooling system. The engine was started and brought to operating temperature and then the cooling system tested for combustion gasses. This is something that I do on any engine that has been overheated.

In this case, I used the blue block tester fluid with no problems found. Keep in mind that any test we do is telling us only the condition of the problem at the time of testing. The vehicle was test-driven and the engine stayed cool during the test drive. During the test drive, though, the heater quit putting out hot air. Something is still wrong. I have fixed one problem, but I don’t think I have fixed the root problem.

Back at the shop with the engine idling, the coolant temperature was still climbing to “hot” unless the engine speed was increased to 2,500 rpm. Another combustion leakage test was performed. This time I used one of my more “high tech” methods: the balloon test. I fastened a latex glove around the radiator filler neck and then started the engine. After running the engine at 2,500 rpm for about five minutes, the glove began to inflate quickly and fill with coolant. The engine has a combustion leak into the cooling system that will only happen once in a while.

The test with the blue block tester fluid missed the problem, but by using the rubber glove, trapping everything in the cooling system and exercising a little patience, I caught the problem as it happened. The cylinder heads were removed from the engine to find damage to the fire rings on some of the cylinders. During the tear down process, I also noticed the cylinder head bolts were not very tight. Because this engine is a rebuilt engine with only 30,000 miles, I wonder if the cylinder heads were installed properly.

Two problem vehicles, one domestic and one “foreign.” Well, the foreign car might just as well have been a domestic all things considered. Perhaps we should reconsider our use of the word “foreign,” instead using it to describe cars we are as of yet unfamiliar with. Time for a little training? 



ALBIN MOORE
CONTRIBUTING
EDITOR

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

 Email Albin at bwrench@yahoo.com

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WAGNER BRAKE ANNOUNCES LOW-COPPER CERAMIC FRICTION BREAKTHROUGH

As a result of recent environmental legislation, global vehicle manufacturers are rapidly introducing highly advanced low-copper ceramic friction formulations to their next-generation vehicle platforms. This transition will affect virtually every North American automotive service business, including yours.

And by choosing Wagner® Brake Products, you can be ready today.

The Case Against Copper

Copper has long been a primary friction modifier within ceramic formulations. Due to its environmental impact, however, it must be phased out of OE and replacement brake pads and shoes. This challenge affects service providers in all markets due to leading OEMs' choice to convert to low-copper technology as quickly as possible on vehicles to be sold in North America.

As the No. 1 supplier of global friction to OE manufacturers and the aftermarket, Wagner Brake Products has led the industry in developing proprietary low-copper ceramic formulations that meet the new environmental requirements while delivering across-the-board improvements in NVH control, performance, fade resistance and dusting. In fact, the Wagner Brake brand's new OE21™ low-copper formulations have redefined ceramic friction science, which means new opportunity for your business.

Available immediately in Wagner ThermoQuiet® Ceramic^{NXT} brake pads, the Wagner OE21 formulations represent an eco-friendly, low-copper solution that establishes a new industry benchmark for brake performance and customer satisfaction. In short, they're the right choice for superior customer loyalty... right now.

Wagner's Best Formulations Ever

It began as a drive to develop more eco-friendly ceramic friction formulations. It resulted in the best brake pads ever produced by Wagner Brake Products.



The goal of Wagner Brake's global R&D team was to develop a full portfolio of application-specific low-copper formulations that would outperform even the best current Wagner ceramic technologies. To meet this challenge, they developed a sophisticated tribological "fingerprinting" process to isolate and analyze the performance of each material within conventional ceramic friction formulations. Once they mapped the dynamic characteristics of copper in a full range of operating conditions, they screened some 1,500 new raw materials to find the ideal low-copper combinations for a full range of OE and replacement applications.

Quieter. Better Performance. Reduced Fade.

The company's proprietary new OE21 formulations feature a complex matrix of materials that replicate the functions of copper while improving overall brake pad performance in each of five key areas: NVH control; stopping power; fade resistance; wear characteristics; and dusting.

Extensive OE-based testing has shown that the OE21 formulations outperform existing Wagner ceramic materials by providing 35 percent quieter braking, 15 percent more stopping power and up to 40 percent better fade performance.

In fact, this low-copper technology has been so successful that a number of OE manufacturers are replacing conventional ceramic formulations with the new low-copper materials in 2015 models to be sold throughout North America.

Available Today!

The new Wagner OE21 formulations are available for more than 95 percent of automotive ceramic applications, so your business can immediately offer the advantages of OE21 low-copper technology to virtually any customer simply by installing Wagner ThermoQuiet Ceramic^{NXT} brake pads.

Learn more about these exciting new formulations and Wagner ThermoQuiet Ceramic^{NXT} brake pads by contacting your Wagner Brake Products supplier or visiting www.WagnerBrake.com.

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ENGINE-PROTECTING MOTOR OIL

Champion Oil has formulated a SAE 30 grade "Purpose-Built" motor oil specially designed to reduce the potential of engine failure during hard break-in. The formulation is based on the performance achievements of Champion current PowerShield Engine Assembly Lube & Oil Booster product. This technology contains high levels of zincdithiophosphates, in combination with Champion's TVS (Thermal Viscosity Stabilizer), which extends oil film capacity for proper ring seating, the manufacturer states. This product is field tested and suitable for use in all high-performance and racing-type engines, especially those using flat tappet and/or roller cams operating at high rpms and requiring high-pressure (stiff) valve springs. Champion SAE 30 PowerShield Break-In Motor Oil part No. 4270 is available in 12-quart case lots, 5-gallon pails or 55-gallon drums.

www.championbrands.com
Champion Brands LLC

STORAGE WALL SYSTEM

Lista International Corporation offers the Lista Storage Wall System, a flexible storage system that combines modular drawers, shelves and roll-out trays. The Storage Wall System provides high cubic density storage, can utilize all available ceiling height and is available in two different depths. This unique storage solution is ideal for maintaining an organized and smooth-running parts department in automotive dealerships, the company states. The Storage Wall System's unique combination of drawers, shelves and roll-out trays optimizes storage space by allowing large, medium and small items to be stored together.

www.listaintl.com
Lista International Corporation



ALIGNMENT AUDIT SYSTEM

With the new John Bean Alignment Audit System, service technicians or advisors can conduct fast and easy wheel alignment audits with complete color-coded reports in approximately 60 seconds. The easy-to-read, customer-focused reports increase shop productivity and ease the sales process, according to the company. The John Bean system uses live, computerized 3D modeling and high-resolution cameras, coupled with an extensive database of vehicle information to provide fast and accurate alignment audits under an array of working conditions. The AC400 Touchless Alignment Wheel Clamps offer accurate and repeatable results without touching the rim. This lightweight and durable patented design eliminates the opportunity for wheel damage while offering ease of use and increased productivity. Because the John Bean Alignment Audit System does not need a lift, service technicians or advisors can perform alignment audits outside of the alignment bay, leaving the bay free to conduct other revenue generating services.

www.snaponequipment.com
Snap-on

TPMS REPLACEMENT PARTS CATALOG

Continental Commercial Vehicles & Aftermarket has released its new VDO 2013 TPMS Replacement Parts Program catalog. This new catalog has been significantly expanded to include the latest application validations for the VDO REDI-Sensor Multi-Application TPMS Sensor line, which now provides coverage for more than 85 percent of all vehicles in North America with just three sensor SKUs, the manufacturer reports. The overall VDO TPMS Replacement Parts Program also has been expanded with additional coverage of OE sensors and service kits for a wider range of domestic, European and Asian vehicles.

www.continental-corporation.com
Continental Corporation



LED RETRACTABLE WORK LIGHT COMBO

The Eastwood Company has launched a new SMD LED retractable work light flashlight combo — two powerful lights in one. SMD, otherwise known as Surface Mount LED, is the next level of LED lighting. Unlike traditional LEDs that are in epoxy enclosures, SMD LEDs are mounted directly on the circuit board. This provides a powerful light with a wider viewing angle, according to the company. The Eastwood work light features 30 powerful SMD LEDs that emit more than 200 lumens and are two-times more powerful than the same count regular LEDs. Featuring a retractable body, the user can control the amount of light with a simple sliding action.



www.eastwood.com
Eastwood



TRANSMISSION FLUIDS

CRP Automotive offers a wide range of Pentosin OE-quality transmission fluids to cover a wide range of European vehicles, including popular makes such as Audi, BMW, Jaguar, Land Rover, Porsche, Volkswagen and Volvo. The Pentosin transmission fluid line is formulated on a fully synthetic base oil technology and incorporates special anti-wear chemistry and friction modifiers to deliver safe and stable friction performance in various types of transmissions — manual, automatic and double clutch, the manufacturer reports.

www.crpindustries.com
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SILICONE-BASED BRAKE FLUID

Champion Brands is now offering to private label customers DOT 5 and DOT 5.1 in addition to traditional North American designations of automotive hydraulic brake fluids, the company states. DOT 5 denotes a particular mixture of chemicals imparting specified ranges of boiling point. DOT 5 is a silicone-based brake fluid, which contains at least 70 percent by weight of a diorgano polysiloxane. Unlike polyethylene glycol based fluids, it is hydrophobic. An advantage over other forms of brake fluid is that silicone has a more stable viscosity index over a wider temperature range. Another property is that it does not damage paint. Using DOT 5 in a DOT 3 or DOT 4 system without proper flushing will cause damage to the seals and cause brake failure. DOT 5-brake fluid is not compatible with anti-lock brake systems.



www.championbrands.com
Champion Brands, LLC

SEALING COMPONENTS FOR BRAKES

ContiTech Vibration Control has expanded its range of sealing components for brakes. The company manufactures micro composite parts for technologies like compact ABS systems, for example. Composite microparts are of particular importance in the realm of active brake management. The trend to light-weight engineering in the auto industry makes compact systems a necessity, the company says. In keeping with this development, ABS blocks are being constructed to be more and more lightweight as well. Alongside their use in ABS systems, compact seals are also employed in engine management, electronic control devices and brake power simulators in electric vehicles.



www.contitech-usa.com
ContiTech

MULTI-MEDIA INSPECTION CAMERAS

ACDelco has two new 6V alkaline battery multi-media inspection cameras that allow service professions to easily identify and document issues, download the information to their computer and allow supervisors or customers to view the findings. ACDelco says the ARZ6055 (shown) offers these features: records and plays back images and audio/video, 4GB SD memory card (included) records up to 42,800 pictures or two hours of video, USB port for images and video output and three-inch (320 by 240 pixels) LCD screen.



www.acdelco.com
ACDelco

COMMERCIAL JUMP STARTER

Clore Automotive presents the FMB1224, a commercial jump starter with 12- and 24-volt jump starting capability, from SOLAR. This rugged, powerful unit provides endless jump starts for commercial fleets and construction equipment. The FMB1224 delivers the instant raw power of 1800 CCA in 12-volt mode and 900 CCA in 24-volt mode. It's the perfect unit for permanent installation on a service vehicle, featuring 16-foot long cable leads made of 4/0 cable, heavy-duty clamps to penetrate battery corrosion, an alternator harness for vehicle-powered recharging and three installed Group 31 batteries, according to the company. The FMB1224 features an enhanced 3-channel charging system. The new charging system charges each battery independently to ensure a complete charge for each battery during every charging cycle. In addition, the new charging system features charge settings for both flooded acid and AGM batteries.



www.cloreautomotive.com
Clore Automotive

SPARK PLUG STARTER SET

The spark plug starter set is used to start and remove spark plugs in deeply recessed holes. The 9-inch flexible shaft allows technicians to obtain the desired angle to accurately install most spark plugs, without cross threading. 3/8-inch square drive with strong neodymium magnet to hold the spark plug in the socket during installation and removal. Can also be used as a magnetic pickup tool with a weight capacity of 1.56 lbs. The set includes four spark plug sockets, 9/16-inch, 5/8-inch, 3/4-inch and 13/16-inch, the manufacturer reports.



www.lislecorp.com
Lisle Corp.

LIQUID TUNE-UP PACKAGE

The Penray Companies, Inc. has introduced Penray Plus Liquid Tune-Up, a package of chemicals designed to work in harmony to restore vehicle engines to optimal performance and efficiency, they company states. Penray Plus Liquid Tune-Up is an integrated package containing specially-blended, made-in-the USA chemicals and designed as a three-step process to fortify the three key fluids in today's vehicles the fuel, the lubricating oil and the engine coolant. Optimizing the fuel, lubrication and cooling systems will help extract the best performance and efficiency from your engine, while offering protection for vital systems that will impact service life and resale value.



www.penray.com
Penray

GYROSCOPIC SCREWDRIVER

DEWALT introduces its new 8V MAX Gyroscopic Screwdriver. The 8V MAX Gyroscopic Screwdriver (DCF680) includes gyroscopic technology often found in electronic devices that has now been integrated into a professional-grade 8V MAX* screwdriver, the company says. The variable speed control sets the DCF680 gyroscopic screwdriver apart from traditional stick screwdrivers and makes applications easy, and the adjustable two-position handle allows for operation in either in-line or pistol grip. The tool is powered by an 8V MAX* lithium ion battery that provides the performance required by end users to complete jobsite applications.



www.dewalt.com/us/core
DeWalt Industrial Tool Co.

BMW EXHAUST

CORSA Performance Exhausts makes available its dual exit, axle-back exhaust system for the 2012-2013 BMW F10 M5. Now BMW F10 M5 owners can take advantage of the performance gains and sound quality CORSA is known for while still enjoying comfortable, drone-free highway cruising, the maker states. CORSA's new BMW F10 M5 exhaust system utilizes the company's Reflective Sound Cancellation (RSC) technology to deliver a whisper-quiet note at cruising speeds, yet retains CORSA's bold, crisp high-performance sound during harder acceleration. This exhaust system is fashioned out of premium 3-inch diameter stainless steel pipes and terminates in a dual rear exit consisting of twin, Pro-Series 4-inch tips. The Pro-Series tips are available in either a polished (part #14934) or black finish (part No. 14934BLK).



www.corsaperformance.com
CORSA Performance

UNIVERSAL TOW EYE

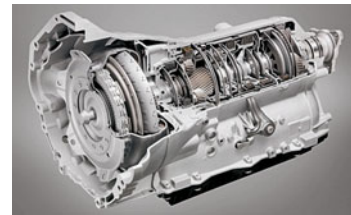
Steck Manufacturing Co. has released a tool to enable technicians to safely load disabled foreign and some domestic vehicles on roll back wreckers and frame racks, without causing damage. I-Bolt is a 2-by-1 1/2-inch loop connected to a 7-inch long steel shaft with unique gripping teeth that lock into the threaded holes on the front or rear of the vehicle. Insert the I-Bolt into the threaded hole, ideally behind the nut or the back of the hole, engage the gripping teeth by turning the loop clockwise (while holding the knurled 1 3/4-inch knob) until the teeth engage behind the nut or in the threaded hole. I-Bolt is able to fit threaded holes having diameters of 1/2 inch up to 1 1/4 inch. This unique design provides a universal hook up solution for the 200-pillus vehicles identified in the Towing and Service Manual from AAA.



www.steckmfg.com
Steck Manufacturing Co.

TORQUEFLITE TRANSMISSION

Chrysler's all-new 8-speed TorqueFlite transmission features a hydrodynamically cooled, high-efficiency modular design that reduces weight over the existing Chrysler 5- and 6-speed automatics while producing more rear-wheel-torque, the manufacturer reports. Named TorqueFlite, after the previous "bulletproof" automatics made famous by the Mopar musclecars of the 1960s and '70s, the new 8-speed automatics were designed to be easily modified to fit all current RWD and AWD Chrysler applications, be it behind the new Pentastart V6, the existing 5.7L, 6.4L and the upcoming supercharged 6.2L Hemi, and the "stump-pulling" Cummins turbo diesel.



www.jiffy-tite.com
Jiffy-Tite

FUNNEL FOR OBSTRUCTED FUEL SYSTEMS

Rislone has created a series of solutions for vehicle owners with obstructed fuel systems. Rislone Gasoline Fuel System Treatment and the company's super-concentrated line of fuel additives all come equipped with capless-compatible packaging. For users who find themselves in emergency situations or want to use up old bottles, Rislone introduces the EZ Nozzle Funnel. When inserted into the fuel filler neck, the EZ Nozzle Funnel opens any obstructions, according to the company. It features a wide, asymmetrical mouth that makes it simple for users to cleanly empty any bottle or gas can into the fuel tank. The funnel is less than eight inches long, so it can be easily stored within the vehicle. In addition to fuel additives, it can be used with engine oil, power steering fluid and other fluids needed for routine maintenance.



www.barsproducts.com
Bar's Products

CV JOINT

The RCV Performance Ultimate Series 30 CV joint provides unsurpassed strength and reliability for high stress off road applications. The CV joint is used by Championship winning Pro4 teams, and is race prepped and ready to go. The joint is ideal for use on rock crawlers, buggies, sand rails and other IFS applications. The Ultimate Series 30 CV joint is manufactured with a size 30 RCV housing and features a bearing cage and inner race made with 300M alloy steel for high strength, shock resistance and durability, the company says. An isotropic finishing process is used on the housing, bearing cage and race for reduced friction. Plunging versions of the joint are available with up to 28° of articulation. Non-plunging versions with up to 40° of articulation are also offered. The CV joints are available in 35, 40 and 47 spline counts, and can also be configured to your requirements. Housings receive Black Oxide coating as standard, and optional nickel plating is available for extra corrosion resistance.



www.rcvperformance.com
RCV Performance

GMB EXPANDS FAN CLUTCH PRODUCT OFFERING

As the world's leading manufacturer of automotive products, GMB has expanded its offering to include fan clutches. Product specs include reduced fan noise and vibration during acceleration or cruising; greater life expectancy and maximized engine performance/efficiency; and a 10 to 20 percent reduction in fuel consumption due to minimum air flow required for cooling. GMB also offers water pumps, universal joints, fuel pumps and wheel hub assemblies.



GMB

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Using patented Invisible Heat[®] to quickly release previously hard to remove parts that are corroded or bonded in place, the Mini-Ductor II can heat a 1/2-inch nut red hot in seconds. Plugging into 110V, 15 amps, it is much faster and safer to use than a naked flame, as the heat is localized on the frozen part. The Mini-Ductor II can be used on all undercar areas including body mount bolts, tie rod ends, control arm ends, ball joints, wishbone bolts, brake lines, stabilizer bars and more.



Induction Innovations Inc.

WORLDPAK BRAKES RESOURCES ROTORS, PADS & CALIPERS

WORLD BRAKE RESOURCES (WBR) is a complete braking solution for Asian, Domestic and European vehicles. Products include WBR brake rotors with Run True[™] Technology for exceptional braking performance, WBR Dual-Technology 100 percent copper free metallic brake pads with high heat formulation, WBR Dual-Technology ceramic brake pads with low noise and low dust formulation, and WBR Premium and Premium OptiSelect calipers remanufactured to match exact OE specification. All WBR products offer professional quality with proven performance and are available exclusively at WORLDPAK. www.wbrautoparts.com



WORLDPAK

DENSO WIPER BLADES

DENSO's First Time Fit Wiper Blade program offers a wide range of wiper blades to meet your needs. The program offers conventional, beam and designer styles, allowing a direct replacement of your original equipment blades. DENSO's wiper blades provide quiet, streak-free performance with its durable design. Quick and easy installation makes replacing your wiper blades a snap. Bottom line — DENSO First Time Fit Wiper Blades deliver the engineering, quality and performance that makes them the best choice when it's time to see clearly.



Denso

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Choose Gabriel Premium ReadyMount for the best selection of fully loaded struts. With almost 200 SKUs, 40 of which are first-to-market, Gabriel's ReadyMount line is one of the broadest available. And all new Premium ReadyMount designs are precision engineered to OE specifications, component- and unit-tested, then fit- and ride-tested to ensure quality, durability and performance. Check out the full line at www.Gabriel.com.



Gabriel

INNOVA PRO 31603

The Innova PRO 31603 expert diagnostic tool allows technicians to quickly retrieve and view vital information in order to diagnose OBDII, ABS and SRS issues so they can complete more repairs more efficiently. Shop management software reports manage vehicle diagnostics and RepairSolutions[®] is available. For more information, visit www.pro.innova.com.



Innova

HUNTER ANNOUNCES NEW GENERATION SWING AIR JACKS

Hunter's RX16 lift rack is now shipping with new generation 9,000-pound swing air jacks. The new generation jacks make vehicle service easier and safer with lower clearance height, a 6-inch wider reach and many other productivity improving features. The new jacks also are compatible with older RX16, L44X and P44X rack models capable of accepting 9,000-pound jacks.



Hunter Engineering

MOVING TARGETS HAS NEW PROMOTIONS

Moving Targets offers five Targeted Neighborhood Promotions: Moving Targets New-Resident Direct Mail Service; Birthday Connections Neighborhood Mail Service; Loyal Rewards Do-It-For-Me Email, Text Club, and Social Media Marketing Services. Each service is 100 percent turnkey — they do all the work for you! Call 800-926-2451 or visit www.movingtargets.com.



Moving Targets

MOVERAS TRANSMISSIONS

Moveras Transmissions available from Advance Auto Parts Professional are manufactured in a world-class facility to deliver the strong and clean transmissions customers need. Moveras builds to OE standards for virtually every automatic vehicle on the road. For the latest promotions on Moveras products, visit AdvanceCommercial.com/seasons or call your local Advance delivery store.



Advance Auto Parts

DENSO CABIN AIR FILTERS

The First Time Fit Cabin Air Filter program offers the quality engineering and performance you expect from DENSO. There are 190 part numbers that cover more than 117 million vehicles for a full range of domestic and import applications. OE specified media types include Electrostatic and Charcoal. DENSO's Electrostatically-charged particulate filters capture ultra fine particles such as diesel pollutants, soot and pollen. Our charcoal filters feature a multi-layer filter structure embedded with activated charcoal that removes odors and captures harmful particles.



Denso

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NUCAP continues to deliver innovative technology solutions to the automotive aftermarket with its NRS mechanical attachment system for brake pad backing plates. "Research shows that the adhesive (glue) bonded brake pad backing plate is a leading cause of most premature braking system noise, vibration and wearout issues, and an accident waiting to happen," according to Jayson Keever VP Global Marketing NUCAP Industries. "Our NRS technology was developed to help our customers eliminate brake system come-backs and warranty returns." Said Keever, "Pads manufactured with our NRS Mechanical Bond, last up to 30 percent longer, by avoiding the most common causes of pad failures — like rust jacking, edge lift and friction material delamination. They will not fail."



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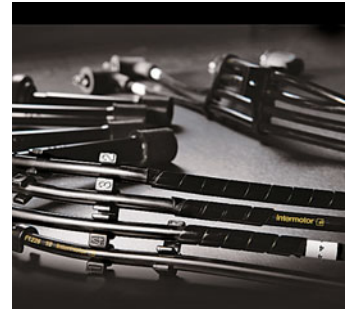
DEPO introduces 335-5409L/R3EFH1, the side view mirrors for Chevrolet Silverado/GMC Sierra 07-10 with signal lights. With knowledge and experience in auto lamp industry, DEPO has redesigned the internal components of the signal light and applied for a patent. In addition, the appearance of the signal light on the mirror surface is changed to DEPO logo. Please see more information on www.maxzone.com.



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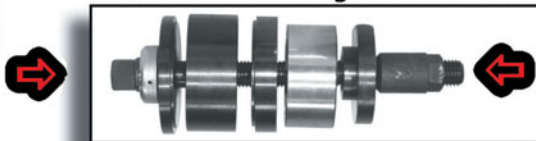
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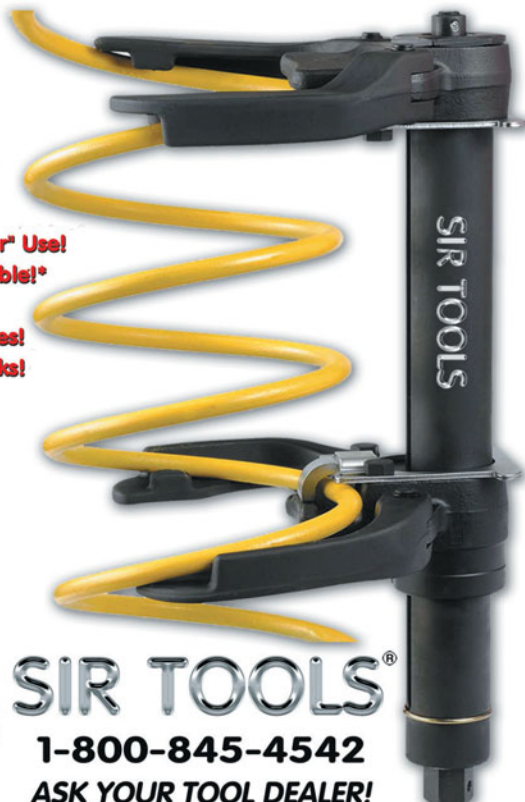
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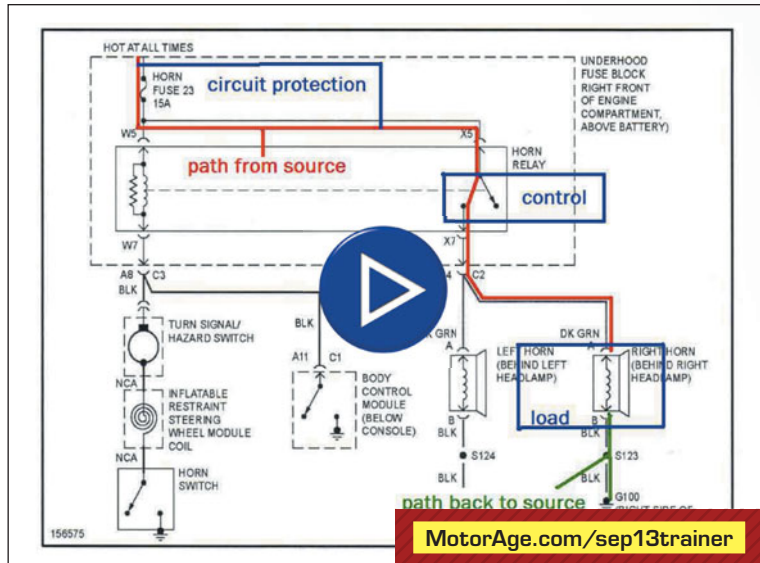
LET'S WALK YOU THROUGH A SIMPLE DIAGNOSIS.

BY **PETE MEIER**
Technical Editor

As we've shared with you over the years, there are three areas you need (at a minimum) to be assured of success when tackling an electrical diagnosis. The first is a solid understanding of electrical fundamentals. You need to be comfortable in your knowledge of what voltage, resistance and current are and the relationship among them. We covered those as the main topic of The Trainer video we posted in May 2013.

The second "must have" is competence in a variety of electrical testing techniques, starting with the understanding of what your digital multimeter (DMM) can and can't do. You should know how to perform a static resistance test, static voltage test, dynamic current tests and absolutely be confident in your ability to perform and understand a voltage drop test. We've covered these topics and more in videos and archived webinars that you'll find in the AutoPro Workshop and on our YouTube channel.

Third on the list is the ability to read and understand a wiring schematic and/or wiring diagram. These are more than just the electrical road map that tells you what components are a part of the circuit you are troubleshooting. They also are instrumental in helping you understand how the circuit works and are vital to organizing your diagnostic strategy.



In this edition of The Trainer, we'll focus on the third. We'll show you how to identify the circuit elements (source, load, control(s), circuit protection and path) and, based on that information, how to decide on what type of tests you'll need to perform. Then we'll walk you through a simple circuit diagnosis and show you how to put all this "theory" to use.

Past episodes of The Trainer are available in our Workshop, www.workshop.search-autoparts.com. For the last several years, we have put together these how-to videos to help technicians of all levels better their service skills. Check out the past videos on diagnostics, drivability, undercar service, electrical problems, tires and more.

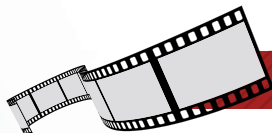
And if you have a topic you'd like us to cover to help training in your shop, just let us know. We're always open to readers' suggestions. *TM*

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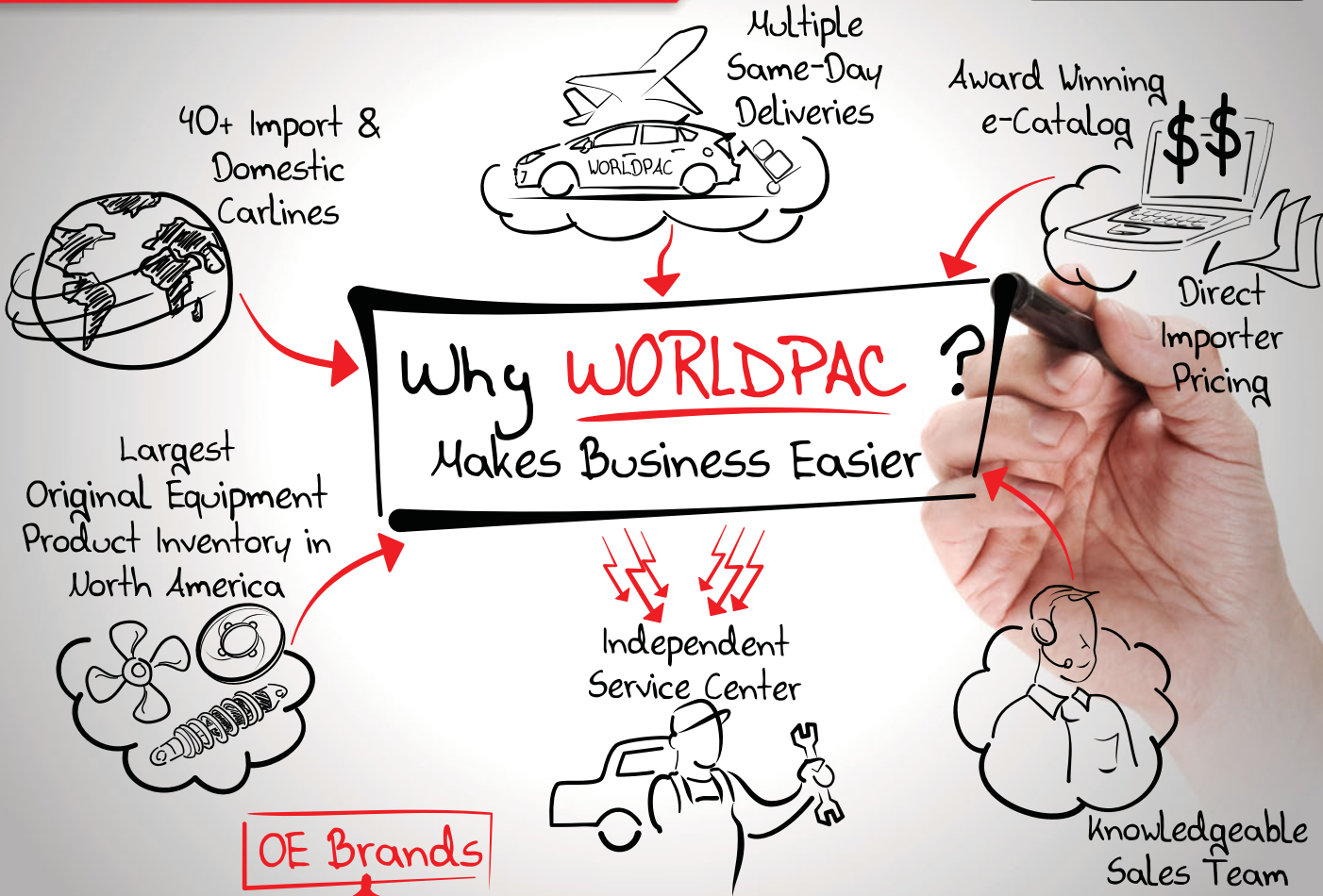


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